COLORADO WATER

Newsletter of the Water Center at Colorado State University

December 2004

Current Front Range woodland conditions (inset photo) contrast with historical conditions (large photo) which evidence more open spaces. See article on Colorado State Forest Service and Denver Water on p. 16

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Ag Experiment Station, p. 14

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EDITORIAL

History and Water

by Robert Ward

In a state where the *prior appropriation* doctrine guides water management, knowledge of past water laws, compacts, polices, allocations, uses, diversions, and consumption is important to today's management actions and future water supply plans. Higher education in Colorado has been involved in preserving, protecting, and promoting Colorado's rich water history for many years. This issue of *Colorado Water* is devoted to highlighting: (1) the contributions of higher education faculty and students who study and write about 'water' history; and (2) the history of contributions to water research and education by state agencies associated with higher education (e.g. CWRRI, Cooperative Extension, Colorado State Forest Service, and the Agricultural Experiment Station).

Study of Colorado's water history requires access to records, i.e. original sources, which contain and document history. Colorado water managers have been accommodating, over many years, in sharing their records, knowledge, experiences and lessons learned. For example, Russel N. Bradt, in his 1948 University of Northern Colorado thesis entitled "Foreign Water in the Cache Le Poudre Valley", gives particular thanks to Mr. Don Farnham, Secretary of the Water Supply and Storage Company. Similarly, in 2003 Dan Tyler, CSU history professor who authored Delph Carpenter's biography, acknowledges the generous sharing of time and resources by the staff of the Northern Colorado Water Conservancy District. The willingness of water and water-related organizations (such as the Colorado Department of Natural Resources, water conservation and conservancy districts, Denver Water Board, State Supreme Court, District Courts, and private collections) to permit researcher access to records, is greatly appreciated and acknowledged, as the above two examples illustrate.

In addition to the above mentioned agencies, a number of libraries, museums, and universities possess excellent collections. Several of the depositories of historical papers specialize in water collections. For example, the CSU Morgan Library, in 2001, established a Water Archives, to preserve, protect and promote Colorado's water history. The Carpenter family papers, used by Dan Tyler in writing the *Silver Fox of the Rockies*, are now housed in the CSU Water Archives. For an overview of archival collections relevant to Colorado's water history, review the CSU Water Archives website: http://lib.colostate.edu/water/

Using these sources, historians and other social scientists are able to piece together a story of our water history. Dan Tyler, on page 4, shares his thoughts about the role of leadership in Colorado's rich water history, especially noting the emerging needs for well informed water leaders who can carefully build on the lessons of the past. Mark Fiege, Professor of History at CSU and author of *Irrigated Eden* (history of the development of irrigation in the Snake River Valley of Idaho), shares his thoughts about how water history fits into the emerging environmental history field on page 6. Rose Laflin, a graduate student in history at CSU, discusses her recently completed manuscript about the history of water development and management in the Poudre River Valley. This latter work is part of an effort to create a National Heritage Area around the rich history of water development and use in the Poudre River valley.

Colorado authorizes four state 'agencies' housed at CSU: the Agricultural Experiment Station; Cooperative Extension, the Colorado State Forest Service and the Colorado Water Resources Research Institute. These organizations have a long history of connecting agricultural and natural resources knowledge contained in higher education with the needs of Colorado water managers and users. A brief history of each of these organizations begins on page 10.

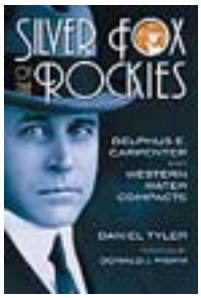
Colorado's public discourse about water revolves among a number of themes over the years. In the first part of the 20th century, water development to enhance water storage and supplies dominated the dialogue. The 1960s and 1970s brought considerable attention to the need for water quality controls and in-stream flows. The 1980s and 1990s introduced snow making, rafting, and kayaking into Colorado's water management system. Within the past five years, there has been a return to a public focus on water supply as the extreme drought year of 2002 unfolded and has been followed by below normal flows. This cycling of water concerns through Colorado's history reinforces the recognition that Colorado is a semi-arid state that requires careful management of its limited water resources. Understanding Colorado's historical relationship with water, and the changes in opinions about this relationship, is critical to a healthy and constructive public discourse as Colorado confronts and defines a future relationship with its limited water resources, especially as Colorado's population continues to grow.

Higher education, as this issue of *Colorado Water* hopefully illustrates, has been a part of Colorado's water history, both in terms of producing new knowledge needed to address emerging water management challenges as well as in examining and documenting water history in the West. Higher education, with its proactive efforts to continue to preserve, protect and promote Colorado's water history, through such organizations as the Water Archives at CSU's Morgan Library, will be able to play an even larger role in fostering a healthy and constructive public discourse about Colorado's future relationship with its limited water resources.

Reflections on Leadership

By Daniel Tyler, Professor Emeritus, Colorado State University

We all have a special connection to water. Mine began on the Crystal River Ranch in Carbondale, Colorado where we labored yearly to keep water flowing through a seventeen-mile ditch to our high mesa ranch for cattle and crops. That ditch was our Achilles heel; without it we had no operation. Every summer the thunderstorms, landslides, and occasional pig in the siphon served as reminders that our survival depended on the constancy of water in the ditch. Even if that ditch functioned without leaks and breaks, we were always conscious of the need to secure adequate water at the head gate. We didn't measure our decreed 75 cfs too carefully in those days (early 1950s). There was no Parshall flume, and the water commissioners were neighbors too busy with their own ranching operations to worry about our senior rights. So, when the Crystal River started to get low in the summer, we pushed sand and gravel into the center of the stream with bull dozers to make sure the ditch would run full. It seemed as if we were always needing to assure ourselves of more water, and there were times it appeared to me that we were sucking up the entire flow of the Crystal River.



Fifty years later, after a career as an historian, focusing much of my research and teaching on water development in the West, I can see a broad connection between the Crystal River Ranch and other entities dependent on irregular water supplies. In a sense, we are all like alcoholics: we are afraid the source will run out, so we protect ourselves by going after more than we need, stashing it away, if we can, for the time when we might be victims of drought or unexpected litigation.

Look at the seven Colorado River Compact commissioners when they first met in Washington, D. C. to adopt a compact. Assured by the director of the Reclamation Service that enough water flowed in the Colorado River to satisfy the requirements of each state, the commissioners, to a man, exaggerated their state's agricultural needs with requirements, which, if implemented, would have bankrupted the river. Herbert Hoover, the federal government's representative and chairman of the Commission, was apoplectic. He didn't see any way the states could agree to a compact based on an irrigable acreage allocation to each state, and he was ready to adjourn the meeting as a failure. Colorado's Delphus E. Carpenter, equally guilty of braggadocio in Washington, finally came to his senses and persuaded the Commission to meet again in the Southwest after a series of public hearings. His suggestion to Hoover that a Colorado River Compact should be based on a 50-50 division of water between upper and lower basin states served as the underlying basis for the 1922 agreement. But Carpenter continued to fight for more water. In discussions with fellow commissioners at Santa Fe, he argued stubbornly for Colorado's right to use all the water from the Colorado River the state could utilize. Because of Colorado's mountainous terrain, he asserted, that use would be limited by geography. In a way he was right. Even his estimates on trans-basin diversion (600,000 acre-feet) to the Front Range and delayed west slope development were quite accurate. But he was also responding as a typical water attorney, convinced that the slower developing upper basin needed to secure more water than what it could reasonably use in 1922. His foresight was commendable, but his modus operandi requires revision as competition for water increases exponentially amongst a host of new stake holders in the twenty-first century.

Carpenter was criticized for being arrogant, unbending, and haughty. In fact, his behavior was typical of those who represent interests at the headwaters of rivers or ditch head gates. Theirs is an attitude born of the certainty that scarce water supplies will come first to them. Stanley Crawford makes this point clearly in *Mayordomo*, a wonderful story about a year in the life of an irrigation ditch (acequia) in New Mexico over which Crawford acted as ditch boss. Those living at the bottom of the Acequia de la Jara were always running out of water, always suspecting their upstream neighbors of conspiratorial actions. Those at the head gate felt more powerful, had better self-esteem, and looked down at settlers in the lower lying lands. Every year, the same conflicts emerged accentuated or diminished by the amount of water available.

In his excellent study of the Pecos River (*High and Dry*), G. Emlen Hall offers a disclaimer on his own up-river bias. Hall lived and worked in Pecos for a decade. In *High and Dry* he criticized the downstream Roswell farmers, the Carlsbad Irrigation District, and Texans who claimed they were being denied water promised under the 1948 compact with New Mexico. He concluded that there is a culture of geographical location in matters of water; that regardless of science, law and technology, those who run out of water at the lower end of a stream will fight for it, regardless of any legal agreements in place. Interstate compacts designed to level the playing field along the stream for all time are meant to be precise and certain, but as demographic patterns evolve over time, the finite terms of these compacts are strained, resulting in the very litigation they were supposed to prevent. And when the parties go to court, the data presented by "enginawyers" become so extensive and convoluted, not even the appointed special masters can understand the details. Principals become so wedded to their points of view, they fight on from hospital beds. Litigation drags on for years. Ultimately, Hall says, states just

"bumble along," rivers remake themselves, democracy suffers, and everyone looks for new leadership.

Given the fact that Nevada was awarded only 300,000 acre-feet under the 1922 Colorado River Compact, and that Las Vegas is now the fastest growing city in the nation, one wonders when that state will mount a legal challenge for more water. If this happens, the culture of geographical location will manifest itself in stiff resistance from the upper basin (Wyoming, Utah, Colorado and New Mexico). And, perhaps, what is more alarming, if the seven states of the Colorado River basin can't come up with a plan to protect each other from serious shortage, the Department of the Interior has promised to impose its own plan -- a guarantee of litigation. Just what Carpenter hoped to avoid.

Perhaps, Jefferson was right: every generation needs a new revolution. Although he was thinking about national government, the sociological and demographic changes he knew would occur in the United States have happened in dramatic fashion in the West. Existing laws and institutions that control water ownership and delivery may need revision in order to avoid the conflict that is certain to result in drawn out and expensive litigation.

University of Colorado professor Charles F. Wilkinson addressed these issues in *Crossing the Next Meridian: Land, Water and the Future of the West* (Island Press, 1992). Natural resources in western states, he noted, determine much of the intellectual, emotional, and economic behavior in society. The old laws and policies of the nineteenth century, what Wilkinson called the "lords of yesterday," still wield extraordinary influence. If the environment is to be preserved, and states are to remain on an equal footing, western laws must be reformed, and government policies must be brought in line with the realities of the twenty-first century.

Sustainability is now the buzz word, but it is hard to find two people who agree on what that means. In *Rivers for Life: Managing Water for People and Nature* (Washington: Island Press, 2004), Sandra Postel and Brian Richter argue for a "quantum shift" in attitudes toward the health and conservation of flowing rivers. New models for decision making, they insist, are the only way to assure equitable, sustainable outcomes that recognize and preserve the bio-diversity of western rivers. They are in favor of removing some dams – gradually – in order to emulate the rivers' natural hydrograph. Conclusion? The new ethic for western rivers in the twenty-first century should be an expanded public trust doctrine.

Silver Fox of the Rockies
Delphus E. Carpenter and Western Water Compacts
by Daniel Tyler ISBN: 0-8061-3515-8
Hardcover
416 pages, 6 x 9
27 b&w illustrations, 8 maps
Published: 2003

ISBN: 0-8061-3515-8

Order at: http://www.oupress.com/

Not everyone would agree with Postel and Richter, but their conclusion resonates with many who search for an equitable way to include those who wish to reap the natural wealth of the land and those who wish to preserve the region with less development. "It will take political champions," they state, "willing to buck special interests in order to do what is right for river health and society at large. It will take water managers willing to work and think outside the box. It will take citizens willing to lead the charge for changes in river management in their particular watersheds, and others willing to toil hard behind the scenes. And it will take scientists willing to work for policy and management reforms, even if academia doesn't reward them for it." (p. 198)

Leadership! This is what Carpenter exercised in the Twenties at considerable cost to his health. Although Carpenter's Colorado River Compact is flawed, it represents a negotiated compromise that has preserved Colorado's water for the present generation. Now, the time has come for new leaders to be trained in the universities; articulate, broadly read social scientists who can formulate the needs of the present and foreseeable future, directing all participants in conflict toward equitable solutions. What an opportunity for bright young men and women! The "Silver Fox of the Rockies" would be proud, indeed, if our institutions of higher education would put energy into making this happen.

Colorado Water now available electronically!

If you'd prefer to subscribe to eColorado Water instead of the paper copy, please send an email to Gloria.Blumanhourst@research.colostate.edu with

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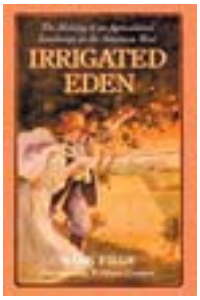
To Eden and Back: Lessons from Idaho's Irrigated Landscape

By Mark Fiege, Associate Professor, History Department, Colorado State University

Across southern Idaho sprawls a vast area of astonishing natural and human diversity that, in one way or another, is tied to the flow of water. I traveled through this area off and on for seven years during the 1990s, examining its physical features and researching its history. Then I wrote *Irrigated Eden: The Making of an Agricultural Landscape in the American West* (Seattle: University of Washington Press, 1999). In my view, the book contains three basic lessons about the relationship of people, land, and water.



First, the act of manipulating water has created a landscape that is a composite of human systems and natural processes. When Idaho irrigators excavated canals and drains, for example, they did more than just install an agricultural water technology--they also created habitat for muskrats, beavers, gophers and other mammals whose burrowing habits threatened the integrity of that same hydraulic system. In turn, the human organizations founded on irrigation eventually reflected some of its fundamental ecological characteristics. Consider the Twin Falls Canal Company, which hires dozens of workers to clear silt and vegetation from its conduits, and which has retained a trapper to reduce the numbers of mammals that live inside them. This entangling of the human and the non-human has shaped virtually everything else in the irrigated landscape, from potatoes to dams, alfalfa to apples, jackrabbits to carp. It's a fascinating history, and one that speaks volumes about the human relationship to the biophysical world.

Second, groups of people as much as individuals have defined the irrigated landscape. I realize that this insight runs counter to the general perception that the West is a place in which the values of "every man for himself" and "first in time is first in right" are dominant. I'm not arguing that individualism and prior appropriation are irrelevant in southern Idaho. Rather, I'm arguing that collective action, not just the work of solitary souls, has made the landscape what it is. Mormons, Quakers, Mennonites, families, villages, mutual canal companies (that word *mutual* is central to my point), and other groups have coordinated the effort of many people in digging ditches and scratching a living from the Earth. It has been a social process in which irrigators acted together to realize their individual aspirations. The story of Idaho water and the irrigated landscape thus is a story of cooperation and community, not just of individuals going it alone.

Third, people have imbued the manipulation of water and the irrigation of land with deep spiritual meaning. I realized this one afternoon while researching in the Ricks College library in Rexburg, Idaho. While rummaging in a box of dusty manuscripts, I came across the score for *Ode to Irrigation*, which a Salt Lake City musician had composed in the early 1900s. I'm not much good at reading music, but as I flipped through the pages, I could practically hear the voices of a heavenly choir and see the sunbeams breaking through a dark, brooding sky. And this is but one example of song, story, poetry, and pageant through which Idahoans and other western irrigators defined the essence of their land and lives. To come to grips with western water, one must come to grips with the fact that the irrigated regions of the West quite literally have been holy land.

These, then, are some of the irrigated landscape's core lessons. Yet getting ordinary people to pay attention to those lessons has been a challenge. Let's face it, irrigation is simply not a topic that excites much passion in a generic American citizen. I became acutely aware of this problem in the early stages of my travels and research. Family, friends and colleagues–virtually all of them cosmopolitan city dwellers–did not understand what I was doing, did not share my hydraulic sensibilities, indeed at times appeared to doubt my sanity. They thought that irrigated places in general, and southern Idaho in particular, were monotonous and hardly worth a passing glance, and they wondered why in the world anyone would want to spend much time in them. My mother, an Ohio native who raised me in the Puget Sound country's moist clime, was mystified. Our telephone conversations frequently came around to her asking me the same question: "Now, just what is it that you're trying to do in that doctoral dissertation, dear?" Her bafflement was matched by the response of friends and colleagues. When they questioned me about my research, their reactions to my answers almost always went something like this: "God, southern Idaho is boring! When I drive through it on I-84, I turn up the music, set the cruise control at 90, and head for the state line. What are you doing out there? How can you stand it?!" Clearly, these people did not see the riches that I saw.

Undaunted, I pressed on with my work, and in the end I'm confident that I managed to encourage some people to reconsider the importance of western water and irrigation. I may not have inspired passion in anyone, but at least a few now understand that the irrigated landscape is more than just a monotonous wasteland to be endured at 90 miles per hour. My mother, among other people, has made remarks suggesting she's now aware that something important has been happening in those arid-land canals beyond the Cascade Mountains. And, I'm happy to say, *Irrigated Eden* has been only one among many historical studies of western water to appear in recent years. Jared Orsi's *Hazardous Metropolis* (2004), about infrastructure and floods in Los Angeles, and

Dan Tyler's *Silver Fox of the Rockies* (2003), on Delph Carpenter and the Colorado River Compact, are but two outstanding examples. Such works are, and will be, crucially important to a society in which fewer and fewer people come from rural and agricultural places, and in which most people know nature as urban consumers detached from the immediate messiness of raising plants and animals, working with soil, rock, and concrete, and manipulating water.

Irrigated Eden
The Making of an Agricultural Landscape in the American West
Mark Fiege, Foreword by William Cronon

Pub Date:1999

ISBN: PAPER: 0-295-98013-3 CLOTH: 0-295-97757-4

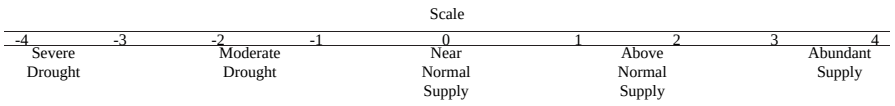
Available at:
http://www.washington.edu/uwpress/search/books/

I'm not convinced, however, that books and articles are enough to educate fellow citizens about water and irrigation. The task is huge, and it will require many people to make common cause in building an entire culture in which environmental knowledge (including knowledge of nature, technology, laws, policies, social institutions, values, and history) is essential for informed citizenship and sound decision-making. Research and education at Colorado's universities should be part of a larger process in which people continually learn about the possibilities and limits inherent in the fluid that touches all life. This process should be based on empirical facts and persuasive interpretations of those facts, not propaganda and polemic. Most important, the process should follow the lead of the early irrigators, who realized that cooperation is the best method of realizing individual ends. Citizens working together on water research and education will best ensure that political divisions, which are necessary and inevitable, yield wise policies that enable private dreams by first securing a greater public good.

WATER SUPPLY

Reports from most of the basins indicate that stream flows during October 2004 were improved over October flows over the past several years. Demand for direct flow irrigation water generally ceases during October, except in limited areas where irrigators continue to apply water during into the late fall to build up soil moisture as they look forward to next spring. With the reduction in direct flow irrigation diversions and the calls by those direct flow rights, diversions to storage increase. Statewide, at the end of October, reservoir storage was at approximately 85% of average.

Basin	SWSI Value	Change From Previous Month	Change From Previous Year
South Platte	+1.5	-0.1	+1.8
Arkansas	-0.8	+0.8	+1.0
Rio Grande	+0.1	-1.2	+2.1
Gunnison	-1.0	+0.9	+2.4
Colorado	+0.7	+1.4	+0.6
Yampa/White	+0.7	+1.8	+3.9
San Juan/Dolores	+1.5	-0.4	+3.2



The Surface Water Supply Index (SWSI) developed by the State Engineer: Colorado Division of Water Resources 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 November 1, 2004, and reflect the conditions during the month of October. The full report can be accessed at http://www.water.state.co.us/pubs/swsi.asp .

Lessons From A River

by Rose Laflin, Graduate Student

In August 2002, I began working on a history of the Cache la Poudre's water delivery system for the National Park Service. The plains portion of the Poudre was designated a national heritage Corridor in 1996. No comprehensive account of water development and management on the river existed, even though it had long been tapped for irrigation. As I researched when and how the Poudre's water delivery system developed I was struck by the recurring themes of cooperation and change. Cooperation was necessary when moving and managing water in a semi-arid climate. Change occurred as people used the Poudre in different ways and, consequently, revised their policies and their perceptions of the river. Understanding the changes that happened over time on the Cache la Poudre helped me appreciate the river's role in northern Colorado history and realize the dynamic role the Poudre still plays today.

The Cache la Poudre's water delivery system - its ditches, canals, and reservoirs - was one of the first irrigation systems in northern Colorado. In the early 1860s, settlers converging on the Front Range following the discovery of gold claimed land along the Poudre and dug small ditches to water bottomland crops. Irrigation on a broader scale occurred after 1870 with the settling of the Union Colony on the Poudre near its confluence with the South Platte. Union Colony members constructed canals that were several miles long and irrigated thousands of acres on high benchlands above the river.

Union Colonists and other early irrigators approached canal building cooperatively. They moved water where they wanted it by pooling labor and capital and formed cooperative irrigation companies in which irrigators owned the canals and reservoirs they used. In addition to building and managing the water delivery structures together, Poudre valley irrigators used their water in an extraordinarily cooperative manner through a system of water exchanges. Water exchanges were a way of moving water from one place to another and between one user and another without injuring one's individual water rights or requiring anyone to sell their rights. At the same time, exchanges maximized the efficiency of the entire system.

Simple water exchanges existed between neighbors and ditch companies since the beginning of the Poudre's irrigation system and took place on other Colorado rivers as well; however, the Poudre's exchanges were the first on such a large and complex scale. An exchange could be as simple as one neighbor giving another his portion of ditch water when he did not need it and the neighbor returning the favor at another time. This was a very informal exchange but the concept was the same as when canal and reservoir companies carried out exchanges. Irrigation companies exchanged water with each other and transferred water around the system in an effort to make sure that all users got their proper share. This moved water in a more efficient manner, minimized evaporative and seepage losses in canals when water was carried long distances, and made reservoir construction cheaper because companies utilized natural depressions in the land, regardless of whether the reservoir was far away from their canals and water users.

The Poudre's efficient and cooperative water delivery system changed the river, the landscape and the area's inhabitants. High elevation ditches and tunnels transported foreign water from other watersheds into the Poudre and augmented its native water supply. Dozens of ditches and larger canals drew water away from the river. Reservoirs stored and regulated the delivery of water to farmers in the late summer and early fall when the Poudre's flow was typically at its lowest. The land around the river changed as cultivated fields replaced open prairie, and trees and towns thrived. Settlers were able to own land and farm, an ideal for many in the nineteenth century, despite the semi-arid climate of the Front Range. Agriculture became increasingly important to Colorado's economy as irrigation flourished. Politicians and lawyers, many from the Poudre basin, helped shape Colorado's water law with input from Poudre valley irrigators. The attempt to administer and distribute water fairly and logically required the development of a new water bureaucracy.

Cooperation and change continued on the Poudre into the twentieth century. The population of the Poudre valley multiplied and residents tapped the river for municipal and industrial purposes in addition to irrigation. This increased demand, combined with drought in the 1930s, prompted irrigators and the general public to agree on the construction of an ambitious Bureau of Reclamation project that would transport Colorado River water to the Poudre and other northern Colorado rivers. The Bureau of Reclamation's Colorado-Big Thompson (C-BT) Project was a technological achievement that brought water under the Continental Divide via a thirteen-mile long tunnel and effectively doubled the size of the Cache la Poudre's flow, although not all C-BT water was destined for the Poudre.

Successfully negotiating the political shoals of a Bureau of Reclamation project in the midst of the Depression demanded strong leadership and cooperation from irrigators along the Poudre, South Platte, St Vrain, Boulder Creek, and Big Thompson. Ditch and reservoir companies supported the formation of a new water conservancy district to negotiate with the United States for the C-BT project. Since a mill levy tax was necessary to repay construction costs, support operation, and pay for maintenance, the Water Board put the project

up for a public vote. A majority of the public favored C-BT project and the creation of a conservancy district to manage the new water. Front Range irrigators, including those in the Poudre valley, also cooperated with Western Slope water users and added the concept of compensatory storage (Green Mountain Reservoir) to the C-BT project to satisfy those who were losing West Slope water to out of priority diversion upstream.

The Colorado-Big Thompson Project eventually included 12 reservoirs, 35 miles of tunnels, 95 miles of canals, an irrigated area stretching 150 miles east to west, and 65 miles north to south. The change on the landscape was marked. Dams, dikes, pumping stations, canals, siphons, pipes, tunnels, and new roads appeared along the northern Front Range. C-BT water changed the way the Poudre valley looked as cities expanded and new industries were attracted to the area. These changes affected perceptions of the river and policies regulating it. Some Poudre valley residents turned to the river for a recreational outlet as fewer people farmed and the post-World War II economy diversified. Clashes erupted between agriculturists who used the Poudre's water for their livelihood and citizens who were only concerned about the river's water quality and environmental values. New regulations were imposed on water users – municipalities, industries, and agriculturalists – as competition for river water increased with the growing and changing population.

Today, users share the river and complications continue to arise. The past tells us that change on the river is constant and that cooperation has prevailed in the past and will be necessary in the future. Cooperation and compromise on the Poudre in the past 140-odd years does not belie the divisive nature of water in the American West. Rather, such lessons may help future generations deal with inevitable conflict.

Laflin's manuscript is pending publication.

Leo Eisel Receives Henry P. Caulfield, Jr. Award

On November 3, 2004, Leo Eisel, project manager with Brown and Caldwell in Denver, received the Henry P. Caulfield, Jr. Medal from the American Water Resources Association (AWRA) at their annual convention in Orlando, Florida. Leo was recognized for his outstanding contributions to the water management field, from his service with the Illinois Water Survey and the National Water Council, to his membership on National Research Council panels studying national water issues. Leo has been active in Colorado water consulting for the past 25 years, serving as President of McLaughlin Water Engineers and Vice President of Wright Water Engineers before joining Brown and Caldwell.

In a letter of reference accompanying Leo's nomination for the AWRA award, Stephen Parker, Director, Water Science and Technology Board, National Research Council, noted:

> Dr. Eisel is a water resources engineer of near-unique experience and credentials, with experience in all sectors including state and federal government, private industry, the NGO sector, and academe. His renaissance expertise in science, engineering, and policy aspects of surface and ground water, quantity and quality has contributed a solid technical basis for the formulation of national water policy. … Dr. Eisel is extremely well-grounded in theory yet always capable of applying his skills to practical problems, small and large, local and national.

Henry Caulfield, for whom the AWRA award is named, and who was a long-time Political Science professor at Colorado State University, served as the first Director of the National Water Council during the Kennedy administration while Leo served as director of the same council during the Carter administration.

Water Management and Policy in the Great Plains: Implications of Drought and Climate Change
Second Annual Water Law, Policy and Science Conference
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Colorado Water Resources Research Institute – 39 Years Supporting Water Research in Colorado

This article is based on a history of CWRRI authored by Jill Marsh and published in Issue Number 5 of CWRRI's Water in the Balance Series (http: //cwrri.colostate.edu/pubs/balance/no.5/bal5.html)

In 1959 Montana Senator Mike Mansfield told a group of fellow western senators that water was the greatest resource problem facing not only the West, but the entire nation. He proposed that they sponsor an investigation of the nation's water situation and the problems that would have to be faced to the year 2000.

That year, as a result, the United States Senate Select Committee on National Water Resources was formed to assess the management of the nation's water resources. The Committee found that while water demands were increasing rapidly, there was a widening gap between the requirements for water and its availability in the amounts and quality needed.

The committee report, released on January 30, 1961, said that demands on the nation's water resources would double by 1980 and triple by 2000. Colorado Senator Gordon L. Allott, in a speech to the Western Resources Conference of 1963, stated that 'It is from the field of research that our hopes really spring … as our society becomes larger and in turn places greater demands upon this limited water resource, only research can be counted on to provide the answers which we must and will have for America.'

The Select Committee also recognized that decision making concerning water management belonged at the source, and that problems were directly related to the particular area involved. The committee concluded that the control, disposition, and use of natural resources would be attained more effectively if policies originate with the states.

To provide more effective coordination of the nation's water research programs, New Mexico Senator Clinton Anderson and others drafted legislation to create a national Water Resources Research Program. The bill, drafted in the summer of 1961, consisted of three parts to provide for river basin planning, a water supply demand inventory, and state aid. The bill was studied and revised by the executive branch and submitted to Congress as a Kennedy Administration proposal. Title 1 of the bill authorized $75,000 increasing to $100,000 a year for the establishment of water resources research institutes at land grant colleges or state universities in each state.

The proposed water research program received widespread support from Congress and the university community. William E. Morgan, president of Colorado State University and chair of the Water Resources Committee of the National Association of State Universities and Land Grant Colleges at the time, played a key leadership role. Congress passed the bill and on July 12, 1964 President Lyndon B. Johnson signed into law the Water Resources Research Act of 1964. At the signing, Johnson said,

> "The Water Resources Research Act of 1964, which I have approved today, fills a vital need … it will create local centers of water research. It will enlist the intellectual power of universities and research institutes in a nationwide effort to conserve and utilize our water resources for the common benefit".

The Act authorized the establishment of Water Resources Research Institutes in each of the 50 states and Puerto Rico. Later, Institutes would be formed in Washington, D.C., Guam, and the Virgin Islands. The Institutes were created to fulfill three main objectives:

1. To develop through research new technology and more efficient methods for resolving local, state, and national water resources problems;
2. To train water scientists and engineers through on-the-job participation in research; and
3. To facilitate water research coordination and the application of research results by means of information dissemination and technology transfer.

The national federal-state water research partnership provides the unifying focus for the 54 Water Resources Research Institutes. Initially authorized in 1964, the program currently is conducted under provisions of the Water Resources Research Act of 1984, as amended in 2000. The Act of 1984 incorporated the administration of the water resources research institutes program under the U.S. Geological Survey through its Water Resources Division.

Although CWRRI remains accountable for the expenditure of its federal funds to the federal government through the USGS, it received statutory authority from the Colorado General Assembly in 1981 to operate as a unit of Colorado State University. This authority was extended to 2007 in 1997. At CSU, CWRRI operates under the supervision of Colorado State's Vice President for Research and Information Technology.

In the 1997 Colorado Legislature reauthorization, CWRRI's connections with Colorado's water manager and user community was formalized in the Advisory Committee for Water Research Policy. Today, the eleven-member Advisory

Committee guides CWRRI's water research program, helping establish water research priorities and determining relevance of research activities funded by CWRRI. Current members of CWRRI's Advisory Committee are provided below.

Over almost 40 years of life, CWRRI has enhanced the active dialogue among Colorado water managers and users and the researchers in Colorado's higher education system. This dialogue has fostered a wide range of collaborative activities, from co-sponsoring water conferences around the state to co-sponsoring water research projects.

What types of water research has CWRRI supported? There are over 400 reports available from CWRRI, on a wide range of topics, from new applications of information technology to water management to the impact of forest management practices on water yield from forests. Other topics include use of recycled wastewater on urban landscapes, mitigation of salinity impacts on crop yields in the Arkansas Valley, the life cycle of the Brassy Minnow, and the impact of severe sustained drought in the Colorado River Basin. A complete list of all of CWRRI's publications can be viewed at: http://cwrri.colostate.edu/

This year CWRRI was forced to suspend its annual water research competition due to higher education budget reductions. CWRRI is currently supporting a Water Research Fellowship competition. Higher education faculty and students are willing and able to conduct water research that benefits water managers, water users, and Colorado citizens; however, the funding to support such research, on the part of CWRRI, has been greatly reduced. With CWRRI facing Legislative reauthorization in 2007, an appropriate time to consider the future of water research in Colorado may be upon us.

Colorado Water Resources Research Institute Advisory Committee on Water Research Policy 2003/2004

Appointed by position

Chair, Senate Agriculture, Natural Resources and Energy Committee
Senator Lewis Entz
Chair, House Agriculture, Livestock and Natural Resources Committee
Representative Diane Hoppe
Executive Director, Colorado Dept of Natural Resources
Russell George
Director, Water Quality Control Division, Colorado Dept of Public Health and Environment
Mark Pifher
Commissioner, Colorado Dept of Agriculture
Don Ament

Appointed by CWRRI Director

Fred Anderson, Former Pres. of Colorado Senate
Sara Duncan, Public Relations Denver Water
David Merritt, Manager, Colorado River Water Conservation District
John Porter, Former Manager, Dolores Water Conservancy District
David Robbins, Hill & Robbins
Ralph Curtis, Manager, Rio Grande Water Conservation District

Ex Officio

Lee Sommers, Director, Agricultural Experiment Station
Jim Hubbard, Director, Colorado State Forest Service
Milan Rewerts, Director, Cooperative Extension

Colorado State University Cooperative Extension

An Abbreviated History of Colorado State University Cooperative Extension's Water Related Activities

by Reagan Waskom

In 1862, the Morrill Act established the land grant college system with a mission to foster practical instruction in the agricultural and mechanical arts. Shortly thereafter, a group of Fort Collins promoters, concerned about the future of their town after the closure of the U.S. Army fort, successfully lobbied the Colorado Territorial Legislature to establish the State Agricultural College of Colorado in 1870. The University had three faculty members as they welcomed their first students when classes finally began in Fort Collins on September 1, 1879. Agricultural research was one of the first priorities for the College because so little was known about agriculture in the territory. Almost immediately, the University began efforts to transfer research-based knowledge to the farmers and ranchers of Colorado.

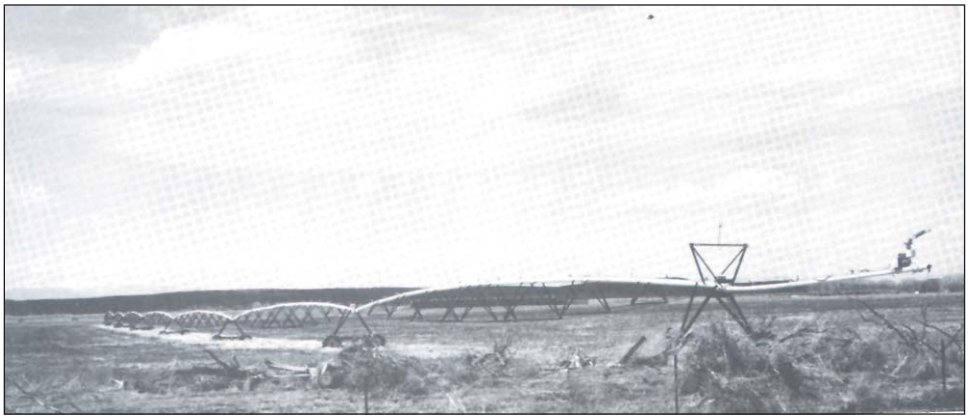
D.C. Bascom was the first county extension agent in Colorado. He began work in Logan County in 1912, carrying a traveling library of books in his horse drawn buggy on visits to farmers in the region. Two weeks after Bascom was appointed in Logan County, W.H. Lauck was transferred from the Office of Irrigation Investigations of the USDA to become the first extension agent for El Paso County. Other counties followed, and in 1914, the U.S. Congress passed the Smith-Lever Act, establishing a federally supported Agricultural Extension Service at each state land grant college. Colorado Agricultural College President, Charles Lory, initiated Cooperative Extension in Colorado on July 30, 1914, just three months after the Smith-Lever Act became effective.

When the U.S. entered World War I in April of 1914, Colorado adopted the slogan, "Food will win the war", and it became a patriotic duty to increase food and fiber output. By 1918, fifteen of the twenty-nine Colorado counties served by extension agents were receiving emergency federal funds to improve agricultural production and reduce inefficiency and waste. W.H. Lauck began irrigation demonstrations in El Paso County during this time. Crop production in Colorado increased dramatically during the war and Extension's work on irrigation water management began in earnest, with county agents and university faculty collaborating to help farmers and ranchers improve their irrigation systems and management practices.

In 1935, the school became the Colorado State College of Agricultural and Mechanic Arts or Colorado A&M. Irrigation water management was included in the extension agronomy program until July 1, 1937, when an extension irrigation project was established and Floyd E. Brown was hired as the state's first Extension Specialist in Irrigation Practice. Information from the Ag Experiment Station, USDA, Bureau of Reclamation, irrigation organizations and successful farmers was organized and made available to farmers in irrigated regions throughout the state. The program included information on the water requirement of various crops, proper preparation of land and the lay-out of ditches, the most effective irrigation methods, and water supply and structures including measurement, storage and pumping.

Following World War II, Cooperative Extension began to employ additional engineers to serve as irrigation specialists. A.J. Hamman, a former county agent for Prowers County, was hired as Extension Irrigation Specialist after the war. In 1952, A.J. chaired the program committee appointed by Colorado Governor Dan Thornton to arrange the official observance of "A hundred years of organized and continuous irrigation in Colorado", hosted by Delfino Salazar of San Luis at Adams State College. The proceedings of this observance were published by the Colorado Water Conservation Board and make fascinating reading for water enthusiasts. (Available on-line at http://cwrri.colostate.edu/pubs/WaterRight.pdf)

The 1950s brought irrigation development to the Ogallala aquifer in eastern Colorado, and an area previously suited only for stock grazing and marginal dryland farming flourished, as irrigation wells were drilled on the plains. William Code and A.J. Hamman published "An irrigation guide for Colorado" in 1954 to help farmers evaluate their potential for



Pivot sprinklers

irrigation. Floyd Brown was still serving as state irrigation specialist at that time and published a bulletin on "Irrigation Water Measurement" in 1957.

During the drought of the mid-1950s, water conservation became a major extension thrust under Cooperative Extension Director, James Morrison. At that time, the term conservation signified productive use of the resource, rather than prevention of waste. In this context, San Miguel county agent, Sam Haslem, was assigned by the Director to work on developing support for the authorization of Reclamation projects that would develop water resources in Colorado. One project Sam worked on in southwest Colorado, the Dolores Project, was eventually brought on-line.

Colorado A&M was renamed Colorado State University in 1957. The 1960s brought the establishment of regional Extension Irrigation Engineers to eastern Colorado, as irrigation technology was revolutionized by high output submersible pumps and center pivot systems. These positions were established in Burlington, Rocky Ford, Akron and other locations as funding and need dictated. These regional engineers were charged with working closely with irrigators to solve problems associated with surface and ground water use. In the 1970s and 1980s, Extension Irrigation Specialist Don Miles, worked with irrigators in the Arkansas Valley and began to document the problems associated with the salinization of the basin.

Weld County pasture tour circa 1959

A period of intense water education activities began in the mid-1970s with the Colorado River Salinity Control Project, an outgrowth of the 1944 treaty with Mexico. Up to nine Cooperative Extension irrigation specialists worked on the project at one time, in collaboration with the NRCS and the Bureau of Reclamation, to help producers reduce deep percolation through the use of pipeline, surge valves, irrigation water management, and other cost-shared practices. Extension's last two salinity specialists on the west slope completed their assignments in the late 1990s.

The reauthorization of the federal Clean Water Act in 1987 began a new phase of Extension activity surrounding water quality issues. Extension's first water quality specialist, Dr. Jim Loftis, was present at a national meeting in Dallas as the USDA initiated Cooperative Extension's nationwide efforts on nonpoint source pollution and agriculture. USDA special funding quickly followed and the era of USDA water quality demonstration projects and hydrologic unit area projects began. Colorado had a USDA water quality demonstration project in the San Luis Valley from 1994 to 1999 and a Hydrologic Unit Area project in the Patterson Hollow stretch of the Arkansas River during this same time. Among the accomplishments of these projects was the introduction of PAM and the widespread adoption of surge irrigation. The Patterson Hollow Hydrologic Unit Area Water Quality Project facilitated the installation of $1,660,730 worth of Best Management Practices. Collaborating with the Natural Resource Conservation Service and the Farm Service Agency, this project positively impacted 35,000 acres spread over 427 participating farms. The passage of Colorado Senate Bill 126 in 1990 formalized cooperation between the Colorado Department of Agriculture and CSU Cooperative Extension to develop and promote agricultural BMPs to protect ground water quality. This program continues today and farmers have widely adopted these practices throughout Colorado.

Today, Cooperative Extension has offices in 59 of Colorado's 64 counties, delivering research-based information and education to citizens locally. Budgets and external funding realities have reduced water programs significantly from the past and Cooperative Extension currently has one Regional Water Resources Specialist located on the Eastern Plains (Joel Schneekloth) and one the in Uncompahgre Valley (Aung Hla). Extension has one faculty member located in the Denver Metro area to work cooperatively with the Department of Health and Environment on nonpoint source education (Loretta Lohman). Four CSU faculty members in Fort Collins have partial extension salary coverage to provide statewide educational programming support on water quality, irrigation, salinity and water resource issues (Troy Bauder, Israel Broner, Luis Garcia, Reagan Waskom). In spite of budget reductions, water remains a high priority for CSU Cooperative Extension, as adequate supplies of high quality water are crucial to Colorado's continued prosperity and quality of life.

Sources:

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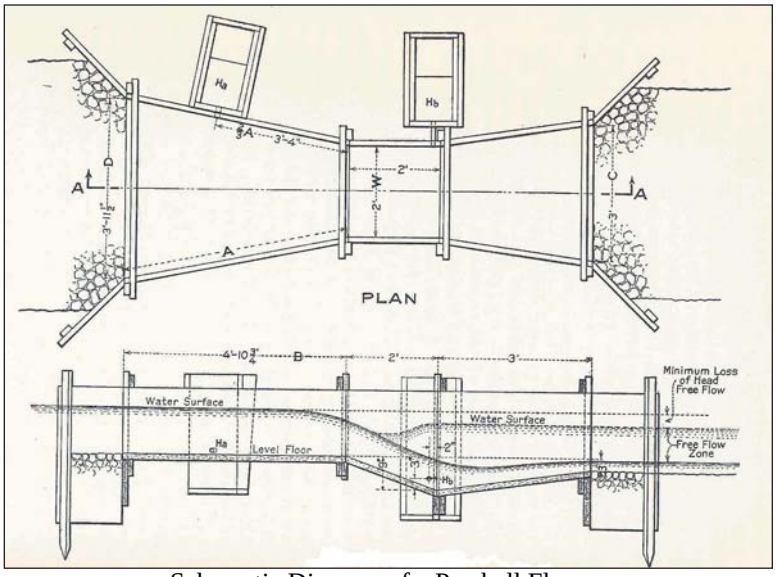
History of Agricultural Experiment Station and Colorado Water Issues

by Dan Smith, Department of Soil and Crop Sciences, CSU

The Colorado Agricultural Experiment Station (AES) was established by the Colorado Legislature in 1888, following enactment by congress of the Hatch Act of 1887, which authorized funding for such research facilities at all existing and future land-grant institutions. The Colorado station was organized as a research agency under the administration of the recently opened state Agricultural College at Fort Collins. The principle mission of these agricultural experiment stations was to conduct research and experimentation to benefit the nation's agricultural industry.

Water resources research was firmly imbedded in the mission of the Colorado AES from its inception. The original organizational structure called for five sections of inquiry, one of which was the meteorology and engineering section. Although the main station was located in Fort Collins, the first two sites designated for substations, Del Norte and Rocky Ford, were located in areas where irrigated agriculture already had a rich history. The inaugural issue of the Bulletin series of Colorado AES publications was titled, "Report on Experiments in Irrigation and Meteorology."



Schematic Diagram of a Parshall Flume
(source: Colorado Agricultural Experiment Station Bulletin No. 336. Reprinted with permission)

This early emphasis on water studies by the AES was the product of converging events, both at the state level and within the new College itself. By the time the Hatch Act was passed, Colorado had demonstrated its leadership among western states in the practice of irrigation and the development of legal structures for administering irrigation water rights. Total land under irrigation at this time was estimated at 1.25 million acres. With the development of irrigated agriculture, the legislature created a system of water allocation including water courts to issue decrees and administrative structures to divide the water among users based on their priority according the Doctrine of Prior Appropriation. The division of water under this system was administered at the state level by the State Engineer, who was charged with making measurements of the amount of water available for irrigation use.

Internally, two key personnel decisions that would lead eventually to an institutional focus on water occurred within the young College's brief 10-year history prior to the establishment of the Station. The first of these involved the hiring of Elwood Mead as a temporary mathematics instructor. Mead's background in civil engineering led him to pursue knowledge of irrigation principles at a practical level, which led first to irrigation engineering courses and eventually to the formal establishment of a Department of Physics and Engineering, within which he led instruction in irrigation engineering. When Mead left the College in 1888 to pursue a distinguished career in public service, the institution hired a replacement, Louis G. Carpenter, whose passion for irrigation engineering proved to be equal to that of Mead's. Within a year of Carpenter's appointment, the State Board of Agriculture, the College's governing body established irrigation engineering as one of only four distinct courses of study that could be pursued by undergraduates during their junior and senior years.

Although Mead left the institution prior to the establishment of the AES, his insight into the most important information needs of the irrigation industry in Colorado greatly influenced the early research agenda of the Station. He invested much effort in observing how the irrigation infrastructure functioned. In the process, he developed keen insight into the critical needs of irrigated agriculture and initiated research studies to answer the most pressing questions. Carpenter, who became the head of the irrigation engineering section after the Station was established, enthusiastically sustained the effort initiated by Mead.

The original AES investigations in irrigation engineering were a direct response to critical problems of the time. With the rapid expansion of irrigated acreage in the South Platte, Arkansas, and Rio Grande basins, overappropriation of exist-

ing supplies was becoming more common. Administration of water rights under these conditions required more accurate measurements of water use variables. Early AES-sponsored research led to the development of devices that improved the accuracy of water measurement and efficiency of water distribution in ditch systems. In addition, critical studies were conducted to determine the duty of water – the amount of water required to meet crop requirements without waste – for various conditions and the factors affecting the rates of evaporation from open water surfaces. Mead and Carpenter also initiated long-term studies on the climate of Colorado during this early period. This work was designed to answer questions about the potential for irrigated agriculture to produce overall changes in climate in the region.

These early research initiatives clearly established Colorado Agricultural College's reputation of excellence and leadership in irrigation studies. Continued AES support of irrigation research during the early period of the Twentieth Century was instrumental in maintaining the institution's leadership. The most visible work during this period was the result of collaborative research between the Station and the Irrigation Investigations Office of USDA. Ralph Parshall, a graduate of Colorado Agricultural College in 1904, was employed by this agency in 1913. Parshall, who was also appointed to the Station staff in Fort Collins, provided outstanding leadership in several areas of inquiry that brought widespread recognition to the institution. His most notable contribution was the development of the Parshall flume, a simple device for providing accurate measures of water flow in open channels. By 1925, this device was accepted as the standard for water-flow measurements by irrigation engineers world-wide. Other contributions by Parshall included studies, first conducted by L. G. Carpenter, to document the contribution of water seepage from irrigation to return flows to the lower South Platte River. Parshall also participated in the first mountain snow surveys, which continue to the present day and serve an important role in forecasting water availability from snowmelt.

From these early contributions to the present era, support of water research by the Colorado AES has been a vital force in providing science-based information for water resources managers in Colorado and elsewhere. Topics of investigation have included surface and ground water hydrology, the economics of irrigation practices, irrigation scheduling, the economic value of water for irrigation and other purposes, the impacts of irrigation water transfers, consumptive irrigation water use by crops and urban landscapes, and various aspects of irrigation water management. The Station has continued to invest in long-term climate observations through its support of the Colorado Climate Center. Currently, the AES funds a wide array of water projects that account for the entire range of water issues of concern to society. Examples include emphasis on irrigation impacts on soil salinization, nutrient contamination of surface and ground water, and fish and wildlife habitat; water use by urban landscapes and lawns; and drought assessments.

When we review the entire record of AES contributions to water resources research in Colorado, several important themes emerge. The earliest contributions by the Station were vital to agricultural industry in Colorado. Much of this work provided information that was essential to the implementation of water administration systems in Colorado and elsewhere in the western US. In the longer view, the continuity of support over more than 100 years has provided a stable source of funding for climate observations. This stability also has provided the flexibility to deal with emerging problems that reflect changing societal values. From its inception, the Station has supported research that has brought significant recognition to the institution as a whole. It has also fostered collaboration with scientists and water managers from a wide range of federal and state agencies.

In the final analysis, one can conclude that AES support of water resources research in Colorado has fulfilled the intent of the Hatch Act. Federal and state funding support has combined to greatly benefit the state's agricultural industry. In the process, Colorado as a whole has received a watershed of benefits from the information generated by this important investment in research.

Father of the Flume: Ralph Parshall

Ralph L. Parshall (1881-1959) may be one of the most celebrated internationally-known alumni in the history of Colorado State University. A pioneer in the fields of civil engineering and hydrology, Parshall is best known for developing the Parshall Flume at the then-named Colorado Agricultural College's hydrology lab in 1922. Noticing problems with stream flow measurements, Parshall developed the device that, when placed in a channel, measures the flow of the water as it uniquely relates to water depth. Today, the Parshall Flume is still widely used to help gain more accurate measurements of water flow.

An exhibit created by the Water Resources Archive depicts events in Parshall's long and productive association with what is now Colorado State University. From his start at the college as a freshman in 1899 to his development of the flume and subsequent honors from the College, Ralph Parshall's career is traced through photos and personal objects, highlighting the remarkable successes that have served to make him such a recognized and remarkable alumnus.

The exhibit will be available for viewing until December 20 in Morgan Library, Suite 210, Monday-Friday, 8:30-4:30.

Denver Water and Colorado State Forest Service: Working Together to Preserve Colorado's Water and Forest Resources

By Katherine Timm, Colorado State Forest Service
with assistance from Denver Water

The American Indians and the pioneers who lived and traveled across the semi-arid Great Plains relied on the South Platte River and Cherry Creek for their very survival. The first Colorado residents drank directly from the creek and river, where they set up camp. While surface-well and buckets of water served their purpose for a while, early settlers soon replaced them with irrigation ditches.

In 1867, City Ditch was completed; it connected the South Platte in the Littleton area to Capitol Hill. Soon after, the purity of the water became a concern, and with good reason. Apparently, loose pigs were contaminating the ditch, raising the threat of cholera. Three years later, the Denver City Water Company was formed, making it one of the oldest water utilities in the Western United States.

In 1870, the population of Denver was 4,759 and growing rapidly. To address the growing need for safe water, in 1872, Denver City Water Company installed a large well, a steam pump and four miles of main, which provided water to homes. In the early years, fly-by-night contractors were abundant and the editorial pages of the papers were filled with articles about concerns related to hydrant pressure.

During the next two decades, as many as 10 water companies fought for the right to provide water to Denver citizens—many collapsed while others merged. In 1892, the Citizens Water Company offered water at no cost in an effort to drive out the American Water Works Company of New Jersey. The strategy worked. In 1894, the Denver City Water Company merged with the Denver Union Water Company and several smaller companies serving various areas of Denver, which continued to grow at a rapid pace. Walter S. Cheesman and David Moffat eventually headed the Denver Union Water Company, the predecessor of Denver Water, and established a stable system.

Grass recovery two years after treatment is excellent. Prairie gayfeather, an important food source of the endangered Pawnee montane skipper butterfly, is now abundant in this area.

The first water treatment system was installed on Cherry Creek in 1886 and the Platte Canyon Filtration Plant was added to the system in 1889. Located high in the foothills, the facility was renamed the Kassler Treatment Plant. By 1906, chlorination was added to Denver's water to prevent cholera and typhoid.

To this day, some of Denver Water's facilities, including the Cheesman Dam and Reservoir on the South Platte River, are considered by many to be engineering landmarks. Completed in 1905, Cheesman was viewed as the solution to Denver's water-storage problems. Over the decades, Denver Water's system expanded to meet new demand, but Cheesman Reservoir remains a major engineering accomplishment and continues to be an important source of water for Denver metro's fast-growing population.

Today, Denver Water provides a continuous supply of safe, clean water to nearly 1.1 million people in the Denver metro area—or nearly one-fourth of all Coloradans. Most of the supply comes from mountain snowmelt and is distributed through 2,574 miles of water mains, 23.5 miles of nonpotable pipes, 18 pumping stations and 34 underground reservoirs. Dillon, Elevenmile Canyon and Cheesman reservoirs account for nearly 81 percent of Denver Water's total storage capacity. These reservoirs also are important recreation areas, and the 8,000 acres of ponderosa pine forest that surrounds Cheesman Reservoir is considered one of the most historically important ponderosa pine landscapes in Colorado.

In addition, the branch of the South Platte River that runs through the small towns neighboring Cheesman Reservoir is home to some of the best gold-medal trout fishing waters in the state. Recognizing the historical, ecological and recreational significance of the Cheesman property, in 1998,

The hydro-ax is a specialized piece of equipment used to thin forests. It also breaks up hydrophobic soils caused by wildfires, which promotes faster recovery of grasses.

Denver Water began to employ the Colorado State Forest Service (CSFS) to develop and implement a forest management plan for the area. The goal of the forest management plan is to restore the forest to pre-settlement conditions, and thus reduce the risk of potentially catastrophic insect and disease outbreaks and wildfires.

The land around Cheesman Reservoir had not been logged since 1905. It had also been protected from grazing, making it an ideal laboratory to conduct research on ponderosa pine landscapes, particularly as they relate to fire behavior. Research has been underway since the early 1990s and is being conducted by Merrill Kaufmann, a forest ecologist with the Rocky Mountain Research Station. Historic photographs, dendrology studies and modeling indicate that pre-settlement ponderosa pine forests were characterized by low tree density, a limited number of small trees and an understory that was dominated by grasses and shrubs. In contrast, when settlement occurred and inhabitants began to suppress forest fires, the forest stands became much denser.

This is illustrated by the study of crown closure in the pre-settlement forest conditions in the Cheesman area. In 1996, only a small percent of the Cheesman Reservoir landscape had crown closures of 30 percent or less. Prior to 1900, more than 90 percent of the landscape exhibited crown closures no greater than 30 percent. In forests with crown closures of 30 percent or less, fires typically do not spread from crown to crown. The current condition of ponderosa pine/Douglas-fir forests throughout much of the forested lands along the Front Range exhibit these high levels of crown closure. Such crown closures promote crown fires that carry with them a high risk of catastrophic fire, which remove complete stands of trees.

Exceptions to the increased density of forests and crown closure in the Cheesman Reservoir landscape were areas that burned in 1851, the 1880s and 1963. These areas were dramatically thinned by the fires and created numerous openings within the forest. Openings that resulted from the 1851 fire were still apparent in 2002. These persistent openings are one of the major differences between the Cheesman area and forest lands outside the area.

Attempts to apply the research from Cheesman are ongoing within the Upper South Platte Project. One such research project is the Trumbull Forest Restoration Demonstration Area northeast of Cheesman Reservoir. Chuck Dennis, the CSFS project forester responsible for forest management on Denver Water property, created the demonstration area to model historic conditions and assess the impacts of wildfire. In addition, fuelbreaks were created along the entrance roads and defensible space was completed around the structures at Cheesman Reservoir headquarters.

The 1996 Buffalo Creek Fire occurred 10 miles north of Cheesman Reservoir and burned 11,900 acres—7,500 acres were burned by a crown fire that traveled 11 miles in 4 ½ hours. Considered the most damaging and costly fire in Colorado history until the Hayman Fire occurred, it taught Denver Water the importance and value of forest management. Runoff from the Buffalo Creek Fire carried silt, ash and debris into Strontia Springs Reservoir, threatening Denver's water supply and costing several hundred thousand dollars to restore.

The Hayman Fire provided land managers the opportunity to learn how a major wildfire would impact not only the Trumbull demonstration area, but areas that had yet to be treated. At Cheesman, the fire did what Chuck Dennis thought it would do—it laid down when it hit the demonstration area. Even without intervention by firefighters, Denver Water lost only one storage building. None of the other structures at the reservoir sustained damage. In contrast, the fire moved quickly through the crowns of the untreated areas, burning all but a few hundred acres of trees. Unfortunately, there was not enough time to implement forest restoration treatments throughout the property before the fire.

Although the Hayman Fire spared the buildings, forest restoration and rehabilitation on the land surrounding Cheesman Reservoir has cost millions. Immediately following the fire, Denver Water assembled a small team to begin addressing concerns around the headquarters at Cheesman, where the drainage is steep. They used straw bales, sand bags and burned trees, employing a technique called contour felling, to prevent severe erosion. Thanks largely to these efforts, the headquarters remained operational throughout the rehabilitation process.

Within three weeks, the team developed a plan to treat the entire 8,000 acres. Burned trees were mulched using a hydro-ax, which helps break up hydrophobic soils caused by the extreme heat from the fire, which allows grass to recover more quickly. Harvesting of the burned trees began in early 2003 and continued until April of that same year. During that time, 20-30 semi-loads of timber totaling 10 million board feet were removed daily and hauled to Intermountain Resources in Montrose, where it was processed. Removal of the burned trees reduced the biomass and salvaged some of the wood.

Contractors were also employed to seed the entire property, and the Colorado State Forest Service nursery supplied 60,000 trees, which were planted in 2003 and 2004. A few rehabilitation projects and implementation of smaller projects are currently underway. Planting of 25,000 trees will continue every year through 2012.

Future plans call for prescribed burning to improve the grassland ecosystem, which will dominate the area until the trees can once again establish themselves. Grass is an important source of food for wildlife and insects, including the endangered Pawnee montane skipper butterfly, whose population has actually increased since the Hayman Fire. As of August 2004, it appears that grass recovery is excellent, although some scouring from surrounding property still occurs in the drainages.

Capitalizing on lessons learned during the Buffalo Creek and Hayman fires, Denver Water and Chuck Dennis are coordinating forest management projects on other Denver Water properties in Grand, Summit, Boulder, Douglas, Jefferson and Park counties, which will be implemented by CSFS districts. Because the management and health of Colorado's forests ultimately dictates water quality, Denver Water hopes the management being done on their properties will serve as an example of proper land stewardship and be a catalyst for similar action on surrounding lands. Denver Water recognizes the important relationship between forests and water and has invested the resources necessary to continue to supply Denver metro's growing population with safe, clean water—just as it has for the past 100 years.

Before (above) and after (below) photos of an area near Cheesman Reservoir in which thinning has occurred to create more openings and reduce the risk of catastrophic wildfires.

Colorado Water Congress
47th Annual Convention
January 27-28, 2005
Denver Colorado.
For progam and registration materials, go to www.cowatercongress.org/meeting_notices.htm

Creating Order Out Of Chaos

By Patricia J. Rettig, Head Archivist for Water and Agriculture Archives, Colorado State University Libraries

Other articles in this issue show the importance of history in the world of water resources. Archives preserve the "stuff of history." To many, archival work can seem straightforward--simply storing papers in boxes. However, making archival collections accessible is rather labor-intensive, time-consuming work—from which many benefits follow.

Unprocessed files received from donor

Collections usually arrive at the archives in chaos. Sure, the occasional person empties orderly filing cabinets directly into boxes, but more often than not it appears that someone has boxed up numerous piles of papers and delivered them to the archives. Either way, the archives' job is to gain control over the materials in order to provide access to them. No matter the condition upon arrival, the entire collection is examined and sorted, and sometimes working on the chaotic collections can be more fun!

Gaining control over a collection is the activity from which all else follows in archives. Since the purpose of having archives is to make important, unique primary sources available for public use, order has to be created out of the chaos. It is much easier and more efficient for a researcher to go through a box of carefully organized and preserved materials than through unsorted miscellany.

For order to be created out of chaos, all of the material has to pass through a person's brain. Careful thought about the materials has to be applied even as more mechanical processes like pulling staples occur. This does not mean that the archives staff thoroughly reads all materials worked on. Rather, they quickly scan documents to get a general sense of what is there and only read thoroughly as necessary.

Gaining control occurs both physically and intellectually. In archives, physical control means not only arranging materials, but also preserving them. For most collections—there are always exceptions in archives—like objects are kept together. So diaries are kept separate from photographs which are kept separate from correspondence and so on. This benefits a researcher who wants to see all the photographs (for example) in a collection, and it also helps the materials in providing uniform housing.

The preservation part of physical control can be more important than the arrangement part, since items have been selected to be in archives for their long-term importance. The main thing archives focus on in preserving materials is correcting situations which contribute to deterioration. Since it is the breakdown of acids in materials over time which causes much of the deterioration, that breakdown is something we try to prevent or slow. All housing materials—mainly boxes and folders—used in archives are made to be acid free; original manila file folders and plastic-coated binders are replaced with these materials. Other damaging items are also removed: paper clips and staples (which can rust); rubber bands (which harden and adhere to materials); sticky notes (the adhesive on which damages documents). Newspaper clippings, which discolor anything near them, are photocopied and the originals discarded.

Occasionally more intensive preservation actions must be undertaken. If collections arrive having mold, mouse droppings or similar hazards, the materials have to be sequestered and cleaned using intensive, specialized cleaning methods. Another condition requiring extra attention is when materials have been rolled or folded for most of their lives. Having researchers try to open these documents to read them can be harmful, so flat storage is always preferred. Much care has to be taken to flatten such items, often requiring a special humidification process.

The two activities of eliminating physical chaos by arranging materials and preserving them occur simultaneously—along with creating order intellectually. This is done by describ-

Files sorted, cleaned, with staples, paper clips, rubberbands, and sticky notes removed, then filed in archival quality storage materials and labled

ing the contents of the boxes, primarily through listing folder titles, occasionally by listing items, by giving titles of reports, maps or photographs. Researchers can then use the lists to identify where to potentially find specific items of interest. These lists form the inventory section of documents called finding aids, or collection guides.

The inventory is the most detailed part of the finding aid, so researchers tend to skip over the rest and focus just on it. However, the front part of the finding aid should not be missed. The introductory material provides descriptive, contextual information. It includes some background on the person or organization that the collection documents, as well as background on the collection itself—who donated it and when and what kind of work was done on the materials once received. The collection contents are also described narratively at a broad level to show how different sections of the collection relate to each other. Researchers who are familiar with archives appreciate the benefits a finding aid provides, and researchers who aren't familiar with them quickly learn to appreciate their utility.

An engineering graduate student who came to the Water Resources Archive recently used a collection and its finding aid. Upon reviewing the finding aid, he quickly identified materials related to his research--much faster than going through twenty-one boxes himself! He stated several times during his visit, "You guys are so organized!" He was quite pleased, and his comments told us we are doing our job well.

Creating order out of chaos can be a very satisfying endeavor, though complicated by the details of arranging, preserving and describing. Giving attention to such details makes for many hours spent laboring over a box of documents. Processing one standard-size box of twentieth-century paper documents takes an average of four hours. Boxes containing photographs or other special formats can take longer. Nineteenth-century collections can also take longer because the aging can cause fragility, requiring more careful handling.

Once collections are under control all other archival functions can follow. Collections can be served to researchers efficiently, and the finding aids can be put on the Internet for easy access. Materials can be used for exhibits, publicity, class instruction, and special programs. The time put into the work of gaining control pays off big dividends for many people for years to come.

Regional Evapotranspiration and Pan Evaporation: Complementary Interactions and Long-Term Trends across the Conterminous United States

Mike Hobbins, Civil Engineering Department, Colorado State University

Large-scale, direct observational evidence in support of the hypothesis of a complementary relationship in regional evapotranspiration is provided using long-term observations of pan evaporation and water budget-derived evapotranspiration across the conterminous United States. The complementarity between potential and actual evapotranspiration is observed both in terms of the evaporation rates themselves and of long-term trends in their component dynamics and, contrary to recent conclusions, long-term trends in actual evapotranspiration are determined to originate in either the radiative energy flux or the regional advective flux, or both.

Pan evaporation data are gathered for 228 pans across the conterminous US toward an examination of long-term trends in annual and warm-season totals. The data are homogenized in a manner that preserves climatically driven trends. The so-called "Pan Evaporation Paradox" is shown to be no more than a manifestation of the natural complementarity between actual and potential evapotranspiration.

Actual evapotranspiration is modeled using a regional, seasonal Advection-Aridity approach to create a spatially distributed, monthly time-series for a 42-year period at a 5-km resolution over the conterminous US. Formulations of both the radiative and advective dynamics in the evaporative process are improved with respect to the applicability of the model across large topographic and climatic variations. Trends in modeled actual evapotranspiration and its components are examined at a variety of spatial scales as to their direction, magnitude, statistical significance, and spatial distributions.

Dissertation Abstract
Available through CSU's Morgan Library

MEETING BRIEFS

Colorado's Future 2004: Economic Development and Policy

On October 22, 2004, the Colorado Institute of Public Policy at CSU, in collaboration with the Center for Colorado Public Policy Studies at the University of Colorado at Colorado Springs, sponsored a water session entitled water policy and economic development.

(Above) Mooey Hammond and Diane Hoppe

Participants in the panel were: Mooey Hammond (Partner with Carlson, Hammond, and Paddock), Diane Hoppe (Representative in the Colorado Legislature), Peter Nichols, (Attorney with Trout, Whitwer and Freeman), Eric Schuck (Assistant Prof with Ag. and Resource Economics, CSU). Eric Wilkinson (General Manager, Northern Colo. Water Cons. District).

(Upper Left) Diane Hoppe and Lyn Kathlene

The speakers served on a panel moderated by Robert Ward, Director of CWRRI. The panel was assigned to examine connections between science, water policy and economic development. Water is a contentious issue in Colorado and the region. From the prior appropriation doctrine, to trans-diversion projects, to water quality and ecosystem health, the demands on water are nearly infinite; yet, the supply is not. The questions of interest posed to the panel were: (1) How does water science inform water policy; in what ways is it effective and ineffective? (2) Can the science remain or be perceived neutral with respect to the political and economic interests? (3) Are partnerships among scientists, policymakers and the business community worth pursuing; realistic to pursue?

(Lower Left) Daphne Greenwood and Erick Schuck

(Below) Eric Wilkinson and Peter Nichols

The panel discussed answers to the following questions: (1) Describe what science can bring to the table and what it cannot. (2) Identify, if possible, successful models of the past (in water or other resource arenas) that we can draw upon to model future partnerships. (3) Consider the types of partnerships – research, policy, business – that would be fruitful to explore.

Audio proceedings of the water panel will be available in January, on the conference site at www.cofuture2004.colostate.edu .

Now Available On-line
Coping with Severe Sustained Drought in the Southwestern United

Bob Young lead the team of scientists who conducted the severe sustained drought study, the report of which is now available on-line. Additionally, he has contributed greatly to the field of water reseource economics. His efforts were recognized with the 2004 Warren A. Hall Medal.

To access Coping with Severe Sustained Drought on-line, go to:
http://www.awra.org/publications/ssd_papers/ssd_papers.html

A printed copy of the Water Resources Bulletin costs $15 and can be ordered by phone (520) 792-3124.

His contributions to CWRRI studies are presented on-line from the CWRRI web page at http://www.cwrri.colostate.edu .

CSU's Morgan Library Examines Future of Water and Agricultural Archives

On November 11, 2004, 33 people convened on the CSU campus to review the current status of Morgan Library's Water and Agricultural Archives and examine the challenges facing the archives. Catherine Murray-Rust, Dean of the University Libraries at CSU, opened the meeting. Robert Longenbaugh, a water engineering consultant, and Mark Fiege, a CSU history professor, presented their perspectives on why archives matter. The two perspectives addressed the value of adding important papers to the collections and the importance of using the archives to extract an understanding of Colorado's water and agricultural history, culture and heritage.

Patty Rettig, Archivist for Water and Agricultural Collections at CSU, reviewed the collections currently in the archives (see box) as well as present and future challenges. In particular, she highlighted efforts to place finding aids online, digitize priority portions of the collections, inventory for users key complementary collections at other institutions, continue to serve as a location for collections not yet in an archive, establish and maintain active connections with key water and agricultural interests in Colorado, and address the budget problems facing the archives – problems similar to those afflicting all parts of higher education in Colorado today. She also discussed the need to treat the recently acquired Carpenter Collection (containing the papers of Delph Carpenter) for mold before it can be made available to the public.

Sharon Hyatt, Mark Fiege, and Greg Silkenson discuss presentations.

After a box lunch, a 'preparing for the future' discussion was held among all participants. Collection acquisition and linking, ways to raise awareness, use of modern information technology, and funding opportunities tended to dominate the discussion. The input and ideas received from the participants will be used by the archives to create a plan for the future. A follow-up report on the meeting is available from the archives (970-491-1844), and additional input is always welcome.

Catherine Murray-Rust, Bob Longenbaugh, and Mark Fiege prepare to respond.

(Above) Allison Level and David Freeman ponder the fine points of a talk.

(Left) Karen Rademacher and Greg Silkenson examine archive materials.

Water Resources Archives
Colorado State University Libraries

M. T. Axtell
Morton W. Bittinger*
Whitney M. Borland*
Delph E. Carpenter
Louis G. Carpenter*
Eric Eidsness*
Robert F. Glover
Ival V. Gosline*
Carl J. Hoffman
Charles W. Howe and Bob Davis
Charles A. Lory / Ivan D. Wood
DaviD McComb Big Thompson-Flood Collection
James L. Ogilvie*
Ralph L. Parshall
Daryl B. Simons*
Gilbert G. Stamm
Rollin Q. Tenney
Herbert Vandemoer (Colorado Water Conservation Board)*
David Walker (Colorado Water Conservation Board)*

American Public Works Association
Colorado Association of Soil Conservation Districts*
Colorado Water Resources Research Institute*
DARCA
Groundwater Data Collection*
Iliff and Platte Valley Ditch Company*
Larimer County District Court*
National Water Resources Association*
Rocky Mountain Hydrologic Research Center*

*Summaries and finding aids are on line at http://lib.colostate.edu/water/collections/
For all other collections, contact the Archives at specialcollections@manta.colsotate.edu

South Platte Forum Convenes, Honors Schleiger's Contributions

"Navigating the Future, Water Supplies in the South Platte" was the theme of the 15th Annual South Platte Forum held Oct. 27 and 28, in Longmont, Co. More than 180 people participated in sessions on water supply issues including legislation, climate, habitat restoration, nutrient standards, polyacrylamide, storage projects, and well augmentation. For a copy of the program/proceedings, go to http://cwrri.colostate.edu/pubs/series/information/islist.htm .

(Top left) Don Kennedy, Bret Bruce, Sandy Vana-Miller, Jennifer Brown, Cynthia Brady, Gene Schleiger (with Friends of the South Platte recognition), Jay Skinner, Frank Jaeger, members of the organizing committee of the South Platte Forum.

(Lower left) Don Ament, Reagan Waskom and Robert Sakata compare perceptions of the presentations.

(Below) Troy Bauder and Dick Wolf visit during break.

Gene Schleiger was honored with the first Friends of the South Platte Award at this meeting in recognition of his contributions to the organization. The award includes a framed copy of the photo "South Platte Sunset," generously provided by John Fielder.

The 2005 South Platte Forum will be held Oct. 26-27, 2005. Watch www.southplatteforum.org for details.

WATER NEWS DIGEST

Ancient civil engineers recognized
By Shane Benjamin
(Mesa Verde National Park) Prehistoric reservoirs and ditch systems were recently dedicated as Historic Civil Engineering Landmarks. The landmark designation recognizes Mesa Verde National Park's ancestral Puebloans for designing, constructing and maintaining at least four reservoirs for domestic water-storage between 750 and 1180 A.D.
Durango Herald, Sep. 28, 2004

The Last Drop Series One-Five
By Todd Hartman and Jerd Smith,
The series of articles "The Last Drop" discusses water claims in Grand, Summit, Eagle, and Pitkin counties. The series focus is on Front Range utilities and Denver Water who are looking to acquire water sources from these counties to satisfy the demands of growing cities.
Rocky Mountain News October 2, 4, 5, 6, 7

Contaminant found in Lockheed groundwater
By Todd Hartman and Katy Human
Lockheed Martin will spend $8 million as part of a voluntary effort to remove elevated levels of a contaminant associated with rocket fuel which were discovered in groundwater and creek water running through Lockheed Martin's Waterton Canyon facility in southwestern Jefferson County. The contaminant, known by its shorthand of NDMA, was discovered at levels about 5,000 times greater than state and federal environmental standards. But tests conducted by Lockheed Martin suggest the contaminant hasn't escaped the Waterton site or made it into drinking water wells or streams.
Denver Post and Rocky Mountain News, Saturday, Oct. 2, 2004

These articles were summarized from articles listed on http://www.npscolorado.com/news.html which is compiled by Loretta Lohman. You can visit this website to access links to the whole article, and see other articles related to water and NPS.

Requests for Proposals

Request for Proposals - FY 2005
Water Resources Research
National Competitive Grants Program
Administered by
U.S. Geological Survey and National Institutes for Water Resources

The U.S. Geological Survey in cooperation with the National Institutes for Water Resources requests proposals for matching grants to support research on the topics of water supply and water availability, which are issues of importance nationwide. Proposals are sought in not only the physical dimensions of supply and demand, but also quality trends in raw water supplies, the role of economics and institutions in water supply and demand, institutional arrangements for tracking and reporting water supply and availability, and institutional arrangements for coping with extreme hydrologic conditions. For planning purposes, the amount available for research under this program is estimated to be $1,000,000 in federal funds, though there has not been a FY 2005 appropriation of funds for this program as of the date of this Announcement. Any investigator at an institution of higher learning in the United States is eligible to apply for a grant through a Water Research Institute or Center established under the provisions of the Water Resources Research Act of 1984, as amended. Proposals involving substantial collaboration between the USGS and university scientists are encouraged. Proposals may be for projects of 1 to 3 years in duration and may request up to $250,000 in federal funds. Successful applicants must match each dollar of the federal grant with one dollar from non-federal sources.

The RFP may be obtained either by going to https://niwr.org/ and clicking on "View the RFP" under "National Competitive Grants Program" or by going directly to https://niwr.org/2005_104G_RFP.

Proposals must be filed on the Internet at https://niwr.org/ by 5:00 PM, Eastern Standard Time, February 22, 2005 and must be approved for submission to the National Competitive Grants Program not later than 5:00 PM, Eastern Standard Time, March 4, 2005 by the Institute or Center through which they were submitted. In Colorado, this is the Colorado Water Resources Research Institute (CWRRI) and Colorado State University Sponsored Programs. The Government's obligation under this program is contingent upon the availability of appropriated funds.

To Contact CWRRI and CSU Sponsored Programs call 491-6308 or email cwrri@colostate.edu .

WATER NEWS DIGEST

Fort Collins, Greeley seal deal for water
Two reservoirs to be expanded
By Nikolaus Olsen
Fort Collins and Greeley will team up to expand two mountain reservoirs in the coming years, in part to help insulate the Northern Colorado region from drought. Reaching an agreement to expand both the Halligan and Milton Seaman reservoirs, the two cities are seeking more water storage for their collective water shares from the North Fork of the Poudre River.
Fort Collins Colorodoan, Oct. 5, 2004

Study: Animal antibiotics found in Poudre
Maria Sanchez-Traynor,
Antibiotics used on animals were found in the Poudre River. In a study conducted by Colorado State University, researchers say the highest levels of animal antibiotics on the Poudre were found near and in Greeley. The antibiotic monesin, used for cattle growth enhancement, was detected in agricultural areas around Greeley and Windsor.
Greeley Tribune, Oct. 21, 2004

These articles were summarized from articles listed on
http://www.npscolorado.com/news.html
which is compiled by Loretta Lohman. You can visit this website to access links to the whole article, and see other articles related to water and NPS.

Calls for Papers

Call for Papers and Posters

Deadlines: Abstracts for presentations and posters due February 11, 2005
Papers to be included in Abstracts due February 18, 2005

25th Annual
American Geophysical Union
Hydrology Days 2005
March 7 - March 9, 2005

Cherokee Park Room
Lory Student Center
Colorado State University
Fort Collins, Colorado, USA
http://hydrologydays.colostate.edu/
Sponsored by Hydrology Section of the American Geophysical Union

Overview
Hydrology Days has been held on the campus of Colorado State University each year since 1981. Hydrology Days is a unique celebration of multi-disciplinary hydrologic science and its closely related disciplines. The Hydrology Days vision is to provide an annual forum for outstanding scientists, professionals and students involved in basic and applied research on all aspects of water to share ideas, problems, analyses and solutions. The focus includes the water cycle and its interactions with land surface, atmospheric, ecosystem, economic and political processes, and all aspects of water resources engineering, management and policy.

Sessions
Special Session: Analysis and Use of Montane Snowpack Data
A majority of the streamflow in the Western U.S. is derived from snowmelt, which either contributes directly as surface runoff and interflow or indirectly as groundwater recharge and discharge. Our understanding of the snowpack processes that dictate the hydrology of montane systems is limited to the data that are collected. This session will focus on snowpack data collected in montane regions and will present some of our understanding of the nature, meaning and scale of these data.

Regular Sessions:
Papers are welcome on all topics in hydrology and hydrology-related fields of science and engineering. See web page for more detail.

Student Awards
Awards and prizes will be given for the best student papers as oral and poster presentations in the following categories: B.S., M.S. and Ph.D. Criteria for judging: clarity of presentation, technical soundness and originality of contribution, relevance to hydrologic practice, and quality of written paper if submitted for the Proceedings.

Abstract Submittal
Submit your abstract online (https://hydrologydays.colostate.edu/submit.asp). See sample document (http://hydrologydays.colostate.edu/HD's_sample.doc) for format specifications. Abstracts are due by February 11, 2005 to: Professor Jorge A. Ramirez, Civil Engineering Department, Colorado State University, Fort Collins, Colorado, 80523-1372. Telephone: (970)491-7621 Fax: (970) 491-7727 E-mail: hydrologydays@engr.colostate.edu

Registration Fees
Regular: $100 by February 25, 2005; and $150 after February 25, 2005.Student Registration FREE

Cosponsors
- American Geophysical Union (AGU) Hydrology Section and the Front Range Branch
- American Society of Civil Engineers (ASCE), Water Resources Engineering Division and the Colorado Section
- American Water Resources Association

Calls for Papers

CALL FOR PAPERS
American Water Resources Association
Institutions for Sustainable Watershed Management:
Reconciling Physical and Management Ecology in the Asia-Pacific

Deadline: **JANUARY 24, 2005**
Conference: **June 27-29, Hyatt Regency Waikiki, Honolulu, Hawaii**
For more information go to http://www.awra.org/meetings/Hawaii2005/index.html

Meetings

The Universities Council on Water Resources
2005 Annual Conference
Portland, Maine
July 12-14, 2005

Theme: River and Lake Restoration: Changing Landscapes
River and Lake Restoration is an applied science and a national environmental agenda in water resources management that reflects changing landscapes – institutional, legal, infrastructural and geographic. It takes different forms across North America:

- Removing industrial revolution era dams in New England
- Re-establishing historic meanders and flow regimes in the Kissimmee River and Everglades in South Florida
- Improving spawning habitat for native salmon in the Northwest
- Replacing wetlands on the floodplains of major rivers and reducing nutrient flux to lakes in the Midwest
- Replacing water storage formerly held as snow in the Rocky Mountains

For more information, go to http://www.iwr.msu.edu/ucowr/

Colorado Water Congress
2005 Annual Convention: Water Transfers
January 27-28, 2005
Denver, Colorado

Presentations include:

Patricia Mulroy
(General Manager, Southern Nevada Water Authority and Las Vegas Valley Water District, Las Vegas, Nevada)
Evan Vlachos
(Professor of Sociology and Civil Engineering, Colorado State University)
Gale A. Norton
(Secretary of the Interior, U.S. Department of Interior)

CWRRI is organizing two sessions entitled

Economics Surrounding Water Transfers
James Pritchett (CSU's Ag and Resource Econ Department)
Erick Schuck (CSU's Ag and Resource Econ Department)
Options for Land Productivity when Water Availability is Reduced
Dan Smith (CSU's Soil and Crop Sciences Department)
Gary Peterson (CSU's Soil and Crop Sciences Department)

For a complete program and registration materials, go to: http://www.cowatercongress.org/ .

RESEARCH AWARDS

COLORADO STATE UNIVERSITY, FORT COLLINS, COLORADO
Awards for December 2, 2002 to January 25, 2003

PI	Department	Sponsor	Title
Gates,Timothy K	Civil Engineering	Lower AR Valley Water Conservancy Dist.	Monitoring and Modeling Toward Optimal Management of the Lower Arkansas River
Kummerow,Christian D	Cooperative Institute for Research in the Atmosphere (CIRA)	DOC-NOAA-Natl Oceanic & Atmospheric Admn	Variability & Trends in Global Precipitation
Grasso,Lewis O	Cooperative Institute for Research in the Atmosphere (CIRA)	DOC-NOAA-Natl Oceanic & Atmospheric Admn	Severe Weather & Tropical Cyclone Product Development for the National Polar-orbiting Operational …
Knaff,John A	Cooperative Institute for Research in the Atmosphere (CIRA)	DOC-NOAA-Natl Oceanic & Atmospheric Admn	Improvements in Deterministic & Probabilistic Tropical Cyclone Surface Wind Predictions
Pielke,Roger A	Cooperative Institute for Research in the Atmosphere (CIRA)	DOC-NOAA-Natl Oceanic & Atmospheric Admn	An Evaluation of Ultrasonic Snow Depth Sensors for Est 6 & 12 Hr Snowfall Totals
Vukicevic,Tomislava	Cooperative Institute for Research in the Atmosphere (CIRA)	DOC-NOAA-Natl Oceanic & Atmospheric Admn	Efficient All-Weather (Cloudy & Clear) Observational Operator for Satellite Radiance Data Assimilation
Vukicevic,Tomislava	Cooperative Institute for Research in the Atmosphere (CIRA)	DOC-NOAA-Natl Oceanic & Atmospheric Admn	Efficient All-Weather (Cloudy & Clear) Observational Operator for Satellite Radiance Data Assimilation
Vonderhaar,Thomas H	Cooperative Institute for Research in the Atmosphere (CIRA)	DOC-NOAA-Natl Oceanic & Atmospheric Admn	Development of Three-Dimensional Polar Wind Retrieval Techniques Using the Advanced Microwave Sounder Unit
Waskom,Reagan M	Civil Engineering	USDA-CSREES-Coop State Rsrch Edu & Ext	Coordinated Agricultural Water Quality Programming for the Northern Plains and Mountains Region
Garcia,Luis	Civil Engineering	USDA-CSREES-Coop State Rsrch Edu & Ext	Toward Successful Pilot Implementation of Strategies for Remediation of a Salinity-Threatened Irrigated ...
Doherty,Paul F Jr	Cooperative Fishery and Wildlife Research	DOI-USGS-Geological Survey	Design and analysis for evaluation of human impacts on trust species of the US Fish & Wildlife Service
Watson,Chester C	Civil Engineering	DOI-USGS-Geological Survey	Assessment of Sediment Stability after Gradual Drawdown of Brewster Creek by Dam Notching
Brown,Cynthia S	Bioagricultural Sciences and Pest Management	DOI-NPS-National Park Service	Cataloguing local knowledge of restoration techniques
Clements,William H	Fishery and Wildlife Biology	DOI-USGS-Geological Survey	Effects of heavy metals in Rocky Mountain strems
Loftis,Jim C	Civil Engineering	DOI-NPS-National Park Service	Trends of Impaired, threatened & outstanding National State Resource Waters
Loftis,Jim C	Civil Engineering	DOI-NPS-National Park Service	Modification to: Guidance & tech support to thel NRPC of the NPS
Poff,N LeRoy	Biology	DOI-USGS-Geological Survey	Compilation & Analysis of Macroinvertebrate Species Traits for the National Water Quality Assessment Program
Berg,Wesley K	Atmospheric Science	NASA - Natl Aeronautics & Space Admin.	A New Approach to Quantifying Both Random Errors & Systematic Climate Regime Biases in Tropical Rainfall Measuring …
Stephens,Graeme L	Atmospheric Science	NASA-Goddard	CloudSat
Stephens,Graeme L	Atmospheric Science	NASA-Goddard	CloudSat
Austin,Richard T	Atmospheric Science	NASA - Natl Aeronautics & Space Admin.	Combined Active/Passive Retrieval of Snowfall

Stephens,Graeme L	Atmospheric Science	NASA - Natl Aeronautics & Space Admin.	Determination of the Role of Tropical Thin Cirrus Clouds in Climate Feedback through an Improved Cirrus Climatology
Kummerow,Christian D	Atmospheric Science	NASA - Natl Aeronautics & Space Admin.	A Physical Validation Approach for Precipitation
Johnson,Richard H	Atmospheric Science	NASA - Natl Aeronautics & Space Admin.	Studies of Rainfall & Convection for Tropical Rainfall Measuring Mission and Global Precipitation Measurement
Kummerow,Christian D	Atmospheric Science	NASA - Natl Aeronautics & Space Admin.	A Next Generation Microwave Rainfall Retrieval Algorithm for Use by Tropical Rainfall Measuring Mission & Global …
Prenni,Anthony J	Atmospheric Science	NASA - Natl Aeronautics & Space Admin.	Laboratory & Field Measurements of Aerosol Particle Effects on Cloud Ice Formation in the Amazon Basin
Garcia,Luis	Civil Engineering	USDA-ARS-Agricultural Research Service	Apply & Enhance the Object Modeling System for Building New Models for Field, Farm, & Watershed Scales
Westfall,Dwayne G	Soil and Crop Sciences	USDA-ARS-Agricultural Research Service	Precision Farming to Protect Water Quality & Conserve Resources
Fausch,Kurt D	Fishery and Wildlife Biology	USDA-NRCS-Natural Resources Consvtn Srv	Effects of Grazing on Input of Terrestial Invertebrates That Feed Stream Fish
Peterson,Gary A	Soil and Crop Sciences	USDA-ARS-Agricultural Research Service	Develop Sustainable & Flexible Dryland Cropping Systems & Management - Decision Support Technology for the Great…
Kondratieff,Boris C	Bioagricultural Sciences and Pest Management	Valles Caldera National Preserve	Inventory of Aquatic Invertebrates of the Valles Caldera National Preserve, Jemez Mountains, New Mexico
Ramirez,Jorge A	Civil Engineering	DOD-ARMY-ARO-Army Research Office	Request for Instrumentation for Continued Hydrologic Research in Yuma Wash, Arizona
Sale,Thomas C	Civil Engineering	DOD - US Department of Defense	Electrically Induced Redox Barriers for the In- Situ Treatment of Contaminated Groundwater OFF CAMPUS
Shaw,Robert B	CEMML	DOD-ARMY	Fisheries Program Support at Fort McCoy, Wisconsin
Shaw,Robert B	CEMML	DOD-ARMY	Fisheries and Wildlife Habitat Management at Fort McCoy, Wisconsin
Pielke,Roger A	Atmospheric Science	DOI-USGS-Geological Survey	Modeling Assessment of LULC Change Influences on Land Surface Hydrology, Regional Weather, and Climate Variability
Julien,Pierre Y	Civil Engineering	DOI-Bureau of Reclamation	04D8854006 Middle Rio Grande
Johnson,Brett Michael	Fishery and Wildlife Biology	DOI-Bureau of Reclamation	Request for Systhesis, Part Two
Cooper,David Jonathan	Forest Rangeland Watershed Stewardship	DOI-NPS-National Park Service	Restore Snake River Gravel Pit, John D. Rockefeller, Jr. Memorial Parkway to a self sustaining Riparian ...
Hannah,Judith L	Geosciences	DOI-NPS-National Park Service	Inventory & Monitoring Natural Resource Status and Trends in NPS
Cooper,David Jonathan	Forest Rangeland Watershed Stewardship	DOI-NPS-National Park Service	Stream & Riparian Characterization & Analysis in Petrified Forest National Park, Arizona
Paschke,Mark W	Forest Rangeland Watershed Stewardship	DOI-NPS-National Park Service	Development of Tools to Integrate Restoration Activities in the National Park Service
Wilkins-Wells,John Reese	Sociology	DOI-Bureau of Reclamation	Management Practice Study II - County Land Use Impacts on Irrigation Districts
Rathburn,Sara L	Geosciences	DOI-NPS-National Park Service	Channel Restoration of Lulu Creek and the Colorado River, RMNP
Cooper,David Jonathan	Forest Rangeland Watershed Stewardship	DOI-NPS-National Park Service	Fens of Yellowstone National Park: Identification, Classification, Geochemistry, Floristics and Vegetation
Culver,Denise R	Fishery and Wildlife Biology	DOI-BLM-Bureau of Land Management	Survey of Critical Wetlands in Dolores County on BLM Lands
Butler,Courtney M	Center for Science, Math and Technology Education	UCAR-NCAR-Nat Ctr for Atmospheric Res	Digital Water Education Library

Reising,Steven C	Electrical and Computer Engineering	NSF - National Science Foundation	CAREER: Three-Dimensional Measurements of Atmospheric Water Vapor Using Miniaturized Microwave Radiometers
Poff,N LeRoy	Biology	NSF - National Science Foundation	Thermal Fragmentation & Genetic Differentiation of Fish Populations in a Riverine Landscape
Cifelli,Robert C	Atmospheric Science	NSF - National Science Foundation	Bringing CoCoRaHS to the Central Great Plains: An Informal Science Education Project for Rural Communities
Knapp,Alan Keith	Biology	Kansas State University	Belowground Responses to Warming and More Extreme Precipitation Patterns in a Grassland Ecosystem
Demott,Paul J	Atmospheric Science	Battelle Memorial Institute	Ice Nuclei Measurements in the Mixed Phase Arctic Clouds Experiment
Wilkins-Wells,John Reese	Sociology	DOI-Bureau of Reclamation	Pilot Water Banking Study
Salas,Jose D	Civil Engineering	DOI-Bureau of Reclamation	Preliminary Research for the Development of Stochastic Hydrology for the Colorado River System
Spraker,Terry R	Microbiology, Immunology and Pathology	DOI-NPS-National Park Service	Technical Assistance to the National Park Service Wildlife Health Team
Farmer,David A	Colorado State Forest Service	DOI-NPS-National Park Service	WUI Ed Coor. NPS
Loftis,Jim C	Civil Engineering	DOI-NPS-National Park Service	Guidance & Technical Support to the Natural Resource Program Center of the National Park Service Incorporating ...
Loftis,Jim C	Civil Engineering	DOI-NPS-National Park Service	Continuation of Inventorying & Monitoring Natural Resources Status & Trends in the National Park System
Loftis,Jim C	Civil Engineering	DOI-NPS-National Park Service	Continuation of Inventorying & Monitoring Natural Resources Status & Trends in the National Park System
Loftis,Jim C	Civil Engineering	DOI-NPS-National Park Service	Development of Natural Resource Education & Outreach Programs & Techniques
Sanders,Thomas G	Civil Engineering	DOI-NPS-National Park Service	Preservaton, Protection, & Management of Water Aquatic Resources of Units of the National Park System
Roesner,Larry A	Civil Engineering	Water Environment Research Foundation	Long-term Study on Landscape Irrigation Using Household Graywater
Jacobi,William R	Bioagricultural Sciences and Pest Management	Denver Water Department	Water Usage by Cottonwood Trees
Gates,Timothy K	Civil Engineering	Lower AR Valley Water Conservancy Dist.	Monitoring and Modeling Toward Optimal Management of the Lower Arkansas River
Grigg,Neil S	Civil Engineering	Agencia Colombiana de Cooperacion Intl	Technical Assistance for Colombian Water Law
Cifelli,Robert C	Atmospheric Science	Various Non-Profit" Sponsors"	CoCoRaHS Charter Members Cost Share
Macdonald,Lee H	Forest Rangeland Watershed Stewardship	USDA-USFS-Forest Research	Monitoring, Assessing, & Predicting Sediment Production, Sediment Deliver, & Cumulative Watershed Efforts in…
Ramirez,Jorge A	Civil Engineering	USDA-USFS-Rocky Mtn. Rsrch Station - CO	The system-wide water quality impacts of watershed disturbance
Smith,Freeman M	Forest Rangeland Watershed Stewardship	USDA-USFS-Rocky Mtn. Rsrch Station - CO	Mapping Snow Properties: A Multi-Scale Approach
Shaw,Robert B	CEMML	USDA-USFS-Rocky Mtn. Rsrch Station - CO	Support for Fort McCoy Fisheries Program

RESEARCH AWARDS

UNIVERSITY OF COLORADO, BOULDER COLORADO
Awards for September-October, 2004

PI	Dept	Sponsor	Title
Armstrong, Richard	Cooperative Institute For Research In Environmental Sciences	National Aeronautics and Space Administration; Goddard Space Flight Center	Development of an Internally Consistent Multi-Sensor, Multi-Platform Long-Term Series of Global Snow Cover Using Heritage and EOS-ERA Data
Armstrong, Richard	Cooperative Institute For Research In Environmental Sciences	National Aeronautics and Space Administration; Goddard Space Flight Center	Development of an Internally Consistent Multi-Sensor, Multi-Platform Long-Term Series of Global Snow Cover Using Heritage and EOS-ERA Data
Armstrong, Richard and Roger Barry and Mark Dyurgerov	Cooperative Institute For Research In Environmental Sciences; Geography; Institute of Arctic and Alpine Research	National Aeronautics and Space Administration; Goddard Space Flight Center	Global Land Ice Measurements From Space (GLIMS) Core Functions: Populating and Mining The GLIMS Glacier Database to Assess Glacier Change with EOS Sensors
Clark, Martyn	Cooperative Institute For Research In Environmental Sciences	National Oceanic and Atmospheric Administration	Improving Operational Streamflow Forecasting In The Colorado River Basin
Clark, Martyn	Cooperative Institute For Research In Environmental Sciences	National Oceanic and Atmospheric Administration	Development Of Operational Hydrologic Forecasting Capabilities
Kingsmill, David	Cooperative Institute For Research In Environmental Sciences	National Aeronautics and Space Administration; Goddard Space Flight Center	Microphysical Validation For NASA Precipitation Measurement: The Transition From TRMM to GPM
Pampel, Fred	Graduate School	U.S. Geological Survey	Provide Research And Research Support Services In Areas Of Hydrology and Water Resources
Stroeve, Julienne	Cooperative Institute For Research In Environmental Sciences	National Aeronautics and Space Administration; Goddard Space Flight Center	Satellite Studies of Arctic Climate Connections Between Sea Ice, the Greenland Ice Sheet, the Adjacent Land and Atmospheric Cloud Properties
Weaver, Ronald and Vince Troisi	Cooperative Institute For Research In Environmental Research	National Aeronautics and Space Administration; Goddard Space Flight Center	Snow and Ice Distributed Active Archive Center
Weaver, Ronald and Vince Troisi	Cooperative Institute For Research In Environmental Research	National Aeronautics and Space Administration; Goddard Space Flight Center	Snow and Ice Distribute Active Archive Center
Zagona, Edith	CE&A Advanced Decision Support for Water and Environ Systems	Dept of Interior: Bureau of Reclamation	USBRLC- Riverware R & D and Tech Transfer
Zagona, Edith	CE&A Advanced Decision Support for Water and Environ Systems	Dept of Interior: Bureau of Reclamation	USBRLC- Riverware R & D and Tech Transfer
Zagona, Edith	CE&A Advanced Decision Support for Water and Environ Systems	Dept of Interior: Bureau of Reclamation	USBR – Truckee Basin S & T
Zagona, Edith	CE&A Advanced Decision Support for Water and Environ Systems	Dept of Interior: Bureau of Reclamation	USBR S&T GPAT
Zagona, Edith	**CE&A Advanced Decision Support for Water and Environ Systems**	**Dept of Interior: Bureau of Reclamation**	**Riverware Model System Improvement – Upper Colorado Model Development**

Zagona, Edith	**CE&A Advanced Decision Support for Water and Environ Systems**	**Dept of Interior: Bureau of Reclamation**	**USBR Eastern Colorado Area Office HDB**
Zagona, Edith	**CE&A Advanced Decision Support for Water and Environ Systems**	**Dept of Interior: Bureau of Reclamation**	**Riverware Model System Improvement – Upper Colorado Model Development**
Ryan, Joseph and Limerick, Patricia	**Civil, Environmental, and Arch Engin History**	**Environmental Protection Agency**	**Center of the American West Acid Mine Drainage Workshop**
Lewis, William	**Coop Inst for Research in Environmental Sciences in Eco and Evolutionary Bio**	**Environmental Protection Agency**	**Refinement of Nutrient Criteria for Montane Streams and Lakes in Colorado**

CALENDAR

2005	**2005**
Jan. 18	**Endangered Species / Three State Agreement.** Denver, CO. For more information go to: http://www.awra.org/state/colorado/ .
Jan. 27-28	**Colorado Water Congress 47th Annual Convention.** Denver, CO. For more information go to: www.cowatercongress.org, or phone 303/837-0812, or email macravey@cowatercongress.org .
Feb. 11-12	**Storm Water Detention System Design.** University of Colorado at Denver Continuing Engineering Education Program. For more information go to: www.cudenver.edu./engineering/cont .
Feb. 14-15	**2nd National Water Resources Policy Dialogue.** Tucson, AZ. For more information go to: http://www.awra.org .
Feb. 22	**Bureau of Rec. Projects in Colorado.** Denver, CO. For more information go to http://www.awra.org/state/colorado/ .
Feb. 23	**Lower South Platte Forum.** Sterling, CO. For more information contact Joel Schneekloth, jschneek@coop.ext.colostate.edu .
Mar. 21-25	**Applied Environmental Statistics** ID # 05-1 with Denis Helsel and Ed Gilroy. Colorado School of Mines. Golden, CO. For information go to http://typhoon.mines.edu/short-course/.
Mar. 29	**Fountain Creek USACE Watershed Study.** Denver, CO. For more information go to: http://www.awra.org/state/colorado/ .
Mar. 30	**Water District Management and Governance.** San Diego, CA. For more information go to: http://www.uscid.org/05idconf.html
Apr.	**Annual Symposium of American Water Resources Association Colorado State Section.** For more information go to: http://www.awra.org/state/colorado/ .
Apr. 7-8	**Water Management and Policy in the Great Plains: Implications of Drought and Climate Change, Second Annual Water Law, Policy, and Science Conference.** University of Nebraska-Lincoln. Lincoln, NE. For more information go http://snr.unl.edu/waterconference/ .
May 19-20	**Urban Flood Channel Design and Culvert Hydraulics.** University of Colorado at Denver Continuing Engineering Education Program. For more information go to: www.cudenver.edu./engineering/cont .
May 24	**Scholarship recipient presentations of American Water Resources Association Colorado State Section.** Denver, CO. For more information go to: http://www.awra.org/state/colorado/ .
Aug. 25-26	**Colorado Water Congress 2005 Summer Convention.** Steamboat Springs, CO. For more information go to: www.cowatercongress.org, or phone 303/837-0812, or email macravey@cowatercongress.org .
Oct. 13-15	**MODFLOW: Introduction to Numerical Modeling** ID # 05-2 with Eileen Poeter Colorado School of Mines, Golden, CO. For more information go to: http://typhoon.mines.edu/short-course/.
Oct. 17-18	**UCODE: Universal Inversion Code for Automated Calibration** ID # 05-3 with Eileen Poeter. Colorado School of Mines, Golden, CO For more information go to: http://typhoon.mines.edu/short-course/.

Nov. 6-10	**American Water Resources Association 2005 Annual Conference.** Seattle, WA. For more information go to: http://www.awra.org/ .
Dec. 5	Call for papers: Proposals for MODFLOW and More 2006: Managing Ground-Water Systems (May 22-24, 2006). For submittal criteria go to http://typhoon.mines.edu/events/modflow2006/abstract_form.shtml.
2006	2006
Jan. 26-27	**Colorado Water Congress 48th Annual Convention.** Denver, CO. For more information go to: www.cowatercongress.org, or phone 303/837-0812, or email macravey@cowatercongress.org .
May 22-24	**MODFLOW and More 2005: Managing Ground-Water Systems**. International Ground Water Modeling Center. For more information go to http://typhoon.mines.edu/events/modflow2006/modflow2006.shtml
2007	2007
Jan. 25-26	**Colorado Water Congress 49th Annual Convention.** Denver, CO. For more information go to: www.cowatercongress.org, or phone 303/837-0812, or email macravey@cowatercongress.org .
	For more information go to: For more information contact:

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