Wyoming Hydrogram

April 1991 Wyoming Water Research Center Newsletter Vol. 3, No. 2

Snowy Range Observatory important to nationwide watershed research

-- *with Chris Goertler and Tom Wesche, WWRC*

The Snowy Range Observatory (SRO) is a densely instrumented hydrologic and climatologic research and educational watershed located in the Snowy Range Mountains about 35 miles west of Laramie, Wyoming.

The SRO is representative of a subalpine/alpine watershed in Wyoming. Centered in the 7.5 square mile Nash Fork Creek drainage of the Medicine Bow National Forest, the SRO has been maintained by the WWRC since the late 1960s.

Extensive data gathering network

The basic data collection network consists of 16 recording precipitation gages, six recording hygrothermographs, five anemometers, and seven streamflow gaging stations. Instrumentation extends along an elevational gradient from the sagebrush-aspen community at 8,440 feet elevation to the alpine zone at over 11,000 feet. Data collection is on a weekly basis throughout the year.

Since its establishment, the SRO has served as the study area for a variety of hydrologic, climatologic, and biologic research projects involving many departments and units at the University of Wyoming.

The results of this work have been detailed in 35 water resource series publications, 23 master's theses and doctoral dissertations, and 58 journal articles and proceedings papers.

Also, the SRO has been used to educate over 100 graduate and undergraduate students in watershed data collection/analysis techniques, and serves as a field training site each summer for the Wyoming Water Institute for Teachers program.

Chris Goertler, Research Associate, WWRC, takes readings from precipitation gage at Snowy Range Observatory

Observatory aids agencies in research

Many state and federal agencies take advantage of the unique capabilities of the SRO.

The USDA Soil Conservation Service gathers snowpack data by means of a *SNOTEL* site and snow courses within the watershed area.

(*See article on SNOTELs, Wyoming Hydrogram, February 1991*)

Also, the US Forest Service operates two

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How much snow?

As we begin the sixth month of the water year, the USDA-SCS basin-wide forecast indicates that streamflow prospects for all Wyoming water users dipped downward as a result of the low precipitation so far this year.

Very few locations throughout the state reported any gain in snowpack accumulations during February or early March. The Big Horn Mountains, along with the Greybull River drainage, appear to be the only bright spots in the state. Their data sites show amounts to be near to slightly below average for this time of year.

Precipitation across much of Wyoming during February was sparse. Only the northeastern corner of the state reported above normal precipitation.

Water stored in major reservoirs across the state varies in amount from excellent to very poor based on averages for this time of year. Palisades is only 45 percent of average for this time of year, which is 45 percent less than this time last year. Reservoirs in the Wind River drainage are all holding above average amounts of water. Pilot Butte is currently at 85 percent of capacity. In the Black Hills, only Deerfield and Shadehill reservoirs are at or slightly above average for this time of year.

EPA reviews Wyoming funding applications

The Wyoming Department of Environmental Quality - Water Quality Division (DEQ-WQD) has requested $509,080 from congressional 319 funds administered by the US Environmental Protection Agency (EPA).

The Clean Water Act, Section 319, lends its name to these funds used to implement *nonpoint source* pollution control projects. (*See related article on the NPS Task Force, page 5*)

Beth Pratt, Planning and Nonpoint Supervisor, DEQ-WQD, reviewed requests for the funds from a variety of agencies and organizations in the state. The requests for funding totaled over $1.3 million.

DEQ-WQD staff submitted all applications received and requested that EPA fund nearly all requests for one year of the proposed projects. Some projects, though forwarded to EPA, did not meet project proposal guidelines and will probably not receive funding.

The total amount of funding for those projects which met proposal guidelines, if approved for funding, with matching state and local funds could exceed $800,000.

A decision on funding from the EPA could be received as early as late spring.

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Thanks to this issue's contributors:
Chris Goertler, Barry Lawrence, Ari Michelsen, Cath Voigtsberger, Tom Wesche

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.

 Address editorial material and correspondence c/o Editor, *Wyoming Hydrogram* to:

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

Scholarship for water resources studies available at UW

The *Willard C. and Elaine N. Rhoads Scholarship* for Graduate Studies in Water Resources was established to honor Willard Rhoads, a member of the Research Review and Priorities Committee for the Wyoming Water Research Center and a long time member of the Wyoming Water Development Commission.

Funds for the *Rhoads Scholarship* were donated to the University of Wyoming by Mrs. Rhoads, her family, and friends, with matching funds provided by UW.

An annual award for the academic year will be made in the amount of $1,500 to a master's degree candidate for use in furthering research on Wyoming's water resources. An engraved register of past recipients is displayed at the WWRC.

The **deadline** for receipt of application materials is **April 15, 1991**.

For information on application requirements, please contact the WWRC at Box 3067, Laramie WY 82071-3067, or phone (307) 766-2143.

Excellent turnout at state water resources seminars

Speakers at this year's Water Resources Seminars held in Torrington, Jan 29, and in Casper on Feb 19 enjoyed large and inquisitive audiences. The Seminars covered local and regional issues addressing water quality, water supplies and management, and the role of water resources in economic development.

More than one hundred people heard speakers from nearly every state and federal agency involved in water management at each Seminar.

The Seminars are sponsored by the WWRC and the UW Cooperative Extension Service and are held annually at two locations, usually at Wyoming's community colleges. The Seminars are held in different areas of the state each year to provide an opportunity for people from throughout Wyoming the chance to attend. Details on next year's Seminars, scheduled for early spring next year, will be published in the *Wyoming Hydrogram* and in area newspapers.

AWRA state section schedules meeting

The fourth annual meeting of the American Water Resources Association (AWRA), Wyoming State Section, will be held in Laramie, at the University of Wyoming, November 6-8, 1991.

The final agenda has not yet been decided upon, but proposed presentation and poster topics include Quality Assurance/Quality Control and the Significance of Hydrologic Data, Impacts of Changes in Water Law - including the issues of Federal Reserve Rights and Instream Flow, the Wind River and Big Horn Basins, Water-related Land Use Issues, and Impacts of Computers on Hydrology.

State section president, James Rankl, also announced that two scholarships would be offered this year. One each will go to the best graduate and undergraduate paper presented at the meeting.

For further information on the meeting, contact Rankl, c/o USGS-WRD, 2617 E. Lincolnway, Suite B, Cheyenne WY 82001 or phone (307) 772-2153.

National meeting proposed for Wyoming

The AWRA Spring 1994 Symposium, "Effects of Man-Induced Changes on Hydrologic Systems," is scheduled to be held in Jackson Hole, Wyoming.

For Symposium information, contact David Naftz, Symposium Chair, USGS-WRD, 2617 E. Lincolnway, Suite B, Cheyenne WY 82001, phone (307) 772-2153.

Snowy Range Observatory

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National Atmospheric Deposition Program sites within the Observatory to monitor airborne inputs to these high mountain areas.

Precipitation data leads to area estimates

The purpose of establishing a network of precipitation gages is to determine how much precipitation falls to the ground at the location of each gage and then, hopefully, to arrive at a close estimate of the total amount of precipitation falling over the area sampled by the network.

The accuracy of the areal estimate depends on two things: first, the accuracy with which each gage measures the amount of precipitation which would have fallen to the ground if the gage had not been there; and second, how well the value derived from the gage network represents the total mass of water falling from the clouds to the earth's surface. The quantity of input to an area by rainfall and snowfall is of prime concern in hydrology, climatology, and meteorology.

Wind effects on gages lead to inaccurate data

It has long been recognized that an unprotected gage catches less precipitation than actually reaches the ground, and the deficiency in catch is related primarily to windspeed and the form or character of the precipitation.

Turbulence in the windstream created by the gage causes snow particles to be deflected over or around the gage, so that precipitation is undermeasured. As a result, there has been continuing interest in devising a shield to minimize the wind effects.

Various types of shields have been developed to reduce the deleterious effects of wind. A shield specifically designed for gages operated in an exposed, windy environment was developed by the Wyoming Water Research Center in the early 1970s.

Shield specifications

The Wyoming shield gage system consists of two concentric shields mounted around a National Weather Service standard precipitation recording gage.

The gage orifice is 7.6 ft above ground, which is the same height as the top of the inner shield. The top of the outer shield is 9.6 ft above ground. The diameter of the top of the inner shield is 10 ft, and the diameter of the top of the outer shield is 20 ft. The inner shield is 45 degrees and the outer shield 30 degrees from the vertical.

The shielding is constructed from 4 ft, 50% density snow fence or synthetic fencing of the same dimensions.

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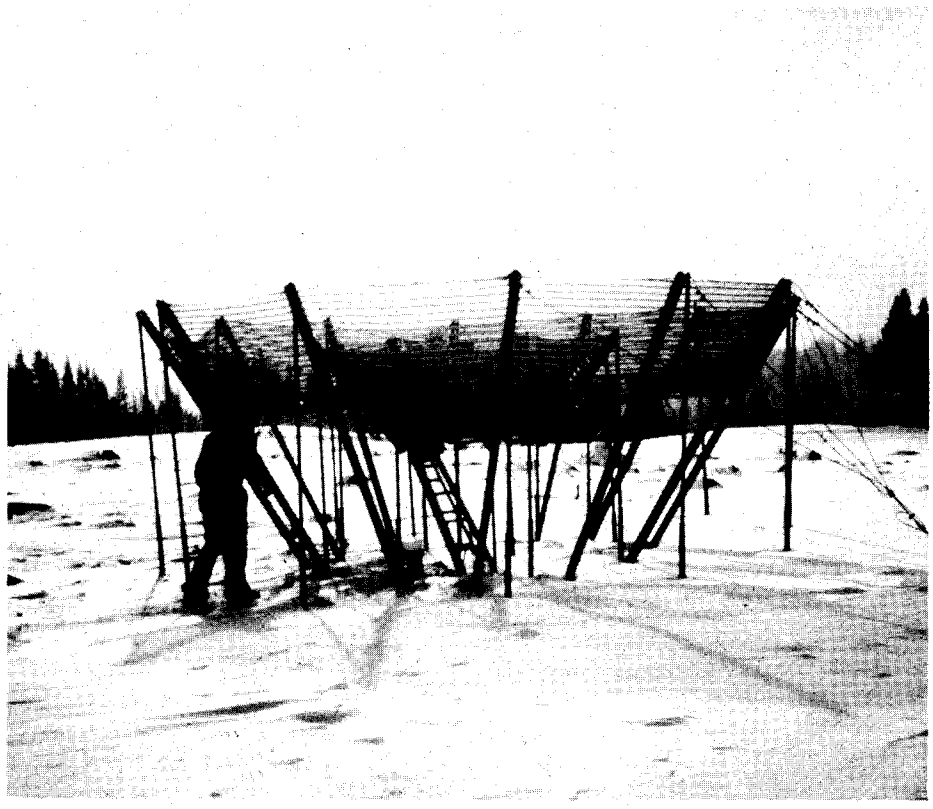

Wyoming wind shield in use at Snowy Range Observatory

Governor Sullivan announces Nonpoint Source Task Force

In November, 1990, Wyoming citizens were asked to serve on a task force aimed at combatting *nonpoint source pollution. Nonpoint source pollution* (NPS), says Sullivan, is the "most widespread water pollution problem affecting the State of Wyoming."

Nonpoint source pollution is that which is carried to streams and rivers by overland runoff or percolates through the soil to contaminate ground water. Common nonpoint sources are construction sites, logging areas, agricultural operations, and urban runoff.

Selection of Task Force participants was made by the Governor with recommendations from the Wyoming Department of Environmental Quality-Water Quality Division (DEQ-WQD). Task Force members include not only representatives of industries which may contribute to NPS, but also representatives from society who are impacted by the problem.

Members represent diverse constituencies and geographic areas

From the 55 applications received, Sullivan chose the following 13 Task Force members. The constituency represented by each member is in parentheses immediately following his or her name.

Tom Best, Worland (local government); Doug Cooper, Casper (sheep industry); Robert Crooks, Evanston (sportsmen/wildlife groups); Frank Eathorne, Douglas (cattle industry); William Edwards, Cheyenne (environmental groups); Lloyd Eisenhauer, Cheyenne (public-at-large); Wendy Frueauf, Casper (oil & gas industry); Jim Hoxie, Newcastle (timber industry); John Johnson, Jackson (travel & recreation industry); Larry Means, Lander (environmental groups); Ed Norlin, Powell (cropland industry); Rodney Pfister, Lusk (conservation districts); and William Townsend, Newcastle (conservation districts).

Task Force functions

The US Environmental Protection Agency and the DEQ-WQD administer the State NPS Management Plan. They have agreed on the functions of the new NPS Task Force.

The Task Force will review and make recommendations for proposed amendments to the Wyoming Nonpoint Assessment Report and Nonpoint Source Management Plan. They will also recommend modifications to best management practices (BMPs) for nonpoint sources.

The Task Force will prioritize and recommend demonstration projects for NPS control funding, disseminate information and educate their constituencies, review contract reports for completeness, and oversee activities of federal agencies to assist in determining NPS funding priorities.

Governor Sullivan has emphasized the importance of having citizen participation in making the difficult decisions necessary to make the NPS program successful. NPS is a difficult problem to identify, evaluate, and correct. In his letter to the selected members, Sullivan thanked them for their commitment of time and expertise to this program.

Snowy Range Observatory

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Wyoming shields used in many areas

Investigations of Wyoming shield gages for the measurement of snowfall indicate that the catch characteristics of precipitation gages are improved by the installation of these shields.

Therefore, in locations where wind is a significant factor, and where snowfall represents more than 20% of the mean annual precipitation, these shields are often standard equipment.

Use of the Wyoming shield at Barrow, Alaska tripled estimates of winter precipitation compared to measurements from unshielded gages.

The Wyoming shield gages have been used at many locations in Wyoming as well as in Colorado and Idaho.

Water Resources Data System serves Wyoming and the region

The Water Resources Data System (WRDS) is a computerized data storage and analysis system housing the largest single repository of hydrological and climatological data for the state of Wyoming. Data from more than 80 different collecting agencies are housed on the system, and offer requestors a high degree of reliability and fast response time to user queries.

All data and computer programs are resident on University of Wyoming computers. WRDS is funded through an allocation from the Wyoming Water Development Commission and is administered through the WWRC.

The WRDS is staffed by three full-time employees, Barry Lawrence (*see Focus article on page 8*), Ken Carnes, and Cath Voigtsberger.

Data sets and bibliography provide diverse information

The system is comprised of several unique data sets, including surface water quantity, water quality, climatological, well level, snow course, and the Wyoming Water Bibliography which, alone, includes over 12,000 citations.

Numerous parameters and collection frequencies are available for each of the data sets. Output may be generated in the form of printouts, plots, floppy diskettes, tapes, microfiche, and color slides, among others.

Also, data may be sent electronically to users on the Bitnet or Internet communication networks. Other queries are responded to via text and graphics images delivered by fax machine.

Updates and verification ensure high quality data

In an effort to keep the data current and of high quality, frequent updates are performed as data becomes available from pertinent sources. Extensive data verification is performed prior to loading on the WRDS system.

Supplementary sources of data include a variety of compact discs with climatological and hydrological data on the western United States, as well as global weather statistics.

Requests come from agencies and the general public

The WRDS responds to a broad spectrum of requestors each year, including municipal, county, state, and federal agencies, the educational community, public and private industry, research organizations, and consultants.

If the information requested is not present on a resident data base, the WRDS can access almost a dozen alternate systems around the nation from their base at the WWRC. Frequently, data requests are referred from state and federal agencies in Colorado, Nevada, and other western states.

Recently, requests have been for information on wind speeds and relative humidity data for construction firms, snow and ice data for the crop industry, and general climate data for architectural planners.

Occasionally, private citizens will call to request climatological information on a specific location in Wyoming as well as other data.

The WRDS also serves as a user assistance center for the National Water Data Exchange and maintains a cooperative access agreement with the Western Regional Climate Center in Reno, Nevada.

For more information:

Persons interested in placing a WRDS request or wanting further information about the Water Resources Data System, its capabilities, data sets available, or alternate systems accessed, should contact the WRDS staff:

Water Resources Data System
Wyoming Water Research Center
Box 3067
Laramie WY 82071-3067
or phone (307) 766-2143
or fax (307) 766-3718

USGS, EPA launch major water quality study

The US Geological Survey, in conjunction with USEPA and other federal agencies, has launched the National Water Quality Assessment Program (NAWQA), funded at $18 million under President Bush's FY91 budget, is aimed at defining long term trends in water quality and identifying causes of water degradation.

The NAWQA will study 60 bodies of water across the nation -- covering 45% of the land area in the contiguous US and serving about 65% of the population served by public water supplies. The assessment of the first 20 areas will begin in 1991.. USGS expects to have all areas studied by 2002.

Beginning in 1986, seven pilot projects were conducted by USGS prior to launching NAWQA.

Among key findings from those projects was a discovery that pesticides are commonly found in suburban areas as well as agricultural areas. -- *from the Environmental Policy Alert.*

WATER SAVER TIP

Start a compost pile with lawn and garden trimmings and food waste from the kitchen. The compost makes a good mulch for plants and helps retain soil water.

Water under the bridge

Construction of Lake Hattie Dam, circa 1909. Photographer unknown. From the Lewis Holliday Collection, courtesy of the American Heritage Center, University of Wyoming.

Water Calendar

American Geophysical Union 11th Annual "Hydrology Days", Apr 1-5, 1991, Colorado State University, Fort Collins CO, Contact: Dr. Morel-Seytoux, (303) 491-6762.

5th Biennial Symposium on Artificial Recharge of Ground Water, May 29-31, 1991, Tucson AZ, Contact: Susanna Eden, (602) 621-7607.

American Geophysical Union Chapman Conference on Continental Isotopic Indicators of Climate, June 10-14, 1991, **Jackson WY**, Contact: AGU (202) 462-6900.

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 Hole WY**, Contact: David Engles, (307) 672-5280 or Harry LaBonde, (307) 856-6505

Wyoming Water Atlas

The WWRC is processing orders for the *Wyoming Water Atlas*. The beautifully illustrated volume was published by the Wyoming Water Development Commission and UW.

For information, contact Pam Murdock at the WWRC, (307) 766-2143.

WWRC Focus: *Barry Lawrence*

Barry Lawrence has been with the WWRC since 1984 and is responsible for the maintenance and update of the Water Resources Data System (WRDS) for the State of Wyoming. WRDS is a complex of hydrological, climatological, and bibliographic databases. (*See related article on the Water Resources Data System on page 6*)

Barry is responsible for over 500 operational computer programs, procedures, subroutines, and accompanying documentation. He provides computer support for the WWRC faculty and staff researchers via programming and user assistance and serves as "superuser" for the WWRC.

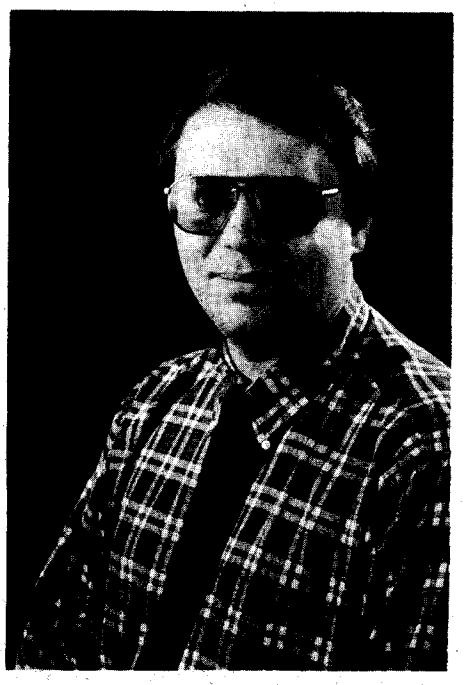
Barry graduated from Mount Vernon Nazarene College in Ohio with majors in both Computer Science and Zoology. This unique mix of studies equips Barry well for the task of analysis and manipulation of biological data. Barry was named to Who's Who Among Students in American Universities and Colleges.

His graduate work has been in both zoology and statistics and he has engaged in research on marine zoology on South Padre Island, Texas and cloud forest ecology in the mountains near Tamaulipas, Mexico.

The WRDS, which Barry manages, serves as the "service" arm of the WWRC. The staff responds to over 350 requests per year for data retrieval and analysis services. Many of these requests are from resource management agencies around the state. The WRDS staff has a well-earned reputation for fast, efficient service, especially when it comes to finding the "un-findable".

When a rafting firm wants data on streamflow, they call Barry. If a balloon launch is being planned, the WRDS staff is asked to retrieve prevailing wind data.

A company needed to know the temperature in Cheyenne on a given date and hour -- their chemical passed through Cheyenne on a train, and they wanted to make sure the chemical had not been altered by freezing temperatures. They got the data they needed from the WRDS.



Barry serves as liaison between the WRDS and state agency personnel. Agencies know that Barry has the information or he can find and access a system that does.

Barry keeps busy when he's away from the job, too. When he's not analyzing data, Barry keeps track of one-year-old Kira, while his wife, Jan, teaches piano in her studio at home.

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RESEARCH BRIEFS

Wyoming Water Research Center

Open conduit flow through the Madison limestone as determined from seasonal fluctuations in the discharge chemistry and temperature of Periodic Spring, Salt River Range, Wyoming

Investigators Mark R. Blanchard, Peter W. Huntoon, and James I. Drever, Department of Geology and Geophysics, University of Wyoming

Purpose

Periodic Spring is located in the Salt River Range, 4 miles east-northeast of Afton, Wyoming. It has served as Afton's water supply since 1958. The goals of this study were to (1) determine from spring water chemistry and temperature the existence or non-existence of highly transmissive karstic conduits (conduits in cavernous limestone terrain) in the Madison limestone feeding Periodic Spring, (2) define the recharge area for Periodic Spring, (3) understand the seasonal fluctuations in discharge, and (4) assess the potential impact of contamination in the recharge area on Afton's water supply.

Methods

Our basic strategy was to frequently sample spring discharge between the spring and fall seasons in order to capture a record of seasonal changes in water chemistry and temperature. Interpretations based on the concentrations of major cations and anions, temperature data, and discharge data were independently verified by isotope (deuterium, oxygen-18, and tritium) concentration data.

Results

Periodic Spring was sampled seven times between May and September 1989 and 17 times between April and September 1991. Discharge peaked between late June and middle July. Midsummer water has the same chemistry pattern as spring or fall water, but an overall lower total dissolved solids (TDS) concentration, indicating that peak discharge water is a mix of storage water with lower TDS snowmelt.

Midsummer water is colder, and this decrease in temperature coincides with the decrease in TDS. Thus, rapid flow occurs in the Madison limestone. A portion of the spring snowmelt recharge moves completely through the system in a matter of weeks. This can only occur in a karstic system.

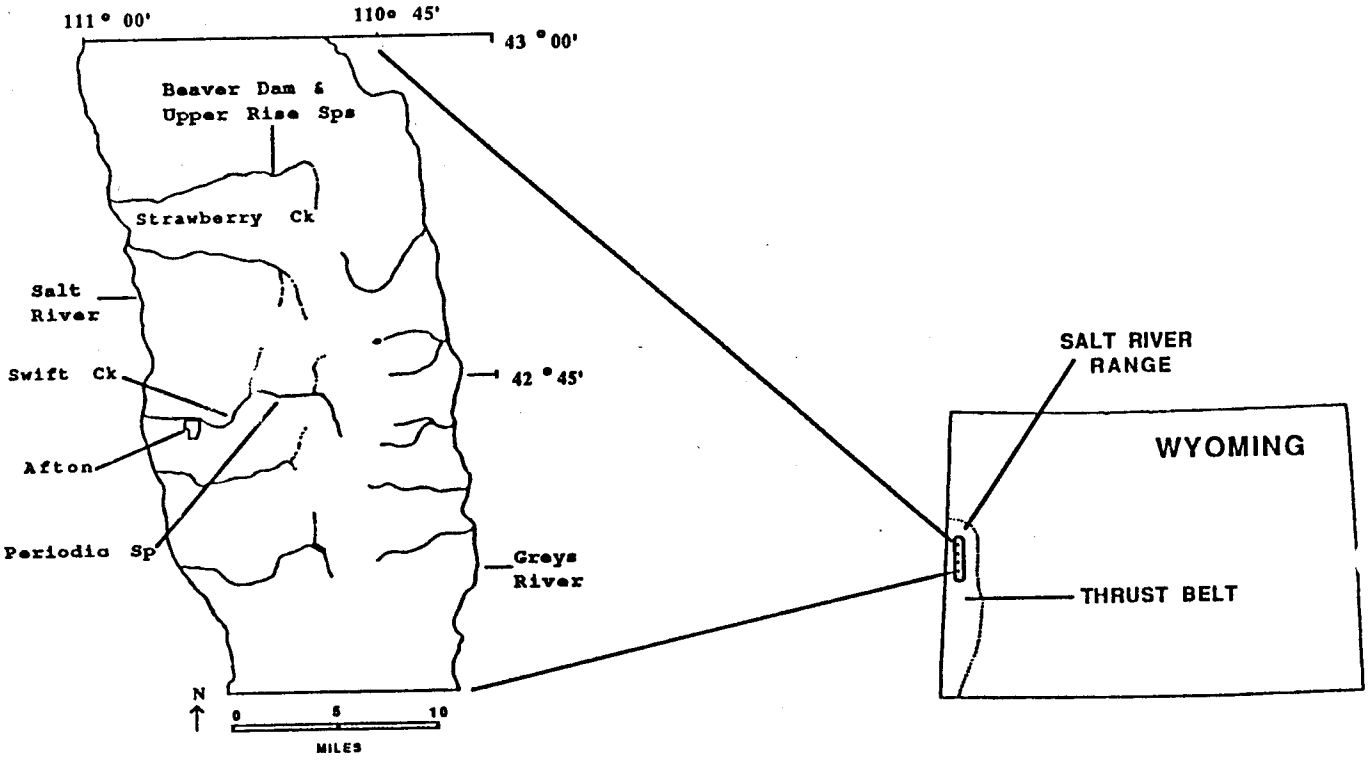
While part of the snowmelt recharge moves rapidly through the system, the remaining portion replenishes aquifer storage. Releases from this storage allow Periodic Spring to flow year round. The discharge fluctuates between the wintertime low discharge of 5 cubic feet per second (cfs) and the summertime peak discharge of up to 100 cfs.

Contamination in the recharge area (uplands 6 mi. east of the Spring) of Periodic Spring would pose both immediate and long-term problems. Rapid flow would bring contamination to Periodic Spring in a matter of weeks, whereas aquifer storage could prevent this system from flushing clean for years.

Publications

Blanchard, M.R., 1990. Discrimination between flow-through and pulse-through components of an alpine carbonate aquifer, Salt River Range, Wyoming. Master's Thesis, University of Wyoming, Laramie WY, 77 pp.

Huntoon, P.W. and Coogan, J.C., 1987. The strange hydrodynamics of Periodic Spring, Salt River Range, Wyoming. *In*: Wyoming Geological Association Guidebook - 38th Field Conf: 337-345.



Location map showing Salt River Range area near the Idaho/Wyoming border.

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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