Colorado Water

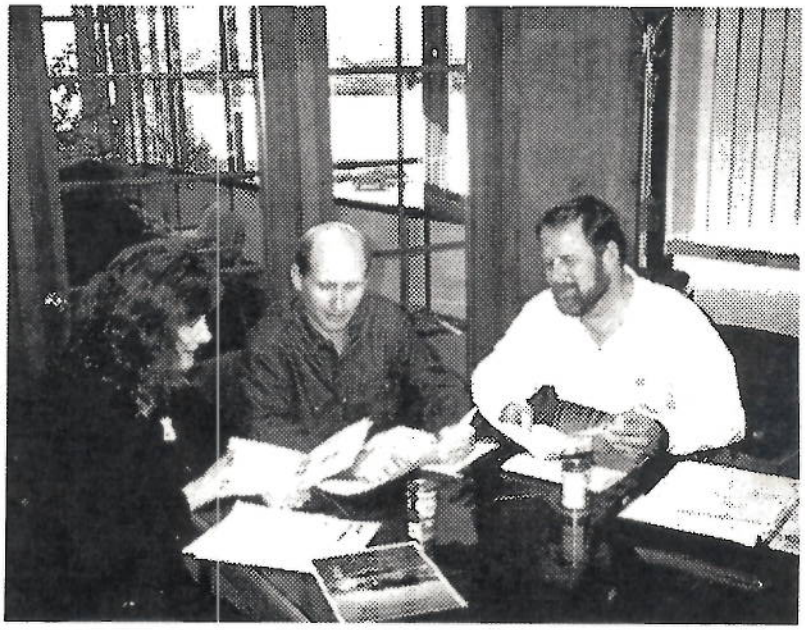
Newsletter of the Colorado Water Resources Research Institute. Fort Collins, Colorado 80523

APRIL 1998

Plans for the 24th Annual Colorado Water Workshop are underway --

This summer's conference will feature a special appearance by former U.S. Bureau of Reclamation Commissioner Floyd Dominy.

See Page 34



From left: Robin Helken, Director, Colorado Water Workshop; Brian Werner, Northern Colorado Water Conservancy District; and Larry Howard, City of Loveland, discussing plans for 1998 Colorado Water Workshop.

FOR AN UPDATE ON THE RIO GRANDE DROUGHT ASSESSMENT PROJECT, See Page 5

Colorado State University

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COLORADO WATER

Vol. 15, No. 2 April 1998

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Robert C. Ward, Director

EDITORIAL

GOOD NEWS – BAD NEWS: AN UPDATE ON WATER RESEARCH FUNDING

Editorial by Robert C. Ward

The national water institutes program organizes an annual meeting where institute directors learn about the federal funding for the institute program (through the U.S. Geological Survey) as well as water research funding opportunities in various Federal agencies. This year's meeting was held in Washington, D.C. March 16-18, 1998.

Informally, the institute directors exchange information about efforts to improve university water education and water research in their own states. This exchange of information allows the formulation of new approaches to water education and research that can build upon the experiences of other institutes and universities.

What are the status and trends in water research this year? There is both good news and bad news to report. First the bad news. The Wyoming Water Resources Center is being closed due to state budget problems. Wyoming provided $765,000 annually to its water center. It is unfortunate that, at a time of great stress in water management across the west, the ability of higher education in Wyoming to contribute to solving water problems will be greatly diminished.

The good news relates to improving prospects for water research funding at the federal level. The administration's Clean Water Action Plan and Research Fund for America bode well for at least maintaining existing water research programs while offering the possibility of expansion in some cases. The President's FY 1999 budget request calls for a 23 percent increase in the national water institute program funding. This is the first increase in the institute program budget proposed by any administration in almost 15 years.

There are also new efforts to streamline and coordinate water research opportunities at the U.S. Environmental Protection Agency (EPA), U.S. Department of Agriculture (USDA), the National Science Foundation (NSF) and the U.S. Geological Survey (USGS).

The USDA and EPA have established strong extramural, competitive research programs. They are also using a peer review process to identify the proposals worthy of funding (more closely allied with the process employed by NSF). The recent addition of USDA to the NSF/EPA-sponsored Water and Watershed competition indicates the use of a common proposal format and review process. This trend toward more common proposal formats and selection processes should permit faculty to spend more time developing the scientific content of the proposal and less time on learning the nuances of each agency's guidelines and budget forms.

Another trend I noticed is the effort of USDA and EPA to collect research competition information for their agency/department in one location. The following URLs, which provide an overview of the water research funding opportunities and procedures in the respective agencies, represent the current results of these efforts to consolidate information.

1. National Science Foundation

The following URL provides information on how the NSF grants program operates:
http://www.nsf.gov/home/grants.htm

The next URL presents an overview of NSF programs for FY 1998:
http://www.nsf.gov/od/lpa/news/publicat/nsf97150/start.htm

Water research opportunities, of course, are scattered throughout NSF programs.

2. **U.S. Department of Agriculture**
The following URL contains descriptions and deadlines of current USDA funding 'rounds', as well as abstracts of previously funded projects.
http://www.reeusda.gov/funding.htm

3. **U.S. Environmental Protection Agency**
The U.S. EPA is coordinating many of its research competitions through the National Center for Environmental Research and Quality Assurance's Science to Achieve Results (STAR) Program.
http://es.epa.gov/ncerqa/grants

In a number of the national research competitions described in the above home pages, there is often a requirement that partnerships be developed among 'stakeholders' and researchers. As faculty compete for water research funding, Colorado water users and managers must be willing to work with the universities to enhance the success of bringing water research funding to Colorado. Such partnerships are already common and more can be expected in the future. CWRRI will do all it can to connect the water research needs of Colorado water users and managers to the efforts of faculty to compete successfully for Federal water research funding.

Thus, while there is good and bad news, overall I feel the opportunity for faculty in Colorado's higher education system to obtain water research funding is improving, particularly at the national level. As with many dimensions of Colorado's water resources, to be successful in supporting water research requires Colorado's entire water management infrastructure to work together.

♦♦♦♦♦

RICH HERBERT MEMORIAL SCHOLARSHIP
Offered by the Colorado Section,
American Water Resources Association

The applicant must meet the following criteria:

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

Involvement in research or independent study pertaining to hydrology, engineering, hydrogeology, geomorphology, aquatic biology, water law, water-resources policy or planning, environmental science or other topics concerning water resources in Colorado.

STIPEND: Scholarships are awarded for one academic year. The amount is determined by the AWRA-Colorado Section Board of Directors. Previous awards have ranged from $750 to $1500.

APPLICATIONS: Must be received no later than June 1 prior to the beginning of the academic year. They must include a resume, an abstract of current research, and a letter of recommendation from a faculty adviser. SEND TO: Chairman, Scholarship Committee, AWRA-Colorado Section, P.O. Box 9881, Denver, CO 80209-0881.

RESEARCH

INTERDISCIPLINARY TEAM DEVELOPS RIO GRANDE DROUGHT ASSESSMENT PROCESS

Introduction

The Rio Grande River originates on the east slopes of the Continental Divide in a basin formed by the San Juan and the Sangre de Cristo Ranges of the Rocky Mountains in southern Colorado. Its Colorado drainage basin is 8,900 square miles. The river then flows on through the States of New Mexico and Texas, ending its course in the Gulf of Mexico. Along its way through New Mexico and Texas, the Rio Grande winds through some of the fastest-growing urban areas in the nation, and the current population is expected to continue to grow rapidly. From 1990 to 2010, U.S. border cities on the river are predicted to grow by as much as 86 percent.

The river's annual streamflow is highly variable, and the basin area is geologically diverse. The climatic differences from the headwaters of the Rio Grande to El Paso are extreme. The Rio Grande and its tributaries span an altitude range of more than 9,000 feet and traverse several climatological zones, from alpine tundra to Chihuahuan Desert. The Rio Grande from El Paso, Texas to the Gulf of Mexico forms the international boundary between the United States and Mexico for 1,250 miles (2,010 kilometers). United States and Mexico activities governing the waters of the Rio Grande and the demarcation of this river as the international boundary are entrusted to the International Boundary and Water Commission, United States and Mexico (IBWC). (Department of State. 1944, 1970).

In 1997, water scientists in Colorado, New Mexico and Texas initiated a regional research project to define the existing engineering-institutional-economic system in place on the Rio Grande, to characterize probable drought scenarios, and to assess the capability of existing infrastructural and institutional systems to respond to drought.

The Rio Grande Compact (1938) regulates the interstate flow of the Rio Grande between Colorado and New Mexico, and between New Mexico and Texas. A 1944 Water Treaty regulates the flow of the Rio Grande between the United States and the Republic of Mexico. Costilla Creek, located in Colorado and New Mexico, is regulated by the Costilla Compact of 1946 as amended in 1963. Surface-water rights on the Rio Grande in Colorado and New Mexico exceed the mean annual flow of the river.

To overcome seasonal and multi-year water shortages and meet projected future demands in the Rio Grande Basin, federal and state governments have built an extensive network of water storage and conveyance systems. Regional water management systems have developed and linked the water resources of the Rio Grande to serve users in Colorado, New Mexico and Texas. Yet, to date no comprehensive analysis has been conducted to provide the information needed to get through a drought period with minimal economic disturbance.

In 1997, water scientists in Colorado, New Mexico and Texas initiated a regional research project to define the existing engineering-institutional-economic system in place on the Rio Grande, to characterize probable drought scenarios, and to assess the capability of existing infrastructural and institutional systems to respond to drought. The researchers set out to develop evaluative criteria that would identify economic damages of drought from the perspectives of each water-use sector: instream, agricultural, muncipal and industrial. To perform the drought assessment, three initial tasks were set forth by the interstate, interdisciplinary team: Task 1: Formulate Credible Drought Scenarios; Task 2: Formulate a Hydrology-Institutions Model of the Rio Grande Basin; and Task 3: Develop an Economics Drought Damage Component.

The project director is Tom Bahr, Director, New Mexico Water Resources Research Institute. Investigators for the project are:

From New Mexico State University: Frank Ward, Principal Investigator, Department of Agricultural Economics and Agricultural Business; Tom McGuckin, Co-Investigator, Department of Agricultural Economics and Agricultural Business; J. Philip King, Co-Investigator, Department of Agricultural Engineering.

From Colorado State University: Robert Young, Co-Investigator and Colorado Leader, Department of Agricultural and Resource Economics; Marshall Frasier, Co-Investigator, Department of Agricultural and Resource Economics; Grant Cardon, Department of Soil and Crop Sciences.

From Texas A&M University: Ronald Lacewell, Co-Investigator, Department of Agricultural Economics; John Ellis, Co-Investigator, Department of Agricultural Economics; and Raghavan Srinivasan, Co-Investigator, Texas Agricultural Experiment Station.

Consultants working on the project are Dr. James Booker, a Colorado State University graduate who recently completed a similar model for the Colorado River Basin, and Water Law expert Dr. Charles DuMars, University of New Mexico.

Status of the Rio Grande Drought Study Model, February, 1998

by Tom Lynch and Frank Ward
New Mexico State University

♦General Structure

The model is structured in nodes, where each node is a point at which any of several management decisions may be made (Figure 1). Decisions include: surface and/or ground water withdrawals, use for agricultural or municipal uses, returns to surface and/or ground water, and reinjection into the aquifer at agricultural or municipal nodes; storage or release for hydropower and downstream use at reservoir nodes; and measurement for treaty purposes at gauge nodes.

Currently, the model is a rough hydrologic model of the upper Rio Grande from the headwaters to Fort Quitman Texas (Figure 2). It has been developed by Dr. Phil King at New Mexico State University in cooperation with Dr. Raghavan Srinivasan and Dr. Seiichi Miyamoto at Texas A&M. Management nodes include:

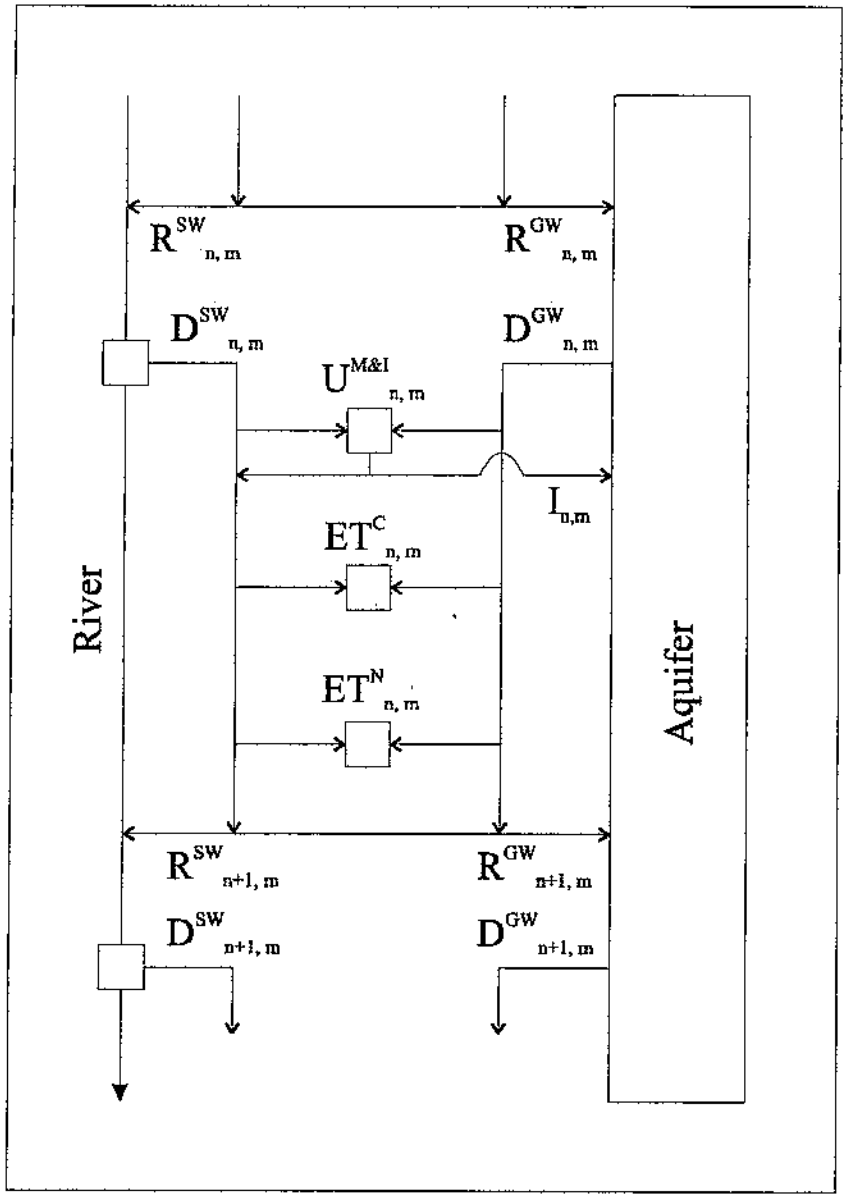
- Del Norte, CO, which includes the irrigation districts on the Rio Grande;
- Mogote, CO, which includes the irrigation district on the Conejos;
- Lobatos Gauge, CO, which includes the Closed Basin Project inflows;
- Embudo Gauge, NM;
- Heron Reservoir;
- El Vado Reservoir;
- Abiquiu Reservoir;
- Otowi Gauge;
- Cochiti Reservoir;
- Middle Rio Grande Conservancy District, NM;
- Albuquerque, NM;
- Elephant Butte Reservoir;
- Caballo Reservoir;
- Elephant Butte Irrigation District;
- Mexican Canal; and
- El Paso County Water Improvement District #1,TX.

♦Rio Grande Compact

The central core of constraints in the model allocates annual streamflow among the states in accordance with the Rio Grande Compact; any examination of institutional adjustments to mitigate the effects of drought will be made within this framework.

The important management nodes are the gauging stations at Del Norte, Mogote, Lobatos, Otowi, and Elephant Butte. Equations

Figure 1. Node structure of model



Key:

n: Index indicating the node under consideration
m: Index indicating the month under consideration
$D^{SW}_{n,m}$: Diversion of surface water
$D^{GW}_{n,m}$: Diversion of ground water
$U^{M\&I}_{n,m}$: Municipal and industrial use
$I_{n,m}$: Injection into aquifer
$ET^{C}_{n,m}$: Water used for crop evapotranspiration
$ET^{N}_{n,m}$: Water used for non-crop evapotranspiration
$R^{SW}_{n,m}$: Returns to surface water
$R^{GW}_{n,m}$: Returns to ground water

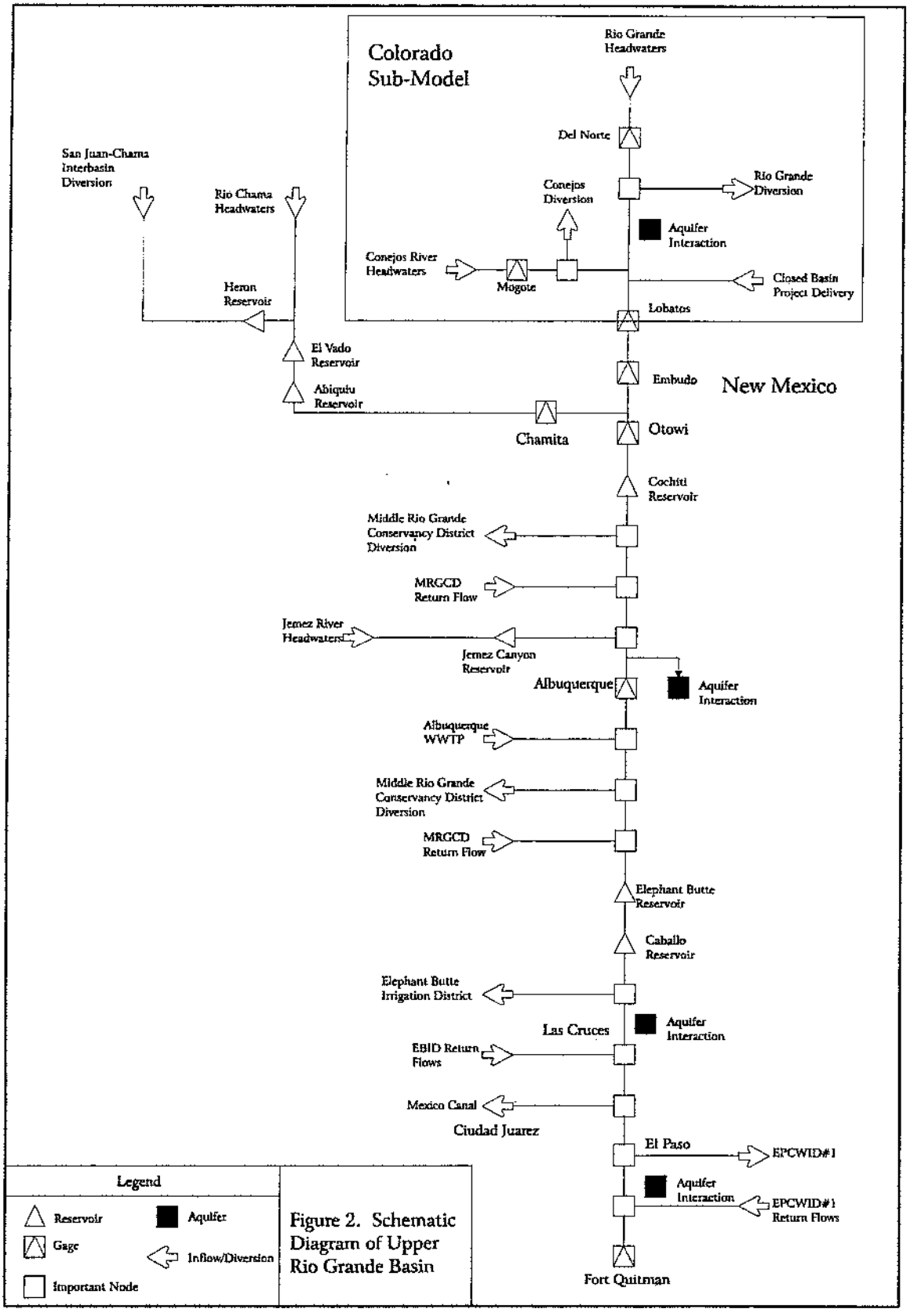


Figure 2. Schematic Diagram of Upper Rio Grande Basin

have been estimated that equal the look-up table values that define annual stream flow allocation listed in Article III and the Resolution of 1948 of the Rio Grande Compact. For modeling purposes, the annual streamflow requirement at Elephant Butte is met at the inflow rather than the outflow as required by the Compact because of the difficulty in specifying the mathematical equations incorporating total outflows and changes in storage. This change was discussed with Don Lopez, Assistant New Mexico State Engineer, who felt that the change closely approximates Compact requirements.

♦1906 Treaty with Mexico
This model will meet the requirements of the treaty as specified in Article II. One issue is the statement that "In case, however, of extraordinary drought ... the amount delivered to the Mexican Canal shall be diminished in the same proportion as the water delivered to lands under said irrigation system in the United States." Extraordinary drought has not been defined, so Dr. Charles DuMars will attempt to clarify the point at which deliveries may be reduced.

♦Stream Flows
Stream flows are modeled as a simple mass balance: The flow at any node is the flow at the upstream node minus the diversions at the upstream node plus the inflow at the current node plus or minus any gains or losses between nodes. These gains and losses represent such things as evaporation, changes in bank storage, or infiltration through the stream bed. The structure is in place; however, parameter values need to be estimated.

Because of federal legislation regarding endangered species, one question that must be addressed is the issue of the Rio Grande Silvery Minnow. Minimum streamflows in the region between Albuquerque and Elephant Butte may be required. An issue of contention will be whose surface water allocation is reduced to maintain that flow. This will be another area in which Charles DuMars will play a significant role.

♦Ground Water
To date, parameters for ground water pumping have not been developed. Phil King is responsible for providing aquifer parameters. Variables have been entered into the structure, but there are no constraints to limit ground water pumping. There is also a variable that defines injection into aquifers; this is important for El Paso and may be a future policy option for Albuquerque.

♦Economic Benefits
Mathematical equations relating economic benefits to alternative levels of water supply are being developed for all uses of water for each of the relevant nodes. These so-called "benefit functions" are designed to reflect foregone economic values for different degrees of drought. These include agriculture, municipal and industrial (M&I), electric power, and recreation.

M&I benefits functions have been developed by Dr. Tom McGuckin. Currently they are expressed on an annual basis, so they must be modified to fit the monthly time step of the model.

Recreational benefits for instream and lake recreational benefits will be estimated by Dr. Frank Ward and will be based on recreational values of streamflow and reservoir storage. Data will be obtained for fishing and other water-based recreation from previous regional studies.

Agricultural benefits will be based on representative farms for each agricultural node. Dr. Grant Cardon at Colorado State University is developing yield functions for various crops which show the effects of water shortages on crop yields. These yield functions will be calibrated to fit conditions for irrigated agriculture in the three states. Drs. Ron Lacewell and John Ellis at Texas A&M are responsible for applying the functions for agriculture in the El Paso area. Dr. Phil King is responsible for New Mexico agriculture. These functions are based on the timing of water applications, soil characteristics, and climatic conditions.

Hydroelectricity generation and benefits equations have been entered into the model for the three reservoirs that have generating facilities.

♦Reservoir Operations
Area-capacity and elevation-capacity functions have been estimated based on tables generated by the US Army Corps of Engineers

and Bureau of Reclamation. These are necessary for volume accounting, evaporation estimation, recreational benefits, and hydropower production.

Average evaporation data has been entered for El Vado, Abiquiu, Heron, and Cochiti Reservoirs. Data needs to be acquired for Elephant Butte and Caballo.

There is a term in the objective function that maintains the surface area of Cochiti Lake at 1200 acres, as stipulated in the Corps of Engineers Water Control Manual. This requirement was not put in the constraints because in periods of reduced flows it will most likely not be met and the result will be an infeasible problem. By placing it in the objective the surface area can vary, but any variation alters the objective value; so this introduces a cost into the model that shows the user the value of water used for maintaining a specified surface area at Cochiti Lake. Jemez Canyon Reservoir is used only for flood control, so it is ignored for the time being.

Future Work

♦Upstream of Lobatos

Dr. Marshall Frasier and Dr. Robert Young are developing a model that treats the San Luis Valley as a separate unit. One advantage to this approach is that more details can be included and the output will be more comprehensive than would be possible in a basin-wide model. Dr. Frasier and his graduate assistant, Mark Sperow, are developing a model that will use annual inflow, starting aquifer storage, and basinwide equilibrium water values to produce a monthly streamflows at Lobatos, ending aquifer storage, and agricultural benefits accruing to the San Luis Valley. The basinwide equilibrium water values will be used in the future to estimate the quantity of water that farmers would be willing to sell or rent across state lines if interstate water banking were to occur. This approach is acceptable to other members of the research team because Colorado has no significant storage to complicate water allocation under the Rio Grande Compact.

♦Downstream of Lobatos

The major challenges being faced are incorporating aquifer parameters and benefits functions for agricultural and municipal uses. The model is becoming complex, and it may be necessary to run a series of small models for each node and have a the basin-wide model only be a skeleton that links the smaller models. The model is reaching the size limit allowed by the available software. Once equations have been estimated, experimentation for the best way to proceed will be required.

Rio Grande Drought Study Advisory Council

COLORADO

Robert Ward, Director, Colorado Water Resources Research Institute, Fort Collins, CO
Ralph Curtis, General Manager, Rio Grande Water Conservancy District, Alamosa, CO
Allen Davey, Davis Engineering Services, Del Norte, CO
Leroy Salazar, Agro Engineering, Inc., Alamosa, CO
Steve Vandiver, Division III Engineer, Division of Water Resources, Alamosa, CO

TEXAS

Wayne Jordan, Director, Water Resources Research Institute, College Station, TX
Darron Powell, Engineer Advisor to the Texas Rio Grande Compact Commissioner, El Paso, TX
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John M. Bernal, Commissioner, International Boundary & Water Commission, El Paso, TX
Wayne Halbert, General Manager, Harlingen Irrigation District, Harlingen, TX
Mike Personett, Director, Local and Regional Assistance, Texas Water Development Board, Austin, TX
Cindy Martinez, Rio Grande Watermaster, McAllen, TX
John Kaiser, Environmental Planner, South Texas Development Council, Laredo, TX
Armando Garza, Jr., Executive Director, South Texas Development Council, Laredo, TX
Paul Kyke, Director, Integrated Information Management Laboratory, Blackland Research Center, Temple, TX
Gordon L. Thorn, P.E., Texas Water Development Board, Austin, TX

NEW MEXICO

Tom Bahr, Director, Water Resources Research Institute, Las Cruces, NM
Tom Turney, State Engineer, New Mexico State Engineer's Office, Santa Fe, NM
Gary Daves, City Planner, City of Albuquerque Public Works, Albuquerque, NM
Gary Esslinger, Treasurer-Manager, Elephant Butte Irrigation District, Las Cruces, NM
Subhas K. Shar, Chief Engineer, Middle Rio Grande Conservancy District, Albuquerque, NM
Steve Hanson, U.S. Bureau of Reclamation, Albuquerque, NM
Richard Kreiner, U.S. Army Corps of Engineers, Albuquerque, NM
Russ Livingston, District Chief, U.S. Geological Survey, Albuquerque, NM

Partial Sources: (1) Anderholm, S.K., Radell, M.J., and Richey, S.F., 1995, Water-quality assessment of the Rio Grande Valley Study Unit, Colorado, New Mexico, and Texas—Analysis of selected nutrient, suspended- sediment, and pesticide data: U.S. Geological Survey Water-Resources Investigations Report 94-4061, 203 p. (2) FY96 Rio Grande Assessment Report: Overview, http://beat.riogrande.org/pages/assesstext.html.

CWRRI SUBMITS PROPOSALS TO FY1998 WESTERN REGION GRANTS PROGRAM

The State Water Institute Program, once again operating under a Regional Water Resources Competitive Grants Program, solicited proposals from Western Region Institutes or Centers (AK, AZ, CA, CO, ID, NM, NV, OK, OR, TX, UT, WA, WY). A requirement of the competition was research collaboration among two or more states in the Western Region. Colorado State University is the lead institution for the first three water research proposals described below, and co-leader for the fourth.

♦Integrating Biohydrology and Water Management To Benefit Native Fishes in the Western United States

Previous efforts to mitigate effects of water development on stream fish have been based on minimum flow criteria for instream habitat. However, thi focus has proven inadequate to halt species declines. It is now recognized that protecting native fish and other aquatic species requires an understanding of how hydrologic processes at the entire watershed scale help generate and maintain aquatic biodiversity and the health of the river system. A major advantage of this proposed research collaboration by California, Oregon and Colorado is that the three states share many of the same stream fish species. The regional project will involve two interrelated components: a field study to compare and contrast the reproductive success of native fishes in rivers and streams in California, Oregon and Colorado that differ in the type and degree of flow modification and have varying degrees of influence on nonnative fishes; and flow regime analyses of a larger set of rivers and streams in California, Oregon and Colorado to provide a broader context for analyzing the significance of field observations and to provide information on ecologically significant flow regime alterations that can be applied to future studies of river and riparian biota. The principal investigator for the proposed research is Dr. Kurt Fausch, Department of Fishery and Wildlife Biology, Colorado State University. Dr. Elizabeth Strange of the same department is co-investigator. Co-investigators for California and Oregon are Dr. Peter Moyle, Department of Wildlife, Fish, and Conservation Biology, University of California, Davis; and Dr. Hiram Li, Professor and Assistant Leader, Cooperative Fish and Wildlife Research Unit, Oregon State University.

♦Meeting Time-Dependent Instream Flow Requirements in a Fully Appropriated Multi-State River Basin

Water users in the three basin states of Colorado, Wyoming, and Nebraska have effectively fully appropriated the flows of the South Platte, North Platte, and Platte Rivers — primarily for irrigation uses. At the same time, species dependent on the habitat are listed as threatened or endangered. To comply with the ESA mandate for recovery of these species, the U.S. Fish and Wildlife Service estimates that on average as much as 373,000 acre-feet of additional water must be made available. In 1997 the Governors of Colorado, Wyoming and Nebraska, along with the Secretary of the Interior, signed a Memorandum of Agreement to develop a program to meet ESA requirements. A ten-person Governance Committee is responsible for implementation of the MOA. In the first 10 to 13-year increment of the agreement, the parties commit to reduce shortages to target flows at Grand Island an average of 130,000 acre-feet. Approximately half of the water commitment is to come from specific water projects in the three states. The remaining half is expected to come from water conservation and water supply options to be identified initially by a consultant and included in an action plan by the Committee. This proposed research will complement the efforts of the Committee and its consultant to identify potential water conservation and water supply projects. It will develop a conceptual analytical framework in which to evaluate the feasibility, effectiveness, and effects of alternative approaches for supplying additional instream flows to the central Platte River in Nebraska. The principal investigator for the proposed research is Dr. Marshall Frasier, Department of Agricultural and Resource Economics at Colorado State. Dr. Robert A. Young of the same department, and Dr. Tim Gates,

Department of Civil Engineering, are co-investigators. Co-investigators from other states are: Dr. Ari Michelsen, Washington State University-Vancouver; Dr. James Booker, Alfred University, NY; Dr. Garth Taylor, University of Nebraska; and Dr. Steve Gloss and Dr. Mark Squillace, University of Wyoming.

♦Simulation Model for Design and Management of Irrigation and Drainage Systems for Water Quality

This proposed research would validate and calibrate a simulation model for designing and managing irrigation-drainage systems. These systems will be capable of maintaining crop productivity and controlling contaminant loads in drainage return flows. The simulation model, Colorado State University Irrigation and Drainage model (CSUID), will be used to evaluate best management practice (BMP) alternatives for irrigation and drainage systems in arid and semi-arid irrigated areas. The ability to accurately simulate the effect of BMPs will greatly reduce the amount of money, time, and effort that is spent evaluating different BMPs and will allow researchers to focus their field research on the most promising alternatives. The proposed methodology will evaluate appropriate irrigation and drainage strategies in two field sites (one in southeastern Colorado and a second in southwestern Kansas) that could become part of a real-time watershed water quality management system. The results of this study should provide information applicable to most of the Arkansas River Basin and other basins experiencing salinity problems. The principal investigators are Dr. Luis A. Garcia and Dr. Robert Ward at Colorado State University. Collaborators include Todd P. Trooien at Kansas State University and James C. Valliant, Colorado State University Cooperative Extension.

♦Experiments on Erosion of Cohesive River Bends

This proposed research would expand knowledge about rates of lateral migration in cohesive river bends. Little is known about this problem, yet it is important in defining the hydraulic geometry and the morphology of small drainage systems and gullies that develop throughout the Western United States. Experiments on scour rate determination in cohesive soils have been completed at Colorado State for rills forming in agricultural fields. The proposed analysis would extend previous work to larger fluvial systems, and particularly to surface runoff in river bends. The experiments would be carried out at the Hydraulics Laboratory, Engineering Research Center, Colorado State, and would be supplemented with field investigations at Washington State University. The principal investigator for Washington State University is Dr. T. Papanicolaou. Dr. Pierre Y. Julien of CSU's Civil Engineering Department would carry out experiments at the Foothills Hydraulics Laboratory.

WATER EDUCATION

CHILDREN'S WATER FESTIVALS: SUCCESS BREEDS SUCCESS IN COLORADO

Condensed from material provided by Brian R. Werner, Northern Colorado Water Conservancy District and Mary DiMartini Andre, CSU Water Center

A number of Colorado water agencies, municipalities, and educational institutions have combined efforts recently to coordinate a relatively new concept in water education — Children's Water Festivals. We trace the idea for the Colorado festivals to the Nebraska Groundwater Foundation, which organized Nebraska's first groundwater festival in 1989. Tom Cech, Executive Director of the Central Colorado Water Conservancy District, transported the water festival idea to Colorado two years later. Cech, referred to as "the grandfather of water festivals here" by Brian Werner, organized and hosted the first Colorado Children's Water Festival, held in Greeley in March 1991. Now, Children's Water Festivals are hosted in over 40 states and several other countries. The festivals include a wide variety of activities including classroom presentations, exhibit areas, poster and essay contests, water knowledge competitions, and teacher resource rooms.

On January 28, 52 Children's Water Festival organizers and supporters met in Northglenn, Colorado to share their experiences and ideas. The event was organized by Brian Werner of the Northern Colorado Water Conservancy District. Tom Cech of the Central Colorado Water Conservancy District, and Terry Moulton of the Colorado Water Conservation Board. With its success, as evident in the enthusiasm of a large and diverse group of participants, the event is planned again next year, to be held during the Colorado Water Congress annual meeting. Information about water festival resource lists and upcoming water festivals in Colorado is available on the Northern Colorado Water Conservancy District web site at **http://www.ncwcd.org/festivals.html**.

UNIVERSITY WATER NEWS

NEW FACULTY IN WATER

by Laurie Schmidt

Andrew F. Seidl
Department of Agricultural and Resource Economics
Colorado State University

Andrew Seidl joined the faculty in the Department of Agricultural and Resource Economics at Colorado State University in 1997. Dr. Seidl received his M.S. in Food and Resource Economics and his Ph.D. in Food and Resource Economics, with a concentration in natural resource and regional economics, from the University of Florida. In 1995, he worked as commodity analyst for the Food and Agriculture Organization of the United Nations (FAO-UN) in Rome, Italy. There, he developed a framework for a global generic promotion program for citrus products and reviewed research on the environmental impact of world citrus production.

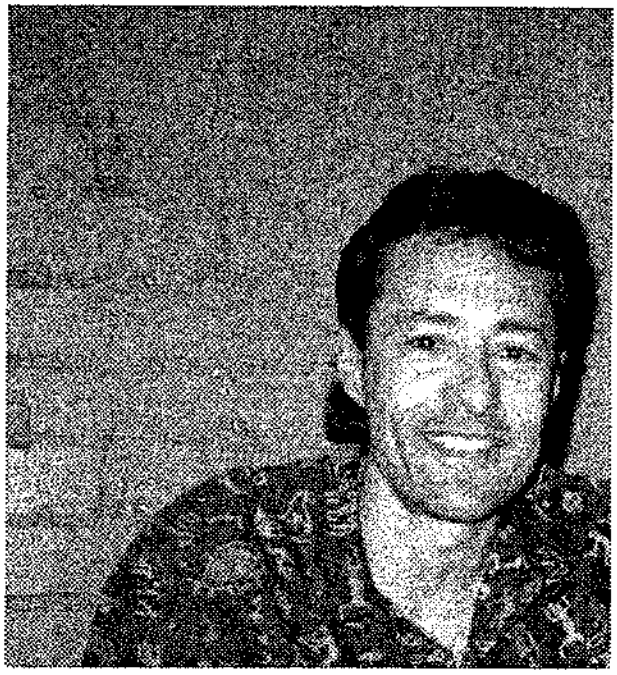
Dr. Seidl also maintains a continuing research relationship with the Center for Agricultural Research in the Pantanal (CPAP-EMBRAPA), Brazil. From 1996-1997, funded by the PROMOAGRO program of the Interamerican Development Bank, he served as consultant/natural resource economist to undertake agricultural research in the Pantanal, the world's largest freshwater wetland. His research there included investigating the incentives for cattle ranchers to deforest land and plant pastures; examining tropical livestock diseases, including Trypanosoma evansi and T. vivax; combining local knowledge of fisheries with limnological research of a naturally occurring die-off phenomenon; and looking at fishing and tourism development in the region.

Dr. Seidl is currently assistant professor and extension economist in the Department of Agricultural and Resource Economics. His research interests lie in the areas of land-use on the rural-urban fringe, the role of agriculture in community development, the interface of agriculture and the environment, and the implications of federal, national and local legislation.

In 1997, he received the Mitchell Young Scholar Prize for Sustainable Development, awarded by George and Cynthia Mitchell of the Houston Advanced Research Center and selected by the National Academy of Sciences. He also currently serves on the International Union for the Conservation of Nature's (IUCN) Commission on Ecosystem Management (CEM).

NEW FACULTY IN WATER

by Laurie Schmidt



Mark Hernandez
Department of Civil, Environmental, and Architectural Engineering
University of Colorado

Mark Hernandez joined the faculty in the Department of Civil, Environmental, and Architectural Engineering at the University of Colorado/Boulder in 1996. Dr. Hernandez received his M.S. and his Ph.D. in Environmental Engineering from the University of California at Berkeley. He also served a post-doctoral fellowship there, during which time he was responsible for leading research to apply direct quantitative microscopy and biochemical assays to evaluate enhanced and intrinsic in-situ bioremediation in hydrocarbon and solvent contaminated soils. The research was subsequently used for health and environmental risk assessment for closure of the Alameda Naval Air Station in California.

In 1993, Dr. Hernandez served as laboratory instructor at the International Association on Water Quality in Perugia, Italy. His professional experience also includes several years of industrial civil engineering design.

Dr. Hernandez's research focuses on direct microscopic characterization techniques to investigate soil bioremediation, biological waste treatment processes, and indoor bioaerosols. His most recent research activities include characterizing the presence and activity of airborne bacteria and the control of the sulfur-oxidizing bacteria that cause concrete corrosion and acid mine drainage.

As associate professor, Dr. Hernandez teaches courses on introductory environmental engineering and wastewater treatment engineering at the University of Colorado. In addition, he has initiated new courses that present fundamentals and advanced techniques of microbiology, biochemistry, and microbial ecology in the context of civil and environmental engineering applications. These courses are designed to introduce environmental microbiology to upper division engineering undergraduates and to graduate students who do not possess a strong background in the biological sciences. He is also the principal investigator for an externally funded graduate research program in applied environmental microbiology.

Dr. Hernandez is the recipient of numerous awards in his field, including the National Science Foundation's Career Development Award in 1997 and the Water Environment Federation's Robert A. Canham Award in 1992. He has also authored and co-authored several journal articles related to his research.

INVENTORY OF COLORADO'S HIGHER EDUCATION ACTIVITIES AND EXPERTISE IN WATER

Five years ago, CWRRI published an inventory of the water expertise available in Colorado's higher education system in its newsletter, *Colorado Water*. The inventory consisted of a list of water-related courses available and of faculty who apply their disciplines to water resources. It included water expertise at the Colorado School of Mines, the University of Colorado at Boulder, and Colorado State University.

Recently, the inventory was updated, and it is being provided again to the readers of *Colorado Water* in a sequence of issues. In this issue is a list of the "water"courses at the **Colorado State University**. Copies of the complete inventory of "water" faculty and courses are available on the CWRRI website (**http://www.ColoState.EDU/Depts/CWRRI**) or upon request from CWRRI. During the next year, the **complete** inventory list will be published in *Colorado Water*.

COLORADO STATE UNIVERSITY WATER COURSES, 1997/98

The following courses offered at Colorado State University (at the senior level and above) are particularly relevant to water (e.g. water quantity, water quality, and the causes and management of both).

The following course letters refer to the department or college in which the course is taught:

A, AG	Agricultural Sciences	
AT	Atmospheric Science	www.atmos.colostate.edu
B	Biology	
CB	Chemical & Bioresource Engineering	www.lance.colostate.edu/depts/chembio
CE	Civil Engineering	www.engr.colostate.edu/depts/ce
EA	Agricultural & Resource Economics	
EG	Engineering	www.lance.colostate.edu
EH	Environmental Health	www.bernardino.colostate.edu/enhealth/riteside.html
EN	Bioagricultural Sciences/Pest Management	www.colostate.edu/depts/bspm/index.html
ER	Earth Resources	
FW	Fishery & Wildlife Biology	www.colostate.edu/FWB/intro.html
HY	History	www.colostate.edu/dept/hist/histhome.html
MB	Microbiology	
ME	Mechanical Engineering	www.engr.colostate/depts/me
NR	Forestry & Natural Resources	
PL	Philosophy	www.colostate.edu/depts/philosophy/
PO	Political Science	www.colostate.edu/depts/polisci/grad.html
RR	Natural Resources Recreation & Tourism	
RS	Range Science	
S	Sociology	
SC	Soil & Crop Sciences	www.colostate.edu/depts/soilcrop
ST	Statistics	www.stat.colostate.edu
Z	Zoology	

Course #	Credits	Title
Climatological Processes		
AG 580	3	Environmental Biophysics
AT 440	2	Meteorology
AT 606	3	Climatology
AT 620	3	Thermodynamics and Cloud Physics
AT 621	2	Atmospheric Chemistry
AT 712	3	Dynamics of Clouds
AT 724	2	Cloud Microphysics
AT 752	3	Weather Modification
AT 753	3	Atmospheric Water Resources
AT 755	3	Theoretical and Applied Climatology
SC 322	3	Principles of Microclimatology
SC 522	3	Plant Canopy Meteorology
Economics		
EA 540	3	Economics of Natural Resources
EA 541	3	Environmental Economics
EA 542	3	Economics of Water Resources
EA 662	3	Planning for Development (ME 610) Resources Planning
Groundwater		
CB 538	3	Groundwater Hydrology
CB 540	3	Groundwater Measurements
CB 638	3	Groundwater Quality and Contaminant Transport
CB 733	3	Flow in Porous Media
CE 423	3	Groundwater Engineering
CE 631	3	Solutions to Groundwater Problems
CE 633	3	Groundwater Cont. Transport Modeling
CE 635	3	Quantitative Hydrogeology
ER 446	3	Environmental Geology
ER 542	3	Hydrogeology
ER 552	2	Advanced Topics in Hydrogeology
Hydraulics		
CE 502	4	Introduction to Fluid Mechanics
CE 510	3	Operation of Hydraulic Systems
CE 514	3	Hydraulic Structures/Systems
CE 515	3	Hydropower
CE 605	3	Experimental Fluid Mechanics and Hydraulics
CE 607	3	Computational Fluid Dynamics
CE 612	4	Open Channel Flow
CE 614	3	Hydraulics of Closed Conduits
CE 700	3	Aero- and Hydrodynamics
CE 701	3	Advanced Mechanics of Viscous Fluids
CE 702	3	Turbulence
CE 714	3	Hydromachinery
CE 716	3	Erosion and Sedimentation
CE 717	3	River Mechanics
S 664	3	Sociology of Water Resources

Hydrology

CE 422	3	Basic Hydrology
CE 520	3	Physical Hydrology
CE 521	3	Hydrometry
CE 522	3	Engineering Hydrology
CE 524	3	Modeling Watershed Hydrology (ER 524)
CE 622	3	Risk Analysis in Water Resources
CE 624	3	Control of Floods and Drought
CE 720	3	Theoretical Physical Hydrology
CE 721	3	Stochastic Analysis in Water Resources
CE 722	3	Large Scale Hydrology
ER 416	3	Land Use Hydrology
ER 417	2	Watershed Measurements
ER 440	3	Watershed Problem Analysis
ER 616	3	Hillslope Hydrology and Runoff Processes

Irrigation & Drainage

CB 464	4	Soil-Water Engineering
CB 530	3	Irrigation Management for Water Quality
CB 532	3	Drainage and Wetland Engineering
CB 533	3	Water Control and Measurement
CB 535	3	Surface Irrigation Systems
CB 536	3	Sprinkler and Trickle Irrigation Systems
CB 537	1	Surface Irrigation Laboratory
CB 567	3	Monitoring and Evaluation of Irrigation Systems
CB 568	3	Irrigation System Management
CB 610	2	Irrigation Field Trip
CB 767	3	Advanced Irrigation Topics
CE 450	4)	Introduction to Geotechnical Engineering
CE 656	3	Design of Dams
SC 470	3	Soil Physics
SC 471	1	Soil Physics Laboratory
SC 770	4	Advanced Soil Physics

Law, Policy, History, Sociology

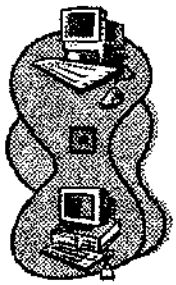
CB 462	3	Environmental Law
EA 575	3	Water Law
EA 678		Agricultural and Resource Policy
HY 464	3	American Environmental History
HY 510A	3	Reading Seminar: Water Development in the United States
NR 521	2	Natural Resource Administration
PL 545	3	Concept of Natural Value
PL 565	3	Seminar in Environmental Philosophy
PO 670	3	Politics of Growth and the Environment
PO 709	3	Environmental Politics in the U.S
PO 739	3	International Environmental Politics
PO 749	3	Comparative Environmental Politics
PO 759	3	Environmental Policy and Administration
S 421	3	Sociology of Natural Resource Utilization
S 460	3	Technology, Culture and Society

Management & Planning

CE 544	3	Water Resources Planning
CE 546	3	Water Resource Systems Analysis
CE 577	3	Urban Water Management
CE 578	3	Infrastructure Engineering and Management
CE 639	3	Technology Assessment and Social Forecasting
ER 440	3	Watershed Problem Analysis
ER 510	2	Watershed Management in Developing Countries
ER 516	3	Cumulative Effects and Watershed Analysis
ME 610	3	Planning for Development
NR 400	3	Public Relations in Natural Resources
NR 622	3	Analysis of Environmental Impact
RS 472	4	Range Ecosystem Planning

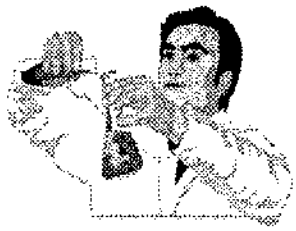
Models/Computer Data Management/GIS

CE 645	3	Computer-Aided Water Management and Control
CE 575		Expert System Applications in Engineering
EG 510/M 510	3	Linear Programming and Network Flow
EG 610	3	Engineering Decision Support/Expert Systems
ER 524	4	Modeling Watershed Hydrology
ER 712	3	Watershed Systems
NR 510	3	Geographic Information Systems
NR 621	3	Design of Geographic Information Systems
NR 793	1	Seminar in Geographic Information Systems



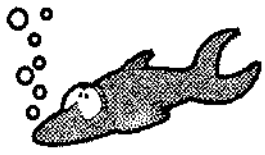
Non-point Source Pollution Control

A 468	3	Management and Control of Turfgrass Pests
AN 300-O	1	Animal Waste Nutrient Management
CB 405	3	Non-point Source Pollution
RS 400	2	Rangeland Improvements
RS 478	3	Surface Mining Rehabilitation
RS 578	3	Ecology of Disturbed Lands
SC 455	3	Soil Microbiology
SC 467	3	Soil Chemistry
SC 500	2	Environmental Agronomy
SC 560	3	Chemical Equilibria in Soils
SC 564	3	Chemical Analysis
SC 666	3	Salinity and Soil-Water Management
SC 755	3	Advanced Soil Microbiology
SC 760	3	Soil Chemistry and Plant Nutrition



Recreation Resources

ER 504/RR 504	2	Water-Based Recreation
RR 450	3	Wilderness Philosophy and Ethic Development
RR 454	3	Wilderness Management Planning



Sediment Transport

CE 413	3	Environmental River Mechanics
CE 716	3	Erosion and Sedimentation
CE 717	3	River Mechanics
ER 652	3	Fluvial Geomorphology

Snow Hydrology/Glaciers

ER 406	3	Seasonal Snow Environments
ER 474	3	Snow Hydrology
ER 574	3	Advanced Topics in Snow Hydrology
ER 674	3	Modeling in Snow Hydrology

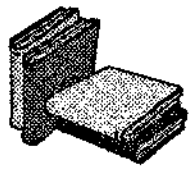
Stream and Riparian Zone Biology/Wetlands

B 332	4	Introductory Phycology
EN 445	4	Aquatic Insects
FW 300	3	Ichthyology
FW 400	3	Fish Ecology
FW 401	3	Fishery Science
FW 420	2	Water Quality for Fish and Wildlife
FW 521	3	Fish Habitat Management
FW 540	3	Fisheries Ecology
FW 560	3	Management of Fish in Ponds and Reservoirs
Z 440	4	Freshwater Biology
Z 441	3	Stream Biology
Z 443	3	Limnology

Toxicology

EH 446	3	Environmental Toxicology
EH 500	2	Principles of Toxicology
EH 501	2	Toxicology - Environmental Agents
EH 648	3	Environmental Health Risk Assessment
FW 544	3	Ecotoxicology

Water Quality Management/Monitoring

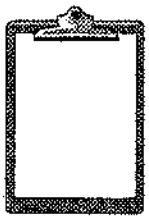


CB/CE 545	3	Water Quality Monitoring and Management
CB/ST 547		Statistics for Environmental Monitoring
ER 418	3	Land Use and Water Quality
ER 419	2	Water Quality Laboratory for Wildland Managers
ER 714	3	Water Quality for Wildland Managers
MB 624	2	Microbial Ecology

Water and Wastewater Treatment/Environmental Engineering

CB 442	3	Rate-Controlled Separations
CB 524	3	Environmental Biotechnology
CB 548/CE 548	3	Water Quality Management
CB 549/CE549	33	Design of Water Quality Monitoring Systems

CE 438	4	Water Supply and Wastewater Removal
CE 537	3	Residuals Management
CE 538	3	Aqueous Chemistry
CE 539	3	Water and Wastewater Analysis
CE 540	3	Treatment of Water Contaminants I
CE 541	4	Treatment of Water Contaminants II
CE 543	3	Industrial Wastes Management
CE 623	3	Water Quality Hydrology
MB 432	4	Aquatic Microbiology
SC 378	2	Environmental Soil Science
SC 478	3	Advanced Environmental Soil Sciences



WATER SUPPLY

The state's water supply conditions remain acceptable overall. Snowpack is below average at a statewide value of 87 percent of normal. The river basin with the highest average snowpack is the Arkansas at 99 percent of normal, and the basin with the lowest average is the San Juan/Dolores at 77 percent of normal. Stream flows and reservoir storage levels are generally quite good throughout the state.

The Surface Water Supply Index (SWSI) developed by the State Engineer's Office and the U.S.D.A. Natural Resources Conservation Service is used as an indicator of mountain-based water supply conditions in the major river basins of the state. It is based on stream flow, reservoir storage, and precipitation for the summer period (May through October). During the summer period stream flow is the primary component in all basins except the South Platte basin where reservoir storage is given the most weight. The following SWSI values were computed for each of the seven major basins for March 1, 1998 and reflect conditions during the month of February.

Basin	Mar. 1, 1998 SWSI Value	Change From Previous Mo.	Change From Previous Year
South Platte	2.1	-0.2	-1.1
Arkansas	-0.8	-1.0	-4.1
Rio Grande	-0.8	+0.2	-4.3
Gunnison	-0.8	-0.5	-4.7
Colorado	-0.3	-0.2	-3.8
Yampa/White	-2.2	-0.1	-6.0
San Juan/Dolores	-1.5	+0.2	-5.0

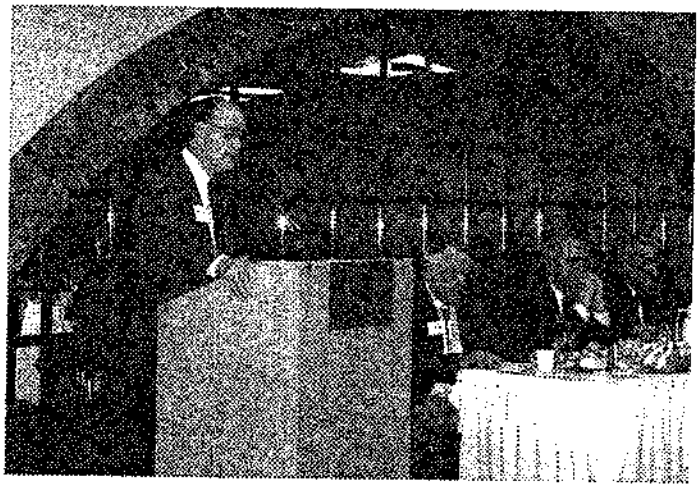
-4	-3	-2	-1	0	+1	+2	+3	+4
Severe Drought		Moderate Drought		Near Normal Supply		Above Normal Supply		Abundant Supply

MEETING BRIEFS

COLORADO WATER CONGRESS HOLDS ITS 40TH ANNUAL CONVENTION

by Laurie Schmidt

The Colorado Water Congress held its fortieth annual convention in Northglenn, Colorado on Thursday and Friday, January 29-30, 1998. Eluid Martinez, Commissioner of the U.S. Bureau of Reclamation, presented the luncheon address on Thursday. Commissioner Martinez discussed some of the changes the Bureau has undergone, saying, "The Bureau of Reclamation is not the same organization it was 10 years ago." He also addressed the federal government's role in water management and stated his belief that Bureau staff members should not have preconceived notions on issues related to water. "I tell my staff that if they have an agenda, they need to leave it at the door - or they shouldn't be working for our agency," Martinez said.



From left: Colorado Senator Tilman "Tillie" Bishop, former Senator Fred Anderson, Senator Don Ament, and Representative Lewis Entz at the CWC's Legislative Breakfast.

Former U.S. Senator Hank Brown presented the keynote address on Thursday afternoon. Senator Brown focused on the importance of educating Colorado residents about the state's water history, declaring that people who have no knowledge of Colorado history shouldn't be responsible for making water policy. "Those who don't understand the history and background of water problems in our state can't really understand the present issues," Brown said.

Two views of the draft Western Water Policy Review Advisory Commission report were the focus of a panel discussion. While a number of weaknesses in the report were identified, the panel presented an excellent overview of water management trends.

General Session --"Two Viewpoints on the Western Water Policy Review Advisory Commission Report "-- From left: David Getches, School of Law, University of Colorado; Sue O'Brien, Columnist, Denver Post; William Perry Pendley, President and Chief Legal Officer, Mountain States Legal Foundation; and Rod Kuharich, City of Colorado Springs.

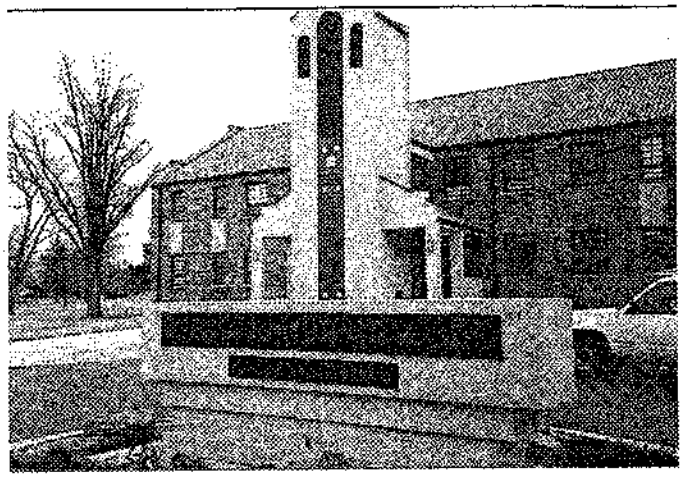
COOPERATIVE EXTENSION ACTIVELY INVOLVED IN REGIONAL WATER MEETINGS

La Junta, Sterling and Montrose all hosted water meetings recently in which Cooperative Extension played a major role.

ARKANSAS RIVER FORUM — On February 4 and 5, 1998, the Arkansas River Forum was held on the campus of Otero Junior College in La Junta. Jim Valliant, Extension Irrigation Specialist located in Rocky Ford, Colorado, and a number of his Extension colleagues in Pueblo and at Colorado State have worked closely with water users and managers in the Arkansas Valley to organize the annual meeting over the past four years. Jim's energy and enthusiasm for the exchange of information that takes place at the meeting ensures its success. More than 140 people attended this year's meeting.

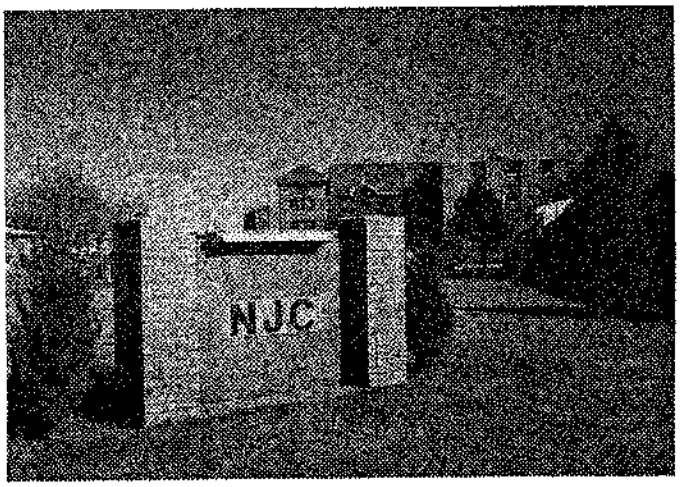
Jim Valliant and Steve Arveschoug, Manager, Southeastern Colorado Water Conservation District

The theme of the 1998 Arkansas River Forum was "Water Development in the Arkansas River Basin: Past, Present and Future." In addition to a number of updates on water issues in the basin, time was set aside during the meeting for a progress report on the Future Water and Storage Needs Assessment being conducted in the Arkansas Valley. Projected water needs to the year 2040, currently available water supplies, and options to meet the shortfalls were discussed.

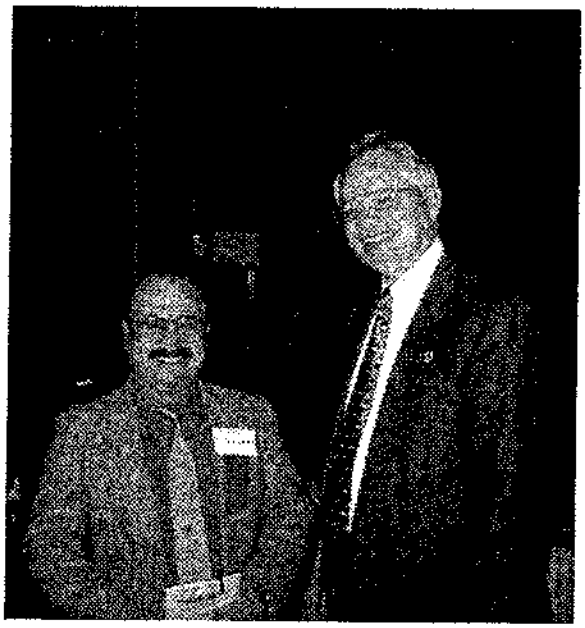


Otero Junior College, site of the 4th Annual Arkansas River Basin Forum

OGALLALA SYMPOSIUM — On February 12, 1998, the second Ogallala Symposium was held on the campus of Northeastern Junior College in Sterling. Mahdi Al-Kaisi, Extension Water Management Specialist located in Akron, Colorado, worked closely with a number of water users and managers in the Ogallala region to organize the meeting.

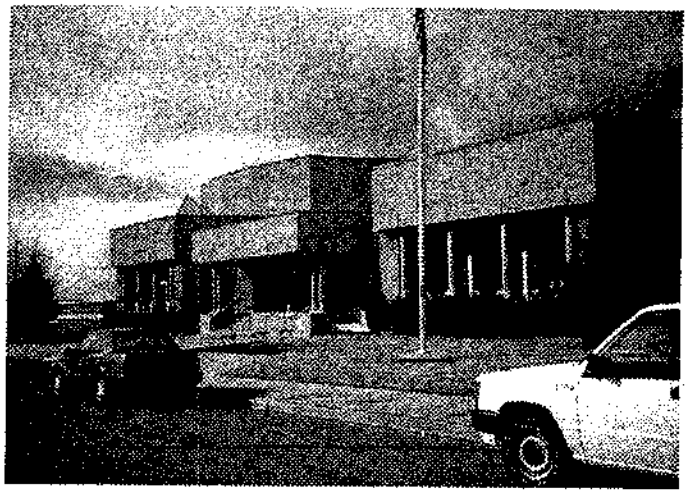


Northeastern Junior College, site of the 2nd Ogallala Symposium



Mahdi Al-Kaisi, Extension Water Management Specialist, with Colorado Senator Don Ament

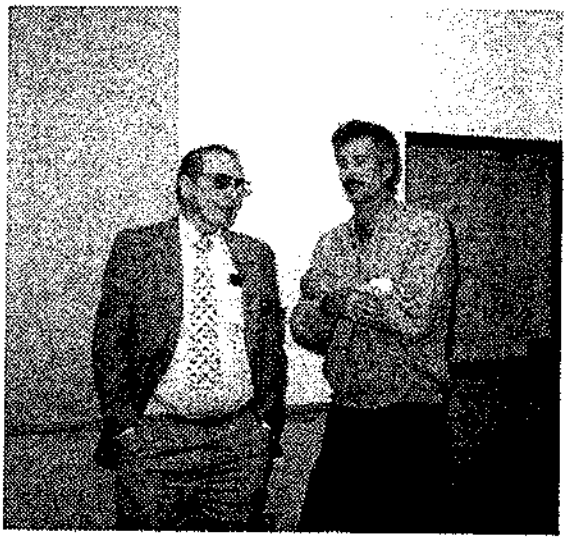
Mary Gray, Cooperative Extension Associate Director, welcomed the 160 attendees to the meeting. Senator Don Ament presented the keynote address. The meeting provided information on a number of issues facing Ogallala water users. The influx of hog farming, obtaining water to meet population growth, and improving efficiency of center-pivot irrigation systems were three of the many topics discussed at the meeting.



The Montrose Pavilion, site of the first Gunnison River/Colorado River Forum

COLORADO RIVER FORUM — *(Summary by Reagan Waskom, Extension Specialist, Soil and Crop Sciences).* The first Gunnison River/Colorado River Forum was held at the Montrose Pavilion on February 26, 1998. The purpose of the forum was to raise public awareness of water quality issues in the basin.

Colorado State University Cooperative Extension specialists Richard Antonio, Wayne Cooley, Dick Bartholomay, and Dan Champion worked with a large committee of local soil, water, and agricultural interests, as well as federal and local agencies to organize the program. Greg Parsons of the Colorado Department of Public Health and Environment presented the keynote address on Non-Point Source Pollution. Representatives from local and federal agencies spoke on salinity, grazing management, public lands issues, fish and wildlife concerns regarding selenium, private septic systems, and municipal interests in water quality.



Dick Bartholomay, Cooperative Extension Specialist, with John Almey, U.S. Forest Service

Over 120 individuals participated in this first Colorado River Forum and there is strong local support to continue the program. A professionally produced video which captures the highlights of the forum is currently in production and will be available soon.

FEATURES

PATTERSON HOLLOW HYDROLOGIC UNIT AREA WATER QUALITY PROJECT

The following is a summary of the impacts and activities of the USDA-sponsored Patterson Hollow Hydrologic Unit Area Water Quality Project in Otero and Pueblo Counties in southeast Colorado. The information was compiled by James Valliant, Regional Irrigation Specialist, Cooperative Extension, US Department of Agriculture, Colorado State University.

The Patterson Hollow Hydrologic Unit Area (HUA) Water Quality Project is a cooperative effort of Colorado State University Cooperative Extension and Agricultural Experiment Stations, Natural Resources Conservation Service, Farm Service Agency, and the East and West Otero Soil Conservation Districts. The HUA includes the area south of the Arkansas River from eastern Pueblo County to east of La Junta in Otero County in southeast Colorado. The project began in 1991 and encompasses 89,850 total acres, of which 59,700 are irrigated. The area's land use is 66 percent irrigated cropland, 30 percent rangeland, 3 percent urban, and 1 percent other uses.

The objective of the project is to improve water quality in the Arkansas River and its groundwater basin by implementing Best Management Practices (BMPs) to reduce runoff and deep percolation that carry salts, nutrients, and other non-point source pollutants back to the river. A key function of the project is to provide irrigators with information that will encourage them to implement these BMPs.

The objective...is to improve water quality in the Arkansas River and its groundwater basin by implementing Best Management Practices (BMPs) to reduce runoff and deep percolation that carry salts, nutrients, and other non-point source pollutants back to the river.

Proven Impacts

♦In 1995 the Patterson Hollow HUA introduced PAM, a linear-linked, soil-stabilizing polyacrylamide, to area farmers. PAM is now being used to reduce erosion and increase infiltration on over 10,000 acres in the Arkansas River Basin. Hydrogel, a cross-linked water retaining polyacrylamide that can absorb up to 250 times its own weight in water, has also been used with great success.

♦In 1996 demonstrations using a combination of PAM and Hydrogel on market tomatoes and jalapeno peppers generated substantially increased yields and quality and also reduced soil loss from erosion. For tomatoes, yields were increased from 14.8 tons per acre to 20.8 tons per acre, and soil loss was reduced by 39 percent for eight irrigations. For jalapeno peppers, yields were increased from 6.5 tons per acre to 10.7 tons per acre, and soil loss was reduced by 47 percent for nine irrigations.

♦In 1997, similar results were produced on the Hydrogel treated areas as compared to the untreated check areas. On market tomatoes, the untreated check areas produced 5.87 tons per acre while the Hydrogel treated areas produced up to 8.27 tons per acre. Untreated Mira Sol peppers yielded 6.46 tons per acre while Hydrogel increased yields to 9.53 tons per acre. PAM was used on all areas in 1997 because of its previously proven ability to reduce soil loss during irrigation.

♦Demonstrations at different locations between 1994 to 1996 have shown that surge irrigated corn produces the same yields as conventional furrow irrigation, using 11 percent less irrigation water with 30 percent less runoff. Soil loss was also reduced 52 percent by surge.

♦Economic budget analyses have proven that improved irrigation technology can increase net farm income by more than $50 per acre.

♦Controlled demonstrations have shown that improved irrigation water management, including underground pipe and lined ditches, can reduce total dissolved solids (salts) returning to the river by up to 37 percent.

♦BMPs such as surge valves, irrigation control structures, trash screens, concrete ditch, underground pipe, gated pipe, and polyacrylamides have directly impacted about 35,000 irrigated acres by reducing runoff, soil loss, seepage, and deep percolation.

♦The HUA has brought $1.1 million in federal cost-share money to the area, which has generated an additional $2.4 million in matching funds from local landowners for BMPs.

Activities

♦Annual winter workshops provide updated information on irrigation water management demonstrations and bring together scientists who share their results and introduce new technology.

♦The annual Arkansas River Basin Water Forum, partially funded by the HUA, was initiated in 1995 and brings together agricultural, environmental, government, industrial, mining, municipal, and political water users to work on problems and seek solutions together.

♦An Arkansas River Basin Technical Group was started in 1997 to work collectively on water-related problems. The group meets quarterly and reviews proposed projects.

♦A satellite communications system, funded by the HUA, provides current weather, market, crop, and livestock information to over 250 growers via computer monitors located in gathering places that are frequented by farmers and ranchers.

♦Colorado State University Cooperative Extension, East and West Otero Soil Conservation Districts, Natural Resource Conservation Service, and Farm Service Agency teamed up to produce a 30-minute video showing and describing the HUA. The video is being used extensively for area and state programs, and two public television stations aired the video in 1996-97.

The Patterson Hollow HUA was the recipient of the Colorado State University Cooperative Extension Team Award in 1993, the Epsilon Sigma Phi Western Regional Distinguished Team Award in 1994, and the Governors Smart Growth and Development Award for Agriculture in 1996. The Patterson Hollow HUA video was also a finalist in the 1996 Annual Telly Awards.

For additional information, or to receive a complete copy of the Patterson Hollow HUA Impacts and Activities brochure, contact:

James Valliant, Regional Irrigation Specialist
Cooperative Extension, Colorado State University
P.O. Box 190
Rocky Ford, CO 81067
(719) 254-7608

AN UPDATE ON WATER LEVELS IN THE OGALLALA AQUIFER

by Maile Ceridon

Recently, the Ogallala Symposium examined a number of issues facing the people dependent upon the Ogallala Aquifer for their water supplies. Current and up-to-date information on the status of the Ogallala Aquifer was presented. For example, is the aquifer still being depleted in Colorado? What is the current status of water levels? To begin, the Ogallala Aquifer is the largest underground water reserve in the country. It provides 30 percent of all irrigation water derived from groundwater in the United States. The aquifer underlies approximately 225,000 square miles in the Great Plains region and covers eight states.

Colorado

During the winter of 1996/97, 647 wells were measured in the Northern High Plains Designated Basin. An attempt was made to measure all the wells within a six-week period beginning approximately in mid-December 1996. This goal was achieved due to the mild winter throughout the basin. All wells were measured prior to February 10, 1997. By measuring the wells in a short time period, it is hoped that seasonal fluctuations will be dampened and that the hydrographs and comparison of water level change will more accurately reflect the true ground water conditions. The data taken from wells with continuous recorders show that the aquifer receives recharge up to the beginning of the irrigation season and that measuring the wells at the same time each year is critical to obtaining consistent data.

Throughout the Northern High Plains, the water levels continue to show the regional decline, which is to be expected when water is being "mined." The average rate of decline for the past year is less than that for the preceding year (0.17 feet during 1996/1997 as compared to 0.49 feet in 1995/1996). Based on previous work, the overall decline of 0.17 feet equals approximately 151,000 acre-feet, which have been removed from storage. Overall, the average depletion of the Ogallala Aquifer has been 0.65 feet per year from 1992 to 1997. Although the rate of decline has slowed, there was an increase in the aquifer's depletion in 1994. From 1994 to 1995, the aquifer's water depletion increased from 0.30 feet in 1993/1994 to 1.30 feet in 1994/1995. The depletion again slowed in 1995/1996 and 1996/1997 with the water level dropping only 0.49 feet and 0.17 feet respectively to each year.

Texas

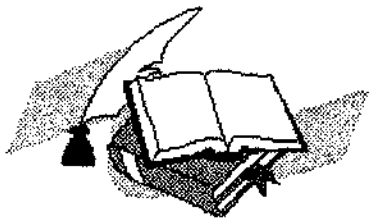
A study written by Texas Water Development Board (TWDB) geologists John Ashworth and Darrell Peckham reported that the amount of groundwater pumped for irrigation dropped by 17% from 1980 to 1990. Irrigated acreage in the region declined by 1.4 million acres between 1979 to 1989. An updated aquifer simulation model was applied to predict future conditions and indicated that slightly more water will be available, although the amount of groundwater pumped from the aquifer will still likely exceed recharge.

In a separate report written by TWDB geologist Janie Hopkins, the results of a program that tested over 700 wells in the region from 1989 to 1992 indicated that the average levels of dissolved solids, chloride, and fluoride are all much higher in the wells in the southern portion of the aquifer. Nitrate was found in 15% of the wells that were surveyed in the southern part of the study area, and small amounts of selenium were found in the region.

Currently, a group of more than 130 area water leaders are working to develop the High Plains Ogallala Aquifer Regional Water Management Plan (Ogallala Water Plan). The goal of the plan is " to develop, promote, and implement water conservation, augmentation, and management strategies to provide adequate water supplies for the Ogallala (Aquifer) Region of the High Plains of Texas and to stabilize or improve the economic and social viability and longevity of the region through these activities."

To order *Water Quality Evaluation of the Ogallala Aquifer* (Report 342) by TWDB geologist Janie Hopkins; or to order *The High Plains Aquifer System of Texas: 1980 to 1990 Overview and Projections* (Report 341) by TWDB geologists John Ashworth and Darrell Peckham, call the TWDB at (512) 463-8337. For more information about the High Plains Ogallala Area Regional Water Management Plan, contact hpwd@hub.ofthe.net.

Sources: *Water Levels in the Northern High Plains Designated Ground Water Basin*, by George D. VanSlyke, Project Manager, Colorado Division of Water Resources, Office of the State Engineer. March 1997; and publications listed above, summarized on website http://twri.tamu.edu/twripubs/NewWaves/v7n2/report-2.html



PUBLICATIONS

An Analysis of Rainfall for the July 28, 1997 Flood in Fort Collins, Colorado, by Nolan J. Doesken and Thomas B. McKee. Climatology Report 98-1.

The Fort Collins storm on the evening of July 28, 1997 in combination with the rains that fell in eastern Larimer County from late afternoon July 27 through midday July 28 produced the heaviest documented rainfall in Colorado since 1981 and one of the 11 most severe rainstorms of the 20th Century along the Colorado Front Range. From all available data, this appears to be the heaviest rainfall ever recorded over a developed urban area in Colorado. The area of high intensity rainfall was small and covered only a few square miles. Gradients of rainfall were so remarkable that many residents of Fort Collins and outlying areas were unaware that flood-producing rains had fallen while other neighborhoods only a short distance away were inundated with heavy rain and flooding. Many large storms of the past have been documented and described based on limited rain gauge data supplemented by "bucket survey" analyses. With nearly 300 gauge measurements over a relatively small area, the Fort Collins storm is the most throughly documented of any extreme rainfall event in Colorado up to this time.

For more information about this report contact Nolan Doesken, Colorado Climate Center, Department of Atmospheric Science, Colorado State University. Phone: 970/491-8545.

WATER LAW REVIEW — The University of Denver has announced its newly formed biannual publication, created to provide a unique, high-quality forum for sharing ideas, information, and legal and policy analyses on issues in water law. The ***REVIEW*** will solicit and publish scholarly works that discuss water law as it affects and is affected by related areas, legal or otherwise. It will include articles by nationally recognized experts, practitioners, officials, scholars, and others involved in the fields of water law and planning. The *REVIEW* will continue the tradition of its predecessor, the University of Denver *Water Court Reporter*, and provide a regular section on significant developments in the Colorado Water Court Divisions. However, the new publication will not be limited to any one jurisdiction.

The inaugural issue of ***WATER LAW REVIEW*** includes a lead article by Colorado Supreme Court Justice Gregory Hobbs, Jr. in which he chronicles critical events in Colorado and western water law development. From the administrative perspective, Barbara Green and Jon Alby delineate the ways in which the integration of watershed protection and land use planning help local planners and communities improve their water quality. From private practice, Carmen Sower-Hall and Holly Holder author an article analyzing the complex relationship between water quality and water rights in the context of augmentation plans and exchanges prepared under Colorado statutory guidelines. Karen Crass examines the far-reaching potential for unexercised tribal water rights in the *Winters* doctrine. The inaugural issue is dedicated to Lucius Ward Bannister, one of the West's foremost authorities on water law, who acted as special counsel for Colorado in a number of water compact matters.

Call for Papers -- Papers are now being accepted for upcoming issues of ***The Small Flows Journal,*** the only juried technical journal devoted specifically to small community wastewater issues. Papers in the following categories will be considered for review:

- technology/research
- operation and maintenance
- regulations
- management
- finance
- public education

For additional information about the journal, manuscript submission guidelines, and publication deadlines, contact Cathleen Falvey, editor, at 1/800-624-8301, ext. 5526, or mail to Editor, The Small Flows Journal, National Small Flows Clearinghouse, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064.

WATER NEWS DIGEST

by Jacklyn Bryant, Maile Ceridon and Laurie Schmidt

DAMS

USBR Releases Highline Canal Plans

The U.S. Bureau of Reclamation has issued a draft study on an $8.4 million plan to install seven new check dams in the Government Highline Canal, an automated canal monitoring network, a new spillway at Palisade and a pump station at Highline Lake. Federal and state agencies will pay for the project, expected to yield a 10 percent reduction in water diversions into the Highline Canal. That adds up to an average of 28,400 acre-feet of water a year staying in the Colorado River. The stretch of river, between Palisade and the Gunnison River confluence, is considered to be excellent habitat for endangered fish, but it is severely dewatered by irrigation in the summer and fall. Seven new check structures would hold back water near lateral canal headgates, allowing irrigators to get the water they need without using a lot of extra "carrying" water. Improvements would also be made at the eight existing check structures on the Highline. An automated monitoring system, wired in to the Grand Valley Water Users' office, would control the canal water surface elevation at all 15 check structures.

Source: *Grand Junction Daily Sentinel* 1/20/98

FERC Decision on Maine Dam May Have Consequences in the West

The Federal Energy Regulatory Commission has unexpectedly ruled that the Edwards Dam on the Kennebec River near Augusta ME be demolished. The decision marks a 10-year campaign against the dam by environmentalists. The ruling's significance lies in the potential attitude change at the FERC. No longer can dam owners assume a pro-development decision. The industry must be better prepared to demonstrate the economic viability of projects and to defend their environmental record. The decision has caused controversy, with hundreds of dams proposed for irrigation, flood control and electricity currently bogged down in the licensing process.

Source: *Denver Post,* 1/29/98

DEVELOPMENT

Giving Up the Bid for Two Forks Dam?

Denver Water is prepared to give up forever the right to build Two Forks Dam as a part of a proposal to save the scenic South Platte River. In 1986, the Denver Water Board filed for federal permits to begin construction of the 617 foot-high dam that would hold 1.1 million acre-feet of water. After EPA vetoed the project in 1990, the Board still held hope for a smaller dam that would hold 60,000 acre-feet of water. Last April, the US Forest Service responded by recommending a wild-and-scenic designation for the site. Denver Water officials feared that such a designation would bring massive federal rules that would interfere with the agency's ability to supply water from the river to 1.5 million city and suburban residents.

The Denver Water Board's proposal asks the US Forest Service to drop the wild-and-scenic designation in return for Denver Water relinquishing claims on the stream bed that date back to 1931. These claims are necessary to construct a dam at the confluence of the main stem of the South Platte and the river's North Fork. The proposal hinges, however, on Denver finding other places to store water. An example of how this could be accomplished is to pump water from the river to reservoirs in plains counties or to aquifers beneath Douglas County, said Charles Jordan of Denver Water. The Denver Water proposal also calls for the following:

- An end to sharp fluctuations in the volume of water flowing down the South Platte River as the water agency releases water from upstream dams or pumps water over the Continental Divide from Dillon Reservoir.
- A commitment not to build structures in Eleven-Mile or Cheesman canyons along the Platte.
- A $1 million endowment to fund conservation projects.
- Creation of a park or recreation area along the South Platte, using state, national forest and land owned by Denver Water.

According to Sue Spear, the Forest Service's special projects coordinator who has followed the drafting of the proposal, the plan would be subject to an environmental impact review and public comment if accepted.

Source: *Rocky Mountain News* 2/6/98

ENDANGERED SPECIES

Meetings Focus on Preble's Mouse

If the Preble's meadow jumping mouse is listed as an endangered or threatened species, it could mean problems for hundreds of Colorado projects worth billions of dollars. State officials are trying to figure out a way around the Endangered Species Act with a special provision called a Habitat Conservation Plan that allows for loopholes in the law. About 40 people in Boulder County met in February to discuss the future of the mouse, the first of several Boulder County meetings and one of five regional meetings across the state. The Habitat Conservation Plan will include other plants or animals already listed as endangered in Colorado or scheduled to be listed. It is designed to protect endangered species while allowing for development at the same time by relaxing the rules about disturbing a protected species or its habitat. Colorado Rep. David Skaggs convinced Congress to spend $400,000 to study the Habitat Conservation Plan. The state has asked the federal government to delay its scheduled decision on the mouse by six months.

Source: *Longmont Times Call*, 2/24/98

Proposal Made to Provide More Water for Endangered Fish

Two environmental groups have advanced a "conceptual proposal" to revamp one of the two most senior water rights on the Colorado River to provide more water in the spring and summer for endangered fish. The proposal is not a formal one, according to Jim Lochhead, Director of the Colorado Department of Natural Resources. Under the proposal, advanced by the Nature Conservancy and Environmental Defense Fund, the Shoshone water right in Glenwood Canyon, owned by Public Service Company of Colorado, would not be used for generation of electricity during the winter at PSC's Shoshone power plant. Instead, water would be stored in existing upstream reservoirs like Williams Fork, and then released in the spring and summer to provide additional water, potentially 10,000 to 20,000 acre-feet a year. PSC would be compensated, possibly by funding available through the federal/state fish recovery program, for the loss of revenue during times the plant would not be generating its usual amount of power.

The Colorado River District Board expressed concern regarding the proposal at their quarterly meeting in Glenwood Springs. Removing the plant's senior water right would reduce winter flows and increase spring and summer runoff. This may benefit the endangered fish, but it could increase the amount of water diverted to the Front Range cities for consumption. This would change the traditional administration of the Colorado River. In addition, the Board expressed concern over a Colorado headwater tributary, the Blue River. The district suspects that Front Range cities may be using Blue River water for uses other than those legally intended. Concerns are heightened by Front Range proposals to increase diversion from the Blue River for recharge of the Denver Basin groundwater aquifer.

Source: *Denver Post* 2/3/98

HABITAT AND WILDLIFE

Most Native Front Range Fish Healthy

Biologists with the state Division of Wildlife recently completed an unprecedented, four-year, 2,000 site survey of the Arkansas and all its tributaries, including Monument and Fountain creeks through Colorado Springs. Scientists were pleasantly surprised to find nearly all 22 native fish species of the river in good shape. However, the tiny suckermouth minnow and the southern redbelly dace appear to be vanishing and could become listed as endangered species in Colorado.

Biologists surveyed 1,500 sites along the South Platte and found seven species of native fish in decline. But as in the Arkansas, most of the 29 native species in the South Platte are faring well. Of the seven types in decline, five are of most concern: the common shiner, the brassy minnow, the northern redbelly dace, the suckermouth minnow and plains minnow.

One big reason the natives likely are doing so well in both the South Platte and the Arkansas: the lack of predatory, non-native species in the river. That is in sharp contrast to Western Slope rivers, like the Colorado, where non-native fish have flourished, taking over habitat and feasting on struggling native species such as the Colorado squawfish.

The surveys are important because they show how fish are faring now and they give biologists a foundation of information to work from in the future. It also gives officials a remarkably detailed map of critical habitats, important in guiding farmers, or road and bridge workers, who may need to do construction or divert water near the river or its tributaries.

Source: http://www.gazette.com/daily/top1.html

Colorado Division of Wildlife Seeks to Purchase Riparian Habitat

The DOW has advertised for proposals from landowners interested in selling river bottomlands. The Division is currently seeking land along the Yampa and Colorado rivers. These lush wetland habitats are sought for public access and to protect fish and wildlife. The Division reports good response to their offerings, with 8897 acquired to date. The acquisition process was streamlined by legislative action taken in 1992 and holdings have increased significantly since. Lottery funds contributed $775,900 of the $3.6 million total.

Source: *Denver Post*, 2/16/98

Fish Passage Opened on the Colorado

The Grand Valley Irrigation Co. has opened the new fish passage around the company's diversion dam in the Colorado River, offering year-round passage for fish to three miles of the river upstream. The new fish passage, which drops three vertical feet over a distance of 400 feet, is a passive structure made of basalt boulders quarried near Collbran. It is a channel of descending S-curves that weaves down in a series of pools and riffles from a notch in the top of the diversion dam. Grand Valley Irrigation Co. built the structure under a $600,000 contract with the U.S. Bureau of Reclamation. At high water, the whole thing will be underwater. At low water, Reclamation will send water, set aside in Ruedi Reservoir for endangered fish, downstream for the fish passage.

Source: *Grand Junction Daily Sentinel* 2/2/98

Nebraska Considers Water Rights Leasing to Preserve Platte Habitat

With habitat and species in danger along the Platte, Nebraska is again considering establishment of a water bank. The state would lease water rights from farmers in dry years for environmental purposes. Lease options would be exercised in February, based on snowpack and projects river flow. This issue has risen again because of the cooperative agreement between Colorado, Nebraska, Wyoming and the US government to improve river habitat in central Nebraska. The issue is complex, with farmers, cities and wildlife all being impacted.

Source: *Fort Collins Coloradoan*, 12/7/97

WATER QUALITY

The Pollution of Roaring Fork River

Recently, high levels of pollution have been discovered in the Roaring Fork River. The fecal coliform level was double the health standard limit in May 1996, and was 25 percent above the state guideline in August 1997. State health officials said they also found high level of ammonia, usually related to discharges from sewage treatment plants. The fecal coliform bacteria, often associated with human waste, could possibly be from residential sewage, a result of poorly designed or failed septic tanks, or sewage treatment plants operating beyond capacity because of the developmental boom in the valley. Animal fecal material may also be a contributing factor. Although the state controls water treatment plants, it has no authority over the septic tanks. The state Water Quality Control Division also found pollution in rivers flowing through Eagle County, near Vail, in Grand County, near Winter Park, and in Summit County near Silverthorne, Breckenridge, and Copper Mountain. Health officials say that there is no regular water monitoring on the 50 miles of river from Aspen to Glenwood Springs, where the Roaring Fork joins the Colorado River. More and more people are going to the valley, as owners of second homes and as full-time residents, and this equates to more wastewater and more discharge into the river. An indirect cause for the pollution is the extensive use of the natural resource. As more people fish, ski the local mountains, and spend more time in the valley itself, the river is bound to suffer. Additional enemies to Roaring Fork are the rocks, gravel, soil and sediment flowing into the river from roads and construction sites. These pollutants can decimate the trout habitat. Stormwater containing antifreeze, motor oil and ground-up tire rubber can also damage the river's ecology.

The Water Quality Control Division plans to take a series of water samples from different stretches of the Roaring Fork in the coming weeks. These samples will determine the standard for discharge limits of new treatment plants, as well as those seeking expansion. These new standards will be set with existing water quality standards in mind. There is no movement afoot to lower water-quality standards on the river to accommodate more growth or more pollution. The Roaring Fork Conservancy has also launched an educational program from Aspen to Glenwood Springs in hopes of informing the public of proper river use.

The U.S. Environmental Protection Agency may become involved in the concern about explosive growth in the high country by joining the U.S. Forest Service in regulating ski areas. The EPA revealed its new role in recent letters to the Forest Service that raised serious concerns about expansions in Breckenridge, Keystone and Vail. The major focus of EPA's interest is mountain wetlands further threatened by the spinoff of ski resorts: condos, second homes, parking lots and roads.

Sources: *Glenwood Post* 02/26/98; *The Aspen Times* 03/16/98; http://www.gazette.com/daily/top2.html

WQCC Lists 90 Streams That Do Not Meet Federal Standards

Ninety Colorado streams do not meet federal pollution standards and pose a threat to aquatic life. David Holm of the Colorado Water Quality Control Commission said only parts of the streams are affected. He said the water is more of a danger to aquatic life than to humans. The two dozen stream segments given the highest priority on the list are mostly downstream of mines or abandoned mines. An exception is the South Platte River as it flows through Denver and Adams County.

Source: *Grand Junction Daily Sentinel (Associated Press) 3/12/98*

The Future of Rocky Flats

Due to federal budget cuts, the final clean up of Rocky Flats will probably be set for the year 2010 rather than the original estimate of the year 2006. The Department of Energy released a report on March 2nd that charted the clean up and closure plans for 353 projects across the nation, including Rocky Flats. Experts now predict the shutdown won't occur until the year 2010 at a cost of about $7.3 billion. Under the original plans set forth for Rocky Flats, officials would need about $694 million a year in the years 1998, 1999, and 2000. The cleanup plan came up about $60 million short of that goal during the 1998 fiscal year, and fell even further below under the budget proposal set forth by President Clinton. The future of the 6,500 acre site has been discussed by the Rocky Flats Local Impacts Initiative (RFLII). On February 24th, the RFLII unveiled six ideas, and the public will have until April 3rd to comment. Among the suggestions are:

- to turn Rocky Flats into a large office and industrial area; to build an eco-industrial park focusing on environmental technology;
- to make the site a hub for research with partners such as universities and federal labs that specialize in ecological, environmental remediation, and renewable energy research and demonstrations;
- to create a Cold War museum with artifacts; leave the site as open space;
- or wait for a single large tenant.

Comments on the future of Rocky Flats can be made at the Rocky Flats Local Impact Initiative's website, <http://www.votelink.com/rfr>. A final report on reusing Rocky Flats is scheduled for release on May 29th.

Sources: *Denver Post* 2/25/98, *Grand Junction Daily Sentinel* 2/7/98, *Fort Collins Coloradoan* 2/7/98, *Rocky Mountain News* 3/3/98, 3/4/98, *Boulder News* 2/5/98

Goldrush Hangover

The mining boom of the late 19th century has transformed into a colossal pollution headache for the state of Colorado. About a mile east of Breckenridge lies the old Wellington Ore mine. Miners began excavating the site in the 1880s in hopes of finding gold. The mine reached its peak in the 1920s, but rather than mining gold, lead and zinc were the desired commodities. B&B Mines purchased the property in the 1940s and salvaged some rock in the 1950s and the 1960s. At that time, little was known about the pollution side effects of mining. In 1989, EPA began looking at the mine after reports of a fish kill in the Blue River. Water monitoring found high cadmium and zincs levels in French Creek below the mine, where the fish population has declined. Above the mine, fish thrive in the creek. As the water flows from French Creek to the Blue River, zinc levels are about 100 times higher than state standards. They dissipate before the river reaches Lake Dillon. A study has also found elevated metal levels in fish livers. This finding does not pose a huge threat to people, but could be harmful to birds that feed on the fish.

Despite the problems, local officials are reluctant to designate the mine as a Superfund site because of the controversy that erupted in Leadville when the EPA declared the area a Superfund project in 1983. Currently, attempts are being made to clean up the site. B&B Mines is paying for an environmental study of what to do about mine waste on the surface. The study should be finished by summer and work could begin this year. Alternatives include burying the waste on site and re-contouring the ground. The water contamination poses a more difficult problem. Some solutions are to revamp the water treatment plants, seal some of the mines' fractures, or find ways to divert the groundwater before it passes through a maze of mine tunnels. A community group by the name of French Gulch Remediation Opportunities Group (FROG) meets regularly to come up with solutions.

Source: *Rocky Mountain News* 2/5/98

WHIRLING DISEASE

French Researchers May Have Found Solution

French researchers say a broad-spectrum antibiotic called fumagillin, developed by a French pharmaceutical company, has shown promise in controlling the effects of whirling disease. Studies done in European fish production sites seem to show that not only can you control the

infection in the fish, you can eliminate about 99 percent of the parasites even after the fish are infected, according to DOW fisheries researcher Barry Nehring. State hatchery manager Eric Hughes said French scientists fed the drug to fingerling trout raised in whirling disease-infected earthen ponds and by the third year all symptoms of the disease had disappeared. The drug doesn't kill the spore or its worm host. Instead, the drug prevents the spore from developing the "grappling hook" arms it uses to attach itself to trout when it infects them. Preventing this stage eventually can destroy the parasite. The state fish health lab in Brush and the state hatchery system are part of a multi-state testing effort to gain FDA approval, according to Barry Nehring.

Source: *Grand Junction Daily Sentinel* 2/25/98

MISCELLANEOUS

Analyzing Nebraska's NRD System

Nebraska's one-of-a-kind system of natural resources districts (NRDs) celebrated 25 years of working to conserve and improve that state's often strained natural resource base. The NRD concept is a substantial departure from the approach of other states, but evolution of Nebraska's NRDs continues. The Nebraska Legislature through LB1085 (1996) directed the Nebraska Natural Resources Commission to issue a report by September 1, 1997 analyzing natural resources district revenue base, board size, boundary changes, and consolidation of districts. The report, titled *An Analysis of Natural Resources District Revenue Base, Board Sizes, and Potential for Boundary Changes or Consolidation*, outlined the following five possible changes, which represent the opportunities most likely to stabilize and enhance the natural resources district system through restructuring and cost efficiencies:

- The current statutes allow natural resources districts the flexibility to make changes in board size, cooperatively change boundaries, or merge. That flexibility has resulted in one merger and a number of boundary changes. Districts should be encouraged to reexamine their potential for boundary changes and mergers.

- The current statutes allow natural resources districts the flexibility to make changes in board size. That flexibility has been used and should be retained. Each natural resources district should be encouraged to reexamine its board size. Districts that reduce their board sizes should consider ending the at large director position.

- It is appropriate that the state continue to assign the natural resources districts new responsibilities as resource needs arise. However, state government should also provide the funds to accomplish those newly mandated activities.

- Remove limitations to natural resources districts' abilities to charge for services. The limitation to chemigation charges is one example.

- Change or remove the sunset date for the fertilizer fee. Institute a fee similar to the fertilizer fee for wholesale chemicals.

Source: *Water Current*, April 1997

Iowa Buffer Initiative: Water Quality Protection Through Vegetative Buffer Systems

The work of the Leopold Center's Agroecology Issue team, led by Iowa State University forestry professor Dick Schultz, has galvanized work toward a common goal: water quality protection through the installation of vegetative buffer systems along Iowa waterways. Key sponsoring partners of the $1 million-plus Iowa Buffer-Initiative include Novartis Crop Protection, Inc., Iowa Farm Bureau Federation, Iowa Department of Natural Resources, the U.S. Environmental Protection Agency, and the Natural Resources Conservation Service. This first-of-a-kind program will promote water quality by reducing soil erosion, enhancing landscapes, and providing wildlife habitat. Trees Forever, a nonprofit group whose mission is to facilitate the planting and care of trees, woodlands, and forests through programs that build community and promote environmental awareness, will coordinate the program. The original riparian buffer system developed by Schultz' team consists of zones of native grasses, shrubs and trees strategically planted along waterways. The first such system was established in Iowa in 1990 along Bear Creek in Story County; since then, a total of nine landowners have invested in buffer technology on ten farms along the creek. This technology will now be demonstrated at 20 riparian (river or stream) sites across Iowa annually for the next five years. The nationwide model will also establish technical assistance networks to support landowners, establish shelterbelts as buffers around livestock confinement operations, formally recognize landowners who protect streams and waterways with grass/tree buffers, and use field days to increase awareness among farmers, landowners, and youth about the value of such buffers.

Source: *Leopold Letter,* Spring 1998

CALLS FOR PAPERS

XTH WORLD WATER CONGRESS
MELBOURNE 2000, March 11-17, 2000

In the 21st Century, the water industry will face threats to sustaining valuable water resources and achieving a balance between urban and rural water demands and environmental needs. The Xth World Water Congress will address these challenges while highlighting such critical issues as: Sharing the Waters of the Earth and Sustainable Water Management in a New Millenium. Deadline: March 8, 1999. Authors are required to prepare a 500-word abstract for inclusion in the Congress proceedings. The presenter of each accepted paper should register as a paying delegate upon submission of the final manuscript. For further information on the Xth World Water Congress contact the Congress Secretariat: ICMS Pty Ltd., 84 Quennsbridge Street, Southbank Victoria Australia 3006, Phone +61 3 9682 0244, FAX +61 3 9682 0288.

FOURTH WESTERN REGIONAL INSTEAM FLOW CONFERENCE
Water for Fish vs. Water for People: A Real Conflict?
Copper Mountain Resort, Colorado, October 8-9, 1998

Contributed papers and poster presentations are being solicited for the Fourth Western Regional Instream Flow Conference, "Water for Fish vs. Water for People: A Real Conflict?" Those wishing to contribute papers or make poster presentations should submit a brief (200 words or less) abstract **before May 15.** Include names and contact information for all authors. Written versions of papers will be needed by October for inclusion in the conference proceedings. Send abstracts to: Western Regional Instream Flow Conference, 190 E. Ninth Avenue, Suite 120, Denver, CO 80203, or by E-mail to: WesternISF@aol.com. For more information regarding the conference program, contact conference director David Nickum at 303/837-9383.

18TH INTERNATIONAL SYMPOSIUM
NORTH AMERICAN LAKE MANAGEMENT SOCIETY (nalms)
Cooperative Lake and Watershed Management: Linking Communities, Industry and Government
Banff, Alberta, Canada, November 10-13, 1998

Oral and poster presentations that deal with all aspects of the management, protection and restoration of lakes, reservoirs and watersheds are invited. Consider submitting a poster version of your talk to facilitate discussion. Students presenting papers or posters as senior authors will be considered for awards. **Abstracts are due May 1, 1998.** Authors are encouraged to E-mail abstracts as an attachment to: rzurawel@gpu.srv.ualberta.ca. Alternatively, the abstract can be typed into the main body of an E-mail message. If this is not possible, submit two printed copies and a diskette (IBM-compatible) to: NALMS Abstract Submissions, Alberta Lake Management Society, c/o Department of Biological Sciences, University of Alberta, Edmonton, Alberta, Canada T6G 2E9.

Abstract and registration information can be found at the NALMS web site http://www.biology.ualberta.ca/alms/1998/htm.

CALL FOR POSTERS

PEAKS TO PRAIRIES: A CONFERENCE ON WATER STEWARDSHIP
SUSTAINING COMMUNITIES AND THE ENVIRONMENT
Rapid City, South Dakota, September 27-30, 1998

Create a "toolbox" of methods, ideas and examples that provides answers for using the watershed approach to building community and sustaining the natural environment. Interactive workshops, discussions facilitated by knowledgeable professionals, field trips, hands-on activities and case studies will help participants relate the current practices in watershed stewardship to their own situations. You are invited to submit a poster for a poster session at the conference. Contact Thorne Ecological Institute by July 15. Phone 303/499-3647, FAX 303/499-8340, E-mail dir@thorneecoinst.org.

MEETINGS

The 24th Annual

COLORADO WATER WORKSHOP

Western State College
Gunnison, Colorado
July 29-31, 1998

WORLD WATER LESSONS FOR A CHANGING WEST
Management, Conservation and Public Education

What can the fast-growing New West learn from other lands where water issues parallel our own? Join us at the 24th annual Colorado Water Workshop for a unique and fascinating journey through global water experiences that mirror what we face in navigating the Colorado River today and in the 21st century. This summer's conference will feature some of the best minds in international and local water today, with a special appearance by former U.S. Bureau of Reclamation Commissioner and water legend Floyd Dominy.

Later in the 3-day program, we'll turn the mirror on ourselves and our most pressing western water issues: The catch-22 of conservation and prior appropriation doctrine; the proposal for statewide water planning - with an intensive discussion of House Bill 1288; projections on growth trends in Colorado and our future water supplies and demands; and the ways in which we might better educate an increasingly diverse population which includes many newcomers who are often taken by surprise at what water means in the West. Concurrent session blocks will provide a variety of pertinent subject matter to allow attendees an opportunity to explore favorite concerns.

To learn more about the 1998 Colorado Water Workshop, including sponsorship and exhibitor opportunities, please contact:

Robin Helken, Director
Colorado Water Workshop
1181 County Road 20
Gunnison, Colorado 81230
Phone 970/641-6215/FAX 970/641-6219

MODFLOW'98

October 4-8, 1998
INTERNATIONAL GROUND WATER MODELING CENTER (IGWMC)
COLORADO SCHOOL OF MINES
Golden, Colorado

The IGWMC, in cooperation with the Office of Special Programs and Continuing Education of the Colorado School of Mines, is organizing its 3rd international conference, MODFLOW '98 focusing on MODFLOW, its add-ons, extensions, plug-ins, spin-offs, interfaces, shells, etc. The conference will bring together the users and developers of MODFLOW and related modeling programs to present the latest innovations in model applications, discuss the capabilities and limitations of MODFLOW, and explore the needs and directions for future developments. The conference will include a series of keynote presentations on topics ranging from the history of MODFLOW to the visions for groundwater modeling in the 21st Century, demonstrations of the latest MODFLOW-related software products, and participation in workshops, seminars and poster sessions. The conference will be held on the Colorado School of Mines campus in Golden, Colorado, October 4-8, 1998. Conference registration is $545 which covers the conference proceedings, evening receptions, lunches and breaks. A reduction will be made for students registered for a degree. For more information, contact the Colorado School of Mines, Office of Special Programs and Continuing Education at 303/273-3321, FAX 303/273-3314, e-mail space@mines.edu. ***Co-sponsored by U.S. Geological Survey and Waterways Experiment Station, U.S. Army Corps of Engineers.***

FREE Xeriscape Seminars — Open to the public. No registration required

Sat. April 25 — 1-3 p.m. Treehouse Nursery, 75th & Valmont	*Creating a Formal Water-Wise Garden*	Paula Schulte, Landscape Architect
Wed. May 6 — 6:30-8:30 p.m 13th Street Conf.Ctr Between Arap. &Canyon	*Trees for Boulder: A How-to Session* **We'll plant a tree that night!**	Ken Fisher City of Boulder Forestry
Sat. May 16 — 9-noon Meadows Library	*Xeriscape:It costs less to build and maintain.* AND *Firewise Landscaping*	Jim Knopf, Landscape Architect Author: *Xeriscape Flower Gardener*
Sat. June 20 — 9-noon Main Library	*Trees, Shrubs and Vines for your Water-Wise Landscape*	Jim Knopf

FREE Brown Bag Sessions — Open to the public. No registration required.

City of Boulder, Water Quality and Environmental Services

Wednesdays: Noon to 1:00 p.m.

Each Wednesday noon in April, a video/discussion will be held at the 13th Street Conference Room, 1720 13th St., between Arapahoe and Canyon. Bring your lunch and learn a little about water!

April 1st, 8th, 22nd, 29th	**Cadillac Desert - A PBS series on water development in the West, based on book by Marc Reisner.**
April 15th	**Xeriscape videos - How to convert your landscape to use less water while providing more enjoyment.**

HOT TOPICS

The University of Colorado Natural Resources Law Center
Announces a Luncheon Program on
UPPER COLORADO RIVER FISH RECOVERY PROGRAM
Wednesday, April 29, 1998

Eric Kuhn, Secretary and General Manager of the Colorado River Water Conservation District, and Robert Wigington of the Nature Conservancy will discuss the Recovery Implementation Program for endangered fish Species in the Upper Colorado River Basin. They will focus on the programmatic biologic opinion for water depletions above the 15 mile reach of the Colorado River in the Grand Valley. By April, the most recent round of heated negotiations on the programmatic opinion should either be close to producing an agreement or breaking down. Kuhn and Wigington will highlight selected issues from their perspectives. Dan Luecke, Director of the Rocky Mountain Regional Office of the Environmental Defense fund and a Natural Resources Law Center Advisory Board member, will moderate the discussion. ***For further information, contact the University of Colorado Natural Resources Law Center – 303/492-1272.***

CALENDAR

Apr. 19-22	INTEGRATING WILDLIFE HABITATS AND PEOPLE ACROSS LANDSCAPES: CONFLICTS, CONSEQUENCES AND SOLUTIONS FOR THE NEW WEST, Glenwood Springs, CO. Contact: Thorne Ecological Institute, Phone 303/499-3647, FAX 303/499-8340, E-mail dir@thorneecoinst.org.
Apr. 19-23	FIRST FEDERAL INTERAGENCY HYDROLOGIC MODELING CONFERENCE, Las Vegas, NV. Contact: Don Frevert or Jim Thomas, Phone 303/236-0123 x235; FAX 303/236-0199; or E-mail dfrevert@do.usbr.gov or jthomas@do.usbr.gov.
Apr. 26-28	WATER DISTRIBUTION SYSTEM DISINFECTION RESIDUALS WORKSHOP, Philadelphia, PA. Complete information is available on the Internet at http://www.awwa.org/tande/dsdrw.htm.

Apr. 28-30	SOURCE WATER PROTECTION INTERNATIONAL 98, Dallas, TX. Contact: National Water Research Institute, 10500 Ellis Ave., PO Box 5, Fountain Valley, CA 92728-0865, FAX 714/378-3375, E-mail NWRI-1@worldnet.att.net
May 3-6	WATERSHED '98 — WATERSHED MANAGEMENT: MOVING FROM THEORY TO IMPLEMENTATION, Denver. CO. Contact: Water Environment Federation at 800/666-0206 or E-mail confinfo@wef.org.
May 26-30	SPECIALTY CONFERENCE ON RANGELAND MANAGEMENT AND WATER RESOURCES, Reno, NV. Contact: American Water Resources Association, Phone 703/904-1225, FAX 703/904-1228.
June 3-6	14TH TECHNICAL CONFERENCE ON IRRIGATION, DRAINAGE AND FLOOD CONTROL - Contemporary Challenges for Irrigation and Drainage, Phoenix, AZ. Contact: Larry D. Stephens, Phone 303/628-5430, FAX 303/628-5431, E-mail stephens@uscid.org. Visit the USCID Web page at http://www.uscid.org/~uscid.
July 5-9	BALANCING RESOURCE ISSUES, Soil and Water Conservation Society Annual Conference, San Diego, CA. Contact: SWCS, Phone 513/289-2331, FAX 515/289-1227, webpage http://www.swcs.org, or Email swcs@swcs.org/.
July 7-9	MONITORING: CRITICAL FOUNDATIONS TO PROTECT OUR WATERS (National Water-Quality Monitoring Council), Reno, NV. Contact: GWPC, NWQMC Conference, 827 NW 63rd, Suite 103, Oklahoma City, OK 73116, FAX 405/848-0722, http://gwpc.site.net
Aug. 4-7	CROSS CURRENTS IN WATER POLICY — UCOWR '98, Sponsored by the Universities Council on Water Resources, Hood River, OR. Contact: Dr. Tamim Younos, Virginia Water Resources Research Center, 10 Sandy Hall, Virginia Tech, Blacksburg, VA 24061-0444, Phone 540/231-8039, FAX 540/231-6673, E-mail tyounos@vt.edu.
Aug. 10-14	The 1998 U.S. Committee on Large Dams (USCOLD) 18th Annual Meeting and Lecture, MANAGING THE RISKS OF PROJECT DEVELOPMENT, SAFETY OPERATION, Buffalo, New York. Contact: Richard C. Harlan, Chair, 1998 USCOLD Lecture, FAX 415/288-9881, E-mail rcharlan@email.msn.com.
Sept. 9-10	PRACTICAL APPROACHES TO BETTER GROUNDWATER MANAGEMENT, San Antonio, TX. Contact: The Groundwater Foundation, P.O. Box 22558, Lincoln, NE 68542-2558, FAX 402/434-2742, E-mail susan@groundwater.org.
Sept. 27-Oct. 2	GAMBLING WITH GROUNDWATER, Physical , Chemical, and Biological Aspects of Aquifer-Stream Relations, Las Vegas, NV. Contact: IAH/AIH Conference Las Vegas — Conference Headquarters, Attn: Helen Klose, 2499 Rice St., Suite 135, St. Paul, MN 55113-3724, Phone 612/484-8169, FAX 612/484-8357, E-mail AIHydro@aol.com.
Oct. 11-14	DAM SAFETY '98, Las Vegas, NV. Contact: Assoc. of Dam Safety Officials, Phone 606/257-5140, FAX 606/323/1958, E-mail damsafety@aol.com.

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