

Colorado Water

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

WATER ITEMS AND ISSUES . . .

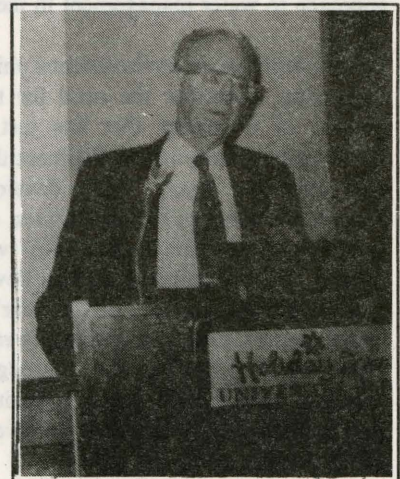
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FOURTH ANNUAL SOUTH PLATTE FORUM

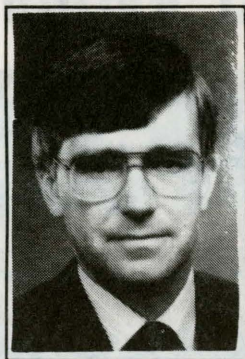
Seeking An Integrated Approach to Watershed Management in the South Platte Basin
October 27-28, 1993

**Holmes Rolston, III describes
society's attempts to shift
from development to
sustainability at South Platte
Forum**

See Page 9



**Colorado
State
University**



SEEKING!

by Robert C. Ward

The theme of the 1993 South Platte Forum (held Oct. 27-28, 1993, in Fort Collins) was "Seeking an Integrated Approach to Watershed Management in the South Platte River Basin". After listening to the many speakers, who represented many different dimensions of water management within a river basin, I was particularly struck at how very appropriate the word "seeking" was for the theme.

The new National Biological Survey, described at the forum by Tom Muir, is an attempt by the federal government to seek a new approach to management of the country's biological resources. The USGS's National Water Quality Assessment program, described by Kevin Dennehy, seeks to develop a much stronger data base for integrated watershed decision making. The Denver Water Board's new long-range planning process, as described by Dave Little, seeks new ways of defining the Board's future directions. The Colorado River Headwaters Forum, as presented by Doug Kemper, seeks to develop new formats for conflict resolution. The Rocky Mountain Farmers Union, as presented by Bill Thompson, seeks a state water policy. And the courts in Colorado, as discussed by Judge Robert Behrman, are seeking guidance in how to address the many emerging legal issues that surround a more integrated approach to water management. These were just of few of the many talks that described new efforts to seek an integrated approach to water management in the South Platte River basin.

Holmes Rolston, an environmental philosopher at Colorado State University, describes the need for the above changes in the context of a society that has just gone through the most remarkable century of development the world has ever seen, or will ever see again. The development activities of this remarkable century, Holmes argues, are not sustainable from a world ecosystem viewpoint. This viewpoint is requiring that society shift its behavior from a development orientation to a sustainable orientation. At this year's South Platte Forum, we heard about a society attempting to make that change. It won't come easily or quickly, but it is beginning. The huge natural resource management "ship" is beginning to change directions and there is a lot of creaking involved.

While we see agencies and organizations within the South Platte basin seeking new approaches to watershed management, we also see Congress seeking to reauthorize the Clean Water Act, the Safe Drinking Water Act, and Superfund and Endangered

Species legislation. We see universities facing the fact that many of their natural resource educational programs are oriented around narrow disciplines that emerged during the "development" century. They are now seeking ways to educate students in a more integrated manner without losing the in-depth knowledge that will be needed to confront and solve future, complex water problems. And, as I discussed in the last editorial, CWRRI is seeking a new format for its research program to better match the emerging needs of water managers operating in this integrated management system.

Thus, I walked away from the South Platte Forum this year feeling that change is being accepted in the way we manage water in Colorado. There is still, however, a tremendous amount of work ahead to determine exactly how this change will occur in a fair and equitable manner. It is a very exciting time to be involved in Colorado's water management system, but it is also a time that will require the very best from all of us as we seek a more sustainable basis for managing Colorado's water in the future.

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Robert C. Ward, Director

2ND ANNOUNCEMENT

COLORADO WATER RESOURCES RESEARCH INSTITUTE REQUEST FOR PREPROPOSALS

CLOSING DATE: January 10, 1994

Preproposals are invited for the Colorado Water Resources Research Institute FY1994-95 water research program. CWRRI is especially interested in projects that feature collaboration between university researchers and water management organizations. Demonstrating collaboration in the preproposal stage will enhance the possibility of an award. Highest priority will be given to projects that address Colorado's most critical water problems as identified by CWRRI's Research Planning Advisory Committee:

- Nonpoint source pollution control -- voluntary or regulatory approaches?
- Agricultural water conservation -- myth or reality?
- What are the economics of ecological integrity?
- Integration of water quantity and quality management in Colorado -- feasible? How?
- Interstate water marketing -- quantifying impacts on Colorado
- Water information for the public -- how can we make it meaningful, interesting, and informative?
- Integrated watershed management -- what does it mean to Colorado?
- Are we prepared for a drought?
- Basin of origin protection -- do the water courts need additional guidance regarding what to consider in evaluating out-of-basin water transfers?
- What is the quality of Colorado's groundwater?

The Colorado Water Resources Research Institute (CWRRI) has, for many years, funded individual faculty to study rather specific and narrow research questions. The lack of basic knowledge about water behavior, movement, quality, and impacts led to this research strategy. More recently, there are indications that knowledge synthesis (integrating existing knowledge to answer broader management questions) is an increasingly important focus for water "research." These indications come from evolving shifts in water management that now employ such concepts as "integrated watershed management" involving "ecological integrity" goals. Within such concepts, information needs are developing around agricultural water conservation, basin-of-origin protection, integrated water quality and quantity management, and informing the public about water management activities and results.

During this next cycle of CWRRI's water research program, in addition to basic research proposals, proposals that involve a number of faculty attempting to integrate knowledge that supports a better understanding of broader water management issues will also be sought. The goal is to have a blend of individual and group projects for 1994/95, all focused directly on the needs of Colorado's water managers, users and citizens.

The proposals that attempt to synthesize knowledge must involve a group of faculty (and water managers/users) so that something like a "White Paper" on the topic can be developed. Such a product is designed to be readily useful to Colorado's water managers. Furthermore, it is desired that such groups of faculty, as part of their deliberations, also prepare a follow up proposal to seek additional funding from sources other than CWRRI. CWRRI monies are being used to direct faculty attention into those areas of investigation critically important to Colorado, realizing that CWRRI's funding levels cannot, of themselves, fund the level of research needed to adequately address the complexity of many of these issues.

Project Duration: Awards will be made for one year beginning July 1, 1994.

Funds Available: For 1993-94 CWRRI awarded 12 projects with direct costs in the range of \$10,000-20,000. Without additional funding, 1994-95 awards will be similar.

Indirect Costs/Cost Sharing: If additional funding for CWRRI's research program is obtained, cost sharing may be required of the principal investigator. Indirect costs must be provided as a contribution by the performing institution. Do not show indirect costs in this preliminary, direct-cost budget estimate. Financial arrangements for projects will be negotiated after successful preproposals have been identified.

Review Procedures: Preproposals will be evaluated by the Technical Advisory Committee (faculty of CU, CSM and CSU) and by the Research Program Advisory Committee (practitioners). Authors of preproposals judged to have a strong chance of final award will be invited to prepare full proposals. Criteria of selection include: (1) the ability of the proposed research "product" to be readily useful to Colorado's water users and managers; (2) relevance of research product to priority Colorado water problems; (3) scientific merit; and (4) performance record of principal investigator.

Eligibility: Open to regular, full-time faculty of Colorado State University, the University of Colorado and the Colorado School of Mines. **For Instructions and Preproposal Format** contact your Contracts and Grants office or call CWRRI (491-6308).

WATER RESEARCH

CWRRI PARTICIPATES IN REGIONAL STUDY ON THE EFFECTS OF SEVERE, SUSTAINED DROUGHT

Systematic river flow measurements in the Colorado River Basin began only a little over a century ago. However, tree ring studies of the period prior to the formal records suggest that droughts of extreme duration and magnitude probably occurred in the basin during earlier centuries. The most serious of these periods was a 38-year drought between 1579 and 1616. In the present century, the southwestern states have come to rely on near normal Colorado River flows, and when severe drought returns to the region, significant economic, social and environmental impacts can be foreseen.

A consortium of the water research institutes in the Colorado River Basin states, aided by funding from the US Geological Survey and Corps of Engineers, is in the second phase of a study to determine the impacts of such a severe, sustained drought (SSD). The analysis is being conducted by an interdisciplinary, interstate team from the Universities of Arizona, California, Colorado, Nevada and Wyoming plus faculty at Colorado State and Utah State Universities and the Boulder, Colorado-based consulting firm, Hydrosphere, Inc. Included on the team are engineer/hydrologists, tree ring scientists, environmentalists, lawyers, economists, sociologists and specialists on public administration. Robert A. Young, Emeritus Professor of Agricultural and Natural Resource Economics, has represented CSU on the team. Early in 1993 he took over responsibilities as Technical Coordinator of the study, and will serve as editor of the final project reports.

Taking the present-day configuration of the storage and diversion structures and the economic conditions in the basin as the base-point, the general objectives of the study are three:

- assess the hydrologic impacts of a Severe, Sustained Drought (SSD);
- forecast the economic, social and environmental impacts on the southwestern United States, and
- assess alternative institutional arrangements for coping with a SSD.

The project is proceeding by first predicting water availabilities at key locations in the basin during a representative severe, sustained drought. (The representative drought is patterned after the 38-year dry period identified by the tree ring studies.) Concurrently, socio-economic conditions in the region for future decades are projected. These hydrologic and socio-economic projections form the basis for the impact assessment and the institutional analyses that are the primary objectives of the study.

The second general set of tasks is to estimate damages or impacts from droughts on economic sectors (including both

instream and offstream beneficiaries), social considerations and the environment.

A third, concurrent component is a legal and institutional assessment, designed to identify and investigate alternative legal and organizational arrangements which could be used to increase capacity for preparing for a coping with SSD.

All of these results are then incorporated into two complementary types of interdisciplinary modeling assessment exercises. One exercise is a computer optimization which evaluates economic impacts on instream and offstream water users of alternative policy instruments.

The second modeling exercise is a dynamic "gaming" phase, in which an interactive computer program representing various basin interests is developed. Researchers, acting in the role of "water managers" who represent various state and federal interests, respond to an unfolding drought scenario and interact with each other collectively, applying and changing management rules under which the river is managed.

SOME PRELIMINARY FINDINGS

Preliminary findings were presented recently at the 1993 annual conference of the American Water Resources Association in Tucson, Arizona. A final report on the study will be submitted in early 1994.

Early results suggest that a strict application of the existing institutional arrangements may not be the best way to cope with a severe, sustained drought in the Colorado River Basin. In particular, strict adherence to the Lower Basin's delivery requirements embodied in the present "Law of the River" would impose severe impacts on the states other than Arizona and California.

The models predict that, under present institutional arrangements, water available from storage in Lake Powell and other major Upper Basin reservoirs would be reduced to zero and Lake Mead nearly so after two decades of sub-normal flow. Water available for consumptive use in the Upper Basin is seen to fall to less than half of normal levels. In economic terms, the largest impact would be on the loss from electricity sales. This category accounts for about two-thirds of the basinwide losses; net economic value of hydropower sales could fall by over \$1.6 billion annually, 90 percent from normal levels. Municipal/industrial benefits would fall by more than one-third from normal levels, while agricultural benefits would also slip. Recreational benefits would decline significantly, and salinity, the basin's most important water quality measure, would cause adverse effects.

Subsequent analyses have studied the effects of changing the institutions governing basin water allocation. (For example, present rules appear to give little attention to hydropower interests.) A coordinating council of basin interests is one proposed option. Interstate water banking and water markets incorporating instream and offstream beneficiary groups are other approaches under study.

Because of the large geographic scale and technical complexity of the problem, and the limited resources and time available to the research team, the results must be considered as preliminary

and tentative. The research team hopes to continue their unique collaboration, and to refine and extend the study over the next several years.

Present and former Colorado-based researchers have played an important role in the modeling effort. Hydrologic impact modeling of the drought scenarios was performed by Ben Harding of Hydrosphere, Inc. in Boulder, Colorado. James Booker, former CSU doctoral and post-doctoral researcher, continued his economic impact work at the University of Wyoming.

In August, CWRRI's Research Planning Advisory Committee was polled to determine top-priority research issues for the 1994-95 water research program. Drought was ranked as one of the top ten priority issues selected by committee members. The following material was prepared to give COLORADO WATER readers some idea of Colorado's recorded drought history.

WHAT CAUSES DROUGHT?

Droughts are caused by several factors, mostly weather. The immediate cause of drought is sinking air, which causes high pressure. Clouds are then unable to form in these high pressure regions, resulting in lower humidity and less precipitation. Droughts that last for several years are usually caused by large-scale disturbances in atmospheric circulation patterns, persisting for long periods. El Nino and the Southern Oscillation are major contributors to weather patterns all over the world. El Nino is the name given to warm ocean surface temperatures, usually in the western Pacific Ocean, that move east toward South America. Its counterpart, La Nina, is the occurrence of strong easterly winds that move cold, deep ocean water from the eastern Pacific to the west.

Usually, El Nino events cause plentiful winter rain in the United States, while La Nina events cause drought. The 1987 drought was associated with La Nina, which caused conditions favorable for a strong high pressure ridge to develop along the West Coast and low pressure on the Pacific Ocean. This caused a split jet stream, so the midwestern and southern states received little precipitation.

Researchers have also found that human activity appears to affect weather. Overgrazing grasslands, plowing prairies, irrigating fields, clearcutting forests and constructing man-made lakes are just a few examples.

Predicting Drought -- According to the Office of Hydrology, National Weather Service, existing knowledge and technology cannot be used to forecast the onset or extent of a drought because the beginning of a drought is ill-defined and slow to develop. The climate parameter important in the development of a drought -- below-normal precipitation -- is difficult to predict. Ongoing monitoring of weather, hydrologic, and agricultural conditions eventually indicates drought at some time after it begins. However, if scientists could predict El Nino events, weather all over the world could be predicted with much greater accuracy than now.

Drought Consequences -- Drought causes an average \$1.2 billion annual loss in the United States. Drought also causes environmental impacts, especially to animals, plants and fish. Water and air quality are also degraded during a drought because of the dust concentration associated with it.

Sources: Special Drought Issue, *Closed Circuit*, Western Area Power Administration, 1/25/93; Federal Efforts to Monitor and Coordinate Responses to Drought, June 1993, GAO/RCED-93-117.

HOW HAS DROUGHT AFFECTED COLORADO IN THE PAST?

The boundaries of the Dust Bowl were not precise, but its general location encompassed the area where drought and wind erosion hazard were the worst -- a 97 million-acre section of southeastern Colorado and northeastern New Mexico, western Kansas, and the panhandles of Texas and Oklahoma.

Tree rings show times of wet seasons and drought, and when compared to early records and recent geological research, they seem to confirm that long-standing droughts have occurred in the West. Although some scientists are skeptical of this new research, tree ring studies in the Great Plains indicate that during the 748-year period prior to 1958, 21 droughts occurred which lasted five or more years, with recurrence every 35.7 years. During that time, the average drought lasted 12.8 years. A drought of 10 or more years came every 55.6 years. With these droughts came dust storms, which were not unique to the 1930s.

The drought of the 1860s ranked in severity with that of the 1930s, with rainfall in some areas of the Great Plains averaging 10 to 11 inches below normal. A dust storm on April 5, 1860 was so severe that "...it was impossible to distinguish objects at the distance of a dozen yards," according to the *Fort Scott (Kansas) Democrat*.

On February 19, 1870, the *Junction City (Kansas) Union* reported that "...a great deal of Kansas is not located where it used to be. Some of it we have no doubts is located in South America, while some covers the British possessions."

Dust storms recurred periodically during the 1880s, and probably the worst dust storm of the 19th century swept across the Great Plains in March, 1880. It obscured the sun at 10:00 a.m. and drifted soil 1 to 2-1/2 feet deep at Howard, Nebraska. In January 1883, Las Animas, Colorado had four dust storms. And in 1894, with precipitation at 63 percent of normal, once again the dust storms came. Several of the storms were so intense that trains were stalled until crews with snow plows and scoop shovels could clear the drifted sand. On April 9 a fierce sand storm in northeastern Colorado and southeastern Wyoming killed an estimated 20 percent of the range stock. The 1894 drought coincided with a national depression, and many were forced to abandon their farms and leave the area.

In 1890, only 5,762 farms and ranches existed in a 22-county area in the Dust Bowl portions of Kansas, Colorado and Texas, averaging 256 acres. By 1920 the average farm increased in size to 771.4 acres, and the amount of land in farms rose from 38.9 percent to 68.4 percent of the total land area.

Following the first World War, wheat acreage expanded 200 percent between 1925 and 1931. Much of this expansion in the southern plains went unnoticed, but increased tillage and expansion of farm holdings were often made at the expense of wise land-use practices.

Rainfall in the south-central Great Plains was below normal from 1910 to 1918, and as a result the dust began to blow again. The drought caused the wheat crop to fail in 1911 and 1912, and little root system remained to hold the soil against the wind.

Some people argued that dust storms were actually beneficial to agriculture -- with the top soil blown away, the dirt on the surface was virgin soil and therefore more productive. Farmers as well as others would make this same false assumption during the 1930s.

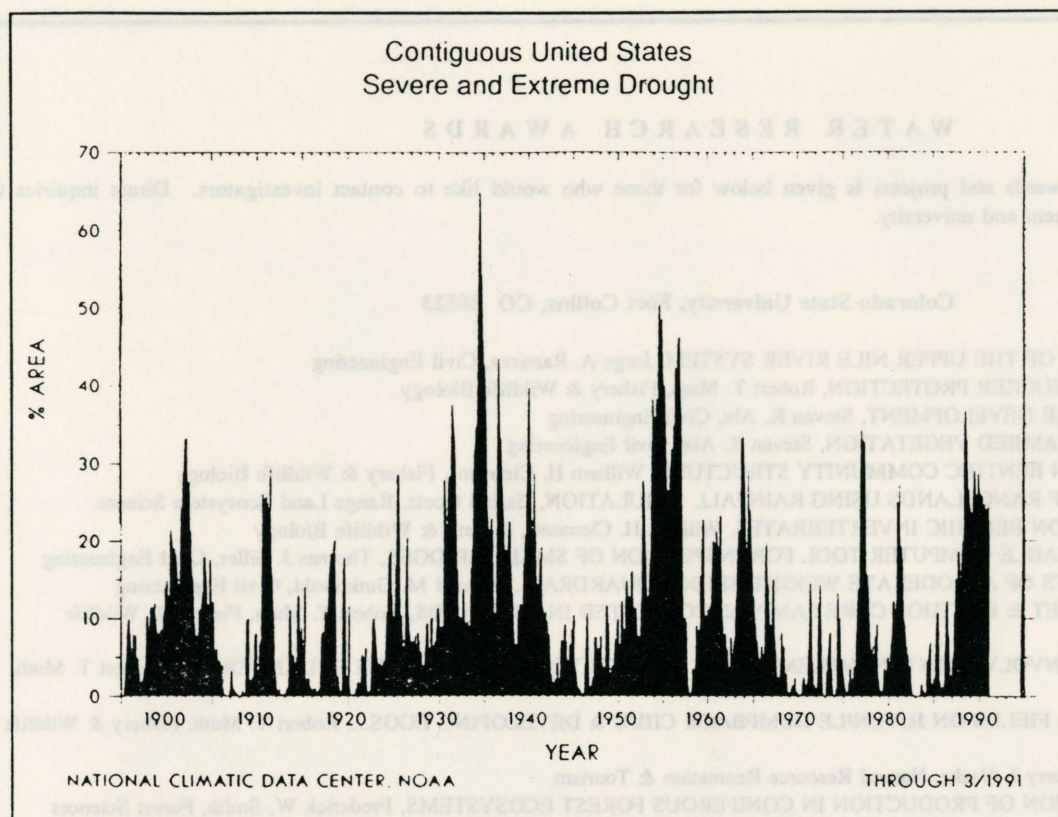
In April 1934, Baca County, Colorado experienced a dust storm with winds of 50 miles per hour that obscured the sun for six days and forced residents to remain indoors with wet towels muffling their faces. On April 14, 1935, Sunday worshippers sought divine deliverance from the drought, then entering its fifth year. But at that very time a high pressure system was sweeping southward across eastern Colorado and western Kansas, lifting the soil as it went. By the early afternoon it had created the most awesome "black blizzard" the people of the Dust Bowl would experience in the 1930s.

The consecutive drought years of 1930-1937 resulted in a total deficit of 540,000 acre-feet of water in the Poudre Basin alone. One-third of all farms in Larimer County were put up for sale, with 44 percent of the crop acreage abandoned.

By 1940 the return of a wet cycle ended Dust Bowl storms, but the average farmer had been made acutely aware that he had to change his agricultural methods, and in order to halt the dust storms completely, grazing lands had to be restored. Yet, by the end of the '40s so much land had been plowed in eastern Colorado, west Texas and western Oklahoma that not enough grass remained to anchor the soil in case a prolonged drought returned.

By mid-January 1950 several areas in Colorado were blowing badly -- the approach of another drought was apparent. Rain did not come, and the agricultural situation was critical. Wheat losses were estimated at more than 7 million bushels with a monetary loss at over \$14 million in a seven-county area in the heart of the Colorado Dust Bowl. In March 1954, the Colorado legislature passed a stringent wind erosion law that set up a \$1 million emergency fund for Colorado's Dust Bowl farmers. The USDA, on a national level, allotted \$2.5 million to the Dust Bowl states for emergency tillage, with an additional \$12.5 million soon forthcoming.

By March 1955 wind erosion had damaged about 4.7 million acres, two-thirds of which was located in eastern Colorado. The damage was caused by inadequate vegetative cover, lack of crop residue and insufficient moisture. With the situation growing progressively worse, the USDA released additional funds for emergency tillage. During 1955, the USDA also modified its agricultural conservation program by providing a cost-sharing program to shift crop lands out of production. Two years later,



Although drought and erosion in the '50s affected a larger area than during the '30s, conservation techniques implemented during the previous two decades in most areas prevented a return to the conditions of 20 years earlier. And, fearing the return of prolonged drought and Dust Bowl conditions, many farmers turned increasingly to irrigation to ensure good harvests. Irrigation changed the nature of Dust Bowl agriculture, while creating another potential problem -- exhaustion of the underground water supply.

The '50s also brought dynamic expansion and growth along the Front Range corridor, increasing the demand for supplies of municipal water. At that time, nonagricultural uses of treated water in the Front Range area required deliveries totaling about 540,000 acre-feet per year. Drought again came to Colorado in 1976-1977, with 48 percent of normal precipitation on the West Slope and a spring runoff only 50 percent of normal. The ski industry suffered a \$78 million loss, agriculture, was hit hard, and many cities instituted restrictive water policies.

In early 1977, Western governors assembled a group called the Western Region Drought Action Task Force, to be headquartered with the Western States Water Council in Salt Lake. The task force, chaired by Colorado Governor Richard Lamm, eventually included 21 states. Each of the states named a drought coordinator, and a task force representative was assigned to Washington, DC to work closely with a White House drought coordinator. Western governors designated the Western States Water Council as the lead agency for regional

as the drought was ending, the federal government also provided a deferred grazing program to help ensure adequate protection for grazing lands. Under that program, farmers and ranchers in the drought area could receive federal dollars equal to the fair rental value of their land in exchange for not grazing livestock.

drought policy. The Council found that, while Western states responded well to the drought crisis, much government effort "might be better categorized as relief activities." Believing that preventive action could be more effective in mitigating the impacts of drought, the Council recommended that states "prepackage" drought response plans.

In the next issue of COLORADO WATER we will review drought conditions from 1981 to date and what responses are in place for mitigation purposes.

SOURCES:

The Dust Bowl: An Agricultural and Social History, by R. Douglas Hurt, 1981.

Drought Network News, June 1991.

About Drought, Colorado Division of Disaster Emergency Services, Oct. 1989.

Western State Drought Management, Prepared by staff of Western States Water Council, Oct. 1986.

A Model for Western State Drought Response and Planning, Prepared by staff of Western States Water Council, Oct. 1987.

Colorado Front Range Project, Initiated by Governor Richard Lamm in November, 1979.

WATER RESEARCH

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

MODELING AND SIMULATION OF THE UPPER NILE RIVER SYSTEM, Jorge A. Ramirez, Civil Engineering

SAMPLING FOR RAZORBACK SUCKER PROTECTION, Robert T. Muth, Fishery & Wildlife Biology

STREAM CONTROL STRUCTURE DEVELOPMENT, Steven R. Abt, Civil Engineering

SEDIMENT LOADING ON STREAMBED VEGETATION, Steven R. Abt, Civil Engineering

LONGITUDINAL VARIATION IN BENTHIC COMMUNITY STRUCTURE, William H. Clements, Fishery & Wildlife Biology

HYDROLOGIC ASSESSMENT OF RANGELANDS USING RAINFALL SIMULATION, Harold Goetz, Range Land Ecosystem Science

EFFECTS OF HEAVY METALS ON BENTHIC INVERTEBRATES, William H. Clements, Fishery & Wildlife Biology

IMPLEMENTATION OF A PORTABLE COMPUTER TOOL FOR INSPECTION OF SMALL BRIDGES, Thomas J. Siller, Civil Engineering

DYNAMIC IMPACT LOAD TESTS OF A MODERATE WEIGHT BRIDGE GUARDRAIL, Richard M. Gutkowski, Civil Engineering

PROCESSING OF PLANKTON-NET & BENTHOS CORE SAMPLES COLLECTED IN WETLANDS, Robert T. Muth, Fishery & Wildlife

Biology

LARVAL FISH LABORATORY INVOLVEMENT IN IMPLEMENTING RECOVERY ACTIONS FOR THE ENDANGERED..., Robert T. Muth, Fishery & Wildlife Biology

EFFECTS OF ELECTROFISHING FIELDS ON JUVENILE HUMPBACK CHUB & DEVELOPING EGGS..., Robert T. Muth, Fishery & Wildlife

Biology

ANGLER HARVEST SURVEY, Jerry J. Vaske, Natural Resource Recreation & Tourism

CONTROLS ON THE ALLOCATION OF PRODUCTION IN CONIFEROUS FOREST ECOSYSTEMS, Frederick W. Smith, Forest Sciences

EFFECT OF NITROGEN AVAILABILITY ON THE RATE OF RANGELAND RECOVERY, Edward Redente, Range Land Ecosystem Science

QUALITY ASSURANCE SUPPORT FOR THE NATIONAL ATMOSPHERIC DEPOSITION PROGRAM, David S. Bigelow, Natural Resource

Ecology Lab

WEIR AERATION STUDY, James F. Ruff, Civil Engineering

DEVELOP CLASSIFICATION AND MONITORING SYSTEMS FOR THE THUNDER BASIN GRASSLANDS, Harold Goetz, Range Land

Ecosystem Science

ANALYSIS OF GREEN AND COLORADO RIVER LARVAL FISH SAMPLES, Robert T. Muth, Fishery and Wildlife Biology

EVALUATION OF BIODEGRADABLE PROTOTYPE BEADS FOR PASSIVE DRIFT STUDIES, Robert T. Muth, Fishery and Wildlife Biology

FISH SAMPLING IN WHIRLPOOL CANYON, Robert T. Much, Fishery and Wildlife Biology

POPULATION MODELING, Gary C. White, Fishery & Wildlife Biology

University of Colorado, Boulder, CO 80309

DESIGN RELIABILITY FOR ESTIMATING COSTS OF PILE FOUNDATIONS PHASE 3: IMPLEMENTATION AND GENERALIZATION,

George Goble, Civil, Environmental and Architectural Engineering*

BIODIVERSITY OF OPEN SPACE GRASSLANDS AT A SUBURBAN/AGRICULTURAL INTERFACE, Carl Bock, Environmental, Population and Organismic Biology

TEMPERATURE, OZONE, NITROGEN OXIDE EXPERIMENT, David Rusch, Laboratory for Atmospheric and Space Physics

PROJECT ARCC: ANALYSIS OF RAPID AND RECENT CLIMATE CHANGE, Jonathan Overpeck, Institute of Arctic and Alpine Research*

UCE-PROXIMAL PALEOCLIMATES AT THE WISCONSIN-HOLOCENE, Scott Elias, Institute of Arctic and Alpine Research

DELTA-D AND DEUTERIUM EXCESS MEASUREMENTS ON THE GISP II DEEP ICE CORE, Mark Meier, Institute of Arctic and Alpine

Research

CONCEPTUAL PLANNING FOR INTEGRATED ANALYSES (INTEGRAL) OF WATER RESOURCE SYSTEMS AND POWER OPERATIONS,

Edith Zagana, CADSWES, Civil, Environmental and Architectural Engineering*

*Indicates additional funds and/or extension of date

FEATURES

A VISION OF THE SOUTH PLATTE

by

Lloyd Walker

Extension Agricultural Engineering

The annual South Platte Forum was just completed. This year the Forum discussed agricultural water quality issues in addition to the broader water issues in the basin. Such conferences always provide insights on future policies and issues, and I will share my impressions with you. While the focus is on the South Platte, the points often apply statewide.

■ One of the most thought-provoking ideas is that our method of water allocation may need re-thinking. Treating water as a property right and allocating it by the doctrine of prior appropriation has served Colorado well. The South Platte basin is home to two million people and some of the most productive agricultural land in the country. Success of our water allocation system cannot be disputed. However, that success is initiating the rethinking process. A more urban, environmentally oriented population considers water use for recreation, wildlife, and minimum stream flows as important as agricultural production. Therefore, a mechanism to recognize the value of all uses of water in the basin, while respecting the existing systems for water allocation, is needed.

■ Federal involvement in basin activities continues to increase. Enforcement of the Endangered Species Act, the Clean Water Act reauthorization, and facility licensing by the Federal Energy Regulatory Commission and the U.S. Forest Service are just a few examples of the intensifying level of federal involvement. Future activity at the federal level will impact water use and allocation issues basinwide.

■ The current debate on the reauthorization of the Clean Water Act focuses on nonpoint source pollution. Agriculture is recognized as the largest nonpoint source contributor. The focus of the nonpoint source debate is whether voluntary or regulatory "Best Management Practices" (BMPs) work best. Some form of regulation may be likely. However, success of regulation depends on acceptance by those being regulated. Cooperative Extension is developing a program of localizing BMPs for agriculture. By this approach, BMPs, which may become regulations, are determined by a local BMP committee composed of interested agricultural producers. This is similar to existing local groups that address grazing, soil conservation, etc. Giving those regulated a voice in developing the regulations should result in more practical, acceptable regulations.

■ Municipalities in Colorado which rely on groundwater for drinking are very interested in agricultural BMPs. They may adopt them as part of a municipal wellhead protection program. Such a program delineates an area around a

municipal well which influences the quality of the well water. In this area, BMPs may be mandated.

■ An integrated watershed protection approach to water pollution is being promoted by EPA and other federal agencies. By this approach, an entire watershed is viewed holistically in assessing water quality problems. One key aspect of such an approach is assessing the water quality in a watershed.

In the South Platte, assessment of the water quality is being done by several agencies. The consensus at this time is:

- Nitrate is the pollutant of concern.
- The reach of the river between Denver and Greeley has nitrate in groundwater in concentrations up to 40 ppm.
- Nitrate contributions from Denver Metro wastewater are inconsequential.
- Agriculture as an industry is likely responsible for the nitrate pollution.
- Significant nitrate contributions are from human and animal manure. Feedlots are the most likely source.
- The problem of feedlot manure is in the method of disposal rather than the feedlot itself (i.e., over-application on agricultural land).

By the above analysis, a watershed approach would focus on agricultural practices, especially feedlot operations. Fortunately Colorado has legislation and programs in place to address the issue. This includes Senate Bill 90-126, the Colorado Agricultural Chemicals and Groundwater Feeding Regulations. Through these programs, Colorado can demonstrate it is addressing the problem and does not need EPA's oversight.

■ In the South Platte basin, there are proposed and ongoing activities funded by EPA. These include the Northern Colorado Water Conservancy District Irrigation Management Program and the Lower South Platte Water Conservancy District Water Quality Monitoring Program. Proposed for this year is the Central Colorado Water Conservancy District FIDCO demonstration program to develop resource management plans for producers on the Farmer Independent

Ditch Company (FIDCO). Cooperative Extension also is proposing a program to recover and dispose of banned and unusable agricultural pesticides. Another source of program funds is the USDA Water Quality Initiative program which is funding the South Platte nitrogen project. In this project, Extension is demonstrating new methods and technologies for nutrient management.

The overriding reality of the South Platte is that human activity has completely redefined the river. Prior to non-native human habitation, the South Platte River had virtually no riparian forest and no minimum stream flows. The spring floods on the river gave way to a dry river bed in the summer. The sand and gravel of the alluvial aquifer were in place but not full of water. By eliminating the buffalo, diverting water from the West Slope, and building reservoirs and canals, humans have

created the river environment as we know it today -- increased water volume, perennial flows, a shallow water table, a cottonwood- dominant riparian forest, and wildlife adapted to such an environment. It also has problems of nitrate contamination, rampant noxious weeds, and high salinity as it exits the state. As a state, we have come to accept the positive elements created, but now need to address the problems which also were created.

From the forum, I formed a vision for the South Platte: (1) an enhanced riparian forest habitat accessible by the public for various recreation uses; (2) a sustainable highly productive environmentally sound agriculture; (3) urban areas which value and respect the South Platte as an irreplaceable resource; and (4) an integrated approach to water resources management and problem solving in the basin.

THE USGS NAWQA PROGRAM: IMPROVING THE INFORMATION BASE FOR INTEGRATED DECISION-MAKING IN THE PLATTE RIVER WATERSHED

by
Greg Silkensen

In 1991 the U.S. Geological Survey (USGS) began to implement its National Water Quality Assessment (NAWQA) program. The program was undertaken because of the national need for information about the quality of the nation's water resources. During the past two decades significant strides in the protection and enhancement of water quality have been made, but information is not available to answer rather fundamental questions: Are national water quality goals being met? How effective have past efforts been? How should limited finances be allocated among competing water quality problems?

A critical factor in understanding water quality is the ability to make comparisons within and among watersheds through time. Nationally consistent and comparable information is needed to make valid conclusions about current water quality conditions and changes in these conditions. Water quality in a basin or watershed is a product of its environmental setting. Natural conditions such as physiography, climate, geology, and soils affect ambient water quality, as do anthropogenic factors such as land and water use, population, and water management practices. The relative effects of mining, urban, and agricultural water and land uses on water quality are poorly understood. The interrelationship of surface water and groundwater systems and the chemical and biological processes that affect the transport of water constituents also needs to be addressed. In most of the nation's watersheds this type of comprehensive and integrated information is not available.

The U.S. Geological Survey's NAWQA program is designed to support these information needs. Long-term goals of the program are to describe the status and trends in the quality of a large, representative part of the nation's surface water and groundwater resources and to provide a sound, scientific

understanding of the primary natural and human factors affecting the quality of these resources.

NAWQA studies are currently underway in 20 watersheds across the United States, with the second phase scheduled to commence in 1994. The South Platte River in Colorado and the mainstem of the Platte River in Nebraska are both included in the current NAWQA case studies. It is hoped the results will furnish uniform and useful data, create a more holistic view of the Platte River watershed, and provide answers to current and pertinent questions facing the watershed.

Certainly there is no shortage of questions to be answered and controversies to be resolved. One example is a current proposal by the U.S. Fish and Wildlife Service (FWS) which would require six Colorado Front Range entities with mountain reservoirs in the Arapaho and Roosevelt National Forests in the South Platte basin to release water to help preserve wildlife habitat in Nebraska. The habitat of the pallid sturgeon, whooping crane, least tern, and piping plover in central and eastern Nebraska is threatened by low flows in the Platte River. The wildlife use the Platte River and its shoreline for habitat, nesting, and migration.

The FWS claims the Colorado reservoirs, which store water during peak spring runoff, threaten the wildlife habitat by depleting the river's flow. Permits issued by the USFS for operation of the reservoirs are up for renewal, and require FWS biological opinions. The FWS has issued the biological opinions on several of the water projects, and has recommended the water releases. The affected reservoirs are operating on temporary USFS permits until the environmental review is completed. Colorado water users are critical of the FWS proposal. They claim the reservoirs have little if any

impact on Platte River flows in Nebraska, and that the responsibility of solving the problem should not be borne solely by a few Front Range water projects.

This controversy is an excellent example of a problem the NAWQA study units will be expected to supply data to and ultimately help resolve. The problem of low flows on the Platte River in Nebraska is a complex one. There is no doubt the practice of storing high spring runoff along the Front Range in Colorado needs to be examined. But other factors also need attention, such as historical flows in the river system before and after storage reservoirs existed, water diversion and groundwater aquifer pumping along the Platte River in Nebraska, and water use and storage along the North Platte in

Wyoming. NAWQA's goals include providing comprehensive, integrated information on watersheds and river systems. Resolution of this controversy along the Platte River requires just such an approach.

(NOTE: The Rio Grande is also a current NAWQA study unit and the Upper Colorado River will become one in the next round of studies beginning next year.)

Sources: *Water Resources Bulletin* (AWRA) July/August 1993; *GAO Report: NAWQA, Geological Survey Faces Formidable Data Management Challenges*, June 1993; *Denver Post* 10/23/93, 10/28/93; *Fort Collins Coloradoan* 10/27/93

LEGAL ISSUES ASSOCIATED WITH AN INTEGRATED WATERSHED MANAGEMENT APPROACH

by

Judge Robert Behrman

Presented at the South Platte Forum, October 27-28, 1993, Fort Collins, Colorado

It is really a pleasure to be here today. I see a number of familiar faces that we see in our water court in Greeley from time to time. I am sorry that I wasn't able to join you yesterday; particularly because I gather there was a discussion between Ms. Bates and Mr. Raley that ties into my subject. I have been conducting a bit of research on my own and I have just returned to court. It is a matter of some interest to me that the State of Hawaii is the only western state that does not have the Prior Appropriations system. I went over there to check up on that. I am sorry to say that the folks on the beach didn't know why. In any event, I wish that I could have been here yesterday.

In the program that I received, this is denoted as a keynote speech. In political conventions you rally the cause and tell the attendees that only hard work is necessary to bring the party to a successful electoral conclusion. I am sorry to say that my talk today is the reverse of that. My general theme will be that the existing water law is not, in my opinion, conducive to an integrated watershed management approach. I am a judge and not a legislator, so I am talking about "what is" in my view and not "what should be."

The basic problem, from a legal point of view, of an integrated water management approach is that the laws concerning water are not themselves integrated. We have in the South Platte River basin two systems of law that govern matters: federal law and state law. Federal law is superior, because the Constitution of the United States takes precedence over state law. There is no integrated federal water law. There is no United States water code of any nature, and matters covering water are scattered through a great many acts. The Clean Water Act, the Endangered Species Act, the Wild and Scenic River Act, and others all cover water in a piecemeal manner. I must admit that our court does not have too many federal cases. Although the United States occasionally has to litigate in our court, as was true recently, I think that they don't care

particularly for that, although we try to be fair to all concerned. I really say that seriously, because at my bench we have the flag of the United States as well as the flag of the State of Colorado, and I try to remember that.

In any event, federal law is not an integrated body of law, and the federal agencies that administer these laws do not take what is, in my mind, an integrative approach in their own fields. This was brought home to me in the reserved rights case that we had concerning national forests. This was one of the cases in which the United States litigated in our court. One of the main issues was stream channel maintenance. The United States Forest Service presented very interesting evidence on that point, and in the course of the evidence pointed out methods that they thought were examples of exactly how channel maintenance should not be attempted. Their examples all involved the work of the United States Army Corp of Engineers. It seems that it is not possible to have integration even under federal law when the federal agencies are each out after their own ends. I don't think that this perspective is particularly susceptible to application to an integrated watershed management approach.

Now, federal law is superior, but it is less unified than state law. Federal law generally covers instream matters, matters of supply and so forth. The distribution of water is primarily within a state (not only within Colorado but the national pattern) and the subject of state law. States generally are charged with the responsibility, and have under their sovereign authority the ability to administer and to govern the distribution of water within their borders. Here in Colorado, the law finds its basis in the Constitution of the State of Colorado, and there are two sections that are particularly important. I will read them:

Article 16 Section 5: "...the water of every natural stream, not here before appropriated within the state

of Colorado is hereby declared to be the property of the public and the same is dedicated to the use of the people of the state, subject to appropriation that is hereinafter provided."

That does not sound too bad from the point of view of a basin-wide integrated management idea. The most quoted language from the Constitution of the State, heard over and over again and seen in Colorado Supreme Court decisions over and over again, is:

"...the right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied."

That, of course, leads to an individualized approach to the withdrawal side of watershed management. The history has been (and what the statute appears to be aimed at) a matter of individual initiative. Individuals, not only individuals in the sense of particular persons but also municipalities, water districts, and irrigation companies each will be looking after their own interests and making appropriations as they see fit.

Colorado's language about the right to appropriate water is the strongest language in the Constitution of any state in the Union. Most western states have something similar to that but in every other case there are some conditions, i.e. subject to public interest, etc. However, that is not present in the Colorado Constitution. Colorado is unique in that no permit is required before making a surface appropriation. The situation is somewhat different with wells because well permits are required. There is no prior permit required to make an appropriation of surface water. Colorado's theory is that it is made by initiating appropriation, which the court does not grant the right to do, but confirms that it was done by a conditional decree. When water is placed to beneficial use, the court does not permit the beneficial use, but merely confirms that it has taken place and recognizes that the decree is complete.

This whole system is aimed at a plan of individual initiative. It seems to me that the whole scheme is not well-suited to a plan of integrated management, which in my mind involves some oversight not present in Colorado law. I have played the devil's advocate for a little bit, and I think that we have to admit that the results of the prior appropriation system have not been bad. As we look around we see one of the most fertile and productive agricultural regions in the entire country, based on what has been done under this system. It has transformed what was essentially a semi-desert into one of the most productive agricultural regions in the United States.

About 150 years ago when Hartman was retracing the Oregon Trail (I don't know how many of you are familiar with his book) he recites a situation where they were near the confluence of Cherry Creek and the South Platte River. They wanted to water their horses, but they had to dig holes in the streambed to find any water -- that area now supports a

population of 2 million people. This system is not a failure. In addition, there was a study made some years ago that I will mention, because I am playing devil's advocate. The study was of the Columbia River basin, which is if anything even more complicated than the South Platte basin. The study looked for any empirical evidence (and there again, the control is very fractured) that a unified control system would produce superior results compared to the existing system, which is very similar to the South Platte. The conclusion was that there was no evidence that it would be superior. The unified system, by bringing in bureaucratic control, creates unanticipated results that are not all that favorable.

As I say, I don't think that our water law as presently constituted is favorable to unified control, and that may or may not be a bad idea. I do think that this type of law may have been more applicable to a period when the question was development, because there really is not that much surface water remaining to be appropriated in the South Platte basin. The question is sustainability. I think we are seeing more and more cooperative schemes based not on any sort of legal feat, but by concluding that individual self interest is better served by cooperation than by competition.

The cities of Thornton and Northglenn have an arrangement with the Farmer's Reservoir and Irrigation Company whereby pristine water belonging to the Farmer's Company goes through the city system and then the cities return with a bonus of 10% the treated sewage effluent to the Farmer's Company for use in irrigation. This is not to suggest that all water is suitable for irrigation, but I think there is a lot of water that is suitable for irrigation and not for human consumption. I think this is an approach that is developing, as I say, on the basis of individual cooperation based on self-interest.

The program that we are presently considering (although I can't discuss it in any detail because the matter is not completely resolved in our court), the program undertaken by the City of Thornton in the northern part of this county and Weld County, is in essence the same thing as Farmer's Company, but on a much larger scale -- taking the pristine water to Thornton for use in their municipal system and then returning it for irrigation in this area. This may be a method that has further application as this area's population grows. And if we desire to maintain our agricultural economy, it may be of increasing importance.

The future may be different than the past, but it is going to require legislation to create a unified approach to watershed management. In the last presentation Mr. Wright mentioned that he hoped that as an integrated approach develops, people would not overlook what has accrued in recreation along the South Platte corridor in Denver and surrounding areas.

Similarly, I hope that the benefits that have been achieved under our present system of water law will also not be overlooked.

UNIVERSITY WATER NEWS

Colorado State to Help Upgrade Environment in Newly Independent States of former Soviet Union

Colorado State University has been awarded a portion of a USAID project to be implemented in the Newly Independent States (NIS or ex-Soviet Union). USAID's goal is to provide a catalyst for upgrading the NIS's neglected environment in a way that strengthens the free market economy and democratization in the new coalition of states. The project will:

- Evaluate environmental policies, legislation, regulations and institutions that currently influence or control management of environmental resources and remediation of environmental damage. Make recommendations for additional or revised policies, institutions and legislation if needed.
- Undertake the most urgent environmental remediation or management, if needed, through demonstration projects that apply US-based environmental know-how and technology.
- Enhance public awareness of environmental issues and encourage democratic participation in environmental management.

The broad, general goals outlined above could include such specifics as:

- no-cost and low-cost waste minimization measures by industry and municipalities;
- introduction of environmental revolving funds;
- development of explicit environmental liability policies for privatization;
- introduction of negotiated compliance schedules; and
- working with public and private financial institutions to introduce new environmental financing facilities.

The contract has two main components: a core contract, initially for \$10 million, and a requirements contract. The core contract will include offices in Washington, DC; Moscow, Russia; Kiev, Ukraine; and Almaty, Kazakhstan. The requirements contract calls for a pool of experts to be available for short-term assignments as required. The Request for Proposals included 39 specialties including aspects of engineering, agriculture, sociology, health, law, and management.

The announcement for the project generated over 900 requests for the RFP, one of the largest responses ever. Colorado State University is a subcontractor to CH2M Hill, the prime contractor, and is the lead university for the Consortium for

International Development (CID). The proposal was written by a large team from CH2M Hill with input from several subcontractors. Merle Niehaus, Director of International Research and Development at Colorado State, Ron Curtis, Executive Director of CID, and William Marlatt of CID participated. Marlatt, formerly Professor of Earth Resources at CSU, has spent considerable time in the Newly Independent States, and is familiar with the region's environmental problems.

The project has the active interest of the White House, the Congress and Vice President Al Gore.

Subcontractors participating in the project are: Consortium for International Development (CSU as lead); International Resources Group; International Programs Consortium; Price-Waterhouse; Ogden Environment & Energy Service Co.; Hughes Technical Services Co.; Center for International/Environmental Law; World Wildlife Fund; Interfax News Agency, NIS; Harvard Institution for International Development; Environmental Compliance, Inc.; Ecojuris, NIS; K&M Engineering Consulting Corporation; and Clark Atlanta University & HBCU Environmental Consortium.

John Eckhardt is New CWRRI Associate Director

John Eckhardt has accepted a joint appointment at Colorado State as CWRRI Associate Director and faculty member with the Civil Engineering Department. Many remember John as former Assistant State Engineer in Colorado's Division of Water Resources. In that position he directed the Engineering, Geotechnical, Information Services; Computer Modeling and Simulation; Dam Safety and Hydrological Branches. Most recently he was the Assistant Manager, Water Department, Imperial Irrigation District of California. In addition to the direction of several units, his responsibilities included the creation and direction of a regional drinking water task force, master planning for a regional stormwater district, and the development of a strategic information system plan to integrate a water conservation verification program with water operations.

A native Coloradan born and raised on a farm near Kersey, John brings to his new position over 25 years of experience in the design, construction, operation and maintenance of agricultural and municipal water systems.

John received a B.S. in Civil Engineering with High Distinction from Colorado State University in 1970; a Masters in Civil Engineering in 1976; and a Ph.D in Hydraulics and Water Resources from Colorado State in 1991. He is a registered Professional Engineer in Colorado. He has developed software for water accounting, water operations, water operations scheduling, real-time runoff forecasting, hydraulic control algorithms, and integrated groundwater-surface water river basin models.

A member of several professional societies, John has written and presented numerous papers in his field.

John's CWRRI activities will include working with faculty and Colorado water users to ensure that university research and education is relevant to the water problems facing Colorado. He will also be developing his own research thrusts in the general area of computer modeling, database development and maintenance, and user interface of both models and databases.

CWRRI is very fortunate to have someone with John's experience and knowledge of the Colorado water "landscape."

Colorado State Consolidates Denver Activities

Colorado State's new Center for Continuing Education in downtown Denver provides a well-coordinated program of

educational and technical services to the Denver-metro area.. Located in the Petroleum Building at 16th and Broadway, the newly renovated Center consolidates CSU's Denver activities at one location to serve the public better while enhancing the administrative and fiscal efficiency of such programs. With more than 110,000 workers and a flurry of new corporate activity in the Downtown Corridor, the central business district is an ideal site for Colorado State's outreach center. Included among the goals for the Denver Center are student recruitment, development of partnerships for external funding and research support, training and retraining for the Workforce 2000, technology transfer, and the provision of instructional programs for nontraditional students. Colorado State's Office of Admissions, the College of Business Executive MBA program, Cooperative Extension, Colorado State Forest Service, the Division of Continuing Education, the Children's Trust and the State Board of Agriculture all have offices and classrooms on the 2nd, 3rd and 6th floors of the Petroleum Building.

CEP Takes 2nd Environmental Poll

The Human Dimensions in Natural Resources Unit (College of Natural Resources, CSU) conducted its second Colorado Environmental Poll (CEP) in March and April of 1993. Questions for the 1993 CEP were focused on the concerns and impacts surrounding the passage of Amendment 1 in the November 1992 election, and the limits it placed on state government growth and spending. A key task for policy makers in attending to Amendment 1 will be to balance spending

programs -- to allow some programs to grow, some to remain constant and some to decrease.

Poll questions were designed to determine the public's opinion on whether to increase, decrease or maintain the same spending on environmental programs in Colorado. The results for questions relating to water resources and related issues are as follows:

Should Colorado increase, decrease or maintain the same

...spending on water conservation activities in the state?	Increase - 44%	Same - 47%	Decrease - 9%
...spending on managing fish and wildlife in the state?	Increase - 23%	Same - 61%	Decrease - 16%
...spending on managing state parks?	Increase - 20%	Same - 69%	Decrease - 11%
...spending on protecting endangered species of fish and wildlife?	Increase - 28%	Same - 53%	Decrease - 19%
...spending on protecting prime agricultural land from development?	Increase - 37%	Same - 48%	Decrease - 15%

CEP was established in 1992 to assist decision makers in representing the public interest. Its overall goal is to provide timely information on key natural resource issues that affect citizens of the state. The Poll is conducted semiannually or as needed for special circumstances. For more information, write or call the Human Dimensions in Natural Resources Unit, College of Natural Resources, Fort Collins, CO 80523; TEL: 303/491-6591, FAX: 303/491-2255.

WATER PUBLICATIONS, DATABASES

National Geographic Special Edition "Water: The Power, Promise and Turmoil of North America's Fresh Water" -- This is a collection of articles not to miss. National Geographic's team of writers tackles the issues surrounding water supply, development, pollution and restoration. The poignant photography awakens the reader to the fact that water, *fresh water* is our lifeline. The edition includes articles about buckling down in California; competing interests in James Bay; and the pollution issues surrounding the Mississippi River. "Fresh water is the blood of our land, the nourishment of our forests and crops, the blue and shining beauty at the heart of our landscape...These many scenes, as you add them up, begin to tell a single story. They tell us that a change is coming -- a fundamental change in the way we use, see, and think about water." For information about this special issue, contact: National Geographic Society, 1145 - 17th St., NW, Washington, DC 20036.

National Institutes for Water Resources Publication Database

The National Institutes for Water Resources announces the availability of the NIWR Publication Database containing citations of more than 6500 research products produced between 1984 and 1990 by the 54 Water Resources Research Institutes. The publication database is available on computer disk (DOS-compatible) with a powerful and quick search utility developed by the U.S. Geological Survey that allows complex searches of the database. A DOS-compatible computer with at least 6 Mbytes of free hard disk space is required. Provided with the database is a report summarizing its notable characteristics and easy-to-follow instructions on its installation and use. There is no charge for the report and disks, although a donation of \$2 to cover packaging and mailing will be appreciated. The database will be updated annually, and a request card for automatic updates is included with the report. Send requests to:

NIWR, The Massachusetts Water Resources Research
Center, Blaisdell House, University of Massachusetts,
Box 30820, AMHERST MA 01003-0820.

Please specify disk size (3.5" or 5.25") and format (double density or high density).

1992 Pesticides in Ground Water Database Report

The pesticides in Ground Water Database (PGWDB) is a collection of groundwater monitoring studies conducted by federal, state and local governments, the pesticide industry, and private institutions. It was created to provide a more complete picture of groundwater monitoring for pesticides in the U.S., and consists of monitoring data and auxiliary information in both computerized and hard-copy form. The report, Pesticides in Ground Water Database--A Compilation of Monitoring Studies: 1971-1991, consists of 11 volumes including a national

summary and ten EPA regional summaries. Each volume provides a detailed description of the computerized PGWDB and a guide to reading and interpreting the data, presented as maps, graphs and tables. To make this information available to as many decision makers in state and other federal agencies as possible, the computerized portion of the PGWDB will become a part of the Pesticide Information Network (PIN), a computerized collection of files that contains pesticide monitoring and regulatory information. The PIN functions much like a PC-PC bulletin board and can be accessed by anyone with a computer and a modem. The PIN is currently undergoing an expansion that will allow new types of information to be included and increase the number of simultaneous users. The new PIN will be available in 1993 and will contain the PGWDB, environmental fate chemical/physical parameters for pesticides, pesticide regulatory information, and a certification and training bibliography.

For Your Information, EPA August 1992

Handbook on Rocky Flats

This reference source answers some of the most commonly asked questions about the Rocky Flats Plant in Golden, Colorado. Copies available for \$2 from the Colorado Council on Rocky Flats, 1536 Cole Blvd., Suite 325, Golden, CO 80401. Phone 303/232-1966; FAX 303/232-1448.

Drinking Water and Well Contamination

The General Accounting Office (GAO) has released the report, "DRINKING WATER: Stronger Efforts Needed to Protect Areas Around Public Wells From Contamination (Spring 1993). Order by mail, phone or FAX: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20884-6015. Phone 202/512-6000; FAX 301/258-4066.

Groundwater Protection Tips

Farmers might want to keep this book within easy reach -- Cooperative Extension has published "50 Ways Farmers Can Protect Their Groundwater." Tips included relate to water quality, herbicides, pesticides, livestock disposal and other issues that are of concern to farmers. The book is available from Cooperative Extension for \$5. Call 217/333-2007 or 217/333-9410.

Groundwater Quality Data -- Colorado and Gunnison River Drainages

The State Engineer's Office has compiled a report on "Available Ground Water Quality Data in the Colorado and Gunnison River Drainages, Colorado Western Slope. The data is currently contained in, or being added to, a database in the Colorado Department of Natural Resources, Division of Water

Resources, Geographic Information System (GIS). Authors of the report are William Schenderlein, Stephani Schupbach and Bahman Hatami. Funding was provided by the US Environmental Protection Agency under Section 319 of the Clean Water Act.

A New Vision for Western Water

Searching Out the Headwaters, explores the historical and cultural context in which western water laws were created and explains how the situation has changed since the frontier days of the 19th century. The authors illustrate, through narrative, poetry and song, how deeply embedded water is in the culture of the West. They propose a water ethic that recognizes the legitimacy of diverse viewpoints and emphasizes the fundamentally public nature of water. They offer three basic principles which should govern future water laws throughout the West: conservation, equity and ecology. Authors are: Sarah F.

Bates, Associate Director of the Natural Resources Law Center at the University of Colorado School of Law; David H. Getches, Professor at the University of Colorado School of Law; Lawrence J. MacDonnell, Director of the Natural Resources Law Center; and Charles F. Wilkinson, Moses Lasky Professor of Law at the University of Colorado. Publication Date: Nov. 15, 1993. For information contact: Linda B. Chase, Island Press, (202)232-7933; FAX (202)234-1328.

Balancing Western Water Use

Proceedings are now available for the symposium on "Western Water Law and Policy: Implications for Wetland and Riparian Ecosystems." The symposium was held in Lakewood, Colorado February 24-26, 1993. For information on ordering contact: Rocky Mountain CH SWS, c/o Douglass Owen, USGS MS 939 DFC, Denver, CO 80225-0046.

WATER SUPPLY

Basin Outlook Report for Colorado

Released by Duane L. Johnson

Soil Conservation Service

655 Parfet Street, Rm. E200C

Lakewood, Colorado 80215-5517

The 1993 water year brought an end to the pattern of dry winters, followed by fairly wet summers, which dominated the climatic conditions of the last several years. For the first winter since 1984 snow surveys showed an above normal snowpack nearly every month. The winter got off to a good start in November with a series of heavy storms. By December 1, the state had accumulated a snowpack of 100% of normal. Although no major storms occurred again until late December, we received enough snowfall to maintain a January 1 total of 101% of normal. Colorado took advantage of the intense storms which occurred across the Western U.S. during January. These storms helped to increase the statewide percentage to 111% of average by February 1. February was one of the best months of the winter for additional snowpack. By March 1, the statewide figures had increased to 134% of normal. March's weather was fairly dry in the mountains, which contributed to a decrease in the percentages to 126% of average by April 1. Then winter gave Colorado another boost during April. The additional snowpack translated into the highest percentages of the season, at 149% of average on May 1. For the first time in many years, the high snowpack totals increased fears of flooding from the melting snowpack. The state received little additional snowfall during May, and this contributed to a decline in the statewide snowpack, to 128% of average for June 1. In all, the winter of 1992-93 will be remembered as an excellent year for the state's water supplies.

During most of the summer months, precipitation was generally near average to above average. Precipitation during June was well above normal across the state with the exception of the

South Platte and Yampa-White basins, which were below average for the month. During July, statewide precipitation was much below normal statewide. None of the major basins reported precipitation totals for July that even approached the normals for the month, and many locations across the state received less than 50% of average rainfall for the month. The dry spell was short-lived, and with the plentiful runoff of this spring, many water users hardly noticed the dry month. The typical monsoonal pattern set in during August, bringing above normal precipitation across southern Colorado.

Streamflows were above normal across most of Colorado this summer. The highest volumes occurred in the southern and western river basins. Volumes of 120% to 140% of normal were common throughout this region. The lowest streamflows, which were near average to slightly below average, occurred across northern Colorado. For the most part, temperatures were below normal during most of the summer months, which helped to minimize some of the demands on this year's water supplies.

Reservoir storage has been maintained in excellent condition across the state. As of October 1, the statewide storage was 114% of average. Currently, reservoir storage is above normal in every major river basin, except the South Platte Basin at 93% of average. The highest storage is in the Rio Grande Basin, at 199% of normal storage. For the most part, reservoir storage has been above normal across the state during the entire summer period. Although the state's current reservoir storage is in good condition, these levels are only 57% of the total available capacity.

EDITOR'S IN-BASKET

CWCB Selects Water Banking Option

Based on a study of water transfer alternatives for the Fort Lyon Canal Company system, the Colorado Water Conservation Board has selected water banking as the most promising way to transfer FLC Company water to new uses in the Arkansas Valley. The CWCB considered the Phase 1 report prepared by Gronning Engineering Company (GEC), public comments received, and recommendations from GEC in making its decision. Phase 2 of the study will provide, as described in a detailed work plan, for conceptual design of a water bank using FLCC water. The goal of the study is to present the FLCC and its shareholders with a workable plan for creating a water bank with a portion of their water rights. The plan will only be put in motion if and when the FLCC decides to do so. The CWCB wants to adequately address the issues that are of concern to all water users in the Valley. With only moderately successful public meetings during Phase 1 of the study, during Phase 2 the CWCB will rely on direct input from all interested parties. For information or to provide input to the study, contact: Steve Miller, Senior Water Resource Specialist, Interstate Streams Investigations Section, Colorado Water Conservation Board. Phone 866-3441; FAX 866-4474.

CASCD Receives EPA Grant for Colorado Projects

The Colorado Association of Soil Conservation Districts (CASCD) has received a \$30,000 grant from the Environmental Protection Agency's Section 319 water quality funds for a two-year Colorado project. Grant funds will be used to carry out education and training on using the Coordinated Resource Management (CRM) process in planning for watershed-based nonpoint source pollution control projects in Colorado. CASCD will work in cooperation with the Society for Range Management (SRM) to implement the project. CRM is based on the belief that resolving resource problems or conflicts is best achieved by effective communication among land owners, conservation groups and others so that trust and cooperation can occur. CASCD President Calista Graves said the goal is to "...reduce nonpoint source pollution in Colorado through the implementation of best management practices on a watershed boundary basis." Phase I of the project will include a two-day educational symposium and facilitator training workshop in February 1994 during the SRM International Meeting in Colorado Springs. CASCD expects to conduct CRM training in group sessions throughout the state.

Source: *The Colorado Conservator*, 9/1993 and the *Society for Range Management Colorado Section Newsletter*, 10/93.

CSNHR Establishes Colorado HazardNet

The Colorado Society for Natural Hazards Research has established an electronic bulletin board system (BBS) called

Colorado HazardNet, which is open to all researchers, engineers, educators, government officials, students, and members of the general public interested in understanding and managing hazards. BBS will include all of the various hazards found in Colorado, including avalanches, floods and drought. To contact **Colorado HazardNet** call, via your computer, (303)465-5013 (the system operates at 2400 baud, eight data bits, no parity, one stop bit). The BBS is available 7:00 a.m.-11:00 p.m. mountain time, seven days a week. For more information, contact: Lee Wesley Row III, National Geophysical Data Center, World Data Center-A for Solid Earth Geophysics, 325 Broadway E/GCI, Boulder, CO 80303, (303)497-6764; FAX (303)497-6513; e-mail: lwr@mail.ngdc.noaa.gov.

Source: Natural Hazards Observer 7/93

New Ag Pollution Hot Line Available

A new hot line (1-800-945-7577) is available to answer questions on agricultural pollution and environmental regulations. The Colorado Agricultural Pollution and Environmental Regulation Information Network is an educational component of the Colorado State University Cooperative Extension System. The Network is a source of information for those who want to better understand the issues related to agricultural non-point source pollution. Questions will be received by Steve Carcaterra, an Extension Water Quality Specialist with Colorado State University. He will provide, upon request, written summaries of current state and federal regulations and respond to questions related to reducing the potential for non-point source pollution from agricultural activities. Callers will not be talking to a regulator or law enforcement agency. Those who call are assured of complete anonymity and confidentiality.

DWD Uses Storage Reservoirs for Flood Control

The Denver Water Department has reservoirs and diversion systems in three major Western Slope watersheds: the Blue, Williams Fork and Fraser river basins. With runoff forecasts predicting very high flows in the Western Slope basins, DWD's reservoirs doubled as flood control facilities in the spring.

The Blue River -- When flows are over 1,800 cubic feet per second (cfs) above Dillon Reservoir, homes next to the river near Silverthorne, below the reservoir, are in danger of flooding. Last spring the forecast was for well over 2,000 cfs. DWD engineers created a space in Dillon Reservoir just large enough to hold the excess water and prevent flooding, but not so large that the reservoir would not be filled after the flood passed. DWD Water Resource Engineer Beth Faber calls this a "tricky business." If the space is not large enough, some of the water will spill from the reservoir and pass downstream, but if the reservoir is drawn down too low, it might not fill completely.

The Fraser River -- The Fraser River has no reservoir, so the remedy for high flows was to divert water from each of its tributaries and send it through the Moffat Tunnel to Gross Reservoir on the Eastern Slope. The key was estimating when the peak flows would come, and not diverting too much before.

Source: *RUMBLES*, November 1993.

Current Projects, Water Science and Technology Board :

Irrigation's Future -- A new WSTB study, "The Future of Irrigation in the Face of Competing Demands," is under way. The study will explore the impacts of changing supply and demand conditions and pricing policies on the cost of water, assess current and potential future technologies that might help water users adapt to changing conditions, and assess the short- and long-term problems associated with irrigation and how they might be mitigated. Colorado participants are: Dale F. Heermann, USDA/ARS; Lawrence MacDonnell, University of Colorado, Catherine Vandemoer, Council of Energy Resource Tribes; James Watson, Consultant, Littleton; and James L. Wescoat, University of Colorado.

Groundwater Recharge -- A report is expected in early 1994 on a study of the artificial recharge of groundwater using water of impaired quality. The report will evaluate issues related to groundwater recharge including questions about appropriate pretreatment and recharge technologies, transport processes and transformations, impacts on hydrologic and biological systems, monitoring, health implications, and public policy issues.

Groundwater Cleanup -- The Committee on Groundwater Cleanup Alternatives has nearly completed of its two-year study. It is examining whether restoring contaminated groundwater to drinking water standards is technically feasible. A report and recommendations are expected in early 1994.

For information about the first two studies contact Chris Elfring, WSTB; for information about the third study contact Jackie MacDonald, WSTB. Phone 202/334-3422.

WSTB members have identified the following as possible future study categories:

- a review of the Water Resources Planning Act of 1965 and other attempts to coordinate national water policy;
- an evaluation of the mitigation process and whether it has fulfilled the goals of the Clean Water Act and the Endangered Species Act;
- a review of the impacts of the Wild and Scenic Rivers Act;
- an investigation of water supply alternatives;
- an evaluation of the merits and constraints of water demand management; and

- an analysis of the costs and benefits of nonconsumptive uses of water.

Source: *WSTB Newsletter*, Oct. 1993

President Signs Funding Bill

On October 21, the President signed the FY1994 Agriculture, Rural Development, FDA and Related Agencies Appropriations Bill. The research and education program total for CSRS is \$456,586,000. It includes:

- \$171,304,000 for the Hatch Act;
- \$20,809,000 for the McIntire-Stennis Cooperative Forestry program,
- \$28,157,000 for the Evans-Allen program;
- \$5,551,000 for Animal Health and Disease,
- \$72,917,000 for Special Research Grants including \$3,228,000 integrated pest management/biological control, \$6,750,000 pesticide clearance, \$1,250,000 global change and \$4,500,000 water quality;
- \$112,150,000 for the National Research Initiative Competitive Grant program;
- \$7,400,000 for the Sustainable Agriculture program;
- \$4,000,000 for Aquaculture Centers;
- \$475,000 for Rangeland Research Grants;
- \$1,818,000 for Supplemental and Alternative Crops;
- \$3,500,000 for Graduate Fellowships;
- \$1,500,000 for Institution Challenge Grants;
- \$10,550,000 for 1890 Institution Capacity Building Grants;
- \$2,850,000 for Morrill-Nelson; and
- \$1,000,000 for a new Minority Scholars program.

The committee provided \$56,874,000 for selected buildings and facilities.

House Passes National Biological Survey Act

By a vote of 255 "yeas" to 165 "nays," the U.S. House of Representatives passed the National Biological Survey Act of 1993 (H.R. 1845) on October 26, 1993. H.R. 1845 has been referred to the Senate Committee on Environment and Public Works. No action is expected by the Senate until 1994.

USBR Announces Proposed Organizational Changes

The Bureau of Reclamation, responding to goals set forth in the President's National Performance Review, has released a *Blueprint for Reform* for the agency. Reclamation's mission statement is: "To manage, develop and protect water and related resources in an environmentally and economically sound manner in the interest of the American public." Guiding principles added to accomplish the agency mission include: (1) facilitating water transfers to new uses according to state law; (2) coordinating and improvement management of existing water and power resources; (3) promoting sustainable and environmentally sensitive water and land uses; and (4) facilitating integrated water resources management on a watershed basis. Regional directors, in consultation with

Washington and Denver offices, will develop a plan to delegate more authority to the field offices and propose a new alignment of area offices. The proposed changes have been approved by Betsy Rieke, Assistant Interior Secretary for Water and Science. Commissioner Dan Beard said, "We were stuck working on yesterday's issues...By adopting...these reforms, we can help manage the water needs and problems of today, while preparing for the future." Beard expects the changes to be implemented no later than the end of FY94.

Source: *Western States Water*, 11/5/93

Lopez Elected AWRA President

Nancy C. Lopez, Chief of the Federal Office of Water Data Coordination at the U.S. Geological Survey in Reston, Virginia, has been elected President of the American Water Resources Association for 1994. Lopez has over 20 years experience in water resources, working with both federal and non-federal organizations. She graduated Magna Cum Laude in Mathematics from Frostburg State University followed by a masters degree in Civil Engineering (water resources) from the University of Hawaii. She has received numerous awards and honors, including the Department of Interior Meritorious Service Award. She has held numerous leadership positions within AWRA: Chair of the Strategic Planning Committee, National Secretary, Vice President, and President-Elect.

NCWCD Engineer Wins National Award

Darell Zimbelman, interim general manager of the Northern Colorado Water Conservancy District in Loveland, is one of six engineers nationwide to receive the State-of-the-Art of Civil Engineering Award from the American Society of Civil Engineers. The annual award recognizes outstanding work focusing on the status of knowledge in specialized areas of engineering. Zimbelman was a member of the ASCE Task Committee of the Irrigation and Drainage Division that received the award for preparing an ASCE manual on management, operation and maintenance of irrigation and drainage systems.

Source: *Greeley Tribune*, 11/14/93

AWRA Selects New Editor for Water Resources Bulletin

Dr. Christopher Lant has been appointed the new editor of the journal of the American Water Resources Association, the *Water Resources Bulletin*. Dr. Lant is assistant professor of geography at Southern Illinois University at Carbondale. Lant received his

M.A. and Ph.D. in geography from the University of Iowa and his work in agricultural water pollution, wetland policy, and urban water conservation has been published widely. His three-year term as editor begins January 1, 1994. He replaces Dr. William Lord of the University of Arizona who will complete his term at the end of this year.

Report on Central Arizona Project Completed

The Arizona "Governor's Central Arizona Project Advisory Committee," charged with developing recommendations to assure the long-term viability of the Central Arizona Project (CAP), has recently issued its final report. The CAP is facing significant underutilization of its capacity. The project was designed on the assumption that agriculture would use most of the water in the early years, but agricultural water use in Arizona has recently been declining. Potential consequences of this decline include a shift of CAP costs to the municipal/industrial sector, a possible threat to Arizona's Colorado River water allocation if it leaves water it is entitled to under the Colorado River Compact in the river, and Congressional intervention if irrigation districts in Arizona default on federal CAP loans. The committee recommends that:

- the Central Arizona Water Conservation District (CAWCD) and the USBR look for potential cost reductions -- including a recommendation that M&I subcontractors for water pay their share of CAP costs whether they take water delivery or not.
- the federal government pay the fixed CAP costs associated with allocations for federal purposes.
- the CAWCD and the Arizona Department of Water Resources (ADWR) develop an intrastate CAP marketing program and allow CAP to benefit from implementing a fee structure for such transfers.
- the ADWR study arrangements where California and Nevada could take advantage of unused entitlement and canal capacity to store water in Arizona in exchange for the right to increase Colorado River diversions.
- the federal government make settlement of Indian water rights claims in Arizona a priority.
- 3 levels of water allocation be considered for environmental enhancement (50,000, 100,000, 150,000 acre feet) with an evaluation of the impact on CAP users.

"Biological diversity is the full variety of life in an area, including the ecosystem, plant and animal communities, species and genes, and the processes through which individual organisms interact with one another and their environment."

USDA Forest Service, Rocky Mountain Regional Guide, Biological Diversity Assessment of May, 1992.

WATER NEWS DIGEST

WATER ALLOCATION

Front Range Water Forum Established

Gov. Roy Romer has signed an executive order that may forestall future water wars caused by Front Range growth. The order sets up a 40-member Front Range Water Forum (FRWF) to find ways to conserve water now available and locate water in the future. The forum's study, to be carried out with Hydrosphere Inc. as study consultant, will begin by identifying specific projects for analysis. An advisory committee appointed by FRWF members will direct the project analysis. The forum includes the mayors of Front Range cities, water leaders from the Front Range and the Western Slope, legislators, representatives from business and environmental organizations, and state agency officials. Funding for the forum will be provided by the Legislature and the Colorado Water Conservation Board, and will cost approximately \$450,000. The forum is an outgrowth of the 1993 Colorado Water Convention, which drew more than 800 participants last January to Denver.

Montrose Daily Press 10/7/93

WATER PROJECTS

Fort Lupton Water Proposal Goes to Ballot

Fort Lupton residents have overwhelmingly approved a drinking water project that will cost an estimated \$15 million by using tax revenues over and above the Amendment 1 tax-and-spending-limit law. Voters said the city should circumvent Amendment 1 and use the money. The city issued \$3 million in bonds in 1991 to begin work on the project, which will pipe water from Carter Lake southwest of Loveland to Fort Lupton.

Greeley Tribune 10/13/93, 11/3/93

Developer Files Claim on Lake's Water

Aspen resident Howard Christopher Lambert has filed an application for the rights to all water in Hanging Lake and a mining claim along the trail to the lake, hiked by over 50,000 people a year. The Hanging Lake Trail begins 10 miles east of Glenwood Springs in Glenwood Canyon, and takes hikers 1.2 miles to the lake fed by Bridal Veil Falls. Lambert filed an application for the water rights with the District Court Water Division 5 in Glenwood Springs on Aug. 3. Lambert said in his application that the water will be used for drinking, which is not enough detail to support his claim, according to a Water Resources Division engineer. It appears unlikely the water claim will be approved, but the mining claim may have a chance, experts say.

Rocky Mountain News 10/11/93

Westminster Reservoir Plan Put on Hold

The Adams County Board of Commissioners has given the city of Westminster 60 to 90 days to draw up a new plan for an 800 acre-foot storage reservoir at 62nd Avenue and Lowell Boulevard. Westminster was originally ordered to construct the reservoir to satisfy a complex 1988 water-rights agreement with Golden, Thornton, and the Adolph Coors Brewing Company. After the agreement, Westminster bought the Crestview Water and Sanitation District Lakes at the site of the proposed reservoir. The current plan is to enlarge the lakes, line them with clay to prevent groundwater infiltration, and fill the reservoir with treated effluent from the Coors plant. To quell fears that the water would carry an unpleasant smell, Westminster assured residents the water would be aerated. Westminster also conceived of the site as a recreational facility, but further angered residents by designing the reservoir with an unsightly 17-foot berm. The new plan must meet conditions on the height of the berms, odor control, and liability for possible damage to neighboring homes.

Denver Post 10/21/93

Grand Junction to Offer Wolford Settlement

The Grand Junction City Council has agreed to submit a settlement offer for the construction of Wolford Mountain Reservoir based on protecting the future development of Grand Valley water rights. Terms of the agreement will recognize salinity limits in the basin, future de-watering of the West Slope, long-term development of the Grand Valley, and joint discussions in substitution years to evaluate salinity impacts. The resolution represents the position of Clifton Water District as well. Both are the last major water providers who had filed objections to construction of the 60,000 acre-foot reservoir north of Kremmling on Muddy Creek. Denver Water, in an agreement with the Colorado River Water Conservation District, seeks to transfer additional water from the Blue River drainage through the Roberts Tunnel in exchange for building Wolford Mountain Reservoir for the West Slope. Williams Fork Reservoir water would also be released to curb increased salinity levels expected with the construction of Wolford Mountain.

Grand Junction Daily Sentinel 11/4/93

Environmentalists' Intervention in Two Forks Case Barred

A federal appeals court has ruled that a coalition of environmental groups cannot intervene in a lawsuit against the EPA over the agency's rejection of the proposed Two Forks dam. Two Forks, a multi-million dollar plan by the Denver Water Board and other suburban water suppliers to dam the South Platte River southwest of Denver, would have flooded 30 miles of prime trout habitat. The EPA vetoed Two Forks in

1990 because it would have violated the federal Clean Water Act. Eight suburban water providers sued the EPA over its decision. Four environmental groups sided with the EPA, and asked the district court to allow them to assist the EPA in defending its decision. The groups are the Environmental Defense Fund, the Colorado Environmental Caucus, American Rivers, and the National Audubon Society. The district court denied their request, stating that the EPA would adequately represent their interests.

Rocky Mountain News 11/10/93

WATER TRANSFER

State Claims No Plans to Export Box T Water

The State Board of Land Commissioners has no plans to transfer to Denver the groundwater underlying the 86,000-acre Box T Ranch in Pueblo and El Paso counties. Groundwater controlled by the state land board was identified as a potential source of metro needs in Gov. Roy Romer's new executive order creating a Front Range Water Forum. State legislators were expected to question the board on its recent \$4.2 million purchase of the Box T Ranch and the state's bid to designate a larger area encompassing the ranch as a groundwater basin. The proposed basin covers some 500 square miles stretching from Colorado Springs to Pueblo, of which perhaps one third underlies the ranch.

The State Engineer's Office estimates the amount of water recharged in the basin at 25,000 acre feet. Before the Colorado Ground Water Commission approves the basin, however, a public hearing is scheduled for Dec. 6 to establish whether or not it would interfere with the flow of water tributary to the Arkansas River. If too much tributary water is involved, the commission might reject the basin designation. If it is minimal, as the State Engineer's office asserts, the area could become the Lower Black Squirrel Creek Basin.

Pueblo Chieftain 10/7/93

First Voluntary Water Transfer Negotiated in California

On September 21, the Metropolitan Water District of Southern California (MWD) announced it had reached the first negotiated voluntary water transfer authorized under last year's Central Valley Project Improvement Act. Under the agreement, MWD will pay \$7 million to Arcias Dairy Farms of Los Banos for up to 35,000 acre-feet of water over a 15-year period. MWD may choose to take up to 5,000 acre-feet of water in each of any seven years. Arcias Dairy Farms will receive \$6.25 million (\$175/acre-foot), while the remaining \$875,000 will go to an environmental restoration fund. If MWD's board grants final approval, the agreement will be reviewed by the Secretary of the Interior, the California Department of Water Resources Control Board, and other regulatory agencies. MWD must pay to transport the water to Southern California.

Western States Water 9/24/93

WATER QUALITY

Environmental Studies Okayed for Desalination Plant

A Milwaukee company has won approval to conduct environmental and economic studies of a proposed \$45 million desalination plant for Glenwood Springs. The plant would remove 200 tons of salt per day from the outflow of the Hot Springs Pool and other nearby springs. Plans call for piping the water five miles west to a plant site up South Canyon, where Aqua-Chem Inc. will lease 40 acres from the city. The environmental and economic feasibility studies are likely to take at least six months. The Colorado River Basin Salinity Control Forum has decided to endorse the idea under the conditions that Aqua-Chem resolve land-use issues and secure a payment contract from the U.S. Bureau of Reclamation.

Montrose Daily Press 9/30/93, *Grand Junction Daily Sentinel* 10/28/93

New Standard Set for Water Near Arsenal

By a vote of 6-2 the Colorado Water Quality Control Commission has set a strict standard of 8 parts per billion for the nerve gas byproduct DIMP. State health officials pressed for the stricter level after spending \$40,000 a year for the last three years to provide bottled water to 600 Henderson neighborhood residents near the Rocky Mountain Arsenal. The community's water supply is contaminated by DIMP that has migrated from the arsenal where the Army and Shell Oil Inc. manufactured chemicals and pesticides. The state wants to force the Army and Shell -- which share cleanup costs at the arsenal -- to link the Henderson residents to a safe municipal water supply, which could cost millions of dollars.

Grand Junction Daily Sentinel 10/5/93

Wastewater Tanks May Replace Pits

Weld County Commissioners will recommend to the Colorado Oil and Gas Conservation Commission that tank batteries replace open pits in the disposal of brine wastewater produced in most oil and gas operations on Weld County irrigated farmland. Complaints from landowners over surface damage caused by drilling during the past two years have prompted the request. The use of tanks would be only a recommendation as an operational standard, but county commissioners left the door open to future enactment of county regulations requiring the use of tanks instead of pits. The Oil and Gas Conservation Commission does not have to follow county recommendations in issuing drilling permits. The commissioners also agreed to several other policies regarding oil and gas operations, to set minimum standards for performance and operation of injection wells used to dispose of brine wastewater, and to discourage development of evaporative pond facilities in the Weld County Comprehensive Plan, also a method for disposal of brine wastewater.

Greeley Tribune 10/13/93

USBR Salinity-Control Work Not Jeopardized

Salinity-control work in the West will move forward in spite of top-to-bottom reform of the Bureau of Reclamation, according to Daniel Beard, the agency's new director. Agency reforms may change the way salinity-control projects are administered, and they will compete for fewer federal dollars, but salinity-control is not on the budget-cutting chopping block. Congress has appropriated \$15 million for Grand Valley projects in 1994, \$4 million for a winter stock-watering project in Montrose and Delta, and \$4 million for the Paradox brine-pumping project.

Grand Junction *Daily Sentinel* 11/4/93

ENVIRONMENT

Five Flats Ponds to Close Early

Five contaminated ponds at the Rocky Flats plant will be cleaned up and closed 16 months ahead of schedule, according to the Department of Energy. The ponds contain plutonium, heavy metals, and nitrates. According to a Colorado Health Department spokesperson, state health officials forced the early cleanup after Flats operators missed more than 30 cleanup deadlines. DOE officials said the move is a critical step forward in the massive cleanup of the former nuclear weapons plant.

Greeley *Tribune* 10/7/93

EPA Seeks \$\$ From Summitville Promoter for Cleanup

Canadian promoter Robert Friedland is being asked to pay part of the cleanup costs at the Summitville gold mine, which has poisoned 17 miles of the Alamosa River. Friedland is a resident of Canada, which could make it difficult for U.S. authorities to collect. First, lawyers must build a case against Friedland and prove him liable in a U.S. court. Friedland recently issued a written statement saying he resigned as chief executive officer and as a director of Summitville's parent company, Galactic Resources Ltd., two years before the mine became an environmental crisis. Friedland resigned on Nov. 2, 1990, the day the EPA issued an ultimatum to Colorado regulators that if they didn't fine Summitville operators for water quality violations, the federal agency would take over. EPA lawyers also believe Bank of America played a key role as a high-pressure lender in the mine, but Bank of America has submitted documents to the EPA saying it was only a lender and not involved in managing the mine. U.S. taxpayers continue to spend millions to clean up the mine, and the claim against Friedland could reach \$100 million.

Pueblo *Chieftain* 10/18/93

Conservancy to Buy Ranch Near Hayden

The Nature Conservancy has entered into an option agreement to buy the 957-acre Carpenter Ranch east of Hayden. The conservancy plans to continue managing the property as a working ranch and to use it as a site for educating the public

about the compatibility of western ranching and conservation of critical habitats, such as the Yampa River. Ferry Carpenter operated the ranch from 1926 until his death in 1980. It is one of the oldest in the Yampa Valley, with its original buildings still intact. The ranch is adjacent to the conservancy's existing Yampa River Preserve, a 315-acre property covering roughly two miles of river upstream. The Nature Conservancy already owns 570 acres on the Yampa River, most of which is open to the public for day use.

Montrose *Daily Press* 10/27/93

WETLANDS

Wetlands Still Undefined

The Clinton Administration has issued a new wetlands policy that may change the tenor of the fractious debate over renewal of the Clean Water Act. The policy attempts to reconcile conflicting interests by offering farmers an exemption for existing cropland. For developers, it offers the prospect of a speedy appeals process, and environmentalists may get a reaffirmation of the "no overall net loss" goal and preservation of Alaska's coastline. But the new policy avoids the controversy over the definition of wetlands. The administration said it would wait until the National Academy of Sciences completes its study and produces a comprehensive definition next year. The policy exempts about 53 million acres of wetlands that were drained and cleared for agricultural use before 1985, and designates the Soil Conservation Service as the lead federal agency for identifying wetlands on agricultural acreage under the terms of the Clean Water Act and other laws.

U.S. *Water News* 10/93

Wetland Treatment of Wastewater Studied

As the first wetland wastewater treatment system constructed by a Colorado municipality becomes operational at Platteville along the South Platte River north of Denver, state officials are reviewing results to determine if it actually is an inexpensive solution to treatment problems. With state funding assistance, Platteville selected the constructed wetland alternative on the basis of low construction and maintenance costs. The town utilized its existing lagoon for the wetland system. Construction began a year ago, and last spring six-inch cattail seedlings were planted in one foot of imported topsoil. By July, the cattails were more than two feet tall, and the system became operational in late September. The big test will come when winter arrives. Colorado Department of Health officials are concerned whether the wetland will function during cold weather.

U.S. *Water News* 10/93

Resort, Feds Reach Wetlands Deal

The U.S. Department of Justice has proposed to settle the largest violation of federal wetlands law in Colorado history by forcing the Telluride ski resort to pay a \$143,000 fine and construct 42

acres of new wetlands. EPA officials say the resort illegally developed all or parts of up to 40 acres of wetlands between 1984 and 1990 during construction of the Telluride Mountain Village, the ski area's main base. Telluride executives say they were unaware of 1984 federal law changes that made it illegal to bulldoze various types of wetlands without a permit. In January 1990 the Army Corps of Engineers, which regulates wetland development, caught the violations and referred the case to the EPA for enforcement. The EPA and the ski resort have been negotiating since then. The settlement would require the resort to restore 15 acres of destroyed wetlands at the ski area and create another 27 acres at a farm 60 miles away near Montrose. Federal officials will consider public comment on the proposed settlement of 30 days. The most controversial part of the deal is allowing the resort to replace wetlands destroyed at the base of the ski area with new marshes in a separate river valley in Montrose County.

Denver Post 10/20/93

Corps Pulls Project Permit

The Army Corps of Engineers has withdrawn a developer's permit to build townhouses on one of the Denver area's last remaining wetlands. Environmentalists have fought for months to protect the 12-acre Jewell Wetland's large grove of cottonwoods and cattails located in the heart of Aurora. They hope donors will come up with enough money to buy the wetlands and turn it into an environmental education center. The developer, Gary Pashel, was first issued a permit in 1989, and says he will appeal the decision in addition to finding a way to preserve the wetlands.

Montrose Daily Press 11/8/93

WILDLIFE

Refuge Causes Apprehension

U.S. Fish and Wildlife Service officials want to establish a 15,000-acre Centennial National Wildlife Refuge along the South Platte River as a proposed haven for ducks, geese, hawks, deer, and about 300 other species of animals that live in the northeastern Colorado region. But concern has been expressed that federal acquisition of property for the refuge will lead to minimum streamflow requirements or higher water quality expectations for the river. Boundaries of the proposed reserve include farms, irrigation ditches, aquifer-recharge projects, and water rights whose owners are suspicious of federal plans. State Senator Don Ament, R-Illiff, a rancher whose district includes the proposed refuge, said he will oppose the refuge until the FWS answers questions about water issues.

Montrose Daily Press 9/29/93

Series of Swaps Enhance Wildlife

Colorado's warm-water fisheries and sharp-tailed grouse are the latest winners in a series of swaps designed by the Colorado

Division of Wildlife (DOW) to enhance the state's wildlife. The exchange between DOW and Nebraska features sending about 100 pronghorn antelope from northeast Colorado to Nebraska in exchange for a larger number of warm-water fish and some sharp-tailed grouse, an endangered species in Colorado. The trade with Nebraska has already brought a large number of warm-water fish to Colorado. Approved by the Colorado Wildlife Commission at its September meeting, the rest of the trade should occur within the year.

Montrose Daily Press 10/12/93

Funds from Duck Stamps Help Habitat

More than \$780,000 will be spent to create and improve waterfowl habitat in Colorado this year under the state's duck stamp program. Money from water fowl stamp sales combined with contributions from a host of other public and private groups goes to help reduce declines of duck populations by protecting and preserving critical habitat. Colorado duck and goose hunters must purchase a \$5 state waterfowl stamp in addition to a small game hunting license and a federal duck stamp. Proceeds from the state and federal stamp sales and art prints of the stamps pay for acquiring wetlands for North American waterfowl, habitat enhancement, and other conservation programs. In the past 200 years, habitat loss has been the major cause of significant population declines of some waterfowl populations. Since 1990 when the state program began, stamps and art print sales have generated \$1.6 million, and when combined with other contributions, total \$2.7 million.

Montrose Daily Press 10/12/93

Hatchery is Approved

A resolution supporting construction of a hatchery where endangered fish and other aquatic species would be reared was approved by the Colorado Wildlife Commission. The Colorado Water Conservation Board, concerned about the impact endangered species can have on water development, approved the resolution. The Division of Wildlife is currently evaluating a number of sites for the hatchery. The availability of water and cost of construction and operation of the hatchery are key factors.

Montrose Daily Press 10/12/93

Feds Believe Reservoirs Harmful to Habitat

A proposal by the U.S. Fish and Wildlife Service could require six Front Range entities with mountain reservoirs to release water to help preserve wildlife habitat for the pallid sturgeon, whooping crane, least tern, and piping plover. The birds use the Platte River and its shoreline in central and eastern Nebraska for nesting and migration. Local water entities are critical of the proposal because federal officials are using local water supplies to solve a major, interstate issue for Colorado and Nebraska.

Denver Post 10/28/93

Settlement Reached Over Use of Wildlife Refuges

The Interior Department, settling a lawsuit brought by environmental groups, has promised to ban all activities that threaten inhabitants of federal wildlife refuges. The settlement will require the Fish and Wildlife Service to review all so-called secondary uses -- such as recreational, hunting, grazing, and farming uses -- across the 491-refuge system. Any uses found to be a threat to wildlife or incompatible with the refuge are to be terminated. The National Audubon Society, Wilderness Society, and Defenders of Wildlife sued, alleging that the FWS was permitting detrimental grazing, motorized boating, and other recreational uses in nine refuges.

Grand Junction *Daily Sentinel* 10/21/93

Study Indicates Fish Plan a Boon to California

A federal plan to protect four endangered Colorado River fish would boost the economy of southwestern states by \$167 million, according to a U.S. Fish and Wildlife study, but most benefits would go to California. At issue is a plan to designate 2,094 miles of the Colorado River and tributaries in seven states as protected habitat for the Colorado squawfish, razorback sucker, humpback chub, and bonytail chub. Biologists propose to restore the fish populations by protecting stream habitat and changing federal dam operations to allow more natural river flows, with large releases during spring snowmelt and smaller discharges in fall and winter. The new management plans would yield complex economic results. Some dams would generate less hydropower and store less water, some whitewater rafting companies would get more business because more water would be released into canyons, some ranchers would grow less hay because less water would be available, and some farmers would grow more vegetables because they would end up with more water. California would realize a \$262 million economic boost, while New Mexico and Utah would each lose about \$60 million. Colorado would receive a net gain of about \$1 million.

Fort Collins *Coloradoan* 11/14/93

PEOPLE

Montana Man is New EPA Official

William Yellowtail has been named the new Regional Administrator for the EPA's office in Denver, which oversees the enforcement of federal environmental programs in Colorado, Montana, Utah, Wyoming, and the Dakotas. Yellowtail, a Crow Indian, is the first American Indian and the first non-Coloradan to hold the post.

Fort Collins *Coloradoan* 10/20/93

NCWCD Board Member Named

Marjorie Knievek of Berthoud has been appointed Larimer County representative on the Northern Colorado Water

Conservancy District's board of directors. Knievek was born in Loveland, attended Loveland High School and Colorado Women's College, and has a degree from Brown University. She has an extensive background in farming and irrigation, and has researched and written on the subject. She replaces Nancy Gray of Fort Collins, who did not resubmit her name for consideration.

Fort Collins *Coloradoan* 9/21/93

World Bank Lures Expert From District

Larry Simpson, general manager of the Northern Colorado Water Conservancy District for the past 12 years, has resigned to work as a consultant for the World Bank, a Washington D.C.-based agency that lends money to developing countries. Simpson's resignation was effective in late October. The district board has appointed Darell Zimbelman as acting general manager. Simpson, an internationally-known expert on water projects, will maintain his home and farm near Loveland, but travel as a consultant to South America, Latin America, and China.

Fort Collins *Coloradoan* 10/19/93

PUBLIC LANDS

Campbell to Introduce Black Canyon Bill

An 11-year-old proposal to designate the Black Canyon of the Gunnison National Monument a national park was presented by West Slope representatives to legislators and government officials recently in Washington D.C. U.S. Sen. Ben Campbell gave his support to the effort and promised to introduce a bill in the Senate within 30 days to change the monument to a national park. This will mark the first time a bill on this issue has been introduced in the Senate. According to a West Slope proponent of the designation, each year efforts to create the national park get one step further.

Montrose *Daily Press* 10/5/93

New Grazing Rules/Water Rights Issue Remains Unsettled

Colorado Senators have yet to agree to a compromise offered by Interior Secretary Babbitt on a federal rangeland grazing bill. Babbitt has offered clarifying language to the bill on water rights because some western senators suggested the legislation could be interpreted to allow the federal government to supersede state water authority. Babbitt has also agreed to hold off on implementing any standards and guidelines for rangeland management reform until the public has had ample time to discuss the issue. But the issue remains unsettled, with Sens. Brown and Campbell claiming they had not seen the new language.

Fort Collins *Coloradoan* 11/6/93

RECREATION

Jackson County Ski Area Ruling Expected by December

The Colorado Land Board will decide by mid-December whether to accept or reject a California developer's proposal to build a ski area/resort complex in Jackson County. Developer Fred Sauer proposes building a ski area, golf course, 1,250 condos, 200 homes, a 300-room motel, ice rink, equestrian center, and medical clinic on 4,200 acres of state-owned land. The board, which oversees the state trust land, will announce whether it approved a letter of intent to allow the project to proceed to a second phase of environmental and land-use review by federal, state, and local officials. If approved, Sauer would be required to buy 4,200 acres of land of equal or superior value elsewhere in Colorado and turn it over to the state.

Rocky Mountain News 10/16/93

GROUNDWATER

Contaminated Water Leads to Well Closings

Methane gas that seeped into drinking water wells near Durango has prompted state officials to call for a study of the area, which could lead to a moratorium on gas drilling. The state plans to order Amoco to shut down 10 nearby gas wells and will ask the state Oil and Gas Conservation Commission to launch a study to determine the extent of contamination. Over the summer state investigators found at least two wells near Bayfield saturated with methane. Methane gas has been detected in the crawl space of at least one house, and has been bubbling to the surface in the Los Pinos River. Area residents have joined a class-action suit alleging the companies knowingly polluted their water wells in a rush to drill for methane. State officials suspect a link between the water contamination and the drilling.

Grand Junction Daily Sentinel 11/11/93

MISCELLANEOUS

Bureau of Reclamation to Eliminate 300 Denver Jobs

The U.S. Bureau of Reclamation estimates it will cut more than 300 people from its 2,000-person Denver office and sell off some of its smaller dams and water projects as part of an overall change in the mission of the bureau. The scaleback is part of the bureau's move away from dam construction and toward balancing agricultural irrigation with conservation and environmental needs. The bureau also intends to increase federally subsidized water rates for Western farmers as longterm water contracts come up for renewal.

Fort Collins Coloradoan 10/26/93

Denver Suburbs to Take Water Fight to Legislature

Some suburban Denver governments, frustrated with water supply problems and the response of the Denver Water Board, plan to approach the state legislature with the issue. The latest development occurred when a judge upheld Denver's water rate structure, which charges the average suburban customer nearly double the amount Denver residents pay. Members of the group, including Littleton, Sheridan, and seven water and sanitation districts, are among the most water-short. They want DWB to come under control of the Public Utilities Commission, something only the legislature can accomplish. Short of that, the group wants representation on the board. Officials of the Denver Water Board strongly disagree, saying the opposition represents a small minority of suburban customers supplied by Denver, and that water rates charged to suburbs are not arbitrary, but based on a complex calculation.

Fort Collins Coloradoan 11/15/93

CALLS FOR PAPERS

Biodiversity: Meeting Tomorrow's Challenges Today -- March 18, 1994, Denver, CO. Presented by AWRA-Colorado Section. Presentations will be 20 minutes. Submit abstract to: Dave Merritt, Colorado River Water Conservation District, PO Box 1120, Glenwood Springs, CO 81602. FAX: 303/945-8799. For information contact Dave Merritt at 303/945-8522 or Jerry Kenny at 303/987-3443. Deadline: December 15, 1993.

7th International Symposium, Agricultural and Food Processing Wastes -- June 18-20, 1995, Chicago, IL. Topics include: Water pollution control, waste utilization, waste minimization and management procedures. Proposal instructions available from: Dr. David T. Hill, Agric. Engr. Dept., Auburn Univ., Auburn, AL 36849-5417. Phone 205/844-3531; FAX 205/844-3534. Deadline: April 15, 1994.

Interdisciplinary Conference, Animal Waste and the Land-Water Interface -- July 16-19, 1995, Fayetteville, AR. Submit 300-word abstract to: Arkansas Water Resources Center, Attn: Patti Snodgrass, Univ. of Arkansas, 113 Ozark Hall, Fayetteville, AR 72701. FAX: 501/575-3846. Deadline: Feb. 11, 1994.

Assessing and Managing Health Risks from Drinking Water Contamination: Approaches and Applications -- September 13-17, 1994, Rome, Italy. Submit one-page abstract to: International Scientific Secretariat, Dr. Eric Reichard, U.S. Geological Survey, Water Resources Division, 5735 Kearny Villa Rd., Suite 0, San Diego, CA. Phone 619/637-6834, FAX 619/637-9201. Deadline: January 21, 1994.

FOURTEENTH ANNUAL "HYDROLOGY DAYS"

April 5-9, 1994

CALL FOR PAPERS

Hydrology Days will be held from April 5-9, 1994 at Colorado State University, Fort Collins, Colorado. The conference provides a forum for hydrologists and hydrology students to get acquainted and to share problems, analyses and solutions. A Special Keynote Address will be given by Dr. L. Douglas James, Director, Hydrologic Sciences Program, National Science Foundation. Planned special sessions include: Large-Scale Experiments, Hydrologic and General Circulation Models; Cross-Scale Integration and Disaggregation of Hydrologic Processes; Integrated Physical-Stochastic Hydrology; The Transfer Function Approach in Hydrology; Hydrology of Landfills; Characterization of Soil Capillary and Hydraulic

Properties; and Decision Support Systems for River Basin Management.

STUDENT AWARDS: Awards and prizes will be presented for the best student papers as oral or poster presentation in two or three categories: B.S. and/or M.S. and Ph.D. candidates.

ABSTRACT INFORMATION: For abstract instructions and information contact: Janet Montera, HYDROLOGY DAYS, Civil Engineering Department, Colorado State University, Fort Collins, CO 80523. Phone 303/491-7425; FAX 303/491-7727. Deadline: January 10, 1994.

SHORT COURSE - UNIVERSITY OF COLORADO

Rocky Mountain Water and Wastewater Plant Operators School

University of Colorado at Boulder -- January 23-28, 1994

The course is aimed primarily at the C and D-level operators and at those new to the water/wastewater industry. The focus is on general subjects such as water treatment, sewage treatment, drinking water, quality standards, and plant safety. D-Level certification examinations will be administered Friday, January 28, 1994, 6 pm - 9 pm at the conference center. Applications will be available at the opening session on Sunday, January 23. The fee for each exam is \$15. A representative from the Colorado Plant Operators Certification Board will be available on Tuesday, Wednesday and Thursday mornings, 7:30 am - 8 am prior to class to answer questions about certification and the exams. Continuing Education Units -- the CPOCB will accept the 4.2 Continuing Education Units you earn upon completion of this course for its requirements. You must send the Board a copy of the certificate you receive at the end of the course.

Fee -- the registration fee is \$165 if postmarked by January 3, 1994; \$180 after January 3. The fee includes instructional costs and the notebook but DOES NOT include lodging and meals. For information contact: Sara Tanner, Office of Conference Services, Campus Box 454, University of Colorado, Boulder, CO 80309-0454. Phone: 303/492-5151.

GROUND WATER MODELING SHORT COURSE - COLORADO SCHOOL OF MINES

International Ground Water Modeling Center -- January 24-27, 1994

Modeling of Three-Dimensional Contaminant Transport and Remediation Designs

This short course is intended to familiarize participants with fundamental concepts and numerical methods underlying contaminant transport simulation. The implications of these concepts and methods in field modeling studies will be stressed. The course will provide in-depth introduction to the MT3D transport model, hands on experience using MODFLOW/MT3D, PostMT3D, SURFER and GRAPHER programs; and ModelCad II. Four days of lectures and computer sessions are scheduled. The fee is \$1295 if paid in full before Jan. 4, 1994 or \$1495 after. For course content information contact IGWMC Director Paul K.M. van der Heijde; for logistical information contact Program Assistant Mary Pigman. IGWMC, Colorado School of Mines, Golden, CO 80401-1887. Phone 303/273-3103, FAX 303/273-3278.

MEETINGS

Water Policy and Management: Solving the Problems, May 23-26, 1994, Denver, Colorado -- 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." The conference will

refocus on national water issues and will also serve as a forum for western water issues. 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.

COLORADO WATER CONGRESS 1994 CONVENTION PROGRAM

January 19-21, 1994

Holiday Inn, Northglenn, Colorado

The Annual Convention of the Colorado Congress will feature four GENERAL SESSIONS, four Concurrent Workshops, a legislative breakfast and the Wayne N. Aspinall Memorial Luncheon.

GENERAL SESSION topics on Thursday, January 20 will include: "The American Opportunity" -- Howard B. Propst; and invited speakers who will address reauthorization of the Clean Water Act, Endangered Species Act, Safe Drinking Water Act; the "New" Bureau of Reclamation; "New" Directions by the Forest Service; BLM and Wilderness and Wetlands.

Concurrent workshops will focus on government water activities, engineering and management developments, water education and legal developments and issues.

At Friday's legislative breakfast, six legislators will address the delegates: invited are Senators Don Ament, Tilman Bishop, John Johnson and Tom Norton; and Representatives Bill Jerke and Jeannie Reeser.

GENERAL SESSION III topic will be a debate, "Have the Feds Declared War on the West?" For GENERAL SESSION IV, a panel will discuss issues related to the Colorado River Compact, Interstate Water Transfers and Colorado River Strategies.

Chuck Green, Editor of the Editorial Pages of the *Denver Post*, will be speaker at the Wayne N. Aspinall Memorial Luncheon.

For additional information, contact the Colorado Water Congress, 1390 Logan, #312, Denver, Colorado, 80203. Phone: 303/837-0812; FAX 303/837-1607.

11TH HIGH ALTITUDE REVEGETATION WORKSHOP

March 16-17, 1994

University Park Holiday Inn, 425 W. Prospect Road, Fort Collins (303/482-2626)

The High Altitude Revegetation Committee, through its workshops and summer field tours, strives to promote understanding of reclamation and revegetation techniques and problems when fragile ecosystems are modified by human activities. Some special topics to be covered this year will be ecological restoration, acid rock drainage and the Summitville Superfund cleanup. The keynote address will be given by ecologist W.D. Billings, Professor Emeritus at Duke University, on high elevation ecology and ecosystems as they relate to reclamation. Historian Robert Brown will be banquet speaker and show slides of ecological recovery of 100-year-old mining disturbances in Clear Creek and Gilpin Counties, Colorado. The workshop will include poster papers and educational and exhibitor displays.

For information contact: Gary L. Thor, HAR Committee Secretary, Department of Agronomy, Colorado State University, Fort Collins, CO 80523. Phone 303/491-7296; FAX 303/491-0564.

ASSOCIATION OF STATE DAM SAFETY OFFICIALS SCHOLARSHIPS

The ASDSO has established two annual scholarships of \$2,500. Successful recipients must be enrolled at the junior or senior level in an accredited civil engineering program, or in a related field as determined by ASDSO, and must demonstrate an interest in pursuing a career in hydraulics, hydrology, or geotechnical disciplines, or in another discipline related to the design, construction, and operation of dams.

Undergraduate students planning to graduate in May 1995 will be eligible for the 1994 senior scholarship. Undergraduate students planning to graduate in May 1996 will be eligible for the 1994 junior scholarship. Awards made at the junior level may be renewed the following year at the discretion of ASDSO. However, the junior scholarship recipient must reapply if interested in receiving a scholarship for the senior year.

Minimum Criteria -- Applicants must have a cumulative grade point average of 3.0 for the first two years of college and be recommended by their academic advisor. They must also submit a two-page typewritten essay describing his or her goals and purpose for applying.

Basis for Award -- The basis for selection will generally follow these guidelines: Academic Scholarship; Financial Need; Work Experience/Activities; Essay. ADSSO will be the final determiner in each instance as to which applicants will be recipients of a scholarship. **Deadline:** January 30, 1994. Request application forms from or submit application and accompanying materials to: Association of State Dam Safety Officials, 450 Old East Vine, 2nd Floor, Lexington, Kentucky 40507. Phone: 606/257-5140.

CALENDAR

- Jan. 19-21 CONFERENCE ON TAILINGS & MINE WASTE '94, Fort Collins, CO. Contact: Janet Lee Montera, Dept. of Civil Engineering, Colorado State University, Fort Collins, CO 80523. Phone 303/491-7425; FAX 303/491-7727.
- Mar. 21-23 ASSESSMENT OF MODELS FOR GROUNDWATER RESOURCES ANALYSIS AND MANAGEMENT, Honolulu, Hawaii. Contact: Water Resources Research Center, University of Hawaii at Manoa, 2525 Correa Rd., HIG 441, Honolulu, Hawaii 96822. Phone 808/956-6331; FAX 808/956-2538.
- Mar. 23-26 9TH ANNUAL MEETING OF THE INTERNATIONAL ASSOCIATION FOR LANDSCAPE ECOLOGY, Tucson, AZ. Contact: Jim Laukes, The Univ. of Arizona Extended University, 1955 E. 6th St., Tucson, AZ 85719. Phone: 1-800/955-UofA; FAX 602/3269; internet jlaukes@ccit.arizona.edu.
- Mar. 27-30 SECOND INTERNATIONAL CONFERENCE ON GROUNDWATER ECOLOGY, Atlanta, GA. Contact: John Simons, USEPA, Groundwater Protection Div., Mail Code WH550G, 401 M St., SW, Washington, DC 20460. Phone 202/260-7091.
- Mar. 27-31 SYMPOSIUM ON THE APPLICATION OF GEOPHYSICS TO ENVIRONMENTAL AND ENGINEERING PROBLEMS, Boston, MA. Contact: Tom Fenner, SAGEEP '93, Geophysical Survey Systems, Inc., P.O. Box 97, North Salem, NH 03073-0097.
- Apr. 5-9 14TH ANNUAL HYDROLOGY DAYS, Colorado State University, Fort Collins, CO. Contact: Janet Montera, Civil Engineering Dept., Colorado State University, Fort Collins, CO 80523. Phone: 303/491-7425; FAX 303/491-7727.
- Apr. 17-20 RESPONSE TO CHANGING MULTIPLE-USE DEMANDS: NEW DIRECTIONS FOR WATER RESOURCES PLANNING AND MANAGEMENT, Nashville, TN. Contact: Ralph H. Brooks, Tennessee Valley Authority, Knoxville, TN. Phone 615/632-6770.
- 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 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 26-29 EFFECTS OF MAN-INDUCED CHANGES ON HYDROLOGIC SYSTEMS, Jackson Hole, WY. Contact: David Naftz, USGS, Salt Lake City. Phone 801/975-3389.

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