

## Public meetings on WHP in Wyoming

The Wyoming Department of Environmental Quality (DEQ) Water Quality Division, will hold public meetings in June and July to discuss the benefits of wellhead protection (WHP) programs for cities and towns.

The purpose of WHP is to help prevent contamination of public water supplies. Through these meetings, the DEQ will

gauge public interest for developing local wellhead protection programs for communities in Wyoming.

Over 75% of the population in Wyoming relies on groundwater for all or part of their drinking water supply.

The quality of water from these wells is extremely important to the quality of life and

livelihood of Wyoming residents.

Groundwater can be contaminated from many sources such as, landfills, cropland and lawns treated with fertilizers and pesticides, abandoned wells, and accidental spills. Once groundwater is contaminated, it is very difficult and expensive to clean up or treat the water supply.

By developing a WHP program, state and local governments and communities can designate wellhead protection areas around drinking water wells to safeguard their underground water supply for the future.

For further information about the wellhead protection program or public meetings in your area, contact the Wyoming Department of Environmental Quality, Water Quality Division, Groundwater Program, at (307) 777-7781.

All meetings will take place at 7:00 pm.

### Schedule of WHP Public Meetings

June 25	<i>Cheyenne</i> , Highway Dept. Auditorium
June 26	<i>Wheatland</i> , 4-H Building
June 27	<i>Torrington</i> , City Hall Council Chambers
July 1	<i>Sundance</i> , Court House
July 9	<i>Powell</i> , Northwest Comm. College
July 10	<i>Worland</i> , Community Hall
July 11	<i>Casper</i> , Oil & Gas Commission
July 16	<i>Riverton</i> , Central Wyoming College
July 17	<i>Rawlins</i> , Jeffrey Center
July 18	<i>Jackson</i> , Ranch Inn

## Forecasting streamflow runoff

by Ed Kouma, USDI-Bureau of Reclamation, and Ted Gilbert, USDA-Soil Conservation Service

The North Platte River Basin has its headwaters in northern Colorado. From the headwaters, the river flows north into Wyoming to the vicinity of Casper where the direction of flow gradually changes to the southeast, and continues to the eastern border where it exits the state near Torrington, Wyoming.

The Bureau of Reclamation

(Reclamation) has six major reservoirs and power plants on the North Platte River in Wyoming which are operated to supply irrigation water, power generation, flood control, municipal and industrial water supplies, recreation, and fish and wildlife needs.

In order to operate a system as complicated as the North

Platte River, with its dams, reservoirs, and power plants, some idea of how much water will be flowing into the reservoirs is required. Reclamation creates an operating plan in October of each year that contains a schedule of releases from each reservoir.

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## Basin streamflow outlook

According to the June Basin Outlook Report from the USDA Soil Conservation Service office, streamflow prospects improved in many drainages across the state. This is the second month in a row in which flow outlook has improved.

Though forecasted flow improved about two percent during the month in the northwest portion of the state, users will still see less than average runoff this summer.

Those waterusers in the Wind River drainage, the Big Horn Basin, and along the drainages from the Big Horn Mountains will most likely have an abundant water supply during the season.

In the Platte and Green River Basins, flows are predicted to be less than average by 20 to 40 percent. Users can expect shortages as the season wears along. The same holds true for the Little Snake and the Upper Bear River drainages.

Snowpack over the state is in the melt phase. Remote *SNOTEL* sites are showing less snow remaining each day. Currently, there are 51 sites that are showing no snow present. The greatest amount is at the Two Ocean Plateau *SNOTEL* site in Yellowstone National Park.

Every area of the state received above normal precipitation for the month of May. Precipitation has been so plentiful that high streamflows, even to the point of flooding has occurred in several areas of the state. As a result of the abundant

rainfall this spring, water stored in major reservoirs over the state improved for the most part. Only in the North Platte and Black Hills is storage much below average for this time of year.

## Gloss elected to national post

The Director of the Wyoming Water Research Center (WWRC), Dr. Steven P. Gloss, was elected chairman-elect of the National Association of Water Institute Directors (NAWID) during a recent meeting of the organization in Washington, D.C. He will serve three years: 1991-92 as chairman-elect, 1992-93 as chairman, and 1993-94 as past chairman.

At the time of his election, Gloss was serving as Missouri Basin representative to the 12-member NAWID Council. He has been Director of the WWRC since 1987.

The NAWID represents 54 institutes and their associated programs nationwide. Linking and coordinating the Water Research Institute Program through the U.S. Geological Survey, the organization is a vehicle for information exchange and research coordination.

The organization sponsors regional and national conferences, helps identify and prioritize water problems and issues from local to national levels. It also works to organize and coordinate appropriate research and information transfer projects and to generate interest and support for programs involving water prob-

lems at all levels.

In effect, NAWID networks the vast facilities and expertise of the nation's colleges and universities, bringing these resources to bear on local, regional, and national water problems in the most cost-effective and efficient manner.

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### Director

Steve Gloss

### Associate Directors

Vic Hasfurther, Research

Ari Michelsen, Information

### Editor

June Rain, (307) 766-6205

### Thanks to this issue's contributors:

Ted Gilbert, Karl Harper, Ed Kouma, Pam Murdock


### Note to readers:

We welcome guest editorials and other articles of interest. Please write or call the Editor for guidelines.

Please keep us informed about address changes, and let us know about meetings and news items the *Wyoming Hydrogram* should cover. We need time-sensitive materials at least 3 weeks in advance of publication dates. Publication dates for 1991 are the first week of the months of February, April, June, August, October, and December.

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Wyoming Water Research Center  
Box 3067  
Laramie WY 82071-3067  
or phone (307) 766-2143  
FAX: (307) 766-3718

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## Forecasting

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The key element to the operating plan is an estimate of runoff of water into the reservoirs. This estimate is made using

The operating plan can be adjusted to reflect the updated forecasted inflows to the reservoirs.

Currently, three agencies create a forecast of the snowmelt runoff for the North Platte River Basin in Wyoming. These agen-

The Basin is one of many basins for which the SCS prepares a forecast, whereas Reclamation's North Platte Projects Office in Casper forecasts only the North Platte River. The agencies use similar techniques in their forecasts; however, there are significant differences in the approach.

Reclamation and SCS use regression techniques on historic data to create an equation which can be used to predict future inflow from current conditions. *Table 1* shows some differences in the two forecast methods.

The dual forecast is not looked upon as competition by the two agencies but, rather, reinforcement. SCS and Reclamation coordinate closely in providing data and producing the forecasts.

A comparison of the forecast for the 1991 spring snowmelt runoff is shown in *Table 2*.

Forecasts are also prepared for other segments of the North Platte River Basin in order to anticipate the total basin water supply.

Method	SCS	Reclamation
Forecast period	April-September	April-July
Forecast parameters	Snowpack, fall precipitation	Snowpack, fall precipitation, November inflows, expected spring precipitation
Forecast points	Northgate, CO; Encampment and Sinclair, WY; Medicine Bow River near Hanna, WY = Seminoe inflow	Seminoe inflow
Snow courses used	4-9 snow courses for each forecast point	11 snow courses total

*Table 1 Selected differences in SCS and Reclamation streamflow runoff forecasting methods.*

predictions derived from statistical analysis of historical data.

Historical records show that approximately 75 percent of the annual inflow to the North Platte River above Seminoe Dam occurs during the months of April through July.

The basin above Seminoe Dam is of great importance to the system because 75 to 80 percent of the water entering the North Platte River in the state of Wyoming does so above Seminoe Dam.

Therefore, a forecast of the snowmelt runoff in the April through July period is made monthly as the mountain snowpack develops.

cies are Reclamation, the Soil Conservation Service (SCS), and the National Weather Service. This article only compares SCS and Reclamation methods.

	SCS	Reclamation
Jan	665,000	no forecast
Feb	575,000	575,000
Mar	410,000	485,000
Apr	435,000	535,000
May	490,000	555,000

Forecasts for anticipated runoff in the April-July period (in acre-feet) are adjusted throughout the year as snowpack and climate data are collected. SCS begins this forecast in January, Reclamation in February of each year. This year's Reclamation forecast is for more runoff than that predicted by SCS. Analysis of historical data would need to be done to determine whether Reclamation consistently predicts more runoff than does SCS.

*Table 2 Comparison of SCS and Reclamation 1991 streamflow runoff forecasts for the N. Platte River above Seminoe Reservoir.*

## Information transfer, one of WWRC's "basic four"

Information transfer is a significant part of the WWRC. It is our means of relaying research results, or education and service opportunities, to those who would not otherwise know of these resources.

The four main functions of the WWRC are

- research,
- education,
- service, and
- information transfer.

In previous issues of the *Wyoming Hydrogram*, we have discussed the education and service functions and each issue of the newsletter highlights at least one research project. This newsletter is one part of a network to inform the people of Wyoming, as well as neighboring states and regions, of what the WWRC is doing in education, research, and interagency cooperation to better manage Wyoming's, and the nation's, water resources.

### Water resource seminars, workshops, conferences

The WWRC conducts, co-sponsors, and coordinates seminars, workshops, and conferences to provide and enhance the information transfer of water resources research results, education programs and instructional materials, discussion of state and regional water resource issues, and encourage interagency coordination of water resource programs.

Some examples include

- regional **Water Resource Seminars** for the public, co-sponsored by UW's Cooperative

Extension Service. Two are held each year at alternating community colleges in the state.

- **Water Institutes for Teachers** are co-sponsored by the Wyoming Institute for the Development of Teaching.
- **Water Resources and Law Forum for Wyoming Legislators**, co-sponsored by the Legislative Services Office and held in cooperation with agencies involved in water resource issues.
- The WWRC co-sponsored the **Water Engineering and Management Conference**, organized by the Colorado Water Resources Institute and Office of the State Engineer.

### Cooperative education and research efforts

- UW's Cooperative Extension Service's **Water Quality Issues Task Force**, with WWRC as cooperator, identifies state water quality education needs and develops educational materials and workshops so that extension agents will be able to provide the public with accurate and timely water quality information.
- The WWRC is coordinating the educational efforts of agencies having primary responsibility for **nonpoint source water quality programs**.
- The WWRC participates in **Great Plains Agricultural Council's Water Quality Task Force**.

### Publications

- **Wyoming Hydrogram**, our newsletter, produced and distributed bi-monthly by the WWRC to over 1,600 people

and organizations in Wyoming and throughout the United States.

- **WWRC Research Briefs**, produced and distributed to newsletter readers as well as to academic departments at the University of Wyoming, other universities and the other 53 water research centers nationwide.
- The WWRC and the UW Cooperative Extension Service, in cooperation with the Wyoming State Engineer's Office, published an updated bulletin on **Wyoming Water Law**.
- The College of Law at UW produces a refereed law journal, *Land and Water Law Review*. Publication costs for the journal are partially funded by the WWRC.
- A *publication list* is available, upon request, which lists the variety of professional publications supported by the WWRC.

### A network for information transfer

These publications, conferences, symposia, seminars, and institutes, are all part of the network which the WWRC uses to relay information to the people of Wyoming, as well as others. It is important that our citizens know what we are doing in education, research, and interagency cooperation so that the water resources of Wyoming, and the nation, will be better managed and protected in the future.

## Water pollution prevention starts at home

The term "hazardous waste" usually conjures up the image of people in "moon suits" probing around mysterious, closed-down industrial sites, trying to avoid contamination by exotic materials with long, long names.

Do any of the ingredients in the products beneath your kitchen sink have long, long names?

If any product in your home has written on its label any of the following words -- TOXIC, CORROSIVE, FLAMMABLE, POISONOUS, CAUSTIC, DANGER -- it is considered a hazardous material.

A definite link exists between household hazardous waste and water pollution; you can easily help break the chain.

### Proper use is important to protect water quality

How we use and dispose of the many common household, automotive, paint, pesticide, and fertilizer products that include hazardous ingredients has a corresponding effect on the world around us.

Whenever we overuse pesticides or fertilizers outdoors, or discard paints, lubricants, solvents, or other hazardous materials on or in the ground -- rainfall can wash them into the water supplies we depend on.

The list of household products which contain hazardous materials can include all sorts of cleaners, polishes, batteries, petroleum products, solvents, mineral spirits, rodent poisons, bug sprays, aerosol cans, etc., etc. The hazardous qualities of each product may differ.

### Spin the "wheel" for guidance

The WWRC has supplied to each Cooperative Extension Service office and each Wyoming Conservation District office in the state a "Household Hazardous Waste Wheel." The wheels are small (about 6" diameter) cardboard, double layer circles with a window in the top circle. When the window area is aligned with the hazardous waste category on the bottom circle, information pertaining to the specific hazardous waste on the top circle is given.

The wheel is a helpful guide in determining disposal practices for household hazardous wastes as well as less toxic alternatives. The wheels were provided by the Wyoming Department of Environmental Quality, the University of Wyoming Cooperative Extension Service, and the WWRC. Stop by your local Extension Service or Conservation District office for a look at the wheel.

### "Down the drain" isn't the answer

Of course, the easiest way to get rid of potentially dangerous materials is not to acquire them in the first place. Buy no more than you need, look for less hazardous alternatives, and, yes, "Dispose of Properly."

Tossing these materials into the environment is unwise, yet it may be just as unwise to pour many of them down the drain.

It has been estimated that residents in a city of 10,000 pour nearly 700 pounds of used

motor oil *alone* down city sewer drains each month!

Sewage treatment plants are not designed to treat motor oil or other hazardous ingredients, and many of them pass through the process untreated and are returned to our water supplies.

If you throw them in the trash, these corrosive or caustic materials not only can leach through, but destroy landfill liners that are designed to prevent ground water pollution.

### Prevention starts with you and me

Cans and bottles containing hazardous materials also list recommended application amounts as well as disposal instructions; read the label carefully. Years of research result in the recommendations you read on pesticide and fertilizer labels. When you use more than is required to do the job -- you're also pouring *money* down the drain.

Because there are so many hazardous materials in everyday use, and because they are so lethal to the environment, it is imperative that we learn which products are hazardous, how to use them safely, and how we can dispose of them properly within our communities.

It's easy to prevent water pollution: it starts with you and me.

*-- portions of this article are reprinted with the permission of the Texas Water Commission*

## Water calendar

**Water Institute for Teachers**, July 8-19 in Laramie, WY and July 22 - Aug. 2 in Riverton, WY, Contact: Wyoming Institute for the Development of Teaching (307) 766-6381.

**Joint Conference of the Rocky Mountain Section of the American Water Works Association and the Rocky Mountain Water Pollution Control Association**, Sep. 8-12, 1991, Jackson, WY, Contact: David Engles (307) 672-5280 or Harry LaBonde (307) 856-6505.

**27th annual AWRA Conference, Water Management of River Systems**, Sep. 8-13, 1991, New Orleans, LA, Contact: Harry C. McWreath, Fort Worth, TX (817) 334-5551.

**4th annual meeting of the Wyoming State Section of the AWRA**, Nov. 6-8, 1991, Laramie, WY, Contact: Jim Rankl (307) 772-2153.

## Climate and water resources conference

A major conference on Climate and Water Resources Management is scheduled for Nov. 5-7, 1991, in Albuquerque, NM. The conference is sponsored by the Bureau of Reclamation, Army Corps of Engineers, Environmental Protection Agency, National Oceanic and Atmospheric Administration, and the

US Geological Survey.

The conference will present water resource managers, planners, and policy makers with the newest thinking on the potential sensitivity of water resources to climate change and shifts in climate variability, and start a dialogue on how those changes might affect water management systems and resources.

Additional information is available from Joel Smith, EPA, (202) 475-9655, or Tom Ballentine, Corps of Engineers, (703) 355-2072.

## Endangered species and waterways seminar

The National Water Resources Association (NWRA) is sponsoring the 1991 Western Water Seminar, July 30-Aug. 3, in Welches, OR. The topic of this year's seminar is, "Endangered Species Act -- Saved, But at What Price?"

Scheduled presenters include Hon. Mark Hatfield, U.S. Senator-OR and Hon. John Turner, Director, U.S. Fish and Wildlife Service. The seminar topics are aimed at providing insight into how to deal with the increasing conflict between protection and development along our nation's waterways.

The seminar will conclude with a tour of Mount St. Helens to explore one of the country's natural wonders with an up-close view of the volcanic destruction and activity.

Registration information may be obtained from the NWRA, 3800 N. Fairfax Drive,

Suite 4, Arlington, VA 22203; phone (703) 524-1544.

## Madison Aquifer study approved

The 1991 Wyoming Legislature approved a \$400,000 appropriation for the State Engineer's Office to conduct a detailed study of the Madison Aquifer in the northeastern portion of the state. Many municipalities in northeast Wyoming obtain their municipal supplies from the Madison Aquifer. The aquifer outcrops in both the Black Hills and the Bighorn Mountains, dipping to depths of over 10,000 ft in the Powder River Basin.

Sand Creek, a popular fishing and vacation site near Beulah, Wyoming on the South Dakota line, is fed by springs from the Madison Formation. Several years of drought have diminished flows of the springs which feed Sand Creek.

Proposed increases in the number of Madison Aquifer wells by Rapid City, South Dakota has also raised concern about the possibility of diminished water supplies for Wyoming users. The monitoring study approved by the Wyoming Legislature will help predict the impacts that use of the Madison will have in other portions of the aquifer.

*-- from The Missouri River Report, the official publication of the Missouri Basin States Association. Jeff Fassett, Wyoming State Engineer, is Chairman of the Association.*

# Wyoming Water Atlas available

The WWRC is busy processing orders for copies of the newly published *Wyoming Water Atlas*. The beautifully illustrated, hardbound volume was published by the Wyoming Water Development Commission and the University of Wyoming.

Over 50 color plates in the 136-page book dramatically illustrate the opportunities and constraints for water use in Wyoming.

Topics include irrigation, water rights, state and federal water projects, recreation, and more.

You may use the form below to order a personal copy - and the book makes a nice gift, too! For further information, please contact Pam Murdock at the WWRC, (307) 766-2143.

## Water Under the Bridge



*Tie drive of the Wyoming Tie and Timber Company on Warm Springs Creek. Date and photographer unknown. Photo courtesy of American Heritage Center, University of Wyoming.*

Please send \_\_\_\_\_ copies of the *Wyoming Water Atlas*. I have enclosed a check made payable to the University of Wyoming in the amount of \$35.00 for each book ordered (includes postage).

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## WWRC Focus

### Diana Heft wins Rhoads Scholarship

Diana Heft, a 1990 University of Wyoming (UW) graduate, is winner of the fourth annual *Willard C. and Elaine N. Rhoads Scholarship for Graduate Studies in Water Resources*. A Laramie resident, Diana received a B.S. degree in soil science in 1990 and is currently working toward both a second B.S. degree in geology and the Master's degree in a cross-disciplinary program involving microbiology and soil science.

Diana is enrolled in the water resources option-Master's degree program between the Department of Molecular Biology and the WWRC.

The Rhoads Scholarship provides a stipend of \$1500 annually and recipients are selected on the basis of demonstrated academic achievement,

recommendations from graduate faculty advisers, enrollment for at least nine hours of credit for two semesters, plus a written statement of academic and career goals.

The scholarship honors the memory of Willard Rhoads, long-time member of the Wyoming Water Development Commission. Awards are funded by a permanent fund established by Mrs. Rhoads, her family and friends, and matching money provided by UW.

Diana has a strong academic and career interest in the subsurface management of environmental contaminants. "In today's world we must get away from the idea that *dilution is the solution to pollution* and that anything buried underground automatically degrades to the point that it no longer can pollute the environment," she says.

Her master's degree thesis research centers on the transformation and/or degradation of two common pesticides in use in Wyoming. The work has important implications for long-term

safety in the use of ground water everywhere.

She intends to expend most of the scholarship stipend toward the purchase of certain rather costly chemicals needed to explore a concurrent research project related to her thesis project.

"I have not seen anything in the literature about what I'm going to do, but even if the experiment doesn't work out the way I think it will, we will still contribute to the information base regarding the environmental fate of these chemicals," Heft says.

"Our knowledge of the transport, fate, and impact of contaminants in the saturated and unsaturated subsurface environment is so small that the literature consistently describes it as *practically nonexistent*."

Diana describes her philosophy and career plans with a single phrase: "science in the service of humanity."



Wyoming Water Research Center  
P.O. Box 3067  
Laramie WY 82071-3067

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# RESEARCH BRIEFS



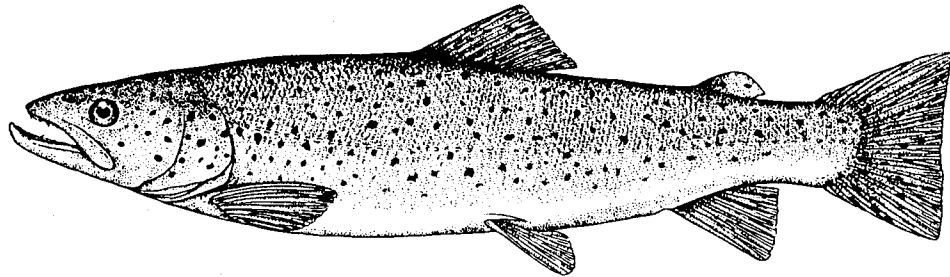
## Biological response of fish populations to increased minimum flow

### Investigators

S.W. Wolff and T.A. Wesche, Wyoming Water Research Center, and D.D. Harris and W.A. Hubert, USDI, FWS/University of Wyoming Cooperative Fish and Wildlife Research Unit.

### Purpose

Most research on minimum flows focuses on development of instream flow and habitat models but minimal reported evidence links biological response of fish populations to changes in minimum flows. This study assessed the biological significance of an increase in minimum flow to the brown trout (*Salmo trutta*) population in Douglas Creek, Wyoming.



### Methods

Stage I of the Cheyenne water project included the construction of Rob Roy Reservoir, completed in 1963. As part of the use permit issued by the US Forest Service, a minimum flow of 1.0 cfs (cubic feet per second) was required downstream from the diversion structure built to carry the impounded water to Cheyenne. A proposal to enlarge this water project, Stage II, required further studies to assess instream flow needs of Douglas Creek fish downstream from Rob Roy Reservoir. These studies were initiated in the 1970s. Population and habitat data obtained during the period when minimum flow was 1.0 cfs (1972-76) were compared with data collected after the minimum flow was increased to 5.5 cfs (1988-89). Four reaches of the stream, divided into eight study sites, were sampled by electroshocking using removal methods.

### Results

A four- to six-fold increase in brown trout standing stock was indicated between 1972 and 1988-89 in the 6.4 mile reach immediately downstream from the point of water diversion. Within this reach, the minimum low flow was 5.5 times greater than in the 1970s; habitat for adult fish was almost five times greater.

More than a twofold increase in brown trout standing stock between 1973 and 1988-89 was measured in a one mile reach between Rob Roy Dam and the point of water diversion. Within this reach, discharge was occasionally as low as 3.0 cfs before 1986, but not as severe as the 1.0 cfs downstream from the water diversion.

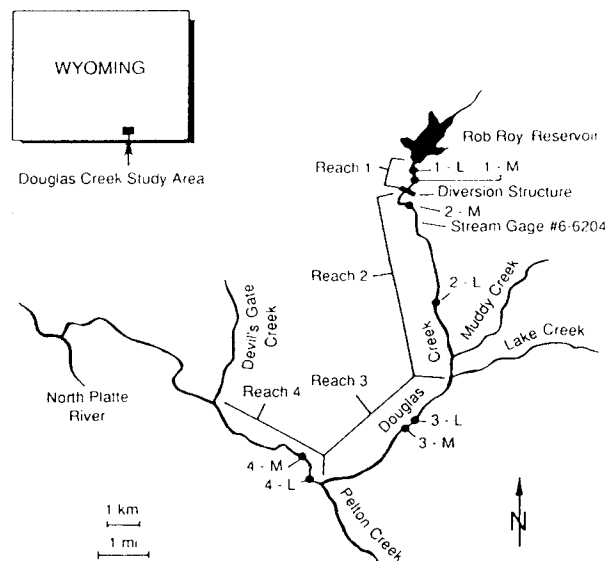
At sites more than 6.4 miles downstream from the water diversion structure, where the effect of reduced flow had been less because of the addition of water from tributary streams, there were no measurable changes related to the enhanced minimum flow.

Though additional work is necessary, this study supports the long-term value of increased minimum flow to fish populations.

## Publication

Brown trout population and habitat changes associated with increased minimum low flows in Douglas Creek, Wyoming. US Department of Interior, Fish and Wildlife Service, Biological Report 90(11).

Map of the Douglas Creek study area, Medicine Bow National Forest, Wyoming. The eight sample sites are labeled with a number representing one of four reaches and letter representing stream gradient (L, <1.0%; M, ≥1.0%).



For a complete list of publications available from the Wyoming Water Research Center, or for further information on this or other research projects, contact the WWRC at (307) 766-2143, FAX: (307) 766-3718, or P.O. Box 3067, Laramie WY 82071-3067.

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