

# Wyoming's Water Resources

## Contents

Wyoming Water Basins .....	1
Water Quantities .....	2
Surface Water .....	2
Groundwater .....	3
Water Use in the State .....	3
Consumptive Uses .....	3
Nonconsumptive Uses .....	4
Reservoir Storage .....	4
Water Rights .....	4
Interstate Water Rights .....	5
Potential Water Uses .....	7
Irrigated Cropland .....	7
Municipal and Domestic .....	7
Industrial .....	7
Hydropower .....	8
Recreation .....	8
Water Planning and Development .....	8
State Engineer's Office .....	8
Wyoming Water Development Commission .....	8
Department of Environmental Quality .....	9
State Water Forum .....	9
Summary .....	9

August 2000

B-969R

James J. Jacobs, Director of the Wyoming Experiment Station, College of Agriculture, University of Wyoming

Donald J. Brosz, Professor Emeritus, Agricultural Engineering, University of Wyoming



## Wyoming Water Basins

The Continental Divide crosses Wyoming and provides the headwaters for four major river basins in the western United States. These major river basins are the Missouri-Mississippi, Green-Colorado, Snake-Columbia, and Great Salt Lake. Wyoming's location in relation to these four major river basins is shown in Figure 1.

The Yellowstone, Wind, Big Horn, and Shoshone Rivers in northwestern Wyoming; the Tongue, Powder, Belle Fourche, Cheyenne, and Niobrara Rivers in northeastern Wyoming; and the North Platte and Laramie Rivers in southeastern Wyoming are all headwaters of the Missouri-Mississippi River Basin. Approximately 72 percent of Wyoming's land area drains into and is part of the headwaters of the Missouri-Mississippi River Basin.



Figure 1. Wyoming: Headwaters to the major river systems of the western United States.



The Green and Little Snake Rivers in southwestern and southcentral Wyoming are part of the headwaters of the Colorado River. The Green-Colorado River Basin drains approximately 17 percent of Wyoming's land area.

The Bear River along the southwestern border of Wyoming drains into the Great Salt Lake Basin. The land area that drains into the Great Salt Lake Basin represents approximately 2 percent of Wyoming's total land area.

The Snake and Salt River along the Idaho border in northwestern Wyoming are part of the headwaters for the Snake-Columbia River Basin. Approximately 5 percent of Wyoming's land area is drained by the Snake-Columbia River Basin.

In addition to these four major river basins, nearly 4 percent of Wyoming's land area is in the Great Divide closed basin. This area is part of the Red Desert west of Rawlins.

The major river basins discussed above and some of the larger rivers in those basins are shown in Figure 2.

## Water Quantities

### Surface Water

On average, about 16.3 million acre-feet of surface water are produced each year by precipitation on Wyoming's land area (1 acre-foot is 1 foot of water covering 1 acre of land and equals approximately 326,000 gallons). Approximately 70 percent of Wyoming's surface water supply comes in the form of snow. On average, another 1.9 million acre-feet of water flows into the state each year. Streams that bring water into the state include the Laramie and North Platte Rivers in southeastern Wyoming; the Little Snake River in southern Wyoming; the Blacks Fork, Henry's Fork, and Bear Rivers in southwestern Wyoming; and the Clarks Fork River in northwestern Wyoming. These rivers give a total annual surface water supply of about 18.2 million acre-feet. Through interstate compacts and court decrees, Wyoming may legally consume 6.4 million acre-feet of this surface water annually.

## Groundwater

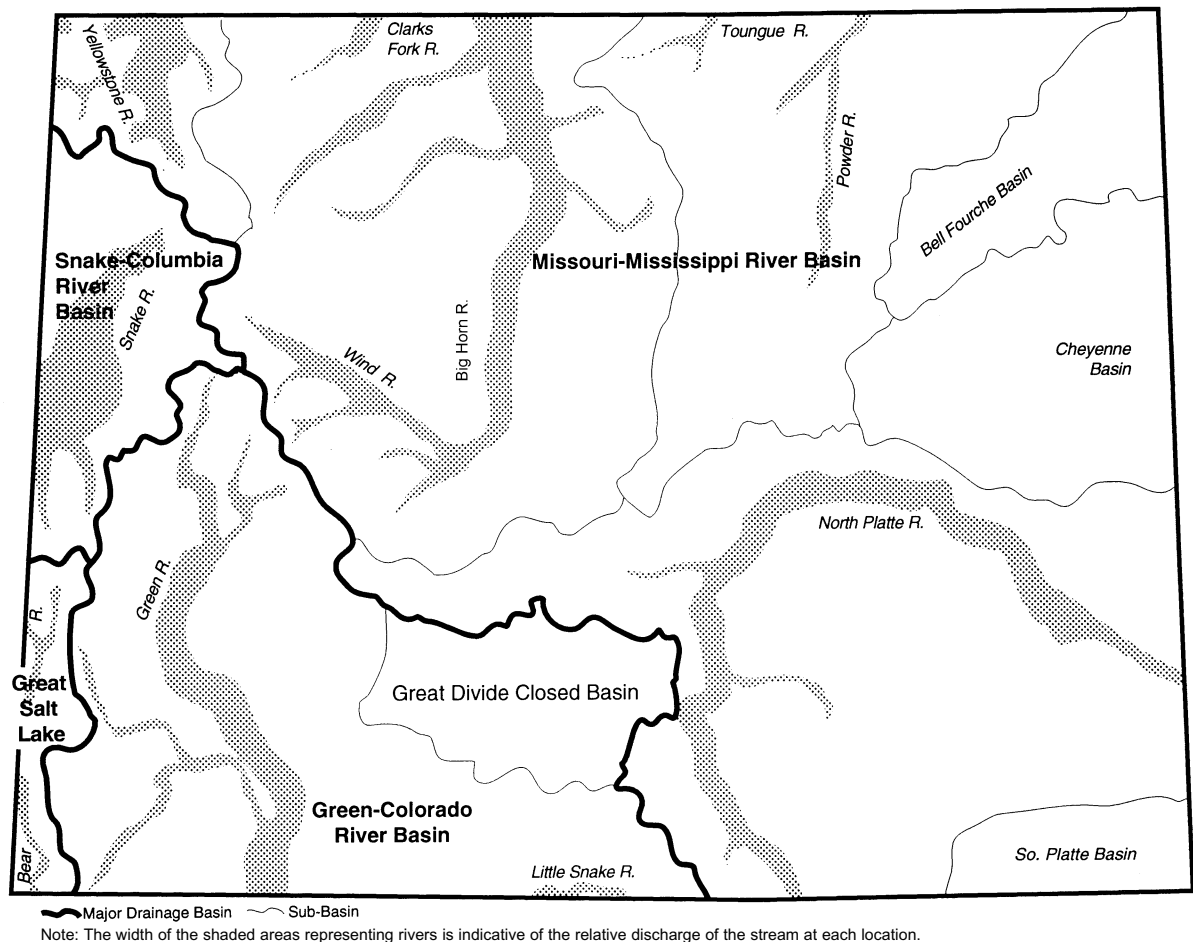
Groundwater can be found throughout the state and a substantial amount is available for future use. It is estimated that 10 million acre-feet in alluvial aquifers and 3 billion acre-feet in bedrock aquifers are stored. However, its use in the future depends upon the cost of recovery and the decision of whether to mine the resource or to limit use to the recharge rate. While large quantities of water are stored in alluvium and bedrock (consolidated sediment) formations, average annual recharge (the quantity of water entering these aquifers) is estimated to be 1 to 4 million acre-feet per year, respectively.

## Water Used in the State

### Consumptive Uses

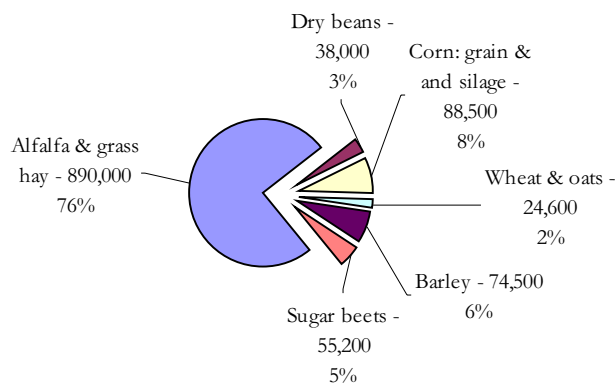
Consumptive use refers to the quantity of water evaporated, transpired, and/or incorporated into the products produced in connection with vegetative growth, food and industrial processing, and municipal use. Irrigation is by far the largest consumptive use of water in the state. Average annual consumptive use of surface water in irrigated agriculture is estimated to be 2.3 million acre-feet. Approximately 300,000 acre-feet of groundwater also is consumed by irrigated agriculture each year.

Figure 2. Major rivers of Wyoming.



As in all western states, Wyoming's irrigated agriculture accounts for 80 to 85 percent of the consumptive use in the state. Approximately 60 percent of the farms and ranches in Wyoming irrigate. Wyoming's irrigated cropland acreage varies between 1.2 and 1.6 million acres from year to year, depending upon available surface water supplies. Average distribution of irrigated cropland for 1998-1999 is shown in Figure 3 (*Wyoming Agricultural Statistics*).

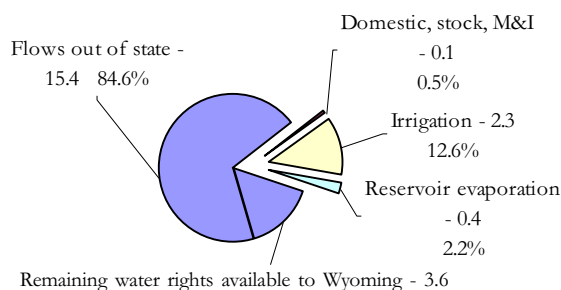
Figure 3. Irrigated acres by crop.



The second largest consumptive use of water is evaporation from reservoirs, which amounts to about 400,000 acre-feet annually. All other water users in Wyoming (municipal, domestic, livestock, and industrial) annually consume approximately 60,000 acre-feet of surface water and 100,000 acre-feet of groundwater.

The above consumptive uses result in an average depletion of about 2.8 million acre-feet of surface water supplies. On average, 15.4 million acre-feet of surface water flows out of Wyoming into neighboring states each year. These consumptive uses of surface water are summarized in Figure 4.

Figure 4. Wyoming's surface water resources.



## NonConsumptive Uses

Nonconsumptive uses include recreation on streams and lakes, hydropower generation, fisheries in streams and lakes, and return flows from irrigated agriculture, industry, or municipality. As a result, much of the water flowing out of the state is used in Wyoming in a nonconsumptive way.

The terminology of consumptive and nonconsumptive water use is a very important concept in managing water resources. This terminology can be used to illustrate the four main attributes of a water supply: (1) quantity, (2) quality, (3) location, and (4) timing. As individuals or communities withdraw water, they generally consume part of the water and return part of it to the stream and/or groundwater. However, each water use is likely to affect one or more of the four primary attributes of water. These effects also may influence subsequent water use because water is continually flowing. The nature of water and its attributes have to be considered in planning for and using Wyoming water resources.

## Reservoir Storage

As indicated earlier, approximately 70 percent of Wyoming's water supply comes in the form of snow. Snow melts from March through early July. Reservoir storage plays an important role in Wyoming by holding water supplied from melted snow and making it available during summer and fall—times of limited precipitation and heavy demand. Major storage reservoirs in Wyoming and storage capacities are shown in Table 1.

## Water Rights

The Wyoming Constitution declares that the waters of all natural streams, springs, lakes, or other collections of still water within the boundaries of the state are the state's property. Constitutional provisions also allow for the appropriation of water for beneficial use. The Office of State Engineer and Board of Control supervise such appropriations. The Board of Control includes the state engineer (president)

Table 1. Names and sizes of reservoirs in Wyoming.

River system	Reservoir	Storage capacity
North Platte	Seminole	1,017,000
North Platte	Kortes	4,740
North Platte	Pathfinder	1,017,000
North Platte	Alcova	184,000
North Platte	Glendo	517,000
North Platte	Guernsey	46,000
Laramie	Wheatland No. 2	98,000
Laramie	Wheatland No. 3	80,000
Laramie	Grayrocks	104,000
Belle Fourche	Keyhole	340,000
Wind/Big Horn	Bull Lake	153,000
Wind/Big Horn	Boysen	802,000
Wind/Big Horn	Yellowtail	1,375,000
Shoshone	Buffalo Bill	695,300
Powder	Lake DeSmet	239,000
Snake	Jackson Lake	847,000
Snake	Palisades	1,401,000
Green	Big Sandy	39,700
Green	Fontenelle	345,000
Green	Flaming Gorge	3,788,900
Bear	Woodruff Narrows	57,000
Bear	Sulphur Creek	19,600

and the superintendents of each of the state's four administrative water divisions. These water divisions are shown in Figure 5. The state engineer has general supervision of the state's water distribution.

State statutes establish the procedure for the appropriation of water for beneficial use. First, a permit to use water must be obtained from the

state engineer. After the water has been put to use and proof of beneficial use has been made to the Board of Control, the board will adjudicate the water right. Priority of appropriation is based upon the date applications for permits were received in the State Engineer's Office.

Within Wyoming's water laws, one aspect that receives considerable emphasis is water transfer. It is possible to transfer water to an alternative use if it is to a "preferred use." Under Wyoming water law, the preferred uses of water are:

- a. Water for drinking purposes for both humans and livestock
- b. Water for municipal purposes
- c. Water for steam engines and general railway use, culinary, laundry, bathing, refrigerating uses, steam and hot water heating plants, and steam power plants
- d. Water for industrial use

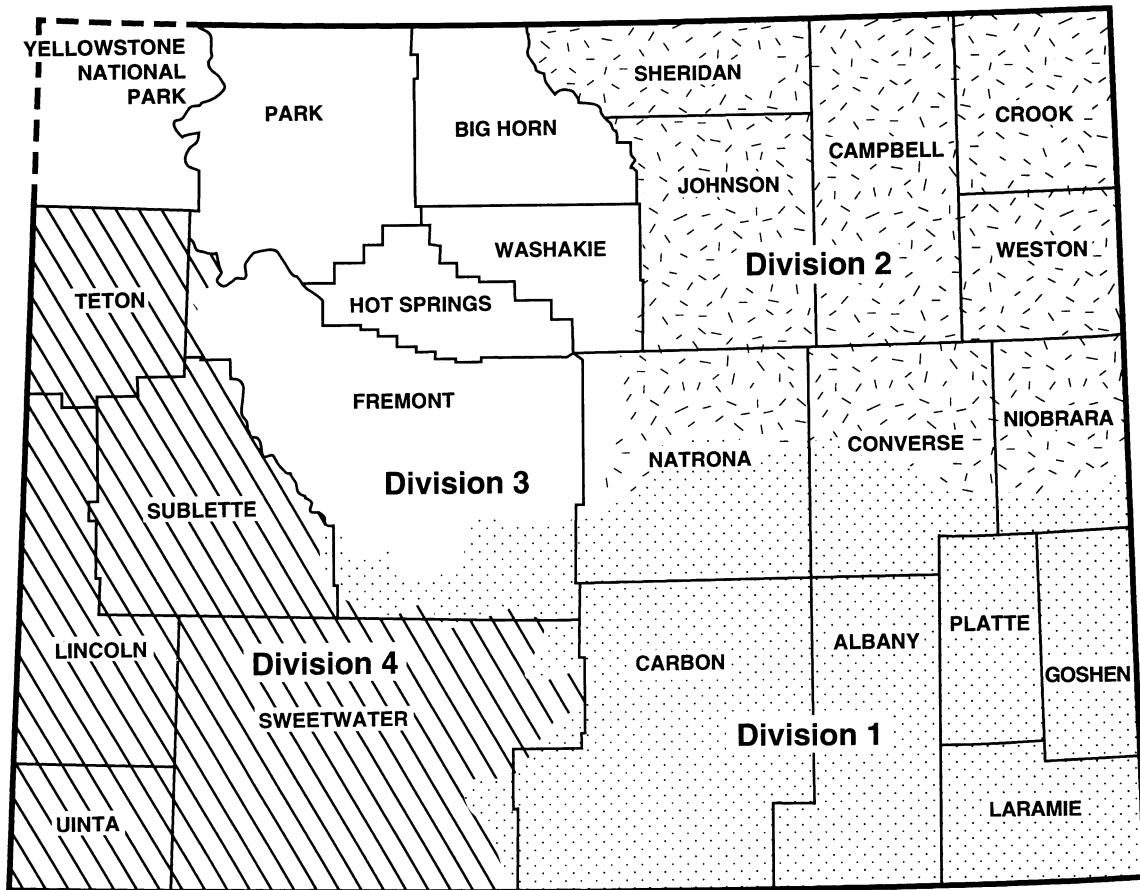
The transfer of a water right to a preferred use is initiated by filing a petition requesting a change with the State Board of Control. The petition should present all of the facts regarding the existing use and the proposed change. The board will review the facts and may allow the transfer provided it does not in any way injure other existing lawful appropriators. For a more complete summary of Wyoming water law, see UW CES Bulletin B-849 R.

## Interstate Water Rights

Although the Wyoming Constitution declares water to be the property of the state, depletion of Wyoming streamflow is also limited by interstate river basin compacts established with other states and by court decrees.

The state's leaders realized many years ago that downstream states developing faster than Wyoming might establish prior water rights that could stifle future Wyoming development. So, interstate compacts (agreements allocating the water of an interstate stream among states) were negotiated on most of Wyoming's streams. The rights of states to the waters of some interstate streams have been settled by U.S. court decrees.

Figure 5. Administrative water divisions of Wyoming.



The rights of Colorado and Wyoming to the waters of the Laramie River and the rights of Colorado, Wyoming, and Nebraska to the waters of the North Platte River have been established by U.S. Supreme Court decrees. The rights of Wyoming and Idaho to the waters of Teton Creek and South Leigh Creek have been established by a decree of the District Court of the United States for the District of Wyoming. Wyoming's rights to the waters of the Bear, Belle Fourche, Colorado (Green River, Little Snake River, Henry's Fork of the Green River, Ham's Fork), Niobrara, Snake, and Yellowstone Rivers (Clarks Fork of the Yellowstone River, Wind/Big Horn River, Tongue River) have been apportioned by interstate compacts.

Wyoming also can be affected by international treaties where some of the water that rises in Wyoming eventually finds its way to another

country. This is the case with the international treaty between the United States and Mexico on the Colorado River, of which the Green River is a major tributary.

Water allocation, through compact agreements among the states, was done by dividing the unused and unappropriated flows of the respective streams on a quantity or percentage basis. Table 2 shows the unappropriated waters from various streams, which are available to Wyoming annually for consumptive uses.

Approximately 3.6 million acre-feet of compacted surface water supplies still remain for Wyoming's future annual consumptive uses out of the total 15.4 million acre-feet that flows out of the state. Also, a limited quantity of water is available from streams that are not compacted.

## Potential Water Uses

### Irrigated Cropland

As indicated earlier, irrigation is by far the largest consumptive use of water in the state. However, future development of water for irrigation purposes (both surface water and groundwater) will depend primarily on economics and the political process. Most of the better irrigation projects already have been developed and the remaining surface water development includes bench lands that are some distance from the streams. Groundwater development potential is somewhat difficult to estimate because of the very limited information available on depths, quantity, and quality.

### Municipal and Domestic

Approximately 30 percent of the municipal population uses surface water as its source of water supply, 25 percent uses groundwater, and the remaining 45 percent uses a combination of surface water and groundwater. Those who do not reside in a municipality have their own domestic water supply systems. Very little information is available on private domestic water uses in the state, but the majority of the population uses groundwater.

Municipal, domestic, and stock water uses are projected to increase from about 60,000 acre-feet to 148,140 acre-feet per year by the year 2020 (*The Wyoming Framework Water Plan*, 1973).

### Industrial

Wyoming's industry currently depletes the state's water supply by approximately 85,000 acre-feet per year. Of the amount of water used by industry, approximately two-thirds of it comes from groundwater supplies. Industrial water needs have been projected to be 845,000 acre-feet per year by the year 2020 (*The Wyoming Framework Water Plan*, 1973); however most of the projected increase in water consumption was to be by the coal industry, which has not grown to the point projected in the early 1970s.

Table 2. Unappropriated waters available for consumptive use in Wyoming.

River system	Acre-feet available	Comments
Clarks Fork	424,000	
Wind/Big Horn	1,600,000	Indian water rights being settled
Tongue	94,000	
Powder	165,000	
Belle Fourche	7,000	
North Platte	0	Fully appropriated
Green/Little Snake	455,000	
Snake	150,000	
West Teton Tributaries	355,000	
Bear	1,073	Based on 1980 Compact, only part is available for use in Wyoming, as some minimum flow must enter Idaho.
Noncompacted rivers		
Yellowstone	2,700,000	Not likely to be used in Wyoming because of location
Little Big Horn	114,000	
Little Missouri	31,000	
Cheyenne	58,000	

---

## Hydropower

An important nonconsumptive use of Wyoming's water is hydroelectric power generation. Major hydro-plants in or adjacent to Wyoming and their generating capacities are:

- **Green River:** Flaming Gorge (152,000 kW) and Fontenelle (10,000 kW)
- **North Platte River:** Seminoe (45,000 kW), Kortess (36,000 kW), Fremont Canyon (66,800 kW), Alcova (36,000 kW), Glendo (38,000 kW), and Guernsey (6,400 kW)
- **Wind River:** Boysen (15,000 kW), Pilot Butte (1,600 kW)
- **Shoshone River:** Ralston (1,500 kW), Buffalo Bill (18,000kW), Heart Mountain (5,000 kW), Shoshone (3,000 kW), and Spirit Mountain (4,500 kW)
- **Big Horn River:** Yellowtail (250,000 kW)

The present hydroelectric generating capacity on Wyoming rivers is 688,800 kilowatts.

## Recreation

Water-based recreation, largely nonconsumptive, is another important use of the state's water resources. Based on a survey conducted in 1990, rivers and streams provide about 1.6 million fishing days per year, and standing waters provide nearly 2 million fishing days each year. It has been estimated that fishing pressures could increase to 1.75 million and 2.14 million days on streams and still water, respectively (*The Wyoming Framework Water Plan*, 1973). Wyoming waters also are used for other recreational and leisure purposes.

## Water Planning and Development

---

### State Engineer's Office

Constitutional provisions allow for the appropriation of water for beneficial uses. As previously discussed, Wyoming water law is based on the doctrine of prior appropriation, meaning

the first in time is first in right. The state engineer is the chief administrator of Wyoming water resources. Therefore, procedures for obtaining a legal water right and administration of all associated water laws and regulations, including those for interstate water, are administered through the State Engineer's Office.

Inquiries may be directed to the State Engineer's Office, Herschler Building, Cheyenne, Wyoming 82002.

### Wyoming Water Development Commission

The Wyoming Water Development Commission was established in 1979. The commission includes 10 members appointed by the governor with three advisory members, including the state engineer, a representative from the University of Wyoming appointed by the UW president, and a representative of the Economic Development and Stabilization Board. The commission is administered by a director and staff.

The commission serves as the water development and planning agency and administers new development construction and rehabilitation for both surface water and groundwater. The commission generates and assembles the necessary data for prioritizing by commission members and a Select Legislative Water Committee. Money for the water development program comes from designated taxes on coal, oil, and gas.

The 1999 session of the Wyoming Legislature authorized the Water Development Commission to initiate a statewide water planning process. The commission has initiated a river basin by river basin planning process and formed a Basin Advisory Group (BAG) in each river basin. BAG in each river basin is made up of all water interests within the river basin, including local, state, and federal representatives.

For more information on the state's water planning process, access the Web site: <http://waterplan.state.wy.us>. Inquiries also may be directed to the Wyoming Water Development Commission, Herschler Building, Cheyenne, Wyoming 82002.



---

## Department of Environmental Quality

The Department of Environmental Quality (DEQ) was created in 1973. DEQ is designated as the regulatory agency responsible for enforcing the Wyoming Environmental Quality Act, which includes water quality regulation. Administration of water quality issues are addressed by the Water Quality Division within DEQ.

DEQ operates under the guidance of an Environmental Quality Council. The council comprises seven private citizens appointed by the governor. Each division within DEQ, such as the Water Quality Division, has a separate advisory council.

The Clean Water Act Amendment of 1972 (PL-92-500), under Section 208, provides the authority to plan and manage water quality by state and local governments. A 208 plan provides the opportunity to tie together the point and nonpoint source pollution through a single management scheme. The plan identifies water quality problems and alternative management practices for addressing the identified water quality problems, sets priorities and timetables for implementation of the best management practices, and identifies institutional organizations for carrying out the water quality programs in the state.

The DEQ Water Quality Division is carrying out the provisions of the Federal Water Pollution Act. Through its council, plans are being implemented to address Wyoming water quality problems. Wyoming has developed a State Water Quality Plan, which has been certified by the governor and approved by the U.S. Environmental Protection Agency, upon which water quality planning is proceeding in the state.

Inquiries regarding water quality can be addressed to the Department of Environmental Quality, Water Quality Division, Herschler Building, Cheyenne, Wyoming 82002.

## State Water Forum

Numerous state and federal agencies are involved and interested in the state's water resources. To update each other and coordinate water programs, representatives from both state and federal agencies meet once a month. The forum is chaired by the state engineer. In addition to agency updates, a special report on a selected water issue and/or program of current interest or concern is given at each monthly meeting.

---

## Summary

Water concerns cut across all lines; it is important to agriculture, municipalities, industries, recreation, and people. Water is an important factor in the social and economic growth of any community and for the state itself. The wise development, use, and management of this precious resource is essential.

As indicated earlier, the state has approximately 3.6 million acre-feet of surface water that could be consumed annually. Wyoming citizens are concerned about the economic effects of allowing unappropriated surface waters to leave the state. However, due to the foresight of our early state leaders and legislators, Wyoming has allocations of available surface waters in perpetuity under the existing compacts and decrees. To develop this water, state water development officials need reliable information on the benefits that would be generated by the major water dependent sectors of agriculture, the coal-energy industry, and recreation. State agencies and the University of Wyoming need to work together in developing a framework in which development benefits and costs of using water in the three major water-dependent sectors can be computed and compared. These data would provide the basis for establishing water development priorities and a sound water development policy.

Editor: Diana Marie Hill-Chavez, Office of Communications and Technology

Layout: Bill Talbert, Office of Communications and Technology

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Glen Whipple, Director, Cooperative Extension Service, University of Wyoming, Laramie, Wyoming 82071.

Persons seeking admission, employment, or access to programs of the University of Wyoming shall be considered without regard to race, color, religion, sex, national origin, disability, age, political belief, veteran status, sexual orientation, and marital or familial status. Persons with disabilities who require alternative means for communication or program information (Braille, large print, audiotape, etc.) should contact their local UW CES Office. To file a complaint, write the UW Employment Practices/Affirmative Action Office, University of Wyoming, P.O. Box 3434, Laramie, Wyoming 82071-3434.