

High Country News

November 10, 1986

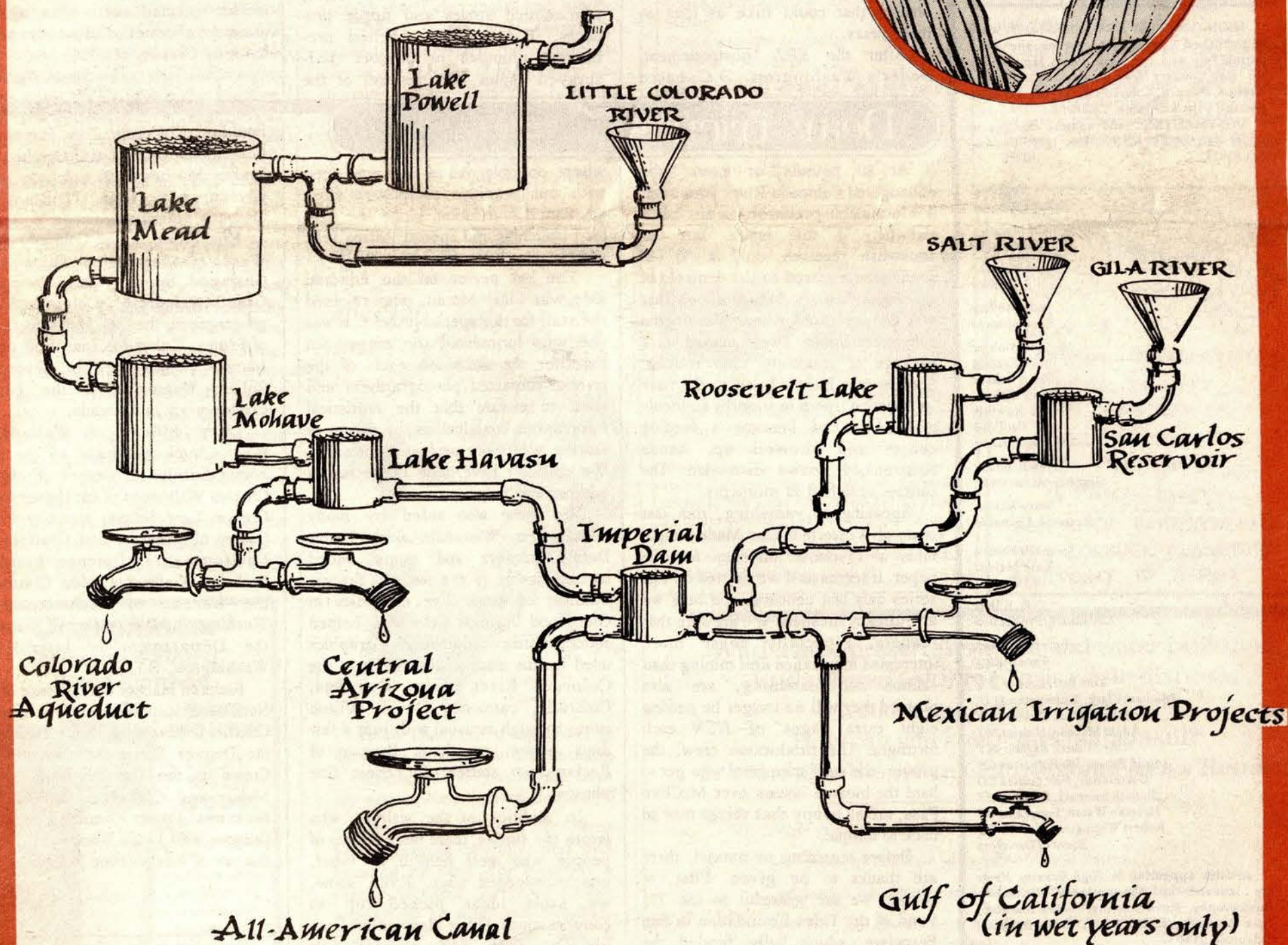
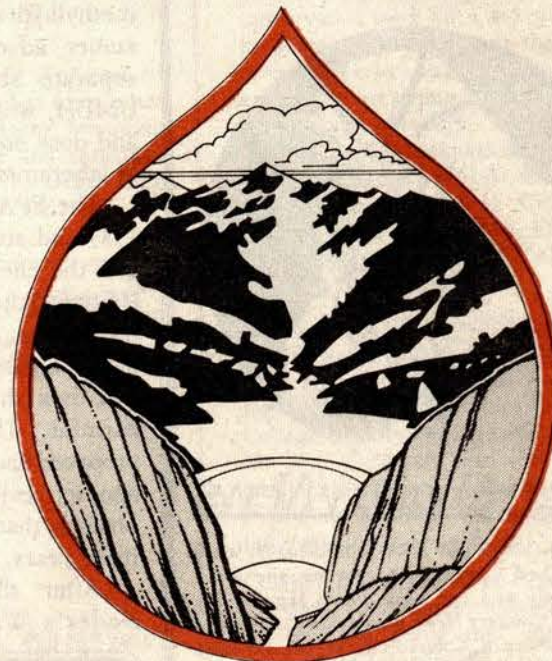
Vol. 18 No. 21

A Paper for People who Care about the West

One Dollar

The Colorado River As Plumbing

WATER



Western Water Made Simple

The last of four special issues starts on page 4

WESTERN ROUNDUP



High Country News

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Tom Bell
Editor Emeritus
Ed Marston
Publisher
Betsy Marston
Editor
Judy Moffatt
Development
Marjane Ambler
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The market eliminates possible carcinogen

Several supermarket chains have agreed to boycott apples treated with the chemical daminozide, even though the Environmental Protection Agency's refused to ban the growth-regulator.

Daminozide, trade-named Alar, makes apples shiny and firm, delays ripening and prolongs shelf life. Although Alar is relatively harmless by itself, when heated or processed it produces a carcinogenic by-product called UMDH (unsymmetrical dimethylhydrazine). According to consumer advocate Ralph Nader, five separate studies have shown that UMDH, which penetrates the apples and does not wash off, causes cancer in laboratory animals.

The EPA reviewed daminozide in 1983 and announced its intentions to ban the chemical in 1985. However, Uniroyal, the company that manufactures Alar, and an EPA advisory panel challenged the validity of the test data showing daminozide to be harmful. The EPA withdrew the proposed ban in January 1986 and said another review will begin in 1987, a process that could take as long as three years.

After the EPA postponement, Nader's Washington, D.C.-based



Lorena Wade, 1912,
Paonia, Colorado

group, the Center for the Study of Responsive Law, began a campaign to get retailers to voluntarily reject Alar-tainted apples and apple products. The campaign elicited pre-harvest promises to boycott Alar-sprayed apples from several of the

nation's largest food chains, including Safeway, A & P, Giant Foods and Kroger, according to center spokesman Lou Nemeth. Cider manufacturers Tree Top, Motts, Very Fine and Red Cheek also said they would not buy apples treated with Alar. Baby-food processors Heinz, Beech Nut and Gerber have long avoided Alar because of the increased risk of cancer, Nemeth says.

The corporate decisions were made without publicity, but now Nader researchers say contaminated stock may be getting into retailers' supplies. Few retailers can afford spot checks to test for chemical residues on apples, Nemeth says, and most rely on letters of certification from growers or suppliers.

While Alar-contaminated apples may have reached the shelves this year, Nemeth doubts there will be a problem next season. Both the Washington State Apple Commission and its Michigan counterpart have advised growers against using the chemical growth-regulator, and the Massachusetts Department of Public Health enacted strict rules against using the chemical, and plans to phase it out by October of 1988.

--Steve Hinchman

Dear friends,

At 80 pounds or more, the endangered Colorado River squawfish is a formidable predator, as discussed elsewhere in this issue. But the squawfish receives only a 'B' in predation compared to the denizens of the High Country News office. That was demonstrated when Washington subscriber Susan Tweit mailed us a package of chocolate chip cookies. Staffers who hadn't been in the back 'production' room in months suddenly realized it had become a feeding center and showed up, hands outstretched, maws distended. The cookies vanished in moments.

Speaking of vanishing, this last issue of Western Water Made Simple ends a 15-month odyssey for the paper. It seems as if we started on this series only last century, and here we are, already finished. We are sure that readers, especially those more interested in grizzlies and mining than salmon and damming, are also pleased they will no longer be getting eight extra pages of HCN each fortnight. The production crew, the printer, the staff members who get to haul the bloated issues over McClure Pass, are all happy that things now go back to normal.

Before returning to normal, there are thanks to be given. First, of course, we are grateful to the 777 Fund of the Tides Foundation in San Francisco, which fully funded the proposal to produce these four special issues, and then mail them to 26,000 non-subscribers we thought might be interested in the issues.

Obtaining the sample lists fell to development director Judy Moffatt, who had the thankless job of begging, borrowing or trading them from a score or so of different organizations in regions the paper had not dealt with before. Once she had obtained the lists, it fell to circulation manager C.B. Elliott and her crew to merge the lists and scan them to remove duplicates

where possible. All of this was done with our primitive computers on a quicksand foundation, since the date for publishing the special issues kept sliding.

The key person on the editorial side was Mary Moran, who rejoined the staff for this special project. It was she who formulated the maps, put together the tables on each of the rivers, contacted photographers and tried to ensure that the statistical information contained in the scores of stories was more or less consistent. We couldn't have done these issues without her help.

We were also aided by many non-staffers. Wisconsin artist Lester Doré's artwork and maps added immeasurably to the issues. Francis Stanton of Eagle Eye Graphics in Glenwood Springs, Colorado, helped conceptualize "plumbing" graphics used in this issue's illustration of the Colorado River basin. Durango, Colorado, cartoonist David Wilson came through as usual with just a few days notice; we thank Bureau of Reclamation staffers for their fine photos.

In addition to the writers who wrote the stories, there were scores of people who were helpful in other, unacknowledged ways. From some, we stole ideas picked up in conversations. Other ideas came from articles they had written, or contributions they had made to committee meetings we attended. Some suggested people to contact for help, or sent us photos.

So we end this Dear Friends by listing those who were helpful, while apologizing to those we have omitted, and exempting everyone but ourselves from the mistakes, misconceptions and omissions: Mike Jacobs of the Grand Forks Herald in North Dakota; Denver area consultants Ben Harding and Bob Weaver; Dan Luecke of the Environmental Defense Fund in

Boulder, Colorado; Tom Havens of Colorado Springs; David Getches and Laurie Mathews of Colorado state government; John Thoreson of Montana state government;

Eric Kuhn of the Colorado River Water Conservation District in Glenwood Springs; Greg Trainor of Grand Junction, Colorado, city government; the John Hutchins family of Fruita, Colorado; Tom Wolf of the Nature Conservancy in Wyoming; Robert Wigington of the Nature Conservancy in Colorado;

Larry Mosher of Washington, D.C.; Chuck Hendricks of the U.S. Forest Service in Denver; Professor Charles Wilkinson of the University of Oregon Law School; attorney Frank Cooley of Meeker; Tom Graff of the Environmental Defense Fund in Berkeley, California; Mike Clinton of the Bureau of Reclamation in Washington, D.C.; Mitchell Snow of the Department of Interior in Washington, D.C.;

Richard Hart of the Institute of the North American West in New Mexico; Charlie Jordan and Monte Pascoe of the Denver Water Department; Bill Crews of the state of Iowa; Dulcy Mahar and Carlotta Collette at the Northwest Power Planning Council in Oregon; and Linda Woodworth of the Bureau of Reclamation in Denver.

--the staff

FILL THIS SPACE WITH YOUR ARTWORK. HCN needs line drawings for the Bulletin Board page and occasional stories. We need cartoons, too! We pay (a little) upon publication and look forward to seeing your artwork. Send it to HCN, attn. Jen Brunner, P.O. Box 1090, Paonia, CO 81428.

LETTERS

NOT DISAPPOINTED

Dear HCN,

I expected people to go berserk when I said I would dive bomb the gathering of bald eagles in Glacier Park unless the Park Service stopped helicopters from dive bombing grizzlies in the Apgar Mountains. I haven't been disappointed.

I've been called a yahoo, a crack-pot and an insane, asinine lunatic. Park assistant superintendent Alan O'Neill said the Park Service would take legal action against me.

But it's hypocritical to condemn my flights while condoning helicopter harassment of grizzlies. There's just one critical difference between what's actually happening to grizzlies and what could happen to the eagles at McDonald Creek Bridge -- you can see the eagles. You can drive to the bridge and watch them. You can't drive to the Apgars and "view" grizzlies. You have to walk seven miles. It's an extremely dangerous walk. At least 25 bears a day feast on huckleberries in the Apgars, and you'll probably bump into one of them.

Most people won't walk that far or accept that kind of risk. So until the 1980s, only a handful of people had witnessed the incredible gathering of grizzlies in the Apgars. Then Jim Kruger began taking tourists on scenic helicopter flights to see the grizzlies. He flew at tree-top level, and the griz ran like hell. People complained. Dive bombing grizzlies was wrong. Helicopters shouldn't be allowed to ruin wilderness areas. Now the Park Service has closed the only trail into the Apgars to protect bears from excessive human disturbance. Now park officials say they have "no evidence that Kruger has intentionally harassed wildlife." Of course not. Nobody can see what Kruger is doing. And the Park Service doesn't attempt to monitor Kruger from the Camas Creek Road or the road along Lake McDonald. If park officials are going to take legal action to stop my flights, shouldn't they be democratic and take action against Kruger, too?

There are three reasons why the Park Service condones Kruger's flights. First, he has a contract to do

all the park's fire and rescue work. This creates an inherent conflict of interest. Second, Kruger draws wealthy tourists to the park. Park officials are trying to increase tourism in Glacier because bureaucracies, like cancer, have a propensity for mindless, destructive growth. To a bureaucrat, it makes sense to lock a handful of hippie derelicts out of the Apgars so Kruger can haul hundreds of tourists to the same area.

Finally, Kruger flies Park Service biologist Kate Kendall in his helicopter to count the Apgar grizzlies. This is a bogus scientific study. I invite anybody with a science background to evaluate the methodology of Kendall's study and its number of uncontrolled variables. Even if the study produced meaningful data, it's wrong to count bears in a wilderness area with a helicopter.

But no one can see what Kruger and Kendall are doing so they don't care. Just for the sake of argument, however, let's say people could watch 25 grizzlies, not 200 eagles, from the McDonald Creek Bridge. Imagine the outcry if Kruger came roaring in 100 feet overhead and scattered the bears. Imagine the indignation if Kendall tried counting those bears with a helicopter. Science or not, people would be outraged. No, I didn't really plan to dive bomb eagles and tourists in Glacier. I did want people to suddenly understand the parallel, to care about the fate of the grizzly, and to urge that the official dive bombing cease.

David 'Arthur Dogmeat' Smith
Missoula, Montana

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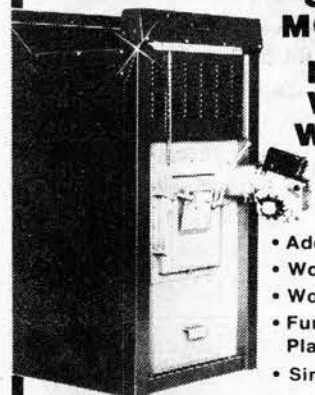
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WATER



Table of contents

5

THEY BUILT BETTER THAN THEY KNEW, by Ed Marston.

The upper Colorado River was plumbed to put water on arid lands and to generate electricity. Today those uses are in decline while recreation, urbanization and aesthetics come on strong. Through luck or forethought, the river's plumbing is proving adaptable to the new demands.

7

WITH RECKLESS IMPETUOSITY, by Rose Houk.

Human journeys of whatever length must start with a single step. The 1,400-mile-long Colorado River starts in the Rocky Mountain snowfields as a cold, thin trickle.

8

FROM ROARING RAPIDS TO TEPID PUDDLE, by Mary Moran.

By rights, a major river like the Colorado should meet the ocean as an equal, challenging and diluting the salt water with a strong flow of sweet water. The sweetening presence of the Columbia River, for example, can be detected far out into the Pacific. But the Colorado, in most years, dies a miserable inland death in the deserts of northern Mexico.

9

SHARING WATER WITH THE COLOSSUS OF THE NORTH, by Dr. José Trava.

An account of the settlement of Mexico's Mexicali Valley; the escape and subsequent recapture of the Colorado River in the early 1900s; the shattering of a made-in-the-U.S.A. hacienda; and the settlement of an international dispute over the river's saltiness.

14

THE BUREAU'S RUBE GOLDBERG MACHINES, by Paul Krza.

Rube Goldberg's cartoon machines were complex mechanisms that performed simple tasks. In the high arid plains of southwest Wyoming, the U.S. Bureau of Reclamation has built Rube Goldberg irrigation systems that keep farmers on the edge of poverty and load up the rivers with salt. Nearby, the Bureau's Fontenelle Dam has courted disaster for years. Its major achievement

has been to make its downstream neighbors nervous each high-water year.

16

WHAT SIZE SHOE DOES AN ACRE-FOOT WEAR? by Ed Quillen.

A glossary of water terms for those who wonder why water diversions are not diverting and why it is morally offensive to leave water flowing in a stream.

17

NIGHT WATCH, by Chip Rawlins.

A night-time expedition to plumb the vital signs of a mountain lake.

18

REWORKING THE COLORADO RIVER BASIN, by Ed Marston.

The large dams -- Hoover, Glen Canyon, Flaming Gorge -- and the big water diversions -- Imperial, L.A., Denver Front Range -- are in place. Despite their overwhelming physical presence, however, the Colorado River is still far from a finished form. Especially in the Upper Basin, it isn't in its dotage; it isn't even in middle age. Instead, it is being nudged by a variety of large and small forces into new configurations to meet new demands.

21

DIGGING IN THEIR HEELS, by Betsy Marston.

A conservation group fights a transmountain diversion planned for a Colorado wilderness.

22

THE SNOW ALSO RISES, by Allen Best.

In the quaint 1970s, the Colorado ski season started when enough snow fell to cover the slopes. Today, the season starts when resort managers order it to start. As a result, winter water is as important to ski areas as summer water is to farmers.

23

A COLORADO RIVER BOOKSHELF, by Peter Wild.

With the possible exception of the Mississippi, the Colorado is the most written-about river in the United States. From that large choice, here is a brief bibliography for those interested in further pursuing the river.

The writers

Ed Marston has been publisher of *High Country News* since 1983.

Jose Trava is a soil scientist in the Mexicali Valley, Mexico, and is associated with the Institute of the North American West.

Rose Houk is a freelance writer and editor who specializes in metro resource topics. She lives in Grand Junction, Colorado.

Mary Moran worked for *High Country News* in an editorial/graphics position from 1983 until early 1986. For the last six months, she has worked as a research associate for the four river basin issues.

Paul Krza lives in Rock Springs, where he is the southwest Wyoming regional correspondent for the *Casper Star-Tribune*. He pays special attention to the Bureau of Reclamation.

Ed Quillen is a freelance writer and resident of Salida, Colorado.

C.L. Rawlins, besides being HCN's poetry editor, has worked on acid deposition studies in Wyoming's Bridger Wilderness since 1985. He lives in Boulder, Wyoming.

Allen Best is a newspaper reporter for the *Vail Trail*. He formerly edited newspapers at Winter Park and Kremmling, Colorado.

Betsy Marston has been editor of *High Country News* since 1983.

Peter Wild is a professor of English at the University of Arizona.

William Voigt Jr. is a writer who lives at Rockin' Cheer Farm in Blackshear, Georgia.

COLORADO RIVER BASIN

RIVER LENGTH [miles]	1,450(1)
BASIN SIZE [square miles]	210,000(1) 244,000(2) 250,000(3)
AVERAGE ANNUAL RUNOFF [acre-feet]	16 million (1) 14.8 million [1896-1983 average](2) 14 million(4)
AVERAGE FLOW AT RIVER MOUTH [acre-feet]	0
IRRIGATED LAND [acres]	0.644 million - Upper Basin (5) 1.527 million - Lower Basin (5) 2.171 million - Total
RESERVOIR STORAGE CAPACITY [acre-feet]	84 million [total capacity](5) 60.3 million [total, major reservoirs](2) 54 million [active capacity](4) 58.9 million [active, major reservoirs](2)
HYDROPOWER CAPACITY [megawatts]	1,586 - Upper Basin (5) 2,200 - Lower Basin (5) 3,786 - Total

Sources noted are as follows: 1) *The Upper Colorado River Basin and Colorado's Water Interests*, 1982, by the Colorado Forum, Denver, Colorado; 2) *The Salty Colorado*, 1986, by Taylor Miller, Gary Weatherford and John Thorson, printed by the Conservation Foundation and John Muir Institute at Inter-Collegiate Press, Shawnee Mission, Kansas; 3) *World Book Encyclopedia*, 1986 edition; 4) Bonneville Power Association; and 5) Bureau of Reclamation.



Mel Davis, BurRec

Glen Canyon Dam and Lake Powell on the Colorado River, Utah-Arizona

They built better than they knew

The upper Colorado River was plumbed to put water on arid lands and to generate electricity. Today those uses are in decline while recreation, urbanization and aesthetics come on strong. Through luck or forethought, the river's plumbing is proving adaptable to the new demands.

by Ed Marston

Philip Fradkin called the Colorado *A River No More*. This issue of *High Country News* is titled "The River As Plumbing." The point is the same. For this geologic instant, before siltation and mudslides and tectonic twitches again take charge -- man is in control of the Colorado River. His plumbing is in place, embedded beneath the Continental Divide, anchored to the walls of high canyons, dug through the shaley soil of countless hillsides.

There are lessons to be gained from arguing the morality and aesthetics of this plumbing: the loss of Glen Canyon, the gaining of hydroelectricity, the transformation of land from desert to neat rows of vegetables, the conversion of the once relatively pure lower Colorado River into a sink for salt and heavy metals in such concentrations that it stunts crops and deforms ducks.

But the American West isn't big on backward looks and moral analysis. The radical environmental group Earth First! may fantasize about the

destruction of Glen Canyon Dam. But the West's environmental movement is more interested in gaining a say in the control of the plumbing than in decrying its existence.

So "a river no more" and "the river as plumbing" are deceptive phrases. The Colorado is no longer natural, but neither is it a dead-and-gone river. It has been plumbed -- the big projects are in place or being put in place. The billions of dollars for the huge pipes, dams, pumps and canals have been sunk on the basis of decisions by a tiny group of men in Congress, in the Bureau of Reclamation and in the state engineers' offices.

But the billions spent on this plumbing will now be dwarfed by tens of billions to be spent to modify it, to mitigate its impacts, and to buy out old water users and put the plumbing to new uses. The era of massive construction is about over; the much more expensive era of nudging the river into a modified shape is just beginning.

As the first issue of this series on water showed, at the national level the plumbers -- the Bureau of Reclamation

and the Corps of Engineers -- are dying or renewing themselves, attempting to escape old roles and adapt to new. That issue of *HCN*, in its look at Sulphur Springs Valley, Arizona, and California's Imperial Irrigation District, also showed old economic uses -- the growing of hay, cotton and other commodity crops -- being driven out, with the pressure on to convert the water to other uses.

The Columbia and Missouri help to understand the Colorado. The Columbia and Missouri drain interesting regions, but compared with the Colorado River, they are one-note rivers: In the Dakotas, the Missouri, deserted by the era that spawned the Pick-Sloan plan, has no visible alternatives for change. It seems stuck with enormous reservoirs that produce some hydroelectricity and float a few barges in the lower basin. In the Northwest, the Columbia is dominated by the competition between hydropower and salmon. The river was developed mainly for hydropower in a sledgehammer approach dictated by a single federal agency -- the Bonneville Power Administration.

The Colorado has developed in a more diverse way. The 1922 Colorado River Compact reserved for each of the seven basin states some portion of the river's annual flow of 14 to 18 million acre-feet (the range depends on which series of years you average). Without that apportionment, southern California's farms and cities would have drunk the river dry in the years after World War II. The region would also have consumed all of the Colorado's hydropower to light its

cities and power the pumps that lift Colorado River water over the mountains to the coastal plain.

Saving the Colorado River from California also required a federal policy directed at helping all seven states develop their compact-share of the Colorado. The main federal instrument of this policy was the U.S. Bureau of Reclamation. That agency robbed Indian tribes of land and water; it proceeded with reckless disregard of the environment; it at times made stunning engineering errors.

That was the fallout, the side effects, of a populist policy intended to put tens of thousands of people on the land and to economically anchor hundreds of small communities in the rural West. At its most idealistic, the Bureau was a mechanism for spending hundreds of millions of dollars to create independent farmers and ranchers in the Upper Basin states of Colorado, Utah, Wyoming and New Mexico. It is no accident that part of the Bureau's funding came from federal mineral-lease income. The Bureau's projects were ways for the West to convert its mined minerals into more permanent wealth.

In southern California, Bureau projects often went to agribusiness. But in the Upper Basin, many small projects on the main-stem Colorado and its tributaries still keep, even in these difficult times, rural communities from blowing away. Grand

(Continued on page 6)

They built...

(Continued from page 5)

Junction, Colorado, near the Utah border, is most famous for its recent oil shale bust. The town is in bad shape; it would be in worse shape if not for 70,000 acres of fertile land in the Grand Valley irrigated by a mix of private and federal projects.

The Grand Valley is the last major irrigation project on the upper Colorado River. It is one of the last places on the upper Colorado where major water diversions are possible without pumping. Beyond the Grand Valley, the Colorado separates from the land, sinking into the canyon country of Utah and then into the Grand Canyon of Arizona. Below the Grand Canyon, only big straws are put into the river: the Central Arizona Project, southern California's Colorado River Aqueduct, the Imperial and Coachella valleys' diversions.

There is some flexibility in the Lower Basin, but it is the flexibility of elephants. Southern California cities are looking at Imperial's excess water; the Central Arizona Project's water will first be used for crops, but then, as Phoenix-Tucson grows, it will be converted to municipal and industrial use. Agriculture is slated to die. Even in the productive Arizona and California valleys, irrigated agriculture is seen as stopgap: a 100-year-long activity that will be bought out or forced out by urbanization.

This fourth HCN water issue is not about the Lower Colorado River Basin. The only Lower Basin story concerns Mexico's Mexicali Valley. It shows how the 1900s' effort to harness the Colorado River in its lowest reaches sent waves upriver. Efforts to divert the Colorado into the Imperial Valley and to Los Angeles forced the creation of the 1922 Colorado River Compact and construction of Hoover Dam. Today, by forcing major salinity projects on it, those lower reaches of the Colorado are still shaping the Upper Basin.

No one knows what is a trend, what is a spike, what is a misinterpretation of data. With that disclaimer, it appears that the trend in the Upper Basin is toward a rapid decline of agriculture and a slower decline in the

value of hydroelectricity relative to other water uses.

There are many examples. For decades, the Shoshone hydroelectric power plant in Colorado's Glenwood Canyon dominated the paper Colorado River. The "paper" river is that collection of water rights and laws that determines where the plumbing will direct the wet river to flow. Shoshone's hydroelectric right required that upstream diverters such as Denver, which takes water out of the high mountains for diversion eastward under the Continental Divide, permit at least 1,250 cubic feet per second to stay in the river for use by Shoshone. That water is then run through Shoshone's turbines to make electricity.

A few months ago, Denver and Public Service Co., which owns Shoshone and its water rights, struck a deal. Denver can reduce the river's flow below 1,250 cfs so long as it reimburses PSCo for the lost electricity. The foregone electricity is worth a pittance compared to the value of the water to Front Range cities.

If the courts agree, that deal will drastically alter the paper river. Hundreds of water rights downstream of Shoshone on the Colorado once sheltered in that 1,250 cfs flow. The holders of those rights, some of which are used now and some of which are planned for development, face a new world.

More important than the direct effect of the deal is its precedent. Upper Colorado River reservoirs such as the 1.2 million acre-foot Blue Mesa on the Gunnison River in western Colorado and the 4.7 million acre-foot Flaming Gorge on Utah and Wyoming's Green River have little function apart from hydroelectricity.

In Colorado, those hydroelectric rights set limits on the amount of water Denver, Aurora, Colorado Springs or whoever can take from the upper reaches of the Gunnison or Colorado for diversion to the Front Range. But Shoshone demonstrates that the paper river can be altered. Low-value hydropower can be suborned to high-value urban development. The fact that the U.S. Bureau of Reclamation will make the decision at most hydropower dams rather than an electric company does not change matters over the long run.

Right now, the plumbing in the upper Colorado River is managed mainly for hydroelectricity. Neither Colorado nor Wyoming come close to

using their compact allotments of Colorado River water. The economic, demographic truth is that there are not enough farmers, industry, and towns and cities in the Upper Basin to soak up the water impounded in its reservoirs. To the east, the Denver Front Range farmers and cities divert some water into the Missouri River basin for their use, but Colorado-Wyoming-Utah still send several million acre-feet downstream each year for California, and now Arizona, to use for free. For years, California took unused Upper Basin water for its cities; now Arizona will put that water into the Central Arizona Project, and use it until, or if, the Upper Basin develops.

There is talk of the Upper Basin leasing its water to the Lower Basin. Entrepreneurs have attempted to figure out how such leases could occur without requiring too much alteration of the law. But it takes two to make a deal, and as of now, there isn't even one. The Lower Basin states see no reason to lease what they get for free; the Upper Basin states say their policy remains the development of water for use within their boundaries.

Instead of seeking deals with the Lower Basin, most Upper Basin energy is spent jockeying for control of the existing plumbing. The water establishment built Upper Basin reservoirs for agricultural, municipal and industrial use. Their vision of western Colorado's and Wyoming's future was conventional: the conversion over time from agriculture to urban and industrial water uses, much as is occurring in the Phoenix-Tucson area.

It hasn't worked out that way in the Upper Basin. Western Colorado, whose mountains produce much of the river's water, lost its Great White Hope for water use when the oil shale industry collapsed. That industry was to use great amounts of water to convert rock into gasoline, and to water the cities that were to spring up to house the industry's workers.

Instead of oil shale, new uses have appeared -- downhill and cross-country skiing, fishing, hunting, rafting, hiking and retirement -- to compete for the Colorado River's water.

The recreation "industry" has always been in the rural West. It either searched out still undeveloped areas and streams, or it has piggybacked on the reservoirs and regulated streamflows created by water development. Glen Canyon Dam, for example, has extended the river-running season through the Grand Canyon. In western Colorado, the Bureau just completed McPhee Dam on the Dolores River for farmers who now can't afford the water. But an infant rafting industry on that river would happily take all the water the Bureau will allocate to it.

Although environmental and recreation interests often coincide, they conflict on occasion. Snowmaking for downhill skiing takes water out of high mountain streams just when streamflow is at a minimum, and thus threatens fish. The effort to re-establish conditions appropriate to the mud and warm-water loving endangered species in the Colorado has run into a sports fishing industry based on introduced, 'exotic' varieties, such as rainbow trout.

These conflicts don't detract from the overall direction of the moment: recreation and environmental interests are becoming influential on the Colorado River. Instream flow was crammed down the Wyoming water establishment's throat by the Wyoming Wildlife Federation. In Glenwood Springs, commercial rafters stopped a hydroelectric project that had the tax and water laws behind it, but which lacked the political support that once would have automatically rallied to it. The Sierra Club's attempt to use the courts to establish water rights in wilderness areas has stopped Colorado's wilderness bill for the moment, but may yield dividends when political negotiations begin.

The western Colorado ski town of Crested Butte, always out front in fighting for its interests, has taken on Aurora, which wants to divert water out of its valley. Ski resorts in the Colorado Rockies are now intensely involved in water matters, establishing water rights and building small, high-altitude reservoirs to make snow in the winter and water golf courses in the summer. They are engaged in the same kind of colonization of water that ranchers and farmers engaged in 80 years ago.

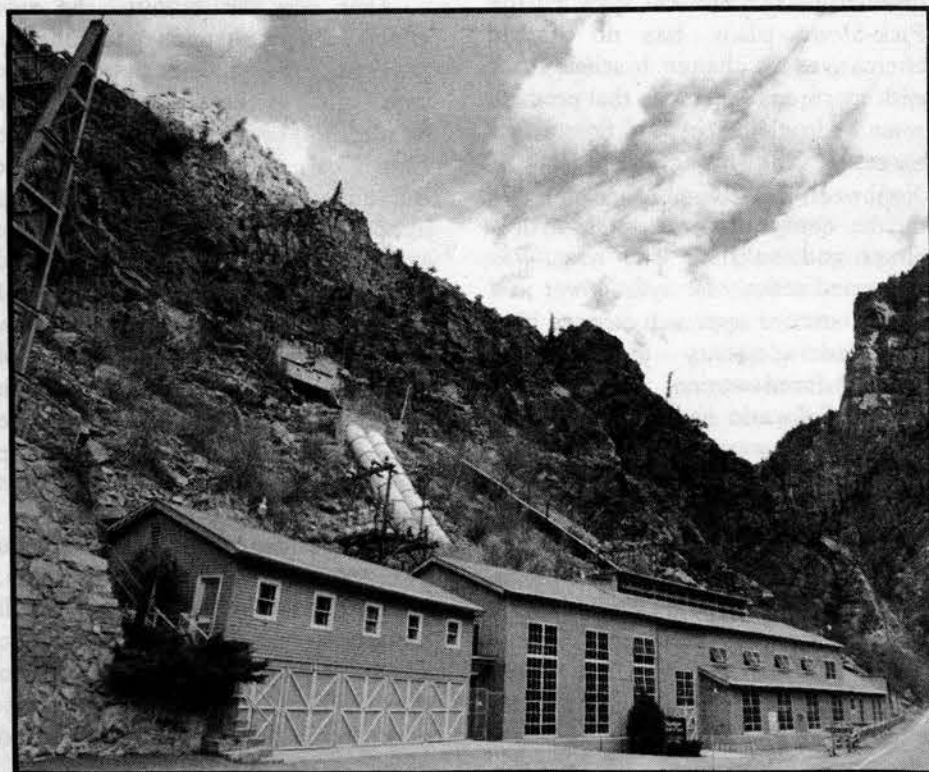
One is struck by the vitality of upper Colorado River water issues and by the number of people and interests involved in water. Ten years ago, water was an issue for the few. Today, contrary to the theory that harnessing a river leads in a totalitarian direction, it is a matter for the many.

The river is up for grabs because, although the plumbers did indeed reconstruct the river, they failed to secure the uses. Dams were built under the slogan, "use it or lose it." But dams are not uses, and once the reservoirs were in place users descended on those reservoirs and the streamflows they controlled.

Is this revisionist history? Did the dam-builders, after all, know what they were doing? Under disguising slogans and catchwords, did they use federal funds to provide wisely for the future? Were Congressman Wayne Aspinall and his associates in Congress and the Bureau visionaries, and not the porkbarrelers and villains they are painted in so many muckraking books?

There are no answers to the questions. We can say that their work, accidentally or deliberately, left in place an adaptable system of plumbing. Today, various Upper Basin interests and economies are striving to use that plumbing in ways not written into the original plans. We can also say that those who plumbed the Colorado left a more flexible structure than those who plumbed the Columbia or Missouri.

Those who plumbed the river or inherited their mantles represent traditional interests and often fight the new uses. A Water Establishment is still present. But its powers are diluted; it must now negotiate rather than dictate solutions. And the negotiating table must be constantly fitted with new leaves to accommodate the expanding number of water interests.



Stuart T. Wagner

The Shoshone hydroelectric power plant, Colorado



Kent and Donna Dannen

The Never Summer Range at the headwaters of the Colorado River, Rocky Mountain National Park, Colorado

With reckless impetuosity

Human journeys of whatever length must start with a single step. The 1,400-mile-long Colorado River starts in the Rocky Mountain snowfields as a cold, thin trickle.

by Rose Houk

The signs along Trail Ridge Road in Colorado's Rocky Mountain National Park say that the rivulet in the valley below is the Colorado River. It trickles through a meadow at the foot of the Never Summer Range with the torpor of September. It is hard to believe this is the same river whose frigid Grand Canyon waters downstream can capsize river-runners into fearsome rapids.

Ironically, this tiny new river has more water than it will in its final course, 1400 miles to the southwest. There, only a trickle of alkaline water remains to flow past Yuma, Arizona, through Mexico and, in wet years, into the Gulf of California.

At its headwaters, the Colorado is intercepted even before it earns the name river. Grand Ditch, completed by settlers in 1892, is visible along the eastern flank of the Never Summer Range, depriving the newborn river below of melting snow. The ditch hustles water to the northeast across the Continental Divide, while the river flows southwest, toward the Gulf of

California. The ditch is an 80-year-old symbol of the persistent fight for the river's water.

Major John Wesley Powell got his start here. His desire to explore the canyons of the Grand (the former name of the upper Colorado), the Green, and the Colorado was stimulated by natural history expeditions in 1867 and 1868 in this high country. His base camp was at Middle Park Hot Springs, now the town of Hot Sulphur Springs that was a well-known watering place in Powell's time. The park, a flat, grassy high-altitude valley, is bounded by forests of spruce and fir. Everywhere there are mountains -- Longs Peak to the northeast, the Gore Range to the southwest, and the Continental Divide and Berthoud Pass on the east. Powell's party heard the unearthly scream of mountain lions, and fought off tortuous black gnats and mosquitoes.

The park has changed in many respects. A U.S. highway now runs through it and, down out of Middle Park, the Denver and Rio Grande tracks follow the river past Grand County's Hereford ranches and

through a spectacular deep canyon. The gradient picks up and the river drops into a stretch now designated as "Gold Medal Waters" for its excellent trout fishing.

The river carves a 2,000-foot-deep canyon along the northern end of the Gore Range, then works its way through the sagebrush plateaus above the small western Colorado towns of Burns and McCoy. At McCoy, the landscape is different. The rocks are sedimentary, flat-lying. Dark green pinon and juniper trees dot the red hillsides.

A pair of raccoons waddles along the dirt road that follows the river, characters straight out of *Wind in the Willows*. They scoot down the bank as a car drives by, and then come back up and resume their journey along the roadside.

They are a reminder that the river provides a haven for all sorts of living creatures -- there are fish that provide food for the raccoons, beavers chomping down the giant cottonwoods, and eagles, cranes, herons, and magpies that wouldn't be here were it not for the water, fish, cottonwoods and willows.

The Blue River entered back at Kremmling; the Eagle River at Dotsero. The confluence of the Colorado and Interstate 70 also occurs at Dotsero, and to many this is the Colorado River. A sign warns that this tumultuous segment of river is "CLOSED TO BOATING." During the Pleistocene, about a million or so years ago, the Colorado River, swollen with the water of melted glaciers, began cutting Glenwood Canyon, slicing through the Paleozoic limestones and sandstones, down into the tough, old Precambrian granites.

Beyond Glenwood Canyon, after the Roaring Fork River has entered at Glenwood Springs, the Colorado neatly bisects the Grand Hogback, a sharp-crested ridge of steeply tilted rock. The guidebooks say this is where you officially leave the Rocky Mountains. This is the land of flat-topped mesas -- Battlement and Grand mesas and the Bookcliffs -- that stretch all the way to the Wasatch Mountains in Utah. The Rockies are behind, ahead lies the Colorado Plateau.

Here are the canyons that John Wesley Powell made famous. To many they are the Colorado River. The town of Grand Junction takes its name from the joining of the Gunnison and the Colorado, just as the river lazily skirts the northern end of the Uncompahgre Plateau. (See map on page 12.) Ruby, Horsethief, and Westwater canyons ease you into the heartland, the canyonlands of Utah. Here the Green River, the Colorado's greatest tributary and arguably its true source, flows in just above Cataract Canyon in Canyonlands National Park.

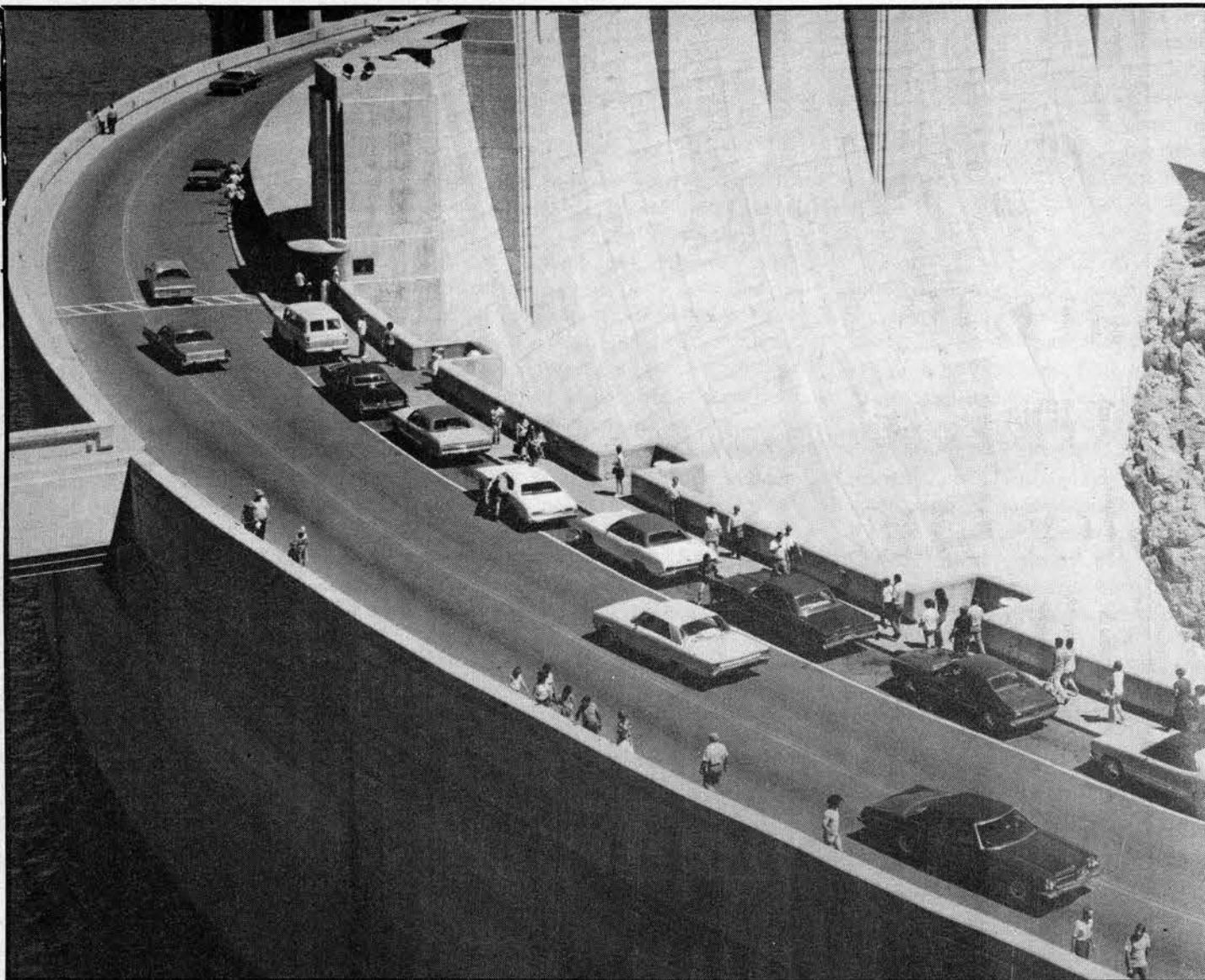
Frederick Dellenbaugh, on Powell's second expedition down the Green and Colorado in 1871 and 1872, described the great confluence: "The two rivers blended gracefully on nearly equal terms, and the doubled volume started down with reckless impetuosity."

Powell was not content to call the whitewater here merely rapids, for it was not like anything he had experienced so far. These were cataracts, and one set now bears the infamous title of "The Big Drops." The river often goes on rampages in the spring, but it is stopped dead by

(Continued on page 8)

From roaring rapids to tepid puddle

E.E. Hertzog, BuRec



Tourists atop Hoover Dam, which backs up giant Lake Mead

By rights, a major river like the Colorado should meet the ocean as an equal, challenging and diluting the salt water with a strong flow of sweet water. But the Colorado, in most years, dies a miserable inland death in northern Mexico.

by Mary Moran

Lee's Ferry in northernmost Arizona is the place where 15,000 people a year board motor and oar-driven rafts, kayaks and dories to experience the Colorado River's grandest canyon.

They come to experience the river: its current, eddies, boils, calm stretches and renowned rapids; its life: ducks scurrying ahead of the boat or bursting out of the water; flocks of those skillful flyers, the swallows, in pursuit of insect prey; pink blooms of the prolific tamarisk bushes at the water's edge; the canyon wren with its long descending call of solitude; the ring-tailed cat that checks out camp at night; a rattlesnake that momentarily takes the mind off a rapid being scouted from shore; the plastic-perfect and fluorescent-colored cactus flow-

ers; the rare peregrine falcon or eagle flying between the canyon walls; the desert bighorn sheep somehow standing upright on slopes that appear impassable.

Adventurers on the river also experience the canyon rocks: the mostly flat-layered sedimentary rocks of various colors and hardnesses that arose from Paleozoic era seabeds and river floodplains; the older Precambrian schists and granites of the narrow inner gorge; the younger lavas that once dammed the canyon and formed a lake until the river could cut through the canyon walls and once again flow freely downstream.

And there are the river's side canyons: the blue-green waters of the Little Colorado River or lush Havasu Creek; waterfalls of every shape and size as streams crash down from the

canyon rim to the river as much as 6,000 feet below; swimming holes, a respite from temperatures reaching over 110 degrees in the summertime; cottonwood trees and other plant life not found along the river itself because of periodic floods from Glen Canyon Dam; and with luck (good or bad, depending on where you are), a flash flood bringing brown water, mud and rocks of every size crashing down toward the river and sometimes creating new rapids at the side stream's mouth.

Boaters emerge from the river at Diamond Creek and follow a dirt and rock road up the creek through the Hualapai Indian Reservation. Or they float another 50 miles into a bathtub called Lake Mead, which has twice as much water in it as flows down the entire Colorado River in an average year. Mead stands behind the oldest large manmade plug in the Colorado River, 50-year-old Hoover Dam. The lake is dotted with water skiers, sunbathers and fishermen; the dam crawls -- both inside and out -- with 300,000 people per year taking guided tours of it and its powerplant.

Peter Fradkin, in his book, *A River No More*, describes the river below Hoover Dam as "a plumbing system of varying efficiency. Sometimes it gets stopped up and has to be relieved by dredging... The water runs, for the most part, between channelized banks whose rock-ribbed sides have been stripped of all water-sucking plants." The water along this last stretch of the Colorado River is intensely used. Water is diverted to California's Imperial Valley and the metropolitan areas of southern California, both outside the Colorado River basin. Soon the river will also irrigate much of central Arizona and slake the thirsts of city-dwellers in Phoenix and Tucson. And each dam in the series along this stretch of river is accompanied by an electricity-producing powerplant. Recreation is also big here; Fradkin calls this part of the river "a tepid puddle for urban crowds."

The end of the story is perhaps the saddest part. In average rainfall years, the riverbed of the mighty Colorado dries up 10 or 20 miles before it reaches the Gulf of California, just after the last Mexican water diversion. So you can forget about standing atop the Continental Divide in Colorado's high country and expecting to be able to spit into both oceans. Perhaps your eastward spit will make it to the Gulf of Mexico. Your westward spit may irrigate an orchard or beanfield in the high country, or lettuce in the Imperial Valley. Perhaps it will be tunneled back under the Divide to the Denver area, or maybe it will evaporate from one of those big bathtubs in the southwestern deserts. It could end up in a coffee cup in Los Angeles. But unless it's a wet year, there's one thing you can be sure of: It won't make it to the Gulf of California.

With reckless...

(Continued from page 7)

the slack waters of Lake Powell. For now, the Colorado stops being a river.

Curving side canyons and sandbars. Springs dripping with maiden-hair ferns. Datura flowers slowly opening at dusk. Painfully sweet sand verbenas. Soaring sandstone cliffs. Many have written of the incredible magic that pervades this southeastern Utah canyon country, that has as its heart the Colorado River.

Across the border in Arizona lies Glen Canyon Dam, and below it, Lees Ferry, where the Paria River quietly flows in from the west. The ferry is a topographic and historic landmark, designated for many reasons as the river's mile zero. It is the only place for the next 225 miles where you can drive down to the river's edge and stick your big toe into the 50 degree waters of the Colorado River.



Grand Canyon's Inner Gorge

Kent and Donna Danner

Sharing water with the colossus of the North

An account of the settlement of Mexico's Mexicali Valley; the escape and subsequent recapture of the Colorado River in the early 1900s; the shattering of a made-in-the-U.S.A. hacienda; and the settlement of an international dispute over the river's saltiness.

by José Trava

"Don't get apprehensive, Juan... Look! Can you see all that dust in the distance? There... down the road. Do you see that brownish spot? Yeah, that's El Rio... That's where we're heading."

"You will see, Juan... You will see! We are going to be rich, really rich. Look, all of them are virgin lands. They are only mud and dust right now, but with a little bit of work, they will become green and beautiful... and productive. Twenty years from now, El Rio will be flourishing. You will see, Juan... we all will see it."

At the turn of the century, Mexican pioneers came from the west, from the played-out mines in the mountains along Baja California's Pacific coast, to settle what is now the Mexicali Valley. They had heard of this isolated region, and they put their hopes on "nobody" land -- land free for the taking. Even the sight of this desolate floodplain of the Colorado River, near the Gulf of California, couldn't dim their enthusiasm.

One account from February 1901 describes the early settlement: "That morning I found myself in the middle of those new lands, facing a new sun and new people from El Rio. Close to our camp there was a marsh and on its surroundings other families also settled and built small huts under the mesquite's shadows. That was the way El Rio, the town, was born. No planification was made, nobody gave any kind of order to build it."

"Labor work, provided by the Americans at the other side (of the fence) made it possible for the town to grow. It was born very, very close to the canal that divided the United States from Mexico... It was like a flower from the wilderness -- defenseless, in the hands of the Lord."

It is extraordinary that, until the turn of this century, the mouth of a major U.S. river should have been occupied by only 1,200 Cucapah Indians. But the Colorado River delta was no place for a New Orleans or New York. Its approach was up the narrow, isolated Gulf of California; it was

guarded by huge mud flats, fluctuating river flows that could ground vessels in a moment, an unstable riverbed that shifted more often than the Mississippi, and very rough water called tidal bores -- caused by the interaction between the gulf's tide and the river's flow -- that could and did sink boats that navigated the lower Colorado.

When development finally came to this hot and barren place, it came in a rush, on both sides of the border. In 1902, El Rio was renamed Mexicali. Across the border, its sister American city got a sister name: Calexico.

A form of civilization had preceded Juan and the other settlers. The "nobody" lands already belonged to Don Guillermo Andrade, a Mexican from the state of Sonora. In 1877, he had been granted the rights to colonize 300,000 hectares (A hectare is 2.47 acres) within the delta. Such concessions were common during the dictatorship of General Porfirio Diaz, who was driven from power at the start of the Mexican Revolution in 1911.

Plans to irrigate the Arizona side of the border began in 1891, but foundered. In 1899, the California Development Company decided that California's Imperial Valley, the northern extension of the Mexicali Valley, should be irrigated. To reach it, water had to pass through Andrade's lands, and a deal was struck. In June 1901, irrigation water flowed into the Imperial Valley by way of Mexico. A month later, 6,000 acres were under cultivation.

The Cucapah Indians had moved up into the mountains, but one of them, Dos de Bastos, would come to Mexicali and, being invited to drink coffee and alcohol at Don Ramon Zumaya's grocery store, would tell how the world looked to him:

"All of this, everything, will be water again very soon... because the soul of the Colorado River will look for his old and cherished home in the salty sea of the north... and also because our Cucapah Great Elder has announced that some day the river

body will follow his soul; that's why we Indians still live in the mountains and watch the white men fight for the lands... which belong to the Cucapahs..."

In spring 1905, the soul of the river spoke. Engineering works on the diversion dam -- the dam that pushed the Colorado out of its bed and into a canal leading to the Imperial Valley -- gave way, and spilled water over the land. Uncontrolled, the river hit Mexicali, and total destruction threatened. Christmas 1905 was tragic. Almost all 50 houses in Mexicali were abandoned; people fled to Calexico.

The floods returned in 1906, and in January 1907, "A general feeling of distress got on everybody in the valley." People on both sides of the border had good reason for fear. All efforts to recapture the river failed. For two years, the Colorado, untamed, wreaked havoc.

It was no surprise. As anyone who has visited the Grand Canyon or southern Utah could guess, the Colorado carries an enormous amount of silt. Historically, much of it ended up in the Colorado River delta, lifting whatever bed the water was flowing in at the moment until the river was forced to change course. A single day's supply of water to the valley had enough silt, according to Frank Waters' *The Colorado*, to build a levee 20 feet high, 20 feet wide and a mile long. The river filled in canals in a moment. It dumped mountains of silt at diversion points. It toyed with the toy structures the would-be diverters had built.

Finally, in 1905, it got serious. The river, in part due to operating and engineering mistakes, quit its built-up, elevated path to the gulf and headed via old river channels to the inland Salton Sea, in the north of the Mexicali-Imperial Valley. The irrigation company made several attempts to push the river out of its new channel, but the dams and levees it built were pushed aside by the river.

Farmers in the Imperial Valley feared the sea would grow indefinitely and drown their fertile land. It was then that President Theodore Roosevelt both exerted pressure and made promises of federal payment to Edward Harriman, president of the Southern Pacific Railroad Company, if the firm would recapture the river. In response, the railroad galvanized its resources, giving track priority to rock and gravel trains throughout the system. Frank Waters writes:

"Two railroad trestles of 90-foot

piling were built across the break. Across these were run trains dumping rock into the river faster than it could be swept away. That was all there was to it."

"But to achieve this, the Los Angeles and Tucson divisions of the Southern Pacific and 12,000 miles of main-line traffic were tied up for three weeks... Rock was rushed in from the mountains near Patagonia, Arizona, 485 miles away, and from quarries on the Santa Fe and Salt Lake roads. Special trains carrying piling and timbers from New Orleans were given right-of-way. Dumping began. Never before had rock been dumped so fast: 3,000 cars of rock totalling 80,000 cubic yards in 15 days. The whole river was raised bodily 11 feet."

It was a contest between the Southern Pacific's ability to carry in dirt and rock and the Colorado's ability to carry it away. On Feb. 10, 1907, the railroad won and the river was pushed back into its old trough to the gulf. (Harriman never did get any help from Congress with his \$3 million bill.)

People were jubilant. The flood menace had ended for the moment. On the open and still wet fields, a great Mass was offered.

Unfortunately, the land the Mexicans were praying on was not theirs, or even Andrade's. It now belonged to the Colorado River Land Co., a subsidiary of the California-Mexico Land and Cattle Co., which was founded by American Harry Chandler in August 1902. The company had come into possession of 350,000 hectares (875,000 acres) in the delta by paying \$173,000 to Andrade.

Soon the pioneer-settlers were told: "In the name of the Colorado River Land Co. and due to the fact that all of the land of the northern part of Baja California known as the 'Andrade Concession' is now in our possession, take notice you must move out of the area within two months upon receiving this notification..."

All 400 pioneers who had settled on "nobody's" land, the promised land, now felt the force of capitalism's modern machine. In a very few years, the frontier had vanished and a new era begun: that of bold American investors who, through a series of land and water speculations, became the most powerful and richest men in southern California.

(Continued on page 10)

C.M. McDougall, BuRec



Construction of the All-American Canal, 1935

10-High Country News -- November 10, 1986

Sharing water...

(Continued from page 9)

The area changed and grew under this new order. In 1910, Don Gustavo Terrazas, first magistrate of the city of Mexicali, ordered a census: 462 people were counted, of whom 294 were men and 168 women. There were another 1,417 people in the surrounding area, including 273 Cucapah Indians. Los Algodones, 50 miles east of Mexicali, had 195 people, most working men.

In 1912, cotton was grown for the first time in the Mexicali Valley. By 1916, 26,600 acres were harvested by the Colorado River Land Co. for a \$1 million profit. It was the Golden Epoch. Between 1915 and 1930, cotton harvests increased; in 1919, at the end of World War I, profits were over \$18 million. The population was also changing. By 1915, more than 10,000 Chinese 'coolies' had arrived, the majority doing farm work.

By 1920, Mexicali was flourishing, but agriculture had little to do with it. As a result of Prohibition, cabarets, casinos and canteens proliferated. Americans, Chinese, Greeks, Japanese, Spanish, Italians and French were the owners of lusty places where Americans, escaping the "dry law," spent enormous amounts of money. On July 23, 1923, Jack B. Tenney, a young pianist in one of the casinos, made the city famous by composing *The Mexicali Rose* for a dancer he was in love with.

Meanwhile, the Colorado River Land Co. had hit on a way to increase its profits: The lands were given on lease to users who had to hand over 20 percent of their harvest to the company; the remaining 80 percent went to traders specified by the company. Lessors were chosen from illegal aliens -- mainly Chinese, Japanese and Hindustani; Mexicans were excluded.

In the Imperial Valley, a few hundred yards to the north, settlers had transformed themselves into dependable farmers who owned and understood their land and water. But the dominance of the Colorado River Land Co. severely hindered development of the Mexicali Valley by Mexicans. The company had converted the region into an immense hacienda, in which Mexicans, when lucky enough, worked almost as slaves in their own motherland.

The system went on for years. Then, on Jan. 27, 1937, determined campesinos, peasants from different parts of the Mexicali Valley, peacefully invaded the company's empire. When Presidente Lazaro Cardenas got the news, he summoned the campesinos to Mexico City and promised a solution "as soon as possible."

Their leaders were skeptical. Earlier attempts at land reform had been beaten back. For example, under the new constitution, only Mexican citizens could own land. But the law wasn't enforced. In 1929, a woman named Felipa Velazquez helped organize an agrarian reform committee and claimed land. The Mexican government arrested all of the campesino leaders and sent them to Marias Island, a federal prison.

Repression didn't stop the push for land. Due to the Great Depression of

1929 in the U.S., many Mexican workers returned to Mexico. In 1936, the Mexican government under Presidente Cardenas forced the Colorado River Land Co. to agree that all of the firm's 258,000 hectares would eventually be occupied by campesinos. The government would compensate the firm.

The company was too rich and proud to comply. During the next six months, only 426 hectares were assigned to campesinos. So in March 1937, a letter from Presidente Cardenas was given to astonished campesino leaders. It gave them the right to settle on 4,120 hectares of company land. Soon after, more permission came. The hacienda was shattered. A year later, the land reform was extended when Mexico expropriated the property of foreign oil companies.

It took until 1937 for the Mexican government to help its own people in the Mexicali Valley get control of the land. By comparison, U.S. efforts to aid those who settled in neighboring Imperial Valley had begun when Roosevelt got the Southern Pacific to control the rampaging Colorado.

The recapture of the Colorado didn't solve all problems. It was still an "overhead" river, riding a channel several hundred feet higher than the Imperial farmland, and carrying an enormous amount of silt. Canals regularly silted up and another runaway flood was not out of the question. Continued problems had prompted the U.S. settlers to form the Imperial Irrigation District in 1911, and to purchase Southern Pacific's facilities and water rights in 1916. (The railroad had gotten control by infusing capital into the irrigation company as it struggled to control the flooding Colorado.)

The farmers' next step, for security reasons, was to seek an "all-American" canal -- one north of the border. But the Bureau of Reclamation said such a canal would be impractical without an upriver dam to control flooding and to capture silt. During the same period, Los Angeles was seeking a power supply. A large dam would provide both electricity and flood control.

But there was political opposition to the plugging of the Colorado River to provide

electricity and water for California. The six other states on the river feared that California, whose growth far exceeded their own, would drain the river dry of both water and hydropower.

The result was the Colorado River Compact of 1922, allocating water between the three Lower Basin states (California, Arizona and Nevada) and the four Upper Basin states (Wyoming, Colorado, New Mexico and Utah). (See map on page 12.) Under the impression that the river ran 18 million acre-feet a year, it gave 7.5 million acre-feet a year to each basin. We now know the compact was negotiated during a wet period, and that the river actually averages about 14 million acre-feet.

With the compact more or less out of the way (Arizona refused to ratify it), Congress authorized construction of Boulder Dam, now Hoover Dam, in 1928. It and its reservoir, Lake Mead, were dedicated in 1935. Now the river was physically and legally under control. Excavation for the All-American Canal began in 1934; delayed by floods and an earthquake, it was supplying all the Imperial Valley's needs by 1942.

Mexico was made nervous by U.S. development of the Colorado. Attempts to divide the river's waters internationally had begun in 1912, and occurred sporadically after that. In 1939, the Rio Colorado Irrigation District was established in the Mexicali Valley, giving farmers an organized voice. Soon after, in July 1941, the Mexican ambassador in Washington presented the U.S. with a draft of a treaty.

The U.S. was eager to keep Mexico as an ally, and a treaty was signed in 1944. It assigned 1.5 million acre-feet a year of the Colorado's flow to Mexico, without cutting the allocations to the seven states, and created the International Boundary Water Commission to administer it.

The quality of the 1.5 million acre-feet is not mentioned in the treaty. This stemmed from the way negotiators convinced their respective governments to sign. The U.S. Senate was told that the Mexicans would only get salty irrigation drainage that was heading for Mexico anyway. Mexican negotiators told their country that the U.S. had to deliver "good quality" water.

The treaty took effect in November

1945. In 1948, Presa Morelos, a diversion dam in Mexico a mile south of the border near Yuma, Arizona, began operating. An "All-Mexican" canal stretch was completed soon after. The Mexicali Valley was again a land of promise. It had a secure source of water, fertile land and a growing population -- 124,000 people in 1950, with half of them under age 21. Half of the population lived in Mexicali.

For the next 10 years, peace and goodwill reigned. Even though the Colorado River averaged only 14 million acre-feet a year, there was enough water because the Upper Basin states had not developed the agriculture or cities to use their water. The average delivery to Mexico at the boundary was 4.24 million acre-feet a year. Quality was acceptable, too. Total dissolved solids at Morelos Dam averaged 900 parts per million -- the same as upstream across the border at Imperial Dam.

It couldn't last. In October 1961, at the end of the cotton season, water delivered to Mexico dropped to a minimum, as usual. But that water contained an incredible 2,500 parts per million of salinity. What had happened?

To solve a high water table problem in Arizona's Wellton-Mohawk Valley, a small irrigation area east of Yuma, the Bureau of Reclamation had drilled more than 60 wells. Without warning to Mexico, those wells began lifting 350 cubic feet per second of drain water containing 6,000 ppm of salt that had been washed out of the soil by irrigation. The pumping saved the area's crops from dying a salty, water-logged death.

This salty drain water was dumped into the Gila River near its confluence with the Colorado. To make things worse, this occurred just when Lake Powell in Utah started filling behind Glen Canyon Dam, cutting the water available for dilution. The situation could go on for 25 years.

The Mexicali farmers were furious, and the Mexican government argued that the treaty had been violated. The U.S. pointed out that the treaty didn't discuss water quality. Even worse, the U.S. turned paternal, offering to send technicians to teach Mexican farmers how to deal with salinity problems. Mexico was offended.



Lettuce harvest in the Imperial Valley

E.H. Hennig, BuRec



Laguna Dam, below the Imperial Dam on the Colorado River. The All-American Canal is in the upper left-hand corner of the photo.

Then began years of negotiations, first between President John F. Kennedy and Presidente Lopez Mateos, and later between Lyndon Johnson and Lopez Mateos. A temporary solution led to construction in 1965 of a canal that let drain water from the Wellton-Mohawk Valley bypass Mexico's Morales Dam. Research during this time showed salinity was important. Damages could reach \$3.7 million a year on the 500,000 acres irrigated in the area, or \$370 a year for the average 50-acre farm.

Things got worse for Mexicali's campesinos in 1966, when the Gila South District in the U.S. began discharging salty drainage into the Colorado River. The water upstream of Morelos, even without the Wellton-Mohawk flow, was 1,300 ppm instead of the desired 900 ppm. Adding insult to injury, the salt water from the Gila South District was counted as part of Mexico's share of the Colorado. The dispute during the late 1960s focused on what was "Colorado River water." Mexico said water pumped out of the ground by irrigation districts seeking to lower water tables and carry off dissolved salt was not Colorado River water. The U.S. said it was.

Meanwhile, Mexicali kept growing; it reached 396,000, a 219 percent increase from 1950, in 1970. The possible loss of the valley's irrigated lands to saline water horrified Mexican officials.

After further fruitless negotiations, Mexico came up with a new argument: According to its reading of the 1922 Colorado River Compact, Mexico was the eighth water user, with the seven states. Thus, Mexico should be allowed the same benefits as its neighbors. It was ridiculous, Mexican negotiators said, that

Imperial Valley farmers had 850 ppm water while, a few thousand feet away, campesinos were stunting their crops with 1300 ppm water.

The solution, however, lay not with Mexican arguments, but with the American political process. 1972 was an election year and sympathy for Mexico was building. In March, during an annual meeting held in Mexico City, the National Wildlife Federation supported Mexico's position. In May, at the U.S.A. - Mexico Twelfth Inter-Parliamentary meeting in New Orleans, U.S. Sen. Mike Mansfield of Montana asked for a non-litigious, practical, quick solution. A few days later, Sen. Hubert Humphrey, campaigning for the presidency, said that "based on pure ethical reasons, the U.S. government should bring to an end the salinity controversy."

On June 15, 1972, Mexican Presidente Luis Echeverria spoke to the U.S. Congress: "Imperial and Mexicali valleys belong both to the same basin, that of the mighty Colorado River; the only possible interpretation of the 1944 treaty is that riparian nations should work out solutions based on sincerity and equity... We can't understand why the same spirit and imagination the United States deploys to unravel intricate problems with his enemies are not used to solve very simple matters with his friends..."

Negotiations began again, but now the pressure was toward compromise. After false starts, agreement was reached in August 1973. It guaranteed Mexico a water quality within 121 ppm of that delivered to the Imperial Valley.

Presidente Echeverria called Minute 242 "a triumph of reason and human rights; an honest reward for our tenacious diplomats and... a

promising landmark for our future relations with the United States."

It was a victory for understanding and goodwill. It became a celebrated affair, an example of cordial relations between two neighboring nations.

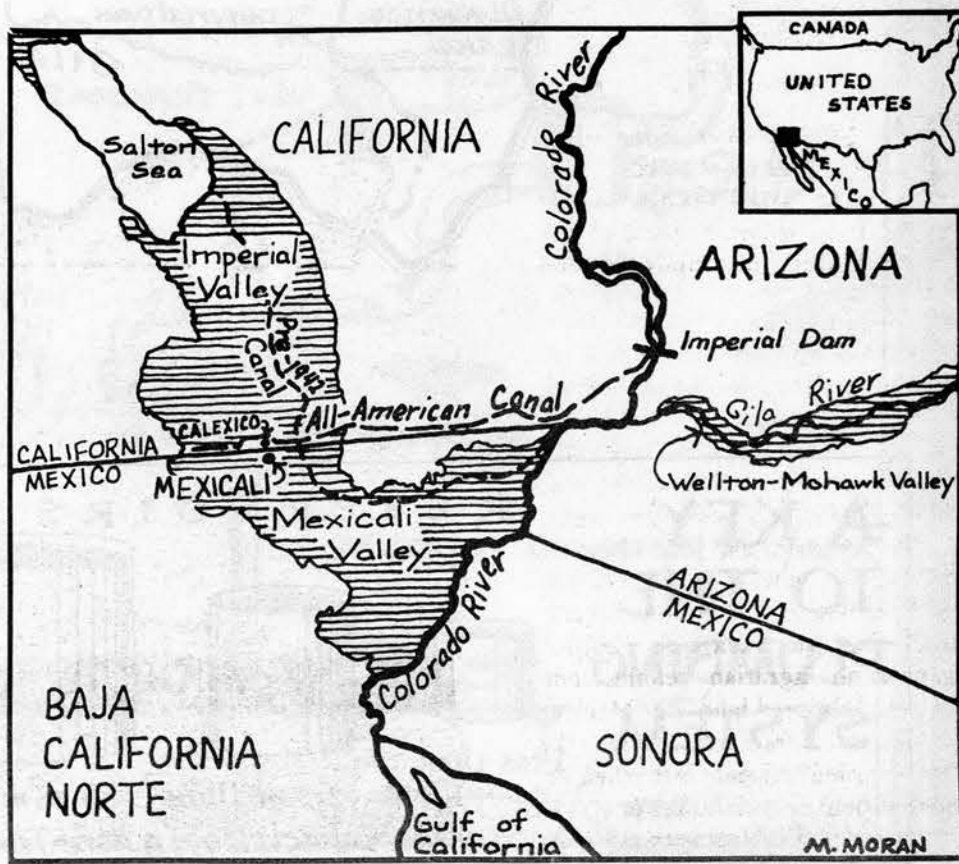
As an agricultural engineer assigned to the region since 1977, I have learned that the solution to the salinity problem was almost equivalent to the 1937 assault by campesinos on the Colorado River Land Company's land: both represented crucial turning points in the region's history.

For Mexico and the Mexicali Valley, it was a matter of survival. Land productivity was in jeopardy and

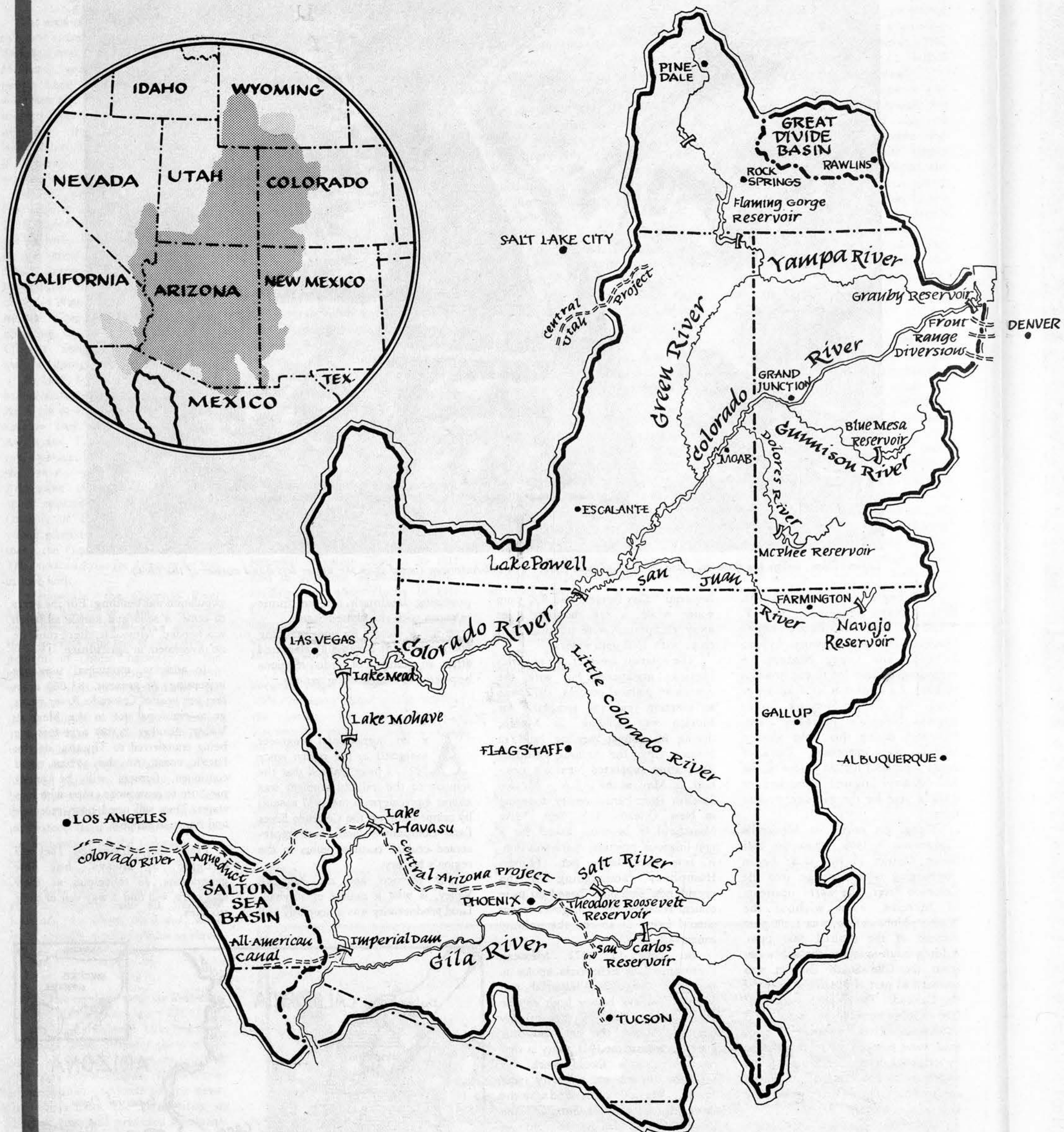
population was building. For the years to come, a solid and stable situation was needed. Without it, there could be no investment in agriculture.

In addition, municipal uses are increasing. At present, 83,000 acre-feet per year of Colorado River water go to municipal use in the Mexicali Valley. Another 25,000 acre-feet are being transferred to Tijuana, on the Pacific coast. As the urban trend continues, farmers will be under pressure to grow more crops with less water. They will need both research and financial support.

I think they will succeed. They will struggle, as always, but new generations, as tenacious as their ancestors, will find a way out of their troubles.

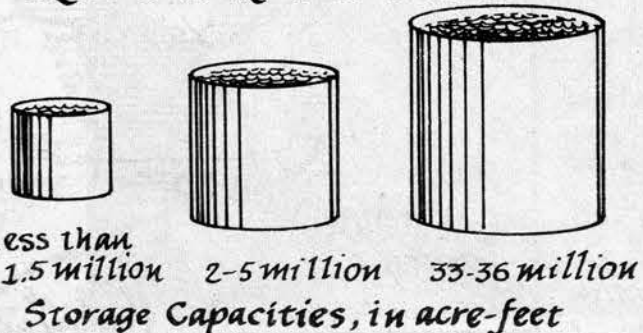


THE COLORADO RIVER BASIN



A KEY TO THE PLUMBING SYSTEM

RESERVOIRS



WATER DIVERSIONS



Depletions, in acre-feet
(Projected figures for CAP and CUP, now under construction)

TRIBUTARY STREAMS



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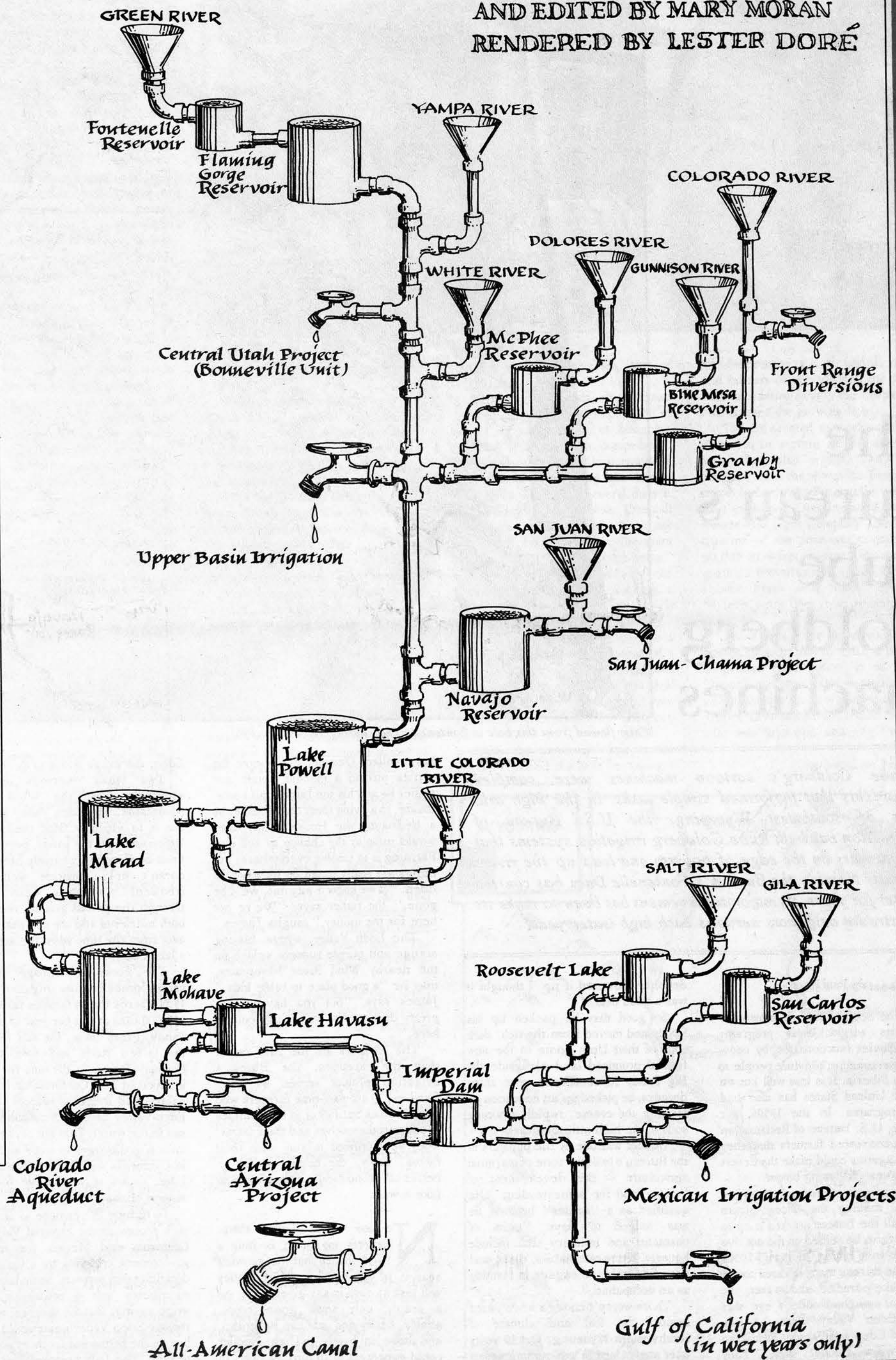
IN

...AND ITS PLUMBING

MAP AND PLUMBING COMPILED
AND EDITED BY MARY MORAN
RENDERED BY LESTER DORÉ

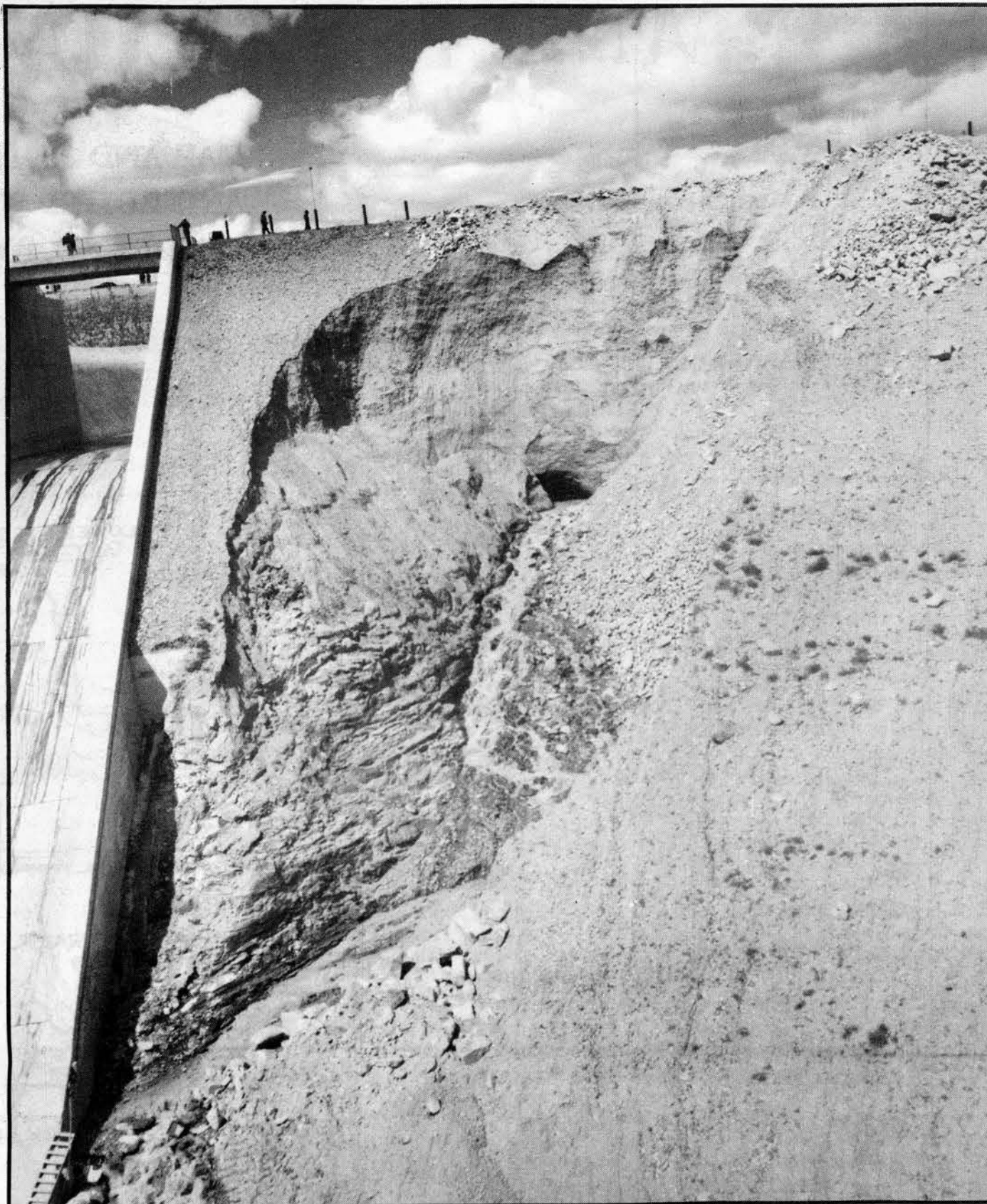
High Country News -- November 10, 1986-13

DENVER



The Bureau's Rube Goldberg machines

Stan Rasmussen, BuRec



Water flowed from this hole in Fontenelle Dam during September 1965

Rube Goldberg's cartoon machines were complex mechanisms that performed simple tasks. In the high arid plains of southwest Wyoming, the U.S. Bureau of Reclamation has built Rube Goldberg irrigation systems that keep farmers on the edge of poverty and load up the rivers with salt. Nearby, the Bureau's Fontenelle Dam has courted disaster for years. Its major achievement has been to make its downstream neighbors nervous each high-water year.

by Paul Krza

The Soviet Union is known for its virgin lands program: Soviet functionaries, by coercion or persuasion, convince people to settle in Siberia. It is less well known that the United States has also had such programs. In the 1950s, for example, U.S. Bureau of Reclamation officials convinced farmers that they and the agency could make the desert of southwest Wyoming bloom.

According to farmer Eugene Hodder, making the desert bloom wasn't all the Bureau cracked it up to be. The farm he settled on did not live up to advance billing. In its mid-1950s pitch, the Bureau made the area sound almost like paradise, and in fact, the land that caught Hodder's eye was called Eden Valley, near the tiny towns of Eden and Farson. Today, an older, wiser Hodder says: "They

definitely flowered it up. I thought it was a good deal."

So good that he packed up his family and moved from the rich, dark soils of their Utah home to the new federal promised land alongside the Big Sandy River. There, over three decades, he picked up an education on farming the coarse, rapidly draining soils of the high-altitude desert.

Hodder was one of the pioneers in the Bureau's twilight zone of marginal agriculture -- the development of "virgin land for homesteading." He qualified as a "settler" because he was judged to have "traits of character and industry that include honesty, temperate habits, thrift, and bona fide intent to engage in farming as an occupation."

Those weren't enough when pitted against the soil and climate of southwestern Wyoming, and 30 years later any visions of a blooming desert

have wilted. Outside, the winter fog settles around a modest house and trailer he and his son James call home. Inside, in a living room that doubles as a bedroom, the Hodders say they would jump at the chance to sell out. Farming is in trouble everywhere, but things are really tough on its edge, in Eden. "If we knew a way out, we'd be gone," the father says. "We're not here for the money," laughs James.

The Eden Valley, where blazing orange and purple sunsets splash on the nearby Wind River Mountains, may be "a good place to raise kids," James says, "but you have to be pretty dedicated to stay in agriculture here."

The Hodders are the rule rather than the exception. The Bureau's irrigation project serves 84 farm families; 79 are part-time farmers who work in Rock Springs or in trona mines to support themselves and their farms. They've sacrificed to stay with their farms. Sadly, the nation would be better off economically if they were to take a walk.

No one would blame them. Experts say there is only a 50-50 chance that the growing season in the 6,500-foot-high valley will last 85 days in any given year. As a result, only small grain crops, alfalfa, barley and oats can be grown, and those just barely. In Utah, Hodder could expect six to 10 tons an acre. In

Eden, the range is one to three tons.

Two small reservoirs impound snowmelt from the Wind River Mountains. The Eden Valley farmers use it to virtually flood their lands. Unfortunately, the sandy, porous soil must be flooded frequently because it doesn't hold moisture well. The frequent waterings wash down through the porous ground, removing both nutrients and the salt that is left over from the time when the area was a lake bottom.

The economic damage to the nation comes because irrigation of the 15,000 acres the 84 families farm adds 133,000 tons of salt per year to the Big Sandy. From there, the salt flows to the Green River and then to the Colorado River. By the time the water is diverted into California or Mexico, natural and irrigation sources such as Eden Valley have put 9 million tons of salt in the water. That salt causes \$490 million in damages to crops and cities in California and Mexico. (Salt from Eden Valley is responsible for \$7.3 million of that damage.)

To reduce the damage to crops in such places as the Imperial Valley of California and Mexico, the federal government is paying for a variety of desalinization projects. Some land that contributes salt is productive, and worth saving. But the cheapest way to remove Eden Valley's salt would be to buy up the farms and let them go back to sage. The feds proposed just that,

but it ran counter to Wyoming state government policy of preserving agriculture.

So the U.S. Soil Conservation Service now wants the farmers to switch from flood irrigation to sprinklers; they would put less water on the land and leach less salt out of the soil. The farmers are willing, if the feds help pay for the sprinklers and for the extra cost involved in operating them.

Although the Eden Valley project looks like a perpetual burden on both the settlers and the taxpayer, it has performed a valuable service as a deterrent. Roughly 30 miles to the west along the Green River where similar lands lie, sagebrush still grows. Farmers like Hodder were to till 60,000 acres of reclaimed desert there, and a dam was built, complete with outlet works and canals. But in the mid-1960s, reality caught up with the Bureau's dream. So the canals trail off into the desert, and the leaking dam doesn't even hold water. Fontenelle Reservoir's emptiness is either an act of nature, according to the Bureau, or an act of poor engineering. The fact that 60,000 acres of desert land aren't in marginal agriculture, contributing hundreds of thousands of tons of salt to the Colorado, is a result of the warning put out by the Eden Valley project.

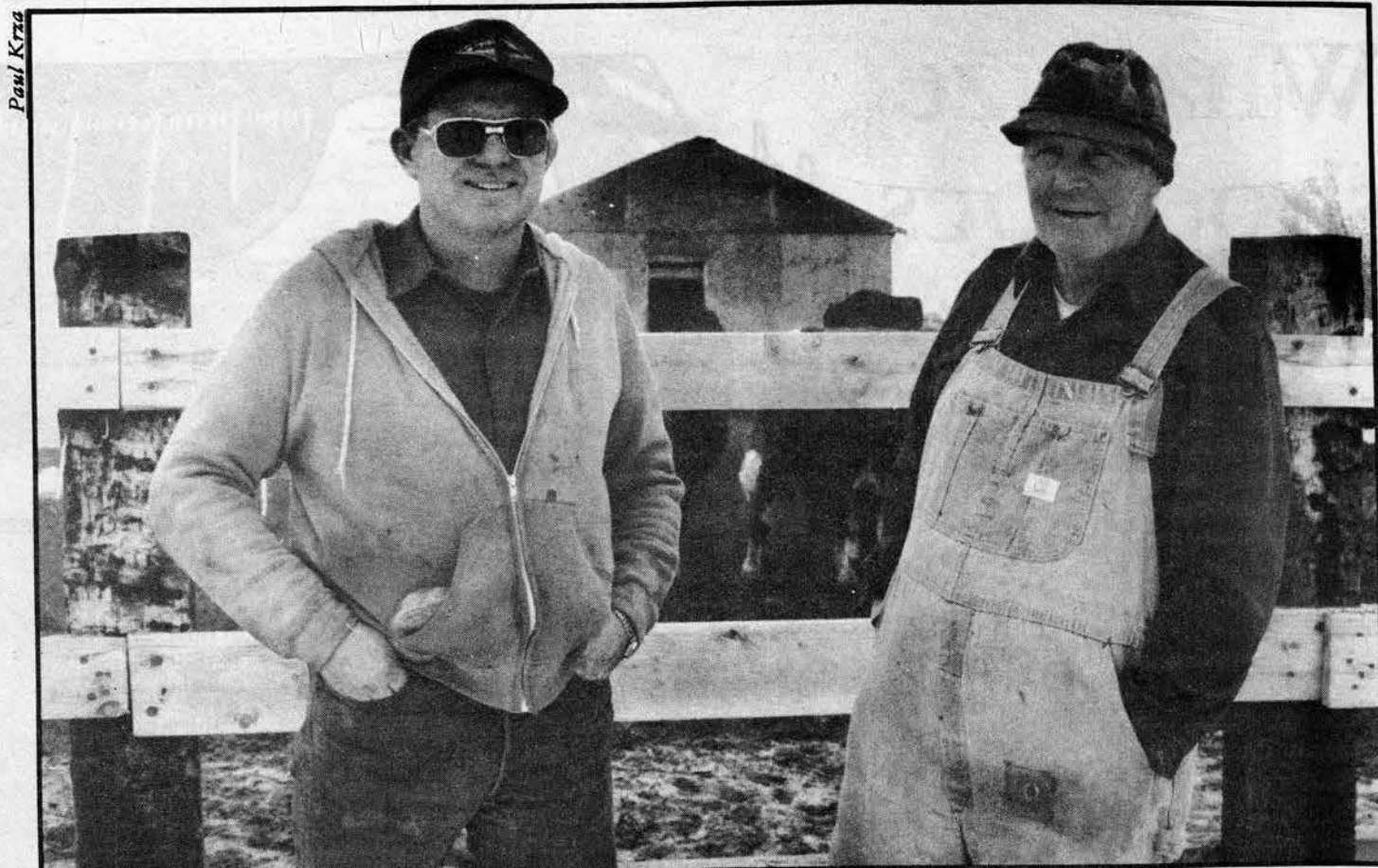
To be fair to the Bureau, it hadn't wanted to build Eden Valley. In 1939, the Bureau and another agency studied the Eden project and both painted a "very bleak picture" of its chances for success, according to Professor David Kathka, a Western Wyoming College history professor. The studies were reinforced by experience: three privately funded irrigation ventures had already failed in the valley.

But powerful Wyoming Democratic Sen. Joseph C. O'Mahoney threatened to go directly to the Secretary of Interior unless Bureau officials changed their minds. O'Mahoney got his way. The senator, who served for 26 years in the Senate, also pushed for Fontenelle and the associated Seedska-dee project to irrigate 60,000 acres of desert on either side of the Green River downstream of Fontenelle.

On Seedska-dee, the Bureau was in accord with O'Mahoney. Bureau engineers, used to seeing water turn desert land green and productive, and apparently unmindful of the different soil and climate of western Wyoming, pushed ahead. The agency got extravagant support in Rock Springs for the project. A 1955 newspaper editorial said the Upper Colorado River Project, of which Seedska-dee was a part, would help develop "vast uranium deposits," irrigate land the U.S. would "desperately need" in 25 years, create jobs, aid the national defense and "make America stronger, better, richer and more beautiful."

The project was pushed forward by economic developments in southwest Wyoming. The Union Pacific Railroad, after converting its engines from coal to diesel, closed coal mines at Rock Springs and trimmed rail crews at Green River. An Appalachian-like depression gripped the area.

That depression coincided with heady times for the Bureau, fresh from a series of technical triumphs. According to Kathka, who has studied the era, agency officials were touring the globe, pushing reclamation as the



James and Eugene Hodder at their farm in the Eden Valley

key to "feeding the world and fighting communism."

With local pressures reinforcing O'Mahoney's work in Congress, the project got funding, and in June 1961, work began on Fontenelle. It was to be a 137-foot-high earthen dam stretching about a mile across the wide Green River Valley, 59 miles northwest of the city of Green River. It is the only dam in Wyoming on the Green, the largest tributary of the Colorado.

Bids were taken, the jobless hired and heavy equipment put to work. But a few months later, the project began to unravel. The first blow came from a budding industry. Trona, or soda ash, producers were worried that irrigation water would seep into their underground mines and ruin the water-soluble mineral. So the project was scaled back.

A year later, in May 1962, as workers were pouring concrete for the irrigation canals, the Commissioner of Reclamation halted the irrigation part of the project. O'Mahoney's Seedska-dee project had been stopped by O'Mahoney's Eden Valley Project.

Congressional hearings on Eden and another project on the Wind River Indian Reservation in central Wyoming (HCN, 10/27/86) "brought to light the serious financial and economic problems encountered by farmers on these high-altitude projects," the stop order said. The 1939 warnings had reached Washington.

But work on Fontenelle Dam went on; it was finished and apparently ready to hold water by late summer 1964. Trouble appeared immediately, in the form of suspicious seeps downstream. The dam held the record snowmelt of 1965 only until Sept. 3, when a Bureau engineer's nightmare appeared: a "wet spot" on the dam embankment. By the next morning, the next worst Bureau experience to Teton Dam was developing: a "near failure" of Fontenelle.

"We saw the harsh reality of the flowing wound on the downstream face," Bureau Regional Director David Crandall recalled later. A quick drain, made quicker by dumping water into the irrigation canal works that led out into the desert, averted a break and the

flooding of the downstream town of Green River.

Anyone who has visited a Bureau dam will remember the impression of control, of cleanliness, of humming turbines, of unflappable competence. The Bureau attempted to portray the same infallibility during the Fontenelle crisis. Over the several days it took to drain the reservoir, Crandall went on the radio to tell the locals not to worry. Agency "technical engineers who really know what they are doing" were keeping close tabs on the situation. Moreover, it was not a situation of the Bureau's making. It was all Mother Nature's fault:

"The leak problem at Fontenelle is not, I can assure you, the result of a technical inadequacy," Crandall told his radio listeners. "When you deal with the forces of nature, you sometimes encounter the unexpected."

With the reservoir empty, the Bureau repaired the hole, replacing a

345-foot section of dam, and dumping 126 railcars of cement into the leaky rock foundation to stop the seeps that had created the growing hole.

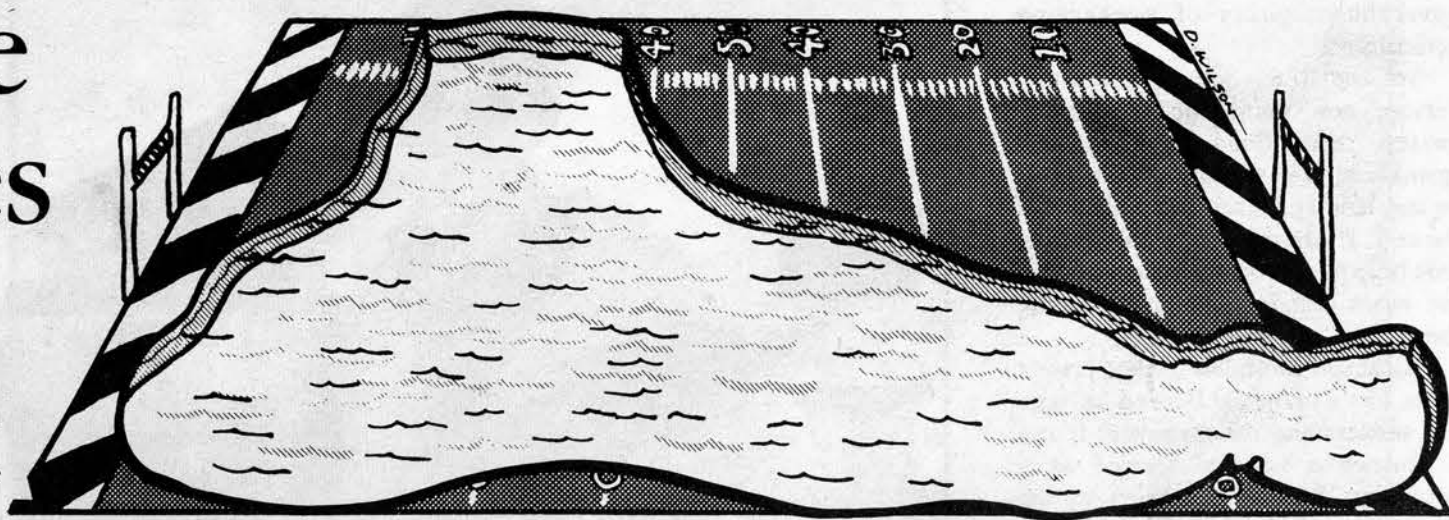
The fix seemed to work, and the dam began storing water uneventfully, but also without any real purpose since there was no irrigation project. In 1970, Fontenelle got its first customer. Oregon-based Pacific Power and Light Company used one quarter of the reservoir's capacity, 60,000 acre-feet a year, to cool its giant 2,000-megawatt Jim Bridger Power Plant near Rock Springs. Sixteen years later, that remains the only use.

Meanwhile, the reservoir continued to seep, and in 1982 a Bureau inspection team judged it to be in "poor" condition. The determination came during a heavy water year on the Upper Colorado River Basin. Fontenelle was brim-full, and the town of

(Continued on page 16)



What size shoe does an acre-foot wear?



A glossary of water terms for those who wonder why water diversions are not diverting and why it is morally offensive to leave water flowing in a stream.

by Ed Quillen

• **ACRE-FOOT:** The amount of water required to cover one acre, which is about the size of a football field, or 0.40468564 hectare, to a depth of one foot, about the length of a football shoe, or 30.48 centimeters -- that is, about 325,848.882718339 gallons or 1,233.43773084702 steres. Most popularly explained as the amount of water an average family of four uses in one year, but this definition is too fluid; only in desert regions is it appropriate.

For example, in a wet state like Minnesota, the average family of four consumes only 0.44 acre-feet of treated water in a year, and in Oregon, it's all of 0.34 acre-feet. But in dry Colorado, it's 0.93 acre-feet; arid Wyoming, 0.96; thirsty Arizona, 0.99; desert Nevada, 1.12; and parched Utah, 2.46. These dull figures (given the topic, they can't be dry statistics) demonstrate that treated water is unlike other commodities: the less gasoline there is available, the less people consume, but the less water there is, the more people consume.

• **AUGMENTATION:** In standard arithmetic, to augment means to add something. For instance, \$200,000 augmented by \$200,000 comes to \$400,000. Water arithmetic is more complicated. Assume that a basin has an annual water production of 400,000 acre-feet. A metropolis across the mountain range desires to take 300,000 acre-feet. To placate the basin residents, the metropolis builds an "augmentation reservoir" with a capacity of 50,000 acre-feet. Before augmentation the basin residents had 400,000 acre-feet. After augmentation, they have 100,000 acre-feet. Thus 400,000 augmented by 50,000 comes to 100,000. For more insight into the logic upon which water arithmetic is based, see Charles Dodgson's influential works, *Through the Looking Glass* and *Alice's Adventures in Wonderland*.

• **BENEFICIAL USE:** Any use of water which 1) takes water out of a natural channel, and 2) benefits a bank account. Thus courts have held that keeping water in rivers so that fish might swim in it is not a beneficial use, whereas using the water to carry silt into collection impoundments (often called reservoirs) is a beneficial use.

• **CALIFORNIA:** A mythical land, first described in the 15th-century

Spanish romance, *Las Sergas de Esplandian*, by Garcia Ordonez de Montalva. This California was populated only by women, ruled by virgin Queen Califa, and contained vast quantities of gold and pearls. In current mythology, California is the place to which water flows and then vanishes utterly, as in "If we don't use it, then California will take it." The only way to prevent this awful waste of Upper Basin resources is to allow the water to evaporate from Denver lawns and Utah reservoirs.

• **CFS:** See Cubic Feet per Second. Colorado writer Lewis Newell once discovered an interesting similarity between the CFS and the UFO; many people believe in both, but no reliable witness has ever seen either.

• **COMPACT:** An agreement, such as the famous Colorado River Compact, concerning deliveries of water between states. One of the most curious must be the Colorado-Kansas Compact. In 1984, Colorado erred and allowed the Arkansas River to flow into Kansas for the first time in years; normally, the riverbed by Holly is as dry as a Baptist wedding because Colorado grabs every last drop. Unaccustomed to seeing water in the river, Kansas promptly responded with a lawsuit.

• **CONSERVANCY DISTRICT:** In standard English, conservancy refers to the preservation of natural resources. In water English, a conservancy district is a legal device for destroying fisheries, riparian habitats, wetlands and indigenous populations.

• **CUBIC FEET PER SECOND:** See Cusec.

• **CUSEC:** See CFS.

• **DIVERSION:** An entertainment. For instance, a popular metropolitan diversion is to dry up high mountain valleys by piping water to the cities below. Then the metropolis invites immigrants by promoting both its ample water supply and its proximity to pristine mountain valleys with sparkling fishing streams.

• **IRRIGATION:** The construction of vast works (dams, tunnels, canals, etc.) at public expense in order to produce surplus agricultural commodities, which are then purchased and stored at public expense.

• **MYTH:** A fictitious belief widely held by influential people. Water myths have had an important effect on Western settlement and public policy. To wit, dozens of explorers died

searching for the Rio Buenaventura, a mythical water route from the Midwest to the Pacific Ocean. Thousands of sodbusters faced starvation because they believed the myth that "rain follows the plow" or that "the smoke from locomotives makes it rain." Current myths include "water development assures prosperity" and "there is unappropriated water available in the Gunnison River for the city of Aurora, 200 miles and three mountain ranges away."

• **REASONABLE DILIGENCE:** Something that must be exercised in order to convert a conditional water right into an adjudicated water right. In olden times, this meant making an effort to construct a dam and a ditch. Currently, making regular payments to a water attorney constitutes reasonable diligence.

• **RECLAMATION:** In standard English, "reclamation" means to return something to a former use. In water English, "reclamation" means converting land that has always been desert into farmland, a use it never had.

• **SALINITY:** A measure of water degradation related to the concentration of sodium ions; the chief characteristic of water delivered by the United States to Mexico to fulfill treaty obligations.

• **SEX:** Often compared to water in light of certain similarities:

1. Many believe in the doctrine of "first in time, first in right."
2. Many believe you must "use it or lose it."
3. Nobody ever has enough.

• **UPHILL:** The natural direction that Western water flows, providing there is money uphill.

• **WATER RIGHT:** A property right to certain quantities of water in certain locations, depending upon the use of the water and the priority date of the water right. Water rights are either very valuable, because men have given their lives in battles over water rights, or else of little value, because, unlike other forms of real and personal property, water rights are not taxed.

• **WINDYGAP:** Windy Gap is the site of a reservoir and pumping plant near Granby, Colorado, constructed by six cities on the other side of the Rockies. When the six cities began the project, they said they needed additional municipal water supplies because they would otherwise buy up Colorado-Big Thompson water shares to slake the thirsts of their growing populations, and thus dry up productive farmland. Then the cities turned around and assigned much of their Windy Gap water for cooling the Rawhide Electric Power Plant near Fort Collins, claiming that they needed the electricity for their

municipal utilities. However, all of the Rawhide electric production is being sold to Public Service Co.; the customers in those cities have yet to receive so much as a kilowatt from Rawhide. Now some of the cities are trying to sell their Windy Gap water, saying that they really didn't need the water in the first place. Thus a new verb has been coined. To "windygapped" is to deceive, plunder resources, and waste money on a colossal scale, as in "We never thought we'd get that project approved by those rural county commissioners, but we windygapped it right through, after we persuaded them that it was for their own good if we took their water."

Rube...

(Continued from page 15)

Green River was nervous. Bureau engineers said there was no danger.

The agency also announced an expensive plan to re-repair the ailing dam -- this time with "state-of-the-art" construction techniques. A thin concrete "wall" was to be inserted inside the earthen embankment for \$52 million. But Washington had changed since Sen. O'Mahoney got free dams for his constituents. Wyoming was asked to foot part of the bill. The Legislature appropriated \$5.3 million and Congress approved the project. It will take at least three summers to install the wall, which means three more nervous years for Green River.

Why not simply open the dam gates and let the river run as if it were not there? First, because of the "use it or lose it" doctrine. Wyoming officials see the 240,000 acre-foot reservoir as a key to hanging onto the state's share of Colorado River water. Common sense says that only 60,000 acre-feet are being used; water sense says Wyoming is using 240,000 acre-feet.

Second, there is no constituency for abandoning the dam, even among environmentalists. Just downstream is the Seedskadee Wildlife Refuge, prime duck habitat. It was created to make up for the drowning of the river habitat by Fontenelle. If Fontenelle were abandoned, there would be no dependable flow of water to maintain the refuge's wetlands.

The result is that land in the Eden Valley continues to pour salt into the river and \$52 million is being spent to repair a dam that, given the depressed nature of Wyoming's economy, has little foreseeable future use. Just downstream of Fontenelle, the ducks in the Seedskadee Refuge are happy. Farther downstream, in Green River, the residents are hoping the upper Colorado won't have a heavy water year until the dam is repaired.



Dean Krabel

Lake in the Wind River Mountains

Night watch

A night-time expedition to plumb the vital signs of a mountain lake.

by C.L. Rawlins

A lone, in a gray boat on a black lake, cold water cupped in bedrock above 10,000 feet. No moon, no wind; high, thin clouds and scattered stars. I row with short, even strokes and the boat rises and dips with the movement of my body and the thrust of the oars. My marker light, a candle lantern on a shoreline boulder, throws cat-eyes in the wake until I round the point and it's gone.

Darkness pales around the granite outcrops, gathers heavily in the conifers, looms around the high peaks and opens at the ragged horizon where stars begin. In the darkness of the lake, the deepest black of all, stars swim with an ominous, flat glint. The surface seems less like a mirror than like a window on a galaxy beneath, a fragile membrane between voids. For an instant, there is no up or down. I miss a stroke and the splash leaps up to lick my face with chill.

I should be near the spot, between a cliff and silver snag of dead limber pine. I peer into the dark, ship the oars and drift into sudden quiet. Little, cold feet walk up my back.

I know this place in daylight, having come here before to catch this water in bottles, test it for pH and alkalinity, take its temperature and seine it for aquatic insects and plankton. I've carried it out of the mountains, filtered it, preserved it, labeled it and shipped it to far-off labs where people I've never met subject it to tests: aluminum, calcium, carbon, chlorides, fluorides, iron, lead, magnesium, manganese, ammonium, nitrates, phosphates, potassium,

silica, sulfates. I've caught and eaten its trout, scooped it into pots for coffee, mixed it with my blood, taught it to walk and tell lies and pissed it back onto the ground. This lake and I share more than a casual acquaintance, yet in the dark it seems not to know me, to hold me in a blank, star-flecked indifference.

To be unrecognized is, often, to be afraid. So much of human existence is based on recognitions, gestures of belonging: to nations, companies, families, towns, clubs, and classes. Armed with the proper passwords and emblems, we usually go our way in groups and are comforted by it as much as we are oppressed. This nudge of fear creates forms as diverse as herds of elk and political parties. To feel it here and now is natural: it comes with the body and the mind.

No reason to doubt the boat, an Avon inflatable that could float a baby elephant, nor the weather. Apart from mild night breezes, it will stay open and calm under elevated clouds.

I could fear my own error: Li Po, the Old Wine Genius of Chinese poetry, is said to have died when drunk, leaning from a boat to embrace the reflected moon. He fell through the white dazzle and drowned. I have neither wine, nor moon, nor the absolute clumsiness required to fall from a rubber boat on a still lake, yet the feeling of threat is palpable. The boat ceases its drift; for a moment the silence hovers, sheer and inhuman.

I slip a hand into the water's shifting black; cold, but no monster rises and gapes from the deep.

Hello, lake.

Fear is real, though not always accurate. Given the state of the world, there are few places safer than the center of an alpine lake on a fine, dark night. Statistics would prove more danger to an overweight businessman in bed asleep in his new ranchstyle on the San Andreas Fault, particularly if his wife happened to hear about that last conference in Chicago. As he commutes to work on a crowded freeway, dependent on the collective judgment of himself and all others within crashing range, he is closer to death than I am now. There are places in this country where it is dangerous simply to walk the streets and breathe the air. Familiarity with danger carries with it a sort of numb acceptance.

How otherwise might we function in a world complete with megalomaniac politicians and nuclear devices?

Enough of drift and thought. I grope for the Van Dorn bottle and find it, slick, heavy and efficient. Science. I switch on the flashlight and hold it in my teeth, feeling conspicuous in the night. I set the trigger and lower it, watching the swirl around the white line as it disappears, counting marks until it reaches the proper level. The messenger is a cylindrical brass weight that slips down the rope and bumps the trigger, snapping the ends of the bottle shut. I hear the faint click, haul the loaded bottle and plop it into the raft, then switch the light off. My pupils bloom to admit starlight.

Why am I here? In part because the Forest Service is conducting a study of atmospheric deposition and its effects on these high lakes. The present tests are to assess chemical changes in this lake during a 24-hour period, with tests of pH and alkalinity each four hours. I drew the night shift. Back in camp, where my partner

sleeps, are meters and flasks in which water, primed with a chemical indicator, changes color with the measured drip of acid. We record numbers as analogues for the events we observe -- abstract-impressionist renderings of the water and its qualities -- and arrange them in ways that are significant to scientists, computers and society. I am a horsepacker and he teaches me hydrology. I teach him good hitches and horse wisdom.

As a working team, we look for omens: clues to this lake's future and, by extension, human fate. We burn no sacred herbs and consult no gods. If I asked a question and an owl called back from the dark, there would be nothing in the message for a computer to gnaw.

We gather data: fragments. From broken shards, archaeologists may infer the sizes and shapes of pots that no longer exist and pose theories to account for their existence, yet a pot can be made only once. A shattered pot becomes something else. It won't hold water.

I listen to the mild slap of water on rubberized fabric. Water is a persistent archetype, the basis of life. Enriched to a warm broth, it surrounds us in the womb. Up here, held in the granite, it is clear, cold, soft, essential. It can be a metaphor for purity: pure as mountain water. Clouds leave it here as snow. Rain races down the rocks to gather before the fall over ledges and talus, a thousand feet down to Gorge Lake, then Suicide Lake, Long Lakes, Fremont Lake, Pine Creek, the New Fork River, the Green, the Colorado and perhaps the sea, if it has not been evaporated from a reservoir or the cooling towers of a powerplant, has

(Continued on page 19)

18-High Country News -- November 10, 1986



Reworking the Colorado River basin

The large dams -- Hoover, Glen Canyon, Flaming Gorge -- and the big water diversions -- Imperial, L.A., Denver Front Range -- are in place. Despite their overwhelming physical presence, however, the Colorado River is still far from a finished form. Especially in the Upper Basin, it isn't in its dotage; it isn't even in middle age. Instead, it is being nudged by a variety of large and small forces into new configurations to meet new demands.

by Ed Marston

The big structures and diversions are mostly in place on the Colorado River. Hoover Dam backs up 35 million acre-feet in Lake Mead, near Las Vegas, while Lake Powell floods Glen Canyon in Utah with 33 million acre-feet. Smaller dams -- Flaming Gorge, Blue Mesa, Navajo -- control the Green, the Gunnison and the San Juan. Hundreds of yet smaller dams regulate the tributaries -- the North Forks, the South Forks, the Muddies, the Clear Forks...

In the Lower Basin, the water is taken out of the Colorado River via a few very large straws. Southern California diverts its drinking water from Parker Dam just downstream of Hoover, and pumps it westward in the Colorado River Aqueduct. The Imperial and Coachella valley farmers take their one-sixth share of the river out downstream at Imperial Dam and ship it via the All-American Canal to their desert lands. A few large Arizona irrigation districts tap the river after it emerges from the Grand Canyon.

It is different in the Upper Basin, above Lake Powell, where the Colorado River and its tributaries are nicked by many, many relatively small diversions. A major set of diversions are found along the Continental Divide in Colorado. There, at the river's headwaters, irrigation districts and cities take water out of the Colorado River basin and send it eastward via tunnels and canals into the Missouri River basin. Water that escapes that eastern fate flows downhill to be diverted from the Colorado and its tributaries at thousands of points by farms, towns, cities and industry.

All together, the Upper and Lower Basin diversions in the late 1970s

consumed 11 million acre-feet a year out of a virgin basinwide flow of 14 million acre-feet; three million acre-feet reached Mexico. The 11 million acre-feet were shipped out of the basin, evaporated from reservoirs or taken up by plants.

Although the basin does not have a lot more water to give, three major diversions are in the works: the Central Arizona Project, the Central Utah Project, and a set of collectively large transmountain diversions from the headwaters in Colorado to the Denver Front Range.

The last big ones

When the Central Arizona Project is at full strength in a few years, sending water from behind Parker Dam to Phoenix and Tucson, it will be able to suck two million acre-feet yearly out of the river. Much of it, according to the 1922 Colorado River Compact, belongs to the Upper Basin states of Colorado, Wyoming, Utah and New Mexico. As those states develop their water over the next 50 years, CAP will cut down its diversion, possibly to as little as 500,000 acre-feet a year.

The Central Utah Project is smaller than CAP. It will take 170,000 acre-feet out of Colorado River basin streams in eastern Utah and transport them west through the mountains for use by farms and cities in the Salt Lake City area. Both CUP and CAP are being built by the Bureau of Reclamation with big federal subsidies. They are part of the government's fulfillment of its promise to help Colorado River states develop their shares of the river.

Colorado has the largest claim to undeveloped water in the Colorado River. It now consumes about two million acre-feet annually out of a share of three million acre-feet. On the Western Slope, with oil shale dead, the only hope for water development is construction of federally subsidized dams.

Such construction, however, does not guarantee use of the water. The Bureau of Reclamation recently completed McPhee Dam on the Dolores River in southwestern Colorado. But many of the farmers who signed up to take the water are desperately trying to escape that obligation. They say it will bankrupt them. Their plight is being used in the fight by environmentalists against the Animas-LaPlata Project, another rural project costing about one half billion dollars, and located near the Dolores Project.

If Colorado does succeed in further dewatering the Colorado River in the near future, it won't be through dams for agriculture and energy. It will rather be through new diversions to the Front Range metro area that stretches from Fort Collins in the north to Colorado Springs and Pueblo in the south. The Front Range cities and farmers already take 500,000 acre-feet a year; additional large and small projects are in the works.

The largest of the several proposed new projects is Two Forks -- a 1.2 million acre-foot reservoir on the South Platte River near Denver. It is being sponsored by 46 or so public entities led by Denver. The Front Range has tapped into most of the water close to the Continental Divide. The large capacity of Two Forks will let the cities penetrate much deeper into western Colorado to bring that water under the Continental Divide for safekeeping on the Front Range itself.

The complexity and scale of the effort is illustrated by the environmental impact statement that is examining the Front Range's water options and the permitting of Two Forks and some smaller projects. The EIS has already cost Denver and its partners an extraordinary \$35 million -- enough to build a small water project even in these inflated times.

That money has loosed on the

world an enormous amount of information. But its main result has been to illuminate the structural political problems faced by the Front Range. Denver is a static city of 500,000 barred by law from annexing neighboring land. It is unable to lead the 2.5 million person metropolitan area. Moreover, its fellow counties and cities have been unable to come together to create a single entity, such as southern California's Metropolitan Water District, to pursue large, expensive water projects. The metro area's inability to deal collectively with water is symptomatic of similar problems: everything from the sharing of the retail sales tax base to the provision of cultural and health services.

This is a particularly difficult time for the Denver area to be considering an expensive water project. An incredible 30 percent of its offices stand empty. The lack of people in offices and high-tech factories is mirrored in housing. In many neighborhoods, utility poles are festooned with *For Rent* and *For Sale* ads posted by desperate homeowners and landlords. Only Colorado Springs, with its Star Wars industry, thrives.

Discouraged by the gold-plated EIS and the roadblocks in the path of Two Forks, some Colorado cities have begun to poach on Front Range agricultural water, buying up farms and water companies. Even though it means the end of farming for both farmers and their communities, the farmers are going along with the sales, and even seeking them in some cases. The alternative is often foreclosure or bankruptcy.

Salting and desalting

The quiet issue in the Colorado River basin is salinity. The Colorado River starts out pure at its headwaters, but it naturally picks up a very tolerable 4.7 million tons of salt in its trip to the Gulf of California.

However, that natural saltiness has been aggravated over the years by diversions of pure water out of the headwaters that reduces the water

available for dilution. In addition, the use of water for irrigation by farmers and ranchers in the Upper Basin about doubles the salt load by the time the river reaches the lower Colorado.

The result is a salt concentration in southern California and Mexico diversion points of about 900 parts per million -- enough to damage plumbing and industrial fixtures and to stunt crops. It is estimated that each additional part per million of salt causes \$600,000 in damage. Put another way, each 11,000 tons of salt added to the river causes \$600,000 in damage in the Lower Basin and Mexico.

Further development in the Upper Basin, such as new diversions to the Front Range and additional irrigation of salt-laden Wyoming, Utah and Colorado soil, would mean more damage to the Lower Basin and Mexico. At the same time, given the formal and informal bargains struck among the seven basin states and the federal government, salinity cannot be used to stop water development in the Upper Basin states.

The result has been a complex, expensive dance. With the Salinity Control Act of 1974, Congress undertook to keep everyone whole. In essence, it pledged to spend what was necessary to control salinity while not hindering Upper Basin development.

That policy is visible in Colorado's broad, fertile Grand Valley around Grand Junction, near the Utah border. Farmers there use the Colorado River to irrigate 70,000 acres of land. In large part because of the irrigation, the Colorado River picks up an additional 580,000 tons of salt each year in the Grand Valley. The 580,000 tons raises the salinity level in southern California 53 ppm, and causes a theoretical \$31 million in damage each year.

To reduce that burden while allowing additional development in the Upper Basin, the federal government plans to remove 370,000 tons of salt from the river by improving canals, ditches and farming practices.

Of the total, 230,000 tons will be removed by improving on-farm ditches and farming practices. That part is under the control of the Soil Conservation Service. It consists of lining or piping small, seepy dirt ditches, and of encouraging farmers to put just enough water on the ground to nourish the crops without percolating deep into the salty layers of the soil. The total cost will be \$35 million, of which the federal government will pay 70 percent and the farmers 30 percent.

The project is noncontroversial. The Soil Conservation Service, a part of the Department of Agriculture, works one on one with farmers. Its contract arrangements are simple, it doesn't ask for easements or rights-of-way, and farmers generally feel like they are getting an improved farm even as they remove salt from the river. A large chunk of the on-farm work is done or underway.

But the 230,000 tons the SCS program will remove isn't enough. So Congress, with some help from hydropower revenues in the Upper and Lower basins, will spend \$250 million more to remove 143,000 tons of salt off-farm. This part of the program consists of lining the big canals that carry water from the Colorado River to

the farm area. It will also be used to line or pipe the medium-sized canals, or off-farm laterals, which carry water from the major canals to groups of farmers.

This program is in the hands of the Interior Department's Bureau of Reclamation, and it is controversial. Some shareholders in the area's largest canal, the Grand Valley Irrigation Company, fear that the Bureau and the state of Colorado are engaging in a land and water grab as part of the salinity control program.

The Bureau entered the program in a heavy-handed way. Unlike the Soil Conservation Service, the Bureau doesn't know how to deal with many small water users. To accommodate its own centralized nature, it insisted that the farmers organize themselves so that it would only have to deal with one entity. Moreover, it wanted that entity to be able to condemn ditch rights-of-way if farmers refused to cooperate voluntarily. The Bureau also created suspicion by demanding that all ditches be lined, even if the farmers had already gotten together to line them. The result has been a revolt among some farmers, a delay in the project and a steady softening of position by the Bureau.

Even had the Bureau and its helper, the state's Colorado Water Conservation Board, been less clumsy initially, there would probably have been suspicion among the many shrewd Grand Valley farmers. Anyone who can do simple arithmetic has got to question the logic of spending \$250 million on 70,000 acres of salt-producing land.

The \$250 million works out to over \$3,000 an acre. If the government were to offer even \$2,000 an acre, probably every farmer in that valley would leap to sell. In fact, a large percentage of the land wasn't farmed this summer. Much of it fell into the hands of speculators and developers during the last oil shale boom, and that plus depressed farm prices and numerous foreclosures have led to a lot of land being left fallow.

From a purely market stance, the retirement of the Grand Valley's 70,000 acres from farming, and thus from salt production, makes sense. But such a buy-out would mean the creation of an Owens Valley, of Chinatown fame, in western Colorado for the benefit of southern California, Mexico and the urban Front Range. However much economic sense such a step may make, it does not yet make political sense. So the federal government has chosen to spend \$250 million to fix the system without making political waves, other than those that come from federal-budget deficits.

The farmers are in an interesting position. They know their water is very valuable to urban areas. They know their farming causes \$31 million a year in downstream damages even as they struggle to survive. Politically, they can't stop the desalting efforts, since the Bureau's program doesn't cost them anything. But they will continue to be very touchy over any attempts by the Bureau to get pushy over rights of way and easements.

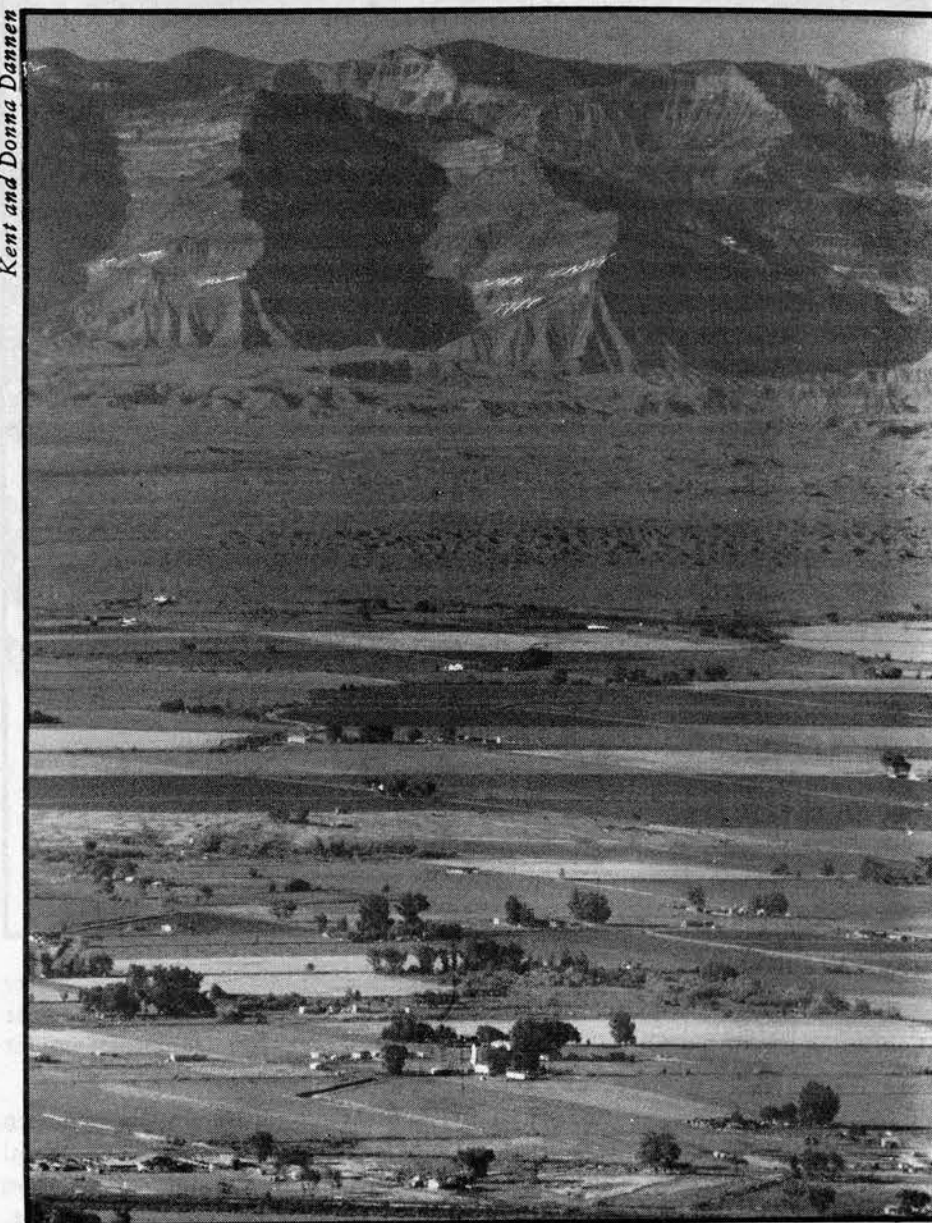
Even if the farmers keep control of the water, they may be in a worsening position as the Bureau program continues. Thus far, the Bureau has only spent about 20 percent of the \$250 million. As it sinks more and more into canal improvement, the Grand Valley land and water will become less and less valuable, since it

will be less of a problem to the developing and developed parts of the basin. No one will pay them just to stop them from farming any more.

If irrigated agriculture in the Upper Basin recovers, then the ditch

lining and piping project guarantees Grand Valley farmers a continued existence. But if agriculture is to continue to slide downhill, then the time for Grand Valley farmers to make

(Continued on page 20)



Grand Valley fields, western Colorado

Night watch...

(Continued from page 17)

not been claimed for irrigation, thirsty cattle or thirstier cities.

The water itself, universal solvent that it is, does not concern us as much as what it bears: oxides of nitrogen from the autoerotic tangles of the urban West, lead, sulfur compounds from heavy industry, traces of the complex airborne pall that has made hundred-mile views a thing of the past anywhere in the West.

There is no doubt that these waters are tainted -- or affected, as a scientist might say. The question is one of degree: Will a certain species of daphnia cease to exist in certain lakes or a pH-sensitive mayfly fail to reproduce? Will the trout die as a result? What are the relative values of brookies in Wyoming and copper-industry jobs in Arizona? How many angels can dance on the head of a pin?

The same question can be asked in terms of values: What are we going to care about and what are we going to do? If we are poisoning our headwaters at the source, then how are we to live? What shall we do with our notions about purity and nature and wilderness? On the other hand, what if the studies, after due argument and interpretation, read "measurable though insignificant degradation of water-resource quality, given present concentrations of airborne acid precursors, for the next 25-year period, assuming no augmentation or spatial redistribution of point-sources or load-levels?" Will

this be a signal to reinsert the national head in the national posterior and get back to business as usual?

Perhaps. Scientists swarm in these mountains, taking cores from lakebeds and glaciers, clipping foliage and scraping lichens, carrying bits and pieces back to labs from Maine to California. Conclusions will differ, though it's probably safe to say no one will claim beneficial effects on alpine ecosystems from airborne pollutants.

Strange how quickly thoughts can remove you from a place. Returning, I feel safe, even loved. The lake and the darkness seem acceptant; clean and perfect in a way I can sense but never grasp. The oars fit smoothly into their locks, but I'm not ready to go; to clamber back onto the rock of the world again to meters and flasks, numbers and names, duties and debts, tents to be folded and horses to catch.

I like this silence in which there is hunger but no greed; such beauty is absolute. I feel the urge that drew Li Po out of the boat to the reflection of the selfless, bright moon, which offered nothing and everything.

The reflection of light on black water has no measureable depth, yet stars wink at me from the lake. This change from fear to calm has come over me many times, but it doesn't take; it will not abide. Any move I make will take me back.

I dip the oars and pull. The boat surges, rounding the invisible, rocky point. The candle in the lantern still burns, warmer and closer than the stars. Among the mirrored stars, a path of dancing light extends across the water, gold as willow leaves, and on it I return.



Dick Randall, Defenders of Wildlife

Salting...

(Continued from page 19)

their Owens Valley deal may be now, while they are still pouring millions of tons of salt a year into the Colorado River.

The snowpack reservoir

The headwaters of almost all Western rivers are on national forests. A major reason, perhaps the reason, for national forests and the U.S. Forest Service was to safeguard watersheds. The 1897 Organic Act, the foundation of national forest management, reads:

"...No national forest shall be established, except to improve and protect the forest within the boundaries, or for the purpose of securing favorable conditions of waterflows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States..."

One would expect to find the agency heavy with hydrologists, fishery biologists and water-quality experts. One would look for policy manuals to bulge with directives on water quality and quantity. In fact, only a small percentage of the agency's employees are specialists in water. And the agency's manual is almost devoid of water-quality policy. Law professor Charles Wilkinson, in a 1985 *Oregon Law Review* article, wrote that the Forest Service has not implemented its authority to control water quality:

"Unfortunately, confusion and misconceptions about the NFMA's (National Forest Management Act) applicability to national forest water-quality issues seem to be pervasive. The Forest Service manual's cursory provisions on water quality may result from a perceived lack of agency authority over water quality. But the NFMA water quality provisions, which are subsequent to and more specific

than section 208 of the Clean Water Act of 1972, plainly supplement the Clean Water Act requirements for national forest lands."

Wilkinson writes that the approach to water quality has been controversial since the agency tilted away from water and toward timber in the 1940s. The controversy surfaced most loudly in the 1960s' struggle over clear-cutting and overcutting on the Monongahela and Bitterroot national forests of West Virginia and Montana/Idaho, leading in 1976 to passage of the NFMA.

Its passage has not settled all battles over water on national forests. The struggle resurfaced recently on the Gunnison National Forest in western Colorado's Delta County. There, a group of farmers south of the Grand Mesa have directed their four small water companies to oppose a plan to build roads to cut several hundred million board-feet of timber over the next 150 years. The first 10 years of the plan will not affect their water, but the farmers fear road construction will set the stage for damaging development.

Their objections persuaded the agency to do an environmental impact statement; now the farmers will appeal the results of the EIS. They have thus far spent about \$15,000 fighting the plan, according to Mark Welsh, the consultant-activist the farmers hired to represent them.

The two sides disagree over the economics of the logging, the need for the timber, the effect on wildlife, the need for more roaded recreation, and so on. But the landowners, most of whom have other jobs to support their farms, mainly fear that long-term cutting in the 35,000-acre Stevens Gulch area will alter the flow of water off the hillsides each summer. They catch the flow in hillside-hugging ditches, and convey it to their land by gravity flow. They also fear the alteration will be permanent. The same Paonia Ranger District so intensively logged another high-altitude part of its domain, the Black

Mesa, that the forest is not recovering.

The farmers' written objections state that the cutting of trees above their ditches will expose each year's snowpack to stronger sunlight than at present, resulting in earlier runoff. If the ditch companies had reservoirs to catch their water, the timing would not matter. But their reservoir is the snowpack. They depend on slow melting to provide them with water late into the summer. A quick, early melt would deprive them of late summer water.

The Forest Service says its computer model shows that any early melt will be offset by increased moisture in the snowpack caused by the cutting of the trees. The EIS also says that increased sediment due to roading and skidding will not be excessive. Welsh says the agency has done a quick and dirty job of investigating the hydrologic effects, that it has not examined all watersheds the farmers are concerned about, and that its roading program is driven by the availability of money rather than by the resources.

The factual questions are interesting. More interesting is the agency's response to the farmers' repeated requests for a clear policy statement on water in the EIS, and an application of that policy to Stevens Gulch. Their requests were not answered. The draft EIS had a brief discussion of water policy. The final EIS and record of decision by Forest Supervisor Raymond Evans have no policy in them.

Although the agency has chosen not to discuss its policy on water quantity in the EIS, and its application to the specific roading and logging, its policy is clear. One 1986 briefing paper describes the policy as directed at "a range and duration of in-channel flows necessary to maintain the stability and effective function of the

streams' channel." Translated, that means the agency seeks a high enough spring flow to clean out sediment that may have accumulated in stream channels. Without such structural flows, channels become filled in and overgrown.

The "structural" water position is a fallback for the agency. Its original position was that it was entitled to reserved water rights to maintain fisheries, recreation, etc., on all national forests. It argued that the Congress, in establishing national forests, also established an implicit federal right to water, just as Indian reservations are entitled to water.

The U.S. Supreme Court in its 1978 Rio Mimbres decision (Rio Mimbres is a river in New Mexico's Gila National Forest) said differently. It ruled that forests' only reserved rights are for stream maintenance and timber. And in the thirsty West, even getting that water has been a struggle. In Colorado, the state and water users are opposing agency attempts in the court to establish such reserved rights. If the states and water interests have their way, the Forest Service will be treated as just another water user.

The Forest Service seems transfixed by Rio Mimbres. Policy papers and agency officials come back repeatedly to that case. The draft EIS on Stevens Gulch mentioned structural flows. The court's limitation of the agency's pursuit of reserved rights appears to have become its maximum position in all water situations. The farmers protesting the roading and logging plan, for example, are not concerned with agency claims to reserved rights. They want, Welsh says, the Forest Service to control the impacts on water quantity and quality that may be caused by its own timber policy. They want it to put more emphasis on water and less on timber, he says.

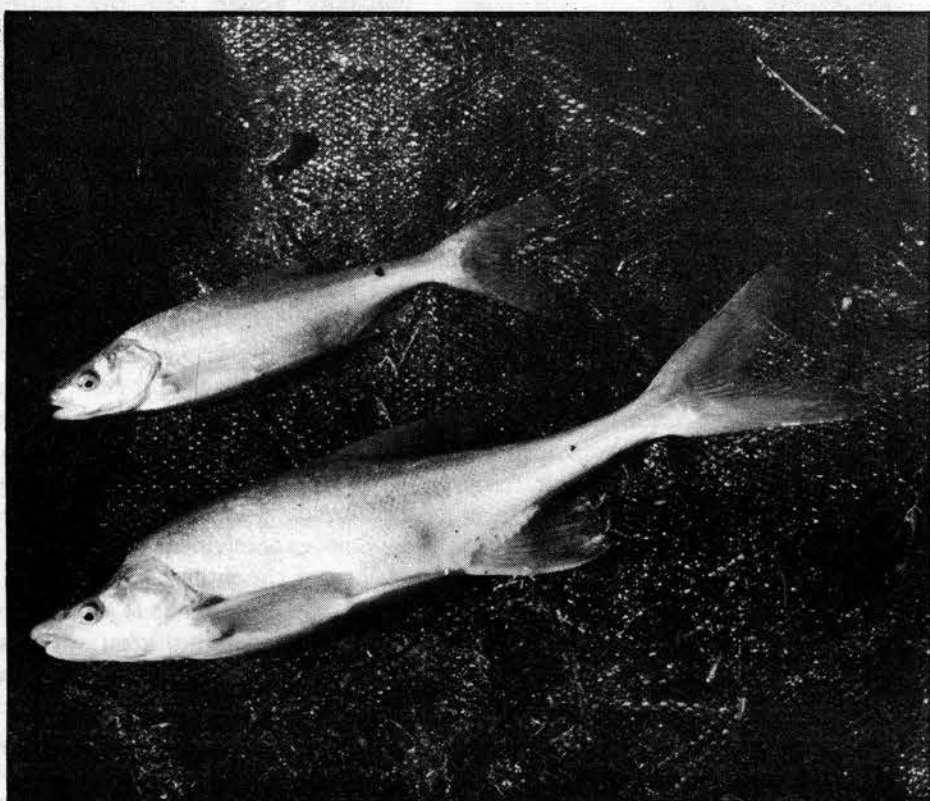
Recovering the squawfish, et al

Although there are plenty of dams on the upper Colorado River, it is still more river than reservoir. Unlike the lower Colorado, and the Columbia and Missouri, the upper Colorado still looks like a river. But it is an altered river. The dams reduce spring flows, change water temperatures in summer and fall, block fish migration, catch silt, and create and destroy habitat.

One result has been to destroy or endanger four species of fish native to the Colorado: the Colorado squawfish, the humpback chub, the bonytail chub and the razorback sucker. Their plight has not attracted the same attention as the Columbia River's salmon because the Colorado fish have neither sport nor commercial value.

(Continued on page 21)

David Sumner



Endangered humpback chub

Digging in their heels

A conservation group fights a transmountain diversion planned for a Colorado wilderness.

by Betsy Marston

Led by a doctor who lives in the college town of Boulder, Colorado, conservationists have dug in their heels to oppose the diversion of water from a wilderness surrounding a 14,000-foot peak.

The doctor is Warren Hern, 48, a public health physician, and his organization, the Holy Cross Wilderness Defense Fund, includes 750 members from both sides of the Continental Divide.

The project they oppose is Homestake II, a diversion of 19,600 acre-feet a year from Holy Cross Wilderness -- close to the Vail resort -- to the Denver suburb of Aurora and city of Colorado Springs. The project was specifically allowed in the 1980 Colorado Wilderness Act, thanks to Colorado Republican Sen. Bill Armstrong, who pushed through a clause that prohibits the Forest Service from interfering with dams, pipelines and tunnels meant for Homestake II. Homestake II is a proposed expansion of an earlier project completed in 1967 that dammed Homestake Creek, created a reservoir, and moved its waters east and out of the watershed.

The disclaimer in the wilderness bill put conservationists in a difficult spot. The result in 1980 was support for the bill although no one agreed not to fight against a second water diversion on Holy Cross mountain.

As planned, Homestake II would

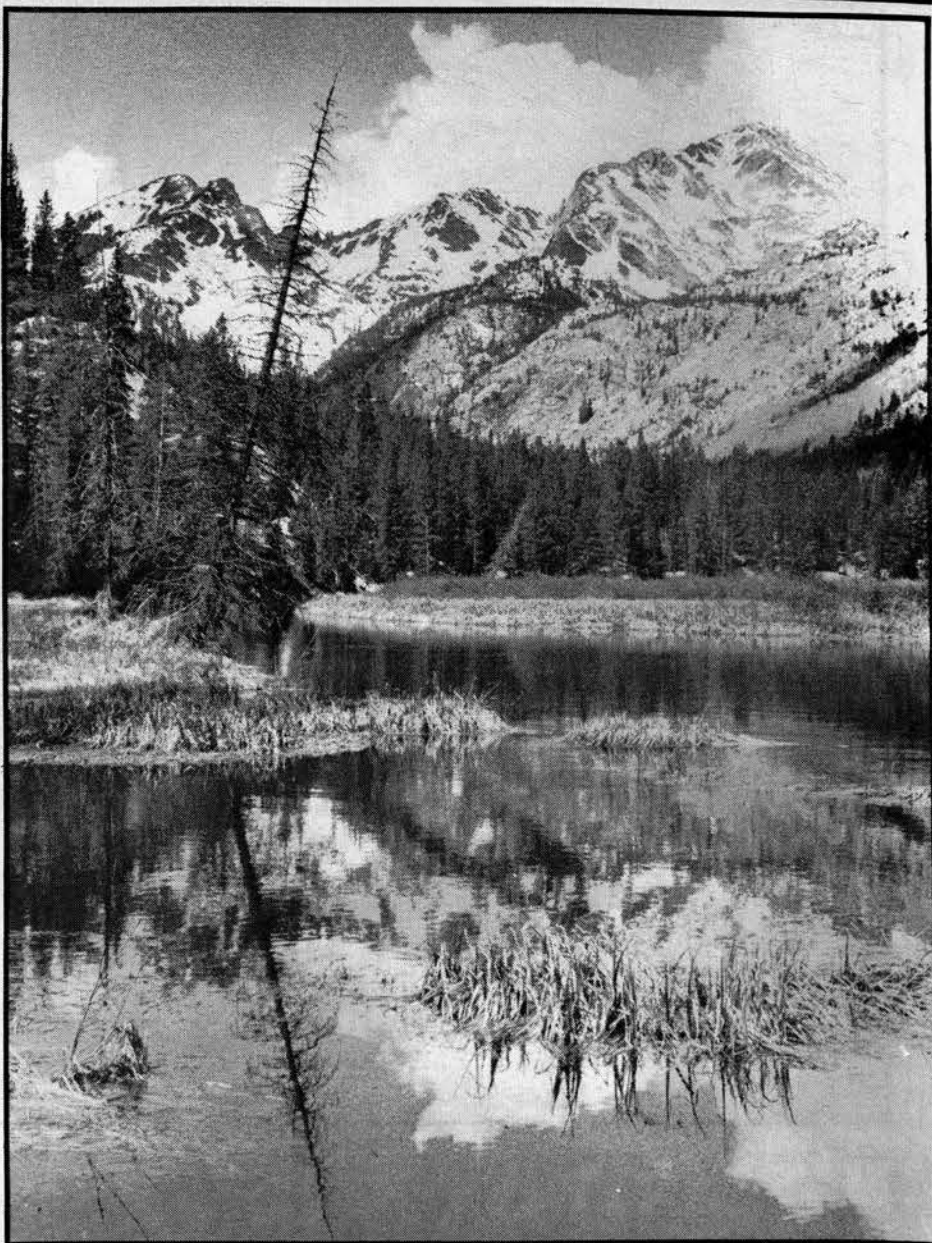
capture water from the main tributaries of Cross Creek, then ship the water to fast-growing Colorado Springs and Aurora through 11 miles of tunnels.

The cities, which warn of impending water shortages without Holy Cross water, say mitigation would soften the impact of building within a wetlands ecosystem. Only six acres would be affected by diversion structures, they say.

Hern's Defense Fund says 240 acres would be harmed by water shortages. Dams built and rebuilt by beavers would be overloaded with sediment, marshes would dry up and plants, some of which were recently found to be endangered, would die, say conservationists.

Hern's group has paid for its own biological studies of the Cross Creek terrain, and their conclusions are bleak: tinkering with wetlands means their destruction.

A tireless speaker about the need to save the Holy Cross Wilderness from further development, Hern says one tactic of opposition is public information. He tells the East Slope cities, for example, that "they'd be better off buying Perrier water." The estimated cost of the diversion began at \$67 million in 1984 and rose to \$91 million in 1985. Hern suggests a more accurate figure would be \$250 million. His group proposes other alternatives to transmountain diversion, including



View from the Holy Cross Wilderness

conservation, some metering, buying agricultural water or trading for more water.

Meanwhile, the conservationist strategy is, in Hern's words, "infinite delay." In October 1985, the Defense Fund sued both the Forest Service and Army Corps of Engineers in federal district court in Denver, charging that the agencies issued permits with woefully inadequate environmental analyses. Hern says the cities have been warned to plan on "20 years of litigation."

Why does Hern persist in the fight against water diversion from the Holy Cross Wilderness? One reason is that he hiked its meadows below the 14,000-foot peak as a child. He knows the land and loves it. Another is a repugnance for cities illustrating "the mindless growth of a cancer cell," he says.

"Colorado Springs can grow uncontrollably if it wants to do so, but not at the expense of the Holy Cross Wilderness." The Defense Fund is at 1130 Alpine, Boulder, CO 80302.

Recovering...

(Continued from page 20)

Moreover, the natural river the endangered species are adapted to is one most people do not find attractive: highly variable flows, very warm water at times, lots of silt, and flooding and scouring in springtime.

The Colorado River has been transformed from that early river. Especially in the Lower Basin, but also in the Upper Basin, it has been changed into a series of mountain streams, with new "headwaters" starting at each major dam. Large reservoirs reset the river by capturing the silt and the cold runoff in the spring. When the water is released in the summer and fall, it flows from the bottom of the reservoir, clear and cold, as if it were snowmelt coming off the mountains.

The result has been to create "gold medal" conditions for such exotic, or non-native, species as cutthroat trout, rainbow trout, brook trout, and so on. They now thrive in the clear, cold water below Hoover, Flaming Gorge, Blue Mesa, Glen Canyon and other river sections where they once were not found. In addition, catfish, bass,

northern pike and other introduced species find new habitat in the reservoirs.

Some of the introduced species also prey on the native fish. At its full fighting weight of 80 pounds, the squawfish can take care of itself. But its young are easy prey to various introduced species. Moreover, the squawfish is a migratory species -- the white salmon of the Colorado -- and the dams block it from reaching its breeding places.

The situation appears beyond repair in the Lower Basin, where the intensity of damming and diversion has totally wiped out the native fish, and replaced them with introduced varieties. The Upper Basin has relatively few dams and a relatively low level of diversion, so the native fish are still hanging on, for the moment.

For obvious reasons, there has been no support for the squawfish and its endangered brethren from sportsmen, and the water developers have been scornful of these "trash" fish. In fact, the Colorado water establishment attempted to gut the Endangered Species Act in the last Congress to prevent its application to Colorado River dams and diversions. The Endangered Species Act has the potential to block water projects, or to force existing projects to alter the ways in which they operate.

The issue was brought to a head in the early 1980s by a U.S. Fish and Wildlife Service proposal to restore pre-1960s flows to the Upper Basin. The reaction was intense, and the result was the creation of a coordinating committee to seek a compromise.

The committee was made up of the Fish and Wildlife Service, the Bureau of Reclamation, the states of Colorado, Utah and Wyoming, the water developers and environmentalists. Surprisingly, the committee hammered out a compromise that is now making its way through the National Environmental Policy Act public process.

The compromise gives dam builders and water diverters freedom from proving that their particular effect on the river won't further weaken the fish. But it also commits the private developers, the Bureau of Reclamation and the states to help recover the fish, rather than just prevent further deterioration.

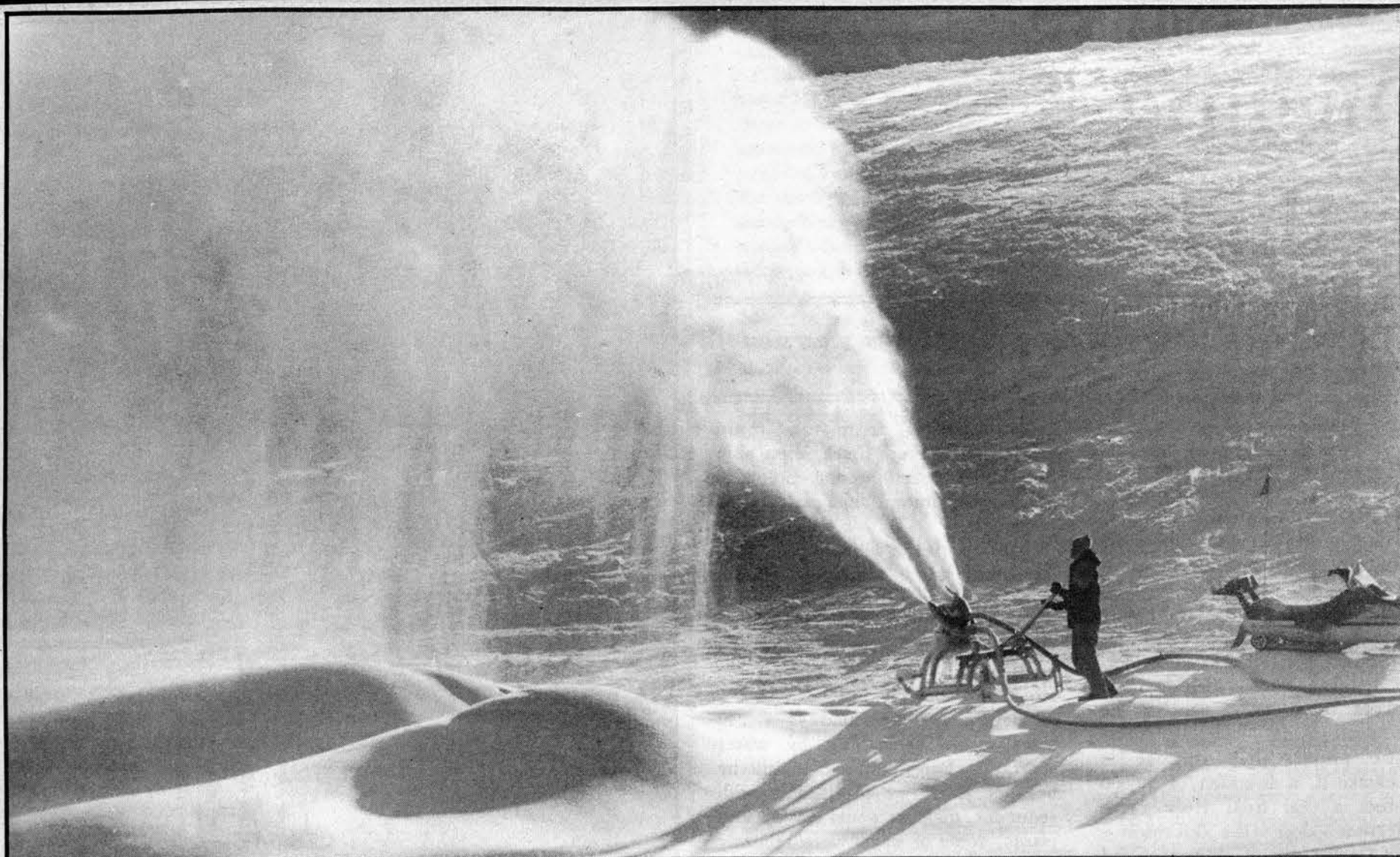
The key to the plan is a \$10 million initial appropriation from Congress to purchase water rights to help the fish. Congress will also be asked to appropriate \$2.4 million a year for recovery. The kitty will be fattened by a fee each new water development must pay toward the recovery.

The Bureau of Reclamation, whose

management of existing dams plays a large role in the regulation of the river, has committed 15,000 acre-feet out of Colorado's Ruedi and Blue Mesa reservoirs. The water will be released at key times to improve the spawning of the native fish species. Funds will also be used to build fish ladders to aid migration, to do biological research (little is now known about the fish), to produce hatchery fish, and to take other steps to improve habitat.

An important role will be played by the states. Colorado, Utah and Wyoming now all have instream flow laws on the books. So the legal means exist to keep water in streams as a beneficial use. Prior to passage of those laws, there was no way to prevent the total dewatering of streams.

The fact that the states, the water developers and the environmental community have agreed to the recovery program gives it a good chance of obtaining funds from Congress. But there are obstacles. Sport fishing interests fear that the recovery effort will harm trout habitat downstream of dams. And some Upper Basin interests ask why the Lower Basin is getting off free. They say California and Arizona are being rewarded for having totally destroyed the native fish and their habitat in the lower Colorado.



Mike Rawlings

The snow also rises

In the quaint 1970s, the Colorado ski season started when enough snow fell to cover the slopes. Today, the season starts when resort managers order it to start. As a result, winter water is as important to ski areas as summer water is to farmers.

by Allen Best

Two years ago, for reasons of no consequence here, I briefly worked as a snowmaker at the SilverCreek Ski Area. The resort is located on the west flank of the Indian Peaks Wilderness Area, 20-odd miles from where the infant Colorado River flows out of Rocky Mountain National Park in Colorado.

Although snowfall is plentiful in the surrounding mountains, SilverCreek's top elevation is only 9,200 feet and even in January, bushes and rocks occasionally show. That's when I made snow.

Making snow is a simple process, even in the dark. You merely combine water and compressed air at the nozzle of a snowgun. The colder it gets, the less water you need, and the easier it is to make big mounds. The job is no more complicated than irrigating a hay field.

But like irrigating, it does take time. All night we buzzed around on snowmobiles, dragging heavy hoses to the air and water spigots lined along the trails, rassing the heavy snowmaking guns into position, and adjusting and readjusting the mixture of air and water until we were producing just the right kind of snow crystals.

Good man-made snow crystals are unlike the star-shaped flakes that fall naturally. The manufactured variety are small and dense, more like sleet than snow. Man-made snow weighs at least 25 pounds per cubic foot; natural snow in Colorado weighs 12 to 15 pounds.

Ski racers love man-made snow because of its density. When Vail

hosts the World Cup races in March, racers ski on man-made snow cranked out for the occasion. Because of the density, it's more durable and the 50th racer encounters virtually the same conditions as the first racer. Natural snow on a race course steadily deteriorates.

The rule of thumb for achieving the preferred crystal is to mix four parts air to one part water. A computer controls the air pressure, but snowmaking is still more art than science, and the quality of the next day's skiing depends on the judgment of someone standing on a dark ski slope, swaddled in layers of clothing with a miner's lamp on his or her head. Next to him is a snowgun blasting like a powered-up jet plane, which he adjusts depending on how the ice crystals bounce off his glove.

Finally, at dawn, we blew out the hoses, and the snowgroomers took over. I went home to bed, arising in time for the setting sun. If it sounds dull, it was.

Dull or not, snowmaking is vital to SilverCreek and ski resorts around the world. Come November and cold weather, people want to go skiing, with vacations planned months in advance. Opening dates are set months in advance. This tremendous investment is underwritten by snowmaking, the "life insurance policy of ski areas."

Snowmaking became a vital element of the Colorado ski industry relatively late. The basic technology existed in the 1960s, and most New England ski areas invested heavily.

But Colorado resorts were slow to follow. Skiing was not yet big business, and it always snowed by January.

That changed during the 1970s. First, the ski industry boomed. With the new automatic-release bindings, people could ski without risking broken bones each time they slid off a lift chair. Along with the better equipment came out-of-state skiers willing to shell out for expensive skiing vacations. At many resorts, destination skiers outnumbered Coloradoans.

In the midst of this boom, Mother Nature brought the industry to its knees. Snow was spare during the 1977-78 season and people across the country stayed away by the plane-load.

That winter was viewed as a fluke, but after several more record-setting seasons, Mother Nature failed even more spectacularly in the winter of 1980-81. Trails at Breckenridge and Steamboat were brown at Christmas and they never got much better. The message was clear, and by the next year, virtually every ski hill was putting in air compressors and water pumps.

Today, snowmaking covers a quarter of the ski acreage in Colorado. It enables ski areas across the state to promise that they will open, and it allows some ski areas to guarantee when they will open.

This insurance policy is not cheap. At Vail, it took the first 17,200 skiers last year to pay for snowmaking operating costs. That excludes the over \$3 million capital investment. Several years ago, Winter Park figured it cost \$16,028 per acre of man-made snow. At SilverCreek, three years ago, the electricity bill dropped from \$40,000 a month to \$4,000 a month when snowmaking ended.

The effect of snowmaking on water resources of the upper Colorado River drainage is increasingly significant. Ski resorts on the upper Colorado River drainage, from Crested Butte to Steamboat, collectively use nearly 4,000 acre-feet, or as much water as is needed for 16,000 people. Most of that water is consumed on the main stem, above Glenwood Canyon. In contrast, according to a study by the industry trade group, Colorado Ski Country U.S.A., 1.5 million acre-feet are used in Colorado for municipal and industrial use in a year; agriculture uses 16 million acre-feet. So on a river basin scale, snowmaking is invisible. But local impacts of snowmaking are already significant and likely to become more significant.

First, snowmaking normally occurs in late fall and early winter, among the driest months of the year. Streams are at their lowest flows, and snowmaking reduces them further. More important, snowmaking is most needed during and after drought years, when there is even less water in headwater streams. And ski resorts, of course, are generally found at the top of river drainages.

The various resorts are dealing with this problem in different ways. Vail is enlarging a small dam near the summit of Vail Pass. Water officials say that this five-fold increase in reservoir storage will allow them to release enough water in drought winters to guarantee a wintertime flow of about six cubic feet per second in Gore Creek even while the snowmaking machines operate full blast. The augmentation scheme promises to accommodate not just snowmaking, but also more condos. A peak population of 40,000 is planned, compared to current peak populations of 25,000.

Summit County has taken a different approach. It has a peak

A Colorado River bookshelf

With the possible exception of the Mississippi, the Colorado is the most written-about river in the United States. From that large choice, here is a brief bibliography for those interested in further pursuing the river.

by Peter Wild

“The Nile of the West,” they called it around the turn of the century. It was a dream of Oriental proportions that, once turned to human ends, this muscular river, leaping for hundreds of miles from the snowfields of Wyoming and Colorado to the subtropical Gulf of California, could transform a barren region. (See map on page 12.)

It was a dream largely fulfilled. Today, the Colorado River illuminates the neon shimmer of Las Vegas and waters cabbages in California. Thanks to the dams that stud its length, retired folk pluck catfish from its depths while the younger set water ski across its surface. It gushes out of thousands of taps and obediently flushes toilets. It is indeed a genie taught to do man's bidding.

A bidding, however, with one end: to make money. And that involves some issues ignored by the visionary technocrats.

One need not be a romantic to lament that the Colorado is a river no more, that it usually no longer reaches the sea, to mention one obvious insult to nature. Despite billions of dollars and the most glittering technology ever brought to bear on a watercourse, in just a few short years since its taming, the Colorado is beginning to rebel. Floods, salination, erosion,

siltation, plant diseases, and yes, water shortages are plaguing its vast watershed. Such are the ills visited upon other societies that eagerly overexploited their riverine lifelines.

Faced by such intractable, man-made problems, some people wonder if the Colorado hadn't best been left in its bed. All of which is to say that a force that great for good or ill is bound to produce voluminous and various writings about it. It was true of the Egyptians, and it is no less true of us.

In this short bibliography, I have glided over much of the technical

literature. It is of great value, of course, but also of interest primarily to the specialist, and, at any rate, several of the items cited below will lead the reader quickly to it.

A long list has been narrowed to 12 books essential to an overview of the Colorado, to the major social, political, legal, environmental, and spiritual issues that great river has inspired. Each river-lover could compile his own

tenaciously defended list; these, at any rate, have been most valuable to me. They are listed chronologically.

Obscure John Wesley Powell became famous overnight when he shot out of the downstream end of the feared Grand Canyon as its first successful navigator. With an eye on Congress and increased aid for future expeditions, he penned *Exploration of the Colorado River of the West and its Tributaries* (Washington, D.C.: U.S. Government Printing Office, 1875). It is doubly notable: for the dramatic, day-by-day account of this "impossible" journey, and historically for its sympathy toward a hostile environment.

In *The Colorado Conquest* (New York: Dodd, Mead, 1941), David Oakes Woodbury spins heroic stories about the taming of what he calls the menacing "Red Bull" of the Colorado. Especially readable is Woodbury's account of how men got more than they bargained for. In 1905, the "Red Bull" leapt out of its bed, shot down an irrigation ditch and began flooding California's Imperial Valley. About

(Continued on page 24)

population of 60,000 and three resorts now with snowmaking: Breckenridge, Copper Mountain, and Keystone. Each of the three areas has signed comprehensive agreements with the Colorado Water Conservation Board, promising to restock streams with fish if, in the event of another drought year, they must drain the waterways below levels the fish can survive.

Winter Park, part of the Denver parks system, gets water from the Denver Water Board, which has nearby diversion facilities. Denver doesn't need the water in the winter, and it gets most of the water back when the snow melts in the spring.

But not all ski areas are lucky enough to tie into the Denver Water Board's system, and the demand for winter water has prompted a scheme centered on the Shoshone hydroelectric plant in Glenwood Canyon. That plant has a 1905 water right to a 1,250 cubic feet per second, which it sends through its turbines. The scheme calls for satisfying the right by taking the water as it flows out of the plant's discharge pipes and pumping it back upstream to the plant's intake pipes.

The idea, which was hatched by water attorney Scott Balcomb, makes no sense from an energy point of view. It will take about 120 kilowatts of power from another source for

Shoshone to produce 100 kilowatts. But endlessly recycling the same water at Shoshone lets upriver ski areas draw the river down below 1,250 cfs for snowmaking and other uses. The plan may be moot because of Denver's recent arrangement with Public Service Company, discussed elsewhere in this issue. But it does show the sorts of things ski areas may have to do to get water.

Actually, water is available for the asking to the ski areas out of Green Mountain Reservoir. But the water is priced at \$60 an acre-foot by the Colorado River Water Conservation District, which has been given the water-sale franchise by the Bureau of Reclamation. The ski areas object to the huge profit the River District will make at \$60 an acre-foot.

Glenn E. Porzak, an attorney for Vail Associates says: "The actual cost to the River District is \$3 to \$5 an acre-foot. Green Mountain Reservoir was not put there to give a profit to the middleman, the River District, with which to build future projects. Green Mountain was built for future users on the Western Slope, particularly those upstream of the Shoshone Plant."

Those future users, says Porzak, are now there in the form of ski resorts. Vail, unlike the Summit County resorts, might have initially

gone along with the \$60 charge if the River District had planned future projects of greater benefit to ski resorts. But now, if Vail can get water for \$30 an acre-foot in the Balcomb pump-back scheme, there's no need to spend \$60 an acre-foot for Green Mountain water.

"Our future needs will depend upon smaller, strategically placed reservoirs," he says, ones higher up on river drainages. Instead, the River District anticipates a large dam, perhaps on Muddy Creek, just north of Kremmling.

Porzak says the dispute illustrates conflicting attitudes about water use on the upper Colorado River. The big reservoir eyed by the River District would be of use to agricultural interests that are the traditional constituency of the River District, he says. But there is little new demand for agricultural water rights. The demand comes from recreation, now the largest industry on the Western Slope. And the recreation industry, he says, wants small projects, located on headwater streams, to maintain minimum flows through tourist towns and augment streamflows for downriver calls.

Despite the lavish outlays by Colorado ski areas in the last year, evidence is strong that the number of skiers has leveled off. At first glance,

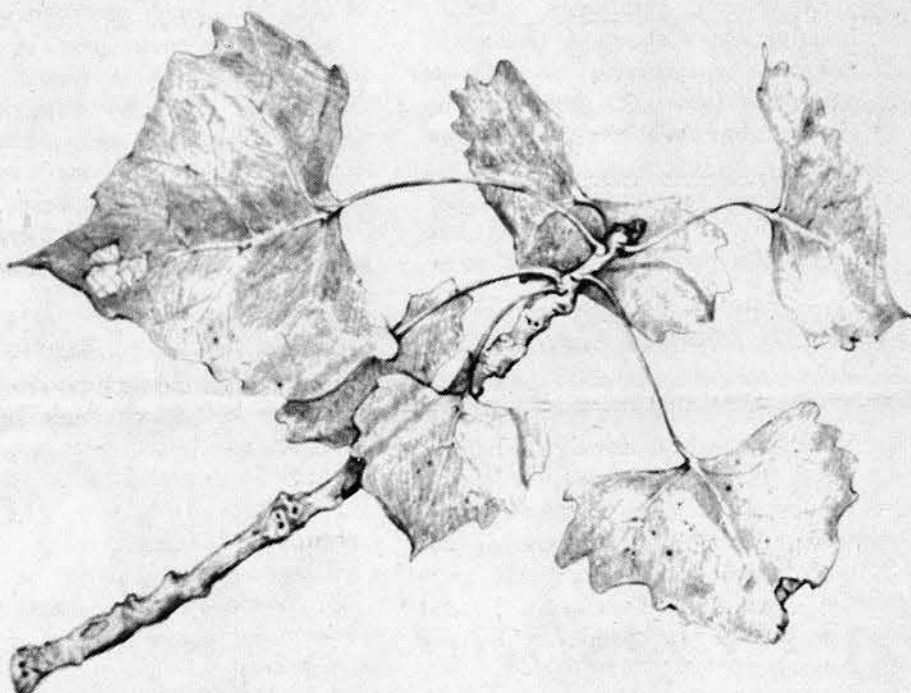
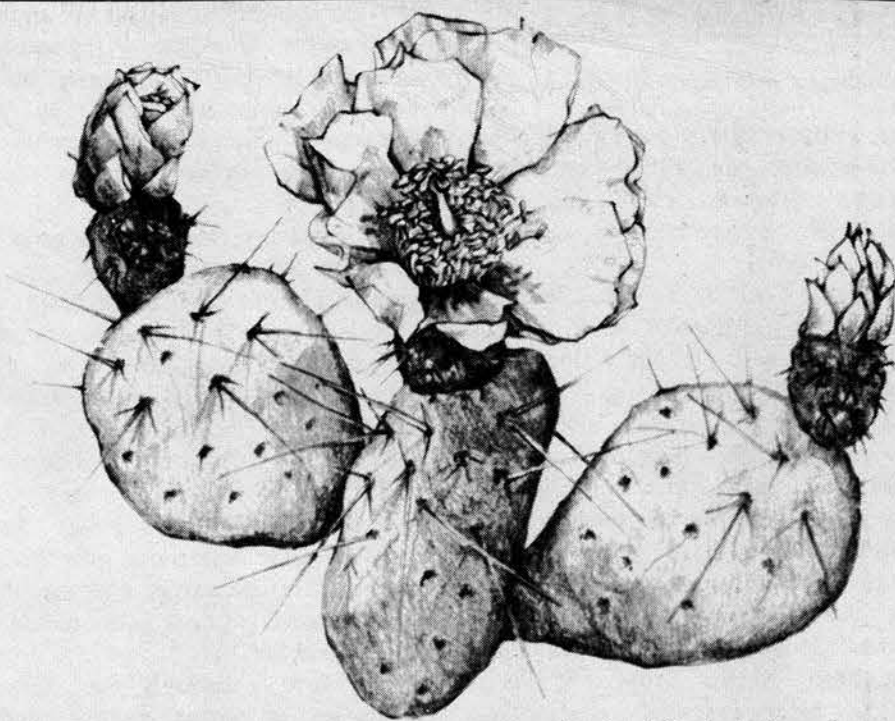
that would seem to indicate that these elaborate machinations on the upper Colorado River are unnecessary. But Porzak says that a flat market for skiers will instead increase snowmaking demands.

If you indeed have a flat industry, then to compete for that stable base you must offer a higher quality product, he says, with more high-speed lifts and more snowmaking, to put you one step ahead of your competitor. That, in turn, means higher lift ticket prices.

With Vail already at \$30 and other ski resorts on the upper Colorado not far behind, some question how many people can afford to pay for that improved product.



Stars indicate some of Colorado's downhill ski areas. The Continental Divide is shown.



24-High Country News -- November 10, 1986

Bookshelf...

(Continued from page 23)

successful efforts to put a ring in the river's nose, the author concludes, "The Colorado has met its match at last." An ironic book in light of current events.

Edwin Corle's *The Gila: River of the Southwest* (New York: Rinehart, 1951) deals with a tributary, but it is a key to the variety of the immense watershed drained by the Colorado. It covers the Spanish conquest, folklore, flora and fauna of a sub-region's "burning deserts and snow-capped mountains."

In *Beyond the Hundredth Meridian: John Wesley Powell and the Second Opening of the West* (Boston: Houghton Mifflin, 1954), Wallace Stegner offers essential and stylistically gracious reading for understanding the role of water in shaping the West. Stegner illuminates Powell as a John the Baptist of water reform, the man who battled popular delusions about water abundance in an arid land.

One's fingers should tremble at the touch of another Stegner book, *This Is Dinosaur* (New York: Alfred A. Knopf, 1955). This is one of the sacred tales of conservation. In the 1950s, the Bureau of Reclamation decided to build Echo Park Dam on the Green River (actually the main branch of the Colorado). This would flood parts of Dinosaur National Monument. Heated by the invasion, the grand old men of modern conservation -- Stegner, Bernard DeVoto, David Brower, and

Howard Zahniser -- rallied the nation to preserve Dinosaur's supposedly inviolate treasure. Helping their campaign along, colorful *This Is Dinosaur* initiates a rallying cry taken up by later format books on other conservation issues.

Giving a new twist to the approach, Eliot Porter's portfolio of photographs, *The Place No One Knew* (San Francisco: Sierra Club, 1963) stung the nation's conscience over the mysteries lost when Glen Canyon Dam inundated a priceless section of the Colorado in 1963. In his introductory essay, David Brower states the obverse of Woodbury's ethic: "The menace is... the notion that growth and progress are the same, and that the gross national product is the measure of the good life."

A journey through the steamy intricacies of water politics, John Upton Terrell's *War for the Colorado River* (2 vols. Glendale, California: A.H. Clark, 1965) recounts the legal battles over the Colorado. One supporter of the multimillion-dollar Central Arizona Project raged that without the project, taxes would go up, schools close, and crime run rampant through the streets of the Southwest, thus illustrating that often hysteria carried the day.

As Norris Hundley's scholarly *Dividing the Waters: A Century of Controversy Between the United States and Mexico* (Berkeley: University of California Press, 1966) shows, divvying up the Colorado has had international repercussions. The tug-of-war over the river's overallocated waters has produced chronic sores,

not only among the states but between two countries.

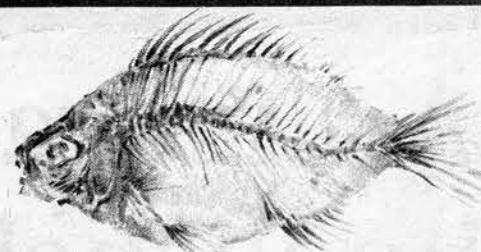
With *The Monkey Wrench Gang* (Philadelphia: Lippincott, 1975), Edward Abbey gives us the Colorado's dams rising sky-high and high-speed chases as a band of eco-raiders attempts to right technology's wrongs with dynamite. An excursion through environmentalists' wish fulfillment.

"Beneath the beating of the wind I can hear the river beginning." So Ann Zwinger, standing in western Wyoming's Knapsack Col, records the start of her trip down the Green River. More impressionistic than Philip Fradkin's work mentioned below, *Run, River, Run* (New York: Harper and Row, 1975) exemplifies the poetic approach to river-trip books: "running whitewater is like riding a horse: if you fall off, you'd better get right back on." As is usual in Zwinger's volumes, her graceful drawings parallel a graceful text.

Meanwhile, the resource crunch on the Colorado continues. *Values and Choices in the Development of the Colorado River Basin* (Dean F. Peterson and A. Berry Crawford, eds., Tucson: University of Arizona Press, 1978) brings together 15 articles discussing the agricultural, recreational, legal, and other Gordian knots of tangled Colorado controversies.

Of special note here is Helen Ingram's "Politics of Water Allocation," pages 61-75. She suggests that the early dreams of water abundance in the arid lands often have turned out to be expensive mirages.

Hands down, Philip L. Fradkin's compendious *A River No More* (New



Drawings copyright Ann H. Zwinger, 1975, from *Run, River, Run*

York: Alfred A. Knopf, 1981) is the best place to start reading about the Colorado River. Fradkin pauses on his river journey to fill the reader in on the history, faulty economics and social patterns generated by the conquest of a once grand resource.



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