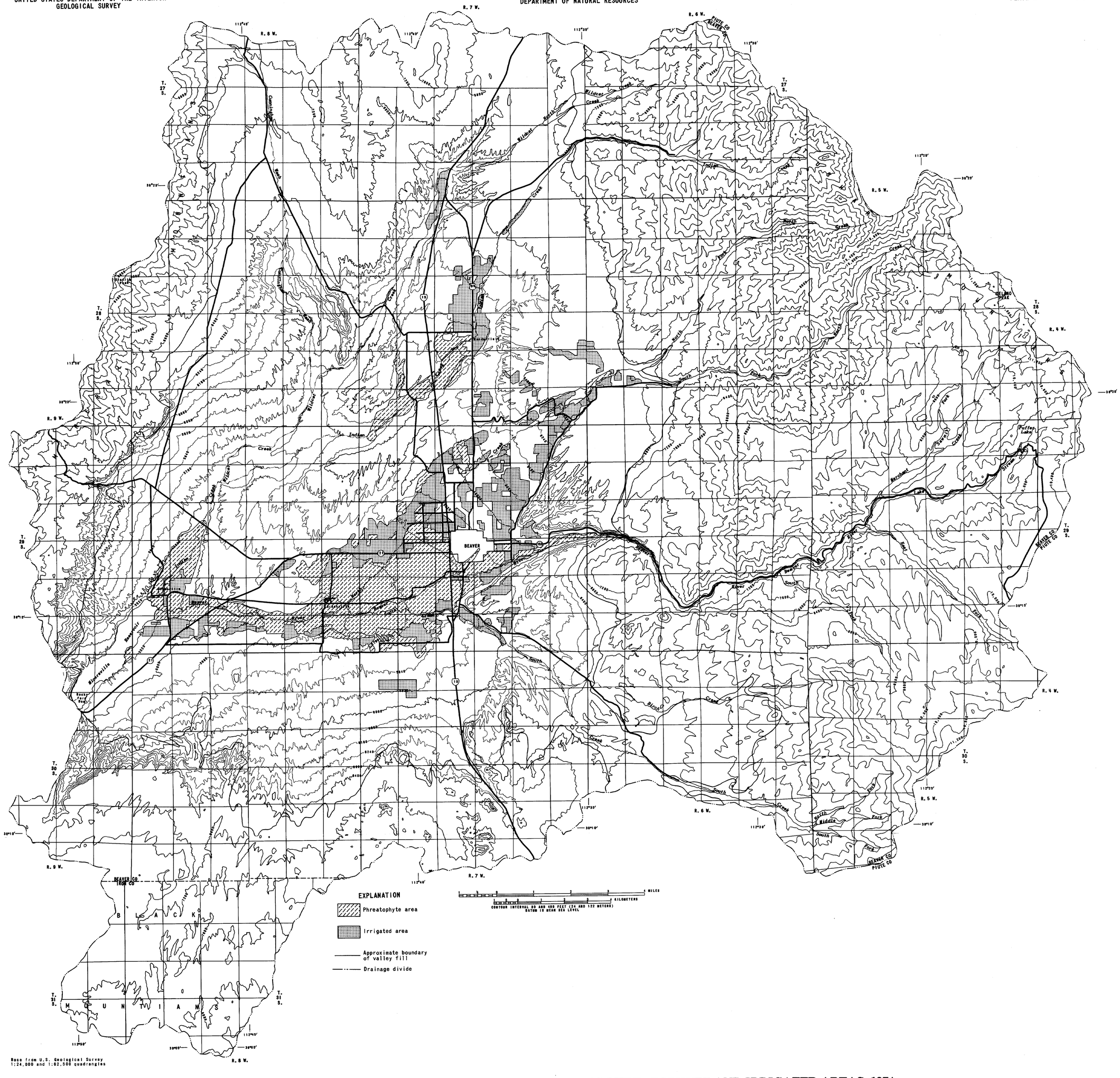
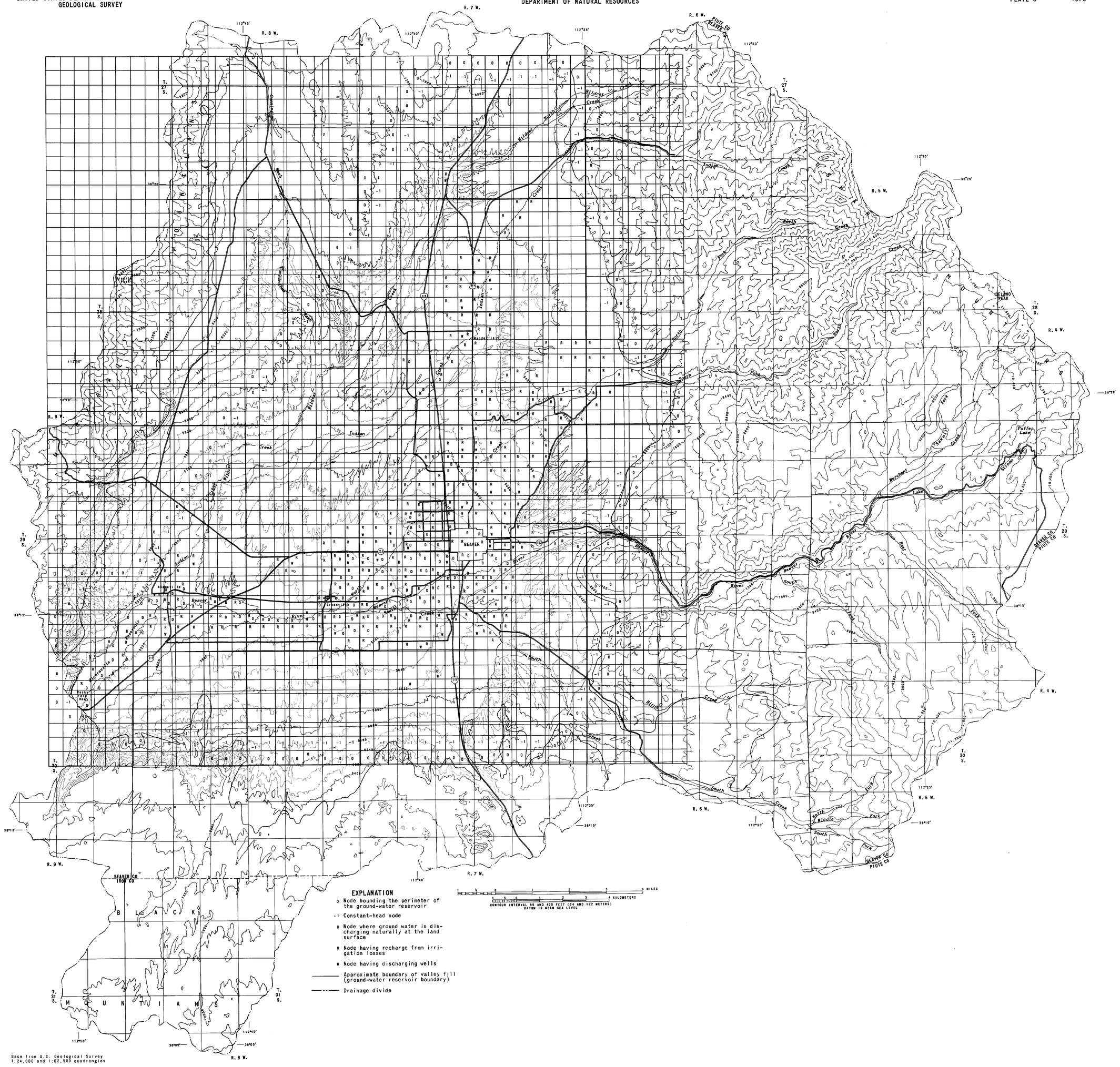


MAP OF BEAVER VALLEY, BEAVER COUNTY, UTAH, SHOWING PHREATOPHYTE AND IRRIGATED AREAS, 1974



Base from U.S. Geological Survey
1:24,000 and 1:62,500 quadrangles

RECTANGULAR GRID USED WITH THE DIGITAL-COMPUTER MODEL OF THE GROUND-WATER RESERVOIR IN BEAVER VALLEY, BEAVER COUNTY, UTAH

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES

Technical Publication No. 63

HYDROLOGY OF THE BEAVER VALLEY AREA, BEAVER COUNTY, UTAH, WITH EMPHASIS ON GROUND WATER

by

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

1978

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U.S. CUSTOMARY–TO–METRIC CONVERSION FACTORS

Most values are given in this report in U.S. customary units followed by metric units. The conversion factors used are shown to four significant figures. In the text, however, the metric equivalents are shown only to the number of significant figures consistent with the accuracy of the value in U.S. customary units.

U.S. customary Unit (Multiply)	Abbreviation	(by)	Metric Unit (to obtain)	Abbreviation
Acre		0.4047	Square hectometer	hm^2
Acre-foot	acre-ft	.001233	Cubic hectometer	hm^3
Acre-foot per square mile	acre-ft/mi^2	.0004761	Cubic hectometer per square kilometer	hm^3/km^2
Cubic foot per second	ft^3/s	.02832	Cubic meter per second	m^3/s
Cubic foot per second per mile	$(ft^3/s)/mi$	.01760	Cubic meter per second per kilometer	$(m^3/s)/km$
Foot	ft	.3048	Meter	m
Foot per mile	ft/mi	.1894	Meter per kilometer	m/km
Gallon per minute	gal/min	.06309	Liter per second	L/s
Gallon per minute per foot	(gal/min)/ft	.2070	Liter per second per meter	(L/s)/m
Inch	in.	25.40	Millimeter	mm
		2.540	Centimeter	cm
Mile	mi	1.609	Kilometer	km
Square mile	mi^2	2.590	Square kilometer	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 U.S. customary unit, parts per million.

Micrograms per liter (μg/L) is a unit expressing the concentration of chemical constituents in solution as weight (micrograms) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter.

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

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

HYDROLOGY OF THE BEAVER VALLEY AREA, BEAVER COUNTY, UTAH, WITH EMPHASIS ON GROUND WATER

by

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ABSTRACT

Beaver Valley includes 534 square miles (1,383 square kilometers) in southwestern Utah, in the Basin and Range physiographic province. The project area consists of a valley plain underlain by unconsolidated to partly consolidated material. The valley plain is bounded by mountains that are composed of partly consolidated to consolidated rocks of Pennsylvanian through Tertiary age except for local thin unconsolidated surficial deposits of Quaternary age.

The water needs of the valley are supplied mainly by four streams rising in the Tushar Mountains along the eastern side of the valley and by wells in the unconsolidated to partly consolidated materials of the valley plain. The 1966-74 combined mean annual inflow of the four streams was 59,020 acre-feet (72.77 hm^3 [cubic hectometers]). Withdrawals from wells for irrigation increased from 250 acre-feet (0.31 hm^3) in 1934, the first year of such withdrawal, to 8,880 acre-feet (10.9 hm^3) in 1974; the average withdrawal for 1966-74 was 5,080 acre-feet (6.3 hm^3). Withdrawals for all other uses increased from 125 acre-feet (0.15 hm^3) in 1934 to 1,055 acre-feet (1.3 hm^3) in 1974.

The unconsolidated and partly consolidated materials underlying the valley plain contain the principal ground-water reservoir of Beaver Valley. This reservoir consists of three hydrogeologic units that are hydraulically connected and have a total thickness of at least 800 feet (240 meters) and probably more than 1,000 feet (305 meters).

Recharge to the principal ground-water reservoir is estimated to be about 56,000 acre-feet (69 hm^3) annually. The largest sources of recharge were infiltration of seepage from irrigation, 38,900 acre-feet (48 hm^3) principally from surface-water sources and 7,000 acre-feet (8.6 hm^3) from ground-water pumpage. Subsurface inflow from the mountains was 7,600 acre-feet (9.4 hm^3) and infiltration of precipitation on the valley floor was 2,100 acre-feet (2.6 hm^3).

Discharge from the principal ground-water reservoir for 1974 was estimated to be 56,000 acre-feet (69 hm^3). Discharge was mainly from springs, 28,000 acre-feet (35 hm^3); evapotranspiration, 18,000 acre-feet (22 hm^3); wells, 9,900 acre-feet (12 hm^3); and subsurface outflow, 300 acre-feet (0.4 hm^3).

Ground water in the principal ground-water reservoir is moving from the recharge areas--the alluvial fans, the bounding mountains, and the irrigated areas--to discharge areas in the valley. Some water moves out of the valley as subsurface flow near Rocky Ford Dam at the southwest side.

The total amount of water in storage in the principal ground-water reservoir is about 12 million acre-feet (15,000 hm^3). An average decline of 1 foot (0.3 meter) in water levels from the levels of spring 1974 would release about 29,000 acre-feet (36 hm^3) of water. This quantity per foot is not a constant value, however, but decreases with depth. At an altitude of 100 feet (30 meters) below the levels in the spring of 1974, the quantity of water released by 1 foot (0.3 meter) of water-level decline would be about 15,000 acre-feet (18 hm^3).

The dissolved-solids concentration is less than 500 milligrams per liter in water from streams, springs, and wells in most parts of the valley. The chemical quality of ground water from wells generally deteriorates with increased depth. Generally surface and ground water of the best quality occur at the east side of the valley along the front of the Tushar Mountains, and water of the poorest quality occurs in the lower southwestern part of the valley.

INTRODUCTION

The investigation of the water resources of the Beaver Valley area in southwestern Utah, was made as a part of a cooperative program with the Utah Department of Natural Resources, Division of Water Rights, to investigate the water resources of the State. The primary purpose of this report is to provide hydrologic information needed for optimum development of the available water and the proper administration and adjudication of water rights in the valley.

The study on which this report is based was made during 1973-75. It included an evaluation of the total water resources of the Beaver Valley area, but surface water was evaluated mainly as it pertained to the understanding of the ground-water resources. The primary elements of the study included a determination of the source, quantity, and quality of recharge to the ground-water reservoir; the quantity and quality of the water in storage; the amount and location of both natural discharge and withdrawals from wells; and the effects of withdrawal from wells on ground-water levels, natural discharge, and quality of the water. The applicable data were assembled in a digital-computer model to simulate the ground-water reservoir for purposes of verifying hydrologic concepts developed during the study.

The basic data on which this report is based are given in tables 11-17, and the locations of wells, springs, and other hydrologic-data sites are shown on plate 1.

Well- and spring-numbering system

The system of numbering wells and springs in Utah is based on the cadastral land-survey system of the U.S. Government. The number, in addition to designating the well or spring, describes its position in the land net. By the land-survey system, the State is divided into four quadrants by the Salt Lake base line and meridian, and these quadrants are designated by the uppercase letters A, B, C, and D, indicating 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 enclosed in parentheses. The number after the parentheses indicates the section, and is followed by three letters indicating the quarter section, the quarter-quarter section, and the quarter-quarter-quarter section--generally 10 acres (4 hm^2);[1] the letters, a, b, c, and d indicate, respectively, the northeast, northwest, southwest, and southeast quarters of each subdivision. The number after the letters is the serial number of the well or spring within the 10-acre (4-hm^2) tract; the letter "S" preceding the serial number denotes a spring. If a well or spring cannot be located within a 10-acre (4-hm^2) tract, one or two location letters are used and the serial number is omitted. Thus (C-29-8)13dda-1 designates the first well constructed or visited in the NE¼SE¼SE¼ sec. 13, T. 29 S., R. 8 W., and (C-29-7)28a-S designates a spring known only to be in the NE¼ sec. 28, T. 29 S., R. 7 W. The numbering system is illustrated in figure 1.

Physiography and drainage

The Beaver Valley area includes 534 mi^2 (1,383 km^2) of both valley and mountainous areas in southwestern Utah. The valley is bounded by drainage divides in the Tushar Mountains on the east and north, the Mineral Mountains on the west, and the Black Mountains on the south. Rocky Ford Dam lies in a narrow gap between the Mineral and Black Mountains near the southwestern side of the valley, the only place along the boundary lacking a drainage divide.

The Beaver Valley area is in the eastern part of the Basin and Range physiographic province (Fenneman, 1931). The valley plain is mostly between altitudes of 5,500 and 6,300 ft (1,700 and 1,900 m) above mean sea level. Most of the mountainous areas are below 9,000 ft (2,700 m); however, Delano Peak in the Tushar Mountains reaches an altitude of 12,173 ft (3,710 m) and Granite Peak in the Mineral Mountains reaches an altitude of 9,578 ft (2,919 m).

---

[1] Although the basic land unit, the section, is theoretically 1 mi^2 (2.6 km^2), many sections are irregular. Such sections are subdivided into 10-acre (4-hm^2) tracts, generally beginning at the southeast corner, and the surplus or shortage is taken up in the tracts along the north and west sides of the section.

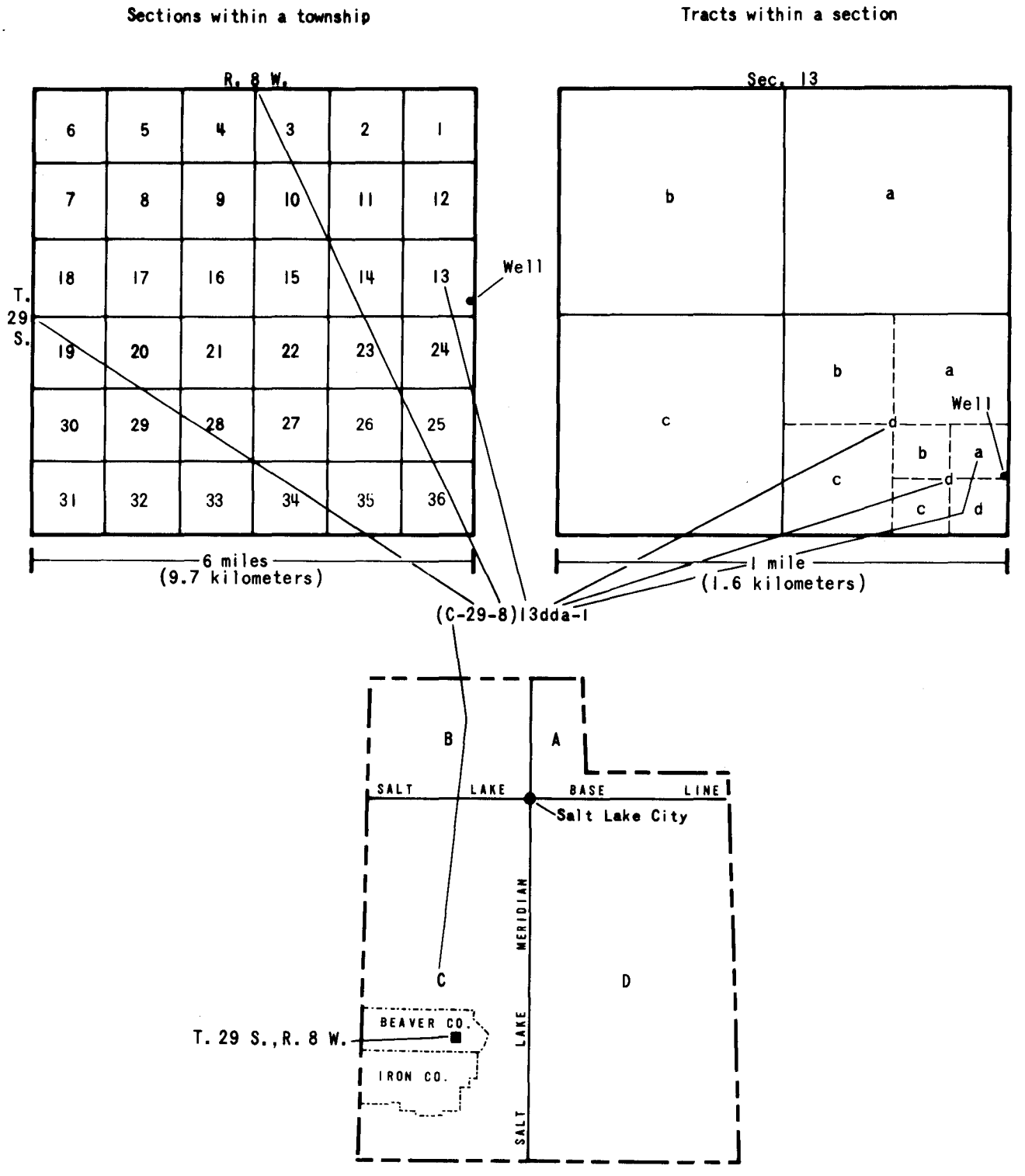

Figure 1.—Well- and spring-numbering system used in Utah.

Parts of the valley contain moderate to steep hills and terraces ranging to several hundred feet in height, which have resulted from the erosion of older alluvium of Quaternary age and the Sevier River Formation of late Tertiary and early Quaternary age (table 1). The tops of some hills and terraces have broad, relatively gentle slopes in comparison to the side slopes, and they are farmed where sufficient water is available for irrigation and the soils are suitable.

The central lowland part of the valley is underlain mainly by younger alluvium of Quaternary age, deposited by North and South Creeks and the Beaver River, and possibly by deposits in an ancient lake. This central lowland part of the valley is about 21 mi (34 km) long and about 0.2 to 3 mi (0.3 to 5 km) wide. Even here, where the gradient of the land surface is the most gentle of any place in the valley, it is relatively steep, averaging 55 ft/mi (10 m/km).

The Beaver Valley area is drained by the Beaver River. The river and its principal tributaries, Indian, North, and South Creeks, all rise in the rugged Tushar Mountains. Only a small part of the stream runoff is stored in reservoirs in the mountains; most of it runs off uncontrolled. Usually, however, all the flow of the mountain streams, except for large floodflows and some of the winter flow of the Beaver River, is diverted at or near where they enter the valley plain.

The Beaver River flows generally westward to near the southwestern part of the valley, where the flow is impounded in Minersville Reservoir by Rocky Ford Dam for use outside the valley. The river is a gaining stream west of the city of Beaver. The increase of streamflow represents flood runoff, winter flow, and return flow from irrigation.

Hydrogeology

Beaver Valley and the adjacent mountains are underlain in part by consolidated rocks ranging in age from Pennsylvanian to Quaternary, and in part by Quaternary unconsolidated rocks (pl. 1). Unconsolidated to partly consolidated rocks, consisting of recent stream deposits, lake deposits, and fanglomerates, constitute most of the valley fill. The lithologic units in the valley are combined on the basis of hydrologic properties, for purposes of this report, into four hydrogeologic units (table 1 and pl. 1). The saturated parts of three of these units in the valley fill compose the principal ground-water reservoir.

The partly consolidated Sevier River Formation, which probably underlies all of Beaver Valley, is exposed at many places in the surrounding foothills and mountains and locally is exposed in the north-central part of the valley. Callaghan and Parker (1961) mapped this formation in the northeast part of the valley, from near the mouth of North Creek to the north edge of the valley. They described the Sevier River Formation as "* * * a valley-fill deposit, consisting of partly consolidated fanglomerate, conglomerate, sand, and silt, which for the most part have been derived from the nearby highlands." Extrusive volcanics form the uppermost unit of the Sevier River Formation where it caps some of the higher hills in the north-central part of the valley west of Manderfield. The Sevier River Formation, which generally underlies the extrusive volcanics, in exposures is composed mostly of consolidated clay, silt, and sand. In much of the southern part of the valley, the Sevier River Formation underlies surficial Quaternary alluvium. In some places in this part of the valley, drillers' logs of wells indicate that the formation contains a large proportion of sand, gravel, and boulders.

The sedimentary deposits of the Sevier River Formation are similar in most respects to the deposits of Quaternary alluvium, and it usually is difficult to distinguish between them. The Sevier River Formation in the subsurface sometimes can be differentiated on drillers' logs of wells by the use of such terms as cemented, hardpan, rock ledge, etc., or by determination of the presence of cementation through microscopic examination of drill cuttings.

The Sevier River Formation may be differentiated from the Quaternary alluvium at the outcrops by: (1) a generally steeper topographic form; (2) excessive, deficient, or reversed dip of bedding planes (Willard and Callaghan, 1962); (3) faulting within the formation (Callaghan and Parker, 1962b); (4) a generally poorer degree of sorting and stratification; (5) a generally greater degree of consolidation; and (6) the presence of lake deposits similar to those in the type area of the formation (Callaghan, 1938, p. 100-101, and Callaghan and Parker, 1962a).

Table 1.–Hydrogeologic units and their qualitative hydrologic properties

Unit	Hydrogeologic units: Geologic age (name)	Hydrogeologic units: Lithology	Hydrologic properties
1	Quaternary (younger alluvium)	Unconsolidated deposits of gravel, sand, silt, and clay.	Contains the most commonly developed unit of the principal ground-water reservoir. Coarse-grained deposits accept a large quantity of recharge at irrigated fields, especially in the east-central and southeastern parts of the valley. The sand and gravel deposits, which are generally less than 200 ft (60 m) thick, yield water moderately rapidly to wells.
2	Quaternary (older alluvium)	Loosely to moderately consolidated deposits of gravel, sand, silt, and clay	Contains a less commonly developed unit of the principal ground-water reservoir. Probably accepts a moderate quantity of recharge at irrigated fields in the east-central part of the valley; little, if any, recharge occurs elsewhere. The coarser and more loosely consolidated deposits, which range in depth from 0 at the eroded edge to probably as much as 1,000 ft (305 m), yield water slowly to moderately rapidly to wells.
3	Quaternary and Tertiary (Sevier River Formation)	Basalt and partly consolidated deposits of gravel, sand, silt, and clay	Contains a less commonly developed unit of the principal ground-water reservoir. The basalt probably accepts a low rate of recharge; elsewhere at the land surface, recharge probably is nil. The coarser and more loosely consolidated deposits of the Sevier River Formation, which range in depth from 0 at the eroded edge to probably as much as 1,000 ft (305 m), yield water slowly to moderately rapidly to wells.
4	Quaternary through Pennsylvanian	Quartzite, limestone, sandstone, basalt, conglomerate, gravel, sand, silt, and clay	Bounds the principal ground-water reservoir. The Quaternary unconsolidated materials are thin surficial deposits, which together with the well-developed and interconnected open joints in the older partly consolidated to consolidated rocks, probably accept large quantities of recharge and contribute large quantities of water to the principal ground-water reservoir at the eastern and southern sides of the valley, but probably little or none elsewhere. Would yield water to wells at varying rates depending upon how well-developed and interconnected the open joints are that the wells intersect.

Most of the Sevier River Formation in Beaver Valley is greatly eroded and is buried by Quaternary alluvium; therefore, its thickness cannot easily be determined. The greatest observed thickness is in the hills northwest of Manderfield where it exceeds 1,000 ft (305 m). The thickness is difficult to determine accurately in the lowland part of the valley near Beaver where the formation is covered with younger sediments, but a study of drillers' logs indicates that the thickness in some places is at least 800 ft (244 m).

The Quaternary alluvium has been mapped as older alluvium and younger alluvium (Stokes, 1964). The older alluvium is exposed as terraces and on hillsides mainly around the south and east sides of the valley. Its typical topographic form is similar to that of the Sevier River Formation, and the units may be of equivalent age. Also, much of the material shown by Stokes (1964) as older alluvium is thought by the writer to be part of the Sevier River Formation, because several outcrops that were inspected meet the criteria given above, especially (2) and (3).

Most of the geology of the valley plain and foothills was mapped by reconnaissance (Stokes, 1964). According to Eugene Callaghan (oral commun., 1975), it is likely that some of the material that has been mapped as older alluvium in Beaver Valley is actually part of the Sevier River Formation.

The younger alluvium includes alluvial-fan, flood-plain, lake, and marsh deposits. Both the older and the younger alluvium consists of interbedded, lenticular and interfingering deposits of sediments ranging in size from clay to bolders. Sorting and stratification of the younger alluvium, in particular, range from poor to moderate. The most permeable water-bearing zones are the moderately to well sorted and stratified beds of gravel and sand which have been deposited in stream channels in alluvial fans.

The combined thickness of the Sevier River Formation and the older and younger alluvium in the lowland part of Beaver Valley ranges from several hundred to more than 1,000 ft (305 m). The saturated parts, however, probably may be only as great as 1,000 ft (305 m).

Climate

The climate of Beaver Valley is characterized by mild summers and cool winters. Daytime temperatures rarely exceed 100°F (38°C). Winter temperatures usually are below freezing at night, but seldom are below -10°F (-23°C). The mean annual temperature at Beaver is 47.4°F (8.6°C). The average growing season is 108 days, from mid-May to mid-September.

The normal annual precipitation (1931-60) is less than 12 in. (305 mm) in most irrigated parts of the valley and ranges from about 12 to about 40 in. (305 to 1,016 mm) in the mountains (pl. 1) (U.S. Weather Bureau, 1963). Figure 2 shows the cumulative departure from average annual precipitation for the period 1935-75. The departure curve trends downward during periods of below-normal precipitation and upward during periods of above-normal precipitation. Annual precipitation at Beaver during 1935-75 ranged from an estimated low of 6.7 in. (170 mm) in 1950 to a high of 20.78 in. (528 mm) in 1936. The annual average was 11.67 in. (296 mm), which is slightly higher than the 1931-60 normal annual of 11.35 in. (288 mm).

Figure 3 shows the monthly variation of precipitation at Beaver for the period 1935-75. About 55 percent of the precipitation occurs during May-October, and 45 percent occurs during November-April. The range in mean monthly precipitation is not great, the range being from 0.68 in. (17 mm) in November to 1.49 in. (38 mm) in August. In contrast, however, the range between minimum and maximum precipitation is great, varying from zero in 9 months of the year to 5.76 in. (146 mm) in July. Also in contrast with the rather uniform monthly means is the range between the total of the monthly minimum precipitation of 0.14 in. (4 mm) and the total of the monthly maximum precipitation of 36.29 in. (922 mm).

Average yearly pan evaporation during April-October 1953-74 at Milford, about 25 mi (40 km) northwest of Beaver was 78 in. (1,981 mm). The high rate of evaporation for the latitude and altitude at Milford is due largely to the unobstructed barren area and to excessive wind, which averaged 22,800 mi (36,700 km) a year during April-October 1953-74.

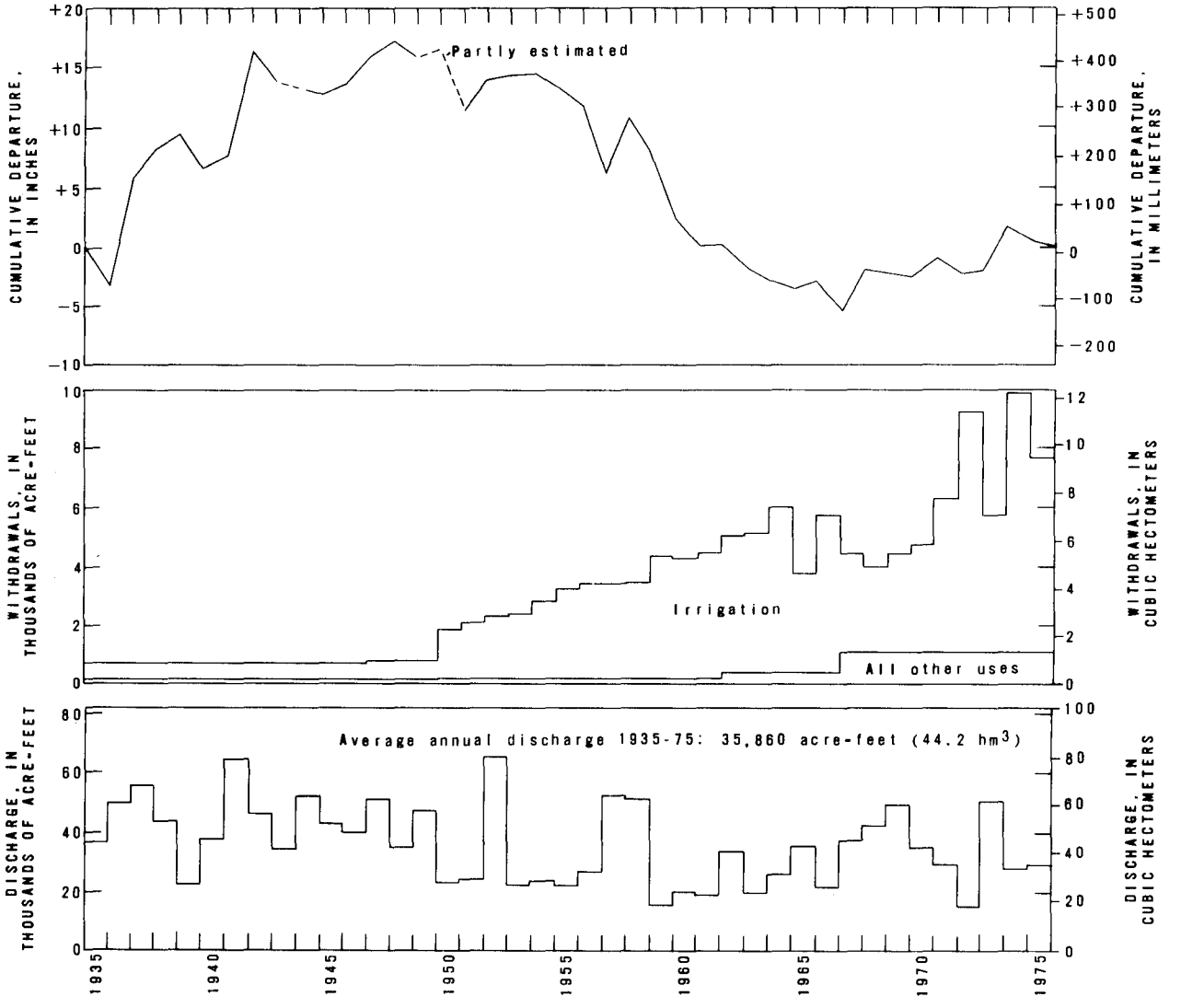

Figure 2.—Relation of cumulative departure from the 1935-75 average annual precipitation at Beaver to withdrawals of ground water in Beaver Valley and to discharge of the Beaver River near Beaver.

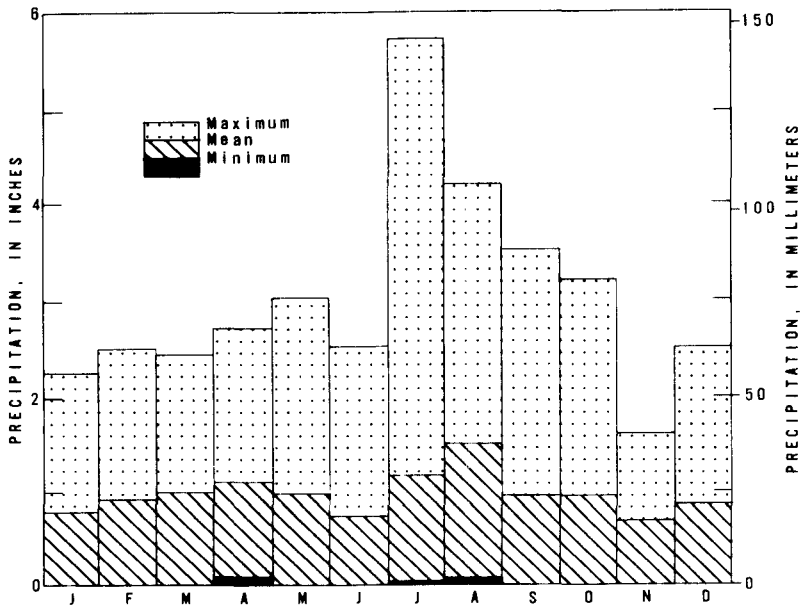

Figure 3.—Monthly variations of precipitation at Beaver, 1935-75. The bars show maximum, mean, and minimum values for each month. (The minimum for 9 months is zero.)

Water-surface evaporation was computed to be about 64 in. (1,626 mm) at Milford and about 53.9 in. (1,369 mm) at Beaver by the U.S. Department of Agriculture (1973a, map following p. 14). The lower rate of evaporation at Beaver is due largely to less exposure and wind movement and a higher altitude than at Milford.

Previous investigations

Gilbert (1890) studied the geology of ancient Lake Bonneville, into which the Beaver River discharged near the southwest edge of Beaver Valley. The geology of the valley and contiguous mountains has since been studied in detail or by reconnaissance; publications pertinent to this investigation are listed in Selected references.

The first ground-water investigation that included Beaver Valley was made in 1906 (Lee, 1908). Data are reported for selected wells in the lowland part of the valley between Beaver and Adamsville, including water levels in several selected wells and chemical analyses of water from a few wells and springs. Several interesting observations and conclusions by Lee, including the following, suggest that there has been little or no change in the hydrology of that area or improvement in water management in the intervening three-quarters of a century.

"All the summer flow has long since been appropriated, although much of it is misused."(Lee, 1908, p. 18.)

"During spring and early summer the ground-water level gradually rises, and during late summer and early autumn a considerable part of the lowlands of the valley between Beaver and Adamsville is transformed into a marsh. Many of the roads are rendered impassable and many of the fields useless for tillage or even pasturage." (Lee, 1908, p. 22.)

More recently, the ground-water hydrology of Beaver Valley was included in a study of the ground-water resources of selected basins in southwestern Utah (Sandberg, 1966). The basic data, including information about wells, well logs, water-level measurements, and water analyses, were compiled in a separate report (Sandberg, 1963).

A study by the U.S. Department of Agriculture (1973g, p. 9) was made "* * * to inventory the water and related land resources, to define resource related problems, to evaluate needs, and to determine opportunities for resource development." It was not a study of hydrology but it "* * * consisted mostly of an accumulation and evaluation of previously recorded data, both published and unpublished, * * *" and contains information useful in a hydrologic study.

The U.S. Geological Survey has measured water levels in selected wells and withdrawals from most of the irrigation wells since 1935. Many of the measurements were reported in the annual series of water-supply papers for the years 1935-55 and in the 5-year series for the years 1956-70 (see Selected references).

The Geological Survey has measured the flow of the Beaver River since 1913 and the flows of South Creek, North Fork North Creek, South Fork North Creek, and of Indian Creek since 1965. Miscellaneous periodic and shorter-term continuous measurements have been made also at other times on some of these streams or at stations other than the present gaging-station sites. Both continuous-flow measurements and periodic measurements are reported in water-supply papers for 1931-60 and in water-supply papers or in Part 1, annual series of surface-water records, or both, for 1961-74 (see Selected references).

Chemical-quality data have been gathered intermittently since that obtained in 1906 by Lee (1908). Chemical-quality data for ground water and surface water in Beaver Valley were included in a compilation of water analyses made by public agencies in Utah through September 1955 (Connor, Mitchell, and others, 1958). Since 1961, all surface-water analyses and some ground-water analyses have been reported in the Part 2, annual series of surface-water records (see Selected references).

Acknowledgments

Appreciation is extended to all who aided in this study. Well drillers, particularly Ronald Bradshaw and Victor McCann, supplied logs and information relating to the drilling and testing of wells in Beaver Valley. Personnel in the office of the Utah State Engineer gave helpful assistance and suggestions and provided many well records and other useful information. Several well owners granted permission for the measurement and testing of their wells and supplied other useful information. A special thanks is extended to Lee Strong, the Water Commissioner for the Beaver River, for providing surface-water diversion records, information about streams and canals, and suggestions and assistance on many occasions.

WATER RESOURCES

The principal source of the water supply to Beaver Valley is precipitation in the contiguous mountains, foothills, and terraces on the eastern side of the valley. This precipitation results in inflow to the Beaver River and to Indian, North, and South Creeks from the Tushar Mountains. An additional source of supply is derived from underflow, mainly from the Tushar and the Black Mountains on the eastern and southern sides of the valley.

Much of the water from streams that is applied for irrigation in the valley is not consumed and is available for additional use as described in following sections of this report. Unused irrigation water that recharges the ground-water reservoir is, in effect, another increment of the valley's total water supply.

Volume of precipitation

Average annual precipitation in Beaver Valley and the contiguous uplands is estimated to be 530,000 acre-ft (653 hm^3) (table 2). About 241,000 acre-ft (297 hm^3) is concentrated on 161 mi^2 (417 km^2) of the Tushar Mountains that contributes most of the surface water used for irrigation in Beaver Valley. Most of the other 289,000 acre-ft (356 hm^3), which is concentrated on 373 mi^2 (966 km^2) of the lower-lying Black Mountains and on the valley plain, infiltrates to the ground-water reservoir or is evaporated. Infrequently, unmeasured small quantities of runoff reach the Beaver River and Minersville Reservoir.

Table 2.—Average annual precipitation and annual runoff from drainage basins in Beaver Valley and the contiguous uplands, 1931-60

Drainage basin	Area (mi^2)	Precipitation Total (acre-ft)	Precipitation per mi^2 (acre-ft)	Annual runoff 1931-60 (acre-ft)	Annual runoff Percent of precipitation	Annual runoff per mi^2 (acre-ft)
Tushar Mountains:						
Beaver River near Beaver[1]	90.7	142,100	1,567	36,690	26	405
North Fork North Creek[1]	14.1	17,900	1,270	4,370[2]	24	310
South Fork North Creek[1]	23.0	35,500	1,543	14,190[2]	40	617
South Creek[1]	14.7	22,500	1,531	2,600[2]	12	177
Indian Creek	18.5	23,000	1,243	5,800	25	314
Total or average	161.0	241,000	1,497	63,650	26	395
Black Mountains and lowlands:						
Ungaged drainage areas between stations Beaver River near Beaver and Beaver River at Adamsville	160	122,400	765	–	–	–
Beaver River at Adamsville	321	363,400	1,060	25,800	8	80
Ungaged drainage areas between stations Beaver River at Adamsville and Beaver River at Rocky Ford Dam	213	164,500	772	–	–	–
Beaver River at Rocky Ford Dam (rounded)	534	530,000	993	26,800[3]	5	50

[1] Drainage basin above gaging station near mouth of canyon. Location of station and drainage basin shown on plate 1.

[2] The 1931-60 annual discharge for stations other than the Beaver River stations was calculated to be 1.08 times the 1966-74 mean flow, which relation is that of the Beaver River near Beaver determined by dividing the average annual flow for 1931-60 by the average annual mean flow for 1966-74.

[3] Because of insufficient data, the runoff was not adjusted for differences in content of Minersville Reservoir at beginning of 1931 and end of 1960 nor for accretions from precipitation or deletions by evaporation.

The volume of precipitation in each drainage basin was computed from a map of Utah showing normal annual precipitation for 1931-60 (U.S. Weather Bureau, 1963) by summing the product of the mean precipitation rate between two successive lines of equal precipitation and the area between them. The volume of precipitation thus determined is not precise, but it is in the right order of magnitude.

Much of the precipitation that contributes to the water supply that is available for managed use occurs as snow that accumulates in the Tushar Mountains during November-April and runs off during late April-early August. Little of the precipitation on the Black Mountains and lowlands ever becomes available for managed use other than for small quantities on certain irrigated lands and some recharge to the ground-water reservoir as described in following sections of the report. Water not available for managed use evaporates or replenishes the soil moisture used by native vegetation.

Surface water

The total mean annual surface-water runoff during 1966-74 in five gaged Tushar Mountain streams was 59,020 acre-ft (72.77 hm^3) as shown in table 3. This amount probably represents more than 95 percent of the runoff within Beaver Valley. Because most of the ungaged areas are at relatively low altitudes and are drained by small intermittent or ephemeral streams, the runoff characteristics differ markedly from those of the gaged areas. Because of the relatively small quantity of water in the ungaged streams, no attempt was made to determine the amount of runoff in them.

Table 3.—Summary of annual runoff, in acre-feet, in five Tushar Mountain streams near the canyon mouths

(Figures in parentheses following maximum and minimum values are percent of mean)

Stream	Statistic	Water years 1966-74	
Indian Creek[1]	Maximum	14,250	(265)
	Mean	5,380	
	Minimum	1,325	(25)
North Fork North Creek	Maximum	6,960	(172)
	Mean	4,050	
	Minimum	1,550	(38)
South Fork North Creek	Maximum	27,010	(205)
	Mean	13,150	
	Minimum	4,480	(34)
Beaver River	Maximum	49,780	(146)
	Mean	34,000	
	Minimum	15,170	(45)
South Creek	Maximum	4,600	(189)
	Mean	2,440	
	Minimum	769	(32)
Combined flow	Maximum	102,600	(174)
	Mean	59,020	
	Minimum	23,290	(39)

[1] Records for 1966-68 estimated to be 15 percent of that in Beaver River.

Seasonal fluctuations of runoff are illustrated by the hydrograph of monthly combined runoff in figure 4, which shows that the bulk of the runoff occurs in a few months of spring and early summer. The period shown indicates the broad range of runoff that may be expected in Beaver Valley.

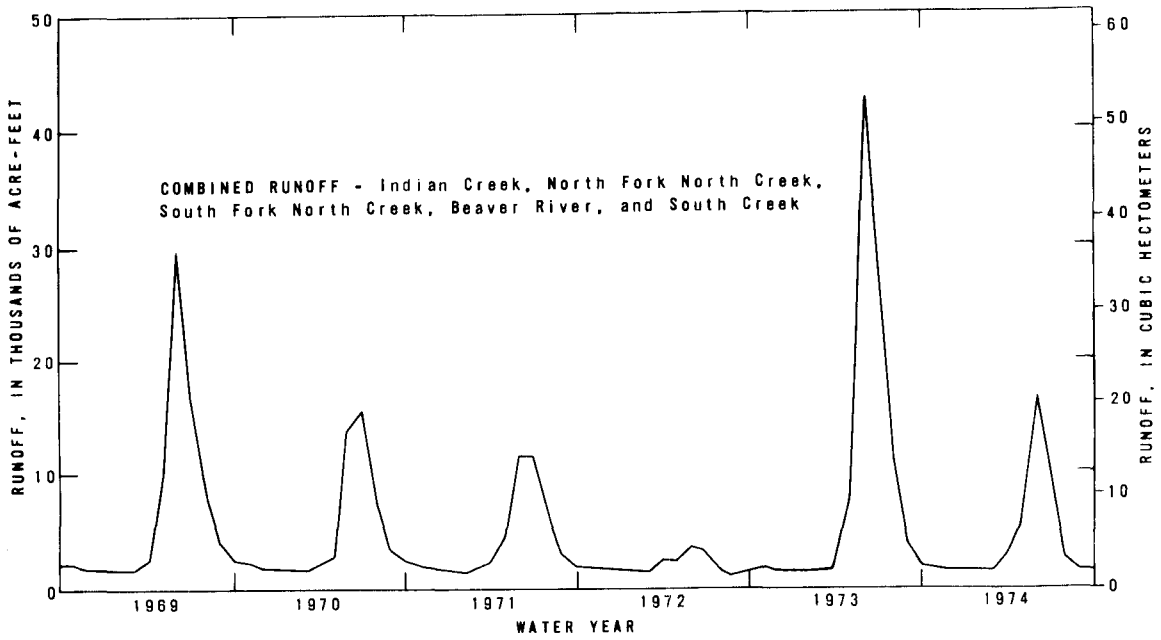

Figure 4.—Monthly combined runoff of five Tushar Mountain streams, 1969-74 water years.

The runoff in 1972 was less than one-fourth of the runoff in 1973. The other 4 years show about what typically may be expected. The role of ground-water seepage in sustaining the fall and winter discharge is evident from the generally long period of approximately uniform wintertime flow during 1969-74, regardless of the amount of the maximum peak flow during the preceding summer. The range of combined monthly runoff generally is 1,000-2,000 acre-ft (1.2-2.5 hm^3) during October-February, when the runoff is sustained principally by ground water, to more than 10,000 acre-ft (12.3 hm^3) a month during peak runoff.

The annual means and extremes of runoff during 1966-74 for each of the five Tushar Mountain streams are given in table 3, and the runoff per square mile is given in table 2. The data in the tables indicate the difference in magnitude and variability of runoff in each stream and also show the difference in magnitude and range in runoff per unit area.

The wide range in runoff per unit area is the result of the combination of difference in precipitation rates, topography, and geologic materials. For example, precipitation per unit area in the South Creek drainage area is 1,531 acre-ft/mi^2 (0.7289 hm^3/km^2), or about the same as the 1,543 acre-ft/mi^2 (0.7346 hm^3/km^2) in the South Fork North Creek drainage area; however, only about 12 percent of the precipitation runs off in South Creek while about 40 percent runs off in the South Fork North Creek.

The slope of the land surface is much steeper in the drainage area of the South Fork North Creek and more of the surface is composed of consolidated rocks than in the drainage area of South Creek. Therefore, more of the precipitation infiltrates into the soil to replenish soil moisture and to recharge the ground-water reservoir in the South Creek drainage area than in the South Fork North Creek drainage area.

Ground water

Ground water occurs in subsurface materials throughout Beaver Valley, and probably in all the contiguous mountains (fig. 5). Some of the ground water in the mountainous areas discharges by evapotranspiration, some discharges to mountain streams, and the remainder moves through the bedrock directly into the valley-fill materials in Beaver Valley. Most of the ground water eventually reaches the valley.

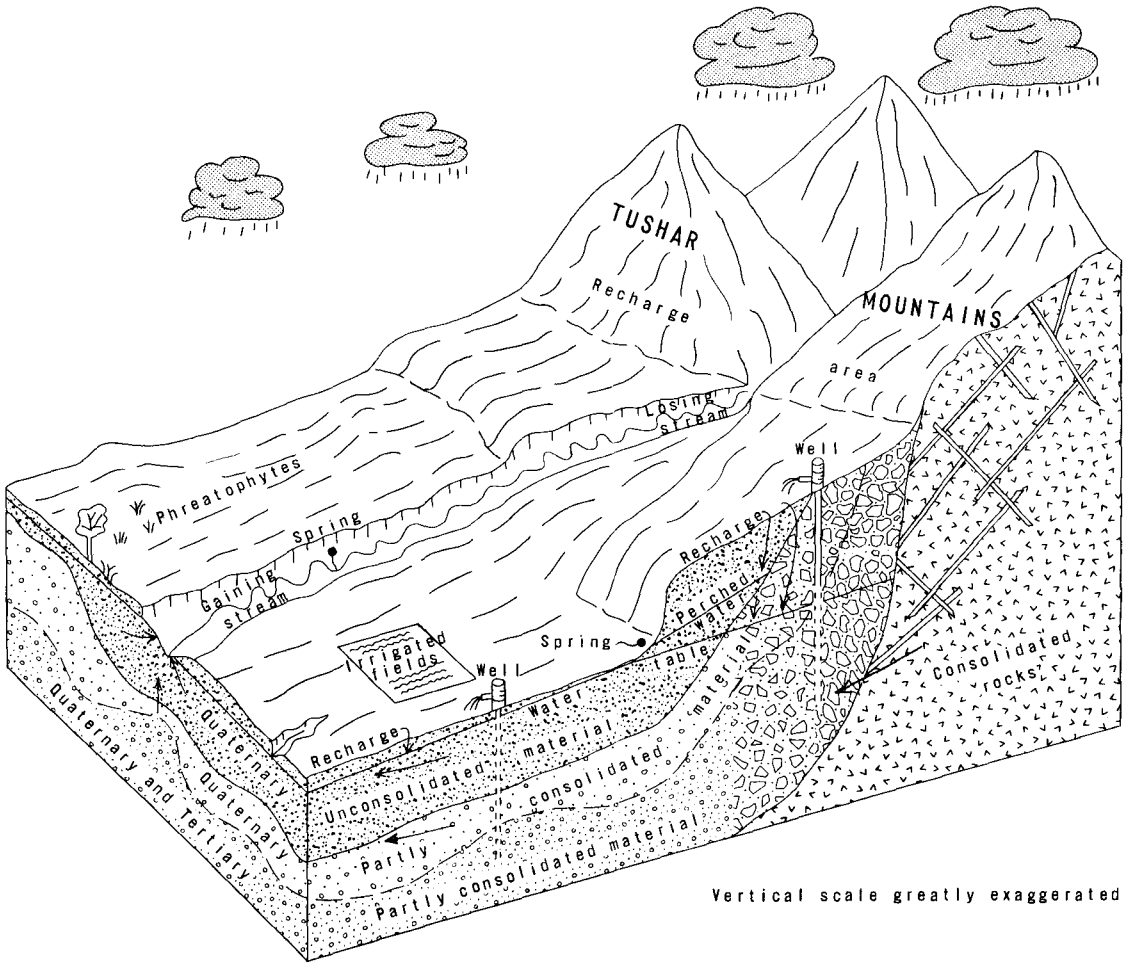

Figure 5.— Sketch illustrating general location of recharge areas, types of occurrence, location of water table, direction of ground-water movement, and discharge points in Beaver Valley. Well at right withdraws only from partly consolidated material; well at left, like most large-yielding wells in the valley, withdraws water from both the unconsolidated and the partly consolidated material.

The quantity and rate of movement of water in various subsurface materials depend in part on the nature of the materials. In unconsolidated or partly consolidated deposits, the size, sorting, and arrangement of the particles are governing factors. Sand and gravel, for example, may contain moderately large quantities of water and transmit it readily. Clay also may contain large quantities of water, but transmits it slowly. In consolidated rock, the joints, fractures, faults, and solution channels are the principal water-bearing voids, and some of them may be large enough to transmit water as freely as a surface stream. Most of them are small, however, and water moves through them as slowly as it does through unconsolidated deposits.

Almost all materials at or near the earth's surface contain and transmit some water, but the porosity and permeability vary greatly. A deposit that readily yields water to wells is called an aquifer. Other deposits have such low permeability that their ability to retard flow or confine water in a contiguous aquifer is of greater hydrologic significance than their ability to transmit water.

The top of the saturated zone in an unconfined aquifer is called the water table and is defined by the level at which water will stand in an open well that is under atmospheric pressure only. Capillary forces hold water in saturated voids above the water table against the pull of gravity; therefore, a capillary fringe extends above the water table to heights varying inversely (within limits) with the sizes of the voids. This capillary fringe is significant chiefly because ground water is consumed by evapotranspiration when the fringe is close to the land surface.

Replenishment or recharge of an unconfined aquifer generally is by downward percolation of water from the land surface, by upward leakage from an underlying confined aquifer, or by lateral movement from another aquifer, such as the consolidated rocks of the contiguous mountains in the Beaver Valley area. Discharge occurs naturally by evapotranspiration, seepage into streams or spring areas, and movement into adjoining aquifers.

In a confined aquifer, natural recharge may occur by downward or lateral movement from adjoining aquifers or by upward movement from underlying confined aquifers. The water in a confined aquifer is under artesian pressure, and when a well taps the confined aquifer, the water rises above the bottom of the confining bed and sometimes above the land surface. The levels at which water would stand in an open well or pipe is called the potentiometric level, and the imaginary surface formed by connecting such levels is called the potentiometric surface. Natural discharge from a confined aquifer generally is by slow upward leakage through the confining bed into an overlying confined aquifer or into an unconfined aquifer.

A perched aquifer may occur by the accumulation of downward or laterally moving water from local recharge where a bed of fine material having low permeability lies above a deeper water table. Thus, an unsaturated zone exists between the deep water table and the body of perched water above it. Although water usually moves slowly down through the fine-grained bed supporting the body of perched water, most perched bodies may never drain completely. They enlarge during periods when the rate of infiltration from recharge exceeds the rate at which water moves downward through the fine bed, and they shrink during periods of little or no recharge.

In some areas, ground water in two or more aquifers is so intimately related naturally that there is relatively free movement of water between them, and thus oftentimes they are developed as a unit. Such is the case in Beaver Valley where, for purposes of the current study, all water-bearing deposits composing the valley fill are considered to be a single hydrologic unit, designated herein as the principal ground-water reservoir.

The principal ground-water reservoir

The principal ground-water reservoir at any specific location in Beaver Valley includes materials of one or more of the following units: Sevier River Formation, the older alluvium, and the younger alluvium (table 1). This reservoir extends throughout the three hydrogeologic units containing unconsolidated to partly consolidated materials and has a maximum saturated thickness of at least 800 ft (240 m) and possibly more than 1,000 ft (305 m). Good hydraulic continuity does not exist everywhere between these hydrogeologic units nor between different strata of the same unit because of the lenticular nature of some deposits containing fine to coarse materials and because some strata are more consolidated than others. Nevertheless, hydraulic connection between different stata of the principal ground-water reservoir was proven during aquifer tests, when pumping one well quickly caused water-level declines in other wells completed in different strata.

During relatively short-term aquifer tests (less than 1 week of continuous pumping), the magnitude of the effects in observation wells varied inversely with the vertical distance between the beds tapped by the pumped well and by the observation wells. This effect was observed during aquifer tests even when observation wells were completed in a different hydrogeologic unit than the one in which the pumped well was completed.

Over a relatively long period (several months or more) of continuous or intermittent pumping or of continuous nonpumping, the hydraulic head in all components of the ground-water reservoir has sufficient time to respond to pressure changes induced by pumping. For all long-term analyses, therefore, the principal ground-water reservoir must be analyzed as a unit.

Occurrence

Most of the ground water in Beaver Valley occurs in an unconfined ground-water reservoir consisting of three hydraulically connected components of different geologic age and composition. A small area of confined water in the vicinity of Greenville is not considered to be a separate aquifer, but is included as part of the principal ground-water reservoir because the confining materials are only slightly less permeable than the materials in the other beds, and also as explained by Lee (1908, p. 26) "The wells in the low ground flow apparently not because of pressure caused by an impervious layer overlying a water-bearing stratum, but because these wells afford places of comparatively easy escape for water which would eventually reach the surface by natural means, but which is somewhat retarded on account of friction within the beds through which it passes."

One small, but untapped, body of perched water occurs about 3 mi (5 km) southwest of Beaver and a larger body occurs in the North Creek drainage area from about 1 to 6 mi (2 to 10 km) northeast of Beaver. Hofheins Spring, (C-29-7)32aac-S1, and Susi Spring, (C-29-7)32abd-S1, discharge from the small body of perched water, and some domestic and stock wells tap the larger perched aquifer northeast of Beaver. Most of the perched water in both areas provides recharge to the principal aquifer.

Hydraulic properties of the ground-water reservoir

The capacity of an aquifer to transmit and store water is described by the transmissivity of the aquifer, the hydraulic conductivity of the water-bearing material, and the storage coefficient of the aquifer.

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, as used in this report, 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.

The hydraulic conductivity (K) of a water-bearing material is the volume of water that will move through a unit cross section of the material in unit time under a unit hydraulic gradient. The units for K, as used in this report, are cubic feet per day per square foot $[(ft^3/d)/ft^2]$, which reduces to ft/d. The term hydraulic conductivity replaces the term field coefficient of permeability, which was formerly used by the U.S. Geological Survey and which was reported in units of gallons per day per square foot. To convert a value for field coefficient of permeability to the equivalent value of hydraulic conductivity, divide by 7.48; to convert from hydraulic conductivity to coefficient of permeability, multiply by 7.48.

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. 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.

Specific yield (Sy) is defined as the ratio (sometimes expressed as a percentage) of the volume of water that an aquifer will yield by gravity to the volume of the aquifer dewatered. The specific yield is generally several thousand times larger than the small quantity released by compaction of an aquifer and expansion of the water. For practical purposes, the specific yield (Sy) can be considered equal to the storage coefficient (S) for unconfined aquifers.

Knowledge of aquifer characteristics allows prediction of hydraulic behavior of an aquifer under specified pumping or other stresses. The hydraulic properties of an aquifer can be estimated from detailed lithologic descriptions and the observed thickness, but more accurate quantitative estimates are obtained from laboratory or field tests.

The most reliable values for the hydraulic properties of the ground-water reservoir in Beaver Valley were determined by analyzing data from three pumping-test sites where the pumped well tapped all or most of the aquifer. In addition, transmissivity was estimated at 28 sites from the specific capacities (table 11) of wells that yield more than

350 gal/min (22 L/s). In some other areas where there are no large-yield wells, transmissivity was estimated from lithologic logs by multiplying hydraulic conductivity values, assigned according to different materials (table 4), by the estimated thickness of the ground-water reservoir. Estimated transmissivity values in most of Beaver Valley, however, were determined by use of the digital-computer ground-water model for the area. The computer derived transmissivity values fit well with the measured field values. The computer values were generally smaller than the field values because the reservoir is shallower or is finer grained away from the test areas.

Table 4.—Estimated average values of hydraulic conductivity, K, in feet per day, of materials described in drillers' logs of wells in Beaver Valley

Gravel	400
Boulders	200
Sand and gravel	100
Sand	25
Sand, clay, and gravel	10
Sand and clay	3
Hardpan and cemented materials	1
Clay or silt or a combination	1

Data from the aquifer tests were analyzed by the Theis equation (1935) and by the straight-line solutions of Cooper and Jacob (1946). Transmissivity and hydraulic conductivity at some wells were estimated from specific capacity by using a method described by Theis, Brown, and Meyer (1963). The map of transmissivity (fig. 6) of the ground-water reservoir in Beaver Valley was prepared from values of hydraulic conductivity and reservoir thickness used in the digital model because field measurements are available for only a few points. The nature of digital models is such that much generalization of input data is required. Thus, the transmissivity values shown in figure 6 should be applied with caution at specific local sites.

During the aquifer tests, wells were pumped at a measured constant rate for periods ranging from 81 to 163 hours; and water-level measurements were made periodically in as few as one and as many as five observation wells at distances ranging from 242 to 2,440 ft (74 to 744 m). The area influenced by pumping from an unconfined aquifer for such short periods is small, and the results apply only to small areas in the vicinity of the pumped wells.

The transmissivity (T) of the ground-water reservoir ranges from about 0 to slightly more than 10,000 ft^2/d (930 m^2/d). The largest values of T are generally in the vicinity of the larger perennial streams where the upper part of the ground-water reservoir consists mostly of unconsolidated coarse deposits.

The computed storage coefficients (S) range from about 0.20 in some parts of the reservoirs, generally where the aquifer materials are coarsest, to about 0.001 in the semiconfined parts as near Greenville. S, as determined from the relatively short-term pumping tests, such as were run in Beaver Valley, is an apparent value only; it becomes larger and approaches a true value only after a relatively long period of time, perhaps a year or longer, when all the water than can be drained by gravity has moved out of the dewatered section. Initially, when pumping begins at a well tapping an unconfined aquifer, ofttimes most of the early discharge is derived from compaction of the aquifer materials and expansion of the water. As pumping progresses, an increasing percentage of the discharge is derived from the area that is dewatered between the water table prior to pumping and the water table during pumping. This area is called the "cone of depression." Water may drain from the cone of depression slowly--perhaps over a period of several years, if the cone remains. It is for this reason that ofttimes S cannot be determined accurately from short-term aquifer tests, although procedures are available for determining S for some tests.

Studies with a neutron-radiation meter to determine S in the Milford area, in the next valley west of Beaver Valley, yields an average value of 0.20 for use during analysis periods of 1-20 years (Mower and Cordova, 1974, p. 15). On the basis of the Milford study, and because some of the aquifer materials in both valleys are from the same source, S probably averages about 0.20 in the Beaver Valley ground-water reservoir. This value was confirmed during verification of the ground-water model.

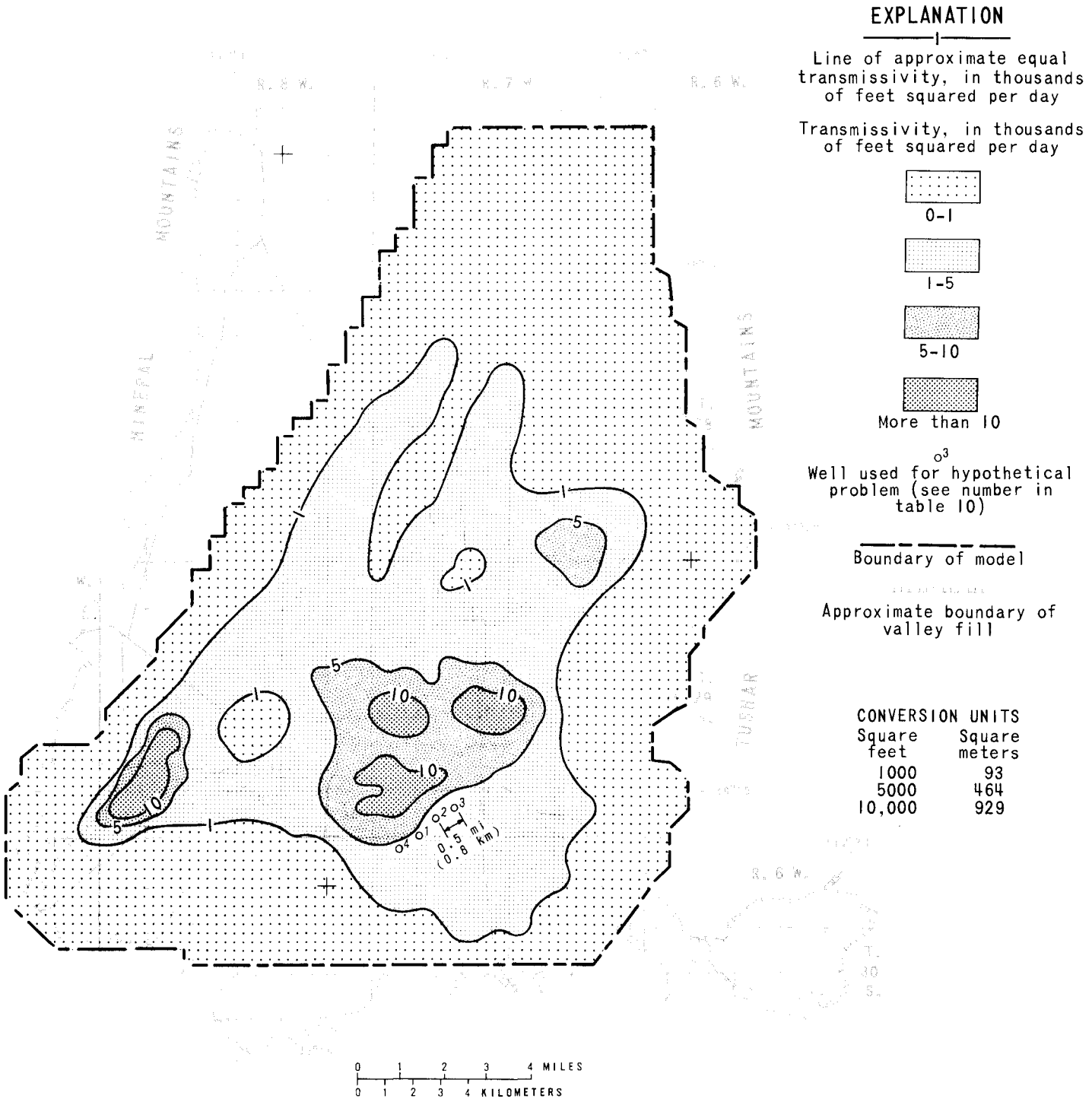

Figure 6.— Transmissivity of the ground-water reservoir as used in the digital-computer model.

Recharge

Recharge to the principal ground-water reservoir in Beaver Valley is from four principal sources (table 5). All the recharge is derived from precipitation, however, within the Beaver Valley drainage area.

Table 5.—Summary of estimated ground-water recharge to the principal ground-water reservoir in Beaver Valley

	Average annual quantity (acre-ft)
Subsurface inflow from bedrock in the mountains	7,600
Infiltration of seepage from irrigation sources, 1931-60 average	38,900
Infiltration of seepage from ground-water pumpage	7,000
Infiltration from precipitation on the valley plain	2,100
Total (rounded)	56,000

Subsurface inflow from bedrock in the mountains

The amount of ground water entering Beaver Valley in the subsurface from the mountains surrounding the valley probably has remained nearly constant since the valley was settled more than a century ago. Essentially all the inflow from the bedrock enters the principal ground-water reservoir near the perimeter of the valley. The valley-fill materials composing the ground-water reservoir are coarser grained, and the bedrock is more intensely fractured around the perimeter than in the central part (fig. 5). Thus, at the perimeter the water in the bedrock may move easily into the valley fill.

In the central part of the valley, the valley-fill materials are finer grained, and fine-grained material probably fills the bedrock fractures and greatly restricts ground-water movement. The amount of ground water entering the valley as subsurface inflow was estimated by use of the digital-computer model to be 7,600 acre-ft (9.4 hm^3) per year.

The quantity of ground water entering as subsurface inflow from each of the four sides of the vallley may be estimated by using an equation based on Darcy's Law:

$$Q = TIL \times 365/43{,}560$$

where,

Q = subsurface inflow, in acre-feet per year,
T = transmissivity, in feet squared per day (from fig. 6),
I = hydraulic gradient (dimensionsless) (from fig. 7),
L = length of saturated cross section, in feet (from fig. 6),
43,560 = constant to convert cubic feet to acre-feet, and
365 = days per year.

The section across which subsurface inflow is calculated is placed about 2,000 ft (610 m) inside the valley from the model boundaries to facilitate the calculations. Also, by placing the section in this position, it is assumed that all the subsurface inflow moving toward the valley in the bedrock has entered the principal ground-water reservoir where the more permeable valley fill abuts the bedrock, and it is assumed further that the direction of the ground-water movement is perpendicular to the section. These assumptions may not be entirely valid, but they are sufficiently accurate for the purpose of apportionment of the inflow to the four sides of the valley.

The subsurface inflow at each side of the valley, which corresponds approximately to subsurface inflow from each of the mountains and foothills as indicated, and the data used in the calculations are given in the following table:

Side of valley (mountains)	T (ft^2/d)	I	L (ft)	Q (acre-ft/yr)
East (Tushar)	159	0.0405	102,000	5,500
North (foothills)	14	.0128	20,000	30
West (Mineral)	47	.0065	101,000	260
South (Black)	342	.0102	62,000	1,810
Total (rounded)				7,600

Infiltration of seepage from all irrigation sources

Seepage from canals—Unlined canals in Beaver Valley lose water where they traverse unsaturated unconsolidated to partly consolidate deposits. Vegetation along the canals uses some water and some water evaporates, but most of the water lost from the canals recharges the principal ground-water reservoir. A study in 1974 of selected reaches, usually the first few miles, of nine canals aggregaging 25.3 mi (40.7 km), however, showed only small to moderate gains or losses (Cruff and Mower, 1976).

The total average loss for all nongaining reaches, which have an aggregate length of 21.2 mi (34.1 km) was 4.8 ft^3/s (0.14 m^3/s), and the average unit loss was 0.23 (ft^3/s)/mi [0.004 (m^3/s)/km]. During the seepage runs, an average total of 200.6 ft^3/s (5.68 m^3/s) entered the nongaining reaches, thus the average loss in the canals studied was only 2.4 percent of the available water. The aggregate average loss from all canals in the valley probably is only slightly more than this because the reaches of the canals not studied have smaller perimeters and usually contain water for shorter periods of time.

Four canals in Beaver Valley with an aggregate length of 4.1 mi (6.6 km) were observed to gain water during the 1974 seepage runs, but the data were insufficient to compute a meaningful average; although, like the losses, the amount of gain is small in relation to the amount of available water.

Some seepage from the canals recharges the principal ground-water reservoir, and ultimately some of it reappears in lower canals, the Beaver River, or its tributaries as rejected recharge when the reservoir is full; thus, once again, some seepage becomes available in streams for irrigation. Most of the remainder of the seepage is consumed by evapotranspiration in native pastures and by crops in some of the lower-lying fields. The amount of seepage that reappears in the lower canals or in the Beaver River and its tributaries in comparison to the amount consumed by evapotranspiration is not known.

Recharge derived from canal seepage is closely related to recharge from irrigated fields and probably aggregates only a few hundred acre-feet a year. For these reasons, canal seepage is included with recharge from irrigation in later analyses and discussions in the report.

Seepage from stream channels—Losses from natural stream channels during most years usually comprise only a relatively small quantity because essentially all streamflows are diverted near the canyon mouths. Recharge from stream seepage occurs mainly when the streamflows exceed the carrying capacity of the canals; consequently, the excess continues down the channel. During most years, this excess flow usually occurs for no more than a few weeks during late spring and early summer, and it never occurs during some years.

Most of the recharge derived from stream-channel seepage occurs in a 3-mi (4.8-km) reach of the Beaver River from the mouth of the canyon to about the east edge of Beaver and in an 8-mi (13-km) reach of North Creek from the mouth of the canyon to a point about 1 mi (1.6 km) northwest of Beaver. The channel beds along these reaches,

which are composed principally of gravel and boulders, lie above the water table most of the year. The beds of all other stream channels are composed principally of clay and silt; therefore, there is little or no stream-channel seepage even on the rare occasions when the channels contain water.

The amount of recharge derived from stream-channel seepage, which probably averages only a few hundred acre-feet per year, is included in the amount of recharge derived from irrigation for the same reasons as given for the seepage from canals.

Seepage from irrigated fields—The amount of seepage from irrigated fields recharging the ground-water reservoir in Beaver Valley depends largely on the amount of water applied. Records of diversions from streams are incomplete, but all the flow of the four major streams is diverted most of the time. The quantity of water diverted can be estimated fairly accurately because the recording gages on the streams are located a short distance above the irrigation diversions, and one gage on the Beaver River is located below all major diversions. The method used to determine quantity of ground water used for irrigation is explained in the section on discharge from wells. The annual long-term average amount of irrigation water available from all surface- and ground-water sources is 54,400 acre-ft (67.1 hm^3) (see table 6).

The long-term average annual diversions for 1931-60 are used because this is the period for which the long-term areal precipitation averages are available. The average annual quantity of inflow from the mountains that is diverted from the Beaver River is the difference between the flow at the stations Beaver River near Beaver and Beaver River near Adamsville, after accounting for the gain in the reach between Beaver and Adamsville. The amount of gain was computed from observations made at weekly intervals during the 1974 irrigation season. Because of the absence of measurements at any other time, the amount computed for 1974 is assumed to be a long-term average.

Table 6.—Summary of water diverted annually for irrigation and amount going to recharge, in acre-feet

Stream or source	Quantity of water diverted	Long-term average recharge, 1931-60: Basis of Dept. of Ag. irrigation efficiency (27 percent)	Basis of potential consumptive use	Digital-computer model: Percent of diverted water	Digital-computer model: Quantity
Indian Creek	3,970	2,900	2,610	60	2,380
North Creek	13,700	10,000	9,010	73	10,000
South Creek	1,780	1,300	1,170	73	1,300
Beaver River inflow from mountains	25,100	18,300	16,500	73	18,320
Stream accretion in the valley	9,200	6,700	6,600	70	6,400
Ground water (pre-1950)	700	510	460	70	490
Total (rounded)	54,400	39,700	36,400		38,900

Diversions from Indian, North, and South Creeks during 1931-60 were assumed to be proportional to the flow of the Beaver River during this same period. Also, it is assumed that diversions from the Beaver River of inflow from the mountains are proportional to the flow of the river at the gaging station near Beaver. The mean annual flow of the Beaver River during 1966-74 was 34,000 acre-ft (41.9 hm^3) (table 3), but the average during 1931-60 was 36,690 acre-ft (45.2 hm^3) (table 2), thus the long-term average diversion (1931-60) is larger than that for the 1966-74 period by about 8 percent.

The following calculations for Indian Creek can be used as an example to explain how diversions from the other streams were estimated:

$$\text{Diversions from Indian Creek 1931-60} = \text{Indian Creek mean flow 1966-74} \times \frac{\text{Beaver River diversions 1931-60}}{\text{Beaver River mean flow 1966-74}}$$

$$\text{Substituting: (data from tables 2 and 3)} = 5{,}380 \times \frac{25{,}100}{34{,}000}$$

$$= 3{,}970 \text{ acre-ft}$$

The amount of infiltration from irrigated farms will decrease as more efficient farm distribution systems and irrigation methods are employed. Some infiltration from irrigated fields is necessary, however, to prevent an excessive accumulation of harmful salts in the soil and to insure adequate restoration of soil moisture in all parts of the fields. More efficient use of the irrigation water is being attained on some farms by land leveling and by use of sprinkler-irrigation systems, concrete ditches, and pipelines.

No comprehensive studies of irrigation efficiencies are known to have been made in Beaver Valley that are available for determining precisely the amount of recharge from irrigation. The U.S. Department of Agriculture (1973b, app. II, table 9), however, estimated the overall irrigation efficiency, which includes conveyance on farm systems for both ground and surface water, to be 26 percent in the Beaver-Greenville area and 28 percent in the Manderfield area. The estimates by the Department of Agriculture were based primarily on information obtained in interviews with the local landowners and irrigation company officials (Gareth Spencer, oral commun., Oct. 1, 1975).

An average efficiency of 27 percent for the entire valley was used during the first trial runs of the digital model. This percentage was found to be too low in the area irrigated with water from accretions to streams in the valley. The irrigation efficiencies were estimated from model analyses to be 40 percent in the Beaver-Greenville area and 30 percent in the Manderfield area.

The average annual long-term recharge derived from irrigation losses, as based on irrigation records for 1931-60, is 38,900 acre-ft (48.0 hm^3) or 72 percent of the diverted water. The average annual recharge as return flow from ground water withdrawn for all purposes is estimated to be 74 percent of the withdrawals in 1974 (table 16) less the average amount withdrawn during 1931-60 (table 6) or 0.74 x (9,900 acre-ft - 700 acre-ft) = 7,000 acre-ft (rounded).

The amount of recharge that is derived from irrigation water may also be estimated by subtracting the computed potential consumptive use by irrigated crops in Beaver Valley from the amount of water diverted. Potential consumptive use for a specified period may be defined as the amount of water needed by vegetation in building plant tissue and the amount evaporated from the soil or precipitation intercepted by the plant foliage.

The potential consumptive use of water by irrigated crops in Beaver Valley was computed to be 18,000 acre-ft (22.2 hm^3) by the Blaney-Criddle formula (Criddle and others, 1962). The difference between the quantity of water diverted and the potential consumptive use by irrigated crops is the amount of recharge from irrigation water, which is 36,400 acre-ft (44.8 hm^3) (table 6). This quantity is confirmed by the value obtained with the digital model.

Infiltration from precipitation on the valley plain

The average annual precipitation on most of the valley plain is less than 12 in. (305 mm) (pl. 1). This quantity is much less water than would be consumed by vegetation if the optimum quantity that could be consumed was available. Therefore, everywhere on the valley plain, except at some irrigated fields and meadowlands, where the

quantity of available water exceeds the optimum quantity that can be consumed by the vegetation, contribution to recharge from precipitation is nil.

Precipitation may contribute to recharge from irrigated fields that are saturated so that any additional water supplied will move downward beyond the root zone and recharge the ground-water reservoir. The total estimated average annual recharge from precipitation on irrigated fields and meadowlands is 2,100 acre-ft (2.6 hm^3).

In the discussion of infiltration from irrigated fields, it was shown that historically 60 to 73 percent of the diverted water recharged the ground-water reservoir. Recharge may diminish in the future as the irrigation systems and methods are made more efficient. It may be assumed, therefore, that at least an equivalent percentage of the precipitation during the irrigation season on the same irrigated fields also recharges the ground-water reservoir when the soils are saturated.

Precipitation in the irrigated parts of the valley during the irrigation season, April-September, averages about 6 in. (150 mm) (U.S. Weather Bureau, 1963), and the soils are saturated beyond their capacity to hold water against the pull of gravity for an estimated one day out of ten assuming that irrigation occurs at 10-day intervals. During the 9 days between irrigations the quantity of precipitation usually is not sufficient to saturate the root zone and it is consumed; therefore, none is available for recharge. Thus, the amount of water from precipitation on the 8,000 acres (3,200 hm^2) of irrigated areas, including residential areas (table 9), that reaches the ground-water reservoir is (6/12) x (1/10) x 8,000 = 400 acre-ft (0.49 hm^3) per year.

Precipitation may contribute directly to recharge in phreatophyte areas (pl. 2) where the capillary fringe is at or near the land surface and indirectly by supplying water to plants that usually derive their supply from the ground-water reservoir. These processes are closely related and both occur in the same localities. No attempt was made, therefore, to determine the quantity of recharge from each process, although most of the direct recharge occurs during the nongrowing season, and most of the indirect recharge occurs during the growing season.

Logically, it may be assumed that the minimum quantity of recharge from precipitation on meadowlands is at the same rate as on irrigated lands. Recharge in the meadowlands is greater per unit area, however, because when the capillary fringe is at or near the land surface a small addition to soil moisture may result in recharge. It is estimated that the meadowlands are sufficiently saturated 3 months a year and that all precipitation there goes to recharge.

Recharge from precipitation on the 6,700 acres (2,700 hm^2) of meadowgrass areas (table 9) therefore is estimated to be 12/12 x 0.25 x 6,700 = 1,700 acre-ft (2.1 hm^3) per year.

There is little or no recharge from precipitation in most of the greasewood and rabbitbrush areas. The reason for this is because the depth to the water table, usually 5-20 ft (1.5-6.1 m) below the land surface, prevents continuity between the saturated soil and the upper part of the capillary fringe. Precipitation amounts usually are insufficient to create the continuity necessary for recharge.

Movement

Ground water moves from the recharge areas downgradient in the direction of the slope of the water table or potentiometric surface and approximately at a right angle to the water-level contours. The general direction of ground-water movement in Beaver Valley is shown on plate 1; more detailed information on the direction of flow in spring 1974 is available by analysis of the water-level contours shown in figure 7.

The wells in which water levels were measured for the preparation of the potentiometric map range from about 15 to 1,000 ft (6 to 305 m) deep. Most wells are perforated through the saturated valley-fill material. The water-level measurements were made in March-June 1974, a period during which the water levels in most wells reached the highest level for the year. The water-level contours, therefore, show the ground-water surface as it existed at that time. The general shape of this surface may vary from that in figure 7 as recharge and discharge vary, or at sites away from data points depending on difference in depth with depth of well at the data point.

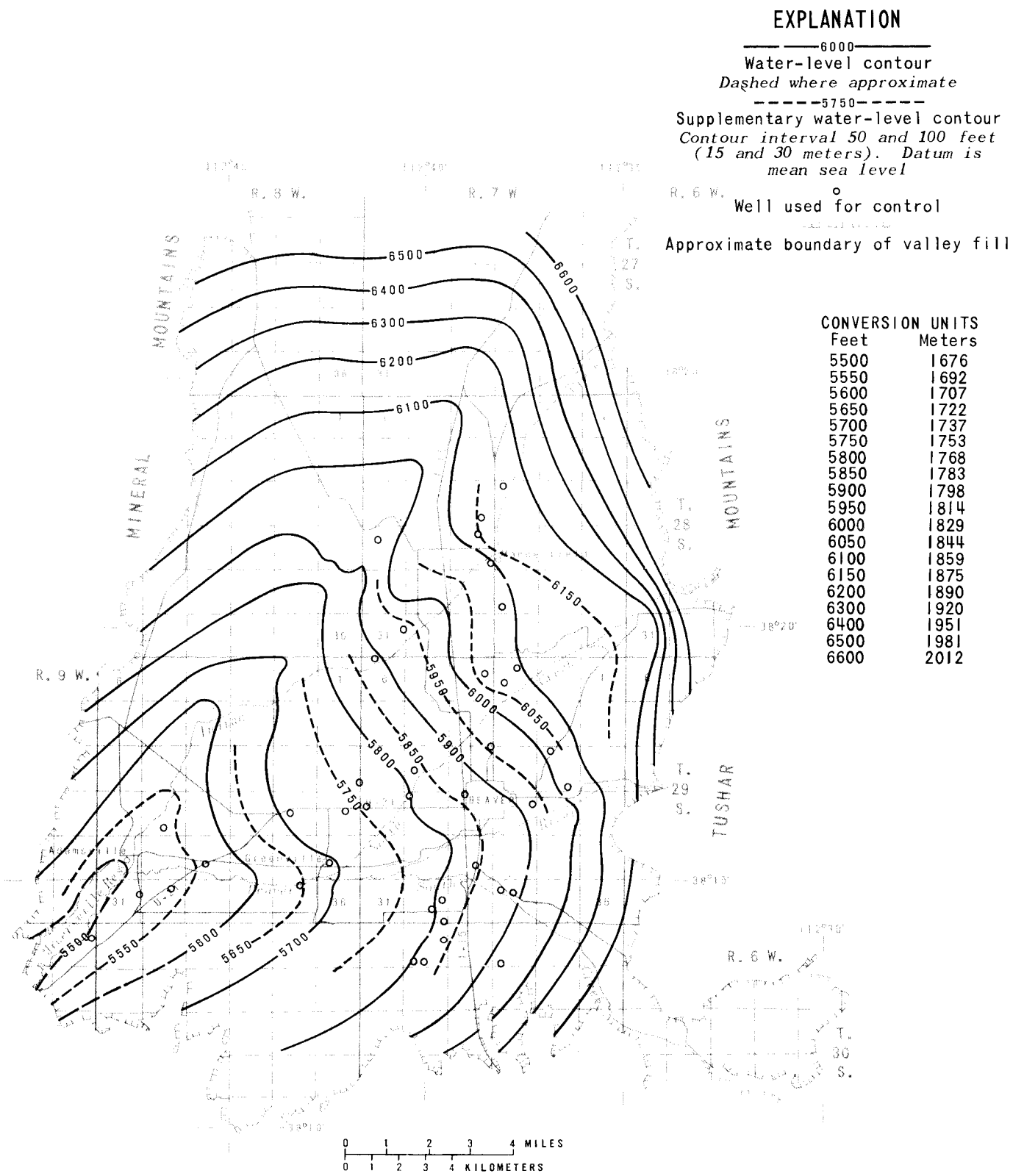

Figure 7.—Map of Beaver Valley showing water-level contours, spring 1974.

Wells in which water levels could be measured were sparse in most of the valley and nonexistent in some places, as in the area generally west of Wildcat Creek. For this reason, the locations of the water-level contours are approximate in much of the valley and highly conjectual in the northwestern part.

The general direction of ground-water movement, however, is as shown on the map, but the direction may be somewhat different locally. The configuration of the potentiometric surface (fig. 16) as used in the digital-computer analysis is slightly different from the configuration shown in figure 7, because of the generalization necessary in the construction of the model and because the two maps represent different times, 1949 and 1974, respectively.

Ground water moves from deeper to shallower zones within the ground-water reservoir throughout most of the valley because the higher hydrostatic pressure in the deeper zones causes upward leakage through the semiconfining beds into shallower zones with lower hydrostatic pressure. The water is eventually discharged at the land surface in the lower parts of the valley. The usual upward component of the hydraulic gradient may be reversed locally by pumping, which causes the head in the deeper zones to decline below the head in shallower zones, and may also be reversed locally when recharge from irrigation losses is sufficient to cause the head in the shallower zones to rise above the head in the deeper zones.

The rate of movement of ground water is extremely slow in comparison to the rate of flow of surface streams. The velocity of ground water (v) is governed by the hydraulic conductivity (K) and porosity (θ) of the aquifer materials and the hydraulic gradient (I) in accordance with the equation:

$$v = KI/\theta$$

An example is afforded by substituting in equation 3 the data applicable to the area about 1 mi (1.6 km) north of Beaver. K is 10 ft/d (3 m/d), I is 0.015 (figs. 17 and 7), and θ is estimated to average 0.35. Hence,

$$v = [(10 \text{ ft/d}) \times (0.015)]/0.35 = 0.43 \text{ ft/d } (0.13 \text{ m/d})$$

This average horizontal velocity of 0.43 ft/d (0.13 m/d), or about 160 ft/yr (49 m/yr), may be typical of ground-water velocities in the Beaver-North Creek area, but large variations are to be expected because of variations in hydraulic gradient and hydraulic conductivity. The above example represents conditions during spring 1974 when no large withdrawals were being made from wells in the area.

The range of hydraulic conductivities of the aquifer materials is 1 to 400 ft/d (0.3 to 122 m/d) (table 4). Assuming the same hydraulic gradient as in the example, the velocity of water in a bed consisting only of one of the types of material listed in the table could range from one-tenth as much to 40-times greater than the average in the example, or about 16 to 64,000 ft/yr (4.9 to 1,950 m/yr). It is likely that locally in some beds the velocities may approach these extremes.

Areal variations of the hydraulic gradient are indicated by the difference in spacing of the contour lines on the map of the potentiometric surface. The range of average values is from about 0.032 ft/ft (170 ft/mi or 32 m/km) in the east-central part of the valley to about 0.002 ft/ft (10 ft/mi or 2 m/km) in the southwestern part of the valley.

The hydraulic gradient within the ground-water reservoir is steepest in the younger alluvial-fan deposits, where the reservoir generally is thinnest, and flattest in the older alluvium and in the Sevier River Formation. A combination of steep hydraulic gradient and large hydraulic conductivity, as in the area between Beaver and North Creek, tend to produce high velocities and rapid movement of water. Conversely, the moderate to steep hydraulic gradients in combination with low hydraulic conductivities result in lower velocities in the northwestern part of the valley.

Water-level fluctuations

Measurements of water levels in Beaver Valley have been made in some wells since 1935. Graphs of the water levels in nine selected observation wells in different parts of the valley are shown in figures 8 and 9, and the water levels in 44 selected wells are given in table 13. The locations of the observation wells are shown on plate 1.

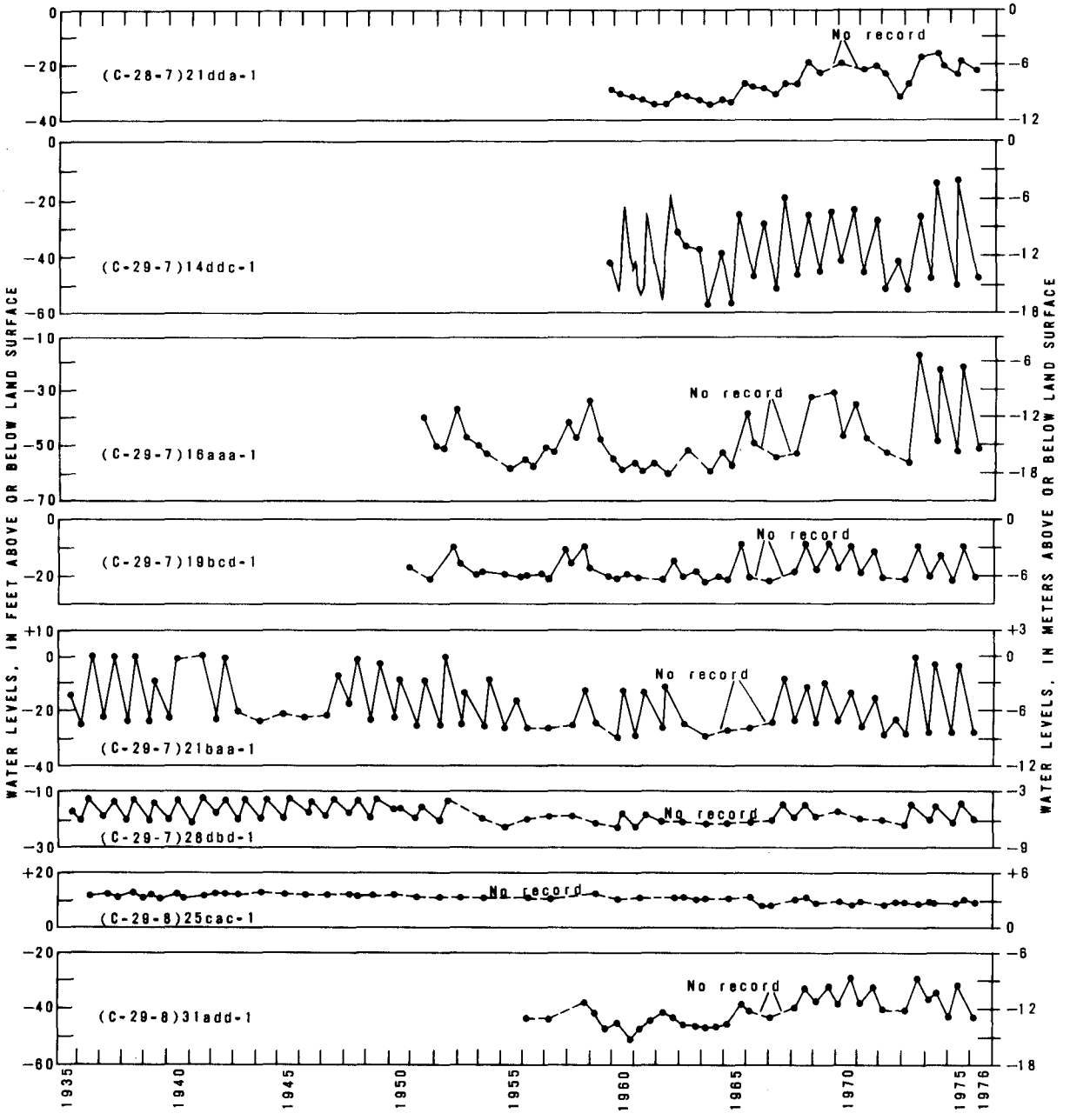

Figure 8.—Water levels in selected wells in Beaver Valley, 1935-76.

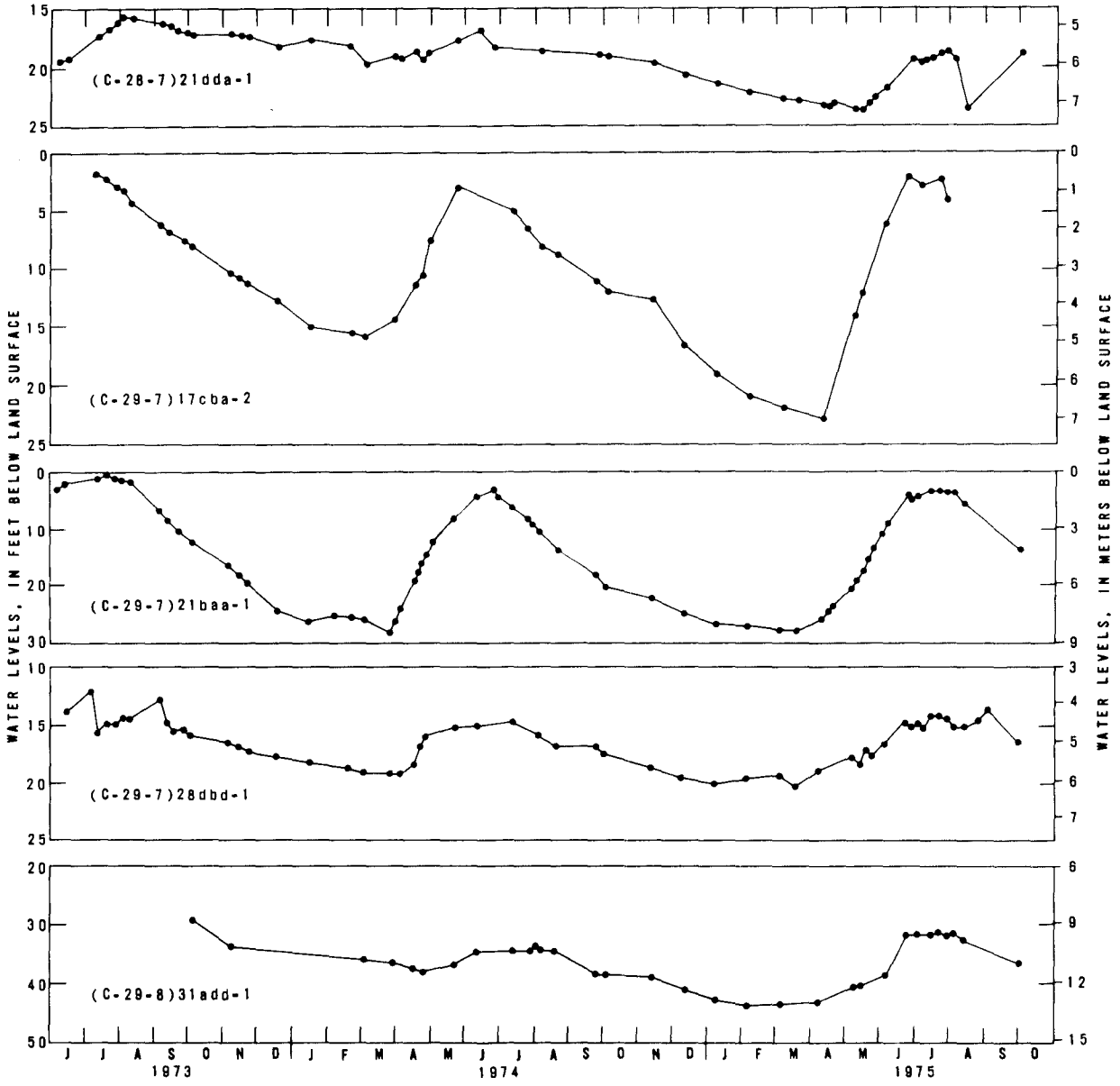

Figure 9.— Seasonal water-level fluctuations in selected wells in Beaver Valley, 1973-75.

The long-term (a few decades) trend of water levels in the observation wells has not changed significantly since periodic water-level measurements were begun in 1935. This long-term water-level trend suggests that the ground-water system had reached equilibrium in most parts of the valley by 1935 from the stresses imposed after the streams were diverted for irrigation of valley lands beginning in the mid-nineteenth century. Locally, in a few small areas somewhat removed from the principal recharge areas, the hydrologic system has been disturbed slightly since 1935 by withdrawals from large-yield wells.

Withdrawals for irrigation in or near most areas irrigated with surface water is replenished early in the following irrigation season. Large irrigation losses from the usually plentiful supply from surface streams in late spring and early summer move rapidly to the ground-water reservoir. Ground-water levels rise rapidly, consequently reaching a peak at about the same time or soon after runoff peaks in the streams.

Water levels in most wells below Beaver usually peak at about the same altitude each year regardless of the amount of surface runoff, suggesting that the ground-water reservoir in that area is filled to capacity every year. The hydrographs shown in figure 8 for wells (C-29-7)21baa-1 and (C-29-7)28dbd-1 illustrate this phenomenon for the years in which the water levels were measured at the approximate annual peak. For example, during 1936-47 and 1973-75 water levels were measured periodically at short intervals of time during late spring and early summer (see table 13). The time intervals were short enough that at least one measurement was at the approximate annual peak at each well.

During most of the other years, the water levels were not measured at the proper time to determine the peak. Because the ground-water reservoir is filled, and the peak level reaches the same approximate altitude nearly every year, the evidence suggests that there has been little or no change in ground-water storage and no change in long-term water levels since 1935.

Storage

The amount of ground water in storage in the principal ground-water reservoir in Beaver Valley was estimated from the volume of saturated deposits and their water content. The volume of saturated deposits in the ground-water reservoir is estimated from the map showing the thickness of saturated valley fill (fig. 10) as 34 million acre-ft (42,000 hm^3).

The water content of the saturated materials was estimated from well logs by assigning an estimated water content to various lithologic types (table 7). The values given in table 7 were based on a laboratory and field study by Mower and Cordova (1974, p. 24-27) of soil moisture in the Milford area. One lithologic log was examined for each square mile of land where logs were available; usually the log of the deepest well in the section was used.

It was estimated from the logs and from the data in table 7 that the saturated materials in the valley contain an average of 35 percent water by volume. The amount of ground water in storage in the principal ground-water reservoir, therefore, is 0.35 times 34 million acre-ft (42,000 hm^3) of saturated materials, or about 12 million acre-ft (15,000 hm^3), only about 60 percent of which may be recoverable. Part of the other 40 percent is held so tightly by the aquifer materials that it cannot move to wells and part is in inaccessible areas.

Table 7.—Estimated water content of saturated deposits of the principal ground-water reservoir

Lithologic material as described by drillers	Water content (percent)
Clay; clay and silt	50
Clay and sand; sandy clay	40
Sand	30
Gravel	25
Sand and gravel	20
Hardpan; conglomerate; all other cemented materials	10

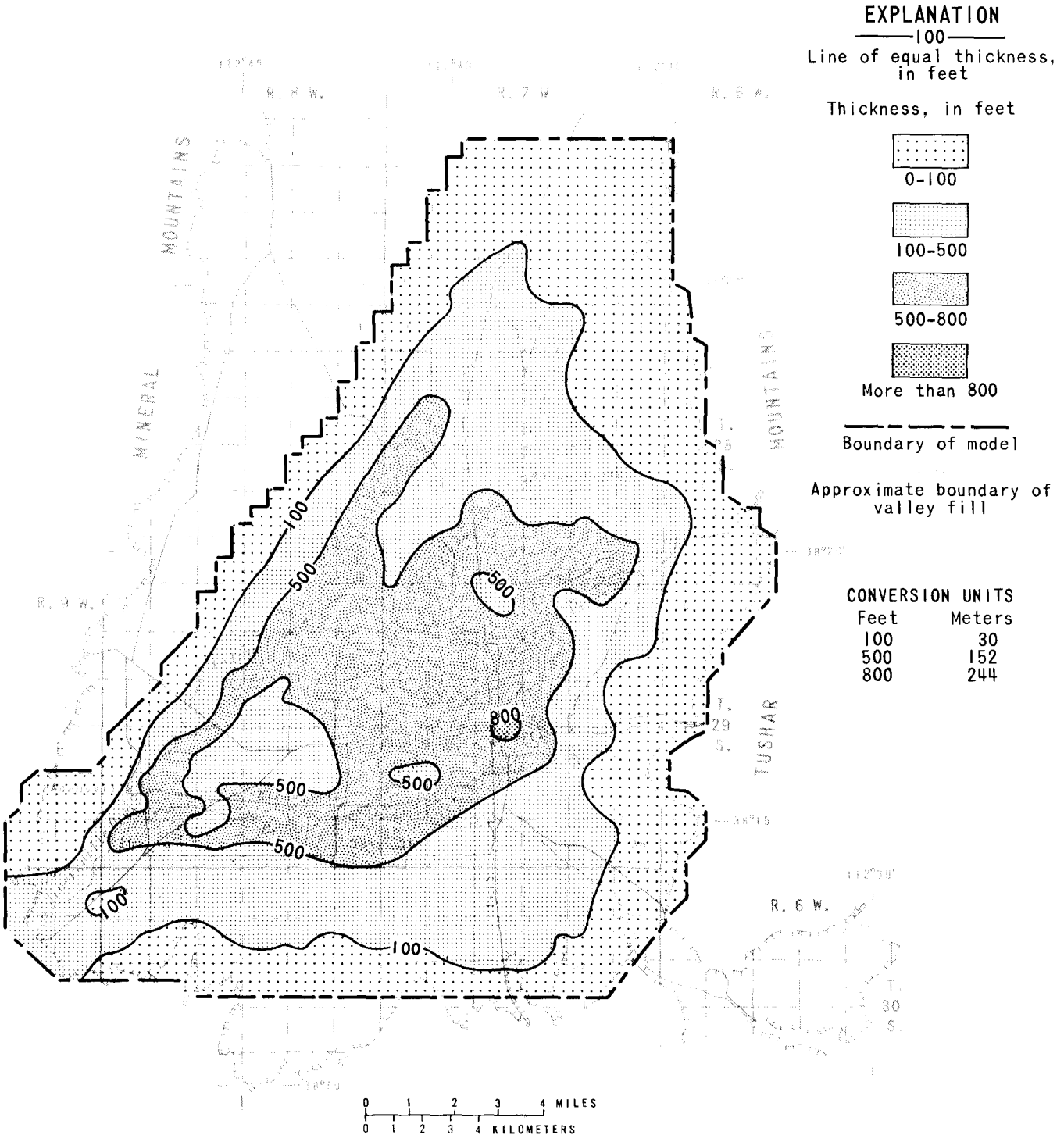

Figure 10.—Thickness of the ground-water reservoir as used in the digital-computer model.

The amount of ground water in storage is greater than the amount that is available for withdrawal from storage. One measure of the amount of water available from storage is the quantity of water that can be removed from storage in a ground-water reservoir by lowering water levels a specified distance. This quantity is determined by the volume and the specific yield of the reservoir.

An average change in water level of 1 ft (0.3 m) from the spring 1974 level (fig. 7) over an area of 1 mi^2 (2.6 km^2) would result in a change in ground-water storage of 128 acre-ft (0.158 hm^3), assuming an average specific yield of 0.20. For the entire area underlain by the principal ground-water reservoir, the 1-ft (0.3-m) change represents a change in storage of about 29,000 acre-ft (36 hm^3).

In estimating the amount of change in storage, due consideration must be given to the difference between the water levels being studied and those of spring 1974, because the areal extent of the aquifer changes with changes in the saturated thickness. The lower curve in figure 11 shows the amount of water that can be withdrawn from storage at various average water levels below those of spring 1974. The amount of water recoverable from storage per foot of decline gradually decreases as water levels decline; the amount is about 29,000 acre-ft/ft (117 hm^3/m) at 1974 levels and would be about 15,000 acre-ft/ft (61 hm^3/m) when water levels are 100 ft (30.5 m) below 1974 levels.

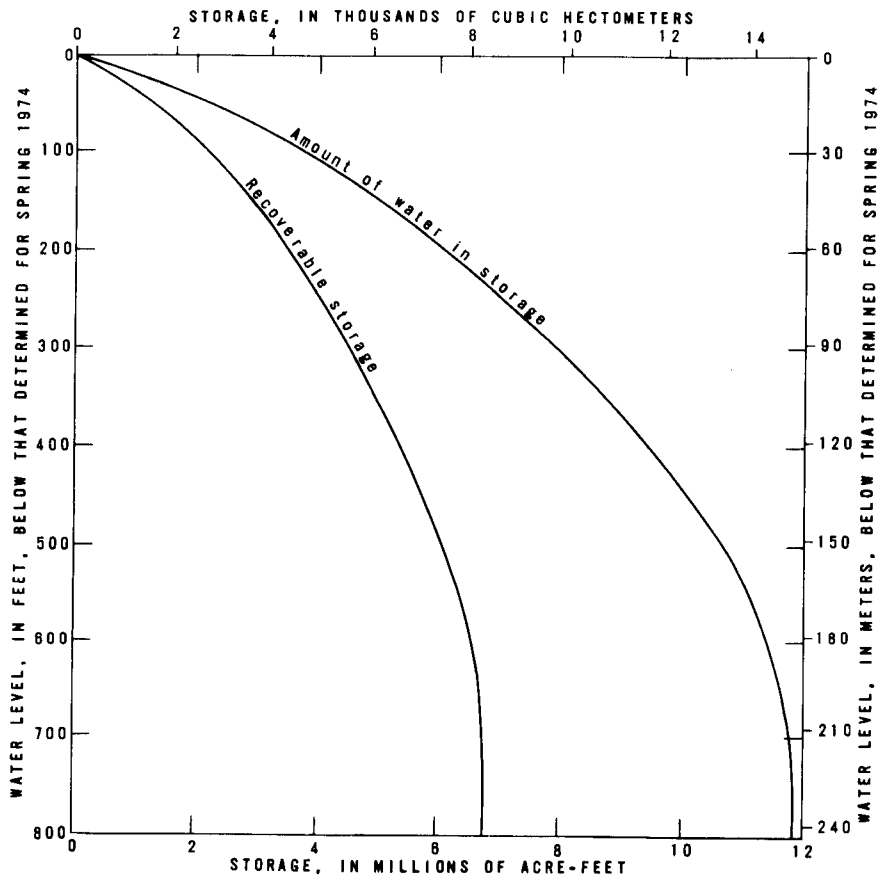

Figure 11.—Approximate amount of water in storage in the principal ground-water reservoir in Beaver Valley and the approximate amount that can be withdrawn with uniform lowering of water levels below the levels of spring 1974.

Ground-water storage in the valley was near its maximum in 1974, when water levels in most parts of the valley were at or near their highest levels of record (see section on water-level fluctuations).

Discharge

Ground water in the principal ground-water reservoir in Beaver Valley is discharged by (1) springs, (2) evapotranspiration, (3) subsurface outflow, and (4) wells. Before irrigation began in the valley and the resulting change in recharge with water diverted from the several streams that enter the valley from the Tushar Mountains, the long-term average annual discharge equaled the average annual recharge. Recharge from the developing irrigation projects went into ground-water storage, some of which accumulated and increased the amount of the long-term storage, but some storage was more ephemeral because it was discharged in the lowland areas each year.

It is assumed that the ground-water system was in equilibrium in 1935, which was before relatively large withdrawals of ground water began for irrigation. Withdrawals from wells may be derived from (1) an increase of recharge to the ground-water reservoir, (2) a decrease of natural discharge, (3) a decrease of the amount of water in storage, or (4) various combinations of these sources. The ground-water discharge is summarized in table 8, and the details are discussed in the following sections.

Table 8.—Summary of the ground-water discharge from the principal ground-water reservoir, 1974

Source	Average annual quantity (acre-ft)	
Springs		
In marsh area between Beaver and Adamsville	23,000	
In bottom of Minersville Reservoir	2,200	
In Indian Creek drainage	1,800	
In sec. 4, T. 29 S., R. 7 W.	900	
Total springs (rounded)		28,000
Evapotranspiration		18,000
Wells		
Domestic and stock	100	
Public supply and industrial	900	
Irrigation	8,900	
Total wells (rounded)		9,900
Subsurface outflow		300
Total discharge (rounded)		56,000

Springs

A large number of springs discharge water from the ground-water reservoir in the lower reaches of Beaver Valley, particularly in the area from the vicinity of Beaver to the vicinity of Greenville. Springs are most numerous at the foot of irrigated gravel benches and in shallow drainageways that intersect the water table as they meander through the marshy lowland areas. Much of the spring water is return flow from irrigated fields; consequently, the seasonal flow rates and the quantity discharged are governed largely by the availability of irrigation water.

Spring discharge reaches a peak near midsummer and a low in late spring, coinciding with high and low ground-water levels represented particularly well by hydrographs of observation wells (C-29-7)21baa-1 and (C-29-7)28dbd-1 near the northeast and the southeast edges, respectively, of the main spring-discharge area (fig. 9). Springs having similar characteristics occur in the bottom of Minersville Reservoir, in the Indian Creek drainage area, in the vicinity of Manderfield, and in sec. 4, T. 29 S., R. 7 W., about midway between Beaver and Manderfield. Several springs yielding up to a few gallons a minute also occur elsewhere in and around the margin of the valley.

The amount of spring discharge in the main discharge area is extremely difficult to determine accurately because of the intermingling of overland runoff from irrigated fields, subsurface return flows from irrigated fields and irrigated lowland native pastures, and runoff from local precipitation in the vicinity of the springs. Also, much of the spring discharge is diverted in many small ditches for irrigation of nearby lowland pastures and cultivated fields. Then once again, overland runoff and subsurface return flow comingle with discharge from still lower springs, thus compounding the problem of making accurate measurements.

Much of the wintertime (October-March) spring discharge flows into the Beaver River thence to the Minersville Reservoir, where it is stored for use outside of Beaver Valley. Undetermined quantities of winter discharge never reach the reservoir, however, because it is diverted for stock watering and irrigation. Thus, although the flow of the Beaver River is measured at a gaging station near the head of the reservoir (10237000 Beaver River at Adamsville), an accurate measure of the wintertime spring discharge is not possible.

To overcome the complications in determining the amount of spring discharge, 79 flow measurements were made in all the principal drainageways and diversion ditches and in many of the minor ones that contain identifiable spring water. The measurements were made during September 28-October 2, 1973. During this period, overland runoff from irrigated fields was minimal, the spring discharge during 1973 probably was at about or only slightly above the annual average, and there was no overland discharge of underflow or runoff from precipitation preceding or during the period. The annual discharge rate, which was slightly above average, probably compensates for any undetected spring discharges, thus the total measured discharge rate of 31.8 ft^3/s (0.9 m^3/s) or 23,000 acre-ft (28 hm^3) per year seems reasonable. Of this accretion to streams, an analysis of streamflow and diversion records for 1973 shows that 9,200 acre-ft (11 hm^3) is diverted for irrigation.

The flow from springs in the bottom of Minersville Reservoir is an estimated 3 ft^3/s (0.08 m^3/s) or 2,200 acre-ft (2.7 hm^3) per year. About 1 ft^3/s (0.03 m^3/s) flows directly into a pipeline and is conveyed outside the valley. The other 2 ft^3/s (0.06 m^3/s) discharges directly into the reservoir and can only be estimated.

Spring discharge in the Indian Creek drainage area was 2.5 ft^3/s (0.07 m^3/s) on September 28, 1973. The average discharge rate for five sets of spring-discharge measurements in sec. 4, T. 29 S., R. 7 W., between August 20, 1974, and June 24, 1975, was 1.25 ft^3/s (0.035 m^3/s). The total volume of spring discharge in the Indian Creek drainage is 1,800 acre-ft (2.2 hm^3) per year.

The total volume of spring discharge from the sources described above is 28,000 acre-ft (35 hm^3) per year. In comparison with this amount, the quantity from all unmeasured springs is insignificant; therefore, no allowance is made for the discharge from unmeasured springs in calculations elsewhere in this report.

Evapotranspiration

An estimated 18,000 acre-ft (22 hm^3) of ground water was consumed in 1974 by evapotranspiration from both cultivated cropland and phreatophytes in low-lying lands in the valley. The amount of evapotranspiration of ground water was estimated by use of a digital-computer model of the ground-water reservoir.

Alfalfa is the principal cultivated crop, and corn and small grains are the minor crops grown in the lowland areas where they also obtain part of their water requirements from the ground-water reservoir. Data are not available to determine the quantity of ground water used by individual cultivated crops or phreatophytes. Phreatophytes, however, consume most of the ground water discharged by evapotranspiration because the water table is nearer the land surface in phreatophyte areas than elsewhere.

There are 8,900 acres (3,600 hm^2) of phreatophytes that obtain part or all their water requirements from the ground-water reservoir (table 9). Saltgrass (Distichlis stricta) and sedges (Carex sp.) are the predominant phreatophytes in the valley, as well as the principal vegetation in the meadow pastures and native hay lands. The most vigorous growths are on fertile soils where the depth to water is less than 5 ft (1.5 m) and where irrigation water is applied.

Table 9.—Summary of areas of consumptive use of water by irrigation and from the ground-water reservoir, in acres, 1974

Cultivated crops:		
Alfalfa	6,300	
Small grains	840	
Corn	160	
Total cultivated crops		7,300
Residential areas		700
Phreatophytes:		
Meadow grasses	6,700	
Greasewood	800	
Rabbitbrush	500	
Greasewood and rabbitbrush	900	
Total phreatophytes		8,900
Total area of consumptive use		16,900

Greasewood (Sarcobatus vermiculatus) and rabbitbrush (Chrysothamnus nauseosus) also occupy large tracts of land in the valley, generally around the fringe of the meadowlands. The most vigorous growths are on fertile soils where the depth to water is less than 5 ft (1.5 m); however, in most of the area occupied by greasewood and rabbitbrush, the water table is 5-20 ft (1.5-6.1 m) below the land surface.

Other phreatophytes were observed in the valley, but the areas of growth were too small or growth densities too sparse to have significant effect on the water supply of the valley. Still other plants not dependent upon ground water as a source of supply may grow in association with the phreatophytes, but they were not mapped or studied because they use little water and do not depend upon ground water for survival. The main cultivated areas and the areas occupied by phreatophytes in 1974 are shown on plate 2, and the amount of land occupied by various crops and phreatophytes are listed in table 9.

Wells

The first wells in Beaver Valley were dug probably by about 1860 for domestic and stockwater supplies where ground water was within a few tens of feet of the land surface. A few wells had been drilled by 1906 (Lee, 1908) to depths as great as 475 ft (145 m). In 1906, according to Lee, most of the residents of Beaver depended almost entirely on shallow open wells for their drinking water.

The well records compiled by Lee (1908) are the earliest records available, but apparently Lee inventoried and recorded information about only a few selected wells. Most of the wells in use in 1906 had been destroyed or otherwise became unused for various reasons by 1975, but mainly because a water system supplying most of the residents has been installed in Beaver.

The amount of withdrawals from domestic and stock wells is not known accurately, but the amount probably changed little during 1906-75 because withdrawals from more recently constructed wells have been offset by

abandonment of wells drilled subsequent to the installation of the water system in Beaver. It is estimated that withdrawals for domestic and stockwater supplies averaged about 100 acre-ft (0.12 hm^3) a year during 1906-73 and 125 acre-ft (0.15 hm^3) a year during 1974-75 (table 16).

The first industrial well probably was drilled about 1924, and the first public-supply well was drilled in 1950. There are no records of withdrawals for industrial purposes, but the amount probably never exceeded 25 acre-ft (0.03 hm^3) per year, and in 1974-75 there were no withdrawals for industrial purposes. Withdrawals for public supply increased from 50 acre-ft (0.06 hm^3) in 1950 to 930 acre-ft (1.15 hm^3) in 1967 and has remained constant since; however, most of this water is used to irrigate a cemetery, lawns, and vegetable gardens.

The first wells used exclusively for irrigation were drilled during the drought in 1934, when several wells were installed to supplement the meager surface-water supply. The wells were not equipped with pumps, so the only withdrawals were from wells in the lower parts of the valley where some wells flowed as much as 160 gal/min (10 L/s) when they were first constructed. The first pump was installed on an irrigation well in 1947. By 1974 there were five flowing wells yielding 10 to 120 gal/min (0.6 to 7.6 L/s) and 29 pumped wells yielding 100 to 2,525 gal/min (6.0 to 159 L/s).

The only ground water used for irrigation before 1934 was excess water from flowing wells drilled for other purposes, and the amount probably never exceeded 100 acre-ft (0.12 hm^3) a year. Such flowing wells were reported in some lower parts of the valley in 1906 (Lee, 1908), but the number and rates of flow are not known.

Withdrawals for irrigation increased slowly from 250 acre-ft (0.31 hm^3) in 1934 to 560 acre-ft (0.69 hm^3) in 1946; but beginning in 1947, when the first pump was installed on an irrigation well, withdrawals increased rapidly to 8,880 acre-ft (10.9 hm^3) in 1974 (fig. 2 and table 16). The amount of annual withdrawals from individual pumped irrigation wells was determined from power-consumption or operating-time records and from periodic discharge measurements.

The volumes of withdrawal from all wells for all purposes increased during the period of record from a minimum of about 400 acre-ft (0.5 hm^3) in 1934 to a maximum of about 9,900 acre-ft (12.2 hm^3) in 1974 (table 16). These volumes are equivalent to average annual flow rates of 0.6 ft^3/s (0.02 m^3/s) and 13.7 ft^3/s (0.4 m^3/s).

Subsurface outflow

Ground water is moving out of Beaver Valley by subsurface outflow only in the southwestern part of the valley near Rocky Ford Dam (fig. 7). The contours representing the ground-water surface indicate that everywhere in the lowlands, ground water is moving toward that area. Most of the ground water is discharged into surface waterways, lost by evapotranspiration, or pumped from wells, however, long before it reaches the valley boundary.

The amount of underflow was estimated by Mower and Cordova (1974, p. 16) to be 700 acre-ft (0.86 hm^3) per year at a point near the mouth of Beaver River Canyon about 4 mi (6 km) downstream from the boundary. The amount of underflow computed by the digital model is 300 acre-ft (0.37 hm^3) per year near Rocky Ford Dam; the increase in the reach between Rocky Ford Dam and the mouth of the canyon probably results from river losses and subsurface inflow from tributary canyons.

Many springs occur downstream for about 0.5 mi (0.8 km) from the face of Rocky Ford Dam to the gaging station on the Beaver River. All the water in the river at this point is spring discharge when water is not purposely being released from the reservoir through the outlet works or spillway. Probably all the discharge from the springs is leakage from Minersville Reservoir through Rocky Ford Dam and underlying basaltic rocks.

The basalt, which underlies the reservoir for a distance of at least 0.5 mi (0.8 km) east of the dam, is highly fractured. The fractures afford the passageways for ready movement of water from the reservoir to the outcrops below the dam where it is discharged and soon returns to the Beaver River. All the spring discharge between the dam and the gaging station, therefore, is considered to be surface water.

Yield of wells

The yield of a well is determined by the characteristics of both the well and the aquifer and is measured by the specific capacity, which in this report is defined as the yield of the well in gallons per minute per foot of drawdown after pumping for 24 hours. Well characteristics that affect the specific capacity include the depth of penetration of the well into the aquifer; the diameter of the well; the extent, type, and location of the perforations or screen; the degree of corrosion, encrustation, and plugging of the perforations or screen; and the effectiveness of well development. Proper well development removes the finer grained material from around the perforated casing or screen and for a short distance out into the aquifer, and forms a more permeable pack of coarse-grained material. Thus, the effect of well development is similar to that of increasing the well diameter.

Water can be withdrawn from a well at the same rate it can be yielded by the aquifer if the efficiency of the well is 100 percent. The efficiency of a well is the ratio of the theoretical drawdown in a perfectly constructed and developed well to the actual drawdown multiplied by 100. In a well that is 100 percent efficient, the water in the well and the water immediately outside the casing, assuming that the casing has no thickness, remain at the same levels regardless of drawdown. In a well that is less than 100 percent efficient, however, the water level in the well is below the water level in the aquifer immediately outside the well when the well is pumped.

Efficiencies were computed for 27 wells in Beaver Valley. The theoretical drawdown was determined by using the formula of Theis (1935), the transmissivity values given in figure 6, and a long-term estimated storage value of 0.20. The well efficiencies ranged from 9 to 100 percent. Sixteen of the wells had efficiencies of less than 25 percent, nine had efficiencies of 26-75 percent, and two had efficiencies of 76-100 percent.

Actual T and S values at a given well may deviate slightly to moderately from those used for computing well efficiencies, mainly because the length of time that the well had been pumped was not known. The large percentage of wells having low efficiencies, however, suggests that the wells were improperly constructed, that well development was inadequate, or that the casing perforations had become partly plugged. Actually, the low efficiencies may be caused by all three factors, but probably the chief factor is plugging of the perforations by encrustations of mineral matter deposited from water as it moves through them.

Interference among wells

When a well flows or is pumped, the potentiometric surface in the aquifer around the well is lowered. The area of lowered potentiometric surface is called the cone of depression or cone of influence of the well. The amount of lowering increases with time but decreases with increasing distance from the discharging well until the ground-water system reaches a new equilibrium. The cones of depression around discharging wells sometimes overlap, a situation called interference among wells that results in additional water-level declines at each well.

The Theis formula (Theis, 1935) may be used to determine the amount of interference under various conditions of transmissivity, storage coefficient, discharge, distance, and time. Results obtained from using this formula may deviate from field observations because the restrictions imposed in deriving the formula are never fully met in a real aquifer. In Beaver Valley, the restrictions of homogeneous sediments of infinite areal extent in which T is constant at all times and places are those which may have the greatest affect on the accuracy of the results. A cone of depression reaching a site having a smaller T than the one at a site being investigated will result in larger drawdowns than might be expected, whereas if T is larger, smaller drawdowns may be expected. Changes in discharge and recharge within the cone of depression will have like effects.

Theoretical graphs were constructed from solutions of the Theis equation to provide a basis for estimating interference among wells and water-level declines due to pumping in Beaver Valley (fig. 12). The graphs were prepared from computed water-level declines for commonly occurring combinations of T and S, and for distances of 0.1-10 mi (0.16-16 km) from a well pumping 1,000 gal/min (63 L/s) for 180 days. Values used for T are in the [illegible] values s[illegible]n in figure 8. The value used for S was 0.1, the approximate average value determined for periods of less th[illegible] 180 days. The drawdown graphs are approximations because, as explained in an earlier section of the report, S approaches a true value with pumping time.

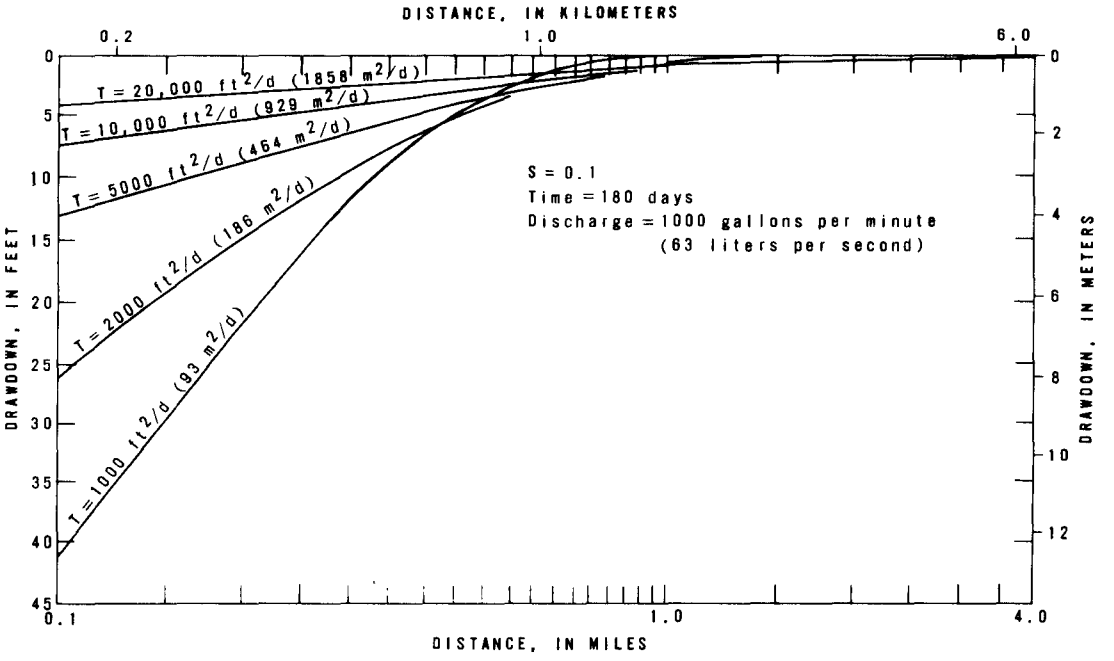

Figure 12.—Distance-drawdown graph for the principal ground-water reservoir in Beaver Valley.

As an example of a well-interference problem in Beaver Valley, assume that three neighboring wells will be pumped simultaneously for 180 days and that there is no recharge. (See table 10 for data for the problem and fig. 6 for locations of the hypothetical wells.) Well 1 will be pumped continuously at 1,000 gal/min (63 L/s), well 2 will be pumped 12 hours a day at 1,000 gal/min (63 L/s), and well 3 will be pumped continuously at 100 gal/min (6.3 L/s). It is assumed that the intermittent pumping may be averaged for the period; the average pumping rate for well 2 is 12/24 of 1,000 gal/min (63 L/s) or 500 gal/min (32 L/s). It is desired to estimate the water-level decline at nonpumping well 4 at the end of 180 days.

Table 10.—Approximate interference for hypothetical problem ($T = 5{,}000\ ft^2/d$)

Pumped well	Average pumping rate during 180 days (gal/min)	Distance from pumped well to well 4 (mi)	Interference at well 4 at end of 180 days (ft)
1	1,000	0.5	3.7
2	500	1.0	.6
3	100	1.5	.1
	Total interference on well 4		4.4

The four wells lie in a straight line at 0.5-mi (0.8-km) intervals. In this area, T is an average 5,000 ft^2/d (464 m^2/d) and S is 0.1. The appropriate distance-drawdown curve is selected from figure 12.

The effect on the water level at well 4 caused by pumping at wells 1, 2, and 3 is analyzed separately; the total interference is the sum of the effects of the three pumping wells, which is 4.4 ft (1.3 m). The effect of well 1 after being pumped for 180 days is determined as follows: on figure 12, locate the intersection of the distance-drawdown

curve and the vertical line at a distance of 0.5 mi (0.8 km), then move horizontally to the left edge and read 3.7 ft (1.1 m). The effects of wells 2 and 3 are determined in the same manner, except that the effect of well 2 is 500/1,000 of that read from the graph because the effect of pumping is linearly proportional between the actual pumping rate and the assumed pumping rate used in preparation of the curve. The effect of well 3 is 100/1,000 of the amount read from the graph.

Chemical quality of the water

The type and amount of minerals in solution in water depend chiefly on the chemical and physical composition of the soil or rocks with which the water comes in contact; the length of time the water is in contact with the soil or rocks, and other factors, such as water temperature and pressure. Chemical analyses and water temperatures of water samples from wells, springs, and streams in Beaver Valley are given in tables 14 and 15. The dissolved-solids concentration of water from streams, springs, and wells in most parts of Beaver Valley is less than 400 mg/L.

The dissolved-solids concentration in the water in the principal ground-water reservoir generally is lowest in water from hydrogeologic unit 1 and highest in unit 3 (table 14). Some of the wells listed in table 14 tap water in two and possibly in all three hydrogeologic units that compose the ground-water reservoir, and few data are available to determine precisely which units or how much of each unit is tapped. The quality of water in each unit, therefore, is not known.

The few available applicable data suggest that the dissolved-solids concentration in the water in the two lower hydrogeologic units of the principal ground-water reservoir is greater than that in the upper unit. The principal reason is that most of the water in the upper unit is derived from relatively recent seepage losses from irrigation water of relatively good chemical quality. A smaller proportion of the water in the lower two units is derived from this source. The poorest quality water generally is in the lowest (southwest) part of the valley (fig. 13).

Most of the large-yielding wells tap at least two of the three hydrogeologic units of the reservoir, but the proportion of water withdrawn from each is not known. Thus, another well tapping different thicknesses of the reservoir units may yield water of a different quality than the wells used in the construction of this map (fig. 13). For this reason, the map should be used only as a general guide to the quality of water at specific locations. At any given specific location, wells shallower than those used in the construction of the map usually yield water with a lower concentration of dissolved solids, while the deeper wells usually yield water with a higher concentration of dissolved solids.

Public supply

The U.S. Public Health Service (1962) has recommended quality standards for drinking water and public water-supply systems. A partial list of these standards is as follows:

Constituent	Recommended maximum limit (mg/L)
Dissolved solids	500[1]
Sulfate	250
Chloride	250
Nitrate	45

[1] Concentrations to 1,000 mg/L is permissible if better water is unavailable. In Beaver Valley, a specific conductance of about 800 and 1,600 μmho/cm at 25°C is equivalent to 500 and 1,000 mg/L, respectively (fig. 14).

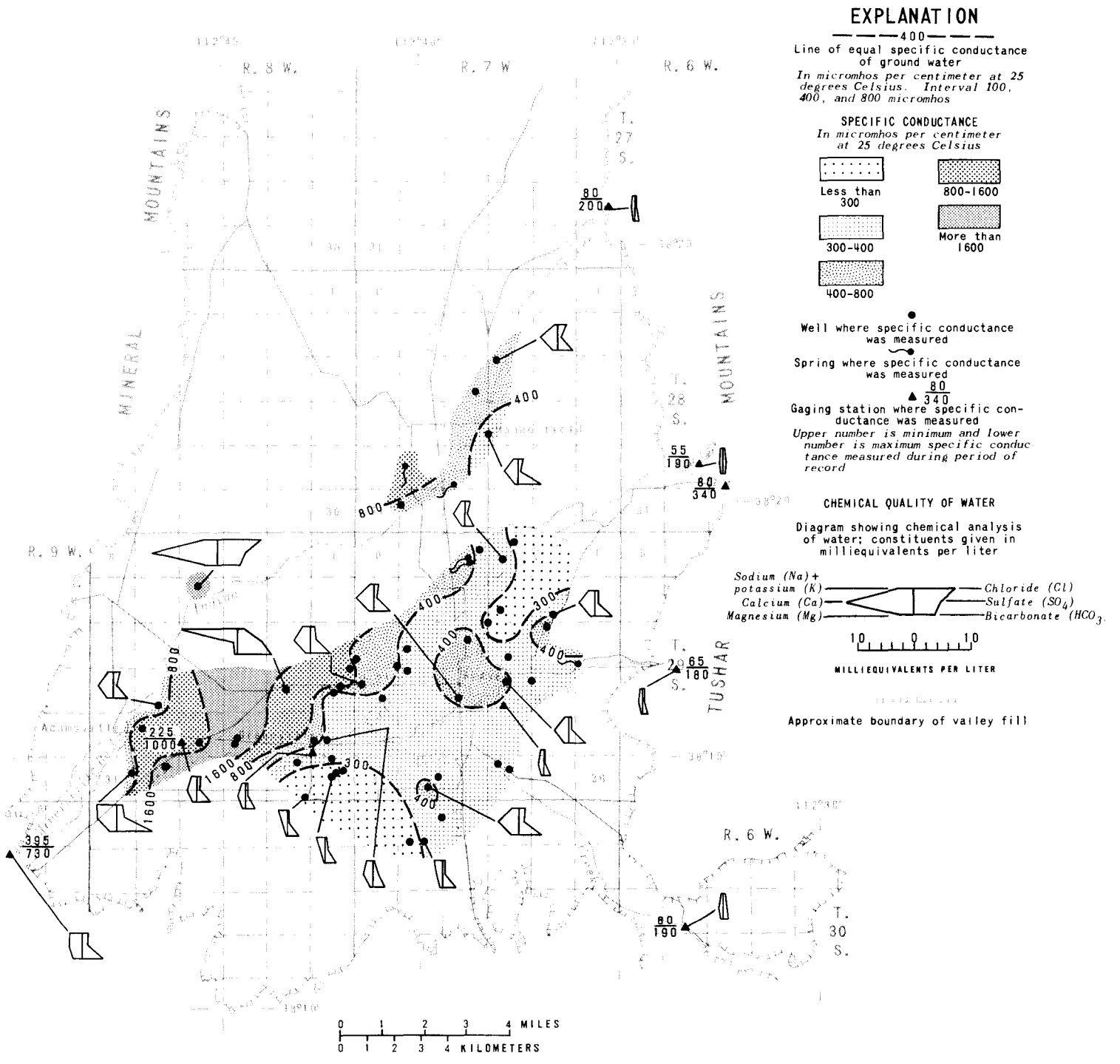

Figure 13.—Map of Beaver Valley showing the chemical composition of water from selected wells, springs, and streams and general distribution of quality of ground water as measured by specific conductance, 1946-75.

A comparison of the chemical data from ground-water sources in table 14 with the recommended standards shows that the dissolved-solids concentration of water from only 3 wells out of a total of 18 wells sampled exceeds the recommended maximum limit for drinking water. Similar comparisons of chemical data from surface-water sources show that the dissolved-solids concentration exceeds the recommended limit only in the southwest part of the valley, and then, only when the streamflows probably consist only of ground-water discharge in the lower reaches. The areas where the dissolved-solids concentration of water from selected wells and springs exceeds the maximum limit as measured by specific conductance is shown in figure 13. Sulfate, chloride, and nitrate concentrations in water from all wells sampled are well below the recommended maximum limits, except for sulfate and chloride which are at or exceed the limits at well (C-29-8)9bad-1. The concentrations of some or all these constituents may exceed the limits, however, in places where the specific conductance exceeds 1,600 micromhos.

Hardness is a characteristic of water which is mainly the result of the concentration of calcium and magnesium. The following classification is used in this report:

Rating	Hardness as $CaCO_3$ (mg/L)
Soft	0-60
Moderately hard	61-120
Hard	121-180
Very hard	More than 180

Comparison of the data in tables 14 and 15 with the hardness ratings indicates that the water from most wells is hard to very hard and water in streams is soft to very hard. Some wells in the vicinity of Greenville and south of the Beaver River yield water that is soft to moderately hard. Most of the water in streams near the canyon mouths is soft to moderately hard, but it becomes progressively harder as it flows across the valley until most of the water flowing past Rocky Ford Dam is very hard.

Irrigation

The water from wells and streams in Beaver Valley was classified (fig. 15) according to salinity hazard and sodium hazard using the method of the U.S. Salinity Laboratory Staff (1954, p. 69). In classifying water for irrigation, it is assumed that an average quantity of water will be used under average conditions of soil texture, salt tolerance of crops, climate, drainage, and infiltration. The classification illustrated in figure 15 is based on the relation between sodium-absorption ratio (SAR) and specific conductance (conductivity). The SAR is a measure of the sodium hazard and the specific conductance is a measure of the salinity hazard. Depending upon the values of SAR and specific conductance, a water may fit into one of 16 classes.

For Beaver Valley, water from the streams near where they enter the valley is in both the low-sodium and low-salinity hazard classes, but the quality deteriorates to the low-sodium and high-salinity class near the lower end of the valley, as at the Beaver River station at Adamsville. The quality of water from most wells is in the low-sodium and medium-salinity hazard class. Low-sodium hazard water is usable on nearly all soils without the development of harmful amounts of exchangeable sodium. Medium-salinity hazard water is usable if a moderate amount of

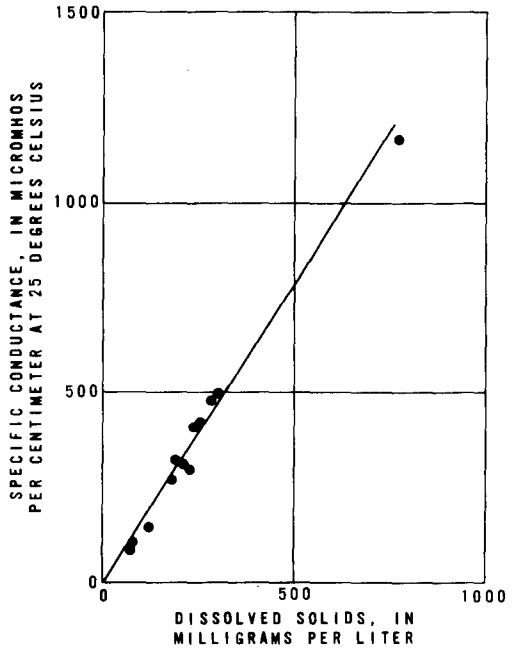

Figure 14.—Relation of specific conductance to dissolved solids in water in Beaver Valley.

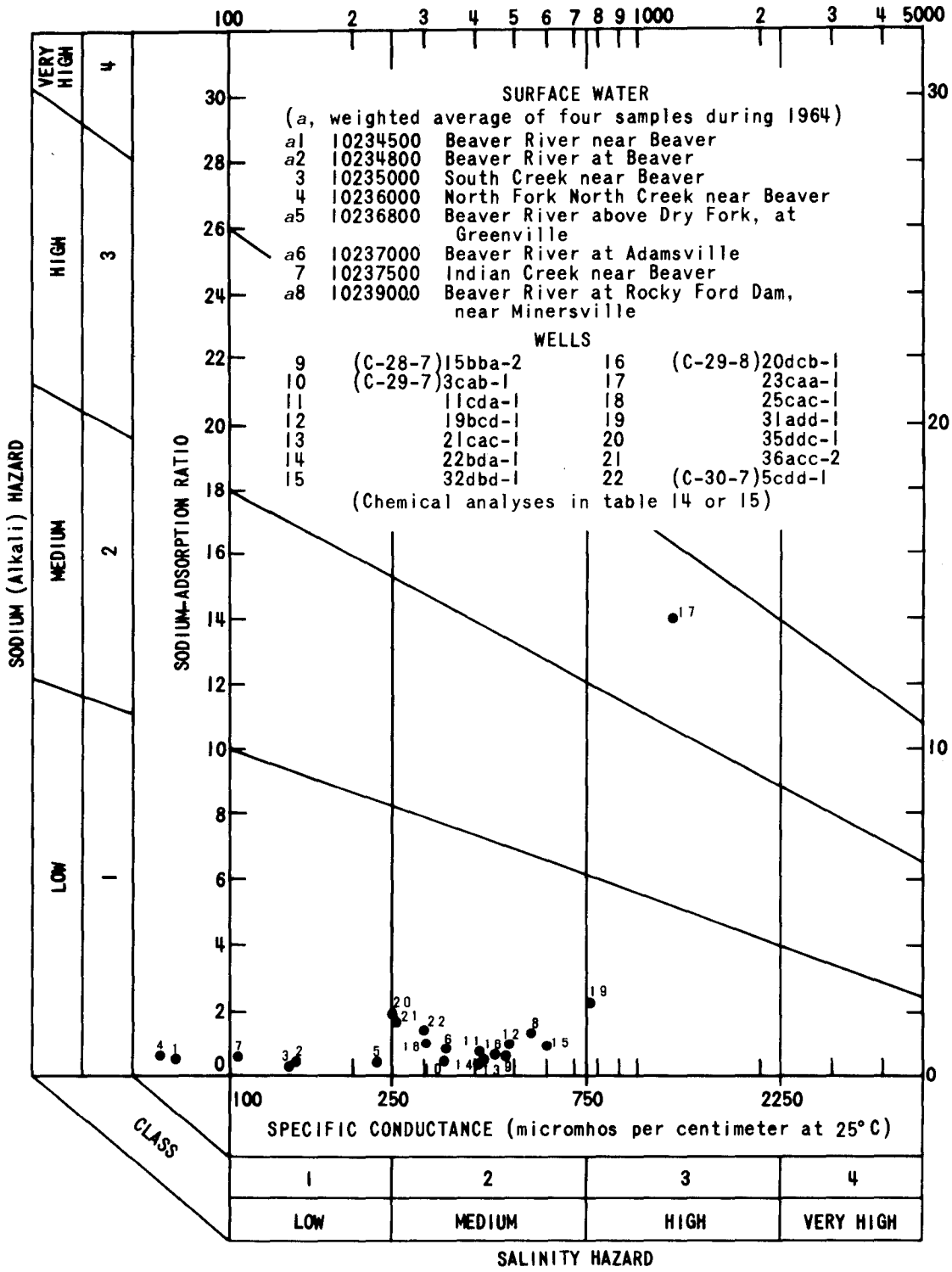

Figure 15.—Analysis of irrigation water (method of the U.S. Salinity Laboratory Staff, 1954).

leaching occurs and if plants grown have a moderate salt tolerance. High-salinity hazard water is not recommended for use on poorly drained soil, and special salinity management practices may be required even with well-drained soil.

DIGITAL-COMPUTER MODEL OF THE GROUND-WATER RESERVOIR

One of the objectives of the Beaver Valley investigation was to prepare a digital-computer model to determine the effects of changes in recharge and discharge on water levels and amount of discharge form the principal ground-water reservoir.

An accurate digital-computer model requires a complete and accurate description of the characteristics and hydrology of the ground-water reservoir based chiefly on geologic and hydrologic data gathered in the field. Observational data, however, are seldom complete enough for the required description; and for Beaver Valley, the necessary data were more incomplete than usual for most modeled areas. For this reason, much of the required data and certain relations not defined by observational data were estimated for large parts of the principal ground-water reservoir. All the assembled descriptive information is reduced to a set of number arrays which are used in a series of complex computations to determine the reservoir response.

Because a reservoir response over a period of many years can be simulated on the model in an extremely short time, tests of reservoir response can be made for many assumed conditions. Thus, the model is useful to the hydrologist for testing and evaluating assumed descriptive information and hydraulic relations, and to both the hydrologist and the water-rights administrator for determining probable water-level changes and changes in natural discharge from the ground-water reservoir in response to specified changes of recharge and discharge.

Description of digital-computer model

The digital-computer model used in this study is a finite-difference model based on the work of Pinder (1970), Trescott (1973), and P. C. Trescott (written commun., 1974). It uses an iterative alternating-direction implicit technique to solve the finite-difference approximation of the differential equations of ground-water flow. In this study, the special water-table equation is solved. A rectangular grid of node points is superimposed on a map of the part of Beaver Valley to be modeled, and a series of data arrays that defines certain physical dimensions and hydraulic characteristics of the ground-water reservoir are modeled at each node point. Additional information on the application of digital-modeling technology to the theory of ground-water flow may be found in Pinder and Bredehoeft (1968).

The lateral boundary of the principal ground-water reservoir is approximately at the contact between the saturated materials composing the reservoir and the older, mostly consolidated rocks as shown on the geologic map of Utah (Stokes, 1964). The lateral boundary was drawn on a U.S. Geological Survey topographic map, scale 1:62,500, with a superimposed rectangular grid of node points spaced 2,000 ft (610 m) apart in both the east-west and the north-south directions (pl. 3). A requirement of the computer program is that a model be bounded by nodes of zero hydraulic conductivity. For most of the boundary of the Beaver Valley model, the node immediately outside and adjacent to the node representing the boundary of the saturated valley fill is assigned a value of zero hydraulic conductivity. Inside the model border realistic boundary conditions are imposed.

The base of the ground-water reservoir was determined by extrapolating data from well logs and geologic outcrops. The maximum depth to the base of the reservoir is assumed to be 1,000 ft (305 m) below the land surface, which is the depth of the deepest water well in the valley. The top of the reservoir is represented by water-level contours on the potentiometric map for 1949 (fig. 16). This map was prepared largely by extrapolation of data from the 1974 potentiometric map and the few water-level data that were available for 1949.

The difference between the altitude of the base of the ground-water reservoir and the altitude of the potentiometric surface is the saturated thickness, which exceeds 500 ft (152 m) in about 25 percent of the valley (fig. 10). Number arrays of the altitude of the base and of the potentiometric surface at each node is entered into the model. Other data arrays include altitude of the land surface, hydraulic conductivity, specific yield, no-flow lateral boundaries, recharge, pumpage, hydraulic conductivity of the confining bed at nodes where ground water discharges naturally at the land surface, head at the bottom of the confining bed, and thickness of the confining bed.

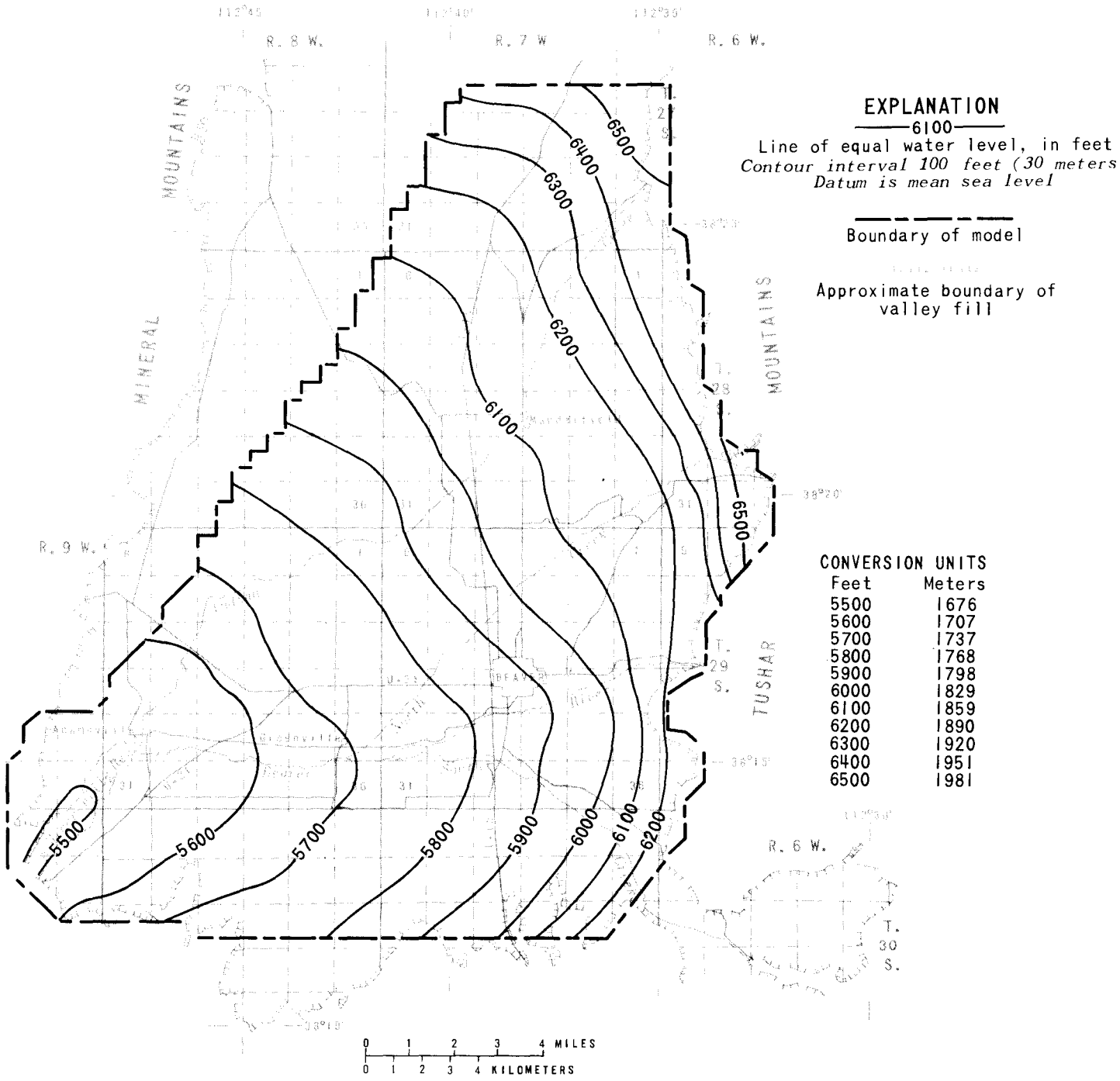

Figure 16.—Water-level contours, top of the ground-water reservoir in 1949, at start of digital-computer model analysis.

The land-surface array is the altitude above mean sea level, taken from the topographic maps of the valley, of the center of each node. This array is used in the computation of evapotranspiration by phreatophytes at nodes where the potentiometric surface is within 10 ft (3 m) of the land surface. Evapotranspiration was modeled to increase linearly from 0 ft at a depth of 10 ft (3 m) to 3.5 ft (1.1 m) per year for localities where the potentiometric surface is at the land surface. The minimum, or 0 ft of evapotranspiration, is taken at 10 ft (3 m) because most phreatophytes in Beaver Valley probably do not use more than a few inches of ground water a year when the water table is deeper. The maximum, 3.5 ft (1.1 m), is the total potential use in Beaver Valley under optimum conditions according to calculations made with the Blaney-Criddle formula (Criddle and others, 1962).

Because the contour interval of the altitude is as much as 80 ft (24 m) in some parts of the valley, the potential errors in modeled altitude may be as much as half the contour interval, or 40 ft (12 m). The potential errors in the land-surface altitude are smaller, however, in some central lowland parts of the valley where the contour interval on some of the topographic maps is as small as 20 ft (6 m). Actually, at most field data points, the altitudes are accurate to within 1 ft (0.3 m).

Errors in estimating the altitude of the land-surface array can cause, directly or indirectly, usually small errors in the altitude of the potentiometric surface and the altitude of the base of the reservoir, and these errors then may cause errors in computed evapotranspiration.

The preliminary map of hydraulic conductivity used in the model was constructed by using the results of aquifer tests, well-completion reports filed with the Utah State Engineer, and estimates for areas where field data were sparse. The hydraulic conductivity of the modeled area ranges from slightly less than 1 ft/d (0.3 m/d) to slightly more than 20 ft/d (6.1 m/d) (fig. 17).

The specific yield was estimated to be 0.20 throughout the modeled area on the basis of tests made in the Milford area, as explained in the section on storage. Parameter sensitivity tests, performed through the model, suggest that this is a good average value for the valley. To make a sensitivity test, values for a selected parameter are changed a known amount and the computer program is rerun. The magnitude of the effect on model results is noted. If the effects are small relative to the amount that the parameter was changed, the model is considered to be insensitive to this parameter.

The potentiometric surface was assumed to remain constant at all nodes along the boundary (indicated by a −1 on the grid on pl. 3). This assumption probably is valid because the available data suggest that there has been little or no change at the boundaries due to developments in the valley. Also, results of the computer analyses showed zero drawdown at nearly all nodes adjacent to the constant-head nodes. The boundaries generally are sufficiently removed from areas where recharge and discharge rates have been changed by man that the boundary effects are negligible. This hypothesis is true even for long-term analyses, as was verified by the calibrated model.

The only recharge that is modeled directly is that which occurs as seepage from irrigation systems and of irrigation water and precipitation from irrigated lands. The quantity of all other recharge is negligible, except that at constant-head boundary nodes. The recharge was modeled as occurring at a recharge well in the center of each node where recharge occurs. The recharge rate at each node is determined as a part of the total estimated recharge on the basis of a ratio of the nodal irrigated area to total irrigated area.

Recharge as subsurface inflow through bedrock in mountains bounding the valley could not be determined from available field data. This inflow may be determined indirectly, however, with the digital model by placing constant-head nodes at the boundary where inflow occurs. This method of determining inflow is applicable only where changes in ground-water levels that result from the activities of man do not reach the boundary during the period of the model analysis. Constant-head nodes were placed everywhere along the boundary, except where subsurface underflow leaves the valley (pl. 3). Recharge of about 7,600 acre-ft (9.4 hm^3) per year through bedrock is required to maintain a constant head at the boundary.

The amount of pumpage from all wells was determined to average only about 0.8 ft^3/s (0.02 m^3/s) prior to 1950. The quantity of water pumped from individual wells was so small over such a long period of time that the ground-water system probably had reached equilibrium long before 1949.

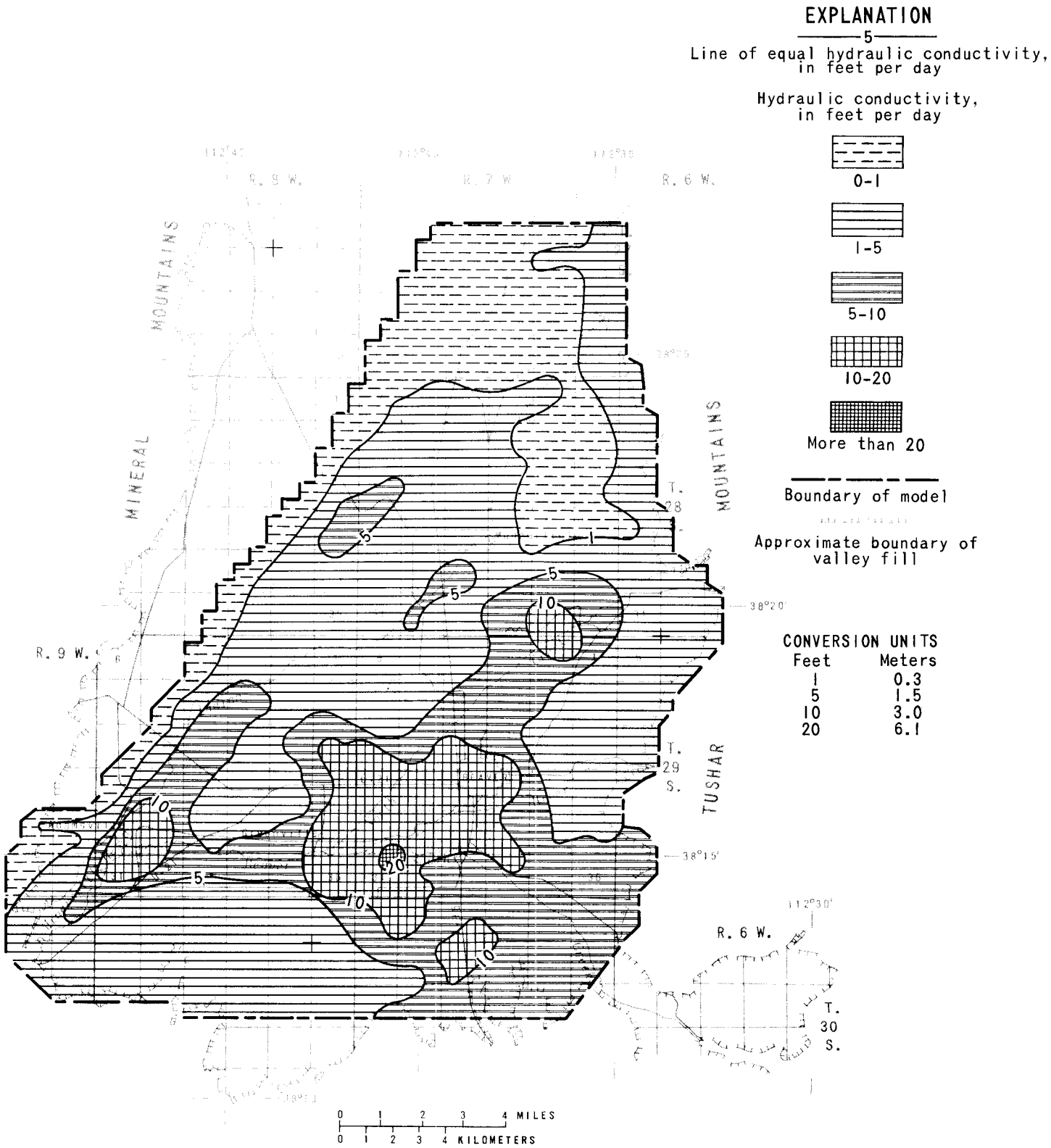

Figure 17.—Hydraulic conductivity of the ground-water reservoir as used in the digital-computer model.

Ground water discharges naturally in some lowland parts of the valley, as explained in the section on discharge from springs. An inspection and interpretation of the potentiometric map (fig. 7) suggested that, on the average if ground-water levels declined 10 ft (3 m) at nodes containing springs, they would cease to flow. Spring discharge was so modeled to cease flowing when the head dropped 10 ft (3 m) and to remain at zero discharge with greater declines. This discharge was simulated as discharge by leakage from a confined aquifer. Three data arrays were required for this simulation: (1) thickness of a hypothetical semiconfining bed, which is estimated to average 1 ft (0.3 m); (2) head on the base of the semiconfining bed, which is estimated to average 10 ft (3 m) and is modeled as altitude; and (3) hydraulic conductivity of the semiconfining bed.

The hydraulic conductivity was computed for each applicable node from thickness, head, and the estimated average annual rate that ground water is being discharged by springs on the basis of field measurements in 1974. The discharge is assumed to be evenly distributed over the entire node. The aggregate average annual discharge of ground water by springs for all nodes is 28,000 acre-ft (35 hm^3) (see page 31), which is 38.7 ft^3/s (1.1 m^3/s).

Model calibration

Model calibration for steady-state conditions consisted of matching the calculated potentiometric surface with the observed potentiometric surface for 1949. The calculated potentiometric map in figure 16 matches, sufficiently close, in areas where field data are available so that little difference can be detected between the calculated and observed heads.

During the calibration period 1935-49 when there was essentially no change in the potentiometric surface, hydraulic conductivity, the altitude of the base of the aquifer, the altitude of the potentiometric surface in areas of no field control, and the quantity of recharge were varied many times and placed in various combinations with each other, within the probable range of values judged reasonable for the Beaver Valley ground-water reservoir, to obtain the best fit between the calculated and observed potentiometric surfaces. In resolving the differences between the calculated and observed potentiometric surfaces, the values for some parameters were changed areally, but the values of hydraulic conductivity and the altitude of the base of the aquifer, because they were known less precisely, were changed more often than the altitude of the potentiometric surface and the quantity of recharge. In some parts of the valley, particularly where there is little or no withdrawal, certain model parameters for example, aquifer thickness, hydraulic conductivity, evapotranspiration, recharge, and spring discharge may have a greater affect on the potentiometric surface than does pumping. In such parts of the valley the parameter responsible for the poor match between calculated and observed heads could not be positively identified. As might be expected, agreement is best in areas where field data are most abundant and accurate. Overall agreement throughout the valley is fair; the model therefore should be updated when more reliable field data becomes available.

Test of model calibration

Data available for a convincing verification of the model are more sparse than those for calibration. Withdrawal data are complete and reasonably accurate, but the effects of the stress of withdrawals on the ground-water reservoir are poorly known, principally because the stress caused by withdrawals is so small that the results are too small to be differentiated from the effects of other stresses such as local intermittent recharge and discharge.

The period 1950-75 was selected for testing the calibration of the model because in 1950 there was a relatively large increase in ground-water withdrawals for irrigation. The period was divided into four pumping periods, during each of which the annual withdrawals were reasonably constant. An average pumping rate was used in preference to a series of seasonal rates in order to reduce computer computation time. The average annual rate during specific periods of withdrawal of ground water from wells was:

Period	Cubic feet per second	Cubic meters per second
1934-49	1.0	0.03
1950-54	3.0	.08
1955-61	5.2	.15
1962-70	6.5	.18
1971-74	10.5	.30

Using an average annual pumping rate rather than a series of seasonal pumping rates will result in slightly greater computed drawdowns during the test periods. The reason is that during the off-season, water levels partly recover, but by averaging withdrawals over the year there is no water-level recovery. The average annual pumping rate is about half the seasonal rate; thus, after periods longer than a year, drawdowns tend to become nearly equal.

None of the parameters, other than pumpage, used in the model calibration were changed for the test of calibration. The effects of the pumping stress were to lower the water levels in some areas. There were no changes in water levels near the perimeter of the modeled area, in a small area near the central part of the valley about 4-5 mi (6-8 km) north of Beaver, and in the lowland part of the valley along the Beaver River from near Beaver west to the boundary (fig. 18). Elsewhere in the valley, water levels declined. The largest observed declines were slightly more than 2 ft (0.6 m) at Manderfield and in a small area about 4 mi (6 km) south of Beaver. The largest computed declines occurred where withdrawals are greatest and recharge is least.

The magnitude of the computed declines in the area south of Beaver probably are approximately correct, but the computed declines near Manderfield are slightly too large. There are insufficient historical water-level measurements near Manderfield to make a satisfactory analysis of the computed and observed declines.

Model sensitivity

A digital model of a ground-water reservoir is sensitive to a particular parameter or stress if changes in the parameter or stress, within the range of probable values, make a significant change in model results. The sensitivity of the model to recharge associated with irrigation, recharge from direct precipitation, discharge at springs, specific yield, hydraulic conductivity, and saturated thickness was evaluated in this study.

The sensitivity of each parameter in the model was tested individually by changing the value by a known amount. The model is so sensitive to areal recharge, as might occur from local precipitation, that it is concluded that in most parts of Beaver Valley there is no recharge from areal precipitation. Modeling an increase of as little as 0.5 in. (13 mm) of recharge from precipitation caused drastic rises in the computed water level, so much so that if such recharge was actually occurring, the ground-water levels would be far above their present level. There is recharge from precipitation on irrigated fields, however, as explained in the section on recharge. The accuracy of the modeled recharge from the deep seepage of irrigation water is believed to be high, because the model is very sensitive to recharge.

Doubling the hydraulic conductivity cause such large computed water-level changes and changes in the configuration of the potentiometric surface that it is concluded that the hydraulic-conductivity array is reasonably correct as modeled. This conclusion is valid only if the modeled saturated thickness is correct, because the product of of hydraulic conductivity and saturated thickness is used in the computer program to determine the transmissivity. For this reason, the model has the same sensitivity to saturated thickness as it has for hydraulic conductivity.

The model is highly sensitive to changes in natural ground-water discharge to springs, inasmuch as a small change in head in the aquifer results in a relatively large change in ground-water discharge. The principal significance of this phenomenon is that no matter how much additional recharge may occur in the vicinity of the bottom lands along the Beaver River (above the modeled long-term average), there is little or no increase in ground-water storage. Secondly, this high sensitivity suggests that withdrawals from wells in the general bottom-land area where ground water is discharging to streams is essentially withdrawals from streams except for some additional recharge induced by pumping.

Evaluation of the digital model

Although the digital-computer model was assembled with sparse field data, it has proven to be a valuable tool in the evaluation and understanding of the total hydrology of Beaver Valley. It can be a valuable tool for planners and administrators in developing the full potential of the available water supply, despite the lack of sufficient field data to properly calibrate and verify the model.

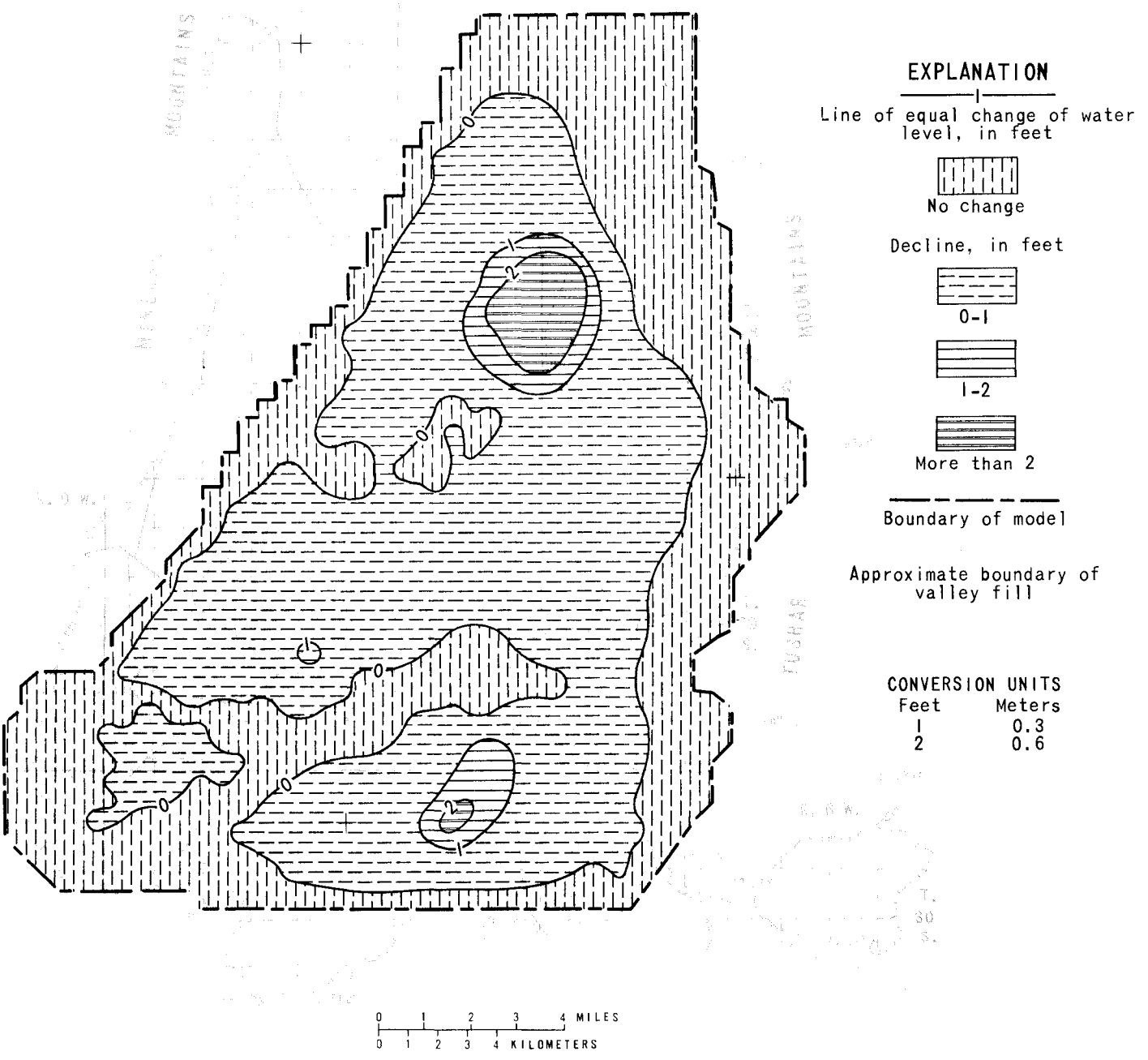

Figure 18.— Computed water-level changes, 1949-75, with ground-water withdrawals modeled.

The assigned values of the parameters used in the calibration of the model were varied widely to test the sensitivity of each on the model. Those parameters used in the present final model are based on the best available data and on the results of the sensitivity tests. Thus, known pumping stresses of different magnitudes may be applied to the present model in areas for which there are field data with a fair confidence in the computed results. The same stresses applied in areas where field data are sparse or missing may produce erroneous results; however, the results probably will indicate the approximate effects of pumping in such areas. In areas where there are little or no field data, it may be desirable to vary certain critical parameters to determine a probable range in effects from the applied stresses.

The use of constant head nodes around the periphery of the valley is applicable only where the effects of man's activities on the water table have not reached to the boundary. Such effects probably have been small and at only a few boundary nodes through the end of the present study. The effects, however, will become greater and will occur at more places as ground-water withdrawals continue at a higher rate than they were for most of the study period. For this reason, subsurface inflow may have to be modeled differently in future models.

SUMMARY AND CONCLUSIONS

The unconsolidated to partly consolidated materials underlying the Beaver valley plain compose the principal ground-water reservoir, which may consist of one to three hydrogeologic units overlying older and relatively impermeable rocks.

The materials composing the ground-water reservoir consist of interbedded, lenticular, and interfingering deposits of alluvial sediments ranging in size from clay to boulders, except that locally, the lower of the three units also contains basalt. The hydraulic continuity between the hydrogeologic units and between beds of the same unit are not good everywhere, but the connection is sufficient for all three units to be considered as part of the same ground-water reservoir.

The principal ground-water reservoir is in approximate hydrologic equilibrium; that is, the long-term trend of water levels has not changed much and recharge equals discharge—about 56,000 acre-ft (69 hm^3) a year. Storage, therefore, is not changing. The total amount of water in storage in the ground-water reservoir is about 12 million acre-ft (14,800 hm^3). A 1-ft (0.3-m) average change of water level over the valley from that of spring 1974 would result in a change in storage of about 29,000 acre-ft (36 hm^3). The amount of change in storage per foot of change in water level decreases to 15,000 acre-ft (18 hm^3) with the depth to water 100 ft (30 m) lower.

Ground-water storage has not been reduced by withdrawals from wells because withdrawals have been restored by recharge. Appreciable changes in storage will not occur until the rejected recharge and natural discharge are greatly reduced because all large-yielding wells are in or near areas where these are occurring. Discharging wells at more distant points from areas of recharge, however, may cause some reduction in storage.

The concentration of dissolved solids in most of the water in the valley is well within the U.S. Public Health Service (1962) recommended maximum limit for drinking water. In the ground-water reservoir the limit is exceeded only in the southwestern part of the valley and elsewhere in small local areas. In surface streams the limit is exceeded usually during periods of low flow in the Beaver River.

According to the U.S. Salinity Laboratory Staff (1954) classification, surface water ranges from low-sodium and low-salinity hazard classes near canyon mouths to low-sodium and high-salinity hazard class at Beaver River near Adamsville. The quality of most of the ground water is in the low-sodium and medium-salinity hazard class.

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Table 11.—Records of selected wells

Location: See page 2 for explanation of numbering system.
Use of water: C, commercial; H, domestic; I, irrigation; N, industrial; P, public supply; R, recreation or public supply at campground; S, stock; U, unused.
Well depth: From land surface. Code following depth: 1, depth measured by U.S. Geological Survey; 3, reported by other source.
Casing depth: Depth to top of screen or first perforation. Well may have open hole, screen, perforations, or blank casing to greater depth.
Altitude of land-surface datum: Above mean sea level. Code following altitude: 0, 1, 2, instrument level more accurate than 1 foot; 3, 4, 5, interpolated from topographic maps, accurate to 5, 10, 20 feet, respectively.
Water level: Below or above(+) land-surface datum at well; F, flows but head not measured. Code following water level: A, measured, accurate to within 1 foot; B, measured, less accurate than 1 foot; D, reported by well driller; I, measured with manometer.
Drawdown: Code following drawdown applies to both yield and drawdown: 0, measured, accurate to within 1 foot; 1, measured, less accurate than 1 foot; 2, measured with air line; 3 reported by well driller; 5, estimated.
Other data available: C, chemical analysis in table 14; H, hydrograph in figure 8 or 9; L, log in table 17; W, water-level measurements in table 13.

LOCATION	OWNER	USE OF WATER	DATE DRILLED (YEAR)	WELL DEPTH (FT)	CASING DEPTH (FT)	CASING DIAMETER (IN)	ALTITUDE OF LSD (FT)	WATER LEVEL (FT)	DATE WATER LEVEL MEASURED	YIELD (GAL/MIN)	DRAW DOWN (FT)	SPECIFIC CAPACITY [(GAL/MIN)/FT]	TEMPERATURE (°C)	OTHER DATA AVAILABLE
(C-27- 7)33BAD- 1	ABE BOYLE	I	1952	320 3	60	16	6190 5	77 D	12-52	--	--	--	--	W
(C-27- 7)33CCA- 2	ABE BOYLE	U	--	--	--	8	6145 5	31 A	6-75	--	--	--	--	L
(C-28- 6)29CBC- 1	E CORRAL ET AL	H	1974	216 3	120	6	6560 5	68 D	12-74	--	--	--	--	
(C-28- 6)29CBD- 2	F J PUFFER	H	1972	140 3	80	6	6590 5	50 D	-72	--	--	--	--	
(C-28- 6)30CCA- 2	J E PUFFER	H	1971	283 3	120	6	6460 5	80 D	10-71	--	--	--	--	
(C-28- 6)30DBD- 2	C F DANIELS	H	1959	84 3	--	6	6520 5	20 D	11-59	--	--	--	--	
(C-28- 6)31ABB- 1	A M MCCAHAN	H	1972	385 3	--	6	6485 3	329 A	6-75	--	--	--	--	
(C-28- 7)15BBA- 1	S R BRADSHAW	U	1959	492 3	100	14	6275 0	93 A	2-68	--	--	--	--	W
(C-28- 7)15BBA- 2	S R BRADSHAW	I	1972	984 3	--	14	6272 0	149 A	9-73	900	200 3	4.5	10.0	C,L,W
(C-28- 7)16DCA- 2	LAVEL BRADSHAW	I	1955	300 3	50	14	6197 0	22 A	9-73	880	38 0	23.2	9.4	L,W
(C-28- 7)19BDB- 1	NORTH DIVIDE CO	S	1955	207 3	90	6	5976 0	46 A	6-73	--	--	--	--	L,W
(C-28- 7)21ABD- 1	V V BRADSHAW	U	1955	422 3	60	14	6166 0	9 A	9-73	750	140 3	5.4	--	
(C-28- 7)21DAA- 1	E F BALDWIN	U	--	30 1	--	--	6149 0	24 A	3-56	--	--	--	--	W
(C-28- 7)21DDA- 1	H L BRADSHAW	I	1959	232 3	70	12	6120 0	22 A	6-75	800	100 3	8.0	--	C,H,L,W
(C-28- 7)27CCA- 1	D W KENT	H	1973	362 3	240	6	6169 0	79 A	9-73	--	--	--	--	L,W
(C-28- 7)31ADA- 1	BISHOP BROS	U	1944	111 3	45	4	5945 2	14 A	8-73	--	--	--	--	W
(C-28- 7)34ABD- 1	RICHARD BROWN	H	1975	258 3	120	6	6235 5	102 B	5-75	--	--	--	11.0	
(C-29- 7) 3ABC- 1	RONALD BRADSHAW	S	--	--	--	6	6137 0	37 A	8-73	--	--	--	--	W
(C-29- 7) 3CAB- 1	RONALD BRADSHAW	I	1971	1000 3	300	14	6086 0	20 A	7-73	1080	114 0	9.5	13.0	C,L,W
(C-29- 7) 4ACA- 1	L J BEAUMONT	S	1970	207 3	--	6	6064 0	10 A	8-73	--	--	--	--	L,W
(C-29- 7) 6AAA- 1	BILLY MILAM	U	1957	350 3	80	14	5910 5	18 A	8-73	400	100 3	4.0	--	L
(C-29- 7)10CDB- 1	RONALD BRADSHAW	I	1971	740 3	300	16	6022 0	45 D	12-71	820	--	--	12.2	L,W
(C-29- 7)11ADC- 2	K DEREBEEW	H	1967	206 3	98	6	6165 5	50 A	2-68	--	--	--	--	
(C-29- 7)11CDA- 1	SAM HUTCHINGS	I	1972	600 3	80	14	6098 0	89 A	3-74	610	132 5	4.6	12.3	C,L,W
(C-29- 7)14BAC- 1	SAM HUTCHINGS	S	1970	201 3	--	6	6088 0	59 A	9-70	--	--	--	--	L,W
(C-29- 7)14DDC- 1	FRED B HARRIS	U	1950	125 3	52	12	6043 0	47 A	2-68	--	--	--	--	H,W
(C-29- 7)15CDA- 1	BEAVER CITY	P	1950	152 3	32	12	5962 5	56 A	1-60	--	--	--	11.6	
(C-29- 7)16AAA- 1	W G BALDWIN	I	1950	185 3	42	16	5985 0	57 A	3-73	540	82 1	6.6	11.8	H,L,W
(C-29- 7)16DBB- 1	NW DITCH CO	I	1974	802 3	198	14	5915 5	65 A	9-74	2525	96 1	26.3	13.1	L,W
(C-29- 7)17CBA- 1	RONALD BRADSHAW	I	1950	274 3	19	16	5840 3	17 A	7-51	1175	94 1	12.5	11.5	W
(C-29- 7)17CBA- 2	ATWIN & SMITH	S	1959	72 3	40	6	5840 4	2 A	7-73	--	--	--	--	H,L,W
(C-29- 7)17CBA- 3	RONALD BRADSHAW	I	1974	462 1	195	14	5840 4	66 A	7-74	--	--	--	--	W
(C-29- 7)18DDD- 1	SMITH ET AL	I	1954	406 3	60	14	5798 4	32 A	5-75	1250	88 1	14.2	11.9	L
(C-29- 7)19BCD- 1	W R YARDLEY	I	1950	256 3	20	16	5773 2	21 A	3-73	1170	96 3	12.2	12.5	C,H,L,W
(C-29- 7)20BBA- 1	S ROBERTS ET AL	I	1963	400 3	170	14	5820 4	15 A	7-73	1240	68 5	18.2	12.2	L,W
(C-29- 7)20CCD- 1	YARDLEY CAT CO	I	1963	390 3	--	12	5788 3	10 D	12-63	900	80 3	11.2	--	
(C-29- 7)21BAA- 1	FRED SMITH	U	1934	415 3	--	12	5865 0	28 A	3-73	--	--	--	--	H,L,W
(C-29- 7)21CAC- 1	FISH AND GAME	R	1954	401 3	49	14	5825 5	6 D	10-54	1800	84 3	21.4	--	C
(C-29- 7)21DBB- 1	MILAND DAIRY	N	1975	150 1	--	8	5850 4	7 A	5-75	--	--	--	--	L
(C-29- 7)22ADA- 1	B W & S A SMITH	I	1963	453 3	--	14	5962 0	54 A	3-74	1075	40 1	26.9	11.5	L,W
(C-29- 7)22BDA- 1	BEAVER CITY	P	1966	318 3	150	14	5924 1	--	--	1250	125 3	10.0	12.8	C,L
(C-29- 7)27CCA- 1	G B LOW	S	1961	138 3	98	6	5948 0	69 A	7-73	--	--	--	--	
(C-29- 7)28DBD- 1	MURDOCK INV CO	U	1900	213 3	--	3	5856 0	21 A	3-73	--	--	--	--	H,W
(C-29- 7)32DAA- 1	DALE HARRIS	U	1947	157 3	27	12	5830 3	12 D	4-47	--	--	--	--	
(C-29- 7)32DAA- 2	DALE HARRIS	I	1950	228 3	16	12	5830 3	15 A	12-51	760	23 2	33.0	13.5	W
(C-29- 7)32DBD- 1	P & B SMITH	I	1950	156 3	40	14	5819 3	35 A	3-73	--	--	--	12.3	C,L,W
(C-29- 7)33ADB- 1	ROWLAND YARDLEY	C	1973	304 3	140	6	5896 0	23 A	--	--	--	--	--	
(C-29- 7)34ACB- 1	ROWLAND YARDLEY	S	1934	119 3	--	6	5964 0	66 A	11-73	--	--	--	--	W
(C-29- 7)34BAC- 1	D MORWOOD	S	1971	230 3	200	6	5938 0	55 A	6-73	--	--	--	--	
(C-29- 7)34BBD- 1	W R YARDLEY	I	1973	490 1	140	12	5934 0	53 A	7-73	1200	77 0	15.6	13.5	C,L,W
(C-29- 7)34BDD- 1	ROWLAND YARDLEY	S	1900	110 3	62	6	5958 3	63 A	8-59	--	--	--	--	
(C-29- 8) 9BAD- 1	BUR OF LAND MAN	S	1934	150 3	--	6	5653 0	98 D	10-34	--	--	--	18.0	C
(C-29- 8)13CCD- 1	BEAVER N RANGE	S	1972	200 3	--	6	5800 5	63 A	8-74	--	--	--	--	
(C-29- 8)13DDA- 1	MORGAN & CARTER	I	1955	410 3	80	14	5808 2	53 A	7-73	1200	62 0	19.4	16.5	L,W
(C-29- 8)20DCB- 1	S JESSUP	I	1959	175 3	40	12	5563 0	33 A	3-73	750	47 3	16.0	11.5	C,L,W
(C-29- 8)23CAA- 1	R M WILLIAMS	I	1961	440 3	--	14	5739 0	28 A	3-73	400	86 2	4.7	16.0	C,L,W
(C-29- 8)24AAB- 1	MORGAN & CARTER	S	1960	92 3	70	6	5792 2	38 A	7-73	--	--	--	13.5	
(C-29- 8)24DBA- 1	W YARDLEY ET AL	I	1950	254 3	15	16	5748 2	7 A	3-74	800	68 5	11.8	14.5	
(C-29- 8)24DBB- 1	MORGAN & CARTER	S	1904	--	--	3	5740 4	F	9-73	2	--	--	18.4	
(C-29- 8)25CAC- 1	LDS CHURCH	H	1905	250 3	250	2	5672 3	+10 I	2-73	10	7 0	1.4	19.0	C,H,W
(C-29- 8)25CBC- 2	C E HUTCHISON	H	1973	200 3	--	6	5665 4	F	9-73	--	--	--	12.5	
(C-29- 8)26DAA- 1	V E EDWARDS	H	1936	160 3	40	6	5670 4	+18 D	3-36	--	--	--	14.8	
(C-29- 8)26DAA- 2	V E EDWARDS	S	1936	447 3	35	6	5667 4	+18 D	4-36	--	--	--	--	L
(C-29- 8)27CAC- 1	E C COSPER	U	1973	550 3	496	6	5648 2	46 A	9-73	--	--	--	--	
(C-29- 8)27CDB- 1	E C COSPER	H	1974	136 3	--	--	5615 4	--	--	--	--	--	--	
(C-29- 8)28CDA- 1	DALE MURDOCK	U	1934	180 3	43	12	5566 0	2 A	9-73	--	--	--	--	
(C-29- 8)29BCD- 1	R B STEWART	I	1902	--	--	3	5520 3	F	9-73	80	--	--	11.3	
(C-29- 8)30BDD- 4	D J ROLLINS	--	1956	110 3	45	6	5525 3	40 D	9-56	--	--	--	--	
(C-29- 8)31ADD- 1	MURDOCK & MYERS	I	1955	310 3	45	14	5548 2	41 A	3-73	1400	110 3	12.7	12.1	C,H,L,W
(C-29- 8)32ACA- 1	SMITH & NIELSON	H	1973	370 3	160	8	5589 2	47 A	11-73	--	--	--	--	L,W
(C-29- 8)35ABD- 1	ABERDARE CANAL	I	1961	514 3	90	14	5653 3	5 A	5-74	355	73 0	4.9	18.5	L,W
(C-29- 8)35DBC- 1	F D SMITH	I	1974	300 3	120	12	5742 3	45 A	6-75	--	--	--	16.5	C,W
(C-29- 8)36ABB- 1	BARTON DITCH	I	1934	335 3	172	6	5677 3	F	9-73	--	--	--	21.5	
(C-29- 8)36ACC- 1	ABERDARE CANAL	I	1934	360 3	135	6	5681 3	F	9-73	55	--	--	22.0	
(C-29- 8)36ACC- 2	ABERDARE CANAL	I	1970	518 3	--	16	5686 3	F	9-73	1300	173 2	7.5	25.0	C,L
(C-29- 8)36ACD- 1	ABERDARE CANAL	I	1934	360 3	115	6	5687 3	F	9-73	120	--	--	21.0	
(C-30- 7) 5AAA- 1	P & B SMITH	S	1961	80 3	28	6	5859 3	27 A	7-73	--	--	--	--	W
(C-30- 7) 5ABD- 1	KEN HUFF	I	1973	400 3	130	16	5915 3	78 A	7-73	--	--	--	14.4	W
(C-30- 7) 5BBC- 1	BEAVER CITY	U	1948	97 3	94	4	5828 3	69 D	12-48	18	5 3	3.6	--	
(C-30- 7) 5CCD- 1	S A & B W SMITH	I	1969	610 3	--	14	5910 3	108 A	3-75	--	--	--	18.9	L,W
(C-30- 7) 5CDD- 1	S A & B W SMITH	I	1973	805 3	250	16	5914 3	98 D	2-73	1000	202 5	5.0	22.0	C,W
(C-30- 7)[illegible]	ROWLAND YARDLEY	S	1972	200 3	--	6	6005 3	80 A	7-73	--	--	--	--	W
(C-30- 9)14DDC- 1	T L GIESING	C	1973	190 3	120	6	5538 0	75 D	1-73	60	15 3	4.0	--	W
(C-30- 9)[illegible]AAC- 1	ST PK & REC COM	R	1965	161 3	145	6	5520 5	34 D	11-65	400	20 3	20.0	--	

Table 12.—Records of selected springs

Location: See page 2 for explanation of numbering system.
Use of water: I, irrigation; R, recreation or public supply at campground; S, stock.
Altitude of land-surface datum: Above mean sea level. Code following altitude: 0, instrument level, more accurate than 1 foot; 3, 4, 5, interpolated from topographic maps, accurate to 5, 10, 20 feet, respectively.
Other data available: C, chemical analysis in table 14.

Location	Owner or name	Use of water	Altitude of land-surface datum (ft)	Yield (gal/min)	Temperature (°C)	Other data available
(C-28-7)19bda-S1	North Divide Co.	S	5,930 4	1	13.0	
28cca-S1	Nellie Spring	I	6,030 5	5	11.0	
29bcc-S1	Phillip Spring	S	6,015 5	120	11.0	
(C-29-7)4dbb-S1	Harris Bros.	I	6,030 4	.4	17.0	
4dbb-S2	do.	I	6,030 4	.7	17.0	
4dbc-S1	do.	I	6,030 4	.5	21.0	
4ddb-S1	Lavar Gale	I	6,030 4	--	--	
13ccc-S1	Smith Spring	I	6,050 4	180	19.5	
19bcb-S1	Morgan & Carter	I	5,768 4	50	15.0	
20aab-S1	--	I	5,840 3	400	11.0	
21cad-S1	Utah Div. Parks & Recreation	R	5,830 5	--	13.5	C
21cdb-S1	do.	R	5,830 5	--	14.0	C
28a-S	--	I	5,860 5	--	--	C
28dcd-S1	Danny Spring	I	5,850 5	10	--	
32aac-S1	Hofhein Spring	S	5,797 4	15	12.0	
32abd-S1	Susi Spring	S	5,797 4	6	13.0	
33aba-S1	--	S	5,861 0	--	10.0	

Table 13.—Water levels in selected observation wells

[Measurements by U.S. Geological Survey unless indicated otherwise]

See page 2 for explanation of numbering system.
Altitude of land-surface datum (LSD) given in feet above mean sea level (MSL).
Water levels are given in feet above(+) or below land-surface datum.
Explanation of symbols appearing after measurements - A, well being pumped; B, well pumped recently; C, nearby well being pumped; E, estimated; G, measurement by another agency; H, tape measurement.

NUMBER (C-27- 7)33BAD- 1. STATE APPLICATIONS 24004 AND 30189. ABE BOYLE. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 16 IN (41 CM), DEPTH 320 FT (98 M), CASED TO 320 FT (98 M), PERFORATED UNKNOWN DISTANCE BELOW 60 FT (18 M). MP TOP OF CASING, 0.50 FT (0.2 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 6190 FT ABOVE MSL.
HIGHEST WATER LEVEL 77.00 BELOW LSD, DEC. 6, 1952,
LOWEST WATER LEVEL 91.80 BELOW LSD, MAR. 18, 1957.
RECORDS AVAILABLE: 1952-59, 1975-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
DEC. 6, 1952	77.00G	NOV. 29, 1955	89.55	DEC. 9, 1957	88.63	APR. 4, 1959	90.76
APR. 6, 1953	81.92	MAR. 22, 1956	90.15	MAR. 21, 1958	88.62	JUNE 4, 1975	87.95
MAR. 22, 1954	85.08	DEC. 5	91.00	OCT. 13	90.01	OCT. 2	90.45
MAR. 15, 1955	88.28	MAR. 18, 1957	91.80	DEC. 8	90.10	MAR. 4, 1976	89.48B

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-29-7)21BAA-1. STATE APPLICATION 21717. F. D. SMITH. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 12 TO 6 IN (30 TO 15 CM), DEPTH 415 FT (126 M). CASED TO 380 FT (116 M). MP TOP OF CASING, 0.20 FT (0.06 M). ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5665.15 FT ABOVE MSL.
HIGHEST WATER LEVEL 0.05 BELOW LSD, JUNE 29, 1938,
LOWEST WATER LEVEL 29.71 BELOW LSD, MAR. 29, 1960.
RECORDS AVAILABLE: 1935-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
SEP. 18, 1935	14.55	MAR. 28, 1945	21.41	MAR. 21, 1958	25.24	NOV. 20, 1973	19.90
OCT. 15	17.17	DEC. 12	20.13	OCT. 13	13.39	DEC. 17	24.69
NOV. 24	22.14	MAR. 14, 1946	22.91	DEC. 8	21.29	JAN. 14, 1974	26.41
FEB. 4, 1936	25.64	DEC. 9	21.02	APR. 4, 1959	24.27	FEB. 6	25.40
APR. 15	20.41	MAR. 19, 1947	22.30	OCT. 31	23.65	FEB. 20	25.64
JUNE 14	0.53	SEP. 10	7.20	DEC. 28	28.26	MAR. 2	25.97
JULY 30	0.39	DEC. 5	18.57	MAR. 29, 1960	29.71	MAR. 25	28.30
SEP. 22	4.55	MAR. 9, 1948	17.82	MAY 12	16.89	MAR. 28	26.35
NOV. 14	14.57	JULY 13	1.75	JUNE 20	12.92	APR. 4	24.15
DEC. 14	19.50	AUG. 25	9.71	JULY 15	16.65	APR. 15	19.15
FEB. 1, 1937	23.35	SEP. 25	15.73	AUG. 2	19.46	APR. 19	17.92
FEB. 10	23.60	OCT. 25	16.93	SEP. 10	21.74	APR. 22	16.01
MAR. 12	22.12	NOV. 26	20.78	OCT. 20	23.75	APR. 27	14.56
APR. 1	18.55	DEC. 2	21.14	JAN. 3, 1961	29.12	MAY 3	12.21
APR. 7	17.02	FEB. 25, 1949	23.88	MAR. 14	27.47	MAY 20	8.36
APR. 26	13.66	MAR. 31	21.85	MAY 2	18.07	JUNE 10	4.52
MAY 19	1.96	APR. 18	20.80	JUNE 9	13.86	JUNE 24	3.36
JUNE 25	0.40	MAY 1	11.47	AUG. 10	21.09	JUNE 28	4.60
AUG. 6	1.53	JULY 21	3.75	SEP. 11	21.53	JULY 10	6.12
AUG. 27	6.33	JULY 31	2.80	OCT. 5	21.97	JULY 23	8.20
SEP. 29	11.44	SEP. 7	7.30	APR. 2, 1962	26.54	JULY 28	9.38
OCT. 21	13.64	DEC. 6	20.29	MAY 7	11.80	AUG. 5	10.42
DEC. 2	19.58	MAR. 21, 1950	22.86	OCT. 16	18.91	AUG. 18	13.48
FEB. 17, 1938	22.65	JUNE 19	9.01	MAR. 20, 1963	24.65	AUG. 21	14.15
MAR. 7	24.49	AUG. 3	14.32	OCT. 11	21.87	SEP. 23	18.09
APR. 21	17.65	AUG. 12	16.17	MAR. 25, 1964	29.24	OCT. 2	20.37
JUNE 20	0.28	SEP. 25	19.86	OCT. 28	20.88	NOV. 12	22.11
JUNE 29	0.05	DEC. 5	24.79	MAR. 13, 1965	27.02	DEC. 10	25.00
AUG. 1	1.45	MAR. 19, 1951	25.80	NOV. 3	16.48	JAN. 7, 1975	26.52
SEP. 3	7.99	MAY 11	15.80	MAR. 12, 1966	26.36	FEB. 5	27.33
OCT. 27	15.10	JUNE 5	11.72	AUG. 29	20.28	MAR. 4	27.73
DEC. 16	20.89	JULY 6	9.50	FEB. 28, 1967	24.10	MAR. 17	27.95
JAN. 25, 1939	23.65	JULY 11	9.66	AUG. 28	8.28	APR. 8	25.78
FEB. 23	24.38	AUG. 21	14.40	FEB. 27, 1968	23.65	APR. 9	24.78
MAR. 31	22.62	OCT. 18	19.54	SEP. 25	11.35	APR. 10	25.52
MAY 4	13.60	DEC. 4	24.94	MAR. 13, 1969	24.58	APR. 14	24.36
JUNE 15	8.96	MAR. 31, 1952	25.77	OCT. 1	10.12	APR. 18	23.74
JULY 18	13.67	MAY 23	3.20	MAR. 4, 1970	23.75	MAY 5	20.48
AUG. 12	15.97	JUNE 24	0.08	SEP. 28	13.55	MAY 9	19.15
OCT. 24	19.34	AUG. 1	0.88	MAR. 16, 1971	25.56	MAY 13	18.08
DEC. 18	23.30	SEP. 10	6.37	OCT. 8	15.29	MAY 14	17.86
FEB. 9, 1940	23.41	NOV. 10	16.41	MAR. 6, 1972	28.60	MAY 15	17.68
APR. 8	22.04	DEC. 2	20.99	OCT. 2	23.12	MAY 19	15.33
JUNE 6	1.57	MAR. 11, 1953	25.07	MAR. 6, 1973	27.99	MAY 23	13.35
JULY 19	5.87	APR. 10	20.90	JUNE 5	3.03	JUNE 2	10.92
AUG. 7	10.36	MAY 13	13.80	JUNE 12	2.39	JUNE 6	9.32
SEP. 12	13.62	DEC. 8	25.51	JULY 10	1.62	JUNE 23	4.17
DEC. 10	21.60	MAR. 22, 1954	26.16	JULY 18	0.70	JUNE 26	4.27
JULY 14, 1941	0.07	JUNE 8	8.90	JULY 26	1.20	JULY 3	4.16
SEP. 22	5.92	JULY 29	15.938	AUG. 1	1.64	JULY 7	7.51
NOV. 28	16.25	MAR. 15, 1955	26.43	AUG. 8	1.90	JULY 14	3.24
MAR. 13, 1942	22.96	SEP. 2	16.80	SEP. 4	6.92	JULY 21	3.42
JULY 22	0.93	NOV. 29	25.77	SEP. 12	8.75	JULY 28	3.56
DEC. 7	20.65	MAR. 22, 1956	26.40	SEP. 21	10.60	AUG. 4	3.88
MAR. 9, 1943	21.09	DEC. 5	27.22	OCT. 2	12.39	AUG. 13	5.47
DEC. 4	22.31	MAR. 18, 1957	26.59	NOV. 5	16.68	OCT. 1	13.72
MAR. 11, 1944	24.08	DEC. 9	21.10	NOV. 13	18.34	MAR. 2, 1976	27.40
DEC. 6	19.35						

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-28- 7)15BBA- 1. STATE APPLICATION 25067. S. R. BRADSHAW. DRILLED UNUSED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 492 FT (150 M), PERFORATED UNKNOWN DISTANCE BELOW 100 FT (30 M). MP TOP OF CASING, 1.00 FT (0.30 M) ABOVE LSD. WELL SILTED; MEASUREMENTS DISCONTINUED. WATER LEVEL BELOW LSD.
LSD 6274.90 FT ABOVE MSL.
HIGHEST WATER LEVEL 80.48 BELOW LSD, NOV. 3, 1965,
LOWEST WATER LEVEL 101.04 BELOW LSD, OCT. 28, 1964.
RECORDS AVAILABLE: 1959-68.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT. 31, 1959	90.15	SEP. 10, 1960	90.74	APR. 4, 1962	95.89	NOV. 3, 1965	80.48
MAR. 29, 1960	92.76	OCT. 21	90.76	MAR. 20, 1963	97.41	MAR. 12, 1966	93.22
MAY 12	89.82	JAN. 3, 1961	92.49	MAR. 25, 1964	100.19	FEB. 27, 1967	94.90
JUNE 20	88.95	MAR. 14	94.20	OCT. 28	101.04	FEB. 26, 1968	93.00
AUG. 2	89.04	MAY 2	92.75	MAR. 13, 1965	98.53		

NUMBER (C-28- 7)15BBA- 2. STATE APPLICATION 25067. S. R. BRADSHAW. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 984 FT (300 M). MP BOTTOM OF HOLE IN CASING, 1.20 FT (0.37 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 6271.88 FT ABOVE MSL.
HIGHEST WATER LEVEL 136.97 BELOW LSD, MAR. 27, 1974,
LOWEST WATER LEVEL 152.05 BELOW LSD, MAR. 4, 1976.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
SEP. 11, 1973	149.05	JULY 11, 1974	189. A	APR. 8, 1975	148.46	MAR. 4, 1976	152.05
MAR. 27, 1974	136.97	MAR. 5, 1975	149.57				

NUMBER (C-28- 7)16DCA- 2. STATE APPLICATION 19931, A-2458. LAVEL BRADSHAW. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 300 FT (91 M), PERFORATED UNKNOWN DISTANCE BELOW 50 FT (15 M). MP TOP OF CASING, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 6196.72 FT ABOVE MSL.
HIGHEST WATER LEVEL 36.45 BELOW LSD, AUG. 5, 1974,
LOWEST WATER LEVEL 42.29 BELOW LSD, MAR. 5, 1975.
RECORDS AVAILABLE: 1973-75.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
SEP. 13, 1973	56.71A	APR. 17, 1974	34.00	JULY 11, 1974	69.85A	MAR. 5, 1975	42.29
MAR. 27, 1974	33.87	APR. 30	70.93A	AUG. 5	36.45		

NUMBER (C-28- 7)19BDB- 1. STATE APPLICATION NUMBER 27119. NORTH DIVIDE GRAZING CO. DRILLED STOCK WATER-TABLE WELL IN ALLUVIUM, DIAM 6 IN (15 CM), DEPTH 207 FT (63 M) PERFORATED UNKNOWN DISTANCE BELOW 90 FT (27 M). MP TOP OF CASING, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5975.50 FT ABOVE MSL.
HIGHEST WATER LEVEL 45.35 BELOW LSD, MAR. 27, 1974,
LOWEST WATER LEVEL 47.70 BELOW LSD, APR. 7, 1962.
RECORDS AVAILABLE: 1962, 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
APR. 7, 1962	47.70	JUNE 12, 1974	45.50	OCT. 2, 1974	45.85	MAY 7, 1975	45.57
JUNE 13, 1973	45.74	JULY 10	45.42	NOV. 12	45.86	JUNE 5	45.56
MAR. 27, 1974	45.35	JULY 23	46.09	DEC. 9	45.77	JUNE 25	45.66
APR. 17	45.49	AUG. 2	45.69	MAR. 5, 1975	45.58	OCT. 2	45.91
APR. 30	45.51	AUG. 20	45.77	APR. 8	45.59	MAR. 4, 1976	45.49
MAY 22	45.49	SEP. 24	45.84				

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-28- 7)21DAA- 1. EARL F. BALDWIN. DUG UNUSED DOMESTIC WATER-TABLE WELL IN ALLUVIUM, DEPTH 30 FT (9 M), UNCASED. MP TOP OF WOODEN WELL COVER, AT LSD. WELL DESTROYED; MEASUREMENTS DISCONTINUED. WATER LEVEL BELOW LSD.
LSD 6149.30 FT ABOVE MSL.
HIGHEST WATER LEVEL 6.75 BELOW LSD, JUNE 24, 1952,
LOWEST WATER LEVEL 27.97 BELOW LSD, APR. 27, 1939.
RECORDS AVAILABLE: 1935-56.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
SEP. 16, 1935	25.03	DEC. 16, 1938	24.73	SEP. 22, 1941	16.63	SEP. 7, 1949	19.30
OCT. 16	25.16	JAN. 25, 1939	25.65	NOV. 29	14.49	DEC. 6	18.47
NOV. 24	25.59	FEB. 23	26.15	MAR. 13, 1942	19.29	MAR. 21, 1950	19.82
FEB. 4, 1936	25.91	APR. 1	26.22	JULY 22	16.14	SEP. 29	19.92
APR. 15	25.90	APR. 27	27.97	DEC. 3	19.83	DEC. 5	18.19
JUNE 14	16.00	JUNE 15	26.75	MAR. 9, 1943	21.38	MAR. 19, 1951	21.89
JULY 30	19.27	JULY 18	26.48	DEC. 4	24.49	JUNE 7	21.60
SEP. 21	22.50	AUG. 12	26.63	MAR. 11, 1944	11.21	OCT. 18	24.80
NOV. 14	23.80	OCT. 25	26.61	DEC. 6	17.36	DEC. 5	25.25
FEB. 11, 1937	24.65	DEC. 18	26.65	MAR. 29, 1945	8.82	MAR. 31, 1952	25.27
APR. 7	21.10	FEB. 9, 1940	25.79	DEC. 14	17.33	JUNE 24	6.75
MAY 18	7.12	APR. 8	25.75	MAR. 14, 1946	21.00	AUG. 1	9.90
AUG. 3	16.70	APR. 29	23.92	DEC. 8	12.92	DEC. 2	18.36
OCT. 3	22.24	JUNE 6	16.44	MAR. 19, 1947	21.25	MAR. 11, 1953	20.25
NOV. 5	22.40	AUG. 7	20.53	DEC. 5	14.55	DEC. 4	24.49
DEC. 2	21.95	SEP. 9	23.35	MAR. 9, 1948	22.59	MAR. 22, 1954	23.48
FEB. 17, 1938	25.42	DEC. 10	22.53	JULY 12	16.43	JULY 16	20.00
APR. 21	23.10	MAR. 25, 1941	12.21	DEC. 2	19.70	MAR. 15, 1955	25.20
JUNE 30	13.60	APR. 29	15.15	MAR. 30, 1949	23.48	NOV. 29	25.00
SEP. 3	21.21	JULY 14	12.33	JULY 21	17.90	MAR. 22, 1956	23080
OCT. 27	24.44						

NUMBER (C-28- 7)21DDA- 1. STATE APPLICATION 27279. H. L. BRADSHAW. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 12 IN (30 CM), DEPTH 232 FT (71 M), PERFORATED UNKNOW DISTANCE BELOW 70 FT (21 M). MP TOP OF CASING, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 6119.78 FT ABOVE MSL.
HIGHEST WATER LEVEL 15.67 BELOW LSD, JULY 31, 1973,
LOWEST WATER LEVEL 55.00 BELOW LSD, JULY 15, 1960.
RECORDS AVAILABLE: 1959-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT. 31, 1959	29.32	AUG. 28, 1967	26.96	OCT. 2, 1973	17.04	FEB. 5, 1975	22.17
DEC. 28	29.70	FEB. 28, 1968	27.59	NOV. 5	17.11	MAR. 5	22.61
MAR. 29, 1960	30.57	SEP. 25	18.94	NOV. 13	17.23	MAR. 17	22.93
JUNE 20	37.30	MAR. 12, 1969	22.92	NOV. 20	17.38	APR. 8	23.22
JULY 15	55.00	MAR. 4, 1970	19.46	DEC. 17	18.17	APR. 10	23.35
AUG. 2	39.75	MAR. 16, 1971	21.82	JAN. 14, 1974	17.66	APR. 14	23.34
SEP. 10	32.19	OCT. 8	20.77	FEB. 19	18.16	APR. 18	23.03
OCT. 21	31.82	MAR. 6, 1972	23.45	MAR. 2	19.62	MAY 7	23.59
JAN. 3, 1961	32.22	OCT. 2	31.89	MAR. 27	19.02	MAY 14	23.62
MAR. 14	32.65	MAR. 6, 1973	27.31	APR. 3	19.22	MAY 19	23.01
MAY 2	34.45	JUNE 5	19.41	APR. 15	18.57	MAY 23	22.58
OCT. 5	34.38	JUNE 12	19.21	APR. 22	19.20	JUNE 5	21.70
APR. 4, 1962	34.40	JULY 10	17.33	APR. 27	18.81	JUNE 25	19.35
OCT. 16	31.03	JULY 19	16.68	MAY 22	17.69	JULY 3	19.56
MAR. 20, 1963	31.67	JULY 26	16.07	JUNE 11	16.95	JULY 7	19.43
OCT. 11	33.66	JULY 31	15.67	JUNE 24	18.24	JULY 14	19.24
MAR. 25, 1964	34.65	AUG. 4	15.93	AUG. 5	18.54	JULY 21	18.87
OCT. 28	32.76	AUG. 9	15.75	SEP. 25	18.80	JULY 28	18.60
MAR. 13, 1965	33.39	SEP. 4	16.26	OCT. 2	18.95	AUG. 4	19.16
NOV. 3	26.81	SEP. 11	16.51	NOV. 12	19.68	AUG. 13	23.49
MAR. 12, 1966	28.04	SEP. 18	16.77	DEC. 9	20.64	OCT. 1	18.90
AUG. 29	28.81	SEP. 27	16.99	JAN. 7, 1975	21.47	MAR. 4, 1976	21.90
FEB. 27, 1967	30.72						

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-28- 7)27CCA- 1. STATE APPLICATION 40336. D. W. KENT.
DRILLED DOMESTIC WATER-TABLE WELL IN ALLUVIUM, DIAM 6 IN (15 CM), DEPTH 362 FT (110 M), CASED TO 362 FT (110 M), PERFORATED 240-362 FT (73-110 M). MP TOP OF CASING, 0.30 FT (0.09 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 6169.02 FT ABOVE MSL.
HIGHEST WATER LEVEL 78.75 BELOW LSD, SEP. 4, 1973,
LOWEST WATER LEVEL 83.95 BELOW LSD, MAY 7, 1975.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
SEP. 4, 1973	78.75	JULY 10, 1974	80.34	OCT. 2, 1974	80.30	MAY 7, 1975	83.95
MAR. 27, 1974	81.41	JULY 23	80.54	NOV. 12	80.90	JUNE 5	83.36
APR. 17	81.42	AUG. 5	80.88	DEC. 9	81.36	JUNE 25	82.13
MAY 2	81.33	AUG. 20	81.25	MAR. 5, 1975	82.83	OCT. 2	79.40
MAY 21	81.01	SEP. 25	80.24	APR. 8	83.43	MAR. 4, 1976	81.98
JUNE 12	79.43						

NUMBER (C-28- 7)31ADA- 1. STATE APPLICATION 16098. BISHOP BROS.
DRILLED UNUSED STOCK WATER-TABLE WELL IN ALLUVIUM, DIAM 4 IN (10 CM), DEPTH 111 FT (34 M), CASED TO 108 FT (33 M), PERFORATED 45-108 FT (14-33 M). MPTOP OF CASING, 0.80 FT (0.24 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5945 FT ABOVE MSL.
HIGHEST WATER LEVEL 8.44 BELOW LSD, MAR. 27, 1974,
LOWEST WATER LEVEL 17.19 BELOW LSD, OCT. 2, 1975.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
AUG. 6, 1973	13.68	JULY 10, 1974	12.53	OCT. 2, 1974	16.75	MAY 7, 1975	9.54
MAR. 27, 1974	8.44	JULY 23	13.33	NOV. 12	16.88	JUNE 5	9.97
APR. 17	8.66	AUG. 2	13.91	DEC. 9	15.22	JUNE 25	11.07
MAY 1	8.97	AUG. 20	14.96	MAR. 5, 1975	11.56	OCT. 2	17.19
MAY 22	9.69	SEP. 25	16.55	APR. 8	9.97	MAR. 4, 1976	13.70
JUNE 12	10.61						

NUMBER (C-29- 7) 3ABC- 1. RONALD BRADSHAW. DRILLED STOCK WATER-TABLE WELL IN ALLUVIUM, DIAM 6 IN (15 CM), DEPTH 216 FT (66 M). MP BOTTOM OF HOLE IN CASING, 0.50 FT (0.15 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 6137.49 FT ABOVE MSL.
HIGHEST WATER LEVEL 36.77 BELOW LSD, AUG. 1, 1973,
LOWEST WATER LEVEL 88.74 BELOW LSD, MAR. 4, 1976.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
AUG. 1, 1973	36.77	JULY 30, 1974	47.33	MAR. 5, 1975	80.49	JUNE 26, 1975	40.45
MAR. 27, 1974	43.52	AUG. 6	49.73	APR. 8	49.29	JULY 3	38.60
APR. 17	41.18	AUG. 19	52.62	APR. 9	49.06	JULY 14	39.80
APR. 22	41.35	SEP. 25	58.29	MAY 6	47.50	JULY 21	38.88
APR. 30	42.32	OCT. 2	58.83	MAY 13	47.37	JULY 28	39.76
MAY 21	44.29	NOV. 12	60.37	JUNE 2	44.62	AUG. 4	42.50
JUNE 11	42.78	DEC. 9	65.53	JUNE 6	43.97	OCT. 2	55.70
JULY 10	42.69	JAN. 7, 1975	72.68	JUNE 23	40.36	MAR. 4, 1976	88.74
JULY 23	44.77	FEB. 5	76.47				

NUMBER (C-29- 7) 3CAB- 1. STATE APPLICATION 26234, A-4620. RONALD BRADSAW. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 M), DEPTH 1,000 FT (305 M) CASED TO 900 FT (274 M), PERFORATED 300-900 FT (91-274 M). MP BOTTOM OF HOLE IN SOUTH SIDE OF CASING, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 6086.36 FT ABOVE MSL.
HIGHEST WATER LEVEL 19.67 BELOW LSD, JULY 30, 1973,
LOWEST WATER LEVEL 47.42 BELOW LSD, JUNE 5, 1975.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JULY 26, 1973	20.38	MAR. 28, 1974	31.29	MAR. 4, 1975	37.97	JUNE 5, 1975	47.42
JULY 30	19.67	APR. 17	31.59	MAY 6	158.47A	MAR. 4, 1976	42.02
AUG. 2	135.81A	AUG. 5	142.05A				

NUMBER (C-29- 7) 4ACA- 1. STATE APPLICATION 38895. L. J. BEAUMONT. DRILLED STOCK WATER-TABLE WELL IN ALLUVIUM, DIAM 6 IN (15 CM), DEPTH 207 FT (63 M). MP TOP OF CASING, 4.00 FT (1.22 M) BELOW LSD. WATER LEVEL BELOW LSD.
LSD 6083.60 FT ABOVE MSL.
HIGHEST WATER LEVEL 8.53 BELOW LSD, AUG. 4, 1975.
LOWEST WATER LEVEL 14.45 BELOW LSD, MAY 6, 1975.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
AUG. 9, 1973	10.49	DEC. 10, 1974	11.95	JUNE 5, 1975	11.13	JULY 28, 1975	8.66
AUG. 5, 1974	12.02	JAN. 7, 1975	12.43	JUNE 25	10.16	AUG. 4	8.53
AUG. 19	12.25	MAR. 4	13.10	JULY 3	9.83	AUG. 13	9.09
SEP. 25	10.90	APR. 8	13.25	JULY 14	8.99	OCT. 2	10.44
OCT. 2	11.01	MAY 6	14.45	JULY 21	8.78	MAR. 4, 1976	12.47
NOV. 12	11.64						

NUMBER (C-29- 7)10CDB- 1. STATE APPLICATION 27278, A-4627. RONALD BRADSHAW. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 16 IN (41 CM), DEPTH 740 FT (226 M) CASED TO 740 FT (226 M), PERFORATED 300-740 FT (91-226 M). MP BOTTOM OF HOLE IN PUMP CASE, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 6022.41 FT ABOVE MSL.
HIGHEST WATER LEVEL 45.00 BELOW LSD, DEC. 1, 1971.
LOWEST WATER LEVEL 92.06 BELOW LSD, APR. 8, 1975.
RECORDS AVAILABLE: 1971, 1974-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
DEC. 1, 1971	45.00G	MAR. 4, 1975	91.28	MAY 6, 1975	176.16A	OCT. 2, 1975	83.10
MAR. 28, 1974	76.66	APR. 8	92.06	JUNE 5	166.43A	MAR. 4, 1976	91.02

NUMBER (C-29- 7)11CDA- 1. STATE APPLICATION 27007, A-5307. SAM HUTCHINGS. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 600 FT (183 M), CASED TO 600 FT (183 M), PERFORATED 80-600 FT (24-183 M). MP BOTTOM OF HOLE IN CASING, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 6098.33 FT ABOVE MSL.
HIGHEST WATER LEVEL 80.65 BELOW LSD, OCT. 1, 1973.
LOWEST WATER LEVEL 109.70 BELOW LSD, OCT. 1, 1975.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
SEP. 28, 1973	84.71B	APR. 16, 1974	89.98	APR. 8, 1975	91.21	OCT. 1, 1975	109.70
OCT. 1	80.65	OCT. 2	89.67	MAY 6	94.28A	MAR. 4, 1976	91.43
MAR. 27, 1974	89.69	MAR. 5, 1975	91.31	JUNE 5	226. A		

NUMBER (C-29- 7)14BAC- 1. STATE APPLICATION 27007, A-5776. SAM HUTCHINGS. DRILLED STOCK WATER-TABLE WELL IN ALLUVIUM, DIAM 6 IN (15 CM), DEPTH 201 FT (62 M). MP TOP OF CASING, 5.00 FT (1.52 M) BELOW LSD. WATER LEVEL BELOW LSD.
LSD 6088.38 FT ABOVE MSL.
HIGHEST WATER LEVEL 59.34 BELOW LSD, SEP. 29, 1970.
LOWEST WATER LEVEL 93.02 BELOW LSD, JUNE 5, 1975.
RECORDS AVAILABLE: 1970-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
SEP. 29, 1970	59.34	SEP. 5, 1973	71.21	APR. 23, 1974	81.28	NOV. 12, 1974	75.10
MAR. 16, 1971	76.20	SEP. 14	70.18	MAY 1	87.43C	DEC. 9	74.50
MAR. 6, 1972	79.20	SEP. 20	67.63	MAY 21	90.79	JAN. 7, 1975	74.96
MAR. 6, 1973	90.30B	SEP. 27	69.65	JUNE 11	87.50	MAR. 5	79.82
JUNE 5	85.72	OCT. 2	67.75B	JULY 10	82.75	APR. 8	82.80
JUNE 12	85.90	NOV. 5	68.31	JULY 23	84.16	MAY 6	87.73
JULY 10	77.81	NOV. 13	68.26	AUG. 6	80.49	JUNE 5	93.02
JULY 18	75.26	MAR. 2, 1974	76.57	AUG. 20	83.74	JUNE 23	91.72
JULY 27	74.26	MAR. 27	78.26	SEP. 25	79.98	OCT. 1	79.67
AUG. 2	73.47	APR. 2	79.26	OCT. 2	79.48	MAR. 4, 1976	81.61
AUG. 9	70.25	APR. 15	80.71				

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-29- 7)14DDC- 1. STATE APPLICATION 21448. FRED B HARRIS.
DRILLED UNUSED WATER-TABLE WELL IN ALLUVIUM, DIAM 12 IN (30 CM), DEPTH 125 FT (38 M), PERFORATED 52-120 FT (16-37 M). MP TOP OF CASING, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 6042.55 FT ABOVE MSL.
HIGHEST WATER LEVEL 13.41 BELOW LSD, JUNE 23, 1975,
LOWEST WATER LEVEL 57.42 BELOW LSD, MAR. 25, 1964.
RECORDS AVAILABLE: 1959-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT. 31, 1959	42.14	DEC. 28, 1959	45.23				

1960

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
5	.....	.....	.....	39.83	32.55	22.26	24.26	30.69	38.87	42.94	43.10	39.76
10	.....	.....	52.80	39.59	30.53	21.99	25.16	31.94	39.51H	44.07	42.70	44.07
15	.....	.....	51.79	37.91	27.16	21.92	26.02	33.21	38.42	44.38	41.95	45.80
20	.....	.....	49.98	37.38	26.50	22.66H	26.78	35.13	39.86	44.04	42.38	47.17
25	.....	.....	46.33	35.59	24.94	22.25	27.83	36.57	40.95	43.32	43.00	48.37
EOM	.....	.....	40.33	34.16	23.04	23.07	29.25	37.90	40.97	43.14	33.78	49.7 E

1961

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
5	50.8 E	52. E	54. E	51. E	39.18	24.86	25.90H	32.31	37.85	42.30H	46.10	45.77
10	51. E	53. E	54. E	50. E	38.18	24.17	26.38	33.13H	38.18	43.12	46.43	45.35
15	51. E	53. E	54.3 E	48. E	34.78	24.0 E	27.33	34.61	38.71	43.77	46.5 E	45.30
20	51. E	53. E	54. E	46. E	32.32	24. E	28.20	36.18	39.09	44.33	46.5 E	46.71
25	52. E	54. E	53. E	44. E	28.59	25. E	29.01	36.98	40.46	45.27	46.50	48. E
EOM	52. E	54. E	52. E	41. E	26.37	25. E	31.01	37.91	41.33	45.50	46.35	49. E

1962

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
5	50.28	54.63	50.55	41.23	25.6 E	21.12	19.90	22.84	26.92	.....	.....	.....
10	51.13	55.05	49.20	38.6 E	23.12	20.35	20.65	23.77	26.90	.....	.....	.....
15	51.98	55.37	47.6 E	36.0 E	22.00	19.61	20.62	23.75	27.76	.....	.....	.....
20	52.68	55.55	46.0 E	33.4 E	21.65	19.36	21.15	24.38	28.15	.....	.....	.....
25	53.41	51.95	44.4 E	30.8 E	21.61	19.95	21.92	25.0 E	28.51	.....	.....	.....
EOM	54.13	52.36	42.8 E	28.2 E	21.85	19.45	22.00	25.88	.....	.....	.....	.....

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT. 16, 1962	31.78	MAR. 12, 1969	45.82	SEP. 5, 1973	23.30	AUG. 6, 1974	22.49
MAR. 20, 1963	36.30	OCT. 1	24.47	SEP. 14	24.98	AUG. 20	23.18
OCT. 11	37.42	MAR. 4, 1970	41.68	SEP. 20	25.57	SEP. 25	25.17
MAR. 25, 1964	57.42	SEP. 29	23.90	SEP. 27	26.78	OCT. 2	26.37
OCT. 28	38.69	MAR. 16, 1971	45.95	OCT. 2	25.90	NOV. 12	29.90
MAR. 13, 1965	56.74	OCT. 7	27.60	MAR. 2, 1974	44.91	DEC. 9	31.02
NOV. 3	25.77	MAR. 6, 1972	51.42	MAR. 26	47.58	MAR. 5, 1975	48.13
MAR. 12, 1966	46.91	OCT. 2	41.61	APR. 17	30.43	APR. 8	50.15
AUG. 29	28.15	MAR. 6, 1973	51.92	APR. 27	29.97	MAY 6	41.16
FEB. 27, 1967	51.49	JULY 10	16.49	MAY 21	16.97	JUNE 5	15.05
AUG. 30	19.58	JULY 27	16.25	JUNE 11	14.72	JUNE 23	13.41
FEB. 27, 1968	46.58	AUG. 2	16.53	JULY 10	16.72	OCT. 1	24.12
SEP. 25	25.60	AUG. 9	17.88	JULY 23	18.50	MAR. 4, 1976	48.72

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-29- 7)16AAA- 1. STATE APPLICATION 21720. WILLIAM G. BALDWIN. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 16 IN (41 CM), DEPTH 185 FT (56 M), PERFORATED 42-46, 49-57, 74-90, 96-100, 109-122, 128-131, 140-143, 173-177 FT (13-14, 15-17, 23-27, 29-30, 33-37, 39-40, 43-44, 53-54 M). MP TOP OF HOLE IN PUMP BASE, 0.50 FT (0.15 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5985.46 FT ABOVE MSL.
HIGHEST WATER LEVEL 17.57 BELOW LSD, JULY 26, 1973,
LOWEST WATER LEVEL 60.73 BELOW LSD, APR. 4, 1962.
RECORDS AVAILABLE: 1951-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JUNE 5, 1951	40.80	OCT. 21, 1960	57.17	JULY 30, 1973	18.36	AUG. 6, 1974	34.34
DEC. 4	50.86	JAN. 3, 1961	58.04	AUG. 2	18.66	AUG. 18	37.56
MAR. 31, 1952	51.55	MAR. 14	59.18	AUG. 9	19.74	AUG. 21	37.50
NOV. 10	37.64	MAY 2	59.88	SEP. 4	28.63	SEP. 24	43.12
APR. 6, 1953	47.76	JUNE 9	46.35	SEP. 11	30.35	OCT. 2	45.70
DEC. 8	50.70	JULY 5	50.90	SEP. 18	31.89	NOV. 12	45.68
MAR. 22, 1954	53.16	AUG. 10	53.62	SEP. 27	33.46	DEC. 10	47.40
MAR. 15, 1955	56.33	SEP. 11	56.95	OCT. 2	34.13	JAN. 7, 1975	49.26
NOV. 29	55.67	APR. 4, 1962	60.73	NOV. 5	38.17	FEB. 5	50.64
MAR. 22, 1956	57.98	MAR. 20, 1963	52.50	NOV. 13	38.70	MAR. 4	51.72
DEC. 5	51.25	MAR. 25, 1964	59.60	NOV. 20	38.62	MAR. 17	52.28
MAR. 18, 1957	52.50	OCT. 28	52.62	DEC. 17	40.87	APR. 8	52.98
DEC. 9	42.24	MAR. 13, 1965	57.84	JAN. 14, 1974	45.97	APR. 14	52.96
MAR. 21, 1958	47.89	NOV. 3	39.36	FEB. 20	45.86	APR. 18	52.79
OCT. 13	34.20	MAR. 12, 1966	49.80	MAR. 2	45.04	MAY 5	52.90
DEC. 8	38.87	FEB. 28, 1967	55.09	MAR. 27	46.67	MAY 23	50.48
APR. 4, 1959	48.08	FEB. 28, 1968	53.55	APR. 2	47.72	JUNE 5	35.83
OCT. 31	55.67	SEP. 25	32.95	APR. 15	48.60	JUNE 25	24.85
DEC. 28	57.31	OCT. 1, 1969	31.55	APR. 22	48.49	JULY 3	23.60
MAR. 29, 1960	59.58	MAR. 4, 1970	47.60	APR. 27	48.22	JULY 7	22.28
MAY 12	59.38	MAR. 29	35.98	MAY 21	30.06	JULY 14	21.86
JUNE 20	46.89	MAR. 16, 1971	48.00	JUNE 12	22.89	JULY 28	24.34
JULY 15	50.52	MAR. 6, 1972	53.37	JULY 10	28.57	OCT. 2	39.58
AUG. 2	51.53	MAR. 6, 1973	56.52	JULY 25	32.26	MAR. 4, 1976	51.94
SEP. 10	54.54	JULY 26	17.57				

NUMBER (C-29- 7)16DBB- 1. NORTHWEST DITCH CO. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 802 FT (244 M), CASED TO 796 FT (243 M), PERFORATED 198-796 FT (60-243 M). MP BOTTOM OF HOLE IN SOUTH SIDE OF CASING, 2.00 FT (0.61 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5915 FT ABOVE MSL.
HIGHEST WATER LEVEL 64.69 BELOW LSD, OCT. 2, 1974,
LOWEST WATER LEVEL 98.50 BELOW LSD, MAY 15, 1975.
RECORDS AVAILABLE: 1974-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
AUG. 18, 1974	119.76A	DEC. 10, 1974	65.47	APR. 8, 1975	70.41	JUNE 23, 1975	78.84
SEP. 23	64.99	JAN. 7, 1975	65.93	MAY 6	167.96A	OCT. 1	86.80
OCT. 2	64.69	FEB. 5	66.92	MAY 15	98.5 B	MAR. 3, 1976	80.37
NOV. 12	64.91	MAR. 4	68.98				

NUMBER (C-29- 7)17CBA- 1. STATE APPLICATION 21365. RONALD BRADSHAW. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 16 IN (41 CM), DEPTH 274 FT (84 M), PERFORATED 19-270 FT (6-82M). MP BOTTOM OF HOLE IN CASING, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5840 FT ABOVE MSL.
HIGHEST WATER LEVEL 17.30 BELOW LSD, OCT. 13, 1958,
LOWEST WATER LEVEL 34.28 BELOW LSD, MAR. 4, 1975.
RECORDS AVAILABLE: 1951, 1955-61, 1974-75.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JULY 11, 1951	17.40	MAR. 19, 1958	21.49	DEC. 28, 1959	30.30	MAR. 14, 1961	34.20
AUG. 22	6[illegible]. A	OCT. 13	17.30	MAR. 29, 1960	30.60	MAR. 28, 1974	28.04
MAR. 22, 1955	29.35	DEC. 8	19.60	OCT. 20	27.44	DEC. 10	30.30
DEC. 5, 1956	27.10	APR. 4, 1959	22.00	JAN. 3, 1961	30.25	MAR. 4, 1975	34.28
DEC. 9, 1957	19.06	OCT. 31	27.82				

NUMBER (C-29- 7)17CBA- 2. STATE APPLICATION 31396. LAVAR ATKIN AND LELAND SMITH. DRILLED STOCK WATER-TABLE WELL IN ALLUVIUM, DIAM 6 IN (15 CM), DEPTH 72 FT (22 M), PERFORATED UNKNOWN DISTANCE BELOW 40 FT (12 M). MP TOP OF CASING, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5840 FT ABOVE MSL.
HIGHEST WATER LEVEL 1.78 BELOW LSD, JULY 9, 1973,
LOWEST WATER LEVEL 23.01 BELOW LSD, APR. 8, 1975.
RECORDS AVAILABLE: 1968-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
AUG. 19, 1968	2.71	SEP. 26, 1973	7.51	APR. 29, 1974	7.68	FEB. 5, 1975	21.10
MAR. 13, 1969	12.47	OCT. 2	8.07	MAY 22	3.02	MAR. 5	22.10
MAR. 4, 1970	13.48	NOV. 6	10.47	JULY 10	5.17	APR. 8	23.01
MAR. 16, 1971	14.60	NOV. 13	10.78	JULY 23	6.54	MAY 7	14.09
MAR. 7, 1972	16.06	NOV. 20	11.38	AUG. 5	8.04	MAY 14	12.07
JULY 9, 1973	1.78	DEC. 17	12.78	AUG. 19	8.77	JUNE 2	6.22
JULY 18	2.21	JAN. 15, 1974	15.02	SEP. 23	11.19	JUNE 23	2.08
JULY 26	2.99	FEB. 20	15.54	OCT. 2	12.06	JULY 3	2.90
AUG. 1	3.19	MAR. 2	15.90	NOV. 12	12.65	JULY 21	2.51
AUG. 9	4.36	MAR. 28	14.47	DEC. 10	16.73	JULY 28	4.05
SEP. 5	6.32	APR. 16	11.92	JAN. 7, 1975	19.09	MAR. 2, 1976	20.05
SEP. 12	6.83	APR. 22	10.66				

NUMBER (C-29- 7)17CBA- 3. STATE APPLICATION 21365. RONALD BRADSHAW. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 462 FT (141 M), PERFORATED UNKNOWN DISTANCE BELOW 195 FT (59 M). MP BOTTOM OF HOLE IN NORTH SIDE OF CASING, 1.50 FT (0.46 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5840 FT ABOVE MSL.
HIGHEST WATER LEVEL 24.09 BELOW LSD, JUNE 23, 1975,
LOWEST WATER LEVEL 66.05 BELOW LSD, JULY 30, 1974.
RECORDS AVAILABLE: 1974-75.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JULY 30, 1974	66.05	MAR. 4, 1975	36.57	MAY 7, 1975	39.95	JUNE 5, 1975	32.58
SEP. 23	63.46	APR. 8	36.90	MAY 14	46.40	JUNE 23	24.09
DEC. 10	34.96						

NUMBER (C-29- 7)19BCD- 1. STATE APPLICATION 21825. W. R. YARDLEY. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM, 16 IN (41 CM), DEPTH 256 FT (78 M), PERFORATED 20-245 FT (6-75 M). MP BOTTOM OF HOLE IN SOUTH SIDE OF CASING, 0.63 FT (0.19 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5773 FT ABOVE MSL.
HIGHEST WATER LEVEL 7.87 BELOW LSD, JULY 26, 1973,
LOWEST WATER LEVEL 36.15 BELOW LSD, OCT. 5, 1961.
RECORDS AVAILABLE: 1950-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
DEC. 13, 1950	17.05	DEC. 8, 1958	12.35	MAR. 25, 1964	21.98	JUNE 5, 1973	10.54
JUNE 5, 1951	77. A	APR. 4, 1959	17.69	OCT. 28	18.29	JUNE 12	8.74
OCT. 18	21.90	OCT. 31	20.10	MAR. 13, 1965	21.54	JULY 17	8.67
DEC. 4	17.49	DEC. 28	20.40	NOV. 3	8.88	JULY 26	7.87
MAR. 31, 1952	18.29	MAR. 29, 1960	20.75	MAR. 12, 1966	20.61	OCT. 2	9.68
DEC. 2	9.91	AUG. 2	18.09	FEB. 28, 1967	21.42	NOV. 6	11.40
MAR. 11, 1953	16.03	SEP. 10	19.62	FEB. 28, 1968	18.57	MAR. 2, 1974	19.05
DEC. 8	19.70	OCT. 20	20.20	SEP. 25	8.43	MAR. 28	19.79
MAR. 22, 1954	18.96	JAN. 3, 1961	20.60	MAR. 13, 1969	17.84	APR. 16	19.87
MAR. 15, 1955	19.78	MAR. 14	21.02	OCT. 1	8.49	APR. 22	19.72
NOV. 29	20.30	AUG. 10	20.56	MAR. 4, 1970	17.53	OCT. 2	12.61
MAR. 22, 1956	20.30	OCT. 5	36.15	SEP. 28	9.33	DEC. 10	18.66
DEC. 5	19.75	APR. 2, 1962	21.13	MAR. 16, 1971	18.94	MAR. 4, 1975	21.18
MAR. 18, 1957	20.70	OCT. 16	14.24	OCT. 8	11.34	APR. 8	21.42
DEC. [illegible]	10.56	MAR. 20, 1963	20.28	MAR. 7, 1972	20.48	OCT. 1	9.54
MAR. 21, 1958	15.84	OCT. 11	19.26	MAR. 6, 1973	21.14	MAR. 3, 1976	20.20
OCT. 13	9.32						

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-29- 7)20BBA- 1. STATE APPLICATION 21857, A-3966. S. H. ROBERTS AND OTHERS. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 400 FT (122 M), CASED TO 400 FT (122 M), PERFORATED 170-400 FT (52-122M). MP BOTTOM OF HOL IN EAST SIDE OF CASING, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5820 FT ABOVE MSL.
HIGHEST WATER LEVEL 14.78 BELOW LSD, JULY 26, 1973,
LOWEST WATER LEVEL 32.07 BELOW LSD, SEP. 23, 1974.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JULY 26, 1973	14.78	APR. 16, 1974	17.86	JULY 30, 1974	90.93A	APR. 8, 1975	19.72
JULY 31	16.69	APR. 22	17.33	SEP. 23	32.07	MAY 7	87.09A
SEP. 22	83.21A	APR. 29	17.03	OCT. 2	24.67	JUNE 5	83.51A
SEP. 23	24.20B	MAY 22	15.74	DEC. 10	19.57	OCT. 1	27.35
SEP. 26	19.83	JUNE 13	15.26	MAR. 4, 1975	19.54	MAR. 2, 1976	17.79
MAR. 28, 1974	18.31						

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-29- 7)21BAA- 1. STATE CLAIM 6919. FRED D. SMITH. DRILLED UNUSED WATER-TABLE WELL IN ALLUVIUM. DIAM 12 IN (30 CM), DEPTH 415 FT (126 M), CASED TO 380 FT (116 M). MP TOP OF CASING, 0.20 FT (0.06 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5865.15 FT ABOVE MSL.
HIGHEST WATER LEVEL 0.05 BELOW LSD, JUNE 29, 1938.
LOWEST WATER LEVEL 29.71 BELOW LSD, MAR. 29, 1960.
RECORDS AVAILABLE: 1935-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
SEP. 18, 1935	14.55	MAR. 28, 1945	21.41	MAR. 21, 1958	25.24	NOV. 20, 1973	19.90
OCT. 15	17.17	DEC. 12	20.13	OCT. 13	13.39	DEC. 17	24.69
NOV. 24	22.14	MAR. 14, 1946	22.91	DEC. 8	21.29	JAN. 14, 1974	26.41
FEB. 4, 1936	25.64	DEC. 9	21.02	APR. 4, 1959	24.27	FEB. 6	25.40
APR. 15	20.41	MAR. 19, 1947	22.30	OCT. 31	23.65	FEB. 20	25.64
JUNE 14	0.53	SEP. 10	7.20	DEC. 28	28.26	MAR. 2	25.97
JULY 30	0.39	DEC. 5	18.57	MAR. 29, 1960	29.71	MAR. 25	28.30
SEP. 22	4.55	MAR. 9, 1948	17.82	MAY 12	16.89	MAR. 28	26.35
NOV. 14	14.57	JULY 13	1.75	JUNE 20	12.92	APR. 4	24.15
DEC. 14	19.50	AUG. 25	9.71	JULY 15	16.65	APR. 15	19.15
FEB. 1, 1937	23.35	SEP. 25	15.73	AUG. 2	19.46	APR. 19	17.92
FEB. 10	23.60	OCT. 25	16.93	SEP. 10	21.74	APR. 22	16.01
MAR. 12	22.12	NOV. 26	20.78	OCT. 20	23.75	APR. 27	14.56
APR. 1	18.55	DEC. 2	21.14	JAN. 3, 1961	29.12	MAY 3	12.21
APR. 7	17.02	FEB. 25, 1949	23.88	MAR. 14	27.47	MAY 20	8.36
APR. 26	13.66	MAR. 31	21.85	MAY 2	18.07	JUNE 10	4.52
MAY 19	1.96	APR. 18	20.80	JUNE 9	13.86	JUNE 24	3.36
JUNE 25	0.40	MAY 1	11.47	AUG. 10	21.09	JUNE 28	4.60
AUG. 6	1.53	JULY 21	3.75	SEP. 11	21.53	JULY 10	6.12
AUG. 27	6.33	JULY 31	2.80	OCT. 5	21.97	JULY 23	8.20
SEP. 29	11.44	SEP. 7	7.30	APR. 2, 1962	26.54	JULY 28	9.38
OCT. 21	13.64	DEC. 6	20.29	MAY 7	11.80	AUG. 5	10.42
DEC. 2	19.58	MAR. 21, 1950	22.86	OCT. 16	18.91	AUG. 18	13.48
FEB. 17, 1938	22.65	JUNE 19	9.01	MAR. 20, 1963	24.65	AUG. 21	14.15
MAR. 7	24.49	AUG. 3	14.32	OCT. 11	21.87	SEP. 23	18.09
APR. 21	17.65	AUG. 12	16.17	MAR. 25, 1964	29.24	OCT. 2	20.37
JUNE 20	0.28	SEP. 25	19.86	OCT. 28	20.88	NOV. 12	22.11
JUNE 29	0.05	DEC. 5	24.79	MAR. 13, 1965	27.02	DEC. 10	25.00
AUG. 1	1.45	MAR. 19, 1951	25.80	NOV. 3	16.48	JAN. 7, 1975	26.52
SEP. 3	7.99	MAY 11	15.80	MAR. 12, 1966	26.36	FEB. 5	27.33
OCT. 27	15.10	JUNE 5	11.72	AUG. 29	20.28	MAR. 4	27.73
DEC. 16	20.89	JULY 6	9.50	FEB. 28, 1967	24.10	MAR. 17	27.95
JAN. 25, 1939	23.65	JULY 11	9.66	AUG. 28	8.28	APR. 8	25.78
FEB. 23	24.38	AUG. 21	14.40	FEB. 27, 1968	23.65	APR. 9	24.78
MAR. 31	22.62	OCT. 18	19.54	SEP. 25	11.35	APR. 10	25.52
MAY 4	13.60	DEC. 4	24.94	MAR. 13, 1969	24.58	APR. 14	24.36
JUNE 15	8.96	MAR. 31, 1952	25.77	OCT. 1	10.12	APR. 18	23.74
JULY 18	13.67	MAY 23	3.20	MAR. 4, 1970	23.75	MAY 5	20.48
AUG. 12	15.97	JUNE 24	0.08	SEP. 28	13.55	MAY 9	19.15
OCT. 24	19.34	AUG. 1	0.88	MAR. 16, 1971	25.56	MAY 13	18.08
DEC. 18	23.30	SEP. 10	6.37	OCT. 8	15.29	MAY 14	17.86
FEB. 9, 1940	23.41	NOV. 10	16.41	MAR. 6, 1972	28.60	MAY 15	17.68
APR. 8	22.04	DEC. 2	20.99	OCT. 2	23.12	MAY 19	15.33
JUNE 6	1.57	MAR. 11, 1953	25.07	MAR. 6, 1973	27.99	MAY 23	13.35
JULY 19	5.87	APR. 10	20.90	JUNE 5	3.03	JUNE 2	10.92
AUG. 7	10.36	MAY 13	13.80	JUNE 12	2.39	JUNE 6	9.32
SEP. 12	13.62	DEC. 8	25.51	JULY 10	1.62	JUNE 23	4.17
DEC. 10	21.60	MAR. 22, 1954	26.18	JULY 26	1.20	JULY 3	4.16
JULY 14, 1941	0.07	JUNE 8	8.90	AUG. 1	1.64	JULY 7	7.51
SEP. 22	5.92	JULY 29	15.93B	AUG. 8	1.90	JULY 14	3.24
NOV. 28	16.25	MAR. 15, 1955	26.43	SEP. 4	6.92	JULY 21	3.42
MAR. 13, 1942	22.96	SEP. 2	16.80	SEP. 12	8.75	JULY 28	3.56
JULY 22	0.93	NOV. 29	25.77	SEP. 21	10.60	AUG. 4	3.88
DEC. 7	20.65	MAR. 22, 1956	26.40	OCT. 2	12.39	AUG. 13	5.47
MAR. 9, 1943	21.09	DEC. 5	27.22	NOV. 5	16.68	OCT. 1	13.72
DEC. 4	22.31	MAR. 18, 1957	26.59	NOV. 13	18.34	MAR. 2, 1976	27.40
MAR. 11, 1944	24.08	DEC. 9	21.10	NOV. 20	19.90	OCT. 2	22.09
DEC. 6	19.35	MAR. 21, 1958	25.24				

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-29- 7)22ADA- 1. STATE APPLICATION 20307, A-4291. B. W. AND S. A. SMITH. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 453 FT (138 M), CASED TO 453 FT (138 M). MP TOP OF CASING, ATLSD. WATER LEVEL BELOW LSD.
LSD 5961.69 FT ABOVE MSL.
HIGHEST WATER LEVEL 48.66 BELOW LSD, SEP. 26, 1973,
LOWEST WATER LEVEL 55.50 BELOW LSD, APR. 8, 1975.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
SEP. 22, 1973	89.87A	MAR. 29, 1974	53.62	OCT. 2, 1974	54.75	MAY 6, 1975	95.60A
SEP. 23	49.75B	APR. 17	52.95	MAR. 5, 1975	54.80	OCT. 1	52.24
SEP. 26	48.66	MAY 2	51.33	APR. 8	55.50	MAR. 4, 1976	54.77

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-29- 7)28DBD- 1. MURDOCK INVESTMENT CO. DRILLED UNUSED WATER-TABLE WELL IN ALLUVIUM, DIAM 3 IN (8 CM), DEPTH 213 FT (65 M). MP TOP OF CASING, 3.50 FT (1.07 M) BELOW LSD. WATER LEVEL BELOW LSD.
LSD 5856.43 FT ABOVE MSL.
HIGHEST WATER LEVEL 12.30 BELOW LSD, JUNE 27, 1944.
LOWEST WATER LEVEL 22.83 BELOW LSD, NOV. 29, 1955.
RECORDS AVAILABLE: 1935-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
SEP. 18, 1935	17.10	MAY 26, 1943	13.20	APR. 18, 1949	15.92	OCT. 7, 1971	15.45
OCT. 15	18.43	JUNE 26	13.00	JUNE 17	12.88	MAR. 6, 1972	19.40
NOV. 24	19.38	JULY 29	15.15	JULY 21	14.73	OCT. 2	20.27
FEB. 4, 1936	20.40	AUG. 25	15.58	SEP. 7	15.32	MAR. 6, 1973	21.49
APR. 16	19.09	SEP. 28	17.00	DEC. 6	17.45	JUNE 12	13.81
JUNE 15	12.98	OCT. 26	18.04	MAR. 21, 1950	16.06	JULY 10	15.56
JULY 30	14.07	NOV. 27	17.60	JUNE 19	16.02	JULY 19	14.78
SEP. 22	15.80	DEC. 4	19.38	AUG. 3	17.25	JULY 26	14.72
NOV. 14	16.25	DEC. 27	19.60	SEP. 25	19.45	AUG. 2	14.42
FEB. 10, 1937	19.84	JAN. 28, 1944	20.00	DEC. 5	20.37	AUG. 8	14.44
APR. 1	18.87	FEB. 26	20.30	MAR. 19, 1951	19.52	SEP. 5	12.90
MAY 19	13.95	MAR. 11	20.32	JUNE 5	15.40	SEP. 11	14.92
AUG. 6	13.95	MAR. 27	20.20	DEC. 4	19.71	SEP. 18	15.61
SEP. 29	16.27	APR. 27	16.80	MAR. 31, 1952	20.36	SEP. 26	15.51
OCT. 21	17.61	MAY 26	12.90	AUG. 1	13.20	OCT. 1	15.91
DEC. 2	19.16	JUNE 27	12.30	DEC. 2	16.54	NOV. 5	16.52
FEB. 17, 1938	20.63	JULY 27	13.20	MAR. 11, 1953	19.51	NOV. 13	16.93
APR. 21	19.82	AUG. 28	15.00	DEC. 8	20.77	NOV. 22	17.31
JUNE 29	13.28	SEP. 27	16.70	MAR. 22, 1954	19.58	DEC. 17	17.66
AUG. 1	14.68	OCT. 29	17.10	MAR. 15, 1955	22.20	JAN. 15, 1974	18.37
SEP. 3	14.85	NOV. 28	18.15	NOV. 29	22.83	FEB. 19	18.65
OCT. 27	17.30	DEC. 6	18.14	MAR. 22, 1956	19.85	MAR. 2	19.08
DEC. 16	19.12	DEC. 30	18.64	DEC. 5	21.70	MAR. 26	19.13
JAN. 25, 1939	19.84	JAN. 29, 1945	19.10	MAR. 18, 1957	18.85	APR. 4	19.18
FEB. 23	20.58	FEB. 27	19.12	DEC. 9	16.97	APR. 16	18.38
MAR. 31	20.42	MAR. 27	19.10	MAR. 21, 1958	18.50	APR. 22	16.92
MAY 12	15.08	MAR. 29	19.14	OCT. 13	16.31	APR. 27	16.01
JUNE 15	14.40	APR. 28	18.00	DEC. 8	18.72	MAY 21	15.11
JULY 18	16.24	MAY 28	13.60	APR. 4, 1959	20.87	JUNE 12	15.14
AUG. 12	17.09	JUNE 28	12.60	OCT. 31	21.70	JULY 12	14.71
OCT. 24	19.30	JULY 27	12.60	DEC. 28	21.90	AUG. 5	15.90
DEC. 18	19.66	AUG. 28	14.25	MAR. 29, 1960	22.08	AUG. 20	16.86
FEB. 9, 1940	20.37	SEP. 28	15.28	JUNE 20	17.46	SEP. 25	16.93
APR. 8	19.62	OCT. 27	14.90	AUG. 2	20.29	OCT. 2	17.63
JUNE 6	13.39	NOV. 29	16.90	SEP. 10	21.13	NOV. 12	18.67
JULY 19	14.98	DEC. 12	17.37	OCT. 20	18.72	DEC. 9	19.63
AUG. 7	15.92	JAN. 27, 1946	16.90	JAN. 3, 1961	22.21	JAN. 7, 1975	20.03
AUG. 25	16.38	FEB. 27	16.80	MAR. 14	19.67	FEB. 5	19.63
SEP. 12	16.59	MAR. 14	17.04	MAY 2	18.80	MAR. 4	19.41
SEP. 25	17.40	MAR. 27	17.20	JULY 5	17.53	MAR. 17	20.27
OCT. 25	18.42	APR. 27	17.30	AUG. 10	19.55	APR. 7	19.00
NOV. 26	19.40	MAY 27	14.41	SEP. 11	19.77	APR. 10	19.51
DEC. 10	19.92	JUNE 26	13.90	OCT. 5	17.82	APR. 14	20.90
JAN. 5, 1941	20.84	JULY 26	15.30	APR. 4, 1962	20.14	APR. 18	19.51
JAN. 28	21.50	AUG. 27	16.40	OCT. 16	17.66	MAY 6	17.86
MAR. 25	20.45	SEP. 27	17.40	MAR. 20, 1963	20.55	MAY 14	18.45
JUNE 27	12.7	OCT. 29	17.60	OCT. 11	20.85	MAY 19	17.38
JULY 28	12.5	NOV. 28	18.38	MAR. 25, 1964	21.15	MAY 23	17.79
SEP. 22	14.2	DEC. 9	18.00	OCT. 28	19.78	JUNE 4	16.84
NOV. 1	14.8	JAN. 27, 1947	19.20	MAR. 13, 1965	20.87	JUNE 23	14.93
NOV. 28	16.40	FEB. 28	18.20	NOV. 3	17.17	JUNE 26	15.12
MAR. 13, 1942	18.48	MAR. 19	19.02	MAR. 12, 1966	20.54	JULY 3	15.08
JULY 22	13.08	MAR. 27	18.45	AUG. 29	17.45	JULY 7	15.27
SEP. 15	16.0	APR. 27	17.80	FEB. 27, 1967	19.80	JULY 14	14.14
OCT. 27	16.04	MAY 26	13.80	AUG. 28	14.34	JULY 21	14.14
NOV. 26	17.10	JUNE 26	12.89	FEB. 28, 1968	18.90	JULY 28	14.48
DEC. 7	17.86	SEP. 10	16.18	SEP. 25	14.30	AUG. 4	15.22
DEC. 29	16.0	DEC. 5	17.45	MAR. 12, 1969	18.39	AUG. 13	14.24
JAN. 28, 1943	16.1	MAR. 9, 1948	17.77	OCT. 1	14.61	AUG. 25	14.89
FEB. 27	19.35	JULY 13	13.56	MAR. 4, 1970	16.89	SEP. 4	13.75
MAR. 5	19.48	DEC. 2	18.92	SEP. 29	15.88	OCT. 1	16.56
MAR. 31	20.00	FEB. 25, 1949	19.82	MAR. 16, 1971	19.30	MAR. 3, 1976	19.00
APR. 27	17.1	MAR. 31	15.86				

NUMBER (C-29- 7)32DAA- 2. STATE APPLICATION 18546, A-2791. DALE HARRIS. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 12 IN (30 CM), DEPTH 228 FT (69 M), PERFORATED 16-210 FT (5-64 M). MP BOTTOM OF HOLE IN EAST SIDE OF CASING, 2.00 FT (0.61 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5830 FT ABOVE MSL.
HIGHEST WATER LEVEL 11.70 BELOW LSD, DEC. 2, 1952.
LOWEST WATER LEVEL 29.30 BELOW LSD, AUG. 22, 1951.
RECORDS AVAILABLE: 1951-62, 1974-75.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
AUG. 22, 1951	29.3 B	NOV. 29, 1955	13.98	OCT. 31, 1959	15.36	APR. 15, 1974	13.37
DEC. 4	14.77	MAR. 22, 1956	14.20	DEC. 28	14.57	APR. 25	13.47
MAR. 31, 1952	12.90	DEC. 5	14.80	MAR. 29, 1960	14.76	APR. 27	13.35
DEC. 2	11.70	MAR. 18, 1957	15.00	OCT. 20	15.20	APR. 30	13.10
MAR. 11, 1953	12.35	DEC. 9	12.55	JAN. 3, 1961	15.35	MAR. 4, 1975	15.26
DEC. 8	13.30	MAR. 21, 1958	13.16	MAR. 14	15.61	APR. 7	15.31
MAR. 22, 1954	13.40	DEC. 8	12.11	APR. 4, 1962	15.50	MAY 6	15.48
MAR. 15, 1955	13.63	APR. 4, 1959	12.96	MAR. 26, 1974	13.80		

381420112394701. LOCAL NUMBER (C-29- 7)32DBD- 1. STATE APPLICATION 21465. PAUL AND BERT SMITH. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 156 FT (48 M), PERFORATED 40-153 FT (12-47 M). MP TOP OF HOLE IN PUMP BASE, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5819 FT ABOVE MSL.
HIGHEST WATER LEVEL 29.89 BELOW LSD, DEC. 2, 1952,
LOWEST WATER LEVEL 38.95 BELOW LSD, OCT. 2, 1974.
RECORDS AVAILABLE: 1951-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
AUG. 22, 1951	51.0 A	DEC. 8, 1958	32.05	FEB. 27, 1967	34.17	MAR. 2, 1974	32.98
DEC. 4	32.50	APR. 4, 1959	31.84	FEB. 28, 1968	33.05	MAR. 26	32.91
MAR. 31, 1952	31.71	OCT. 31	35.34	SEP. 25	32.18	APR. 4	32.98
DEC. 2	29.89	DEC. 28	34.60	MAR. 12, 1969	31.34	APR. 15	32.86
MAR. 11, 1953	30.10	MAR. 29, 1960	34.04	OCT. 1	31.22	APR. 22	32.85
DEC. 8	32.44	OCT. 20	36.25	MAR. 4, 1970	31.13	APR. 29	32.83
MAR. 22, 1954	31.80	JAN. 3, 1961	35.39	SEP. 29	33.90	MAY 3	32.77
MAR. 15, 1955	32.87	MAR. 14	34.99	MAR. 16, 1971	32.79	OCT. 2	38.95
NOV. 29	34.08	APR. 4, 1962	35.67	MAR. 6, 1972	36.29	DEC. 9	36.35
MAR. 22, 1956	33.50	MAR. 20, 1963	36.98	MAR. 6, 1973	35.36	MAR. 4, 1975	35.43
DEC. 5	35.50	MAR. 25, 1964	36.00	JUNE 12	34.18	APR. 7	35.20
MAR. 18, 1957	34.65	OCT. 28	35.68	OCT. 1	33.81	MAY 6	35.04
DEC. 9	33.37	MAR. 13, 1965	35.56	NOV. 6	33.39	MAY 14	35.02
MAR. 21, 1958	32.80	NOV. 3	32.44	NOV. 13	33.01	OCT. 1	37.40
OCT. 13	32.65	MAR. 12, 1966	33.05	NOV. 23	33.29	MAR. 3, 1976	35.36

381440112374301. LOCAL NUMBER (C-29- 7)34ACB- 1. STATE CLAIM 8112. ROWLAND YARDLEY. DRILLED STOCK WATER-TABLE WELL IN ALLUVIUM, DIAM 6 IN (15 CM), DEPTH 119 FT (36 M). MP TOP OF STEEL WELL COVER, AT LSD. WATER LEVEL BELOW LSD.
LSD 5963.87 FT ABOVE MSL.
HIGHEST WATER LEVEL 65.62 BELOW LSD, MAY 21, 1974,
LOWEST WATER LEVEL 70.73 BELOW LSD, APR. 7, 1975.
RECORDS AVAILABLE: 1973-75.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV. 5, 1973	65.77	APR. 22, 1974	65.84	AUG. 5, 1974	67.63	MAR. 4, 1975	70.20
NOV. 11	65.80	MAY 21	65.62	AUG. 20	68.24	APR. 7	70.73
NOV. 16	66.03	JUNE 12	65.73	OCT. 2	69.96	MAY 6	69.88
NOV. 23	66.53	JULY 12	67.44	NOV. 12	69.66	JUNE 4	69.50
MAR. 26, 1974	66.21	JULY 24	67.70	DEC. 10	69.69		

NUMBER (C-29- 7)34BBD- 1. STATE APPLICATION A-6986. WILLIAM R. YARDLEY. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 12 IN (30 CM), DEPTH 520 FT (158 M), CASED TO 520 FT (158 M), PERFORATED 220-520 FT (67-158 M). MP TOP OF CASING, 1.20 FT (0.37 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5933.59 FT ABOVE MSL.
HIGHEST WATER LEVEL 52.84 BELOW LSD, APR. 30, 1974,
LOWEST WATER LEVEL 59.62 BELOW LSD, OCT. 2, 1976.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JULY 19, 1973	53.45	NOV. 5, 1973	53.27	APR. 22, 1974	53.03	MAR. 4, 1975	54.99
JULY 26	53.59	NOV. 12	53.28	APR. 30	52.84	APR. 7	55.06
JULY 31	53.67	NOV. 13	129.97A	MAY 21	53.39	MAY 6	120.46A
AUG. 2	53.67	NOV. 19	134.00A	JUNE 12	57.98B	JUNE 4	55.86
SEP. 4	53.95	NOV. 23	55.18	JULY 12	132.60A	JUNE 23	55.68
SEP. 11	54.17	MAR. 2, 1974	53.40	AUG. 5	55.60	OCT. 2	56.60
SEP. 17	54.40	MAR. 26	53.48	OCT. 2	56.47	MAR. 3, 1976	55.02
SEP. 26	54.18	APR. 16	53.21	DEC. 10	54.80	OCT. 2	59.62
SEP. 30	53.93						

NUMBER (C-29- 8)13DDA- 1. STATE APPLICATION 27133. J. B. MORGAN AND C. B. CARTER. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 410 FT (125 M), PERFORATED UNKNOWN DISTANCE BELOW 80 FT (24 M). MP BOTTOM OF HOLE IN NORTH SIDE OF CASING, 0.50 FT (0.15 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5808 FT ABOVE MSL.
HIGHEST WATER LEVEL 50.79 BELOW LSD, APR. 16, 1974,
LOWEST WATER LEVEL 83.33 BELOW LSD, JULY 11, 1974.
RECORDS AVAILABLE: 1955, 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JAN. 19, 1955	70. 6	APR. 16, 1974	50.79	OCT. 2, 1974	64.42	MAY 6, 1975	52.65
JULY 26, 1973	52.78	JULY 11	83.33B	DEC. 10	55.02	OCT. 1	58.10
JULY 31	52.62	JULY 31	62.75	MAR. 4, 1975	52.95	MAR. 2, 1976	51.77
MAR. 28, 1974	50.85	AUG. 19	146.4 A	APR. 8	52.74		

NUMBER (C-29- 8)20DCB- 1. STATE APPLICATION 21018. SHELDON JESSUP. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 12 IN (30 CM), DEPTH 175 FT (53 M), PERFORATED UNKNOWN DISTANCE BELOW 40 FT (12 M). MP TOP OF CASING, AT LSD. WATER LEVEL BELOW LSD.
LSD 5563.06 FT ABOVE MSL.
HIGHEST WATER LEVEL 31.22 BELOW LSD, NOV. 6, 1973,
LOWEST WATER LEVEL 34.45 BELOW LSD, OCT. 28, 1964.
RECORDS AVAILABLE: 1964-65, 1967-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT. 28, 1964	34.45	MAR. 16, 1971	32.38	MAR. 2, 1974	32.49	OCT. 2, 1974	32.20
MAR. 13, 1965	34.15	MAR. 7, 1972	32.97	MAR. 28	32.25	MAR. 4, 1975	32.75
FEB. 28, 1967	33.06	MAR. 6, 1973	33.18	APR. 16	32.66	APR. 8	32.99
FEB. 27, 1968	32.43	SEP. 15	32.09	APR. 22	32.70	MAY 14	32.40
MAR. 13, 1969	31.87	OCT. 2	31.63	APR. 29	32.80	OCT. 1	32.74
MAR. 4, 1970	32.26	NOV. 6	31.22	AUG. 19	32.07	MAR. 2, 1976	32.72

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-29- 8)23CAA- 1. STATE APPLICATION 25537, A-3795. R. M. WILLIAMS. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 440 FT (134 M), CASED TO 440 FT (134 M). MP TOP OF CASING, AT LSD. WATER LEVEL BELOW LSD.
LSD 5739.33 FT ABOVE MSL.
HIGHEST WATER LEVEL 21.49 BELOW LSD, MAR. 16, 1971,
LOWEST WATER LEVEL 70.88 BELOW LSD, JULY 31, 1973.
RECORDS AVAILABLE: 1962-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
MAY 7, 1962	30.48	MAR. 12, 1969	21.83	APR. 16, 1974	29.87	JAN. 7, 1975	31.67
MAR. 20, 1963	28.05	MAR. 4, 1970	22.00	APR. 22	29.75	FEB. 5	30.24
MAR. 25, 1964	28.36	MAR. 16, 1971	21.49	JULY 25	43.27	MAR. 4	29.82
OCT. 28	32.78	MAR. 7, 1972	23.46	AUG. 6	39.96	APR. 7	29.32
MAR. 13, 1965	27.51	MAR. 6, 1973	27.90	AUG. 19	38.03	MAY 8	29.14
NOV. 3	22.87	JULY 31	70.88	SEP. 24	34.92	MAY 15	29.08
MAR. 12, 1966	22.63	OCT. 2	63.46	OCT. 2	34.78	JUNE 5	114.92A
FEB. 28, 1967	28.03	MAR. 2, 1974	31.27	NOV. 12	32.37	MAR. 2, 1976	34.21
FEB. 27, 1968	25.50	MAR. 28	30.49	DEC. 10	31.39		

NUMBER (C-29- 8)25CAC- 1. STATE CLAIMS 13115 AND 20661. LDS CHURCH. DRILLED DOMESTIC AND STOCK ARTESIAN WELL IN ALLUVIUM, DIAM 2 IN (5 CM), DEPTH 250 FT (76 M). MP TOP OF ELBOW, 2.40 FT (0.73 M) ABOVE LSD. WATER LEVEL ABOVE (+) LSD.
LSD 5672 FT ABOVE MSL.
HIGHEST WATER LEVEL 13.00 ABOVE LSD, JUNE 29, 1938,
LOWEST WATER LEVEL 8.30 ABOVE LSD, SEP. 27, 1966, MAR. 8, 1967.
RECORDS AVAILABLE: 1936-57, 1959-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JUNE 15, 1936 +	12.0 B	APR. 15, 1940 +	12.1 B	MAR. 21, 1950 +	12.3 B	MAR. 25, 1964 +	10.5 B
JULY 31 +	12.3 B	JUNE 6 +	12.3 B	DEC. 5 +	11.1 B	MAR. 13, 1965 +	11.0 B
SEP. 22 +	11.65B	SEP. 12 +	11.7 B	MAR. 19, 1951 +	11.3 B	MAR. 12, 1966 +	11.5 B
NOV. 15 +	11.85B	DEC. 10 +	11.8 B	DEC. 4 +	11.7 B	SEP. 27 +	8.3 B
FEB. 10, 1937 +	12.55B	SEP. 22, 1941 +	12.3 B	MAR. 31, 1952 +	11.9 B	MAR. 8, 1967 +	8.3 B
MAR. 29 +	12.9 B	NOV. 28 +	12.0 B	DEC. 2 +	11.6 B	FEB. 27, 1968 +	10.9 B
MAY 19 +	12.7 B	MAR. 13, 1942 +	12.7 B	MAR. 11, 1953 +	11.6 B	SEP. 25 +	11.2 B
AUG. 6 +	12.3 B	JULY 22 +	12.6 B	DEC. 8 +	11.1 B	MAR. 13, 1969 +	9.7 B
SEP. 29 +	11.95B	DEC. 7 +	12.7 B	MAR. 22, 1954 +	11.4 B	MAR. 4, 1970 +	9.7 B
OCT. 21 +	12.3 B	MAR. 9, 1943 +	12.2 B	NOV. 29, 1955 +	10.6 B	SEP. 28 +	9.0 B
DEC. 2 +	12.7 B	DEC. 5 +	12.4 B	MAR. 22, 1956 +	11.3 B	MAR. 16, 1971 +	9.3 B
FEB. 18, 1938 +	12.85B	MAR. 11, 1944 +	12.65B	DEC. 5 +	10.1 B	MAR. 10, 1972 +	8.8 B
APR. 21 +	12.9 B	DEC. 6 +	12.4 B	MAR. 18, 1957 +	10.7 B	OCT. 2 +	9.8 B
JUNE 29 +	13.0 B	MAR. 29, 1945 +	12.4 B	APR. 4, 1959 +	12.6 B	FEB. 28, 1973 +	9.8 B
SEP. 3 +	12.5 B	DEC. 12 +	12.0 B	OCT. 31 +	10.5 B	JULY 10 +	9.3 B
OCT. 28 +	11.9 B	MAR. 14, 1946 +	12.2 B	MAR. 29, 1960 +	10.8 B	JULY 27 +	9.4 B
DEC. 16 +	12.25B	DEC. 9 +	12.8 B	OCT. 20 +	10.1 B	OCT. 2 +	9.3 B
JAN. 25, 1939 +	12.3 B	MAR. 19, 1947 +	12.4 B	JAN. 3, 1961 +	10.3 B	MAR. 2, 1974 +	9.8 B
FEB. 23 +	12.35B	DEC. 5 +	12.7 B	MAR. 14 +	11.5 B	MAY 22 +	9.4 B
MAY 4 +	12.05B	MAR. 9, 1948 +	12.3 B	OCT. 5 +	11.0 B	OCT. 2 +	9.6 B
JUNE 15 +	11.8 B	JULY 13 +	12.0 B	MAY 7, 1962 +	10.5 B	MAR. 4, 1975 +	9.5 B
AUG. 12 +	11.5 B	DEC. 2 +	12.9 B	OCT. 16 +	11.2 B	JUNE 5 +	9.4 B
DEC. 18 +	11.8 B	MAR. 31, 1949 +	12.4 B	MAR. 20, 1963 +	11.3 B	OCT. 1 +	10.2 B
FEB. 9, 1940 +	11.9 B	DEC. 6 +	12.0 B	OCT. 11 +	10.3 B	MAR. 3, 1976 +	9.7 B

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-29- 8)31ADD- 1. STATE APPLICATION 25520. MURDOCK AND MYERS. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 310 FT (94 M), PERFORATED UNKNOWN DISTANCE BELOW 45 FT (14 M). MP TOP OF HOLE IN PUMP BASE, 0.50 FT (0.15 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5548 FT ABOVE MSL.
HIGHEST WATER LEVEL 29.02 BELOW LSD, SEP. 28, 1970,
LOWEST WATER LEVEL 54.50 BELOW LSD, SEP. 10, 1960.
RECORDS AVAILABLE: 1956-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
MAR. 22, 1956	43.92	APR. 2, 1962	41.54	MAR. 7, 1972	40.31	NOV. 12, 1974	38.84
DEC. 5	44.21	OCT. 16	43.05	MAR. 6, 1973	40.89	DEC. 10	40.95
MAR. 18, 1957	44.02	MAR. 20, 1963	45.86	OCT. 2	29.23	JAN. 7, 1975	42.60
DEC. 9	37.59	OCT. 11	46.07	NOV. 6	33.85	FEB. 5	43.33
MAR. 21, 1958	39.80	MAR. 25, 1964	47.00	MAR. 2, 1974	35.77	MAR. 4	43.16
OCT. 13	37.54	OCT. 28	46.70	MAR. 28	36.50	APR. 8	42.97
DEC. 8	37.45	MAR. 13, 1965	45.74	APR. 16	37.27	MAY 8	40.15
APR. 4, 1959	41.59	NOV. 3	38.16	APR. 22	37.57	MAY 14	40.06
OCT. 31	47.01	MAR. 12, 1966	40.98	APR. 29	37.97	JUNE 4	38.29
DEC. 28	47.02	FEB. 28, 1967	43.45	MAY 21	36.86	JUNE 24	31.71
MAR. 29, 1960	45.34	FEB. 27, 1968	40.02	JUNE 10	34.64	JULY 3	31.60
AUG. 2	53.76	SEP. 25	32.68	JULY 11	34.42	JULY 14	31.75
SEP. 10	54.50	MAR. 12, 1969	37.60	JULY 26	34.09	JULY 21	31.28
OCT. 20	51.59	OCT. 1	31.92	AUG. 1	33.88	JULY 28	31.77
JAN. 3, 1961	47.05	MAR. 4, 1970	38.45	AUG. 6	34.00	AUG. 4	31.51
MAR. 14	46.97	SEP. 28	29.02	AUG. 19	34.13	AUG. 13	32.61
MAY 2	44.98	MAR. 16, 1971	38.15	SEP. 24	38.05	OCT. 1	36.31
OCT. 5	44.72	OCT. 8	32.34	OCT. 2	38.30	MAR. 2, 1976	41.18

NUMBER (C-29- 8)32ACA- 1. STATE APPLICATION A-6798. F. D. SMITH AND H. F. NIELSON. DRILLED DOMESTIC WATER-TABLE WELL IN ALLUVIUM, DIAM 8 IN (20 CM), DEPTH 370 FT (113 M), CASED TO 370 FT (113 M), PERFORATED 160-370 FT (49-113 M). MP TOP OF CASING, 2.00 FT (0.61 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5589 FT ABOVE MSL.
HIGHEST WATER LEVEL 41.72 BELOW LSD, JULY 28, 1975,
LOWEST WATER LEVEL 52.47 BELOW LSD, APR. 29, 1974.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV. 8, 1973	46.98	AUG. 1, 1974	47.86	MAR. 4, 1975	50.88	JULY 14, 1975	45.10
MAR. 28, 1974	52.10	AUG. 6	47.64	APR. 7	51.71	JULY 21	42.08
APR. 16	52.32	AUG. 19	47.22	MAY 8	49.56	JULY 28	41.72
APR. 29	52.47	SEP. 24	48.46	MAY 14	49.51	AUG. 4	41.86
MAY 21	52.33	OCT. 1	49.00	JUNE 4	49.20	AUG. 13	42.46
JUNE 13	50.72	NOV. 12	44.71	JUNE 24	46.59	OCT. 1	43.11
JULY 11	48.26	DEC. 10	46.35	JULY 3	46.13	MAR. 2, 1976	50.59
JULY 26	48.18						

NUMBER (C-29- 8)35ABD- 1. STATE APPLICATION 22728. ABERDARE CANAL CO. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 514 FT (157 M), CASED TO 514 FT (157 M), PERFORATED 90-514 FT (27-157M). MP TOP OF CASING, AT LSD. WATER LEVEL BELOW LSD.
LSD 5653 FT ABOVE MSL.
HIGHEST WATER LEVEL 5.22 BELOW LSD, JUNE 24, 1975,
LOWEST WATER LEVEL 14.23 BELOW LSD, JULY 14, 1975.
RECORDS AVAILABLE: 1973-75.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT. 2, 1973	6.60	JULY 12, 1974	78.52A	APR. 8, 1975	6.43	JUNE 24, 1975	5.22
MAR. 28, 1974	6.34	SEP. 25	7.34	MAY 6	6.52	JULY 3	5.70
APR. 18	6.30	MAR. 4, 1975	6.36	JUNE 4	5.86	JULY 14	14.23
MAY 22	5.29						

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-29- 8)35DDC- 1. STATE APPLICATION A-7765. F. D. SMITH. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 12 IN (30 CM), DEPTH 300 FT (91 M), CASED TO 300 FT (91 M), PERFORATED 120-300 FT (37-91 M). MP TOP OF CASING, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5742 FT ABOVE MSL.
HIGHEST WATER LEVEL 43.10 BELOW LSD, MAR. 3, 1976,
LOWEST WATER LEVEL 80.00 BELOW LSD, JUNE 26, 1974.
RECORDS AVAILABLE: 1974-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JUNE 26, 1974	80. G	MAR. 4, 1975	45.52	MAY 14, 1975	45.26	OCT. 1, 1975	48.08
SEP. 25	51.20	APR. 8	45.34	JUNE 4	45.18	MAR. 3, 1976	43.10
DEC. 10	46.31	MAY 6	45.23				

NUMBER (C-30- 7) 5AAA- 1. STATE APPLICATION 32472. PAUL AND BERT SMITH. DRILLED STOCK WATER-TABLE WELL IN ALLUVIUM, DIAM 6 IN (15 CM), DEPTH 80 FT (24 M), CASED TO 80 FT (24 M), PERFORATED 28-80 FT (9-24 M). MP TOP OF CASING, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5859 FT ABOVE MSL.
HIGHEST WATER LEVEL 24.00 BELOW LSD, APR. 27, 1974, MAY 3, 1974,
LOWEST WATER LEVEL 29.43 BELOW LSD, AUG. 20, 1974.
RECORDS AVAILABLE: 1973-75.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JULY 31, 1973	27.04	MAY 3, 1974	24.00	AUG. 20, 1974	29.43	MAR. 4, 1975	25.30
MAR. 26, 1974	24.08	MAY 20	26.51	SEP. 25	28.61	APR. 7	25.22
APR. 5	24.12	JUNE 12	28.33	OCT. 2	28.18	MAY 6	25.36
APR. 15	24.05	JULY 12	28.20	NOV. 12	26.21	JUNE 4	28.05
APR. 22	24.05	JULY 23	28.44	DEC. 9	25.67	JUNE 24	29.17
APR. 27	24.00	JULY 31	28.25				

NUMBER (C-30- 7) 5ADD- 1. STATE APPLICATIONS 25067; 32259, A-6632. KEN HUFF. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 16 IN (41 CM), DEPTH 400 FT (122 M), CASED TO 400 FT (122 M), PERFORATED 130-400 FT (40-122 M). MP BOTTOM LIP OF ACCESS PIPE, 0.60 FT (0.18 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5915 FT ABOVE MSL.
HIGHEST WATER LEVEL 71.28 BELOW LSD, APR. 22, 1974,
LOWEST WATER LEVEL 83.55 BELOW LSD, OCT. 1, 1975.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
APR. 1, 1973	83. G	APR. 22, 1974	71.28	JUNE 12, 1974	79.72	APR. 7, 1975	73.25
JULY 31	78.35	APR. 29	72.19	JULY 12	83.34	MAY 6	75.62
MAR. 26, 1974	71.33	MAY 3	73.53	DEC. 9	73.91	OCT. 1	83.55
APR. 5	71.34	MAY 20	78.10	MAR. 4, 1975	73.33	MAR. 3, 1976	73.24
APR. 15	71.29						

NUMBER (C-30- 7) 5CCD- 1. STATE APPLICATION 25067. S. A. AND B. W. SMITH. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 14 IN (36 CM), DEPTH 610 FT (186 M), CASED TO 610 FT (186 M). MP TOP OF HOE IN PUMP BASE, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5910 FT ABOVE MSL.
HIGHEST WATER LEVEL 88.97 BELOW LSD, MAR. 6, 1973,
LOWEST WATER LEVEL 206.00 BELOW LSD, SEP. 14, 1973.
RECORDS AVAILABLE: 1971-75.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
MAR. 16, 1971	106.15	SEP. 14, 1973	206.00B	MAR. 26, 1974	105.62	MAR. 4, 1975	108.71
OCT. 7	115.65	SEP. 26	121.69B	APR. 5	105.15	APR. 7	108.67
MAR. 7, 1972	114.56	OCT. 1	117.01B	APR. 15	105.21	OCT. 1	128.52
MAR. 6, 1973	88.97	MAR. 2, 1974	102.53	APR. 25	105.36		

Table 13.—Water levels in selected observation wells—Continued

NUMBER (C-30- 7) 5CDD- 1. STATE APPLICATION 25067, A-7067. S. A. AND B. W. SMITH. DRILLED IRRIGATION WATER-TABLE WELL IN ALLUVIUM, DIAM 16 IN (41 CM), DEPTH 805 FT (245 M), CASED TO 805 FT (245 M), PERFORATED 250-805 FT (76-245 M). MP BOTTOM OF HOLE IN SOUTH SIDE OF CASING, 0.50 FT (0.15 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 5914 FT ABOVE MSL.
HIGHEST WATER LEVEL 83.83 BELOW LSD, APR. 15, 1974,
LOWEST WATER LEVEL 98.00 BELOW LSD, FEB. 15, 1973.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
FEB. 15, 1973	98. G	APR. 5, 1974	83.87	APR. 25, 1974	83.86	OCT. 1, 1975	97.95
SEP. 26	92.76	APR. 15	83.83	MAR. 4, 1975	86.70	MAR. 3, 1976	86.15
MAR. 26, 1974	83.84	APR. 22	83.96	APR. 7	86.30		

NUMBER (C-30- 7)10BBA- 1. STATE APPLICATION 37471. ROWLAND YARDLEY. DRILLED STOCK WATER-TABLE WELL IN ALLUVIUM, DIAM 6 IN (15 CM), DEPTH 200 FT (61 M), CASED TO 200 FT (61 M). MP TOP OF CASING, 1.00 FT (0.30 M) ABOVE LSD. WATER LEVEL BELOW LSD.
LSD 6005 FT ABOVE MSL.
HIGHEST WATER LEVEL 79.54 BELOW LSD, JUNE 12, 1974,
LOWEST WATER LEVEL 79.79 BELOW LSD, JULY 31, 1973.
RECORDS AVAILABLE: 1973-76.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JULY 26, 1973	79.73	NOV. 22, 1973	79.64	JULY 12, 1974	79.58	DEC. 10, 1974	79.57
JULY 31	79.79	MAR. 2, 1974	79.59	JULY 23	79.55	MAR. 4, 1975	79.62
SEP. 6	79.75	MAR. 26	79.60	JULY 30	79.59	APR. 7	79.62
SEP. 11	79.74	APR. 16	79.58	AUG. 5	79.56	MAY 6	79.65
SEP. 14	79.72	APR. 22	79.62	AUG. 20	79.59	JUNE 4	79.73
SEP. 30	79.70	APR. 30	79.61	SEP. 23	79.58	JUNE 24	79.66
NOV. 6	79.66	MAY 21	79.59	OCT. 2	79.60	OCT. 2	79.76
NOV. 13	79.64	JUNE 12	79.54	NOV. 12	79.62	MAR. 3, 1976	79.75
NOV. 18	79.62						

NUMBER (C-30- 9) 1ADC- 1. STATE APPLICATION A-6559. T. L. GIESING. DRILLED COMMERICAL WATER-TABLE WELL IN ALLUVIUM, DIAM 6 IN (15 CM), DEPTH 190 FT (58 M), CASED TO 190 FT (58 M), PERFORATED 120-190 FT (37-58 M). MP TOP OF CASING, 2.40 FT (0.73 M) BELOW LSD. WATER LEVEL BELOW LSD.
LSD 5538.17 FT ABOVE MSL.
HIGHEST WATER LEVEL 35.52 BELOW LSD, APR. 22, 1974,
LOWEST WATER LEVEL 75.00 BELOW LSD, JAN. 15, 1973.
RECORDS AVAILABLE: 1973-75.

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JAN. 15, 1973	75. G	APR. 22, 1974	35.52	MAY 21, 1974	38.36	APR. 7, 1975	47.15
MAR. 28, 1974	36.02	APR. 27	35.62	DEC. 10	56.20	MAY 8	46.47
APR. 16	35.54	MAY 3	35.88	MAR. 4, 1975	49.85	OCT. 1	57.05

Location: See page 2 for explanation of numbering system.
Date of sample: Year-month-day.

LOCATION	DATE OF SAMPLE	HYDRO-GEOLOGIC UNIT (TABLE 1)	TOTAL DEPTH OF WELL (FT)	TEMPER-ATURE (DEG C)	YIELD (GAL/MIN)	DIS-SOLVED SILICA (SIO2) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED CAL-CIUM (CA) (MG/L)	DIS-SOLVED MAG-NE-SIUM (MG) (MG/L)	DIS-SOLVED SODIUM (NA) (MG/L)	DIS-SOLVED SODIUM PLUS POTAS-SIUM (MG/L)	DIS-SOLVED PO-TAS-SIUM (K) (MG/L)	BICAR-BONATE (HCO3) (MG/L)	CAR-BONATE (CO3) (MG/L)
(C-28- 7)15BBA- 2	74-07-11	2,3	984	10.0	680	29	--	60	11	19	--	2.1	164	--
(C-28- 7)21DDA- 1	62-06-27	1,2	232	11.5	375	31	--	48	6.8	--	16	--	134	66
(C-29- 7) 3CAB- 1	74-05-22	2,3	1000	13.0	1180	27	--	39	6.4	12	--	1.6	88	0
	74-08-05			13.1	1090	--	--	--	--	--	--	--	--	--
(C-29- 7)11CDA- 1	74-04-24	2,3	600	12.3	750	27	--	52	9.9	21	--	1.9	188	0
(C-29- 7)19BCD- 1	61-09-11	1,2	256	13.5	1105	50	--	44	7.3	--	49	--	184	90
	64-09-01			13.0	--	45	--	46	9.7	40	--	7.0	199	0
	65-07-28			12.5	1204	41	--	58	--	--	40	--	228	--
	66-07-07			12.5	--	--	--	--	--	--	--	--	--	--
	73-09-15			12.5	1170	41	--	57	10	29	--	6.0	212	--
	74-08-19			12.5	1170	--	--	--	--	--	--	--	--	--
	75-06-05			12.7	820	--	--	--	--	--	--	--	--	--
(C-29- 7)21CAC- 1	60-08-02	1,2	401	13.0	855	28	--	56	10	15	--	3.5	180	0
	61-07-08			12.5	--	31	0	59	8.8	14	--	2.5	180	0
	62-05-03			10.5	--	--	0	--	--	--	--	--	155	--
(C-29- 7)21CAD-S1	61-07-08	--	--	13.5	--	31	0	38	6.3	10	--	2.5	142	0
(C-29- 7)21CDB-S1	61-07-08	--	--	14.0	--	32	0	36	7.3	12	--	2.9	144	0
(C-29- 7)22BDA- 1	74-03-28	1,2	318	12.8	450	27	30	52	11	13	--	1.9	180	0
	74-07-29			12.2	450	--	--	--	--	--	--	--	--	--
(C-29- 7)28A -S	55-01-23	--	--	--	--	24	--	43	37	--	--	--	153	--
(C-29- 7)32DBD- 1	75-06-24	1,2	156	12.2	1210	53	--	72	18	32	--	5.3	255	0
(C-29- 7)34BBD- 1	75-05-06	1,2	491	--	1230	--	--	--	--	--	--	--	--	--
(C-29- 8) 9BAD- 1	62-08-09	3	150	17.5	--	44	--	248	30	--	63	--	253	0
(C-29- 8)20DCB- 1	75-06-24	1,2	175	11.5	250	32	--	51	12	21	--	3.2	175	0
(C-29- 8)23CAA- 1	74-04-29	3	440	16.0	600	57	--	13	5.5	240	--	8.6	380	0
	75-06-05			16.4	400	--	--	--	--	--	--	--	--	--
(C-29- 8)25CAC- 1	45-02-25	2	--	--	--	58	--	34	6.6	--	16	--	65	--
	61-09-11			20.0	--	69	--	32	5.4	--	29	--	128	0
	64-09-01			19.5	--	65	--	30	5.4	20	--	7.7	125	0
	65-07-28			19.5	--	67	--	32	4.6	--	24	--	122	--
	72-05-23			19.0	--	71	--	31	5.5	20	--	8.1	123	0
	75-06-05			19.7	9.6	--	--	--	--	--	--	--	--	--
(C-29- 8)31ADD- 1	60-08-10	2	310	11.5	1200	49	--	82	18	97	--	5.3	347	0
	64-09-01			11.0	960	43	--	79	18	92	--	5.6	392	0
	65-09-08			11.0	1130	40	--	92	19	85	--	--	394	0
	66-07-07			11.0	--	--	--	--	--	--	--	--	--	--
	69-08-25			10.0	--	--	--	--	--	--	--	--	--	--
	73-07-26			12.1	900	49	--	68	17	77	--	5.5	363	0
(C-29- 8)35DDC-1	74-07-12	2,3	300	16.5	100	--	--	--	--	--	--	--	--	--
	75-06-24			16.5	330	56	--	15	2.2	29	--	6.2	117	0
(C-29- 8)36ACC- 2	74-05-22	3	518	25.0	--	40	--	17	2.8	28	--	8.2	119	0
	74-08-19			24.5	1300	--	--	--	--	--	--	--	--	--
(C-30- 7) 5CDD- 1	74-04-25	2,3	805	22.0	--	59	--	22	6.1	28	--	5.7	135	0
	74-07-24			21.5	--	--	--	--	--	--	--	--	--	--

DIS-SOLVED SULFATE (SO4) (MG/L)	DIS-SOLVED CHLO-RIDE (CL) (MG/L)	DIS-SOLVED FLUO-RIDE (F) (MG/L)	DIS-SOLVED NITRATE (NO3) (MG/L)	DIS-SOLVED NITRITE PLUS NITRATE (N) (MG/L)	DIS-SOLVED ORTHO PHOS-PHATE (PO4) (MG/L)	DIS-SOLVED ORTHO. PHOS-PHORUS (P) (MG/L)	DIS-SOLVED BORON (B) (UG/L)	HARD-NESS (CA,MG) (MG/L)	NON-CAR-BONATE HARD-NESS (MG/L)	DIS-SOLVED SOLIDS (RESI-DUE AT 180 C) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	ALKA-LINITY AS CACO3 (MG/L)	SODIUM AD-SORP-TION RATIO	PERCENT SODIUM	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)
27	47	.4	--	1.2	.06	.02	30	200	61	--	282	135	.6	17	483	7.1
25	30	.5	3.7	--	--	--	--	148	38	230	227	220	.6	19	361	7.4
25	34	.5	--	.63	.09	.03	20	120	52	--	192	72	.5	17	321	7.5
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	305	7.3
30	15	.7	--	2.7	.25	.08	30	170	16	--	262	154	.7	21	421	7.6
60	22	--	2.8	--	--	--	--	140	0	305	325	301	1.8	43	445	7.5
45	22	.9	4.0	--	--	--	0	156	0	313	318	163	1.4	35	450	7.3
55	23	--	1.3	--	--	--	--	190	3	341	341	187	--	--	532	7.4
--	19	--	--	--	--	--	--	--	--	--	--	--	--	--	450	--
41	23	--	--	--	--	--	--	174	10	--	312	174	.9	25	497	--
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	420	7.3
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	400	7.3
30	31	.4	2.7	--	--	--	0	183	35	263	266	148	.5	15	412	7.4
27	28	.4	--	--	--	--	0	184	36	266	266	148	.4	14	414	7.4
--	29	--	2.2	--	--	--	--	172	45	--	--	127	--	--	39	7.5
16	6.0	.3	--	--	--	--	0	120	4	188	194	116	.4	15	283	7.3
15	7.5	.4	--	--	--	--	0	120	2	190	190	118	.5	17	289	7.4
25	16	.4	--	20	.15	.05	20	180	28	--	244	148	.4	14	404	7.6
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	380	7.7
54	16	.3	1.7	--	--	--	--	126	0	233	--	126	--	--	--	7.3
46	41	.3	--	2.3	.15	.05	160	250	45	--	404	209	.9	21	600	7.5
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	340	7.7
250	292	.7	.70	--	--	--	--	745	538	1220	1050	208	1.0	16	1700	7.3
30	38	1.3	--	.58	.21	.07	40	180	33	--	278	144	.7	20	450	7.8
220	35	7.5	--	.24	.37	.12	750	55	0	--	776	312	14	89	1160	8.5
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1140	7.9
39	1.0	.6	.00	--	--	--	--	113	60	244	--	53	--	--	--	7.9
48	7.0	--	.70	--	--	--	--	103	0	245	254	105	1.2	38	298	7.9
41	5.6	.7	.30	--	--	--	0	98	0	236	237	103	.9	29	298	7.4
42	5.9	--	.02	--	--	--	--	99	0	244	236	100	--	--	297	8.0
--	--	--	--	--	--	--	--	100	0	--	--	101	.9	28	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	300	7.9
89	54	.4	1.8	--	--	--	--	277	0	579	592	326	2.5	43	886	7.8
74	56	.3	2.5	--	--	--	--	272	0	579	564	322	2.4	42	874	7.8
90	54	--	3.8	--	--	--	--	310	0	584	578	323	2.1	--	924	7.7
--	48	--	--	--	--	--	--	--	--	--	--	--	--	--	888	--
--	37	--	--	--	--	--	--	--	--	--	--	--	--	--	778	--
65	36	--	--	--	--	--	--	240	0	--	496	298	2.2	40	--	7.3
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	240	8.3
15	7.8	.6	--	.03	.09	.03	50	47	0	--	190	96	1.9	54	250	8.1
22	6.8	.7	--	.08	.21	.07	40	54	0	--	185	98	1.7	49	260	8.1
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	250	8.3
17	16	.3	--	.56	.06	.02	40	80	0	--	223	111	1.4	41	300	8.0
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	305	8.1

DATE OF SAMPLE: YEAR-MONTH-DAY.

STATION NUMBER AND NAME	DATE OF SAMPLE	TEMPERATURE (DEG C)	INSTANTANEOUS DISCHARGE (FT^3/S)	DISSOLVED SILICA (SIO2) (MG/L)	DISSOLVED IRON (FE) (UG/L)	DISSOLVED CALCIUM (CA) (MG/L)	DISSOLVED MAGNESIUM (MG) (MG/L)	DISSOLVED SODIUM (NA) (MG/L)	DISSOLVED SODIUM PLUS POTASSIUM (MG/L)	BICARBONATE (HCO3) (MG/L)	CARBONATE (CO3) (MG/L)	DISSOLVED SULFATE (SO4) (MG/L)	DISSOLVED CHLORIDE (CL) (MG/L)	DISSOLVED FLUORIDE (F) (MG/L)
10234500 BEAVER RIVER NEAR BEAVER	49-08-01	--	--	--	--	33	3.0	9.0	--	172	--	8.2	6.0	--
	49-08-08	--	--	--	--	13	3.0	3.9	--	75	--	5.8	.4	--
	64-03-12	35.0	--	32	--	28	5.4	--	15	94	0	38	6.0	--
	64-05-21	50.0	--	9.1	--	8.8	1.9	--	5.9	38	0	8.4	1.9	--
	64-07-30	54.0	--	19	--	15	3.4	--	6.9	66	0	9.5	2.0	--
10234800 BEAVER RIVER AT BEAVER	64-09-24	66.0	--	23	--	18	4.4	--	9.3	80	0	14	1.9	--
	64-03-11	42.0	--	27	200	25	8.0	7.8	--	91	--	30	8.0	.3
	64-05-21	57.0	--	16	190	12	2.4	4.8	--	45	0	6.0	5.0	.1
	64-07-29	72.0	--	23	30	22	5.0	10	--	91	0	8.0	5.0	.3
	64-09-23	61.0	--	35	60	48	10	12	--	193	1	15	14	.4
10235000 SOUTH CREEK NEAR BEAVER	65-07-30	--	--	--	--	--	--	--	10	55	0	15	2.8	--
	74-07-24	--	--	34	--	15	4.1	4.7	--	54	0	25	1.9	.2
10236000 NORTH FORK NORTH CREEK NEAR BEAVER	74-07-31	19.7	--	28	--	6.9	1.7	5.3	--	15	--	20	2.0	1.2
10236800 BEAVER RIVER ABOVE DRY CREEK, AT GREENVILLE	64-03-11	45.0	--	30	20	35	3.5	12	--	134	0	29	12	.4
	64-05-21	61.0	--	19	140	19	5.5	6.7	--	83	0	11	10	.3
	64-07-29	72.0	--	30	20	27	7.0	10	--	120	1	14	11	.4
	64-09-23	68.0	--	38	40	64	18	26	--	261	4	33	23	1.4
10237000 BEAVER RIVER AT ADAMSVILLE	50-07-13	--	--	--	--	51	22	98	--	333	--	102	54	--
	51-02-07	--	--	41	--	48	14	--	34	195	0	48	28	--
	64-03-11	45.0	--	35	30	45	12	25	--	181	0	37	20	.6
	64-05-21	55.0	--	16	170	20	6.0	16	--	87	0	18	20	.3
	64-07-29	82.0	--	31	20	35	14	19	--	155	0	21	15	.8
	64-09-23	71.0	--	38	30	76	22	65	--	324	3	78	50	1.6
	74-10-08	17.5	2.6	45	80	80	21	93	--	395	3	83	58	1.7
	75-01-07	3.0	36	37	50	38	8.8	20	--	167	--	24	20	.4
	75-02-05	.0	30	38	--	41	9.5	24	--	183	--	27	17	.5
	75-03-04	4.5	36	35	--	44	11	26	--	192	0	29	19	.6
	75-04-08	5.5	28	35	20	53	13	30	--	227	0	34	24	.8
	75-05-06	10.0	2.0	35	--	71	21	66	--	327	0	64	48	1.1
	75-06-02	16.0	29	29	--	37	10	24	--	173	0	26	16	.7
	75-07-08	25.0	27	42	70	72	21	63	--	328	17	48	37	1.4
	75-08-05	20.5	--	44	--	69	22	65	--	375	3	39	38	1.3
	75-09-04	22.0	23	44	--	75	23	79	--	398	0	61	51	1.3
	75-10-07	11.5	5.4	38	40	77	24	98	--	521	0	74	59	1.1
	75-11-04	10.0	40	32	--	49	11	26	--	213	6	23	17	.6
	75-12-02	6.0	37	34	--	47	11	26	--	200	0	24	18	.6
	76-01-29	5.0	26	32	10	40	10	21	--	190	0	23	16	.6
	76-02-10	3.5	30	31	--	47	11	27	--	200	0	29	23	.6
	76-03-03	2.0	32	34	--	46	19	29	--	240	(1/)	30	24	.7
	76-04-07	12.0	16	41	30	56	15	44	--	(1/)	280	40	32	1.0
	76-05-05	20.0	.80	31	--	79	23	96	--	390	20	110	71	1.3
	76-07-12	22.0	.30	45	60	51	20	90	--	290	30	82	62	1.3
	76-08-04	22.0	.32	44	--	64	22	95	--	350	30	95	66	1.4
	76-09-02	25.0	.10	38	--	51	21	110	--	290	13	100	86	1.2
	76-09-09	25.0	.10	--	--	--	--	--	--	147	6	--	--	--
	76-10-08	5.5	.68	40	60	86	24	110	--	399	0	120	81	1.2
	76-11-09	10.0	--	--	--	--	--	--	--	230	11	--	--	--
10237500 INDIAN CREEK NEAR BEAVER	65-08-02	--	--	--	--	--	--	--	53	29	0	8.0	3.0	--
	74-07-30	16.0	--	22	--	10	1.8	5.9	--	40	--	10	3.6	.6
10238000 INDIAN CREEK AT ADAMSVILLE	64-03-12	32.0	--	30	--	104	73	--	261	705	0	311	185	--
	64-05-21	69.0	--	13	--	32	10	--	13	145	0	21	5.7	--
10239000 BEAVER RIVER AT ROCKY FORD DAM, NEAR MINERSVILLE	50-07-13	--	--	48	--	47	16	60	--	281	--	--	43	--
	64-03-11	56.0	--	37	10	56	18	55	--	233	3	54	50	.6
	64-05-21	61.0	--	29	60	53	18	43	--	233	5	48	42	.8
	64-07-29	77.0	--	28	30	40	20	50	--	219	1	53	41	.9
	64-09-23	68.0	--	40	20	53	26	50	--	231	3	55	50	.6

1/ANALYZED FOR BUT NOT DETECTED.

DIS- SOLVED NITRATE (NO3) (MG/L)	DIS- SOLVED NITRITE PLUS NITRATE (N) (MG/L)	DIS- SOLVED ORTHO PHOS- PHATE (PO4) (MG/L)	DIS- SOLVED ORTHO. PHOS- PHORUS (P) (MG/L)	DIS- SOLVED BORON (B) (UG/L)	HARD- NESS (CA,MG) (MG/L)	NON- CAR- BONATE HARD- NESS (MG/L)	DIS- SOLVED SOLIDS (RESI- DUE AT 180°C) (MG/L)	DIS- SOLVED SOLIDS (SUM OF CONSTI- TUENTS) (MG/L)	DIS- SOLVED SOLIDS (TONS PER AC-FT)	ALKA- LINITY AS CACO3 (MG/L)	SODIUM AD- SORP- TION RATIO	PERCENT SODIUM	SPE- CIFIC CON- DUCT- ANCE (MICRO- MHOS)	PH (UNITS)
.40	--	--	--	--	95	0	--	--	--	141	.4	16	320	--
.20	--	--	--	--	45	0	--	--	--	62	.3	15	170	--
.10	--	--	--	--	92	15	--	163	.22	77	--	--	222	7.5
.30	--	--	--	--	30	0	--	64	.09	31	--	--	72	7.5
.10	--	--	--	--	52	0	--	84	.11	54	--	--	118	7.6
1.7	--	--	--	--	64	0	--	103	.14	66	--	--	150	7.4
1.0	--	--	--	--	94	19	--	164	.22	75	.3	15	255	7.8
.50	--	--	--	--	40	3	--	85	.12	37	.3	20	111	7.3
1.0	--	--	--	--	76	1	--	121	.16	75	.5	21	175	7.0
5.3	--	--	--	--	162	2	--	280	.38	160	.4	13	370	8.0
--	--	--	--	--	48	3	--	96	.13	45	--	--	125	7.5
--	.15	.28	.09	30	54	10	--	115	.16	44	.3	15	144	8.0
--	.03	.03	.01	20	24	12	--	74	.10	12	.5	31	82	7.8
2.4	--	--	--	--	130	20	--	204	.28	110	.5	18	300	7.4
.50	--	--	--	--	70	2	--	128	.17	68	.3	16	166	7.2
1.2	--	--	--	--	96	0	--	168	.23	100	.4	18	240	8.0
.50	--	--	--	--	234	0	--	368	.50	237	.7	19	515	8.4
.10	--	--	--	--	218	0	--	--	--	273	2.9	48	870	--
1.3	--	--	--	--	178	18	--	310	.42	160	--	--	464	--
3.1	--	--	--	--	160	11	--	293	.40	148	.9	24	410	7.5
1.1	--	--	--	--	74	3	--	160	.22	71	.8	31	220	7.0
3.1	--	--	--	--	146	18	--	224	.30	127	.7	21	325	7.6
.20	--	--	--	--	280	10	--	526	.72	271	1.7	33	730	8.2
--	--	--	--	--	290	0	596	591	.81	329	2.4	40	--	8.4
--	--	--	--	--	130	0	234	236	.32	137	.8	24	330	7.5
--	--	--	--	--	140	0	250	252	.34	150	.9	26	310	7.7
--	--	--	--	--	160	0	273	266	.37	157	.9	26	375	7.4
--	--	--	--	--	190	0	308	308	.42	186	1.0	25	450	7.8
--	--	--	--	--	260	0	486	476	.66	268	1.8	34	800	8.6
--	--	--	--	--	130	0	241	236	.33	142	.9	27	360	7.8
--	--	--	--	--	270	0	471	472	.64	237	1.7	33	750	8.7
--	--	--	--	--	260	0	486	476	.66	313	1.7	34	740	8.7
--	--	--	--	--	280	0	550	540	.75	326	2.0	37	850	8.3
--	--	--	--	--	290	0	610	638	.83	427	2.5	41	760	8.0
--	--	--	--	--	170	0	273	275	.37	185	.9	25	415	8.5
--	--	--	--	--	160	0	267	265	.36	164	.9	25	413	8.2
--	--	--	--	--	140	0	238	241	.32	156	.8	24	350	8.3
--	--	--	--	--	160	0	271	274	.37	164	.9	25	410	8.0
--	--	--	--	--	190	0	289	306	.39	197	.9	24	450	8.1
--	--	--	--	--	200	0	382	517	.52	466	1.3	31	590	8.3
--	--	--	--	--	290	0	615	632	.84	353	2.4	41	980	8.7
--	--	--	--	--	210	0	496	533	.68	288	2.7	47	820	8.7
--	--	--	--	--	250	0	535	600	.73	337	2.6	44	780	8.9
--	--	--	--	--	210	0	551	572	.75	260	3.3	52	850	8.6
--	--	--	--	--	--	--	--	--	--	132	--	--	850	8.6
--	--	--	--	--	310	0	586	667	.80	327	2.7	43	1050	7.9
--	--	--	--	--	--	--	--	--	--	207	--	--	440	8.5
--	--	--	--	--	28	4	--	61	.08	24	--	--	80	6.8
.02	--	.00	--	--	32	0	--	75	.10	33	.5	28	110	8.0
3.6	--	--	--	--	560	0	--	1300	1.77	578	--	--	1900	7.5
1.0	--	--	--	--	122	3	--	189	.26	119	--	--	262	7.8
.10	--	--	--	--	171	0	--	--	--	230	2.0	41	680	--
1.4	--	--	--	--	212	17	--	420	.57	196	1.6	35	620	8.3
1.4	--	--	--	--	206	6	--	376	.51	199	1.3	30	540	8.6
.00	--	--	--	--	182	1	--	369	.50	181	1.6	36	535	7.8
.70	--	--	--	--	238	44	--	410	.56	194	1.4	31	575	8.3

Table 16.—Estimated withdrawals, in acre-feet, of ground water in Beaver Valley, 1934-75

Year	Use				
	Irrigation	Public supply	Industry	Domestic and stock	Total (rounded)
1934	250	0	25	100	400
1935	550	0	25	100	700
1936	550	0	25	100	700
1937	560	0	25	100	700
1938	570	0	25	100	700
1939	550	0	25	100	700
1940	550	0	25	100	700
1941	560	0	25	100	700
1942	560	0	25	100	700
1943	560	0	25	100	700
1944	560	0	25	100	700
1945	560	0	25	100	700
1946	560	0	25	100	700
1947	640	0	25	100	800
1948	640	0	25	100	800
1949	630	0	25	100	800
1950	1,650	50	25	100	1,800
1951	1,910	50	25	100	2,100
1952	2,120	50	25	100	2,300
1953	2,210	50	25	100	2,400
1954	2,620	50	25	100	2,800
1955	3,060	50	25	100	3,200
1956	3,480	50	25	100	3,700
1957	3,470	50	25	100	3,600
1958	3,500	50	25	100	3,700
1959	4,160	50	25	100	4,300
1960	4,140	50	25	100	4,300
1961	4,280	50	25	100	4,500
1962	4,750	200	25	100	5,100
1963	4,840	200	25	100	5,200
1964	5,680	200	25	100	6,000
1965	3,440	200	25	100	3,800
1966	5,370	210	25	100	5,700
1967	3,400	930	25	100	4,500
1968	2,940	930	25	100	4,000
1969	3,380	930	25	100	4,400
1970	3,680	930	25	100	4,700
1971	5,230	930	25	100	6,300
1972	8,200	930	25	100	9,300
1973	4,670	930	25	100	5,700
1974	8,880	930	0	125	9,900
1975	6,600	930	0	125	7,700

Table 17.—Selected drillers' logs of wells

Location: See page 2 for explanation of numbering system.
Altitude: Surveyed altitudes are given in hundredths of a foot; altitudes interpolated from topographic maps are given in feet.

Material	Thickness (ft)	Depth (ft)
(C-28-6)29cbc-1. Log by Vic's Drilling Co. Alt. 6,560.		
Soil	2	2
Gravel and boulders	35	37
Gravel, cemented	148	185
Sand and gravel	16	201
Gravel	15	216
(C-28-7)15bba-2. Log by B and B Drilling Co. Alt. 6,271.88.		
Soil	7	7
Clay and gravel	11	18
Gravel and boulders	102	120
Sand, gravel, and boulders	35	155
Clay and boulders	55	210
Sand and gravel	26	236
Clay, sand, and gravel	39	275
Conglomerate	40	315
Clay, sand, and gravel	55	370
Conglomerate	40	410
Clay and gravel	36	446
Clay, sand, and gravel	56	502
Boulders	10	512
Gravel	62	574
Boulders	7	581
Clay and gravel	15	596
Clay and cobbles	54	650
Clay	2	652
Boulders	9	661
Clay and boulders	15	676
Conglomerate	26	702
Gravel	29	731
Boulders	27	758
Soft streaks	17	775
Material not reported	190	965
Gravel	14	979
Clay	5	984
(C-28-7)16dca-2. Log by B and B Drilling Co. Alt. 6,196.72.		
Soil	6	6
Clay, sandy	31	37
Boulders and gravel	8	45
Clay	11	56
Clay with sand lenses	19	75
Sand and gravel	10	85
Clay	9	94
Clay, gray, sandy	21	115
Clay with gravel lenses	13	128
Clay and boulders	10	138
Clay	17	155
Sand and gravel	9	164
Clay	8	172
Boulders, gravel, and clay	30	202
Clay	9	211
Boulders	7	218
Sand and gravel	8	226
Clay	12	238
Boulders and gravel	17	255
Clay	8	263
Sand	7	270
Clay, hard	16	286
Gravel and boulders	10	296
Clay	4	300
(C-28-7)19bdb-1. Log by B and B Drilling Co. Alt. 5,975.50.		
Soil	90	90
Sand and clay	20	110
Clay and gravel	4	114
Sand and gravel	8	122
Clay and gravel	5	127
Gravel	3	130
Clay and gravel	20	150
Clay and boulders	6	156
Clay, cemented	14	170
Gravel	5	175
Sand	10	185
Clay, cemented	19	204
Sand and gravel	3	207
(C-28-7)21dda-1. Log by B and B Drilling Co. Alt. 6,119.78.		
Soil	9	9
Gravel and boulders	12	21
Boulders and clay	11	32
Gravel and boulders	7	39
Clay, sandy	20	59
Clay	3	62
Sand and gravel	5	67
Clay	7	74
Sand and gravel	11	85
Clay	11	96
Sand and gravel	6	102
Clay and boulders	32	134
Gravel and boulders	4	138
Clay	20	158
Boulders and gravel	4	162
Clay	5	167
Boulders and clay	17	184
Gravel and clay	16	200
Clay	7	207
(C-28-7)21dda-1.- Continued		
Gravel	9	216
Clay	12	228
Gravel and sand	2	230
Clay, blue	2	232
(C-28-7)27cca-1. Log by Vic's Drilling Co. Alt. 6,169.02.		
Soil	2	2
Sand, gravel, and boulders	17	19
Clay	16	35
Sand and gravel	15	50
Clay	7	57
Sand, gravel, and boulders	27	84
Clay	14	98
Sand and gravel	7	105
Clay	8	113
Sand, gravel, and boulders	4	117
Clay	4	121
Sand, gravel, and boulders	5	126
Clay	12	138
Sand, gravel, and boulders	16	154
Clay	9	163
Sand, gravel, and boulders	10	173
Clay	3	176
Sand, gravel, and boulders, with lenses of clay	11	187
Clay	10	197
Sand and gravel	2	199
Clay	3	202
Sand, gravel, and boulders, with lenses of clay	51	253
Clay	3	256
Sand, gravel, and boulders, with lenses of clay	48	304
Clay	6	310
Sand, gravel, and boulders	19	329
Clay	8	337
Sand, gravel, and boulders, with lenses of clay	25	362
(C-29-7)3cab-1. Log by B and B Drilling Co. Alt. 6,086.36.		
Soil	3	3
Gravel and boulders	40	43
Clay, gravel, and boulders	74	117
Boulders	4	121
Clay and gravel	17	138
Boulders	3	141
Clay and gravel	5	146
Gravel	174	320
Clay and sand	5	325
Clay and cobbles	7	332
Sand and boulders	13	345
Clay, sand, and boulders	55	400
Clay	61	461
Cobbles	11	472
Sand	49	521
Clay	26	547
Clay and gravel	138	685
Cobbles	25	710
Clay	162	872
Clay and sand	32	904
Clay	96	1,000
(C-29-7)4aca-1. Log by B and B Drilling Co. Alt. 6,083.60.		
Soil	18	18
Clay	147	165
Clay, yellow, sand, and gravel	7	172
Clay	23	195
Gravel and boulders	9	204
Clay	3	207
(C-29-7)6baa-1. Log by B and B Drilling Co. Alt. 5,910.		
Soil	11	11
Boulders and clay	4	15
Clay	6	21
Boulders and gravel	9	30
Clay	11	41
Gravel and clay	13	54
Clay, blue	38	92
Boulders and gravel	6	98
Clay, soft	6	104
Sand and gravel	5	109
Clay	3	112
Boulders, gravel, and sand	5	117
Clay	6	123
Boulders, sand, and gravel	3	126
Clay	13	139
Boulders, sand, and gravel	5	144
Clay	3	147
Boulders and gravel	3	150
Clay, blue	58	208
Sand and gravel	8	216
Clay	12	228
Boulders, gravel, and sand	16	244
Clay	4	248
Boulders, gravel, and sand	16	264
Clay	5	269
Boulders and gravel	8	277
(C-29-7)6baa-1.- Continued		
Clay	12	289
Gravel and sand	5	294
Clay	11	305
Gravel and sand	10	315
Clay	9	324
Gravel and sand	22	346
Clay	4	350
(C-29-7)10cdb-1. Log by B and B Drilling Co. Alt. 6,022.41.		
Soil	2	2
Gravel and boulders	16	18
Gravel	77	95
Boulders	6	101
Clay	5	106
Boulders	2	108
Clay	13	121
Clay, sand, and gravel	8	129
Clay and gravel	6	135
Sand and gravel	3	138
Clay and gravel	4	142
Sand and gravel	2	144
Clay and gravel	14	158
Sand and gravel	5	163
Clay and gravel	4	167
Gravel and boulders	5	172
Clay and gravel	14	186
Gravel and boulders	6	192
Clay and gravel	13	205
Gravel and boulders	12	217
Clay and gravel	25	242
Boulders	2	244
Clay and boulders	12	256
Boulders	24	280
Clay	12	292
Boulders	4	296
Clay and gravel	22	318
Boulders	6	324
Clay and gravel	28	352
Boulders	4	356
Clay and gravel	17	373
Boulders	6	379
Clay and gravel	27	406
Boulders	3	409
Clay	96	505
Boulders and sand	20	525
Sand and gravel	5	530
Boulders	26	556
Clay	23	579
Boulders and sand	16	595
Clay with sand lenses	90	685
Sand and gravel	25	710
Sand and clay	10	720
Clay	20	740
(C-29-7)11cda-1. Log by Grimshaw Drilling Co. Alt. 6,098.33.		
Silt	6	6
Cobbles	5	11
Boulders	34	45
Gravel	16	61
Cobbles	6	67
Boulders	12	79
Clay	6	85
Gravel	47	132
Boulders	17	149
Clay	14	163
Sand	40	203
Cobbles	14	217
Clay	58	275
Cobbles	23	298
Sand	23	321
Boulders	11	332
Sand	27	359
Gravel	8	367
Sand	40	407
Boulders	5	412
Clay	28	440
Sand	34	474
Clay	9	483
Sand	14	497
Clay	54	551
Sand	38	589
Gravel, fine	11	600
(C-29-7)14bac-1. Log by B and B Drilling Co. Alt. 6,088.38.		
Soil	25	25
Sand	20	45
Gravel	27	72
Gravel and boulders	33	105
Clay	16	121
Clay and gravel	11	132
Clay	15	147
Sand and gravel	6	153
Clay	35	188
Sand and gravel	13	201
(C-29-7)16aaa-1. Log by P. C. Bradshaw Alt. 5,985.46.		
Boulders	38	38

Table 17.—Selected drillers' logs of wells—Continued

Material	Thickness (ft)	Depth (ft)
(C-29-7)16aaa-1.- Continued		
Clay, brown	4	42
Gravel, brown; water	4	46
Clay	3	49
Gravel	8	57
Clay	17	74
Gravel	16	90
Clay	6	96
Gravel	4	100
Clay	9	109
Gravel	13	122
Clay	6	128
Gravel	3	131
Clay	9	140
Clay and gravel	3	143
Clay	30	173
Gravel	4	177
Clay	8	185
(C-29-7)16dbb-1. Log by B and B Drilling Co. Alt. 5,915.		
Gravel and boulders	120	120
Sand and gravel	12	132
Gravel and boulders	78	210
Cobbles	60	270
Sand and gravel, cemented	65	335
Clay and cobbles	45	380
Clay and cemented gravel layers	60	440
Clay	22	462
Clay and gravel; broken	98	560
Clay and gravel	130	690
Boulders and sand, cemented	50	740
Sand and gravel	62	802
(C-29-7)17cba-2. Log by B and B Drilling Co. Alt. 5,840.		
Soil	5	5
Gravel	9	14
Clay	13	27
Sand and gravel	21	48
Clay	5	53
Gravel	15	68
Clay	4	72
(C-29-7)18ddd-1. Log by B and B Drilling Co. Alt. 5,798.		
Soil	4	4
Boulders and gravel	27	31
Clay	4	35
Boulders, gravel, and sand	2	37
Clay	17	54
Boulders and gravel	5	59
Clay	13	72
Boulders, gravel, and sand	4	76
Sand, clay, and gravel	9	85
Boulders and clay	9	94
Gravel with clay lenses	15	109
Gravel, sandy	7	116
Gravel and clay	9	125
Clay	6	131
Boulders and gravel	6	137
Clay	4	141
Boulders and clay	5	146
Boulders and gravel	13	159
Clay and gravel	22	181
Gravel, sandy	6	187
Gravel with clay lenses	21	208
Clay	6	214
Boulders and gravel	8	222
Boulders with clay lenses	9	231
Gravel, sandy	8	239
Clay	12	251
Gravel, sandy	13	264
Gravel and clay	23	287
Gravel	11	298
Clay	6	304
Sand and clay with gravel lenses	10	314
Clay, hard	7	321
Boulders and gravel	18	339
Clay and gravel	9	348
Gravel	8	356
Clay	9	365
Gravel	5	370
Gravel and clay	8	378
Boulders and gravel	18	396
Clay	10	406
(C-29-7)19bcd-1. Log by P. C. Bradshaw Alt. 5,773.		
Soil gravelly	6	6
Clay, sandy	6	12
Clay and gravel, in lenses	213	225
Gravel	20	245
Clay	11	256
(C-29-7)20bba-1. Log by B and B Drilling Co. Alt. 5,820.		
Soil	5	5
Gravel	14	19
Clay	4	23
(C-29-7)20bba-1.- Continued		
Gravel	47	70
Clay	7	77
Sand and gravel	20	97
Clay	41	138
Sand and gravel	26	164
Sand	33	197
Clay and sand	27	224
Sand and gravel	47	271
Sand, gravel, and boulders	51	322
Clay	23	345
Sand and gravel	21	366
Clay	15	384
Sand, gravel, and boulders	19	400
(C-29-7)21baa-1. Driller unknown. Alt. 5,865.15.		
Gravel	25	25
Clay and gravel	9	34
Gravel	19	53
Clay and gravel	19	72
Clay	2	74
Clay and gravel	9	83
Gravel	6	89
Clay and gravel	6	95
Clay, hard	20	115
Gravel	2	117
Clay and gravel	27	144
Gravel	3	147
Clay, hard	3	150
Clay and gravel	14	164
Gravel, fine	2	166
Clay, hard, and gravel	14	180
Clay	6	186
Gravel	12	198
Clay	10	208
Gravel, fine	3	211
Clay	14	225
Clay and gravel	12	237
Gravel	3	240
Clay and gravel	18	258
Gravel	9	267
Gravel, fine	3	270
Gravel	10	280
Clay	18	298
Clay and gravel	36	334
Gravel	3	337
Clay and gravel	18	355
Gravel	2	357
Clay	58	415
(C-29-7)21dbb-1. Log by B and B Drilling Co. Alt. 5,850.		
Gravel and boulders	65	65
Sand and gravel	7	72
Gravel and boulders	31	103
Sand and gravel	9	112
Gravel and boulders	16	128
Sand and gravel	6	134
Gravel and boulders	16	150
(C-29-7)22ada-1. Log by B and B Drilling Co. Alt. 5,961.69.		
Soil	12	12
Gravel and boulders	91	103
Clay and gravel	23	126
Clay and boulders	84	210
Gravel and boulders	99	309
Clay and boulders	45	354
Gravel and boulders	99	453
(C-29-7)22bda-1. Log by B and B Drilling Co. Alt. 5,924.		
Soil	5	5
Sand and gravel	28	33
Clay, sand, and boulders	26	59
Clay and boulders	26	85
Sand	22	107
Clay and boulders; water	56	163
Clay and boulders	44	207
Clay, gravel, boulders	51	258
Clay and large boulders	21	279
Boulders, large, and gravel, very loose	39	318
(C-29-7)32dbd-1. Log by P. C. Bradshaw Alt. 5,819.		
Clay	18	18
Gravel; dry	6	24
Clay	4	28
Clay, sandy	11	39
Gravel	23	62
Sand	4	66
Gravel and hardpan	90	156
(C-29-7)34bbd-1. Log by B and B Drilling Co. Alt. 5,933.59.		
Soil	6	6
Sand, gravel, and boulders	114	120
Gravel, boulders, and conglomerate	95	215
Clay and boulders; cemented	85	300
(C-29-7)34bbd-1.- Continued		
Sand, gravel, boulders, and conglomerate	110	410
Clay, sand, and boulders	95	505
Clay, cemented	15	520
(C-29-8)13dda-1. Log by B and B Drilling Co. Alt. 5,808.		
Soil	6	6
Clay and gravel	24	30
Clay and gravel lenses	40	70
Clay, blue	66	136
Boulders and clay	6	142
Boulders and gravel	16	158
Clay and gravel	11	169
Sand and gravel	25	194
Clay, sandy	21	215
Gravel, sandy	9	224
Clay and sand	9	233
Sand and gravel	6	239
Clay, blue	5	244
Boulders and gravel	5	249
Gravel and clay	12	261
Gravel and sand	13	274
Gravel and clay	14	288
Gravel and boulders	14	302
Clay, sandy	40	342
Boulders and gravel	13	355
Gravel	3	358
Clay	7	365
Boulders and gravel	5	370
Clay	4	374
Boulders	6	380
Clay	8	388
Boulders and gravel	12	400
Clay	10	410
(C-29-8)20dcb-1. Log by B and B Drilling Co. Alt. 5,563.06.		
Gravel	32	32
Boulders and gravel	38	70
Clay	8	78
Gravel	61	139
Clay	5	144
Gravel	14	158
Clay, blue	17	175
(C-29-8)23caa-1. Log by B and B Drilling Co. Alt. 5,739.33.		
Soil	4	4
Clay and gravel	7	11
Sand	8	19
Gravel	6	25
Clay	5	30
Clay and boulders	2	32
Clay	26	58
Clay and gravel	8	66
Sand	1	67
Clay	1	68
Sand and gravel	2	70
Clay and sand	8	78
Clay	51	129
Clay and sand	31	160
Sand	4	164
Clay and sand	40	204
Sand and gravel	7	211
Clay and sand	25	236
Sand and gravel	5	241
Clay and sand	17	258
Sand and gravel	15	273
Clay	33	306
Sand and gravel	11	317
Clay	7	324
Sand, gravel, and boulders	19	343
Clay	4	347
Sand and gravel	25	372
Clay and gravel	14	386
Sand and gravel	17	403
Clay	10	413
Boulders	27	440
(C-29-8)26daa-2. Log by H. L. Hall. Alt. 5,667.		
Clay	8	8
Sand	5	13
Clay, brown	8	21
Clay, blue	4	25
Gravel, coarse; water	10	35
Clay, brown	12	47
Clay, blue	8	55
Sand, gray; water	15	70
Sand, black	5	75
Clay, blue, and sand	32	107
Clay, blue	26	133
Clay, gray, and sand	7	140
Clay, blue	15	155
Clay, gray, and sand	9	164
Sand, black; water	6	170
Clay, gray, and sand	5	175
Clay, blue	10	185
Sand, gray; water	5	190

Table 17.—Selected drillers' logs of wells—Continued

Material	Thickness (ft)	Depth (ft)
(C-29-8)26daa-2.- Continued		
Clay, green	19	209
Sand, gray; water	5	214
Clay, gray	28	242
Clay, blue	1	243
Sand; water	2	245
Clay, gray	15	260
Clay, blue	19	279
Sand; water	4	283
Clay, blue	7	290
Clay, gray	4	294
Sand, fine	10	304
Sand; water	4	308
Clay, gray	4	312
Clay, blue	6	318
Sand; water	5	323
Clay, gray	10	333
Sand, water	9	342
Clay, gray	5	347
Clay, blue	5	352
Sand; water	4	356
Clay, blue	3	359
Sand; water	2	361
Clay, gray	3	364
Sand; water	4	368
Clay, gray	2	370
Sand; water	4	374
Clay, blue	6	380
Sand; water	13	393
Clay, blue	25	418
Sand; water	4	442
Clay, blue	12	434
Sand; water	8	442
Clay, blue	1	443
Sand; water	2	445
Clay, blue	2	447
(C-29-8)31add-1. Log by B and B Drilling Co. Alt. 5,548.		
Soil	2	2
Boulders, clay, and gravel	28	30
Boulders and gravel	2	32
Boulders and clay	5	37
Sand, gravel, and boulders	8	45
Boulders and clay	32	77
Gravel and boulders	13	90
Gravel and clay	5	95
Gravel and sand	20	115
Clay and gravel	6	121
Gravel and boulders	16	137
Boulders and clay	18	155
Clay, blue	79	234
Sand and gravel	16	250
Clay	16	266
Sand and gravel	38	304
Clay	6	310
(C-29-8)32aca-1. Log by Vic's Drilling Co. Alt, 5,589.		
Soil	1	1
(C-29-8)32aca-1.- Continued		
Sand, gravel, and boulders	61	62
Clay, blue	150	212
Sand and gravel	6	218
Clay, blue, soft	4	222
Clay, blue, with lenses of sand and gravel	58	280
Clay	18	298
Sand and gravel	8	306
Clay, blue	14	320
Sand and gravel	4	324
Clay, blue, hard	8	332
Sand and gravel	10	342
Clay, blue	28	370
(C-29-8)35abd-1. Log by B and B Drilling Co. Alt, 5,653.		
Soil	3	3
Sand, gravel, and boulders	29	32
Clay, sand, gravel, and boulders	58	90
Clay, blue	186	276
Sand and gravel	10	286
Clay	2	288
Boulders	1	289
Clay, blue	50	339
Sand and gravel	11	350
Clay	12	362
Sand and gravel	9	371
Clay and gravel	9	380
Sand and gravel	15	395
Clay	13	408
Sand and gravel	14	442
Clay	12	434
Sand and gravel	7	441
Clay	11	452
Sand and gravel	8	460
Clay	16	476
Sand and gravel	22	498
Clay	16	514
(C-29-8)36acc-2. Log by B and B Drilling Co. Alt. 5,686.		
Soil	15	15
Clay and boulders	19	34
Sand	4	38
Clay and boulders	13	51
Sand	2	53
Clay	17	70
Gravel and boulders	6	76
Clay and boulders	10	86
Clay	8	94
Clay and gravel	17	111
Gravel and boulders	4	115
Clay	19	134
Sand, gravel, and boulders	17	151
Clay	18	169
Sand and gravel	2	171
Clay	31	202
Sand and gravel	16	218
Clay	13	231
(C-29-8)36acc-2.- Continued		
Sand and gravel	15	246
Clay	25	271
Sand	18	289
Clay and gravel	45	334
Sand and gravel	15	349
Clay	24	373
Sand and gravel	18	391
Clay	30	421
Sand and gravel	30	451
Clay	13	464
Gravel and boulders	11	475
Clay	18	493
Sand and gravel	25	518
(C-30-7)5ccd-1. Log by B and B Drilling Co. Alt. 5,910.		
Soil	4	4
Gravel and boulders	14	18
Sand and gravel	6	24
Boulders	11	35
Clay	10	45
Boulders	2	47
Gravel	38	85
Clay	58	143
Boulders	4	147
Clay and gravel	22	169
Clay	53	222
Sand and gravel	37	259
Clay	2	261
Sand and gravel	27	288
Clay	9	297
Clay and gravel	13	310
Clay	8	318
Gravel and boulders	-8	326
Clay	8	334
Sand and gravel	11	345
Clay	6	351
Hardpan	12	363
Clay	36	399
Gravel and boulders	4	403
Gravel	22	425
Clay	10	435
Sand and gravel	8	443
Clay	12	455
Gravel and boulders	14	469
Clay	16	485
Gravel and sand	13	498
Clay	10	508
Sand and gravel	10	518
Clay	12	530
Gravel and sand	8	538
Clay	9	547
Sand and gravel	12	559
Clay	4	563
Sand and gravel	9	572
Clay	19	591
Sand and gravel	7	598
Clay	12	610

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(*)-Out of Print

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