

HEADWATERS

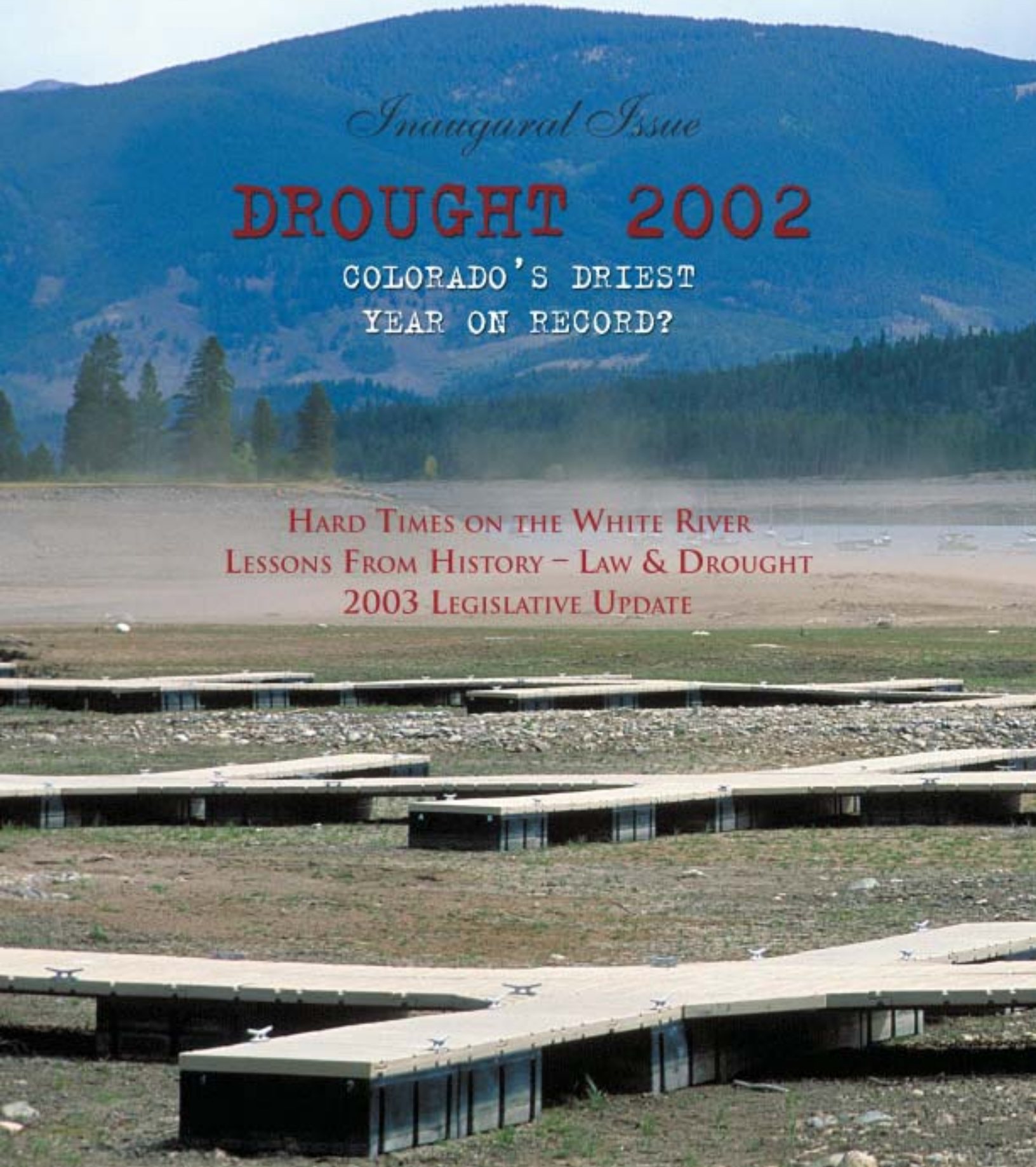
COLORADO FOUNDATION FOR WATER EDUCATION | VOL. 1, NO. 1

Inaugural Issue

DROUGHT 2002

COLORADO'S DRIEST
YEAR ON RECORD?

HARD TIMES ON THE WHITE RIVER
LESSONS FROM HISTORY – LAW & DROUGHT
2003 LEGISLATIVE UPDATE



HEADWATERS

Headwaters magazine is designed to provide Colorado citizens with balanced and accurate information on a variety of subjects related to water resources.

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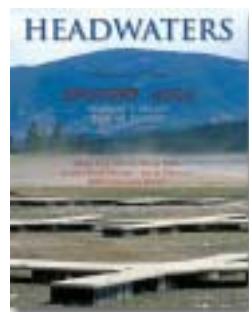


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Page 10 – Forest Nelson and others used a combination of high-tech stream gauging equipment and common sense to help their community through the hard times.



About the Cover
Photographed in August 2002, high winds kick up dust clouds on the exposed bottom of Dillon Reservoir. Marina platforms lie high and dry on the reservoir floor. Photo by William Green.

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MISSION STATEMENT

The mission of the Colorado Foundation for Water Education is to promote better understanding of water resources through education and information. The Foundation does not take an advocacy position on any water issue.

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LETTER – FROM THE PRESIDENT



WELCOME FROM DIANE HOPPE INAUGURAL ISSUE, HEADWATERS MAGAZINE

Welcome, readers, to this inaugural issue of *Headwaters* magazine published by the Colorado Foundation for Water Education. I certainly hope you enjoy it.

The Colorado Foundation for Water Education was established legislatively by the Colorado General Assembly in 2002, during one of the state's worst droughts. The purpose and mission of the Foundation is to promote a better understanding of water issues through educational opportunities and resources, so Colorado citizens will understand water as a limited resource and make informed decisions. The Foundation does not take an advocacy position on any water issue.

Headwaters magazine is designed to provide up-to-date information on recent events and fundamental concerns related to Colorado's water resources. Growth, legal developments, drought, floods and the use of water in the everyday lives of Coloradans are some of the very public and personal themes we will explore in every quarterly issue.

The feature of this inaugural issue is drought, a very timely topic in the fall of 2003. In this issue we recount the 2002 drought – its severity and what it says about our vulnerability to future droughts. Thank you, Roger Pielke, our State Climatologist, for presenting us with important information on just how little precipitation we did receive during last year's withering dry spell. Reagan Waskom, Colorado State University, provides us with critical information on how

severe drought conditions in 2002 had significant impacts on the state's economy and natural resources. And, as Justice Hobbs recounts, drought events have profoundly shaped our state's water laws and institutions.

Our 'Profiles' section features individuals from around the state whose lives are shaped by their relationship and dependence on our water resources. In this issue we highlight residents from the small town of Meeker who all managed to "give a little bit" so that the community as a whole could survive in tough times.

In our special section 'Voices' we ask writers and poets to submit their original work. Thank you, Mary Crow, Colorado's Poet Laureate, for creating the poem "Colorado Drought" especially for this inaugural issue of the magazine. Also, thanks to Katie Post, for sharing your River Of Words prize winning poem, "I Am the Headwaters."

I hope you will consider becoming a member of the Foundation and subscribing to *Headwaters* magazine.

The Foundation for Water Education is a non-profit organization, and proceeds from your membership or subscription will be used to fund additional water education efforts.

Thank you!

Diane Hoppe

State Representative (R-Sterling)
& President, CFWE



Eric Wumow

Flat Tops Wilderness,
Upper Colorado River Basin

"Growth, legal developments, drought, floods and the use of water in the everyday lives of Coloradans are some of the very public and personal themes we will explore in every quarterly issue."

ESTIMATED WATER USE IN THE UNITED STATES 2000

Every five years the U.S. Geological Survey publishes a report summarizing how much water is withdrawn from our nation's rivers and groundwater aquifers for drinking water, irrigation, industry and other purposes. The 2000 report is scheduled for release this October.

Water withdrawal measurements are compiled from national, state, and county records. Withdrawals refer to the amount of water diverted from streams or pumped from groundwater aquifers. In years past the report also included data on consumptive use of water. Consumptive use refers to water consumed (for example by growing plants or evaporation) and not returned to the surface or ground water system. Consumptive use information is important because it is used to measure water



rights if they are changed to another type of use, or when developing augmentation plans. However, lack of funding and other constraints have forced the USGS to exclude these statistics.

Due for release in October 2003, the report will be posted on the USGS website (water.usgs.gov/watuse) prior to distribution of print versions.

ALGAE MAY BE FIRST ALERT TO WATER SUPPLY ATTACK

KNOXVILLE, Tenn (AP) – Researchers from the University of Tennessee and Oak Ridge National Laboratory may have found a way to use algae to protect America's water supplies from accidental contamination or terrorist attack.

The idea behind the system is to monitor the health of the algae in much the same way that miners once used canaries to test for the presence of gas in coal mines. Algae is present in all bodies of water, and basic chemical tests can detect even small changes in the algae's health that could indicate a chemical attack.

"Unlike other biosensor technology where the sensors wear out, no such limitation is imposed here," said Dr. Eli Greenbaum, who worked with fellow researchers Charlene A. Sanders and Miguel Rodriguez Jr. to create the process, called AquaSentinel. "The algae is an integral part of the environment we're trying to protect." A full automated prototype system should be commercially available within two years.



EPA FUNDS AVAILABLE TO SUPPORT PUBLIC AWARENESS ON WATER EFFICIENCY

Washington, D.C. -- The U.S. Environmental Protection Agency's Assistant Administrator for Water, G. Tracy Mehan, III, recently announced that the Agency is planning a national program to promote water-efficient products to consumers. Water use has gained national attention with more than 36 states expecting to experience water shortages over the next ten years even without drought conditions. A total of \$400,000 has been made available in the 2003 Budget to support the program.

One of the tools under consideration is a water efficient product labeling program that is based on EPA's highly successful Energy Star program, a government-backed program to protect the environment through superior energy efficiency.

As a first step, the EPA will hold a series of stakeholder meetings, the first one scheduled for Oct. 9, 2003 in Washington, D.C., to develop opportunities to promote water efficiency in the residential, commercial and industrial sectors.

WORLD WATER MONITORING DAY: OCTOBER 18, 2003

In celebration of the 31st anniversary of the signing of the Clean Water Act, America's Clean Water Foundation and the International Water Association are promoting World Water Monitoring Day.

From September 18 to October 18, local volunteer monitoring groups and watershed groups are encouraged to collect samples, clean debris and restore vegetation along waterways. Water quality monitoring results will then be entered into an international database. Check the organizers website (www.watermonitoringday.org) for events in your area, or plan your own monitoring event and post it on their site.



2003 LEGISLATIVE UPDATE

By CFWE Staff

The Colorado General Assembly opened its 2003 Session in the fourth year of a record drought. This session produced a variety of significant changes to Colorado water law – adding new laws and increasing the law's flexibility. Major legal changes involved:

(1) Authorizing the State Engineer to approve:

- Establishment of water banks throughout the state (House Bill 1318);
- Temporary changes of water rights (HB 1334);
- Substitute supply plans (HB 1334); and,
- Emergency water supply plans to aid drought-stricken farmers and cities (HB 1334).

(2) Allowing loans of water to the Colorado Water Conservation Board to help keep water in the river (i.e., instream flows) during drought emergencies (HB 1320);

(3) Prohibiting new residential covenants that restrict the use of drought-tolerant landscaping (HB 1001);

(4) Authorizing conservation easements for water rights, allowing owners of water rights to keep that water in use for open space, wetlands, recreation, ecological diversity, or farming (HB 1008);

(5) Providing financial mitigation to counties that suffer tax revenue losses as a result of the transfer of water used for agriculture to other uses in other counties (Senate Bill 115);

(6) Allowing interruptible water leases permitting farmers to retain agricultural water rights, while leasing water to cities during periods of drought emergency (HB 1334).

(7) Authorizing the Department of Local Affairs to provide technical assistance to local governments to help implement tiered water pricing with higher rates for higher water consumption (HB 1001).

While the 2003 changes to Colorado water law were significant, they do not change the state's duty to protect existing water rights from injury. Nor do they change the authority of Colorado water courts to perform their basic functions.

The General Assembly also concentrat-

ed on improving Colorado's ability to meet its water supply needs. It did this by:

(1) Directing the Colorado Water Conservation Board to conduct a statewide assessment of water supply, demand, and development strategies (SB 110). This assessment is called the Statewide Water Supply Initiative (SWSI) and is due for completion by November 2004. Several requirements are built into any recommendations coming out of this study:

- Proposed SWSI water project alternatives must address social, economic, and environmental impacts; and,
- Solutions to water supply needs should be developed using a consensus-building approach.

(2) Directing the Colorado Water Resources and Power Development Authority to proceed with development and financing for projects requested by local government agencies, such as water conservancy or conservation districts and cities, as prioritized by the Colorado Water Conservation Board by means of the Statewide Water Supply Initiative (SB 236).

Further, the Colorado Water Resources and Power Development Authority need not obtain approval from the Colorado Water Conservation Board or the General Assembly to provide revenue bond financing for small projects proposed by government agencies requesting less than \$500 million dollars (increased from \$100 million).

(3) Allocating \$500 thousand dollars for a feasibility study of a water supply project commonly known as the "Big Straw" (SB 110). This project would assist in developing Colorado's remaining water allowed under the Colorado River Compact to help meet the water supply needs of the Front Range and Western Slope. The proposed project would divert water from the Colorado River below Grand Junction.

(4) Placing before the voters a measure known as "Referendum A" which would issue \$2 billion dollars in revenue bonds to meet Colorado's water supply needs through projects recommended by the Colorado Water Conservation Board and approved by the Governor (SB 236).

At least one project must have a 2005 start date.

If voters approve the referendum, the Colorado Water Conservation Board could provide revenue bond financing for water projects developed by private corporations as well as government agencies, or a combination of the two (Colorado Water Resources and Power Development Authority financing is restricted to governmental entities).

Up to \$100 million dollars of the revenue bonds would be earmarked for rehabilitating existing facilities or for conservation measures that do not involve new storage (SB 110). In addition, the General Assembly has declared that a portion of any bond proceeds, as determined by the Colorado Water Conservation Board, should be expended for projects that provide benefits to fish and wildlife, recreation, the environment, and fair mitigation for the water's basin of origin.

A **conservation easement** is a legal agreement made by a property owner to restrict the type and amount of development on their property. The conservation easement is held by a public agency or a nonprofit organization such as a local land trust.

Revenue Bonds are government-issued debt securities which have a defined revenue source to repay both principal and interest. Revenues come from the funded activity or project, not from taxes. Revenue bonds for water projects are typically paid back by water user fees.

Water conservancy districts are local government agencies originally created to construct, pay for, and operate water projects. There are 51 water conservancy districts in Colorado.

Water conservation districts are regional policy-making bodies created by the State Legislature to protect and develop the waters of the state. Conservation districts have the power to issue bonds and levy taxes and user fees.

Lessons from History: HOW DROUGHT SHAPES COLORADO WATER LAW AND POLICY

By Greg Hobbs, Jr.



Dust storm, Baca County, 1933. Photo courtesy of the Western History Collection of the Denver Public Library.

As tree-ring and archeological evidence shows, extended droughts are frequent visitors to the Rocky Mountain region. In the short term, Coloradans are confronted with withered crops and dry stream channels. Yet in the long term, drought's lasting legacy is written in the history of Colorado's water laws and institutions.

NEW SETTLERS IN AN ARID CLIMATE

Life in Colorado's arid environment quickly necessitated a new set of laws governing water use. In 1872, the Territorial Supreme Court moved Colorado water law in an entirely new direction, allowing diversions from the river and construction of ditches across public and private land. Water in Colorado became a public resource available for use by all private individuals and public agencies.

RECLAMATION ERA

The years 1893-1905 witnessed multi-year cycles of severe drought in many areas of the West. In southwestern Colorado, 1899-1902 saw four consecutive years with less than 80 percent of average precipitation. Faced with an unreliable water supply, the West's largely agrarian society struggled to remain productive. In 1897 and 1899, Colorado adopted its first statutes allowing exchanges of water and changes of water

rights between agricultural, municipal and other users.

To promote continued settlement and development of the western United States, Congress passed the 1902 Reclamation Act, creating the Bureau of Reclamation. Today, the Bureau of Reclamation is best known for its construction of more than 600 dams, power plants, and canals across the 17 western states.

One of the first authorized Bureau projects in Colorado was the Gunnison (Uncompahgre) Project in western Colorado. The Uncompahgre Project, opened in 1909, now irrigates some 80,000 acres from Montrose to Delta. The Gunnison Tunnel made the project possible, diverting Gunnison River water through 5.8 miles of solid rock into the Uncompahgre Valley.

ROOSEVELT'S NEW DEAL AND WATER SUPPLY PROJECTS TO SOOTHE THE PARCHED WEST

In October 1929, the Wall Street crash launched the nation into the worst depression in American history. Further intensifying the economic crisis, the most widespread and longest lasting drought in Colorado's recorded history dragged on from 1930-1940, famously known as the "Dust Bowl Years." Severe drought peaked in 1934 and 1935, culminating in 1939 with one of the driest years in

recorded history, especially along the Front Range.

By March 1933, desperate to bolster the failing economy, Franklin D. Roosevelt called a special session of Congress to develop a series of programs known as the "New Deal." As part of these efforts, Congress gave the newly-created Public Works Administration \$3.3 billion for construction of public works projects, including reservoirs.

By 1937, Colorado Senator Alva B. Adams and Congressman Ed Taylor helped secure reclamation funding from the Interior Department to construct, among others, the Colorado-Big Thompson (CB-T) Project. One of the first of its kind to provide both agricultural and municipal water, this project tapped the headwaters of the Colorado River by boring a hole through the Continental Divide. Presently, the C-BT Project delivers over 200,000 acre-feet of water each year to northeastern Colorado for agricultural, municipal, and industrial uses, with Green Mountain Reservoir providing some 100,000 acre-feet of water annually for western slope use.

CREATION OF LOCAL AND STATEWIDE WATER MANAGEMENT AGENCIES

The Dust Bowl years motivated the Colorado State Legislature to find better ways to manage water locally. The 1937 Conservancy Law created a network of

local and statewide water management agencies known as conservancy districts. Created to construct, finance, and manage water projects, today 51 conservancy districts operate in Colorado.

At the same time, the Legislature established the Colorado River Water Conservation District, later followed by the Rio Grande, and Southwestern water conservation districts, to assist in the development of water policy. Finally, on a statewide level, the Colorado Water Conservation Board was established in 1937 to coordinate the protection and development of the state's waters.

DROUGHT IN THE 1950s

From 1950 to 1956 another drought hit the West, with some areas reporting conditions more severe than the Dust Bowl. In response, in 1956 the U.S. Congress enacted the Colorado River Storage Project Act to establish a savings account of reservoirs designed to help the Upper Colorado River Basin states (Colorado, New Mexico, Utah and Wyoming) meet their Colorado River Compact entitlements. The resulting projects – the Aspinall Unit, Navajo, Glen Canyon, Fontenelle and Flaming Gorge dams – today also provide sub-

stantial hydropower and recreational benefits.

During the dry years of the fifties, farmers faced with dwindling surface water supplies looked to newly-improved groundwater well-pumping technologies to keep their crops from failing. Well use blossomed. Particularly in the lower reaches of the South Platte River Basin, wells provided some farmers with what may have seemed like insurance against further drought. But many of these wells tapped groundwater tributary to surface water. This meant that in some years, pumping of these wells diminished the water available to senior surface water rights.

Not until 1965 did the Colorado Legislature pass the Groundwater Management Act, which attempted to regulate groundwater use and well construction by requiring every new well in the state diverting tributary, nontributary, Denver Basin groundwater, or geothermal resources to have a permit.

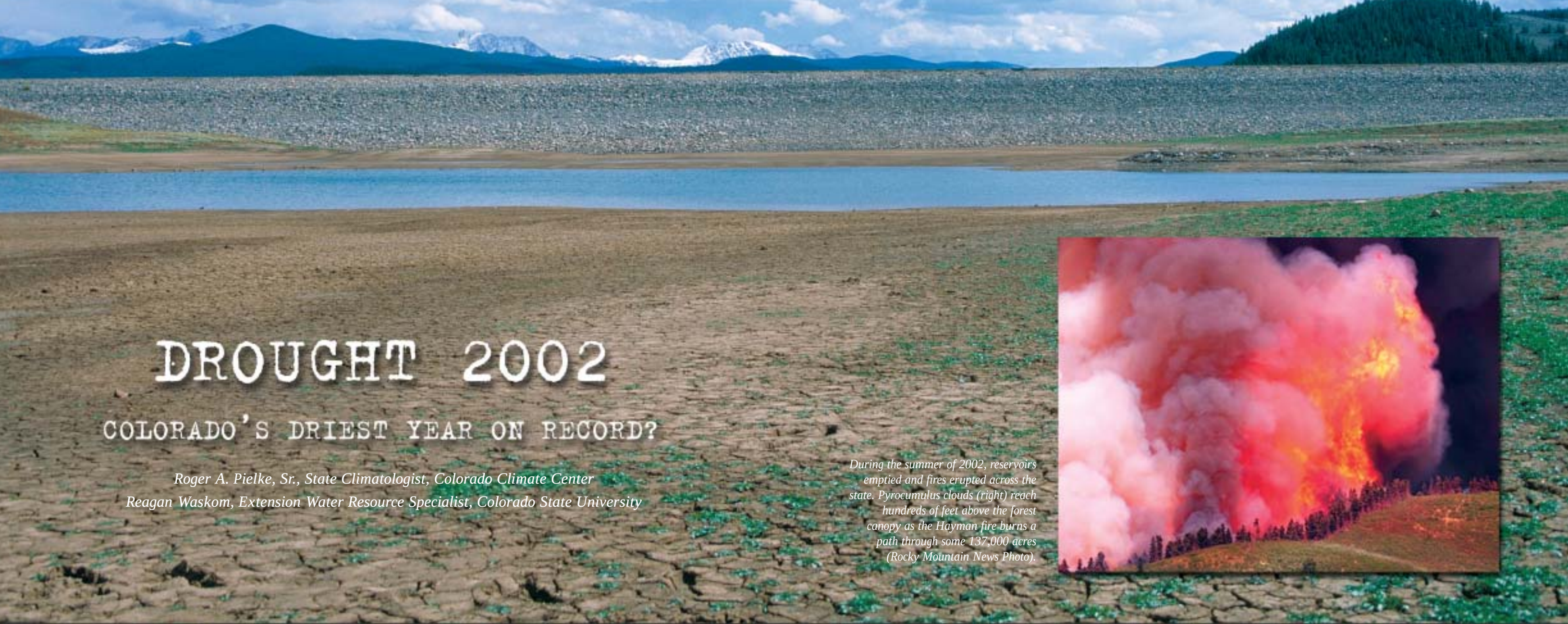
The 1950s drought also served as the worst-case scenario for municipal water supply planning in Colorado. However, the ongoing 1999-2003 drought has called into question whether this benchmark is still appropriate.

PLANNING FOR THE FUTURE

Coinciding with a sustained multi-year drought from 1974 to 1978, state lawmakers started to put efforts into planning for prolonged dry cycles. By 1981, Colorado initiated drought planning efforts at the state and local level incorporating monitoring, impact assessment, response, and mitigation systems. Colorado's "Drought Response Plan" came out of this dry cycle, as well as the formation of the "Water Availability Task Force" which continues to meet quarterly. These plans and organizations became particularly important in the year 2002, as stream flows hit record low levels.

It is still too early to say when the current drought will end, or how it will impact Colorado's current water law and policy. Significant new water legislation in 2003 has already developed some responses. Yet looking at historical trends reminds us that we do not operate in a vacuum, and that our ancestors wrestled with some of the same unknowns and challenges. Understanding what they did well and what they did poorly can serve as a useful tool for informing ourselves for the future.

Drought Duration	Region Impacted	Policy and Legal Changes
1865-1872	Statewide	1872: Colorado Territorial Supreme Court announces basic water law principles of water scarcity and public access to water sources for beneficial use
1890-1894	Eastern Colorado	1897-99: Colorado General Assembly adopts first statutes allowing exchanges of water and changes of water rights between agricultural, municipal, and other users.
1898-1904	Southwestern Colorado	1902: Reclamation Act establishes the Bureau of Reclamation
1930-1940	Statewide	1937: General Assembly creates Water Conservancy and Conservation Districts, and the Colorado Water Conservation Board. U.S. Congress authorizes construction of the Colorado-Big Thompson Project
1950-1956	Statewide	1956: Colorado River Storage Project funds construction of Aspinall Unit, Glen Canyon, Flaming Gorge, Blue Mesa, Navajo, and Fontenelle dams 1965: Colorado Groundwater Management Act
1974-1978 1980-1981	Mountains & Western Slope	1981: Water Availability Task Force forms; Colorado Drought Response Plan developed



DROUGHT 2002

COLORADO'S DRIEST YEAR ON RECORD?

*Roger A. Pielke, Sr., State Climatologist, Colorado Climate Center
Reagan Waskom, Extension Water Resource Specialist, Colorado State University*

During the summer of 2002, reservoirs emptied and fires erupted across the state. Pyrocumulus clouds (right) reach hundreds of feet above the forest canopy as the Hayman fire burns a path through some 137,000 acres (Rocky Mountain News Photo).



The year 2002 was dry. The hot, cloudless summer of 2002 surprised many Coloradans with its relentless intensity – impacting all our lives to some degree. The three dry years preceding it had worried some, but passed unnoticed by many. Yet when our snowpack evaporated in May, reservoirs turned into dust bowls, and fires roared across the state, people started to wonder: could it get any worse?

With our complex monitoring equipment and computer analysis, this seems a simple question: was this Colorado's driest year in recorded history? The answer: it depends.

SCIENCE AND STATISTICS

Scientists read drought's signature on the landscape through precipitation data, tree rings, soil moisture, and streamflow gauges. Historical records tell us how long other droughts have lasted, their severity, and where they hit the worst.

Certainly, in 2002 reservoir storage and river runoff were at record low levels. In a normal year, Colorado rivers carry an average of some 16 million acre feet (maf) of flowing water. According to the State Engineer's office, 2002 river flows plunged to 4 maf. Even with residential watering restrictions, farmers fal-

lowing fields, and other water conservation measures across the state, some 6 maf of water had to be drained from the state's reservoirs just to keep taps flowing.

Snowmelt runoff is critical. Colorado receives over 80 percent of its water from spring snowmelt. Last year, by May 1 statewide snowpack was only 19 percent of average – a record low. At a time when the mountains usually release their moisture, huge bare patches devoid of snow sent water managers scurrying to recalculate their water supply predictions.

Scorching temperatures didn't help either. Above-average temperatures enhanced evaporation, snowmelt, and plant water uptake, exacerbating already dry conditions. The spring of 2002 saw the earliest recorded ice-off at Lake Granby and the earliest ever opening of Trail Ridge Road in Rocky Mountain National Park.

Precipitation throughout the rest of the summer was no less generous. Rainfall in June and July was little to zero in many areas of western Colorado. Eastern Colorado received some precipitation but it evaporated quickly with high temperatures. August saw precipitation levels still well below average statewide, although some areas of eastern Colorado received

some respite with several heavy rains.

No doubt the 2002 drought was bad. Minimal snowpack, baking heat, and summer monsoons that never arrived, all made 2002 the driest year ever recorded for many areas around the state. But from a statewide perspective, it wasn't the worst we've ever seen.

Although the May 1 record low snowpack of 19 percent was much discussed, in reality it was not far below the previous record low snowpack measured on May 1, 1981, which was only 21 percent of average. Daytime temperatures were not as extreme as the Dust Bowl of the 1930s when southeastern Colorado recorded highs above 110°F. However, it is the record of total precipitation for the year that tells the interesting story.

According to the state climatologist, total precipitation measurements collected across the state for the specific time period of September 2001 through August 2002 show that a majority, or some 60 percent of the representative monitoring stations selected, experienced their driest year ever recorded. However, evaluate the same data using the traditional water year calendar – October 2001 to September 2002 – and only 33 percent of those same sites reported their driest year on record.

Grand Lake, Meeker, Pueblo, Rocky Ford, and Akron all recorded their driest year ever. However, in the Grand Junction area, 2002 was only the 43rd driest ever. For Montrose it ranked 29th, Cheyenne Wells 9th, Kassler 6th, and 4th driest ever for Center and Leroy.

Although we do extract a certain amount of deep groundwater to supplement our need for municipal, agricultural, and other water uses, precipitation in the form of rain and snowfall provides the majority of the water the state uses: filling our reservoirs, sustaining our ecosystems, and making our rivers flow. What the 2002 climate record tells us is that we could have received less. Last year's precipitation deficit was not as extreme as it might be in the future or has been in the past.

WATER CRISIS

No matter how much precipitation falls within our state, another type of drought can still plunge the region into a water crisis. Called hydrologic drought, it occurs when demand exceeds supply.

Colorado's unprecedented population and development boom of the 1990s increased the state's population by some 30

percent. Lawns, golf courses, and swimming pools demanded more water.

In contrast, the farm economy stagnated. With input costs for tractors and equipment skyrocketing, intense international competition, and commodity prices that have not increased in real terms for the last 30 years, many farmers could ill afford expensive efficiency improvements to their irrigation systems. In many cases, it made better sense to sell their liquid gold to the cities.

These changes in Coloradan's land uses and lifestyles occurred during one of the longest periods of wet weather since the 1920s. From 1982 to 1997, Colorado enjoyed a string of wet springs and plentiful monsoons, while total water storage increased very little and water conservation received minimal attention.

Lulled into a sense of security by largely inexpensive and plentiful water supplies, the summer of 2002 shocked many Coloradans when they found their public swimming pools closed, their lawns and pastures brown and dusty, and their water rights so quickly reduced in priority by some of the most senior water rights in the state.

WAKE UP CALLS

With little water to go around, the

state's prior appropriation system works cruelly well – prioritizing sparse surface water deliveries from senior to junior decrees. As water levels drop, a senior water right holder will 'call' for their water. Diversions by junior users are then reduced or shut down until the senior decree is fulfilled.

In river basins across the state, calls for reservoir releases began in April and May, when reservoirs are normally filling, not releasing. Water commissioners had to dust off some of their files as calls for water went back further in the priority system than recent memory. This ended the irrigation season early for all but the most senior diverters.

The most senior call on the South Platte River came from the 1865 Farmers Independent water right. It had not been necessary to call for this water since 1967. East of the Front Range, plains reservoirs used primarily for agricultural irrigation were virtually empty by the end of August.

In southwestern Colorado, Lemon and Vallecito reservoirs were drained by August to the point where no more water could be removed without pumping. Similarly, Denver chose to completely drain its Antero Reservoir to protect its water supply system.

On the Arkansas River, historic low

flow conditions created serious water supply challenges. In an unprecedented occurrence, a more senior water right called out the City of Pueblo's emergency drought reserve water supply dating from 1874.

In the Rio Grande Basin, Water Division Engineer Steve Vandiver issued nearly 500 emergency drilling permits for farms and residences where groundwater wells, some 150 years old, went dry. The Rio Grande Water Conservation District reported a drop of 750,000 acre feet in the unconfined aquifer in the past three years, with some wells falling as much as 35 feet during the summer.

For the first time ever, none of the major reservoirs on the mainstem of the Colorado River managed to fill. As a whole, the Colorado River Basin relied on numerous cooperative agreements to make it through the year. The Shoshone Power Plant near Glenwood Springs voluntarily let some water flow by its intake structures during the spring. West Slope municipalities donated unused water where possible, and Xcel Energy donated 5,000 acre-feet of stored water. To preserve as much upper basin storage as possible, the Colorado River Water Conservation District compensated the Grand Junction utility - Redlands Water and Power - to reduce its diversions during the summer and eliminate its winter diversions.

In the Gunnison Basin, the Uncompahgre Valley Water Users Association had to call for water from the Gunnison Tunnel, curtailing water use in the Upper Gunnison Basin. The last time this call had been placed was before construction of Blue Mesa Reservoir in the 1960s.

HIT HARD

The climate record tells us that for the majority of the state, dry conditions related to last year's precipitation deficit were extreme, but not as bad as they've been in the past. This statement is perhaps most troubling when considering how hard the 2002 drought hit the state's economy. Although drought-related losses continue to accumulate, the direct economic cost to Colorado of the 2002 drought alone is estimated at \$1-1.5 billion.

Agriculture was the hardest hit, with dryland farmers and ranchers feeling the effects more than any other economic

sector in the state. A \$5.4 billion industry in the state, agriculture suffered approximately \$500 million in direct losses last year. Dry land wheat growers lost \$125 million alone as yields were less than half of average. Almost 30 percent of wheat plantings had to be abandoned as worthless. Irrigated corn production was down approximately 15 percent below average, while the dryland corn crop was almost a total loss. Hay yields were about 65 percent of the 10-year average.

High hay prices helped some, but crippled many. Feed for cattle became so expensive that many producers had no choice except to sell off their entire herd. Don Ament, Commissioner of Agriculture, estimated that 40-50 percent of breeding stock (more than 200,000 head) were sold or shipped out of state during 2002.

In the cities, the landscape and horticulture industry took the brunt of strict outdoor watering restrictions. Nurseries and landscape contractors suffered as many homeowners and businesses decided not to install new plantings. Colorado's "green industry" is a \$2.2 billion industry supplying some 40,000 jobs. Last year, turf industry representatives reported 50 percent lay-offs of seasonal employees and laborers. Denver's former mayor, Wellington Webb, stated that tree losses and replacement costs alone would exceed \$500 million.

Tourism and recreation, typically an \$8.5 billion industry in Colorado, suffered a 20-25 percent decline, as river flows slowed down to a trickle and fish struggled to survive. The rafting industry was particularly hard hit, with a 50 percent decline in total sales. Outfitter's businesses were down 45 percent, a projected \$25 million impact, while fishing licenses were down by 93,000, translating into a \$1 million loss to the Division of Wildlife.

Fire was undoubtedly the most visible and frightening aspect of the 2002 drought, with a record 4,612 wildfires burning 619,000 acres and roughly 1,000 structures. Fire suppression alone carried a \$152 million price tag. Insurance and restoration costs are estimated at an additional \$100 million.

Four of the five largest forest fires in recorded Colorado history occurred in 2002, with the record breaking 137,000 acre Hayman fire garnering the full atten-



For the first time since his grandfather homesteaded on the plains of northeast Colorado near Grover, no cows graze Frank Burnett's ranch. Drought left Burnett without adequate pasture or feed for his herd.

A \$5.4 billion industry in the state, agriculture suffered approximately \$500 million in direct losses last year.

tion of Denver residents last June. People caused so many wildfires in 2002 that for the first time in state history, the U.S. Forest Service and the Bureau of Land Management declared millions of acres of federal land off-limits to the public, while fire bans were enacted across the state.

Fish suffered as low flows caused higher stream temperatures and lower dissolved oxygen levels, putting additional stress on aquatic ecosystems. At Antero Reservoir, Division of Wildlife (DOW) officials salvaged over 10,400 trout and other fish species jeopardized by Denver Water's plans to drain the reservoir. Fish traps, seines, and electroshocking were used to capture fish for transport to nearby Elevenmile Reservoir.

In the Gunnison River above Blue Mesa Reservoir, low water levels threatened the seasonal spawning of kokanee salmon. Using five gallon buckets, DOW staff and volunteers transferred over 20,000 fish to waiting trucks which transported them to the Roaring Judy Fish Hatchery. Similar stories, including rescue of isolated populations of threatened and endangered native fish, abound through the state. Other stream reaches were not so lucky, and many fish and other aquatic life were lost due to low

flows and high water temperatures.

LEARNING AND CHANGE

Although providing just a brief snapshot of the region's history, Coloradans have been collecting climate measurements of our frequent drought periods for more than 100 years. Some of the driest conditions statewide occurred in 1894, 1910-11, 1924-25, 1935, 1953, 1977, and now 2002.

The big droughts of the past prompted significant changes in water management, policy, land use, and economic growth. This drought will be no different, although it is too soon to declare the drought over, or how we have changed.

Clearly the dry year of 2002 was severe, but not unprecedented.

Historic river calls, startling economic costs, and significant environmental impacts reflect the stresses on our resources caused by ever increasing water demands. Near the limits of our natural supplies and legal entitlements, Coloradans are increasingly vulnerable to extreme drought cycles. And no matter how much precipitation falls within our state or how much groundwater we pump, when demand exceeds supply, we can still find ourselves in a water crisis. 



Dillon Reservoir photographed in August 2002 (left) and August 2003 (right). Dillon is the largest water storage facility in the Denver Water system.



Recreation-related income provides a vital piece of the Meeker area economy. Some area ranchers lease part of their property to the Colorado Division of Wildlife for public fishing access along the White River.

MAKING IT THROUGH HARD TIMES

*By Dan MacArthur
Photographs by Cynthia Hunter*



The Miller Creek Ditch headgate regulates the diversion of White River water.

In a good year, you can stand on the bridge just north of the town of Meeker and watch the clear cold waters of the White River gurggle downstream. Originating in the pristine high country of the Flat Tops Wilderness Area, the river flows through the White River National Forest and meanders through Meeker as it makes

its way west into Utah. Like many small Colorado communities, this close-knit town of 2,600 relies heavily on agriculture and recreation to support its rural economy. White River flows provide the irrigation diversions and high-quality fisheries to keep the community thriving.

In the midst of several dry years, the intensely dry summer of 2002 reduced the White River to a trickle in some stretches. Local ranchers watched hay fields turn brown as yields plummeted by a third and prices doubled to over \$150 a ton. At the same time, state wildlife officials feared for the survival of the rainbow and cutthroat trout prevalent through that stretch of river, and threatened by lack of water and rising temperatures in what little water remained.

The trouble started early. As spring approached, state water officials were already sounding the alarm that unless the skies opened up, empty reservoirs were going to make this a record dry summer. The citizens of Meeker braced themselves for what was looking like a parched and dusty year.

In mid-May, things went from bad to worse when a quarter-mile section of the Miller Creek Ditch, one of the main irrigation diversion ditches in the area, collapsed – blocking the channel

and creating an unstable slope prone to further landslides. Costly and complex repairs prevented the ditch from delivering water until June. Having missed the drought's half-hearted version of spring runoff, and holding water rights junior (lower in priority) to their downstream neighbors, Miller Creek Ditch irrigators were looking at the potential of little or no water available for their fields.

That's when David Smith and officers of the two other major ditch companies intervened. Meeting with water commissioner Bill Dunham, they agreed to reduce their more senior downstream diversions long enough for Miller Creek shareholders to start slaking the thirst of their failing fields.

"None of us knew how little water there would be," said Smith, a third-generation rancher who serves as president of the White River Highland Ditch Company. "Cooperation was the main theme, and we tried to get everybody to survive," Smith explained while shepherding his well-worn Jeep on a whirlwind tour of the irrigation system west of town. Strong and compact, he remains surprisingly scrappy for a 72-year-old who just endured quintuple heart bypass surgery. His modest manner also disguises his encyclopedic understanding of water. Smith



Dan Prenzlöw (above), area wildlife manager for the Division of Wildlife, knew the White River would experience a major fish kill unless they could find more water. Local irrigation company president Dan McGraw, with his family (right), cooperated with other local ditch officials to help keep the fish, such as the white fish (opposite page), alive.



has been a member of the Colorado Water Conservation Board for more than two decades and the Colorado River Water Conservation District Board for a dozen years.

"The whole idea was to cut back our diversions together, and not get into a water rights fight," said Oak Ridge Ditch Company president Dave McGraw. He and his family ranch and raise purebred Angus and Gelbvieh cattle on 1,500 acres. "We were trying to get everyone to give a little bit."

In doing so, they avoided placing a river call that would have seriously disrupted irrigation all along the river. A river call is the process whereby a senior water right holder asks the local water commissioner to find enough water to fulfill his or her decreed diversion amount by reducing or shutting down all other junior diversions.

"When a call comes on the river, everything comes apart. It's a pretty major undertaking," explained McGraw. "We did it (reduced diversions) by mutual agreement and kept the call off for a month."

"We just all got together and shared the water without any hard feelings," said Miller Creek Ditch Company president Don Hilkey. "It was just out of the goodness of their hearts that they (the other ditch companies) helped."

Although some fields were still badly

burned, "Most of these guys got irrigated before it got real touchy," explained Rio Blanco County Commissioner Forest Nelson, who is also a paint horse breeder and president of the Old Agency Ditch Company. His is one of the oldest ditches with the most senior water rights in the valley dating from the creation of the original White River Ute Indian Agency in the late 1870s.

As the summer progressed with high temperatures and no rain, the White River was slowly drying up. Nelson estimated two to three miles of the White River below the ditch diversions were on the verge of going dry. Flows plummeted to 20 cubic feet per second (cfs) from a 100 cfs average.

Under such extreme conditions, the area's normally healthy trout population was struggling to survive. Nelson leases part of his property to the Colorado Division of Wildlife (DOW) for public fishing access; he and others in the community benefit from the revenue anglers and other recreationists introduce into the local economy.

"There was basically no water," recalled McGraw, a former school board member who still coaches high school football and basketball. "We could see the fish dying."

The shallow water had dangerously warmed to nearly 70 degrees, well above the 50-55 degrees trout need to flourish.

Dan Prenzlöw, area wildlife manager for the Division of Wildlife, said it became obvious the fish would die unless there was some way of getting more water into the river.

One possible solution involved release of reservoir water owned by the DOW and stored 10 miles upstream in Lake Avery, which borders the White River National Forest. But the problem was getting it down to the fish.

That's because under Colorado water law, in times of shortage, senior water right holders can divert water before their juniors. Simply put, the local ditch companies with their more senior rights could have legally slurped up the water intended for the fish before it ever reached the threatened trout.

The Division could have attempted legal action, but Prenzlöw knew the fish would be dead before the process was complete – if it was even successful. Instead he chose the bold move of asking the ranchers to help the fish by allowing water to flow past their headgates – the same water they so badly needed to keep their operations productive.

Prenzlöw first ran the idea by Smith. When Smith expressed his support, they called a meeting with the water commissioner and other ditch company officers to see if they'd agree. "To a man, they said 'It's your water, we'll let it



"None of us knew how little water there would be," said David Smith, third-generation rancher and president of the Highland Ditch Company. As it turned out, 2002 was Meeker's driest year in recorded history.

pass," said Prenzlöw.

Getting the water to the failing fish was perhaps the community's greatest test at collaboration. White River flows had to be carefully monitored to assure the ditch companies were getting every available drop while still assuring the fish were getting sufficient water. "We worked very hard to get the water down the creek where it could be used," said Smith.

That's an understatement. An electric blue glow illuminated Smith's home every day before daybreak as he monitored stream gauge readings on his computer. Gathered by satellite and posted on a government web site by 4 a.m., the numbers showed how much water was flowing down the White River.

Within an hour he was calling his colleagues to determine how to divide the water between the ditch companies and the fish. The ditch companies in turn contacted their irrigators with the information needed to set their diversions.

Coordinating the whole effort was probably the most difficult and important part, according to McGraw. He and the others made countless phone calls each day letting irrigators know how much water was in the river so they could adjust their headgates accordingly. Those beyond the reach of a phone often were intercepted on the road or out in the

field. While it was tough maintaining contact with so many folks, McGraw considered it essential that all understood what was happening.

"They worked pretty diligently and that water did get down the river. It worked wonderfully," said Prenzlöw. "Dave Smith and all those guys were extremely helpful. I can't stress it enough."



The increased flows continued for three weeks from mid-July to early August, when the river recovered enough to once again support the fish.

"Any one of those ditches could have intercepted that water and this whole effort would have been for naught," said Smith. "But if you get them together and agree to do it, their word is good."

Smith believes people were so willing in part because of the exceptional sense of cooperation already established

while assisting the Miller Creek irrigators. "Ranchers are probably the best ecologists alive. They wanted to see those fish survive."

Reaching the agreement was no small feat in this community where water is serious business. "When it comes to water, there's no more hard-nosed people than in this country," said Smith. Nelson agreed, noting that, "When you take somebody's water, you're taking money out of their pocket."

How people deal with controversy and hardship says a lot about their attitudes toward community and their place in it. Choosing common sense over legal fights, Meeker residents managed to look beyond the confines of the state's strict water allocation system, to put together short-term solutions benefiting the whole. "Agriculture always puts things together with baling wire," said Smith. That same innovative spirit allowed diverse interests to cobble together a solution that worked to help both fish and ranchers.

Acknowledging these time-tested values of ingenuity and integrity served the Meeker community well during the drought of 2002, proving once again that even under the most adverse conditions, solutions don't always come in legal packages or inch-thick reports.

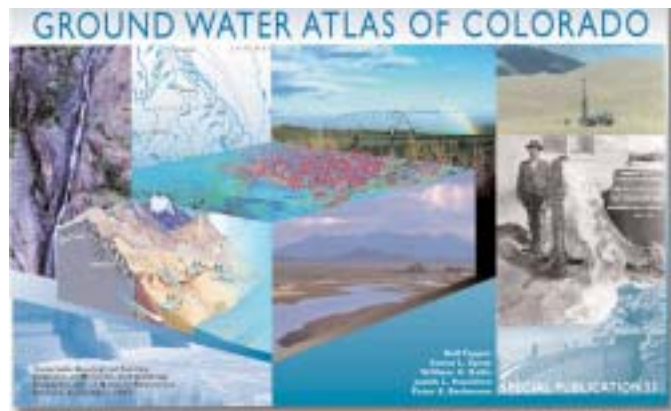
GROUND WATER ATLAS OF COLORADO

Upon initial approach the Ground Water Atlas of Colorado appears to need its own easel, like the giant dictionary at the library. Leafing through the oversized pages, the reader is in for a nice surprise. Full-color photos and attractive maps make this atlas easy to follow.

The key word to remember is atlas. There's barely a page without a map, picture, or diagram. Important features of Colorado's varied geology and hydrology are presented using a multitude of statewide and regional graphics.

Produced by the Colorado Geological Survey, this large-format book provides basic and detailed information about Colorado's ground water. While topics such as alluvial, sedimentary rock and mountainous rock aquifers comprise most of the book, sections about water law and hydrogeology help round out the information. Intended for policy makers, students, and water professionals, the atlas is easily accessible to the general public as an educational resource.

Ground Water Atlas of Colorado is available directly from the Colorado Geological Survey for \$40. Call 303.866.2611 to order, or visit their website at <http://geosurvey.state.co.us>.



WATER FOR THE ANASAZI

Forget the idea that 19th century Hispanic and Anglo settlers built the first water supply ditches and reservoirs in Colorado.

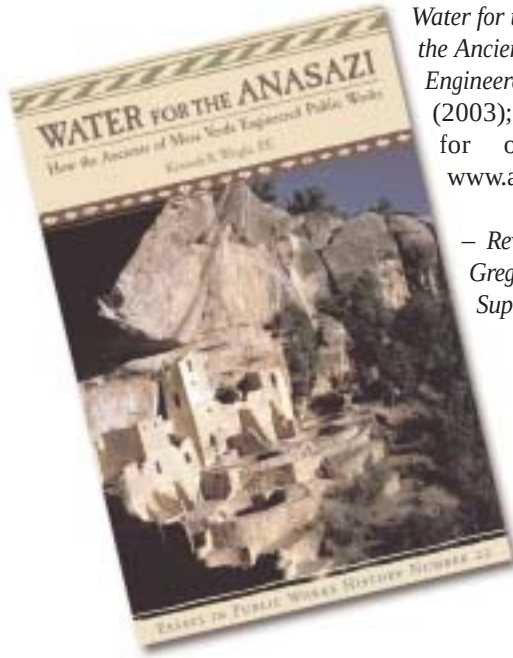
Water for the Anasazi by Kenneth Wright documents the existence of at least four reservoirs constructed by the Pueblo people of Mesa Verde beginning as early as A.D. 750.

Archeologists previously disputed whether these mound-ed-over sites were dance platforms or reservoirs. However, working with National Park Service and the Colorado Historical Society, Wright and his wife Ruth put together a team of experts in hydrology, soil science, geomorphology, ceramic analysis, and archeology to verify the true nature of these early public works structures.

Their research indicates that the Pueblo People at Mesa Verde constructed mesa and canyon reservoirs to supply drinking water. They were dry land corn farmers who knew extended droughts. To fend off starvation, they were known to keep up to two years of corn in nearby rock granaries. Now we know their strategy for survival also included careful water harvesting.

Wright compliments the Pueblo people's organizational capabilities and skill in mounting large public works with rudimentary tools in a harsh climate. At the canyon reservoir sites, archeological evidence shows they had to dig out sediment, and change diversions and canals again and again to intercept shifting stream channels.

Well-written, full of charts, maps, and photographs, Water for the Anasazi documents a compelling age-old story. Water is a public resource; its careful conservation and use requires good planning and community cooperation.



Kenneth R. Wright, P.E., *Water for the Anasazi, How the Ancestors of Mesa Verde Engineered Public Works* (2003); \$15. Available for order through www.apwa.net

— Reviewed by Justice Greg Hobbs, Colorado Supreme Court

COLORADO DROUGHT

Drier than the left husks
of last year's corn, drier than dead lichen,
air carries death to leaves,
a red dream burning stem and flower
with its flare.

Overtaken by air's fire,
the greens turn brown, then browner.
Wind sears the afternoon,
twisting the yuccas on hillcrests
while the mountains melt.

In fear of their homes,
people gather in restless circles
and the earth bakes hard.
In the hush of noon, the sun lets down
its terrible streamers.

— Mary Crow



Mary Crow

Poet Laureate of Colorado, Mary Crow created "Colorado Drought" especially for this inaugural issue of Headwaters magazine.

A teacher in the Creative Writing program at Colorado State University, her most recent book of poems is *I Have Tasted the Apple* (BOA Editions, Ltd., 1996). Over the years, she has planted more than a thousand trees and lost many to drought.

SUBMISSION GUIDELINES

We encourage submissions of original essays, non-fiction, poetry and/or photographs for our Voices department. *Headwaters* magazine publishes one to two selections of creative work in each issue.

Voices is a forum for Coloradoans to creatively express their relationship to Colorado's water resources. As a literary and artistic outlet, we are looking for well-crafted, and preferably unpublished work.

Literary submissions should not exceed 500-600 words. Longer pieces may be considered, but may require editing. Photo submissions need to include pertinent caption information.

Deadline: review on a continuing basis.
Articles or digital photos may be submitted to info@cfwe.org.
Print submissions should be mailed to:
1580 Logan Street, Suite 410
Denver, CO 80203

2002
RIVER OF WORDS POETRY CONTEST:
COLORADO WINNER

I AM THE HEADWATERS

I am the headwaters plunging, and racing down rocky
walls,
I am the river foaming, rushing over rocks worn smooth at
my touch,
I am home to the river otter, swimming playfully or
snoozing on my banks,
I am the carver of the canyons,
I am the home of the fish, small and sleek or big and fat,
I am the playground of the ducks,
I know where I am going and I will get there,
I flow slowly,
I rush swiftly,
I am the commander of the floods,
I guide the trickling streams,
I am as clear as the wind in the mountains,
I never stop my journey to the salty sea, where I tickle the
brightly colored fishes,
I am the greatest traveler in the world, if you don't believe
me try and beat me, for I am
the river.

First Prize
Katie Post, Grade 6, Logan School, Denver
Teacher: Jamie Newton

If desired, please enclose a self-addressed stamped envelope (SASE) with enough postage for us to return your materials to you.

The writer retains the copyright and, therefore, the right to resell or repack the original manuscript to another party after publication in *Headwaters* magazine. The right to republish the edited manuscript in a subsequent anthology or on the Colorado Foundation for Water Education website is retained by Colorado Foundation for Water Education.

With photographs, CFWE exercises "one-time" or "first serial" rights, both of which include the right to reprint the photo (as originally used) for marketing and promotional purposes, such as ads or on the Colorado Foundation for Water Education website.

NEW RELEASE!

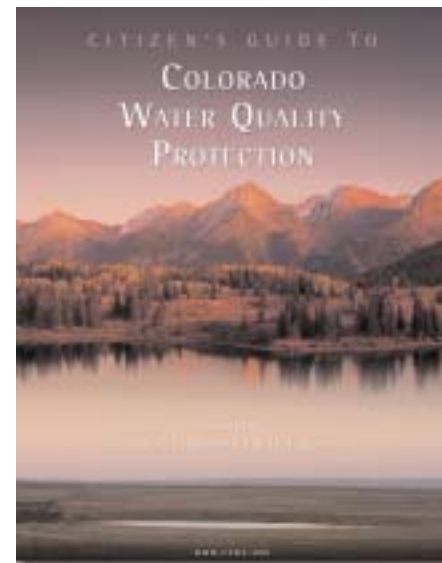
The Colorado Foundation for Water Education is pleased to announce the release of the Citizen's Guide to Colorado Water Quality Protection.

Curious how the state decides what rivers are healthy for fish, or what lakes are safe for swimming?

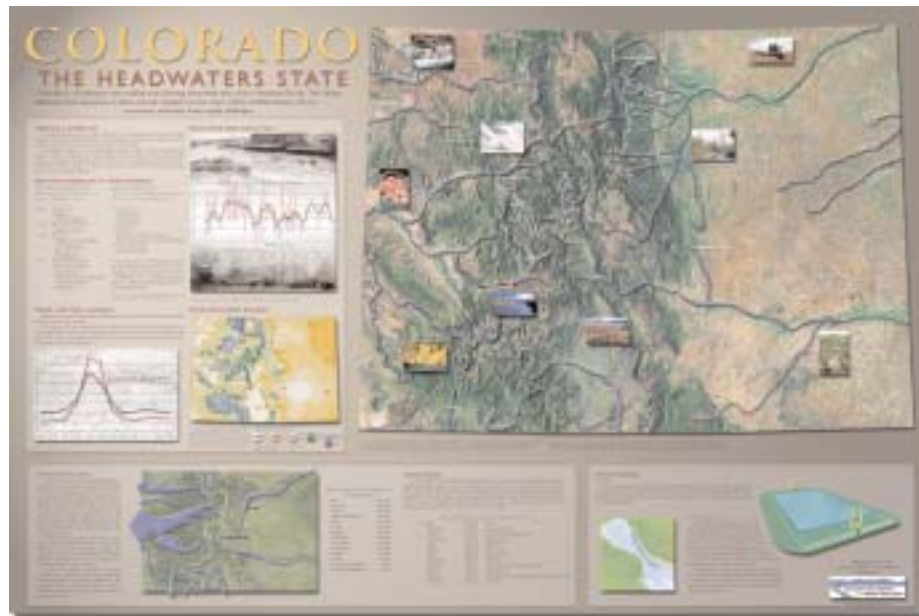
The Citizen's Guide to Colorado Water Quality Protection summarizes how national and state regulations determine "how clean is clean." Authored by Paul D. Frohardt of the Colorado Water Quality Control Commission, this 33-page booklet tackles our complex system of water quality laws and regulations.

Colorado is blessed with high quality water originating in mountain streams. In fact, over 90 percent of our lakes, reservoirs, and rivers meet or exceed their water quality goals. However, development and population growth increase water pollution risks. From the headwaters to the plains, this desk reference helps explain the risks and investigates the solutions to our water quality problems.

Booklets may be ordered online at www.cfwe.org, or by completing the order form provided.



COLORADO WATER RESOURCES POSTER



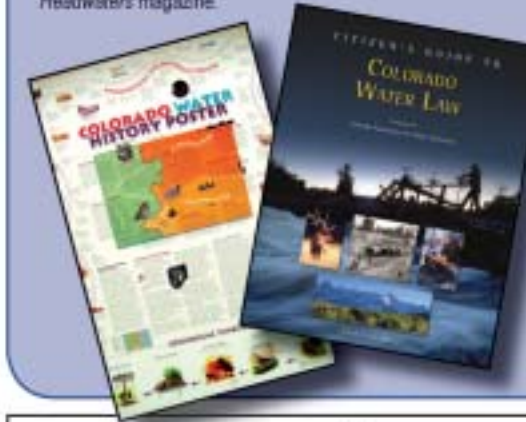
Recently revised, the *Colorado: the Headwaters State* poster provides an eye-catching summary of the major surface waters in the state, including lakes, reservoirs and rivers. Illustrations show how precipitation varies across the state, from less than 12 inches on the plains to more than 45 inches in the mountains. Other graphics trace the state's history of drought and flood over the last 100 years. Statewide water use percentages show how water is divided between agriculture, commerce and industry, municipal, and other uses. Non-consumptive uses of water such as recreation and aquatic habitat are also highlighted.

This attractive 24"x 36" wall hanging makes a useful addition to any business, school, or office – showcasing the beauty of our state and illustrating important water facts and figures in an accessible and easy-to-read format.

In honor of the inaugural issue of *Headwaters* magazine, these posters are FREE with your order (plus shipping and handling).

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Support the Foundation's efforts to provide balanced and accurate information on water resources issues. All members receive regular updates and notices on new Foundation products and events, discounts on all publications and event registrations, and FREE subscriptions to the quarterly *Headwaters* magazine.



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- 10% off registration for Foundation tours and events

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Student member (currently enrolled students only) - \$25

- FREE annual subscription to *Headwaters* magazine
- 50% off all tours and events

Your contribution is tax-deductible, in accordance with state and federal laws.

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Citizen's Guide to Colorado Water Law This 33-page full color booklet explores the basics of Colorado water law, how it has developed, and how it is applied today. Designed to be easy-to-read, yet comprehensive enough to serve as a valuable reference tool.		\$6.30 each; \$4.50 each if ordering 10 or more	\$7 each; \$5 each if ordering 10 or more	\$
Citizen's Guide to Water Quality Protection This handy desk reference is designed for those who need to know more about Colorado's complex regulatory system for protecting, maintaining, and restoring water quality. Wondering if your local creek is safe for fishing or swimming? This guide can help you find the answers.				
Headwaters Magazine Our quarterly magazine features interviews, legal updates, and in-depth articles on fundamental water resource topics. Available by subscription or free with your membership. <i>Headwaters</i> keeps you up-to-date and informed about water resource concerns throughout the state.		FREE	\$25 annually	\$
Colorado: The Headwaters State Poster Recently updated, this colorful poster provides an overview of the major lakes, reservoirs and rivers in Colorado and describes how humans and the environment rely on these variable resources.				FREE
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COLORADO
HEADWATERS

HEADWATERS OF THE
NORTH PLATTE RIVER,
MOUNT ZIRKEL
WILDERNESS AREA.
PHOTO BY ERIC
WUNROW



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