Colorado Water

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

AUGUST 1997

BASIN STATES CELEBRATE 75TH ANNIVERSARY OF COLORADO RIVER COMPACT

Water Education Foundation Hosts Gathering in Santa Fe

See Page 7

Dan Tyler, CSU History Department, and Bruce Babbitt, Secretary of the Interior at Santa Fe celebration of Colorado River Compact Anniversary

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COLORADO WATER

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Robert C. Ward, Director

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EDITORIAL

AFTER WATER EDUCATION

by Robert C. Ward, Director

Colorado hosted the joint American Water Resources Association (AWRA) and Universities Council on Water Resources (UCOWR) national meeting in Keystone June 29 through July 3, 1997. The theme of the joint meeting was water education – a topic addressed by both these organizations in a number of meetings over the years.

K-12 Water Education

While the Colorado joint meeting combined the professionally-oriented AWRA with the academically-oriented UCOWR in discussing water education for professionals and college students, what made the Keystone meeting truly unique was the proactive effort to include K-12 and emerging integrated watershed management efforts. Sessions addressed the efforts of universities to develop better and more up-to-date water education programs. For example, the new CSU water "minor" was described, and a number of federal and state water agencies and municipal water departments described their efforts to educate the public about water.

As the Keystone program unfolded, many of the attendees were impressed by the sophistication of the emerging K-12 water education efforts. Many of these efforts are now nationally coordinated, designed by people who thoroughly understand water issues, and implemented with enthusiasm and energy.

Integrated Watershed Management

A number of sessions focused on integrated watershed management (and the resulting councils/forums) and the efforts of these new groups to involve "stakeholders" in water management decision-making. The evolving water education activities associated with the watershed-based groups help the public gain water knowledge. With this knowledge and personal values, the public is actively participating in the current water management discussions occurring in its communities. As I listened to the talks at the Keystone meeting and reflected upon the growing water education efforts, I realized that at some point the public will feel informed enough to take upon itself major water management decisions. Professional water managers, who have made these decisions in the past, soon may find the public looking over their shoulders in a much more informed and inquisitive manner than in the past. Is the professional water management community prepared for a public that is fully informed about water and ready to act upon that knowledge? Is the university community educating future water managers with the skills needed to interface science, management and public opinion? From what I heard at Keystone, such a time will be coming sooner rather than later.

Many water professionals and university educators have assumed that future water managers are educated within the university and seasoned by professional experience. Further, it is assumed that such managers need highly specialized education to make the complex and difficult decisions associated with society's multi-faceted use of water. The efforts to include much more water education in K-12 schools and the efforts of watershed councils/forums to educate the public will force universities and professional water managers to carefully evaluate the knowledge needed to manage water.

A public fully informed about water issues implies that the professional manager will be formulating future water policy and management strategies in a public forum. Are universities educating future water management professionals to operate in such a public environment? Are today's water managers shifting their management styles to incorporate the rapidly developing public understanding of water? What will water management look like after water education has succeeded?

RESEARCH

RESEARCH OPPORTUNITIES

The WATER ENVIRONMENT RESEARCH FOUNDATION (WERF) will release 18 Requests for Proposals (RFPs) valued at nearly $4.8 million on August 1, 1997. These RFPs were selected based on WERF subscriber input through a recent Annual Subscriber Research Needs Survey. For a copy of the actual RFP check WERF's Environment Research WEB at:

http://www.werf.org after August 1 or

Phone WERF at 703/684-2470, or FAX to 1/703/684-2492. Proposals are due by close of business October 31, 1997.

PANEL SELECTS REGIONAL RESEARCH PROJECTS

As in 1996, the Western Regional Grants Program for Water Resources Research replaced the traditional State Water Institute Research Program in FY1997. The $805,000 formerly distributed among the Western Region Institutes/Centers for state programs was allocated for a regional competition. Awards were available only to Water Research Institutes or Centers in the Western Region (AK, AZ, CA, CO, ID, NM, NV, OK, OR, TX, UT, WA, WY). Research proposals were intended to address water resources problems of regional or multi-state significance, and proposals were required to involve collaboration among at least two or more states in the western region. The lead institute for the western region was the Wyoming Water Resources Center. Twenty-one proposals involving 65 different universities were received in the regional competition. The selection panel for the WRGP met June 5, 1997 in Las Vegas to evaluate the top ten ranked proposals based upon written reviews by peer scientists. The panel selected the following five proposals for FY1997 funding:

TITLE	*INSTITUTE/CENTER*	*INVESTIGATORS*	*FUNDING*
Impact of Climatic Variations on Flood Magnitude and Frequency in Three Hydroclimatic Regions of the Western US	Washington Water Research Center	L. Ely (CWU); P. House (U. of NV)	$129,180
Salinity Management in Western Wetlands: Effects of Irrigated Agriculture on Avian Diversity	Desert Research Institute	L. Oring, M. Rubega (U of NV); J. Dow, S. Haig (U of OR)	$117,936
Value Assessments in Surface Water Transfers: Deterministic and Stochastic Issues for Buyer, Seller and Third Parties	Texas Water Resources Institute	D. Eaton, P. Wilcoxen (UT-Austin), A. Utton (UNM)	$115,064
A Problem-Solving Tool for Mitigating the Impact on Water Quality of Management Practices in Small Rural Watersheds	Washington Water Research Center	C. Stockle, S. Chen (WSU); J. Boll, B. Izadi (U of ID)	$170,107
Geochemical and Microbiological Influences on Terminal Electron Accepting Processes and Their Relation to the Biodegradation of Pollutants in the Subsurface: a Study of an Aquifer Contaminated by Landfill Leachate	Oklahoma Center for Water Research	J. Suflita (U of OK); E. Grossman, L. Cifuentes (TX A&M); G. Breit (USGS-Boulder, CO)	$272,713

A sixth alternate proposal, selected for funding should any of the first five projects be withdrawn or additional funding become available, was: "Efficient Irrigation for Water Conservation and Reduced Non-Point Source Pollution from Low Desert Vegetables," Arizona Water Resources Center, Principal Investigators C. Sanchez, T. Thompson and P. Brown (UA), and K. Bali (UC-Holtville). While no Colorado proposals were selected for funding in the Western Regional Competitive Grants Program, Lee MacDonald, Department of Earth Resources, is co-investigator for a proposal funded through the Water Institute at the Virgin Islands. The proposal, funded under that institute's regional competitive program, is titled "Erosion and Sedimentation on St. John, Virgin Islands." The principal investigator is Henry Smith of the University of the Virgin Islands.

WATER RESEARCH AWARDS

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

Colorado State University, Fort Collins, CO 80523

*__Systems Analysis Methods for Water & Natural Resources Decision Making__, Marshall Flug, Civil Engineering. Sponsor: National Biological Survey.

__Climate Sensitivity of Thaw Lake Systems on the Alaskan North Slope__, Roger A. Pielke, Atmospheric Science. Sponsor: Nat'l. Acronautics & Space Admin. — Goddard.

__Colorado Drought Action__, Dennis Lamm, Cooperative Extension. Sponsor: New Mexico State University.

__Whirling Disease PCR Testing__, Robert P. Ellis, Microbiology. Sponsor: Colorado Division of Wildlife.

__Fish Pathogens__, Eric P. Bergersen, Cooperative Fish & Wildlife Research. Sponsor: Colorado Division of Wildlife. REU Supplement to: __Biogeochemical & Hydrologic Controls on Fluxes in Freshwater Ecology__...Jill S. Baron, Natural Resource Ecology Lab. Sponsor: National Science Foundation — Geosciences.

*__Effects of Woody Vegetation on Channel Roughness__, Steven R. Abt, Civil Engineering. Sponsor: Army-Corps of Engineers.*Quality Assurance Support for the National Atmospheric Deposition Program/National...., David M. Swift, Natural Resource Ecology Lab. Sponsor: Environmental Protection Agency.

*__The NBS Global Change Data Center__, Carol L. Simmons, Natural Resource Ecology Lab. Sponsor: National Biological Survey.

__Spatial Information Technology in Geographic Education__, Melinda J. Laituri, Earth Resources. Sponsor: National Geographic Society Education Foundation.

*__Developing a Decision Support System for the South Platte Basin__, Luis Garcia, CWRRI. Various "Non-Profit" Sponsors.

*__Bedload Transport Processes in Gravel-Bed Rivers__, Steven R. Abt, Civil Engineering. Sponsor: USDA-USFS-Rocky Mtn. Experiment Station.

*__Ecological Monitoring in Lake Mead National Recreation Area__, Charles D. Bonham, Rangeland Ecosystem Science. Sponsor: National Park Service.

*__Reducing Environmental Contamination from Feedlot Manure in the South Platte River Basin...__, Jessica G. Davis, Soil & Crop Sciences. Sponsor: Utah State University.

__Satellite Data Reception & Analysis Support__, Thomas H. Vonderhaar, Atmospheric Science. Sponsor: Natl Oceanic & Atmospheric Admin.

*__International Satellite Cloud Climatology Project Sector Processing Center for GOES...__, Thomas H. Vonderhaar, Atmospheric Science. Sponsor: Nat'l. Oceanic & Atmospheric Admin.*Development of User-friendly Graphical Interfaces for Ecological __Simulation Models...__, Debra P. Coffin, Natural Resource Ecology Lab. Sponsor: National Science Foundation — Biological Centers.

__Sustainable Irrigation Development in Indonesia__, Ramchand Oad, Chemical & Bioresource Engineering. Sponsor: CID—Consortium for Internat'l. Development.

*__Establishment of Baseline Water Quality Conditions in the National Park Service__, Judith Hannah, Earth Resources. Sponsor: National Park Service.

*__Projecting the Effect of Global Change on Vegetation in Park Landscapes...__, Dennis Ojima, Natural Resource Ecology Lab. Sponsor: National Park Service.

*__Larval Fish Laboratory Involvement in Implementing Recovery Actions for the Endangered Species...__, Robert T. Muth, Fishery & Wildlife Biology. Sponsor: Bureau of Reclamation.

*__Levee Removal & Floodplain Connectivity Evaluation in the Green River, Utah__, Robert T. Muth, Fishery & Wildlife Biology. Sponsor: Bureau of Reclamation.

*__Initial Implementation of a Monitoring Program for Evaluation of Restoration Activities__, Robert T. Muth, Fishery & Wildlife Biology. Sponsor: Bureau of Reclamation.

*__Effects of Winter & Spring Flows on Colorado Squawfish__, Daniel W. Beyers, Fishery & Wildlife Biology. Sponsor: Bureau of Reclamation.

*__Flaming Gorge Studies: Technical Integration & Synthesis__, Robert T. Muth, Fishery & Wildlife Biology. Sponsor: Bureau of Reclamation.

*__Assessment of Drifting Larval Fishes in the Yampa & Green Rivers__, Robert T. Muth, Fishery & Wildlife Biology. Bureau of Reclamation.

*Flaming Gorge Studies: Annual Assessment of Mainstem Razorback Sucker Production, Robert T. Muth, Fishery & Wildlife Biology. Sponsor: Bureau of Reclamation.

*Responses of Hydrologic & Aquatic Ecosystem Processes to Potential Climate Change..., Jill S. Baron, Natural Resource Ecology Lab. Sponsor: National Park Service.

*Developing an Inventory & Monitoring Plan for Rocky Mountain National Park, Thomas J. Stohlgren, Natural Resource Ecology Lab. National Biological Survey.

*Climate Change in the Colorado Rocky Mountains: Bounding Projected Changes in Region, Roger A. Pielke, Atmospheric Science. Sponsor: National Park Service.

*Projecting Climate & Vegetation Change for the Central Grasslands Biogeographic Region..., Roger A. Pielke, Atmospheric Science. Sponsor: National Park Service.

Development of an Expert Support System for Assessing Tribal Water Quality, Freeman M. Smith, Earth Resources. Sponsor: Environmental Protection Agency.

*Further Analysis of the Shipboard Radar Data from COARE: Rainfall, Convective Organization..., Steven A. Rutledge, Atmospheric Science. Sponsor: NOAA-Natl Oceanic & Atmospheric Admin.

The University of Colorado, Boulder, CO 80309

*Reservoir Stratigraphy and its Controls on Reservoir Architecture and Performance: An Investigation of Key Surfaces and Fabrics in Marginal Marine Environments, Andrew Pulham, Geological Sciences. Sponsor: Various Oil Companies.

*Late Glacial Paleoceanographic and Climatic Conditions on the East Greenland and the SE Baffin (Canada) Margins: Comparisons and Contrasts, John Andrews, Geological Sciences. Sponsor: Univ. of California at San Diego.

*TVA PRYSM Maintenance, Edith Zagona, Civil Engr. (CADSWES). Sponsor: Tennessee Valley Authority.

*An Integrated Approach for Examining the Large-Scale Interactions Between the Atmosphere and Oceans on Intraseasonal Time Scales, Peter Webster, Program in Atmospheric and Oceanic Sciences. Sponsor: National Science Foundation.

*Effects of Climate Change in the Colorado Alpine..., Timothy Seastedt, Institute of Arctic and Alpine Research. Sponsor: National Science Foundation.

Late Quaternary History of the Western and East-Central Ross Sea, Antarctica: A Contribution to the West Antarctic Ice Sheet Initiative, John Andrews, Institute of Arctic and Alpine Research. Sponsor: National Science Foundation.

Development of a 3-D Sea Ice Model for Climate Applications, Judith Curry, Program in Atmospheric and Oceanic Sciences. Sponsor: National Science Foundation.

Variable Ice-Sheet Discharge and Coastal Change in West Antarctica, Theodore Scambos, Cooperative Institute for Research in Environmental Sciences. Sponsor: National Aeronautics and Space Administration (NASA).

Sea Ice and Ocean Processes in Baffin Bay: A Study Using Radarsat Data and Numerical Modeling, Konrad Steffen, Cooperative Institute for Research in Environmental Sciences. Sponsor: NASA.

Greenland Ice Sheet Climatology and Surface Energy Balance Modeling: Greenland Climate Network, Konrad Steffen, Cooperative Institute for Research in Environmental Sciences. Sponsor: NASA.

The Effects of Sedimentation on Overpressures in Front of the Northern Barbados Accretionary Complex, Elizabeth Screaton, Geological Sciences. Sponsor: Texas A&M Research Foundation.

Key Connections in Arctic Aquatic Landscapes, Donald Walker, Institute of Arctic and Alpine Research. Sponsor: Marine Biological Laboratory.

*Comparative Response of Moist and Dry Arctic Tundra to Altered Snow and Temperature Regimes, Donald Walker, Institute of Arctic and Alpine Research. Sponsor: National Science Foundation.

*Global Glacier Mass Balance Synthesis, Mark Meier, Institute of Arctic and Alpine Research, Russell Monson, Environmental, Population and Organismic Biology. Sponsor: National Science Foundation.

*Land and Land-Use Change in the Climate-Sensitive High Plains: An Automated Approach with LANDSAT, Alexander Goetz, Cooperative Institute for Research in Environmental Sciences. Sponsor: NASA.

*Potential Effects of Global Climate Change on Western River Basins, Edith Zagona, Civil Engineering (CADSWES). Sponsor: Bureau of Reclamation.

*The Effects of Climate Variation on Disturbance Regimes and the Dynamics of Montane Forests in the Colorado Front Range, Thomas Veglen, Geography. Sponsor: National Park Service.

An Investigation of the Nature and Predictability of El Nino — Southern Oscillation Using Statistical Dynamical Modeling Approaches, Cecile Penland, Cooperative Inst. For Research in Environ. Sciences. Sponsor: National Science Foundation.

*Supplement to existing award.

MEETING BRIEFS

75th ANNIVERSARY OF COLORADO RIVER COMPACT CELEBRATED

by Robert C. Ward, Director

The Colorado River Compact, a legal document that initiated the process of allocating water among the seven Colorado River Basin states, is 75 years old. The document's historical importance and relevance to many of today's water management issues was celebrated May 28-31, 1997, in Santa Fe, New Mexico.

The celebration was held at Bishop's Lodge, where final compact negotiations were conducted. A reception was held in the Palace of Governors in Santa Fe, where the compact was officially signed on Nov. 24, 1922. The historical relevance of the celebration's setting was inspiring in itself.

The Water Education Foundation (WEF) sponsored the celebration. Rita Schmidt Sudman, Executive Director of WEF, and her staff brought together an outstanding array of speakers to ensure a highly successful celebration.

Dan Tyler, Professor of History at Colorado State University, presented original insights into the personality and motivations of the Colorado River Commission's Colorado representative, Delph Carpenter, considered the "Father" of the Colorado River Compact. Dan currently is doing background research for a biography of Delph Carpenter.

Panels of water managers and experts examined the issues surrounding the compact over its years of existence. For example, one panel examined the situation in 1922, from each state's perspective, that led to the need for a compact. Other panels examined ramifications of the compact to the water management situation today. Two highlights of the celebration were the luncheon presentation of Colorado Supreme Court Justice, Greg Hobbs, Jr. titled "Historical Perspective on Western Land and Water Law," and the banquet presentation by former Secretary of the Interior, Stewart Udall. Udall spoke about the changing values and political climate in the Colorado River Basin. Udall was introduced by current Secretary of the Interior, Bruce Babbitt.

Rita Sudman, Executive Director of the Water Education Foundation, and Stewart Udall, Former Secretary of Interior

The Water Education Foundation will publish the proceedings of the celebration. For information about the proceedings, call the WEF at 916/444-6240.

Celebrating water history, through a careful, original, and well-prepared examination of the reasons and motivations of the participants, along with an assessment of where this history has taken us, can be extremely enlightening and refreshing. This participant came away from the celebration with a renewed enthusiasm for addressing the many difficult water issues that face citizens living in, and using water from, the Colorado River. The energy and enthusiasm of people like Delph Carpenter and his contemporaries in solving difficult water conflicts 75 years ago can be inspiring to all of us today.

COLORADO RIVER COMPACT IS 75 YEARS OLD —

Document's Historical Importance Celebrated

From top left, clockwise: ; Stewart Udall, former Secretaryof the Interior,and Bruce Babbitt, current Secretary of the Interior; Gregory J. Hobbs, Jr., Colorado Supreme Court; Betsy Rieke, Director, Natural Resources Law Center; Dan Tyler, Professor of History , and Stewart Udall; James Lochhead, Executive Director, Colorado Department of Natural Resources, and Thomas Turney, State Engineer, New Mexico.

FEATURES

THE SILVER FOX OF THE ROCKIES: A CRITIC'S VIEW OF DELPHUS EMORY CARPENTER AND THE COLORADO RIVER COMPACT

by
L. Ward Bannister, President
United States Chamber of Commerce

A summary of Daniel Tyler's remarks at the Colorado River Compact Symposium

***Editor's note:** History came alive at the May 29 Colorado River Compact Symposium when Daniel Tyler, assuming the role of L. Ward Bannister, gave a critic's view of Delph Carpenter, the "Father of Colorado River Treaties." The centerpiece of Delph Carpenter's career was the Colorado River Compact, which involved seven states, the Federal Government and the Republic of Mexico. Bannister, contemporary and antagonist of Carpenter, served as president of the Denver Chamber of Commerce, as president of the United States Chamber of Commerce, and attended meetings of the Colorado River Commission as a special guest. Below is a summary of Bannister's views, as presented by Daniel Tyler, Professor of History at Colorado State University*

Dan Tyler paints a portrait of Delph Carpenter as seen through the eyes of L. Ward Bannister.

If states can draw a line across lands so as to fix the limits of each state's ownership, Carpenter contended, they can just as certainly draw a line across the flow of a river...The mind of Delph Carpenter reached the height of its accomplishments and his was the hand which penned the major portion of the great document.

Text of Governor Ralph L. Carr's 1943
Salute to Delph Carpenter

Nearly 75 years ago I joined representatives of the seven Colorado River Basin states, their advisors and Secretary of Commerce Herbert Hoover to negotiate the Colorado River Compact. Then, all of us believed that the Colorado River carried sufficient water for all needs for all time. The seeds of controversy for the Colorado River Compact were sown. Both upper and lower basins now worry about their future.

Let us recreate as best we can the mood and spirit of the Santa Fe negotiations as they evolved 75 years ago, culminating with one of the most significant documents in the "Law of the River." In terms of interstate water law, Carpenter was a pioneer who in later life would look back on Compact negotiations as his magnum opus.

Growing up on his parents' farm in Greeley, Carpenter expressed an early interest in irrigation law. He graduated from the School of Law at the University of Denver in 1899 and almost immediately was admitted to the Colorado Bar. For ten years he tried to develop a practice in Greeley, gravitating more and more towards water law disputes. He accepted an invitation from the Republican Party to run for the State Senate and became its youngest member when he took the oath of office in 1908. Known as "Give-a-Damn Carpenter," he said, "I try to give others a square deal, but I demand a square deal myself." He opposed measures designed to weaken the agricultural community. "The people in my portion of the state," Carpenter noted, "have two don'ts — Don't fool with our water right laws or the state constitution." Around the principle of prior appropriation he determined to do battle.

"The people in my portion of the state," Carpenter noted, "have two don'ts -- Don't fool with our water right laws or the state constitution." Around the principle of prior appropriation he determined to do battle.

As chairman of the Senate Committee on Agriculture and Irrigation, Carpenter was charged with preparing a special report on the condition of Colorado's streams and watersheds. The paper he submitted concluded that priority of appropriation and beneficial use should remain the fundamental criteria for acquiring title to water rights. Additionally, it urged the state to appropriate sufficient funds to fight off encroachments by the federal government. To Carpenter, the federal government appeared increasingly disposed to build its projects with scant attention to statutes and judicial decisions of sovereign states. He believed that Colorado could expect further attacks on its water. The idea of interstate compacts began to take root in Carpenter's mind as a superior alternative to outside domination or litigation.

Carpenter learned that litigation would be lengthy and costly...

In 1911 Carpenter was appointed directing counsel in Wyoming v. Colorado (259 U.S., 1922). The suit focused on Colorado's plans to take water out of the Laramie River basin for use in the Cache la Poudre Valley. Wyoming claimed priority. Colorado argued its right to the water as a sovereign state of origin. With the Court's decision in 1922, Carpenter learned that litigation would be lengthy and costly, that basin-of-origin states could no longer successfully claim that they owned all of their water, that the Reclamation Service would continue to claim jurisdiction over western waters, that an equitable amount of transmountain diversion was acceptable to the Court, and that if states failed to negotiate compacts, the Court would determine how water on interstate streams was to be appropriated. His plans for an interstate compact on the Colorado River were first articulated to representatives of the River Basin States at a meeting of the League of the Southwest.

In August 1920, the governors of the Colorado River states met in Denver to discuss how the Colorado River Basin might be developed and protected for future generations. Of special concern was how the states might secure drought relief and what could be done to diminish the threat of floods to the Imperial Valley because of weakening Colorado River levees. Participants wanted government surveys on the river so that storage areas and power sites might be identified. They already had passed a resolution in Salt Lake City in 1919 to cooperate in the construction of reservoirs and irrigation works and had urged the Department of the Interior to consider the river as a whole and to proceed in conformity with state laws.

Arthur Powell Davis, Director of the Reclamation Service, confidently told the delegates that the Colorado River Basin contained sufficient water to supply present and future needs of the seven states and that construction of reservoirs on the lower river would in no way interfere with future development in the upper basin. Carpenter, however, could not be convinced that government involvement in construction of works would be benign for Colorado, Wyoming, Utah and New Mexico. He felt the only basis for amicable negotiations was an interstate compact with participation by the United States. Carpenter had been asked by Colorado Governor Oliver H. Shoup to come up with a plan that would protect the origin states in their goal of future development. He decided to present the outline of an interstate compact plan in hopes that a resolution would ensue. Approved by all members, it stated in part:

That it is the sense of this conference that the present and future rights of the several States whose territory is in whole or in part included within the drainage area of the Colorado River, and the rights of the United States to the use and benefit of the waters of said stream and its tributaries, should be settled and determined by compact or agreement between said States and the United States, with consent of Congress, and that the legislatures of said States be requested to authorize the appointment of commissioners...for the purpose of entering into such compact...for subsequent ratification and approval by the legislatures of each of said States and the Congress of the United States.

For the first time, states had agreed to use their power under the Commerce Clause of the Constitution to draw up a treaty regulating an interstate river, a compact that they would submit to Congress and the state legislatures for ratification. Carpenter then prepared language for a bill that authorized the selection of commissioners from each state to participate in the first meeting of a Colorado River Commission. That meeting took place in Washington on January 26, 1922. Carpenter had urged President Warren G. Harding to appoint a federal representative with international experience and national stature. He feared that Harding might allow the Reclamation Service to choose one of its people, but the President surprised him by selecting Herbert Hoover, Secretary of Commerce. Initially disturbed by Hoover's imperious tone, Carpenter grew to respect Hoover and worked closely with him throughout compact negotiations. He successfully advocated Hoover's election as chairman and Hoover returned the favor by recognizing Carpenter's role in founding the commission and persuading the President and Congress to approve authorizing legislation.

For the first time, states had agreed to use their power under the Commerce Clause of the Constitution to draw up a treaty regulating an interstate river, a compact that they would submit to Congress and the state legislatures for ratification.

In a preliminary attempt to divide up the Colorado River on the basis of potentially irrigable acreage, each commissioner, including Carpenter, exaggerated the amount of land that would be irrigated in the future. While the California representative challenged the commissioners to move forward with construction of dams and reservoirs, Upper Basin representatives demanded assurance that construction of a dam in Boulder Canyon would not jeopardize future rights of the origin states. Carpenter extended this demand even further. He asked the commissioners to consider a compact in which the Upper States had no limitations placed on them and the Lower States could claim no preferred right of title to the use of Colorado River water following the building of dams and reservoirs on the lower river.

With the Upper Basin's need for protection opposed by the Lower Basin's need for rapid construction, Hoover feared that the two groups were too far apart for further deliberations. But Carpenter refused to throw in the towel. He urged the commissioners to work harder and he supported Hoover's suggestion for a meeting later in the spring, somewhere in the Southwest. Before then, it was agreed that public hearings should be held. They began on March 15 and lasted for two weeks, convening many interested individuals in Phoenix, Los Angeles, Salt Lake City, Grand Junction, Denver and Cheyenne. Hoover hoped that during these meetings a leader would emerge who was capable of presenting a plan enabling the seven states to abandon their defensive attitude. By the close of the Cheyenne hearing, it was obvious that Carpenter was his man. Hoover asked Carpenter to prepare a compact based on a 50-50 allocation of the Colorado River's water supply. Despite his involvement in ongoing negotiations with New Mexico regarding the La Plata River and with Nebraska involving the South Platte River, Carpenter sent a compact draft to Hoover in August and included the following personal comments in his cover letter:

The sphere of my personal endeavors during the past fifteen years has in a large measure isolated me in my own profession and has frequently provoked a feeling of extreme loneliness which at times has been almost overwhelming... He was grateful that Hoover had recognized his talents.

Hoover and Carpenter were anxious to sign an agreement at the November meeting of the Colorado River Commission in Santa Fe. The 17 Santa Fe meetings began on November 9 and ended on November 24. The principal ideas which Carpenter brought to the table and which in some form were incorporated either in the writing or the spirit of the Colorado River Compact were:

- To ensure that a major component of a Colorado River Compact would be the preservation of state autonomy.
- To ensure a commitment to the common law doctrine of equitable apportionment.
- To allow the time needed for the states to ratify the Compact once it was signed. Even 10 to 15 years might be necessary to complete a seven-state agreement.
- To allow the Upper Basin a sufficient interval to match the more rapid growth in the Lower Basin.
- To ensure that no construction should begin prior to signing a compact.

Commissioners decided to leave Mexico's claims completely out of Compact negotiations. At the same time, Carpenter felt he could not consistently argue the doctrine of equitable apportionment for part of the river without applying the same principles to the entire basin. Prior to the Santa Fe meeting, he had studied a treaty between Egypt and the Sudan regarding the Nile River that paralleled the relationship between Mexico and the United States. His emphasis on viewing the Colorado River as a whole suggests that he was influenced by these studies. Even though the law, as he understood it, gave the United States the right to appropriate all waters of the Colorado River, he believed that Mexico was entitled to its equitable share by treaty.

The qualities he admired -- fair play, courtesy, and the respect between gentlemen -- were the qualities he himself showed best under pressure. With insight and the patience of Job, he encouraged the commissioners to compromise and he earned their respect.

In sum, Carpenter should be seen as a consensus builder, a broker of ideas. The qualities he admired — fair play, courtesy, and the respect between gentlemen — were the qualities he himself showed best under pressure. With insight and the patience of Job, he encouraged the commissioners to compromise and he earned their respect. After becoming President, Hoover wrote to Carpenter:

That compact was your conception, and it was due to your tenacity and intelligence that it succeeded. I want to be able to say this and say it emphatically to the people of the West.

COLORADO MANURE REGULATIONS UNDER REVIEW

by Jessica G. Davis, Extension Soil Specialist

The Colorado Water Quality Control Commission is currently reviewing the Confined Animal Feeding Operations Control Regulation to determine whether this regulation needs revision in order to ensure protection of the state's water quality. The Commission has formed a work group whose purpose is to develop consensus, make recommendations, and identify options for the Commission. The work group includes water districts, health departments, Rocky Mountain Farmers Union, Sierra Club, Catholic Rural Life Conferences, Colorado Corn Growers, Colorado Cattle Feeders Association, Colorado Pork Producers Council, Western Dairymen Cooperative, Colorado Farm Bureau, Natural Resources Conservation Service, Colorado State University, Colorado Department of Agriculture, and a number of individuals representing specific farms. The work group is scheduled to meet every two weeks through the end of October, and work group meetings are open to anyone. An informational hearing is scheduled for November 3 for presentation of the work group's conclusions to the Water Quality Control Commission.

The topics which the work group has been asked to address are:

1) Off-site Manure Application
The original regulation was not intended to cover manure application off-site, on land that does not belong to the livestock producers. However, the state Attorney General interprets the regulation to apply to off-site disposal of manure. Therefore, the Commission must decide whether the regulation should apply to farmers who apply manure from a livestock feeder, and if so, who is responsible, the feeder or the farmer?

2) Adequacy of Land Application Provisions
The Water Quality Control Division does not currently know whether animal feeding operations are complying with the existing regulations, since enforcement of regulations is largely complaint-driven. The current regulations do require recordkeeping regarding manure application rates, soil test, and manure nutrient analysis, but there is no reporting required (except for cases where manure is applied at greater than agronomic rates). Should operations be required to send their records to the state on a regular basis?

3) Adequacy of Retention Structure Provisions
There is a lack of public confidence regarding seepage from lagoons and wastewater storage structures. Currently, there is no state oversight over construction of these structures, nor are there any general monitoring requirements. Owners of these facilities are required to certify compliance, but they are not required to prove this compliance to the Water Quality Control Division. Should the Division have greater oversight over construction and monitoring of lagoons and storage structures?

4) Scope of Coverage
Currently, a concentrated animal feeding operation is generally defined as one with 1000 animal units fed for at least 45 days per year. There are discrepancies between Colorado and the EPA regarding animal unit equivalency factors for swine and horses. Should these be modified to be the same as the federal equivalency factors? Should smaller operations be included in the regulation?

5) Long-term Impacts
Excessive rates of manure application can take a long time to impact groundwater quality. Do the regulations protect water quality over the long-term or do they only come into play after groundwater becomes contaminated? How can the regulations ensure that water quality will not be diminished over the long-term?

6) Information Base
The Water Quality Control Division is charged with implementing this regulation, but does not have a list of who is actually under the regulation. This lack of information leads to a lack of public confidence that the water supply is being adequately protected. Therefore, there is interest in collecting data from producers so that the Division knows who is supposed to be regulated and who is following regulations. On the other hand, producers are concerned that this information might be misused.

7) Resources for Implementation
Currently, only one-tenth of one person's time at the Water Quality Control Division is allocated to enforcement of the Confined Animal Feeding Regulation. If the regulations become more stringent, the state will have to allocate more resources to enforcement.

If you would like to attend the work group meetings or express your opinion on these possible changes to the regulation, feel free to call Derald Lang (Water Quality Control Division) at (303)692-3561 or Paul Frohardt (Water Quality Control Commission) at (303)692-3526.

STATUS OF MANURED CROPLAND AND WATER QUALITY IMPLICATIONS

by Jessica G. Davis, Extension Soil Specialist

Excessive manure application rates have been related to high soil salinity, nitrate leaching to groundwater, and P runoff. We sampled forty-one fields with a history of manure application to determine the status of these problems in the South Platte River Basin. Soil salinity levels were not excessive; none of the fields had EC > 4.0 dS/m. Residual soil nitrate averaged 395 lb N/A on the clay soils and 300 lb N/A on the sandy soils. Soil nitrate concentration decreased with depth, but even at the 36-48 inch depth, the average NO_3-N concentration was 12 ppm. Average soil P concentrations were 5 to 11 times higher than the lower limit of the Very High range, which is a measure of crop requirement. Therefore, the manured fields had excessive soil P and deep soil NO_3-N buildup, which could result in surface and/or groundwater contamination.

Soil nitrate was measured down to 4 feet. In the top 2 feet, there was no significant difference between the clayey soils and the sandy soils, but from 2-4 feet deep, the clay soils had significantly greater soil nitrate levels than the sandy soils (Figure 1). When the soil nitrate credit was calculated according to Colorado State University's Fertilizer Suggestions for Corn (Mortvedt et al., 1996), the clay soils had an average N credit of 395 lb N/A, and the sandy soils had an average N credit of 300 lb N/A. If samples had been taken only to 2 feet deep, the N credits for soil nitrate would have been identical for the sands and the clays. By sampling to 4 feet, the soil nitrate credit increased by nearly 100 lb N/A.

When crop requirements and irrigation water nitrates were also factored in, the sandy soils had a N balance in excess of crop needs of 474 lb N/A as compared to only a 265 lb N/A credit on the clay soils. This difference was primarily due to greater use of groundwater for irrigation in the sandy areas, since groundwater nitrate levels tend to be considerably higher than surface water nitrate levels in this area (Table 1).

Repeated manure applications have not yet resulted in topsoil pH levels > 8.0 or EC levels > 4.0 dS/m; however, the potential for these problems is greater in heavier-textured soils. Soil nitrate levels were present in excess of crop requirements, and excess nitrate could leach to groundwater. Soil P levels were Very High, and, therefore, the potential for P runoff adsorbed to soil sediments eroding from manured cropland is also high.

Reference:
Mortvedt, J.J., D.G. Westfall, and R.L. Croissant. 1996. Fertilizer suggestions for corn. Service in Action no. 538. Colorado State University Cooperative Extension; Fort Collins, CO.

Figure 1. Comparison of NO_3-N concentrations with depth on clayey and sandy soils which have been fertilized with feedlot manure. The letters "A" and "B" designate that a significant difference was found by t-test at $p<0.05$.

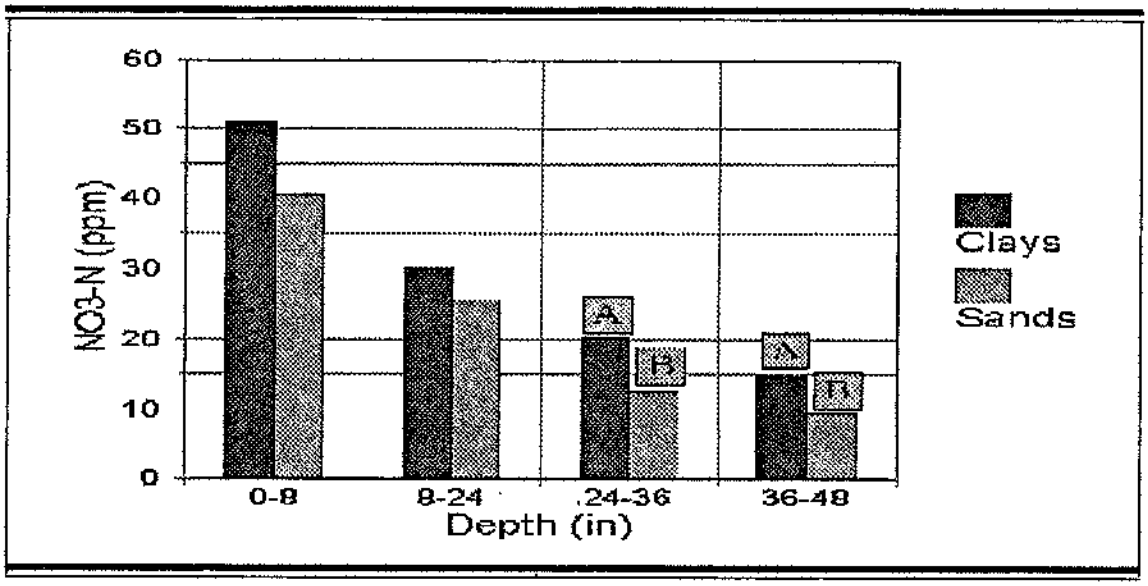


Table 1. Quality of water used for irrigation of manured clayey and sandy soils in the South Platte River Basin.

	Sandy Soils (primarily groundwater)	Clayey Soils (primarily surface water)
Electrical Conductivity (dS/m)		
Average	1270	1440
Minimum	210	380
Maximum	2330	2660
NO3-N Concentration (mg/L)		
Average	23.1	6.6
Minimum	<0.1	0.7
Maximum	42.7	15.4

U.S. GEOLOGICAL SURVEY DATA COLLECTION AND STUDIES IN THE ARKANSAS RIVER BASIN

by Doug Cain, Subdistrict Chief

Editor's note: Doug Cain, Subdistrict Chief, U.S. Geological Survey, presented the following paper at the ***Arkansas River Basin Water Forum, "A River of Dreams and Realities,"*** *January 22-23, 1997. The forum was held in Pueblo, Colorado. Cain describes the USGS data collection efforts and the status of water quality in the valley.*

The U.S. Geological Survey has taken on additional responsibilities within the last year. In the past, we were the nation's mapmakers, geologists and hydrologists. We have recently incorporated the National Biological Survey as one of our divisions, so now we have the capability to do biological studies also. Another thing I should mention about the USGS is that we are not a regulatory agency; we are a scientific agency. We are proud of our unbiased approach to science.

Our office in Pueblo is responsible for water resources data collection and studies, both in the Arkansas Valley and the San Luis Valley of Colorado. I will focus on the Arkansas Valley today. Within the basin, we work with about 20 local agencies to do data collection and studies and with about five other federal agencies that provide us funding for various activities related to water. The office in Pueblo includes about 35 people, mostly hydrologists and hydrologic technicians, who collect data and do studies on water.

I would like to give you an overview of our activities before I go into detail about some of the results of our work. We are responsible for data collection and studies in the basin, and that includes the operation of a large number of stream gages and continuously recording water quality monitors. We collect data on surface and groundwater quality, suspended sediment in streams, and precipitation primarily related to studies that we have in process. Another site that we operate in this basin, near the Las Animas fish hatchery, is a part of the National Trends Network, which looks at the acidity of precipitation. We have a number of groundwater level networks in the Arkansas River Basin. For many of the stream gage and water quality monitoring sites, the data (both real-time and historic) have been available on the Internet now for about two years. The same address (web server.cr.usgs.gov/home.html/) can provide you links to get real-time stream flow information for virtually the entire United States. You might want to take a look at that website.

I will talk today about the results of either recent or ongoing studies that we have done in the basin. I will start by looking at groundwater levels in the basin. We have a number of water level networks in the basin, the largest of which is in the alluvial aquifer along the Arkansas River between Pueblo and the Kansas state line. There, we have measured water levels in a number of wells for more than 25 years. In the last year, we have gone back and looked at data from a number of those wells that had been measured for that entire period to see if we can identify trends.

Many of you know that there is concern about high water-table conditions in the basin, and I think Figure 1 will give you an idea of what we have seen. It shows the average change in water level (in feet).

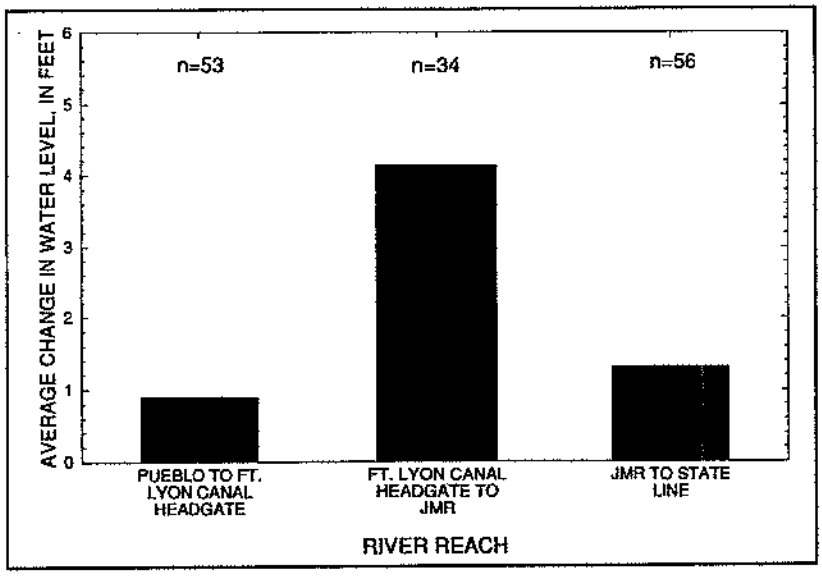


Fig. 1. Average 25-Year (1969-94) Change in Groundwater Levels.

These are all increases in water level, and this is the level where groundwater will stand in a well below the

land surface. In three reaches of the river — from Pueblo to the Fort Lyon headgate, from the Fort Lyon headgate to John Martin Reservoir, and from John Martin Reservoir to the state line — there has been an average rise in water level. The largest average rise is in the reach from the Fort Lyon canal headgate to John Martin Reservoir. This is the focus of some interest, especially by the Colorado Water Conservation Board right now, in trying to determine the causes and possible ways to mitigate the situation.

I want to talk to you today about water quality in the basin. We have collected data over the years, much of it between 1990 and 1993, as part of a study that involved about 15 different entities in the basin. Some of this material will not be new to those of you who know about salinity in the Arkansas River (see Figure 2).

In the upper basin, salinity, or salts in the water, generally are in very low concentrations, frequently less than 100 mg per liter, where the drinking water standard is 500 mg per liter. As that water moves, say, between Parkdale and Portland, you get a lot of pick-up of salts because of saline sedimentary rocks in that area. Then, through the Pueblo area, most of the time water is below the drinking water standard in the Arkansas River.

As the water is used and reused, there is return flow and the water goes back to the river. Each time that occurs, the salts are concentrated in the water. We sometimes hear about the salinity of the Colorado River where it goes into Mexico, and the concerns about that. That is at a level of around 800-900 mg per liter. In the Arkansas Basin, the dissolved solids are generally very high, especially downstream from Pueblo, and increase rapidly, especially downstream from La Junta.

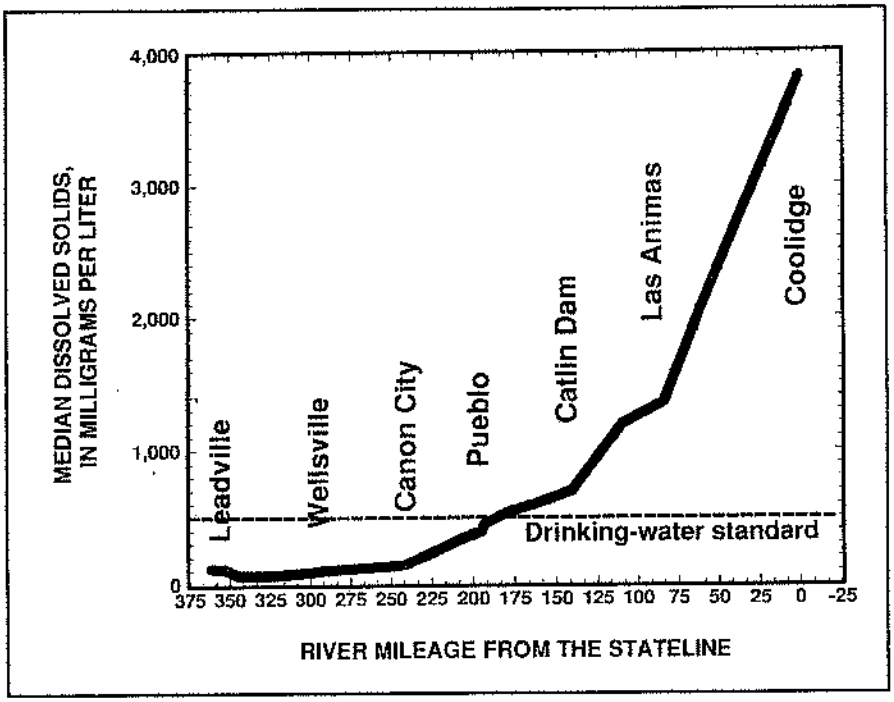


Fig. 2. Dissolved Solids in the Arkansas River

There are some other interesting results from water quality studies that we have done in the Arkansas. I will give you a number of highlights. We will have reports coming out within the next few months that will give more detail on a lot of these. Between 1990 and 1993, we collected data on metals in the upper basin coming into the Arkansas River from abandoned mines and mine drainages in the area near Leadville. It happened that in 1992 water treatment plants were installed both on the Yack Tunnel near Leadville and the Leadville Mine Drainage Tunnel, and so we had two years of data before that occurred and one year of data after that occurred.

There was speculation at the time about how much water quality improvement we might see as a result and, in general, the further upstream you were, the more improvement there was. We saw statistically significant improvement in water quality. Cadmium, copper, lead, manganese and zinc all appeared to decrease in concentrations after those treatment plants went on-line. In general, those effects were greater nearer Leadville, and you could not discern effects once you got much downstream from Wellsville and, in some cases, even further upstream. There were no exceedences of water quality standards in that one year after we collected data at those sites. Anecdotal reports indicate that there have been some improvements in the fishery as a result of this, so this is really good news for the basin!

There is another piece of good news in the basin. There is always concern in agricultural areas about whether pesticides are getting into water supplies. We did not do extensive sampling for pesticides, but we did do some sampling for pesticides in the river itself (see Figure 3). (We have not done sampling for pesticides in the groundwater system.) We sampled at four sites, one upstream and three downstream from Pueblo, during the irrigation season when irrigation and applications of pesticides were going on, and again saw good news. Nearly 97 percent of the pesticides analyzed were not detected. Where we did see detec-

tions, and for some pesticides we did see detections, they were generally much lower than the standard set by the EPA. For Diazinon, which occurred frequently, there is no standard, but concentrations we saw were very low. So again, some good news!

•Four sites sampled- Portland, Avondale, Catlin Dam, and Las Animas

•Sampled during pesticide application and irrigation seasons

Results

•Nearly 97% of pesticides analyzed were not detected

•2,4-D detected at all sampled sites and about 75% of the time but well below EPA standards

Fig. 3. Pesticides in the Arkansas River

One other thing we have done as part of examining water quality is to look at the water quality effects of water operations in the basin, meaning storing water in reservoirs, releasing it for later use, exchanging water from one place to another in the basin, drying up agricultural land, and changing pumpage that might come about as a result of the Compact lawsuit. We have done some studies to look at reductions in ground water pumpage and taking agricultural land out of use. We did this in a small study area between La Junta and the county line downstream between La Junta and Las Animas, where we have done some modeling in the past to look at salinity. We developed a digital computer model of the groundwater system and the surface water system. We got that model to fairly accurately reproduce the conditions we saw both in the river and in the groundwater system for the period from 1971 to about 1995.

Then we played some games with that model. We looked at how groundwater quality might change in that area with changes in pumpage from the groundwater system (see Figure 4). The first scenario was 25 percent reduction in pumpage, a second scenario was a 50 percent reduction of pumpage from historic patterns, and a third was complete cessation of pumpage from the groundwater system for irrigation in that area.

We asked, If we had made these changes in 1971, what would things be like in 1995? In these scenarios we had about a 200 mg per liter decrease in dissolved solids in this irrigated area, or this is what we projected would have happened if we had completely done away with groundwater pumpage.

There were other interesting things. We saw that there were lesser effects with smaller decreases in pumpage, but we also saw that it took about ten years for that groundwater system to destabilize. We also looked at a situation similar to what has occurred under the Rocky Ford Canal, where part of that land was taken out of production and water was transferred to another location.

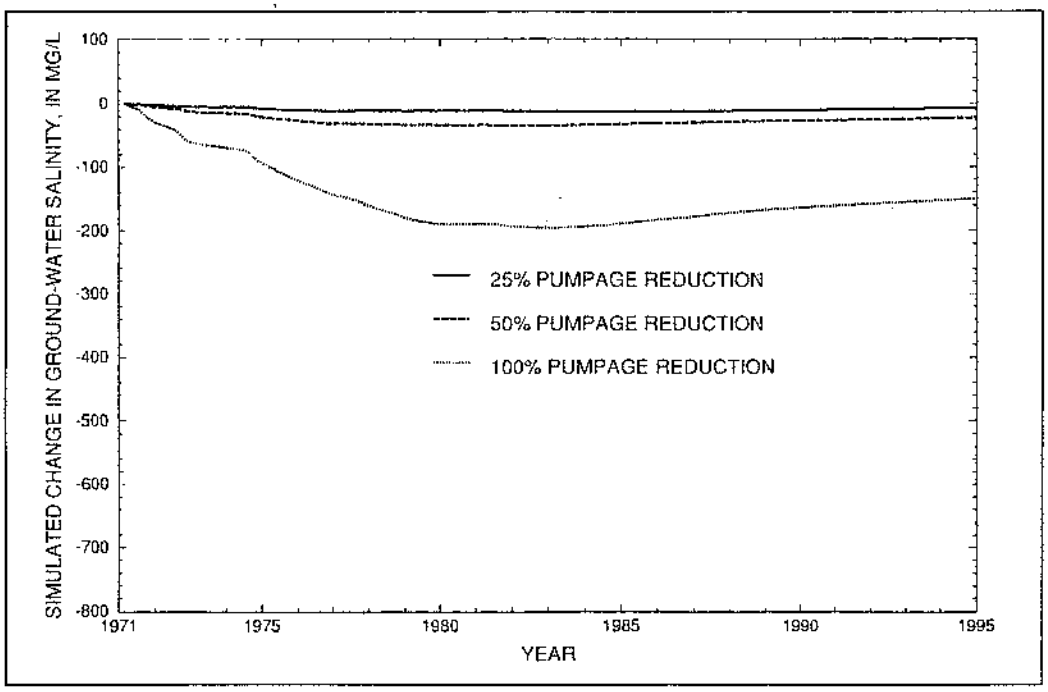


Fig. 4. Simulated Change in Groundwater Salinity Relative to Historic Conditions for Scenarios of Reduced Pumpage.

We looked at various possibilities for drying up that land to see how changes in groundwater quality would have occurred (see Figure 5). With the same kind of scenarios, we put this change into the model as if it had occurred in 1971 and looked at how those changes would have occurred. For reference, these are shown as simulated change in groundwater quality, but the average dissolved solids in that groundwater at the beginning of this period was about 2200 mg per liter. The maximum change we saw

was about a 10 percent decrease in dissolved solids with 100 percent dryup. There was about a 30 percent decrease in dissolved solids. We can see that some of these changes that are happening in the basin can have positive effects on water quality, although there are also the associated effects that might not be so positive. Another thing I have not shown here but that will be in the publication is how this change might have affected water quality in the river itself.

We have looked at how specific conductance, which is a measure of the salts in the water, has changed at sites downstream from both Pueblo Reservoir and John Martin Reservoir before and after Pueblo Reservoir went in (about 1974) and before and after the 1980 operating plan for John Martin Reservoir. The first site is above Pueblo, just down-stream from Pueblo dam. We will show the daily mean streamflow for various months, both before and after Pueblo Reservoir went into place. Look at the average salt concentration in water coming out of Pueblo Reservoir (Figure 6). We see a shift in the monthly concentrations of salts passing the site after the reservoir was built, so there is much less variation on an annual basis in the salts coming out of the reservoir. Before, we would see higher salts in the spring and much lower salts during spring runoff. Now, because all of that water is mixed together in the reservoir, we do not see nearly as much change. This means that people using the water, irrigators downstream, see more consistent water quality but the water is not as clean as it was in the past during the spring.

To show this more dramatically, instantaneous measurements of salts in the river at the site from 1966 to 1994 showed that before the reservoir went in there was a lot of variation. After the reservoir went in, the annual variation is much smaller (Figure 7). We also saw a slight, average improvement in water quality at this site.

Downstream, at the next site (Avondale is just east of Pueblo and downstream from Fountain Creek, the outfall from CF&I and the outfall from the Pueblo Wastewater Treatment Plant),

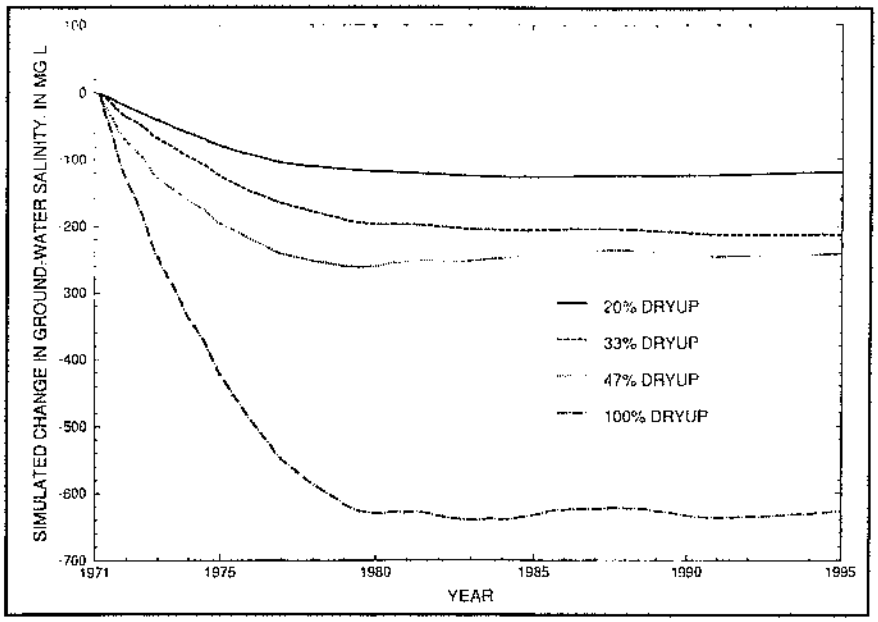


Fig. 5. Simulated Change in Groundwater Salinity Relative to Historic Conditions for Scenarios of Agricultural Dryup.

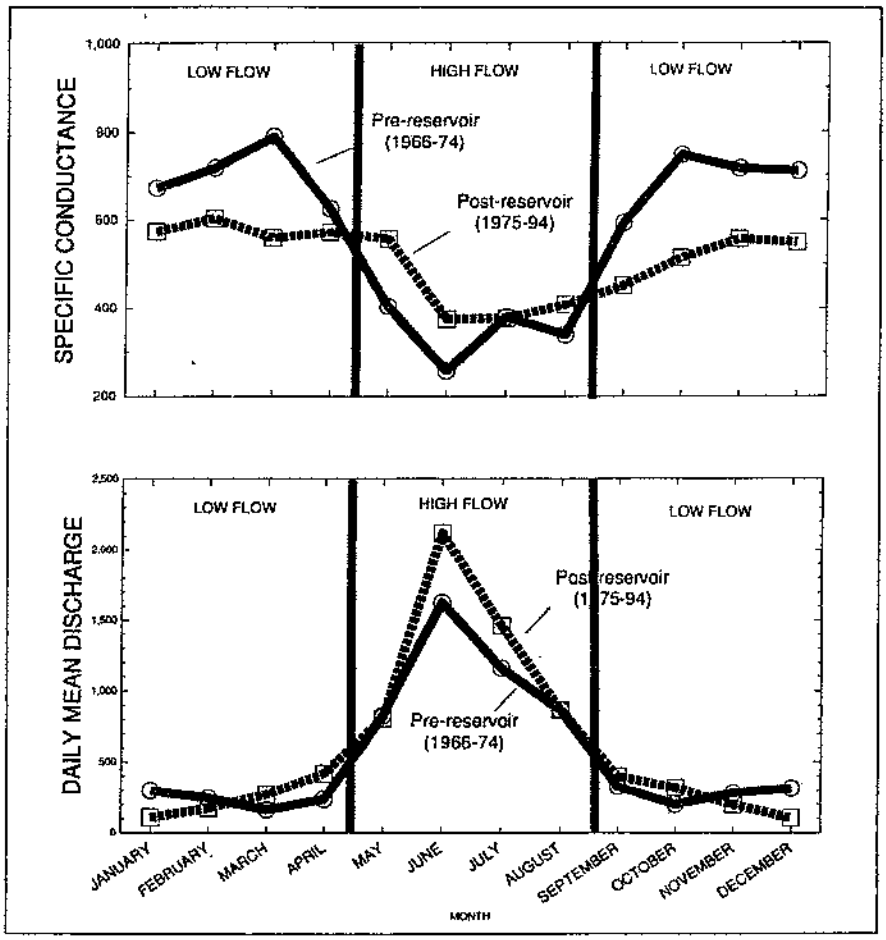


Fig. 6. Arkansas River Above Pueblo.

we see a somewhat different picture (Figure 8). The variation that we see after Pueblo Reservoir went in appears to be greater. We see a slight increasing trend in salts at this site. Some of the effects of improved water quality or more consistent water quality are not present at this site. Looking at records from Fountain Creek, this increasing trend is because of an increase in dissolved solids coming out of Fountain Creek that are measured at this station.

One other site I would like to show you is the site below John Martin Reservoir both before and after the 1980 operating plan (see Figure 9). We see something similar to what we saw in Pueblo Reservoir. There is less variation, but also, generally, water quality since 1980 below John Martin has improved. There are fewer salts in the river at that point. We believe this is because of a dramatically increased flow. In general, when the flows are higher the salts in the water are lower.

As some of you may have read in the newspaper recently, the State of Kansas has expressed concerns about the problems in the aquifer along the Arkansas River in Kansas because of salts moving into that aquifer from the river. Based on the work that we have done, it appears that since1980, at least at the Lamar site (we do not have the data to look at this in detail at the site near thestate line), water quality has probably improved (see Figure 10). I am not sayingit is great water quality, because dissolved solids at the state line are still very high, but there definitely is an improvement at that site.

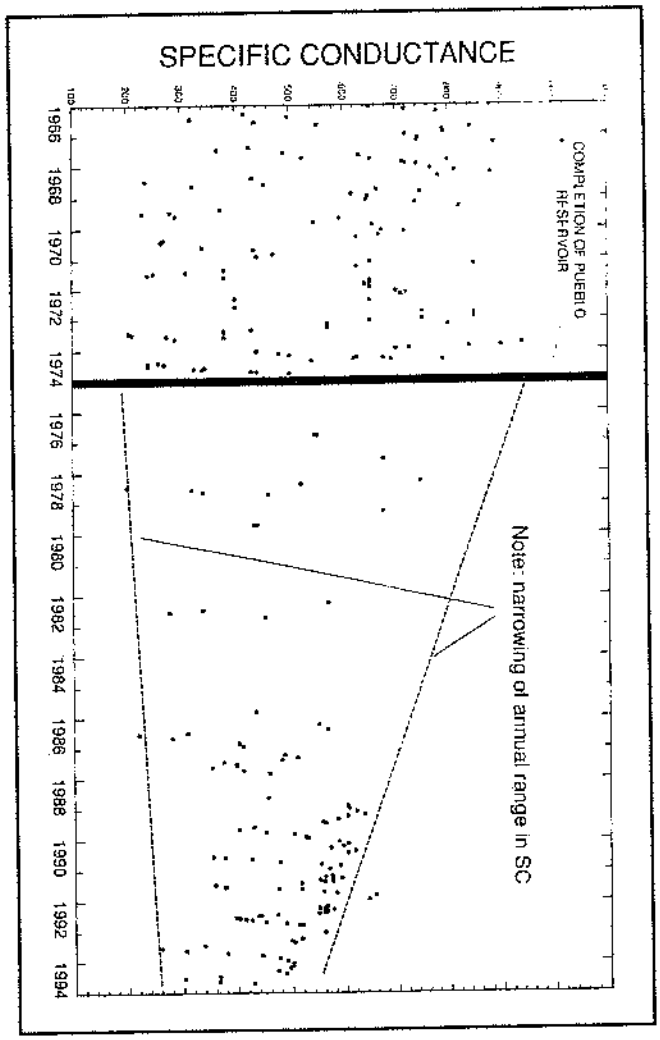


Fig. 7. Specific Conductance at Arkansas River Above Pueblo, 1966-94.

One other study that I would like to mention is a two-year study done in cooperation with the Purgatoire River Water Conservancy District to look at losses in stream flow along that river. The prevailing wisdom, based upon a number of fairly specific studies in the past, was that there was a lot of water loss in the Purgatoire River between Trinidad Dam and the mouth of the Purgatoire near Las Animas. We looked at about 12 years of data for that period, and it appears that on average, at least in the lower two-thirds of that reach, losses are fairly small. In fact, sometimes there are even gains. It appears that the earlier studies may have looked at fairly specific situations when losses were quite high.

The information presented in this article is based on several recently approved or published reports, including:

Water-quality data for the Arkansas River Basin, southeastern Colorado, 1990-93, by R.G. Dash and R.F. Ortiz (USGS Open-File Report 95-464).

Metal speciation in the upper Arkansas River, Colorado, 1990-93, by M.L. Clark and M.E. Lewis (Water-Resources Investigations Report 96-4282).

Evaluation of streamflow traveltime and streamflow gains and losses along the lower Purgatoire River, southeastern Colorado, by R.G. Dash and P. Edelmann (Water-Resources Investigations Report 96-4291).

Water-quality assessment of the Arkansas River Basin, southeastern Colorado, 1990-93, by R.F. Ortiz, M.E. Lewis, and M.J. Radell (Water-Resources Investigations Report 97-4111, in press).

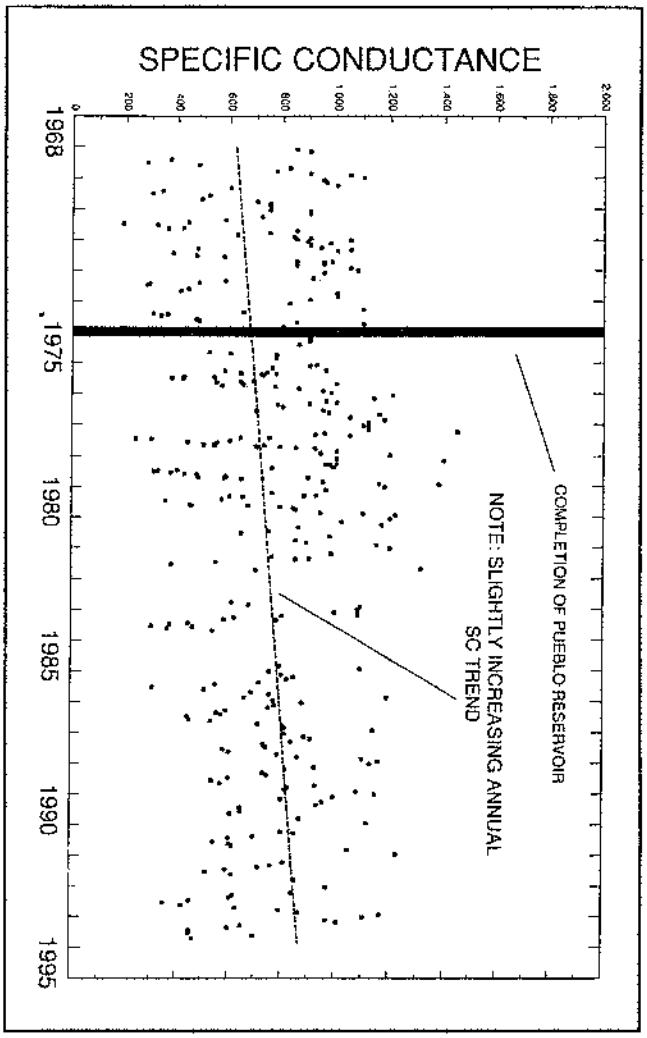


Fig. 8. Specific Conductance at Arkansas River Near Avondale, 1969-94.

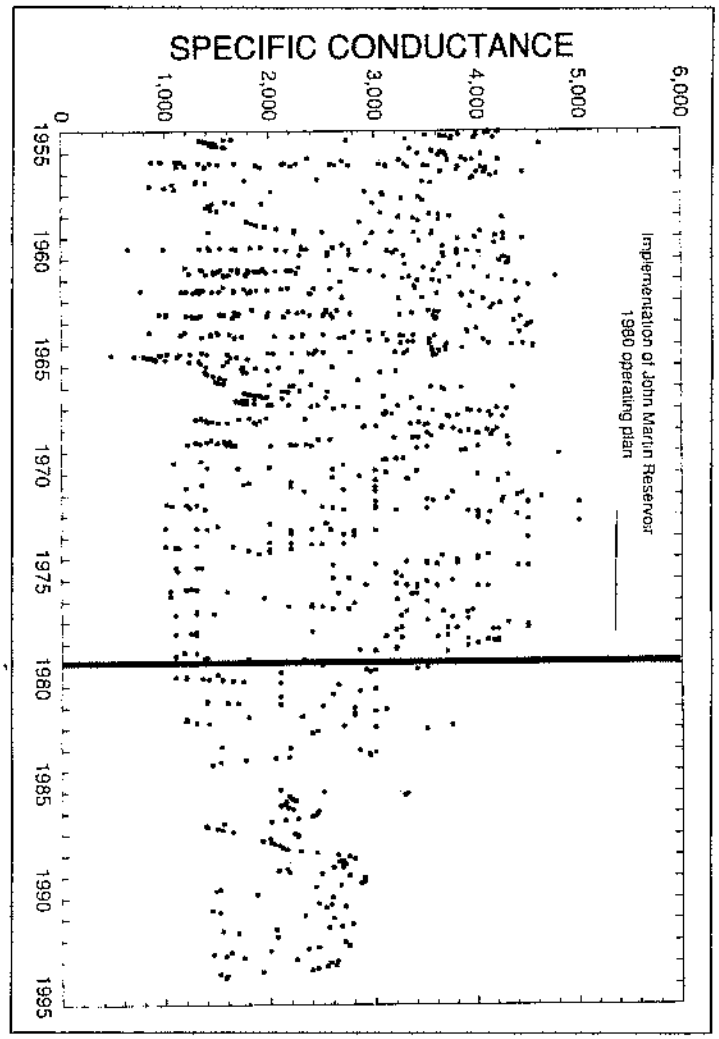


Fig. 9. Specific Conductance at Arkansas River Below John Martin Resoirvoir, 1955-94.

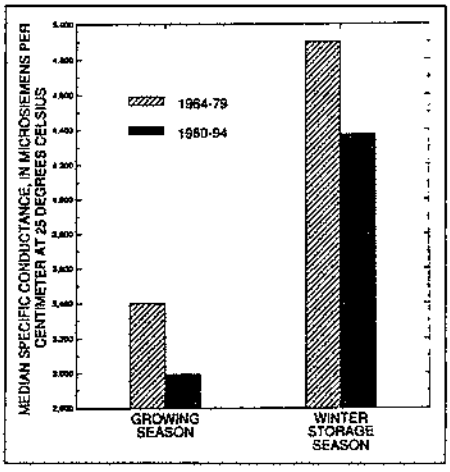


Fig. 10. Specific Conductance at Lamar, 1964-94.

UNIVERSITY WATER NEWS

CSU WATER CENTER REPORTS ON PROGRAMS

Colorado State University's Water Center was officially established on February 19, 1996. The Center succeeds and replaces the Center for Water Resources Engineering and Science (CWRES), which was established in 1990 to administer the Program of Excellence in Water Resources funded by the Colorado Commission on Higher Education.

The Water Center and CWRRI are often confused with each other, but their missions are different. The Water Center focuses on advancing Colorado State's programs, whereas CWRRI is essentially a state agency operating a federal-state program that involves other Colorado higher education institutions. The Water Center provides an umbrella for the many water-related programs at Colorado State, including CSU's Program of Research and Scholarly Excellence in Water Resources.

Student Activities — Student and curriculum activities that the Water Center has been involved with include the undergraduate curriculum, graduate curriculum, organization of student events, and student projects. In the Department of Civil Engineering, eight of fourteen student groups, worked on water projects, most with direct application to problems of rural areas in Colorado. These included a channel stability study for Creede, a storm drainage study for Johnstown, a water distribution system study for Monte Vista, a project to assist residents of the Platte Valley between Sterling and Julesburg with their water issues, a channel restoration study for Granby, a water supply study for Boone, a water quality study for Kodak, and a sanitary sewer study for Walden.

Colorado State University's new Water Resources Interdisciplinary Studies Program (WRISP) offers undergraduate students, regardless of their major, an opportunity to introduce themselves to the many dimensions of water management. WRISP students complete 21 credits in core and elective courses that are particularly relevant to today's water issues. Completion of the program is certified on the student's academic record. A copy of the Water "Minor" brochure and a list of WRISP Key Advisers are available from CWRRI by phone 970/491-6308, FAX 970/491-2293 or email CWRRI@Colostate.edu.

LEE SOMMERS SELECTED AS AG EXPERIMENT STATION DIRECTOR

Lee Sommers is the newly selected director of the Colorado Agricultural Experiment Station. Sommers, who has served as CAES interim director, accepted the position effective July 1.

Sommers received his bachelor's in agriculture from Wisconsin State University in 1966 and both his masters in soil science in 1969 and his doctorate in soil science in 1971 from the University of Wisconsin-Madison. During his tenure as a soil science professor at Purdue University, Sommers spent an eight-month sabbatical at Colorado State in 1977. He returned to serve as professor and head of the Department of Soil and Crop Sciences in 1985. Dr. Sommers is a member of numerous professional organizations and currently is president-elect of the Soil Science Society of America.

As director of the Colorado Agricultural Experiment Station, Sommers is responsible for all programming, budgeting and related activities. He reports to Kirvin Knox, the Vice Provost for Agriculture and University Outreach. CAES works in partnership with Colorado State Cooperative Extension to provide Colorado consumers and agricultural producers with the latest information relevant to maintaining a healthy economy and a vibrant community.

Public Relations Department, CSU

RESTORING THE WATERS NOW AVAILABLE FROM CU'S NATURAL RESOURCES LAW CENTER

RESTORING THE WATERS is the latest publication of the Natural Resources Law Center at the University of Colorado. The Center, in cooperation with the Natural Heritage Institute, the Natural Resources Defense Council and Northwestern School of Law of Lewis and Clark College has produced this full-color publication — 64 pages with 67 photos and line drawings — with funding from the Ford Foundation. In 23 one-to-three-page stories, *RESTORING THE WATERS* portrays innovations in water use and management that have provided important environmental benefits. The stories identify some of the public and private groups working to conserve, protect and restore water resources, as well as the strategies by which these innovations have been implemented. States represented in the stories include Arizona, California, Colorado, Idaho, Nevada, Oregon, Washington and Wyoming. The booklet is available for educational purposes from the Center at no charge — also through funding provided by the Ford Foundation. For copies of the booklet or more information, contact Kathryn Mutz at 303/492-1287 or email kathryn.mutz@colorado.edu.

CSM'S INTERNATIONAL GROUND WATER MODELING CENTER IS CHANGING

by Eileen Poeter

WHO WE ARE — Most of you are probably familiar with the International Ground Water Modeling Center (IGWMC), but for those of you who are not...IGWMC is a research center at Colorado School of Mines (CSM) with the mission of stimulating the correct and efficient use of ground-water models, while training and facilitating interaction of ground-water professionals.

WHY ARE WE CHANGING? — From the late -'70s until the early -'90s the center was strongly supported by the US Environmental Protection Agency (USEPA). About three years ago, governmental changes caused considerable cutbacks in funding for environmental work, resulting in termination of USEPA support for IGWMC. The loss of federal funds also caused a slow-down in the environmental industry, which reduced software sales and short-course attendance for the center. The State of Colorado and the Colorado School of Mines have not, and will not subsidize the center.

With the advent of these changes, it became apparent that the IGWMC had to become a self-supporting center by offering services of value to all ground-water professionals at cost-effective prices. Also, Paul van der Heijde, who has served as director of IGWMC since 1981, recently decided that it was time for him to pursue independent consulting and research projects. The CSM administration retained Paul in a research faculty position and asked A. Keith Turner and me to jointly undertake direction of the IGWMC as of May 1, 1997. Our challenge is to structure a self-supporting center that will be valuable to you into the next century.

NEW ACTIVITIES OF THE IGWMC

ADVISORY SERVICES — Think of IGWMC as a "teaching hospital," with the patients being ground-water problems faced by professionals and companies. IGWMC will provide a telephone advisory service, not only for supporting software distributed by IGWMC, but also for advising professionals on generic modeling questions and site-specific applications. Graduate students will document questions and provide solutions. For more-difficult questions the students will organize information and associated materials and pass it all on to experienced faculty members. The service is intended to save hours of time that would have been spent unraveling a problem or, further down the line, correcting an error resulting from mishandling of a problem. While utilizing the service, companies and professionals will be furthering the education of ground-water engineering students who will be learning by doing, and who will receive training to answer the phones. Charges for services vary: Advice will be Free when a software bug or faulty disk occurs in a product from IGWMC. Problem-solving will cost a flat fee of $15 for the first five minutes. Thereafter, the cost will be $.50/minute for student services, and $2.50/minute when faculty are required to help.

Funds that are not utilized to directly run the service will support student work in the area of ground-water modeling. The students have begun specific training for this task and are very enthusiastic about this endeavor. The advisory service will be in place by September 15, 1997, and the number will be 303/273-3105.

SOFTWARE — Software sales will continue at IGWMC. In addition, the center will develop packages of software, data-sets, and exercises designed for classroom use; conduct software testing projects; and support public domain code development and distribution.

COURSES — Courses will be designed to serve the present-day professional more effectively. Professionals find it hard to get away from the office for an extended period of time. We are planning one- and two-day short courses with tightly focused objectives, as well as courses on the World Wide Web and/or on CD ROM with access to the advisory line for questions that arise while studying.

CONFERENCES -- IGWMC plans to offer a specialty modeling conference every other year, starting with a conference on MODFLOW and related codes and activities October 5-8, 1998. A call for papers will be released soon.

NEWSLETTER — The first newsletter will be mailed with a card for returning contact information. We especially want to focus on obtaining E-mail addresses, because future newsletters will be published on the World Wide Web. An E-mail announcement will notify everyone when a new issue is released and provide a button-connection to the electronic newsletter. Hard copies will be mailed to those who do not have an E-mail address. We welcome suggestions for and contributions to the newsletters!

RESEARCH AND DEVELOPMENT — Research projects will include consortium projects, individually sponsored projects, and development of software to enhance what is available in the industry. Consortium research projects will be selected by center sponsors.

MEMBERSHIPS IN IGWMC — Government agencies are no longer supporting entities such as IGWMC. However, if many ground-water-oriented companies and individual ground-water professionals maintain low-cost memberships in the center, stable support will be provided to IGWMC to ensure that its services are there when people want them. Memberships will also support the education of ground-water professionals by providing graduate students with a means of augmenting their finances while practicing in their technical area. Finally, memberships will entitle participants to reduced rates on IGWMC events and services and numerous other items as indicated below.

THE IGWMC WEB PAGE IS BEING REMODELED .... SOON THE NEW PAGES WILL BE ONLINE ...VISIT US PERIODICALLY FOR: - A current thought page, presenting an interesting topic or approach - A Listing of center members - Software distributed by the center - A Newsletter to download - Upcoming events - Educational materials and exercises - Job coordination - Abstracts of student work - Links to other, related pages.

IF THE NEW IGWMC ACTIVITIES ARE OF INTEREST TO YOU, PLEASE CONTACT:

Eileen P. Poeter or A. Keith Turner at - phone (303) 273-3103 OR fax 303-384-2037 OR
igwmc@mines.edu OR http://www.mines.edu/igwmc/

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 now being provided again to the readers of Colorado Water in a sequence of issues. In this issue, we begin by presenting a list of the "water" faculty at the Colorado School of Mines. Copies of the complete inventory of "water" faculty and courses are available upon request from CWRRI. During the next year, the complete inventory list will be published in Colorado Water.

COLORADO SCHOOL OF MINES

FACULTY EXPERTISE IN WATER RESOURCES, 1997/98

The attached inventory of water expertise at Colorado School of Mines has been designed to facilitate access of the expertise by Colorado citizens. The inventory is a brief summary; specific details on the water faculty or courses can be obtained by calling or writing the faculty members listed. To facilitate access by off-campus citizens, the categories of expertise are identified by current terminology rather than by academic disciplines. Faculty are listed only once under the topic most relevant to their teaching, research and/or service. Except as noted, all addresses can be completed by adding, "Colorado School of Mines, Golden, CO 80401." Also, all phone extensions can be completed by adding (303) 273-xxxx. E-mail addresses are provided where available.

Name	Phone Ext.	Address	E-Mail
Economics			
Roderick Eggert	3981	Economics and Business	reggert@mines.edu
Wade Martin	3507	Economics and Business	wamartin@mines.edu
Groundwater			
Robert Baldwin	3727	Chemical Engineering and Petroleum Refining	rbaldwin@mines.edu
Annette Bunge	3722	Chemical Engineering and Petroleum Refining	abunge@mines.edu
Helen Dawson	3401	Environmental Science and Engineering	
Vaughan Griffiths	3669	Engineering	vgriffit@mines.edu
Wendy Harrison	3821	Geology and Geological Engineering	wharriso@mines.edu
Jerry Higgins	3817	Geology and Geological Engineering	jhiggins@mines.edu
Alexander Kaufman	3457	Geophysics	akaufman@mines.edu
Kenneth Kolm	3932	Environmental Science and Engineering	
Gary Olhoeft	3458	Geophysics	golhoeft@mines.edu
Eileen Poeter	3829	Geology and Geological Engineering	epoeter@mines.edu
Phillip Romig	3454	Geophysics	promig@mines.edu
Sami Selim	3728	Chemical Engineering and Petroleum Refining	sselim@mines.edu

Hydrology

David Munoz	3658	Engineering	dmunoz@mines.edu
Karl Nelson	3683	Engineering	knelson@mines.edu

Law, Institutions, Policy, History

Hussein Amery	3750	Liberal Arts and International Studies	
Arthur Sacks	3750	Liberal Arts and International Studies	asacks@mines.edu
Karen Wiley	3754	Liberal Arts and International Studies	kwiley@mines.edu

Models/Computer Data Management and Decision Support

Joan Gosink	3524	Engineering	jgosink@mines.edu
Ronald Knoshaug	3501	Engineering	rknoshau@mines.edu
Keenan Lee	3808	Geology and Geological Engineering	klee@mines.edu
Steven Pruess	3860	Mathematical and Computer Sciences	spruess@mines.edu
A. Keith Turner	3802	Geology and Geological Engineering	kturner@mines.edu
Paul Van der Heijde	3104	Geology and Geological Engineering	

Oceans

Norm Bleistein	3461	Center for Wave Phenomena	nbleiste@mines.edu

Stream and Riparian Zone Biology/Wetlands

John Emerick	3520	Environmental Science and Engineering
Kevin Mandernach	2224	Chemistry and Geochemistry

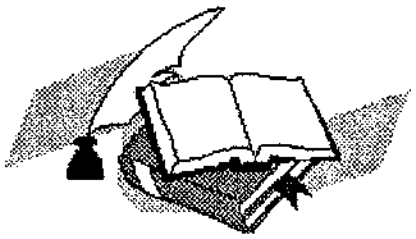
Water Quality Management/Monitoring

Stephen Daniel	3622	Chemistry and Geochemistry
Ronald Klusman	3617	Chemistry and Geochemistry
Donald Macalady	3996	Chemistry and Geochemistry
Kent Voorhees	3616	Chemistry and Geochemistry
Tom Wildeman	3642	Chemistry and Geochemistry
Kim Williams		Chemistry and Geochemistry

Water and Wastewater Treatment/Environmental Engineering

Ronald Cohen	3421	Environmental Science and Engineering
Nevis Cook		Environmental Science and Engineering

PUBLICATIONS



HIGH PLAINS STATES GROUNDWATER DEMONSTRATION PROGRAM, DENVER BASIN AQUIFER ARTIFICIAL GROUNDWATER RECHARGE DEMONSTRATION PROJECT SUMMARY, March 1997.

This project was one of 13 demonstration projects implemented under the High Plains States Groundwater Demonstration Program Act of 1983 (P.L. 98-434), to advance state-of-the-art groundwater recharge techniques. The demonstration project tested the feasibility of injecting excess treated surface water supplies into the Denver Basin aquifers to store and subsequently recover during high demand periods and/or during drought cycles. The local sponsor, Willows Water District, has a water demand curve typical of Front Range municipal water suppliers. The demonstration project used potable surface water supplies provided by Denver Water from its water rights holdings. The water was diverted at Denver Water's terminal reservoir at Strontia Springs, treated at the Foothills Water Treatment Plant, and delivered through Denver Water's transmission system to the vicinity of Willows. The Arapahoe aquifer, part of the Denver Basin, was the target aquifer for the project. At the completion of the project in 1996, results showed that overall the injection of water into the Arapahoe aquifer increased water levels, as additional water was stored above the native volume of Arapahoe aquifer water. The project found that a full-scale injection, storage and recovery project in the Denver Basin is technically, economically, and institutionally feasible.

This was a cooperative project by Willows Water District and Denver Water (local sponsors), the Bureau of Reclamation, the U.S. Environmental Protection Agency, the U.S. Geological Survey and the U.S. Fish and Wildlife Service. The Colorado State Engineer's Office was also a participant. Detailed project information can be found in the final report, available from John C. Halepaska & Assoc., Inc., 26 West Dry Creek Circle, Suite 640, Littleton, CO 80120; 303/794-1335.

ARIZONA'S CHANGING RIVERS: HOW PEOPLE HAVE AFFECTED RIVERS, by Barbara Tellman, Richard Yarde, and Mary G. Wallace.

This book takes a unique approach to the interaction between people and the environment. It is a synthesis of the works of hundreds of scholars who have studied Arizona history, archaeology, water law, hydrology, ecology and other topics. The book', as described in a feature section, "Some Suggestions for Reading this Book," is organized unlike other books about rivers — with history chapters, which contain information needed to understand impacts on the rivers, alternated with chapters about specific rivers. The river chapters contain information specific to each river, with frequent references to the history chapters for information common to several rivers. The chapters are designed so that readers can start almost anywhere in the book and read chapters without having to read what went before. The book includes sections on ***Changing Rivers; Changing Landscape and People; A Time of Change - 1500-1850; Anglo-Americans Arrive; Miners, Ranchers and Farmers Settle Arizona; Woodcutting and Timber Harvesting; Growth of Towns, Farm, Cities and Industry Compete for Water; Engineers Control the Rivers; Riparian Areas, Cienegas, and Wildlife***; and Some Rivers are Protected or Restored. Color maps and charts are included in the publication. For more information or to order, contact: Water Resources Research Center, College of Agriculture, The University of Arizona, 350 N. Campbell Ave., Tucson AZ 85719. Phone 520/792-9591, FAX 520/792-8518, E-mail: wrrc@ag.arizona.edu.

WATER NEWS DIGEST

by Laurie Schmidt

ENDANGERED SPECIES

Fish Barriers at Arizona Dam Face Three-Sided Opposition
The U.S. Bureau of Reclamation wants to construct barriers to keep exotic species out of the San Pedro River and Aravaipa Creek, southern Arizona tributaries of the Gila River that hold four endangered or threatened species of fish. But the plan is hitting a barrier of its own. Central Arizona Project (CAP) operators don't want to pay for the barriers and claim the concept is based on unsound science. Environmentalists say the plan isn't comprehensive enough, and Rep. Jim Kolbe (R-AZ) has pulled funding for the barriers once and is opposed to funding for the fiscal year beginning in October. The U.S. Fish and Wildlife Service has determined that the CAP jeopardizes four endangered and threatened native fish by serving as a way for the introduction of exotic species that could eat native fish or compete with them for food and habitat. Wildlife officials say the barriers would keep foreign fish from swimming or jumping upstream.

Grand Junction Daily Sentinel, 6/3/97 (Associated Press)

Predator "Cell from Hell" Threatens Coastal Fisheries
A bizarre, one-celled predator that appears to transform itself from animal to plant and back again captured the attention of scientists worldwide when it emerged six years ago from the murk of North Carolina's coastal estuaries. The dinoflagellate, called Pfiesteria piscicida, is a warning that humans are changing environments in ways that could have serious consequences for wildlife and people, scientists say. In recent years, pollution has shifted the natural balance and created an opening for harmful microorganisms that thrive in waters rich in sewage, animal waste, and fertilizers from burgeoning coastal settlements. No one knows what triggers the Pfiesteria feeding frenzies that have plagued some river estuaries in recent years, but lab tests suggest the animal prefers dirty, nutrient-rich water such as that found near some municipal sewage outflow pipes.

Fort Collins Coloradoan, 6/10/97

Colorado Squawfish Avoid Dam Ladder
Biologists had hoped that spring runoff would lure the endangered Colorado squawfish to the new $1 million fish passageway around the Redlands diversion dam. The C-shaped passageway was built to re-open habitat for native fish from Grand Junction to Delta. So far, one fish has used the passage since it opened last June. A spokesperson for the U.S. Fish and Wildlife Service said the high, cold water from spring runoff may be sending the fish downstream. The ladder has, however, been a huge success for native fish that are not endangered. Weekly counts are ranging from 200 to 1,200 fish. The lack of interest shown in the passageway by squawfish has recovery program officials waiting to see what happens before launching similar projects on the Colorado River.

Grand Junction Daily Sentinel, 6/12/97

HISTORY

Earthen Mound in Mesa Verde May be Remains of Ancient Reservoir
An excavation team believes a 200-foot wide earthen mound that rises 15 feet above a grassy floor in Mesa Verde National Park may be the remains of a reservoir of the Pueblo II period, A.D. 900-100. After four days of excavation at the site in May, a multi-disciplinary team was convinced of it. According to team leader Kenneth R. Wright, president of Wright Water Engineers, it was a massive public works project for that era. The reservoir was off-channel, built to the side of the canyon's ephemeral stream. It was fed by what ultimately became a 1400-foot long canal that intersected the stream higher in the canyon. Wright and the 20+ experts and other volunteers on the project think that flash floods transported a lot of sediment that quickly filled the reservoir's depression. The mound was just one of hundreds of ancestral Pueblo sites found in the park for which there has been neither time nor money to fully investigate. Wright believed the mound to be unique, and he vowed to solve the puzzle.

Fort Collins Coloradoan, 5/31/97

Adams Tunnel Marks Its 50th Anniversary
The Adams Tunnel, the main artery of the Colorado-Big Thompson Project, celebrated its silver anniversary on June 23, 1997. On that date fifty years ago, an estimated 1,000 people cheered as water entered the west portal of the Alva B. Adams Tunnel for the first time shortly after 11 a.m. Three hours later, it emerged from the east portal southeast of Estes Park—to more cheers. Besides being an engineering masterpiece, the tunnel provided Northern Colorado residents with a stable water supply for the first time. The project now provides a quarter to a third of the region's water supply in parts of Larimer, Weld, Boulder, Sedgwick, Washington, Logan, and Morgan counties, delivering an average of 230,040 acre-feet of water a year.

Fort Collins Coloradoan, 6/23/97; *Grand Junction Daily Sentinel*, 6/22/97

LEGISLATION

Water Rights Adjudications Along the Rio Grande
New Mexico State University and the New Mexico State Engineer's Office have proposed the use of alternative dispute resolution (ADR) methods to expedite and improve Lower Rio Grande adjudication proceedings. NMSU's framework document notes that "the challenge in an adjudication where literally thousands of parties are involved, each with separate property interests, is to develop a method for streamlining the proceedings without denying due process or violating the rules of civil procedure." Five serious impediments to adjudications are listed:

- Inaccurate and/or insufficient information;
- Disagreements between major parties over questions of law;
- Institutional resistance to expedited proceedings;
- Structural impediments in issuing individual water right decrees; and
- Procedural duplication.

NMSU suggests gathering information up-front, structuring cases to allow negotiation between major parties, laying sufficient procedural foundations, obtaining adequate funding, and structuring cases to require negotiations. The State Engineer's Office suggests that ADR may be much more cost-effective than a long, expensive and cumbersome full adjudication process. Both parties agree that a commitment to consensus building within the negotiation process will be critical to ensuring the success of any ADR methods.

New Mexico WRRI Divining Rod, June 1997

PROJECTS

Failed Outlet Tube at Flaming Gorge Dam Forces Shut Down of Power Plant
Bureau of Reclamation employees found a hole in the outlet tube that failed at Flaming Gorge Dam during the weekend of June 21-22. The tube failure caused flooding of a power plant and endangered fish downstream. The Bureau said that the failure of the 6-foot tube may have been due to a bad weld in the bottom of the tube, and officials decided to shut down the dam's other outlet tube to inspect a similar weld. The two outlets were each pouring 2,000 cubic-feet of water per second into the river when the rupture occurred. Engineers and technicians began the process of restarting the Flaming Gorge Dam power plant after repairs were completed in late June.

Grand Junction Daily Sentinel, 6/24/97, 6/26/97, 6/27/97
(Associated Press)

WATER ALLOCATION

Kansas Gets Another Gulp of Colorado Water
A U.S. Supreme Court special master has again found in Kansas' favor over Colorado on a key water issue in the Arkansas River Compact case. According to a recently prepared draft report, 91,565 acre-feet for the period 1986-94 has been added to the 328,505 acre-feet that the Supreme Court has already ruled as Colorado's 1950-85 debt to Kansas. In May, 1995, the Supreme Court ruled that Colorado allowed excess agricultural well-pumping that depleted flows into western Kansas, violating the 1949 Arkansas River Compact. Colorado has already spent $9 million on legal, scientific and related expenses defending the case. The Supreme Court's final ruling may not come until 2000 –15 years after the case started.

Pueblo Chieftain, 6/13/97

WATER QUALITY

Bacteria Render Groundwater Toxins Harmless
Scientists at Cornell University have found a bacterium in sewage sludge that can break down toxic chemicals in polluted groundwater. They have given it the unassuming name of strain 195, claiming that it is the first ever found to make certain toxic solvents harmless. The bacteria function in complicated interactions, and the conditions they require to detoxify pollutants are not fully understood. Scientists hope to eventually use the bacteria to help clean up contaminated groundwater, but an author of the study cautioned that the strain should not be an excuse to pollute freely or to abandon all cleanup efforts.

Denver Post, 6/10/97

WATER TRANSFERS

Transfer of Reservoirs to Ute Water Conservancy District Delayed
A Boulder attorney representing a loose association of Plateau Valley residents persuaded Senator Ben Nighthorse Campbell to postpone a hearing on transferring ownership of 11 reservoirs to the Ute Water Conservancy District. A spokesperson for the 40-member Plateau Valley Association said there have been too many changes in the bill since it was introduced in 1995. Ute and the Collbran Conservancy District would pay the U.S. Bureau of Reclamation $12.3 billion for at least 11 reservoirs on the Grand Mesa, Vega, irrigation canals, and the lower Molina power plants.

Grand Junction Daily Sentinel, 6/13/97; 6/17/97

WILDERNESS

Animas Named Gold Medal Stream

The Division of Wildlife has named the Las Animas River a "Colorado Gold Medal Water" — the 13th stream to receive that designation. To qualify, a river must produce at least 12 fish, 14 inches or longer, per surface acre. The fish must also have the potential to reach 20 inches or more, and the river must be able to support at least 60 pounds of fish per acre. The health of the fishery is the result of 13 years of work by the DOW that has included special fishing regulations and trout stocking efforts.

Natural Resource News, July 1997

MISCELLANEOUS

DNR Prepares for the 21st Century

Preparing to meet natural resources challenges in the new century was the topic as the Department of Natural Resources (DNR) conducted its annual division directors' planning meeting in June. DNR leadership identified several opportunities, including the following:

- The use of a severance tax to address a variety of environmental impacts to land and water resources;
- Implementation of Amendment 16 which can be used to bring additional financial resources to state trust beneficiaries while also helping achieve important wildlife, open space and stewardship goals;
- Agreements between Colorado, other states and federal agencies designed to protect declining native species and recover threatened and endangered species through cooperative efforts that also protect private property and water rights;
- Continued development of Great Outdoors Colorado's potential as past obligations retire and funds available for wildlife, parks, open space and outdoor recreation increase;
- Decentralization of certain federal agriculture programs, which increases the importance of local soil conservation districts; and
- Legislative authorization and oversight of major water resource supply studies to strengthen future decision making as it relates to water policy and administration.

The use of new technologies will continue to play an important role, from developing geographic information systems (GIS) to web pages that can deliver information and service in new ways. DNR leadership also reaffirmed the importance of continuing efforts in environmental education and the Youth in Natural Resources Conservation Corps Program and expanding scholarship opportunities and internship programs.

Natural Resource News, July 1997

Future of the Colorado River Salinity Control Program

On October 1, 1996, annually negotiated funding for the Colorado River Salinity Program (CRSP) among various USDA agencies ceased to exist. Due to reduced funding for these programs and no dollars earmarked specifically for education, extension efforts pertaining to the CRSP need to be scaled back and eventually phased out. The salinity offices in Delta and Montrose are being closed, and salinity education efforts will be consolidated in the Grand Junction office. However, efforts will be focused on the Grand Valley and will not provide coverage for the Lower Gunnison Basin or the Tri River Area. Should no future financial support become available, the Grand Junction salinity office will be closed shortly after January 1, 1998.

The Waterline, July 1997

THE FORT COLLINS FLOOD -- TOO MUCH RAIN TOO FAST

Abstracted from an article by Kevin Duggan
The Coloradoan, 8/3/97

Spring Creek may never be the same for Fort Collins residents.

Monday night, the normally picturesque creek was transformed into a torrent that killed five people, injured dozens and swamped countless homes and businesses.

But as bad as the flooding along Spring Creek was, it could have been worse, Fort Collins officials say. "The amount of rainfall we're hearing about is comparable to what happened in the Big Thompson in 1976," said Bob Smith, director of the city's Stormwater Utility. "We could have had a real catastrophe."

Urban storm drainage systems are designed to handle a 100-year flood, an event that has a 1 percent chance of occurring. The storm that ravaged the city Monday night created what officials describe as a 500-plus year flood.

In the Fort Collins area, a 100-year flood would be caused by a rainfall of 3 inches in one hour, Smith said. Although the official talley for rainfall in Fort Collins in the 24 hours that ended at 8 p.m. Tuesday was 4.63 inches, westside residents reported receiving 8 to 14 inches.

Witnesses report the storm came in two surges, Smith said. The first downpour, which started around 6 p.m., filled to

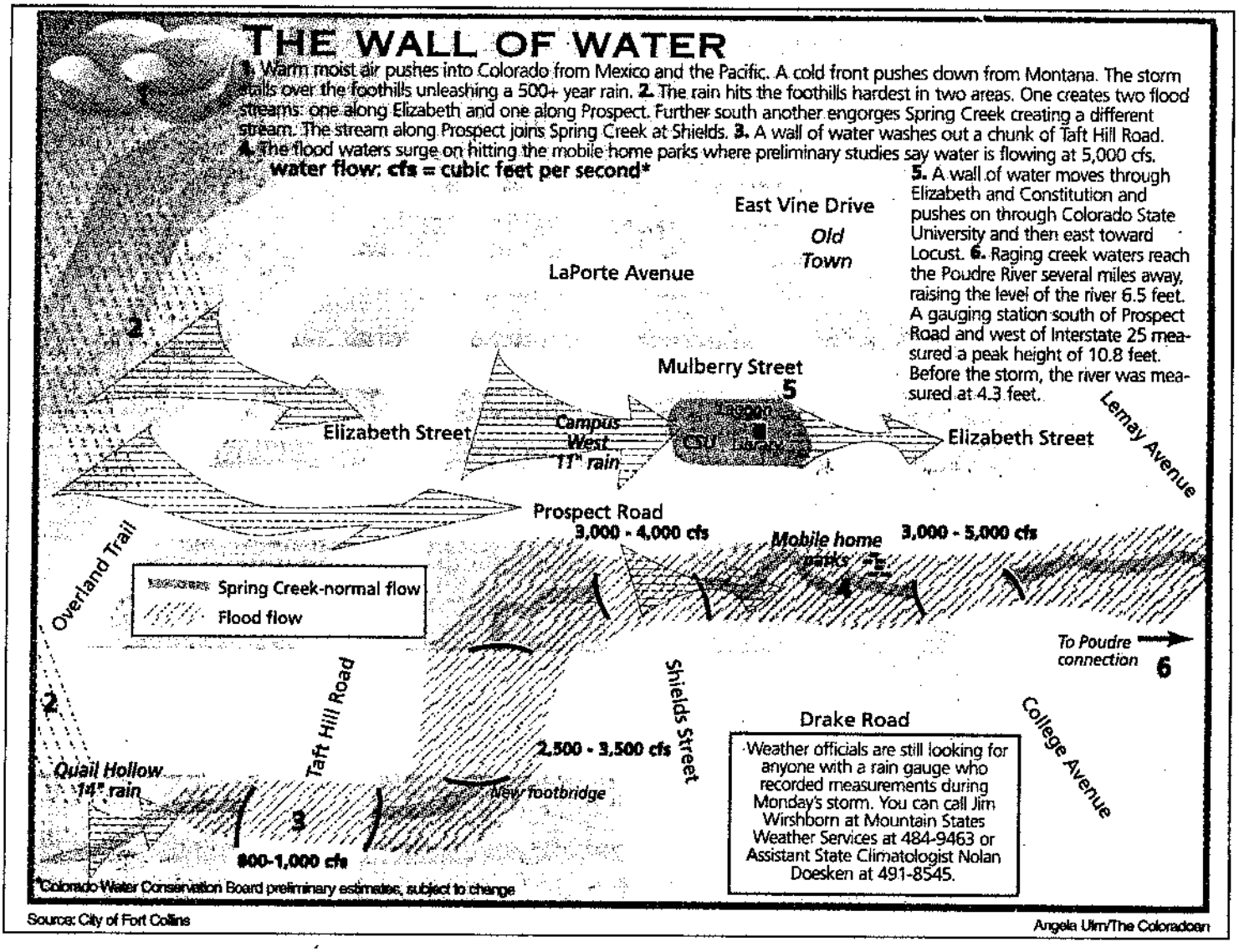
capacity the drainage system and irrigation canals that lace the west side of town.

When the next surge came about an hour later — and persisted for about three hours — there was no place for the water to go. Runoff roared down streets and saturated the ground and began moving from west to east in three distinct flows, Smith said. One cascaded down Spring Creek as another moved down Prospect Road.

The third flow swept along West Elizabeth Street and into the campus of Colorado State University. Part of that flow, which was running about 4 feet high, moved east on Locust Street on its way to the Poudre River. Some of it might have gone south over the top of Prospect Road and added to the Spring Creek water that was surging across South College Avenue.

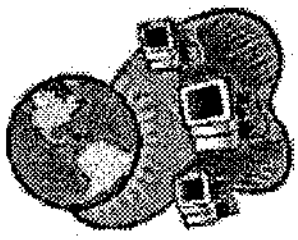
Officials are still trying to measure the magnitude of the extraordinary storm, Smith said. Debris left along Spring Creek near the intersection of Drake and Taft Hill roads indicates water flowed through there at a rate of 3,600 cubic feet per second (cfs), Smith said. The flow of a 100-year flood would be 1,680 cfs. A 500-year flood would be expected to flow at 2,730- cfs.

Fort Collins officials say they have removed all structures from Spring Creek's 100-year flood plain and included the land in some of the city's most popular parks. Mike Matulik, senior water resource specialist at the Colorado Water Conservation Board, said Fort Collins has one of the best flood-control programs in the country. He said the only way to prevent a flood under the same conditions would be to build larger and more expensive facilities — something that is not likely to happen.



WWW WATER PATHS

Find-Water Related Information Quickly and Easily!



The Western Water Policy Review Advisory Commission has opened a home page on the Internet. As Commission products become available for public review and comment, they will be posted on the site, and documents may be downloaded or requested from the WWPRAC office.

http://www.den.doi.gov/wwprac

Western Drought Coordination Council

http://enso.unl.edu/wdcc

The quarterly newsletter of the Office of the State Engineer, Colorado Division of Water Resources, is now on the web. To obtain notification via email when each new issue is available on-line, send an email with current address to joseph.grantham@state.co.us.

http://water.state.co.us

The State Engineer's Office also will begin to publish a list of approved substitute water supply plans on its home page in an effort to keep the public informed of the status of these plans that are approved pursuant to section 37-80-120, Colorado Revised Statutes. The list will be updated monthly.

http://www.dnr.state.co.us

Organization listings in the Rocky Mountain Environmental Directory, which includes 1960 listings from the states of Colorado, Idaho, Montana, Wyoming and Utah, are available on the web.

http://eelink.umich.edu/RMED.html

Directories similar to the one above have been created for eight other US regions. An index with links is available at:

http://eelink.umich.edu/GAIN/ALL/dir/

Water Online **http://www.wateronline.com**
Pollution Online **http://www.pollutiononline.com**
Public Works Online **http://www.publicworks.com**
Solid Wastes Online **http://www.solidwaste.com**
Engineers Online **http://www.engineersonline.com**

WATER SUPPLY

Water supply conditions are currently excellent throughout Colorado. Stream flows, reservoir storage amounts, and precipitation were nearly all above normal during June creating good SWSI values in all 7 major mountain-based river basins. Of special note are the greatly improved conditions in the Rio Grande and San Juan/Dolores basins compared to last year when the southwest corner of the state was experiencing a drought.

This year's snowmelt runoff peaked during June, with nearly all rivers flowing at above average levels. Fortunately, there were only limited reports of any flooding. Many rivers experienced more junior water right calls than normal, with a few such as the South Platte and Colorado mainstems having no call.

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 July 1, 1997 and reflect conditions during the month oof June.

Basin	July 1, 1997 SWSI Value	Change From Previous Mo.	Change From Previous Yr.
South Platte	**3.7**	**+1.1**	**+0.5**
Arkansas	**3.6**	**+1.1**	**+0.8**
Rio Grande	**2.3**	**+0.2**	**+5.1**
Gunnison	**3.6**	**+0.8**	**+2.7**
Colorado	**2.9**	**-0.3**	**+1.1**
Yampa/White	**2.9**	**-0.4**	**+1.9**
San Juan/Dolores	**2.5**	**-0.1**	**+5.3**

SCALE

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

COLORADO ASSOCIATION OF STORMWATER AND FLOODPLAIN MANAGERS
8TH ANNUAL CONFERENCE
CONNECTING WITH OUR COMMUNITY
Vail, Colorado, September 22-24, 1997

The conference will include a choice of two workshops. These **Toolbox Workshops** are designed to provide technical guidance in two areas: HEC-RAS modeling and Water Quality Non-Structural BMPs. For information contact: Kevin Gingery, Phone 970/482-5922, FAX 970/482-6368.

MEETINGS

GROW WITH THE FLOW: Growth and Water in the South Platte Basin
The 8th Annual South Platte Forum, October 29-30, 1997
Raintree Plaza Conference Center, Longmont, Colorado

The South Platte Forum will continue its tradition of presenting multi-disciplinary dialogue on timely resource issues in 1997 with a forum addressing growth and water issues in the South Platte Basin, covering the past history, present happenings and future projections. The conference will include the following sessions and presenters:

SESSION	*PRESENTERS*
SHOW ME THE MONEY	David Carlson, Colorado Department of Agriculture; Dick Wolfe, former Fort Lupton Mayor; Barbara Kirkmeyer, Weld County Commissioner.
LAND OF PLENTY	Lee Rozaklis, Chief Engineer, Hydrosphere; Jim Sullivan, Douglas County Commissioner
LAND OF DEPLETION	Max Dodson, Assistant Regional Administrator, U.S. Environmental Protection Agency; Marcia Hughes, P.C., Metro Water Suppliers Wild & Scenic Task Force
OF MINNOWS, MICE AND MEN	Kevin Bestgen, Larval Fish Laboratory, Colorado State University; Lee Carlson, Colorado Field Supervisor, U.S. Fish and Wildlife Service; Deb Freeman, Trout and Raley, P.C.
VISIONS OF THE FUTURE	Don Ament, Colorado State Senator; Buford Rice, Executive Vice President, Colorado Farm Bureau; Neil Grigg, Water Center, Colorado State University; Mike Besson, Wyo ming Water Development Commission; Betsy Rieke, Natural Resources Law Center, University of Colorado, Boulder; Rick Cables, Forest Supervisor, Pike and San Isabel National Forest.
SPECIAL HISTORICAL PRESENTATION	Paul McIver, U.S. Environmental Protection Agency

Invited Keynote Speakers are U.S. Senator Hank Brown, Secretary of the Interior Bruce Babbitt, and Department of Natural Resources Executive Director Jim Lochhead. In addition to the speaker sessions, there will also be a poster session. Abstracts are due by August 15, 1997. To submit abstracts or request information about the conference, contact Jennifer Mauch, CWRRI, 410 University Services Center, Colorado State University, Fort Collins, CO 80523-2018. Phone 970/491-2657; FAX 970/491-2293.

COLORADO WATER CONGRESS SUMMER CONVENTION
August 21-22, 1997
Sheraton Steamboat Resort, Steamboat Springs, Colorado

Registration for the convention opens at 8:00 a.m., Thursday, August 21, 1997. Thursday's General Session will include presentations by representatives of conservation districts, conservancy districts, Colorado cities, councils of government, county commissioners, county water resources authorities and environmental groups. Lunch will include responses to the morning speakers by Senator Tom Norton and Representatives Russell George and Dan Grossman. A special water tour of Fish Creek Reservoir, arranged by John Fetcher, will take place at 2:00 p.m., lasting approximately three and one-half hours.

Jim Lochhead, Executive Director of the Colorado Department of Natural Resources, will preside over Friday's General Session. Presenters will be Chuck Lile, Director, Colorado Water Conservation Board; Hal Simpson, Colorado State Engineer; David Holm, Director, Colorado Division of Water Quality; and Walt Graul, Administrator for Wildlife Programs, The Division of Wildlife. Congressman Scott McInnis will deliver the luncheon address. There will also be a "Special Video" presentation by CWC. Senators Tilman "Tillie" Bishop, David Wattenberg and Don Ament, and Representatives Jack Taylor and Lewis H. Entz will offer remarks.

CALENDAR

1997

Sept. 3-4 — GROUNDWATER PROTECTION TOOLS FOR A NEW ERA, San Francisco, CA. Contact: Groundwater Foundation, PO Box 22558, Lincoln, NE 68542-2558, Phone 402/434-2740, FAX 402/434-2742, E-mail info@groundwater.org. Web site http://www.groundwater.org.

Sept. 7-10 — DAM SAFETY '97, Pittsburgh, PA. Contact: ASDSO, 450 Old East Vine St., 2nd Fl., Lexington, KY 40507, Phone 606/257-5140, FAX 606/323-1958.

Sept. 17-19 — INTERSTATE WATER MANAGEMENT: NEW TRENDS IN WATER ALLOCATION, Interstate Council on Water Policy 1997 Annual Meeting, San Diego, CA. Contact: Dennis Letl, California Dept. of Water Resources, 1020 Ninth St., Sacramento, CA, Phone 916/327-1764.

Sept. 22-24 — COLORADO ASSOCIATION OF STORMWATER AND FLOODPLAIN MANAGERS (CASFM), Vail, CO. Contact: Cindy Edwards, Arapahoe County Dept. of Engineering, 5332 S. Prince St., Littleton, CO 80166-0001, Phone 303/795-4640.

Sept. 22-26 — NATIONAL WATERSHED WATER QUALITY PROJECT SYMPOSIUM, Washington, DC. Contact: Conservation Technology Information Center, 1220 Potter Drive, #170, West Lafayette, IN 47906-1383, Phone 765/494-9555, FAX 765/494-5969.

Sept. 24-25 — WORKING WITH WETLANDS & WILDLIFE, Denver, CO. Contact: Wildlife Habitat Council, Attn: Wetlands Workshop, 1010 Wayne Ave., Suite 920, Silver Spring, MD 20910, Phone 301/588-8994, FAX 301/588-4629.

Sept. 24-26 — CONNECTIONS '97: GROUND WATER IN THE ROCKY MOUNTAIN REGION, Boise, ID. Contact: Peggy Hammel, Idaho Water Resources Research Institute, Phone 208/885-6429; FAX 208/885-6431; E-mail iwrri@uidaho.edu.

Oct. 8-10 — FIFTH SYMPOSIUM, SETTLEMENT OF INDIAN RESERVED WATER RIGHTS CLAIMS, Phoenix, AZ. Contact: Western States Water Council, Creekview Plaza, Suite A-201, 942 East 7145 South, Midvale, UT 84047, Phone 801/561-5300, FAX 801/255-9642.

Oct. 12-17 — RISK-BASED DECISION MAKING IN WATER RESOURCES VIII, Santa Barbara, CA. Contact: Engr. Foundation, 345 E. 47th St., New York, NY 10017, Phone 212/705-7836, FAX 212/705-7441, E-mail engfnd@aol.com, Website: www.engfnd.org.

Oct. 18-22 — WEFTEC '97, Chicago, IL. Contact: Water Environment Federation, Phone 800/666-0206; FAX 703/684-2471; E-mail confinfo@wef.org.

Oct. 20-23 — ROLE OF NATURAL ORGANIC MATTER IN SOLUTE FATE AND TRANSPORT, Salt Lake City, UT. 1997 Annual Conference of Geological Society of America. See web page http://www.geosociety.org.

Oct. 26-29 — SYMPOSIUM ON CLIMATE VARIABILITY, CLIMATE CHANGE AND WATER RESOURCE MANAGEMENT, Colorado Springs, CO. Contact: Betty Neal, Hagler Bailly Services, Inc., P.O. Box 3524, Eagle, CO 81631. Website: http://civil.colorado.edu/climate.

Nov. 16-18 — NASULGC 110TH ANNUAL MEETING, Washington, DC. Contact: National Assoc. of State Universities and Land Grant Colleges, One Dupont Circle, N.W., Suite 710, Washington, DC 20036-1191, Phone 202/778-0818, FAX 202/296-6456.

Nov. 16-19 — INTERNATIONAL CONFERENCE ON ADVANCES IN GROUNDWATER HYDROLOGY – A DECADE OF PROGRESS, Tampa, FL. Contact: Andy Smith, So. Florida Water Mgmt. Dist., 2379 Broad St., Brookville, FL 34609, Phone 352/796-7211, ext 4235.

1998

Jan. 26-29 — CONFERENCE ON TAILINGS AND MINE WASTE '98, Fort Collins, CO. Contact: Linda Hinshaw, Dept. of Civil Engineering, Colorado State University, Fort Collins, CO 80523-1372, Phone 970/491-6081, FAX 970/491-3584/7727.

Mar. 20-29 — WETLANDS ENGINEERING 7 RIVER RESTORATION CONFERENCE, Denver. CO. Contact: American Society of Civil Engineers, Phone 703/295-6029; FAX 703/295-6144, or visit ASCE website at http://www.asce.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. 28-30 — SOURCE WATER PROTECTION INTERNATIONAL 98, Dallas, TX. Contact: National Water Research Institute, 10500 Ellis Ave., PO Box 20865, 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.

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. 8-10 — MICROBIAL ECOLOGY OF BIOFILMS: CONCEPTS, TOOLS AND APPLICATIONS, Lake Bluff, IL. Contact: Microbial Ecology of Biofilms, c/o Dr. B. E. Rittmann, NW University, Department of Civil Engr., 2145 Sheridan Rd., Evanston, IL 60208-3109, FAX 847/491-4011.

COLORADO WATER CONGRESS

CWC Annual Colorado Water Law Seminar
September 15-16, 1997
Colorado Water Congress Conference Room
1390 Logan Street, Suite 312, Denver, CO

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