WATER RESOURCES OF LINCOLN COUNTY, WYOMING

By Cheryl A. Eddy-Miller, Maria Plafcan, and Melanie L. Clark

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CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATIONS

Multiply	By	To obtain
acre	4,047	square meter
acre	0.4047	hectare
acre-foot (acre-ft)	1,233	cubic meter
acre-foot (acre-ft)	0.001233	cubic hectometer
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
cubic foot per second per square mile [(ft^3/s)/mi^2]	0.01093	cubic meter per second per square kilometer
foot (ft)	0.3048	meter
gallon	0.003785	cubic meter
gallon per minute (gal/min)	0.06309	liter per second
inch (in.)	25.4	millimeter (mm)
inch per year (in/yr)	25.4	millimeter per year
mile (mi)	1.609	kilometer
million gallons (Mgal)	3,785	cubic meter
square mile (mi^2)	2.59	square kilometer

Temperature can be converted to degrees Fahrenheit (^oF) or degrees Celsius (^oC) as follows:

$$^oF = 9/5\ (^oC) + 32$$

$$^oC = 5/9\ (^oF - 32)$$

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called *Sea Level Datum of 1929*.

Abbreviated water-quality units used in this report:

meq/L	milliequivalents per liter
mg/L	milligram per liter
µg/L	microgram per liter
µm	micrometer
µS/cm	microsiemens per centimeter at 25 degrees Celsius

Abbreviations used in this report:

MCL	maximum contaminant level
NAWQA	National Water Quality Assessment Program
NWQL	National Water Quality Laboratory of U.S. Geological Survey
SMCL	secondary maximum contaminant level
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey

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ABSTRACT

Surface-water, ground-water and water-quality data were compiled to describe the general occurrence, availability, and chemical quality of the water resources of Lincoln County, Wyoming. These data are needed to plan for and to manage the increased demands for water in the county. This study was conducted in cooperation with the Wyoming State Engineer.

The average annual runoff varied for the two hydrologic regions that occur in Lincoln County. In the Mountainous Region, average annual runoff ranged from 1.05 to 40 inches per year. Although no streamflow-gaging stations in the county were identified as receiving most of their flow from the High Desert Region, this type of stream does exist in the county. At a gaging station located 40 miles east of the county in the High Desert Region, the average annual runoff was 0.1 inch per year.

Geologic units were grouped mainly by age, and include deposits of Quaternary age, and rocks of Tertiary, Mesozoic, and Paleozoic age. Rocks of Precambrian age are not exposed at the surface in Lincoln County. More wells were developed in Quaternary deposits than any other geologic unit in the county. The most productive alluvial and colluvial aquifers in the Overthrust Belt, with pumping wells discharging up to 2,000 gallons per minute, are located in the valleys of the Bear River and Salt River (Star Valley).

Ground-water movement is related to the location of the recharge and discharge areas and to the thickness and permeability of aquifer materials. The ground-water connection between areas in the Overthrust Belt and the Green River Basin is restricted by folded and faulted rocks that are a result of regional tectonic (or orogenic (mountain building)) activity during middle Mesozoic and early Cenozoic time. Ground-water movement is difficult to define by aquifer within the Overthrust Belt because of the numerous faults and fractures. Most of the water discharged from the major limestone and dolomite aquifers of the Paleozoic (including the Madison Limestone of Mississippian age, Darby Formation of Devonian age, and the Bighorn Dolomite of Ordovician age) in the Overthrust Belt is from large springs. Water recharging these aquifers in one surface drainage basin may discharge in another drainage basin via interbasin transfers of ground water.

Total water use in Lincoln County during 1993 was estimated to be 405,000 million gallons. Surface water was the source for about 98 percent of the water used in the county; ground water accounted for about 2 percent of the water used. Hydroelectric power generation and irrigation used the largest amount of water.

Discharge measurements and surface-water samples were collected from the Salt River and one tributary to the Salt River during a streamflow sampling event in Star Valley, July 18-23, 1994. During that time, the river had an overall gain of 340 cubic feet per second along the reach from the Salt River's entrance into Star Valley to where the river discharges into Palisades Reservoir.

Dissolved-solids concentrations varied greatly for ground-water samples collected from 35 geologic units. Dissolved-solids concentrations in all water samples collected from the Laney Member of the Green River Formation of Tertiary age were greater than the Secondary Maximum Contaminant Level of 500 milligrams per liter established by the U.S. Environmental Protection Agency. All ground-water samples collected from the Salt Lake and Teewinot Formations of Tertiary age, the Madison Limestone of Mississippian age, and the Bighorn Dolomite of Ordovician age contained dissolved-solids concentrations less than the Secondary Maximum Contaminant Level.

Increased population growth in Star Valley and recent detections of nitrate concentrations above the maximum contaminant level of 10 milligrams per liter as nitrogen, established by the U.S. Environmental Protection Agency, prompted a study of the baseline water quality of the ground water. Ten domestic wells completed in the Salt River alluvium and colluvium were established as monitoring wells in 1993. A total of 84 ground-water samples were collected from the wells used in the Star Valley monitoring study. No water sample had a nitrate concentration greater than the maximum contaminant level. Statistical analysis indicated there was no significant difference between the water quality data collected in different seasons, and no correlation between the nitrate concentrations and the depth to ground water.

INTRODUCTION

Lincoln County was established February 20, 1911 with land partitioned from Uinta County. In 1921, Lincoln County was reduced to the current 4,182 square miles when Teton and Sublette Counties were created, making Lincoln the 11th largest county in Wyoming (Wyoming Historical Records Survey, 1941, p. 1) (fig. 1). Lincoln County development was primarily due to mining, westward expansion, and settlement by the Church of Jesus Christ of Latter-day Saints (Wyoming Historical Records Survey, 1941). Water is and has been a critical resource during the development of the county, especially for irrigation and mining use. Construction of canals in Star Valley, which were essential for crop production, was started in 1889 (Corsi, 1990). The county's population according to the 1990 census is 12,625 (Wyoming Data Handbook, 1991, p. 250). Most of the current population is divided between the Kemmerer area and Star Valley.

The topography of the county ranges from the flat intermontane Star Valley in the north-western part of the county; rises quickly to high mountains in the central part of the county; and returns to flat, arid, sage and grasslands in the southern and eastern part of the county. Altitudes range from 5,600 feet near Star Valley to 11,378 feet at the top of Wyoming Peak. The Green, Bear, and Snake Rivers are the principal rivers providing surface-water drainage in the county. Currently, water in the county is used mostly for power generation, agriculture, industry, public supply, and domestic use.

Purpose and Scope

The purpose of this report is to determine and describe the general occurrence, availability, and chemical quality of surface and ground water of Lincoln County, Wyoming. The information presented can be used in management of the water resources, including planning and designing new water supplies and related economic developments. This report, prepared in cooperation with the Wyoming State Engineer, is one of a series of reports describing the water resources of selected Wyoming counties.

The principal water resources in the county are streamflow and ground water. Streamflow is described first, but the emphasis is on ground water. The relation of ground water to geology is described, as well as ground-water recharge, movement, and discharge. A geologic map was compiled for Lincoln County (pl. 1).

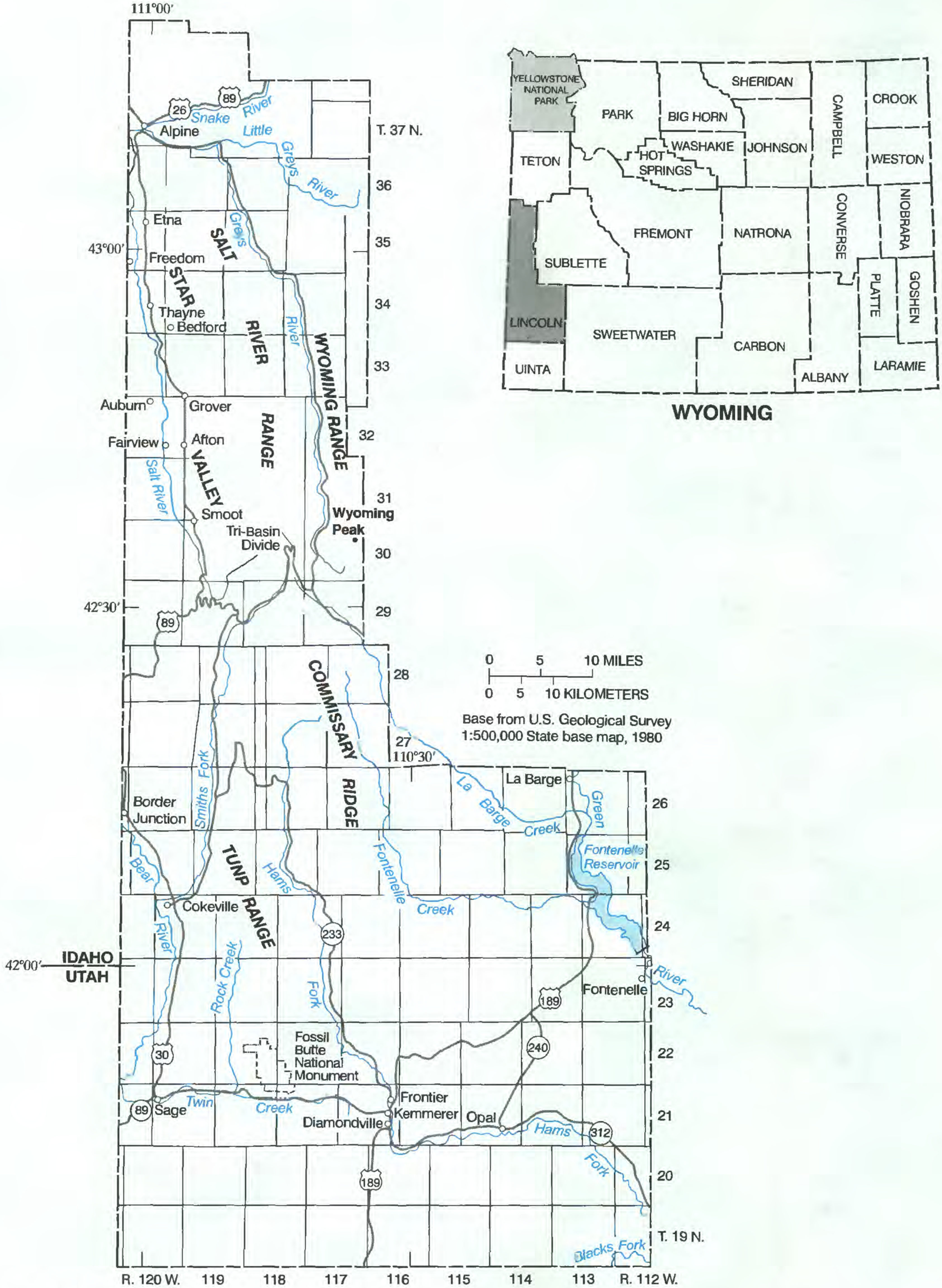


Figure 1. Location and physiography of Lincoln County, Wyoming.

Streamflow (pl. 2) and ground-water (pl. 3) sites were inventoried and sampled for this study from 1993 to 1995 to improve data coverage of the county. In 1994, chemical characteristics and discharge data were collected at 10 sites on the Salt River and one tributary to the Salt River. The ground-water inventory consisted of collecting data at 191 wells and springs during 1993-95, in addition to analyzing the existing data in the U.S. Geological Survey data bases.

Climate

The climate of Lincoln County varies in response to altitude, season, and topographic features. Precipitation in the county ranged from less that 8 inches per year in the southeastern part of the county to an estimated 60 inches in the Wyoming Range during the period of 1951-80 (fig. 2). A weather station at the dam on Fontenelle Reservoir records an average 6.5 inches of precipitation per year in contrast to the station of similar elevation near the Afton that records an average 18 inches of precipitation per year (fig. 3). This difference is attributed to the southeastern part of the county being in a rain shadow, a dry region on the lee side of the Salt River and Wyoming Ranges. Most of the southeastern part of the county receives less than 10 inches of precipitation, and is classified as desert (Martner, 1986, p. 6). The precipitation estimate for the Wyoming Range is based on correlations of annual precipitation with snowpack measurements and terrain factors, such as altitude, and should be regarded with caution (Martner, 1986, p. 78). The estimates are included to show the variability of precipitation with respect to large changes in altitude that occur in the county.

Temperatures in Lincoln County vary mainly in response to changing seasons. Mean monthly air temperatures were recorded at six weather stations located around the county (Afton, Bedford, Sage, Kemmerer, La Barge, and the dam at Fontenelle Reservoir). The temperatures recorded at these stations vary an average of 4°F between the stations at any given time throughout the year. However, the mean monthly temperature at the six stations varies an average of 47°F between winter and summer (Martner, 1986).

Generalized Geologic History

Lincoln County has two distinct geologic terrains, the Overthrust Belt in the western part of the county and the Green River Basin in the eastern part. The north-south trending Darby Thrust Fault separates the regions (pl. 3) (Ahern and others, 1981, fig. II-5). The central and western parts of the county include part of the Overthrust Belt and are characterized by north-south trending mountain ranges and valleys. The eastern part of the county includes a portion of the Green River Basin, which is an intermontane basin characterized by high plains, plateaus, and dissected terrain. Descriptions of the geology of the Overthrust Belt and Green River Basin in this report are limited to the deposits within Lincoln County.

A geologic map of Lincoln County is shown on plate 1. Igneous and metamorphic basement rocks of Precambrian age consisting of granite-gneiss, schist, granite, and pegmatite underlie the Overthrust Belt and the Green River Basin but are not exposed at the surface. Surficial geologic units in the Overthrust Belt range from sedimentary rocks of Cambrian age to unconsolidated deposits of Quaternary age. Surficial geologic units in the Green River Basin range from sedimentary rocks of Tertiary age to unconsolidated deposits of Quaternary age.

Sedimentary rock sequences of Paleozoic and Mesozoic age were deposited by alternating transgressive and regressive seas. In Lincoln County, these rocks are composed mainly of limestone, dolomite, siltstone, sandstone, conglomerate, mudstone, and shale. The Flathead Sandstone, Gros Ventre Formation, and the Gallatin Limestone of Cambrian age are examples of formations deposited by transgressive seas. Mesozoic rocks in the county were deposited in environments ranging from continental shelf to continental. The continental shelf depositional environment occurs between the shoreline and deep ocean. Continental deposits

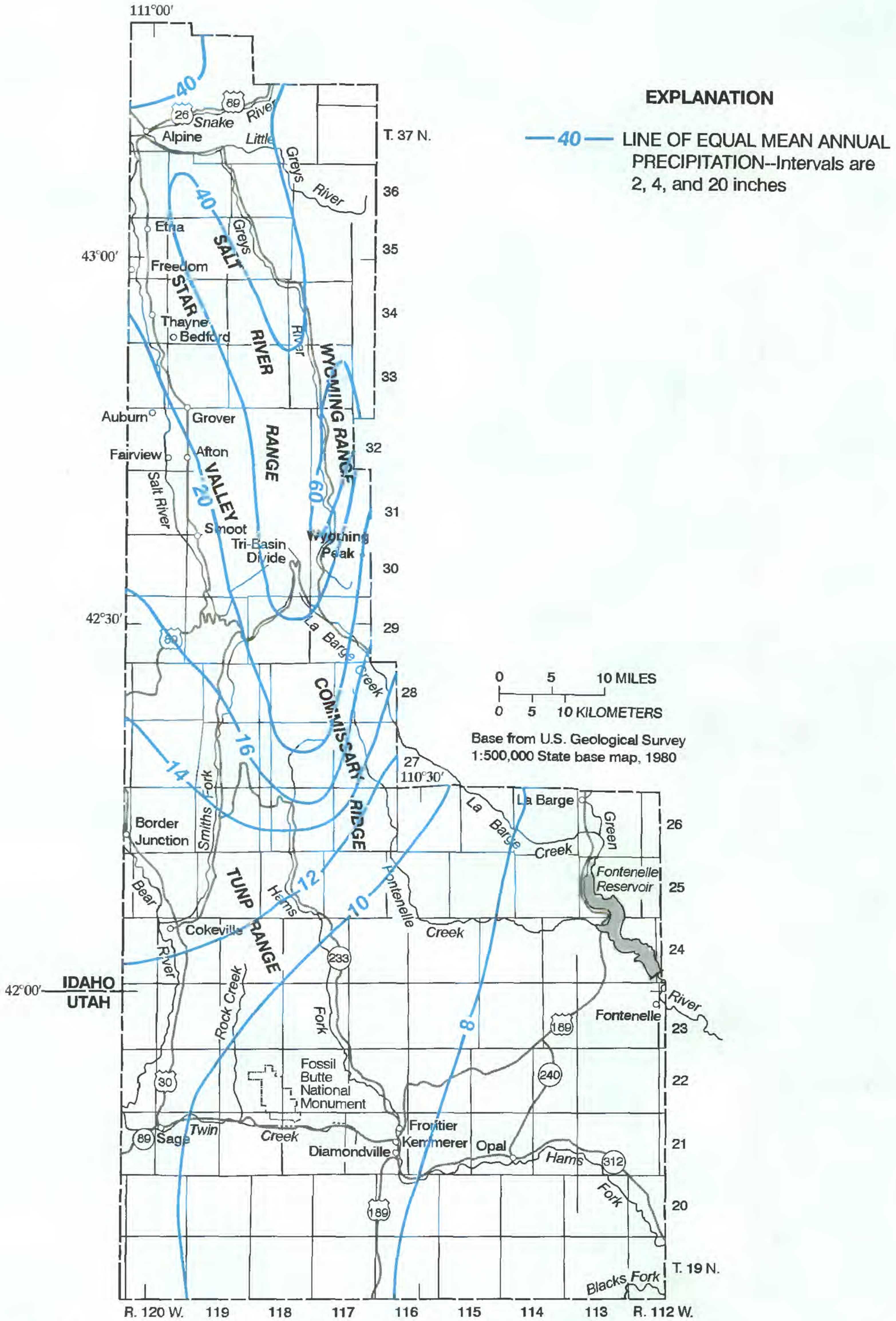


Figure 2. Mean annual precipitation for Lincoln County, Wyoming, 1951-80 (modified from Martner, 1986, fig. 6.1).

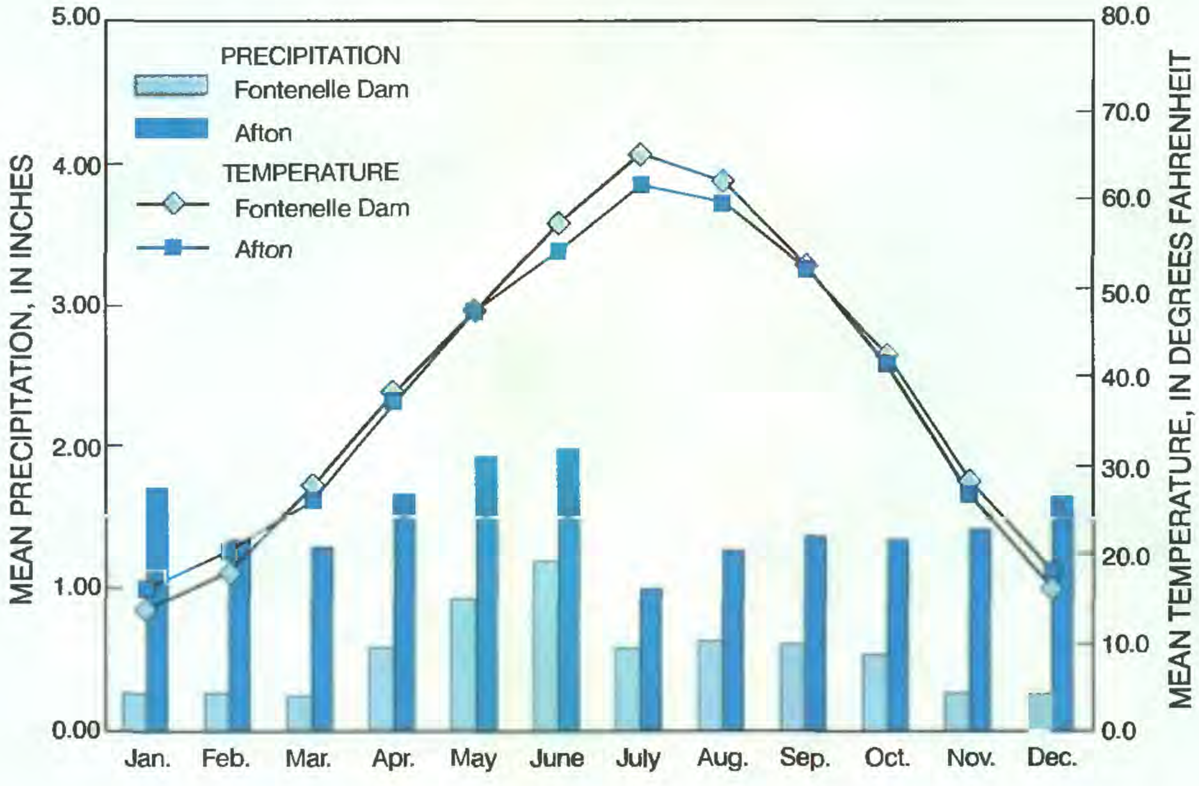


Figure 3. Mean monthly precipitation and air temperatures at Fontenelle Dam (1963-80) and town of Afton (1951-80), Lincoln County, Wyoming (data from Martner, 1986).

are formed on land rather than in the sea and may include sediments of lake, swamp, wind, stream, or volcanic origin. Mesozoic rocks in the county include limestone, siltstone, sandstone, coal, conglomerate, mudstone, and shale. Deposition and erosion of continental sediments has prevailed since the last marine regression during the Upper Cretaceous (Berry, 1955, p. 5). Tertiary rocks generally include intertonguing sandstones, siltstones, mudstones, and conglomerates deposited in fluvial (stream/river) and lacustrine (lake) environments. Unconsolidated Quaternary deposits include terrace gravels, graded fluvial sands and gravels, dune sand and loess, landslide, glacial, fan, and alluvial and colluvial deposits.

Thrust faulting, an overriding movement of one crustal unit over another, began in the western part of the Overthrust Belt during the Late Jurassic, continued during the Laramide orogeny, and ended in the early Eocene (Lines and Glass, 1975, sheet 1). In the Overthrust Belt, Paleozoic and Mesozoic rocks were thrust eastward and folded by a series of low-angle, westward-dipping thrust faults (Ahern and others, 1981, p. 26). The main geologic structural features of the Green River Basin were formed during the Laramide orogeny that extended from the Late Cretaceous into late Eocene time. The Laramide orogeny was not a single, long-term mountain building event, but rather a combination of intermittent tectonic activities that included uplifts, thrust faulting, local folding and normal faulting, and basin subsidence (Roehler, 1992, p. A2). The end of basin subsidence in the Green River Basin marked the end of the Laramide orogeny in the late Eocene (Roehler, 1992, p. A2). Tectonic activity has continued in the Overthrust Belt since the Laramide orogeny as indicated by faulted fan deposits (Lines and Glass, 1975, sheet 1). More recently, a series of earthquakes occurred in 1994 in the western part of Star Valley that ranged in magnitude from 4.3 to 5.9 on the Richter scale (Gary Glass, Wyoming State Geological Survey, written commun., 1994).

Mountains in the Overthrust Belt are bounded on the east by thrust faults and on the west by high-angle normal or reverse faults. Fossil Basin is a small structural basin in the southern part of the Overthrust Belt in Lincoln County. The eastern boundary of the basin is formed by Oyster Ridge, a north-south trending hogback ridge formed by resistent, west-dipping sandstone beds of Upper Cretaceous age (Roehler, 1992, p. A4) (pl. 3). The ridge formed a topographic barrier separating Fossil Basin and the Green River Basin during the deposition of some Tertiary rocks (Oriel and Tracey, 1970, p. 5). Star Valley, in the northwestern part of Lincoln County, is an elongate, northwest-trending intermontane valley. The valley is divided into two sections by a constriction called the Narrows that separates the southern part of Star Valley from the northern part of Star Valley (pl. 3). The valley is bounded to the east by the abrupt uplift of the Salt River Range along the Star Valley Fault and to the west and south by rolling uplands of Paleozoic and Mesozoic rocks called the Gannett Hills (Walker, 1965, p. C3) (pl. 3). Unconsolidated Quaternary fan deposits, built by erosion of the flanking mountains, and alluvium and colluvium occur on the valley floor.

The Darby Thrust Fault is the western geologic boundary of the Green River Basin. Relatively undisturbed Paleozoic and Mesozoic rocks in the Green River Basin are deeply buried beneath Tertiary and Quaternary deposits compared to the folded and faulted Paleozoic and Mesozoic rocks in the Overthrust Belt. The main structural feature within the Green River Basin part of the county is the Moxa Arch (pl. 3), a low-relief, south plunging anticline (Lickus and Law, 1988). The southeastern sector of the study area occupies part of the western limb of the Moxa Arch. During the Paleocene and Eocene, the Green River Basin was occupied by ancient Lake Gosiute. The intertonguing of the Bridger, Green River, and Wasatch Formations is the result of areal water-level fluctuations of Lake Gosiute coupled with regional tectonic activity (Ahern and others, 1981, p. 21). About 10,000 feet of sediments accumulated as a result of various depositional processes operating in and surrounding the Basin during the Tertiary (Ahern and others, 1981).

Water-Right Administration

By Richard G. Stockdale, Wyoming State Engineer's Office

According to Article 8, Section 1 of the Wyoming State constitution, "The water of all natural streams, springs, lakes or other collections of still water, within the boundaries of the state, are hereby declared to be property of the state." Anyone desiring to use water beneficially in Wyoming must apply for and obtain an approved permit from the State Engineer to appropriate water prior to initiating construction of water-diversion structures, such as dams, headgates, spring boxes, and wells. Once a permit to appropriate water has been obtained from the State Engineer, the permittee may proceed with construction of the water-diversion works and with beneficial use of the diverted water for the purposes specified in the permit. Such diversion and beneficial use need to be made in accordance with statutory provisions. After the permittee has beneficially used the diverted water for all of the permitted uses at all of the permitted point(s) or area(s) of use, proof of beneficial use is filed, and the water right is adjudicated (finalized). The adjudication process fixes the location of the water-diversion structure, the use, the quantity, and the points or areas of use for the water right.

Wyoming water rights are administered using the Doctrine of Prior Appropriation, commonly referred to as the "First in time, first in right" system. Article 8, Section 3 of the Wyoming constitution states: "Priority of appropriation for beneficial uses shall give the better right." The priority date of an appropriation is established as the date when the application for permit to appropriate water is received in the State Engineer's Office.

Water-right administration is conducted by the State Engineer and four Water Division Superintendents. Article 8, Section 5 of the Wyoming constitution provides for the appointment of a State Engineer, and Section 4 provides for the creation of four Water Divisions in the State and the appointment of a superintendent in each division. The State Engineer is Wyoming's chief water-administration official and has general supervision of all waters of the State. The superintendents, along with their staff of hydrographers and water commissioners, are responsible for the local administration of water rights and the collection of hydrologic data in their respective divisions.

Deviations from the standard water-right administrative system of "First in time, first in right" might exist. Such deviations might be caused by conditions in compacts, court decrees, and treaties or through the creation of special water-management districts. Virtually every stream exiting the State is subject to a compact, court decree, or treaty that dictates to some degree how the appropriations on that specific stream are administered. Although the interstate nature of ground water and the interconnection of ground water with streams are recognized, the development of interstate agreements on use of water from aquifers is still in its infancy. The reason that few ground-water compacts exist is twofold. First, there is a lack of sound technical data on which to base appropriate administrative allocations of ground water between adjoining States, and second, there is not sufficient competition between Wyoming and adjoining States to require binding interstate agreements or allocations of ground-water resources.

Acknowledgments

The authors gratefully acknowledge the cooperation and assistance of farmers, ranchers, landowners, and drillers of Lincoln County. Individuals from the Star Valley Conservation District provided invaluable assistance with locating monitoring wells within the valley. The help and orientation from Ken Mills of the Natural Resources Conservation Service was greatly appreciated. John P. R. Holland II, Julie A. Whalen, Kirk A. Miller, Pamela M. Hann, and Joel M. Galloway of the U.S. Geological Survey are recognized for exceptional help with data collection.

STREAMFLOW

The headwaters of tributaries to three major drainage basins originate in Lincoln County: the Green River, the Bear River, and the Snake River Basins (Lines and Glass, 1975, sheet 3; Schuetz and others, 1995, p. 2). Major tributaries to the Green River include La Barge Creek and Hams Fork. The major tributary to the Bear River is Smiths Fork. Major tributaries to the Snake River include the Salt River and the Greys River. The geographic location where all three basins meet is the Tri-Basin Divide, located approximately 14 miles southeast of Smoot on National Forest land (fig. 1).

Streamflow Data

Streamflow data are needed when planning, designing, or managing water use and development associated with streams. To obtain these data, streamflow-gaging or sampling stations are installed and operated on the principal streams. At these stations, data are collected continuously or periodically. Streamflow-gaging and sampling stations are operated for a variety of purposes in the county; a primary purpose is for planning and managing irrigation-water supplies.

Streamflow data generally are collected at continuous-record streamflow gaging stations, where water-level sensing equipment and a recorder are housed in a streamside shelter. Using discharge measurements of the streamflow, hydrographers develop a relation known as a rating between stage (water level) and measured discharge at the gaging station (fig. 4). This rating is used with the continuous record of stage from the gaging-station recorder to develop a continuous record of stream discharge. The locations of 61 gaging stations where substantial amounts of data have been collected for streamflow and water quality in the county are shown on plate 2, and specific information concerning these stations is listed in table 1. Records for some stations listed in this table may have been published previously using a slightly different station name. Previously published names are included in the station manuscript of the U.S. Geological Survey (USGS) Water Resources Data report for Wyoming, which is published annually.

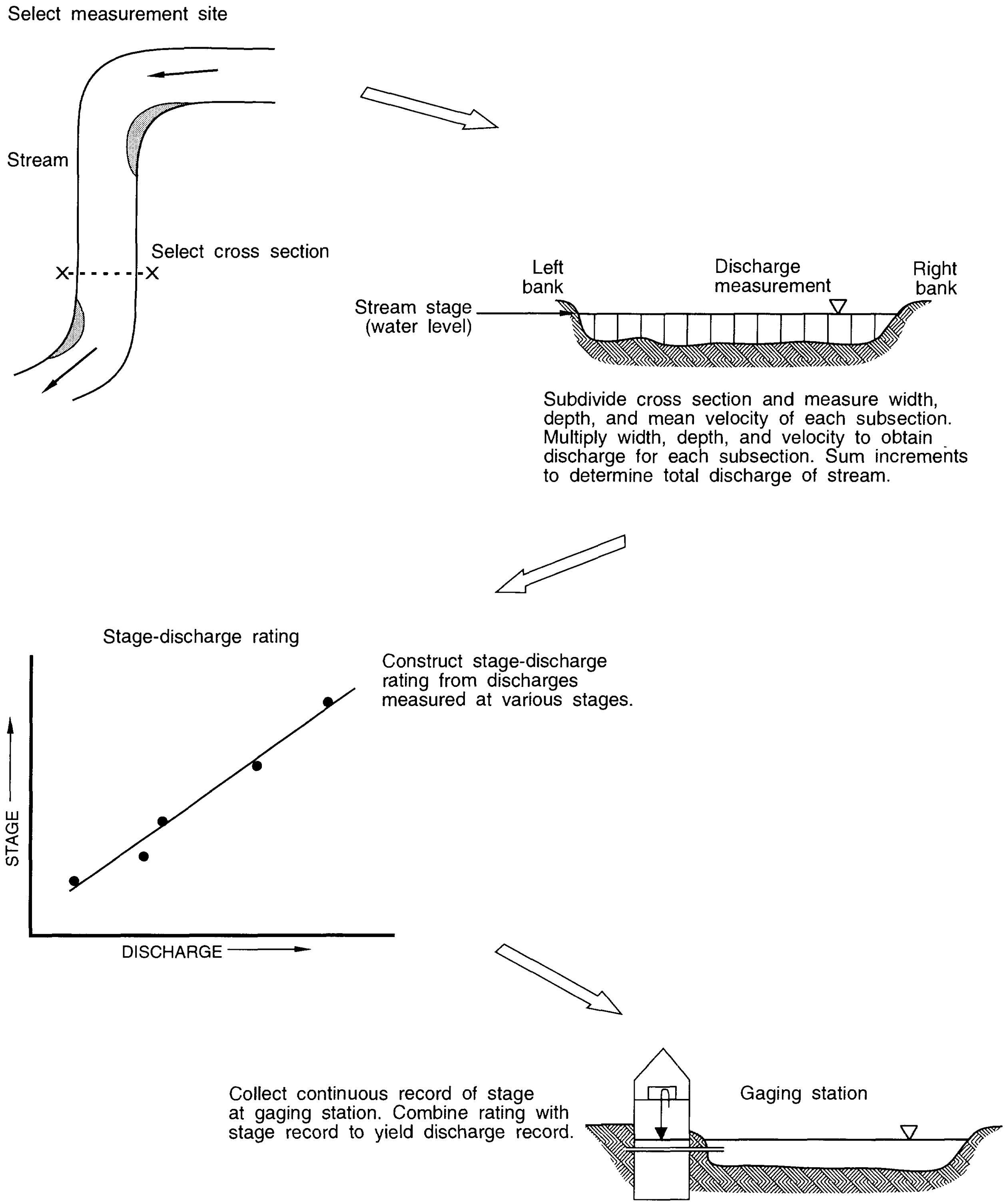


Figure 4. Procedure for collection of streamflow data at a gaging station (from Lowham, 1988, p.13).

Table 1. *Selected streamflow-gaging and reservoir-content stations in Lincoln County, Wyoming*

(Modified from Schuetz and others, 1995, p. lv; lix, lxiii to lxv; lxvi to lxvii)

[Site number: Simplified site number used to identify location of streamflow-gaging stations. Station number: Assigned by U.S. Geological Survey to locations where streams are measured or sampled on a regular basis. The first two digits identify the major basin in which the station is located (Green River —09, Bear River—10, Snake River—13). The remaining six digits identify the relative location. Period of record in calendar years: A date followed by a semicolon indicates a break in the collection of records. Breaks of less than one year are not shown. mi^2, square miles; --, no data; NC, not computed]

Site number (pl. 2)	Station number	Station name	Drainage-basin area (mi^2)	Period of record in calendar years				
				Daily or monthly discharge or content	Annual peak discharge	Quality		
						Chemical	Sediment	Biology
1	09208000	La Barge Creek near La Barge Meadows ranger station	[1]6.3	1940-42; 1950-81	--	1975-78	1975-78	1976-78
2	09208500	La Barge Creek near Viola (La Barge)	172	1913-16; 1940-49	--	1977-78	1978	1977-78
3	09209000	La Barge Creek near La Barge (Tulsa)	193	1931-39	--	1963	--	--
4	09209400	Green River near La Barge	[1]3,910	[2]1963-94	--	[2]1963-94	1975-82; [2]1986-94	1973-80; [2]1986-94
5	09209500	Green River near Fontenelle	3,970	1946-65	--	1962-63	--	--
6	09210000	Fontenelle Creek at upper station, near Fontenelle	[1]58	1941-42	--	--	--	--
7	09210500	Fontenelle Creek near Herschler Ranch, near Fontenelle	152	[2]1951-94	--	1975-78	1975-78	1977
8	09211000	Fontenelle Creek near Fontenelle	224	1914-19; 1931-53	--	--	--	--
9	09211100	Green River tributary near Fontenelle	3.75	--	1961-74	--	--	--
10	09211150	Fontenelle Reservoir near Fontenelle	[1]4,280	[2]1964-94	--	1975	--	--
11	09222250	Little Muddy Creek above North Fork, near Glencoe	366	1980-81	--	1980-81	1980-81	--
12	09222300	Little Muddy Creek near Glencoe	416	1976-80	--	1975-80	1975-80	1976
13	09223000	Hams Fork below Pole Creek, near Frontier	128	[2]1952-94	--	1975-78	1975-78	--
14	09223500	Hams Fork near Frontier	298	1945-1972	--	--	--	--
15	09224000	Hams Fork at Diamondville (Kemmerer)	386	1917-33; 1945-49	--	--	--	--
16	09224050	Hams Fork near Diamondville	--	--	--	1975-89; [2]1992-94	1980-82	1975-89; [2]1992-94
17	10026800	Rock Creek near Fossil	49.0	1961-66	--	--	--	--
18	10026850	Twin Creek tributary near Sage	2.91	--	1965-70	--	--	--
19	10027000	Twin Creek at Sage	246	1943-62; 1976-81	--	1958;1961; 1967-69; 1975-81; [2]1989-94	1976-81; [2]1989-94	1975-80
20	10027500	Twin Creek Ditch near Sage	NC	[3]1944-45	--	--	--	--

Table 1. *Selected streamflow-gaging and reservoir-content stations in Lincoln County, Wyoming--Continued*

Site number (pl. 2)	Station number	Station name	Drainage-basin area (mi^2)	Period of record in calendar years: Daily or monthly discharge or content	Annual peak discharge	Quality: Chemical	Quality: Sediment	Quality: Biology
21	10028000	Diversions from Bear River between Randolph and below Pixley Dam gaging stations	NC	[4]1958 [3]1944-48; [3]1953-56	--	--	--	--
22	10028500	Bear River below Pixley Dam, near Cokeville (near Cokeville)	2,032	1941-43; 1952-56; [2]1958-94	--	--	--	--
23	10029000	Leeds Creek near Cokeville	NC	[3]1944	--	--	--	--
24	10029500	Bear River above Sublette Creek, near Cokeville	[1]2,110	1948-55	--	--	--	--
25	10030000	Sublette Creek near Cokeville	NC	[3]1944-45; [3]1955-56; [4]1958	--	--	--	--
26	10030300	Smiths Fork near Afton	1.62	--	1964-70	--	--	--
27	10030500	Smiths Fork near Smoot	17.3	1943	--	--	--	--
28	10031000	Smiths Fork above Hobble Creek, near Geneva, Idaho	NC	[3]1944-46	--	--	--	--
29	10032000	Smiths Fork near Border	165	[2]1942-94	--	--	--	--
30	10032500	Coal (Howland) Creek near Cokeville	NC	[3]1944-48; [3]1953-56	--	--	--	--
31	10032700	Muddy Creek above Mill Creek, near Cokeville	20.7	1965-69	--	--	--	--
32	10032800	Mill Creek near Cokeville	8.07	1966-69	--	--	--	--
33	10033000	Grade Creek near Cokeville	NC	[3]1944-48; [3]1953-56; [4]1958	--	--	--	--
34	10033500	Pine Creek above diversions, near Cokeville	NC	[3]1944-48; [3]1953-56; [4]1958-65	--	--	--	--
35	10034000	Diversions from Pine Creek	NC	[3]1944-48; [3]1953-56; [4]1958	--	--	--	--
36	10034500	Bruner Creek above Covey Canal, near Cokeville	NC	[3]1944-48; [3]1953-56; [4]1958	--	--	--	--
37	10035000	Smiths Fork at Cokeville	275	1942-52	--	1985-88; 1990-92	1989-92	--
38	10035500	Spring Creek above Covey Canal, near Cokeville	NC	[3]1944-48; [3]1953-56; [4]1958	--	--	--	--
39	10036500	Birch Creek near Cokeville	NC	[4]1944-45	--	--	--	--
40	10038000	Bear River below Smiths Fork, near Cokeville	2,447	[2]1954-94	--	[2]1993-94	--	[2]1993-94
41	10040000	Thomas Fork (Salt Creek) near Geneva, Idaho	45.3	1939-51	--	--	--	--

Table 1. *Selected streamflow-gaging and reservoir-content stations in Lincoln County, Wyoming--Continued*

Site number (pl. 2)	Station number	Station name	Drainage-basin area (mi^2)	Period of record in calendar years				
				Daily or monthly discharge or content	Annual peak discharge	Quality		
						Chemical	Sediment	Biology
42	10041000	Thomas Fork (Salt Creek) near Wyoming-Idaho State line	113	1949-92	--	--	--	--
43	13021500	Bailey Creek near Alpine, Idaho (Wyoming)	15.9	1917-18	--	--	--	--
44	13021700	West Table Creek near Alpine	1.06	--	1964-69	--	--	--
45	13022000	Wolf Creek near Alpine, Wyoming (Idaho)	13.1	1917-18	1964-67	--	--	--
46	13022500	Snake River above reservoir, near Alpine	3,465	[2]1937-39; 1953-94	--	1965-86; 1988	1974-77	1973-80
47	13022550	Red Creek near Alpine	3.88	--	1964-73	--	--	--
48	13022570	Cottonwood Creek near Alpine	2.40	--	1964-72	--	--	--
49	13023000	Greys River above reservoir, near Alpine (near Alpine, Idaho)	448	1917-18; 1937-39; [2]1953-94	--	--	---	--
50	13023500	Snake River below Greys River, at Alpine, Idaho	3,940	1944-54	--	--	--	--
51	13023800	Fish Creek near Smoot	[1]3.60	--	1964-74	--	--	--
52	13023900	Salt River near Smoot	47.8	1932-57	--	1981-85	--	--
53	13024500	Cottonwood Creek near Smoot	26.3	1932-57	--	--	--	--
54	13025000	Swift Creek near Afton	27.4	1942-80	--	1965; 1981-85	--	--
55	13025500	Crow Creek near Fairview	[1]115	1946-49;1961-67	--	1965; 1983-84	--	--
56	13026500	Salt River near Thayne	570	1932-33;1961-67	--	--	--	--
57	13027000	Strawberry Creek near Bedford	21.3	1932-43	--	--	--	--
58	13027500	Salt River above reservoir, near Etna	829	[2]1953-94	--	[2]1965-94	[2]1989-94	1970; 1973-81; 1989-92
59	13028000	Salt River near Alpine, Idaho	878	1917-18	--	--	--	--
60	13028500	Salt River at Wyoming-Idaho State line	890	1933-55	--	--	--	--
61	13029000	Snake River near Alpine	4,841	1916-18;1934	--	--	--	--

[1]Approximate.
[2]Currently in operation (1994).
[3]From reports of Bear River Hydrometric Data (U.S. Geological Survey Open-File Report) as cited in U.S. Geological Survey, 1971, p. 32.
[4]Published in reports of Bear River Commission.

Streamflow and water-quality data are sometimes required locally where streamflow-gaging or sampling stations are not operated. For example, determination of water loss or gain from seepage in a particular stream reach may require measurements of discharge at several locations along the stream reach. Likewise, definition of water-quality changes within a stream reach may require that water samples be collected (periodically or routinely) at several locations to account for the effects of inflows from seeps and tributaries. Locations where measurements or samples were collected infrequently are defined as miscellaneous streamflow sites. Locations of 52 miscellaneous streamflow sites used for this study are shown on plate 2, and specific information concerning these sites is listed in table 2.

Additional information about streamflow-gaging stations and miscellaneous streamflow sites in the county can be obtained from computer files and published reports of the USGS. Inquiries can be directed to the District Chief, U.S. Geological Survey, 2617 E. Lincolnway, Suite B, Cheyenne, Wyoming 82001-5662.

Streamflow Characteristics

Streams in Lincoln County can be classified as ephemeral, intermittent, or perennial. Assigning a stream type can be somewhat arbitrary because the process depends on which reach of the stream is being considered and the length of time the stream has been observed (Lowham, 1985, p. 32).

Streams that primarily drain desert areas of the county are usually ephemeral or intermittent. Ephemeral and intermittent streams only flow periodically in response to direct surface runoff and often have extended periods of no flow (Lowham, 1988, p. 5). The two stream types differ slightly, as intermittent streams may receive some ground-water inflow in addition to direct surface runoff; however, ground-water inflow is insufficient to sustain flow throughout the year (Lowham, 1985, p. 32). For the purpose of this report, ephemeral and intermittent stream types will be classified as one type: ephemeral/intermittent. A hydrograph for Pacific Creek near Farson (located 40 miles east of Fontenelle in Sweetwater County) illustrates the streamflow of an ephemeral/intermittent stream (fig. 5).

Most perennial streams originate in the mountainous areas of the county. Streamflow in these areas occurs mainly as a result of snowmelt runoff (Lowham, 1988, p. 5). Water stored as ground water in the mountains is released slowly, maintaining streamflow throughout the year. An example of a perennial stream is Hams Fork below Pole Creek near Frontier (site 13); a hydrograph for this streamflow-gaging station is shown in figure 5. The hydrograph shows the characteristic period of snowmelt runoff from April through July followed by sustained flow throughout the year.

The continuous record of stream discharge, described in the "Streamflow Data" section, can be summarized statistically to express streamflow characteristics, such as, average daily, monthly, or yearly rates or volumes of discharge. Instantaneous peak flow and total runoff for a particular period also can be determined from the records. Streamflow characteristics at 21 selected streamflow-gaging stations in the county are listed in table 3 and include: average annual flow, average annual runoff, and annual peak flow for selected recurrence intervals. Additional streamflow characteristics can be found in Peterson (1988, p. 52-61; p. 102-109; p. 178-185; p. 188-193, and p. 208-221).

Estimates of streamflow characteristics at sites with no streamflow-gaging stations can be made using equations "that relate streamflow characteristics to features of the drainage basin" (Lowham, 1988, p. 16). Factors affecting streamflow are climate, topography, and geology. Wyoming's terrain is diverse, and because these factors vary with terrain, Lowham (1988, p. 18) identified three distinct hydrologic regions in the State and developed different equations to estimate streamflow characteristics in each region. The three hydrologic regions are Mountainous, High Desert, and Plains. The region boundaries were defined by the use of color-infrared imagery and known streamflow characteristics. Most of Lincoln County is within the Mountainous Region. The southeastern and southwestern parts of the county are located in the High Desert Region: the Plains Region is not present in Lincoln County.

Table 2. *Selected miscellaneous streamflow sites in Lincoln County, Wyoming*

[Site number: Simplified site number used in this report to identify miscellaneous streamflow sites. Miscellaneous streamflow site number: Assigned by the U.S. Geological Survey to locations where only one or a few measurements or samples have been obtained. For all sites, except site 147, the first six digits generally designate latitude of the site, the next seven digits designate longitude, and the last two digits are sequence numbers to distinguish between several sites that may be in close proximity of one another. For site 147, the first two digits of the miscellaneous streamflow number indicate the major drainage basin that the site is in (Snake River), and the remaining six digits identify its relative location]

Site number (pl. 2)	Miscellaneous streamflow site number	Location (degrees, minutes, seconds)		Site name
		Latitude	Longitude	
101	410522110101901	42 05 22	110 10 19	Fontenelle Creek at mouth, near Fontenelle
102	413451110402201	41 34 51	110 40 22	Bell Creek at mouth, near Elkol
103	413452110401801	41 34 52	110 40 18	Little Muddy Creek above Bell Creek, near Elkol
104	413459110340401	41 34 59	110 34 04	Little Muddy Creek above North Fork, near Glenco
105	413513110340001	41 35 13	110 34 00	North Fork Little Muddy Creek at mouth, near Glenco
106	413648110421701	41 36 48	110 42 17	Little Muddy Creek above Sheep Creek, near Elkol
107	413648110422001	41 36 48	110 42 20	Sheep Creek at mouth, near Elkol
108	413740110423201	41 37 40	110 42 32	Carter Creek at mouth, at Elkol
109	413755110333601	41 37 55	110 33 36	North Fork Little Muddy Creek near Elkol
110	413827110423501	41 38 27	110 42 35	Warfield Creek at mouth, near Elkol
111	413827110423901	41 38 27	110 42 39	Little Muddy Creek above Warfield Creek, near Elkol
112	413937110481001	41 39 37	110 48 10	Chicken Creek above Road Hollow, near Elkol
113	413942110480801	41 39 42	110 48 08	Road Hollow at mouth, near Elkol
114	414109110331301	41 41 09	110 33 13	North Fork Little Muddy Creek tributary at Blazon Gap
115	414127110332301	41 41 27	110 33 23	North Fork Little Muddy Creek at Blazon Junction
116	414332110335001	41 43 32	110 33 50	North Fork Little Muddy Creek tributary near Elkol
117	414333110334501	41 43 33	110 33 45	North Fork Little Muddy Creek tributary near Elkol
118	414351110340501	41 43 51	110 34 05	North Fork Little Muddy Creek tributary No. 1 near Elkol
119	414351110340901	41 43 51	110 34 09	North Fork Little Muddy Creek tributary No. 2 near Elkol
120	414500110370000	41 45 00	110 37 00	K1 8ua Pit Kemmerer Coal Wyo Coal Es Sw
121	415016110315501	41 50 16	110 31 55	Willow Creek at mouth, near Frontier
122	415145111003001	41 51 45	111 00 30	Unnamed Ditch at B-Q Dam, near Cokeville
123	415624110591601	41 56 24	110 59 16	Pixley Ditch at Pixley Dam, near Cokeville
124	415652110240201	41 56 52	110 24 02	North Fork Slate Creek below Emigrant, near Fontenelle
125	415900110050001	41 59 00	110 05 00	Slate Creek near Fontenelle

Table 2. *Selected miscellaneous streamflow sites in Lincoln County, Wyoming--Continued*

Site number (pl. 2)	Miscellaneous streamflow site number	Location (degrees, minutes, seconds)		Site name
		Latitude	Longitude	
126	415903110110501	41 59 03	110 11 12	Slate Creek at Highway 189, near Fontenelle
127	415905110111201	41 59 05	110 11 12	Slate Creek near Fontenelle
128	420141110034801	42 01 41	110 03 48	Fontenelle Reservoir near Dam, near Fontenelle
129	420221110554901	42 02 21	110 55 49	Sublette Creek at Highway 30 N, at Cokeville
130	420405110570801	42 04 05	110 57 08	Forgen Slough near Cokeville
131	420426110571901	42 04 26	110 57 19	Spring Creek below railroad bridge, at Cokeville
132	420507110092100	42 05 07	110 09 21	Fontenelle Reservoir at Muddy Creek Arm
133	420518110565501	42 05 18	110 56 55	Spring Creek at Highway 30 N, at Cokeville
134	420534110565901	42 05 34	110 56 59	South Fork at Highway 30, at Cokeville
135	420540110570201	42 05 40	110 57 02	Smiths Fork at Highway 30 N, at Cokeville
136	420610110075201	42 06 10	110 07 52	Fontenelle Reservoir above Fontenelle Creek, near Fontenelle
137	421300110321501	42 13 00	110 32 15	Fontenelle Creek above Perkins Creek, near Fontenelle
138	421450110105001	42 14 50	110 10 50	Green River below Spur Canyon, near La Barge
139	422958110391501	42 29 58	110 39 15	La Barge Creek near Scalers Cabin
140	423132110525801	42 31 32	110 52 58	Salt River above Fish Creek, near Smoot
141	423610110283001	42 36 10	110 28 30	Middle Fork Piney Creek at Forest Boundary, near La Barge
142	423658110555701	42 36 58	110 55 57	Salt River at County Road 148, near Smoot
143	424119110594701	42 41 19	110 59 47	Crow Creek at County Road 143, near Fairview
144	424526110581301	42 45 26	110 58 13	Salt River below Crow Creek, near Afton
145	424741110582801	42 47 41	110 58 28	Salt River at Highway 237, near Auburn
146	425027110584801	42 50 27	110 58 48	Salt River above Narrows, near Auburn
147	130262000	42 50 28	110 59 00	Salt River near Auburn
148	425250110595701	42 52 50	110 59 57	Salt River above East Side Canal, near Thayne
149	425529111005801	42 55 29	111 00 58	Salt River at Thayne
150	425855111015001	42 58 55	111 10 50	Salt River at Highway 239, near Freedom
151	430244111020601	43 02 44	111 02 06	Salt River at County Road 111, near Etna
152	430708110512401	43 07 08	110 51 24	Greys River below Lake Creek, near Alpine

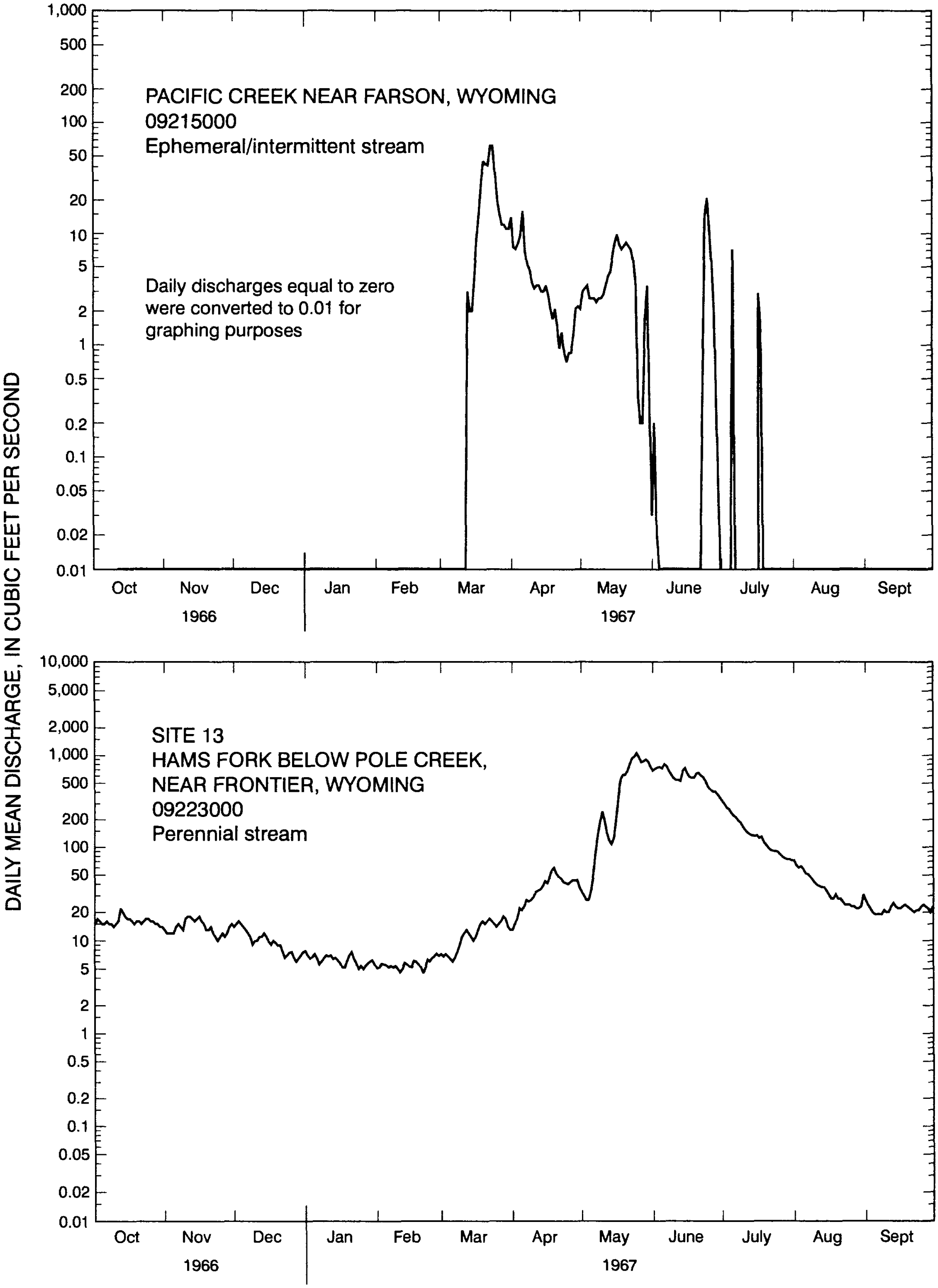


Figure 5. Daily mean discharge for an ephemeral/intermittent stream and a perennial stream, water year 1967.

Table 3. *Streamflow characteristics at selected streamflow-gaging stations in Lincoln County, Wyoming*

[Site number: Simplified site number used in this report to identify location of streamflow-gaging stations. mi^2, square miles; Q_a, average annual flow, in cubic feet per second (ft^3/s), number in parentheses is average annual runoff, in inches; average annual runoff represents average depth, in inches, over the entire drainage basin. M, Mountainous Region (classification from Lowham, 1988, p. 18; pl. 1); P_t, annual peak flow, in cubic feet per second, with subscript designating the average recurrence interval in years (data are from Peterson, 1988, p. 52-61; p. 102-109; p. 178-185; p. 188-193; p. 208-221). The peak flows listed are estimates based on a Pearson Type III probability distribution of gaged discharges; Factors affecting natural flow: descriptions are from Peterson, 1988; --, not computed]

Site number (pl. 2)	Station name	Drainage-basin area (mi^2)	Q_a	P_2	P_5	P_{10}	P_{25}	P_{50}	P_{100}	Factors affecting natural flow
1	La Barge Creek near La Barge Meadows ranger station	[1]6.3	14 (30) M	130	164	184	206	222	236	No diversion above station.
4	Green River near La Barge	[1]3,910	1,750	--	--	--	--	--	--	Natural flow of stream affected by storage reservoirs and diversions for irrigation of about 198,000 acres above station.
5	Green River near Fontenelle	3,970	1,570	--	--	--	--	--	--	Natural flow of stream affected by storage reservoirs, diversions for irrigation, and return flow from irrigated areas.
7	Fontenelle Creek near Herschler Ranch, near Fontenelle	152	75 (6.7) M	493	678	785	906	986	1,060	Diversions for irrigation of about 780 acres above station.
8	Fontenelle Creek near Fontenelle	224	66	--	--	--	--	--	--	Diversions for irrigation of about 8,120 acres (part of which is above and part below station) adjudicated by Wyoming for diversion above station.
13	Hams Fork below Pole Creek, near Frontier	128	105 (11.1) M	862	1,180	1,360	1,540	1,660	1,760	No diversion above station.
14	Hams Fork near Frontier	298	[2]153 [3]138	-- --	-- --	-- --	-- --	-- --	-- --	Flow regulated by Lake Viva Naughton (capacity, 42,400 acre-ft) since May 1961 and Kemmerer Reservoir (capacity 1,058 acre-ft). Diversions above station for irrigation of about 5,050 acres, of which about 90 acres are below station. Water is pumped from river just upstream from station for use at Naughton power plant.
15	Hams Fork at Diamondville (Kemmerer)	386	163 (5.73) M	1,460	2,230	2,720	3,300	3,710	4,090	Adjudicated diversions above stations for irrigation of 8,450 acres above and below station.
19	Twin Creek at Sage	246	19 (1.05) M	224	503	732	1,060	1,310	1,580	Diversions for irrigation of about 1,100 acres above station.

Table 3. *Streamflow characteristics at selected streamflow-gaging stations in Lincoln County, Wyoming--Continued*

Site number (pl. 2)	Station name	Drainage-basin area (mi^2)	Q_a	P_2	P_5	P_{10}	P_{25}	P_{50}	P_{100}	Factors affecting natural flow
29	Smiths Fork near Border	165	200 (16.5) M	983	1,300	1,480	1,680	1,820	1,950	One diversion for irrigation of about 200 acres above station.
37	Smiths Fork at Cokeville	275	200	--	--	--	--	--	--	Diversions above station for irrigation of about 4,000 acres above and about 5,000 acres below station.
40	Bear River below Smiths Fork, near Cokeville	2,447	477	--	--	--	--	--	--	Natural flow of stream affected by diversion for irrigation, return flow from irrigated areas, and regulation by upstream reservoirs.
41	Thomas Fork (Salt Creek) near Geneva, Idaho	45.3	17 (5.1) M	147	250	326	428	506	587	No diversion above station.
42	Thomas Fork (Salt Creek) near Wyoming-Idaho State line	113	57 (6.8) M	468	871	1,150	1,490	1,730	1,950	No remarks.
46	Snake River above reservoir, near Alpine	3,465	4,640 (18.2) M	19,200	23,600	26,100	28,700	30,400	32,000	Flow partly regulated by Jackson Lake. Some diversions from tributaries above station.
49	Greys River above reservoir, near Alpine (near Alpine, Idaho)	448	664 (20.1) M	3,410	4,450	5,100	5,880	6,440	6,990	Less than 500 acres irrigated by diversions from Greys River and tributaries above station.
52	Salt River near Smoot	47.8	36	--	--	--	--	--	--	Diversions for irrigation of about 4,000 acres, adjudicated by Wyoming for diversion above station.
53	Cottonwood Creek near Smoot	26.3	44	--	--	--	--	--	--	No diversion above station. Flow regulated by Cottonwood Lake.
54	Swift Creek near Afton	27.4	87	504	623	695	782	843	902	Small power plant and reservoir, adjudication, 48.45 acre-ft/yr, 0.2 mile upstream. Pipeline, adjudication, 2.5 ft^3/s December 30, 1958.
57	Strawberry Creek near Bedford	21.3	62 (40) M	262	320	354	393	420	445	One small diversion above station.
58	Salt River above reservoir, near Etna	829	805	2,380	3,410	4,070	4,850	5,410	5,940	Diversion above station for power developments, industry, municipal supply, and irrigation of about 60,500 acres, of which about 1,000 acres are below station (1966 determination).

[1]Approximate area.
[2]Before construction of Viva Naughton Dam.
[3]After construction of Viva Naughton Dam.

Average Annual Runoff

Average annual flow (Q_a) is a measure of streamflow past a reference point. Average annual runoff distributes the annual flow across the drainage basin and is a useful estimate of how much water a watershed/ drainage basin will produce. Average annual runoff typically is computed for selected streamflow-gaging stations that have a minimum period of record of 5 years and that monitor streamflow that has not been substantially affected by artificial diversions, storage, or human activities in or on the stream channels (table 3). The streamflow characteristics in table 3 were computed using "10 or more complete years of record (Peterson, 1988, p. 10)." Fewer than one-fourth (4 of 21) of the stations in table 3 are not affected by some sort of diversion.

Average annual runoff from drainage areas in the Mountainous Region of Lincoln County is a function of climatic variables, topography, geology, and the size of the drainage basins. Important climatic variables are precipitation, temperature, wind, evaporation, and solar radiation. Climatic conditions of an intermontane drainage basin are related to the basin altitude and the topographic position of the basin in relation to the mountain ranges. Drainage-basin size is the most important physical characteristic. Water storage in lakes, ponds, and aquifers has some effect on total runoff, but to a lesser degree than the climatic conditions and drainage-basin size (Rankl, 1987, p. 30).

Surface-water runoff in Lincoln County is mainly from the Mountainous Region in the northern and central parts of the county. The average annual runoff for 11 streamflow-gaging stations recording runoff mostly from this region ranged from 1.05 to 40 in/yr (table 3). The runoff measured at these gaging stations originates in the Salt River, Tunp, and Wyoming Ranges.

Average annual runoff of streams originating in the High Desert Region in the southeastern and southwestern parts of Lincoln County is a function of quantity and intensity of precipitation, drainage-basin area, evapotranspiration, and infiltration rate of water into surficial material. Rainstorm intensities or snowmelt rates exceeding the infiltration rate of moisture into the surficial material produce runoff. Irrigation storage, drainage structures, and stock ponds decrease the total runoff from a drainage basin because they divert water for consumptive uses and increase evapotranspiration (Rankl, 1987, p. 30).

None of the streams with streamflow-gaging stations listed in table 3 were described by Lowham (1988) as receiving most of their flow from the High Desert Region. This type of stream, however, does exist in the county. The gaging station on Pacific Creek near Farson (located 40 miles east of Fontenelle in Sweetwater County) is used as a representative station in the High Desert Region. Pacific Creek originates in the High Desert Region and has an average annual runoff of 0.1 in/yr at the gaging station near Farson. The flow at this station, however, is affected by diversions for irrigation, imported water from the Sweetwater River Basin, and an upstream reservoir, Pacific No. 2.

Flow Duration

Streamflow is the result of variable precipitation and the drainage-basin characteristics. Streamflow duration is dependent on the following drainage-basin characteristics: climate, physiography, geology, and land use. Drainage basins where these characteristics are similar can have flow-duration curves similar in shape. High flow is controlled mainly by climate, physiography, and land use in the basin. Low flow is controlled mainly by the geology of the basin, as the flow is sustained primarily from ground water. The effects of precipitation on streamflow are reduced by storage, either on the surface or in the ground (Searcy, 1959, p. 30).

The flow-duration curve is a cumulative frequency curve of daily mean discharges showing the percentage of time that specified discharges were equalled or exceeded during a period of record. This curve does not account for the chronological sequence of hydrologic events, but combines the flow characteristics of a stream throughout its range of discharge. Flow-duration characteristics presented here and the methods used to develop the curves are from Peterson (1988, p. 2). The flow-duration curve applies only to the period of record for which the curve was developed. Streamflow data for complete years of record were used for the flow-duration curves. Although the years need not be consecutive, the records used represent periods when human activities such as reservoir storage and irrigation diversions remain unchanged.

Flow-duration curves can be used to evaluate the variability of streamflow in the county. To illustrate the variability, flow-duration curves were developed for selected streamflow-gaging stations representing each stream type (fig. 6). Hams Fork below Pole Creek, near Frontier, (site 13) is located in the Mountainous Region in the south-central part of the county. The flow-duration curve for site 13 indicates high streamflows (greater than 50 cubic feet per second (ft^3/s)) are sustained primarily by snowmelt. Sustained baseflow in the low-flow range indicates ground-water inflow and characterizes storage in the basin.

Pacific Creek near Farson is located in the High Desert Region in Sweetwater County. The flow-duration curve for this site indicates variable streamflow that is dependent primarily on direct surface runoff. During the period 1955-73, daily mean discharge at Pacific Creek near Farson equalled or exceeded 19 ft^3/s only 5 percent of the time (fig. 6).

The flow-duration curve for each site in figure 6 applies only to the period for which the curve was developed. For each site, all available records were used. Extended high flows of a wet year (or extended low flows of a dry year) tend to skew the curve on the high-flow (or low-flow) end, and care is needed when such curves are applied to specific years. The converse also is true, because curves representing a short period of record do not necessarily represent long-term flow characteristics.

Low Flow

Frequency analysis of low-flow data provides information about water-supply conditions related to municipal, industrial, and irrigation uses, instream fisheries, and waste disposal. Indices generally used to describe low-flow characteristics of streams are the lowest mean discharges averaged over 7 consecutive days and having recurrence intervals of 2 and 10 years. For simplicity, these indices are referred to as the 7-day Q_2 ($7Q_2$) and 7-day Q_{10} ($7Q_{10}$) discharges. In any given year, there is a 50-percent chance that the flow will not exceed the $7Q_2$ for 7 consecutive days (10-percent chance for the $7Q_{10}$).

Seven-day low-flow discharges for 21 selected streams are listed in table 4. The $7Q_2$ and $7Q_{10}$ discharges per square mile (yields) also are listed in table 4 for comparison purposes. However, note that the $7Q_2$ and $7Q_{10}$ discharges in table 4 cannot be extrapolated to other reaches on the same stream or to other streams in the drainage basin without knowledge of the drainage-basin characteristics and without knowledge of the effects of human activities. Low-flow frequency values for the various stations cannot be directly compared because the values are based on different periods of record. For this table, records for Hams Fork near Frontier (site 14) were divided into periods prior to and following the construction of Viva Naughton Dam on the Hams Fork.

The hydrographs in figure 5 illustrate the differences in the occurrence of low flow between ephemeral/intermittent and perennial streams. In ephemeral/intermittent streams, low flow is zero flow, because many of these streams are dry most of the year. Low flows in perennial streams occur in the winter (normally October through March) and are predominantly from ground-water inflows.

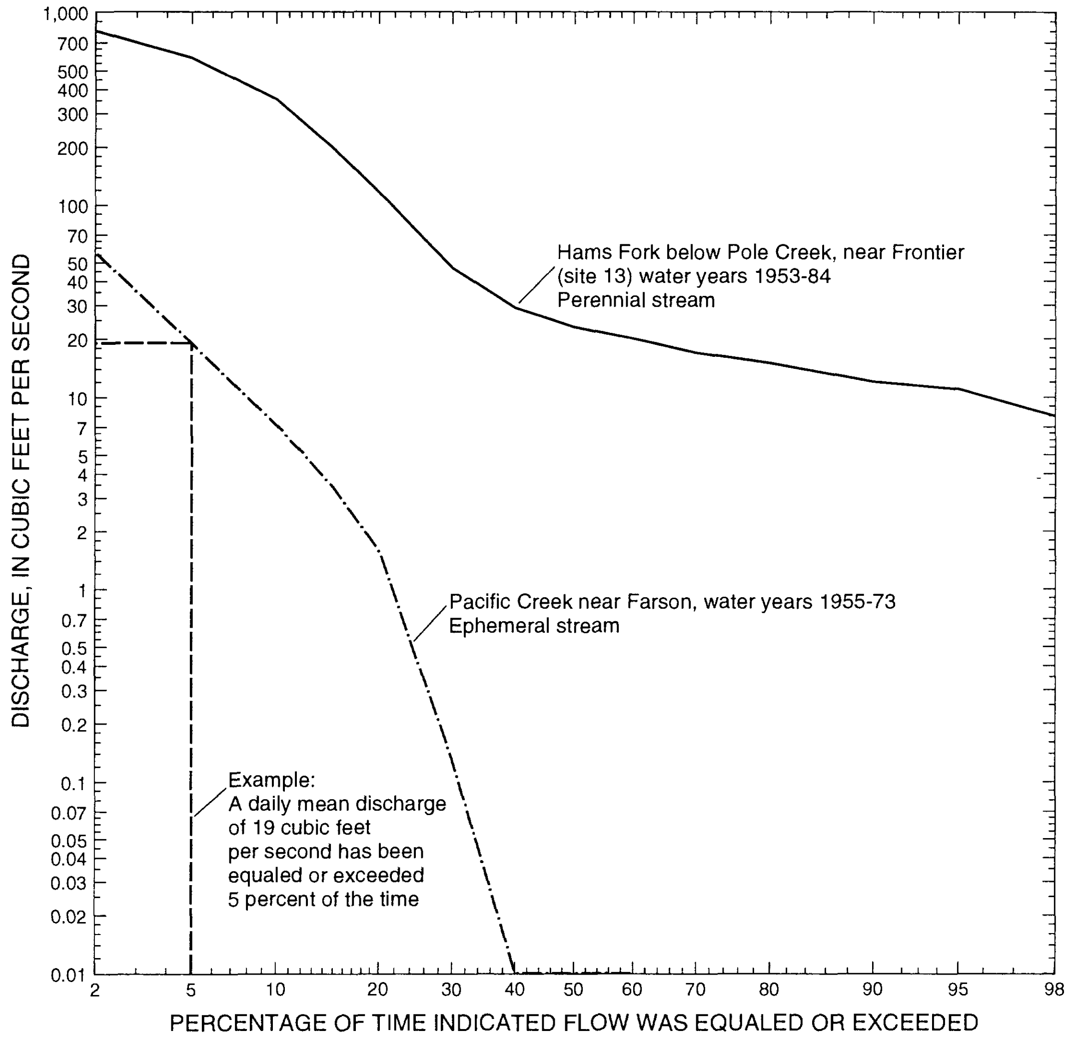


Figure 6. Flow-duration curves of daily mean discharge for Hams Fork below Pole Creek near Frontier, Lincoln County, Wyoming, and Pacific Creek near Farson, Sweetwater County, Wyoming.

Table 4. *Seven-day low-flow discharges for selected streamflow-gaging stations in Lincoln County, Wyoming*

[Site number: Simplified site number used in this report to identify location of streamflow-gaging stations; mi^2, square miles; ft^3/s, cubic feet per second; (ft^3/s)/mi^2, cubic feet per second per square mile of drainage-basin area]

Site number (pl. 2)	Station name	Drainage-basin area (mi^2)	Length of record (years)	Seven-day low-flow discharge for indicated recurrence interval: 2 years, Discharge (ft^3/s)	2 years, Yield [(ft^3/s)/mi^2]	10 years, Discharge (ft^3/s)	10 years, Yield [(ft^3/s)/mi^2]
1	La Barge Creek near La Barge Meadows ranger station	[1]6.3	30	3.1	0.49	2.2	0.35
4	Green River near La Barge	[1]3,910	20	406	.104	293	.0749
5	Green River near Fontenelle	3,970	18	316	.0796	238	.0599
7	Fontenelle Creek near Herschler Ranch, near Fontenelle	152	32	19	.13	12	.079
8	Fontenelle Creek near Fontenelle	224	24	15	.067	0	0
13	Hams Fork below Pole Creek, near Frontier	128	31	12	.094	4.5	.035
14	Hams Fork near Frontier	298	[2]14	11	.037	5.7	.019
			[3]10	12	.040	6.9	.023
15	Hams Fork at Diamondville (Kemmerer)	386	17	13	.034	0	0
19	Twin Creek at Sage	246	23	3.2	.013	1.8	.0073
29	Smiths Fork near Border	165	41	56	.34	50	.30
37	Smiths Fork at Cokeville	275	9	55	.20	32	.12
40	Bear River below Smiths Fork, near Cokeville	2,447	28	129	.0527	69	.028
41	Thomas Fork (Salt Creek) near Geneva, Idaho	45.3	11	2.6	.057	1.7	.038
42	Thomas Fork (Salt Creek) near Wyoming-Idaho State line	113	34	12	.11	7.9	.070
46	Snake River above reservoir, near Alpine	3,465	31	1,280	.369	1,030	.297
49	Greys River above reservoir, near Alpine (near Alpine, Idaho)	448	32	176	.393	145	.324
52	Salt River near Smoot	47.8	24	4.9	.10	1.9	.040
53	Cottonwood Creek near Smoot	26.3	24	11	.42	9.0	.34
54	Swift Creek near Afton	27.4	28	31	1.1	27	.99
57	Strawberry Creek near Bedford	21.3	10	28	1.3	25	1.2
58	Salt River above reservoir, near Etna	829	30	387	.467	301	.363

[1]Approximate area.

[2]Before construction of Viva Naughton Dam.

[3]After construction of Viva Naughton Dam.

High Flow

High-flow characteristics of streams in Lincoln County vary with stream type. High flows in ephemeral/intermittent streams are the result of lowland snowmelt or rainfall runoff during spring thaw or from summer thunderstorms. Snowmelt runoff usually is smaller in magnitude and longer in duration than rainfall runoff. Runoff from intense thunderstorms can be extremely large and of short duration. Magnitude and duration of rainfall runoff depend on drainage-basin characteristics and on the distribution and intensity of precipitation. Peak flow in most ephemeral/intermittent streams is reached quickly from rainfall runoff, and is followed by an equally rapid decrease in flow, with a gradual return to no-flow conditions. Because of these rapid changes in flow, the timing of streamflow measurements to include peak discharge on ephemeral/intermittent streams is difficult. Peak flows on ephemeral/intermittent streams usually are measured by indirect methods, as discussed in Benson and Dalrymple (1967). Perennial streams generally have a period of high flow in May and June as the melting of mountain snowpacks peaks.

Diurnal fluctuations in flow are typical during snowmelt periods with successive daily flows increasing as daylight hours lengthen and temperatures increase. This diurnal pattern, if uninterrupted by changing weather conditions, continues until peak flows occur. However, weather conditions have a substantial effect on snowmelt runoff, making peak flows difficult to predict.

The design of bridges and culverts for road crossings, dams, diversions, and other structures on or near streams requires information about expected peak-flow conditions (floods). If routine streamflow measurements have been made in the vicinity of a planned structure, statistical analysis of the annual maximum instantaneous flows for the period of record can be used to determine the magnitude and frequency of floods. If peak-flow records are not available, then an estimate generally is made using one of several other techniques that are available (Lowham, 1985, p. 34). For example, if a bridge, when built, was planned to be used for 20 or more years, the bridge was designed for the 100-year peak flow (P_{100}). The 100-year peak flow, or 100-year flood, for selected streamflow-gaging stations in the county is listed in table 3. A 100-year flood is defined as the annual maximum instantaneous (peak) discharge that will be equalled or exceeded once in 100 years, on the average. Alternately, the 100-year flood is the discharge that has a 1-percent chance of being equalled or exceeded during any particular year. Instantaneous peak flows with recurrence intervals of 2, 5, 10, 25, and 50 years are also listed in table 3. The magnitude of these flows is listed for stations where the natural flow is not substantially affected by regulation, diversion, or irrigation. The method used to compute the instantaneous peak flows listed in table 3 is described in Peterson (1988, p. 3).

Peak flow in ephemeral and intermittent streams result from precipitation occurring more in the form of widespread general rainstorms and snow and less in the form of convective storms (Lowham, 1988, p.18). Peak flows in the Mountainous Region are small in relation to peak flows in the High Desert Region, but annual runoff is larger in the Mountainous Region (Lowham, 1988, p. 18).

GROUND WATER

The quantity and quality of ground water in Lincoln County differs within and between geologic units and is controlled by the lithologic, structural, and geochemical properties of the rocks. Ground-water data in this report, including water levels, well or spring discharges, and water quality, were compiled from historical inventories contained in the USGS Ground Water Site Inventory and Water Quality data bases, the Wyoming State Engineer's Office data base (Wyoming State Engineer's Office, 1995), and from data collected in the field during 1993-95. These data were used to evaluate wells completed in and springs issuing from as many geologic units as possible, with as even a distribution across the county as possible. Data collected at each well or spring are used to estimate the quantity and quality of ground water at that site. Data collected for multiple wells completed in and springs issuing from a single geologic unit are used to estimate the extent of ground-water occurrence as well as the quantity and quality of ground water for that geologic unit in that area. Descriptions of selected geologic units contain information about the relation of ground water to geology; recharge, movement, and discharge of ground water; and water-level changes. Water-quality analyses of samples collected from wells completed in and springs issuing from different geologic units in the county are described in the Ground-Water Quality section of this report.

Ground-Water Data

The records for selected wells and springs throughout Lincoln County are listed in table 11 (at back of report). The sites in table 11 are sorted first according to the geologic unit a well was completed in or a spring issued from. Within each geologic unit, sites then were sorted by the station number. Locations of the wells and springs are shown on plate 3. The records include the station and the local number, date drilled, depth of well, primary use of water, altitude of land surface, water level, and discharge.

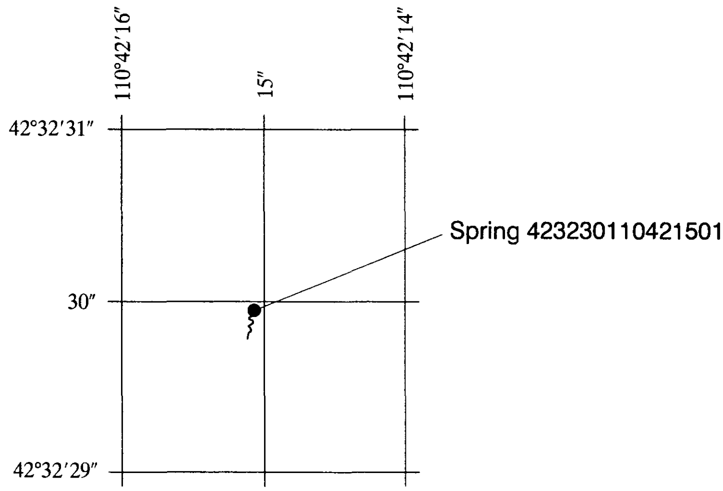
Wells and springs are identified by location in this report. The sites are assigned a station number—a 15 digit code consisting of the latitude, longitude, and a sequence number (fig. 7). For example, site 423230110421501 refers to the first site inventoried at a location having a latitude of 42 degrees, 32 minutes, and 30 seconds, and a longitude of 110 degrees, 42 minutes, and 15 seconds. The last two digits in the station number are a sequence number indicating the order of inventory.

When available, the site also is assigned a local number according to the Federal township-range system of land subdivision. An example of a local number used in this report is 21-116-36dcd01 (fig. 7). The first number (21) denotes the township (T), the second number (116) denotes the range (R), and the third number denotes the section. The first letter following the section number denotes the quarter section (160-acre tract), the second letter, if shown, denotes the quarter-quarter section (40-acre tract), the third letter, if shown, denotes the quarter-quarter-quarter section (10-acre tract). These subsections are designated a, b, c, and d in a counter-clockwise direction beginning in the northeast quarter. The last two digits in the local number are a sequence number indicating the order of inventory. Well 21-116-36dcd01 is the first well inventoried in the southeast quarter of the southwest quarter of the southeast quarter of section 36, T. 21 N., R. 116 W.

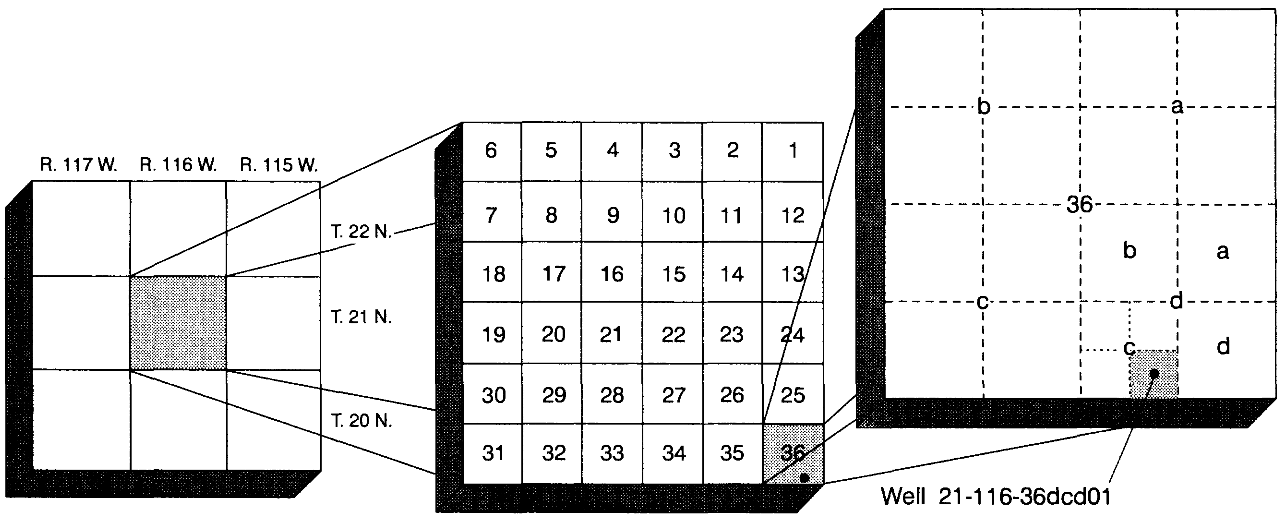
In addition to the ground-water data published in this report, ground-water data are published in: (1) previous USGS investigation reports (such as, Welder, 1968, Lines and Glass, 1975, and Lickus and Law, 1988); (2) USGS Water Resources Data reports (published annually); and (3) various ground-water reports for the State. Ground-water data can also be obtained from USGS computer files. Requests for electronic data and/or published reports can be made to the District Chief, U.S. Geological Survey, 2617 E. Lincolnway, Suite B, Cheyenne, Wyoming 82001-5662. Information such as well construction, initial water level, lithology, and well yields can be obtained from the Wyoming State Engineer. Inquiries should be made to the Groundwater Division Administrator, Herschler Building, 4th Floor-East, Cheyenne, Wyoming 82002.

Relation of Ground Water to Geology

Ground water refers to the subsurface water that is in the zone of saturation where soil and geologic formations are fully saturated. Ground water occurs in rocks in the primary openings between grains and in secondary openings, including fractures and openings from dissolution. Porosity, a measure of the void space in a rock, and permeability, a measure of the ability of a porous medium to transmit fluids, are important physical properties that affect the ability of a geologic unit to store water and to yield water to wells or springs. The source of the ground water could be one or a combination of the following: connate water, water trapped in the interstices of a sedimentary rock at the time of deposition; infiltration of precipitation; irrigation water; surface



System for numbering wells and springs using latitude and longitude.



System for numbering wells and springs in surveyed townships.

Figure 7. Systems for numbering wells and springs.

water; or leakage from other geologic units. Even though water-yielding capabilities or aquifer characteristics of all the geologic units in Lincoln County have not been quantified, some geologic units are known to have better water-yielding capabilities than others.

The lithology and water-yielding characteristics of 53 geologic units in Lincoln County are summarized in table 12 (at the back of report). For this report, terrace deposits, which may be included as Quaternary age geologic units or as a separate unit, are undifferentiated. Ranges of thickness and most common water yields from these geologic units are included in table 12. Well yields are a function of the diameter of the well, well casing, pump capacity and efficiency, as well as the thickness of the saturated interval penetrated, the hydraulic conductivity, and the density and viscosity of the fluid.

The surface distribution of these geologic units is shown on the geologic map (pl. 1). The geologic map in this report is modified from the State geologic map by Love and Christiansen (1985, sheet 1). Because of the scale of the map, some of the members within a formation are not shown on plate 1 but are listed in table 12. For example, plate 1 shows the Green River Formation of Tertiary age, but table 12 describes the lithology and water-yielding characteristics of the Fossil Butte Member of the Green River Formation.

Wells completed in and springs issuing from the geologic units inventoried either for this study or for previous studies are listed in table 11. Inventory measurements of wells may have included a water level or a discharge or both. Inventory measurements of springs may have included a discharge measurement.

Water levels typically are measured using a steel tape. Water levels also can be measured using a sonic, electrical, or pressure-change-sensing device. Static water levels reflect the geologic unit's geohydrologic characteristics. However, effects beyond the investigator's control can make accurate measurements of the static water level difficult. For example, a well that is pumping water, that has been pumped recently, or is located near another pumping well will have a water level lower than the static water level as a result of draw-down in the well caused by the pumping. If a water level is affected by one of these situations, it is indicated in table 11. When a range of water levels is noted in the following section, the range is only for measured static water levels. Reported or estimated water levels also are excluded from the range but might be referenced in the text. The source of reported or estimated water levels is usually from other government agency data bases, driller's logs, or the well owner.

Discharge measurements of water typically are made using a weir, flume, flow meter, or volumetric method. Discharge from a flowing well or undeveloped spring represents the geologic unit's true water-yielding characteristics. The discharge from a pumped well is affected by the bore-hole diameter, pump capacity and efficiency, type and size of openings in the casing, type of filter pack, and thickness and permeability of the saturated interval penetrated. In this report, the range of discharges listed for wells and springs includes measured, reported, or estimated discharges, and measured discharges affected by pumping. The source of reported or estimated discharges is usually from other government agency data bases, driller's logs, the well owner, or field hydrologists.

The water-bearing characteristics of the geologic units in Lincoln County are discussed in the following three sections. The units are organized by geologic age and discussed from youngest to oldest: Cenozoic, (including deposits of Quaternary age, and rocks of Tertiary age), and rocks of Mesozoic and Paleozoic age. The following discussions are limited to the 35 geologic units with inventoried sites during this and previous studies (table 11). The same units and organization are used in the Ground-Water Quality section of this report.

Quaternary Deposits

Deposits of Quaternary age in the county consist of alluvium and colluvium; gravel, pediment, and fan deposits; glacial deposits; landslide deposits; and dune sand and loess (table 12). Terrace deposits can occur as

Quaternary unconsolidated alluvium, within the unconsolidated gravel, pediment, and fan deposits, and can occur as partially consolidated gravels of Quaternary or Tertiary age. Lithologies and water-bearing characteristics, described in table 12, vary for each geologic unit. Quaternary deposits with sites inventoried during this and previous studies include alluvium and colluvium, glacial deposits, landslide deposits, and terrace deposits (table 11). All wells completed in and springs issuing from terrace deposits were assigned to Quaternary terrace deposits. More wells and springs were identified as completed in or issuing from Quaternary deposits than all other geologic units. Well depths ranged from 1 to 300 feet. Discharge from wells and springs ranged from 2 to 2,000 gallons per minute.

Quaternary alluvium and colluvium had the most water development of any geologic unit in the county, as well as the majority of the sites inventoried in overall Quaternary deposits (106 wells and 5 springs). Quaternary alluvium and colluvium occur along major streams, including the Hams Fork, Bear and Salt Rivers, and La Barge Creek. Deposits consist of clay, silt, sand and gravel. Yields from wells completed in alluvium and colluvium are dependent on the thickness of the unit and the size and sorting of materials. Yields from wells completed in alluvium and colluvium of the Hams Fork River were more variable than yields from wells completed in alluvium and colluvium of the Bear River, Salt River, and La Barge Creek. This variability may be the result of different parent material in the alluvium and colluvium and channel meandering characteristics of the Hams Fork River. Aquifer productivity increases where thick sands and gravels predominate. Well depth was variable in alluvium and colluvium and was commonly more than 100 feet deep. Water from these sites was used primarily for domestic supplies. The most productive alluvial and colluvial aquifers in the Overthrust Belt are located in the valleys of the Bear River and Salt River (Star Valley) (Ahern and others, 1981, p. 71). Irrigation wells in the Bear and Salt River valleys may yield up to 2,000 gal/min (Lines and Glass, 1975, sheet 1).

Of the remaining inventoried sites for Quaternary deposits, seven wells were completed in and four springs issued from terrace deposits, two springs issued from glacial deposits, and four springs issued from landslide deposits. Terrace deposits occur in the Green River Basin and the Overthrust Belt; however, all the wells and springs inventoried completed in or issuing from terrace deposits were located in the Overthrust Belt. All six of the springs issuing from glacial and landslide deposits were located in the Overthrust Belt. Discharge from the springs was variable.

Tertiary Rocks

Rocks of Tertiary age are widely distributed in the Green River and Fossil Basins, and Star Valley. Springs are the dominant site type issuing from Tertiary rocks. Tertiary (Pliocene and Miocene) water-bearing units include the Salt Lake and Teewinot Formations. Tertiary (Eocene and Paleocene) water-bearing units include the Fowkes Formation; the Bridger Formation; the Green River Formation, the Laney, Wilkins Peak, Angelo, and Fossil Butte Members of the Green River Formation; the Wasatch Formation, including the New Fork Tongue and La Barge and Chappo Members; and the Evanston Formation. The Evanston Formation of Paleocene age extends into the Upper Cretaceous; however, for this report, the one well completed in and the three springs issuing from the Evanston Formation are listed in the Tertiary. The individual geologic unit was not determined for three Tertiary sites.

The Salt Lake and Teewinot Formations occur as surficial rocks in Star Valley (pl. 1). Love and Christiansen (1985, sheet 1) distinguish between these geologic units; however Lines and Glass (1975, sheet 2) and Oriel and Platt (1980, sheet 1) show only the Salt Lake Formation occurring in Star Valley. For this report, wells completed in and springs issuing from the Salt Lake and Teewinot Formations are not differentiated. The Salt Lake and Teewinot Formations have a maximum thickness of about 1,000 feet (Lines and Glass, 1975, sheet 1). Inventoried wells completed in the Salt Lake and Teewinot Formations range from 70 feet to 309 feet in depth. Typically, the largest expected yield of water from wells is a few tens of gallons per minute (Lines and

Glass, 1975, sheet 1). Fracture permeability locally may produce large yields in the Salt Lake and Teewinot Formations (Lines and Glass, 1975, sheet 1). The yield from a spring used for water supply by the Town of Thayne was 2,200 gal/min.

The youngest Eocene deposits of Tertiary age include the Bridger Formation in the Green River Basin and the Fowkes Formation in the Overthrust Belt. The Bridger Formation is an areally extensive formation in the southern part of the Green River Basin. Springs commonly issue from the Bridger Formation on hillsides; yields from springs range from 2 to 100 gal/min (Ahern and others, 1981, p. 46). The two wells inventoried during this study or previous studies had discharges of 6 and 13 gal/min. The Fowkes Formation occurs as a surficial geologic unit in the southwestern corner of the Overthrust Belt in Lincoln County, and is composed primarily of tuffaceous sandstone and siltstone (table 12). Three springs issuing from the Fowkes Formation were inventoried; yields from springs ranged from 2 to 125 gal/min.

Most of the Tertiary sites inventoried were completed in or issue from the Green River and Wasatch Formations and their members, (25 wells and 40 springs). The intertonguing of these deposits makes differentiating individual geologic units difficult. The Green River and Wasatch Formations generally contain water under artesian pressure in the Green River Basin (Welder, 1968, p. 2). A topographic barrier (Oyster Ridge) separated Fossil Basin and the Green River Basin during the deposition of several Green River Formation members (Oriel and Tracey, 1970, p. 5). The Laney Member of the Green River Formation occurs in the Green River Basin where 10 wells are completed in and 1 spring issues from the member. Yields from wells completed in the Laney Member generally range from 1 to 75 gal/min (Ahern and others, 1981, p. 68). One spring issued from the Angelo Member and one spring issued from the Wilkins Peak Member of the Green River Formation. The Fossil Butte Member of the Green River Formation occurs in Fossil Basin in the Overthrust Belt. Twelve springs issued from the Fossil Butte Member. The maximum discharge of springs inventoried for this study or previous studies was 200 gal/min. The Wasatch Formation was the source of water for 15 wells and 25 springs. In general, wells completed in the Wasatch Formation were located in the Green River Basin at depths greater than 100 feet and springs that issued from the Wasatch Formation were located in the Overthrust Belt. The thickness of the Wasatch Formation ranges from 2,500 to 3,600 feet in the Overthrust Belt and from 4,100 to 5,250 feet in the western Green River Basin (Ahern and others, 1981, p. 46). Well yields from the sandstones and conglomerates of the Wasatch Formation range from 1 to 1,300 gal/min, although most are less than 50 gal/min (Ahern and others, 1981, p. 67).

The Evanston Formation underlies the Wasatch Formation in the Overthrust Belt. One well completed in and three springs issuing from the Evanston Formation were inventoried for this study or previous studies in Lincoln County.

Mesozoic Rocks

Rocks of Mesozoic age occur surficially in north-south trending belts parallel to thrust faults in the Overthrust Belt in Lincoln County. Mesozoic rocks include water-bearing units of Cretaceous, Jurassic, and Triassic age. Cretaceous water-bearing units include the Adaville Formation, Blind Bull Formation, Hilliard Shale, Frontier Formation, Sage Junction Formation, Aspen Shale, Thomas Fork Formation, Bear River Formation, and the Gannett Group (table 12). Jurassic water-bearing units include the Stump Formation, Preuss Sandstone or Preuss Redbeds, and the Twin Creek Limestone. The Nugget Sandstone is a Jurassic(?) and Triassic(?) age water-bearing unit. Triassic water-bearing units include the Ankareh Formation, the Thaynes Limestone, the Woodside Shale, and the Dinwoody Formation.

Of the 50 sites with wells completed in or springs issuing from Cretaceous rocks, 40 sites were springs and 10 sites were wells (table 11). Wells inventoried for this study or previous studies were completed in the Adaville Formation (6); Hilliard Shale (1); Aspen Shale (2); and Bear River Formation (1). Yields of water from wells completed in Cretaceous aquifers generally were less than 30 gal/min. Well depths ranged from 100 to

1,200 feet. Springs issued from the Blind Bull Formation (1); Hilliard Shale (3); Frontier Formation (4); Sage Junction Formation (1); Aspen Shale (10); Bear River Formation (6); Thomas Fork Formation (2); and the Gannett Group (13). Discharge from springs was variable, ranging from less than 1 to about 700 gallons per minute. Cretaceous geologic units generally are considered minor aquifers in the Overthrust Belt. The Hilliard Shale is a major regional confining unit of the Green River Basin and Overthrust Belt, but locally produces water from a sandstone layer. The primary use of springs is for watering livestock.

Of the 28 sites in Jurassic or Jurassic(?)-Triassic(?) rocks, 27 sites were springs (table 11). Springs issued from the Stump Formation (1); Preuss Sandstone or Preuss Redbeds (3); Twin Creek Limestone (5); and the Nugget Sandstone (18). Only one well was completed in Nugget Sandstone, which is considered a major aquifer (Ahern and others, 1981, p. 55). Thickness of the Nugget Sandstone varies from about 600 feet in depth in the Green River Basin to about 1,300 feet in depth in the Overthrust Belt (table 12). Springs issue from the Nugget Sandstone where secondary permeability (fractures) occurs. The maximum discharge of water yielded from a spring issuing from the Nugget Sandstone was 1,400 gal/min (table 11).

Wells and springs inventoried from rocks of Triassic age include: Thaynes Limestone (6 springs and 2 wells), Woodside Shale (2 springs and 1 well), and Dinwoody Formation (2 springs). The Thaynes Limestone is the most productive aquifer in the Triassic system; flow from springs may be as large as 1,800 gal/min (Ahern and others, 1981, p. 56) (table 12). Wells completed in the Thaynes Limestone ranged from 195 feet to 600 feet (table 11). The Woodside Shale and Dinwoody Formation in general are impermeable. Discharge from springs issuing from the Woodside Shale and Dinwoody Formation ranged from 2 to 50 gal/min.

Paleozoic Rocks

Like the younger rocks of Mesozoic time, surficial rocks of Paleozoic time occur parallel to the major thrust faults in the Overthrust Belt in Lincoln County. Paleozoic rocks include the Phosphoria Formation and related rocks of Permian age which are synonymous to the Park City Formation (Lane, 1973); the Tensleep Sandstone and the Wells Formation of Permian and Pennsylvanian age; the Amsden Formation of Pennsylvanian and Mississippian age; the Madison Limestone of Mississippian age; the Darby Formation of Mississippian and Devonian age; the Laketown Dolomite of Silurian age; the Bighorn Dolomite of Ordovician age; and the Gallatin Limestone, Gros Ventre Formation and Flathead Sandstone of Cambrian age (table 12). Sites inventoried in some of these units include wells completed in and springs issuing from the Tensleep Sandstone, the Wells Formation, the Madison Limestone, the Darby Formation, and the Bighorn Dolomite.

One well completed in and one spring issuing from the Phosphoria Formation and related rocks in the southwestern part of Lincoln County were inventoried for this study or previous studies. Locally the Phosphoria produces water where the rock is fractured (Lines and Glass, 1975). Discharge was 200 gal/min from the well and 300 gal/min from the spring (table 11).

Sandstone aquifers in Paleozoic rocks include the Tensleep Sandstone and the Wells Formation. Yields of water range from about 200 to 700 gal.min (table 12). Availability of water is dependent on depth of formation, continuity of beds within a formation, and development of fracture permeability. The Tensleep Sandstone is a white to gray sandstone containing thin limestone and dolomite beds (Lines and Glass, 1975). The well-sorted sand grains of the Tensleep enhance primary permeability, and secondary permeability is excellent where the unit is fractured (Lines and Glass, 1975). Two springs issue from the Tensleep Sandstone in the northern part of the county where the unit occurs at shallow depths. The Wells Formation is a thick interbedded quartzite, calcareous sandstone, and limestone. One well was completed in and four springs issued from the Wells Formation.

Paleozoic limestone and dolomite aquifers in Lincoln County include the Madison Limestone, the Darby Formation, and the Bighorn Dolomite. Permeability in these units is mostly secondary as a result of solution openings and fractures. Where geologic units with carbonate minerals exist at or near the earth's surface, dissolution is enhanced by reactions involving carbonate minerals with water and carbon dioxide from the atmosphere. Carbonic acid, which is derived from rainwater containing carbon dioxide acquired during its passage through the atmosphere, reacts with the carbonate minerals in the soil. If the carbonate minerals are not present in sufficient quantities to neutralize the carbonic acid, carbonate minerals in the rock will react and rock material will pass into solution. Geologic units occurring at topographic highs are probably drained to depths of several hundred feet (Lines and Glass, 1975, sheet 1). In Lincoln County, these units occur on the surface in the Overthrust Belt and in the subsurface in the Green River Basin. All 13 sites inventoried in these units were springs. Discharge was variable from the springs; the largest discharge was greater than 15,000 gal/min. Periodic Spring, near the town of Afton (site 424440110505001) issues from the Madison Limestone. During the inventory site visit, discharge from this spring cycled from 10 gal/min for about 18 minutes, changing quickly to an estimated discharge of 15,000 gal/min for about 18 minutes (table 11). The water discharging from the spring is intercepted by a cave, whose outlet creates a siphon, turning the flow "on" and "off" (Blanchard, 1990). Blanchard, 1990, describes a detailed theory of the process. Based on data from the Overthrust Belt, the Madison Limestone is the most productive aquifer in the county (Ahern and others, 1981, p. 53).

Recharge, Movement, and Discharge

Geologic units in Lincoln County are recharged by one or a combination of the following sources: (1) precipitation that infiltrates the geologic unit in its outcrop area, (2) losing reaches of streams where surface water infiltrates into the geologic unit because the stream's water level is higher than the ground-water level, (3) infiltration of irrigation water, and (4) leakage from another geologic unit from either above or below.

Ground-water movement is controlled by the altitude of the location of recharge and discharge areas, and by the thickness and permeability of the geologic unit. Primary permeability is a function of the grain size, sorting, and cementation between grains. Secondary permeability created by fracturing and dissolution also is an important factor controlling ground-water movement. Fractures along structural features can provide important conduits for vertical and horizontal ground-water flow. Faults may affect ground-water movement where hydrologic properties differ between adjacent rocks. Faults may serve as either ground-water conduits or barriers, depending on the rock type and degree of fracturing (Freethey and Cordy, 1991, p. C8).

Ground water is discharged naturally in Lincoln County by one or a combination of the following mechanisms: (1) intersection of the water table with the land surface, (2) evapotranspiration, (3) leakage from one geologic unit to another, or (4) intersection of water table with streams. Springs and seeps occur in Lincoln County where the local water table intersects the land surface. Changes in lithology or topography, fractures, and faults may produce springs and seepage areas. Ground water in alluvium and colluvium usually discharges to local streams. Ground-water discharge also occurs as a result of human activity, by means of pumping wells.

The ground-water connection between the Overthrust Belt and the Green River Basin is restricted as a result of the folded and faulted rocks which are a result of regional tectonic (orogenic (mountain building)) activity during the middle Mesozoic and early Cenozoic time. These rocks of Mesozoic and Paleozoic age define the boundary between these two regions. Ground-water movement is difficult to define by aquifer within the Overthrust Belt because of the numerous faults and fractures (Ahern and others, 1981, p. 74). Aquifers in the Overthrust Belt primarily of Paleozoic and Mesozoic age receive their recharge from direct infiltration of precipitation in outcrop areas. Most of the water discharged in the Overthrust Belt from limestone and dolomite aquifers, such as the Madison Limestone of Mississippian age, the Darby Formation of Devonian age, and the Bighorn Dolomite of Ordovician age is by means of springs (Lines and Glass, 1975, sheet 1). Water recharging these aquifers in one surface drainage basin may discharge in another surface drainage basin via interbasin transfers of ground water (Lines and Glass, 1975, sheet 1). Ground water recharge to alluvial and colluvial aquifers in Star Valley originates from four sources: (1) water percolating from streams near the heads of fan deposits around the margins of the valley, (2) percolation of water from irrigation diversions on the alluvium and colluvium, (3) infiltration of precipitation on the valley floor (Walker, 1965, p. C8), and (4) older geologic units that have been uplifted along faults and are topographically higher than the alluvial and colluvial aquifers (Lines and Glass, 1975, sheet 2).

Within the Green River Basin, ground-water movement generally is toward the center of the basin which lies in Sweetwater County, east of Lincoln County. Ground-water contributions to Mesozoic and Paleozoic age aquifers from outcrop areas is limited by the thrust faults (Ahern and others, 1981). Recharge to Tertiary aquifers is minimal in areas of high evapotranspiration and low precipitation (Ahern and others, 1981, p. 87). Recharge to aquifers of Quaternary age occurs from infiltration of precipitation, irrigation waters, and surface water during periods of high flow. Recharge to the Laney Member of Tertiary age does occur in some areas from leakage of irrigation waters through alluvium and colluvium (Ahern and others, 1981). Ground-water discharge principally is to tributaries of the Green River.

WATER USE

Total water use in Lincoln County in 1993 was estimated to be 405,000 million gallons (Mgal) (Ogle and others, 1996, p. 1). In the report by Ogle and others, water use estimates were divided into nine categories: public supply, self-supplied domestic, commercial, irrigation, livestock, industrial, mining, thermoelectric power, and hydroelectric power. These terms are defined in the glossary. Surface water was the source of about 397,000 Mgal (98 percent) of the water used in the county, whereas ground water was the source for only about 7,000 Mgal (2 percent) of the water used. Hydroelectric power generation and irrigation used the largest amount of water (table 5).

Table 5. *Estimated ground water, surface water, and total water use in Lincoln County, Wyoming, 1993*

(From Ogle and others, 1996)

Category	Estimated Water Use 1993 (million gallons)		
	Ground water	Surface water	Total
Public supply	1,870	299	[1]2,160
Self-supplied domestic	1.7	0	1.7
Commercial	[2](72)	[2](45)	[2](117)
Irrigation	5,170	153,000	[1]158,000
Livestock	163	40	203
Industrial	[3](27)+ 49	71	[3](27) + 120
Mining	68	85	153
Thermoelectric power	0	5,900	5,900
Hydroelectric power	0	238,000	238,000
TOTAL	[1]7,320	[1]397,000	[1]405,000

[1]Rounded totals.
[2]All commercial water use was from public supply, thus the numbers are reported (in parentheses), but are not added to the total.
[3]Part of the industrial water use was from public supply, thus the numbers from the public supply are reported (in parentheses), but are not added to the total.

Public supply and self-supplied domestic use accounted for 0.5 percent of the water used in Lincoln County. The source of water for public supplies in the county was primarily ground water from springs and wells, with the exception of the Kemmerer and Diamondville system, which was supplied by surface water from the Hams Fork River. Self-supplied domestic water is water withdrawn from a water source by a user rather than a public supplier. The source of water for self-supplied domestic water is primarily ground water.

Irrigation was the second largest water use in Lincoln County. An estimated total of 158,000 Mgal (485,000 acre-feet) of water was used for irrigation in 1993 based on data provided by the Star Valley and Lincoln County Conservation Districts (Ogle and others, 1996, p. 6). Within the Star Valley Conservation District, surface water accounted for about 96 percent of the water applied to irrigated land. About 55 percent of the water was applied using sprinkler irrigation and about 45 percent of the water was applied using flood irrigation. Similar to the Star Valley Conservation District, the Lincoln County Conservation District also used surface water as the primary source of irrigation water (97 percent). In contrast to the Star Valley Conservation District, the Lincoln County Conservation District primarily uses flood irrigation (about 94 percent), with only a small percentage of water applied using sprinkler irrigation (about 6 percent) (Ogle and others, 1996, p. 6).

WATER QUALITY

Water quality refers to biological, chemical, and physical characteristics of a water sample in relation to a standard defined for drinking water or other water uses. Biological water quality is determined by the number and types of organisms, both plant and animal, living in water and is generally restricted to surface water. Only limited biological data have been collected for streams in Lincoln County; therefore, biological water quality is not described here. A general discussion of the chemical and physical characteristics of ground water and surface water follows. For a more thorough discussion of the biological, chemical, and physical characteristics of water, the reader is referred to Hem (1985) or Freeze and Cherry (1979).

The chemical characteristics of surface and ground water are derived from the organic and inorganic materials dissolved and suspended in the water. These dissolved and suspended materials are derived from the rocks and sediment with which the water has been in contact and from materials introduced into the hydrologic environment by human and animal activities. Surface-water quality is dependent on the water source and the exposure of the water to soluble or suspendable material between the source and the sampling site. Ground-water quality is related to the chemical composition of the rocks composing the geologic units through which the water travels. Water temperature, the duration of contact with the rocks, and the rate of movement of the water also will affect the chemical quality of ground water. The source or cause and significance of common dissolved-mineral constituents found in surface and ground water are summarized in table 6. Nutrient samples from wells and spring in Lincoln County were analyzed for nitrite and nitrite plus nitrate. All concentrations of nitrite were much lower than the concentration of nitrite plus nitrate. Therefore, in this report, nitrite plus nitrate will be referred to as nitrate for discussion purposes.

For this study, inorganic materials in water are classified by the size of the particles, and are either dissolved solids or particulate material. Materials that will not pass through a 0.45-micrometer (μm) filter are operationally defined as particulate materials, and particles that will pass through a 0.45-micrometer filter are operationally defined as dissolved solids (Hem, 1985, p. 60). Particulate material can be filtered from water, whereas dissolved solids require more sophisticated techniques for removal, such as reverse osmosis.

Chemical quality at a surface-water site is assumed to be a function of the materials in contact with the water, the duration of the contact, and the stream discharge at that site. The chemical quality can be described using either load or dissolved-solids concentrations. The load is calculated by multiplying the discharge at a site by the dissolved-solids concentration of a chemical in the water. Sites having large discharges have large loads, even though the dissolved-solids concentrations at the site are often small.

Table 6. *Source or cause, and significance of dissolved-mineral constituents and physical properties of water*

(modified from Popkin, 1973, p. 85)

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter]

Constituent or property	Source or cause	Significance
Specific conductance (µS/cm)	Mineral content of the water.	Indicates degree of mineralization. Specific conductance is a measure of the capacity of the water to conduct an electric current. Varies with temperature, concentration, and degree of ionization of the constituents.
pH	Acids, acid-generating salts, and free carbon dioxide lower the pH. Carbonates, bicarbonates, hydroxides, phosphates, silicates, and borates raise the pH.	pH is a measure of the activity of the hydrogen ions. A pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote increasing alkalinity; values lower than 7.0 indicate increasing acidity. Corrosiveness of water generally increases with decreasing pH. However, excessively alkaline water may also attack some metals.
Hardness as calcium carbonate ($CaCO_3$)	In most water nearly all the hardness is due to calcium and magnesium. All metallic cations other than the alkali metals also cause hardness.	Consumes soap before a lather will form and deposits soap curd on bathtubs. Hard water forms scale in boilers, water heaters, and pipes. Hardness equivalent to or less than the bicarbonate and carbonate concentration is called carbonate hardness. Any hardness in excess of this is called noncarbonate hardness. Water with hardness of 60 mg/L or less is considered soft; 61 to 120 mg/L, moderately hard; 121 to 180 mg/L, hard; more than 180 mg/L, very hard.
Calcium (Ca) and magnesium (Mg)	Dissolved from practically all rocks and soil, but especially from limestone, dolomite, and gypsum. Calcium and magnesium are detected in large quantities in some brines. Magnesium is present in large quantities in seawater.	Causes most of the hardness and scale-forming properties of water; soap consuming (see hardness). Water low in calcium and magnesium is desired in electroplating, tanning, dyeing, and in textile manufacturing.
Sodium (Na) and potassium (K)	Dissolved from practically all rocks and soil; also in ancient brines, seawater, industrial brines, and sewage.	Large concentrations, in combination with chloride, give a salty taste. Moderate concentrations have little effect on the usefulness of water for most purposes. Sodium salts may cause foaming in steam boilers. A large sodium concentration may limit the use of water for irrigation.
Bicarbonate (HCO_3) and carbonate (CO_3)	Action of carbon dioxide in water on carbonate rocks such as limestone and dolomite.	Bicarbonate and carbonate produce alkalinity. Bicarbonates of calcium and magnesium decompose in steam boilers and hot-water facilities to form scale and release corrosive carbon dioxide gas. In combination with calcium and magnesium, cause carbonate hardness.
Sulfate (SO_4)	Dissolved from rocks and soil containing gypsum, iron sulfides, and other sulfur compounds. Commonly present in mine water and in some industrial wastes.	Sulfate in water containing calcium forms hard scale in steam boilers. In large concentrations, sulfate in combination with other ions gives bitter taste to water, and may have a laxative effect on some people. Some calcium sulfate is considered beneficial in the brewing process.
Chloride (Cl)	Dissolved from rocks and soil. Present in sewage and found in large concentrations in ancient brines, seawater, and industrial brines.	In large concentrations in combination with sodium, gives salty taste to drinking water. In large concentrations increases the corrosiveness of water towards some metals.

Table 6. *Source or cause, and significance of dissolved-mineral constituents and physical properties of water--Continued*

Constituent or property	Source or cause	Significance
Fluoride (F)	Dissolved in minute to small concentrations from most rocks and soil. Added to most water by fluoridation of municipal supplies.	Fluoride in drinking water reduces the incidence of tooth decay when the water is consumed during the period of enamel calcification. However, it may cause mottling of the teeth and renal disfunction, depending on the concentration of fluoride, the age of the child, quantity of drinking water consumed, and susceptibility of the individual.
Silica (SiO_2)	Dissolved from practically all rocks and soil, commonly less than 30 mg/L. Large concentrations, as much as 250 mg/L, generally occur in alkaline water.	Forms hard scale in pipes and boilers. Transported in steam of high-pressure boilers to form deposits on blades of turbines. Inhibits deterioration of zeolite-type water softeners.
Iron (Fe)	Dissolved from practically all rocks and soil. Also may be derived from iron pipes, pumps, and other equipment. More than 1 or 2 mg/L of iron in surface water generally indicates acid wastes from mine drainage or other sources.	On exposure to air, iron in ground water oxidizes to reddish-brown precipitate. More than about 0.3 mg/L stains laundry and utensils reddish-brown. Objectionable for food processing, textile processing, beverages, ice manufacturing, brewing, and other processes. Larger quantities cause unpleasant taste and favor growth of iron bacteria.
Dissolved solids	Chiefly mineral constituents dissolved from rocks and soil.	Water containing more than 1,000 mg/L dissolved solids is unsuitable for many purposes.
Nitrate (NO_3)	Decaying organic matter, sewage, fertilizers, and nitrates in soil.	Concentration much greater than the local average may indicate contamination. Water with large nitrate concentrations has been reported to be the cause of methemoglobinemia (an often fatal disease in infants) and therefore should not be used in infant feeding. Nitrate has been shown to be helpful in reducing intercrystalline cracking of boiler steel. It encourages growth of algae and other organisms that produce undesirable tastes and odors.
Boron (B)	Found in igneous rocks such as tourmaline, granitic rocks, and pegmatites. Sodium tetraborate (borax) is a widely used cleaning agent, hence, boron may be present in sewage and industrial wastes.[1]	Small concentrations are essential to plant growth, but may be toxic to crops when present in excessive concentrations in irrigation water or in soil. Sensitive plants show damage when irrigation water contains more that 670 µg/L, and even tolerant plants may be damaged when boron exceeds 2,000 µg/L.
Phosphate (PO_4)	Common element in igneous rocks and marine sediments. A component of animal metabolic waste.[1]	Essential to plant growth. Concentrations greater than the local average may indicate pollution by fertilizers or sewage.

[1]Hem, 1985, p. 126-129.

Water can be classified into types on the basis of amount and type of ions present in a water sample. The dominant ions are the cation (positive charge) and anion (negative charge) having the largest concentration expressed in milliequivalents per liter. A milliequivalent is a measurement of concentration, where the charge of the ion is accounted for. For example, in a sodium sulfate-type water, sodium has the largest concentration of the cations present, and sulfate has the largest concentration of the anions present. If a water sample does not contain a dominant cation and anion, the water is classified as a mixture of the cations and anions having the largest concentrations. Modified Stiff diagrams often are used to visually display cation and anion data. A modified Stiff diagram uses three parallel, horizontal axes, extending to the left and right of a vertical zero line. The concentrations of the four most common cations--sodium, potassium, magnesium, and calcium--are plotted on the left on each of the three horizontal lines (sodium and potassium are plotted as one constituent). The five most common anions--chloride, fluoride, sulfate, bicarbonate, and carbonate--are plotted on the right on each of the three horizontal lines (chloride and fluoride, and bicarbonate and carbonate are plotted as one constituent). Modified Stiff diagrams are used to describe the type of water in Lincoln County in the Ground-Water Quality Section.

Physical characteristics of water commonly measured onsite during water-quality studies include water temperature, specific conductance, and pH. Temperature is an important controlling factor in many chemical processes; for example, the solubility of ions and the saturation level of gases are affected by water temperature. The temperature of surface water typically is much more variable than the temperature of ground water. Surface-water temperatures are affected by local climatic factors and physical factors such as shading, stream depth, and proximity to lakes and reservoirs. Ground-water temperatures generally are a function of the depth of the geologic unit below the surface of the earth. Water in deep geologic units generally has higher temperatures than water in shallow units.

Specific conductance is a measure of the ability of water to conduct electrical current. It is expressed in microsiemens per centimeter (μS/cm) at 25 degrees Celsius (^{o}C), and is a function of the concentration and type of dissolved solids in the water. The concentration of the sum of dissolved solids, in milligrams per liter (mg/L), typically ranges from 55 to 75 percent of the specific conductance in μS/cm (Hem, 1985, p. 67). This relation varies with the composition and concentration of dissolved ions.

The measure of the hydrogen activity in water is pH, which is defined as the negative logarithm of the hydrogen-ion concentration. This parameter is dimensionless and typically ranges from 0 to 14. A pH greater than 7 indicates that the water is basic (alkaline), whereas a pH less than 7 indicates that the water is acidic.

A description of the chemical and physical characteristics of water aids in evaluating its suitability for various uses. Water-quality standards for chemical constituents or parameters adopted by the State of Wyoming and used for evaluating ground-water quality for domestic, agricultural, and livestock use are listed in table 7. Because of the variability of water quality at different sampling points and an insufficient number of water samples analyzed in the county, water samples reported here are not classified as suitable for specific uses. However, individual samples listed in tables in this report can be compared to the water-quality standards listed in table 7.

The U.S. Environmental Protection Agency (1996) has established primary and secondary drinking water standards applicable to public drinking-water supplies (table 8). These Federal regulations specify maximum allowable contaminant levels (MCLs) and secondary maximum contaminant levels (SMCLs). The MCLs are health related and legally enforceable. Although MCLs apply only to public drinking-water supplies, the levels are useful indicators of the suitability of water for human consumption. The SMCLs are standards primarily addressing the aesthetic qualities of drinking water, and are not legally enforceable. For example, chloride at concentrations exceeding 250 mg/L may impart a bitter taste to water.

Table 7. *Wyoming ground-water quality standards for domestic, agricultural, and livestock use*

(Modified from Wyoming Department of Environmental Quality, 1993, p. 9)

[All constituent concentrations are in milligrams per liter unless otherwise indicated. --, no established level; µg/L, micrograms per liter; °C, degrees Celsius]

Constituent or property	Domestic use	Agricultural use	Livestock use
Aluminum (µg/L)	--	5,000	5,000
Arsenic (µg/L)	50	100	200
Barium (µg/L)	1,000	--	--
Boron (µg/L)	750	750	5,000
Cadmium (µg/L)	10	10	50
Chloride	250	100	2,000
Chromium (µg/L)	50	100	50
Copper (µg/L)	1,000	200	500
Fluoride	[1]1.4-2.4	--	--
Iron (µg/L)	300	5,000	--
Lead (µg/L)	50	5,000	100
Manganese (µg/L)	50	200	--
Mercury (µg/L)	2	--	.05
Nitrate + nitrite, as nitrogen	10	--	100
Selenium (µg/L)	10	20	50
Silver (µg/L)	50	--	--
Sulfate	250	200	3,000
Dissolved solids	500	2,000	5,000
pH, standard units	6.5-9.0	4.5-9.0	6.5-8.5
Sodium-adsorption ratio (no units)	--	8	--

[1]Dependent on the annual average of the maximum daily air temperature: 1.4 mg/L corresponds with a temperature range of 26.3 to 32.5°C and 2.4 mg/L corresponds with a temperature of 12.0°C and below.

Quality Assurance and Quality Control

During the study of the water resources in Lincoln County, quality-assurance and quality-control protocols were used to ensure the accuracy of the data collected and to assist in the interpretation of historical and collected data. Quality-control samples were collected to assess the adequacy of general water-quality sampling and analysis procedures and to identify factors that may have produced discrepancies in the data.

Quality Assurance

Quality assurance refers to proper office, field, and laboratory procedures. Office quality assurance involved review of historical data as well as evaluation of data collected during the 1993-95 field seasons. All historical data, collected in Lincoln County since 1945 as part of previous investigations or other data-collection activities, were screened before inclusion in this report. All data from surface- and ground-water samples, historical and collected during this study, were checked to ensure that the percent difference between the sum of the cations (in milliequivalents per liter (meq/L)) and the sum of the anions (in meq/L) was less than +/-5 percent. Because water is electrically neutral (the sum of cations equals the sum of the anions), the percent difference between the sum of the cations and the sum of the anions helps determine if the analytical results are accurate. Any data collected from sites that had samples with ionic balances that differed by more than 5 percent were evaluated to determine whether the data were to be included in this report. Only USGS historical data were examined.

Table 8. *Selected maximum and secondary maximum contaminant levels for public drinking-water supplies*

(U.S. Environmental Protection Agency, 1996)

[All constituent concentrations are in milligrams per liter unless otherwise indicated. --, no established level; μg/L, micrograms per liter]

Constituent or property	Maximum contaminant level	Secondary maximum contaminant level
	Inorganic	
Arsenic (μg/L)	50	--
Barium (μg/L)	2,000	--
Cadmium (μg/L)	5	--
Chloride	--	250
Chromium (μg/L)	100	--
Copper (μg/L)	1,300	
Fluoride	4	2.0
Iron (μg/L)	--	300
Lead (μg/L)	15	--
Manganese (μg/L)	--	50
Mercury (μg/L)	2	--
Nitrate, as nitrogen	10	--
Selenium (μg/L)	50	--
Silver (μg/L)	--	100
Sulfate	500	250
Zinc (μg/L)	--	5,000
Dissolved solids	--	500
pH, standard units	--	6.5-8.5
	Organic	
2,4-D	.07	--
Picloram	.05	--

Quality assurance procedures for the field and laboratory were conducted during the 1993-95 field season. Field quality-assurance practices involved calibration of all field meters and probes, and cleaning of sampling equipment prior to all site visits. Immediately prior to each sampling, meters and probes were recalibrated. All calibration information was recorded on USGS water-quality field forms. Samples were collected, preserved, and shipped in accordance with applicable USGS protocols. Quality-assurance procedures used at the USGS National Water Quality Laboratory (NWQL) in Arvada, Colorado, constituted the laboratory quality-assurance program implemented for this study.

Quality Control

Two types of quality-control samples were collected during the 1993-95 field sampling: replicate samples and field-blank samples. Replicate samples, sometimes called splits, were collected from seven sites, and were obtained by dividing the water collected for each analysis into two bottles. The NWQL then analyzed the samples as two separate sites. The purpose of a replicate sample is to evaluate laboratory precision between samples. Field-blank samples collected at 15 sites in the county were obtained by passing inorganic-free blank water through all components of the sample-collection apparatus. Chemical analysis of this water was designed to determine the adequacy of the process of equipment cleaning between sampled sites, or to quantify carryover of any chemical contamination between sites.

Streamflow Quality

Natural and anthropogenic factors affect the water quality of streamflow: geology of the drainage basin, ground-water inflow, and land use. Hem (1985, p. 39) describes natural factors as "reactions of water with mineral solids in the streambed and in suspension, reactions among solutes, losses of water by evaporation and by transpiration from plants growing in and near the stream, and effects of organic matter and water-dwelling biota." Anthropogenic activities affecting streamflow water quality include farming, grazing, mining, disposing of waste, and diverting and augmenting streamflows.

Streamflow water quality is related to the mineral composition of the soil and rocks with which the water is in contact, and is therefore affected by the geology of the drainage basin and ground-water inflow. Sediment loads are related to the erodibility of the rocks and surficial materials in the drainage basin. Land uses in Lincoln County that might affect streamflow water quality are agriculture, mining, oil and gas development, waste disposal, and reservoirs.

The purpose of this section is to describe and evaluate the streamflow water quality in Lincoln County. Previous reports and current studies that include drainage basins in the county are discussed first. Statistical summaries of selected physical properties and chemical analyses were used to evaluate streamflow water quality for the three main drainage basins in Lincoln County. Surface-water samples collected during a sampling event July 18-23, 1994, were used to evaluate streamflow water quality in the Salt River.

Typically, streamflow water quality studies are done for a selected stream or drainage basin. All three basins that occur in the county, (the Green, Bear, and Snake River Basins (fig. 8)) were part of previous studies. The Snake and Bear River Basins are part of current investigations.

Water-quality in the Green River Basin is discussed in several reports published by the USGS (DeLong, 1977; DeLong and Wells, 1988; and Ringen, 1984). Salinity, dissolved solids, and suspended sediments were the primary constituents evaluated because they are the most commonly used factors to evaluate the suitability of water for various uses. In all three reports, a regression model was used to relate the constituent of concern to discharge. At least one streamflow site in Lincoln County was included in all three studies, but usually most of the study area was outside of the county.

DeLong (1986, p. 14-15) evaluated phosphate loads in the Green River because of concerns related to eutrophication and algal growth in the reservoirs on the river. Phosphate loads computed for sites upstream and downstream of Fontenelle Reservoir show that the reservoir traps phosphate. Storage rates were not computed because of the lack of data collected from runoff and tributary streams.

In a study of the water resources of the Overthrust Belt in western Wyoming, Lines and Glass (1975, sheet 3) used major ion data and dissolved-solids concentrations to describe water types and general water quality of samples collected from streams in the Green, Bear, and Snake River Basins. Water samples collected from streams in the southeastern part of the Bear River Basin and the southwestern part of the Green River Basin contained the largest concentrations of magnesium, sodium, sulfate, and chloride. In addition to the differences between drainage basins, Lines and Glass also showed that differences can occur between locations within the same drainage basin and that differences can occur seasonally at a single site.

Lowham (1985) summarized the physical and hydrologic features of a coal bearing area in the Northern Great Plains and Rocky Mountain Provinces, including the Green and Bear River Basins in Lincoln County. Streamflow quality is described using the following parameters: dissolved solids, pH, total phosphorous, suspended sediment, bacteria, algae, invertebrates, fish, and water temperature. Boxplots of dissolved-solids concentration (Lowham, 1985, p. 42) show that most water samples collected from Green River near La Barge (site 4) and Bear River near the Wyoming-Idaho border (on the Idaho side) had concentrations less than 500 mg/L. However, most water samples from Twin Creek at Sage (site 19), a tributary to the Bear River, had concentrations greater than 500 mg/L.

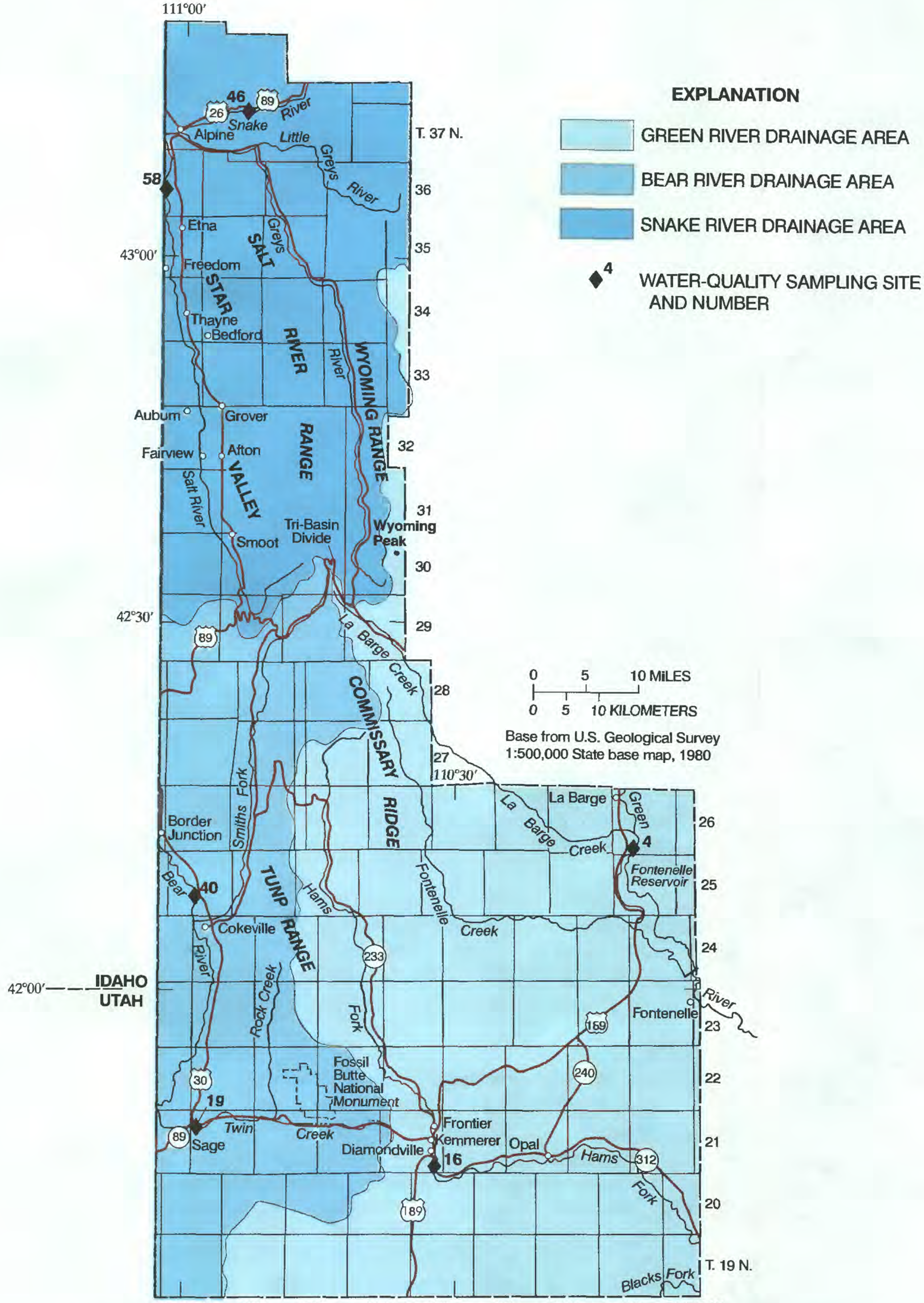


Figure 8. Location of the Green, Bear, and Snake River drainage areas in Lincoln County, Wyoming.

In 1991, the USGS began implementing a full-scale National Water-Quality Assessment (NAWQA) program. The long-term goals of the NAWQA program are to describe the status and trends in the quality of a large, representative part of the Nation's surface- and ground-water resources, and to provide a sound, scientific understanding of the primary natural and human factors affecting the quality of these resources. The Snake River Basin in northern Lincoln County is part of the Upper Snake River NAWQA study that began in 1991. A report describing the quality of surface water "on the basis of nutrient, suspended sediment, and pesticide data" (Clark, 1994, p. 2) from 1975-89 was published in 1994. The Bear River Basin in southwestern Lincoln County is part of the Great Salt Lake NAWQA study that began in 1994.

In the Upper Snake River NAWQA study, water-quality samples were collected from the Salt River (Clark, 1994, p. 29). Upstream and downstream concentrations of nitrate were significantly different; whereas, concentrations of total phosphorus were not significantly different between the upstream and downstream stations on the Salt River. Differences in concentrations of dissolved ammonia, total nitrogen, and orthophosphate were not assessed because of a lack of data.

Statistical summaries (table 9) of selected physical properties and chemical analyses were used to evaluate the water quality for samples collected from streams and rivers in the Green, Bear, and Snake River Basins. The location of the three drainage basins within the county is shown on figure 8. Data are from the USGS water-quality data bases located in Wyoming, Utah, and Idaho Districts. Physical properties and major ion data were screened for duplication of analyses stored in the three data bases. Otherwise, all data were used in the statistical summaries. Values less than the NWQL reporting limit were assumed to equal half of the reporting limit for major ion and nutrient data and were assumed to equal the reporting limit for trace element, pesticide, and sediment data.

Water-quality samples collected at two streamflow sites in each drainage basin were used to summarize streamflow water quality. The sites selected were (table 1): Green River near La Barge (site 4) and Hams Fork near Diamondville (Kemmerer) (site 16), Green River Basin; Twin Creek at Sage (site 19) and Bear River below Smiths Fork, near Cokeville (site 40), Bear River Basin; Snake River above reservoir, near Alpine (site 46) and Salt River above reservoir, near Etna (site 58), Snake River Basin. These sites represent the farthest downstream location on the major tributaries in each drainage basin where a large number of water-quality data were collected. The statistical summary of water-quality constituents listed in table 9 should be considered only as a general condition of the streamflow water quality leaving the county in each drainage basin, because water-quality conditions can change from the headwaters to the lowest downstream point and seasonally at the same site.

General water quality of streamflow typically is described by the dissolved-solids concentration. Evaluating water quality in terms of dissolved-solids concentration or any other constituent is dependent on the use of the water. The SMCL for dissolved-solids concentration is 500 mg/L (U.S. Environmental Protection Agency, 1996) (table 8). Standards or guidelines for other constituents and other water uses are established by various Federal and State agencies, and by industry.

The median dissolved-solids concentration in water samples collected from the Bear River Basin is 563 mg/L (table 9). The dissolved-solids concentrations reported in this study are most representative of streamflow quality at Twin Creek, because most of the analyses (126 of 129) were from water samples collected at site 19. Boxplots of dissolved-solids concentrations for three sites in the Bear River Basin are presented in Larson (1985, p. 43). Larson shows a site on Twin Creek with a water sample having a median dissolved-solids concentration greater than 500 mg/L and dissolved-solids concentration in the same range as site 19. The samples from two mainstem sites on the Bear River had median values less than 500 mg/L (Larson, 1985, p. 43).

Lines and Glass (1975, sheet 3) attributed higher concentrations of magnesium, sodium, sulfate, and chloride in the southern part of the Overthrust Belt area to the composition of Tertiary rocks, low precipitation, and high evapotranspiration in the area. Median concentrations of the same constituents (table 9) are larger in the Bear River Basin, which drains part of the southern Overthrust Belt area, than in the Green and Snake River Basins.

Table 9. *Statistical summary of selected physical properties and chemical analyses of water samples collected from streams and rivers in the Green, Bear, and Snake River Basins, Lincoln County, Wyoming*

[Analytical results in milligrams per liter except as indicated; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; ND, not detected]

	Drainage Basin											
	Green River Basin				Bear River Basin				Snake River Basin			
Constituent or property	Number of analyses	Maximum	Minimum	Median	Number of analyses	Maximum	Minimum	Median	Number of analyses	Maximum	Minimum	Median
					Concentrations							
Specific conductance (µS/cm)	556	800	156	400	340	4,000	250	720	676	925	128	391
pH (standard units)	492	9.5	6.5	8	111	9.2	7.3	8.1	392	9	6.8	8
Water temperature (°C)	459	24	0	7	355	22	0	8	709	25	0	7
Hardness, total (as $CaCO_3$)	458	330	76	180	131	1,800	210	380	532	260	87	200
Calcium, dissolved (as Ca)	458	94	21	49	131	390	44	81	531	79	25	55
Magnesium, dissolved (as Mg)	458	40	21	14	131	190	18	43	530	38	1.8	14
Sodium, dissolved (as Na)	457	75	4	14	130	300	15	47	530	95	2.2	10
Sodium adsorption ratio	457	2	.2	.5	131	3	.4	1	531	3	.1	.3
Potassium, dissolved (as K)	458	6.8	.05	1.6	129	24	.7	3.6	528	6.6	ND	1.4
Alkalinity, total (as $CaCO_3$)	111	210	73	150	44	258	96	190	158	230	82	190
Sulfate, dissolved (as SO_4)	457	200	5.9	61	131	1,100	56	220	531	74	5	35
Chloride, dissolved (as Cl)	455	18	ND	3.9	131	240	11	32	530	140	.4	10
Fluoride, dissolved (as F)	453	1.7	ND	.3	124	1.1	.2	.4	516	3	ND	.2
Silica, dissolved (as SiO_2)	457	15	.05	7.2	131	51	.1	9.4	529	19	ND	8.4
Dissolved solids, sum of constituents	456	478	91	239	129	2,740	283	563	529	493	113	241
Nitrogen, dissolved NO_2+NO_3 (as N)	90	1.6	ND	.05	51	.4	.025	.05	157	3.2	ND	.6

Table 9. *Statistical summary of selected physical properties and chemical analyses of water samples collected from streams and rivers in the Green, Bear and Snake River Basins, Lincoln County, Wyoming--Continued*

Constituent or property	Drainage Basin											
	Green River Basin				Bear River Basin				Snake River Basin			
	Number of analyses	Maximum	Minimum	Median	Number of analyses	Maximum	Minimum	Median	Number of analyses	Maximum	Minimum	Median
	Load (tons per day)											
Calcium, dissolved (as Ca)	246	1,291	0.9	78	102	100	0.3	1.6	330	2,054	36	182
Magnesium, dissolved (as Mg)	246	383	0.2	21	102	36	0.2	0.8	330	412	11	46
Sodium, dissolved (as Na)	245	312	.2	25	102	47	.2	1	330	562	5.4	35
Potassium, dissolved (as K)	246	67	.03	2.5	102	8.7	.02	.07	327	115	.1	4
Sulfate, dissolved (as SO_4)	245	978	1.9	94	102	264	1.3	4.2	330	1,219	11	103
Chloride, dissolved (as Cl)	244	79	.1	6	102	21	.2	.7	330	621	2.9	27
Fluoride, dissolved (as F)	242	5	.004	.4	102	.6	.002	.008	319	34	.1	.7
Silica, dissolved (as SiO_2)	245	250	.002	12	102	12.4	.002	.2	328	648	.1	25
Dissolved solids, sum of constituents	244	6,140	4.7	383	102	595	2.7	11	330	8,320	154	815
Nitrogen, dissolved NO_2+NO_3 (as N)	85	42	.01	.09	51	.3	.0002	.001	145	50	.03	1.9

The source of nitrogen in streamflow varies and can be anthropogenic or natural. Anthropogenic sources include septic tanks, barnyards, and nitrogen fertilizer. The median nitrate concentration in surface-water samples collected from all three drainage basins is less than the MCL of 10 mg/L as nitrogen (U.S. Environmental Protection Agency, 1996). Samples from the Snake River Basin have the highest nitrate concentrations (median = 0.6 mg/L as nitrogen; table 9). Sixty-seven percent (125 of 186) of the samples used in the analysis are from Salt River above reservoir near Etna (site 58), which drains the agricultural area in Star Valley. Greys River above (Palisades) reservoir, near Alpine (site 49), is also in the Snake River Basin, but drains an area unaffected by agriculture. However, no historical data were available from site 49 to include in the statistical summary.

The Wyoming, Utah, and Idaho District data bases were queried for analytical data for the following pesticides: ethion, malathion, parathion, diazinon, methyl parathion, picloram, 2,4-D, 2,4,5-T, silvex, ethyl trithion, methyl trithion, dicamba, and 2,4-DP. Water-quality samples collected from Twin Creek at Sage (site 19) and Bear River below Smiths Fork, near Cokeville (site 40) in the Bear River Basin were analyzed for these 13 pesticides. Picloram, 2,4-D, and dicamba were detected in water samples collected from sites in both the Green and Snake River Basins. All pesticide results for picloram, 2,4-D, and dicamba were less than the MCL or proposed drinking water equivalent level (U.S. Environmental Protection Agency, 1996). The MCL for picloram is 0.5 mg/L and for 2,4-D is 0.07 mg/L. The USEPA has not established an MCL for dicamba, but the proposed drinking water equivalent level in the Generic State Pesticide Management Plan (Wyoming Department of Agriculture, 1995, p. 1A-3) is about 1 mg/L. Ninety-five percent of all the samples in the Green and Snake River Basin had no detection of pesticides.

Streams naturally carry suspended sediment. However, increased concentrations of suspended sediment can be related to land use activities such as irrigation, grazing, logging, mining, recreation, and road construction. High concentrations of suspended sediment can cause (1) reduction in the aesthetic qualities of the water, (2) filling of reservoirs and other water bodies, (3) reduction of light penetration in water to the detriment of many species of aquatic life, (4) deposition of sediments on stream bottoms resulting in a loss of spawning habitat for many species of fish, and (5) sorption and transport of insoluble trace elements and organic compounds onto sediment. The highest median concentration of suspended sediment (70 mg/L) was observed in a water sample collected from the Bear River Basin.

A sampling event on the Salt River was conducted July 18-23, 1994, in cooperation with the Upper Snake River NAWQA. The Salt River was chosen for further study because of the potential for future development in the valley and the Wyoming State Engineer's interest in the impact of human activity on streamflow water quality. The Salt River flows north through the agriculturally based Star Valley in northwestern Lincoln County. The river enters the head of the valley approximately 5 miles south of Smoot (fig. 9) and flows north through "the Narrows" south of Thayne. The Narrows, which divides Star Valley into an upper and lower valley, is a short canyon formed by rock outcrops of the Tertiary Salt Lake Formation to the east and Triassic- and Jurassic-age rocks to the west. The Salt River continues to flow north through the lower valley until it reaches Palisades Reservoir near Alpine.

Streamflow discharge was measured and water-quality samples were collected from 10 sites (fig. 9) on the Salt River and from one tributary site (Crow Creek at county road 143, near Fairview, site 143). Physical properties were measured onsite, and surface-water samples were collected for determination of major ions and nutrients at all sites. Fecal coliform levels were determined in water samples collected at 10 sites, and pesticide concentrations were determined in water samples collected at 6 sites. Water-quality samples were collected in July, after high flow and before low flow (table 13, at the back of report).

As the Salt River flows through Star Valley, the quality and quantity of the river is impacted by agriculture and geothermal activity. As the river flows through the valley, it gains water from tributaries, ground water, and a variety of surface-water returns, and loses water to ground water, surface-water diversions, and evapotran-

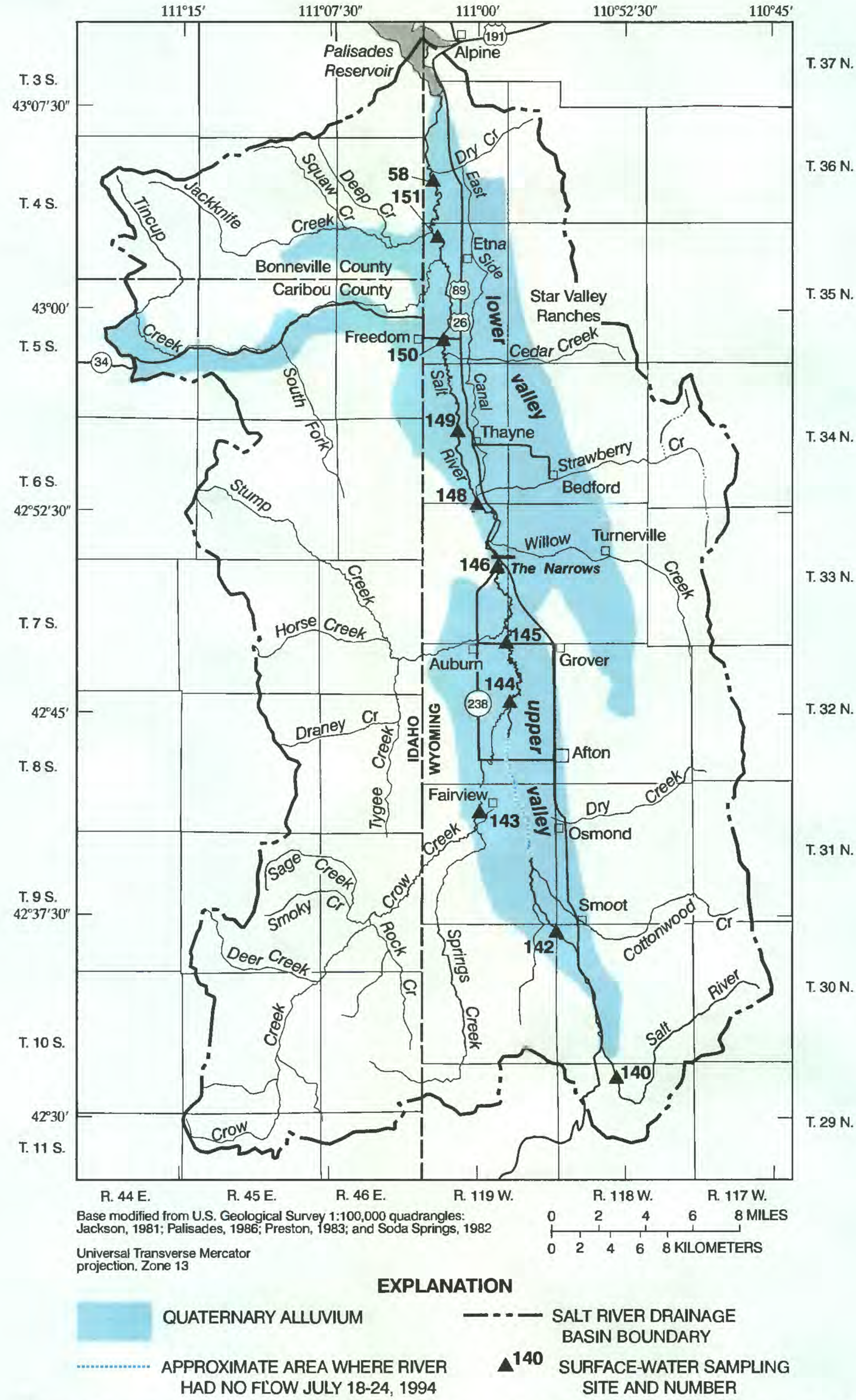


Figure 9. Location of streamflow data collection sites on the Salt River and a tributary to the Salt River sampled July 18-23, 1994.

spiration. During the sampling event, the largest estimated streamflow loss was to East Side Canal—approximately 100 ft^3/s (table 13). Despite these losses, the Salt River gained approximately 340 ft^3/s from Salt River above Fish Creek, near Smoot (site 140) where the Salt River enters the upper valley to the site Salt River above reservoir near Etna (site 58) where the river discharges to Palisade Reservoir (table 13). Between Salt River at County Road 148, near Smoot (site 142) to just upstream of Salt River below Crow Creek near Afton (site 144), the Salt River was dry, in part because of the diversion of Salt River tributaries for irrigation. Discharge from Crow Creek, 24 ft^3/s, combined with ground-water inflow, increased the discharge in the Salt River to 64 ft^3/s at site 144. Streamflow continued to increase from site 144 to the Narrows. The flow in the river is unchanged as it passes through the Narrows. The river loses about 40 percent of its streamflow to East Side Canal after the river exits the Narrows, but more than doubles its streamflow from the site below the East Side Canal, Salt River near Thayne (site 149) to site 58 above Palisades Reservoir. The gain in streamflow is likely from ground-water inflow and surface-water return flow.

Further study is needed to determine cause and effect relations from the water-quality data collected during the sampling event. However, some general observations can be made. Sulfate, chloride, and nitrate were evaluated in surface-water samples, because agricultural practices and geothermal activity can affect those water-quality constituents. Instantaneous discharge, physical and biological properties, and inorganic water-quality data collected during the study are compiled in table 13.

Just as streamflow discharge increased from the farthest upstream site to the farthest downstream in both the upper and lower valleys, so did loads of sulfate, chloride, and nitrate. The concentration, in comparison to the load, of the three chemicals did not always behave similarly in the same stretches of the river. Sulfate and chloride concentrations increased downstream in the upper valley and nitrate concentrations, in general, decreased. Conversely, sulfate and chloride concentrations decreased in the lower valley, and nitrate concentrations, in general, increased. The increased sulfate and chloride concentration and load in the upper valley may be related to geothermal ground-water inflow into the Salt River from the western side of the valley at the Narrows, rather than to an agricultural influence.

Four pesticides--2,4-D, picloram, EPTC, and dicamba--are used by the Lincoln County Weed and Pest Control (Scott Nield, oral commun., 1994). Surface-water samples collected during the study were analyzed for these 4 primary and 39 other pesticides at 6 sites (sites 142, 144, 146, 149, 150, and 58) (fig 9). All pesticide concentrations were less than the minimum reporting limits established by NWQL (2,4-D, picloram, and dicamba reporting limits, 0.01 μg/L; EPTC reporting limit, 0.005 μg/L). Also, all pesticide concentrations were less than the reporting limit for a sample collected in May 1994 at site 58 for the Upper Snake River NAWQA.

Ground-Water Quality

Data describing the water quality of geologic units are obtained by collecting samples of ground water from wells completed in or from springs issuing from a specific geologic unit. The physical and chemical characteristics of ground water are related by the geologic units that water has been in contact with and to human activities (table 6). The physical and chemical characteristics for water samples consist of analyses of samples collected as part of this study of Lincoln County and historical data in the USGS ground-water and water-quality data bases. Ground-water samples collected during this study were analyzed at the NWQL for common ions (table 14, at the back of report), and selected samples were analyzed for select trace elements (table 15, at the back of report). Physical properties of specific conductance, pH, and water temperature determined onsite also are listed in table 14.

Analyses of ground-water samples collected from wells completed in and springs issuing from deposits of Quaternary age, rocks of Tertiary age, and rocks from Mesozoic and Paleozoic age are included in this report. Analysis of a ground-water sample collected during the 1993-95 field season included onsite measurements of specific conductance, pH, and temperature. At many sites, a water sample also was collected for chemical analyses at the NWQL. The distribution of dissolved-solids concentrations in water samples collected from geologic units in Lincoln County is shown in figure 10. Modified Stiff diagrams (fig. 11) represent the water type typically found in selected geologic units at various sites in the county. Box plots (fig. 10) and modified Stiff diagrams (fig. 11) were constructed for geologic units containing five or more sites where ground-water samples were collected. When a site had two or more samples analyzed, the total dissolved-solids concentrations were averaged for box plot and modified Stiff diagrams construction. Modified Stiff diagrams were constructed by determining the median value of each constituent from the geologic unit, then selecting an actual site that most closely represented the median values. With the exception of the Preuss Sandstone or Preuss Redbeds, where three sites were sampled, only geologic units with five or more sites where water samples were collected for chemical analyses are described in detail in each section.

Quaternary Deposits

Ninety-six ground-water samples were collected for chemical analysis and 30 water samples were collected for onsite analysis from 118 sites during this and previous studies from wells completed in and springs issuing from deposits of Quaternary age (table 14). An additional 74 samples (in table 16, at the back of report) were collected from monitoring wells in Star Valley, and are discussed in the Star Valley Monitoring Well Section. Ground-water samples were collected for chemical analysis from the alluvium and colluvium (82), glacial deposits (1), landslide deposits (4), and terrace deposits (9). Quaternary alluvial and colluvial and terrace deposits are located near major streams and rivers throughout Lincoln County (fig. 12). The chemical characteristics of water samples collected from alluvium and colluvium, and terrace deposits are described in the following section.

Eighty-two ground-water samples (plus the additional 74 from the Star Valley Monitoring Wells) were collected for chemical analysis from 76 wells completed in and 2 springs issuing from the alluvium and colluvium. The samples were collected from wells completed in and springs issuing from the alluvium and colluvium located along the following stream and river systems: the Salt River, the Bear River, the Green River, and Hams Fork. Dissolved-solids concentrations in water samples collected from the alluvium and colluvium ranged from 196 to 3,090 mg/L (table 14). Water types of the samples from the alluvium and colluvium differed from the shaley Tertiary parent material of the alluvium and colluvium. This material is different from the parent material of the alluvium and colluvium of the Salt and Bear Rivers, which does not contain much shale; therefore, the water from the Salt and Bear River alluvium and colluvium contains lower dissolved-solids concentrations. Water samples from 64 wells were analyzed for specific trace elements; dissolved concentrations are listed in table 15. The iron concentrations of samples collected from the alluvium and colluvium ranged from less than the method reporting limit (3 µg/L) to 1,200 µg/L (table 15).

Nine ground-water samples were collected for chemical analysis from six wells completed in and three springs issuing from the terrace deposits. Dissolved-solids concentrations of samples from terrace deposits ranged from 231 to 1,010 mg/L. The modified Stiff diagram shows a calcium carbonate water type, with a typical dissolved-solids concentration of 351 mg/L (fig. 11).

Tertiary Rocks

Sixty-eight ground-water samples were collected for chemical analysis and 18 ground-water samples were collected for onsite analysis only from 74 sites during this and previous studies from wells completed in and springs issuing from rocks of Tertiary age. Samples collected from Tertiary rocks in Lincoln County are from sites located mainly in the southern half of the county, with the exception of the Salt Lake and Teewinot Formations near Star Valley (fig. 12). Samples were collected for chemical analysis from undifferentiated Tertiary rocks (4), the Salt Lake and Teewinot Formations (7), the Bridger Formation (2), and the Fowkes

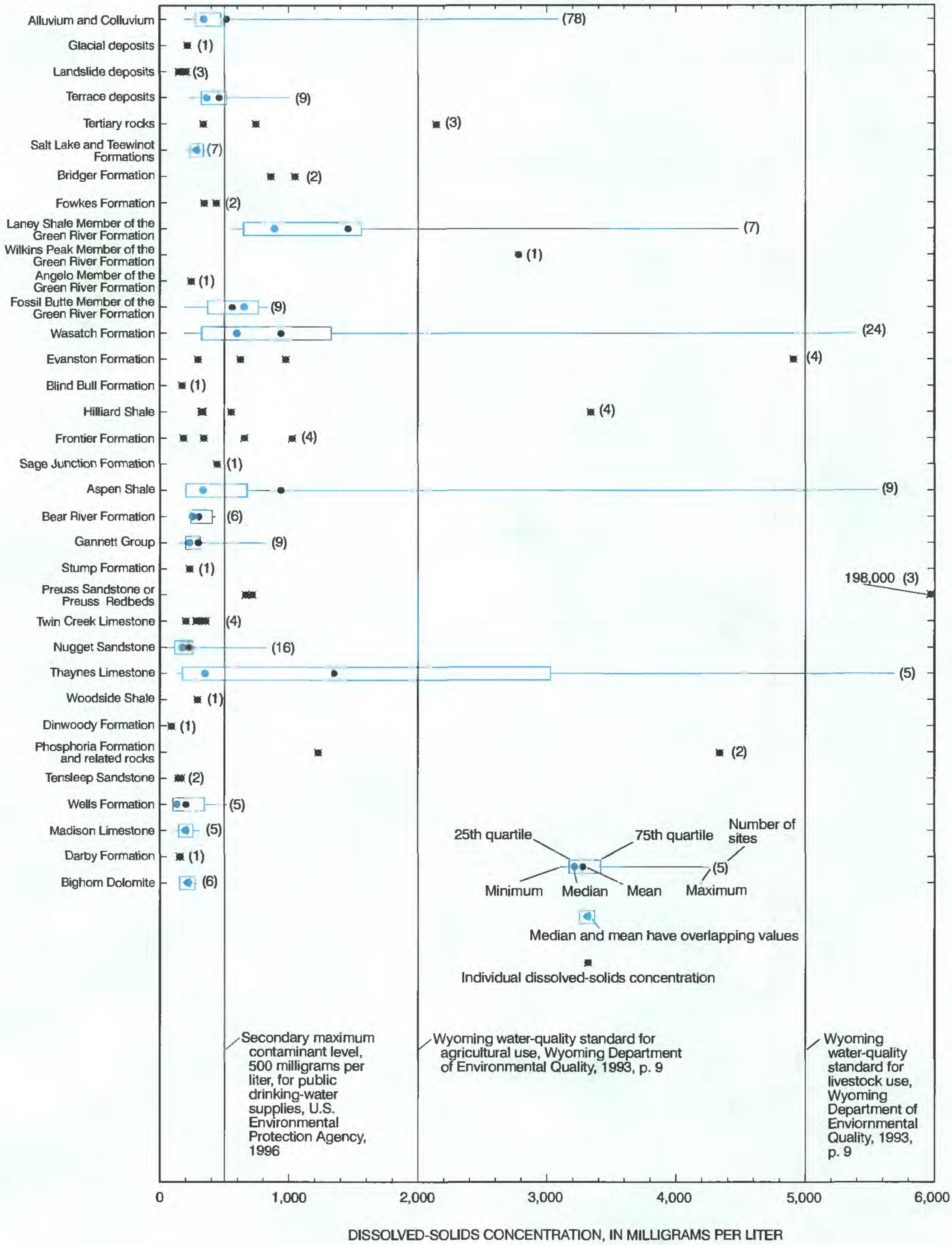


Figure 10. Distribution of dissolved-solids concentrations in water samples collected from wells completed in and springs from selected geologic units in Lincoln County, Wyoming.

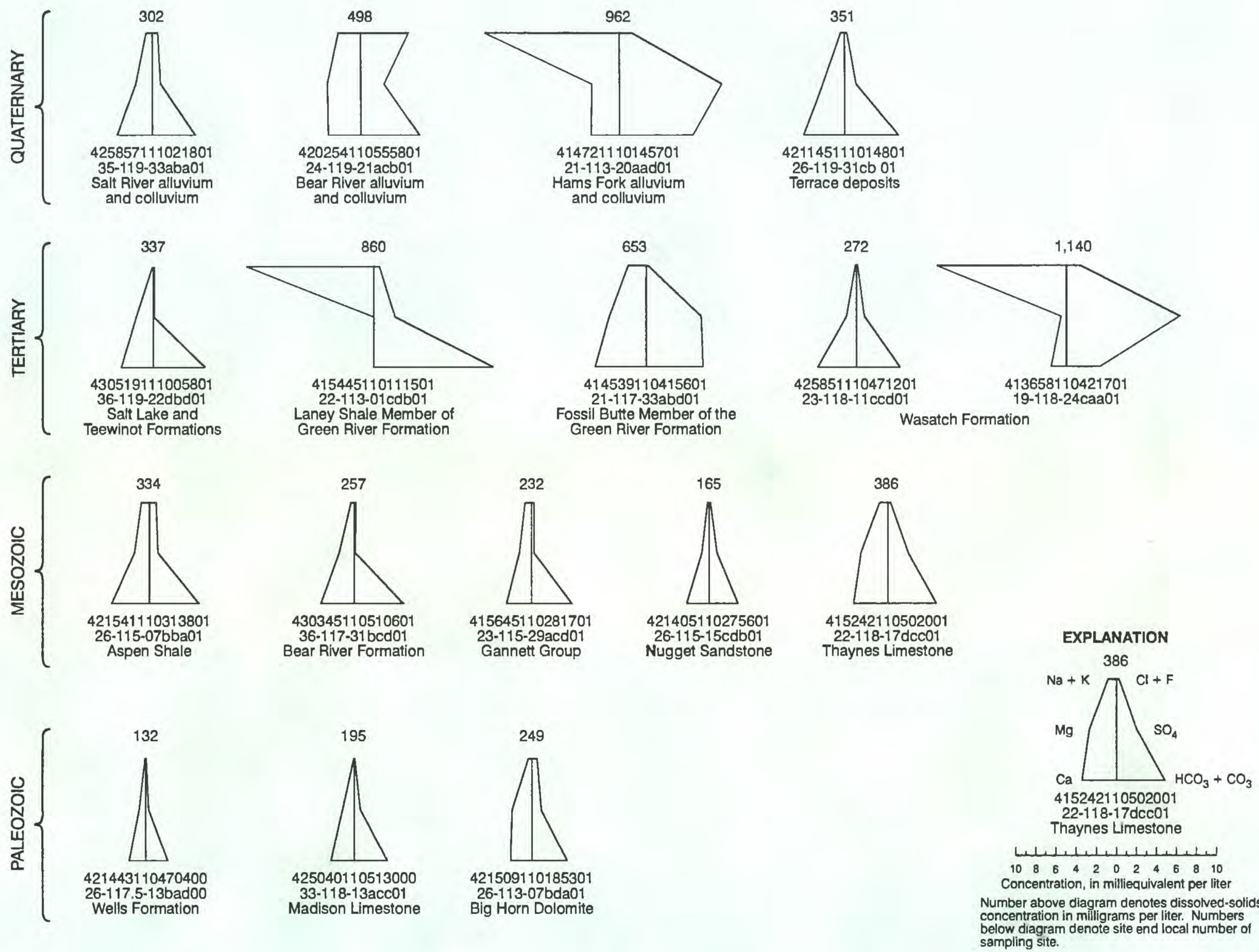


Figure 11. Modified Stiff diagrams showing major cations and anions in selected water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming.

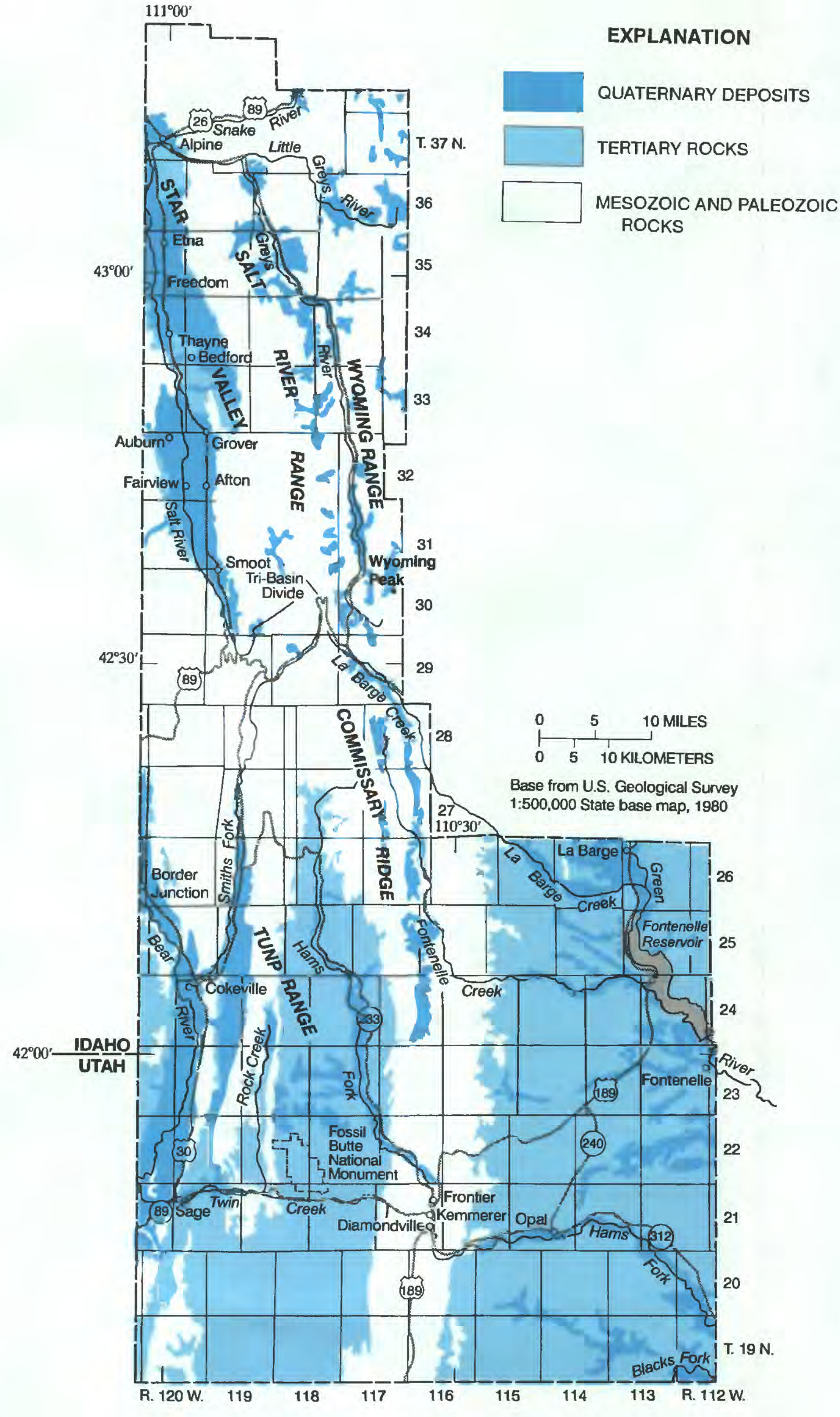


Figure 12. General location of Quaternary deposits, Tertiary rocks, and Mesozoic and Paleozoic rocks in Lincoln County, Wyoming.

Formation (2). Samples were collected from members of the Green River Formation and include, specifically, the Laney Member (10), the Wilkins Peak Member (1), the Angelo Member (1), and the Fossil Butte Member (10). Twenty-seven samples were collected from the Wasatch Formation, and four samples were collected from the Evanston Formation. The chemical characteristics of the water samples collected from the Salt Lake and Teewinot Formations, the Laney and Fossil Butte Members of the Green River Formation, and the Wasatch Formation are described. Forty-four water samples collected from Tertiary rocks were analyzed for trace elements (table 15). Samples from the Wilkins Peak Member of the Green River Formation contained the highest concentration of boron (4,200 μg/L) (table 15). Samples from the Wasatch Formation contained the highest concentration of iron (1,600 μg/L) (table 15).

As previously mentioned, the Salt Lake and Teewinot Formations are not differentiated. Seven ground-water samples were collected for chemical analysis from four wells completed in and three springs issuing from the Salt Lake and Teewinot Formations. All samples were collected in the northwestern part of the county near Star Valley. The dissolved-solids concentrations ranged from 206 to 349 mg/L (table 14). The modified Stiff diagram shows a calcium carbonate water type, with a typical dissolved-solids concentration of 337 mg/L (fig. 11).

Two members of the Green River Formation, the Laney and Fossil Butte Members, were sampled frequently enough to discuss. These two members are quite different with respect to dissolved-solids concentration and water type. This difference may, in part, be due to the location where ground water from these units was sampled. Water from the Laney Member typically was sampled from wells in the central part of the Green River Basin. Ten ground-water samples were collected for chemical analysis from six wells completed in and one spring issuing from the Laney. The dissolved-solids concentrations ranged from 551 to 4,480 mg/L (table 14). All water samples collected from the Laney Member had a dissolved-solids concentration greater than the SMCL of 500 mg/L established by the USEPA, (table 8). The modified Stiff diagram shows a sodium carbonate water type with a typical dissolved-solids concentration of 860 mg/L (fig. 11). The water producing zone in the Fossil Butte Member was a limestone or marlstone layer nearer to the recharge area on the western edge of the Green River Basin. Ten samples were collected for analysis from nine springs issuing from the Fossil Butte Member. The dissolved-solids concentrations of these samples ranged from 193 to 836 mg/L (table 14). The modified Stiff diagram shows a calcium sulfate-carbonate water type with a typical dissolved-solids concentration of 653 mg/L (fig. 11).

Twenty-seven ground-water samples were collected for chemical analysis from 10 wells completed in and 16 springs issuing from the Wasatch Formation. The dissolved-solids concentration ranged from 194 to 5,400 mg/L (table 14). The modified Stiff diagrams indicate two different water types associated with the Wasatch Formation in Lincoln County. Samples collected from springs near the recharge area are influenced more from snow melt and had a calcium carbonate water type with a typical dissolved-solids concentration of 272 mg/L (fig. 11, site 425851110471201). Samples collected from wells or springs farther away from the recharge area were less influenced from snow melt, and had a sodium sulfate water type with a typical dissolved-solids concentration of 1,140 mg/L (fig. 11, site 413658110421701).

Mesozoic Rocks

Seventy-eight ground-water samples were collected for chemical analysis and 28 water samples were collected for onsite analysis only from 82 sites during this and previous studies from wells completed in and springs issuing from rocks of Mesozoic age. Mesozoic rocks from which water samples were collected are located in a north-south direction through the center of Lincoln County (fig. 12). This means that samples collected from one formation, for example the Gannett Group, may be 75-100 miles away from another sample collection site from the same formation. Water samples were collected for chemical analysis from the Blind Bull Formation (1), the Hilliard Shale (4), the Frontier Formation (5), the Sage Junction Formation (1), the Aspen Shale (13), the Bear River Formation (9), and the Gannett Group (11), all of Cretaceous age; the Stump Formation (1), the Preuss Sandstone or Preuss Redbeds (3), and the Twin Creek Limestone (4) of Jurassic age; the Nugget Sandstone (18) of Jurassic(?) and Triassic(?) age; and the Thaynes Limestone (6), the Woodside Shale (1), and the Dinwoody Formation (1) of Triassic age. The chemical characteristics of the water samples collected from the Aspen Shale, the Bear River Formation, the Gannett Group, the Preuss Sandstone or Preuss Redbeds, the Nugget Sandstone, and the Thaynes Limestone are described in this section.

Thirteen ground-water samples were collected for chemical analysis from one well completed in and eight springs issuing from the Aspen Shale. The dissolved-solids concentrations ranged from 192 to 5,570 mg/L (table 14). The dissolved-solids concentrations in the Aspen Shale are dependent on the time of year when samples are collected, as well as the amount of recharge that has occurred from infiltration of recent precipitation. The modified Stiff diagram shows a calcium carbonate water type, with a typical dissolved-solids concentration of 334 mg/L (fig. 11).

Nine ground-water samples were collected for chemical analysis from one well completed in and five springs issuing from the Bear River Formation. The dissolved-solids concentrations ranged from 226 to 505 mg/L (table 14). The modified Stiff diagram shows a calcium carbonate water type, with a typical dissolved-solids concentration of 257 mg/L (fig. 11).

Eleven ground-water samples were collected for chemical analysis from nine springs issuing from the Gannett Group. The dissolved-solids concentrations ranged from 137 to 824 mg/L (table 14). The Gannett Group spans a large area of the county; however, the dissolved-solids concentrations do not differ substantially from the northern to the southern end of the county. The modified Stiff diagram shows a calcium carbonate water type, with a typical dissolved-solids concentration of 232 mg/L (fig. 11).

Three ground-water samples were collected for chemical analysis from three springs issuing from the Preuss Sandstone or Preuss Redbeds. Although there were not enough samples collected to prepare a box plot or a modified Stiff diagram, one sample had a sodium concentration of 120,000 mg/L, a chloride concentration of 75,000 mg/L, and a dissolved-solids concentration of 198,000 mg/L (table 14). This sample was collected from a spring (site 422802110575901) that probably issues from one of the irregular halite deposits noted in Oriel and Platt (1980), and is probably not an indicator of the general water quality found in the Preuss Sandstone or Preuss Redbeds.

Eighteen ground-water samples were collected for chemical analysis from 1 well completed in and 15 springs issuing from the Nugget Formation. All springs in the Nugget Formation sampled during this study discharged through fractures. Fractures (secondary permeability) are prominent in the Nugget, thus the residence time of water in the formation is short when compared to the residence time of water movement from primary permeability. This short residence time generally results in low dissolved-solids concentrations. The dissolved-solids concentrations ranged from 40 to 824 mg/L (table 14). The modified Stiff diagram shows a calcium carbonate water type, with a typical dissolved-solids concentration of 165 mg/L (fig. 11).

Six ground-water samples were collected for chemical analysis from one well completed in and four springs issuing from the Thaynes Limestone. The dissolved-solids concentrations ranged from 128 to 5,690 mg/L (table 14); however, most samples had dissolved-solids concentrations less than 400 mg/L. The modified Stiff diagram shows a calcium-magnesium carbonate water type, with a typical dissolved-solids concentration of 386 mg/L (fig. 11).

Paleozoic Rocks

Twenty-nine ground-water samples were collected for chemical analysis and 2 ground-water samples were collected for onsite analysis only from 21 sites during this and previous studies from wells completed in and springs issuing from rocks of Paleozoic age. Paleozoic rocks in Lincoln County are exposed in a north-south trending alignment through the center of the county, similar to the rocks of Mesozoic age (fig. 12). Water samples were collected for chemical analysis from the Phosphoria Formation and related rocks of Permian age (2); the Tensleep Sandstone (3), and the Wells Formation (7) of Pennsylvania age; the Madison Limestone of Mississippian age (7); the Darby Formation of Devonian age (1); and the Bighorn Dolomite of Ordovician age (9). As a group, water samples collected from Paleozoic rocks have the lowest dissolved-solids concentrations of water samples from all geologic units in Lincoln County. Water from springs issuing from Paleozoic rocks is used as a water supply for several towns and water districts in Star Valley. The chemical characteristics of the water samples collected from the Wells Formation, the Madison Limestone, and the Bighorn Dolomite are described in the following section.

Seven ground-water samples were collected for chemical analysis from one well completed in and four springs issuing from the Wells Formation. The dissolved-solids concentrations ranged from 100 to 521 mg/L (table 14). The modified Stiff diagram shows a calcium carbonate water type, with a typical dissolved-solids concentration of 132 mg/L (fig. 11).

Seven ground-water samples were collected for chemical analysis from five springs issuing from the Madison Limestone. The dissolved-solids concentrations ranged from 104 to 311 mg/L (table 14). The modified Stiff diagram shows a calcium carbonate water type, with a typical dissolved-solids concentration of 195 mg/L (fig. 11).

Nine ground-water samples were collected for chemical analysis from six springs issuing from the Bighorn Dolomite. The dissolved-solids concentrations ranged from 153 to 294 mg/L (table 14). The modified Stiff diagram shows a calcium-magnesium carbonate water type, with a typical dissolved-solids concentration of 249 mg/L (fig. 11).

GROUND-WATER MONITORING IN STAR VALLEY

Increased population growth and recent detections of nitrate concentrations greater than the MCL (10 mg/L as nitrogen) (Ken Mills, Natural Resource Conservation Service, oral commun., 1993) in Star Valley prompted a study of the baseline water quality of the ground water. The baseline data are used to determine the general water quality of the aquifer at the present time. Data from the study was also used to answer the following two questions: (1) do nitrate concentrations vary seasonally, and (2) do nitrate concentrations correlate with the depth to ground water at the time of sampling. Answers to these questions will enhance analysis of past data, as well as assist with the design of future sampling efforts.

Ten domestic wells completed in the Salt River alluvium and colluvium were selected and established as monitoring wells in 1993 (fig. 13). This work was supported, in part, by the Star Valley Conservation District. The wells selected were distributed throughout the valley, and were located away from any potential nitrate source such as a confined animal feeding operation. The wells were sampled four times per year, once each season (fall, winter, spring, and summer), from October 1993 through July 1995, for a total of eight sampling events (table 16, at the back of report).

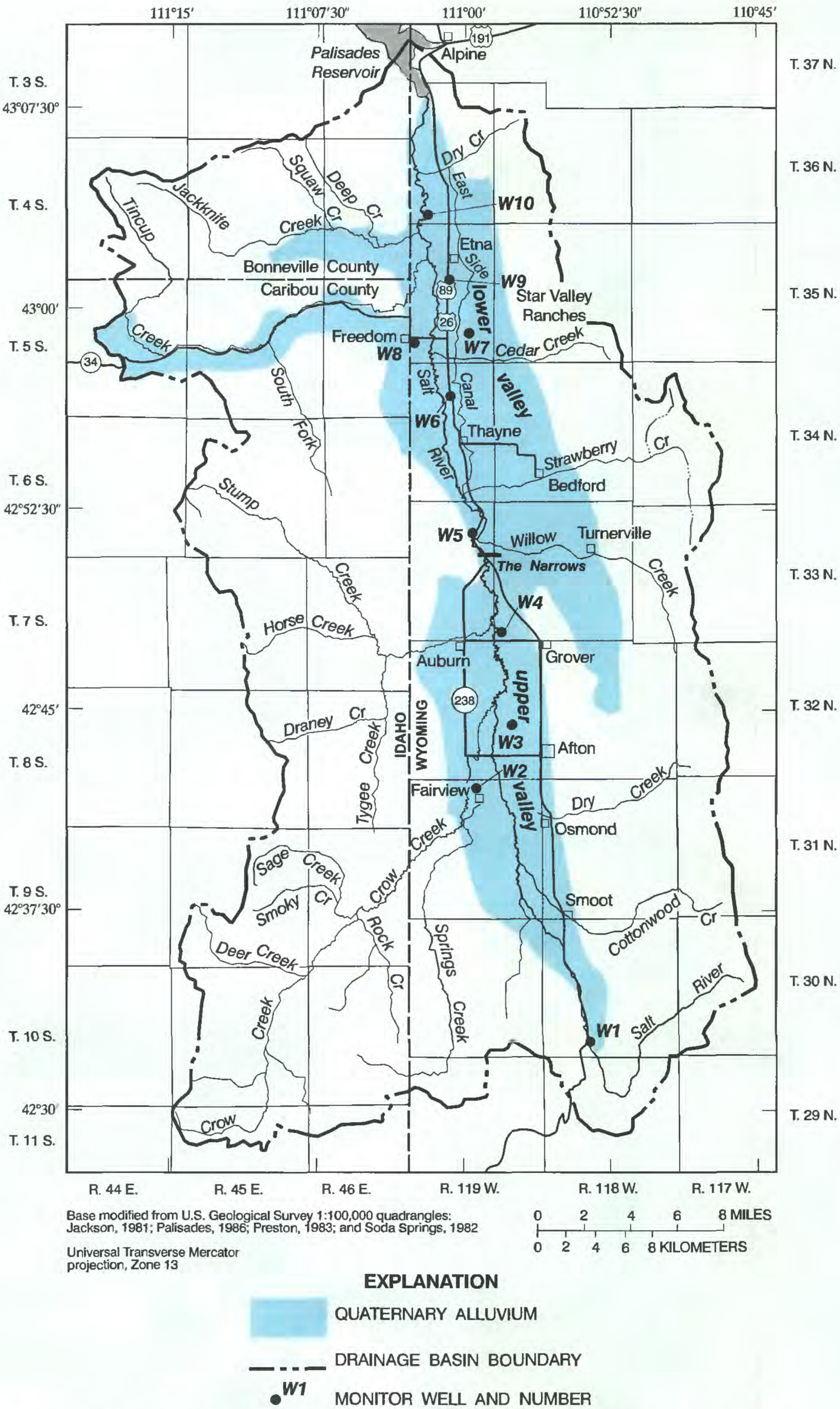


Figure 13. Location of wells used in the Star Valley monitoring study, Idaho and Wyoming.

A total of 84 ground-water samples were collected from the wells used in the Star Valley monitoring study (table 16). No water sample had a nitrate concentration greater than the MCL. The nitrate concentrations in the 10 wells had slightly different ranges during each season (table 10). The widest range was 3.6 mg/L as nitrogen (0.1 to 3.7) in the winter, and the narrowest range was 2.7 mg/L as nitrogen (0.2 to 2.9) in the spring. However, statistical analysis indicated there was no significant difference between the data collected in the different seasons. The data from the ground-water wells in the valley, as a whole, did not show a statistical correlation between the depth to the ground water and the nitrate concentration. Three of the 10 wells showed some relation between the depth to the ground water and the nitrate concentration; however, the differences in nitrate concentrations in the water samples over the sampling period were small, and are more likely because of sampling and analytical inaccuracies, than a true change in the water.

Table 10. *Statistical summary of seasonal nitrite plus nitrate data from ground-water samples collected during the Star Valley monitoring study, 1993-95, Lincoln County, Wyoming*

[Analytical results in milligrams per liter as nitrogen]

Season	Minimum nitrite + nitrate concentration	Maximum nitrite + nitrate concentration	Mean nitrite + nitrate concentration	Median nitrite + nitrate concentration
Winter (early March)	0.1	3.7	1.2	0.9
Spring (mid May)	.2	2.9	1.2	.9
Summer (late July)	.3	3.2	1.3	1.0
Fall (early October)	.2	3.5	1.4	1.2

SUMMARY AND CONCLUSIONS

Surface-water, ground-water, and water-quality data were compiled to describe and evaluate the water resources of Lincoln County, Wyoming. Streams in the county are classified as ephemeral/intermittent or perennial. Ephemeral/intermittent streams, which originate in the High Desert Region in the southeastern and southwestern parts of the county, are characterized by extended periods of no flow. Perennial streams, which originate in the Mountainous Region in the northern and central parts of the county, have sustained streamflow as a result of infiltration of precipitation, low evapotranspiration, and ground-water storage.

The average annual runoff varied for the two hydrologic regions that occur in Lincoln County. In the Mountainous Region, average annual runoff ranged from 1.05 to 40 inches per year. Although, no streamflow-gaging stations in the county were identified as receiving most of their flow from the High Desert Region, this type of stream does exist in the county. At a gaging station located 40 miles east of the county in the High Desert Region, the average annual runoff was 0.1 inch per year.

Geologic units were grouped mainly by age, and include deposits of Quaternary age, and rocks of Tertiary, Mesozoic, and Paleozoic age. Rocks of Precambrian age are not exposed at the surface in Lincoln County. Quaternary deposits had the most water development of any geologic unit in the county. The most productive alluvial and colluvial aquifers in the Overthrust Belt, with pumping wells discharging up to 2,000 gal/min, are located in the valleys of the Bear River and Salt River (Star Valley). Wells completed in and springs issuing from other geologic units inventoried during this study with discharges greater than 500 gallons per minute included: the landslide deposits of Quaternary age, the Salt Lake and Teewinot Formations, and Evanston Formation of Tertiary age, the Gannett Group of Cretaceous age, the Nugget Sandstone of Jurassic(?) and Triassic(?) age, the Wells Formation of Permian and Pennsylvanian age, the Madison Limestone of Mississippian age, and the Bighorn Dolomite of Ordovician age.

Ground-water movement is related to the location of recharge and discharge areas and to the thickness and permeability of the aquifer material. The ground-water connection between areas in the Overthrust Belt and the Green River Basin is restricted by folded and faulted rocks, which are a result of regional tectonic (or orogenic (mountain building)) activity that extended from the middle Mesozoic to the early Cenozoic time. Ground-water movement is difficult to define by aquifer within the Overthrust Belt because of the numerous faults and fractures. Aquifers of Paleozoic and Mesozoic age in the Overthrust Belt primarily receive recharge from direct infiltration of precipitation in outcrop areas. Most of the water discharged from major Paleozoic limestone and dolomite aquifers (including the Madison Limestone of Mississippian age, Darby Formation of Devonian age, and the Bighorn Dolomite of Ordovician age) in the Overthrust Belt is through large springs. Water recharging these aquifers in one surface drainage basin may discharge in another drainage basin via interbasin transfers of ground water.

Total water use in Lincoln County in 1993 was estimated to be 405,000 million gallons. Surface water was the source for about 98 percent of the water used in the county; ground water only accounted for about 2 percent of the water used. Hydroelectric power generation and irrigation used the largest amount of water. Public supply and self-supplied domestic use accounted for 0.5 percent of the water used in Lincoln County. The sources of water for most public supplies in the county are wells and springs. An exception is the Kemmerer and Diamondville municipal system, which withdraws surface water from the Hams Fork River. Self-supplied domestic water is water withdrawn from a water source by a user rather than a public supplier. The source of water for self-supplied domestic water in the county is primarily ground water.

Discharge measurements and surface-water samples were collected from the Salt River and one tributary to the Salt River during a streamflow sampling event in Star Valley, July 18-23, 1994. During that time, the river had an overall gain of 340 cubic feet per second along the reach from the Salt River's entrance into Star Valley to the end of the valley where the river discharges into the Palisades Reservoir.

Dissolved-solids concentrations varied greatly for ground-water samples collected from 35 geologic units. Dissolved-solids concentrations in all water samples collected from the Laney Member of the Green River Formation of Tertiary age were greater than the Secondary Maximum Contaminant Level of 500 milligrams per liter established by the U.S. Environmental Protection Agency. All ground-water samples collected from the Salt Lake and Teewinot Formations of Tertiary age, the Madison Limestone of Mississippian age, and the Bighorn Dolomite of Ordovician age contained dissolved-solids concentrations less than the Secondary Maximum Contaminant Level.

Increased population growth in Star Valley and recent detections of nitrate concentrations above the maximum contaminant level of 10 mg/L as nitrogen, established by the U.S. Environmental Protection Agency, prompted a study of the baseline water quality of the ground water. Ten domestic wells completed in the Salt River alluvium and colluvium were established as monitoring wells in 1993. A total of 84 ground-water samples were collected from the wells used in the Star Valley monitoring study. No water sample had a nitrate concentration greater than the maximum contaminant level. Statistical analysis indicated there was no significant difference between the water quality data collected in different seasons, and no correlation between the nitrate concentrations and the depth to ground water.

REFERENCES

Ahern, J., Collentine, M., and Cooke, S., 1981, Occurrence and characteristics of ground water in the Green River Basin and Overthrust Belt, Wyoming: Laramie, Wyo., Water Resources Research Institute, University of Wyoming, 123 p.

Bear River Commission, Biennial Reports: Bountiful, Utah, Bear River Commission.

Benson, M.A., and Dalrymple, Tate, 1967, General field and office procedures for indirect discharge measurements: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chap. A1, 30 p.

Berry, Delmar W., 1955, Reconnaissance of the geology and ground-water resources of the Cokeville area, Lincoln County, Wyoming: U.S. Geological Survey Open-File Report (not numbered), 11 p.

Blanchard, Mark R., 1990, Discrimination between flow-through and pulse-through components of an alpine carbonate aquifer, Salt River Range, Wyoming: Laramie, Wyo., University of Wyoming, Master's thesis, 77 p.

Clark, Gregory M., 1994, Assessment of selected constituents in surface water of the upper Snake River Basin, Idaho and western Wyoming, water years 1975-89: U.S. Geological Survey Water-Resources Investigations Report 93-4229, 49 p.

Corsi, Elma W., 1990, The hills of home: Afton, Wyo., Afton Thrifty Print, 361 p.

DeLong, Lewis L., 1977, An analysis of salinity in streams of the Green River Basin, Wyoming: U.S. Geological Survey Water-Resources Investigations 77-103, 32 p.

____ 1986, Water quality of streams and springs, Green River Basin, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 82-4008, 36 p.

DeLong, L. L., and Wells, D. K., 1988, Estimating average dissolved-solids yield from basins drained by ephemeral and intermittent streams--Green River Basin, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 87-4222, 14 p.

Freethey, G.W., and Cordy, G.E., 1991, Geohydrology of Mesozoic rocks in the upper Colorado River Basin in Arizona, Colorado, New Mexico, Utah, and Wyoming, excluding the San Juan Basin: U.S. Geological Survey Professional Paper 1411-C, 117 p.

Freeze, R.A., and Cherry, J.A., 1979, Groundwater: Englewood Cliffs, N.J., Prentice-Hall, Inc., 604 p.

Hem, John D., 1985, Study and interpretation of the chemical characteristics of natural water: U.S. Geological Survey Water-Supply Paper 2254, 263 p.

Lane, Dana W., 1973, The Phosphoria and Goose Egg Formations in Wyoming: Laramie, Wyo., Wyoming Geological Survey Preliminary Report no. 12, p. 1-24.

Larson, L.R., 1985, Dissolved solids, *in* Lowham, H.W., and others, Hydrology of area 52, Rocky Mountain coal province, Wyoming, Colorado, Idaho, and Utah: U.S. Geological Survey Water-Resources Investigations Open-File Report 83-761, p. 42-43.

Lickus, M.R., and Law, B.E., 1988, Structure contour map of the greater Green River Basin, Wyoming, Colorado, and Utah: U.S. Geological Survey Miscellaneous Field Studies Map, 1 sheet.

Lines, G.C., and Glass W.R., 1975, Water resources of the Thrust Belt of western Wyoming: U.S. Geological Survey Hydrologic Investigations Atlas HA-539, 3 sheets.

Lowham, H.W., 1985, Surface-water quantity, *in* Lowham, H.W., and others, Hydrology of area 52, Rocky Mountain coal province, Wyoming, Colorado, Idaho, and Utah: U.S. Geological Survey Water-Resources Investigations Open-File Report 83-761, p. 32-39.

____ 1988, Streamflows in Wyoming: U.S. Geological Survey Water-Resources Investigations Report 88-4045, 78 p.

Love, J.D., and Christiansen A.C., 1985, Geologic map of Wyoming: U.S. Geological Survey, scale 1:500,000, 3 sheets.

Love, J.D., Christiansen A.C., and Ver Ploeg, A.J., 1993, Stratigraphic chart showing Phanerozoic nomenclature for the state of Wyoming: Laramie, Wyo., Geological Survey of Wyoming Map Series 41, 1 sheet.

Martner, B. E., 1986, Wyoming climate atlas: Lincoln, Nebr., University of Nebraska Press, 432 p.

M'Gonigle, J.W., and Dover, J.H., 1992, Geologic map of the Kemmerer 30'x 60' Quadrangle, Lincoln, Uinta, and Sweetwater Counties, Wyoming: U.S. Geological Survey Miscellaneous Investigations Series, Map I-2079, 1 sheet.

Ogle, Kathy Muller, Eddy-Miller, C.A., and Busing, C.J.,1996, Estimated use of water in Lincoln County, Wyoming in 1993: U.S. Geological Survey Water-Resources Investigations Report 96-4162, 11 p.

Oriel, S.S. and Platt, L.B., 1980, Geologic map of the Preston 1^{o}x 2^{0} Quadrangle, southeastern Idaho and western Wyoming: U.S. Geological Survey Miscellaneous Investigations Series, Map I-1127, 1 sheet.

Oriel S.S. and Tracey, J.I., Jr., 1970, Uppermost Cretaceous and Tertiary stratigraphy of Fossil Basin, southwestern Wyoming: U.S. Geological Survey Professional Paper 635, 53 p.

Peterson, David A., 1988, Streamflow characteristics of the Green, Bear, and Snake River Basins, Wyoming, through 1984: U.S. Geological Survey Water-Resources Investigations Report 87-4022, 223 p.

Popkin, B.P., 1973, Ground-water resources of Hall and eastern Briscoe Counties, Texas: Texas Water Development Board Report 167, 85 p.

Rankl, James G., 1987, Average flow, *in* Peterson, D.A., and others, Hydrology of area 51, Northern Great Plains and Rocky Mountain coal provinces, Wyoming and Montana: U.S. Geological Survey Water-Resources Investigations Open-File Report 84-734, p. 30-31.

Ringen, Bruce H., 1984, Relationship of suspended sediment to streamflow in the Green River Basin, Wyoming: U.S. Geological Survey Water-Resources Investigations Report 84-4026, 13 p.

Roehler, H. W., 1992, Introduction to greater Green River Basin geology, physiography, and history of investigations: U.S. Geological Survey Professional Paper 1506-A, 12 p.

Schuetz, J.R., Ritz, G.F., Smalley, M.L., and Woodruff, R.E., 1995, Water resources data, Wyoming, Water Year 1994: U.S. Geological Survey Water-Data Report WY-94-1, 363 p.

Searcy, J.K., 1959, Flow-duration curves: U.S. Geological Survey Water-Supply Paper 1542-A, 33 p.

U.S. Environmental Protection Agency, 1991, Secondary maximum contaminant levels (section 143.3 of part 143, National secondary drinking-water regulations): U.S. Code of Federal Regulations, Title 40, Parts 100 to 149, revised as of July 1, 1991, 759 p.

____ 1996, Drinking water regulations and health advisories, Washington D.C., U.S. Environmental Protection Agency Report EPA 822-R-96-001,

U.S. Geological Survey, 1971, Index of surface-water records to September 30, 1970, Part 10--The Great Basin: U.S. Geological Survey Circular 660, 39 p.

Walker, E.H., 1965, Ground water in the upper Star Valley, Wyoming: U.S. Geological Survey Water-Supply Paper 1809-C, 27 p.

Welder, George E., 1968, Ground-water reconnaissance of the Green River Basin, southwestern Wyoming: U.S. Geological Survey Hydrologic Investigations Atlas HA-290, 3 sheets.

Wyoming Department of Administration and Fiscal Control, Research and Statistics Division, 1991, 1991 Wyoming data handbook: Cheyenne, Wyo., 265 p.

Wyoming Department of Agriculture, 1995, Generic state management plan for pesticides in ground water for the state of Wyoming: Cheyenne, Wyo., prepared for the U.S. Environmental Protection Agency by the Ground-water and Pesticide Strategy Committee, variable pagination.

Wyoming Department of Environmental Quality, 1993, Quality standards for groundwaters of Wyoming: Wyoming Department of Environmental Quality, Chap. VIII, 87 p.

Wyoming Historical Records Survey, 1941, Inventory of county archives of Wyoming, No.12, Lincoln County (Kemmerer): 166 p.

Wyoming State Engineer's Office, 1995, Ground water computer data base, September 1995: Cheyenne, Wyo., Wyoming State Engineer.

GLOSSARY

AQUIFER. A body of rock that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

ARTESIAN AQUIFER. Synonymous with confined aquifer.

ARTESIAN WELL. A well deriving its water from an artesian or confined aquifer in which the water level stands above the top of the aquifer.

COMMERCIAL WATER USE. Water for motels, hotels, restaurants, office buildings, and other commercial facilities, and institutions, both civilian and military. The water may be obtained from a public supply or may be self-supplied.

CONFINED AQUIFER. An aquifer bounded above and below by impermeable beds or by beds of distinctly lower permeability than that of the aquifer itself; an aquifer containing confined ground water.

CONFINING BED. A body of impermeable or distinctly less permeable material stratigraphically adjacent to one or more aquifers.

CONSUMPTIVE USE. That part of water withdrawn that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment. Also referred to as water consumed and water depletion.

CONVEYANCE LOSS. Water that is lost in transit from a pipe, canal, conduit, or ditch by leakage or evaporation. Generally, the water is not available for further use; however, leakage from an irrigation ditch, for example, may percolate to a ground-water source and be available for further use.

DOMESTIC WATER USE. Water for household purposes, such as drinking, preparing food, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens. Also called residential water use. The water may be obtained from a public supply or be self-supplied.

GROUND WATER, CONFINED. Confined ground water is under pressure greater than atmospheric throughout the material in which the confined water occurs.

GROUND WATER, UNCONFINED. Unconfined ground water is water in an aquifer that has a water table.

HYDROELECTRIC POWER WATER USE. Water used in the generation of electricity at plants where the turbine generators are driven by falling water. Hydroelectric water use is classified as an instream use.

INDUSTRIAL WATER USE. Water used for industrial purposes such as fabrication, processing, washing, and cooling, and includes such industries as steel, chemical and allied products, paper and allied products, mining, and petroleum refining. The water may be obtained from a public supply or may be self-supplied.

INSTREAM WATER USE. Water that is used, but not withdrawn from a ground- or surface-water source for purposes such as hydroelectric power generation, navigation, water quality improvement, fish propagation, and recreation. Sometimes called nonwithdrawal use or in-channel use.

IRRIGATION WATER USE. Artificial application of water on land to assist in the growing of crops and pastures or to maintain vegetative growth in recreational lands, such as parks and golf courses.

LIVESTOCK WATER USE. Water for livestock watering, feed lots, dairy operations, fish farming, and other on-farm needs.

MAXIMUM CONTAMINANT LEVEL (MCL). Primary drinking water standard for public water supplies established by the U.S. Environmental Protection Agency (1996). MCLs are health related and legally enforceable.

MINING WATER USE. Water used for the extraction of minerals occurring naturally including solids, such as coal and ores; liquids, such as crude petroleum; and gases, such as natural gas. Also includes uses associated with quarrying, well operations (dewatering), milling (crushing, screening, washing, and floatation), and other preparations customarily done at the mine site or as part of a mining activity.

OFFSTREAM USE. Water withdrawn or diverted from a ground- or surface-water source for public-water supply, industry, irrigation, livestock, thermoelectric power generation, and other uses. Sometimes called off-channel use or withdrawal use.

pH. A measure of the acidity or alkalinity of water. It is defined as the negative logarithm of the hydrogen-ion concentration. This parameter is dimensionless and generally has a range from 0.0 to 14.0, with a pH of 7.0 representing neutral water. A pH of greater than 7.0 indicates the water is alkaline, whereas a pH of less than 7.0 indicates an acidic water.

PUBLIC SUPPLY. Water withdrawn by public and private water suppliers and delivered to groups of users. Public suppliers provide water for a variety of purposes, such as domestic, commercial, thermoelectric power, industrial, and public water use.

RAIN SHADOW. A dry region on the lee side of a mountain or mountain range. A rain shadow occurs because much of the moisture in an air mass is removed in the form of precipitation on the windward side of the mountain, as the air mass moves up and over the mountain. Because the air is then drier, precipitation on the lee side is noticeably less.

REPORTING LIMIT. Minimum concentration of an analyte that can be reliably measured and reported by the laboratory using a given analytical method.

SECONDARY MAXIMUM CONTAMINANT LEVEL (SMCL). Secondary drinking water standard for public water supplies established by the U.S. Environmental Protection Agency (1991). SMCLs primarily address aesthetic qualities of drinking water, and are not legally enforceable.

SELF-SUPPLIED DOMESTIC WATER USE. Water withdrawn from a water source by a user rather than a public supplier.

SODIUM-ADSORPTION RATIO (SAR). A measure of irrigation-water sodium hazard. It is the ratio of sodium to calcium plus magnesium adjusted for valence. The SAR value of water is considered along with specific conductance in determining suitability for irrigation.

SPECIFIC CAPACITY. The rate of discharge of water from the well divided by the drawdown of the water level within the well.

SPECIFIC CONDUCTANCE. A measure of water's ability to conduct an electrical current. Specific conductance is expressed in microsiemens per centimeter (μS/cm) at 25 degrees Celsius (25 °C). For water containing between 100 and 5,000 mg/L of dissolved solids, specific conductance in μS/cm (at 25 °C) multiplied by a factor between 0.55 and 0.71 will approximate the dissolved-solids concentration in mg/L. For most water, reasonable estimates can be obtained by multiplying by 0.64.

THERMOELECTRIC POWER WATER USE. Water used in the process of the generation of thermoelectric power. The water may be obtained from a public supply or may be self supplied.

UNCONFINED AQUIFER. An aquifer that has a water table; an aquifer containing unconfined ground water.

WATER TABLE. The water table is that surface in an unconfined water body at which the pressure is atmospheric. It is defined by the levels at which water stands in wells that penetrate the water body just far enough to hold standing water. In wells penetrating to greater depths, the water level will stand above or below the water table if an upward or downward component of ground-water flow exists.

SUPPLEMENTAL DATA

Table 11. *Records of selected wells and springs in Lincoln County, Wyoming*

[Local number: See text describing well-numbering system in the section titled Ground-Water Data. For a detailed description of the geologic units, see table 12. Primary use of water: B, bottling; C, commercial; H, domestic; I, irrigation; N, industrial; P, public supply; S, livestock; U, unused; Altitude of land surface, in feet above sea level. Water level: E, estimated; F, flowing; G, nearby flowing; P, pumping; R, recently pumped; Rp, reported; Z, other; ft, feet. Discharge: gal/min, gallons per minute; E, estimated; Rp, reported by landowner or driller; Z, other; --, no data; NA, not applicable; NE, not established]

Station number	Local number	Date drilled	Depth of well (feet below land surface)	Primary use of water	Altitude of land surface (ft)	Water level (feet below land surface)	Water level Date measured	Discharge Gal/min	Discharge Date measured
				Quaternary Alluvium and Colluvium					
410202110560201	24-119-28aaa01	07-61	230	I	6,195	16	04-07-62	1,930	04-07-62
414036110244701	20-115-33acb01	NA	Spring	U	6,540	NA	NA	--	--
414152110051001	20-112-20cad01	06-15-48	25	H	6,425	15 E	07-14-95	12	07-14-95
414453110271601	20-115-06baa01	--	20	H	6,760	5.1 R	07-10-95	2.5	07-10-95
414459110313601	21-116-36dcd01	04-18-76	105	H	6,875	30.8	07-14-95	12	07-14-95
414606110194601	21-114-27dac01	--	50	H	6,660	0 R	07-10-95	--	--
414642110115201	21-113-23dcd01	1948	50	H	6,548	8.58	06-25-95	4	06-25-95
414644111024101	21-120-21ccc01	--	75	S	6,249	42.4 R	05-18-94	15	05-18-94
414645110121101	21-113-23cdc01	1991	9	S	6,550	3.9	06-25-95	4.5	06-25-95
414708110141201	21-113-21acc01	09-22-87	55	H	6,580	11.8 P	06-25-95	6	06-25-95
414721110145701	21-113-20aad01	09-15-89	15	H	6,580	5.2 R	06-25-95	12	06-25-95
414755110573201	21-119-08bc 01	1970	30	H	6,420	18.0	01-01-70	--	--
415050110333401	22-116-34aad01	09-04-84	80	H	7,030	45.8	08-01-95	6	08-01-95
415058110333801	22-116-34aab01	--	50	H	6,990	12.7 R	08-01-95	7	08-01-95
415109110334101	22-116-27ddb01	07-09-79	40	H	6,980	6.3	08-01-95	8	08-01-95
415250110361301	22-116-17dcd01	1989	15	H	7,040	5.7	06-27-95	8	06-27-95
415442110571801	22-119-05cda01	02-58	250	I	6,210	39.2	04-07-62	500	04-07-62
415557110571502	[1]23-119-32bda02	07-57	230	I	6,220	30.3	04-07-62	900	04-07-62
415557110571701	23-119-32bda03	--	120	H	6,215	19.0	06-09-95	8	06-09-95
415723110161501	23-113-20ccb01	NA	Spring	S	6,660	NA	NA	20 E	05-25-66
415841110563701	23-119-16bbb01	--	150	I	6,210	--	--	--	--
415844110584801	[1]23-120-13aac01	1954	142	I	6,270	45.3	08-19-55	400	12-31-54
420013110560901	23-119-04bcc01	--	200	S	6,180	7.1 R	06-09-95	--	--
420020110575601	[1] 23-119-06ad 01	--	18	S	6,170	11.8	07-15-55	--	--
420103110040401	24-112-25dcd01	NA	Spring	U	6,400	NA	NA	200 E	10-18-77
420112110325401	24-116-35acb01	08-09-79	140	H	7,680	30 E	08-01-95	6 E	08-01-95
420253110554601	24-119-21adb01	--	65	H	6,240	17.7	06-10-95	--	--
420254110555801	24-119-21acb01	--	35	S	6,205	19.9	06-10-95	--	--
420340110583301	24-119-18bdc01	08-13-93	249	H	6,320	154	06-10-95	--	--
420436110561901	24-119-09bd 01	--	75	H	6,220	50 Rp	04-16-56	--	--

Table 11. *Records of selected wells and springs in Lincoln County--Continued*

Station number	Local number	Date drilled	Depth of well (feet below land surface)	Primary use of water	Altitude of land surface (ft)	Water level (feet below land surface)	Water level Date measured	Discharge Gal/min	Discharge Date measured
				Quaternary Alluvium and Colluvium--Continued					
420525110401401	24-117-03dad01	1920	20	H	7,430	5.6	06-27-95	11	06-27-95
420552110223301	24-114-06abb01	1920	--	H	6,880	21.8 R	07-28-95	12	07-28-95
420558110133001	25-113-35ddd01	04-01-81	75	H	6,595	22.3 R	07-28-95	8	07-28-95
420905110111401	25-112-17bcb01	--	60	H	6,510	20 R,E	07-29-95	7 E	07-29-95
421115111012701	25-119-06bca01	--	60	H	6,130	37.9	06-10-95	--	--
421154110095801	26-112-33bba01	1961	10	H	6,540	8 P,Rp	1961	2	08-20-76
421155110100301	26-112-33bba02	1958	1	H	6,540	F,Rp	08-20-76	5 E	08-20-76
421245110113001	26-112-30abc01	1991	75	H	6,650	38.9	07-27-95	8	07-27-95
421247111024601	26-120-25cba01	--	210	H	6,070	F	06-09-95	--	--
421252110113601	26-112-19dcd01	--	100	H	6,640	44.8 R	07-27-95	4	07-27-95
421259110102901	26-112-20ddb01	11-30-73	75	H	6,570	6 Z	08-20-76	5	08-12-89
421301111023201	26-120-25bda01	--	90	H	6,100	31.5 R	06-09-95	--	--
421433110193801	26-114-13ad 01	NA	Spring	S	7,040	NA	NA	--	--
421500110122001	23-113-02 01	NA	Spring		6,620	NA	NA	75 E	05-27-58
421630111015501	26-120-01bb 01	1948	185	H	6,280	70.0 Rp	09-21-71	--	--
423238110533201	30-118-33bcb01	06-17-83	85	H	6,945	25.5 R	10-07-93	8	10-07-93
423610110544601	30-118-08bbc01	--	130	H	6,620	11.6 R	07-29-92	--	--
423620110554000	30-119-12ac 00	1970	140	H	6,820	40 Rp	09-21-71	--	--
423710110544601	30-118-05bbb01	04-15-89	98	H	6,620	52.4 R	07-28-92	--	--
423714110544401	31-118-32ccc01	10-18-85	88	H	6,600	35.2 R	08-03-94	15	08-03-94
423714110545001	31-118-31ddd01	11-18-86	98	H	6,620	57.2 R	07-28-92	--	--
423748110551500	31-118-31ac 01	1953	45	H	6,540	10 Rp	08-61	--	--
423756110571201	31-119-35aad01	--	--	H	6,570	39.6 P	07-29-92	--	--
423838110551401	31-118-30acc01	05-28-82	262	H	6,460	221 R	08-04-94	9	08-04-94
423949110552501	31-118-19baa01	--	--	H	6,340	136	07-28-92	--	--
424006110591601	31-119-15cbd01	09-30-80	65	H	6,320	32.0 R	07-29-92	--	--
424043110580001	31-119-11cdc01	04-10-87	148	H	6,250	57.8 R	07-28-92	--	--
424128110585301	31-119-10abc01	--	120	I	6,196	50 R,Rp	08-23-89	--	--
424132110575501	31-119-11bab01	04-24-79	112	H	6,205	44.1 R	07-28-92	--	---
424133110574301	31-119-11abb01	06-20-83	107	H	6,200	70.9 R	08-03-94	9	08-03-94
424139110585601	31-119-03cdd01	08-29-78	70	H	6,193	20.8 P	07-27-92	252	1978
424215110585201	31-119-03abc01	10-02-84	60	H	6,180	19.6 R	07-27-92	10 Z	1984
424216110585501	31-119-03bad01	--	70	H	6,160	17.0 R	10-06-93	6	10-06-93
424423110570901	32-119-23dad01	--	75	H	6,140	25.5 R	10-08-93	8	10-08-93
424520111014000	32-119-05bb 01	05-70	35	H	6,110	13.7	09-10-71	30 E	09-10-71

Table 11. *Records of selected wells and springs in Lincoln County--Continued*

Station number	Local number	Date drilled	Depth of well (feet below land surface)	Primary use of water	Altitude of land surface (ft)	Water level (feet below land surface)	Water level Date measured	Discharge Gal/min	Discharge Date measured
Quaternary Alluvium and Colluvium--Continued									
424521110594701	32-119-16dac01	09-30-80	70	H	6,080	16.6 R	08-04-94	9	08-04-94
424542110555801	32-119-13ada01	08-21-81	73	H	6,120	22.5 R	07-27-92	--	--
424613110201401	21-114-27caa01	06-14-58	45	N	6,683	11 Rp	06-14-58	85 Rp	06-14-58
424640110555000	33-118-32da 00	11-07-69	146	H	6,180	116 Rp	11-07-69	--	--
424740110572601	33-118-31ddc01	--	50	H	6,040	15.3 R	10-06-93	9	10-06-93
424756110594801	33-119-35dac01	12-13-72	65	H	6,035	13.0 R	08-04-94	9 E	08-04-94
424806110594701	33-119-35adc01	1948	28	H	6,035	10 R,E	08-04-94	4	08-04-94
424851110572801	33-118-30dba01	07-78	80	H	6,070	21.2 R	07-25-92	--	--
424910110574401	33-118-30abc01	1946	70	H	6,030	22.1 R	07-25-92	--	--
424926110595001	33-119-23dcd01	--	40	H	6,010	7.7 R	07-29-92	--	--
425053110563201	33-118-17acb01	--	--	H	6,215	11.5 R	07-27-92	--	--
425107110533501	33-118-11ccc01	10-01-83	105	H	6,430	58.1 P	07-27-92	--	--
425110110590000	33-119-12cd 01	1965	30	H	6,020	--	--	--	--
425127110592701	33-119-12cba02	1947	33	C	6,000	3.9 R	08-06-94	50	08-06-94
425135110592201	33-119-12cba01	--	25	H	6,000	5.1 R	10-06-93	6	10-06-93
425200110591000	33-119-12bab01	09-67	32	S	5,960	20 Rp	09-67	--	--
425228110585301	33-119-01acc01	05-26-89	160	H	5,985	39.4 P	07-26-92	--	--
425324110575201	34-118-31bdd01	--	--	H	6,110	43.9 R	07-28-92	--	--
425327110580701	34-118-31bca01	--	--	H	6,100	--	--	--	--
425438110555701	34-118-21ccc01	--	--	H	6,220	172 P	07-27-92	--	--
425527111010401	34-119-22aba01	--	--	H	5,965	11.9 P	07-27-92	--	--
425540110581801	34-118-18ccb01	--	70	H	6,040	19.2 R	07-27-92	6	10-05-93
425555111013301	34-119-15cab01	12-83	56	H	5,855	17.6 R	08-05-94	7	08-05-94
425617110582001	34-119-13aaa01	--	--	H	6,050	27.4 R	07-28-92	--	--
425622110570901	34-118-07ddd01	02-22-83	--	U	6,160	120	08-05-94	--	--
425638111002201	34-119-11cac01	--	60	H	5,880	8.6 R	10-07-93	12	10-07-93
425650110584000	34-119-12ac 01	05-28-67	169	I	6,010	--	--	1,200 E	09-10-71
425759111003901	34-119-02bbb01	--	130	S	5,880	--	--	--	--
425843111023501	35-119-33bda01	1989	50	H	5,785	17.9 P	08-06-94	8	08-06-94
425855111020601	35-119-33abb01	--	50	H	5,775	12.0 R	10-08-93	12	10-08-93
425857110591901	35-119-25ccd01	--	119	H	5,960	95.3 R	07-25-92	10	10-07-93
425857111021801	35-119-33aba01	11-28-83	60	H	5,775	14.4 R	08-05-94	11	08-05-94
425903111022400	35-119-28dcc00	--	31	S	5,775	17 Rp	11-22-54	--	--
430046111004301	35-119-15ddd01	--	30	H	5,760	25.8 P	07-27-92	6	10-05-93
430057111003801	35-119-14cbc01	--	75	H	5,765	31.8 R	11-20-93	10	11-20-93

Table 11. *Records of selected wells and springs in Lincoln County--Continued*

Station number	Local number	Date drilled	Depth of well (feet below land surface)	Primary use of water	Altitude of land surface (ft)	Water level (feet below land surface)	Water level Date measured	Discharge Gal/min	Discharge Date measured
			Quaternary Alluvium and Colluvium--Continued						
430331111013301	36-119-34cbd01	--	85	H	5,715	20.8 R	10-07-93	6	10-07-93
430356111013000	36-119-34bac00	1920	60	H	5,725	38	1965	--	--
430441111003601	36-119-26bcc01	05-25-82	140	H	5,860	102	10-16-94	5 E	10-16-94
430444111003701	36-119-26bcb01	1978	110	H	5,860	98.2 R	08-05-94	6	08-05-94
430527111011601	36-119-22caa01	10-01-87	110	H	5,762	27.7 R	07-26-92	--	--
430621111012100	36-119-15bdd00	1961	210	H	5,740	40 Rp	08-17-71	12	08-17-71
430626111014501	36-119-15bcc01	04-03-89	50	H	5,670	17.7 R	10-04-93	12	10-04-93
430924111021001	37-118-31baa01	05-25-92	160	H	5,645	44.3 R	09-12-93	13	09-12-93
430951111010800	37-118-29cab01	1969	300	C	5,660	83 Rp	1969	30	08-13-71
431030111020300	37-118-19dcb00	1957	110	H	5,620	--	--	--	--
431041111011801	37-118-20cba01	05-10-81	100	C	5,655	43.7 R	09-12-93	--	--
			Quaternary Glacial Deposits						
424913110441901	33-116-30bbb01	NA	Spring	U	8,020	NA	NA	5 E	09-10-93
424919110444401	NE	NA	Spring	U	7,600	NA	NA	30	09-10-93
			Quaternary Landslide Deposits						
415620110462800	23-118-26ddb01	NA	Spring	S	8,040	NA	NA	22	05-20-94
422402110462501	28-117-19bcc01	NA	Spring	S	7,440	NA	NA	2,000	09-13-94
423319110395201	NE	NA	Spring	U	8,660	NA	NA	25 E	08-02-94
423330110395401	NE	NA	Spring		8,550	NA	NA	5 E	08-02-94
			Quaternary Terrace Deposits						
414749110410101	21-117-15cad01	07-29-82	55	H	6,750	22.6 R	06-23-95	14	06-23-95
414750110323001	21-116-14aaa01	NA	Spring		6,900	NA	NA	7.5 E	05-26-58
414957110321501	21-116-01bb 01	1931	21	H	6,960	14.0	11-07-72	270	11-07-72
415218110294501	22-115-20cba01	NA	Spring	B	7,160	NA	NA	3.5 E	06-15-94
415450110574501	22-119-05ccc01	--	28	H	6,200	22.8	04-16-56	--	--
415555110572001	23-119-32bda01	--	35	H	6,210	20.4	04-16-56	--	--
420106110555401	24-119-33ac 01	--	22	H	6,200	8.3	08-22-55	--	--
420526110530801	NE	NA	Spring	S	6,390	NA	NA	20 E	06-11-95
420827110321301	25-115-20bca01	08-50	5	H	7,400	F,Rp	08-50	20 Rp	08-50
421145111014801	26-119-31cb 01	1947	59	H	6,080	16.7	08-31-47	--	--
423214110525101	30-118-33dbd01	NA	Spring	S	7,080	NA	NA	5 E	08-03-94
			Tertiary Rocks						
414007110172501	20-114-33ddb01	02-27-81	881	S	6,580	F	07-31-95	2	07-31-95
415210110303501	22-115-19 01	NA	Spring		7,120	NA	NA	--	--
415730110160301	23-113-20cbd01	--	900	H	6,855	F	06-13-94	15	06-13-94

Table 11. *Records of selected wells and springs in Lincoln County--Continued*

Station number	Local number	Date drilled	Depth of well (feet below land surface)	Primary use of water	Altitude of land surface (ft)	Water level (feet below land surface)	Water level Date measured	Discharge Gal/min	Discharge Date measured
			Salt Lake and Teewinot Formations						
423958110591600	31-119-15cc 00	1949	70	H	6,350	-20 F	1949	2 E	1949
424828110533601	33-118-34aaa01	NA	Spring	S	6,980	NA	NA	5 E	09-15-94
425430110582001	34-119-24ddc01	NA	Spring	N	6,020	NA	NA	2,200	09-10-71
430544110595800	36-119-23abc00	1967	126	H	6,010	34 Rp	08-17-71	--	--
430550111011401	36-119-22abb01	12-11-77	220	H	5,762	82.8 P	07-25-92	10 Z	1977
430921111003800	37-118-33bab00	NA	Spring	P	5,850	NA	NA	20	08-16-71
430519111005801	36-119-22dbd01	07-94	309	H	5,840	101 R	08-06-94	9	08-06-94
430528111010201	36-119-22dba01	06-94	105	H	5,835	48.6 R	08-06-94	7	08-06-94
430543111010301	36-119-22abd01	--	--	H	5,880	78.7 R	07-26-92	--	--
431224111014001	NE	NA	Spring	S	6,500	NA	NA	10 E	08-10-93
			Bridger Formation						
414546110195401	21-114-34aba01	08-15-74	142	H	6,650	4.0	06-25-95	13	06-25-95
414555110232701	21-114-30dcd01	--	65	H	6,730	-1.12	06-26-95	6	06-26-95
			Fowkes Formation						
413625111023001	19-121-25aad01	NA	Spring	U	6,520	NA	NA	125 E	07-07-72
414343110560701	20-120-12cad01	NA	Spring	S	6,760	NA	NA	2 E	06-20-95
420310110535701	24-119-23bab01	NA	Spring	S	6,305	NA	NA	5 E	05-18-94
			Laney Member of the Green River Formation						
414517110240701	21-114-31cbb01	11-24-84	155	H	6,735	13.8	06-26-95	8	06-26-95
414625110192001	[1]21-114-26bcc01	--	180	P	6,680	29.8	06-23-65	2 E	06-23-65
414708110140001	21-113-21adc01	10-01-86	55	H	6,580	9.6	06-25-95	20	06-25-95
415210110082201	22-112-20dac01	11-08-58	616	S	6,515	F	10-19-65	2.5	10-19-65
						F	05-22-94	1.0	05-22-94
415250110044601	22-112-14ddc01	1983	810	N	6,465	F	1983	--	--
415436110180001	22-114-01cdc01	11-28-72	398	S	6,860	185	5-21-94	--	--
415445110111501	22-113-01cdb01	--	--	S	6,610	F	05-21-94	--	--
415651110045201	23-112-26abd01	11-30-72	508	S	6,620	159	05-21-94	--	--
415858110111201	23-113-12ccd01	NA	Spring	U	6,545	NA	NA	15 E	10-17-77
420430110191901	[1]24-112-08cbb01	08-14-65	150	P	6,560	65.7 P	06-28-66	17	06-28-66
425553110071701	23-112-33caa01	09-16-69	475	S	6,595	43.6	05-22-94	25 Rp	09-16-69
			Wilkins Peak Member of the Green River Formation						
414311110253401	20-115-17ada01	NA	Spring	S	6,740	NA	NA	6 E	11-06-76
						NA	NA	1 E	07-31-95
			Angelo Member of the Green River Formation						
415511110414101	22-117-04abc01	NA	Spring	S	7,530	NA	NA	2 E	09-23-71
						NA	NA	.1 E	10-23-77
						NA	NA	1 E	07-11-95

Table 11. *Records of selected wells and springs in Lincoln County--Continued*

Station number	Local number	Date drilled	Depth of well (feet below land surface)	Primary use of water	Altitude of land surface (ft)	Water level (feet below land surface)	Water level Date measured	Discharge Gal/min	Discharge Date measured
			Fossil Butte Member of the Green River Formation						
413654110470701	19-118-20cba01	NA	Spring	H	7,075	NA	NA	1 E	06-23-95
413715110470701	19-118-20bba01	NA	Spring	S	6,960	NA	NA	80 E	11-06-76
						NA	NA	25 E	06-23-95
413941110402201	19-117-05bcb01	NA	Spring	C	7,160	NA	NA	25 E	06-12-95
414254110505001	20-119-15dad01	NA	Spring	S	7,510	F	05-22-95	20	05-22-95
414358110420501	20-118-12acc01	NA	Spring	S	6,920	NA	NA	5 E	06-13-95
414458110495301	21-118-32ddc01	NA	Spring	S	7,280	NA	NA	25 E	06-21-95
414539110415601	21-117-33abd01	NA	Spring	S	6,920	NA	NA	10 E	06-13-95
414617110440901	21-117-30adc01	NA	Spring	S	6,850	NA	NA	200 E	06-13-95
414717110433001	21-117-20bdb01	NA	Spring	H	6,800	NA	NA	10 E	06-13-95
415212110462201	22-118-23dac01	NA	Spring	P	7,520	NA	NA	14 -	06-16-93
415757110433301	23-117-19aaa01	NA	Spring	S	7,660	NA	NA	20 E	07-11-95
415758110433301	23-117-17ccc01	NA	Spring	S	7,535	NA	NA	25 E	07-11-95
			Wasatch Formation						
413502110531101	19-119-32dad01	NA	Spring	S	7,740	NA	NA	80	06-09-72
						NA	NA	50 E	06-22-95
413658110421701	19-118-24caa01	--	200	H	6,795	110 Rp	11-06-76	--	--
413803110531701	19-119-17aac01	NA	Spring	S	7,720	NA	NA	60 E	06-07-72
						NA	NA	70 E	11-06-76
						NA	NA	25 E	06-22-95
413806110524601	19-119-16bac01	NA	Spring	S	7,630	NA	NA	2 E	06-22-95
413825110513101	19-119-10cda01	NA	Spring	S	7,640	NA	NA	1 E	06-22-95
414055110293601	20-116-26cdd01	NA	Spring	S	6,820	NA	NA	.5 E	11-06-76
						NA	NA	.5 E	07-30-95
414240110240501	20-115-15ccd01	NA	Spring	S	6,610	NA	NA	1 E	07-31-95
414312110480501	20-118-18bac01	NA	Spring	S	7,760	NA	NA	5 E	06-12-95
414439110390501	20-117-04bcd01	NA	Spring	S	7,250	NA	NA	1 E	06-12-95
414603110544701	21-119-27dbc01	NA	Spring	S	6,780	NA	NA	.5 E	06-24-95
414707110485901	21-118-21acc01	NA	Spring	S	7,100	NA	NA	6	06-21-95
414708110533901	21-119-23acc01	NA	Spring	S	6,590	NA	NA	5 E	06-24-95
414800110442001	21-117-18ac 01	NA	Spring	U	6,725	NA	NA	15	09-22-77
414925110473001	21-118-02cc 01	--	350	H	6,600	--	--	--	--
414954110493701	21-118-04bcb01	NA	Spring	H	6,570	NA	NA	9	06-16-93

Table 11. *Records of selected wells and springs in Lincoln County--Continued*

Station number	Local number	Date drilled	Depth of well (feet below land surface)	Primary use of water	Altitude of land surface (ft)	Water level		Discharge	
						(feet below land surface)	Date measured	Gal/min	Date measured
				Wasatch Formation--Continued					
415038110451001	22-118-25dda01	08-14-77	465		6,880	F	10-20-77	.1 E	10-20-77
415117110541301	22-119-26cbc01	NA	Spring	S	6,650	NA	NA	1 E	06-21-95
415411110242301	22-115-12adb01	NA	Spring	S	7,090	NA	NA	15 E	06-15-94
415640110195001	23-114-27cbc01	--	--	S	6,765	F	08-11-65	8	08-11-65
						F	06-13-94	1	06-13-94
415839110241901	23-115-13bbd01	NA	Spring	S	7,080	NA	NA	1 E	06-14-94
415839110261901	23-115-15bad01	NA	Spring	S	7,280	NA	NA	5 E	06-14-94
420611110392801	25-116-32ccb01	NA	Spring	S	7,700	NA	NA	15 E	08-01-95
420708110171101	25-113-29dac01	11-30-66	120	S	6,789	64.7	07-28-95	--	--
420754110423701	25-117-23cdc01	NA	Spring	S	7,590	NA	NA	.1 E	08-01-95
420828110161501	25-113-21aba01	03-27-91	180	S	6,875	48.4	07-28-95	--	--
420958110192701	25-114-12daa01	NA	Spring	H	6,840	NA	NA	25 E	07-29-95
421027110253201	25-114-06ddd01	NA	Spring	S	8,000	NA	NA	1 E	07-29-95
421258110100401	26-112-21ccb01	05-50	300	H	6,560	F	08-20-76	--	--
421311110113601	26-112-19dab01	10-30-68	122	H	6,617	18 Rp	10-30-68	11 Rp	10-30-68
421344110145601	26-113-22aab01	11-01-76	215	H	6,754	30 P,Rp	11-01-76	16 Rp	11-01-76
421446110435701	26-117-16bbd01	NA	Spring	S	7,940	NA	NA	15 E	07-11-95
421501110115001	26-112-07bcd01	06-27	265	H	6,570	20.5 R	08-20-76	25 Rp	08-20-76
421504110195501	26-114-12db 01	NA	Spring	S	7,180	NA	NA	--	--
421512110132601	26-113-11ac 01	1928	145	P	6,700	21.0	06-16-66	20 E	06-16-66
421540110114101	26-112-06acc01	04-18-62	92	H	6,590	F,Rp	08-20-76	10 Rp	08-20-76
421543110115601	26-112-06ca 01	08-08-75	123	H	6,600	9 P,Rp	08-08-75	10 Rp	08-08-75
421545110452001	26-117-05ccc01	NA	Spring	S	8,520	NA	NA	4	09-14-94
421551110120701	26-112-06bcd01	06-15-73	55	H	6,615	17.0 R	08-20-76	10 Rp	08-20-76
421554110112901	21-112-06acd01	08-01-66	85	H	6,585	F,Rp	08-01-66	30 Z	08-01-66
425851110471201	23-118-11ccd01	NA	Spring	S	7,980	NA	NA	40 E	05-20-94
				Evanston Formation					
414758110474701	21-118-15dba01	NA	Spring	S	6,780	NA	NA	25 E	06-13-95
414811110405201	21-117-15acb01	07-31-85	264	H	6,735	51.1	06-23-95	.5 E	06-23-95
415415110373001	22-116-07 01	NA	Spring		7,140	NA	NA	--	--
415515110373001	22-116-06ab 01	NA	Spring	I	7,250	NA	NA	1,000 E	09-30-71

Table 11. *Records of selected wells and springs in Lincoln County--Continued*

Station number	Local number	Date drilled	Depth of well (feet below land surface)	Primary use of water	Altitude of land surface (ft)	Water level (feet below land surface)	Water level Date measured	Discharge Gal/min	Discharge Date measured
				Adaville Formation					
414739110363001	21-116-17cd 01	06-19-75	980	U	7,250	160 G,Rp	06-19-75	--	--
414758110365001	21-116-17cbb01	04-29-76	1,080	U	7,095	40 G,Rp	04-29-76	--	--
414808110361401	21-116-17ac 01	05-05-76	486	U	7,205	75 G,Rp	05-05-76	--	--
414832110364801	21-116-08cc 01	08-23-75	1,200	U	6,985	F,Rp	08-23-75	20 Rp	08-23-75
414832110372401	21-116-07dc 01	08-23-75	800	U	7,020	52 G,Rp	08-23-75	--	--
414845110363201	21-116-08ca 01	05-01-76	320	U	7,120	12 G,Rp	05-01-76	--	--
				Blind Bull Formation					
425840110383200	35-116-36b 00	NA	Spring	U	8,500	NA	NA	25 E	07-12-72
				Hilliard Shale					
413758110342000	19-116-18bd 01	11-65	100	H	6,640	80	11-65	--	--
415315110333001	22-116-15add01	NA	Spring	S	7,130	NA	NA	5 E	06-16-94
415509110355501	22-116-05ada01	NA	Spring	S	7,400	NA	NA	4 E	10-20-77
415631110325701	23-116-26cad01	NA	Spring	S	7,240	NA	NA	9	08-02-95
				Frontier Formation					
414053110314501	20-116-28dcc01	NA	Spring	U	7,040	NA	NA	.3 E	11-05-76
414440110030001	20-112-03 01	NA	Spring		6,440	NA	NA	--	--
415541110363001	23-116-32cab01	NA	Spring	S	7,680	NA	NA	1.5 E	10-20-77
						NA	NA	5 E	06-16-94
415944110305301	23-115-06ccd01	NA	Spring	S	7,490	NA	NA	2 E	06-16-94
				Sage Junction Formation					
413819110565501	19-120-11dcd01	NA	Spring	S	7,340	NA	NA	.2 E	05-20-95
				Aspen Shale					
413450110332201	19-116-32ca 01	--	--	S	6,560	F	--	1 E	09-11-64
414406110304801	20-116-10bda01	06-22-83	100	H	6,960	60.0 P	06-26-95	12	06-26-95
415427110294701	22-115-08bba01	--	--	S	7,340	F	10-05-72	30	10-05-72
						F	06-14-94	1	06-14-94
420023110285401	24-115-32cbd01	NA	Spring	S	7,520	NA	NA	1 E	10-20-77
						NA	NA	2.5 E	06-16-94
421541110313801	26-115-07bba01	NA	Spring	S	8,260	NA	NA	3 E	07-13-95
430635110503401	36-117-18dc 01	NA	Spring	P	6,300	NA	NA	20 E	09-14-71
430806110515401	NE	NA	Spring	U	6,240	NA	NA	5 E	09-19-93
430816110520501	NE	NA	Spring	U	6,090	NA	NA	5 E	09-09-93
430846110524200	NE	NA	Spring	C	5,980	NA	NA	15 E	09-08-71
431158110520801	NE	NA	Spring	U	5,960	NA	NA	5 E	08-03-93
431252110500800	NE	NA	Spring	C	6,240	NA	NA	25 E	08-13-71
						NA	NA	10	09-09-93
431300110483300	NE	NA	Spring	C	5,820	NA	NA	8	08-13-71
						NA	NA	2	09-08-93

Table 11. *Records of selected wells and springs in Lincoln County--Continued*

Station number	Local number	Date drilled	Depth of well (feet below land surface)	Primary use of water	Altitude of land surface (ft)	Water level: (feet below land surface)	Water level: Date measured	Discharge: Gal/min	Discharge: Date measured
				Bear River Formation					
414712110275001	21-115-21add01	1972	--	S	6,910	F	06-17-94	.2 E	06-17-94
415243110281701	22-115-21baa01	NA	Spring	S	7,340	NA	NA	1 E	06-15-94
420928110283201	25-115-14bac01	NA	Spring	U	7,770	NA	NA	15 E	08-14-72
						NA	NA	4 E	10-18-77
425435110433001	34-116-19d 01	NA	Spring	H	6,820	NA	NA	15 E	09-14-71
425830110460001	35-117-35a 01	NA	Spring	P	6,720	NA	NA	8 E	08-24-71
430345110510601	36-117-31bcd01	NA	Spring	U	6,395	NA	NA	5 E	09-14-71
						NA	NA	3	08-11-93
430430110503501	36-117-30dbb01	NA	Spring	P	6,600	NA	NA	5 E	08-24-71
				Thomas Fork Formation					
413819110580101	19-120-10ddc01	NA	Spring	S	7,260	NA	NA	.5 E	05-20-95
413902111001401	19-120-08aab01	NA	Spring	S	6,830	NA	NA	.2 E	05-20-95
				Gannett Group					
413510111010401	19-120-32cbb01	NA	Spring	S	6,760	NA	NA	.25	05-21-95
413551110593201	19-120-28cda01	NA	Spring	S	7,140	NA	NA	.25 E	05-21-95
414321110582801	20-120-15bad01	NA	Spring	S	6,620	NA	NA	1 E	06-20-95
415230110270701	22-115-22bda01	NA	Spring	S	7,340	NA	NA	3	05-22-94
415635110282801	23-115-29dbb01	NA	Spring	S	7,330	NA	NA	10 E	06-14-94
415645110281701	23-115-29acd01	NA	Spring	S	7,170	NA	NA	121	10-17-77
						NA	NA	30 E	06-14-94
420533110533501	24-119-28bdb01	NA	Spring	P	6,390	NA	NA	700 Rp	09-17-71
421558110571301	26-119-02ccb01	NA	Spring	S	7,670	NA	NA	.5 E	07-24-94
421642110431901	27-117-34cdc01	NA	Spring	S	8,820	NA	NA	10 E	07-11-95
422036110572800	27-119-10dab00	NA	Spring	U	7,320	NA	NA	20 E	09-16-71
423340110544000	30-118-29bb 01	NA	Spring	I	7,000	NA	NA	100 E	09-14-71
423348110523000	30-118-35ac 01	NA	Spring	U	7,240	NA	NA	50 E	07-09-72
431306110472400	NE	NA	Spring	C	6,060	NA	NA	10	08-13-71
						NA	NA	1.5	09-09-93
				Stump Formation					
425552110425801	34-116-17bdb01	NA	Spring	P	6,600	NA	NA	10 E	09-09-93
				Preuss Sandstone or Preuss Redbeds					
422333110575500	28-119-27bad00	NA	Spring	S	6,470	NA	NA	20 E	09-15-71
						NA	NA	1	09-17-94
422802110575901	29-119-26cac01	NA	Spring	S	6,620	NA	NA	.1 E	07-24-94
422828110581200	29-119-26bbc01	NA	Spring	S	6,760	NA	NA	50 E	09-15-71
						NA	NA	2 E	09-15-94

Table 11. *Records of selected wells and springs in Lincoln County--Continued*

Station number	Local number	Date drilled	Depth of well (feet below land surface)	Primary use of water	Altitude of land surface (ft)	Water level (feet below land surface)	Water level Date measured	Discharge Gal/min	Discharge Date measured
Twin Creek Limestone									
414708110533101	21-119-23acd01	NA	Spring	S	6,640	NA	NA	15 E	06-24-95
420906110582301	NE	NA	Spring	H	6,200	NA	NA	25 E	06-10-95
421557110263201	26-115-01cbc01	NA	Spring	S	8,300	NA	NA	30 E	07-13-95
422409110323701	28-116-24ada01	NA	Spring	S	8,020	NA	NA	2 E	08-07-94
424730110550000	32-118-06aa 01	NA	Spring	P	6,660	NA	NA	20 E	09-10-71
Nugget Sandstone									
414721110503401	21-118-20bbd01	NA	Spring	S	7,360	NA	NA	5 E	06-21-95
415540110511300	23-118-31dca00	NA	Spring	S	7,450	NA	NA	5	06-17-93
415616110512001	23-118-30dcc01	NA	Spring	S	7,380	NA	NA	42	06-17-93
415704111003701	23-120-26ab 01	NA	Spring	H	6,450	NA	NA	--	--
420120110250301	24-115-35abc01	NA	Spring	S	7,380	NA	NA	1 E	06-16-94
420429110504301	24-118-08cba01	NA	Spring	S	6,800	NA	NA	2 E	06-11-95
420430110505701	24-118-07daa01	NA	Spring	S	6,770	NA	NA	5 E	06-11-95
421211110261901	26-115-26adc01	NA	Spring	U	8,450	NA	NA	10 E	10-18-77
						NA	NA	2 E	07-13-95
421313110255001	26-115-24dcd01	NA	Spring	S	8,100	NA	NA	5 E	07-29-95
421405110275601	26-115-15cdb01	NA	Spring	S	8,060	NA	NA	5 E	10-18-77
						NA	NA	20 E	07-13-95
421429110263501	26-115-13bcc01	NA	Spring	S	8,360	NA	NA	1 E	07-13-95
422821110395800	29-116-28bcb00	NA	Spring	U	8,900	NA	NA	75 E	10-15-71
						NA	NA	10 E	08-07-94
423632110394401	NE	NA	Spring	U	8,000	NA	NA	1,400 E	07-07-72
423645110395401	NE	NA	Spring	U	7,890	NA	NA	100 E	09-14-71
						NA	NA	8 E	08-02-94
423654110393901	NE	NA	Spring	U	7,880	NA	NA	15 E	09-10-93
424356110394201	NE	NA	Spring	U	7,640	NA	NA	140 E	07-15-72
424647110550501	32-118-07aba01	--	230	H	6,280	52.1 R	08-07-94	8	08-07-94
430602110423501	NE	NA	Spring	S	6,840	NA	NA	12	08-12-93
430713110425401	'NE	NA	Spring	S	6,900	NA	NA	200 E	09-14-71
						NA	NA	150 E	08-12-93
Thaynes Limestone									
415242110502001	22-118-17dcc01	1966	600	U	6,720	F	09-22-71	150	06-07-65
						F	06-16-93	12	06-16-93
415304110501601	22-118-17dbb01	NA	Spring	H	6,760	NA	NA	45	06-16-93
420837110490801	25-118-23aba01	NA	Spring	S	7,710	NA	NA	20 E	06-24-95
420958110242401	25-114-08daa01	NA	Spring	S	7,420	NA	NA	1 E	07-29-95
423116110420901	29-116-07bbb01	NA	Spring	H	8,605	NA	NA	10 E	08-04-93

Table 11. *Records of selected wells and springs in Lincoln County--Continued*

Station number	Local number	Date drilled	Depth of well (feet below land surface)	Primary use of water	Altitude of land surface (ft)	Water level (feet below land surface)	Water level Date measured	Discharge Gal/min	Discharge Date measured
Thaynes Limestone--Continued									
423435110440501	NE	NA	Spring	U	9,020	NA	NA	300 E	08-04-93
424955110595500	33-119-23ac 01	NA	Spring	R	6,080	NA	NA	38 E	08-20-71
425003110595001	33-119-23abd01	11-08-71	195	H	6,140	86.7 R	07-26-92	--	--
Woodside Shale									
420408110493601	24-118-09ccc01	NA	Spring	H	7,040	NA	NA	2 E	06-11-95
420415110494401	24-118-08dda01	NA	Spring	S	7,000	NA	NA	10 E	06-11-95
424946110594001	33-119-23daa01	01-20-87	--	H	6,015	4.5 R	07-26-92	--	--
Dinwoody Formation									
422327110361901	28-116-28aac01	NA	Spring	S	8,920	NA	NA	5 E	09-16-94
423126110420401	29-116-06cca01	NA	Spring	U	8,595	NA	NA	50 E	08-05-93
Phosphoria Formation and related rocks[2]									
415150110495501	22-118-29aab01	--	530	U	6,660	F	06-11-65	200 E	06-11-65
415230110494801	22-118-20ad 01	NA	Spring	I	6,800	NA	NA	300	09-22-71
Tensleep Sandstone									
430800110412700	NE	NA	Spring	U	8,600	NA	NA	175 E	07-10-72
431158110562500	NE	NA	Spring	C	6,280	NA	NA	200 E	09-08-71
						NA	NA	7	09-08-93
Wells Formation									
414950111013001	21-120-10da 01	1971	191	N	6,245	42.0 Rp	09-23-71	300	09-23-71
421443110470400	26-117.5-13bad00	NA	Spring	S	8,000	NA	NA	1,600 E	09-17-71
				S		NA	NA	1,100	09-13-94
423155110421501	NE	NA	Spring	U	9,000	NA	NA	200 E	08-25-71
423230110421501	NE	NA	Spring	U	8,320	NA	NA	2,200	09-14-71
						NA	NA	1,800 E	08-04-93
425132110380301	33-116-12b 01	NA	Spring	U	7,600	NA	NA	1,500 E	07-13-72
Madison Limestone									
421543110195501	26-114-01dcc01	NA	Spring	S	7,360	NA	NA	15 E	08-17-76
421702110201501	26-114-01bac01	NA	Spring	I	7,420	NA	NA	4,000 E	09-65
				I		NA	NA	5,500	11-18-76
423148110411601	29-116-06add01	NA	Spring	U	8,620	NA	NA	50 E	08-05-93
424440110505001	NE	NA	Spring	P	7,360	NA	NA	[3]10 E	10-04-93
						NA	NA	[3]15,000 E	10-04-93
425040110513000	33-118-13acc01	NA	Spring	P	6,880	NA	NA	150 E	09-10-71
430838110582200	37-118-34dcd00	NA	Spring		6,000	NA	NA	15	09-08-71
Darby Formation									
425951110562201	NE	NA	Spring	U	7,360	NA	NA	15 E	09-15-94

Table 11. *Records of selected wells and springs in Lincoln County--Continued*

Station number	Local number	Date drilled	Depth of well (feet below land surface)	Primary use of water	Altitude of land surface (ft)	Water level (feet below land surface)	Water level Date measured	Discharge Gal/min	Discharge Date measured
				Bighorn Dolomite					
421504110183101	26-113-07c 01	NA	Spring	H	7,700	NA	NA	3 E	10-18-77
421509110185301	26-113-07bda01	NA	Spring	S	7,440	NA	NA	5 E	10-18-77
						NA	NA	10 E	07-27-95
421612110182301	26-113-06ada01	NA	Spring	S	7,620	NA	NA	2	07-12-95
425420110522001	34-118-26aad01	NA	Spring	P	6,700	NA	NA	3,200 Rp	09-10-71
430157110580500	NE	NA	Spring	I	6,420	NA	NA	450 E	08-17-71
431200111014500	37-118-18aab00	NA	Spring	C	5,940	NA	NA	250 E	08-13-71
						NA	NA	200 Rp	08-12-93

[1]Additional water-level data can be found in the USGS data base or published reports.
[2]In Wyoming, the Phosphoria Formation is synonymous with the Park City Formation (Lane, 1973, p. 4).
[3]Station 424440110505001 is the Periodic Spring. The flow fluctuated between the two discharges every 18 minutes during the visit.

Table 12. *Lithologic and water-yielding characteristics of geologic units in Lincoln County, Wyoming*

[ft, feet; ft/d, feet per day; gal/min, gallons per minute; small, less than 50 gal/min; moderate, 50 - 300 gal/min; large, more than 300 gal/min; --, no data; Ma, millions of years]

Erathem	System	Series	Geologic unit	Range of thickness (ft)	Lithology	Water-yielding characteristics	Range of most common water yields (gal/min)
Cenozoic	Quaternary	Sequence in table does not indicate age relative to other Quaternary entries	Alluvium and colluvium	[1]<100 in the Green River Basin [1]up to 410 in the Overthrust Belt	"Clay, silt, sand, and gravel; includes some slopewash material. Coarser alluvial deposits are in Green River valley north of Green River and along streams in and near highlands..."[2] "Unconsolidated sand and gravel interbedded with silt and clay. The maximum thickness of alluvium in the Bear (and) Salt... River valleys is unknown; however, wells that are 200 ft deep have not penetrated the full thickness in these areas."[3]	Ground-water possibilities good in coarser deposits, but poor where silt and clay predominate. Clean sand and gravel near perennial streams would probably have yields of 500± gal/min.[2] "Sand and gravel in alluvium is the most utilized aquifer in the thrust belt. Irrigation and municipal wells in the Bear (and) Salt...River valleys yield 1,000 to 2,000 gal/min. Yields of wells that tap alluvium are dependent on the thickness, the sorting of the saturated sand and gravel, and the well construction."[3]	[1]50-500
Cenozoic	Quaternary	Sequence in table does not indicate age relative to other Quaternary entries	Gravel, pediment, and fan deposits	[4]15-30	"Gravel, pebble to boulder size, sand, and silt. Located at several terrace levels above the streams and in scattered patches along highlands; includes some glacial outwash material."[2]	"Known well yields are less than 20 gal/min."[2]	[2]<20
Cenozoic	Quaternary	Sequence in table does not indicate age relative to other Quaternary entries	Glacial deposits	[5]<100	"Till and outwash of sand, gravel, and boulders."[6] "Poorly sorted silt, sand, gravel, and boulders as much as 40 feet in diameter."[3]	Glacial deposits may yield small quantities of water to wells. Water yield is limited due to poorly sorted material and small saturated thickness. [3]	[2]<20
Cenozoic	Quaternary	Sequence in table does not indicate age relative to other Quaternary entries	Landslide deposits	[4]<30	"Locally includes intermixed landslide and glacial deposits, talus, and rock-glacier deposits."[6]	"Rock debris is not a potential source of water because of its poorly sorted material and small saturated thickness."[3]	--
Cenozoic	Quaternary	Sequence in table does not indicate age relative to other Quaternary entries	Dune sand and loess	[4]<10	Unconsolidated sand and silt.[2] "Includes active and dormant dunes."[6]	"Generally too thin to hold much water, but aids recharge to underlying formations."[2]	--

Table 12. *Lithologic and water-yielding characteristics of geologic units in Lincoln County, Wyoming--Continued*

Erathem	System	Series	Geologic unit	Range of thickness (ft)	Lithology	Water-yielding characteristics	Range of most common water yields (gal/min)
Cenozoic	Tertiary	Pliocene and Miocene	Intrusive and extrusive igneous rocks	--	"Composition ranges from hornblende monzonite to basalt."[6] Exposure is confined to small outcrops in the northern part of Lincoln County.	"No ground water possibilities."[2] Igneous rocks generally have little primary permeability, but fractures may contain water.	--
Cenozoic	Tertiary	Pliocene and Miocene	Salt Lake Formation	[3]<1000	"White, gray, and green limy tuff, siltstone, sandstone, and conglomerate."[6] "Pale-reddish gray conglomerate, grit, sandstone, siltstone, clay, and white volcanic ash. The formation is most extensive in the Star Valley, where it has a maximum thickness of about 1,000 ft."[3]	The availability of water from this type of aquifer is limited because the conglomerates are usually well indurated, poorly sorted, and have little primary permeability. Springs issue from the conglomerates on side hills, but their flows rarely exceed 20 gal/min.[3]	[3]<20
Cenozoic	Tertiary	Miocene	Teewinot Formation	--	"White lacustrine clay, tuff and limestone. In thrust belt includes conglomerate."[6]	"Poorly consolidated conglomerates are well drained. Yields generally range from 10 to 120 gal/min."[1]	[1]10-120
Cenozoic	Tertiary	Eocene	Bridger Formation	[1]0-2,300	"Mudstone, sandy, tuffaceous, gray to green, locally banded with pink; medium grained, tuffaceous, muddy, brownish-gray sandstone; and thin bedded limestone and marlstone...Contains fewer red beds and much more volcanic ash than Wasatch Formation; base interfingers with Laney Member and generally is poorly defined. Present in much of southern half of (Green River) basin."[2]	"A major aquifer in the southern Green River Basin-Overthrust area. Yields from springs commonly range from 2 to 100 gal/min."[1] Generally, ground-water possibilities from the Bridger Formation are limited in the Green River Basin. Sandstones locally might contain good water where overlain by alluvial or gravel deposits.[2]	[1]2-100
Cenozoic	Tertiary	Pliocene (?) and Eocene	Fowkes Formation	[1]0-2,600	"Light-colored tuffaceous sandstone and siltstone, locally conglomeratic. Locally designated by some as Norwood Tuff."[6] The Fowkes Formation is subdivided into the following units, in ascending order: The Sillem Member (100 to 400 ft thick); the Bulldog Hollow Member (200 to 2,000 ft thick); and the Gooseberry Member (more than 200 ft thick).[3]	"Locally yields water to wells and springs in Overthrust Belt."[1] "Tuffaceous sandstone in the Fowkes is probably capable of yielding small quantities of water to wells."[3]	--

Table 12. *Lithologic and water-yielding characteristics of geologic units in Lincoln County, Wyoming--Continued*

Erathem	System	Series	Geologic unit	Range of thickness (ft)	Lithology	Water-yielding characteristics	Range of most common water yields (gal/min)
Cenozoic	Tertiary	Eocene	Green River Formation, Laney Member	[2]100-1,000 [4]<250 [2]20-265	"Marlstone, oil shale, tuff, siltstone, fine- to medium- grained sandstone; characteristically brown and buff colored."[2]	"Sandstone lenses in Laney Shale generally yield 3 to 100 gal/min to springs and wells."[1] Ground-water possibilities are fair. Sandstone is a significant constituent and yields of about 300 gal/min can probably be obtained locally, but water may contain high dissolved solids.[2]	[1]1-75
Cenozoic	Tertiary	Eocene	Green River Formation, Wilkins Peak Member	[2]0-1,400 [4]<250	"Marlstone, claystone, oil shale, siltstone, tuff, fine-grained sandstone, limestone; contains saline minerals of trona, shortite, halite, etc..."[2]	"Ground-water possibilities poor. Might yield less than 30 gal/min of brine locally..."[2]	[2]<30
Cenozoic	Tertiary	Eocene	Green River Formation, Angelo Member	[4]<200	"Light-gray to buff, mainly white-weathering siliceous limestone, calcareous shale, and siltstone."[4]	One spring inventoried had a discharge of 1 gal/min.	--
Cenozoic	Tertiary	Eocene	Green River Formation, Fossil Butte Member	[4]260-330	"Includes light-gray, tan, and buff limestone, calcareous siltstone, marlstone, and shale, and brown laminated carbonaceous shale and very thinly laminated ("papery") oil shale; tuffaceous interbeds common."[4]	Springs issuing from the Fossil Butte Member had discharges ranging from 1 to 200 gal/min.	--
Cenozoic	Tertiary	Eocene	Wasatch and Green River Formations, includes New Fork Tongue of Wasatch and Fontenelle Tongue or Member of Green River	[1]2,500-5,250 (Wasatch Formation) [1]100-2,800 (Green River Formation)	"Wasatch: Thrust Belt-variegated mudstone and sandstone; southwest-drab to variegated claystone and siltstone, carbonaceous shale and coal, buff sandstone, arkose and conglomerate. Green River: Thrust Belt-buff laminated marlstone and limestone, brown oil shale, and siltstone; Southwest-oil shale, light-colored tuffaceous marlstone and sandstone."[6]	"Conglomeratic sandstones and conglomerates in the Wasatch are capable of yielding large quantities of water to wells... Small to moderate quantities of water are available from finer grained sandstones in the Wasatch and Green River Formations, but well yields are greatly dependent on the thickness of saturated sandstone that is tapped."[3] Major aquifer of the Green River Basin. [1]	[1]<50 (Wasatch Formation)
Cenozoic	Tertiary	Eocene	Wasatch Formation-Main body	[2]0-3,500	"Claystone, silty to sandy, generally variegated red, orange, purple, brown, green, or gray; lenticular beds of fine- to medium-grained sandstone becoming conglomeratic locally at basin periphery."[2]	"A good source of water...Contains more than one aquifer; wells tapping deeper sandstones flow in some areas...Yields of wells range from 1 to 688 gal/min."[2]	--

Table 12. *Lithologic and water-yielding characteristics of geologic units in Lincoln County, Wyoming--Continued*

Erathem	System	Series	Geologic unit	Range of thickness (ft)	Lithology	Water-yielding characteristics	Range of most common water yields (gal/min)
Cenozoic	Tertiary	Eocene	Wasatch Formation-diamictite and sandstone	[5]<1,000	"Diamictite grades laterally into members of the formation."[6] "Unsorted boulders and blocks in mudstone matrix."[5]	Unknown	--
Cenozoic	Tertiary	Eocene and Paleocene	Wasatch Formation-La Barge and Chappo Members	[5]<1,700	La Barge Member consists of red and brown mudstone and conglomerate, yellow sandstone and pisolitic limestone.[5] Chappo Member consists of red to gray conglomerate and sandstone.[5]	Unknown	--
Cenozoic	Tertiary	Eocene and Paleocene	Conglomerate of Sublette Range	[5]<600	"Boulder- to pebble-sized gravel, sand, and silt, crudely stratified."[5]	Unknown	--
Cenozoic and Mesozoic	Tertiary and Cretaceous	Paleocene and Upper Cretaceous	Evanston Formation	[1]1,350-2,900 [5]<800	"Lower member of mudstone, siltstone, claystone, and carbonaceous sandstone; middle member of conglomerate in a matrix of coarse sand; upper member consists of carbonaceous sandy to clayey siltstone interbedded with sandstone and conglomerate."[1]	"The Evanston Formation includes 1,300 to 2,900 feet of well-sorted conglomerates and conglomeratic sandstones that are capable of moderate to large well yields."[1]	--
Mesozoic	Cretaceous	Upper Cretaceous	Adaville Formation	[1]1,400-5,000 [5]<2,100	"Brown and buff fine- to medium-grained calcareous sandstone, gray carbonaceous mudstone, and numerous coal beds. The proportions of sandstone to mudstone are about equal. Thickness varies because of the irregularity of the unconformity that separates the Adaville and overlying Cretaceous rocks."[3]	"Generally considered a minor aquifer of the Overthrust Belt area..."[1] "Small quantities of water are available from sandstone in the base of the Adaville Formation."[3]	--
Mesozoic	Cretaceous	Upper Cretaceous	Blind Bull Formation	[5]<9,200	"Fine-grained to conglomeratic sandstone, siltstone, and shale with some beds of bentonite and coal."[3]	Small quantities of water are available from sandstone layers in the Blind Bull Formation.[3]	--
Mesozoic	Cretaceous	Upper Cretaceous	Hilliard Shale	[1]3,000-6,800? [5]<5,600	"Dark-gray to tan claystone, siltstone, and sandy shale."[6]	"Major regional confining unit of Green River Basin and Overthrust Belt. Locally yields small quantities to wells from sand lenses."[1]	--

Table 12. *Lithologic and water-yielding characteristics of geologic units in Lincoln County, Wyoming--Continued*

Erathem	System	Series	Geologic unit	Range of thickness (ft)	Lithology	Water-yielding characteristics	Range of most common water yields (gal/min)
Mesozoic	Cretaceous	Upper Cretaceous	Frontier Formation	[1]1,100-3,000? [5]<2,600	"Gray, fine- to medium-grained sandstone, and gray mudstone, claystone, and siltstone with some beds of coal. The Oyster Ridge Sandstone Member is near the top of the formation and it contains numerous oyster shells."[3]	"Sandstone aquifers in the Frontier Formation are capable of yielding moderate quantities of water...."[3]	[1]5-50
Mesozoic	Cretaceous	Lower Cretaceous	Sage Junction Formation	[5]<3,300	"Gray and tan sandy siltstone and shale, tan sandstone and quartzite, porcelanite, fossiliferous limestone, and a few coal beds in lower part."[3]	Few hydrologic data are available for the Sage Junction Formation. Based on lithologies, small quantities of water are probably available from sandstone layers in this formation.[3]	--
Mesozoic	Cretaceous	Lower Cretaceous	Aspen Shale	[1]400-2,200 [5]1,100-2,000	"Light- to dark-gray siliceous tuffaceous shale and siltstone, thin bentonite beds, and quartzitic sandstone."[6] "Light gray to black shale, gray fine-grained sandstone, and white to gray porcelanite."[3]	"Locally utilized aquifer, maximum spring and well yields 25 to 30 gal/min. Water yields are mainly from stray sands and fracture zones."[1]	[1]25-30
Mesozoic	Cretaceous	Lower Cretaceous	Quealy Formation	[5]500-1,100	"Red and variegated pastel-tinted mudstone and tan sandstone."[5]	Few hydrologic data are available for the Quealy Formation. Based on lithologies, water is probably not available from this formation.[3]	--
Mesozoic	Cretaceous	Lower Cretaceous	Wayan Formation	[5]<3,900	"Variegated mudstone, siltstone, and sandstone."[6]	Unknown	--
Mesozoic	Cretaceous	Lower Cretaceous	Cokeville Formation	[4]<2,500 [5]850-3,000	"Gray and tan sandstone, siltstone, gray shale, highly fossiliferous limestone, porcelanite, bentonite, and a few coal beds in upper part. About 1,600 ft thick near Cokeville and as much as 2,500 ft thick near Sage Junction."[3]	Few hydrologic data are available for the Cokeville Formation. Based on lithologies, small quantities of water are probably available from sandstone layers in this formation.[3]	--
Mesozoic	Cretaceous	Lower Cretaceous	Bear River Formation	[1,3]800-1,500	"Black shale, fine-grained brown sandstone, thin limestone, and bentonite beds."[6] "Mainly gray to black fissile shale with interbeds of gray sandstone. Thickness generally ranges from 800 to 1,500 ft."[3]	"Minor aquifer with spring yields generally 4 to 15 gal/min and similar well yields."[1] "Small quantities of water are available from sandstone in the Bear River Formation."[3]	[1]4-15

Table 12. *Lithologic and water-yielding characteristics of geologic units in Lincoln County, Wyoming--Continued*

Erathem	System	Series	Geologic unit	Range of thickness (ft)	Lithology	Water-yielding characteristics	Range of most common water yields (gal/min)
Mesozoic	Cretaceous	Lower Cretaceous	Thomas Fork Formation	[4]300-1,300 [5]400-1,700	"Red and variegated mudstone and sandstone with calcareous nodules."[3]	Few hydrologic data are available for the Thomas Fork Formation. Based on lithologies, small quantities of water are probably available from sandstone layers in this formation.[3]	--
Mesozoic	Cretaceous	Lower Cretaceous	Smiths Formation	[4]110-390 [5]300-850	"Interbedded tan quartzitic and black ferruginous shale. About 755 ft thick along Smiths Fork but thins southward."[3]	Few hydrologic data are available for the Smiths Formation. Based on lithologies, small quantities of water are probably available from sandstone layers in this formation.[3]	--
Mesozoic	Cretaceous	Lower Cretaceous	Gannett Group includes: Smoot Formation, Draney Limestone, Bechler Conglomerate, Peterson Limestone, Ephraim Conglomerate	[1,3]800-5,000 [5]790-3,000	Lithologies of the Gannett Group include: brick-red and maroon siltstone and clay-stone, red to brown calcareous to quartzitic sandstone, red to brown conglomerate, and gray to tan nodular limestone (Ephraim Conglomerate); finely crystalline limestone (Peterson Limestone); red sandstone and conglomerate, and purplish- to reddish-gray siltstone and mudstone with thin limestone interbeds (Bechler Conglomerate); gray finely crystalline limestone and gray calcareous siltstone (Draney Limestone); and red siltstone and mudstone (Smoot Formation).[3]	"Water-bearing units restricted to sand-stones and conglomerate in lower part."[1] Rocks in the Gannett Group are mostly impermeable and in most areas they are only capable of yielding small quantities of water. Where the conglomerates are fractured, moderate quantities are available. [3]	[1]5-75
Mesozoic	Jurassic	Upper and Middle Jurassic	Stump Formation	[3]90-120 [5]160-330	"Green to greenish-gray glauconitic sandstone, siltstone and limestone." [3]	The sandstone of the Stump Formation is relatively impermeable and in most areas is capable of yielding only small quantities of water.[3] "Unit is considered a poor aquifer."[1]	--
Mesozoic	Jurassic	Upper and Middle Jurassic	Preuss Sandstone or Preuss Redbeds	[5]360-1,600	Red, maroon, brown, and orange calcareous siltstone, mudstone, and sandstone, and some beds of rock salt in the Overthrust Belt.[3]	The Preuss Sandstone or Preuss Redbeds is relatively impermeable and in most areas is capable of yielding only small quantities of water.[3]	--
Mesozoic	Jurassic	Middle Jurassic	Twin Creek Limestone	[1]800-3,800 [5]980-3,300	"Light-gray to black limestone and shale in the upper part, and red, brown, and orange claystone and gray mainly brecciated but partly honeycombed limestone in the lower part...3,800 ft thick in the southern part of Lincoln County."[3]	Upper part of the Twin Creek Limestone is relatively impermeable and in most areas is capable of yielding only small quantities of water.[3] "Minor aquifer in Overthrust Belt."[1]	[1]20-300

Table 12. *Lithologic and water-yielding characteristics of geologic units in Lincoln County, Wyoming--Continued*

Erathem	System	Series	Geologic unit	Range of thickness (ft)	Lithology	Water-yielding characteristics	Range of most common water yields (gal/min)
Mesozoic	Jurassic(?) Triassic(?)		Nugget Sandstone	[1,3]750-1,300 [5]590-1,000	"Varicolored (generally pink to salmon) crossbedded fine- to medium-grained well-sorted quartzitic sandstone, and a few beds of maroon, red, and brown mudstone in the lower part. About 1,300 ft thick in southern part of Lincoln County."[3]	The Nugget Sandstone is capable of yielding moderate to large quantities of water where outcrop or recharge areas are large; bedding is continuous and not offset by faults, and in topographic lows where large thicknesses occur. Many springs issue from the Nugget and flows greater than 1,000 gal/min are common.[3]	[1]3-300
Mesozoic	Triassic	Upper and Lower Triassic	Ankareh Formation	[1]200-800 [3]200-600	"Red to brown shale, siltstone, and fine-grained sandstone, and, locally, greenish-gray limestone in about the middle part. About 200 ft thick in the northern part of Lincoln County and about 600 ft thick in the southern part."[3]	Rocks in the Ankareh Formation are relatively impermeable and in most areas are probably capable of only yielding small quantities of water.[3] "Minor regional aquifer, locally confining." [1]	--
Mesozoic	Triassic	Lower Triassic	Thaynes Limestone	[1,3]1,100-2,600 [4]700-1,300 [5]980-1,600	"Mainly buff to dark-gray silty limestone, and red to tan siltstone and shale predominately in the upper part. About 1,100 ft thick in the northern part of Lincoln County and 2,400 to 2,600 ft thick in the southern part."[3]	"Where the Thaynes has secondary permeability in the form of fractures and (or) solution openings, the limestone will yield moderate quantities of water to wells."[3] "Generally considered a regional aquifer with spring flows of 5 to 1,800 gal/min..."[1]	[1]5-1,800
Mesozoic	Triassic	Lower Triassic	Woodside Shale	[1]350-600 [3]350-500	"Mainly red and orange partly anhydritic siltstone and mudstone, and some orange fine-grained sandstone."[3]	Rocks in the Woodside Shale are mostly impermeable and in most areas they are probably capable of only yielding small quantities of water.[3]	--
Mesozoic	Triassic	Lower Triassic	Dinwoody Formation	[1]250-700 [5]250-1,600	"Gray to olive-drab dolomitic siltstone."[6]	Rocks in the Dinwoody Formation are mostly impermeable and in most areas are probably capable of only yielding small quantities of water.[3]	--
Mesozoic	Triassic	Upper and Lower Triassic	Chugwater Formation	--	"Chugwater-red siltstone and shale."[6]	Unknown	--

Table 12. *Lithologic and water-yielding characteristics of geologic units in Lincoln County, Wyoming--Continued*

Erathem	System	Series	Geologic unit	Range of thickness (ft)	Lithology	Water-yielding characteristics	Range of most common water yields (gal/min)
Paleozoic	Permian		[7]Phosphoria Formation and related rocks	[1]200-400 [5]230-360	"Upper part is dark- to light-gray chert and shale with black shale and phosphorite at top; lower part is black shale, phosphorite, and cherty dolomite."[6] "Mainly phosphatic, carbonaceous, and cherty shale and sandstone."[3]	Rocks in the Phosphoria Formation are mostly impermeable and in most areas are probably capable of only yielding small quantities of water. Where extensively fractured, the Phosphoria is capable of yielding moderate quantities of water.[3] "Unit is minor aquifer, locally confining."[1]	--
Paleozoic	Permian and Pennsylvanian	Permian, Upper and Middle Pennsylvanian	Tensleep Sandstone	[1]450-1,000	White, grey, and pink well-sorted fine-grained sandstone and quartzite, and thin layers of white siliceous, dolomitic limestone.[3]	"Sandstone aquifer in the Wells Formation and Tensleep Sandstone are capable of yielding moderate to large quantities of water. Availability is dependent upon local conditions of recharge, continuity of beds and development of permeability. These sandstones on topographic highs may be drained, especially if underlying limestones have extensive solution development."[3] "Major aquifer of Paleozoic System."[1]	[1]210-700
Paleozoic	Permian and Pennsylvanian	Permian, Upper and Middle Pennsylvanian	Wells Formation	[3]450-1,000	"Gray thick-bedded quartzite, calcareous sandstone, and limestone mainly in the upper part."[3]	"Sandstone aquifer in the Wells Formation and Tensleep Sandstone are capable of yielding moderate to large quantities of water. Availability is dependent upon local conditions of recharge, continuity of beds and development of permeability. These sandstones on topographic highs may be drained, especially if underlying limestones have extensive solution development."[3]	--
Paleozoic	Pennsylvanian/ Mississippian	Middle and Lower Pennsylvanian and Upper Mississippian	Amsden Formation	[1]400-700 [4]150-390	"Varicolored mudstone, siltstone, and sandstone, and gray cherty limestone".[3]	Few hydrogeologic data are available for the Amsden Formation. Small quantities of water may be available from the cherty limestone in the Amsden Formation, but, on topographic highs, the Amsden is probably well drained, especially if underlying limestones have extensive solution development.[3] "Minor aquifer in Green River Basin, but locally confining in Overthrust Belt..."[1]	--

Table 12. *Lithologic and water-yielding characteristics of geologic units in Lincoln County, Wyoming--Continued*

Erathem	System	Series	Geologic unit	Range of thickness (ft)	Lithology	Water-yielding characteristics	Range of most common water yields (gal/min)
Paleozoic	Mississippian	Upper and Lower Mississippian	Madison Limestone	[1]800-2,000	"Gray, tan, and brown thin-bedded to partly massive cherty and brecciated limestone and gray to tan thick-bedded massive dolomite."[3]	"Major regional aquifer...Excellent solution and fracture permeability...This permeability is produced by solution zones along bedding plane partings and joints."[1]	[1]<100
Paleozoic	Devonian	Lower Mississippian and Upper Devonian	Darby Formation	[1,3]400-1,000 [4]<890	"Gray to brown thin-bedded massive dolomite and limestone, and black, red, and yellow siltstone...About 1,000 ft thick along the Wyoming-Utah border southwest of Sage."[3]	Availability of water from limestone and dolomite aquifers is largely dependent on the secondary permeability in the form of solution openings and fractures.[3]	--
Paleozoic	Silurian	Upper and Middle Silurian	Laketown Dolomite	[5]980-1,300	"Light-gray thick-bedded finely crystalline dolomite."[6]	Not much is known about this aquifer. Water availability is probably dependent upon secondary permeability.	--
Paleozoic	Ordovician	Upper Ordovician	Bighorn Dolomite	[1]400-1,000	"Gray fine- to medium-grained massive dolomite and dolomitic limestone that has rough pitted surfaces upon weathering."[3]	"Highly productive aquifer where fracture, secondary solution and bedding plane permeability are well developed."[3]	--
Paleozoic	Cambrian	Upper Cambrian	Gallatin Limestone	[1]125-1,000	"Dark-gray brown-mottled thin-bedded limestone and gray partly dolomitic limestone with some beds of conglomerate."[3]	"Well and spring data are not available; however, lithology as well as fracture and secondary solution permeability development are indicative of a potentially productive aquifer." [1]	--
Paleozoic	Cambrian	Upper and Middle Cambrian	Gros Ventre Formation	[1]500-2,500	"Gray and green shale with some conglomerate in the upper part, blue to gray rusty mottled limestone in the middle part, and green and red hematitic shale in the lower part."[3]	Few hydrologic data are available. The Gros Ventre Formation consists predominately of poorly permeable rock and is probably not an important aquifer.[3] "Unit is generally considered a regional aquitard with low vertical permeability due to upper and lower shales."[1]	--
Paleozoic	Cambrian	Middle Cambrian	Flathead Sandstone	[1,3]175-200	"White to pink fine-grained quartzite and some lenses of coarse-grained sandstone. The upper part contains some green silty shale interbeds, and the basal part is conglomeratic."[3]	Few hydrologic data are available. Based on lithology, the Flathead is probably a potential source of water.[3]	--

[1]Ahern, Collentine, and Cooke, 1981.
[2]Welder, 1968.
[3]Lines and Glass, 1975.
[4]M'Gonigle and Dover, 1992.
[5]Oriel and Platt, 1980.
[6]Love and Christiansen, 1985.
[7]In Wyoming, the Phosphoria Formation is synonymous with the Park City Formation (Lane, 1973, p. 4).

Table 13. *Instantaneous discharge, physical and biological properties, and chemical analyses of water samples collected at streamflow sites on the Salt River and a tributary to the Salt River, sampled July 18-23, 1994, Idaho and Wyoming*

[Site number: Simplified site number used in this report to identify miscellaneous streamflow sites. ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; ml, milliliters; K, number of bacterial colonies on plate was outside of ideal range (20-60 colonies); mg/L, milligrams per liter; µg/L, micrograms per liter; --, no data; <, less than]

Site number (fig. 9 and pl. 2)	Station number	Station name	Altitude (feet)	Date sampled	Time	Discharge, instantaneous (ft^3/s)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Air temperature (°C)	Fecal coliform, (colonies/ 100 ml)
140	423132110525801	Salt River above Fish Creek, near Smoot	7,030	07-18-94	1400	19	349	8.4	13.0	25.0	K20
142	423658110555701	Salt River at County Road 148, near Smoot	6,540	07-19-94	1100	18	365	8.6	12.0	22.0	200
143	424119110594701	Crow Creek at County Road 143, near Fairview	6,179	07-19-94	1700	24	616	8.6	15.0	27.0	79
144	424526110581301	Salt River below Crow Creek, near Afton	6,058	07-20-94	0900	64	449	8.1	9.5	15.0	47
145	424741110582801	Salt River at Highway 237, near Auburn	6,021	07-20-94	1900	129	432	8.5	17.0	26.0	27
146	425027110584801	Salt River above Narrows, near Auburn	5,980	07-21-94	0800	259	497	8.1	11.0	15.0	K110
148	425250110595701	Salt River above East Side Canal, near Thayne	5,965	07-21-94	1530	251	476	8.4	20.0	32.0	--
149	425529111005801	Salt River at Thayne	5,860	07-22-94	1000	145	481	8.3	17.0	25.0	K53
150	425855111015001	Salt River at Highway 239, near Freedom	5,771	07-22-94	1500	140	453	8.5	18.0	34.0	K20
151	430244111020601	Salt River at County Road 111, near Etna	5,705	07-23-94	0900	249	490	8.0	13.5	20.0	210
58	13027500	Salt River above Reservoir, near Etna	5,676	07-22-94	1155	359	477	8.2	14.0	28.5	--

Table 13. *Instantaneous discharge, physical and biological properties, and chemical analyses of water samples collected at streamflow sites on the Salt River and a tributary to the Salt River, sampled July 18-23, 1994, Idaho and Wyoming--Continued*

Site number (fig. 9 and pl. 2)	Station number	Total hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Calcium load (tons/day as Ca)	Magnesium, dissolved (mg/L as Mg)	Magnesium, load (tons/day as Mg)	Sodium, dissolved (mg/L as Na)	Sodium load (tons/day as Na)	Sodium adsorption ratio	Potassium, dissolved (mg/L as K)	Potassium load (tons/day as K)	Alkalinity, total (mg/L as $CaCO_3$)	Alkalinity load (tons/day as $CaCO_3$)
140	423132110525801	190	54	2.8	13	0.66	2.9	0.15	0.1	0.40	0.02	155	7.9
142	423658110555701	200	57	2.8	13	.63	3.5	.17	.1	.40	.02	167	8.1
143	424119110594701	230	56	3.6	21	1.4	47	3.0	1	1.0	.06	176	11
144	424526110581301	230	64	11	18	3.1	5.1	.88	.1	.60	.1	191	33
145	424741110582801	230	60	21	19	6.6	6.6	2.3	.2	.40	.1	177	61
146	425027110584801	240	63	44	19	13	15	10	.4	.90	.6	193	130
148	425250110595701	230	61	41	19	13	15	10	.4	1.0	.7	186	130
149	425529111005801	230	61	24	19	7.4	15	5.9	.4	1.0	.4	188	73
150	425855111015001	230	59	22	20	7.5	12	4.5	.3	.90	.3	163	61
151	430244111020601	250	64	43	21	14	12	8.0	.3	1.0	.7	207	140
58	13027500	230	61	59	19	18	10	9.7	.3	1.0	1.0	194	190

Table 13. *Instantaneous discharge, physical and biological properties, and chemical analyses of water samples collected at streamflow sites on the Salt River and a tributary to the Salt River, sampled July 18-23, 1994, Idaho and Wyoming--Continued*

Site number (fig. 9 and pl. 2)	Station number	Carbonate, (mg/L as CO_3)	Carbonate load (tons/day as CO_3)	Bicarbonate (mg/L as HCO_3)	Bicarbonate load (tons/day as HCO_3)	Sulfate, dissolved (mg/L as SO_4)	Sulfate load (tons/day as SO_4)	Chloride, dissolved (mg/L as Cl)	Chloride load (tons/day as Cl)	Fluoride, dissolved (mg/L as F)	Fluoride load (tons/day as F)	Silica, dissolved (mg/L as SiO_2)	Silica load (tons/day as SiO_2)
140	423132110525801	8	0.4	173	8.8	38	1.9	0.60	0.03	<0.10	<0.005	6.0	0.31
142	423658110555701	8	.4	189	9.2	32	1.6	.90	.04	<.10	<.005	6.0	.29
143	424119110594701	13	.8	188	12	53	3.4	62	4.0	.20	.01	7.4	.48
144	424526110581301	0	0	233	40	42	7.2	4.5	.78	.10	.02	7.1	1.2
145	424741110582801	5	1.7	205	71	44	15	7.3	2.5	.10	.03	6.8	2.4
146	425027110584801	0	0	236	160	46	32	18	13	.10	.07	6.9	4.8
148	425250110595701	8	5	210	140	47	32	17	11	.10	.07	6.7	4.5
149	425529111005801	5	2	219	85	46	18	16	6.2	.10	.04	6.5	2.5
150	425855111015001	4	2	192	72	41	15	13	4.9	.10	.04	6.2	2.3
151	430244111020601	0	0	253	170	38	25	14	9.4	.10	.07	6.7	4.5
58	13027500	0	0	240	230	34	33	12	12	.20	.2	6.3	6.1

Table 13. *Instantaneous discharge, physical and biological properties, and chemical analyses of water samples collected at streamflow sites on the Salt River and a tributary to the Salt River, sampled July 18-23, 1994, Idaho and Wyoming--Continued*

Site number (fig. 9 and pl. 2)	Station number	Dissolved solids, sum of constituents (mg/L)	Dissolved solids load (tons/day)	Nitrogen, NO_2+NO_3, dissolved (mg/L as N)	Nitrogen, NO_2+NO_3 load (tons/day as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Nitrogen, ammonia load (tons/day as N)	Phosphorus, dissolved (mg/L as P)	Phosphorus load (tons/day as P)	Iron (µg/L as Fe)	Manganese (µg/L as Mn)	Sediment load, suspended (tons/day)
140	423132110525801	208	10.7	<0.050	<0.003	0.030	0.002	0.020	0.001	5	8	0.31
142	423658110555701	213	10.3	<.050	<.002	.030	.001	.010	.0005	12	4	.39
143	424119110594701	353	22.7	<.050	<.003	.030	.002	.020	.001	10	7	.78
144	424526110581301	262	44.6	1.40	.24	.030	.005	.010	.002	<3	9	2.1
145	424741110582801	254	86.7	.820	.28	.030	.01	.010	.003	3	5	.70
146	425027110584801	288	202	.630	.36	.040	.03	.020	.01	6	12	11
148	425250110595701	281	188	.530	.44	.030	.02	<.010	<.007	5	6	10
149	425529111005801	280	111	.490	.19	.030	.01	.010	.004	4	7	7.0
150	425855111015001	253	102	.520	.20	.030	.01	<.010	<.004	4	4	3.4
151	430244111020601	285	188	.750	.50	.030	.02	<.010	<.007	7	6	12
58	13027500	264	265	.960	.93	.010	.01	.020	.02	4	5	2.9

Table 14. *Physical properties and chemical analyses of water samples collected from*

[Local number: See text describing well-numbering system in the section titled
ft, feet below land surface; µS/cm, microsiemens per centimeter at 25 degrees Celsius;

Station number	Local number (pl. 3)	Date sampled	Well depth (ft)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)	Sodium, dissolved (Na)
									Quaternary Alluvium	
414152110051001	20-112-20cad01	07-14-95	25	3,100	7.4	9.0	630	160	55	530
414453110271601	20-115-06baa01	07-10-95	20	622	7.2	11.0	310	93	19	12
414459110313601	21-116-36dcd01	07-14-95	105	2,470	7.3	9.0	900	220	86	200
414606110194601	21-114-27dac01	07-10-95	50	2,150	8.5	11.0	26	6.7	2.2	460
414642110115201	21-113-23dcd01	06-25-95	50	944	8.7	9.0	37	8.7	3.7	180
414644111024101	21-120-21ccc01	05-18-94	75	1,620	7.5	8.5	480	98	57	140
414645110121101	21-113-23cdc01	06-25-95	9	579	7.5	10.0	270	80	18	18
414708110141201	21-113-21acc01	06-25-95	55	4,140	7.4	8.0	800	140	110	720
414721110145701	21-113-20aad01	06-25-95	15	1,500	7.7	10.0	230	46	27	250
414755110573201	21-119-08bc01	09-22-71	30	1,610	7.4	10.0	670	150	71	100
415050110333401	22-116-34aad01	08-01-95	80	1,760	7.4	9.5	680	170	61	140
415058110333801	22-116-34aab01	08-01-95	50	1,360	7.6	9.5	480	120	43	96
415109110334101	22-116-27ddb01	08-01-95	40	825	7.6	7.0	310	80	27	43
415250110361301	22-116-17dcd01	06-27-95	15	1,180	7.2	8.0	600	140	60	26
415557110571701	23-119-32bda03	06-09-95	120	767	7.6	9.0	330	78	32	29
415723110161501	23-113-20ccb01	05-25-66	Spring	1,200	--	7.0	--	--	--	--
415841110563701	23-119-16bbb01	08-22-89	150	1,090	7.5	14.0	410	88	47	75
420013110560901	23-119-04bcc01	06-09-95	200	1,540	7.6	9.0	480	100	56	130
420020110575601	23-119-06ad01	04-16-56	18	503	7.5	5.5	220	67	14	20
420103110040401	24-112-25dcd01	10-18-77	Spring	540	8.2	13.0	190	18	47	40
420112110325401	24-116-35acb01	08-01-95	140	755	8.1	7.0	49	12	4.5	160
420253110554601	24-119-21adb01	06-10-95	65	677	7.8	10.0	280	41	43	39
420254110555801	24-119-21acb01	06-10-95	35	822	7.7	10.0	320	64	40	49
420340110583301	24-119-18bdc01	06-10-95	249	359	7.8	10.0	150	40	12	14
		06-10-95	249	359	7.8	10.0	150	41	12	15
420436110561901	24-119-09bd01	04-16-56	75	697	8.1	8.0	320	64	40	29
420525110401401	24-117-03dad01	06-27-95	20	434	7.6	5.5	220	70	10	7.2
420552110223301	24-114-06abb01	07-28-95	--	1,110	7.7	9.5	210	48	23	170
420558110133001	25-113-35ddd01	07-28-95	75	2,750	7.5	10.0	1,400	320	140	160
420905110111401	25-112-17bcb01	07-29-95	60	783	7.7	8.0	350	99	26	36
421115111012701	25-119-06bca01	06-10-95	60	1,080	7.7	9.0	320	87	25	62

wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming

Ground-Water Data. Analytical results in milligrams per liter except as indicated; °C, degrees Celsius; --, no data; <, less than; NE, not established; ND, not detected]

Sodium adsorption ratio	Potassium, dissolved (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Alkalinity, total as ($CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, NO_2+NO_3, dissolved (as N)	Phosphorus, total (P)
and Colluvium											
9	0.6	--	--	356	1,300	72	1.0	13	2,350	0.630	<0.010
0.3	2.2	--	--	265	60	6.2	0.20	8.0	361	<.050	<.010
3	8.1	--	--	273	780	210	.30	9.3	1,690	<.050	<.010
39	1.4	--	--	286	660	57	.30	11	1,370	<.050	.020
13	.9	--	--	200	210	35	.70	7.4	559	<.050	.020
3	5.1	--	--	320	310	160	.30	16	960	--	--
.5	1.1	--	--	225	63	7.1	.40	8.6	342	<.050	.030
11	1.7	--	--	359	1,700	170	.50	8.4	3,090	.730	.010
7	1.6	--	--	300	400	35	.50	8.4	962	.120	.020
2	3.5	400	0	--	420	87	.40	15	1,050	1.20	--
2	2.9	--	--	292	590	72	.30	9.9	1,220	.650	<.010
2	3.7	--	--	263	260	110	.20	11	810	1.80	<.010
1	1.9	--	--	236	140	15	.20	9.9	460	.310	<.010
.5	6.9	--	--	366	260	27	.40	10	756	.050	<.010
.7	2.7	--	--	263	73	45	.20	16	437	--	--
--	--	--	--	--	--	--	--	--	--	--	--
2	4.1	--	--	270	180	84	.30	20	666	1.30	--
3	6.6	--	--	266	350	120	.50	17	938	--	--
.6	--	233	0	--	29	30	--	--	285	--	--
1	1.5	170	0	--	120	4.8	.40	7.1	323	.130	.010
10	3.1	--	--	394	23	1.3	.50	8.3	450	<.050	<.010
1	1.5	--	--	302	62	6.2	1.0	23	401	--	--
1	2.1	--	--	290	110	16	.40	26	498	--	--
.5	1.7	--	--	156	8.0	14	.30	26	210	--	--
.5	1.7	--	--	156	8.0	14	.30	26	213	--	--
.7	--	328	0	--	63	33	--	--	405	--	--
.2	1.2	--	--	227	17	7.1	.20	7.6	244	.090	.010
5	2.0	--	--	372	180	30	.30	12	689	<.050	<.010
2	6.3	--	--	262	1,300	50	2.0	22	2,220	15.0	<.010
.8	2.0	--	--	291	120	7.5	.10	21	490	.750	<.010
2	1.7	--	--	228	46	97	.10	18	474	--	--

Table 14. *Physical properties and chemical analyses of water samples collected from*

Station number	Local number (pl. 3)	Date sampled	Well depth (ft)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)	Sodium, dissolved (Na)
									Quaternary Alluvium	
421154110095801	26-112-33bba01	08-20-76	10	700	--	17.0	370	94	33	18
421155110100301	26-112-33bba02	08-20-76	1	700	--	16.5	350	86	32	15
421245110113001	26-112-30abc01	07-27-95	75	683	7.7	9.0	280	74	24	37
421247111024601	26-120-25cba01	06-09-95	210	729	7.6	9.0	350	82	36	12
421252110113601	26-112-19dcd01	07-27-95	100	664	7.7	9.0	160	32	20	88
421259110102901	26-112-20ddb01	08-20-76	75	560	--	18.0	280	74	22	18
		08-12-89	75	620	6.7	11.5	290	80	22	8.4
421301111023201	26-120-25bda01	06-09-95	90	517	7.7	9.0	230	52	25	13
421500110122001	23-113-0201	05-27-58	Spring	1,280	7.5	6.5	570	120	66	91
421630111015501	26-120-01bb01	09-21-71	185	605	7.5	7.0	320	82	27	8.6
423238110533201[1]	30-118-33bcb01	10-07-93	85	431	7.7	8.0	230	72	11	2.8
423610110544601	30-118-08bbc01	07-29-92	130	493	7.5	11.5	--	--	--	--
423620110554000	30-119-12ac00	09-21-71	140	408	7.5	9.5	190	55	12	11
423710110544601	30-118-05bbb01	07-28-92	98	427	7.8	6.0	--	--	--	--
423714110544401	31-118-32ccc01	08-03-94	88	440	7.9	5.0	220	65	15	2.2
423714110545001	31-118-31ddd01	07-28-92	98	427	7.6	6.0	--	--	--	--
423748110551500	31-118-31ac01	09-14-71	45	412	7.5	7.5	220	65	13	2.3
423756110571201	31-119-35aad01	07-29-92	--	492	7.5	9.0	--	--	--	--
423838110551401	31-118-30acc01	08-04-94	262	425	7.7	8.0	220	64	15	2.9
423949110552501	31-118-19baa01	07-28-92	--	421	7.7	10.5	--	--	--	--
424006110591601	31-119-15cbd01	07-29-92	65	559	7.6	9.0	--	--	--	--
424043110580001	31-119-11cdc01	07-28-92	148	398	7.6	10.0	--	--	--	--
424128110585301	31-119-10abc01	08-23-89	120	545	7.2	10.0	270	83	16	4.9
424132110575501	31-119-11bab01	07-28-92	112	424	7.6	9.5	--	--	--	--
424133110574301	31-119-11abb01	08-03-94	107	375	7.8	9.0	190	55	13	2.3
424139110585601	31-119-03cdd01	07-27-92	70	532	7.3	9.5	--	--	--	--
424215110585201	31-119-03abc01	07-27-92	60	538	7.4	10.5	--	--	--	--
424216110585501[1]	31-119-03bad01	10-06-93	70	543	7.6	9.0	260	77	16	11
424423110570901[1]	32-119-23dad01	10-08-93	75	340	8.0	5.0	180	48	14	1.0
424520111014000	32-119-05bb01	09-10-71	35	788	7.4	8.5	320	94	20	33
424521110594701	32-119-16dac01	08-04-94	70	599	7.5	10.0	250	77	14	26

wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued

Sodium adsorption ratio	Potassium, dissolved (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Alkalinity, total as ($CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, NO_2+NO_3, dissolved (as N)	Phosphorus, total (P)
and Colluvium--Continued											
0.4	2.5	--	--	355	56	4.8	0.60	18	428	<0.100	0.010
.4	2.5	--	--	311	74	3.9	.50	18	418	.010	.010
1	1.1	--	--	244	110	6.7	.30	11	411	.100	<.010
.3	1.5	--	--	190	170	13	.10	18	458	2.80	.010
3	1.6	--	--	240	110	6.4	.30	13	416	.130	<.010
.5	1.3	--	--	--	58	4.2	.40	9.8	342	.270	<.010
.2	.7	--	--	220	6	4.0	.40	10	324	<.100	--
.4	1.3	--	--	190	51	11	.10	15	284	--	--
2	--	356	0	--	430	20	--	22	928	--	--
.2	1.1	--	--	218	110	3.9	.20	12	383	1.70	--
.1	.7	--	--	207	29	.9	.10	7.9	250	.300	.010
--	--	--	--	--	--	--	--	--	--	--	--
.4	1.1	--	--	182	43	2.7	.20	20	255	.280	--
--	--	--	--	--	--	--	--	--	--	--	--
.1	.4	--	--	157	73	.9	.20	6.6	263	.980	<.010
--	--	--	--	--	--	--	--	--	--	--	--
.1	.8	--	--	186	43	1.6	0	8.1	247	.460	--
--	--	--	--	--	--	--	--	--	--	--	--
.1	.5	--	--	160	42	1.7	.10	8.5	249	1.20	<.010
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.1	1.0	--	--	220	42	4.9	.20	13	312	3.50	--
--	--	--	--	--	--	--	--	--	--	--	--
.1	.6	--	--	168	30	1.0	.20	7.3	213	.630	.010
--	--	--	--	--	-	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.3	1.1	--	--	224	34	15	.20	11	313	2.50	<.010
0	.7	--	--	150	39	.3	.30	4.8	196	.250	<.010
.8	4.1	--	--	276	24	73	.20	14	433	1.20	--
.7	1.3	--	--	221	26	34	.20	14	343	3.70	.090

Table 14. *Physical properties and chemical analyses of water samples collected from*

Station number	Local number (pl. 3)	Date sampled	Well depth (ft)	Specific conductance (μS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)	Sodium, dissolved (Na)
									Quaternary Alluvium	
424542110555801	32-119-13ada01	07-27-92	73	412	7.7	7.5	--	--	--	--
424640110555000	33-118-32da00	09-10-71	146	499	7.6	9.0	260	83	14	2.8
424740110572601[1]	33-118-31ddc01	10-06-93	50	453	7.7	9.0	240	71	15	2.0
424756110594801	33-119-35dac01	08-04-94	65	926	7.8	8.0	230	62	18	97
424806110594701	33-119-35adc01	08-04-94	28	784	7.8	7.0	210	58	16	83
424851110572801	33-118-30dba01	07-25-92	80	540	7.4	9.0	--	--	--	--
424910110574401	33-118-30abc01	07-25-92	70	413	7.4	9.0	--	--	--	--
424926110595001	33-119-23dcd01	07-29-92	40	623	7.4	10.5	--	--	--	--
425053110563201	33-118-17acb01	07-27-92	--	652	7.3	8.0	--	--	--	--
425107110533501	33-118-11ccc01	07-27-92	105	394	7.8	7.5	--	--	--	--
425110110590000	33-119-12cd01	09-10-71	30	529	7.4	9.0	290	83	19	2.5
425127110592701	33-119-12cba02	08-06-94	33	554	7.6	9.0	250	66	21	18
425135110592201[1]	33-119-12cba01	10-06-93	25	536	7.7	9.0	270	65	25	9.4
425200110591000	33-119-12bab01	09-10-71	32	567	7.5	7.5	250	73	16	12
425228110585301	33-119-01acc01	07-26-92	160	1,380	7.2	9.0	--	--	--	--
425324110575201	34-118-31bdd01	07-28-92	--	317	8.0	5.0	--	--	--	--
425327110580701	34-118-31bca01	07-27-92	--	303	8.1	7.5	--	--	--	--
425438110555701	34-118-21ccc01	07-27-92	--	375	7.9	7.5	--	--	--	--
425527111010401	34-119-22aba01	07-27-92	--	587	7.5	10.0	--	--	--	--
425540110581801	34-118-18ccb01	07-27-92	70	417	7.8	8.5	--	--	--	--
		10-05-93	70	520	7.7	10.0	220	54	21	0.9
425555111013301	34-119-15cab01	08-05-94	56	693	7.3	8.0	330	99	21	17
425617110582001	34-119-13aaa01	07-28-92	--	408	7.7	8.0	--	--	--	--
425638111002201[1]	34-119-11cac01	10-07-93	60	427	7.7	8.0	230	55	22	1.3
425650110584000	34-119-12ac01	09-10-71	169	381	7.5	13.0	200	45	21	1.5
425759111003901	34-119-02bbb01	08-24-89	130	313	7.7	12.0	120	35	8.3	20
425843111023501	35-119-33bda01	08-06-94	50	593	7.5	7.5	290	80	21	13
425855111020601[1]	35-119-33abb01	10-08-93	50	499	7.7	8.0	230	63	18	13
425857110591901[1]	35-119-25ccd01	07-25-92	119	384	7.8	9.0	--	--	--	--
425857111021801	35-119-33aba01	08-05-94	60	540	7.7	8.0	260	70	20	14
		10-16-94	60	530	7.6	8.5	240	68	18	13
425903111022400	35-119-28dcc00	09-10-71	31	529	7.5	10.0	270	77	18	11

Sodium adsorption ratio	Potassium, dissolved (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Alkalinity, total as ($CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, NO_2+NO_3, dissolved (as N)	Phosphorus, total (P)
and Colluvium--Continued											
--	--	--	--	--	--	--	--	--	--	--	--
0.1	0.8	--	--	207	50	2.0	0.20	11	305	3.80	--
.1	1.0	--	--	190	39	4.3	.10	10	273	2.20	0.010
3	.8	--	--	184	48	150	.10	9.6	503	.310	<.010
2	1.0	--	--	214	40	95	.10	9.7	433	.360	.020
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.1	.8	--	--	255	33	1.0	.20	8.8	303	.470	--
.5	1.0	--	--	210	48	20	.30	13	321	.430	.020
.3	1.1	--	--	230	48	8.9	.10	12	312	.710	.030
.3	17	--	--	238	45	13	.20	11	333	.700	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
0	.5	--	--	191	30	1.1	.20	6.1	239	1.80	<.010
.4	5.6	--	--	291	37	20	.40	23	417	1.90	.080
--	--	--	--	--	--	--	--	--	--	--	--
0	.5	--	--	195	30	1.1	.30	6.1	243	1.50	<.010
0	.9	252	0	--	12	1.9	.10	6.5	216	.700	--
.8	1.3	--	--	110	41	<1.0	.30	25	197	1.30	--
.3	1.5	--	--	247	35	14	.20	11	341	2.40	.030
.4	.8	--	--	200	38	15	.20	8.3	282	.670	<.010
--	--	--	--	--	--	--	--	--	--	--	--
.4	.8	--	--	210	38	18	.20	8.9	302	--	--
.4	1.0	--	--	215	39	16	.10	9.2	301	.750	.020
.3	1.4	--	--	242	38	9.7	.20	9.8	313	.660	--

Table 14. *Physical properties and chemical analyses of water samples collected from*

Station number	Local number (pl. 3)	Date sampled	Well depth (ft)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)	Sodium, dissolved (Na)
									Quaternary Alluvium	
430046111004301	35-119-15ddd01	07-27-92	30	598	7.5	10.5	--	--	--	--
		10-05-93	30	582	7.6	8.5	290	84	20	5.5
430057111003801[1]	35-119-14cbc01	11-20-93	75	544	7.9	7.0	270	70	23	6.0
430331111013301[1]	36-119-34cbd01	10-07-93	85	379	7.8	8.0	190	48	18	3.0
430356111013000	36-119-34bac00	09-10-71	60	535	7.6	7.0	270	77	20	8.6
430441111003601	36-119-26bcc01	10-16-94	140	472	7.6	8.0	240	65	20	2.0
430444111003701	36-119-26bcb01	08-05-94	110	466	7.6	8.0	250	62	22	2.4
		10-16-94	110	467	7.6	8.0	240	62	21	2.2
430527111011601	36-119-22caa01	07-26-92	110	839	7.3	9.5	--	--	--	--
430621111012100	36-119-15bdd00	09-08-71	210	432	7.2	9.0	130	42	6.6	42
430626111014501	36-119-15bcc01	10-04-93	50	582	7.6	10.0	260	72	20	6.5
430924111021001	37-118-31baa01	09-12-93	160	601	7.7	8.5	120	34	7.9	82
430951111010800	37-118-29cab01	09-08-71	300	602	7.5	18.0	310	86	24	5.5
431030111020300	37-118-19dcb00	09-08-71	110	426	7.6	8.5	220	62	17	2.1
431041111011801	37-118-20cba01	09-12-93	100	459	7.9	--	240	58	22	3.0
										Quaternary
424913110441901	33-116-30bbb01	09-10-93	Spring	384	7.5	5.0	200	71	5.0	2.5
424919110444401	NE	09-10-93	Spring	319	8.0	5.0	--	--	--	--
										Quaternary
415620110462800	23-118-26ddb01	06-24-75	Spring	350	8.0	5.0	190	59	11	1.6
		05-20-94	Spring	388	7.8	4.0	200	63	11	1.4
422402110462501	28-117-19bcc01	09-13-94	Spring	325	8.0	11.5	160	45	12	1.4
423319110395201	NE	08-02-94	Spring	250	8.2	5.5	120	36	6.9	2.1
										Quaternary
414749110410101	21-117-15cad01	06-23-95	55	1,590	7.6	8.0	380	70	49	200
414750110323001	21-116-14aaa01	05-26-58	Spring	772	7.4	8.5	360	95	31	36
414957110321501	21-116-01bb01	11-07-72	21	579	8.0	9.0	280	79	19	18
415218110294501	22-115-20cba01	11-08-72	Spring	420	--	6.0	--	--	--	--
		06-15-94	Spring	463	7.7	9.0	--	--	--	--
415450110574501	22-119-05ccc01	04-16-56	28	864	7.7	3.5	344	84	32	51
415555110572001	23-119-32bda01	04-16-56	35.40	516	7.5	11.0	260	62	26	9.6
420106110555401	24-119-33ac01	04-16-56	22	855	7.7	5.5	330	60	43	72
420526110530801	NE	06-11-95	Spring	606	7.7	7.5	300	84	22	8.2
421145111014801	26-119-31cb01	09-21-71	59	576	7.5	8.5	310	81	26	8.1
423214110525101	30-118-33dbd01	08-03-94	Spring	410	7.6	6.5	210	60	15	3.8

wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued

Sodium adsorption ratio	Potassium, dissolved (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Alkalinity, total as ($CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, NO_2+NO_3, dissolved (as N)	Phosphorus, total (P)
and Colluvium--Continued											
--	--	--	--	--	--	--	--	--	--	--	--
0.1	0.7	--	--	242	27	9.5	0.20	7.9	337	7.20	<0.010
.2	.9	--	--	245	27	8.4	<.10	9.3	305	3.10	.020
.1	.6	--	--	171	17	4.0	.10	5.8	214	2.60	.020
.2	.9	--	--	240	33	6.9	.10	8.2	316	3.80	--
.1	.6	--	--	217	17	.7	<.10	8.5	271	5.30	<.010
.1	.5	--	--	205	16	1.5	.10	9.1	306	14.0	<.010
.1	.7	--	--	210	16	1.3	<.10	8.8	256	5.90	<.010
--	--	--	--	--	--	--	--	--	--	--	--
2	4.3	--	--	218	2.8	1	.30	15	272	3.80	--
.2	.9	--	--	240	26	7.6	.20	7.6	303	4.10	<.010
3	7.3	--	--	283	32	4.3	1.9	47	388	<.050	.010
.1	1.1	--	--	307	8.8	0	.20	11	351	4.60	--
.1	.7	--	--	220	9.5	1.5	.20	12	242	1.10	--
.1	.7	--	--	244	9.8	2.1	.20	12	257	.640	<.010
Glacial Deposits											
.1	.6	--	--	207	2.7	.2	.10	8.8	216	--	--
--	--	--	--	--	--	--	--	--	--	--	--
Landslide Deposits											
0	.7	--	--	189	1.6	3.6	.10	5.7	197	--	--
0	.4	--	--	211	3.4	.9	.20	6.3	214	--	--
0	.5	--	--	104	60	.5	.10	5.4	190	--	--
.1	.3	--	--	67	54	.5	.20	9.0	150	--	--
Terrace Deposits											
4	2.6	--	--	300	400	83	.90	11	1,010	.080	.030
.8	--	327	0	--	130	22	--	17	501	--	--
.5	2.8	--	--	252	43	14	.30	14	347	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
1.2	--	292	0	--	100	69	--	--	510	--	--
0.3	--	246	0	--	64	10	--	--	297	--	--
2	--	379	0	--	130	25	--	--	521	--	--
.2	0.8	--	--	216	100	5.7	0.30	18	363	--	--
.2	1.8	320	0	--	52	7.3	.20	17	351	--	--
.1	.7	--	--	216	9.1	1.2	.20	11	231	--	--

Table 14. *Physical properties and chemical analyses of water samples collected from*

Station number	Local number (pl. 3)	Date sampled	Well depth (ft)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)	Sodium, dissolved (Na)
										Undifferentiated
414007110172501	20-114-33ddb01	07-31-95	881	3,590	8.7	14.5	8	1.4	1.0	860
		07-31-95	881	3,590	8.7	14.5	7	1.3	1.0	860
415210110303501	22-115-1901	05-26-58	Spring	542	7.9	14.5	9	2.8	.5	130
415730110160301	23-113-20cbd01	06-13-94	900	1,240	9.6	12.0	3	.6	.25	280
										Salt Lake and
423958110591600	31-119-15cc00	09-14-71	70	506	7.4	7.0	240	72	15	14
424828110533601	33-118-34aaa01	09-15-94	Spring	290	7.5	9.0	--	--	--	--
425430110582001	34-119-24ddc01	09-10-71	Spring	394	8.0	8.0	210	53	18	1.0
430544110595800	36-119-23abc00	09-10-71	126	450	7.5	9.0	250	64	21	2.7
430550111011401	36-119-22abb01	07-25-92	220	525	7.6	7.5	--	--	--	--
430921111003800	37-118-33bab00	09-08-71	Spring	494	7.4	8.0	270	75	21	2.9
430519111005801	36-119-22dbd01	08-06-94	309	582	7.6	9.0	300	80	25	8.1
430528111010201	36-119-22dba01	08-06-94	105	607	7.6	8.0	320	84	26	8.0
430543111010301	36-119-22abd01	07-26-92	--	664	7.2	9.5	--	--	--	--
431224111014001	NE	08-10-93	Spring	383	7.6	7.0	210	51	19	0.9
										Bridger
414546110195401	21-114-34aba01	06-25-95	142	1,570	7.6	8.0	420	120	30	190
414555110232701	21-114-30dcd01	06-26-95	65	1,310	7.5	18.0	400	73	52	130
										Fowkes
413625111023001	19-121-25aad01	07-07-72	Spring	696	8.2	11.0	240	58	24	58
414343110560701	20-120-12cad01	06-20-95	Spring	605	7.9	13.0	280	73	24	17
420310110535701	24-119-23bab01	05-31-94	Spring	525	7.8	7.0	--	--	--	--
										Laney Member of
414517110240701	21-114-31cbb01	06-26-95	155	1,050	9.5	8.5	7	1.2	1.0	200
		06-26-95	155	1,050	9.5	8.5	7	1.2	1.0	200
414625110192001	21-114-26bcc01	06-23-65	180	2,350	8.1	12.0	14	5.0	.4	550
414708110140001	21-113-21adc01	06-25-95	55	5,540	7.4	10.0	1,600	330	180	860
415210110082201	22-112-20dac01	10-19-65	616	1,990	9.4	11.0	0	ND	ND	500
		05-22-94	616	1,990	9.6	11.5	1	.4	.1	480
415445110111501	22-113-01cdb01	09-12-64	--	1,450	9.5	13.0	2	0.9	ND	360
		05-21-94	--	1,440	9.6	12.0	2	.5	0.17	330
415858110111201	23-113-12ccd01	10-17-77	Spring	1,300	7.8	7.5	370	68	48	160
420430110191901	24-112-08cbb01	06-28-66	150	971	8.2	11.0	310	58	40	110
										Wilkins Peak Member of
414311110253401	20-115-17ada01	11-06-76	Spring	5,000	9.9	6.0	27	1.3	5.7	1,100

wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued

Sodium adsorption ratio	Potassium, dissolved (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Alkalinity, total as ($CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, NO_2+NO_3, dissolved (as N)	Phosphorus, total (P)
Tertiary Rocks											
140	1.4	--	--	1,080	280	330	2.8	8.2	2,140	--	--
140	1.3	--	--	1,080	290	340	3.3	8.2	2,160	--	--
19	--	320	--	--	27	6.0	--	9.1	338	--	--
75	.5	--	--	430	170	19	1.2	9.7	744	--	--
Teewinot Formations											
.4	1.2	--	--	255	50	6.7	.20	20	315	0.200	--
--	--	--	--	--	--	--	--	--	--	--	--
0	.7	207	0	--	30	2.1	.30	10	236	--	--
.1	.8	--	--	259	4.3	2.7	.10	9.9	263	.480	--
--	--	--	--	--	--	--	--	--	--	--	--
.1	.8	--	--	285	0.3	2.4	.20	12	287	.200	--
.2	.9	--	--	323	9.1	4.2	.20	19	337	<.050	0.020
.2	.9	--	--	309	22	4.1	.20	14	349	<.050	<.010
--	--	--	--	--	--	--	--	--	--	--	--
0	.5	--	--	213	2.3	0.7	<.10	5.3	206	--	--
Formation											
4	.5	--	--	364	420	48	.60	12	1,050	<.050	.010
3	1.6	--	--	323	350	29	.20	25	859	<.050	<.010
Formation											
1.6	5.1	313	0	--	52	42	.40	41	438	--	--
.4	1.6	--	--	243	51	23	.40	10	346	--	--
--	--	--	--	--	--	--	--	--	--	--	--
the Green River Formation											
33	.5	--	--	329	120	17	.90	12	551	.330	.020
33	.5	--	--	360	120	17	1.0	12	570	.330	.020
63	1.0	--	--	272	750	82	1.9	7.4	1,560	--	--
9	4.2	--	--	380	2,600	250	.30	10	4,480	.210	.010
0	1.0	--	--	886	140	29	5.3	11	1,220	--	--
180	.9	698	204	912	130	29	4.4	10	1,200	--	--
100	0.6	514	136	--	100	18	1.9	--	875	--	--
110	.9	476	156	650	110	16	1.6	11	860	--	--
4	1.2	--	--	290	400	18	0.40	22	890	<0.100	0.010
3	2.0	334	0	--	230	22	.50	18	650	--	--
the Green River Formation											
93	2.2	--	--	1,890	200	310	7.1	10	2,780	.080	.240

Station number	Local number (pl. 3)	Date sampled	Well depth (ft)	Specific conductance (μS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)	Sodium, dissolved (Na)
									Angelo Member of	
415511110414101	22-117-04abc01	10-20-77	Spring	400	7.4	6.5	210	46	23	11
		07-11-95	Spring	450	7.6	7.5	--	--	--	--
									Fossil Butte Member of	
413654110470701	19-118-20cba01	06-23-95	Spring	755	7.5	6.0	--	--	--	--
413715110470701	19-118-20bba01	11-06-76	Spring	720	7.3	6.5	380	77	45	22
		06-23-95	Spring	833	7.4	6.0	400	84	45	26
413941110402201	19-117-05bcb01	06-12-95	Spring	675	7.6	6.0	320	57	44	17
414254110505001	20-119-15dad01	05-22-95	Spring	1,060	7.5	5.0	530	110	63	25
414358110420501	20-118-12acc01	06-13-95	Spring	980	7.5	7.0	--	--	--	--
414458110495301	21-118-32ddc01	06-21-95	Spring	1,150	7.4	7.0	630	140	67	18
414539110415601	21-117-33abd01	06-13-95	Spring	990	7.6	7.0	430	100	44	40
414617110440901	21-117-30adc01	06-13-95	Spring	1,210	7.4	7.0	570	130	60	45
414717110433001	21-117-20bdb01	06-13-95	Spring	1,120	7.7	10.0	460	100	52	53
415212110462201	22-118-23dac01	06-16-93	Spring	570	7.7	6.5	280	57	33	9.7
415757110433301	23-117-19aaa01	07-11-95	Spring	345	7.8	6.0	170	37	19	6.4
415758110433301	23-117-17ccc01	07-11-95	Spring	310	8.0	6.5	--	--	--	--
										Wasatch
413502110531101	19-119-32dad01	06-13-72	Spring	485	8.2	6.5	240	55	25	5.3
		06-22-95	Spring	656	7.5	6.5	310	70	33	14
413658110421701	19-118-24caa01	11-06-76	200	1,500	7.7	--	17	52	10	300
		07-19-83	200	--	--	--	12	35	7.7	330
413803110531701	19-119-17aac01	06-07-72	Spring	530	--	7.0	--	--	--	--
		11-06-76	Spring	590	7.9	7.0	290	60	35	7.9
		06-22-95	Spring	579	7.5	7.0	290	63	33	10
413806110524601	19-119-16bac01	06-22-95	Spring	850	7.4	8.0	--	--	--	--
413825110513101	19-119-10cda01	06-22-95	Spring	855	7.5	6.5	--	--	--	--
414055110293601	20-116-26cdd01	11-06-76	Spring	970	8.0	8.0	210	41	26	130
		07-30-95	Spring	1,050	7.1	10.5	--	--	--	--
414312110480501	20-118-18bac01	06-12-95	Spring	650	7.4	6.0	320	81	29	4.7
414707110485901	21-118-21acc01	06-21-95	Spring	777	7.6	7.0	350	81	37	26
414708110533901	21-119-23acc01	06-24-95	Spring	652	7.5	10.0	300	92	16	20
414800110442001	21-117-18ac01	09-22-71	Spring	1,740	7.5	6.0	900	200	97	90

wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued

Sodium adsorption ratio	Potassium, dissolved (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Alkalinity, total as ($CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, NO_2+NO_3, dissolved (as N)	Phosphorus, total (P)
the Green River Formation											
0.3	2.4	--	--	210	15	5.0	.40	14	243	.820	.020
--	--	--	--	--	--	--	--	--	--	--	--
the Green River Formation											
--	--	--	--	--	--	--	--	--	--	--	--
.5	2.4	--	--	332	83	18	.40	7.5	455	.090	.010
.6	2.4	--	--	320	83	33	.40	8.3	479	--	--
.4	2.6	--	--	253	84	15	.60	11	389	--	--
.5	2.4	--	--	287	260	24	.50	12	679	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.3	2.8	--	--	326	300	20	.30	12	764	--	--
.8	1.3	--	--	280	260	6.8	.30	28	653	--	--
.8	2.1	--	--	268	400	17	.30	20	836	--	--
1	.4	--	--	195	400	11	.20	21	757	--	--
.3	1.7	--	--	202	87	12	.30	11	351	--	--
.2	.5	--	--	162	6.0	2.6	.70	14	193	--	--
--	--	--	--	--	--	--	--	--	--	--	--
Formation											
.1	1.2	281	0	--	12	6.7	.30	7.9	263	--	--
.3	1.4	--	--	248	22	48	.30	7.6	349	--	--
10	4.8	--	--	145	590	38	1.0	6.0	1,090	.220	.010
13	3.6	--	--	180	600	50	.80	6.9	1,140	.300	--
--	--	--	--	--	--	--	--	--	--	--	--
.2	1.0	--	--	263	32	12	.30	7.1	317	.800	.010
.3	1.0	--	--	262	27	12	.40	7.8	319	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
4	2.2	--	--	249	190	48	0.80	9.8	597	<0.100	0.010
--	--	--	--	--	--	--	--	--	--	--	--
0.1	1.2	--	--	295	22	18	.20	7.4	344	--	--
.6	2.6	--	--	271	80	44	.40	13	450	--	--
.5	5.1	--	--	195	100	18	.40	11	393	--	--
1	1.4	--	--	273	790	16	.30	26	1,380	.040	--

Table 14. *Physical properties and chemical analyses of water samples collected from*

Station number	Local number (pl. 3)	Date sampled	Well depth (ft)	Specific conductance (μS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)	Sodium, dissolved (Na)
										Wasatch
414925110473001	21-118-02cc01	10-18-71	350	1,980	8.4	7.5	10	3.1	0.6	410
414954110493701	21-118-04bcb01	06-16-93	Spring	920	--	8.5	--	--	--	--
415038110451001	22-118-25dda01	10-20-77	465	8,500	8.0	9.5	190	49	16	2,000
415117110541301	22-119-26cbc01	06-21-95	Spring	770	7.4	13.0	--	--	--	--
415411110242301	22-115-12adb01	06-15-94	Spring	940	7.7	6.5	430	94	48	41
415640110195001	23-114-27cbc01	05-25-66	--	1,380	8.5	9.5	230	24	42	240
415839110241901	23-115-13bbd01	06-14-94	Spring	723	7.6	9.0	300	88	19	38
415839110261901	23-115-15bad01	06-14-94	Spring	801	7.6	6.0	--	--	--	--
420611110392801	25-116-32ccb01	08-01-95	Spring	373	7.7	8.0	190	61	9.1	1.7
420754110423701	25-117-23cdc01	08-01-95	Spring	633	7.8	10.5	--	--	--	--
420958110192701	25-114-12daa01	07-29-95	Spring	583	7.7	8.0	230	59	20	37
421258110100401	26-112-21ccb01	08-20-76	300	2,600	--	17.0	12	2.5	1.3	590
421446110435701	26-117-16bbd01	07-11-95	Spring	349	7.5	4.5	200	76	3.3	2.1
421501110115001	26-112-07bcd01	08-20-76	265	3,400	--	12.0	410	67	60	450
421504110195501	26-114-12db01	06-07-86	Spring	470	--	--	240	50	27	7.0
421512110132601	26-113-11ac01	06-16-66	145	1,010	8.2	8.0	490	86	68	43
421540110114101	26-112-06acc01	08-20-76	92	2,050	--	18.0	570	46	110	290
421545110452001	26-117-05ccc01	09-14-94	Spring	377	7.7	5.0	--	--	--	--
421551110120701	26-112-06bcd01	08-20-76	55	2,200	--	21.0	730	79	130	250
421554110112901	21-112-06acd01	08-20-76	85	1,600	--	12.0	150	17	27	300
425851110471201	23-118-11ccd01	05-20-94	Spring	469	7.5	5.5	240	76	12	2.4
										Evanston
414758110474701	21-118-15dba01	06-13-95	Spring	997	7.4	8.5	410	88	47	48
414811110405201	21-117-15acb01	06-23-95	264	7,680	8.3	12.0	190	30	29	1,800
415415110373001	22-116-0701	05-26-58	Spring	494	7.9	--	210	66	10	22
415515110373001	22-116-06ab01	09-30-71	Spring	1,280	--	11.0	--	--	--	--
		11-06-72	Spring	1,250	7.9	12.0	730	210	49	11
										Blind Bull
425840110383200	35-116-36b00	07-12-72	Spring	303	7.9	6.0	140	37	11	9.3
										Hilliard
413758110342000	19-116-18bd01	10-05-72	100	3,790	7.5	9.0	2,000	520	180	240
415315110333001	22-116-15add01	06-16-94	Spring	560	7.6	7.0	260	70	21	17
415509110355501	22-116-05ada01	09-29-71	Spring	630	--	6.0	--	--	--	--
		10-20-77	Spring	880	7.4	7.0	300	88	19	8.0
415631110325701	23-116-26cad01	08-02-95	Spring	812	7.4	7.0	380	99	33	47

Sodium adsorption ratio	Potassium, dissolved (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Alkalinity, total as ($CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, NO_2+NO_3, dissolved (as N)	Phosphorus, total (P)
Formation--Continued											
56	2.7	--	--	345	300	250	1.8	7.1	1,180	.110	--
--	--	--	--	--	--	--	--	--	--	--	--
63	6.9	--	--	180	510	2,700	1.0	6.2	5,400	.030	.010
--	--	--	--	--	--	--	--	--	--	--	--
.9	2.5	--	--	254	220	20	.20	15	602	--	--
7	1.0	333	33	--	370	18	.70	19	915	--	--
1	1.4	--	--	258	91	28	.20	19	422	--	--
--	--	--	--	--	--	--	--	--	--	--	--
0	<0.1	--	--	165	14	1.1	.10	6.6	194	--	--
--	--	--	--	--	--	--	--	--	--	--	--
1	1.9	--	--	211	90	5.0	.20	20	361	.180	<.010
75	1.5	--	--	520	220	420	7.0	6.8	1,560	.010	.030
.1	.8	--	--	198	3.0	0.9	.10	6.1	213	--	--
10	4.1	--	--	210	260	680	.50	10	1,660	.060	<.010
.2	1.1	--	--	173	69	7.4	.40	6.3	272	.110	--
.8	1.0	235	0	--	360	18	.40	17	705	--	--
5	3.0	--	--	417	610	110	.80	12	1,430	.020	.010
--	--	--	--	--	--	--	--	--	--	--	--
4	4.9	--	--	304	580	270	.80	10	1,510	.150	.010
11	2.2	--	--	445	240	98	1.6	8.7	962	.060	.040
.1	1.4	--	--	213	36	2.6	.20	9.0	272	--	--
Formation											
1	3.1	--	--	266	230	30	.50	12	625	--	--
56	23	--	--	522	1,100	1,600	2.2	4.7	4,910	<.050	.020
.7	--	246	0	--	38	7.5	--	29	295	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.2	1.9	--	--	140	600	12	1.8	8.2	978	--	--
Formation											
0.3	1.0	--	--	141	21	1.0	0.40	5.7	172	0.160	--
Shale											
2	14	--	--	217	2,100	140	.40	7.3	3,340	1.80	--
.5	1.0	--	--	230	62	8.1	.20	11	323	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.2	1.9	--	--	250	50	4.5	.10	14	333	.070	0.010
1	1.9	340	0	278	170	25	.30	11	554	--	--

Table 14. *Physical properties and chemical analyses of water samples collected from*

Station number	Local number (pl. 3)	Date sampled	Well depth (ft)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)	Sodium, dissolved (Na)
										Frontier
414053110314501	20-116-28dcc01	11-05-76	Spring	1,170	9.8	6.5	5	1.4	.4	260
414440110030001	20-112-03 01	05-26-58	Spring	1,470	7.3	--	740	190	64	68
415541110363001	23-116-32cab01	10-20-77	Spring	315	7.4	6.0	170	63	4.0	1.3
		06-16-94	Spring	323	7.6	6.0	170	60	3.8	1.4
415944110305301	23-115-06ccd01	09-29-71	Spring	670	--	6.5	--	--	--	--
		10-20-77	Spring	535	8.1	5.0	200	61	11	44
		06-16-94	Spring	721	7.7	7.0	--	--	--	--
										Sage Junction
413819110565501	19-120-11dcd01	05-20-95	Spring	856	7.7	8.0	390	100	33	27
										Aspen
413450110332201	19-116-32ca01	09-11-64	Spring	8,000	--	15.5	--	--	--	--
		06-14-72	Spring	10,200	8.4	12.5	78	23	5.1	2,200
414406110304801	20-116-10bda01	06-26-95	100	1,460	7.7	9.0	340	58	47	170
415427110294701	22-115-08bba01	11-06-72	Spring	619	8.1	9.0	180	51	12	74
		06-14-94	Spring	616	8.8	8.0	51	12	5.2	120
420023110285401	24-115-32cbd01	10-20-77	Spring	625	7.5	7.0	230	66	16	56
		06-16-94	Spring	949	7.5	7.0	300	90	18	85
421541110313801	26-115-07bba01	07-13-95	Spring	590	7.6	8.0	270	77	19	19
430635110503401	36-117-18dc01	09-14-71	Spring	390	7.8	12.0	180	62	7.1	12
430806110515401	NE	09-10-93	Spring	328	7.9	9.0	--	--	--	--
430816110520501	NE	09-09-93	Spring	359	7.7	9.0	--	--	--	--
430846110524200	NE	09-08-71	Spring	336	7.5	6.5	130	45	5.0	21
431158110520801	NE	08-03-93	Spring	326	8.5	17.0	--	--	--	--
431252110500800	NE	09-08-71	Spring	317	7.5	6.0	140	51	4.1	9.7
		09-09-93	Spring	330	7.6	6.0	150	53	4.2	9.8
431300110483300	NE	09-08-71	Spring	354	7.6	5.0	150	54	4.6	14
		09-08-93	Spring	353	7.7	7.0	150	53	4.6	14
										Bear River
414712110275001	21-115-21add01	11-08-94	--	692	8.3	7.0	46	8.3	6.1	150
		06-17-94	--	720	8.7	7.5	42	6.7	6.1	150
415243110281701	22-115-21baa01	06-15-94	Spring	484	7.8	6.5	--	--	--	--
420928110283201	25-115-14bac01	08-14-72	Spring	780	7.6	7.0	390	120	21	24
		10-18-77	Spring	510	7.3	7.5	220	68	12	17
425435110433001	34-116-19d01	09-14-71	Spring	446	8.2	10.5	260	76	16	1.0
425830110460001	35-117-35a01	09-14-71	Spring	402	7.8	10.5	210	66	12	3.5

Sodium adsorption ratio	Potassium, dissolved (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Alkalinity, total as ($CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, NO_2+NO_3, dissolved (as N)	Phosphorus, total (P)
Formation											
50	0.5	--	--	536	43	9.5	5.2	12	656	.540	.040
1	--	478	0	--	400	57	--	11	1,030	--	--
0	.4	--	--	160	11	0.8	.10	7.3	187	.050	.030
0	.4	--	--	163	12	1.0	.10	7.5	184	--	--
--	--	--	--	--	--	--	--	--	--	--	--
1	2.9	--	--	230	59	13	.20	12	341	.020	<.010
--	--	--	--	--		--	--	--	--	--	---
Formation											
.6	2.0	--	--	294	38	65	.20	7.7	444	--	--
Shale											
--	--	--	--	--	--	--	--	--	--	--	--
110	3.5	439	4	--	0.8	3,100	2.0	11	5,570	--	--
4	4.0	--	--	248	230	160	.50	9.7	875	7.90	<.010
2	.7	--	--	258	56	16	.60	17	382	--	--
7	.4	--	--	262	29	21	1.2	13	365	--	--
2	1.7	--	--	230	76	31	.50	11	396	.050	.010
2	2.0	--	--	234	130	79	.50	10	550	--	--
.5	2.5	--	--	243	37	20	.40	12	334	--	--
.4	1.6	238	0	--	14	3.1	.30	8.4	228	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.8	1.6	--	--	170	9.0	1.3	.30	12	197	.060	--
--	--	--	--	--	--	--	--	--	--	--	--
0.4	1.4	--	--	167	6.8	0.7	0.30	17	192	0.170	--
.3	1.2	--	--	167	6.6	.6	.30	16	195	--	--
.5	1.6	--	--	180	17	1.4	1.0	9.8	212	.140	--
.5	1.3	--	--	181	12	.5	1.3	9.5	202	--	--
Formation											
10	1.6	--	--	291	68	12	.50	9.0	430	--	--
10	1.1	--	--	287	62	20	.50	9.5	428	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.5	2.7	--	--	--	170	16	.50	11	505	.200	--
.5	2.3	--	--	--	57	8.4	.50	9.4	283	.030	0.010
0	0.4	293	0	--	3.3	3.1	.20	7.9	254	--	--
.1	1.6	247	0	--	9.0	3.1	.30	7.5	226	--	--

Table 14. *Physical properties and chemical analyses of water samples collected from*

Station number	Local number (pl. 3)	Date sampled	Well depth (ft)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)	Sodium, dissolved (Na)
										Bear River
430345110510601	36-117-31bcd01	09-14-71	Spring	520	--	6.5	240	66	18	7.2
		08-11-93	Spring	455	7.8	7.0	230	72	12	7.0
430430110503501	36-117-30dbb01	09-14-71	Spring	423	8.0	5.0	210	64	13	9.0
										Thomas Fork
413819110580101	19-120-10ddc01	05-20-95	Spring	670	--	7.0	--	--	--	--
										Gannett
413510111010401	19-120-32cbb01	05-21-95	Spring	1,030	--	9.0	--	--	--	--
414321110582801	20-120-15bad01	06-20-95	Spring	1,450	8.5	9.0	57	7.8	9.1	280
415230110270701	22-115-22bda01	05-22-94	Spring	396	8.3	9.5	70	17	6.6	60
415635110282801	23-115-29dbb01	06-14-94	Spring	462	7.8	8.0	--	--	--	--
415645110281701	23-115-29acd01	10-17-77	Spring	225	7.5	8.0	180	49	15	15
		06-14-94	Spring	396	7.9	8.0	190	50	15	15
420533110533501	24-119-28bdb01	09-17-71	Spring	587	7.5	7.0	310	91	21	7.6
421558110571301	26-119-02ccb01	07-24-94	Spring	430	7.7	7.0	--	--	--	--
421642110431901	27-117-34cdc01	07-11-95	Spring	356	7.3	4.5	190	59	10	1.9
422036110572800	27-119-10dab00	09-16-71	Spring	438	7.6	5.0	200	53	16	13
423340110544000	30-118-29bb01	09-14-71	Spring	407	7.6	7.0	200	48	19	10
423348110523000	30-118-35ac01	07-09-72	Spring	352	8.0	4.5	180	57	8.8	5.1
431306110472400	NE	09-08-71	Spring	241	7.4	7.0	100	29	7.8	8.2
		09-09-93	Spring	240	7.7	8.0	110	32	7.7	5.4
										Stump
425552110425801	34-116-17bdb01	09-09-93	Spring	437	7.7	5.0	230	67	15	3.0
										Preuss Sandstone
422333110575500	28-119-27bad00	09-15-71	Spring	1,350	7.6	9.0	310	88	21	150
		09-17-94	Spring	1,170	8.3	10.0	--	--	--	--
422802110575901	29-119-26cac01	07-24-94	Spring	249,000	6.9	10.0	4,100	1,300	200	120,000
422828110581200	29-119-26bbc01	09-15-71	Spring	1,260	7.7	8.5	220	70	12	170
		09-15-94	Spring	1,670	7.7	9.0	--	--	--	--
										Twin Creek
414708110533101	21-119-23acd01	06-24-95	Spring	466	7.4	9.0	210	65	11	12
420906110582301	NE	06-10-95	Spring	595	7.6	9.0	290	76	25	11
421557110263201	26-115-01cbc01	07-13-95	Spring	354	7.7	5.5	190	64	7.8	2.5
422409110323701	28-116-24ada01	08-07-94	Spring	320	7.7	6.0	--	--	--	--
424730110550000	32-118-06aa01	09-10-71	Spring	526	7.6	7.0	280	82	18	4.0

wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued

Sodium adsorption ratio	Potassium, dissolved (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Alkalinity, total as ($CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, NO_2+NO_3, dissolved (as N)	Phosphorus, total (P)
Formation--Continued											
.2	.9	300	0	--	4.9	5.2	.20	8.8	257	--	--
.2	.7	--	--	242	4.1	.9	<.10	7.9	250	--	--
.3	1.6	256	0	--	16	2.1	.30	7.9	242	--	--
Formation											
--	--	--	--	--	--	--	--	--	--	--	--
Group											
--	--	--	--	--	--	--	--	--	--	--	--
16	1.1	--	--	314	180	140	2.3	8.5	824	--	--
3	.6	--	--	181	12	13	.30	8.2	227	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.5	1.2	--	--	200	17	6.2	.20	14	238	.460	.010
.5	1.1	--	--	196	9.9	7.7	.20	14	232	--	--
.2	1.4	--	--	175	130	4.3	.20	14	378	.810	--
--	--	--	--	--	--	--	--	--	--	--	--
.1	1.1	--	--	171	3.7	4.3	<.10	5.1	193	--	--
.4	.7	--	--	211	7.0	7.5	.20	9.7	243	2.10	--
.3	.8	--	--	220	4.0	1.7	.10	12	228	.190	--
.2	.7	--	--	194	7.1	2.1	0	9.2	208	.320	--
.3	1.0	--	--	107	21	1.4	.20	7.6	141	.040	--
.2	.8	--	--	103	18	.9	.20	7.1	137	--	--
Formation											
0.1	0.4	--	--	235	4.4	0.8	0.20	9.1	232	--	--
or Preuss Redbeds											
4	2.3	--	--	226	99	200	.20	12	715	1.60	--
--	--	--	--	--	--	--	--	--	--	--	--
820	1.7	--	--	26	1,600	75,000	<.10	14	198,000	--	--
5	1.2	--	--	200	67	210	.10	12	664	0.350	--
--	--	--	--	--	--	--	--	--	--	--	--
Limestone											
.4	2.3	--	--	135	75	11	.50	15	283	--	--
.3	.9	--	--	219	86	7.7	.10	14	354	--	--
.1	.8	--	--	189	3.0	1.4	.10	9.3	203	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.1	1.0	--	--	230	67	3.1	.20	12	326	.130	--

Table 14. *Physical properties and chemical analyses of water samples collected from*

Station number	Local number (pl. 3)	Date sampled	Well depth (ft)	Specific conductance (μS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)	Sodium, dissolved (Na)
										Nugget
414721110503401	21-118-20bbd01	06-21-95	Spring	61	6.2	7.0	25	7.7	1.3	2.3
415540110511300	23-118-31dca00	06-24-75	Spring	229	7.4	6.5	100	31	5.8	8.0
		06-17-93	Spring	288	7.2	7.0	--	--	--	--
415616110512001	23-118-30dcc01	06-17-93	Spring	315	7.8	8.0	200	61	12	7.2
415704111003701	23-120-26ab01	04-16-56	Spring	1,270	7.6	6.0	360	77	40	150
420120110250301	24-115-35abc01	06-16-94	Spring	376	7.8	7.0	180	57	9.1	8.0
420429110504301	24-118-08cba01	06-11-95	Spring	591	8.1	8.0	290	71	27	6.8
420430110505701	24-118-07daa01	06-11-95	Spring	548	8.1	7.0	--	--	--	--
421211110261901	26-115-26adc01	10-18-77	Spring	380	7.2	7.0	180	64	5.9	3.8
421313110255001	26-115-24dcd01	07-29-95	Spring	299	7.8	6.0	150	50	5.8	3.6
421405110275601	26-115-15cdb01	10-18-77	Spring	320	8.0	5.0	170	51	11	4.3
		07-13-95	Spring	260	7.9	6.0	150	44	8.9	3.4
422821110395800	29-116-28bcb00	10-15-71	Spring	185	8.0	3.5	95	29	5.5	1.4
		08-07-94	Spring	180	8.3	3.0	--	--	--	--
423632110394401	NE	07-07-72	Spring	178	8.1	4.5	93	25	7.5	1.5
423645110395401	NE	09-14-71	Spring	210	--	4.5	91	29	4.4	1.5
		08-02-94	Spring	180	8.0	4.5	91	25	7.0	1.6
423654110393901	NE	09-10-93	Spring	253	8.3	4.5	--	--	--	--
424356110394201	NE	07-15-72	Spring	605	6.8	5.0	320	89	23	2.1
424647110550501	32-118-07aba01	08-07-94	230	462	7.8	11.0	240	50	27	3.6
430602110423501	NE	08-12-93	Spring	239	7.8	7.5	110	24	12	5.7
430713110425401	NE	09-14-71	Spring	180	--	5.0	130	39	6.8	1.5
		08-12-93	Spring	245	7.7	6.0	--	--	--	--
										Thaynes
415242110502001	22-118-17dcc01	06-07-65	600	543	7.7	--	260	47	34	18
		09-22-71	600	631	7.4	10.0	310	69	33	18
		06-16-93	600	610	--	11.0	--	--	--	--
415304110501601	22-118-17dbb01	06-16-93	Spring	609	7.4	8.5	300	75	28	12
420837110490801	25-118-23aba01	06-24-95	Spring	391	7.9	6.5	210	57	16	3.4
420958110242401	25-114-08daa01	07-30-95	Spring	535	7.9	7.0	--	--	--	--
423116110420901	29-116-07bbb01	08-25-71	Spring	280	--	4.5	--	--	--	--
		08-04-93	Spring	295	7.9	3.0	--	--	--	--
423435110440501	NE	08-04-93	Spring	236	7.9	4.0	120	35	8.6	1.0
424955110595500	33-119-23ac01	09-10-71	Spring	8,640	6.6	55.0	1,300	420	69	1,400
425003110595001	33-119-23abd01	07-26-92	195	409	7.6	21.0	--	--	--	--

Sodium adsorption ratio	Potassium, dissolved (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Alkalinity, total as ($CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, NO_2+NO_3, dissolved (as N)	Phosphorus, total (P)
Sandstone											
.2	.5	--	--	19	4.1	1.9	<.10	9.1	40	--	--
.3	1.6	--	--	98	9.1	9.1	.20	17	141	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.2	1.3	--	--	153	13	11	.20	13	210	--	--
3	--	366	0	--	330	50	--	--	824	--	--
.3	1.0	--	--	175	9.0	11	<.10	8.0	211	--	--
.2	.8	--	--	203	110	3.8	.20	14	360	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.1	.9	--	--	190	4	2.7	.10	11	209	.610	.010
.1	.8	184	0	151	3	2.5	<.10	13	170	--	--
.1	.6	--	--	170	5	3.2	.10	18	198	.250	.040
.1	.7	--	--	140	3	2.4	.90	14	165	--	--
.1	.9	--	--	100	2.8	1.2	ND	5.3	107	.130	--
--	--	--	--	--	--	--	--	--	--	--	--
.1	.9	106	0	--	4.1	1.7	.10	8.5	104	--	--
.1	.4	110	0	--	4.9	2.1	.20	8.0	103	--	--
.1	.3	--	--	87	7.2	.5	.20	7.6	103	--	--
--	--	--	--	--	--	--	--	--	--	--	--
0	.4	153	0	--	190	1.0	.30	7.1	388	--	--
0.1	1.3	--	--	175	69	2.5	0.20	10	270	<0.050	<0.010
.2	0.7	--	--	102	19	0.9	<.10	9.5	134	--	--
.1	.9	150	0	--	2.5	2.1	.20	10	136	--	--
--	--	--	--	--	--	--	--	--	--	--	--
Limestone											
.5	3.9	--	--	179	97	10	.50	13	331	--	--
.4	3.1	--	--	240	97	7.7	.40	14	386	.020	--
--	--	--	--	--	--	--	--	--	--	--	--
.3	2.1	--	--	230	95	8.3	.30	9.5	351	--	--
.1	.6	--	--	197	9.0	1.6	.10	9.5	222	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
0	.2	--	--	119	6.2	.3	<.10	4.7	128	--	--
17 1	50	--	--	681	1,300	1,900	.20	40	5,690	.050	--
--	--	--	--	--	--	--	--	--	--	--	--

Table 14. *Physical properties and chemical analyses of water samples collected from*

Station number	Local number (pl. 3)	Date sampled	Well depth (ft)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)	Sodium, dissolved (Na)
										Woodside
420408110493601	24-118-09ccc01	06-11-95	Spring	430	7.7	9.0	--	--	--	--
420415110494401	24-118-08dda01	06-11-95	Spring	515	7.8	6.5	250	54	28	5.7
424946110594001	33-119-23daa01	07-26-92	--	444	7.5	22.0	--	--	--	--
										Dinwoody
422327110361901	28-116-28aac01	09-16-94	Spring	271	8.0	5.0	--	--	--	--
423126110420401	29-116-06cca01	08-05-93	Spring	174	8.4	5.0	90	23	8.0	0.7
										[2]Phosphoria Formation
415150110495501	22-118-29aab01	06-11-65	530	4,830	7.8	--	2,400	530	260	420
415230110494801	22-118-20ad01	09-22-71	Spring	1,650	7.5	9.5	840	230	65	70
										Tensleep
430800110412700	NE	07-10-72	Spring	264	7.6	4.0	140	41	9.2	.3
431158110562500	NE	09-08-71	Spring	309	7.9	6.0	170	41	16	1.0
		09-08-93	Spring	294	8.0	5.0	160	39	15	.7
										Wells
414950111013001	21-120-10da01	09-23-71	191	839	7.4	14.0	330	75	34	50
421443110470400	26-117.5-13bad00	09-11-71	Spring	237	7.7	3.5	130	37	8.2	1.8
		09-13-94	Spring	237	8.0	5.0	120	33	8.0	1.8
423155110421501	NE	09-14-71	Spring	178	8.1	4.0	90	27	5.6	0.5
423230110421501	NE	09-14-71	Spring	210	--	3.5	100	29	6.8	.5
		08-04-93	Spring	188	7.2	4.5	96	23	9.3	.6
425132110380301	33-116-12b01	07-13-72	Spring	310	6.6	4.5	170	45	13	.9
										Madison
421702110201501	26-114-01bac01	09-15-65	Spring	355	7.7	--	180	46	16	1.2
		08-17-76	Spring	375	7.3	10.0	--	--	--	--
		11-18-76	Spring	--	7.5	8.0	190	48	17	2.3
423148110411601	29-116-06add01	08-05-93	Spring	506	8.0	6.0	270	72	21	.8
424440110505001	NE	09-14-71	Spring	186	8.2	4.0	93	29	5.0	ND
		10-04-93	Spring	189	8.3	4.5	98	25	8.6	.4
425040110513000	33-118-13acc01	09-10-71	Spring	338	7.8	5.0	170	46	14	.8
430838110582200	37-118-34dcd00	09-08-71	Spring	360	8.1	6.0	200	41	24	1.6
										Darby
425951110562201	NE	09-15-94	Spring	287	8.3	4.0	160	36	16	.4

wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued

Sodium adsorption ratio	Potassium, dissolved (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Alkalinity, total as ($CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, NO_2+NO_3, dissolved (as N)	Phosphorus, total (P)
Shale											
--	--	--	--	--	--	--	--	--	--	--	--
.2	1.0	--	--	215	56	3.6	.30	11	293	--	--
--	--	--	--	--	--	--	--	--	--	--	--
Formation											
--	--	--	--	--	--	--	--	--	--	--	--
0	.4	--	--	91	4.1	.4	.30	5.3	91	--	--
and related rocks											
4	51	--	--	146	2,600	360	2.6	8.3	4,340	--	--
1	7.9	--	--	238	650	51	.80	9.2	1,230	.130	--
Sandstone											
0	.3	--	--	135	3.1	1.0	.40	4.5	143	.380	--
0	.3	--	--	167	3.3	.9	.10	5.4	171	.510	--
0	.3	--	--	161	3.1	.4	.10	5.0	161	--	--
Formation											
1	3.1	--	--	225	160	48	0.50	12	521	0.830	--
0.1	0.7	--	--	118	1.0	1.4	.20	8.3	131	.390	--
.1	.4	--	--	108	13	0.7	<.10	7.9	132	--	--
0	.7	104	0	--	4.1	1.0	.40	5.8	100	--	--
0	.2	110	0	--	12	3.1	.30	5.3	110	--	--
0	.3	--	--	85	11	.3	.20	4.8	102	--	--
0	.3	196	0	--	10	1.0	.30	3.3	171	--	--
Limestone											
0	.4	--	--	162	19	.8	.30	5.4	186	--	--
--	--	--	--	--	--	--	--	--	--	--	--
.1	.6	--	--	160	28	3.1	.30	5.8	199	.100	0.010
0	.6	--	--	163	120	.9	.40	4.9	311	--	--
0	.7	101	0	--	9.9	1.0	.50	4.3	104	--	--
0	.2	--	--	85	11	.6	.40	4.0	105	--	--
0	.5	--	--	162	28	1.1	.30	5.6	195	.220	--
0	.6	--	--	203	3.8	.7	.10	7.9	202	.100	--
Formation											
0	.3	--	--	157	1.5	.4	<.10	3.5	155	--	--

Table 14. *Physical properties and chemical analyses of water samples collected from*

Station number	Local number (pl. 3)	Date sampled	Well depth (ft)	Specific conductance (μS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)	Sodium, dissolved (Na)
										Bighorn
421504110183101	26-113-07c01	10-18-77	Spring	500	7.2	9.0	270	59	30	6.9
421509110185301	26-113-07bda01	10-18-77	Spring	400	7.6	8.0	220	46	25	6.0
		07-27-95	Spring	452	8.0	7.5	210	44	25	10
421612110182301	26-113-06ada01	08-10-86	Spring	420	7.3	7.5	210	47	23	5.2
		07-12-95	Spring	350	7.7	8.0	250	57	27	12
		07-12-95	Spring	350	7.7	8.0	260	57	28	12
425420110522001	34-118-26aad01	09-10-71	Spring	281	8.0	4.5	150	35	14	ND
431200111014500	37-118-18aab00	09-08-71	Spring	340	7.7	6.5	200	51	18	.9
		08-12-93	Spring	369	7.6	5.0	--	--	--	--
430157110580500	NE	09-10-71	Spring	245	7.8	4.5	150	35	14	1.2

[1]This well was part of a baseline ground-water monitoring program in Star Valley. Additional chemcial analyses for each site are available in Table 16.

[2]In Wyoming, the Phosphoria Formation is synonymous with the Park City Formation (Lane, 1973, p. 4).

wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued

Sodium adsorption ratio	Potassium, dissolved (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Alkalinity, total as ($CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, NO_2+NO_3, dissolved (as N)	Phosphorus, total (P)
Dolomite											
.2	1.3	--	--	230	33	10	.10	8.3	287	.150	.010
.2	.7	--	--	180	22	7.7	.10	7.6	226	.650	.010
.3	.8	--	--	172	40	15	.20	6.4	249	.970	<.010
.2	.6	--	--	191	23	6.7	.10	6.3	229	.560	--
.3	.4	--	--	191	56	18	.10	7.0	293	--	--
.3	.4	--	--	191	55	18	.10	7.0	294	--	--
0	.4	146	0	--	21	.6	.20	7.4	153	--	--
0	.5	--	--	206	1.3	1.5	.10	5.4	203	.240	--
--	--	--	--	--	--	--	--	--	--	--	--
0	.7	--	--	148	6.3	1.3	.0	4.2	153	.200	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming*

[Local number: See text describing well-numbering system in the section titled Ground-Water Data. Analytical results in micrograms per liter; --, no data; <, less than; ND, not detected]

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
Quaternary Alluvium and Colluvium															
414152110051001	07-14-95	--	--	--	--	--	--	--	24	--	15	--	--	--	--
414453110271601	07-10-95	--	--	--	--	--	--	--	89	--	210	--	--	--	--
414459110313601	07-14-95	--	--	--	--	--	--	--	1,200	--	14	--	--	--	--
414606110194601	07-10-95	--	--	--	--	--	--	--	15	--	17	--	--	--	--
414642110115201	06-25-95	--	--	--	--	--	--	--	<3	--	1	--	--	--	--
414645110121101	06-25-95	--	--	--	--	--	--	--	<3	--	23	--	--	--	--
414708110141201	06-25-95	--	--	--	--	--	--	--	30	--	<3	--	--	--	--
414721110145701	06-25-95	--	--	--	--	--	--	--	4	--	1	--	--	--	--
414755110573201	09-22-71	--	--	--	250	--	--	--	--	--	--	--	--	--	--
415050110333401	08-01-95	--	--	--	--	--	--	--	33	--	<1	--	--	--	--
415058110333801	08-01-95	--	--	--	--	--	--	--	100	--	15	--	--	--	--
415109110334101	08-01-95	--	--	--	--	--	--	--	58	--	5	--	--	--	--
415250110361301	06-27-95	--	--	--	--	--	--	--	570	--	2	--	--	--	--
415557110571701	06-09-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
415841110563701	08-22-89	--	--	--	--	--	--	--	--		--	--	--	<5	--
420013110560901	06-09-95	--	--	--	--	--	--	--	620	--	63	--	--	--	--
420103110040401	10-18-77	--	--	--	40	--	--	--	20	--	20	--	--	--	--
420112110325401	08-01-95	--	--	--	--	--	--	--	500	--	39	--	--	--	--
420253110554601	06-10-95	--	--	--	--	--	--	--	9	--	1	--	--	--	--
420254110555801	06-10-95	--	--	--	--	--	--	--	6	--	<1	--	--	--	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
						Quaternary Alluvium and Colluvium--Continued									
420340110583301	06-10-95	--	--	--	--	--	--	--	<3	--	4	--	--	--	--
	06-10-95	--	--	--	--	--	--	--	7	--	3	--	--	--	--
420525110401401	06-27-95	--	--	--	--	--	--	--	<3	--	10	--	--	--	--
420552110223301	07-28-95	--	--	--	--	--	--	--	120	--	45	--	--	--	--
420558110133001	07-28-95	--	--	--	--	--	--	--	15	--	<3	--	--	--	--
420905110111401	07-29-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
420906110582301	06-10-95	--	--	--	--	--	--	--	36	--	<1	--	--	--	--
421115111012701	06-10-95	--	--	--	--	--	--	--	6	--	<1	--	--	--	--
421154110095801	08-20-76	--	--	--	70	--	--	--	60	--	<10	--	--	--	--
421155110100301	08-20-76	--	--	--	60	--	--	--	80	--	<10	--	--	--	--
421245110113001	07-27-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
421247111024601	06-09-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
421252110113601	07-27-95	--	--	--	--	--	--	--	<3	--	1	--	--	--	--
421259110102901	08-20-76	--	--	--	30	--	--	--	70	--	<10	--	--	--	--
	08-12-89	--	--	--	--	--	--	--	--	--	--	--	--	<5	--
421301111023201	06-09-95	--	--	--	--	--	--	--	4	--	1	--	--	--	--
421630111015501	09-21-71	--	--	--	40	--	--	--	--	--	--	--	--	--	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
					Quaternary Alluvium and Colluvium--Continued										
423238110533201	10-07-93	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	03-15-94	--	--	--	10	--	--	--	--	--	--	--	--	--	--
	05-23-94	--	--	--	<10	--	--	--	--	--	--	--	--	--	--
	07-25-94	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	03-06-95	--	--	--	--	--	--	--	7	--	<1	--	--	--	--
	05-18-95	--	--	--	--	--	--	--	6	--	1	--	--	--	--
	07-25-95	--	--	--	--	--	--	--	10	--	<1	--	--	--	--
	10-17-94	--	--	--	20	--	--	--	10	--	<1	--	--	--	--
423620110554000	09-21-71	--	--	--	30	--	--	--	--	--	--	--	--	--	--
423748110551500	09-14-71	--	--	--	30	--	--	--	--	--	--	--	--	--	--
424128110585301	08-23-89	--	--	--	--	--	--	--	--	--	--	--	--	<5	--
424216110585501	10-06-93	--	--	--	10	--	--	--	--	--	--	--	--	--	--
	03-15-94	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	05-23-94	--	--	--	30	--	--	--	--	--	--	--	--	--	--
	07-25-94	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	03-08-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
	05-18-95	--	--	--	--	--	--	--	6	--	<1	--	--	--	--
	07-25-95	--	--	--	--	--	--	--	7	--	<1	--	--	--	--
	10-17-94	--	--	--	20	--	--	--	6	--	--	<1	--	--	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
Quaternary Alluvium and Colluvium--Continued															
424423110570901	10-08-93	--	--	--	<10	--	--	--	--	--	--	--	--	--	--
	03-15-94	--	--	--	10	--	--	--	--	--	--	--	--	--	--
	05-23-94	--	--	--	<10	--	--	--	--	--	--	--	--	--	--
	07-25-94	--	--	--	<10	--	--	--	--	--	--	--	--	--	--
	03-06-95	--	--	--	--	--	--	--	<3	--	--	<1	--	--	--
	05-18-95	--	--	--	--	--	--	--	<3	--	--	<1	--	--	--
	07-25-95	--	--	--	--	--	--	--	<3	--	--	<1	--	--	--
	10-17-94	--	--	--	10	--	--	--	12	--	--	<1	--	--	--
424520111014000	09-10-71	--	--	--	60	--	--	--	--	--	--	--	--	--	--
424640110555000	09-10-71	--	--	--	30	--	--	--	--	--	--	--	--	--	--
424740110572601	10-06-93	--	--	--	<10	--	--	--	--	--	--	--	--	--	--
	03-16-94	--	--	--	10	--	--	--	--	--	--	--	--	--	--
	05-24-94	--	--	--	10	--	--	--	--	--	--	--	--	--	--
	07-25-94	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	03-06-95	--	--	--	--	--	--	--	8	--	--	<1	--	--	--
	05-18-95	--	--	--	--	--	--	--	<3	--	--	<1	--	--	--
	07-25-95	--	--	--	--	--	--	--	<3	--	--	<1	--	--	--
	10-17-94	--	--	--	20	--	--	--	10	--	--	<1	--	--	--
425110110590000	09-10-71	--	--	--	20	--	--	--	--	--	--	--	--	--	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
Quaternary Alluvium and Colluvium--Continued															
425135110592201	10-06-93	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	03-17-94	--	--	--	30	--	--	--	--	--	--	--	--	--	--
	05-24-94	--	--	--	10	--	--	--	--	--	--	--	--	--	--
	07-26-94	--	--	--	30	--	--	--	--	--	--	--	--	--	--
	10-18-94	--	--	--	20	--	--	--	<3	--	<1	--	--	--	--
	05-18-95	--	--	--	--	--	--	--	5	--	<1	--	--	--	--
	03-07-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
	07-25-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
425200110591000	09-10-71	--	--	--	40	--	--	--	--	--	--	--	--	--	--
425540110581801	10-05-93	--	--	--	<10	--	--	--	--	--	--	--	--	--	--
425638111002201	10-07-93	--	--	--	<10	--	--	--	--	--	--	--	--	--	--
425638111002201	03-17-94	--	--	--	<10	--	--	--	--	--	--	--	--	--	--
	05-23-94	--	--	--	<10	--	--	--	--	--	--	--	--	--	--
	07-25-94	--	--	--	10	--	--	--	--	--	--	--	--	--	--
	03-06-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
	05-19-95	--	--	--	--	--	--	--	4	--	<1	--	--	--	--
	07-26-95	--	--	--	--	--	--	--	4	--	3	--	--	--	--
	10-17-94	--	--	--	<10	--	--	--	<3	--	<1	--	--	--	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
Quaternary Alluvium and Colluvium--Continued															
425650110584000	09-10-71	--	--	--	30	--	--	--	--	--	--	--	--	--	--
425759111003901	08-24-89	--	--	--	--	--	--	--	--	--	--	--	--	<5	--
425855111020601	10-08-93	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	03-16-94	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	05-25-94	--	--	--	10	--	--	--	--	--	--	--	--	--	--
	07-26-94	--	--	--	10	--	--	--	--	--	--	--	--	--	--
	05-19-95	--	--	--	--	--	--	--	9	--	<1	--	--	--	--
	03-07-95	--	--	--	--	--	--	--	8	--	<1	--	--	--	--
	07-26-95	--	--	--	--	--	--	--	5	--	<1	--	--	--	--
	10-18-94	--	--	--	20	--	--	--	4	--	<1	--	--	--	--
425857110591901	10-07-93	--	--	--	<10	--	--	--	--	--	--	--	--	--	--
	03-16-94	--	--	--	<10	--	--	--	--	--	--	--	--	--	--
	05-24-94	--	--	--	10	--	--	--	--	--	--	--	--	--	--
	07-26-94	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	05-19-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
	07-25-92	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03-07-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
	07-26-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
	10-18-94	--	--	--	<10	--	--	--	<3	--	<1	--	--	--	--
425903111022400	09-10-71	--	--	--	20	--	--	--	--	--	--	--	--	--	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
Quaternary Alluvium and Colluvium--Continued															
430046111004301	10-05-93	--	--	--	10	--	--	--	--	--	--	--	--	--	--
430057111003801	03-16-94	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	05-24-94	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	07-26-94	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	10-18-94	--	--	--	20	--	--	--	<3	--	<1	--	--	--	--
	03-07-95	--	--	--	--	--	--	--	4	--	<1	--	--	--	--
	07-26-95	--	--	--	--	--	--	--	4	--	<1	--	--	--	--
	05-19-95	--	--	--	--	--	--	--	8	--	<1	--	--	--	--
430331111013301	10-07-93	--	--	--	<10	--	--	--	--	--	--	--	--	--	--
	03-17-94	--	--	--	10	--	--	--	--	--	--	--	--	--	--
	05-25-94	--	--	--	20	--	--	--	--	--	--	--	--	--	--
	07-26-94	--	--	--	10	--	--	--	--	--	--	--	--	--	--
	03-07-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
	07-26-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
	10-18-94	--	--	--	<10	--	--	--	<3	--	<1	--	--	--	--
	05-19-95	--	--	--	--	--	--	--	4	--	<1	--	--	--	--
430356111013000	09-10-71	--	--	--	10	--	--	--	--	--	--	--	--	--	--
430441111003601	10-16-94	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
430444111003701	10-16-94	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
430621111012100	09-08-71	--	--	--	150	--	--	--	--	--	--	--	--	--	--
430951111010800	09-08-71	--	--	--	40	--	--	--	--	--	--	--	--	--	--
431030111020300	09-08-71	--	--	--	20	--	--	--	--	--	--	--	--	--	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
Quaternary Terrace Deposits															
414007110172501	07-31-95	--	--	--	--	--	--	--	78	--	<3	--	--	--	--
414749110410101	06-23-95	--	--	--	--	--	--	--	120	--	51	--	--	--	--
414957110321501	11-07-72	--	--	--	60	--	--	--	80	--	--	--	--	--	--
420526110530801	06-11-95	--	--	--	--	--	--	--	<3	--	5	--	--	--	--
421145111014801	09-21-71	--	--	--	50	--	--	--	--	--	--	--	--	--	--
Salt Lake and Teewinot Formations															
423958110591600	09-14-71	--	--	--	40	--	--	--	--	--	--	--	--	--	--
430544110595800	09-10-71	--	--	--	20	--	--	--	--	--	--	--	--	--	--
430921111003800	09-08-71	--	--	--	30	--	--	--	--	--	--	--	--	--	--
Fowkes Formation															
414343110560701	06-20-95	--	--	--	--	--	--	--	4	--	14	--	--	--	--
Laney Shale Member of the Green River Formation															
414517110240701	06-26-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
414625110192001	06-23-65	--	--	--	--	--	--	--	470	--	--	--	--	--	--
414708110140001	06-25-95	--	--	--	--	--	--	--	63	--	<3	--	--	--	--
415210110082201	10-19-65	--	--	--	1,400	--	--	--	30	--	--	ND	--	--	--
415858110111201	10-17-77	--	--	--	100	--	--	--	30	--	8	--	--	--	--
Wilkins Peak Member of the Green River Formation															
414311110253401	11-06-76	--	--	--	4,200	--	--	--	60	--	<10	--	--	--	--
Angelo Member of Green River Formation															
415511110414101	10-20-77	--	--	--	50	--	--	--	20	--	<10	--	--	--	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
							Fossil Butte Member of the Green River Formation								
413715110470701	11-06-76	--	--	--	50	--	--	--	50	--	<10	--	--	--	--
	06-23-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
413941110402201	06-12-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
414254110505001	05-22-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
414458110495301	06-21-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
414539110415601	06-13-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
414617110440901	06-13-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
414717110433001	06-13-95	--	--	--	--	--	--	--	<3	--	2	--	--	--	--
415757110433301	07-11-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
							Wasatch Formation								
413502110531101	06-13-72	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	06-22-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
413658110421701	11-06-76	--	--	--	130	--	--	--	50	--	100	--	--	--	--
413803110531701	11-06-76	--	--	--	<20	--	--	--	60	--	<10	--	--	--	--
	06-22-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
414055110293601	11-06-76	--	--	--	100	--	--	--	80	--	<10	--	--	--	--
414312110480501	06-12-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
414707110485901	06-21-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
414708110533901	06-24-95	--	--	--	--	--	--	--	<3	--	1	--	--	--	--
414800110442001	09-22-71	--	--	--	60	--	--	--	--	--	--	--	--	--	--
414925110473001	10-18-71	--	--	--	460	--	--	--	--	--	--	--	--	--	--
415038110451001	10-20-77	<100	<1	<100	200	ND	ND	ND	1,600	<2	200	<0.1	<1	ND	1100

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
							Wasatch Formation--Continued								
420611110392801	08-01-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
420958110192701	07-29-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
421258110100401	08-20-76	--	--	--	640	--	--	--	80	--	<10	--	--	--	--
421446110435701	07-11-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
421501110115001	08-20-76	--	--	--	320	--	--	--	20	--	<10	--	--	--	--
421504110195501	06-07-86	--	--	--	--	--	--	--	--	--	--	--	--	--	--
421540110114101	08-20-76	--	--	--	380	--	--	--	20	--	30	--	--	--	--
421551110120701	08-20-76	--	--	--	330	--	--	--	<10	--	<10	--	--	--	--
421554110112901	08-20-76	--	--	--	470	--	--	--	70	--	<10	--	--	--	--
							Evanston Formation								
414758110474701	06-13-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
414811110405201	06-23-95	--	--	--	--	--	--	--	510	--	70	--	--	--	--
415515110373001	11-06-72	--	--	--	<20	--	--	--	30	--	--	--	--	--	--
							Hilliard Shale								
413758110342000	10-05-72	--	--	--	430	--	--	--	90	--	--	--	--	--	--
415509110355501	10-20-77	--	--	--	30	--	--	--	<10	--	<10	--	--	--	--
415631110325701	08-02-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
							Frontier Formation								
414053110314501	11-05-76	--	--	--	320	--	--	--	150	--	<10	--	--	--	--
415944110305301	10-20-77	--	--	--	50	--	--	--	<10	--	20	--	--	--	--
	10-16-94	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
Sage Junction Formation															
413819110565501	05-20-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
Aspen Shale															
414406110304801	06-26-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
415427110294701	11-06-72	--	--	--	90	--	--	--	20	--	--	--	--	--	--
420023110285401	10-20-77	--	--	--	80	--	--	--	<10	--	30	--	--	--	--
421541110313801	07-13-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
430846110524200	09-08-71	--	--	--	30	--	--	--	--	--	--	--	--	--	--
431158110562500	09-08-71	--	--	--	20	--	--	--	--	--	--	--	--	--	--
431252110500800	09-08-71	--	--	--	20	--	--	--	--	--	--	--	--	--	--
431300110483300	09-08-71	--	--	--	60	--	--	--	--	--	--	--	--	--	--
Bear River Formation															
414546110195401	06-25-95	--	--	--	--	--	--	--	280	--	7	--	--	--	--
414555110232701	06-26-95	--	--	--	--	--	--	--	220	--	15	--	--	--	--
414712110275001	11-08-72	--	--	--	110	--	--	--	30	--	--	--	--	--	--
	10-17-77	--	--	--	60	--	--	--	<10	--	4	--	--	--	--
420928110283201	08-14-72	--	--	--	60	--	--	--	160	--	--	--	--	--	--
	10-18-77	--	--	--	70	--	--	--	<10	--	4	--	--	--	--
425840110383200	07-12-72	--	--	--	50	--	--	--	20	--	--	--	--	--	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
Gannett Group															
414321110582801	06-20-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
420533110533501	09-17-71	--	--	--	30	--	--	--	--	--	--	--	--	--	--
421642110431901	07-11-95	--	--	--	--	--	--	--	4	--	<1	--	--	--	--
422036110572800	09-16-71	--	--	--	30	--	--	--	--	--	--	--	--	--	--
423340110544000	09-14-71	--	--	--	40	--	--	--	--	--	--	--	--	--	--
423348110523000	07-09-72	--	--	--	20	--	--	--	ND	--	--	--	--	--	--
431306110472400	09-08-71	--	--	--	40	--	--	--	--	--	--	--	--	--	--
Preuss Sandstone or Preuss Redbeds															
422333110575500	09-15-71	--	--	--	40	--	--	--	--	--	--	--	--	--	--
422828110581200	09-15-71	--	--	--	40	--	--	--	--	--	--	--	--	--	--
Twin Creek Limestone															
414708110533101	06-24-95	--	--	--	--	--	--	--	800	--	190	--	--	--	--
421557110263201	07-13-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
424730110550000	09-10-71	--	--	--	40	--	--	--	--	--	--	--	--	--	--
Nugget Sandstone															
414721110503401	06-21-95	--	--	--	--	--	--	--	26	--	<1	--	--	--	--
420429110504301	06-11-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
421211110261901	10-18-77	--	--	--	30	--	--	--	<10	--	<10	--	--	--	--
421313110255001	07-29-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
421405110275601	10-18-77	--	--	--	<20	--	--	--	<10	--	<10	--	--	--	--
	07-13-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
422821110395801	10-15-71	--	--	--	10	--	--	--	--	--	--	--	--	--	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
Thaynes Limestone															
415242110502001	09-22-71	--	--	--	80	--	--	--	--	--	--	--	--	--	--
	06-07-65	--	--	--	ND	--	--	--	--	--	--	--	--	--	--
420837110490801	06-24-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
424955110595500	09-10-71	--	--	--	4,100	--	--	--	--	--	--	--	--	--	--
Woodside Shale															
420415110494401	06-11-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
[1]Phosphoria Formation and related rocks															
415150110495501	06-11-65	--	--	--	<1	--	--	--	ND	--	--	--	--	--	--
415230110494801	09-22-71	--	--	--	230	--	--	--	--	--	--	--	--	--	--
Tensleep Sandstone															
430800110412700	07-10-72	--	--	--	ND	--	--	--	10	--	--	--	--	--	--
Wells Formation															
414950111013001	09-23-71	--	--	--	80	--	--	--	--	--	--	--	--	--	--
421443110470400	09-17-71	--	--	--	20	--	--	--	--	--	--	--	--	--	--
Madison Limestone															
421702110201501	09-15-65	--	--	--	10	--	--	--	10	--	10	--	--	--	--
	11-18-76	20	3	<100	<20	ND	ND	3	60	<2	<10	<0.5	2	ND	<20
	10-20-77	--	--	--	6	--	--	--	<10	--	<10	--	--	--	--
425040110513000	09-10-71	--	--	--	10	--	--	--	--	--	--	--	--	--	--
430838110582200	09-08-71	--	--	--	20	--	--	--	--	--	--	--	--	--	--

Table 15. *Concentrations of selected trace elements in water samples collected from wells completed in and springs issuing from selected geologic units in Lincoln County, Wyoming--Continued*

Station number	Date	Aluminum, dissolved (Al)	Arsenic, dissolved (As)	Barium, dissolved (Ba)	Boron, dissolved (B)	Cadmium, dissolved (Cd)	Chromium, dissolved (Cr)	Copper, dissolved (Cu)	Iron, dissolved (Fe)	Lead, dissolved (Pb)	Manganese, dissolved (Mn)	Mercury, dissolved (Hg)	Selenium, dissolved (Se)	Silver, dissolved (Ag)	Zinc, dissolved (Zn)
Bighorn Dolomite															
421504110183101	10-18-77	--	--	--	30	--	--	--	<10	--	<10	--	--	--	--
421509110185301	10-18-77	--	--	--	30	--	--	--	<10	--	20	--	--	--	--
	07-27-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
421612110182301	07-12-95	--	--	--	--	--	--	--	<3	--	<1	--	--	--	--
430157110580500	09-10-71	--	--	--	10	--	--	--	--	--	--	--	--	--	--
431200111014500	09-08-71	--	--	--	30	--	--	--	--	--	--	--	--	--	--

[1]In Wyoming, the Phosphoria Formation is synonymous with the Park City Formation (Lane, 1973, p. 4).

Table 16. *Physical properties and chemical analyses of ground-water samples collected*

[Local number: See text describing well-numbering system in the section titled
ft, feet; µS/cm, microsiemens per centimeter at 25

Monitoring well number (fig. 13)	Station number/ local number	Date sampled	Well depth (ft)	Water level (ft below land surface)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)
W1	423238110533201/ 30-118-33bcb01	10-07-93	85	25.5R	431	7.7	8.0	230	72	11
		03-15-94		28.1R	421	7.8	6.0	200	63	10
		05-23-94		17.7R	483	7.5	7.0	260	84	11
		07-25-94		20.9R	449	7.7	7.0	240	75	12
		10-17-94		26.1R	421	7.6	8.0	220	68	11
		03-06-95		24.2R	416	7.8	7.0	210	67	11
		05-18-95		17.8	485	7.6	6.5	250	81	12
		07-25-95		17.7R	464	7.5	7.5	250	80	11
W2	424216110585501/ 31-119-03bad01	10-06-93	70	17.0R	543	7.6	9.0	260	77	16
		03-15-94		30.8	535	7.7	8.0	240	70	15
		05-23-94		20.6R	533	7.6	9.5	260	79	15
		07-25-94		16.8R	523	7.5	9.5	260	76	16
		10-17-94		26.4	540	7.4	10.0	260	76	16
		03-08-95		27.1R	627	7.7	9.5	290	88	17
		05-18-95		10.9	564	7.6	9.5	260	76	16
		07-25-95		6.8R	544	7.7	10.5	260	77	16
W3	424423110570901/ 32-119-23dad01	10-08-93	75	25.5R	340	8.0	5.0	180	48	14
		03-15-94		41.2	387	7.9	5.0	200	56	15
		05-23-94		34.5R	397	7.9	6.5	200	56	15
		07-25-94		37.0R	389	7.9	6.0	200	56	15
		10-17-94		42.2	380	7.8	6.0	190	53	15
		10-17-94		42.2	380	7.8	5.5	190	52	15
		03-06-95		44.6R	411	8.1	4.5	210	58	16
		05-18-95		40.8	416	7.8	7.0	210	57	17
		07-25-95		26.9R	357	8.0	6.0	190	51	14
W4	424740110572601/ 33-118-31ddc01	10-06-93	50	15.3R	453	7.7	9.0	240	71	15
		03-16-94		16.8R	460	7.7	7.0	220	65	14
		05-24-94		15.8R	457	7.7	8.0	240	72	14
		07-25-94		14.6R	461	7.6	9.0	240	73	15
		10-17-94		16.1	481	7.5	9.5	250	74	15
		03-06-95		16.9R	469	7.9	8.0	240	70	15
		05-18-95		16.1	473	7.7	9.0	240	71	15
		05-18-95		16.1	473	7.7	9.0	240	71	15
		07-25-95		13.4R	566	7.6	9.0	300	89	19

from wells sampled during the Star Valley monitoring study, 1993-95, Lincoln County, Wyoming

Ground-Water Data. Analytical results in milligrams per liter except as indicated;
degrees Celsius; °C, degrees Celsius; <, less than]

Sodium, dissolved (Na)	Sodium adsorption ratio	Potassium, dissolved (K)	Alkalinity, total (as $CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids,' sum of constituents	Nitrogen, $NO_2 + NO_3$, dissolved (as N)	Phosphorus, total (P)
2.8	0.1	0.70	207	29	0.90	0.10	7.9	250	0.30	0.01
3.1	.1	.80	185	39	1.1	<.10	8.5	237	.17	.01
2.5	.1	1.0	243	22	.70	<.10	8.2	281	.60	.01
2.8	.1	3.9	217	26	.50	.10	8.2	262	.28	<.01
2.8	.1	.70	186	36	.80	<.10	7.9	243	.16	.02
3.1	.1	.70	176	46	.90	<.10	6.9	240	.11	.02
2.8	.1	.70	227	26	1.0	<.10	8.0	278	1.2	.02
2.5	.1	.90	229	16	.80	<.10	8.2	260	.64	.01
11	.3	1.1	224	34	15	.20	11	313	2.5	<.01
12	.3	1.2	230	34	13	<.10	12	304	2.4	.01
12	.3	1.2	244	36	14	.10	12	295	2.3	.01
10	.3	1.4	220	36	11	.10	11	306	2.4	.01
11	.3	1.2	208	36	15	<.10	11	312	2.4	.02
14	.4	1.3	222	47	36	<.10	11	353	.75	.01
16	.4	1.1	203	41	31	.10	10	297	.48	.02
13	.4	1.1	216	36	19	<.10	11	310	1.5	<.01
1.0	0	.70	150	39	.30	.30	4.8	196	.25	<.01
1.1	0	.70	119	79	.50	.30	5.3	232	.17	<.01
.9	0	.90	140	69	.50	.30	5.2	234	.27	<.01
.9	0	1.0	146	58	.70	.30	5.1	228	.61	<.01
.9	0	.70	122	66	.50	.30	4.9	222	.38	<.01
.9	0	.70	125	67	.50	.30	4.9	222	.37	<.01
1.0	0	.90	126	79	1.2	.30	4.8	242	.27	.02
1.0	0	.60	124	85	.80	.30	4.7	245	.17	<.01
.9	0	.80	144	40	.80	.30	5.1	201	.35	<.01
2.0	.1	1.0	190	39	4.3	.10	10	273	2.2	.01
1.9	.1	1.0	190	45	1.6	.10	11	265	1.9	.02
1.7	0	1.1	194	47	1.9	.10	9.9	272	1.9	.01
1.8	0	1.2	206	36	2.5	.10	9.8	272	1.6	<.01
1.9	0	1.2	203	41	1.4	.10	11	282	1.8	.02
2.0	.1	.90	188	45	1.5	<.10	10	271	1.9	.02
2.0	.1	1.0	191	46	1.9	.10	10	274	1.8	.02
2.0	.1	.8	191	46	1.9	.10	10	275	1.8	.02
2.1	0	1.2	250	45	4.0	.10	11	333	2.5	.01

Table 16. *Physical properties and chemical analyses of ground-water samples collected*

Monitoring well number (fig. 13)	Station number/ local number	Date sampled	Well depth (ft)	Water level (ft below land surface)	Specific conduct-ance (µS/cm)	pH (standard units)	Water tempera-ture (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magne-sium, dissolved (Mg)
W5	425135110592201/ 33-119-12cba01	10-06-93	25	5.1R	536	7.7	9.0	270	65	25
		03-17-94		4.4	518	7.7	5.0	260	65	24
		05-24-94		4.7	493	7.8	8.0	240	60	22
		07-26-94		5.9R	550	7.6	8.0	270	67	26
		10-18-94		4.9R	544	7.8	9.5	260	64	25
		03-07-95		4.2R	510	7.8	5.0	250	61	23
		05-18-95		4.3	465	7.7	8.5	230	57	22
		07-25-95		4.5	520	7.8	9.5	260	64	24
W6	425638111002201/ 34-119-11cac01	10-07-93	60	8.6R	427	7.7	8.0	230	55	22
		03-17-94		14.7	390	7.9	7.0	210	52	20
		05-23-94		9.3R	396	7.7	8.0	210	51	19
		07-25-94		7.7R	417	7.8	7.5	220	54	21
		10-17-94		11.1R	416	7.5	8.0	210	53	20
		03-06-95		13.9R	388	7.9	8.0	200	49	18
		05-19-95		8.7	413	7.8	8.5	210	53	20
		07-26-95		7.1	423	7.9	7.5	220	55	21
W7	425857110591901/ 35-119-25ccd01	10-07-93	119	78.3R	393	7.8	8.0	210	52	19
		03-16-94		98.3	382	7.9	7.0	210	53	19
		05-24-94		96.2R	381	7.7	8.0	200	50	18
		07-26-94		89.7R	378	7.8	7.5	200	50	19
		10-18-94		94.7R	377	7.8	8.0	200	49	18
		03-07-95		102.6R	388	7.8	8.0	200	50	18
		05-19-95		95.2	380	7.8	8.0	200	49	18
		07-26-95		78.2R	384	7.9	8.0	210	51	19
W8	425855111020601/ 35-119-33abb01	10-08-93	50	12.0R	499	7.7	8.0	230	63	18
		03-16-94		19.8R	496	7.8	5.0	230	64	18
		05-25-94		13.3R	516	7.7	8.0	230	63	17
		07-26-94		12.6R	498	7.8	7.0	230	63	18
		10-18-94		13.0R	507	7.7	9.0	230	63	18
		03-07-95		20.4R	508	7.8	9.5	230	63	18
		05-19-95		13.9	535	7.7	8.0	240	65	19
		07-26-95		9.3R	506	7.8	8.0	230	63	18
		07-26-95		9.3R	506	7.8	8.0	230	63	18

from wells sampled during the Star Valley monitoring study, 1993-95, Lincoln County, Wyoming--Continued

Sodium, dissolved (Na)	Sodium adsorption ratio	Potassium, dissolved (K)	Alkalinity, total (as $CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, $NO_2 + NO_3$, dissolved (as N)	Phosphorus, total (P)
9.4	0.3	1.1	230	48	8.9	0.10	12	312	0.71	0 .03
9.3	.3	1.0	199	45	9.0	<.10	13	305	.69	.03
8.6	.2	1.0	223	38	7.5	<.10	12	286	.63	.09
10	.3	1.2	229	51	11	.10	12	322	.59	.03
9.8	.3	1.1	204	51	10	.10	12	315	.60	.02
9.0	.2	1.1	214	41	8.6	<.10	11	289	.58	.04
8.5	.2	.90	209	29	6.3	.10	12	269	.59	.04
9.1	.2	1.1	228	40	9.2	.10	12	300	.64	.03
1.3	0	.50	195	30	1.1	.30	6.1	243	1.5	<.01
1.2	0	.60	172	30	.80	.20	6.3	224	1.2	<.01
1.1	0	.60	178	31	.80	.20	6.2	222	1.4	.03
1.2	0	.60	191	29	1.1	.20	5.9	236	1.5	<.01
1.1	0	.60	183	29	.90	.20	6.2	233	1.2	<.01
1.0	0	.50	179	28	.70	.20	5.7	215	1.0	<.01
1.1	0	.50	181	28	1.0	.20	6.0	230	1.6	<.01
1.2	0	.50	172	27	1.2	.20	6.3	225	2.0	<.01
1.3	0	.60	193	16	1.1	.20	7.3	220	1.2	.01
1.5	0	.60	214	18	1.3	<.10	7.7	218	.86	.02
1.2	0	.70	192	18	1.2	.10	7.6	214	.78	.02
1.2	0	.50	187	18	1.2	.10	7.1	213	.80	<.01
1.2	0	.60	173	17	1.2	<.10	7.2	211	.82	.01
1.2	0	.60	179	17	1.1	<.10	6.9	209	.78	.02
1.2	0	.50	181	17	1.4	<.10	7.0	210	.75	.01
1.2	0	.60	189	17	1.4	<.10	7.2	215	.99	.01
13	.4	.80	200	38	15	.20	8.3	282	.67	<.01
12	.3	.90	194	41	17	.10	8.5	283	.91	<.01
14	.4	.90	200	40	23	.10	8.4	290	.81	<.01
14	.4	.90	199	39	18	.20	8.2	286	.71	<.01
13	.4	.90	196	38	17	.10	8.7	286	.67	<.01
14	.4	1.0	195	39	19	.10	8.2	284	.76	.01
16	.4	.70	198	41	27	.20	8.2	304	.90	<.01
15	.4	.80	200	35	19	.10	8.4	283	.75	<.01
15	.4	.80	200	3.5	18	.10	8.4	282	.76	<.01

Table 16. *Physical properties and chemical analyses of ground-water samples collected*

Monitoring well number (fig. 13)	Station number/ local number	Date sampled	Well depth (ft)	Water level (ft below land surface)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Hardness (as $CaCO_3$)	Calcium, dissolved (Ca)	Magnesium, dissolved (Mg)
W9	430057111003801/ 35-119-14cbc01	11-20-93	75	31.8R	544	7.9	7.0	270	70	23
		03-16-94		34.6R	555	7.7	8.0	290	76	24
		05-24-94		32.6R	510	7.7	9.5	260	66	22
		07-26-94		29.7R	518	7.6	9.0	270	69	23
		10-18-94		31.1	523	7.8	10.0	260	69	22
		03-07-95		35.3R	560	7.6	9.0	290	75	24
		03-07-95		35.3R	560	7.6	9.0	290	76	24
		05-19-95		31.9	531	7.7	9.0	270	71	23
		07-26-95		27.6R	532	7.8	10.0	270	70	23
W10	430331110133O1/ 36-119-34cbd01	10-07-93	85	20.8R	379	7.8	8.0	190	48	18
		03-17-94		21.8	357	7.9	6.0	170	42	17
		05-25-94		21.2R	352	7.8	7.0	180	45	16
		07-26-94		21.7R	351	7.8	7.0	180	45	17
		10-18-94		21.8R	351	7.9	8.0	180	44	16
		03-07-95		22.1R	345	7.8	6.0	180	44	16
		05-19-95		20.3	345	7.8	7.0	180	45	17
		07-26-95		20.5R	345	8.0	8.0	180	44	16

from wells sampled during the Star Valley monitoring study, 1993-95, Lincoln County, Wyoming--Continued

Sodium, dissolved (Na)	Sodium adsorption ratio	Potassium, dissolved (K)	Alkalinity, total (as $CaCO_3$)	Sulfate, dissolved (SO_4)	Chloride, dissolved (Cl)	Fluoride, dissolved (F)	Silica, dissolved (SiO_2)	Dissolved solids, sum of constituents	Nitrogen, $NO_2 + NO_3$, dissolved (as N)	Phosphorus, total (P)
6.0	0 .2	0.90	420	27	8.4	<0.10	9.3	305	3.1	0 .02
7.0	.2	1.0	228	28	9.9	<.10	10	322	3.4	.01
6.6	.2	.90	248	26	6.4	<.10	9.6	291	2.2	.03
6.1	.2	.90	235	25	6.9	<.10	9.1	299	3.2	.01
5.7	.2	.90	231	24	7.7	<.10	9.2	297	3.2	<.01
6.6	.2	1.0	245	25	8.7	<.10	9.3	317	3.7	.02
6.7	.2	1.0	245	25	8.4	<.10	9.4	318	3.7	.02
6.7	.2	.90	239	25	6.6	<.10	9.4	304	2.9	<.01
6.1	.2	.70	240	25	8.6	<.10	9.2	301	3.2	<.01
3.0	.1	.60	171	17	4.0	.10	5.8	214	2.6	.02
2.8	.1	.70	163	17	3.1	<.10	6.0	197	1.5	<.01
2.8	.1	.70	169	17	3.0	<.10	6.0	198	1.4	<.01
2.9	.1	.60	166	17	2.9	<.10	5.7	198	1.3	<.01
2.8	.1	.60	155	16	2.5	<.10	5.7	194	1.2	<.01
2.8	.1	.60	161	15	2.3	<.10	5.7	190	1.0	<.01
2.8	.1	.60	163	16	2.2	<.10	5.8	194	.90	<.01
2.8	.1	.50	162	15	2.7	<.10	5.8	188	.97	<.01

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