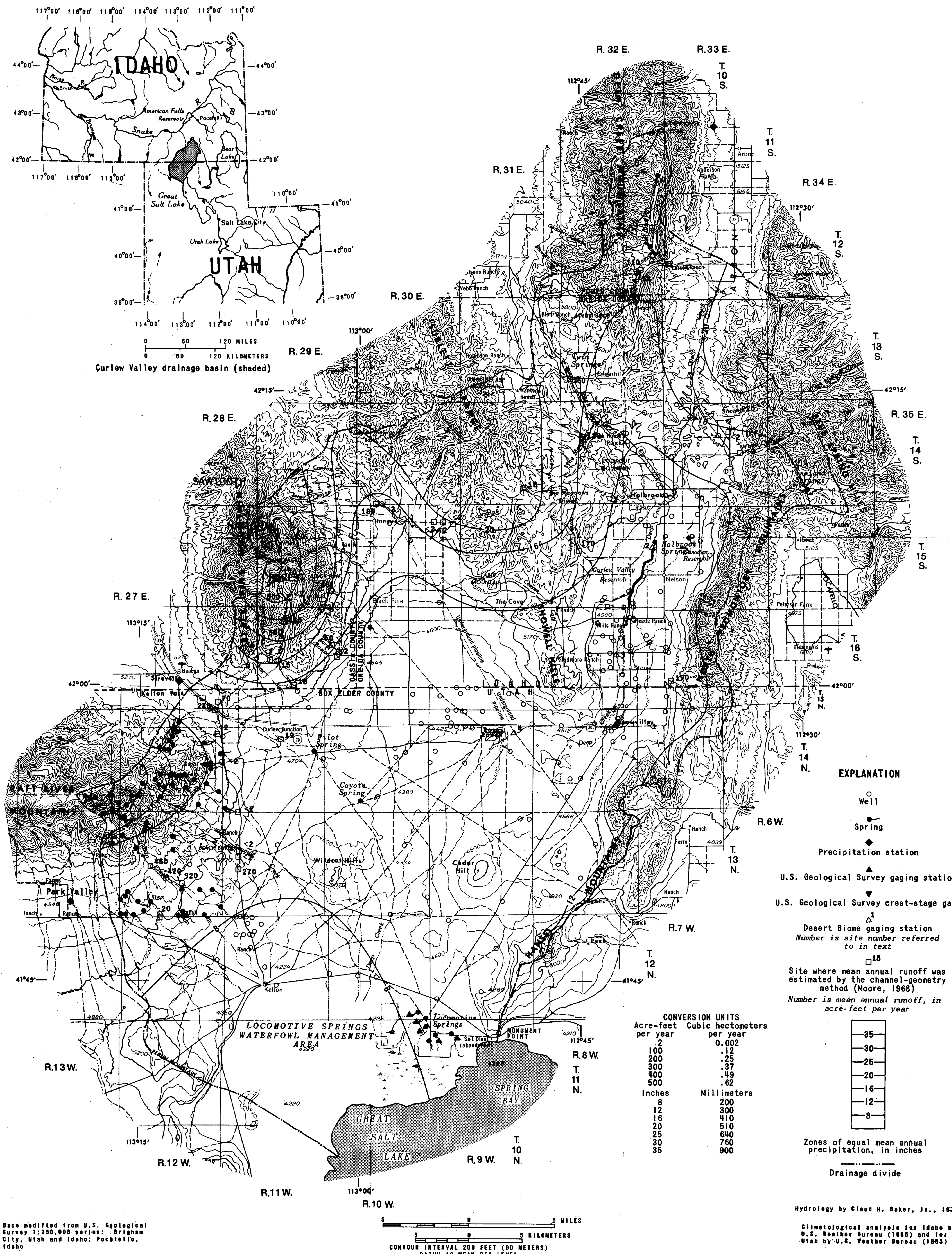
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES

TECHNICAL PUBLICATION NO. 45
PLATE I 1974



Base modified from U.S. Geological Survey 1:250,000 series: Brigham City, Utah and Idaho; Pocatello, Idaho

Hydrology by Claud H. Baker, Jr., 1972

Climatological analysis for Idaho by U.S. Weather Bureau (1965) and for Utah by U.S. Weather Bureau (1963)

MAP SHOWING LOCATIONS OF POINTS WHERE HYDROLOGIC DATA WERE COLLECTED, PRECIPITATION STATIONS, AND ZONES OF MEAN ANNUAL PRECIPITATION, CURLEW VALLEY DRAINAGE BASIN, UTAH AND IDAHO

CONVERSION UNITS

Feet	Meters
440	130
1000	300
2000	600
2700	820
3000	900
3080	940
5000	1500

EXPLANATION

QUATERNARY
- Younger alluvium and colluvium
- Lakebed deposits
- Near-shore lake deposits

QUATERNARY and TERTIARY
- Basalt
- Felsic volcanic rocks

TERTIARY
- Continental sedimentary rocks

PALEOZOIC
- Undifferentiated Paleozoic rocks

PRECAMBRIAN
- Undifferentiated Precambrian rocks

Contact

Fault
Dashed where concealed, dotted where inferred

Thrust fault
Barbs on overriding side

-150
Gravity contour
Shows gravity anomaly, in milligals. Interval 2 milligals. Dashed where approximate. Hachured contours show areas of low gravity closure

Gravity station

3000
Line of equal thickness of low-density material
Interval 1000 feet

○440
Test hole that reached Paleozoic rocks
Number is depth to Paleozoic rocks, in feet

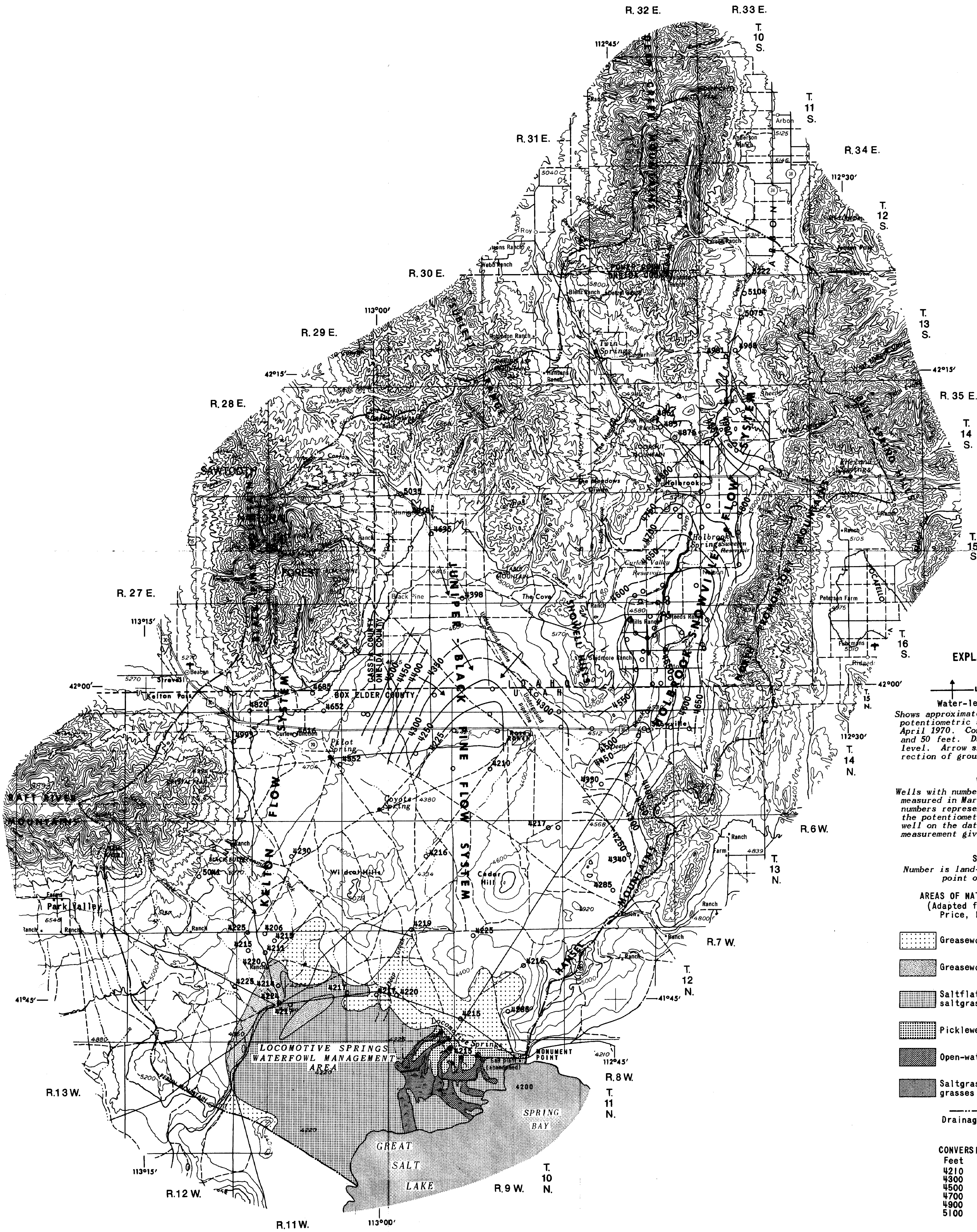
Drainage divide

Base modified from U.S. Geological Survey 1:250,000 series: Brigham City, Utah and Idaho; Pocatello, Idaho

5 0 5 MILES
5 0 5 KILOMETERS
CONTOUR INTERVAL 200 FEET (60 METERS)
DATUM IS MEAN SEA LEVEL

Geology in Idaho adapted from Ross and Forrester (1947) and in Utah from Stokes (1964) and modified by reconnaissance. Interpretation of gravity and thickness of low-density material by Peterson (1973)

MAP SHOWING GENERALIZED GEOLOGY, GRAVITY CONTOURS, AND THICKNESS OF LOW-DENSITY MATERIAL IN THE CURLEW VALLEY DRAINAGE BASIN, UTAH AND IDAHO



EXPLANATION

—4450— Water-level contour

Shows approximate altitude of the potentiometric surface in March-April 1970. Contour interval 25 and 50 feet. Datum is mean sea level. Arrow shows general direction of ground-water movement

4285 ○ Well

Wells with numbers by them were not measured in March-April 1970; the numbers represent the altitude of the potentiometric surface at the well on the date of the water-level measurement given in table 8

4215 Spring

Number is land-surface altitude at point of discharge

AREAS OF NATURAL DISCHARGE
(Adapted from Bolke and Price, 1969, pl. 1)

- Greasewood
- Greasewood and rabbitbrush
- Saltflats (some greasewood, saltgrass, and pickleweed)
- Pickleweed and greasewood
- Open-water surfaces
- Saltgrass and other marsh grasses

—·—·— Drainage divide

CONVERSION UNITS

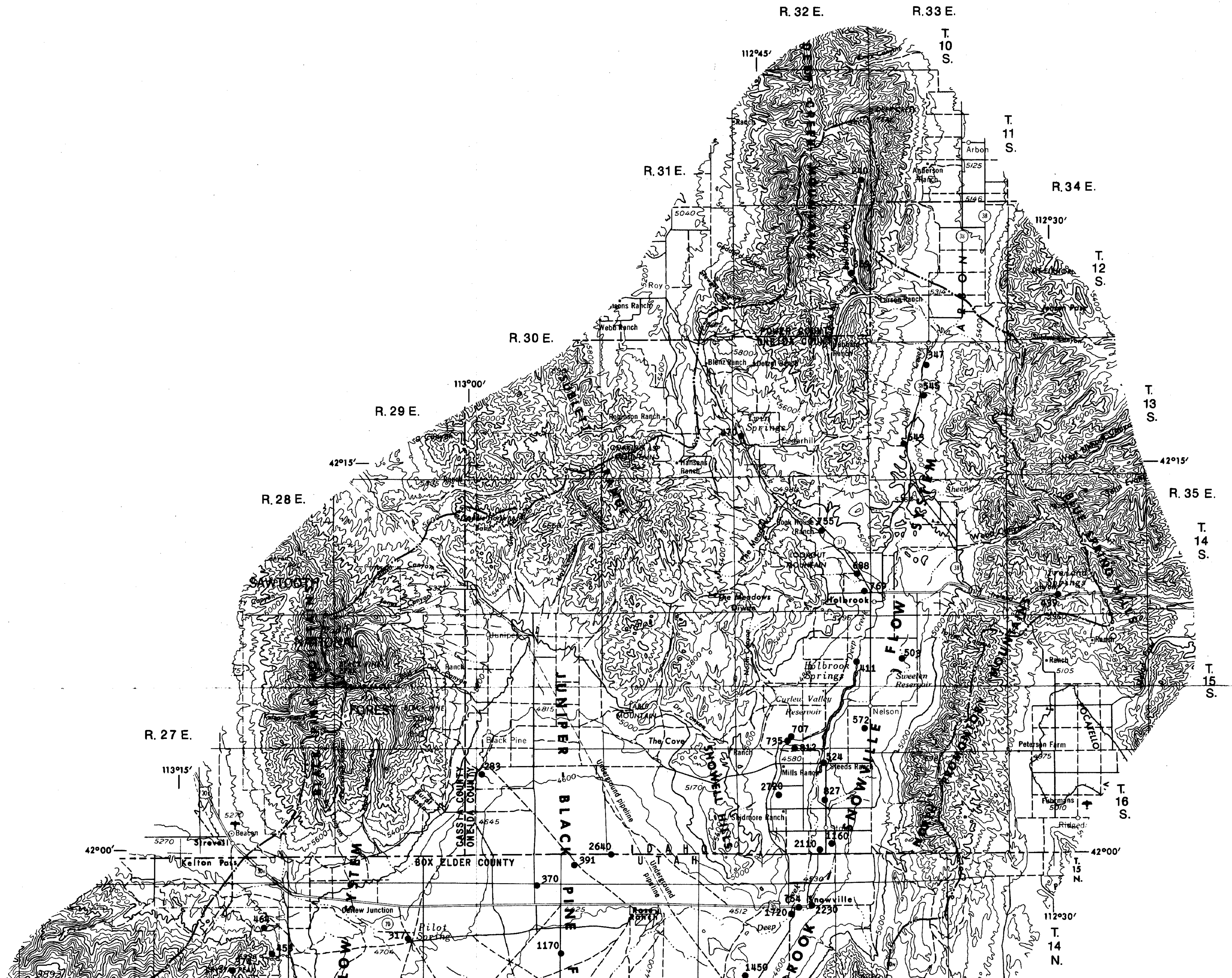
Feet	Meters
4210	1280
4300	1310
4500	1370
4700	1430
4900	1490
5100	1550

Base modified from U.S. Geological Survey 1:250,000 series: Brigham City, Utah and Idaho; Pocatello, Idaho

5 0 5 MILES
5 0 5 KILOMETERS
CONTOUR INTERVAL 200 FEET (60 METERS)
DATUM IS MEAN SEA LEVEL

Hydrology by Ted Arnow and Don Price, 1973

MAP SHOWING WATER LEVELS AND NATURAL DISCHARGE AREAS IN THE CURLEW VALLEY DRAINAGE BASIN, UTAH AND IDAHO



Base modified from U.S. Geological Survey 1:250,000 series: Brigham City, Utah and Idaho; Pocatello, Idaho

5 0 5 MILES
5 0 5 KILOMETERS
CONTOUR INTERVAL 200 FEET (60 METERS)
DATUM IS MEAN SEA LEVEL

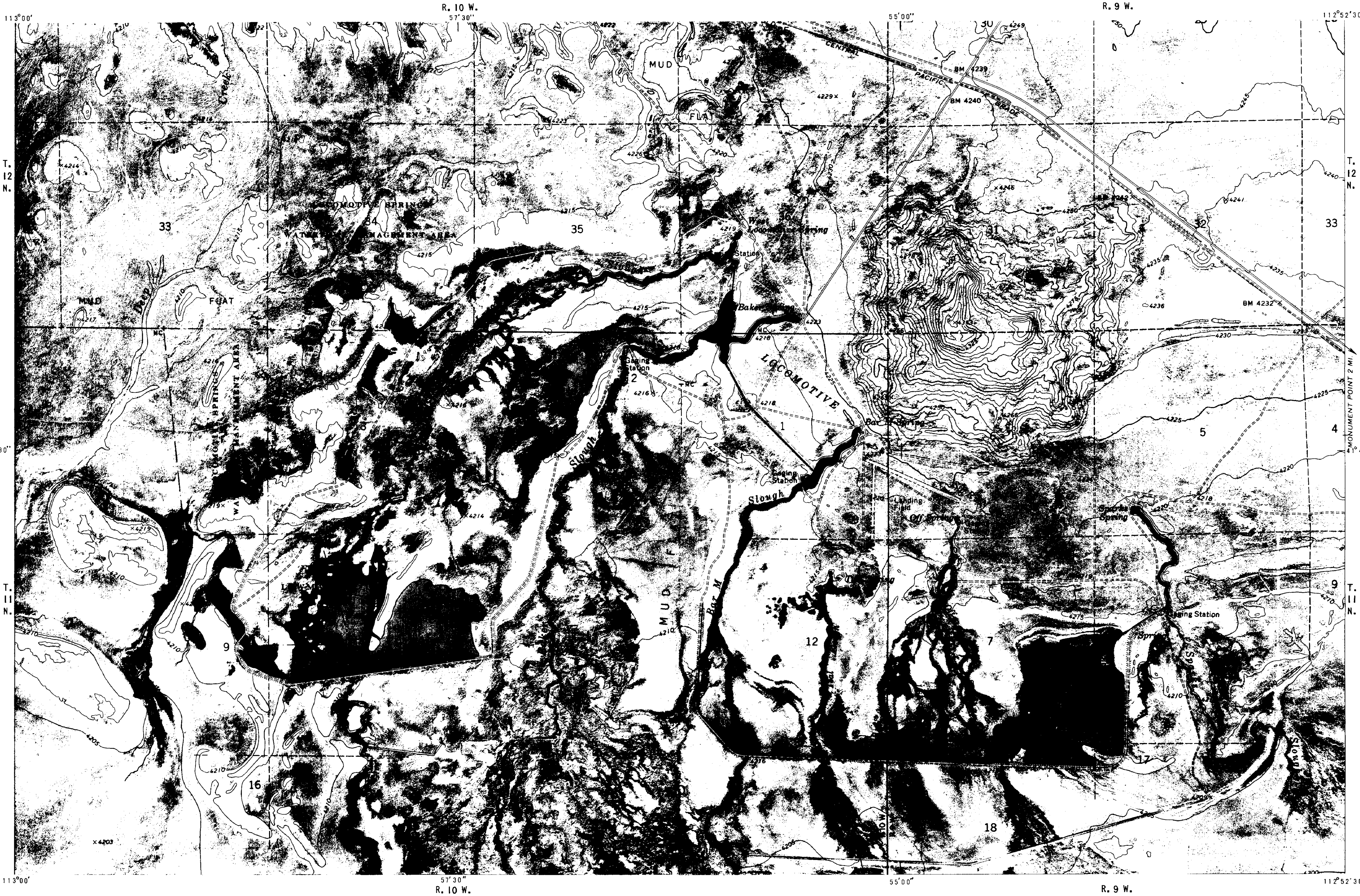
Hydrology by Claud H. Baker, Jr.

MAP SHOWING CONCENTRATION OF DISSOLVED SOLIDS IN WATER FROM WELLS AND SPRINGS SAMPLED FOR CHEMICAL ANALYSIS IN THE CURLEW VALLEY DRAINAGE BASIN, UTAH AND IDAHO

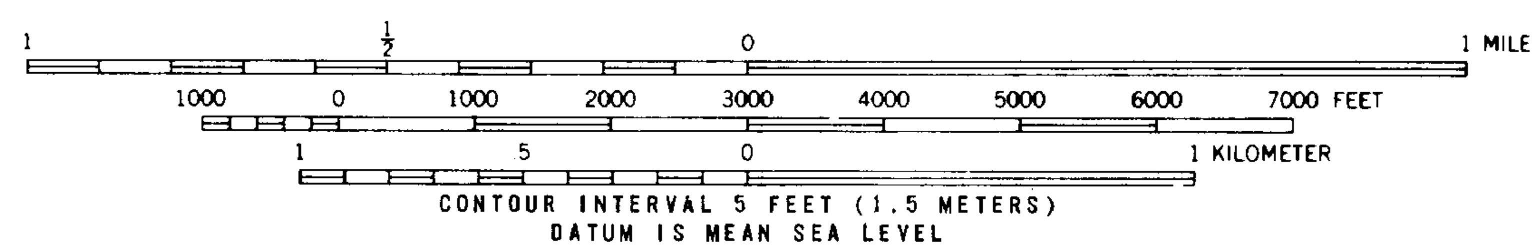
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES

TECHNICAL PUBLICATION NO. 45
PLATE 5 1974



Base from U.S. Geological Survey 1:24,000
series: Locomotive Springs, Utah, 1969



MAP OF LOCOMOTIVE SPRINGS AREA IN CURLEW VALLEY, UTAH

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES

Technical Publication No. 45

WATER RESOURCES OF THE CURLEW VALLEY DRAINAGE BASIN, UTAH AND IDAHO

by

Claud H. Baker, Jr.
Hydrologist, U.S. Geological Survey

Prepared by
the United States Geological Survey
in cooperation with
the Utah Department of Natural Resources
Division of Wildlife Resources

1974

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WATER RESOURCES OF THE CURLEW VALLEY DRAINAGE BASIN, UTAH AND IDAHO

by

Claud H. Baker, Jr.
Hydrologist, U.S. Geological Survey

ABSTRACT

The Curlew Valley drainage basin covers about 1,200 square miles (3,100 km^2) in northern Utah and southern Idaho. Locomotive Springs are in the southern end of the basin. Runoff in this semiarid region is scanty, and the drainage basin includes only two small perennial streams. Deep Creek, the larger of these streams, originates in the northeastern part of the basin in Idaho. A large spring group, Holbrook Springs, contributes an average of about 30 cubic feet per second (0.85 m^3/s) to Deep Creek, but much of the water is diverted in Idaho for irrigation in both States. The mean discharge of the creek near the Utah-Idaho boundary during 1970-72 was about 8.5 cubic feet per second (0.24 m^3/s). Indian Creek drains the Raft River Mountains on the west side of Curlew Valley; the long-term mean discharge of the creek near the foot of the mountains is less than 0.5 cubic foot per second (0.01 m^3/s). No water leaves the drainage basin in either of these streams.

The principal aquifers in Curlew Valley are in valley-fill deposits that include unconsolidated deposits and volcanic rocks. Three major ground-water flow systems have been distinguished that contain water of suitable chemical quality for irrigation, and each is tapped locally by large-capacity wells. A fourth flow system, which contains hot, saline water, is present at depth in the western part of the valley.

Along the west side of the valley, the Kelton flow system contains water under water-table conditions in unconsolidated valley fill. The Kelton flow system receives about 8,000 acre-feet (9.9 hm^3) of recharge per year from the Black Pine Mountains in Idaho and the Raft River Mountains in Utah. Pumpage for irrigation from the flow system near the old townsite of Kelton, Utah, averaged about 5,300 acre-feet (6.5 hm^3) of water during 1970-72. Water levels in the area of pumping had declined as much as 25 feet (7.6 m) between 1954 (when pumping began) and 1967, but they rose as much as 5 feet (1.5 m) between 1967 and 1973. The chemical quality of water in the irrigated area has deteriorated since pumping began, probably primarily as a result of recirculation of unused irrigation water. Natural discharge from the flow system is by evapotranspiration in the southern part of the valley.

In the central part of the valley, the Juniper-Black Pine flow system contains water in unconsolidated valley-fill deposits and interbedded layers of basalt. Leaky artesian conditions occur locally, but unconfined conditions are the rule in the flow system as a whole. Recharge to the flow system, which occurs in Idaho, averages about

22,000 acre-feet (27.1 hm^3) per year; approximately the same volume of water moves in the subsurface across the State line into Utah. Pumpage for irrigation from the flow system in Utah averaged about 12,700 acre-feet (15.7 hm^3) per year during 1970-72. Water levels declined as much as 10 feet (3.0 m) near the center of pumping between 1955 and 1969, but they appear to have stabilized since 1969. The water quality has not changed in the area since pumping began, except near the Showell Hills where the water from one well has increased steadily in salinity since pumping began at the well in 1955. Natural discharge from the flow system is by evapotranspiration in the southern part of the valley. The combined discharge by evapotranspiration from the Juniper-Black Pine and Kelton flow systems was about 12,000 acre-feet (14.8 hm^3) in 1972.

The unconsolidated deposits along the east side of the valley and the much-fractured Paleozoic rocks of the Hansel Mountains contain the Holbrook-Snowville flow system. Recharge to the flow system from mountains in Idaho is estimated to be about 44,000 acre-feet (54.3 hm^3) per year. Approximately 22,000 acre-feet (27.1 hm^3) per year of this water is discharged at Holbrook Springs and about 12,000 acre-feet (14.8 hm^3) per year is pumped from wells for irrigation. Additional recharge from return flow from water diverted for irrigation augments the flow system in Idaho, and approximately 20,000 acre-feet (24.8 hm^3) per year moves in the subsurface across the State line into Utah. Additional recharge from the Hansel Mountains and water diverted for irrigation augments the flow system in Utah, and about 24,000 acre-feet (29.6 hm^3) per year moves toward the southern end of the valley. Of this, about 1,000 acre-feet (1.2 hm^3) is discharged annually by evapotranspiration near Locomotive Springs.

Locomotive Springs, in the southern part of the Curlew Valley in Utah, had an average annual discharge of about 24,000 acre-feet (29.6 hm^3) of water during 1969-72. The discharge from the springs consisted almost completely of water moving through the Holbrook-Snowville flow system, and a decline of water levels in that system therefore will ultimately result in a reduction of discharge at Locomotive Springs. It is also possible that a considerable enlargement of the cone of influence of the wells west of Snowville will result in a diversion of water that might otherwise reach the springs from the Holbrook-Snowville flow system.

Comparison of the available measurements of the discharge at Locomotive Springs suggests that the discharge during 1969-72 was less than that measured in 1939 and 1967. This apparent decrease in spring discharge paralleled a period when withdrawals from wells were substantially increasing in Curlew Valley. The records are incomplete and short, however, and the collection of records of discharge at the springs and withdrawals for irrigation in the valley should be continued in order to define further the relation between the two.

INTRODUCTION

Purpose and scope of the study

This report about the water resources of the Curlew Valley drainage basin, Utah and Idaho, was prepared by the U.S. Geological Survey in cooperation with the Utah Department of Natural Resources, Division of Wildlife Resources. The primary purpose of the study on which this report is based was to determine whether or not the flow of Locomotive Springs--a source of water for a State Waterfowl Management Area--has been or will be diminished as a result of ground-water withdrawals elsewhere in Curlew Valley. To this end, it was necessary to make a quantitative appraisal of the water resources of the Curlew Valley drainage basin, with emphasis on ground water, and to evaluate the effects of both present and planned water-supply developments on the hydrologic regimen.

Surface-water resources and climatic factors were considered primarily in terms of their effects on the ground-water system.

The interpretations and conclusions contained in this report are based on hydrologic data available prior to June 1969 and additional data collected during the period July 1969-September 1973. These data are included in this report in tables 4-9.

Metric units

Most numbers are given in this report in English units followed by metric units in parentheses. The conversion factors used are:

English Units (multiply)	English Abbreviation	(by)	Metric Units (to obtain)	Metric Abbreviation
Acres	acres	0.4047	Square hectometers	hm^2
Acre-feet	acre-ft	.0012335	Cubic hectometers	hm^3
Cubic-feet	ft^3	.02832	Cubic meters	m^3
Feet	ft	.3048	Meters	m
Gallons	gal	3.7854	Liters	l
Inches	in.	25.4	Millimeters	mm
Miles	mi	1.6093	Kilometers	km
Square miles	mi^2	2.59	Square kilometers	km^2

Chemical concentration and water temperature are given only in metric units. Chemical concentration is given in milligrams per liter (mg/l). For concentrations less than 7,000 mg/l, the numerical value is about the same as for concentrations in the English unit, parts per million.

Chemical concentration in terms of ionic interacting values is given in milliequivalents per liter (meq/l). Meq/l is numerically equal to the English unit, equivalents per million.

Water temperature is given in degrees Celsius (°C), which can be converted to degrees Fahrenheit by the following equation: °F = 1.8(°C) + 32 or by use of the following table:

Temperatures in °C are rounded to nearest 0.5 degree. Underscored temperatures are exact equivalents. To convert from °F to °C where two lines have the same value for °F, use the line marked with an asterisk (*) to obtain equivalent °C.

°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
-20.0	-4	-10.0	14	0.0	32	10.0	50	20.0	68	30.0	86	40.0	104
-19.5	-3	-9.5	15	+0.5	33	10.5	51	20.5	69	30.5	87	40.5	105
-19.0	-2	-9.0	16	1.0	34	11.0	52	21.0	70	31.0	88	41.0	106
-18.5	-1	-8.5	17	1.5	35	11.5	53	21.5	71	31.5	89	41.5	107
-18.0 *	0	-8.0 *	18	2.0 *	36	12.0 *	54	22.0 *	72	32.0 *	90	42.0 *	108
-17.5	0	-7.5	18	2.5	36	12.5	54	22.5	72	32.5	90	42.5	108
-17.0	1	-7.0	19	3.0	37	13.0	55	23.0	73	33.0	91	43.0	109
-16.5	2	-6.5	20	3.5	38	13.5	56	23.5	74	33.5	92	43.5	110
-16.0	3	-6.0	21	4.0	39	14.0	57	24.0	75	34.0	93	44.0	111
-15.5	4	-5.5	22	4.5	40	14.5	58	24.5	76	34.5	94	44.5	112
-15.0	5	-5.0	23	5.0	41	15.0	59	25.0	77	35.0	95	45.0	113
-14.5	6	-4.5	24	5.5	42	15.5	60	25.5	78	35.5	96	45.5	114
-14.0	7	-4.0	25	6.0	43	16.0	61	26.0	79	36.0	97	46.0	115
-13.5	8	-3.5	26	6.5	44	16.5	62	26.5	80	36.5	98	46.5	116
-13.0	9	-3.0	27	7.0	45	17.0	63	27.0	81	37.0	99	47.0	117
-12.5	10	-2.5	28	7.5	46	17.5	64	27.5	82	37.5	100	47.5	118
-12.0 *	10	-2.0 *	28	8.0 *	46	18.0 *	64	28.0 *	82	38.0 *	100	48.0 *	118
-11.5	11	-1.5	29	8.5	47	18.5	65	28.5	83	38.5	101	48.5	119
-11.0	12	-1.0	30	9.0	48	19.0	66	29.0	84	39.0	102	49.0	120
-10.5	13	-0.5	31	9.5	49	19.5	67	29.5	85	39.5	103	49.5	121

Description of the area

The Curlew Valley drainage basin covers about 1,200 square miles (3,100 km^2) in northern Utah and southern Idaho (pl. 1). Locomotive Springs are in the southern part of the drainage basin. The climate of the region is semiarid; even the highest peaks in the drainage basin receive little more than 35 inches (890 mm) of precipitation a year, and most of the basin receives less than 12 inches (300 mm). Because of the scanty precipitation on most parts of the basin and the small amount of annual runoff (pl. 1), most streams in the basin are ephemeral or intermittent. The principal streams in the basin are Deep Creek (also called Curlew Creek in older reports) and Indian Creek. The water discharged by these two perennial streams and by major intermittent streams in Curlew Valley is wholly appropriated. At present (1973), no water leaves the drainage basin in any of these surface streams, and there is no streamflow into Great Salt Lake except during unusual floods.

The valley floor of Curlew Valley covers about 900 square miles (2,330 km^2), of which about 550 square miles (1,420 km^2) is in Utah. From about the latitude of Snowville north, the Showell Hills divide the valley into two drainage arms. The broader western arm is generally called the Juniper-Black Pine area; the narrower eastern arm is variously called Holbrook Valley, the Holbrook arm, or Curlew Valley, Idaho. Throughout this report, the name Curlew Valley will be used for the entire valley in both States; the western valley in Idaho will be called the Juniper-Black Pine area, the eastern valley in Idaho will be called the Holbrook arm, and the part of the valley in Utah will be called simply the Utah part of the valley.

Curlew Valley is sparsely populated; the entire drainage basin has fewer than 500 permanent residents. According to figures compiled by the U.S. Department of Commerce, Bureau of the Census (1971 a, b), the only incorporated town in the Curlew Valley drainage basin is Snowville, Utah (population 174 in 1970). Fewer than 100 people live in the Utah part of the valley outside Snowville, and the combined population of the Juniper-Black Pine area and the Holbrook arm is about 200.

The principal native vegetation in the valley north of about latitude 41°50' north is sagebrush (*Artemesia tridentata*) and grasses. Farther south toward the Great Salt Lake the soils become increasingly saline, and the sagebrush gives way to an assemblage dominated by greasewood (*Sarcobatus vermiculatus*). Near the shoreline of the lake, saltgrass (*Distichlis* sp.) and finally pickleweed (*Allenrolfea occidentalis*) are the only plants that are sufficiently salt-tolerant to survive. In the mountainous parts of the drainage basin, sagebrush and juniper (*Juniperus* sp.) predominate; some aspen (*Populus tremuloides aurea*) and conifers are found in the higher parts of the Raft River Mountains, where altitudes exceed 9,000 feet (2,740 m) above mean sea level.

The economy of Curlew Valley is based entirely on agriculture. Livestock raising predominates, and most of the cultivated land is devoted to raising hay and small grains for feed. The most productive croplands are in (1) an area in the Holbrook arm between Snowville and Holbrook, which is irrigated with water diverted from Deep Creek and from wells; (2) an area extending west of Snowville along the Utah State line, which is irrigated entirely from wells; and (3) an area north of the old townsite of Kelton in Utah, which is irrigated with water from wells and from Indian Creek. In the higher altitudes, mainly where the average annual precipitation exceeds about 16 inches (400 mm) (see pl. 1), small grains are raised by dryfarming methods.

Slightly less than one-half the land in the Curlew Valley drainage basin is privately owned. Nearly 50 percent of the land in the basin is Federally owned, including lands in the Sawtooth National Forest, the Curlew National Grassland, and Federal lands managed by the U.S. Bureau of Land Management. About 2 percent of the land in the drainage basin is State owned; most of the State-owned land is in Utah. Most of these public lands are used for grazing and recreation. Locomotive Springs, near the shore of Great Salt Lake, are in a State Waterfowl Management Area.

Previous studies and acknowledgments

The Utah part of Curlew Valley was included in a reconnaissance of the ground-water resources of Tooele and Box Elder Counties, Utah, by Carpenter (1913) and in a ground-water reconnaissance by D. A. Griswold (U.S. Soil Conservation Service, written commun., 1956). A preliminary evaluation of the ground-water resources of the Holbrook arm in Idaho was included in a more comprehensive report on the Malad River valley by Thompson and Faris (1932, p. 71-81), and a listing of wells and springs in Idaho that were visited in 1947-48 was included in a basic-data release by Nace (1952). In 1959, G. L. Whitaker and K. E. Kittock made a reconnaissance of irrigation development and gaging-station sites along Deep Creek (U.S. Geological Survey, written commun., 1959). More recent studies include a hydrologic reconnaissance by Bolke and Price (1969) that dealt mainly with the Utah part of the valley but included some data for Idaho and a study of the water resources of the Juniper-Black Pine area and the Holbrook arm by Chapman and Young (1972).

Sources of geologic data in the Curlew Valley drainage basin include the geologic maps of Utah (Stokes, 1964) and Idaho (Ross and Forrester, 1947), a report on the geology of the Raft River Mountains (Felix, 1956), a report of oil exploration and test drilling in Box Elder County, Utah (Peace, 1956, p. 25-31), and a thesis on the geology of the Wildcat Hills by Howes (1972). Part of Curlew Valley was included in a gravity survey of the northern Great Salt Lake Desert by Cook, Halverson, Stepp, and Berg (1964), and additional geophysical data were given in theses prepared by students of the University of Utah.

The cooperation of landowners and residents in the area who permitted measurements at wells and gave general information about their wells and about the area is gratefully acknowledged. The Raft River Rural Electric Cooperative and Utah Power and Light Co. provided power-consumption records from which gross ground-water pumpage was estimated; and Layne and Bowler Pump Co., Twin Falls, Idaho, furnished data from pumping tests of many wells in the area. Thanks are due to the well drillers in the area who took time to discuss the ground-water hydrology and subsurface conditions with the writer. Many of the data on wells in the Idaho parts of the drainage basin were collected by personnel of the Idaho Department of Water Administration, and S. L. Chapman of that office exchanged data and discussed their interpretation with the writer. Finally, the personnel of the Desert Biome, International Biome Project, especially Drs. G. W. Minshall (Idaho State University) and J. M. Neuhold (Utah State University), furnished information about Deep Creek and Locomotive Springs.

Special thanks are due to Louise L. Miller of the U.S. Geological Survey, who assisted in compiling the basic data.

Well- and spring-numbering systems

The system of numbering wells and springs in Utah is based on the cadastral land-survey system of the U.S. Government. The number identifies the well or spring and locates its position in the land net. By this system, the State is divided into four quadrants by the Salt Lake base line and meridian, and the quadrants are designated by the uppercase letters A, B, C, and D for the northeast, northwest, southwest, and southeast quadrants, respectively. Numbers designating the township and range, in that order, follow the quadrant letter, and all three are separated by dashes and enclosed in parentheses. The number after the parentheses designates the section and is followed by lowercase letters indicating the quarter section, the quarter-quarter section, and the quarter-quarter-quarter section (generally 10 acres or 4 hm^2)[1]; the letters a, b, c, and d indicate the northeast, northwest, southwest, and southeast quarters of each subdivision. The final number is the serial number of the well or spring within its tract; the letter S preceding the number denotes a spring. Thus well (B-14-8)1cbb-1 is the first well constructed or visited in the NW¼NW¼SW¼ sec. 1, T. 14 N., R. 8 W., and (B-14-12)3cda-S2 is the second spring claimed or tabulated in the NE¼SE¼SW¼ sec. 3, T. 14 N., R. 12 W.

The system of numbering wells and springs in Idaho is generally similar to that used in Utah. Locations in Idaho are referenced to the Boise base line and meridian. The quadrant letter is not used; townships are labeled N or S to designate locations north or south of the base line, and ranges are labeled E or W for locations east or west of the meridian. The letter S denoting a spring is not used. Thus, well 15S-32E-33dcd-1 designates the first well constructed or visited in the SE¼SW¼SE¼ sec. 33, T. 15 S., R. 32 E.

The well- and spring-numbering systems are illustrated in figure 1.

SURFACE-WATER HYDROLOGY

Deep Creek

The northernmost parts of the Holbrook arm of Curlew Valley are drained by Deep Creek and its tributaries. Deep Creek flows southward through the Holbrook arm into Utah and toward Great Salt Lake.

Rock Creek, a major tributary that joins Deep Creek near Holbrook rises on the southwest flank of the Deep Creek Mountains. The entire

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[1]The basic unit of land measurement, the section, is theoretically a 1-mile square, but many sections are oversize, undersize, or irregular. Such sections are divided into 10-acre (4 hm^2) tracts, generally beginning from the southeast corner, and the surplus or shortage is taken up in the tracts along the north and west sides of the section.

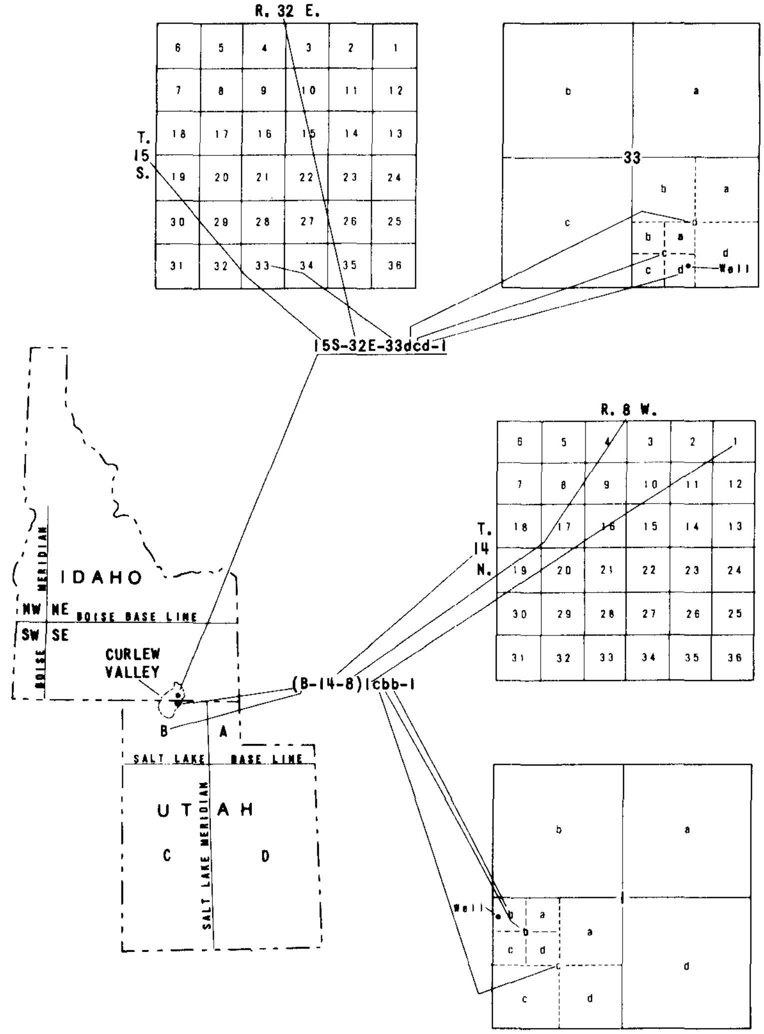

Figure 1.—Well- and spring-numbering systems used in Utah and Idaho.

flow of Rock Creek is diverted for irrigation about 4 or 5 miles (6-8 km) upstream from Holbrook, and the channel is generally dry from the point of diversion to its mouth for several months of the year.

Deep Creek (or Bull Canyon Creek, as it is sometimes called above its junction with Rock Creek) originates in springs in Bull Canyon on the southeast side of the Deep Creek Mountains. The entire flow of the creek is diverted for irrigation near the point where it emerges from the mountains, some 10 or 12 miles (16-19 km) northeast of Holbrook.

Below the junction with Rock Creek, the channel of Deep Creek is dry during most months. About 3 miles (5 km) south of Holbrook, a group of springs, variously called Deep Creek Springs, Big Springs, and Holbrook Springs (the name used throughout this report) discharge in the channel of the creek. About 4 miles (6 km) downstream from the springs, Curlew Dam impounds the water of the creek. When Curlew Valley Reservoir is full, it extends to within a few hundred feet of Holbrook Springs. Releases from Curlew Valley Reservoir and ground-water inflow from the valley fill make Deep Creek a perennial stream from the dam to a small impoundment near Rose Ranch about 7 miles (11 km) southwest of the point where the stream crosses into Utah. The amount of water released from this reservoir is small and the water in the stream disappears into the ground within a few miles.

The Geological Survey has maintained a crest-stage gage on Rock Creek about 1 mile (1.6 km) above the point of diversion (pl. 1) since 1962.

Personnel of the Desert Biome work group from Idaho State University installed a weir and water-stage recorder near the crest-stage gage in the summer of 1970 (station 1, pl. 1). Mean discharge at the weir from September 1970 through August 1972, as determined by the Desert Biome work group, was 1.8 ft^3/s (cubic feet per second) (0.05 m^3/s). Peak discharges at the crest-stage gage are tabulated below. No records of the discharge of Deep Creek above Holbrook exist. The mean runoff at the mouth of Bull Canyon was estimated by the channel-geometry method (Moore, 1968) as about 82 acre-feet (0.1 hm^3) per year (about 0.11 ft^3/s or 0.003 m^3/s).

Rock Creek near Holbrook, Idaho

Peak discharges, 1962-71

Date	Discharge (ft^3/s)	Discharge (m^3/s)	Date	Discharge (ft^3/s)	Discharge (m^3/s)
Jan. 7, 1962	1,100[1]	(31.2)	Mar. 30, 1966	30	(0.85)
Feb. 11 or 12	1,390[1]	(39.4)	Jun. 22, 1967	300	(8.5)
Feb. 1, 1963	350[1]	(9.9)	Feb. 21, 1968	385	(10.9)
June 10	466[1]	(13.2)	May 30, 1969	52	(1.47)
June 17, 1964	232	(6.6)	Apr. 19, 1970	82	(2.32)
Dec. 23	140[2]	(4.0)	May 14, 1971	130	(3.68)

[1]At former site, 1 mile (1.6 km) upstream.
[2]Affected by ice.

The mean discharge of Deep Creek between Holbrook Springs and Curlew Valley Reservoir (station 2, pl. 1) from September 1970 through August 1972 was about 30 ft^3/s (0.85 m^3/s), as determined by the Desert Biome work group. Both Thompson and Faris (1932, p. 73) and Nace (1952, p. 49) report that the discharge below Holbrook Springs ranged from 25 to 35 ft^3/s (0.71-0.99 m^3/s). The Desert Biome work group installed gaging stations at two sites on Deep Creek downstream from Curlew Valley Reservoir in the summer of 1970; the mean discharge at these sites (stations 3 and 4, pl. 1) during 1970-72 was 8.5 and 6.4 ft^3/s (0.24 and 0.18 m^3/s), respectively.

Water discharged by Rock Creek, Twin Springs, the springs in Bull Canyon, and Holbrook Springs contains an average amount of less than 500 mg/l (milligrams per liter) of dissolved solids. The concentration of dissolved solids in the water of Curlew Valley Reservoir is increased by evaporation. Inflow to the creek below the reservoir is principally irrigation return flow; hence, the concentration of dissolved solids in the water of Deep Creek increases downstream from Curlew Dam. The Desert

Biome work group analyzed samples of water from their gaging sites periodically during 1970-72, and their data are summarized below:

Dissolved-solids concentration, in milligrams per liter,

in water from Deep Creek, 1970-72

(Data from Desert Biome work group, Idaho State University; site locations shown on pl. 1)

Site No.	Sept. 4, 1970-Aug. 2, 1971 High	Low	Mean	Sept. 1, 1971-Aug. 4, 1972 High	Low	Mean
1	562	396	464	537	332	443
2	644	403	482	549	416	480
3	1,290	539	851	1,130	682	855
4	1,660	785	1,160	1,370	1,020	1,170

Indian Creek

Indian Creek drains the southeast end of the Raft River Mountains, which border the Utah part of the valley on the west (pl. 2). All the water that reaches Curlew Valley in Indian Creek during the growing season is diverted and used for irrigation. During periods of low flow, water does not reach the valley floor but seeps into the coarse-grained alluvial-fan deposits at the edge of the mountains.

Daily discharges of Indian Creek at the Geological Survey gaging station near Park Valley ranged from 0.19 to 26 ft^3/s (0.01 to 0.74 m^3/s) for the 17 months of record through September 1972 (table 1). The mean annual runoff at the gaging station was estimated by the channel-geometry method as about 320 acre-feet (0.4 hm^3) per year (about 0.44 ft^3/s or 0.012 m^3/s).

Intermittent and ephemeral streams

Runoff from those parts of the Curlew Valley drainage basin not drained by Deep and Indian Creeks is intermittent or ephemeral, and the total volume is small. A few spring-fed streams have perennial flow in their upper reaches, but all are losing streams and become dry within a few miles. Water that reaches the edge of the valley is generally absorbed by the fan deposits at the foot of the mountains.

The mean annual runoff estimated by the channel-geometry method for sites around the drainage basin is shown on plate 1. Even during the peak snowmelt-runoff period, little or no water flows out onto the valley floor from the Sublett Range, the Blue Spring Hills, and the Black Pine, North Promontory, and Hansel Mountains.

Table 1.--Daily discharge, in cubic feet per second, of Indian Creek near Park Valley

[May 1971 to September 1972]

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	16	20	7.5	2.1	1.4	1.9	1.4	1.4	1.0	0.80	2.2	4.0	4.7	10	2.3	0.68	0.71
2	17	18	7.2	1.9	1.3	1.8	1.4	1.4	1.0	.80	2.5	3.8	4.9	10	2.2	.60	.88
3	17	16	6.9	2.0	1.7	1.7	1.4	1.4	1.0	.80	3.8	3.5	5.1	9.1	2.1	.56	.62
4	18	16	7.2	2.0	1.8	1.6	1.5	1.4	1.0	.80	3.6	3.1	5.1	8.5	2.0	.51	.42
5	17	16	6.9	1.9	1.7	1.5	1.4	1.4	.90	.80	3.6	2.9	6.6	9.4	2.0	.47	.32
6	18	17	6.5	4.1	1.6	1.5	1.3	1.4	.90	.80	4.0	2.8	7.1	9.5	1.9	.45	.27
7	19	20	6.3	4.4	1.8	1.5	1.2	1.4	.90	.80	4.4	2.7	7.2	9.0	1.8	.42	.21
8	19	22	5.9	3.1	1.8	1.4	1.3	1.4	.90	.80	4.4	2.6	7.2	8.4	1.7	.40	.20
9	17	22	5.7	2.7	1.6	1.4	1.4	1.4	.90	.80	4.8	2.6	7.1	7.4	1.6	.37	.19
10	16	26	5.5	2.6	1.4	1.4	1.3	1.4	.90	.80	5.3	2.6	6.8	6.6	1.6	.35	.19
11	17	28	5.4	2.4	1.4	1.4	1.3	1.4	.90	.80	4.9	2.7	6.6	6.1	1.6	.35	.19
12	19	22	5.1	2.3	1.3	1.4	1.3	1.4	.90	.84	4.8	2.8	6.5	5.6	1.5	.35	.19
13	23	21	4.6	2.2	1.3	1.5	1.4	1.4	.90	.94	4.9	2.9	7.0	5.2	1.4	.35	.19
14	24	21	4.3	2.0	1.3	1.5	1.6	1.4	.90	1.1	5.1	2.9	8.3	5.7	1.4	.35	.20
15	26	21	4.1	2.0	1.4	1.6	1.5	1.4	.86	1.2	5.7	2.9	9.3	5.1	1.4	.35	.20
16	23	21	4.0	2.0	1.4	1.7	1.4	1.2	.89	1.4	6.7	2.8	10	4.8	1.6	.37	.20
17	20	21	3.9	1.9	1.5	1.7	1.3	1.2	.89	1.6	6.6	2.8	10	4.4	2.0	.38	.21
18	16	20	3.8	1.8	1.6	1.6	1.4	1.2	.91	1.4	6.6	2.7	10	4.3	1.7	.40	.23
19	14	19	4.1	1.8	1.5	1.6	1.3	1.2	1.1	1.4	5.9	2.8	9.7	4.5	1.4	.45	.34
20	13	17	3.9	1.9	1.5	1.5	1.4	1.2	1.0	1.5	5.5	2.9	8.7	4.5	1.2	.47	.34
21	13	17	3.5	1.7	1.5	1.5	1.4	1.2	1.1	1.6	5.3	3.0	7.8	3.8	1.1	.51	.42
22	13	16	3.9	1.6	1.5	1.5	1.4	1.2	1.3	1.7	5.3	3.1	7.1	3.5	1.1	.56	.47
23	14	15	3.7	1.4	1.4	1.5	1.3	1.2	1.1	1.8	5.7	3.2	6.5	3.2	1.1	.56	.51
24	14	14	3.3	1.4	1.4	1.5	1.3	1.2	.95	1.8	5.8	3.4	6.3	3.1	1.0	.56	.56
25	15	13	3.0	1.4	1.4	1.5	1.3	1.2	.88	1.8	5.6	3.5	6.4	2.9	.90	.61	.61
26	17	12	2.7	1.3	1.4	1.5	1.4	1.2	.81	1.7	5.4	3.7	6.9	2.8	.79	.47	.66
27	18	13	2.6	1.3	1.5	1.5	1.5	1.2	.81	1.8	5.3	3.9	7.3	2.7	.84	.47	.93
28	18	11	2.4	1.5	1.6	1.4	1.5	1.2	.84	2.0	5.2	4.1	8.1	2.7	.84	.56	.99
29	19	9.6	2.3	1.6	1.6	2.0	1.5	1.2	.80	2.2	4.9	4.2	8.6	2.6	.91	.56	.88
30	19	8.4	2.2	1.9	1.8	1.7	1.4	1.2	.80	-	4.5	4.4	9.0	2.4	.86	.52	.82
31	19	-	2.1	1.9	-	1.5	-	1.2	.80	-	4.3	-	9.4	-	.76	.61	-

GROUND-WATER HYDROLOGY

Geologic framework

For the purposes of this report, the rocks in the Curlew Valley drainage basin are divided into valley fill and older consolidated rocks. The valley fill that underlies the main part of Curlew Valley is composed of unconsolidated to semiconsolidated sedimentary deposits and assorted volcanic rocks of Quaternary and Tertiary age. The valley fill contains the principal aquifers. Consolidated rocks of Paleozoic and Precambrian age form the bulk of the mountain ranges surrounding the valley and are of only slight economic importance as aquifers, although they may contribute substantial amounts of recharge to the aquifers in the valley fill. The lithology and water-bearing characteristics of the rock units are summarized in table 2 and their areal distribution is shown on plate 2.

Table 2.--Geohydrologic units and their water-bearing properties

		Geohydrologic unit	Description and areal extent	Water-bearing properties
Valley-fill deposits	Quaternary	Younger alluvium and colluvium	Mostly sloping and well-drained land; includes alluvium along active streams and colluvium on steep slopes. Exposed over most of the valley floor above an altitude of about 4,300 feet.	Slightly to highly permeable materials, but except in the upstream reaches of active stream channels is generally above the main ground-water body. Yields water to a few stock wells north of Holbrook. Serves as a ground-water recharge area along the edges of the valley.
		Lakebed deposits	Mostly clay and silt, generally containing some salt. Cover most of the southern end of the valley below an altitude of about 4,300 feet.	Permeability generally low; such water as could be obtained would generally be too saline for most uses. Some water moves up through the deposits from deeper aquifers.
		Near-shore lake deposits	Sand and gravel in bars and spits and on shoreline terraces, mostly along the east side of the valley.	Moderately to highly permeable, but generally are above the main ground-water body. Not known to yield water to wells, but locally serves as a recharge area for underlying deposits.
		Older alluvial and lake deposits	Sedimentary materials ranging in grain size from clay to cobbles; some pyroclastic material. Often poorly sorted. Most beds are lenticular and discontinuous and locally intercalated with lava flows. Not exposed at the surface (and not shown on pl. 2) but probably underlie most of the valley except where older rocks crop out.	Permeability highly variable both vertically and laterally, but average permeability of the deposit as a whole is moderate to high. With the intercalated lava flows, forms the principal aquifers in Curlew Valley and yields from 550 to 3,000 gallons per minute to wells in much of the valley. May contain saline water, particularly at depths of more than 600-900 feet below land surface but locally at much shallower depths.
	Tertiary and Quaternary	Volcanic rocks	Mostly basalts similar to those of the Snake River Group and felsic rocks, particularly in and near the Wildcat Hills. Intercalated with the continental sedimentary materials in the eastern part of the valley in Idaho; possibly present elsewhere in the subsurface but not reported from wells near Kelton nor in the Holbrook arm. Widely scattered outcrops throughout the valley.	Secondary permeability highly variable. Where penetrated in the subsurface, may be either an aquifer or a confining layer but is the principal source of water to many wells in the area. South of Cedar Hill, where lava flows are only a few feet below the surface, well yields from the basalt have been less than 500 gallons per minute and water is not of a quality suitable for irrigation.
	Tertiary	Continental sedimentary rocks	Chiefly tuff, tuffaceous shale, sandstone, and marlstone; some interbedded conglomerate and volcanic flow rocks. Include rocks referred to the Salt Lake Formation in both Utah and Idaho and to the Payette Formation in Idaho. Crop out in the northernmost parts of the valley and along Indian Creek but probably underlie the Quaternary valley fill beneath most of the valley.	Permeability generally is low because of cementation and induration, but locally the rocks are moderately permeable. Yield water to stock wells in the Holbrook arm.
Older consolidated rocks	Paleozoic	Undifferentiated Paleozoic rocks	Predominantly marine carbonate rocks of Carboniferous age but include some sandstone and shale. Most outcrops in Utah are referred to the Oquirrh Formation; outcrops in Idaho have not been identified. Form the bulk of all the mountain ranges surrounding the valley except the Raft River Mountains.	Primary permeability is low but secondary permeability in solution openings and well-developed fracture systems is locally moderate to high. Of little economic importance as aquifers in the area but furnish water to a few stock wells and springs. Large quantities of water may move through these rocks in parts of the drainage basin.
	Precambrian	Undifferentiated Precambrian rocks	Chiefly metasedimentary rocks but include some intrusive igneous rocks. Exposed only in the core of the Raft River Mountains.	Primary permeability is very low; some secondary fracture permeability locally. Yield water to a few small springs but are of little economic importance as aquifers in the area.

Geophysical characteristics

In addition to data available from wells and test holes in Curlew Valley, a gravity survey was used. Gravity data from several sources were compiled into a regional gravity map by Cook, Halverson, Stepp, and Berg (1964). That map covers Curlew Valley west of longitude 112°45' west. Peterson (1973) made additional gravity measurements of the eastern part of the valley and prepared an interpretation of the thickness of the low-density material for the entire valley. Gravity contours and the interpreted thickness of the low-density material are shown on plate 2.

Three deep test holes (locations shown on pl. 2) were drilled in the central part of Curlew Valley by the Utah Southern Oil Co. in 1954-56. Those holes penetrated the full thickness of the unconsolidated material and provided additional control for interpretation.

The gravity interpretation shows structural trends that are in general agreement with the trends deduced from outcrop patterns. The deepest depression is in the Holbrook arm, where the maximum thickness of the valley fill exceeds 5,000 feet (1,525 m) just north of the Utah-Idaho State line. The maximum thickness of fill exceeds 4,000 feet (1,220 m) in the Juniper-Black Pine area. The fill exceeds 3,000 feet (915 m) in thickness in the Utah part of Curlew Valley, between the Raft River Mountains and the Wildcat Hills. Outside the three major structural depressions shown in figure 2, the valley fill is probably thin--generally less than 500 feet (150 m) thick (D. L. Peterson, oral commun., 1971).

Structural features

The consolidated rocks surrounding Curlew Valley and underlying it at depth have been distorted by repeated episodes of structural deformation. Both the outcrop patterns and the gravity interpretation indicate that several major structural trends intersect in the Curlew Valley area. The Black Pine Mountains, the Sublett Range, and the Blue Spring Hills, together with the intervening structural basins, trend about north or northwest. The Hansel Mountains, the North Promontory Mountains, and the structural trough on the west side of the valley trend northeast. On the west side of the valley, the east-trending Raft River Mountains represent a third structural trend.

The abundant faults, fractures, and associated solution openings form the principal conduits through which water moves in the older consolidated rocks in the Curlew Valley drainage basin. Major structural features probably exerted considerable influence on the distribution of the basaltic lava flows, which are an important element of the ground-water flow systems in the valley fill.

Ground water in the Quaternary and Tertiary rocks within Curlew Valley

The valley floor of Curlew Valley is underlain by unconsolidated valley fill and interbedded volcanic rocks of Quaternary and Tertiary age. These deposits contain most of the aquifers in the area. Although they locally extend to depths of more than 5,000 feet (1,525 m) and are saturated with water for most of their thickness, only the shallower water-bearing beds--above a depth of 800-1,000 feet (240-300 m)--are presently exploited as aquifers.

From considerations of geologic and geographic features, chemical quality of water, and hydraulic head, three shallow ground-water flow systems can be distinquished within the valley. Each of these flow systems contains many interconnected beds of varying hydraulic properties, but each can be treated as a hydrologic entity. In this report, these units are called the Kelton flow system, the Juniper-Black Pine flow system, and the Holbrook-Snowville flow system (pl. 3).

The flow systems are not bounded by "areas of no flow" or "impermeable barriers." Rather, they are bounded by zones of lower permeability, in which movement of ground water is slow. Wherever a substantial head difference exists across one of these areas, however, some water will move across the "boundary." In the southern part of the valley, where surface expression of the separation between flow systems is lacking, the "boundaries" cannot be readily distinquished.

A fourth flow system containing hot, moderately saline water,[1] here called the Coyote Spring flow system, underlies at least part of the Kelton and Juniper-Black Pine flow systems. It was not possible to delineate the area of the Coyote Spring flow system on plate 3 because of insufficient data.

Kelton flow system

A subsurface bedrock ridge near the west side of Curlew Valley acts as a barrier to ground-water movement; this ridge, together with the Wildcat Hills, forms the east boundary of the Kelton flow system (pl. 3). Gray hard limestone crops out in a low but distinct escarpment in Tps. 14 and 15 N., R. 11 W. This limestone outcrop marks the trace of a high-angle fault that forms the east boundary of a prominent bedrock trough at the foot of the Raft River Mountains (pl. 2). The upthrown block is on the east side of this fault and is inferred to be tilted to the east; the result is a ridge of bedrock with thick deposits of unconsolidated material on each side. The deposits west of the ridge form the north part of the Kelton flow system.

As the bedrock ridge is much less permeable than the unconsolidated material, it acts as a barrier to the eastward movement of ground water. Thus, water that enters the valley fill from the south end of the Black Pine Mountains and the east end of the Raft River Mountains moves generally southward between the Raft River Mountains and the Wildcat Hills in the Kelton flow system.

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[1]Where descriptive terms for the chemical quality of water are used in this report, the terms have the following meanings (Robinove and others, 1958, p. 3):

Term	Concentration of dissolved solids, in milligrams per liter
Fresh	Less than 1,000
Slightly saline	1,000- 3,000
Moderately saline	3,000-10,000
Very saline	10,000-35,000
Briny	More than 35,000

Little is known about the water-bearing deposits of the Kelton flow system north of T. 12 N. In T. 15 N., drillers' logs of three wells indicate that the water-bearing material is thin-bedded, poorly sorted detritus ranging in size from clay to boulders. Well (B-15-11)31ddd-1[1] was finished at 410 feet (125 m) in such material, and well (B-15-11) 26cdd-1 reached gray hard limestone beneath the unconsolidated deposits at a depth of 485 feet (148 m). In T. 14 N., Pilot Spring, (B-14-11) 13bdd-S1, discharges near the east edge of the system. In T. 13 N., well (B-13-11)10cdc-1 was drilled to a depth of 283 feet (86 m). Most of the material penetrated was sand and fine gravel, with some layers of clayey sand and gravel.

The irrigation wells near Kelton in T. 12 N., R. 11 W., all penetrate valley fill; the proportions of coarse-grained materials decrease with increasing distance from the mountains. Although basalt outcrops form prominent hills within 2 miles (3.2 km) of these wells, no basalt was penetrated by wells, which were drilled to depths as great as 700 feet (210 m).

The water tapped by the irrigation wells near Kelton is unconfined. Although lenses of fine-grained material may produce apparent confined conditions locally, it is probable that water-table conditions generally prevail throughout the flow system.

Average annual recharge to the Kelton flow system is estimated using the method described by Hood and Waddell (1968, p. 22-23) as about 8,000 acre-feet (9.9 hm^3). In using this method, the area between adjacent pairs of lines of equal annual precipitation (isohyets) is multiplied by the average of the two precipitation values to give the total volume of precipitation on the zone. A part of the total precipitation in each zone is assigned to ground-water recharge, and the sum of recharge in all the zones is the total recharge.

The assignment of a percentage of the total precipitation on each zone to ground-water recharge is based on considerations of geology, soil cover, vegetation, and altitude, which represent the best judgment of the person making the assignment. Recharge to the Kelton flow system was estimated as follows:

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[1]See page 7 for description of the well-numbering system.

Precipitation (inches)	Area (acres)	Estimated annual precipitation		Estimated annual recharge	
		Feet	Acre-feet	Percent of precipitation	Acre-feet (rounded)
Utah					
More than 30	200	2.7	540	35	200
25-30	590	2.3	1,360	28	400
20-25	970	1.9	1,840	23	400
16-20	3,960	1.5	5,940	16	1,000
12-16	9,450	1.2	11,300	12	1,400
				Subtotal (rounded)	3,000
Idaho					
More than 30	1,100	2.7	2,970	35	1,000
25-30	2,310	2.3	5,300	28	1,500
20-25	2,560	1.9	4,860	23	1,100
16-20	2,810	1.5	4,220	16	700
12-16	2,790	1.2	3,350	12	400
				Subtotal (rounded)	5,000
				Total (rounded)	8,000

More than half the recharge--about 5,000 acre-feet (6.2 hm^3) per year--comes from precipitation on the Black Pine Mountains in Idaho; the remainder--about 3,000 acre-feet (3.7 hm^3) per year--comes from the Raft River Mountains in Utah. Little or no recharge reaches the water table from the scanty--generally less than 12 inches (300 mm)--precipitation on the valley floor.

Ground water in the Kelton flow system moves generally south from the Black Pine Mountains and southeast from the Raft River Mountains toward Great Salt Lake (pl. 3). As the slope of the water table in the southern part of the flow system is less than the slope of the land surface, the depth to water decreases southward. South of the Wildcat Hills, the water table is within reach of the roots of greasewood, and moderately dense stands of this phreatophyte appear. Farther south, more shallow-rooted phreatophytes, such as saltgrass and pickleweed, are found. Near Great Salt Lake, the capillary fringe reaches to the land surface, and water is consumed directly by evaporation. The approximate distribution of phreatophytes and areas of direct evaporation are shown on plate 3. South of T. 12 N., the surface expression of the separation between the Juniper-Black Pine and Kelton flow systems is missing. In the absence of better subsurface data, the discharge by evapotranspiration from the two systems cannot be accurately separated and consequently is lumped in the following tabulation:

Source	Estimated depth to water (feet)	Estimated areal density of growth (percent)	Rate of evapotranspiration (acre-feet per acre per year)	Area (acres)	Discharge (acre-feet, rounded)
Greasewood	10-40	20-40	0.10[1]	17,100	1,700
Greasewood and rabbitbrush	5-20	50-60	1.00[2]	6,100	6,100
Saltflats (some greasewood, saltgrass, and pickleweed)	0- 5	0- 5	.10[3]	43,600	[illegible]
			Total (rounded)		12,000

[1]Taken from Robinson (1958, p. 62 and 69).
[2]Taken from Mower and Nace (1957, p. 21).
[3]Taken from Feth, Barker, Moore, Brown, and Veirs (1966, p. 68-70).

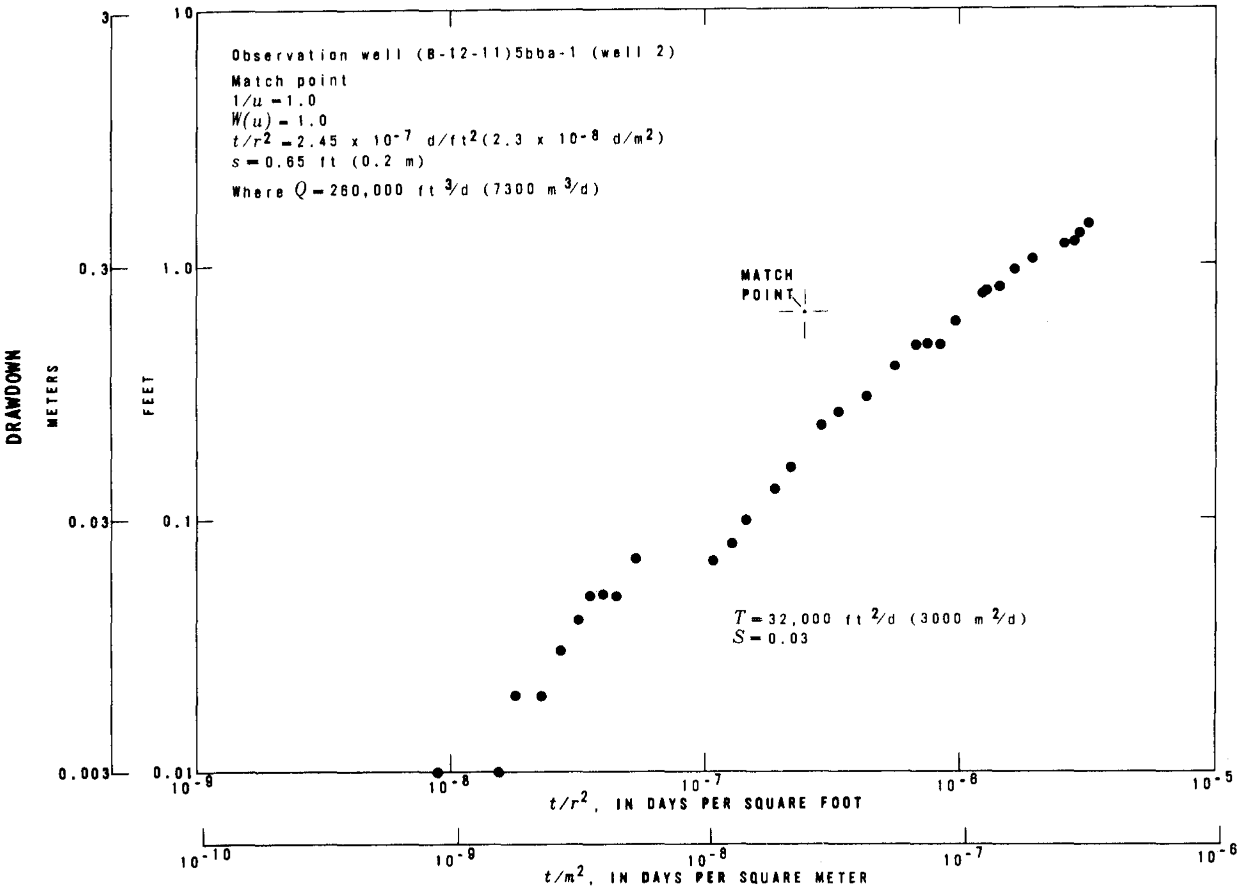
An aquifer test in the Kelton flow system, using irrigation wells near the old townsite of Kelton, was made in March 1972. The arrangement of wells in this area is shown in figure 2, and the numbers used for the wells in the following discussion are those shown in the figure.

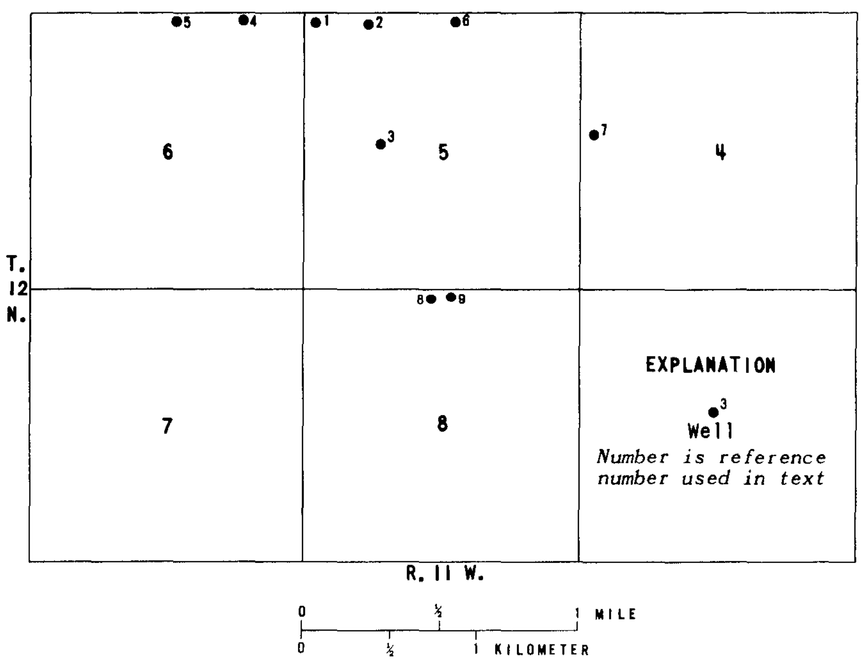
Well 1 was pumped throughout the test at a rate of 3 ft^3/s (0.08 m^3/s), and water levels were measured in nine wells. At the end of 96 hours, no drawdown had been detected in wells 3-9, and drawdown in well 2 was 1.24 feet (0.4 m). From the drawdown data for well 2, transmissivity[1] (T) and storage coefficient[2] (S) were calculated by the Theis nonequilibrium formula (Ferris and others, 1962, p. 92-98) as 32,000 ft^2/d (2,970 m^2/d) and 0.03, respectively (fig. 2). The specific capacity[3] of the pumped well was used to estimate T as described by Theis, Brown, and Meyer (1963, p. 332-336); T was estimated as 24,000 ft^2/d (2,230 m^2/d).

[1]*Transmissivity* (T) is the rate at which water is transmitted through a unit width of the aquifer under a unit hydraulic gradient. The units for T are cubic feet per day per foot ($ft^3/d/ft$), which reduces to ft^2/d. The term transmissivity replaces the term coefficient of transmissibility, which was formerly used by the U.S. Geological Survey and which was reported in units of gallons per day per foot. To convert a value for coefficient of transmissibility to the equivalent value of transmissivity, divide by 7.48; to convert from transmissivity to coefficient of transmissibility, multiply by 7.48.

[2] The *storage coefficient (S)* of an aquifer is the volume of water it releases from or takes into storage per unit surface area of the aquifer per unit change in head. S is a dimensionless number. Under confined conditions, S is typically small, generally between 0.001 and 0.00001. Under unconfined conditions, S is much larger, typically from 0.05 to 0.30.

[3] The *specific capacity* of a well is obtained by dividing the average discharge by the drawdown after some specified period of pumping. In this report, specific capacity values are after pumping for 24 hours unless otherwise noted.





Transmissivity and storage coefficient were calculated from the Theis nonequilibrium formula:

$$T = \frac{Q}{4\pi s} W(u)$$

and

$$S = \frac{4Ttu}{r^2}$$

where T = transmissivity, in square feet per day (square meters per day),
Q = discharge of the well, in cubic feet per day (cubic meters per day),
s = drawdown, in feet (meters),
$W(u)$ = well function of u,
S = storage coefficient (dimensionless),
t = time since pumping began, in days,
u = a dimensionless variable,
and r = the distance from the pumped well to the observation well, in feet (meters).

The derivation of the equations and of the variables u and $W(u)$ and a description of the method are given by Lohman (1972, p. 15-19)

Figure 2.—Wells used in a pumping test of the Kelton flow system and calculation of aquifer characteristics.

After 96 hours, pumping was started at well 3 at a rate of 2.8 ft^3/s ($0.08\ m^3/s$). No effects on water levels in other wells had been detected after 24 hours when pumping was started at well 2 at a rate of 3.5 ft^3/s ($0.10\ m^3/s$). The test continued for 18 more hours, and the combined pumping at the three wells did not result in any detectable drawdown in wells 4-9. T was estimated from the specific capacity as 27,000 ft^2/d (2,510 m^2/d) at well 2 and 28,000 ft^2/d (2,600 m^2/d) at well 3. The difference in T values for well 2 obtained by two different methods is to be expected, because T values obtained from recovery measurements in pumped wells usually are low because of screen losses in the pumped well.

The values of T obtained from this test are reasonably consistent and are believed to be representative of the Kelton flow system in the area of large withdrawals north of Kelton. The computed value of S is reasonable for unconfined conditions and a relatively short period of pumping.

Withdrawal of water from the Kelton flow system by man is chiefly through the irrigation wells near the old townsite of Kelton. The first irrigation well in this area was drilled in 1953, and other wells have been added slowly. Pumpage from the Kelton flow system for irrigation during 1963-72 is tabulated below. About 1,500 acres (610 hm^2) of land was irrigated with ground water in this area in 1972 (J. W. Metcalf, U.S. Soil Conservation Service, oral commun., 1972). The surficial material in the irrigated area is mostly fine grained, and it is estimated that only about 10 percent of the water pumped returns to the aquifer by deep percolation.

<u>Pumpage for irrigation, Kelton flow system</u>

Year	Approximate pumpage (acre-feet)	Approximate pumpage (cubic hectometers)	Number of wells pumped
1963	860	(1.1)	2
1964	3,400	(4.2)	5
1965	3,300	(4.1)	6
1966	3,900	(4.8)	6
1967	3,700	(4.6)	7
1968	3,600	(4.4)	7
1969	4,300	(5.3)	10
1970	5,200	(6.4)	10
1971	5,100	(6.3)	10
1972	5,700	(7.0)	10

Much of the water pumped for irrigation near Kelton has been taken from storage in the system. By the spring of 1967 the water level in well (B-12-11)5bbb-1, the first irrigation well, had declined about 25 feet (7.6 m) since the well was put into operation in 1954 (fig. 3).

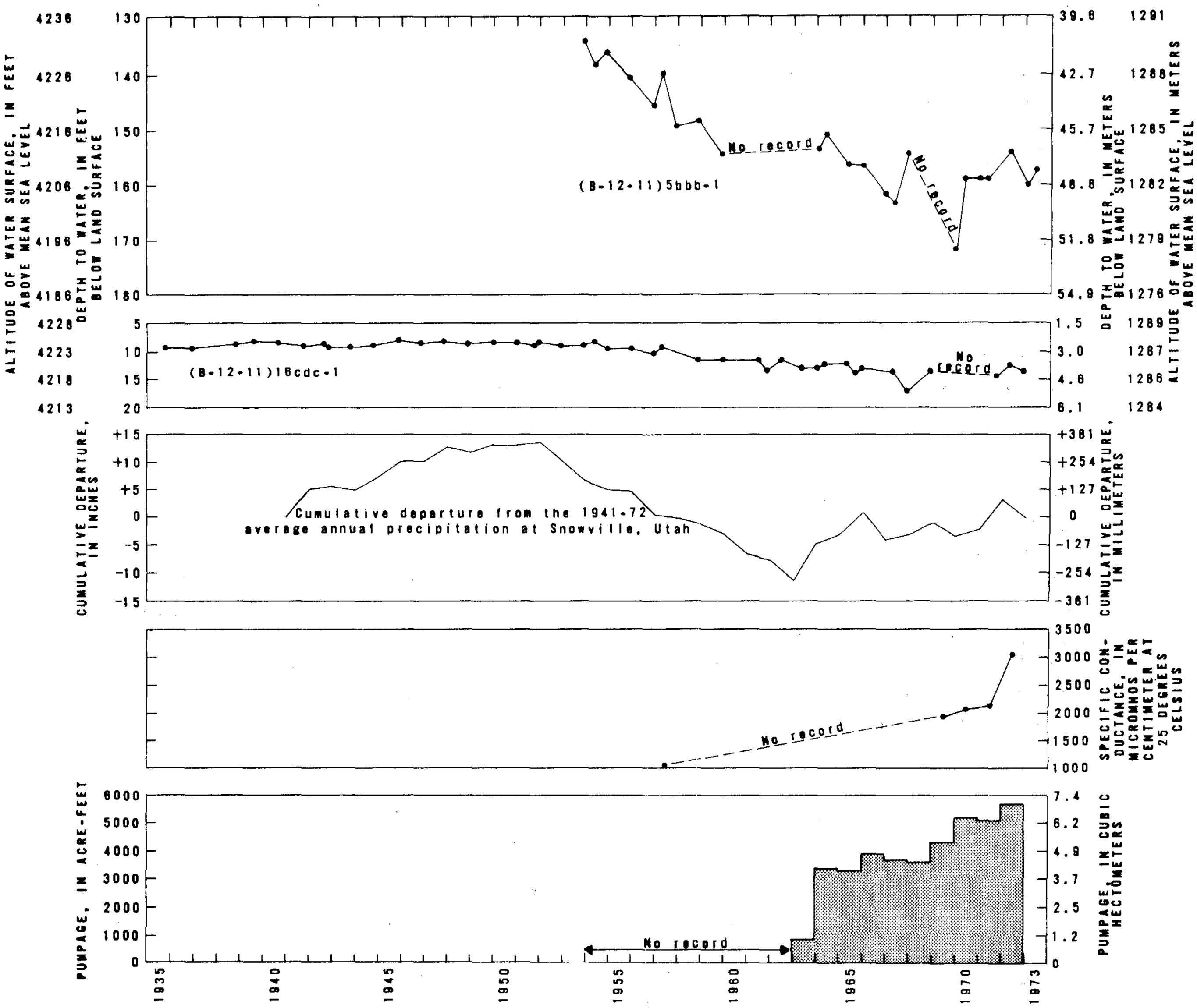


Figure 3.—Changes in water levels in two wells near Kelton, cumulative departure from the 1941-72 average annual precipitation at Snowville, specific conductance of water from well (B-12-11)5bbb-1, and pumpage for irrigation near Kelton.

From the spring of 1967 to the spring of 1973, however, the water level in the well rose about 5 feet (1.5 m). (The extremely low water level in the fall of 1969 was measured soon after pumping ceased at the end of an extremely long pumping season, and it is more representative of seasonal drawdown than of long-term change.) The water level in well (B-12-11)16cdc-1, an unused well about 2 miles (3.2 km) south of the irrigated area, declined about 5 feet (1.5 m) from the spring of 1954 to the spring of 1967 and rose about 1 foot (0.3 m) from the spring of 1967 to the spring of 1972. The rise of water levels between 1967 and 1973 may reflect the 7 years of above-average rainfall during the 10-year period 1963-72, as indicated by the precipitation-departure curve in figure 3. During periods of above-average rainfall, high flows in Indian Creek may result in an increase of recharge to the Kelton flow system.

Although the configuration of the water table in the Kelton area before irrigation began is unknown, the altitude of the water table in 1953 was about 8 feet (2.4 m) lower at well (B-12-11)16cdc-1 than at well (B-12-11)5bbb-1. By about 1957, however, the slope of the water table had changed; and in 1971 the water table was about 10 feet (3.0 m) higher in altitude at well (B-12-11)16cdc-1 than at well (B-12-11)5bbb-1. Thus it appears that a closed depression has formed in the water table around the irrigation wells, and this depression extends beyond well (B-12-11)16cdc-1. (See pl. 3.)

Upgradient from the irrigated area near Kelton, the predominant ions in water from the Kelton flow system are calcium and bicarbonate; for the most part the water contains less than 500 mg/l of dissolved solids (pl. 4). Downgradient from the irrigated area, near the shore of Great Salt Lake, where the shallow sediments contain abundant soluble salts, the predominant ions in the ground water are sodium and chloride. Water from a shallow test hole--(B-12-11)21ddd-1--contained nearly 63,000 mg/l of dissolved solids.

The chemical quality of ground water in the irrigated area near Kelton varies from well to well, and the variations reflect the results of man's activities. The predominant ions in water from well (B-12-11)6abb-1, on the upgradient edge of the irrigated area, are calcium and bicarbonate; the chemical composition of water from this well has changed little since 1956. The predominant anion in water from other wells in the area, however, is chloride. The chemical composition of the water from well (B-12-11)8cda-1, originally on the downgradient edge of the irrigated area, has shown little overall change since 1953. In the three wells in the central part of the irrigated area that have been sampled more than once, however, the concentrations of chloride and calcium have increased substantially, although the concentrations of most of the other ions have changed only slightly. These changes are illustrated in figure 4, and figure 3 shows the relationship between specific conductance of water from well (B-12-11)5bbb-1 and pumpage for irrigation in the Kelton area.

The most probable cause of the observed increase in the mineral content of water from these wells is some recirculation of water pumped for irrigation. This conclusion is strengthened by the fact that well

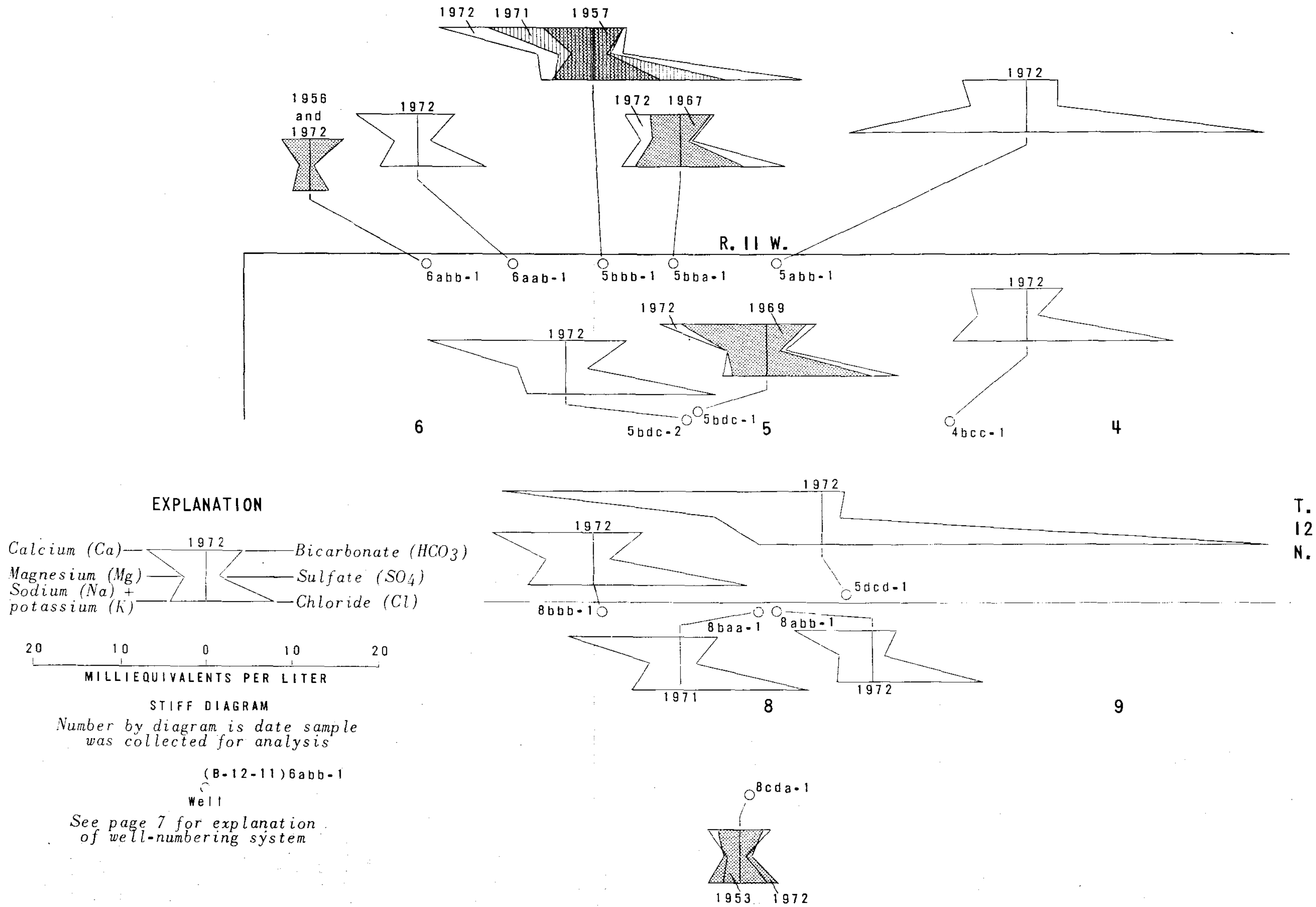


Figure 4.— Changes in chemical quality of ground water in the Kelton area.

(B-12-11)5dcd-1, which yields the most highly mineralized water, is near the center of the irrigated area. About half of the water pumped for irrigation is consumed by crops; some of the applied water is lost by evaporation, and about 10 percent is returned to the saturated zone. The dissolved constituents in the return water have been concentrated by evaporation and transpiration, and additional minerals from the soils are dissolved as the water percolates downward.

The sodium chloride type water yielded by well (B-12-11)5abb-1 (fig. 4) apparently has a different source than that described above. According to the owner, this well was drilled to a depth of about 700 feet (215 m) and encountered hot salty water. This water probably was in the Coyote Spring flow system, which was mentioned previously. The hot salty water was plugged off. The water from this well, however, is about 2-3°C warmer than water from other wells in the area; and the higher water temperature, together with the rather high concentration of sodium chloride, suggests that the plug might not be entirely effective.

Warm salty water also was encountered at a depth of 510 feet (155 m) when well (B-12-11)8cda-1 was drilled; this water also was plugged off.

The history of declining water levels in the irrigated area near Kelton indicates that much of the withdrawal has been from storage. Water levels have stabilized during the period of above-average precipitation from 1967 to 1973, but increased pumping may cause further declines. The concentration of dissolved solids in the water has continued to increase, and this trend may be accelerated by additional increases of pumping.

Juniper-Black Pine flow system

The ground-water flow system in the central part of Curlew Valley is here called the Juniper-Black Pine flow system (pl. 3). It is bounded on the west by the Black Pine Mountains and the Kelton flow system and on the east by the Sublett Range, the Showell Hills, and rocks of Paleozoic age that crop out at several locations along a line that trends south from the Showell Hills to the south end of the Hansel Mountains (pl. 2).

Recharge to the Juniper-Black Pine flow system comes from precipitation on the east side of the Black Pine Mountains and the west side of the Sublett Range, which bound the flow system in Idaho. The average annual recharge to the Juniper-Black Pine flow system, calculated using the method described by Hood and Waddell (1968, p. 22-23) is about 22,000 acre-feet (27.1 hm^3) per year. The calculations are shown in the following tabulation:

Precipitation (inches)	Area (acres)	Estimated annual precipitation		Estimated annual recharge	
		Feet	Acre-feet	Percent of precipitation	Acre-feet (rounded)
More than 35	2,100	3.0	6,300	40	2,500
30-35	2,300	2.7	6,200	35	2,200
25-30	2,600	2.3	6,000	27	1,600
20-25	21,400	1.9	40,700	22	8,900
16-20	16,200	1.5	24,300	14	3,400
12-16	25,200	1.2	30,200	10	3,000
				Total (rounded)	22,000

The area underlain by the flow system in Utah normally receives less than 12 inches (330 mm) of precipitation a year, and little or no water reaches the aquifers from precipitation on the land surface.

Water moves generally toward the center of the valley and south toward Great Salt Lake. Natural discharge from the flow system is mostly in the form of evapotranspiration in Tps. 10-12 N. in Utah. The areas of natural discharge and the configuration of the potentiometric surface are shown on plate 3.

South of the Utah-Idaho border, the valley fill that contains the Juniper-Black Pine flow system is interbedded with lenses and tongues of basalt that become thicker and more numerous southward. However, basalt has not been reported to have been penetrated by wells in the flow system in Idaho. Wells in the flow system produce water from fractured basalt, from clean, well-sorted sand and gravel, or from poorly sorted deposits of clay, sand, and gravel. Although the presence of bodies of basalt or clay cause leaky artesian conditions locally, unconfined conditions generally prevail in the flow system.

The chief withdrawal of water from the Juniper-Black Pine flow system by man is through irrigation wells in Tps. 14-15 N., Rs. 9-10 W., in Utah. Only a minor amount of water for stock, domestic use, and small-scale irrigation is pumped from the system in Idaho. The first irrigation wells in this part of the valley were drilled in Utah in 1955. More wells have been drilled each year since, although not all the completed wells have been put into production. The annual pumpage for irrigation from 1964 through 1972 is tabulated below. A total of about 2,900 acres (1,175 hm^2) was irrigated with ground water in 1972 (J. W. Metcalf, U.S. Soil Conservation Service, oral commun., 1972). The surficial material in the irrigated area is extremely fine grained; thus little or none of the water pumped returns to the aquifer by deep percolation.

Pumpage for irrigation, Juniper-Black Pine flow system

(All pumpage is from Utah)

Year	Approximate pumpage (acre-feet)	(cubic hectometers)	Number of wells pumped
1964	4,200	(5.2)	7
1965	4,300	(5.3)	8
1966	6,000	(7.4)	9
1967	6,200	(7.6)	10
1968	9,100	(11.2)	12
1969	9,900	(12.2)	12
1970	12,000	(14.8)	11
1971	11,400	(14.1)	12
1972	14,800	(18.3)	14

The long-term records available indicate that water levels have declined as much as 10 feet (3 m) near the center of pumping in this area since the beginning of pumping for irrigation in 1956 (fig. 5). The large drawdowns shown in figure 5 for some wells in 1966 and 1969 are the result of longer than usual pumping seasons and do not represent permanent declines.

The net downward trend of water levels in wells (B-14-9)1dda-1, (B-14-9)7bbb-1, and (B-15-10)36bbb-1, despite generally above-average precipitation since 1963 (fig. 5), suggests that part of the water pumped has been taken from storage. Although the declines appear to have leveled off since 1969, increased pumping would probably lead to further declines, especially during periods of below-average precipitation.

The volume of water that moves into Utah from Idaho is of concern to water users and managers in both States. At present (1973), no significant amount of ground water is discharged from wells or by evapotranspiration in the Juniper-Black Pine flow system in Idaho; hence the average amount of water that moves across the State boundary annually is approximately equal to the average annual recharge to the system in Idaho, which was estimated earlier in this section to be about 22,000 acre-feet (27.1 hm^3).

Water discharges naturally from the Juniper-Black Pine flow system by evapotranspiration in the areas delineated on plate 3. South of T. 12 N., the surface expression of the separation between the Kelton and Juniper-Black Pine flow systems is missing. In the absence of better subsurface data, the discharge by evapotranspiration from the two systems cannot be accurately separated and consequently is lumped in the following tabulation:

Source	Estimated depth to water (feet)	Estimated areal density of growth (percent)	Rate of evapotranspiration (acre-feet per acre per year)	Area (acres)	Discharge (acre-feet, rounded)
Greasewood	10-40	20-40	0.10[1]	17,100	1,700
Greasewood and rabbitbrush	5-20	50-60	1.00[2]	6,100	6,100
Saltflats (some greasewood, saltgrass, and pickleweed)	0- 5	0- 5	.10[3]	43,600	4,400
			Total (rounded)		12,000

[1]Taken from Robinson (1958, p. 62 and 69).
[2]Taken from Mower and Nace (1957, p. 21).
[3]Taken from Feth, Barker, Moore, Brown, and Veirs (1966, p. 68-70).

The chemical quality of water in the Juniper-Black Pine flow system varies with location, but in general it deteriorates from north to south. Water from all wells and springs north of the middle of T. 14 N. in Utah, except near the Showell Hills, contains less than 500 mg/l of dissolved solids (pl. 4), and the predominant ions are calcium and bicarbonate. Near the Showell Hills, however, the water from well (B-15-9)28cbb-1 contains more than 2,600 mg/l of dissolved solids, and the predominant ions are sodium, calcium, and chloride. This water is similar in chemical quality to the water from well 16S-32E-16bcb-1, east of the Showell Hills; and the water from both wells is more highly mineralized than water from nearby wells that are more distant from the Showell Hills. The source of the slightly saline water may be a concealed and unmapped fault in the Showell Hills. As water moves south through the flow system, however, it becomes increasingly saline (see pl. 4). The increase in salinity southward is attributed to the solution of salts, primarily sodium chloride, from the sediments through which the water moves.

In the six wells checked, no significant change has been observed in the chemical quality of water in the flow system, other than that of the water from well (B-15-9)28cbb-1, which has increased in salinity steadily since the well was put into production in 1955 (fig. 6). The increase of salinity apparently is related to continued pumping at the well.

Increased development of water from the Juniper-Black Pine flow system is possible, but additional development should be considered carefully to minimize undesirable consequences. An increase in pumping in the area of present development will accelerate the trend of declining water levels, with a corresponding increase in pumping lifts, which were more than 200 feet (61 m) at some wells by 1972. New wells northeast of well (B-15-9)28cbb-1 may yield slightly or moderately saline water.

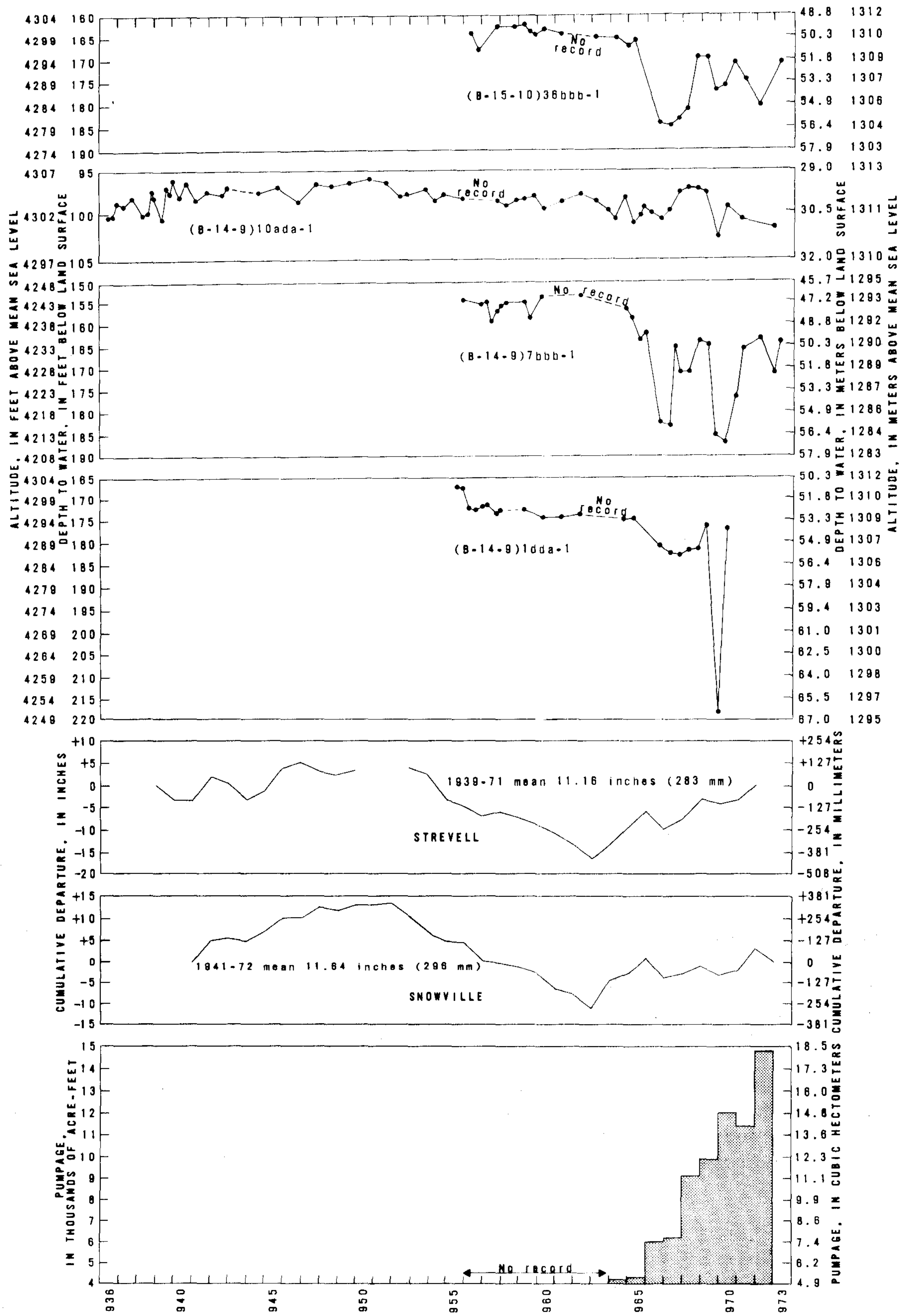


Figure 5.—Water-level fluctuations in wells in the Juniper-Black Pine flow system, cumulative departure from average precipitation at Strevell and Snowville, and pumpage for irrigation in Utah.

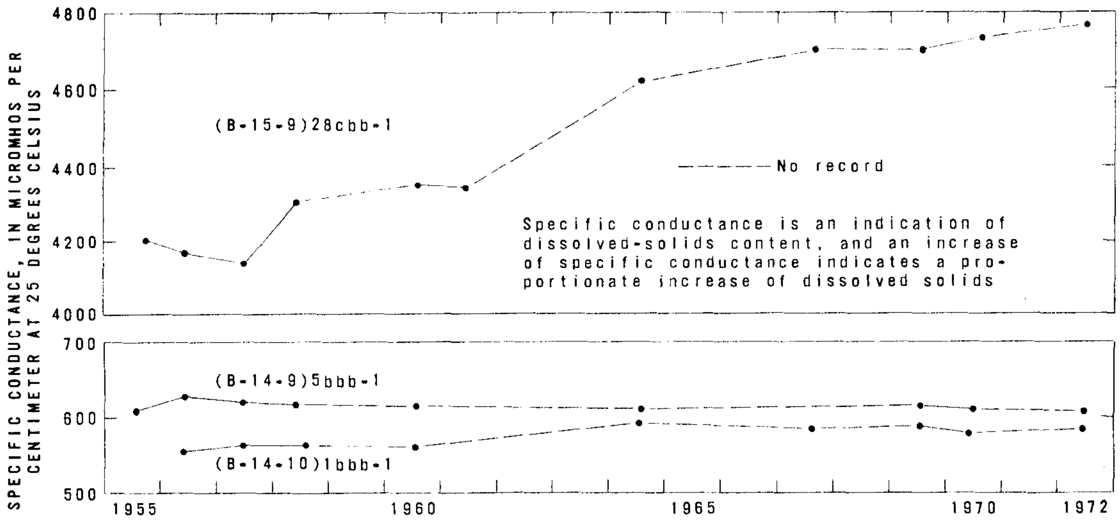


Figure 6.—Specific conductance of water from wells in the Juniper-Black Pine flow system.

Holbrook-Snowville flow system

The aquifers in the valley fill of the Holbrook arm and in both the valley fill and the Paleozoic bedrock along the east side of the valley in Utah apparently function as a unit, which is here called the Holbrook-Snowville flow system (pl. 3). The deep structural depression that underlies the Holbrook arm apparently extends south toward the Hansel Mountains (pl. 2) as a trough of low-density material. Wells (B-13-8)10dcc-1 and (B-13-8)21dcd-1, which were drilled in this trough between the Hansel Mountains and the line of bedrock outcrops south of the Showell Hills, were both finished in what was reported to be "layered rock"; and the consolidated rock yielded water in both wells.

Water in this flow system is unconfined in the northern part of the Holbrook arm in Idaho. Near the Utah-Idaho boundary, however, leaky artesian conditions are common; and south of T. 13 N. in Utah, extensive basalt layers serve as confining beds in the southern part of the flow system.

Recharge to the Holbrook-Snowville flow system comes primarily from precipitation on the east side of the Sublett Range, the southeast end of the Deep Creek Mountains, the west side of the Blue Springs Hills, and the west side of the North Promontory Mountains, which together bound the Holbrook arm in Idaho. Recharge in Idaho was estimated using the method described by Hood and Waddell (1968, p. 22-23) as about

44,000 acre-feet (54.3 hm^3) per year. Some additional recharge, estimated as about 2,000 acre-feet (2.5 hm^3) per year, enters the system from precipitation on the Hansel Mountains in Utah. The calculations are shown in the following tabulation:

Precipitation (inches)	Area (acres)	Estimated annual precipitation		Estimated annual recharge	
		Feet	Acre-feet	Percent of precipitation	Acre-feet (rounded)
Utah					
12-16	10,700	1.2	12,800	12	1,540
				Subtotal (rounded)	2,000
Idaho					
More than 25	2,200	2.1	4,600	28	1,300
20-25	32,300	1.9	61,400	23	14,100
16-20	70,200	1.5	105,300	16	16,800
12-16	72,000	1.2	86,400	14	12,100
				Subtotal (rounded)	44,000
				Total (rounded)	46,000

The average discharge of Deep Creek below Holbrook Springs, most of which comes from the springs, is about 30 ft^3/s (0.8 m^3/s) or about 22,000 acre-feet (27.1 hm^3) per year (see section on Deep Creek). The average discharge of Deep Creek near the Utah-Idaho boundary is about 8.5 ft^3/s (0.24 m^3/s) or 6,000 acre-feet (7.4 hm^3) per year. An estimated 3,000 acre-feet (3.7 hm^3) per year is consumed by evapotranspiration from Curlew Valley Reservoir and the marshy areas along Deep Creek. The remaining water, about 13,000 acre-feet (16.0 hm^3) per year, is diverted to irrigation canals. About one-half of the water diverted to canals is used in Utah (Chapman and Young, 1972, p. 23), and the remainder is used in Idaho. Thus, the disposition of the water discharged at Holbrook Springs is summarized as follows:

Disposition	Acre-ft/yr	(hm^3/yr)
Evapotranspiration	3,000	(3.7)
Flow to Utah in Deep Creek	6,000	(7.4)
Diverted for irrigation	13,000	(16.0)
Total	22,000	(27.1)

Water diverted for irrigation in Idaho is delivered to users in unlined canals and ditches and applied to fields by flooding and furrow methods. It is estimated that less than half the water diverted is consumed by crops, and that about 4,000 acre-feet (4.9 hm^3) per year infiltrates to the ground-water reservoir. An average amount of 12,000 acre-feet (14.8 hm^3) per year was pumped for irrigation in the Holbrook arm during 1969-71. Chapman and Young (1972, p. 48), from crop-water requirements and irrigated-acreage data, estimate the consumptive use of ground water as 6,000 acre-feet (7.4 hm^3) per year.

From the foregoing, the ground-water budget for the Holbrook arm can be summarized as follows:

	Acre-ft/yr	(hm^3/yr)
Recharge in the mountains	44,000	(54.3)
Discharge at Holbrook Springs	-22,000	(-27.1)
Pumpage for irrigation	-12,000	(-14.8)
Return flow from surface water diverted for irrigation	4,000	(4.9)
Return flow from ground water diverted for irrigation	6,000	(7.4)
Net (subsurface inflow to Utah)	20,000	(24.7)

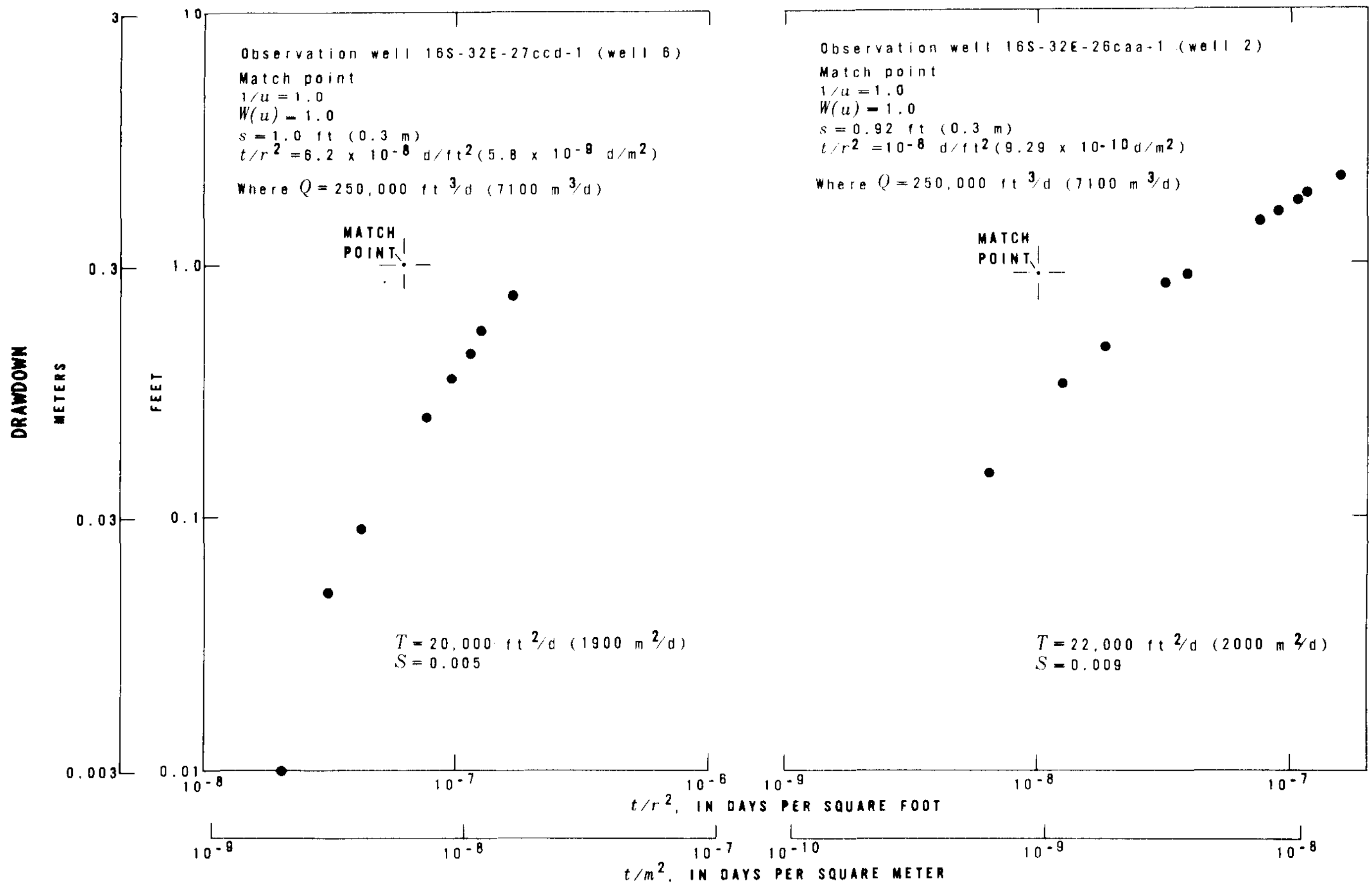
The figure of 20,000 acre-feet (24.7 hm^3) per year for subsurface inflow to Utah is in reasonably good agreement with the 18,000 acre-feet (22.2 hm^3) per year estimated by Chapman and Young (1972, p. 46).

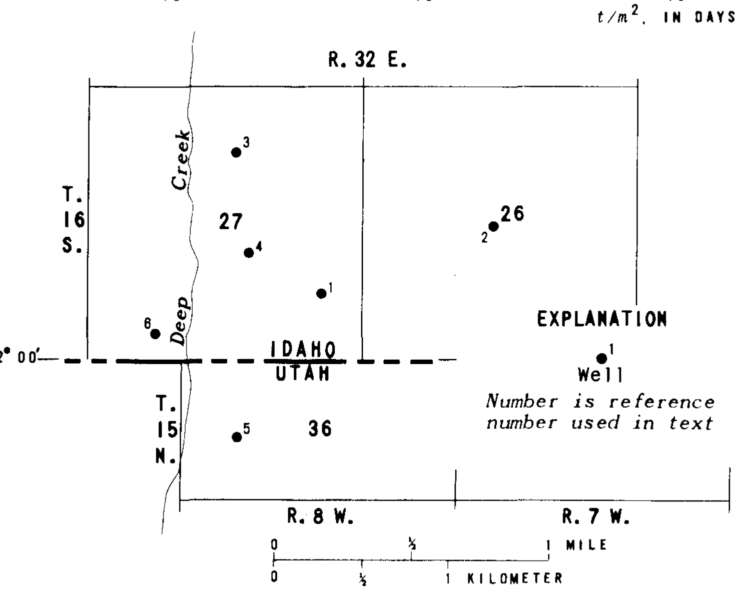
An aquifer test a few miles north of Snowville was conducted by personnel of the Idaho Department of Water Administration in November 1970. This writer was present at the test and assisted in the data collection, and the interpretation of the test data shown in figure 7 is that of this writer.

Well 1 was pumped for about 48 hours at an average rate of 2.9 ft^3/s (0.09 m^3/s), and water levels were measured in six wells. After the pump was turned off, water levels in all wells were measured for an additional 26 hours. Wells 3, 4, and 5 are domestic wells that were pumped intermittently during the test, and data from these wells were too erratic to be useful. Values for T and S were obtained from the data from wells 2 and 6 by matching drawdown data from the wells to the nonequilibrium-type curve, using the method described by Lohman (1972, p. 15-19). (See fig. 7.) Although the number of measurements at each well was small, the fit of the data to the type curve is reasonable; and the computed values of T and S are in good agreement.

The specific capacity of well (B-14-8)11bca-1, about 4 miles (6.4 km) south of the area of the pumping test, was 80 gallons per minute per foot (17 l/s/m) of drawdown, corresponding to a value of T of about 19,000 ft^2/d (1,770 m^2/d).

Withdrawals of ground water from the Holbrook-Snowville flow system in Utah are small. A few wells north of the middle of T. 14 N. produce about 1,000 acre-feet (1.2 hm^3) per year for irrigation and for public supply at Snowville. Water levels in the flow system in Utah have remained fairly constant (fig. 8).





Transmissivity and storage coefficient were calculated from the Theis nonequilibrium formula:

$$T = \frac{Q}{4\pi s} W(u)$$

and

$$S = \frac{4Ttu}{r^2}$$

where T = transmissivity, in square feet per day (square meters per day),
Q = discharge of the well, in cubic feet per day (cubic meters per day),
s = drawdown, in feet (meters),
$W(u)$ = well function of u,
S = storage coefficient (dimensionless),
t = time since pumping began, in days,
u = a dimensionless variable,
and r = the distance from the pumped well to the observation well, in feet (meters).

The derivation of the equations and of the variables u and $W(u)$ and a description of the method are given by Lohman (1972, p. 15-19)

Figure 7.—Wells used in a pumping test of the Holbrook-Snowville flow system and calculation of aquifer characteristics.

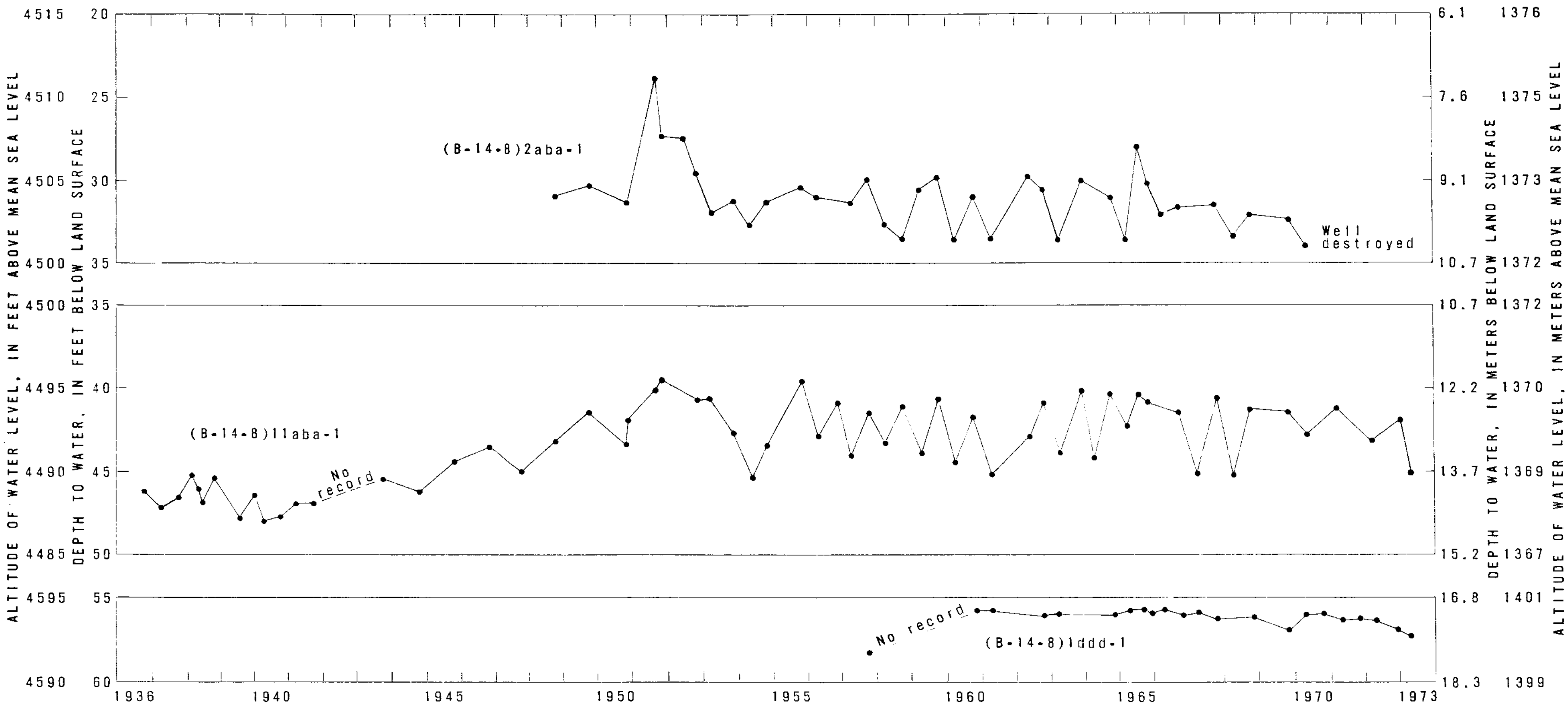


Figure 8.—Water levels in observation wells in the Holbrook-Snowville flow system.

The water diverted from Deep Creek for irrigation in Utah is distributed in unlined canals and ditches. Infiltration losses of this water are estimated as about one-half the diversion, or 3,000 acre-feet (3.7 hm^3) per year. This net addition of about 2,000 acre-feet (2.5 hm^3) per year, together with the 2,000 acre-feet (2.5 hm^3) per year added from precipitation on the Hansel Mountains, gives a total of about 24,000 acre-feet (29.6 hm^3) per year that flows southward toward Locomotive Springs. Of this, about 1,000 acre-feet (1.2 hm^3) is discharged by evapotranspiration near the springs, as shown in the following tabulation:

Source	Estimated depth to water (feet)	Estimated areal density of growth (percent)	Rate of evapotranspiration (acre-feet per acre per year)	Area (acres)	Discharge (acre-feet, rounded)
Greasewood	10-40	20-40	0.10[1]	7,400	700
Saltflats (some greasewood, saltgrass, and pickleweed)	0- 5	0- 5	.10[2]	4,600	500
			Total (rounded)		1,000

[1]Taken from Robinson (1958, p. 62 and 69).
[2]Taken from Feth, Barker, Moore, Brown, and Veirs (1966, p. 68-70).

Most ground water sampled from sources north of T. 14 S. in the Holbrook-Snowville flow system in Idaho contains less than 600 mg/l of dissolved solids (pl. 4), and calcium and bicarbonate are the dominant ions. The concentration of dissolved solids increases downvalley, and several samples obtained in T. 16 S. in Idaho contain more than 1,000 mg/l. This gradual downvalley increase is probably due partly to solution of soluble minerals from the aquifers and partly to the addition of dissolved minerals in irrigation return flows. The markedly higher concentration of dissolved solids near the west side of the valley in T. 16 S. (more than 2,700 mg/l in well 16S-32E-16bcb-1) indicates the addition of more saline water to the flow system in this area from the Showell Hills. This is discussed earlier in the section on the Juniper-Black Pine flow system.

The water samples collected from the Holbrook-Snowville flow system in Utah indicate a gradual southward increase of dissolved solids. The value of 10,000 mg/l of dissolved solids obtained for a sample from well (B-13-9)35bbd-1, however, may represent a perched water zone. No other sample from the system approaches this concentration.

There are few long-term records of the chemical quality of water from this flow system. Comparison of analyses of samples collected in Idaho during 1969-72 with analyses of samples from the same area collected in 1931 and 1947 show no significant changes (see table 3). With increased use of ground water for irrigation, some future deterioration in chemical quality of the shallow ground water is possible, because a large part of the water diverted for irrigation is not consumed but is returned to the aquifer with an increased load of dissolved solids.

Further development of water from this flow system is possible, but the effects may be far reaching. A substantial decline in water levels would ultimately be reflected in decreased discharge at Locomotive Springs. Moreover, because the water table in the southern part of the Holbrook arm is flat, substantial water-level declines might form a closed depression in the water table that would permit the accumulation of soluble salts in the developed area; and the chemical quality of the pumped water then would deteriorate.

Coyote Spring flow system

Coyote Spring, (B-14-10)33bcc-S1, is a moderately saline thermal spring. The water contains 3,240 mg/l of dissolved solids, of which half, 1,620 mg/l, is chloride; the temperature of the water is 43.5°C (110°F). Although no other source in Curlew Valley produces thermal water, two wells in the Kelton area reportedly encountered hot saline water at depth. (See section on the Kelton flow system.) These data suggest that a flow system containing hot saline water may underlie at least part of the western half of Curlew Valley.

No data are available regarding either the recharge or the discharge area of the Coyote Spring flow system other than Coyote Spring itself. The flow system presently is of little economic importance as a source of water because nearly everywhere that it has been found, it is overlain by better quality water at shallower depths. The high temperatures of water in the system presumably indicate the presence in the subsurface of a relatively young intrusive body that is still hot, or relatively deep circulation of the water. No studies have been made of the geothermal gradient in Curlew Valley and adjacent areas; but it is possible that in these areas, which have been subjected to igneous activity in late Tertiary and Quaternary time, the geothermal gradient might be abnormally high.

Ground water in the older rocks surrounding Curlew Valley

The rocks of Paleozoic and Precambrian age that form the mountains around Curlew Valley are, for the most part, well indurated; and their primary permeability is low. Well-developed fracture systems are present in most of these rocks, however, and the carbonate rocks of Paleozoic age locally contain numerous solution openings. Consequently, the secondary permeability is high in many places.

The Raft River Mountains on the west side of Curlew Valley consist of a central core of crystalline rocks of Precambrian age surrounded by sedimentary rocks of Paleozoic age (pl. 2). The older crystalline rocks probably are not a very productive aquifer, but they have some secondary permeability, and some of the precipitation that falls on them enters the subsurface as ground-water recharge. The secondary permeability of the Paleozoic rocks locally is high. Springs are abundant throughout the east end of the Raft River Mountains (pl.

1). Most of them are small--the discharge of only a few exceeds 20 gal/min (gallons per minute) (1.3 l/s)--but they are adequate for watering of livestock. No wells have been drilled in the area. The concentration of dissolved solids in six samples of water from the springs is less than 500 mg/l (pl. 4).

Ground-water discharge from the consolidated rocks of the Raft River Mountains, aside from the small amount discharged by springs, is in the form of subsurface flow to the valley fill.

The Black Pine Mountains, which bound the Juniper-Black Pine area on the west, consist largely of carbonate rocks of Paleozoic age. These rocks are well fractured and the secondary permeability is high, as evinced by the virtual absence of runoff from this mountain range, although on the average it receives a maximum of more than 35 inches (890 mm) of precipitation per year. Small springs in the Black Pine Mountains supply water for livestock, but springs are less numerous there than in the Raft River Mountains. No wells are known to penetrate the rocks in the mountain area, but a few wells in the adjacent valley floor, such as well 14S-30E-32cdd-1, derive part of their water from carbonate rocks. Most of the ground water discharged from the consolidated rocks in the Black Pine Mountains enters the valley fill by subsurface flow and is a major source of recharge to the aquifers in the fill.

The rocks of the Sublett Range, which separates the Juniper-Black Pine area from the Holbrook arm, are generally similar to those of the Black Pine Mountains. Springs are not abundant in the Sublett Range, and most of the water that enters the ground in these mountains flows into the valley fill as subsurface recharge.

A major area of discharge from the consolidated rocks east of the Sublett Range is Holbrook Springs. Although this large spring group appears in the channel of Deep Creek, the temperature and the quality of the water suggest that the source of the springs is water from the consolidated rocks rather than from the valley fill. The temperature of water from the springs is 8-10°C warmer than that of water from the valley fill, and the concentration of dissolved solids is lower (pl. 4 and table 6).

Basalt crops out less than 3 miles (5 km) northwest of Holbrook Springs, and interpretation of data from the gravity survey (pl. 2) indicates that consolidated rocks are present at relatively shallow depth in the vicinity of the springs. The relatively high temperature (20°C) of the water and the relatively low concentration of dissolved solids (411 mg/l), together with the geophysical data, suggest that Holbrook Springs may discharge from basalt underlying the valley fill at shallow depth.

The predominant ions in water discharged from the rocks of the Sublett Range at Twin Springs are calcium and bicarbonate, and the concentration of dissolved solids is 470 mg/l (pl. 4). Water that enters the Juniper-Black Pine and Holbrook-Snowville flow systems from the

Showell Hills, a southward extension of the Sublett Range, is slightly saline (see section on the Juniper-Black Pine flow system).

The Hansel, North Promontory, and Deep Creek Mountains and the Blue Springs Hills, which border Curlew Valley on the north and east, consist of sedimentary rocks of Paleozoic age. Carbonate rocks are the predominant type, and secondary permeability in most places is high. Most of these mountain blocks receive an average of less than 20 inches (500 mm) of precipitation a year; but surface runoff is slight, and most of the precipitation that is not consumed by evapotranspiration becomes ground water.

A few springs in the Deep Creek and North Promontory Mountains and the Blue Springs Hills discharge small quantities of water that are low in dissolved solids; the most concentrated sample, from Ireland Springs, contains 439 mg/l. The principal discharge from these mountain blocks, however, is in the form of subsurface discharge into the valley fill.

The Hansel Mountains, unlike the other mountain ranges that surround Curlew Valley, are not a continuous mass of bedrock outcrops. Moreover, the crest of the range appears on the gravity map (pl. 2) as a gravity trough--that is, an area of lower than average density. On the basis of the geophysical evidence, the rocks of the Hansel Mountains are included with the adjacent valley fill as part of the Holbrook-Snowville flow system.

Locomotive Springs

Locomotive Springs is the source of water to a large tract of marshy land in the southern part of Curlew Valley near the shore of Great Salt Lake (pls. 1 and 5). Six principal springs--West Locomotive, Baker, Bar M, Teal, Off, and Sparks--form small natural ponds near the northern edge of the marshy area. Most of the overflow from these ponds moves through sluggish, winding channels to two artificial impoundments called East Lake and West Lake. The ponds and lakes and much of the surrounding marsh comprise the Locomotive Springs State Waterfowl Management Area. Most of the water discharged by the springs is consumed by evapotranspiration, and only about 2,000 acre-feet (2.5 hm^3) per year (less than 10 percent of the total discharge) flows into Great Salt Lake.

Discharge

Because of extremely low gradients and the abundance of mud and vegetation in the overflow channels, measurement of the total discharge of Locomotive Springs has always been difficult. Measurements and estimates by personnel of the Utah Department of Fish and Game (now the Division of Wildlife Resources) and officials of Box Elder County in March and July 1939 gave a total discharge of about 40 ft^3/s (1.13 m^3/s).

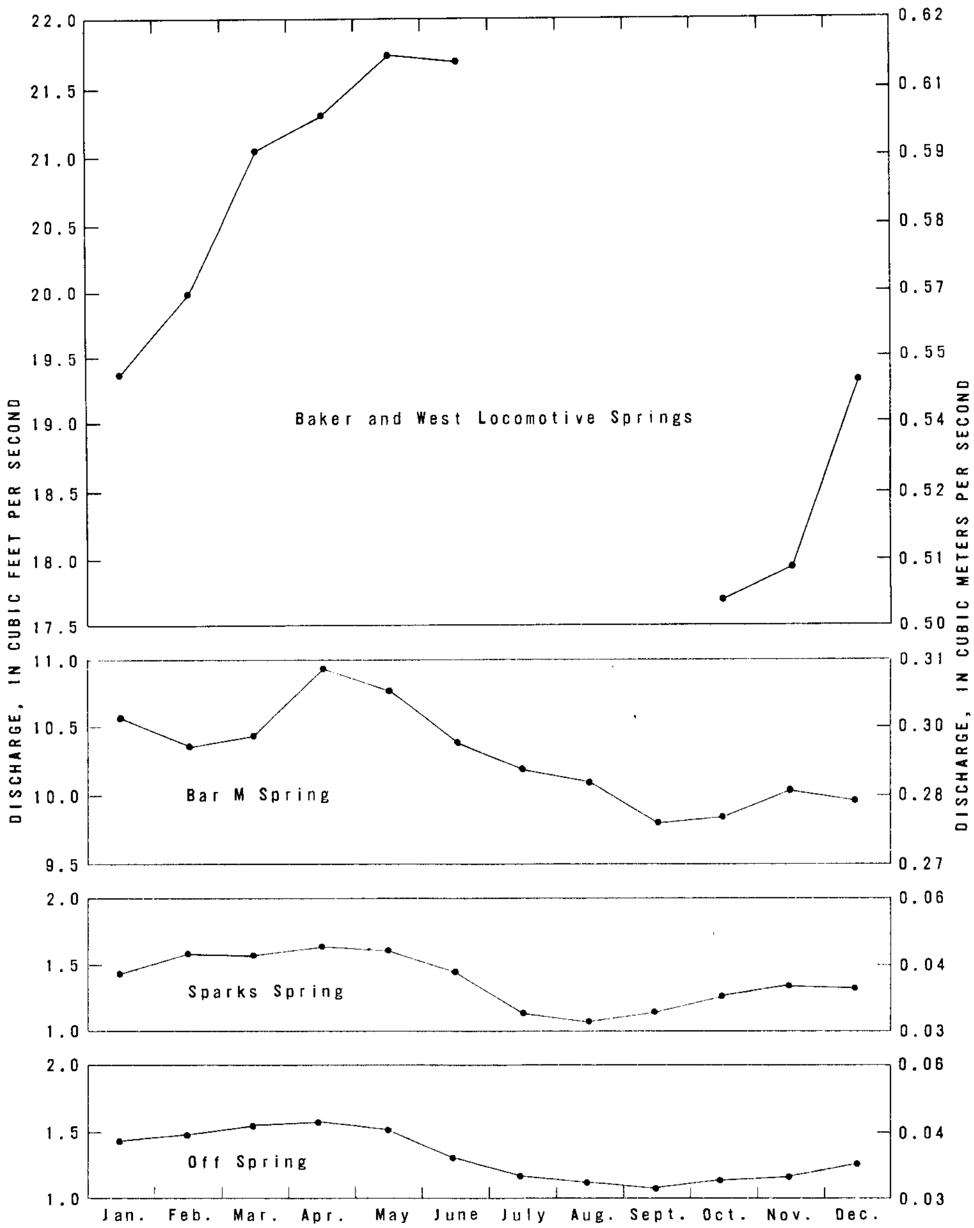


Figure 9.—Mean discharge, by months, at Baker and West Locomotive, Bar M, Sparks, and Off Springs, 1969-72.

difference in concentration between the most dilute water (Baker Spring) and the most concentrated (Teal Spring). Moreover, the ion ratios suggest that the Great Salt Lake or its surrounding saline sediments are the source of the salts in the spring water (B. F. Jones, written commun., 1971). It is possible, however, that the source of the salts may be a small amount of saline water from greater depths, such as is found in the Coyote Spring flow system or such as discharges in springs at Monument Point (Hood, 1971, pl. 1).

Table 3.--Selected chemical-quality data for dissolved constituents from Locomotive Springs, 1959-72

Location	Name	Milligrams per liter									Number of samples
		Calcium (Ca) (mean)	Magnesium (Mg) (mean)	Sodium (Na) (mean)	Bicarbonate[1] (HCO_3) (mean)	Sulfate (SO_4) (mean)	Chloride (Cl) (mean)	Dissolved solids			
								Maximum	Minimum	Mean	
(B-11-9)5cca-S1	Sparks	103	70	1,140[2]	222	151	1,960	3,840	3,330	3,630	10
6cdc-S1	Off	107	72	990	217	147	1,740	3,320	3,170	3,230	6
(B-11-10)1adc-S1	Bar M	122	63	917[3]	213	130	1,640	3,650	2,800	3,050	12
12aac-S1	Teal	102	71	1,220	202	154	2,090	4,160	3,520	3,820	6
(B-12-10)36cab-S1	West Locomotive	104	52	747	204	93	1,360	2,920	2,140	2,550	10
36dcc-S1	Baker	119	60	518	221	88	1,020	2,450	1,820	1,970	11

[1]Not field filtered.
[2]Only nine analyses include separate determination for sodium.
[3]Only 11 analyses include separate determination for sodium.

Source of water to the springs

Prior to the beginning of withdrawal of water through wells in Curlew Valley, the ground water moving down the entire valley was discharged in the southern part of the valley at Locomotive Springs and in the lowlands near and west of the springs by evapotranspiration. By 1972, however, the available data indicate that the discharge from the springs consisted almost completely of water moving through the Holbrook-Snowville flow system.

Some of the ground water that moves downgradient through Curlew Valley may discharge directly to Great Salt Lake as diffuse seepage beneath the lake surface. The volume of such seepage was not determined in this investigation, but it is assumed to be negligible. The fine-grained lakebed sediments that form most of the valley fill in the lower end of Curlew Valley are of low permeability, and they impede the movement of ground water toward the lake. The water is forced upward toward the land surface and discharges north of the lake at the springs or by evapotranspiration.

As discussed previously in this report, recharge to the Kelton and Juniper-Black Pine flow systems averages about 30,000 acre-feet (37.0 hm^3) per year. Withdrawals from wells in the two systems for the period 1970-72 averaged about 18,000 acre-feet (22.2 hm^3) per year, and discharge by evapotranspiration from the two systems in the southern part of Curlew Valley near the springs was about 12,000 acre-feet (14.8 hm^3) per year. The close agreement of the totals for recharge and discharge suggests that during 1970-72 little, if any, of the water moving through the Kelton and Juniper-Black Pine flow systems discharged at Locomotive Springs.

The calculations in the earlier section of this report for the Holbrook-Snowville flow system indicate that about 24,000 acre-feet (29.6 hm^3) of water per year moves southward to discharge at or near Locomotive Springs. Of this, about 1,000 acre-feet (1.2 hm^3) is discharged by evapotranspiration in the southern part of the valley. Thus approximately 23,000 acre-feet (28.4 hm^3) from the Holbrook-Snowville flow system was available annually during 1969-72 for discharge at Locomotive Springs. By comparison, the calculated discharge of the springs averaged about 24,000 acre-feet (29.6 hm^3) annually during 1969-72. The difference is well within the order of accuracy of the methods used to calculate the figures.

After discharging from the springs, some of the water is consumed directly by evapotranspiration from open-water bodies and areas of phreatophytes, some is diverted for irrigation of grass, and the remainder moves overland to Great Salt Lake. Computations of the amounts discharged by evapotranspiration are shown in the following tabulation:

Source	Estimated depth to water (feet)	Estimated areal density of growth (percent)	Rate of evapotranspiration (acre-feet per acre per year)	Area (acres)	Discharge (acre-feet, rounded)
Pickleweed and greasewood	0-10	10- 20	0.45[1]	3,300	1,500
Open-water surfaces (some hydrophytes)	-	-	3.50[2]	3,500	12,200
Saltgrass and other marsh grasses	0- 5	90-100	3.00[3]	2,600	7,800
			Total (rounded)		22,000

[1]Taken from Mower and Nace (1957, p. 21).
[2]Taken from Kohler, Nordenson, and Baker (1959, pl. 2).
[3]Taken from Feth, Barker, Moore, Brown, and Veirs (1966, p. 68-70).

Effects of ground-water development on Locomotive Springs

Little, if any, of the water moving through the Kelton and Juniper-Black Pine flow systems during 1970-72 discharged at Locomotive Springs. Continued withdrawal of ground water in Curlew Valley west of Showell Hills, therefore, is unlikely to have any effect on the springs. It is possible, however, that should the cone of influence of the wells west of Snowville expand greatly, some water that would otherwise reach the springs from the Holbrook-Snowville flow system might be diverted.

A decline of water levels in the Holbrook-Snowville flow system will ultimately result in a reduction of discharge at Locomotive Springs. The magnitude of the effects at the springs and the time before the effects will be discernible cannot be assessed with the data presently available.

Comparison of the available measurements of the discharge at Locomotive Springs suggest that the discharge during 1969-72 was less than that measured in 1939 and 1967. This apparent decrease in spring discharge paralleled a period when withdrawals from wells were substantially increasing in Curlew Valley. The records are incomplete and short, however, and the collection of records of discharge at the springs and withdrawals for irrigation in the valley should be continued in order to define further the relation between the two.

SUMMARY

The surface-water supply of the Curlew Valley drainage basin is small and is wholly appropriated. Much of the present economy of the area and any potential for further development is dependent on ground water.

The drainage basin is a complex of structural ridges and basins. Divertable ground-water supplies in the mountainous regions are small but adequate for the needs of grazing livestock. Within the valley, ground water in sufficient quantities for irrigation is available from three flow systems.

Along the west side of the valley, the Kelton flow system furnishes water for irrigation of about 1,500 acres (610 hm^2) north of the old townsite of Kelton. Water levels in the area of pumping have declined as much as 25 feet (7.6 m) since pumping began in 1953, and the concentration of dissolved solids in the water is increasing. Although water levels appear to have stabilized during 1967-73, increased development would probably result in further lowering of water levels and accelerated increase in the concentration of dissolved solids.

In the central part of the valley, about 2,900 acres (1,175 hm^2) of land are irrigated with ground water from the Juniper-Black Pine flow system. Water levels in the area of pumping have declined as much as 10 feet (3 m) since pumping began in 1956 but have changed little since 1969. No change in water quality has been observed in most of the flow system, but the concentration of dissolved solids has increased in the water from well (B-15-9)28cbb-1 near the Showell Hills. Development of additional water supplies from this flow system is possible, but such development will result in further lowering of water levels. If the lowering of water levels is great enough, it might result in a diversion of water from the Holbrook-Snowville flow system that might otherwise reach Locomotive Springs.

Along the east side of the valley, ground-water development from the Holbrook-Snowville flow system was small until recent years. During 1969-71 an average of about 12,000 acre-feet (14.8 hm^3) of water per year was pumped for irrigation in the Holbrook arm, but only about half the water that is pumped is consumed. No widespread declines in water levels or changes in water quality have been observed in this area. If further development results in a substantial decline of water levels, however, this would ultimately be reflected in a decrease of the discharge of Locomotive Springs.

Most of the recharge areas in the drainage basin are in Idaho, but most of the natural discharge areas are in Utah. In 1972, about 47,000 acre-feet (58.0 hm^3) of water crossed the Idaho-Utah boundary in the subsurface--about 5,000 acre-feet (6.2 hm^3) in the Kelton flow system, about 22,000 acre-feet (27.1 hm^3) in the Juniper-Black Pine flow system, and 20,000 acre-feet (24.8 hm^3) in the Holbrook-Snowville flow system. The recharge in Utah was about 3,000 acre-feet (3.7 hm^3) from the Raft River Mountains and about 2,000 acre-feet (2.5 hm^3) from the Hansel Mountains.

About 12,000 acre-feet (14.8 hm^3) of water is discharged in Utah from the Juniper-Black Pine and Kelton flow systems by evapotranspiration annually, and the average annual pumpage from these flow systems during 1970-72 was about 18,000 acre-feet (22.2 hm^3). Discharge from the Holbrook-Snowville flow system in Utah is about 25,000 acre-feet (30.8 hm^3) per year.

Locomotive Springs, in the southern part of the valley, had an average annual discharge of about 24,000 acre-feet (29.6 hm^3) of water during 1969-72. The discharge from the springs consisted almost completely of water moving through the Holbrook-Snowville flow system. Discharge records at the springs are too short to allow determination of the long-term average discharge, however, and collection of records of discharge at the springs and withdrawals for irrigation in the valley should be continued in order to clarify further the relation between the two.

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BASIC DATA

Table 4.--Records of wells

Location: See text for description of well-numbering system.
Casing: Depth - Depth to first opening or perforation in casing.
Altitude: Altitude of land surface. Underscored altitudes were determined by instruments and are accurate to ±1 foot, other altitudes are interpolated from topographic maps and are accurate to ±10 feet.
Use of water: H, domestic; I, irrigation; P, public supply; S, livestock; U, unused.
Production: Yield and drawdown data are from driller's log or pump installer's test; M, in column for drawdown indicates no data available but yield was measured during 1970-72.
Other data available: C, chemical analysis given in table 6; D, driller's report available from Utah Division of Water Rights; L, driller's log in table 7; W, water-level records in table 8.

Location	Owner or name	Year constructed	Altitude (feet above mean sea level)	Depth of well (feet)	Casing: Depth (feet)	Casing: Diameter (inches)	Use of water	Water level: Above(+) or below land-surface datum (feet)	Water level: Date of measurement	Production: Yield (gal/min)	Production: Drawdown (feet)	Temperature (°C)	Other data available
Box Elder County, Utah													
(B-12-9)													
5bcb-1	E. Peterson	1971	4,415	250	31	10	S	190	5-71	38	0	-	L
10ddc-1	-	-	4,361	161	-	-	U	145	6-72	-	-	-	
28add-1	Holmgren Land and Live-stock Co.	-	4,311	-	-	2	S	26	10-67	1	-	15.0	C
30cda-1	Test hole 3	1972	4,239	162	131	8	U	24	8-72	-	-	15.5	C, L
(B-12-10)													
19bcb-1	Auger hole 2	1972	4,220	64	0	-	U	3	4-72	-	-	-	C, L
20adc-1	Auger hole 3	1972	4,220	64	0	-	U	3	4-72	-	-	-	C, L
21daa-1	Auger hole 4	1972	4,225	64	0	-	U	5	4-72	-	-	-	C, L
(B-12-11)													
4bcc-1	A. Fehlman and others	1969	4,304	230	80	20	I	89	1-69	693	100	-	C, L
5abb-1	do	-	4,333	-	-	-	I	127	11-70	250	M	-	C
5bba-1	do	-	4,355	(1/)	-	-	I	150	11-70	1,610	M	16.0	C
5bbb-1	do	1953	4,366	240	-	16	I	135	11-53	940	M	14.5	C, W
5bdc-1	do	1968	4,340	2/190	125	20	I	125	11-68	1,350	35	14.0	C, L
5bdc-2	A. Fehlman	-	4,340	150	-	8	H	120	-	-	-	-	C
5dcd-1	do	-	4,300	100	-	8	H	70	3-72	-	-	-	C
6aab-1	H. Kunzler and others	1968	4,389	330	160	16	I	170	7-68	-	-	-	C, L
6abb-1	do	1955	4,410	278	200	16	I	185	10-55	125	65	14.0	C, L
7abb-1	J. H. Holmgren	1955	4,320	250	90	16	U	105	10-55	5	M	-	L
8abb-1	Jerry Morgan	1963	4,303	275	90	16	I	92	3-63	700	86	-	C, L
8baa-1	do	-	4,303	320	-	16	I	89	11-70	-	-	13.5	C
8bbb-1	do	1954	4,326	350	100	16	I	95	9-54	150	70	-	C, L
8cda-1	do	1936	4,280	3/195	180	-	S	60	10-36	-	-	-	C, L
16cdc-1	U.S. Bureau of Land Management	1935	4,233	126	126	8	U	9	10-55	30	M	-	L, W
21cdc-1	Lucille R. Jones	1890	4,223	60	60	2	S	+1	10-35	1	M	-	
21ddd-1	Auger hole 1	1972	4,220	64	0	-	U	3	4-72	-	-	-	C, L
(B-12-12)													
13ddd-1	E. R. Morris	1951	4,300	83	83	6	S	75	12-51	-	-	-	D
(B-13-8)													
10dcc-1	E. Deakin	1972	4,685	408	368	6	S	345	1-72	-	-	15.5	C, D, L
21dcd-1	Norman Grover	1971	4,605	362	228	6	S	320	12-71	-	-	-	D, L
(B-13-9)													
1adc-1	Jay Hulet	1967	4,555	420	207	20	I	343	10-67	1,500	25	-	L
1bdc-1	do	1969	4,545	340	32	20	I	328	4-69	-	-	-	L
35bbd-1	Don Rigby	1968	4,502	428	10	20	S	-	2-68	550	102	19.5	C, L
(B-13-10)													
11dcd-1	Test hole 1	1972	4,335	128	10	8	U	119	6-72	-	-	15.5	C, L
25ddd-1	D. Petersen	1971	-	251	25	10	S	180	5-71	-	-	-	D
34ddc-1	Test hole 2	1972	4,305	95	8	8	U	86	6-72	-	-	19.5	C, L
(B-13-11)													
10cdc-1	Test hole 4	1972	4,480	283	168	8	U	250	8-72	-	-	17.0	C, L
(B-13-12)													
14ccc-1	R. H. Morris	1953	5,160	179	179	6	S	119	10-53	-	-	-	D
(B-14-7)													
2bab-1	David G. Nelson	1966	5,250	398	-	6	U	-	-	-	-	-	L
5aca-1	Town of Snowville	1967	4,730	250	50	8	P	50	9-67	-	-	-	L
7aaa-1	Bert Eliason	1969	4,705	100	50	11	H	50	2-69	-	-	15.5	L
(B-14-8)													
1cbb-1	Joseph Larkin	1968	4,540	140	80	8	H	80	1-69	-	-	-	D
1ccc-1	C. F. Neal	1964	4,570	137	137	12	I	120	10-64	75	M	10.5	C, D
1ddd-1	A. P. Larkin	-	4,650	-	-	10	U	58	10-57	-	-	-	W
2aba-1	Thomas F. Larkin	1910	4,535	48	-	4	U	31	10-48	-	-	-	W
2aba-2	do	1969	4,535	247	215	8	H	40	1-69	-	-	-	L
2daa-1	T. Cockran	1960	4,540	240	45	16	I	48	7-60	-	-	-	L
3dcb-1	Wallace Hurd	1965	4,575	63	52	6	S	40	11-65	12	0	-	L
5dcc-1	Charles Taylor	1965	4,501	400	0	20	I	176	10-65	2,050	47	17.5	L
6aca-1	Potomac Corp.	1971	4,495	295	250	6	S	195	12-71	-	-	-	D
6acd-1	do	1968	4,490	460	170	18	I	170	5-68	2,000	1	-	L
11aba-1	B. S. Cutler	1936	4,535	64	64	4	S	46	10-36	-	-	10.0	C, W
11abb-1	Carl Cobia	-	4,525	100	-	6	I	39	10-67	-	-	-	C
11abc-1	do	1971	4,530	92	80	6	H	50	9-71	20	12	-	D
11bca-1	W. M. Rigby	1966	4,526	416	131	16	I	56	12-66	4,000	45	12.5	C, L
11dcc-1	do	1971	-	200	135	10	H	130	8-71	-	-	-	D
12cbd-1	H. L. Sorenson	1971	4,635	245	180	8	H	165	6-71	-	-	-	D
20baa-1	K. H. Cornwall	1959	4,558	303	273	16	I	282	4-59	25	0	10.5	D
28aba-1	Don Rigby	-	4,558	-	-	4	S	131	7-67	-	-	-	
28bbb-1	do	1967	4,539	650	140	12	I	276	8-67	400	121	14.0	C, L
32aaa-1	Bar B Co.	1949	4,550	330	320	4	S	306	8-49	16	4	-	L
(B-14-9)													
1dda-1	Charles Taylor	1955	4,469	380	250	16	H	167	7-55	1,000	M	11.5	C, L, W
1dda-2	do	1955	4,465	312	117	5	H	135	-	-	955	-	L
1dda-3	do	1956	4,465	255	192	8	H	166	7-56	-	-	-	C, L
3bbb-1	do	1964	4,412	205	-	-	U	170	8-64	-	-	-	L
4bbb-1	do	-	4,413	350	-	4	S	182	12-55	-	-	22.0	C
4bbb-2	Ethel Taylor	1968	4,415	375	180	20	I	187	3-68	2,000	225	-	L
4ccc-1	Gary Hanna	1964	4,394	360	170	18	I	175	8-67	2,000	M	20.5	L
5aaa-1	Charles Taylor	1962	4,412	275	186	6	S	188	12-62	-	-	-	L
5abb-1	do	1963	4,416	405	190	18	I	210	4-63	2,890	M	-	L
5bbb-1	do	1955	4,420	300	250	12	I	188	1-55	1,520	M	15.5	C, L

Table 4.--Records of wells - Continued

Location	Owner or name	Year constructed	Altitude (feet above mean sea level)	Depth of well (feet)	Casing: Depth (feet)	Casing: Diameter (inches)	Use of water	Water level: Above(+) or below land-surface datum (feet)	Water level: Date of measurement	Production: Yield (gal/min)	Production: Draw-down (feet)	Temperature (°C)	Other data available
Box Elder County, Utah - Continued													
(B-14-9)													
5bcc-1	Charles Taylor	1963	4,410	405	-	18	I	180	4-63	-	-	-	L
5ccd-1	do	1966	4,397	400	1	20	I	175	4-69	2,420	12	16.0	C, L
5ccd-2	do	1968	4,397	320	194	8	H	-	-	-	-	-	L
5cdb-1	do	1955	4,398	355	137	4	H	180	9-55	-	-	-	L
7bbb-1	Latter-day Saints Church	1955	4,398	608	-	14	I	154	12-55	2,530	M	19.0	C, W
9baa-1	Gary Hanna	1955	4,395	4/341	207	14	H	150	4-55	1,000	130	-	L, W
10ada-1	Rose Ranch	-	4,402	171	135	6	U	100	5-36	-	-	-	W
11bcb-1	do	1953	4,398	245	-	8	H	170	2-53	-	-	-	L
14acd-1	do	1969	4,410	450	351	16	I	197	5-69	675	150	-	L
18bdd-1	Mary Nelson	1967	4,369	400	150	20	I	150	6-67	-	-	-	L
19bbb-1	Charles Taylor	1966	4,371	350	150	20	I	164	8-66	-	-	-	C, L
21bbb-1	do	1964	4,365	586	-	-	U	155	8-64	-	-	-	L
(B-14-10)													
1bbb-1	do	1955	4,438	420	185	22	I	186	11-55	1,435	81	15.5	C, L
1dca-1	do	1951	4,405	243	100	5	H	169	4-55	-	-	-	L
5baa-1	David H. Klegg	1959	4,610	276	95	14	S	82	6-59	-	-	-	L
5bba-1	do	1959	4,610	303	105	16	S	105	6-59	-	-	-	L
14acd-2	M. Palmer	1970	4,392	350	169	22	I	170	11-69	-	-	-	L
14bbc-1	do	1957	4,423	840	246	21	I	181	7-67	900	63	-	L
14cbc-1	do	1970	4,408	400	200	20	I	182	6-70	-	-	-	L
34bbb-1	Wes Bailey	1969	4,390	365	165	10	S	250	12-69	-	-	-	L
(B-14-11)													
7cbb-1	-	-	5,140	-	-	-	S	147	10-37	6	M	-	
10bad-1	U.S. Bureau of Reclamation	1972	4,840	350	-	6	S	224	7-72	-	-	-	
13dda-1	-	-	4,600	-	-	16	U	48	10-67	-	-	-	
(B-15-7)													
29dac-1	David Nelson	1966	4,800	175	118	6	H	90	10-66	-	-	-	L
30cbc-1	Carl Steed	1936	4,575	228	-	4	H	12	11-36	-	-	-	L
32aca-1	Bert Eliason	1967	4,700	315	24	20	I	20	2-67	900	150	-	L
(B-15-8)													
25ddd-1	Edmund Hurd	1937	4,560	100	100	4	H	17	2-37	50	M	-	L
31ccc-1	Potomac Corp.	1970	4,488	550	160	22	I	167	6-70	2,540	M	-	L
(B-15-9)													
28cbb-1	J. Ellis Lee	1955	4,456	400	-	14	I	214	12-55	2,340	M	24.0	C
28dbd-1	M. and J. Wright	1970	4,455	340	220	18	I	215	4-70	-	-	-	D
29dbc-1	Charles Taylor	1966	4,455	480	200	20	I	228	3-66	1,585	M	20.0	L
30cbc-1	Ethel Taylor	1955	4,463	230	152	4	S	-	-	-	-	-	D
31abc-1	do	1969	4,440	407	220	20	I	215	9-69	2,300	27	21.5	C, D
32aba-1	Bert Eliason	1971	4,445	400	90	20	I	90	10-71	-	-	-	D
35abb-1	Rose Ranch	1967	4,484	404	138	20	I	182	11-67	2,700	3	-	L
35abb-2	do	1969	4,484	220	108	8	S	172	4-69	15	0	-	D
36cad-1	Potomac Corp.	1971	4,492	255	235	6	S	195	11-71	-	-	-	D
(B-15-10)													
33ddd-1	Ross Rudd	1967	4,563	355	280	6	S	252	4-67	10	M	12.5	L
36bbb-1	Peter Mayo	1956	4,464	613	175	20	I	165	5-56	2,140	32	10.5	C, L, W
(B-15-11)													
26cdd-1	David H. Klegg	1966	5,050	485	360	6	H	365	5-66	20	0	-	D
31ddd-1	Ida-Ute Cattle Co.	1967	5,100	410	295	8	S	280	10-67	-	-	-	D
36ccc-1	E. D. Carbridge	1967	4,900	320	240	8	S	248	3-67	10	M	12.5	L
Oneida County, Idaho													
13S-33E													
4aaa-1	David Bird	1969	5,260	105	70	10	H	38	6-69	-	-	-	L
4cdb-1	W. R. King	1917	5,200	72	-	4	U	40	5-47	-	-	-	
4cdb-2	do	1966	5,200	80	60	6	H	35	7-66	-	-	14.0	
4dcc-1	J. B. Willie	1917	5,150	90	-	4	H	46	9-69	-	-	11.0	C
16bda-1	George Perry	1917	5,100	70	-	4	H	25	5-47	-	-	12.0	C
16bdc-1	do	1912	5,100	52	-	4	H	17	5-47	-	-	-	
20dcb-1	Arch Neal	-	5,000	54	-	4	H	-	-	-	-	-	
28bbb-1	Ellis Nielson	-	5,000	38	-	60	U	32	5-47	-	-	-	
29acc-2	Arnold Hubbard	-	5,000	34	-	6	H	19	9-69	-	-	11.0	C
14S-30E													
32cdd-1	George Nelson	1966	5,150	202	20	20	I	115	8-66	-	-	-	L
14S-32E													
2dda-1	U.S. Forest Service	-	5,200	-	-	4	S	156	4-70	-	-	-	
9acd-1	Chester Eliason	1963	4,891	150	30	12	I	-	-	-	-	-	
9dab-1	do	1961	4,890	300	-	12	I	-	-	-	-	10.5	
10dcd-1	do	-	4,881	37	-	6	U	20	9-31	-	-	9.5	C
10ddc-1	Don Eliason	1949	4,880	75	75	4	H	45	1949	-	-	-	
15add-1	Ray Zollinger	-	4,853	20	20	9	H	16	9-31	-	-	9.0	C
23aba-1	U.S. Forest Service	-	4,800	80	-	4	U	24	5-47	-	-	10.5	C
24ccb-1	J. N. Ireland Co.	1960	4,790	114	25	16	I	-	-	-	-	10.5	
25acd-2	Wells Willie	1943	4,790	100	-	4	H	10	-	-	-	-	
25bda-1	do	1966	4,800	107	7	14	I	8	11-69	600	52	11.0	C, D
36aac-1	Vernal Nalder	1960	4,784	222	20	18	I	15	4-70	-	-	11.0	C
36aba-1	Darwin Bowen	1965	4,785	86	17	16	I	14	4-70	600	54	10.0	
14S-33E													
6aab-1	U.S. Forest Service	-	5,020	245	-	6	S	125	9-69	-	-	-	
10aab-1	do	-	5,190	130	-	4	U	57	5-47	-	-	10.5	C
10ccd-1	B. O. Marble	1947	5,050	-	-	4	H	165	7-48	-	-	-	
16bbb-1	do	-	4,950	196	-	4	U	157	5-47	-	-	10.0	C
19bad-1	Hunsaker	-	4,955	200	-	4	U	185	4-70	-	-	-	
20aad-1	U.S. Forest Service	-	4,950	130	-	3	S	38	4-70	-	-	-	
22dcc-1	do	-	4,980	193	-	4	S	178	5-47	-	-	14.5	C
26cdb-1	Nielson	-	4,986	232	-	6	U	215	4-70	-	-	-	
27cab-1	-	1912	4,985	200	-	4	S	130	4-70	-	-	-	
30dcd-1	Wells Willie	1957	4,800	60	60	6	I	17	9-69	-	-	-	

Table 4.--Records of wells -Continued

Location	Owner or name	Year constructed	Altitude (feet above mean sea level)	Depth of well (feet)	Casing Depth (feet)	Casing Diameter (inches)	Use of water	Water level Above(+) or below land-surface datum (feet)	Water level Date of measurement	Production Yield (gal/min)	Production Drawdown (feet)	Temperature (°C)	Other data available
Oneida County, Idaho - Continued													
14S-33E													
31ab-1	-	-	-	70	-	4	U	8	3-50	-	-	13.5	C
31acc-1	Bill Willie	-	4,800	95	62	14	I	2	4-70	-	-	10.5	L
31bc-4	-	-	-	-	-	-	U	-	-	-	-	14.5	C
31bd-3	-	-	-	75	-	-	U	-	-	-	-	-	C
31ccb-1	W. Blaisdell	1961	4,800	300	-	16	I	21	4-70	1,000	50	-	
32add-1	-	-	4,798	110	-	18	I	66	-	-	-	11.5	
33cba-1	K. M. Smith	1954	4,805	325	45	14	I	67	9-69	1,000	80	12.5	D
14S-34E													
34dca-1	-	-	5,455	28	-	36	S	5	8-70	-	-	-	
15S-30E													
8aaa-1	Grant Construction Co.	1968	5,150	760	357	12	H	240	12-68	-	-	-	L
15bbb-1	Salt Lake Pipeline Co.	1951	4,900	535	275	16	I	265	7-51	50	10	-	L
35dac-1	Idaho Highway Dept.	1967	4,700	505	373	10	H	302	9-67	60	6	-	L
15S-32E													
2dcd-1	Moyle Facer	-	4,784	232	-	4	S	122	4-70	-	-	-	
9aaa-1	U.S. Bureau of Land Management	-	5,032	248	-	4	S	211	-	-	-	-	
11aad-1	J. Smith	-	4,772	140	-	4	S	107	4-70	-	-	-	
12bbc-1	U.S. Forest Service	-	4,773	114	-	4	S	102	-	-	-	-	
26aac-1	Chester Tubbs	-	4,648	66	-	6	U	45	4-70	-	-	-	
26aac-2	do	-	4,648	53	-	6	U	47	4-70	-	-	-	
33add-1	Dilmore Canal Co.	1969	4,620	400	-	20	I	54	4-70	3,600	147	11.5	C
33caa-1	do	1968	4,620	400	-	20	I	55	4-70	2,700	237	12.0	C
33dcd-1	J. R. Anderson	1961	4,592	267	-	18	I	39	4-70	3,000	61	12.0	C
34aaa-1	Dilmore Canal Co.	1969	4,600	600	-	22	I	51	4-70	2,700	167	-	
35cca-1	U.S. Forest Service	-	4,607	94	-	6	H	39	4-70	-	-	-	
36aaa-1	W. M. Hill	1959	4,600	331	96	18	I	82	4-70	187	116	19.0	C
15S-33E													
4bbb-1	C. Sweeten	1956	4,790	300	-	14	I	43	4-70	2,700	2	-	
5add-1	Garth Sweeten	1911	4,778	72	-	4	U	9	4-70	-	-	11.5	C
6	W. Blaisdell	-	4,750	64	57	4	S	4	4-70	-	-	-	
6caa-1	W. Smith, Jr.	-	4,790	332	-	12	I	13	4-70	750	58	-	
6caa-2	Willard Smith	-	4,790	185	-	6	S	12	4-70	-	-	-	
7ccb-1	Jay Baker	1912	4,768	54	-	4	H	48	4-70	-	-	-	
7ccb-2	do	1937	4,768	198	185	4	I	36	5-47	-	-	-	
8cda-1	do	1957	4,780	900	-	18	I	40	4-70	1,800	150	13.0	C
8dcb-1	do	1956	4,780	288	-	14	I	-	-	-	-	-	
16bbb-1	Carl Smith	1968	4,850	43	-	6	S	35	4-70	-	-	-	
16dcc-1	W. M. Hill	1917	4,889	135	-	4	H	125	9-31	-	-	-	
21ccc-1	do	-	4,888	137	-	4	S	125	4-70	-	-	-	
16S-32E													
2bcd-1	Lyle Steed	1958	4,604	190	38	16	I	35	4-70	-	-	-	L
2ccc-1	do	1930	4,600	50	36	6	U	37	-	-	-	-	C
2ccc-2	do	1968	4,600	80	-	-	H	37	4-70	-	-	-	
3acd-1	Bill Mills	-	4,604	226	-	-	I	37	4-70	3,600	63	-	
9bcb-1	Arthur Stocker	1963	4,603	220	-	16	I	61	4-70	-	-	-	
10bbd-1	George Neal	-	4,590	240	-	16	I	30	4-70	2,000	40	11.0	
10cda-1	do	-	4,590	86	-	4	H	32	4-70	-	-	-	
11bba-1	Ted Harris	1968	4,602	66	-	8	S	34	4-70	-	-	-	
13bcd-1	J. R. Anderson	1968	4,620	322	50	18	U	7	4-70	-	-	-	
14aaa-1	George Neal	1958	4,600	300	-	16	I	54	4-70	-	-	-	
14cbb-1	Harvey Harris	1967	4,590	210	20	18	I	28	9-69	1,800	63	12.0	C, L
14ccc-1	do	-	4,562	45	-	4	H	19	-	-	-	11.5	C
14ccc-2	V. Anderson	1947	4,580	38	-	6	H	24	4-70	-	-	-	
15bad-1	George Neal	-	4,570	110	-	4	U	29	4-70	-	-	-	
15bcb-1	do	-	4,573	90	-	6	H	23	4-70	-	-	-	
16aaa-1	Scott	1922	4,575	100	-	4	U	19	5-47	-	-	10.5	C
16baa-1	Jerry Morgan	1968	4,576	100	-	8	H	26	4-70	-	-	-	L
16bcb-1	do	1964	4,585	400	-	14	I	66	4-70	-	-	11.0	C
20ab-1	Merrill Neal	1921	-	-	-	6	U	182	9-31	-	-	-	C
20dcb-1	Mrs. Russell Roe	1957	4,607	310	-	6	H	301	4-70	-	-	-	
21aab-1	Merrill Neal	-	4,568	114	-	4	H	29	4-70	-	-	-	
21dab-1	John Robins	-	4,570	105	60	12	S	29	4-70	-	-	-	
21dd-1	C. M. Funk	1943	-	165	-	4	U	30	-	-	-	10.5	C
26caa-1	Carl Steed	1968	4,562	220	-	18	I	21	4-70	-	-	11.0	C, L
27acb-1	Harvey Harris	1935	4,564	77	-	4	H	26	5-47	-	-	-	
27acb-2	do	1949	4,565	54	52	-	S	18	9-49	-	-	-	
27ccd-1	-	-	4,560	80	-	4	U	23	4-70	-	-	-	
27ddb-1	Earl Hickman	-	4,559	230	-	16	I	19	4-70	-	-	10.5	C, L
28baa-1	Ray Roe	-	4,607	104	-	4	H	56	4-70	-	-	-	
16S-33E													
6cdb-1	George Neal	-	4,689	240	-	12	S	66	4-70	-	-	-	
18bbc-1	R. Showell	1917	4,670	430	400	4	S	Flows	8-70	-	-	-	
18bbc-2	Rollin Shalb	1969	4,685	65	30	10	I	7	3-69	-	-	-	L
18bca-1	R. Showell	1969	4,670	60	-	6	H	13	4-70	-	-	-	
18bcc-1	Dee Eliason	1905	4,670	125	-	2	I	Flows	8-70	-	-	10.5	
18bcd-1	do	-	4,685	218	200	16	U	23	4-70	-	-	-	

1/ Reportedly drilled to about 700 feet, plugged back to about 300 feet.
2/ Drilled to 208 feet, caved.
3/ Drilled to 510 feet, plugged back.
4/ Drilled to 672 feet, plugged back.

Table 5.--Records of selected springs

Location: See text for description of spring-numbering system.
Name or owner: Spring names are given where known; for unnamed springs, name is that of principal claimant of the water.
Altitude: Altitude of land surface at the spring.
Use of water: I, irrigation; S, livestock; W, wildfowl management.
Discharge: Natural flow of the spring; e, estimated; m, measured; r, reported.
Remarks and other data available: C, chemical analysis in table 6.

Location	Name or owner	Altitude (feet above mean sea level)	Yield: Discharge (gal/min)	Yield: Date of measurement	Temperature (°C)	Specific conductance of water: Micromhos per cm at 25°C	Specific conductance of water: Date	Use of water	Remarks and other data available
				Box Elder County, Utah					
(B-11-9)5cca-S1	Sparks Spring	4,215	450m	2-69	9.0	6,140	2-69	W	In Locomotive Springs group. C.
6cdc-S1	Off Spring	4,215	900m	2-69	14.0	5,710	2-69	W	Do.
(B-11-10)1adc-S1	Bar M Spring	4,215	5,000m	2-69	9.0	5,200	2-69	W	Do.
12aac-S1	Teal Spring	4,215	500e	-	8.0	6,250	2-69	W	Do.
(B-12-10)36cab-S1	West Locomotive Spring	4,215	10,300m	5-71	8.0	4,080	2-69	W	Do.
36dcc-S1	Baker Spring	4,215	500m	9-69	8.0	4,390	2-69	W	Do.
(B-13-12)5dba-S1	Carter and others	6,500	6r	-	-	-	-	S	
5dbc-S1	do	6,300	5r	-	-	-	-	S	
5dcc-S1	do	6,160	2r	-	-	-	-	S	
6bac-S1	G. A. Rose and others	6,500	2r	-	-	-	-	S	
6bbc-S1	do	6,280	6r	-	-	-	-	S	
7bbd-S1	Carter and others	6,520	6r	-	-	-	-	S	
8ccc-S1	G. A. Rose and others	5,740	2r	-	-	-	-	S	
25bdd-S1	E. Morris and others	4,810	-	-	-	-	-	S	
26acd-S1	do	4,840	-	-	-	-	-	S	
30caa-S1	L. G. Carter	5,440	5e	6-66	25.0	482	6-66	S	C.
30cac-S1	do	5,440	15r	-	-	-	-	S	
30cac-S2	do	5,440							
30ccc-S1	do	5,430	7r	-	-	-	-	S	
31ccb-S1	Callahan Spring	5,300	25r	-	-	-	-	S	
34cdd-S1	E. Morris and others	4,880	6r	-	-	-	-	S	
34dbd-S1	do	4,880	5r	-	-	-	-	S	
34dbd-S2	do	4,880							
34dcd-S1	do	4,820	7r	-	-	-	-	S	
34ddd-S1	do	4,780	5r	-	-	-	-	S	
35ddd-S1	Central Pacific Railroad Co.	4,620	1m	9-67	14.0	657	10-67	S	C.
36add-S1	State of Utah	4,520	35r	-	-	-	-	S	
(B-14-10)33bcc-S1	Coyote Spring	4,436	20r	-	43.0	5,590	5-68	S	C.
(B-14-11)13bdd-S1	Pilot Spring	4,645	15e	8-66	10.0	585	8-66	S	C.
31cbd-S1	Hardup Spring	5,050	7e	9-72	13.5	733	9-72	S	C.
(B-14-12)3cda-S1	Dive Hollow Creek Spring No. 1	5,540	80r	-	-	-	-	S	
3cda-S2	Dive Hollow Creek Spring No. 2	5,540							
9dda-S1	Dive Creek Spring No. 2	5,780	100r	-	-	-	-	S	
10bba-S1	Cassia Grazing Assn.	5,590	7r	-	-	-	-	S	
10bba-S2	do	5,590	7r	-	-	-	-	S	
10bbd-S1	do	5,630	7r	-	-	-	-	S	
10bbd-S2	do	5,630	5r	-	-	-	-	S	
11ddd-S1	Cedar Spring	5,520	12e	9-72	13.5	868	9-72	S	C.
13daa-S1	Carlson Spring	5,240	6r	-	-	-	-	S	
15bbb-S1	Dive Creek Spring No. 1	5,720	350r	-	-	-	-	S	
16bac-S1	State of Utah	6,000	7r	-	-	-	-	S	
22dcc-S1	Crystal Spring	5,850	30e	9-72	9.0	631	9-72	S	C.
24bac-S1	Emigrant Spring	5,550	15e	9-72	13.5	853	9-72	S	C.
24bbc-S1	J. and R. Bronson	5,720	15r	-	-	-	-	S	
24bdc-S1	U. S. Forest Service	5,600	13r	-	-	-	-	S	
25bcb-S1	W. Larsen and others	8,940	5r	-	-	-	-	S	
25ddb-S1	do	8,280	5r	-	-	-	-	S	
(B-14-13)34aaa-S1	L. G. Carter	9,000	5r	-	-	-	-	S	
35abc-S1	Birch Spring	8,400	7r	-	-	-	-	S	
35bbd-S1	Rocky Spring	8,920	5r	-	-	-	-	S	
36daa-S1	G. A. Rose and others	7,120	5r	-	-	-	-	S	
36dcc-S1	do	6,900	2r	-	-	-	-	S	
				Oneida County, Idaho					
13S-32E-30bda-1	Twin Springs	5,200	100e	9-69	14.0	754	9-69	S	C.
14S-34E-32aaa-1	Lower Ireland Spring	5,250	1e	8-70	12.5	850	8-70	S	
14S-34E-33bb	Upper Ireland Spring	5,280	3e	8-70	13.0	780	8-70	S	C.
15S-32E-13ac	Holbrook Springs	4,760	12,000m	8-70	20.0	789	7-72	I	C.
16S-30E-7ab	-	4,800	2e	9-72	13.0	504	10-67	S	C.
				Power County, Idaho					
11S-32E-25dcb-1	-	5,800	5e	8-72	13.5	446	8-72	S	C.
12S-32E-24bbb-1	-	5,800	5e	8-72	9.0	712	8-72	S	C.

Table 6.--Chemical analyses of water

Agency making analysis: BR, Bureau of Reclamation; DH, Utah State Department of Health; GS, U.S. Geological Survey; SU, Utah State University.

Location	Date of collection	Temperature (°C)	Milligrams Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Sodium plus potassium (Na+K)	Bicarbonate (HCO_3)	Carbonate (CO_3)
WELLS											
Box Elder											
(B-12-9)28add-1	10-10-67	15.0	39	-	1.6	12	790	17	-	564	0
30cda-1	7- 7-72	14.0	-	-	200	120	660	1.8	-	223	0
	9-25-72	15.5	-	-	120	66	740	46	-	173	0
(B-12-10)19bcb-1	4-25-72	-	-	-	380	300	12,000	480	-	250	0
20adc-1	4-25-72	-	-	-	53	46	2,200	240	-	276	0
21daa-1	4-25-72	-	-	-	130	120	3,000	380	-	220	0
(B-12-11)4bcc-1	3-22-72	-	-	-	130	69	190	18	-	226	0
5abb-1	4-29-72	17.0	-	-	150	76	460	30	-	206	0
5bba-1	7-12-67	15.5	40	-	72	39	112	14	-	222	0
	3-14-72	15.0	-	-	130	58	150	18	-	231	0
5bbb-1	10-17-57	14.5	22	-	111	26	-	-	105	188	0
	7-26-69	-	-	-	-	-	-	-	-	-	-
	6-25-70	14.0	-	-	-	-	-	-	-	-	-
	5-26-71	14.0	26	-	240	49	89	12	-	193	0
	3- 9-72	13.5	25	0.08	350	75	130	10	-	234	0
	3-10-72	14.0	-	-	330	76	110	11	-	231	0
5bdc-1	7-26-69	14.0	19	-	200	58	86	7.2	-	292	0
	6-25-70	14.5	-	-	-	-	-	-	-	-	-
	3-13-72	13.5	-	-	250	58	110	8.4	-	345	0
5bdc-2	7- 6-72	-	-	-	310	68	100	7.1	-	405	0
5dcd-1	3-11-72	-	29	.42	730	150	160	13	-	144	0
6aab-1	3-22-72	-	-	-	140	32	92	6.8	-	255	0
6abb-1	6- 7-56	-	-	-	62	12	43	3.5	-	231	-
	3-22-72	-	-	-	61	13	39	2.7	-	214	0
8abb-1	7-11-72	-	-	-	180	45	87	8.7	-	189	0
8baa-1	5-26-71	13.5	23	-	250	45	120	8.2	-	264	0
8bbb-1	7-19-72	15.5	-	-	230	62	170	8.2	-	337	0
8cda-1	4- 3-53	-	-	-	51	23	69	32	-	171	0
	7-11-72	-	-	-	68	19	42	4.7	-	205	0
21ddd-1	4-25-72	-	-	-	440	590	22,000	690	-	445	0
(B-13-8)10dcc-1	9-25-72	15.5	-	-	210	70	260	15	-	167	0
(B-13-9)35bbd-1	12-11-70	19.5	37	.09	180	140	3,300	180	-	164	0
(B-13-10)11dcd-1	6-16-72	15.5	-	-	72	31	590	.0	-	255	0
34ddc-1	6-28-72	19.5	47	.02	76	48	980	66	-	193	0
(B-13-11)10cdc-1	9-25-72	17.0	-	-	56	28	74	11	-	222	0
(B-14-8)1ccc-1	8-15-68	-	42	.16	200	130	375	24	-	445	-
11aba-1	10-16-57	10.0	28	-	252	112	-	-	765	544	0
11abb-1	10-11-67	-	-	-	23	77	-	-	146	326	0
11bca-1	7-12-67	12.5	44	-	172	90	340	18	-	316	0
28bbb-1	8- 9-67	14.0	43	-	108	46	362	18	-	272	0
(B-14-9)1dda-1	5-24-56	12.0	48	-	102	36	-	-	132	359	0
	6-17-57	7.0	-	-	100	47	-	-	118	355	0
	5-28-58	6.5	-	-	95	38	-	-	138	346	0
	7-17-58	-	42	-	97	37	-	-	138	343	0
	7-12-60	-	44	-	94	38	-	-	141	337	0
	6-27-64	11.5	42	-	95	41	-	-	147	336	0
1dda-3	10-16-57	-	36	-	91	38	-	-	141	338	0
4bbb-1	5-24-56	22.0	61	-	146	35	-	-	123	186	0
5bbb-1	7-27-55	16.5	64	.00	66	16	27	8.0	-	174	0
	5-24-56	17.5	55	-	67	16	28	-	-	176	0
	7-17-57	-	57	-	71	14	-	-	31	179	0
	5-28-58	-	50	-	68	14	-	-	34	175	0
	7-17-58	-	53	-	67	15	-	-	34	174	0
	7-12-60	-	55	-	67	15	-	-	34	176	0
	7-27-64	16.5	50	-	63	16	-	-	35	176	0

from selected wells and springs

per liter									Specific conductance (micromhos/cm at 25°C)	pH	Sodium-adsorption ratio	Agency making analysis
Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids: Residue at 180°C	Dissolved solids: Sum of determined constituents	Hardness (Ca,Mg)	Noncarbonate hardness				
County, Utah												
268	770	2.2	19	0.11	2,250	2,200	54	0	3,690	8.1	47	GS
170	1,500	-	-	-	-	2,760	990	810	5,190	7.4	9.1	GS
100	1,500	-	-	-	-	2,660	570	430	4,890	7.5	13	GS
1,100	19,000	-	-	-	-	33,400	2,200	2,000	-	6.8	110	GS
110	3,700	-	-	-	-	6 480	320	95	12,100	7.6	46	GS
210	5,300	-	-	-	-	9,250	820	640	-	7.5	46	GS
55	590	-	-	-	-	1,160	610	420	2,260	7.4	3.4	GS
160	960	-	-	-	-	1,940	690	520	3,540	7.3	7.6	GS
51	255	.4	2.6	.09	756	695	340	158	1,210	7.6	2.6	GS
54	450	-	-	-	-	974	560	370	1,870	7.5	2.8	GS
68	272	-	3.1	-	-	699	382	228	1,050	7.1	2.3	GS
-	475	-	-	-	-	-	-	-	1,930	-	-	GS
-	525	-	-	-	-	-	-	-	2,090	-	-	GS
77	550	.3	8.3	.10	-	1,180	800	640	2,110	7.4	1.4	GS
150	820	.2	10	-	-	1,720	1,200	990	3,050	7.2	1.6	GS
100	770	-	-	-	-	1,520	1,100	950	2,960	7.2	1.4	GS
63	430	.2	18	.09	-	1,030	740	501	1,850	7.6	1.4	GS
-	475	-	-	-	-	-	-	-	1,950	-	-	GS
99	540	-	-	-	-	2,030	860	580	2,270	7.2	1.6	GS
95	600	-	-	-	-	1,380	1,100	720	2,610	7.3	1.3	GS
100	1,800	.2	4.4	-	-	3,070	2,400	2,300	5,720	7.2	1.4	GS
74	280	-	-	-	-	750	480	270	1,420	7.3	1.8	GS
24	65	-	-	-	340	324	202	13	606	-	1.3	SU
26	77	-	-	-	-	324	210	30	615	7.5	1.2	GS
63	460	-	-	-	-	937	630	480	1,850	7.6	1.5	GS
100	510	.3	6.1	.12	-	1,220	810	590	2,040	7.2	1.8	GS
88	620	-	-	-	-	1,340	830	550	2,520	7.1	2.6	GS
58	151	-	-	-	460	468	222	82	760	-	2.0	DH
31	110	-	-	-	-	375	250	80	713	7.6	1.2	GS
4,800	34,000	-	-	-	-	62,700	3,500	3,200	-	7.1	160	GS
50	890	-	-	-	-	1,580	810	680	3,000	7.8	4.0	GS
460	5,800	.5	.4	1.07	-	10,000	987	852	15,600	7.7	45	GS
93	970	-	-	-	-	1,880	310	98	3,540	7.5	15	GS
120	1,600	.6	.9	-	-	3,040	390	230	5,420	7.7	22	GS
31	150	-	-	-	-	459	250	73	901	7.5	2.0	GS
362	820	.4	56	.63	2,484	2,230	1,036	671	3,670	7.4	5.1	DH
1,460	555	-	2.5	-	-	3,440	1,090	642	4,820	7.3	10	GS
177	170	-	-	-	771	-	374	107	1,280	7.2	3.3	GS
264	690	1.6	.2	.08	1,900	1,720	800	541	2,950	7.6	5.2	GS
88	650	.9	.5	.09	1,570	1,450	460	237	2,520	7.6	7.3	GS
76	233	-	2.3	-	-	806	404	110	1,360	7.4	2.9	GS
67	240	-	.4	-	-	792	444	153	1,370	7.2	2.4	GS
71	239	-	.9	-	-	796	398	112	1,360	7.6	3.0	GS
68	244	-	.7	-	-	796	396	115	1,380	7.7	3.0	GS
66	250	-	.5	-	-	800	392	116	1,380	7.9	3.1	GS
79	262	-	.6	-	878	832	408	132	1,420	7.6	3.2	GS
72	239	-	.4	-	-	783	384	107	1,310	7.2	3.1	GS
34	426	-	3.6	-	-	921	508	355	1,680	7.2	2.4	GS
22	90	.2	4.4	.02	436	384	230	88	608	7.4	.8	GS
29	93	-	4.0	-	-	379	234	90	626	7.6	.8	GS
23	90	-	3.2	-	-	377	232	85	618	7.4	.9	GS
22	94	-	3.2	-	-	371	227	84	618	7.8	1.0	GS
22	94	-	3.3	-	-	374	227	84	622	7.7	1.0	GS
23	94	-	1.9	-	-	377	228	84	612	7.8	1.0	GS
23	94	-	.7	-	422	369	224	80	608	7.4	1.0	GS

Table 6.--Chemical analyses of water from

Location	Date of collection	Temperature (°C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Sodium plus potassium (Na+K)	Bicarbonate (HCO_3)	Carbonate (CO_3)
			Milligrams								
WELLS											
Box Elder											
(B-14-9)5bbb-1	7-12-67	15.5	-	-	-	-	-	-	-	-	-
	7-28-69	16.0	-	-	-	-	-	-	-	-	-
5ccd-1	7-13-67	16.0	51	-	85	20	53	11	-	176	0
7bbb-1	5-24-56	-	64	-	69	21	-	-	37	170	0
	5-26-58	-	62	-	75	19	-	-	48	170	0
	7-17-58	-	61	-	75	18	-	-	47	169	0
	10-15-58	-	65	-	77	20	-	-	45	174	0
18bdd-1	8- 8-67	-	31	-	168	36	210	14	-	146	0
(B-14-10)1bbb-1	5-24-56	16.0	60	-	46	24	-	-	28	194	0
	6-17-57	-	61	-	57	16	-	-	31	193	0
	5-28-58	-	57	-	59	15	-	-	33	190	0
	7-17-58	-	58	-	59	16	-	-	31	190	0
	7-12-60	-	59	-	59	15	-	-	34	191	0
	7-27-64	15.5	54	-	61	16	-	-	37	186	0
	8- 8-67	15.5	52	-	66	15	28	6.8	-	188	0
	7-28-69	16.0	-	-	-	-	-	-	-	-	-
	5-23-70	15.5	-	-	-	-	-	-	-	-	-
(B-15-9)28cbb-1	9-12-55	-	-	-	316	85	518	34	-	152	0
	5-24-56	-	72	-	321	83	-	-	381	142	0
	6-17-57	-	74	-	314	87	-	-	436	146	0
	5-28-58	-	71	-	325	91	-	-	411	140	0
	7-12-60	-	74	-	319	94	-	-	417	145	0
	5-24-61	-	75	0.00	339	81	382	30	-	144	0
	7-27-64	-	64	-	345	97	439	29	-	140	0
	8- 8-67	-	77	-	369	92	452	32	-	144	0
	7-28-69	24.0	-	-	-	-	-	-	-	-	-
	8-12-70	24.0	-	-	-	-	-	-	-	-	-
(B-15-9)31abc-1	9-30-69	16.0	63	-	70	17	31	-	-	181	0
(B-15-10)36bbb-1	5-17-56	-	59	-	42	22	-	-	19	187	0
	5-24-56	16.5	56	-	59	17	-	-	18	198	0
	6-17-57	-	63	-	61	10	-	-	25	173	0
SPRINGS											
Box Elder											
(B-11-9)5cca-S1	9-29-59	15.0	38	-	110	73	-	-	1,180	232	0
	9-30-59	14.5	29	0.00	117	68	1,150	49	-	231	0
	1- 5-60	10.5	35	20	107	66	1,160	47	-	227	0
	4-19-60	14.5	32	.00	109	66	1,130	51	-	225	0
	2- 6-69	9.0	22	-	86	79	1,120	48	-	214	0
	9-16-69	-	31	50	96	73	1,140	51	-	220	0
	2-19-70	11.0	30	-	97	71	1,170	50	-	207	0
	12-11-70	11.5	39	.00	110	69	1,190	54	-	232	0
	9-30-71	10.0	-	-	94	64	1,000	42	-	213	0
	3- 3-72	14.0	-	-	100	67	1,200	60	-	224	0
6cdc-S1	2- 6-69	14.0	29	-	106	74	986	37	-	206	0
	9-16-69	-	33	20	108	75	993	36	-	224	0
	2-19-70	14.0	32	-	110	75	978	39	-	217	0
	12-11-70	14.0	35	-	98	71	1,010	45	-	218	0
	9-30-71	14.0	-	-	110	69	970	34	-	224	0
	3- 3-72	15.5	-	-	110	67	1,000	45	-	212	0
(B-11-10)1adc-S1	9-30-59	16.5	36	20	133	61	865	32	-	213	0
	1- 5-60	15.5	31	10	139	65	1,120	45	-	210	0
	4-19-60	13.5	31	.00	131	60	833	36	-	209	0
	6-19-60	22.0	31	30	130	66	930	37	-	212	0

selected wells and springs - Continued

per liter													
					Dissolved solids								
Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Residue at 180°C	Sum of determined constituents	Hardness (Ca,Mg)	Noncarbonate hardness	Specific conductance (micromhos/cm at 25°C)	pH	Sodium-adsorption ratio	Agency making analysis
- Continued												
County, Utah - Continued												
-	94	-	-	-	-	-	-	-	613	-	-	GS
-	97	-	-	-	-	-	-	-	618	-	-	GS
24	180	0.3	3.1	0.04	587	514	296	152	889	7.4	1.3	GS
28	130	-	2.9	-	-	436	260	121	734	7.6	1.0	GS
24	144	-	3.1	-	-	459	265	126	767	7.8	1.3	GS
23	142	-	2.8	-	-	452	263	124	766	7.8	1.3	GS
22	145	-	2.2	-	-	462	274	131	-	7.9	1.2	GS
25	610	.4	3.1	.05	1,400	1,170	570	450	2,170	7.4	3.8	GS
31	66	-	.9	-	-	352	214	55	558	7.6	.8	GS
24	66	-	.8	-	-	351	209	51	567	7.3	.9	GS
26	67	-	1.0	-	-	351	206	50	553	7.8	1.0	GS
25	69	-	1.8	-	-	353	213	57	564	7.9	.9	GS
28	70	-	.6	-	-	360	210	53	560	8.0	1.0	GS
28	82	-	.9	-	404	370	218	65	592	7.6	1.1	GS
27	82	.4	.3	.03	391	370	224	70	583	7.4	.8	GS
-	81	-	-	-	-	-	-	-	589	-	-	GS
-	75	-	-	-	-	-	-	-	576	-	-	GS
103	1,380	-	-	.10	-	2,480	1,140	1,010	4,200	-	6.7	SU
48	1,290	-	3.9	-	-	2,270	1,140	1,020	4,170	7.2	4.9	GS
125	1,300	-	5.9	-	-	2,410	1,140	1,020	4,140	6.9	5.6	GS
41	1,360	-	4.4	-	-	2,370	1,180	1,070	4,300	7.5	5.2	GS
45	1,360	-	5.2	-	-	2,390	1,180	1,060	4,350	7.6	5.3	GS
42	1,340	.3	2.4	.40	-	2,360	1,180	1,160	4,340	7.5	4.8	GS
66	1,480	.1	.6	.13	-	2,590	1,260	1,150	4,620	7.2	5.4	GS
35	1,500	.5	12	.03	-	2,640	1,300	1,180	4,700	7.3	5.5	GS
-	1,520	-	-	-	-	-	-	-	4,700	-	-	GS
-	1,550	-	-	-	-	-	-	-	4,730	-	-	GS
20	99	-	1.6	-	432	391	244	96	626	7.8	.8	GS
25	50	-	1.9	-	-	311	197	44	480	8.2	.6	GS
23	51	-	2.2	-	-	324	218	56	502	7.4	.5	GS
18	60	-	2.8	-	-	325	194	52	548	7.4	.8	GS
County, Utah												
88	1,960	-	2.0	-	-	3,660	575	385	6,470	7.7	21	GS
161	1,960	0.3	1.5	0.27	3,800	3,650	572	383	6,540	7.2	21	GS
169	1,970	-	2.5	.34	3,880	3,670	540	354	-	7.7	22	GS
152	1,970	-	2.2	.27	3,770	3,620	544	360	6,570	7.6	22	GS
167	1,890	.7	.8	.37	3,570	3,520	540	365	6,140	8.0	21	GS
150	1,980	.6	.1	.31	3,910	3,630	540	360	6,380	7.9	21	GS
164	1,940	.6	2.4	.38	3,760	3,630	532	363	6,270	8.0	22	GS
160	2,100	.5	.6	.37	-	3,840	558	368	6,520	7.6	22	GS
140	1,800	-	-	-	-	3,330[1]	500	320	6,110	8.0	20	GS
160	2,000	-	-	-	-	3,730[1]	530	340	6,790	8.1	23	GS
151	1,750	.7	1.0	.27	3,420	3,240	570	401	5,710	7.7	18	GS
132	1,750	.5	.9	.26	3,380	3,240	580	396	5,680	7.9	18	GS
140	1,730	.4	1.1	.28	3,420	3,210	582	404	5,630	8.0	18	GS
158	1,680	.2	.5	.33	-	3,200	536	357	4,500	7.6	19	GS
140	1,700	-	-	-	-	3,170[1]	560	370	5,910	7.6	18	GS
160	1,800	-	-	-	-	3,320[1]	550	380	6,040	7.8	19	GS
119	1,560	.1	2.1	.18	3,010	2,910	584	409	5,250	7.5	16	GS
184	1,960	-	4.0	-	3,660	3,650	616	444	6,430	7.8	20	GS
113	1,550	-	2.8	.20	3,050	2,860	576	405	5,190	8.0	15	GS
120	1,680	-	2.5	.21	3,290	3,110	596	422	5,420	7.7	17	GS

Table 6.--Chemical analyses of water from

Location	Date of collection	Temperature (°C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Sodium plus potassium (Na+K)	Bicarbonate (HCO_3)	Carbonate (CO_3)
			Milligrams								
										SPRINGS	
										Box Elder	
(B-11-10)1adc-S1	10-12-60	15.5	33	-	127	69	910	35	-	209	0
	2- 6-69	9.0	27	-	114	69	875	42	-	208	0
	6-29-69	14.5	37	-	126	72	-	-	946	224	0
	9-16-69	-	33	20	112	75	939	34	-	225	0
	2-19-70	15.0	33	-	116	75	926	34	-	219	0
	12-11-70	16.0	37	30	96	65	880	33	-	188	0
	9-30-71	15.5	-	-	120	71	860	31	-	225	0
	3- 3-72	-	-	-	120	66	950	42	-	216	0
12aac-S1	9-30-59	13.5	36	10	109	63	1,280	55	-	213	0
	1- 5-60	7.5	34	10	115	66	1,340	60	-	212	0
	4-19-60	12.5	29	10	119	67	1,330	56	-	210	0
	2- 6-69	8.0	22	-	96	73	1,150	48	-	210	0
	9-16-69	-	24	30	68	88	1,110	47	-	162	0
	2-19-70	9.5	27	-	103	69	1,110	46	-	205	0
(B-12-10)36cab-S1	9-30-59	13.5	47	.00	114	50	744	53	-	206	0
	1- 5-60	7.5	43	.00	114	49	786	57	-	198	0
	4-19-60	12.5	43	10	112	51	746	52	-	200	0
	10-12-60	14.5	46	-	122	52	861	60	-	208	0
	2- 6-69	8.0	32	-	104	58	653	42	-	208	0
	9-16-69	-	40	30	100	59	775	58	-	209	0
	2-19-70	11.0	41	-	90	59	789	61	-	204	0
	12-11-70	12.0	45	-	98	49	698	47	-	195	0
	9-30-71	9.0	-	-	87	45	630	41	-	205	0
	3- 3-72	14.0	-	-	100	49	790	63	-	203	0
36dcc-S1	9-30-59	14.5	30	-	125	51	493	27	-	220	0
	1- 5-60	10.0	33	.00	120	54	494	27	-	215	0
	4-19-60	14.5	36	.00	119	57	502	27	-	218	0
	10-12-60	14.5	37	-	125	54	483	28	-	216	0
	10-10-67	-	33	-	120	59	537	28	-	216	0
	2- 6-69	8.0	23	-	126	72	681	38	-	266	0
	9-16-69	-	33	30	112	63	462	26	-	220	0
	2-19-70	12.0	33	-	117	62	517	27	-	218	0
	12-11-70	14.0	41	100	110	62	520	29	-	200	0
	9-30-71	13.0	-	-	110	60	460	27	-	226	0
	3- 3-72	14.0	-	-	120	62	550	32	-	218	0
(B-13-12)30caa-S1	6-17-66	25.0	10	-	39	11	44	.6	-	156	0
35ddd-S1	10-10-67	14.0	21	-	59	21	48	4.5	-	198	0
(B-14-10)33bcc-S1	5-28-68	43.5	29	-	87	19	1,070	56	-	352	0
(B-14-11)13bdd-S1	8-12-66	14.5	15	.00	43	25	-	-	37	180	0
31cbd-S1	9-25-72	13.5	-	-	30	33	65	4.1	-	197	0
(B-14-12)11ddd-S1	9-25-72	13.5	-	-	57	30	71	2.0	-	283	0
22dcc-S1	9-25-72	9.0	-	-	66	20	43	1.4	-	249	0
24bac-S1	9-25-72	13.5	-	-	66	29	74	2.3	-	265	0
										WELLS	
										Oneida	
13S-33E-4dcc-1	9-13-69	12.0	53	-	61	12	-	-	33	218	0
16bda-1	8-15-70	10.0	48	-	102	23	42	7.0	-	261	-
29acc-2	9-15-69	10.0	45	-	96	37	-	-	74	261	0
14S-32E-10dcd-1	5-29-47	9.5	21	-	122	28	-	-	92	346	0
15add-1	9-16-31	9.0	51	690	130	33	-	-	45	329	0
23aba-1	5-29-47	10.5	19	-	124	38	-	-	67	324	0
25bda-1	9-17-69	-	40	-	120	41	62	11	-	338	0
36aac-1	8-15-70	11.0	42	-	113	45	85	13	-	357	-
14S-33E-10aab-1	5-29-47	10.5	22	-	82	27	-	-	109	412	0
16bbb-1	5-29-47	10.0	22	-	90	22	-	-	69	172	0

per liter												
					Dissolved solids							
Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Residue at 180°C	Sum of determined constituents	Hardness (Ca,Mg)	Noncarbonate hardness	Specific conductance (micromhos/cm at 25°C)	pH	Sodium-adsorption ratio	Agency making analysis
- Continued												
County, Utah - Continued												
118	1,640	-	1.6	-	3,190	3,050	598	427	5,400	7.7	16	GS
140	1,560	0.5	.5	0.24	3,120	2,930	570	399	5,200	7.7	16	GS
148	1,650	-	1.6	-	-	3,090	610	426	5,450	7.8	17	GS
112	1,650	.4	1.4	.25	3,300	3,070	588	404	5,390	7.6	17	GS
130	1,640	.4	1.8	.24	3,270	3,060	597	417	5,380	8.0	17	GS
120	1,500	.4	.2	.60	-	2,800	510	356	5,040	7.9	16	GS
120	1,600	-	-	-	-	2,950 1/	590	410	5,610	7.6	15	GS
130	1,700	-	-	-	-	3,150 1/	570	390	5,840	7.6	17	GS
156	2,180	.2	2.7	.32	4,140	3,990	532	357	7,120	7.8	24	GS
159	2,280	-	3.5	.29	4,290	4,160	560	386	7,400	7.9	24	GS
155	2,280	-	2.8	.34	4,420	4,140	572	400	7,690	7.9	24	GS
171	1,900	.6	.9	.32	3,680	3,560	540	368	6,250	7.9	22	GS
128	2,000	.4	.1	.36	3,700	3,550	532	399	6,060	8.0	21	GS
152	1,910	.5	.2	.28	3,720	3,520	543	375	6,160	7.8	21	GS
91	1,360	.2	2.3	.25	2,750	2,560	490	321	4,660	7.9	15	GS
91	1,430	-	3.0	.31	2,840	2,670	486	324	4,900	7.5	15	GS
89	1,380	-	2.5	.23	2,730	2,570	488	324	4,630	7.9	15	GS
93	1,570	-	2.8	-	3,180	2,920	518	347	5,240	7.6	16	GS
107	1,190	.6	1.1	.29	2,440	2,290	500	329	4,080	7.7	13	GS
86	1,420	.6	1.2	.37	2,820	2,640	492	321	4,670	7.6	15	GS
93	1,400	.6	1.4	.39	2,790	2,650	468	301	4,670	8.0	17	GS
95	1,300	.5	.6	.34	-	2,430	446	286	3,610	8.0	14	GS
95	1,100	-	-	-	-	2,140 2/	400	230	4,130	7.7	14	GS
93	1,400	-	-	-	-	2,630 2/	450	280	4,830	7.7	16	GS
88	970	.1	2.3	.16	2,070	1,900	520	340	3,410	7.9	9.4	GS
89	970	-	2.4	.16	2,060	1,900	522	346	3,470	7.7	9.4	GS
90	980	-	3.1	.16	2,110	1,920	532	353	3,510	7.7	9.5	GS
87	960	-	1.5	-	2,050	1,890	536	359	3,390	7.5	9.1	GS
68	1,050	.8	2.1	.01	2,180	2,010	544	367	3,650	7.9	10	GS
116	1,260	.6	.6	.28	2,610	2,450	610	392	4,390	7.7	12	GS
81	975	.2	1.6	.19	2,200	1,860	540	360	3,400	7.8	8.6	GS
70	1,010	.5	2.0	.17	2,140	1,950	548	369	3,560	7.9	9.6	GS
92	990	.4	.6	.00	-	1,900	530	366	3,520	8.2	9.8	GS
96	920	-	-	-	-	1,820 1/	520	340	3,620	7.5	8.8	GS
92	1,100	-	-	-	-	2,100 1/	550	380	3,810	7.5	10	GS
19	65	.2	1.4	.01	274	268	144	16	482	8.0	1.6	GS
27	100	.3	.0	.00	391	378	232	70	657	7.5	1.4	GS
70	1,620	2.7	4.8	.80	3,240	3,130	294	5	5,590	7.6	27	GS
28	80	-	.1	-	332	317	210	62	585	7.5	1.1	GS
46	110	-	-	-	-	385	210	49	733	7.7	1.9	GS
45	120	-	-	-	-	464	270	34	868	7.8	1.9	GS
55	66	-	-	-	-	374	250	43	631	7.6	1.2	GS
31	120	-	-	-	-	453	280	67	853	7.8	1.9	GS
County, Idaho												
16	41	-	24	-	350	347	201	22	530	7.1	1.0	GS
37	135	0.2	23	-	628	545	349	135	934	7.5	1.0	BR
55	188	-	20	-	679	643	392	178	1,070	7.8	1.6	GS
46	200	.2	6.2	-	-	686	420	136	1,180	-	2.0	GS
32	180	-	.6	-	-	755	460	190	-	-	.9	GS
47	210	.4	.6	-	-	666	466	200	1,190	-	1.4	GS
43	204	.5	.2	0.22	765	688	470	193	1,190	8.0	1.2	GS
41	250	.3	3.7	-	796	769	467	174	1,390	7.8	1.7	BR
56	92	.4	33	-	-	624	316	22	1,030	-	2.7	GS
19	210	.2	8.3	-	-	625	315	174	970	-	1.7	GS

Table 6.--Chemical analyses of water from

Location	Date of collection	Temperature (°C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Sodium plus potassium (Na+K)	Bicarbonate (HCO_3)	Carbonate (CO_3)
			Milligrams								
WELLS											
Oneida											
14S-33E-22dcc-1	5-29-47	14.5	19	-	127	28	-	-	22	176	0
31ab-1	5-29-47	13.5	15	-	93	32	-	-	60	260	0
	4- 6-49	-	27	-	89	27	-	-	62	286	-
31bc-4	9- 9-31	14.5	49	300	145	62	-	-	96	376	0
31bd-3	9-21-31	-	31	390	84	26	-	-	38	287	0
15S-32E-33add-1	8-15-70	11.5	47	-	56	34	116	7.8	-	293	-
33caa-1	8- 7-70	11.5	45	-	88	36	115	8.5	-	296	0
33dcd-1	8-15-70	12.0	44	-	71	43	116	8.6	-	275	-
36aaa-1	8-15-70	19.0	66	-	38	23	94	16	-	250	-
15S-33E-5add-1	9- 9-31	11.5	41	350	119	36	-	-	95	236	0
8cda-1	8-15-70	13.0	52	-	29	18	92	8.6	-	251	-
16S-32E-2ccc-1	5-29-67	-	18	-	66	27	-	-	89	256	0
14cbb-1	9-14-69	-	28	-	88	58	155	9.0	-	291	0
	5-31-72	-	-	-	94	38	150	8.9	-	277	0
14ccc-1	5-29-47	11.5	16	-	89	22	-	-	200	258	0
16aaa-1	5-29-47	10.5	43	-	226	83	-	-	134	248	0
16bcb-1	6-23-70	11.0	40	-	401	151	311	18	-	235	0
	8-15-70	11.0	41	-	255	154	296	20	-	231	-
20ab-1	9-18-31	-	40	530	136	50	-	-	196	201	0
21dd-1	5-29-47	10.5	40	-	86	31	-	-	94	281	0
26caa-1	8- 9-70	11.0	49	-	112	54	210	18	-	325	0
27ddb-1	8-15-70	10.5	42	-	119	72	407	23	-	391	-
SPRINGS											
Oneida											
13S-32E-30bda-1	9-11-69	14.0	49	-	74	28	-	-	40	229	0
14S-34E-33bb	8- 6-70	13.0	22	-	80	18	46	3.0	-	211	0
15S-32E-13ac	9-11-31	18.5	16	340	66	25	-	-	48	260	0
	7-17-72	20.0	-	-	54	22	65	5.5	-	261	0
16S-30E-7ab	10-10-67	13.0	15	-	50	19	24	1.2	-	207	0
Power											
11S-32E-25dcb-1	8- 8-72	13.5	-	-	79	5.9	7.3	1.3	-	266	0
12S-32E-24bbb-1	8- 8-72	9.0	-	-	74	18	38	4.2	-	216	0

1/ Includes estimated 35 mg/l of silica.
2/ Includes estimated 40 mg/l of silica.

selected wells and springs - Continued

per liter												
					Dissolved solids							
Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Residue at 180°C	Sum of determined constituents	Hardness (Ca,Mg)	Noncarbonate hardness	Specific conductance (micromhos/cm at 25°C)	pH	Sodium-adsorption ratio	Agency making analysis
- Continued												
County, Idaho - Continued												
45	197	0.4	10	-	-	536	432	288	970	-	46	GS
45	163	.4	2.7	-	-	539	364	51	958	-	14	GS
49	128	-	1.5	-	-	524	323	88	925	-	15	GS
160	247	-	3.9	-	-	1,120	617	309	-	-	17	GS
41	85	-	.4	-	-	473	317	82	-	-	9.3	GS
98	202	.2	1.8	-	780	707	280	40	1,300	7.5	3.0	BR
83	212	.3	1.0	0.00	777	735	366	123	1,220	7.8	2.6	GS
134	256	.2	3.7	-	880	812	354	128	1,500	7.4	2.7	BR
31	178	.3	2.5	-	616	572	190	15	1,040	7.5	3.0	BR
127	230	-	1.9	-	-	842	445	251	-	-	20	GS
32	145	.3	3.1	-	584	503	147	59	935	7.9	3.3	BR
83	144	-	.4	-	-	524	276	66	919	-	23	GS
120	304	.5	.3	.22	936	906	460	221	1,520	8.0	3.1	GS
110	290	-	-	-	-	827	390	160	1,530	7.5	3.3	GS
69	325	.4	4.9	-	-	852	312	100	1,500	-	49	GS
214	545	-	2.0	-	-	1,370	906	703	2.330	-	19	GS
595	1,080	.2	5.8	.00	3,320	2,720	1,620	1,430	4,210	7.6	3.4	GS
581	1,030	.2	11	-	3,350	2,500	1,270	1,080	4,390	7.1	3.6	BR
56	531	-	-	-	-	1,240	545	380	-	-	37	GS
42	192	-	1.3	-	-	625	342	111	1,080	-	22	GS
172	380	.5	2.0	.12	1,230	1,160	500	234	2,020	-	4.1	GS
994	246	1.0	11	-	2,340	2,110	594	273	3,100	7.4	7.3	BR
County, Idaho												
21	124	-	2.1	-	488	470	298	110	754	7.5	1.0	GS
23	123	0.1	20	0.00	503	439	274	101	780	7.6	1.2	GS
22	90	-	.2	-	-	419	268	55	-	-	-	GS
26	110	-	-	-	-	411	230	11	789	7.3	1.9	GS
23	47	.3	1.1	.30	292	283	202	32	504	7.5	.7	GS
County, Idaho												
8.3	7.0	-	-	-	-	240	220	3	446	7.6	0.2	GS
19	100	-	-	-	-	359	260	82	712	7.7	1.0	GS

Table 7.--Logs of selected wells and test holes

Altitude of land surface given in feet above mean sea level.
Depth to base of lithologic unit given in feet below land surface.

Material	Depth
Box Elder County, Utah	
(B-12-9)5bcb-1. Log by Arnold Elsing. Alt. 4,415 ft.	
"Topsoil"	23
Gravel, cemented	49
Cinders, brown	60
Basalt, brown, very hard	68
Basalt, gray, very hard	83
Cinders, brown	91
Basalt, brown	135
Basalt, gray	200
Basalt, gray, broken; water bearing	215
Cinders, red-brown; water bearing	250
(B-12-9)30cda-1. Log by C. T. Sumsion. Alt. 4,239 ft.	
Clay, silty	10
Clay, silt, and sand	23
Basalt, alternately fractured, soft, permeable and very hard, dense	162
(B-12-10)19bcb-1. Log by C. H. Baker, Jr. Alt. 4,220 ft.	
Clay, blue-gray, silty	22
Clay, blue-gray, sandy	52
Silt, brown	64
(B-12-10)20adc-1. Log by C. H. Baker, Jr. Alt. 4,220 ft.	
Clay, blue-gray, silty	22
Sand, gray, fine-grained, moderately well sorted	30
Sand, clayey	64
(B-12-10)21daa-1. Log by C. H. Baker, Jr. Alt. 4,225 ft.	
Silt, sandy	6
Clay, silty and sandy	20
Sand, medium- to coarse-grained	24
Clay, sandy	64
(B-12-11)4bcc-1. Log by Arlo Lloyd. Alt. 4,304 ft.	
Clay and gravel	96
Clay and sand	118
Clay, sand, and gravel	160
Gravel	165
Clay, gray, sticky	195
Clay and sand, brown	230
(B-12-11)5bdc-1. Log by Arlo Lloyd. Alt. 4,340 ft.	
Clay and silt	13
Clay and gravel	30
Gravel	50
Clay and sand	57
Clay and gravel	75
Clay	80
Clay and gravel	138
Clay, gravel, and boulders	145
Clay and gravel	180
Clay	208
(B-12-11)6aab-1. Log by M. Page. Alt. 4,389 ft.	
"Soil"	6
Cobbles	50
Gravel	160
Gravel; water	190
Sand and gravel; no water	310
Gravel; water	330
(B-12-11)6abb-1. Log by D. E. Rogers. Alt. 4,410 ft.	
Topsoil	4
Sand and gravel	36
Clay, sandy, and gravel	70
Clay and gravel	110
Boulders	128
Clay, red	135
Clay, red, and gravel	160
Clay, yellow, and gravel	185
Clay, yellow	200
Clay, yellow, and boulders	230
Gravel, sandy, fine	265
Clay, yellow	267
Gravel and clay	270
Clay, yellow	278
(B-12-11)7abb-1. Log by D. E. Rogers. Alt. 4,320 ft.	
Topsoil	12
Clay, gray, and gravel	48
Clay, yellow, and gravel	53
Clay, red, and gravel	73
Clay, yellow, and gravel	90
Clay, red	105
Sandstone	107
Rock, white, chalky	118
Clay, sandy, red	125
Rock, white, chalky	127
(B-12-11)7abb-1 - Continued	
Clay, sandy, yellow	160
Clay, red	175
Clay, white	180
Clay, blue	200
Clay, red	220
Clay, green	240
Clay, red	250
(B-12-11)8abb-1. Log by R. C. Denton. Alt. 4,303 ft.	
Clay and silt	25
Gravel	28
Clay and gravel	32
Conglomerate	41
Sand and gravel	56
Clay and gravel	84
Sand and gravel	95
Gravel	107
Gravel and boulders	119
Clay and sand	129
Gravel, large	147
Clay and gravel	155
Clay, sand, and gravel	187
Clay and gravel	201
Clay	275
(B-12-11)8bbb-1. Log by D. E. Rogers. Alt. 4,326 ft.	
Topsoil	28
Rock and gravel	103
Clay	105
Rock and gravel; water bearing	140
Clay, yellow	217
Clay, sandy	230
Sandstone	231
Clay, white	235
Clay, sandy, and sand stratas in clay	350
(B-12-11)8cda-1. Log by Hughes and Goss. Alt. 4,280 ft.	
Topsoil	9
Gravel	15
Clay, brown	160
Clay and gravel	200
Sand, white	210
Clay, yellow	500
Sand, gray, fine; warm salty water	510
(B-12-11)16cdc-1. Log by C. A. Holland. Alt. 4,233 ft.	
Clay, sandy	30
Clay and gravel; some water	72
Gravel; water	120
Clay and gravel	126
(B-12-11)21ddd-1. Log by C. H. Baker, Jr. Alt. 4,220 ft.	
Clay, blue-gray, silty, much iron stained	18
Clay, blue-gray, sandy	63
Gravel, fine, sandy	64
(B-13-8)10dcc-1. Log by Arnold Elsing. Alt. 4,685 ft.	
Clay	165
Boulders	180
Clay and gravel	385
Rock, layered	390
Clay	408
(B-13-8)21dcd-1. Log by Arnold Elsing. Alt. 4,605 ft.	
Clay	120
Boulders	140
Rock, layered	230
Rock, dark, hard	270
Rock, light, hard	325
No cuttings (presumed to be hard rock)	362
(B-13-9)1adc-1. Log by A. P. Lloyd. Alt. 4,555 ft.	
Clay	12
Lava, broken, porous	268
Lava, brown	280
Lava, hard, gray	305
Lava, brown, porous	325
Lava, hard, brown	332
Lava, soft, brown; water at 343 ft	364
Lava, hard, black	372
Lava, soft, brown	385
Lava, hard, black	402
Lava, soft, brown	412
Lava, hard, black	420
(B-13-9)35bbd-1. Log by Ivan Bortz. Alt. 4,502 ft.	
"Topsoil"	8
Rock, broken, loose	10
Rock, gray, hard (lava[?])	26
Rock, loose, or cinders	40
Rock, hard	50
Rock, creviced; lost water	54
Cinders, red	60
Rock, hard, solid	80
Sandstone(?), soft	86
Lava, black	125
Cinders, big	130
Rock, hard	135
Rock, creviced	140
Cinders, red	155
Rock, gray, hard	164
Cinders, black and red	173
Rock, solid	183
Cinders	195
Rock, rotten	233
Rock, solid, hard	258
Rock, rotten	268
Rock, extra hard	283
Cinders, red	288
Rock, hard; trace of water	305
Rock; some water	317
Rock, hard	
Clay, brown	
Lava	
Lava, hard; salty water	428
(B-13-10)11dcd-1. Log by C. T. Sumsion. Alt. 4,335 ft.	
Silt and clay	15
Silt, clay, and sand; proportion of sand increases with depth	40
Sand, silt, and clay with some gravel; proportion of gravel increases with depth	67
Basalt, fractured, permeable	108
Sand, silt, clay, and gravel	113
Basalt, fractured, permeable	128
(B-13-10)34ddc-1. Log by C. T. Sumsion. Alt. 4,305 ft.	
Clay, silty	40
Silt, clay, and sand	51
Basalt, fractured, permeable	95
(B-13-11)10cdc-1. Log by C. T. Sumsion. Alt. 4,480 ft.	
Gravel, sand, and silt	55
Sand, silt, and clay with some fine-grained gravel	70
Clay, sandy	75
Sand, medium- to fine-grained; some clay	90
Clay, sandy	155
Sand, some clay, and a little gravel	165
Sand, fine- to very fine grained	195
Sand and clay	210
Sand, clay, and gravel	283
(B-14-7)2bab-1. Log by J. C. Peterson. Alt. 5,250 ft.	
Silt and gravel	28
Gravel, large	47
Clay and small gravel	51
Clay and layered gravel	97
Clay, white, and sand	101
Clay and gravel	122
Clay, white, and sand	124
Gravel, large	128
Clay, layered	160
Gravel, large	167
Clay, white and brown, and coarse sand	169
Limestone, large, gravelly	193
Cobbles	194
Limestone, large, gravelly	205
Limestone, large, gravelly, and sand	213
Clay, silt, sand, gravel, and gravelly limestone	278
Clay, gravel, cobbles, and limestone	302
Sand, gravel, cobbles, and limestone	317
Clay, white, gray, and black, gravel, and cobbles	352
Sand and gravel	358
Clay, white, gray, and black, and cobbles	370
Sand, gravel, and cobbles	379
Clay, white, gray, and black, and gravel	384
Sand, gravel, and cobbles	397
Clay and gravelly limestone	398
(B-14-7)5aca-1. Log by Waymon Yarbrough. Alt. 4,730 ft.	
Clay and gravel	50
Sand and gravel; first water	60
Cobbles	70
Clay and sand	90
Sand and gravel	105
Clay and boulders	115
Gravel	125

Table 7.--Logs of selected wells and test holes - Continued

Material	Depth
Box Elder County, Utah - Continued	
(B-14-7)5aca-1 - Continued	
Conglomerate	135
Clay and boulders	150
Clay, yellow	190
Clay and gravel	210
Clay and sand	225
Gravel	235
Clay and boulders	250
(B-14-7)7aaa-1. Log by Waymon Yarbrough. Alt. 4,705 ft.	
"Topsoil"	3
Gravel	5
Clay, gray	32
Clay, brown	38
Gravel, pea	54
Clay and gravel	60
Clay, brown, with gravel	69
Gravel, cemented	72
Clay, soft; first water	74
Gravel	84
Clay and gravel	86
Gravel	90
Clay and gravel	93
Gravel	94
Gravel with brown clay	100
(B-14-8)2aba-2. Log by Waymon Yarbrough. Alt. 4,535 ft.	
"Topsoil"	8
Soil, sandy	40
Gravel and sand; first water	47
Clay, blue	80
Clay, brown	90
Sand and pea gravel	100
Clay, brown	128
Gravel	132
Clay	138
Gravel	147
Clay, brown	151
Gravel	155
Clay, brown	158
Gravel	161
Clay, brown	164
Gravel	171
Clay, blue	197
Gravel	206
Clay, brown, gravelly	241
Clay, gray	244
Gravel	247
(B-14-8)2daa-1. Log by G. Beukenhurst. Alt. 4,540 ft.	
Topsoil	3
Clay and cobbles	48
Gravel; water bearing	50
Clay and cobbles	72
Gravel; water bearing	74
Clay and cobbles	240
(B-14-8)3dcb-1. Log by Siaperas Drilling Co. Alt. 4,575 ft.	
Topsoil	10
Clay	22
Clay and sand	41
Sand and gravel	55
Gravel; water bearing	63
(B-14-8)5dcc-1. Log by Waymon Yarbrough. Alt. 4,510 ft.	
Silt and sand	40
Clay and sand	61
Lava	93
Clay and sand; water	113
Clay	184
Clay, cobbles, and lava	185
Boulders and lava	187
Lava, hard	198
Clay	212
Gravel, cemented	214
Clay	217
Gravel, cemented	218
Clay	224
Gravel, cemented	225
Clay and pea gravel	238
Gravel, pea	242
Clay and gravel	247
Gravel	248
Clay and sand	268
Clay, hard	270
Clay and sand	310
Gravel	312
Clay, hard, sand, and gravel	324
Clay and sand	340
Clay and boulders	342
Clay	344
Clay, sand, and cobbles	347
Clay, sand, and gravel	365
Sand	367
Clay and sand	375
Limestone and boulders	381
Limestone, hard, gray	400
(B-14-8)6acd-1. Log by Waymon Yarbrough. Alt. 4,490 ft.	
Clay and sand	72
Lava, black	100
Clay and sand	160
Clay	170
Sand, red; first water	190
Lava, black	220
Gravel, red	230
Clay and gravel	280
Gravel	300
Gravel, dark	380
Rock, dark (lava[?])	420
Gravel, dark	460
(B-14-8)11bca-1. Log by T. J. Burkhart Co. Alt. 4,526 ft.	
Clay, light	30
Clay, light, sandy	34
Lava, fractured	41
Lava, hard	51
Clay, light, sandy	77
Clay, light, dense	102
Clay, brown	131
Sand and gravel	145
Gravel	160
Gravel, crushed	200
Clay, dark	216
Clay, gray, dense	220
Gravel	237
Clay, blue, and gravel	281
Gravel, pea	287
Gravel	313
Clay, dark, and gravel	346
Gravel	353
Clay, light	381
Clay, gravel, and slate	395
Slate	416
(B-14-8)28bbb-1. Log by T. J. Burkhart. Alt. 4,539 ft.	
Clay, light	20
Sand, light	24
Lava, dark	132
Clay and sand	138
Clay and gravel	145
Sand and gravel; water	155
Clay, light	175
Clay, dark	188
Lava, dark	246
Clay and gravel	486
Sand and gravel	511
Bedrock	650
(B-14-8)32aaa-1. Log by L. H. Stoddard. Alt. 4,550 ft.	
Topsoil	3
Clay	50
Lava	162
Limestone, blue	283
Lava	330
(B-14-9)1dda-1. Log by T. J. Burkhart. Alt. 4,469 ft.	
Topsoil	2
Clay, sandy	6
Clay	11
Sand	13
Clay and gravel	56
Lava	107
Shale and fractured lava	139
Shale, sandy	154
Shale	188
Lava	258
Shale and small gravel	276
Gravel, cemented	314
Gravel and sand	332
Gravel, cemented	372
Clay	380
(B-14-9)1dda-2. Log by F. P. Conley. Alt. 4,465 ft.	
Clay, sandy	42
Clay	46
Lava	104
Clay	181
Lava	242
Clay, brown	256
Gravel, coarse	258
Clay	264
Clay, sandy	312
(B-14-9)1dda-3. Log by F. P. Conley. Alt. 4,465 ft.	
Topsoil	21
Clay	41
Lava	106
Clay, brown	130
Clay; water	135
Clay, brown	190
Clay and porous lava	192
Lava, porous	202
(B-14-9)1dda-3 - Continued	
Lava	243
Clay	253
Sand and pea gravel	255
(B-14-9)3bbb-1. Log by J. C. Peterson. Alt. 4,412 ft.	
Topsoil	5
Clay and silt	34
Sand, fine, brown	38
Clay, brown	42
Clay and sand	45
Clay, brown	57
Clay, sand, and gravel	72
Clay, buff	79
Clay, sandy, and small gravel	87
Clay and lava	96
Clay, red	132
Clay, white	146
Cobbles, lava	148
Sand and fractured lava	151
Clay, white	152
Cobbles, lava, and clay	192
Sand and fractured lava	205
(B-14-9)4bbb-2. Log by Waymon Yarbrough. Alt. 4,415 ft.	
"Topsoil"	12
Clay	80
Sand and pea gravel	90
Clay	179
Lava	195
Lava, red	205
Lava, black	220
Clay	235
Sand, clayey	245
Clay	265
Sand, cemented	270
Clay	285
Sand	300
Gravel	320
Clay	340
Clay, sandy	360
Sand and gravel	370
Clay	375
(B-14-9)4ccc-1. Log by Waymon Yarbrough. Alt. 4,394 ft.	
Topsoil	20
Clay, brown, and topsoil	80
Clay, light	120
Clay, blue	140
Sand, red	160
Clay, brown	175
Clay, blue-green	186
Lava and gravel; water	195
Lava, black	200
Lava, red	205
Lava, hard	245
Lava, red, hard	252
Clay, red, sandy	260
Clay	270
Clay, brown	285
Sand	290
Clay, hard	295
Sand	305
Clay, hard	315
Clay, brown	325
Sand	335
Clay	340
Sandstone	345
Clay, sandy	355
Clay	360
(B-14-9)5aaa-1. Log by Waymon Yarbrough. Alt. 4,412 ft.	
Topsoil	1
Hardpan	5
Clay, brown	65
Clay, light brown, and gravel	120
Clay, brown	180
Gravel and boulders	186
Rock	222
Clay and sand	230
Clay, sandy	275
(B-14-9)5abb-1. Log by Waymon Yarbrough. Alt. 4,416 ft.	
Topsoil	14
Clay	138
Sand and gravel	150
Clay	195
Lava	210
Clay	212
Lava	217
Clay	235
Sand and gravel	265
Clay	275
Silt	280
Clay	300
Silt	335
Clay	340

Table 7.--Logs of selected wells and test holes - Continued

Material	Depth
Box Elder County, Utah - Continued	
(B-14-9)5abb-1 - Continued	
Silt	355
Sandstone	360
Sand and gravel	385
Clay	405
(B-14-9)5bbb-1. Log by T. J. Burkhart. Alt. 4,420 ft.	
Topsoil	2
Clay	26
Clay and gravel	76
Clay	160
Clay and gravel	167
Lava	191
Clay, sandy	240
Gravel and sandy clay	275
Clay, sandy	280
Gravel and sandy clay	300
(B-14-9)5bcc-1. Log by Waymon Yarbrough. Alt. 4,410 ft.	
"Topsoil"	14
Clay	138
Sand and gravel	150
Clay	195
Lava, black	210
Lava, broken; first water	212
Lava	217
Clay	235
Sand and pea gravel	265
Clay	275
Silt	280
Clay	300
Silt	335
Clay	340
Silt	355
"Sandstone"	360
Gravel and sand	385
Clay	405
(B-14-9)5ccd-1. Log by Waymon Yarbrough. Alt. 4,397 ft.	
Topsoil and hardpan	2
Clay	29
Hardpan	31
Clay	53
Clay and gravel	67
Sandstone	75
Clay, sandy	94
Clay and sandstone	100
Clay	110
Sandstone	112
Clay, light	153
Clay and sandstone	155
Clay	172
Clay, hard	175
Clay	178
Clay and lava pebbles; water	182
Lava boulders	210
Lava	216
Lava, porous; water	222
Lava, hard	231
Lava, gravelly	233
Lava boulders, porous	248
Lava, hard	253
Sand, red, and clay	264
Clay, sandy	272
Clay	274
Clay, sandy	301
Clay	307
Clay, sandy	323
Clay	327
Sandstone and clay	338
Clay	343
Clay, hard, and gravel	344
Clay	345
Clay, hard, and gravel	347
Sand and clay	365
Sand; water	366
Clay, sandy	375
Sandstone	377
Gravel	379
Clay, sandy	400
(B-14-9)5ccd-2. Log by Waymon Yarbrough. Alt. 4,397 ft.	
"Topsoil"	12
Clay	135
Gravel	142
Clay	181
"Rocks"	253
Clay	290
Shale and sand	300
Clay	305
Sand, red, with clay	320
(B-14-9)5cdb-1. Log by F. P. Conley. Alt. 4,398 ft.	
Clay, sandy	113
Clay	179
Lava	252
Shale, red	265
Clay, sandy	329
(B-14-9)5cdb-1 - Continued	
Gravel	340
Clay, sandy	355
(B-14-9)9baa-1. Log by J. S. Lee and Sons. Alt. 4,395 ft.	
Clay, brown	120
Clay, gray	185
Lava	255
Clay, brown, sandy	300
Clay	512
Lava	660
Lava, loose	672
(B-14-9)11bcb-1. Log by F. A. Cagle. Alt. 4,398 ft.	
Topsoil	3
Clay	34
Rock	44
Clay	60
Rock	104
Clay, red	120
Clay, bluish white	145
Lava	245
(B-14-9)14acd-1. Log by Arlo Lloyd. Alt. 4,410 ft.	
Well deepened from 338 ft	
Sand, brown	366
Clay and sand	385
Clay, blue-green	405
Diatomaceous earth, white (tuff[?])	410
Sand, clean	416
Clay, gray-white	422
Sand, brown	439
Lava, dark	450
(B-14-9)18bdd-1. Log by Waymon Yarbrough. Alt. 4,369 ft.	
Clay, yellow	60
Clay, brown, hard	66
Clay, yellow	178
Lava, dark	265
Clay, brown, sandy	290
Clay, yellow, sticky	300
Clay, yellow, sandy	385
Clay, blue, sticky	400
(B-14-9)19bbb-1. Log by Waymon Yarbrough. Alt. 4,371 ft.	
Topsoil	5
Clay and silt	14
Sand, fine	17
Clay, brown	20
Sand and small gravel	23
Clay	25
Sand and silt	27
Clay	32
Sand and small gravel	37
Gravel, sand, and clay	39
Clay, brown	45
Clay and gravel	48
Gravel, small, sand, and clay	129
Sand and clay	161
Bentonite	164
Lava	180
Lava cinders	183
Lava	198
Clay	200
Lava, hard	214
Lava, red	218
Lava, black	224
Lava, gray, hard	230
Lava, porous	235
Lava, hard	245
Clay and lava boulders	248
Lava, hard	260
Clay, hard	290
Clay, sandy	320
Sand, gray	350
(B-14-9)21bbb-1. Log by J. C. Peterson. Alt. 4,365 ft.	
Topsoil	4
Clay and sand	18
Silt and sand	20
Gravel, small	21
Clay and sand	31
Clay, sand, and gravel	55
Clay	59
Sand and clay	60
Gravel	63
Clay, brown	70
Sand, brown	75
Clay, blue-green, and tuff	81
Sand, brown, fine	83
Clay	88
Sand, brown and black	92
Clay and lava gravel	116
Gravel, fine, and cobbles	118
Gravel, lava	121
Clay and lava	131
Clay and lava gravel	133
(B-14-9)21bbb-1 - Continued	
Clay, red-brown	136
Sand, fine	138
Clay, red	139
Clay, red, and small gravel	144
Clay, red	147
Sand	149
Clay, sand, and gravel	150
Sand	152
Clay and gravel	155
Clay, red	185
Clay, sandy	206
Lava and clay	236
Clay, lava, and gravel	267
Lava	274
Gravel	276
Clay, lava, and gravel	288
Sand, gravel, and clay	294
Sand, fine, coarse gravel, and clay	318
Clay, buff	321
Sand, fine	329
Clay, white	339
Sand, fine	340
Clay, buff	345
Sand, fine, and gravel	351
Clay, red	360
Clay, sandy	366
Sand, medium	368
Sand and clay	383
Sand, gravel, and cobbles	388
Clay, buff	403
Clay, sandy	412
Clay, buff	416
Clay, red	421
Sand, coarse	426
Clay	429
Clay, sandy	438
Sand, fine	442
Clay, black	447
Sand, fine	450
Clay, sandy	456
Clay, tuff	462
Clay, lava cobbles, and small gravel	471
Clay and lava	474
Gravel and sand	475
Clay, sandy, and lava cobbles	478
Cobbles and clay with small gravel	481
Sand, gravel, and lava cobbles	485
Sand, fine	488
Clay, gravel, and sand; water	492
Gravel and sand, coarse, and clay	494
Gravel, clay, and cobbles	496
Clay, gravel, and cobbles	546
Sand, clay, and gravel; water	586
(B-14-10)1bbb-1. Log by F. P. Conley. Alt. 4,438 ft.	
Topsoil	22
Lava, gray, with crevices	52
Lava, soft, light red, with crevices	65
Lava, dark red, hard	72
Lava, hard, gray, with large crevices	85
Lava, hard, gray	108
Lava, very hard	162
Clay, light brown	175
Clay, sandy; first water	188
Rock, hard, white, brittle	208
Clay, brown, sandy; water	211
Sandstone	215
Clay, metallic	275
Gravel and brown lava	285
Gravel, cemented	288
Cinders, lava, and sand	310
Sand and gravel, cemented	320
Sandstone, brown	343
Sand, brown, and shale	350
Clay, yellow	365
Gravel and sand	382
Sandstone	395
Gravel and sand	405
Clay	415
Sand	420
(B-14-10)1dca-1. Log by F. P. Conley. Alt. 4,405 ft.	
Clay	17
Gravel	20
Lava	33
Clay	120
Lava	180
Clay and sand	208
Clay, sandy	243
(B-14-10)5baa-1. Log by F. A. Cagle. Alt. 4,510 ft.	
Gravel	80
Clay	116
Rock	150
Clay	187
Bentonite	207
Gravel and sandstone	276

Table 7.--Logs of selected wells and test holes - Continued

Box Elder County, Utah - Continued

Material	Depth
(B-14-10)5bba-1. Log by F. A. Cagle. Alt. 4,610 ft.	
Gravel and clay	105
Gravel and sand; water bearing	108
Hardpan	220
Gravel and clay	240
Clay	283
Sandstone and clay, layered	303
(B-14-10)14acd-2. Log by Waymon Yarbrough. Alt. 4,392 ft.	
Clay	90
Lava	170
Clay, sandy	220
Clay, pale gray	240
Sand and pea gravel	260
Clay	300
Sand and shale	320
Lava, porous	350
(B-14-10)14bbc-1. Log by F. P. Conley. Alt. 4,423 ft.	
Topsoil	25
Gravel	39
Clay	47
Lava, solid	145
Lava, decomposed	160
Lava, hard	197
Clay, light brown	207
Lava, solid	267
Clay, white	286
Clay, brown	385
Lava, hard	420
Clay, brown	480
Sandstone	530
Clay, white, with stratas of sandstone	815
Gravel	840
(B-14-10)14cbc-1. Log by Waymon Yarbrough. Alt. 4,408 ft.	
"Topsoil"	6
Clay	53
Lava	130
Clay	137
Lava, broken; first water	215
Lava, porous	247
Rock, hard (lava)	255
Clay	260
Lava, porous	280
Lava, hard	283
Limestone	304
Lava, hard	310
Clay, gray	320
Clay, white	340
Clay, tan	355
Clay	360
Clay, sandy	365
Clay, pale blue	400
(B-14-10)34bbb-1. Log by Gary Yarbrough. Alt. 4,390 ft.	
Clay, brown	7
Sand and gravel	25
Boulders	30
Clay, brown	40
Sand and gravel	47
Clay, brown	51
Sand and gravel	73
Clay, gray	110
No record	168
Clay, blue	180
Clay, brown	200
Clay, rusty red	212
Clay, brown	230
Sandstone	238
Clay, brown	243
Sandstone	250
Clay, white, sandy	270
Sandstone	272
Clay, sandy, brown	310
Sandstone	312
Clay, gray	322
(B-14-10)34bbb-1 - Continued	
Sandstone	323
Clay, brown	335
Clay and gravel	340
Gravel	350
Clay, sandy, brown	365
(B-15-7)29dac-1. Log by S. Siaperas Drilling Co. Alt. 4,800 ft.	
Topsoil	12
Sandstone	128
Gravel	130
Sandstone and sand	158
Gravel	161
Sand and sandstone	175
(B-15-7)30cbc-1. Log by David Musselman. Alt. 4,575 ft.	
Clay, white	110
Clay, blue	154
Limestone and gravel	185
Mud, blue	228
(B-15-7)32aca-1. Log by Waymon Yarbrough. Alt. 4,700 ft.	
Topsoil, gravel, and clay	15
Clay, hard, and gravel	75
Boulders	100
Clay, hard	115
Sand, clay, and gravel	145
Gravel, cemented, and sand	175
Clay	190
Gravel, cemented	195
Gravel and sand	210
Clay and boulders	240
Shale and gravel	255
Boulders and clay	275
Sand, cemented, and gravel	290
Gravel, cemented	315
(B-15-8)25ddd-1. Log by David Musselman. Alt. 4,560 ft.	
Clay, white	39
Hardpan and conglomerate	41
Clay, green	94
Hardpan	95
Gravel	100
(B-15-8)31ccc-1. Log by Waymon Yarbrough. Alt. 4,590 ft.	
Clay	76
Lava	88
Clay	140
Sand and pea gravel; first water	187
Lava	290
Sand and pea gravel	320
Clay, blue	345
Sand	360
Clay	380
Clay and sand	400
Clay	430
Sand and muck	460
Clay, sticky	490
Lava	525
Lava, hard	550
(B-15-9)29dbc-1. Log by Waymon Yarbrough. Alt. 4,455 ft.	
Topsoil and gravel	2
Gravel, cemented	55
Sandstone	65
Sand	70
Clay	80
Sand	90
Clay	95
Sandstone	115
Clay	120
Sandstone	125
Sand	135
Clay	145
Sand and pea gravel	155
Clay	165
(B-15-9)29dbc-1 - Continued	
Clay, sandy	178
Limestone	180
Clay	190
Sandstone	200
Lava	210
Gravel, loose; water	238
Gravel and sand	250
Clay and sand	295
Lava	305
Clay	315
Gravel	325
Sandstone	350
Clay, sandy	375
Sandstone	385
Clay and sand	395
Sandstone	400
Sand	405
Sandstone	415
Clay	425
Gravel, cemented	430
Sandstone	440
Gravel, cemented	448
Clay	455
Lava boulders	460
Lava	480
(B-15-9)35abb-1. Log by Waymon Yarbrough. Alt. 4,484 ft.	
Clay, yellow	98
Rock, dark	145
First water	185
Rock, gray	245
Rock, brown	250
Rock, gray	280
Little water	290
Rock, brown	377
Lava, porous	404
(B-15-10)33ddd-1. Log by A. P. Lloyd. Alt. 4,563 ft.	
Gravel	30
Boulders	51
Clay and gravel	72
Clay, brown	87
Lava, black	167
Clay, gray	233
Clay, brown	355
(B-15-10)36bbb-1. Log by F. P. Conley. Alt. 4,464 ft.	
Topsoil	2
Clay and gravel	35
Gravel	45
Clay, sandy	78
Clay, sticky	110
Clay and gravel	123
Boulders, lava	127
Sandstone	137
Lava	174
Lava, fractured, mineralized	236
Lava, fractured, and clay	253
Clay, brown, red, and gray, and sandstone	311
Sandstone	313
Clay	314
Sandstone and clay, layered	405
Clay and pea gravel	416
Sandstone and clay, layered	574
Gravel, pea	588
Gravel, porous, and sandstone	598
Lava, porous	607
Lava, nonporous	613
(B-15-11)36ccc-1. Log by A. P. Lloyd. Alt. 4,900 ft.	
Clay, gravel, and cobbles	150
Limestone, dark gray	153
Clay and boulders	181
Limestone	235
Clay and gravel	259
Clay and sand	267
Clay, gray, and boulders	300
Limestone, gray	320

Oneida County, Idaho

Material	Depth
13S-33E-4aaa-1. Log by Waymon Yarbrough. Alt. 5,260 ft.	
Topsoil	2
Gravel, coarse, packed	21
Gravel, loose	24
Gravel, cemented	26
Sand, gravel, and clay	55
Sand, clayey	57
Clay, yellow, with gravel	72
Sand, clayey, soft	75
Clay, sandy	99
Clay, soft	101
Sand, packed	105
14S-30E-32cdd-1. Log by Stanley Lloyd. Alt. 5,150 ft.	
Soil	2
14S-30E-32cdd-1 - Continued	
Clay, gray, with gravel	19
Gravel and sandy clay	42
Clay, gray, with some gravel; water	124
Limestone, gray, hard	127
Rock, gray, soft; water	131
Limestone, gray, hard; water	133
Limestone, gray; water	202
14S-33E-31acc-1. Log by Bernard Gardner. Alt. 4,800 ft.	
Soil	1
Clay, gravelly	17
Clay, blue	63
Gravel; water bearing	84
Clay, blue	95
15S-30E-8aaa-1. Log by Sherman Couch. Alt. 5,150 ft.	
Topsoil	7
Gravel	112
Clay, brown, sandy	147
Clay, brown	214
Clay, sandy	275
Clay, brown	357
Gravel	367
Clay, sandy	490
Clay, sandy, with sandstone lumps	760
15S-30E-15bbb-1. Log by D. V. Robinson. Alt. 4,900 ft.	
Topsoil	4
Clay and gravel, light brown	25
Sand and gravel	70

Table 7.--Logs of selected wells and test holes - Continued

Material	Depth
Oneida County, Idaho - Continued	
15S-30E-15bbb-1 - Continued	
Clay, yellow, with gravel	75
Clay, sandy, brown	80
Clay, brown, with gravel	90
Clay, yellow, with gravel	267
Gravel, small; making water	268
Clay, yellow, with gravel	275
Gravel, small; water	280
Sand, fine, with gravel	285
Sand and gravel, cemented	400
Gravel, fine, cemented	410
Gravel, fine, and sand, cemented	430
Gravel, fine, cemented	443
Clay, sandy, with gravel	458
Clay and gravel	525
Gravel, fine; water	535
15S-30E-35dac-1. Log by Harry King. Alt. 4,700 ft.	
Sand, windblown	16
Clay, tan	47
Clay, tan, with gravel	83
Clay, tan	102
Clay, tan, with gravel	150
Clay, brown, with gravel	246
Clay, brown	342
Clay, brown, with gravel	373
Clay, tan, with gravel	384
Gravel, clayey; water	386
Clay, brown, with gravel	395
Clay, tan, with gravel	415
Gravel, clayey; water	428
Clay, brown	469
Gravel, clayey, tan; water	474
Clay, brown	505
16S-32E-2bcd-1. Log by H. Vanderwood. Alt. 4,604 ft.	
Topsoil	2
Clay	33
Clay, sandy	38
Gravel and sand	41
Clay	43
Gravel and sand	47
Gravel	76
Clay and gravel	85
Clay	96
Gravel	97
Clay	103
Gravel	108
Clay	111
16S-32E-2bcd-1 - Continued	
Gravel	120
Clay	125
Gravel	165
Clay	167
Gravel	178
Rock	180
Clay and gravel	185
Clay	190
16S-32E-14cbb-1. Log by Waymon Yarbrough. Alt. 4,590 ft.	
Clay and soil	40
Sand and gravel	65
Clay	75
Gravel	78
Sandstone	80
Gravel	85
Sandstone	90
Clay	105
Gravel	110
Clay	118
Gravel	125
Clay	128
Gravel	135
Clay	145
Sandstone	150
Clay	155
Gravel, big (coarse)	175
Clay, brown	185
Clay, blue	210
16S-32E-16baa-1. Log by Waymon Yarbrough. Alt. 4,576 ft.	
Topsoil	3
Clay	30
Sand and pea gravel; first water	40
Clay	70
Sandstone	71
Clay	80
Sandstone	81
Sand and clay; little water	88
Sandstone	90
Sand and clay	100
16S-32E-26caa-1. Log by Waymon Yarbrough. Alt. 4,562 ft.	
Topsoil	2
Clay	16
Muck, sandy	24
Clay	38
16S-32E-26caa-1 - Continued	
Sandstone	50
Clay, hard	55
Clay, soft	70
Clay	85
Gravel	95
Clay	110
Gravel	120
Clay	130
Sandstone	132
Clay, sandy	140
Clay, hard	145
Sandstone	147
Clay, pale, soft	150
Sandstone	155
Clay	170
Clay, sandy	201
Clay, blue	207
Gravel	217
Clay, brown	220
16S-32E-27ddb-1. Log by Waymon Yarbrough. Alt. 4,559 ft.	
Topsoil	8
Clay	23
Sand and clay; first water	40
Gravel	45
Sandstone	48
Sand and clay	70
Clay, blue	85
Clay, hard	90
Sand and clay	115
Sand and gravel	125
Sandstone	128
Gravel	135
Clay and gravel	145
Gravel	160
Clay, hard	185
Sand and clay	200
Gravel, pea	210
Clay	230
16S-33E-18bbc-2. Log by Waymon Yarbrough. Alt. 4,685 ft.	
Topsoil	5
Clay, brown	10
Clay, yellow, sandy	20
Gravel	24
Clay, yellow	35
Gravel, cemented	40
Clay, rusty and brown, with gravel	55
Clay, gray	65

Table 8.--Water levels in selected observation wells

[Water levels are given in feet below land surface]

Box Elder County, Utah

(B-12-11)5bbb-1. Records available 1953-59, 1963-67, 1969-73.

Nov. 5, 1953	134.37	Dec. 5, 1963	153.62	Mar. 11, 1970	158.91
Apr. 15, 1954	138.30	Mar. 14, 1964	151.11	Nov. 4	159.11
Oct. 14	136.40	Mar. 11, 1965	156.16	Mar. 22, 1971	159.07
Nov. 2, 1955	140.79	Nov. 2	156.51	Mar. 1, 1972	158.69
Oct. 31, 1956	145.88	Oct. 14, 1966	161.48	8	154.30
Mar. 28, 1957	140.15	Mar. 10, 1967	163.10	9	154.24
Oct. 17	149.60	Oct. 5	154.17	Dec. 20	159.68
Oct. 16, 1958	148.61	Nov. 5, 1969	171.83	Apr. 4, 1973	157.47
Oct. 14, 1959	154.55			Sept. 18	168.17

(B-12-11)16cdc-1. Records available 1935-36, 1938-46, 1948-59, 1961-65, 1967-68, 1971-72.

Oct. 31, 1935	9.26	Nov. 2, 1949	8.60	Oct. 12, 1961	13.28
May 11, 1936	8.35	Nov. 14, 1950	8.50	May 9, 1962	11.52
Aug. 16	9.38	Aug. 29, 1951	8.92	Mar. 7, 1963	12.01
Oct. 10	9.55	Nov. 1	8.61	Dec. 5	12.92
Oct. 12, 1938	8.97	Oct. 24, 1952	8.88	Mar. 14, 1964	12.25
Sept. 29, 1939	8.34	Nov. 5, 1953	8.98	Oct. 28	12.78
Oct. 9, 1940	8.33	Apr. 14, 1954	8.36	Mar. 11, 1965	12.15
Oct. 8, 1941	8.94	Oct. 14	9.35	Aug. 5	13.68
Aug. 6, 1942	8.79	Nov. 2, 1955	9.59	Nov. 2	12.90
Oct. 5	9.08	Oct. 31, 1956	10.05	Mar. 10, 1967	13.50
Sept. 27, 1943	9.08	Mar. 28, 1957	9.32	Oct. 5	17.10
Oct. 24, 1944	8.86	Oct. 17	10.70	Oct. 29, 1968	13.72
Oct. 25, 1945	8.24	Oct. 16, 1958	11.24	Aug. 4, 1971	14.50
Oct. 24, 1946	8.47	Oct. 14, 1959	11.57	Mar. 22, 1972	12.34
Oct. 23, 1948	8.57	Apr. 5, 1961	11.37	Dec. 20	13.41

(B-14-8)1ddd-1. Records available 1957, 1960-73.

Oct. 16, 1957	58.22	Mar. 11, 1965	55.64	Oct. 29, 1968	56.03
Mar. 29, 1960	55.63	Aug. 5	55.72	Nov. 5, 1969	56.86
Oct. 26	55.59	Mar. 23, 1966	55.71	Mar. 10, 1970	55.97
Apr. 4, 1961	55.58	Oct. 12	55.90	Mar. 22, 1971	56.25
Oct. 17, 1962	55.92	Mar. 9, 1967	55.77	Mar. 22, 1972	56.44
Mar. 6, 1963	55.80	Oct. 6	56.19	Dec. 20	56.92
Oct. 28, 1964	55.85	Mar. 22, 1968	55.89	Apr. 4, 1973	57.19

(B-14-8)2aba-1. Records available 1948-70.

Oct. 22, 1948	30.96	Mar. 28, 1957	31.46	Oct. 28, 1964	31.15
Oct. 18, 1949	30.42	Oct. 16	30.00	Mar. 11, 1965	33.54
Nov. 15, 1950	31.30	Mar. 19, 1958	32.71	Aug. 5	28.06
Aug. 28, 1951	23.80	Oct. 15	33.53	Nov. 2	30.34
Oct. 31	27.31	Mar. 24, 1959	30.57	Mar. 23, 1966	32.16
May 28, 1952	27.45	Oct. 13	29.86	Oct. 12	31.57
Oct. 23	29.53	Mar. 29, 1960	33.60	Aug. 8, 1967	30.18
Mar. 31, 1953	31.95	Oct. 26	31.04	Oct. 6	31.50
Nov. 5	31.25	Apr. 4, 1961	33.58	Mar. 22, 1968	33.50
Apr. 14, 1954	32.77	May 9, 1962	29.84	Oct. 29	32.95
Oct. 12	31.35	Oct. 17	30.69	Nov. 5, 1969	32.37
Nov. 1, 1955	30.42	Mar. 6, 1963	33.48	Mar. 10, 1970	33.98
Apr. 4, 1956	31.03	Dec. 4	30.06		

(B-14-8)11aba-1. Records available 1936-41, 1943-73.

Oct. 9, 1936	46.24	July 1, 1950	43.45	May 9, 1962	43.84
Mar. 13, 1937	47.60	Nov. 15	42.02	Oct. 17	40.82
Sept. 24	46.50	Aug. 27, 1951	40.08	Mar. 6, 1963	43.82
Feb. 10, 1938	45.20	Oct. 31	39.55	Dec. 4	40.13
Apr. 18	46.00	May 28, 1952	40.40	Mar. 13, 1964	44.10
June 25	46.80	Oct. 23	40.76	Oct. 28	40.49
Oct. 11	45.30	Nov. 5, 1953	42.76	Mar. 11, 1965	42.36
Dec. 10	45.79	Apr. 14, 1954	45.78	Aug. 5	40.49
Aug. 8, 1939	47.70	Oct. 12	43.50	Nov. 2	40.90
Sept. 28	46.92	Nov. 1, 1955	39.66	Oct. 12, 1966	41.40
Dec. 26	46.47	Apr. 4, 1956	42.85	Mar. 9, 1967	45.03
Apr. 1, 1940	48.00	Oct. 31	40.94	Oct. 6	40.54
Oct. 9	47.73	Mar. 28, 1957	44.12	Mar. 22, 1968	45.13
Mar. 13, 1941	47.02	Oct. 16	41.48	Oct. 29	41.31
Oct. 8	47.00	Mar. 19, 1958	43.35	Oct. 29, 1969	41.31
Sept. 26, 1943	45.50	Oct. 15	41.02	Nov. 5	41.57
Oct. 23, 1944	46.13	Mar. 24, 1959	43.98	Mar. 10, 1970	42.79
Oct. 25, 1945	44.42	Oct. 13	40.69	Mar. 22, 1971	41.13
Oct. 24, 1946	43.59	Mar. 29, 1960	44.55	Mar. 23, 1972	43.29
Oct. 28, 1947	44.98	Oct. 26	41.72	Dec. 20	41.81
Oct. 22, 1948	43.25	Apr. 4, 1961	45.15	Mar. 7, 1973	45.04
Oct. 18, 1949	41.47				

(B-14-9)1dda-1. Records available 1955-57, 1959-62, 1964-70.

July 27, 1955	167.33	Mar. 24, 1959	172.67	Oct. 11, 1967	183.29
Nov. 1	167.45	Mar. 29, 1960	174.25	Mar. 22, 1968	182.10
Apr. 4, 1956	172.30	Apr. 4, 1961	174.13	Oct. 29	181.66
Aug. 14	172.81	May 9, 1962	173.92	Mar. 18, 1969	176.44
Dec. 18	1 1.87	Oct. 28, 1964	174.74	Apr. 3	194.70
Mar. 28, 1957	171.50	Mar. 11, 1965	174.92	Nov. 5	218.33
Oct. 16	173.17	Oct. 12, 1966	181.18	Apr. 24, 1970	177.06
Dec. 13	172.32	Mar. 9, 1967	183.07		

(B-14-9)7bbb-1. Records available 1955-60, 1962, 1964-73.

Dec. 12, 1955	154.28	May 9, 1962	154.02	Oct. 29, 1968	164.20
Dec. 18, 1956	155.76	Dec. 16, 1964	156.75	Apr. 5, 1969	164.90
Mar. 28, 1957	155.20	Mar. 11, 1965	159.00	Nov. 5	185.21
June 18	159.40	Aug. 5	163.63	Mar. 11, 1970	187.56
Oct. 16	157.20	Nov. 2	162.32	Nov. 4	177.25
Dec. 13	156.13	Oct. 12, 1966	182.50	Mar. 23, 1971	165.81
Mar. 19, 1958	155.62	Mar. 9, 1967	183.24	Mar. 22, 1972	163.71
Mar. 24, 1959	155.30	July 12	165.68	Dec. 20	171.79
July 9	158.66	Oct. 6	171.50	Apr. 4, 1973	164.54
Mar. 29, 1960	154.20	Mar. 22, 1968	170.80		

(B-14-9)9baa-1. Records available 1957-70.

Apr. 4, 1957	167.10	June 30, 1960	164.62	July 31, 1963	160.24
Oct. 16	167.63	July 31	164.29	Aug. 31	160.55
Dec. 31	167.10	Aug. 31	163.93	Sept. 30	159.83
Jan. 31, 1958	166.97	Sept. 30	163.94	Oct. 15	159.62
Feb. 28	166.79	Oct. 31	163.74	Dec. 31	158.08
Mar. 31	166.68	Nov. 30	163.42	Jan. 31, 1964	157.68
Apr. 30	166.54	Dec. 31	162.90	Feb. 29	157.12
May 31	166.57	Jan. 5, 1961	162.95	Mar. 31	156.61
June 30	166.82	Feb. 28	162.60	Apr. 30	156.60
July 31	166.95	Mar. 31	162.32	May 31	158.25
Aug. 31	166.88	Apr. 30	162.66	June 30	158.72
Sept. 30	166.84	May 25	163.10	July 31	159.34
Oct. 15	166.82	July 5	164.05	Aug. 31	158.19
Feb. 28, 1959	165.93	Oct. 31	163.80	Sept. 30	158.07
Mar. 31	165.63	Nov. 30	163.53	Oct. 31	157.67
Apr. 30	165.37	Dec. 31	163.37	Nov. 30	156.60
May 31	165.62	Jan. 31, 1962	163.04	Dec. 15	156.32
June 30	165.89	Feb. 28	162.75	Jan. 31, 1965	155.47
July 31	165.78	Mar. 31	162.55	Feb. 28	155.15
Aug. 31	165.52	June 30	163.57	Mar. 31	155.00
Sept. 30	165.47	July 20	163.90	Apr. 30	154.54
Oct. 31	165.47	Aug. 31	163.80	May 31	156.61
Nov. 30	165.09	Sept. 5	163.62	June 30	157.83
Dec. 31	164.60	Oct. 15	164.02	July 31	159.39
Jan. 31, 1960	164.55	Dec. 20	163.37	Aug. 31	158.28
Feb. 29	164.42	Mar. 31, 1963	159.12	Sept. 30	158.42
Mar. 31	164.30	Apr. 30	159.27	Oct. 31	157.79
Apr. 30	164.35	May 31	158.99	Nov. 30	157.05
May 31	164.43	June 30	159.41	Dec. 22	156.46

Well plugged back to 341 feet in summer of 1966; water levels from October 1966 on do not represent the same water-bearing zones as earlier records.

Mar. 25, 1966	155.44	Nov. 30, 1967	172.08	Jan. 22, 1969	171.73
Oct. 31	171.97	Dec. 10	171.58	Mar. 21	171.35
Nov. 30	171.49	Jan. 25, 1968	171.27	Apr. 16	171.50
Dec. 31	171.13	Feb. 29	171.20	May 13	171.35
Feb. 5, 1967	171.00	Mar. 31	170.90	26	174.05
Mar. 10	170.50	Apr. 30	170.95	June 23	174.60
June 30	172.40	May 31	173.58	July 29	176.70
Aug. 20	172.02	June 30	174.54	Mar. 10, 1970	171.33
Oct. 31	174.38	Oct. 29	172.33	Nov. 4	174.63

(B-14-9)10ada-1. Records available 1936-42, 1944-55, 1957-72.

May 11, 1936	100.13	Oct. 25, 1945	96.66	Apr. 4, 1961	98.74
Aug. 16	100.06	Oct. 24, 1946	98.38	May 9, 1962	97.85
Oct. 9	98.54	Oct. 28, 1947	96.49	Mar. 6, 1963	98.93
Mar. 13, 1937	98.80	Oct. 22, 1948	96.74	Dec. 4	99.68
Sept. 24	97.72	Oct. 18, 1949	96.50	Mar. 13, 1964	100.74
Apr. 18, 1938	99.90	Nov. 15, 1950	96.00	Oct. 28	98.43
June 25	99.65	Aug. 28, 1951	96.41	Mar. 11, 1965	101.26
Oct. 11	97.24	Oct. 31	96.14	Aug. 5	100.28
Dec. 10	98.01	May 28, 1952	98.05	Nov. 2	99.66
Apr. 6, 1939	100.50	Oct. 23	97.73	Mar. 23, 1966	100.17
Aug. 8	96.67	Nov. 5, 1953	97.19	Oct. 12	100.90
Sept. 28	97.33	Apr. 14, 1954	98.57	Mar. 9, 1967	99.80
Dec. 26	95.92	Oct. 12	97.98	Oct. 6	97.65
Apr. 1, 1940	97.80	Nov. 1, 1955	98.23	Mar. 22, 1968	97.35
Oct. 9	96.47	Oct. 16, 1957	98.50	Oct. 29	97.30
Mar. 13, 1941	98.45	Mar. 19, 1958	99.20	Mar. 18, 1969	97.74
Oct. 7	97.20	Oct. 15	98.70	Nov. 5	102.73
Aug. 6, 1942	97.55	Mar. 24, 1959	98.45	Mar. 10, 1970	99.46
Oct. 5	96.90	Oct. 13	98.10	Mar. 23, 1971	100.73
Oct. 23, 1944	97.34	Mar. 29, 1960	99.20	Dec. 20, 1972	101.68

(B-15-10)36bbb-1. Records available 1956-61, 1963-73.

May 24, 1956	164.62	Mar. 6, 1963	165.36	Oct. 29, 1968	169.33
Aug. 15	164.76	Mar. 13, 1964	165.85	Apr. 5, 1969	169.70
Oct. 16, 1957	163.25	Dec. 16	167.07	Nov. 5	177.28
Oct. 16, 1958	163.25	Mar. 11, 1965	166.27	Mar. 11, 1970	176.64
Mar. 24, 1959	162.96	Oct. 12, 1966	184.30	Nov. 4	171.08
July 9	164.26	Mar. 9, 1967	185.10	Mar. 23, 1971	174.84
Oct. 13	164.37	Oct. 5	183.60	Mar. 23, 1972	180.60
Mar. 29, 1960	163.58	Mar. 22, 1968	181.20	Apr. 4, 1973	170.92
Apr. 4, 1961	164.85			Sept. 18	173.02

Table 9.--Records of discharge of selected springs in the Locomotive Springs group

West Locomotive Spring at Locomotive Springs, near Snowville, Utah

Location.--Lat 41°43'20", long 112°56'07", in SW¼ sec. 36, T. 12 N., R. 10 W., Box Elder County, at Locomotive Springs State Waterfowl Management Area on the north end of Great Salt Lake and 20 miles (32 km) southwest of Snowville.

Period of record.--December 1968 to September 1973.

Gage.--Water-stage recorder. Datum of gage is 4,214.6 ft (1,284.61 m) above mean sea level.

Remarks.--Records poor. Figures given herein include discharge of Baker Spring (lat 41°42'54", long 112°56'32", in NW¼NE¼ sec. 2, T. 11 N., R. 10 W.) measured at outlet of spring pond. The two spring ponds are connected by a canal, and most of the flow can be diverted to either gage. At times water is diverted from the ponds and is not measured by either gage.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1			17	16	16	16	19	17	25	21	11	16
2			17	17	16	16	19	17	25	23	11	17
3			20	17	16	16	20	17	25	24	11	17
4			19	16	16	16	20	17	25	24	11	17
5			17	16	16	17	20	17	25	24	11	17
6			16	16	16	17	20	16	25	24	11	16
7			16	16	16	17	20	16	24	24	11	16
8			16	16	16	17	20	21	24	24	11	16
9			16	16	16	17	20	24	22	23	11	16
10			16	16	16	18	20	24	24	23	11	13
11			16	16	16	18	20	23	23	23	11	12
12			16	16	16	18	20	22	23	22	11	12
13			16	16	16	18	21	22	23	22	11	14
14			16	16	16	18	21	24	23	22	11	14
15			16	16	16	18	21	23	23	17	11	14
16			16	16	16	18	20	23	23	13	11	20
17			16	16	16	18	20	22	23	14	20	20
18			16	16	16	18	20	21	24	14	16	14
19			16	16	16	18	20	21	24	14	12	12
20			16	16	16	18	19	20	24	14	12	13
21			17	16	16	18	18	20	23	14	12	13
22			17	16	16	18	18	20	23	14	12	13
23			17	16	16	18	18	21	23	13	12	12
24			17	16	16	18	18	21	24	13	13	11
25			17	16	16	18	18	21	23	13	13	11
26			17	16	16	20	18	21	22	13	13	13
27			17	16	16	20	18	22	22	13	13	13
28			17	16	16	20	18	22	21	13	14	13
29			17	16	------	20	17	22	21	13	14	14
30			17	16	------	19	17	22	21	12	14	15
31		------	18	16	------	19	------	22	------	12	16	------
TOTAL			518	498	448	555	578	641	700	552	382	434
MEAN			16.7	16.1	16.0	17.9	19.3	20.7	23.3	17.8	12.3	14.5
MAX			20	17	16	20	21	24	25	24	20	20
MIN			16	16	16	16	17	16	21	12	11	11
AC-FT			1,030	988	889	1,100	1,150	1,270	1,390	1,090	758	861

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

West Locomotive Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15	17	21	21	22	24	23	23	20	17	1.9	13
2	15	16	21	21	23	24	23	23	20	17	1.9	9.8
3	15	17	22	21	23	24	23	23	20	17	1.9	9.0
4	15	17	22	21	23	23	23	23	21	17	1.9	9.0
5	15	17	22	21	22	24	23	23	21	17	1.9	9.4
6	15	17	22	21	22	24	23	23	21	17	1.9	9.0
7	15	17	22	21	23	23	23	23	21	17	1.9	9.0
8	13	18	22	21	24	23	22	23	21	17	1.9	9.0
9	13	18	22	21	24	23	22	24	21	17	1.9	9.0
10	13	18	22	22	23	23	22	23	20	17	1.9	9.0
11	13	18	22	22	23	23	22	23	18	17	1.9	9.4
12	14	18	22	22	23	23	22	23	20	17	1.9	9.4
13	14	18	22	22	24	23	23	23	21	17	1.9	9.4
14	15	18	20	21	23	23	23	23	20	17	1.9	9.0
15	15	18	20	21	24	23	22	23	20	17	1.9	9.0
16	15	18	20	21	24	23	22	23	20	16	1.9	9.0
17	15	18	20	21	24	22	22	25	21	16	1.9	9.0
18	16	18	20	21	24	24	22	24	21	13	1.9	9.0
19	16	18	20	22	23	23	23	23	20	1.9	1.9	23
20	15	20	20	22	23	23	23	23	21	1.9	1.9	20
21	15	21	22	22	24	24	23	23	20	1.9	1.9	18
22	16	20	20	22	24	24	23	23	20	1.9	1.9	17
23	15	20	20	22	24	24	23	23	20	1.9	1.9	18
24	15	20	20	22	24	22	23	22	20	1.9	1.9	19
25	16	20	20	22	24	24	24	22	19	1.9	1.9	19
26	16	20	21	22	24	23	23	14	19	1.9	1.9	19
27	16	20	20	22	24	23	23	15	17	1.9	1.9	19
28	16	20	20	21	24	24	23	17	19	1.9	1.9	19
29	16	21	20	21	------	24	23	18	18	1.9	1.9	19
30	16	21	20	21	------	23	23	18	17	1.9	1.9	19
31	17	------	21	22	------	23	------	18	------	1.9	6.7	------
TOTAL	466	557	648	665	656	723	682	677	597	324.7	63.7	397.4
MEAN	15.0	18.6	20.9	21.5	23.4	23.3	22.7	21.8	19.9	10.5	2.05	13.2
MAX	17	21	22	22	24	24	24	25	21	17	6.7	23
MIN	13	16	20	21	22	22	22	14	17	1.9	1.9	9.0
AC-FT	924	1,100	1,290	1,320	1,300	1,430	1,350	1,340	1,180	644	126	788

CAL YR 1969 TOTAL 6,459.0 MEAN 17.7 MAX 25 MIN 11 AC-FT 12,810
WTR YR 1970 TOTAL 6,456.8 MEAN 17.7 MAX 25 MIN 1.9 AC-FT 12,810

NOTE.--No gage-height record May 26 to Sept. 18 at West Locomotive Spring.

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

West Locomotive Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	20	20	19	20	20	20	22	22	26	25	9.0	25
2	19	20	19	19	20	20	22	22	24	25	29	25
3	20	20	19	18	20	20	22	22	25	25	26	25
4	20	20	19	21	20	21	22	22	25	25	25	24
5	20	20	19	21	20	20	22	22	24	25	24	24
6	20	20	19	20	19	21	22	23	24	25	24	25
7	20	20	19	20	19	21	22	23	24	9.2	23	25
8	20	19	19	21	19	21	23	22	24	7.7	23	24
9	20	19	20	21	19	22	22	22	26	7.8	23	25
10	20	19	20	21	19	22	22	22	24	7.9	23	25
11	20	19	20	21	19	22	23	22	27	7.9	23	24
12	20	19	20	21	19	22	23	22	25	7.9	23	24
13	20	19	20	20	20	22	22	22	26	7.9	22	24
14	20	19	20	20	20	22	23	22	26	7.9	27	24
15	20	19	20	20	21	22	22	22	26	7.9	26	24
16	20	19	20	20	21	22	23	22	24	7.9	26	22
17	20	19	20	20	21	22	23	23	24	7.9	24	23
18	20	18	20	20	20	22	22	19	26	7.9	24	23
19	20	19	19	20	20	22	22	22	26	9.0	24	20
20	20	19	19	20	20	22	22	23	26	9.0	24	19
21	20	19	20	20	20	22	22	23	25	9.0	24	20
22	20	19	20	20	20	22	22	24	25	7.9	24	21
23	21	19	20	20	20	22	22	24	26	7.9	24	21
24	20	19	20	20	20	22	22	24	27	7.9	24	21
25	20	19	20	20	19	22	23	24	25	7.9	24	21
26	19	19	20	20	21	22	23	25	25	7.9	24	21
27	20	19	20	20	20	22	23	24	26	9.0	24	21
28	20	19	20	20	20	22	22	24	26	9.0	25	21
29	20	19	20	20	------	22	22	23	25	9.0	26	21
30	20	20	20	20	------	22	23	24	25	9.0	25	22
31	20	------	20	20	------	22	------	24	------	9.0	25	------
TOTAL	619	577	610	624	556	670	670	704	757	357.3	741.0	684
MEAN	20.0	19.2	19.7	20.1	19.9	21.6	22.3	22.7	25.2	11.5	23.9	22.8
MAX	21	20	20	21	21	22	23	25	27	25	29	25
MIN	19	18	19	18	19	20	22	19	24	7.7	9.0	19
AC-FT	1,230	1,140	1,210	1,240	1,100	1,330	1,330	1,400	1,500	709	1,470	1,360

CAL YR 1970 TOTAL 6,591.8 MEAN 18.1 MAX 25 MIN 1.9 AC-FT 13,070
WTR YR 1971 TOTAL 7,569.3 MEAN 20.7 MAX 29 MIN 7.7 AC-FT 15,010

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

West Locomotive Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	21	19	19	20	20	22	21	21	23	11	8.7	15
2	21	19	19	20	20	22	20	19	23	11	8.7	15
3	21	19	20	19	20	22	21	20	24	12	8.7	15
4	21	19	20	17	20	22	21	21	22	11	8.7	15
5	20	19	19	20	20	22	21	22	21	11	8.7	15
6	21	19	19	20	20	21	21	23	24	11	8.2	15
7	20	18	19	20	21	22	21	23	25	11	8.3	15
8	20	19	17	20	21	22	21	23	23	11	8.3	15
9	20	19	21	20	20	22	21	23	23	11	8.3	15
10	20	19	20	19	20	22	21	22	22	13	8.3	16
11	20	19	21	20	20	21	21	22	22	13	8.3	16
12	20	19	20	19	20	21	21	22	20	14	8.3	16
13	20	19	21	20	20	22	21	22	20	14	8.3	16
14	20	20	20	20	21	21	21	22	20	8.3	8.4	15
15	20	19	20	19	20	22	21	21	19	8.2	8.5	15
16	20	19	20	20	21	22	21	21	18	8.2	8.5	15
17	20	19	21	20	20	21	21	21	18	8.2	8.5	15
18	20	19	20	20	21	21	21	21	18	8.2	8.5	15
19	20	19	21	21	21	21	21	21	17	8.2	8.5	16
20	19	19	20	21	21	21	20	21	16	8.2	8.6	15
21	19	20	21	20	21	21	21	21	16	8.7	8.6	15
22	20	19	21	20	21	21	21	21	14	8.7	8.7	15
23	20	20	21	20	21	20	21	22	14	8.7	22	15
24	19	19	21	20	21	21	21	22	14	8.7	15	15
25	19	19	21	20	22	21	21	22	13	8.7	15	19
26	19	19	21	20	21	21	21	22	12	9.2	15	16
27	19	20	20	20	21	21	21	23	12	9.2	15	16
28	18	19	20	20	22	21	21	22	13	9.2	15	16
29	18	19	20	20	22	21	20	23	13	9.2	15	16
30	19	19	20	20	------	21	21	22	11	9.2	16	16
31	19	------	20	20	------	21	------	23	------	9.2	15	------
TOTAL	613	573	623	615	599	662	627	674	550	310.2	329.6	464
MEAN	19.8	19.1	20.1	19.8	20.7	21.4	20.9	21.7	18.3	10.0	10.6	15.5
MAX	21	20	21	21	22	22	21	23	25	14	22	19
MIN	18	18	17	17	20	20	20	19	11	8.2	8.2	15
AC-FT	1,220	1,140	1,240	1,220	1,190	1,310	1,240	1,340	1,090	615	654	920

CAL YR 1971 TOTAL 7,572.3 MEAN 20.7 MAX 29 MIN 7.7 AC-FT 15,020
WTR YR 1972 TOTAL 6,639.8 MEAN 18.1 MAX 25 MIN 8.2 AC-FT 13,170

NOTE.--No gage-height record Jan. 13 to Feb. 18 at Baker Spring.

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

West Locomotive Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	16	15	16	18	20	22	20	21	24	19	6.4	7.9
2	16	15	15	18	20	20	20	21	19	19	4.7	7.9
3	16	15	15	18	20	20	20	21	20	19	4.7	7.9
4	16	15	15	18	20	22	20	21	19	19	4.7	7.9
5	16	15	14	20	20	20	21	21	20	19	6.4	7.9
6	16	15	16	20	20	20	19	21	20	19	4.7	7.9
7	16	15	16	20	20	20	20	20	20	19	4.7	7.9
8	16	15	16	20	20	20	21	21	18	19	6.4	7.9
9	16	15	12	20	20	20	21	21	19	19	6.4	7.9
10	16	15	14	20	20	22	21	21	19	19	4.7	7.9
11	16	15	14	20	20	22	21	21	19	20	6.4	7.9
12	16	15	16	20	22	22	21	21	19	20	4.7	7.9
13	16	15	16	20	20	21	21	22	19	18	6.4	7.9
14	16	14	16	20	20	21	21	22	22	21	6.4	9.1
15	16	14	16	20	20	21	21	22	20	11	6.4	9.1
16	16	16	18	20	20	21	21	20	19	10	6.4	8.0
17	16	16	18	20	20	21	21	22	19	12	4.7	8.0
18	15	16	18	20	20	21	21	23	19	13	6.5	8.0
19	16	16	18	20	20	21	21	22	20	13	6.5	8.1
20	16	14	18	20	20	21	21	23	19	9.0	6.5	8.0
21	16	14	18	20	20	21	21	22	20	7.9	6.5	8.0
22	16	14	18	20	20	21	22	21	19	9.0	6.5	8.0
23	16	15	18	18	20	21	21	20	20	7.9	6.5	8.0
24	16	15	18	20	22	21	21	20	19	6.5	6.5	8.1
25	16	16	18	20	20	21	21	24	20	6.4	6.5	8.1
26	16	14	18	20	22	21	21	20	19	7.8	7.9	8.1
27	16	14	18	20	22	21	21	20	20	6.4	6.5	10
28	16	14	18	20	20	20	21	21	19	6.4	7.9	9.2
29	16	14	18	20	------	21	21	22	19	7.8	4.8	9.2
30	16	14	18	20	------	20	21	22	19	6.4	4.8	9.2
31	16	------	18	20	------	20	------	19	------	6.4	7.9	------
TOTAL	496	445	515	610	568	646	624	658	587	415.9	187.0	246.9
MEAN	16.0	14.8	16.6	19.7	20.3	20.8	20.8	21.2	19.6	13.4	6.03	8.23
MAX	16	16	18	20	22	22	22	24	24	21	7.9	10
MIN	15	14	12	18	20	20	19	19	18	6.4	4.7	7.9
AC-FT	984	883	1,020	1,210	1,130	1,280	1,240	1,310	1,160	825	371	490

CAL YR 1972 TOTAL 6,286.3 MEAN 17.2 MAX 25 MIN 8.2 AC-FT 12,470
WTR YR 1973 TOTAL 5,998.3 MEAN 16.4 MAX 24 MIN 4.7 AC-FT 11,900

NOTE.--No gage-height record Dec. 6 to Mar. 22 at Baker Spring.

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Bar M Spring at Locomotive Springs, near Snowville, Utah

Location.--Lat 41°42'22", long 112°55'32", in SE¼ sec. 1, T. 11 N., R. 10 W., Box Elder County, at Locomotive Springs State Waterfowl Management Area on the north end of Great Salt Lake and 20 miles (32 km) southwest of Snowville.

Period of record.--December 1968 to September 1973.

Gage.--Water-stage recorder and sharp-crested weirs. Datum of gage is 4,215.2 ft (1,284.79 m) above mean sea level.

Remarks.--Records good.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1			11	12	11	12	12	11	11	11	11	11
2			11	12	11	12	12	11	11	11	11	11
3			11	12	11	12	12	11	11	11	11	11
4			11	12	11	12	12	11	11	11	11	11
5			11	12	11	12	12	11	11	11	11	11
6			11	12	12	12	12	11	11	11	11	11
7			11	12	12	12	12	11	11	11	11	11
8			11	12	11	12	12	11	11	11	11	11
9			11	11	11	12	12	11	11	11	11	11
10			11	11	11	12	12	11	11	11	11	11
11			11	11	12	12	12	11	11	11	11	11
12			11	11	12	12	12	11	11	11	11	11
13			11	11	12	12	12	11	11	11	11	11
14			11	11	12	12	12	11	11	11	11	11
15			11	12	12	11	12	11	11	11	11	11
16			11	12	12	11	12	11	11	11	11	11
17			11	11	12	11	11	11	11	11	11	11
18			11	11	12	11	12	11	11	11	11	11
19			11	11	12	11	12	12	11	11	11	11
20			11	12	12	11	11	11	11	11	11	11
21			12	12	12	11	11	11	11	11	11	11
22			12	12	12	11	11	11	11	11	11	11
23			12	11	12	11	11	11	11	11	11	10
24			12	11	12	11	11	11	11	11	11	10
25			12	11	12	11	11	11	11	11	11	10
26			12	11	12	11	11	11	11	11	11	10
27			12	11	12	11	11	11	11	11	11	10
28			12	11	12	12	11	11	11	11	11	11
29			12	11	------	12	11	11	11	11	11	11
30			12	11	------	12	11	11	11	11	11	11
31		------	12	11	------	12	------	11	------	11	11	------
TOTAL			352	354	328	359	348	342	330	341	341	325
MEAN			11.4	11.4	11.7	11.6	11.6	11.0	11.0	11.0	11.0	10.8
MAX			12	12	12	12	12	12	11	11	11	11
MIN			11	11	11	11	11	11	11	11	11	10
AC-FT			698	702	651	712	690	678	655	676	676	645

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Bar M Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10	11	11	10	10	11	11	10	11	9.7	10	10
2	11	11	11	10	10	10	11	10	11	10	10	10
3	10	11	11	10	10	10	10	11	11	10	10	9.4
4	10	11	11	10	10	10	10	11	11	10	10	10
5	10	11	11	11	10	11	11	11	11	10	10	9.4
6	10	11	11	11	10	11	11	11	11	10	10	9.4
7	10	11	11	11	10	11	11	11	11	10	10	9.4
8	11	11	11	11	10	11	10	11	12	10	10	9.4
9	11	11	11	11	10	11	10	11	12	10	10	9.4
10	11	11	11	11	10	11	11	11	12	10	10	9.4
11	11	11	11	11	10	11	10	11	11	10	10	9.4
12	10	11	11	11	10	11	10	11	12	10	10	9.4
13	10	11	11	11	11	11	11	11	11	10	10	9.4
14	11	11	11	11	11	11	11	11	12	10	10	9.2
15	11	11	11	11	10	11	11	11	12	10	10	9.2
16	11	11	11	11	11	11	11	11	12	10	10	9.2
17	11	11	11	11	11	11	11	11	11	10	10	9.2
18	11	11	11	11	10	11	11	11	11	10	10	9.2
19	11	11	11	11	10	11	11	11	11	10	10	9.4
20	11	11	11	11	10	11	11	11	11	10	10	9.4
21	11	11	11	11	11	11	11	11	10	10	10	9.4
22	11	11	11	11	11	11	10	11	10	10	10	9.4
23	11	11	11	11	10	11	10	11	10	10	10	9.4
24	11	11	11	11	10	11	10	11	10	10	10	9.2
25	11	11	11	10	10	10	10	11	10	10	10	9.2
26	11	11	11	10	10	11	11	11	10	10	10	9.2
27	11	11	11	10	10	10	11	11	10	10	10	9.2
28	11	11	10	10	10	10	11	11	10	10	10	9.2
29	10	11	10	10	------	11	11	11	10	10	10	8.9
30	10	11	10	10	------	11	11	12	9.7	10	10	8.9
31	10	------	10	10	------	11	------	11	------	10	10	------
TOTAL	330	330	337	330	286	335	320	340	326.7	309.7	310	280.8
MEAN	10.6	11.0	10.9	10.6	10.2	10.8	10.7	11.0	10.9	9.99	10.0	9.36
MAX	11	11	11	11	11	11	11	12	12	10	10	10
MIN	10	11	10	10	10	10	10	10	9.7	9.7	10	8.9
AC-FT	655	655	668	655	567	664	635	674	648	614	615	557

CAL YR 1969 TOTAL 4,065.0 MEAN 11.1 MAX 12 MIN 10 AC-FT 8,060
WTR YR 1970 TOTAL 3,835.2 MEAN 10.5 MAX 12 MIN 8.9 AC-FT 7,610

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Bar M Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.2	9.7	10	10	11	9.7	9.7	10	9.7	9.4	9.7	9.4
2	9.2	9.7	10	10	11	9.7	9.7	10	9.7	9.4	9.4	9.7
3	9.2	9.7	10	10	11	9.7	9.7	10	9.7	9.4	9.7	9.4
4	9.2	9.7	10	10	10	10	9.7	10	9.7	9.4	9.7	9.2
5	9.4	9.7	10	10	10	9.7	9.7	10	9.7	9.4	9.7	9.2
6	9.2	9.7	10	10	10	9.7	10	10	9.7	9.7	10	9.4
7	9.2	9.7	10	10	10	10	10	9.7	9.7	9.4	10	9.2
8	9.2	9.7	10	10	10	10	10	10	10	9.7	9.7	9.2
9	9.4	9.7	10	10	10	10	10	10	10	9.7	9.7	9.2
10	9.7	9.7	10	10	10	10	10	10	10	10	9.7	9.2
11	9.4	9.7	10	11	10	10	10	10	12	9.7	9.4	9.4
12	9.7	10	10	10	9.7	10	10	10	10	9.7	9.4	9.2
13	9.7	9.7	10	10	9.7	10	10	11	10	9.7	9.4	9.2
14	9.7	9.7	10	10	9.7	10	11	10	10	9.7	9.2	9.4
15	9.7	9.7	10	10	10	10	11	10	9.7	9.7	9.2	9.4
16	9.7	10	10	10	9.7	10	10	11	9.7	10	9.2	9.4
17	9.7	10	10	10	10	10	10	10	9.7	9.7	9.2	9.4
18	9.7	11	10	10	9.7	9.7	10	10	9.7	10	9.2	9.4
19	9.7	11	10	10	11	9.7	10	10	9.4	10	9.2	9.4
20	9.7	11	10	10	10	9.7	10	10	9.4	10	8.9	9.7
21	9.7	11	10	10	10	9.7	10	10	9.4	10	9.2	9.7
22	9.7	10	10	10	10	9.7	10	10	9.4	10	9.2	9.4
23	9.7	10	9.7	10	10	10	10	10	9.4	10	9.2	9.4
24	9.7	11	10	10	10	10	11	9.7	9.4	10	8.9	9.4
25	9.7	11	10	10	10	10	11	9.7	9.4	10	9.2	9.7
26	9.4	11	10	10	9.7	10	10	9.7	9.7	10	9.2	9.7
27	9.4	10	11	11	9.7	9.7	10	10	9.4	9.4	9.2	9.7
28	9.4	10	11	11	9.7	9.7	10	9.7	9.7	9.7	9.4	9.7
29	9.7	10	11	11	------	9.7	10	9.7	9.4	9.7	9.4	9.7
30	9.7	11	11	11	------	10	10	9.7	9.4	9.7	9.4	11
31	9.7	------	10	11	------	9.7	------	9.7	------	9.7	9.4	------
TOTAL	295.4	303.8	313.7	316	281.6	305.8	302.5	309.6	292.1	301.9	291.3	284.4
MEAN	9.53	10.1	10.1	10.2	10.1	9.86	10.1	9.99	9.74	9.74	9.40	9.48
MAX	9.7	11	11	11	11	10	11	11	12	10	10	11
MIN	9.2	9.7	9.7	10	9.7	9.7	9.7	9.7	9.4	9.4	8.9	9.2
AC-FT	586	603	622	627	559	607	600	614	579	599	578	564

CAL YR 1970 TOTAL 3,751.1 MEAN 10.3 MAX 12 MIN 8.9 AC-FT 7,440
WTR YR 1971 TOTAL 3,598.1 MEAN 9.86 MAX 12 MIN 8.9 AC-FT 7,140

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Bar M Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10	10	9.7	9.7	9.7	9.4	10	10	10	10	10	10
2	10	10	9.7	10	9.7	9.7	10	10	10	10	10	10
3	9.7	9.7	10	10	9.7	9.7	10	10	10	10	10	10
4	9.7	9.7	9.7	10	9.7	9.7	10	11	10	10	10	10
5	9.7	10	9.7	10	9.7	9.7	10	10	10	10	10	11
6	9.7	10	9.7	10	9.7	9.4	10	10	10	10	10	10
7	10	10	9.7	10	9.7	9.4	10	11	11	10	10	10
8	10	10	9.4	10	9.7	9.4	10	11	10	10	10	10
9	9.7	10	9.4	10	9.7	9.7	10	10	10	10	10	10
10	9.7	10	9.4	9.7	9.7	9.7	10	10	11	10	10	10
11	9.7	10	9.4	9.4	9.7	9.7	10	10	10	10	10	10
12	9.7	10	9.4	9.7	9.7	9.7	10	10	9.7	10	10	10
13	9.7	9.7	9.4	9.7	9.7	9.7	10	10	9.7	10	10	9.7
14	10	10	9.4	9.4	9.7	9.7	10	10	9.7	10	10	10
15	9.7	9.7	9.4	9.4	9.7	9.7	9.7	10	10	10	10	10
16	10	9.7	9.4	9.7	9.7	9.7	10	11	10	10	10	10
17	9.7	9.7	9.4	9.7	9.7	9.7	10	11	10	10	10	10
18	9.7	9.7	9.4	9.7	9.4	9.7	10	11	10	10	10	10
19	9.7	9.7	9.4	10	9.4	9.7	10	10	9.7	10	10	9.7
20	9.4	9.7	9.4	9.7	9.4	9.7	9.7	10	9.7	10	10	9.4
21	9.4	9.7	9.4	9.7	9.4	9.7	10	10	10	10	10	9.4
22	9.7	9.7	9.4	9.7	9.7	10	10	11	10	10	10	9.7
23	9.7	9.7	9.4	9.7	9.4	10	10	11	10	10	10	9.7
24	10	9.7	9.4	9.4	9.7	9.7	10	11	10	10	10	9.7
25	10	9.7	9.7	9.7	9.7	10	10	10	10	10	10	9.4
26	10	9.7	10	9.7	9.7	10	11	10	10	10	10	9.2
27	10	9.7	9.7	9.7	9.7	10	10	10	10	10	10	9.4
28	10	9.7	9.7	9.4	9.7	10	10	10	9.7	10	10	8.9
29	10	10	9.7	9.4	9.7	10	11	10	10	10	10	8.9
30	10	9.7	9.7	9.4	------	10	10	10	10	10	10	9.2
31	10	------	9.7	9.4	------	10	------	10	------	10	10	------
TOTAL	304.3	294.6	296.2	301.0	279.8	302.2	301.4	319	300.2	310	310	293.3
MEAN	9.82	9.82	9.55	9.71	9.65	9.75	10.0	10.3	10.0	10.0	10.0	9.78
MAX	10	10	10	10	9.7	10	11	11	11	10	10	11
MIN	9.4	9.7	9.4	9.4	9.4	9.4	9.7	10	9.7	10	10	8.9
AC-FT	604	584	588	597	555	599	598	633	595	615	615	582

CAL YR 1971 TOTAL 900.3 MEAN 2.47 MAX 12 MIN 8.9 AC-FT 1,790
WTR YR 1972 TOTAL 3,612.0 MEAN 9.87 MAX 11 MIN 8.9 AC-FT 7,160

NOTE.--Backwater from moss July 4 to Sept. 1.

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Bar M Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.2	9.4	9.2	9.2	9.2	9.7	9.7	9.2	10	8.9	9.4	9.4
2	9.2	9.4	9.2	9.2	9.2	9.7	9.7	8.9	9.7	8.9	9.4	9.4
3	9.2	9.4	9.2	9.2	9.2	9.4	9.7	8.9	9.7	8.9	9.4	9.4
4	9.4	9.4	9.2	9.2	9.2	9.7	9.4	9.4	9.7	8.9	9.7	9.4
5	9.4	9.4	9.2	9.2	9.2	9.7	9.4	9.4	9.7	8.9	9.4	9.4
6	9.4	9.2	9.2	9.2	9.4	9.7	9.4	9.2	9.7	9.2	9.4	9.4
7	9.4	9.2	9.2	9.2	9.7	9.7	9.4	9.2	9.7	8.9	9.4	9.7
8	9.4	9.4	9.2	9.2	9.4	9.7	9.4	9.2	9.7	8.9	9.4	9.7
9	9.4	9.2	9.2	9.2	9.4	9.7	9.4	9.2	9.7	8.9	9.4	9.7
10	9.2	9.4	9.2	9.2	9.4	9.7	9.4	9.2	9.7	8.9	9.4	9.7
11	9.2	9.4	9.2	9.2	9.4	10	9.4	8.9	9.7	9.2	9.4	9.7
12	9.4	9.4	9.2	9.2	9.7	9.7	9.4	9.2	9.7	9.2	9.4	9.7
13	9.4	9.2	9.2	9.2	9.4	9.7	9.7	9.4	9.7	9.2	9.4	9.7
14	9.4	9.2	9.2	9.2	9.4	9.7	9.7	9.4	10	9.4	9.4	9.7
15	9.4	9.2	9.2	9.2	9.4	9.4	9.4	9.4	9.7	9.2	9.4	9.7
16	9.4	9.4	9.4	9.2	9.4	9.4	9.4	9.4	9.7	9.2	9.4	9.7
17	9.4	9.4	9.4	9.2	9.4	9.4	9.7	9.7	9.7	9.4	9.4	9.7
18	9.4	9.2	9.4	9.2	9.7	9.7	9.7	9.7	9.7	9.4	9.4	9.7
19	9.7	9.4	9.4	9.2	9.4	9.4	9.7	9.7	9.7	9.7	9.4	9.7
20	10	9.4	9.4	9.2	9.4	9.7	9.4	9.7	9.7	9.7	9.4	9.7
21	9.4	9.2	9.4	9.2	9.4	9.7	9.4	9.7	9.7	9.7	9.7	9.4
22	9.4	9.2	9.4	9.2	9.4	9.7	9.4	9.7	9.7	9.7	9.7	9.7
23	9.4	9.2	9.4	9.2	9.7	9.7	9.4	9.7	9.7	9.7	9.7	9.7
24	9.4	9.2	9.4	9.2	9.4	9.4	9.4	9.7	9.4	9.7	9.7	9.7
25	9.4	9.2	9.4	9.2	9.4	9.7	9.4	10	9.4	9.7	9.7	9.7
26	9.4	9.2	9.4	9.2	9.4	9.7	9.2	9.7	9.4	9.7	9.7	9.7
27	9.4	9.2	9.4	9.2	9.7	9.7	9.2	9.7	9.4	9.7	9.4	9.7
28	9.4	8.9	9.4	9.2	9.7	9.7	9.4	9.4	9.2	9.7	9.4	9.7
29	9.4	8.9	9.4	9.2	------	9.7	9.4	9.7	9.2	9.7	9.4	10
30	9.4	9.2	9.4	9.2	------	9.4	9.4	9.7	9.2	9.4	9.4	10
31	9.4	------	9.4	9.2	------	9.7	------	9.7	------	9.4	9.7	------
TOTAL	291.3	278.0	288.4	285.2	264.0	298.9	284.0	293.0	288.9	289.0	293.8	289.5
MEAN	9.40	9.27	9.30	9.20	9.43	9.64	9.47	9.45	9.63	9.32	9.48	9.65
MAX	10	9.4	9.4	9.2	9.7	10	9.7	10	10	9.7	9.7	10
MIN	9.2	8.9	9.2	9.2	9.2	9.4	9.2	8.9	9.2	8.9	9.4	9.4
AC-FT	578	551	572	566	524	593	563	581	573	573	583	574

CAL YR 1972 TOTAL 3,574.6 MEAN 9.77 MAX 11 MIN 8.9 AC-FT 7,090
WTR YR 1973 TOTAL 3,444.0 MEAN 9.44 MAX 10 MIN 8.9 AC-FT 6,830

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Sparks Spring at Locomotive Springs, near Snowville, Utah

Location.--Lat 41°41'50", long 112°53'32", in NE¼ sec. 8, T. 11 N., R. 9 W., Box Elder County, at Locomotive Springs State Waterfowl Management Area on the north end of Great Salt Lake and 20 miles (32 km) southwest of Snowville.

Period of record.--December 1968 to September 1973.

Gage.--Water-stage recorder and 6-inch Parshall flume. Datum of gage is 4,212 ft (1,283.8 m) above mean sea level.

Remarks.--Records fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1			1.6	1.2	1.2	1.7	1.6	1.9	1.4	1.3	1.2	1.2
2			1.6	1.2	1.1	1.7	1.6	1.8	1.4	1.3	1.2	1.2
3			1.6	1.2	1.1	1.7	1.7	1.7	1.5	1.2	1.2	1.3
4			1.6	1.2	1.2	1.7	1.6	1.8	1.5	1.2	1.2	1.2
5			1.6	1.2	1.5	1.6	1.6	1.8	1.4	1.2	1.2	1.2
6			1.6	1.2	1.7	1.7	1.7	1.7	1.4	1.3	1.2	1.2
7			1.6	1.2	1.7	1.7	1.7	1.7	1.3	1.2	1.2	1.3
8			1.6	1.2	1.7	1.6	1.6	1.7	1.4	1.2	1.2	1.3
9			1.6	1.2	1.7	1.7	1.6	1.7	1.4	1.2	1.2	1.3
10			1.6	1.2	1.7	1.6	1.6	1.7	1.4	1.2	1.2	1.3
11			1.6	1.2	1.7	1.7	1.7	1.7	1.4	1.2	1.3	1.3
12			1.9	1.2	1.7	1.7	1.6	1.7	1.4	1.2	1.3	1.3
13			1.2	1.2	1.7	1.7	1.7	1.7	1.3	1.2	1.2	1.3
14			1.3	1.2	1.7	1.6	1.7	1.7	1.3	1.1	1.3	1.3
15			1.3	1.2	1.7	1.6	1.8	1.6	1.3	1.2	1.3	1.2
16			1.3	1.2	1.7	1.7	1.7	1.6	1.4	1.1	1.3	1.3
17			1.3	1.2	1.7	1.7	1.6	1.6	1.4	1.1	1.2	1.2
18			1.2	1.2	1.7	1.7	1.8	1.6	1.3	1.1	1.3	1.2
19			1.3	1.2	1.7	1.7	1.6	1.6	1.3	1.1	1.3	1.2
20			1.0	1.2	1.7	1.7	1.7	1.6	1.3	1.2	1.2	1.2
21			1.0	1.2	1.7	1.7	1.7	1.6	1.3	1.2	1.2	1.3
22			1.1	1.3	1.7	1.6	1.7	1.6	1.3	1.2	1.2	1.3
23			1.2	1.2	1.7	1.8	1.7	1.6	1.2	1.2	1.2	1.3
24			1.2	1.2	1.7	1.5	1.9	1.6	1.4	1.2	1.2	1.3
25			1.2	1.2	1.9	1.6	1.8	1.5	1.3	1.2	1.2	1.3
26			1.2	1.2	1.8	1.6	1.8	1.5	1.3	1.2	1.2	1.3
27			1.2	1.2	1.7	1.6	1.7	1.6	1.3	1.2	1.2	1.3
28			1.2	1.2	1.7	1.6	1.7	1.4	1.2	1.2	1.2	1.3
29			1.2	1.1	------	1.6	1.9	1.4	1.3	1.2	1.2	1.3
30			1.2	1.1	------	1.6	1.7	1.6	1.2	1.2	1.2	1.3
31		------	1.2	1.1	------	1.6	------	1.5	------	1.2	1.2	------
TOTAL			42.3	37.0	45.5	51.3	50.8	50.8	40.3	37.0	37.9	38.0
MEAN			1.36	1.19	1.63	1.65	1.69	1.64	1.34	1.19	1.22	1.27
MAX			1.9	1.3	1.9	1.8	1.9	1.9	1.5	1.3	1.3	1.3
MIN			1.0	1.1	1.1	1.5	1.6	1.4	1.2	1.1	1.2	1.2
AC-FT			84	73	90	102	101	101	80	73	75	75

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Sparks Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.3	1.6	1.5	1.4	1.9	1.6	1.5	1.7	1.8	1.3	1.1	1.3
2	1.4	1.5	1.5	1.5	1.6	1.6	1.7	1.7	1.8	1.3	1.1	1.3
3	1.3	1.6	1.5	1.6	1.6	1.5	1.6	1.7	1.8	1.3	1.1	1.3
4	1.3	1.6	1.6	1.6	1.6	1.6	1.5	1.7	1.7	1.3	1.1	1.4
5	1.3	1.6	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.3	1.2	1.4
6	1.3	1.6	1.4	1.5	1.6	1.5	1.6	1.7	1.7	1.3	1.2	1.3
7	1.4	1.7	1.6	1.4	1.6	1.5	1.6	1.7	1.7	1.2	1.1	1.3
8	1.4	1.6	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.2	1.1	1.3
9	1.4	1.6	1.6	1.7	1.6	1.5	1.6	1.7	1.9	1.2	1.2	1.2
10	1.5	1.6	1.5	1.7	1.6	1.6	1.6	1.7	2.0	1.2	1.1	1.3
11	1.4	1.6	1.5	1.7	1.6	1.5	1.7	1.7	1.7	1.2	1.1	1.3
12	1.3	1.6	1.6	1.7	1.6	1.6	1.6	1.7	1.8	1.1	1.1	1.3
13	1.4	1.6	1.5	1.7	1.7	1.5	1.6	1.7	1.7	1.2	1.1	1.3
14	1.4	1.6	1.5	1.7	1.6	1.6	1.7	1.6	1.7	1.1	1.1	1.3
15	1.4	1.6	1.5	1.7	1.6	1.7	1.7	1.6	1.7	1.1	1.1	1.3
16	1.5	1.7	1.5	1.8	1.6	1.5	1.6	1.7	1.6	1.1	1.1	1.3
17	1.6	1.6	1.5	1.8	1.7	1.6	1.6	1.8	1.6	1.1	1.1	1.3
18	1.6	1.5	1.5	1.7	1.6	1.6	1.6	1.8	1.6	1.1	1.1	1.3
19	1.6	1.6	1.5	1.7	1.6	1.6	1.6	1.8	1.5	1.0	1.1	1.4
20	1.4	1.6	1.6	1.7	1.6	1.5	1.6	1.8	1.5	1.1	1.2	1.3
21	1.5	1.6	1.6	1.7	1.6	1.6	1.6	1.9	1.5	1.0	1.2	1.3
22	1.4	1.6	1.5	1.7	1.6	1.5	1.6	1.8	1.5	1.1	1.2	1.3
23	1.5	1.5	1.5	1.7	1.6	1.6	1.6	1.9	1.4	1.0	1.2	1.3
24	1.5	1.6	1.5	1.7	1.6	1.7	1.6	1.8	1.4	1.1	1.2	1.3
25	1.5	1.5	1.6	1.6	1.6	1.4	1.6	1.8	1.4	1.1	1.2	1.3
26	1.5	1.6	1.6	1.7	1.6	1.7	1.6	1.8	1.4	1.1	1.2	1.3
27	1.5	1.5	1.6	1.8	1.6	1.5	1.6	1.9	1.4	1.1	1.3	1.3
28	1.6	1.5	1.5	1.7	1.5	1.6	1.6	1.9	1.4	1.1	1.2	1.3
29	1.4	1.5	1.3	1.6	------	1.6	1.6	1.8	1.4	1.1	1.2	1.3
30	1.5	1.5	1.6	1.6	------	1.7	1.6	1.9	1.3	1.1	1.2	1.3
31	1.5	------	1.6	1.6	------	1.6	------	1.7	------	1.1	1.2	------
TOTAL	44.6	47.4	47.3	51.0	45.2	48.8	48.2	54.4	48.3	35.6	35.7	39.2
MEAN	1.44	1.58	1.53	1.65	1.61	1.57	1.61	1.75	1.61	1.15	1.15	1.31
MAX	1.6	1.7	1.6	1.8	1.9	1.7	1.7	1.9	2.0	1.3	1.3	1.4
MIN	1.3	1.5	1.3	1.4	1.5	1.4	1.5	1.6	1.3	1.0	1.1	1.2
AC-FT	88	94	94	101	90	97	96	108	96	71	71	78

CAL YR 1969 TOTAL 527.9 MEAN 1.45 MAX 1.9 MIN 1.1 AC-FT 1,050
WTR YR 1970 TOTAL 545.7 MEAN 1.50 MAX 2.0 MIN 1.0 AC-FT 1,080

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Sparks Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.3	1.4	1.5	1.5	1.6	1.6	1.5	2.0	1.7	1.6	1.2	1.1
2	1.3	1.4	1.5	1.5	1.6	1.6	1.6	2.0	1.7	1.5	1.2	1.1
3	1.3	1.4	1.5	1.5	1.6	1.6	1.7	2.0	1.7	1.5	1.2	1.1
4	1.3	1.4	1.5	1.5	1.6	1.6	1.6	2.0	1.7	1.5	1.2	1.1
5	1.4	1.4	1.4	1.5	1.6	1.6	1.7	2.0	1.7	1.5	1.2	1.1
6	1.4	1.5	1.4	1.5	1.5	1.6	1.7	1.9	1.7	1.5	1.2	1.1
7	1.4	1.5	1.4	1.5	1.5	1.6	1.8	1.7	1.7	1.4	1.2	1.1
8	1.3	1.4	1.5	1.5	1.5	1.6	1.6	1.6	1.7	1.4	1.2	1.1
9	1.4	1.4	1.5	1.5	1.5	1.6	1.6	1.6	1.7	1.4	1.1	1.1
10	1.4	1.4	1.4	1.5	1.5	1.6	1.9	1.7	1.7	1.4	1.1	1.1
11	1.3	1.4	1.4	1.6	1.5	1.6	1.5	1.7	1.7	1.4	1.1	1.1
12	1.4	1.5	1.4	1.5	1.5	1.6	1.7	1.7	1.7	1.4	1.1	1.1
13	1.3	1.4	1.4	1.5	1.6	1.6	1.6	1.7	1.7	1.3	1.1	1.1
14	1.4	1.4	1.4	1.5	1.6	1.6	1.7	1.7	1.7	1.3	1.1	1.1
15	1.4	1.4	1.4	1.5	1.6	1.6	1.8	1.7	1.7	1.3	1.1	1.1
16	1.4	1.5	1.5	1.5	1.5	1.6	1.6	1.7	1.7	1.3	1.1	1.1
17	1.4	1.4	1.5	1.5	1.6	1.6	2.0	1.7	1.7	1.3	1.1	1.1
18	1.4	1.5	1.4	1.5	1.6	1.5	1.8	1.7	1.7	1.3	1.1	1.1
19	1.4	1.4	1.4	1.5	1.8	1.6	1.8	1.7	1.7	1.3	1.1	1.1
20	1.4	1.5	1.4	1.5	1.8	1.6	1.7	1.7	1.6	1.2	1.1	1.1
21	1.4	1.5	1.4	1.5	1.6	1.6	2.0	1.7	1.6	1.2	1.1	1.1
22	1.5	1.5	1.4	1.5	1.6	1.6	1.7	1.7	1.6	1.2	1.1	1.1
23	1.4	1.4	1.4	1.5	1.6	1.6	1.8	1.7	1.6	1.2	1.1	1.1
24	1.5	1.5	1.4	1.5	1.5	1.6	1.8	1.7	1.6	1.2	1.1	1.1
25	1.4	1.5	1.4	1.5	1.7	1.6	2.1	1.7	1.6	1.2	1.1	1.3
26	1.5	1.5	1.4	1.6	1.6	1.6	2.0	1.7	1.6	1.2	1.1	1.3
27	1.3	1.5	1.5	1.6	1.6	1.6	1.9	1.7	1.6	1.2	1.1	1.3
28	1.4	1.4	1.5	1.6	1.6	1.6	1.9	1.7	1.6	1.2	1.1	1.3
29	1.4	1.5	1.5	1.6	------	1.6	1.9	1.7	1.6	1.2	1.1	1.3
30	1.4	1.5	1.5	1.6	------	1.6	1.9	1.7	1.6	1.2	1.1	1.7
31	1.4	------	1.5	1.6	------	1.8	------	1.7	------	1.2	1.1	------
TOTAL	42.9	43.4	44.7	47.2	44.4	49.7	52.9	54.2	49.9	41.0	34.9	34.6
MEAN	1.38	1.45	1.44	1.52	1.59	1.60	1.76	1.75	1.66	1.32	1.13	1.15
MAX	1.5	1.5	1.5	1.6	1.8	1.8	2.1	2.0	1.7	1.6	1.2	1.7
MIN	1.3	1.4	1.4	1.5	1.5	1.5	1.5	1.6	1.6	1.2	1.1	1.1
AC-FT	85	86	89	94	88	99	105	108	99	81	69	69

CAL YR 1970 TOTAL 537.4 MEAN 1.47 MAX 2.0 MIN 1.0 AC-FT 1,070
WTR YR 1971 TOTAL 539.8 MEAN 1.48 MAX 2.1 MIN 1.1 AC-FT 1,070

NOTE.--No gage-height record Dec. 19 to Feb. 9, May 5 to Aug. 17, Aug. 24 to Sept. 30.

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Sparks Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.4	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.2	1.0	.80	.80
2	1.4	1.3	1.2	1.4	1.4	1.5	1.4	1.4	1.2	1.0	.80	.80
3	1.3	1.3	1.3	1.4	1.4	1.6	1.4	1.4	1.2	1.0	.80	.80
4	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.3	1.2	.90	.80	.80
5	1.3	1.3	1.3	1.4	1.4	1.5	1.4	1.3	1.2	.90	.80	.80
6	1.4	1.3	1.3	1.4	1.4	1.5	1.4	1.3	1.2	.90	.80	.90
7	1.4	1.3	1.3	1.4	1.4	1.4	1.4	1.3	1.2	.90	.80	.80
8	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.3	1.2	.90	.80	.80
9	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.3	1.2	.90	.80	.80
10	1.3	1.3	1.3	1.4	1.5	1.5	1.4	1.3	1.1	.90	.80	.80
11	1.4	1.2	1.3	1.4	1.5	1.5	1.4	1.3	1.2	.90	.80	.80
12	1.4	1.3	1.3	1.4	1.5	1.4	1.4	1.3	1.2	.90	.80	.80
13	1.4	1.3	1.3	1.4	1.6	1.5	1.4	1.3	1.1	.90	.80	.80
14	1.4	1.4	1.3	1.4	1.5	1.4	1.4	1.3	1.2	.90	.80	.80
15	1.4	1.3	1.3	1.4	1.5	1.4	1.4	1.3	1.2	.90	.80	.80
16	1.4	1.3	1.3	1.4	1.6	1.4	1.4	1.3	1.1	.90	.80	.80
17	1.3	1.3	1.3	1.4	1.5	1.4	1.4	1.3	1.2	.90	.80	.80
18	1.3	1.3	1.3	1.4	1.5	1.5	1.4	1.3	1.2	.80	.80	.80
19	1.3	1.2	1.3	1.4	1.5	1.4	1.4	1.3	1.1	.90	.80	.90
20	1.3	1.3	1.3	1.4	1.5	1.4	1.4	1.3	1.1	1.0	.80	.80
21	1.3	1.3	1.3	1.4	1.5	1.4	1.4	1.3	1.2	.90	.80	.80
22	1.3	1.3	1.3	1.4	1.6	1.4	1.4	1.3	1.1	.90	.80	.90
23	1.3	1.3	1.3	1.4	1.5	1.4	1.4	1.3	1.2	.90	.80	.90
24	1.3	1.3	1.3	1.4	1.6	1.4	1.4	1.3	1.1	.90	.80	.80
25	1.3	1.3	1.3	1.4	1.5	1.4	1.4	1.3	1.2	.90	.80	.80
26	1.3	1.3	1.3	1.4	1.5	1.4	1.4	1.2	1.1	.90	.80	.80
27	1.3	1.3	1.3	1.4	1.5	1.4	1.4	1.2	1.0	.80	.80	.90
28	1.3	1.3	1.3	1.4	1.5	1.4	1.4	1.2	1.0	.80	.80	.90
29	1.3	1.3	1.3	1.4	1.6	1.4	1.4	1.2	1.0	.80	.80	.80
30	1.3	1.3	1.3	1.4	------	1.4	1.4	1.2	1.0	.80	.80	.80
31	1.3	------	1.3	1.4	------	1.4	------	1.2	------	.80	.80	------
TOTAL	41.3	38.9	40.2	43.4	43.1	44.3	42.0	40.0	34.4	27.70	24.80	24.60
MEAN	1.33	1.30	1.30	1.40	1.49	1.43	1.40	1.29	1.15	.89	.80	.82
MAX	1.4	1.4	1.3	1.4	1.6	1.6	1.4	1.4	1.2	1.0	.80	.90
MIN	1.3	1.2	1.2	1.4	1.4	1.4	1.4	1.2	1.0	.80	.80	.80
AC-FT	82	77	80	86	85	88	83	79	68	55	49	49

CAL YR 1971 TOTAL 529.20 MEAN 1.45 MAX 2.1 MIN 1.1 AC-FT 1,050
WTR YR 1972 TOTAL 444.70 MEAN 1.22 MAX 1.6 MIN .80 AC-FT 882

NOTE.--No gage-height record Dec. 7 to Feb. 9, Mar. 22 to Apr. 24, Apr. 28 to June 5.

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Sparks Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.90	.90	1.1	1.2	1.3	1.4	1.3	1.4	1.2	1.1	1.1	1.2
2	.80	1.0	1.2	1.2	1.3	1.4	1.3	1.4	1.2	1.1	1.1	1.2
3	.80	1.0	1.2	1.2	1.3	1.4	1.3	1.5	1.2	1.1	1.1	1.1
4	.90	1.0	1.0	1.2	1.3	1.4	1.3	1.5	1.2	1.1	1.1	1.1
5	.90	1.1	1.0	1.2	1.3	1.4	1.2	1.6	1.2	1.1	1.1	1.1
6	.80	1.0	1.0	1.2	1.3	1.4	1.4	1.5	1.2	1.1	1.2	1.0
7	.80	1.0	1.0	1.2	1.3	1.4	1.3	1.5	1.2	1.0	1.1	1.1
8	.90	1.0	1.0	1.2	1.3	1.4	1.2	1.6	1.2	1.0	1.1	1.0
9	.80	1.0	1.0	1.2	1.3	1.4	1.3	1.5	1.2	1.0	1.1	1.0
10	.80	1.0	1.0	1.2	1.3	1.4	1.3	1.5	1.2	1.0	1.1	1.0
11	.90	1.0	1.0	1.2	1.3	1.4	1.3	1.5	1.2	1.0	1.1	1.0
12	.90	1.0	1.0	1.2	1.3	1.4	1.3	1.5	1.2	1.0	1.1	1.0
13	.90	1.0	1.0	1.2	1.3	1.4	1.4	1.4	1.2	1.0	1.1	1.0
14	.90	1.0	1.0	1.2	1.3	1.4	1.4	1.4	1.2	1.0	1.0	1.1
15	.90	1.0	1.0	1.2	1.3	1.4	1.3	1.4	1.2	1.0	1.0	1.0
16	.90	1.0	1.0	1.2	1.3	1.3	1.4	1.4	1.2	1.0	1.0	1.1
17	.90	1.0	1.0	1.2	1.3	1.3	1.5	1.4	1.2	1.0	1.1	1.0
18	1.0	1.0	1.0	1.2	1.3	1.3	1.4	1.4	1.2	1.0	1.1	1.1
19	1.1	1.0	1.0	1.2	1.3	1.3	1.4	1.4	1.2	1.0	1.1	1.1
20	1.3	1.0	1.0	1.2	1.3	1.3	1.4	1.4	1.2	1.0	1.1	1.2
21	.90	1.0	1.0	1.2	1.3	1.3	1.4	1.4	1.1	1.0	1.1	1.0
22	.90	1.0	1.0	1.2	1.3	1.3	1.3	1.3	1.1	1.0	1.1	1.1
23	.80	1.0	1.0	1.2	1.4	1.3	1.5	1.3	1.1	1.0	1.1	1.1
24	.90	1.0	1.0	1.2	1.4	1.3	1.4	1.3	1.1	1.0	1.1	1.1
25	.90	1.0	1.0	1.2	1.4	1.3	1.4	1.4	1.1	1.0	1.1	1.1
26	.90	1.0	1.0	1.2	1.4	1.3	1.3	1.3	1.1	1.0	1.1	1.0
27	.90	1.0	1.0	1.2	1.4	1.3	1.4	1.3	1.1	1.0	1.1	1.0
28	1.0	1.0	1.0	1.2	1.4	1.3	1.5	1.3	1.1	1.0	1.1	1.1
29	.90	1.0	1.0	1.2	------	1.3	1.6	1.3	1.1	1.1	1.1	1.1
30	.90	1.1	1.0	1.2	------	1.3	1.4	1.2	1.1	1.1	1.1	1.1
31	.90	------	1.0	1.2	------	1.3	------	1.2	------	1.1	1.2	------
TOTAL	27.90	30.10	31.5	37.2	37.0	41.8	40.9	43.5	35.0	31.9	34.0	32.1
MEAN	.90	1.00	1.02	1.20	1.32	1.35	1.36	1.40	1.17	1.03	1.10	1.07
MAX	1.3	1.1	1.2	1.2	1.4	1.4	1.6	1.6	1.2	1.1	1.2	1.2
MIN	.80	.90	1.0	1.2	1.3	1.3	1.2	1.2	1.1	1.0	1.0	1.0
AC-FT	55	60	62	74	73	83	81	86	69	63	67	64

CAL YR 1972 TOTAL 413.80 MEAN 1.13 MAX 1.6 MIN .80 AC-FT 821
WTR YR 1973 TOTAL 422.90 MEAN 1.16 MAX 1.6 MIN .80 AC-FT 839

NOTE.--No gage-height record Dec. 4 to Feb. 22, Feb. 25 to Apr. 4.

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Off Spring at Locomotive Springs, near Snowville, Utah

Location.--Lat 41°42'12", long 112°54'40", in SW¼ sec. 6, T. 11 N., R. 9 W., Box Elder County, at Locomotive Springs State Waterfowl Management Area on the north end of Great Salt Lake and 20 miles (32 km) southwest of Snowville.

Period of record.--December 1968 to September 1973.

Gage.--Water-stage recorder. The control is an 8-inch submerged orifice set inside a 24-inch by 8-foot culvert under an earthfill dam. Datum of gage is 4,208.4 ft (1,282.72 m) above mean sea level.

Remarks.--Records fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.3	1.1	1.1
2			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.3	1.1	1.1
3			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.3	1.1	1.1
4			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.3	1.1	1.1
5			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.3	1.1	1.1
6			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.3	1.1	1.1
7			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.2	1.1	1.1
8			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.2	1.1	1.1
9			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.2	1.1	1.1
10			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.2	1.1	1.1
11			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.2	1.1	1.1
12			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.2	1.1	1.1
13			1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.2	1.1	1.1
14			1.5	1.6	1.6	1.6	1.6	1.6	1.4	1.2	1.1	1.1
15			1.5	1.6	1.6	1.6	1.6	1.6	1.4	1.2	1.1	1.1
16			1.5	1.6	1.6	1.6	1.6	1.6	1.4	1.2	1.1	1.1
17			1.5	1.6	1.6	1.6	1.6	1.6	1.4	1.2	1.1	1.1
18			1.6	1.6	1.6	1.6	1.6	1.6	1.4	1.2	1.1	1.1
19			1.6	1.6	1.6	1.6	1.6	1.6	1.4	1.2	1.1	1.1
20			1.6	1.6	1.6	1.6	1.6	1.6	1.4	1.2	1.1	1.1
21			1.5	1.6	1.6	1.6	1.6	1.6	1.4	1.2	1.1	1.1
22			1.5	1.6	1.6	1.6	1.6	1.6	1.4	1.2	1.1	1.1
23			1.6	1.6	1.6	1.6	1.6	1.6	1.4	1.2	1.1	1.1
24			1.6	1.6	1.6	1.6	1.6	1.6	1.4	1.2	1.1	1.1
25			1.6	1.6	1.6	1.6	1.6	1.6	1.4	1.2	1.1	1.1
26			1.6	1.6	1.6	1.6	1.6	1.6	1.3	1.2	1.1	1.1
27			1.6	1.6	1.6	1.6	1.6	1.6	1.3	1.2	1.1	1.1
28			1.6	1.6	1.6	1.6	1.6	1.6	1.3	1.2	1.1	1.1
29			1.6	1.6	------	1.6	1.6	1.6	1.3	1.1	1.1	1.2
30			1.6	1.6	------	1.6	1.6	1.6	1.3	1.1	1.1	1.2
31		------	1.6	1.6	------	1.6	------	1.5	------	1.1	1.1	------
TOTAL			47.7	49.6	44.8	49.6	48.0	49.5	42.8	37.5	34.1	33.2
MEAN			1.54	1.60	1.60	1.60	1.60	1.60	1.43	1.21	1.10	1.11
MAX			1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.3	1.1	1.2
MIN			1.5	1.6	1.6	1.6	1.6	1.5	1.3	1.1	1.1	1.1
AC-FT			95	98	89	98	95	98	85	74	68	66

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Off Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.2	1.2	1.3	1.3	1.4	1.6	1.6	1.6	1.5	1.3	1.1	1.0
2	1.2	1.2	1.3	1.3	1.4	1.6	1.6	1.6	1.5	1.3	1.1	1.0
3	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.5	1.3	1.1	1.0
4	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.5	1.2	1.1	1.0
5	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.5	1.2	1.1	.99
6	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.5	1.2	1.1	1.0
7	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.5	1.2	1.1	1.0
8	1.2	1.2	1.3	1.3	1.4	1.6	1.6	1.6	1.4	1.2	1.1	1.0
9	1.2	1.2	1.3	1.3	1.4	1.6	1.6	1.6	1.4	1.2	1.1	.99
10	1.2	1.2	1.3	1.3	1.4	1.6	1.6	1.6	1.4	1.2	1.1	1.0
11	1.2	1.2	1.3	1.3	1.4	1.6	1.6	1.6	1.4	1.2	1.1	1.0
12	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.4	1.2	1.1	1.0
13	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.4	1.2	1.1	.99
14	1.2	1.2	1.3	1.3	1.4	1.6	1.6	1.5	1.4	1.2	1.1	.98
15	1.2	1.2	1.3	1.3	1.4	1.6	1.6	1.5	1.4	1.2	1.1	.98
16	1.2	1.2	1.3	1.3	1.5	1.6	1.6	1.5	1.4	1.2	1.1	.98
17	1.2	1.2	1.3	1.3	1.5	1.6	1.6	1.5	1.4	1.2	1.1	.97
18	1.2	1.2	1.3	1.3	1.5	1.6	1.6	1.5	1.4	1.2	1.1	.97
19	1.2	1.2	1.3	1.3	1.5	1.6	1.6	1.5	1.4	1.2	1.1	.97
20	1.2	1.3	1.3	1.3	1.5	1.6	1.6	1.5	1.4	1.2	1.1	.95
21	1.2	1.3	1.3	1.3	1.5	1.6	1.6	1.5	1.4	1.2	1.1	.94
22	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.5	1.3	1.2	1.0	.94
23	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.5	1.3	1.2	1.1	.94
24	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.5	1.3	1.2	1.1	.95
25	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.5	1.3	1.2	1.0	1.0
26	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.5	1.3	1.2	1.0	1.0
27	1.2	1.3	1.3	1.4	1.6	1.6	1.6	1.5	1.3	1.2	1.0	1.0
28	1.2	1.3	1.3	1.4	1.6	1.6	1.6	1.5	1.3	1.1	1.0	1.0
29	1.2	1.3	1.3	1.4	------	1.6	1.6	1.5	1.3	1.1	1.0	1.0
30	1.2	1.3	1.3	1.4	------	1.6	1.6	1.5	1.3	1.1	1.0	1.0
31	1.2	------	1.3	1.4	------	1.6	------	1.5	------	1.1	1.0	------
TOTAL	37.2	37.1	40.3	41.3	40.7	48.9	48.0	47.8	41.8	37.1	33.3	29.54
MEAN	1.20	1.24	1.30	1.33	1.45	1.58	1.60	1.54	1.39	1.20	1.07	.98
MAX	1.2	1.3	1.3	1.4	1.6	1.6	1.6	1.6	1.5	1.3	1.1	1.0
MIN	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.5	1.3	1.1	1.0	.94
AC-FT	74	74	80	82	81	97	95	95	83	74	66	59

CAL YR 1969 TOTAL 503.70 MEAN 1.38 MAX 1.6 MIN 1.1 AC-FT 999
WTR YR 1970 TOTAL 483.04 MEAN 1.32 MAX 1.6 MIN .94 AC-FT 958

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Off Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.0	1.0	1.0	1.3	1.4	1.5	1.6	1.5	1.4	1.3	1.2	1.1
2	1.0	1.0	1.0	1.3	1.4	1.5	1.6	1.5	1.4	1.3	1.2	1.1
3	1.0	1.0	1.0	1.3	1.4	1.5	1.6	1.5	1.4	1.3	1.2	1.1
4	1.0	1.0	1.0	1.3	1.4	1.5	1.6	1.5	1.4	1.3	1.2	1.1
5	1.0	1.0	1.0	1.3	1.4	1.5	1.6	1.5	1.4	1.3	1.2	1.1
6	1.0	1.0	1.0	1.3	1.4	1.5	1.6	1.5	1.4	1.3	1.2	1.1
7	1.0	1.0	1.0	1.4	1.4	1.5	1.6	1.5	1.4	1.3	1.2	1.1
8	1.0	1.0	1.0	1.4	1.4	1.5	1.6	1.5	1.4	1.3	1.1	1.1
9	1.0	1.0	1.0	1.4	1.4	1.5	1.6	1.5	1.4	1.3	1.1	1.1
10	1.0	1.0	1.0	1.4	1.4	1.5	1.6	1.5	1.3	1.3	1.1	1.1
11	1.0	1.0	1.1	1.3	1.4	1.5	1.6	1.5	1.3	1.3	1.1	1.1
12	1.0	1.0	1.1	1.4	1.4	1.6	1.6	1.5	1.3	1.3	1.1	1.1
13	1.0	1.0	1.1	1.4	1.4	1.5	1.6	1.5	1.3	1.3	1.1	1.1
14	1.0	1.0	1.1	1.4	1.4	1.5	1.6	1.5	1.3	1.3	1.1	1.1
15	1.0	1.0	1.1	1.4	1.5	1.5	1.6	1.5	1.3	1.3	1.1	1.1
16	1.0	1.0	1.1	1.4	1.4	1.6	1.6	1.4	1.3	1.3	1.1	1.1
17	1.0	1.0	1.1	1.4	1.5	1.6	1.6	1.4	1.3	1.2	1.1	1.1
18	1.0	1.0	1.1	1.4	1.4	1.5	1.6	1.4	1.3	1.2	1.1	1.1
19	1.0	1.0	1.1	1.4	1.5	1.6	1.6	1.4	1.3	1.2	1.1	1.1
20	1.0	1.0	1.1	1.4	1.5	1.6	1.6	1.4	1.3	1.2	1.1	1.1
21	1.0	1.0	1.1	1.4	1.5	1.6	1.6	1.4	1.3	1.2	1.1	1.1
22	1.0	1.0	1.1	1.4	1.5	1.6	1.6	1.4	1.3	1.2	1.1	1.1
23	1.0	1.0	1.1	1.4	1.5	1.6	1.6	1.4	1.3	1.2	1.1	1.1
24	1.0	1.0	1.2	1.4	1.5	1.6	1.6	1.4	1.3	1.2	1.1	1.1
25	1.0	1.0	1.2	1.4	1.5	1.5	1.6	1.4	1.3	1.2	1.1	1.1
26	1.0	1.0	1.3	1.4	1.5	1.6	1.5	1.4	1.3	1.2	1.1	1.1
27	1.0	1.0	1.3	1.4	1.5	1.5	1.5	1.4	1.3	1.2	1.1	1.1
28	1.0	1.0	1.3	1.4	1.5	1.6	1.5	1.4	1.3	1.2	1.1	1.1
29	1.0	1.0	1.3	1.4	------	1.6	1.5	1.4	1.3	1.2	1.1	1.1
30	1.0	1.0	1.3	1.4	------	1.6	1.5	1.4	1.3	1.2	1.1	1.1
31	1.0	------	1.3	1.4	------	1.6	------	1.4	------	1.2	1.1	------
TOTAL	31.0	30.0	34.5	42.7	40.4	47.9	47.5	44.9	39.9	38.8	34.8	33.0
MEAN	1.00	1.00	1.11	1.38	1.44	1.55	1.58	1.45	1.33	1.25	1.12	1.10
MAX	1.0	1.0	1.3	1.4	1.5	1.6	1.6	1.5	1.4	1.3	1.2	1.1
MIN	1.0	1.0	1.0	1.3	1.4	1.5	1.5	1.4	1.3	1.2	1.1	1.1
AC-FT	61	60	68	85	80	95	94	89	79	77	69	65

CAL YR 1970 TOTAL 463.94 MEAN 1.27 MAX 1.6 MIN .94 AC-FT 920
WTR YR 1971 TOTAL 465.40 MEAN 1.28 MAX 1.6 MIN 1.0 AC-FT 923

NOTE.--No gage-height record Oct. 1 to Dec. 10, Apr. 12 to May 25.

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Off Spring at Locomotive Springs, near Snowville, Utah - Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.2	1.2	1.2	1.4	1.5	1.4	1.5	1.5	1.4	.92	1.1	1.1
2	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.5	1.4	.91	1.1	1.1
3	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.5	1.4	.91	1.1	1.1
4	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.5	1.4	.92	1.1	1.1
5	1.2	1.2	1.3	1.4	1.5	1.4	1.5	1.5	1.3	.92	1.1	1.1
6	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.5	1.3	.92	1.1	1.1
7	1.2	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.3	.92	1.1	1.1
8	1.2	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.2	1.0	1.1	1.1
9	1.2	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.2	1.0	1.1	1.1
10	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.5	1.1	1.0	1.1	1.1
11	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.5	1.1	1.0	1.1	1.1
12	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.5	1.0	1.0	1.2	1.1
13	1.2	1.2	1.3	1.4	1.5	1.5	1.5	1.5	1.0	1.0	1.2	1.1
14	1.2	1.2	1.3	1.4	1.5	1.5	1.5	1.5	1.0	1.0	1.2	1.1
15	1.2	1.2	1.3	1.4	1.5	1.5	1.5	1.5	.98	1.0	1.2	1.1
16	1.2	1.2	1.3	1.4	1.5	1.5	1.5	1.5	.97	1.0	1.2	1.1
17	1.2	1.2	1.4	1.4	1.4	1.5	1.5	1.5	.98	1.0	1.2	1.1
18	1.2	1.2	1.4	1.4	1.4	1.5	1.5	1.5	1.0	1.0	1.2	1.1
19	1.2	1.2	1.4	1.4	1.4	1.5	1.5	1.5	.99	1.0	1.2	1.1
20	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.0	1.0	1.2	1.1
21	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.0	1.0	1.2	1.1
22	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.0	1.0	1.2	1.1
23	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.0	1.1	1.2	1.1
24	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.0	1.1	1.2	1.1
25	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.4	.97	1.1	1.2	1.1
26	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.4	.94	1.1	1.2	1.1
27	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.4	.92	1.1	1.2	1.1
28	1.2	1.3	1.4	1.4	1.5	1.5	1.5	1.4	.92	1.1	1.2	1.1
29	1.2	1.3	1.4	1.4	1.5	1.5	1.5	1.4	.94	1.1	1.2	1.1
30	1.2	1.3	1.4	1.4	------	1.5	1.5	1.4	.94	1.1	1.2	1.1
31	1.2	------	1.4	1.5	------	1.5	------	1.4	------	1.1	1.1	------
TOTAL	37.2	37.1	41.7	43.5	41.4	46.0	45.0	45.8	32.65	31.32	36.0	33.0
MEAN	1.20	1.24	1.35	1.40	1.43	1.48	1.50	1.48	1.09	1.01	1.16	1.10
MAX	1.2	1.3	1.4	1.5	1.5	1.5	1.5	1.5	1.4	1.1	1.2	1.1
MIN	1.2	1.2	1.2	1.4	1.4	1.4	1.5	1.4	.92	.91	1.1	1.1
AC-FT	74	74	83	86	82	91	89	91	65	62	71	65

CAL YR 1971 TOTAL 485.90 MEAN 1.33 MAX 1.6 MIN 1.1 AC-FT 964
WTR YR 1972 TOTAL 470.67 MEAN 1.29 MAX 1.5 MIN .91 AC-FT 934

NOTE.--No gage-height record Oct. 1 to Nov. 11, July 8 to Aug. 19.

Table 9.--Records of discharge of selected springs in the Locomotive Springs group - Continued

Off Spring at Locomotive Springs, near Snowville, Utah -Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.1	1.2	1.2	1.4	1.4	1.4	1.4	1.4	1.2	1.1	1.1	1.1
2	1.1	1.2	1.2	1.4	1.4	1.4	1.3	1.4	1.2	1.1	1.1	1.1
3	1.1	1.2	1.2	1.4	1.4	1.4	1.3	1.4	1.2	1.1	1.1	1.1
4	1.1	1.2	1.2	1.4	1.4	1.4	1.3	1.4	1.2	1.1	1.1	1.1
5	1.1	1.2	1.2	1.4	1.4	1.4	1.4	1.4	1.2	1.1	1.1	1.1
6	1.1	1.2	1.2	1.4	1.4	1.4	1.4	1.4	1.2	1.1	1.1	1.1
7	1.1	1.2	1.2	1.4	1.4	1.4	1.4	1.4	1.2	1.1	1.1	1.1
8	1.2	1.2	1.3	1.4	1.4	1.4	1.3	1.4	1.2	1.1	1.1	1.1
9	1.2	1.2	1.3	1.4	1.4	1.4	1.3	1.4	1.2	1.1	1.1	1.1
10	1.2	1.2	1.3	1.4	1.4	1.4	1.3	1.4	1.2	1.1	1.1	1.1
11	1.2	1.2	1.3	1.4	1.4	1.4	1.3	1.4	1.2	1.1	1.1	1.1
12	1.2	1.2	1.3	1.4	1.4	1.4	1.3	1.4	1.2	1.1	1.1	1.1
13	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.2	1.1	1.1	1.1
14	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.2	1.1	1.1	1.1
15	1.2	1.2	1.3	1.4	1.4	1.4	1.3	1.4	1.2	1.1	1.1	1.1
16	1.2	1.2	1.3	1.4	1.4	1.4	1.3	1.4	1.2	1.1	1.1	1.1
17	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.2	1.1	1.1	1.1
18	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.2	1.1	1.1	1.1
19	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.2	1.1	1.1	1.1
20	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.2	1.1	1.1	1.1
21	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.3	1.2	1.1	1.1	1.1
22	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.3	1.2	1.1	1.1	1.1
23	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.3	1.2	1.1	1.1	1.1
24	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.3	1.2	1.1	1.1	1.1
25	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.3	1.2	1.1	1.1	1.1
26	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.3	1.2	1.1	1.1	1.1
27	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.2	1.2	1.1	1.1	1.1
28	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.2	1.2	1.1	1.1	1.1
29	1.2	1.2	1.3	1.4	------	1.4	1.4	1.2	1.2	1.1	1.1	1.1
30	1.2	1.2	1.3	1.4	------	1.4	1.4	1.2	1.1	1.1	1.1	1.1
31	1.2	------	1.4	1.4	------	1.4	------	1.3	------	1.1	1.1	------
TOTAL	36.5	36.0	39.7	43.4	39.2	43.4	41.0	41.9	35.9	34.1	34.1	33.0
MEAN	1.18	1.20	1.28	1.40	1.40	1.40	1.37	1.35	1.20	1.10	1.10	1.10
MAX	1.2	1.2	1.4	1.4	1.4	1.4	1.4	1.4	1.2	1.1	1.1	1.1
MIN	1.1	1.2	1.2	1.4	1.4	1.4	1.3	1.2	1.1	1.1	1.1	1.1
AC-FT	72	71	79	86	78	86	81	83	71	68	68	65

CAL YR 1972 TOTAL 466.87 MEAN 1.28 MAX 1.5 MIN .91 AC-FT 926
WTR YR 1973 TOTAL 458.20 MEAN 1.26 MAX 1.4 MIN 1.1 AC-FT 909

NOTE.--No gage-height record Jan. 9 to Feb. 22.

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TECHNICAL PUBLICATIONS

No. 1. Underground leakage from artesian wells in the Flowell area, near Fillmore, Utah, by Penn Livingston and G. B. Maxey, U.S. Geological Survey, 1944.

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Measurements by the Utah Division of Wildlife Resources in 1967 (written commun., 1967) show that the discharge of Bar M Spring ranged from 10.7 to 11.6 ft^3/s (0.30-0.33 m^3/s) (23 measurements) and that of Sparks Spring ranged from 1.1 to 1.8 ft^3/s (0.03-0.05 m^3/s) (15 measurements). On March 3, 1967, the combined discharge of West Locomotive, Baker, Bar M, Off, and Sparks Springs was about 38 ft^3/s (1.08 m^3/s); on April 4, 1967, it was about 41 ft^3/s (1.16 m^3/s).

The Geological Survey established gaging stations at West Locomotive, Baker, Bar M, Off, and Sparks Springs in December 1968, and records of discharge at these stations are given in table 9. The mean combined discharge of the five springs during 1969-72 was about 32 ft^3/s (0.90 m^3/s) or about 23,000 acre-feet (28.4 hm^3) per year. The average March-April discharge from the springs during 1969-72 was about 36 ft^3/s (1.02 m^3/s). Graphs of the mean monthly discharge at these springs are shown in figure 9. Because of flow regulation and diversions, the discharge records at West Locomotive and Baker Springs are fragmentary and of questionable reliability during July-September. The discharge of all the springs fluctuates seasonally and annually (table 9).

The combined discharge of West Locomotive, Baker, Bar M, Off, and Sparks Springs probably represents about 95 percent of the total ground-water discharge at Locomotive Springs; thus, the total discharge during 1969-72 averaged about 24,000 acre-feet (29.6 hm^3) per year. The remaining 5 percent was from a few small unnamed springs and seeps and from Teal Spring. The discharge of Teal Springs is estimated as about 1-2 ft^3/s (0.03-0.06 m^3/s). The spring pond is sometimes submerged by East Lake, and even when it is not, the velocity of flow in the flat, tortuous, marshy channel between the pond and the lake is too small for reliable discharge measurements.

Chemical quality

The water discharged at Locomotive Springs is slightly to moderately saline and is of the sodium chloride type; these ions account for about 85 percent of the total ions in solution. (See table 3.) The concentration of dissolved solids in water from each spring varies somewhat throughout the year, but no consistent trend of change from year to year has been observed. (See table 6.) Part of the observed range of dissolved solids may be due to sampling error--samples obtained from a pond, even near the point of inflow, are not consistently representative of the inflow water.

The wide range in concentration of dissolved solids among the springs is believed to result when water from upvalley acquires varying quantities of additional salts near the discharge points. The springs are adjacent to the Great Salt Lake and are surrounded by saline sediments that contain sodium chloride brines. The data in table 3 show that the differences in average concentration of dissolved solids among the springs are primarily due to differences in concentration of sodium and chloride. These two ions account for nearly 96 percent of the