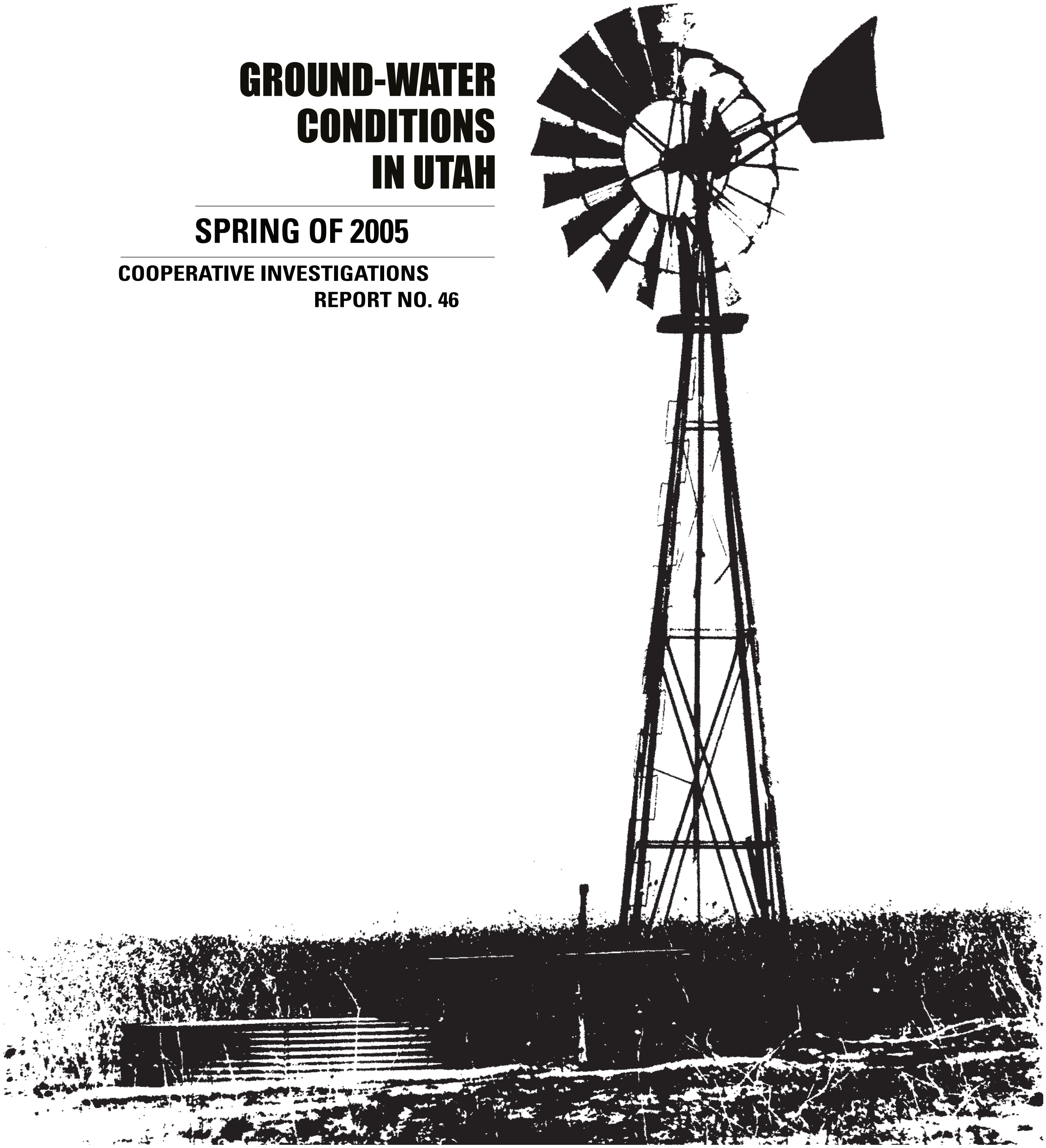
GROUND-WATER CONDITIONS IN UTAH

SPRING OF 2005

COOPERATIVE INVESTIGATIONS
REPORT NO. 46



UTAH DIVISION OF WATER RESOURCES • UTAH DIVISION OF WATER RIGHTS •

U.S. GEOLOGICAL SURVEY

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 2005

By
C.B. Burden and others
U.S. Geological Survey

Prepared by the U.S. Geological Survey
in cooperation with the Utah Department of Natural Resources,
Division of Water Resources and
Division of Water Rights

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CONVERSION FACTORS AND DATUMS

Multiply	By	To obtain
acre-foot	1,233	cubic meter
foot	0.3048	meter
gallons per minute	0.06308	liter per second
inch	25.4	millimeter
mile	1.609	kilometer
square mile	2.590	square kilometer

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 1929). Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Chemical concentration is reported only in metric units—milligrams per liter. For concentrations less than 7,000 milligrams per liter, the numerical value is about the same as for concentrations in parts per million.

DEFINITION OF TERMS

Acre-foot—The quantity of water required to cover 1 acre to a depth of 1 foot; equal to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

Aquifer—A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield substantial amounts of water to wells and springs.

Artesian—Describes a well in which the water level stands above the top of the aquifer tapped by the well (confined). A flowing artesian well is one in which the water level is above the land surface.

Cumulative departure from average annual precipitation—A graph of the departure or difference between the average annual precipitation and the value of precipitation for each year, plotted cumulatively. A cumulative plot is generated by adding the departure from average precipitation for the current year to the sum of departure values for all previous years in the period of record. A positive departure, or greater-than-average precipitation, for a year results in a graph segment trending upward; a negative departure results in a graph segment trending downward. A generally downward-trending graph for a period of years represents a period of generally less-than-average precipitation, which commonly causes and corresponds with declining water levels in wells. Likewise, a generally upward-trending graph for a period of years represents a period of greater-than-average precipitation, which commonly causes and corresponds with rising water levels in wells. However, increases or decreases in withdrawals of ground water from wells also affect water levels and can change or eliminate the correlation between water levels in wells and the graph of cumulative departure from average precipitation.

Dissolved—Material in a representative water sample that passes through a 0.45–micrometer membrane filter. This is a convenient operational definition used by Federal agencies that collect water data. Determinations of “dissolved” constituents are made on subsamples of the filtrate.

Land-surface datum (lsd)—A datum plane that is approximately at land surface at each ground-water observation well.

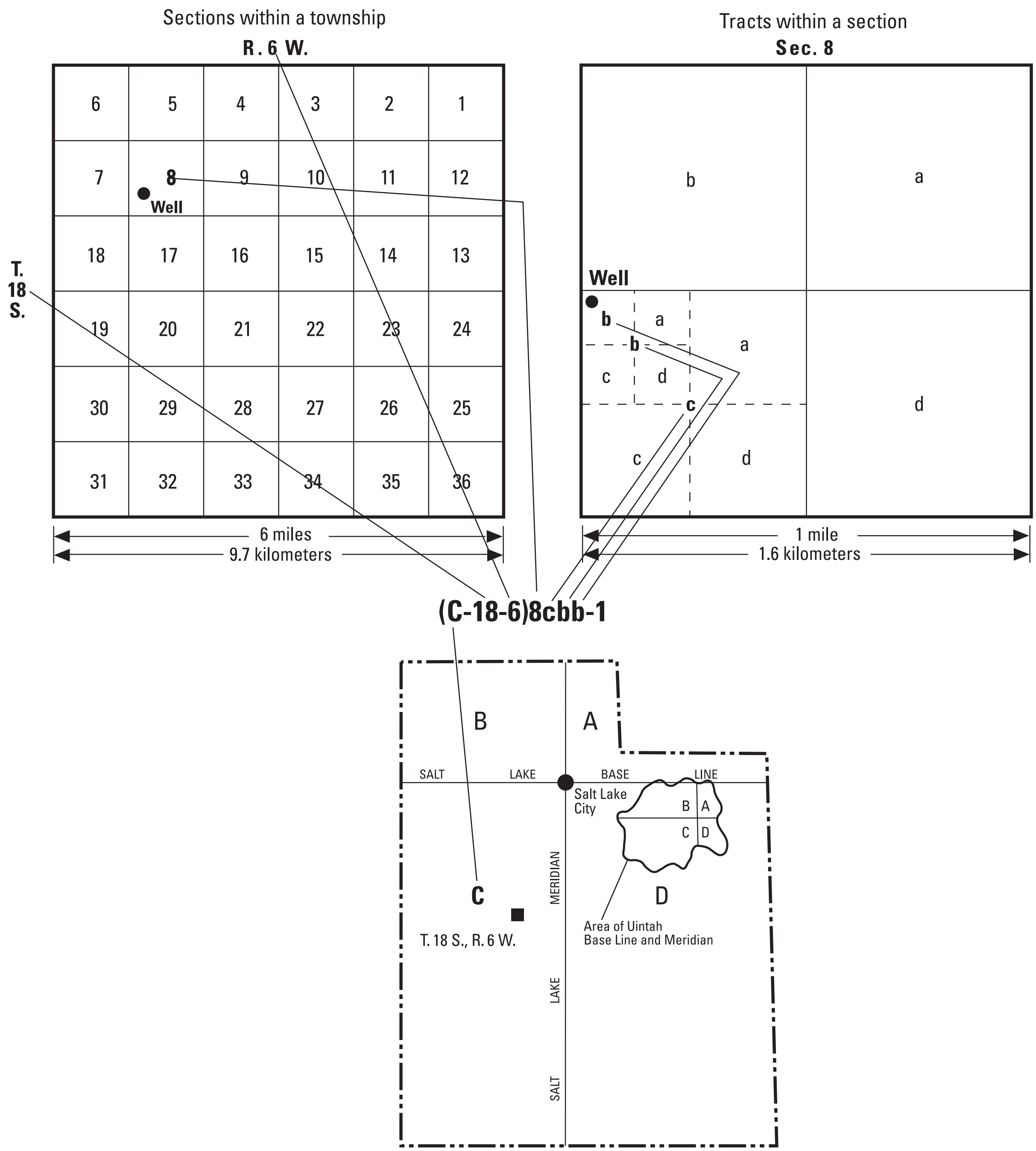
Milligrams per liter—A unit for expressing the concentration of chemical constituents in solution. Milligrams per liter represents the mass of solute per unit volume (liter) of water.

Precipitation—The total annual precipitation in inches for selected locations is computed from monthly total precipitation (rain, sleet, hail, snow, etc.). Data supplied by the National Oceanic and Atmospheric Administration (NOAA) and the Utah Climate Center. Data may be provisional and/or estimated when used to compute annual total and long-term average precipitation values.

Specific conductance—A measure of the ability of water to conduct an electrical current. It is expressed in microsiemens per centimeter at 25 degrees Celsius. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids concentration of the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is about 65 percent of the specific conductance (in microsiemens). This relation is not constant in water from one well or stream to another, and it may vary for the same source with changes in the composition of the water.

WELL-NUMBERING SYSTEM

The well-numbering system used in Utah is based on the Bureau of Land Management's system of land subdivision. The well-numbering system is familiar to most water users in Utah, and the well number shows the location of the well by quadrant, township, range, section, and position within the section. Well numbers for most of the State are derived from the Salt Lake Base Line and the Salt Lake Meridian. Well numbers for wells located inside the area of the Uintah Base Line and Meridian are designated in the same manner as those based on the Salt Lake Base Line and Meridian, with the addition of the "U" preceding the parentheses. The numbering system is illustrated below.



GROUND-WATER CONDITIONS IN UTAH, SPRING OF 2005

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INTRODUCTION

This is the forty-second in a series of annual reports that describe ground-water conditions in Utah. Reports in this series, published cooperatively by the U.S. Geological Survey and the Utah Department of Natural Resources, Division of Water Resources and Division of Water Rights, provide data to enable interested parties to maintain awareness of changing ground-water conditions.

This report, like the others in the series, contains information on well construction, ground-water withdrawal from wells, water-level changes, precipitation, streamflow, and chemical quality of water. Information on well construction included in this report refers only to wells constructed for new appropriations of ground water. Supplementary data are included in reports of this series only for those years or areas which are important to a discussion of changing ground-water conditions and for which applicable data are available.

This report includes individual discussions of selected significant areas of ground-water development in the State for calendar year 2004. Most of the reported data were collected by the U.S. Geological Survey in cooperation with the Utah Department of Natural Resources, Division of Water Rights and Division of Water Resources. This report is available online at *http://www.waterrights.utah.gov/techinfo/wwwpub/gw2005.pdf* and *http://ut.water.usgs.gov/publications/GW2005.pdf.*

The following reports deal with ground water in the State and were published by the U.S. Geological Survey or by cooperating agencies from May 2004 through April 2005:

Ground-water conditions in Utah, Spring of 2004, by C.B. Burden, and others, Utah Division of Water Resources Cooperative Investigations Report No. 45, 120 p.

Quality and sources of ground water used for public supply in Salt Lake Valley, Utah, 2001, by S.A. Thiros, and A.H. Manning, U.S. Geological Survey Water-Resources Investigations Report 03-4235, 107 p.

Seepage study of Mapleton Lateral Canal near Mapleton, Utah, by C.D.Wilkowske and J.V. Phillips, U.S. Geological Survey Scientific Investigations Report 2004-5210, 12 p.

Seepage investigation and selected hydrologic data for the Escalante River drainage basin, Garfield and Kane Counties, Utah, 1909-2002, by D.E. Wilberg and B.J. Stolp, U.S. Geological Survey Scientific Investigations Report 2004-5233, 38 p.

UTAH'S GROUND-WATER RESERVOIR

Small amounts of ground water can be obtained from wells throughout most of Utah, but large amounts that are of suitable chemical quality for irrigation, public supply, or industrial use generally can be obtained only in specific areas. The areas of ground-water development discussed in this report are shown in figure 1 and listed in table 1. Relatively few wells outside of these areas yield large amounts of ground water of suitable chemical quality for the uses listed above, although some of the basins in western Utah and many areas in eastern Utah have not been explored sufficiently to determine their potential for ground-water development.

A small percentage of the wells in Utah yield water from consolidated rock. Consolidated rocks that yield the most water are lava flows, such as basalt, which contain interconnected vesicular openings, fractures, or permeable weathered zones at the tops of flows; limestone, which contains fractures or other openings enlarged by solution; and sandstone, which contains open fractures. Most of the wells that penetrate consolidated rock are in the eastern and southern parts of the State in areas where water cannot be obtained readily from unconsolidated deposits.

Most of the wells in Utah yield water from unconsolidated deposits. These deposits may consist of boulders, gravel, sand, silt, or clay, or a mixture of some or all of these materials. The largest yields are obtained from coarse materials that are sorted into deposits of uniform grain size. Most wells that yield water from unconsolidated deposits are in large intermountain basins that have been partly filled with rock material eroded from the adjacent mountains.

SUMMARY OF CONDITIONS

The total estimated withdrawal of water from wells in Utah during 2004 was about 926,000 acre-feet (table 2), which is about 2,000 acre-feet more than the total for 2003 and 68,000 acre-feet more than the 1994-2003 average annual withdrawal (table 3). The increase in withdrawals mostly resulted from increased irrigation. The total estimated withdrawal for irrigation was about 536,000 acre-feet, which is 14,000 acre-feet more than the value for 2003. Withdrawal for industrial use increased about 6,000 acre-feet to about 77,000 acre-feet. Withdrawal for public supply was about 241,000 acre-fee, which is about 20,000 acre-feet less than the value for 2003. Withdrawal for domestic and stock use was about

72,000 acre-feet, which is about 1,000 acre-feet more than the value for 2003.

Ground-water withdrawal decreased from 2003 to 2004 in 9 of the 16 areas of ground-water development discussed in this report (table 2). Withdrawal in the Milford area decreased about 6,000 acre-feet, the largest decrease of the ground-water development areas (fig. 1). The 2004 withdrawal was more than the average annual withdrawals for 1994-2003 in 10 of the 16 areas (tables 2 and 3).

The amount of water withdrawn from wells is related to demand and availability of water from other sources, which, in turn, are partly related to local climatic conditions. Precipitation during calendar year 2004 at 18 of 28 weather stations included in this report (National Oceanic and Atmospheric Administration, 2004), was greater than the long-term average. The greatest increase in precipitation from average was 6.3 inches at Hatch. The greatest decrease in precipitation from average was 2.1 inches at Silver Lake near Brighton.

About 650 water-level measurements were made in wells for areas included in this report. Water-level data are available online at *http://waterdata.usgs.gov/ut/nwis/gwlevels*.

In 2004, 525 wells were constructed for new appropriations of ground water, as determined by the Utah Division of Water Rights (table 2), which is 470 fewer wells than was reported for 2003.[1] In 2004, 33 large-diameter wells (12 inches or more) were constructed for new appropriations of ground water (table 2). These are principally for withdrawal of water for public supply, irrigation, and industrial use.

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[1]Prior to 2004, total includes some monitoring wells.

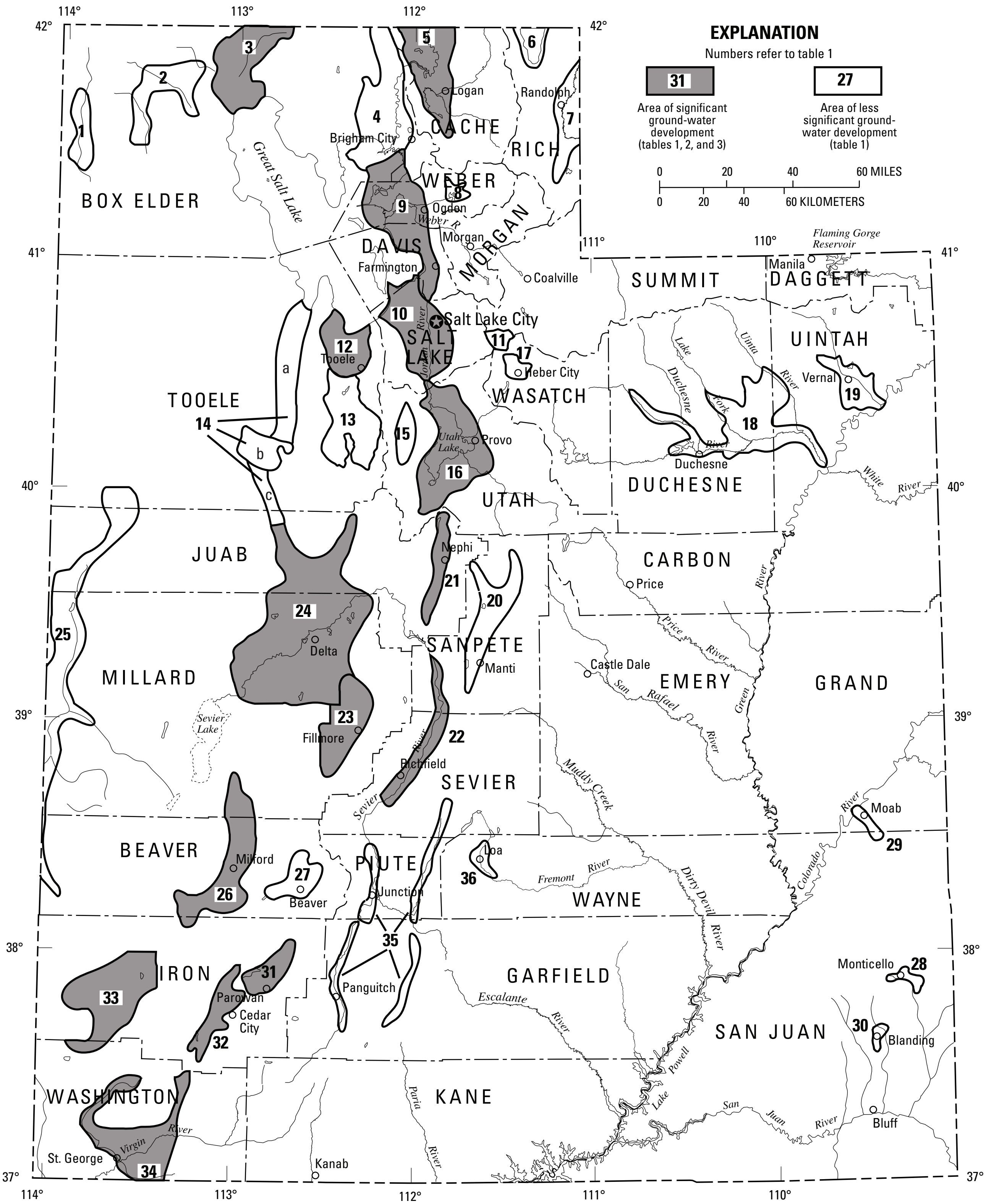


Figure 1. Areas of ground-water development in Utah specifically referred to in this report.

Table 1. Areas of ground-water development in Utah specifically referred to in this report

[Do., ditto]

Number in figure 1	Area	Principal types of water-bearing rock
1	Grouse Creek Valley	Unconsolidated
2	Park Valley	Do.
3	Curlew Valley	Unconsolidated and consolidated
4	Malad-lower Bear River Valley	Unconsolidated
5	Cache Valley	Do.
6	Bear Lake Valley	Do.
7	Upper Bear River Valley	Do.
8	Ogden Valley	Do.
9	East Shore area	Do.
10	Salt Lake Valley	Do.
11	Park City area	Unconsolidated and consolidated
12	Tooele Valley	Unconsolidated
13	Rush Valley	Do.
14a	Skull Valley	Do.
14b	Dugway area	Do.
14c	Old River Bed	Do
15	Cedar Valley, Utah County	Do.
16	Utah and Goshen Valleys	Do.
17	Heber Valley	Do.
18	Duchesne River area	Unconsolidated and consolidated
19	Vernal area	Do.
20	Sanpete Valley	Do.
21	Juab Valley	Unconsolidated
22	Central Sevier Valley	Do.
23	Pahvant Valley	Unconsolidated and consolidated
24	Sevier Desert	Unconsolidated
25	Snake Valley	Do.
26	Milford area	Do.
27	Beaver Valley	Do.
28	Monticello area	Consolidated
29	Spanish Valley	Unconsolidated and consolidated
30	Blanding area	Consolidated
31	Parowan Valley	Unconsolidated and consolidated
32	Cedar Valley, Iron County	Unconsolidated
33	Beryl-Enterprise area	Do.
34	Central Virgin River area	Unconsolidated and consolidated
35	Upper Sevier Valleys	Unconsolidated
36	Upper Fremont River Valley	Unconsolidated and consolidated

Table 2. Number of wells constructed and estimated withdrawal of water from wells in Utah

[Estimated withdrawal from wells—2003 total: from Burden and others (2004, table 2)]

Area	Number in figure 1	Number of wells[1] constructed in 2004		Estimated withdrawal from wells (acre-feet)					
				2004					2003 total (rounded)
		Total	Diameter of 12 inches or more	Irrigation	Industry[1]	Public supply[1]	Domestic and stock	Total (rounded)	
Curlew Valley	3	3	0	37,400	0	200	100	38,000	42,000
Cache Valley	5	44	0	9,300	5,500	10,500	2,000	27,000	27,000
East Shore area	9	13	2	10,900	3,600	26,800	5,000	46,000	49,000
Salt Lake Valley	10	12	5	800	[2]20,500	75,900	28,000	125,000	130,000
Tooele Valley	12	15	0	[3]10,200	550	8,300	1,500	21,000	22,000
Utah & Goshen Valleys	16	49	4	48,500	9,900	49,900	19,600	128,000	130,000
Juab Valley	21	9	1	24,800	0	[4]430	400	26,000	27,000
Sevier Desert	24	9	1	33,300	5,200	1,400	1,200	41,000	28,000
Central Sevier Valley	22	24	0	11,200	90	2,500	900	15,000	15,000
Pahvant Valley	23	2	0	84,000	0	940	320	85,000	86,000
Cedar Valley, Iron County	32	18	4	30,400	100	7,400	1,900	40,000	39,000
Parowan Valley	31	4	0	[5]36,400	10	590	410	37,000	31,000
Escalante Valley									
Milford area	26	0	0	35,800	[6]7,800	730	150	44,000	50,000
Beryl-Enterprise area	33	13	2	95,200	[7]1,700	630	610	98,000	92,000
Central Virgin River area	34	7	2	5,000	200	18,000	2,300	26,000	28,000
Other areas[8,9]		303	12	62,500	22,100	37,100	7,300	129,000	128,000
Total (rounded)		525	33	536,000	77,000	241,000	72,000	926,000	924,000

[1] Data provided by Utah Department of Natural Resources, Division of Water Rights.

[2] Includes some use for air conditoning, about 340 acre-feet. About 95 percent was injected back into the aquifer.

[3] Includes some domestic and stock use.

[4] Previously included some springs.

[5] Includes some stock use.

[6] Includes 5,580 acre-feet for geothermal power generation. About 99 percent was injected back into the aquifer.

[7] Includes 1,440 acre-feet used for heating greenhouses. About 95 percent was injected back into the aquifer.

[8] Withdrawal totals are estimated minimum. See "Other Areas" section of this report for withdrawal estimates for other areas.

[9] Includes withdrawals for upper Sevier Valley and upper Fremont River Valley that were included with central Sevier Valley in reports prior to number 31 of this series.

Table 3. Total annual withdrawal of water from wells in significant areas of ground-water development in Utah, 1994-2003

[From previous reports of this series]

Area	Number in figure 1	Thousands of acre-feet										1994-2003 average (rounded)
		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	
Curlew Valley	3	41	31	39	36	29	29	41	36	[1]38	42	36
Cache Valley	5	31	23	24	25	26	24	30	32	33	27	28
East Shore area	9	60	53	57	62	56	61	60	57	49	49	56
Salt Lake Valley	10	142	120	138	123	122	126	145	151	[1]140	130	134
Tooele Valley	12	31	26	23	25	[1]19	21	24	21	21	22	23
Utah and Goshen Valleys	16	114	77	99	96	86	[1]110	132	128	133	130	110
Juab Valley	21	26	13	19	15	12	14	27	29	29	27	21
Sevier Desert	24	37	18	17	17	12	12	15	19	36	28	21
Central Sevier Valley	22	20	20	21	20	20	20	13	12	11	15	17
Pahvant Valley	23	93	69	83	67	66	76	80	80	89	86	79
Cedar Valley, Iron County	32	34	31	35	34	36	32	[1]35	32	42	39	35
Parowan Valley	31	30	24	29	25	28	[1]26	30	[1]33	39	31	30
Escalante Valley												
Milford area	26	61	48	52	52	41	41	49	42	52	50	49
Beryl-Enterprise area	33	86	70	92	81	74	79	84	81	99	92	84
Central Virgin River area	34	14	15	17	18	20	[1]18	[1]26	27	27	28	21
Other areas		113	97	113	107	99	106	[1]135	114	131	128	114
Total		933	735	858	803	[1]746	[1]795	[1]926	[1]894	[1]969	924	858

[1] Revised.

MAJOR AREAS OF GROUND-WATER DEVELOPMENT

CURLEW VALLEY

By David V. Allen

The Curlew Valley drainage basin extends across the Utah-Idaho State line between latitudes 41°40' and 42°30' north and longitudes 112°30' and 113°20' west, and covers about 1,200 square miles. The valley is bounded on the west, north, and east by mountains that range in altitude from about 6,500 to nearly 10,000 feet and is open to the south, where it drains into Great Salt Lake.

The Utah part of Curlew Valley (Utah subbasin) covers about 550 square miles. It is an arid to semiarid, largely uninhabited area, with a community center at Snowville. Average annual precipitation in the Utah subbasin is less than 8 inches on the valley floor and reaches a maximum that exceeds 35 inches on one of the highest mountain peaks.

The principal source of water in the Utah subbasin is ground water. The ground-water reservoir is primarily composed of confined aquifers in alluvial and lacustrine deposits and volcanic rocks. These formations yield several hundred to several thousand gallons of water per minute to individual large-diameter irrigation wells west of Snowville and near Kelton.

Total estimated withdrawal of water from wells in Curlew Valley in 2004 was about 38,000 acre-feet, which is 4,000 acre-feet less than the value for 2003 and 2,000 acre-feet more than the average annual withdrawal for 1994-2003 (tables 2 and 3).

The location of wells in Curlew Valley in which the water level was measured during March 2005 is shown in figure 2. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Grouse Creek, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells is shown in figure 3.

Water levels in Curlew Valley generally declined from March 1999 to March 2005 (fig. 3). These recent declines probably resulted from less-than-average precipitation and streamflow during 4 of the last 5 years. Water levels in the area generally declined from about 1975 to 1980, generally rose from 1982 to 1987, a period of greater-than-average precipitation, declined from 1987 to 1997, and generally rose again from 1997 to 1999.

Precipitation at Grouse Creek in 2004 was about 11.7 inches, which is about 2.1 inches more than in 2003 and about 0.5 inch more than the average annual precipitation for 1959-2004.

The concentration of dissolved solids in water from well (B-12-11)4bcc-1, north of Kelton, has generally increased since 1972. The concentration of dissolved solids in water from well (B-14-9)5bbb-1, west of Snowville, increased from about 320 mg/L in 1972 to about 640 mg/L in 2005, the highest concentration of dissolved solids measured in water from this well since 1972. These increases may be a result of recharge from unconsumed irrigation water in which dissolved solids are concentrated by evaporation.

Water levels generally declined in the central and southwestern parts of Curlew Valley from March 1975 to March 2005 (fig. 4). The largest decline, about 32.4 feet, was measured in a well about 10 miles west of Snowville. The declines probably resulted from increased withdrawals for irrigation. Water levels rose in isolated parts of Curlew Valley from March 1975 to March 2005; the largest rise, about 6.9 feet, was measured in a well about 3 miles west of Snowville. The rises in water level were probably the result of increased local recharge.

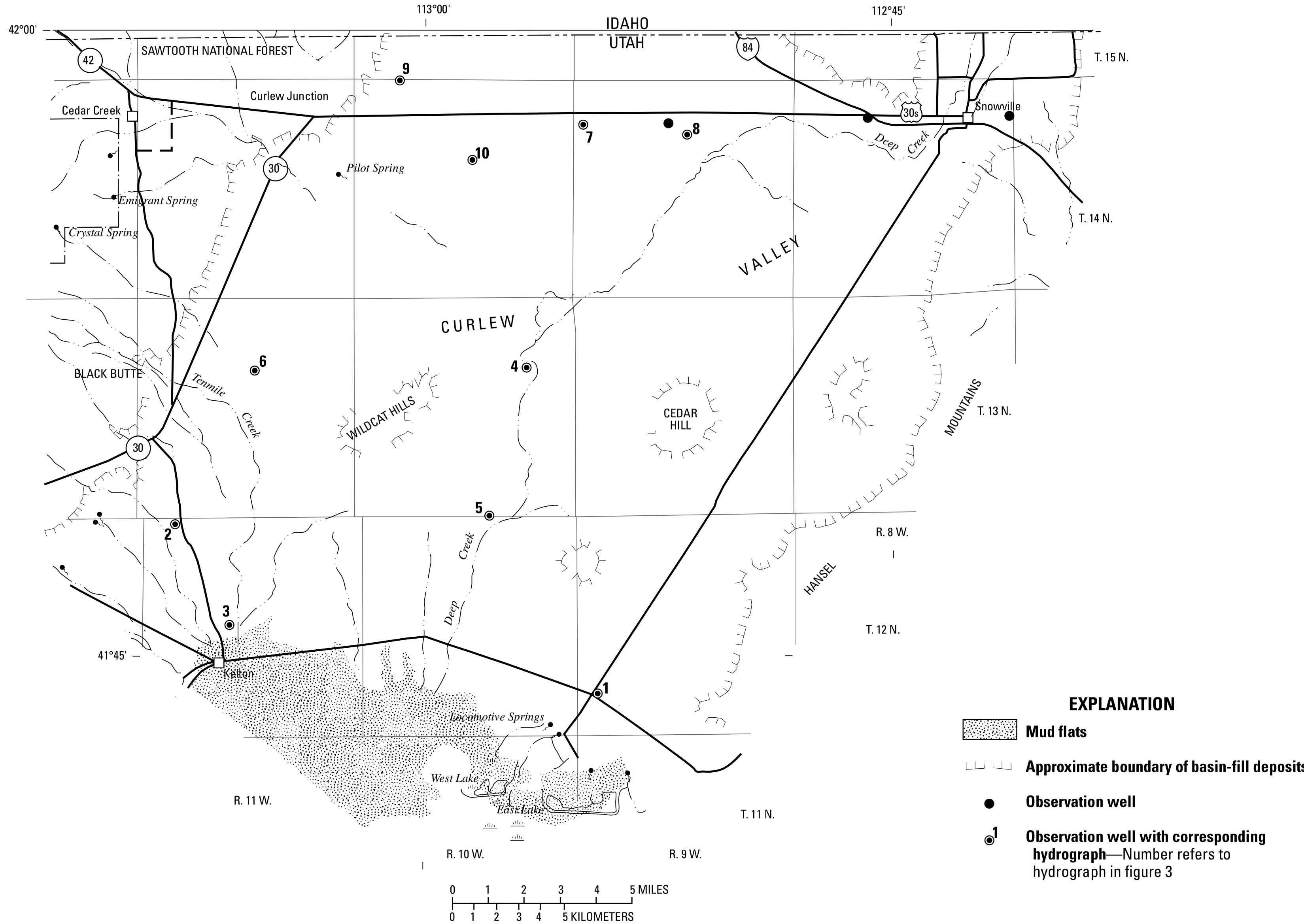


Figure 2. Location of wells in Curlew Valley in which the water level was measured during March 2005.

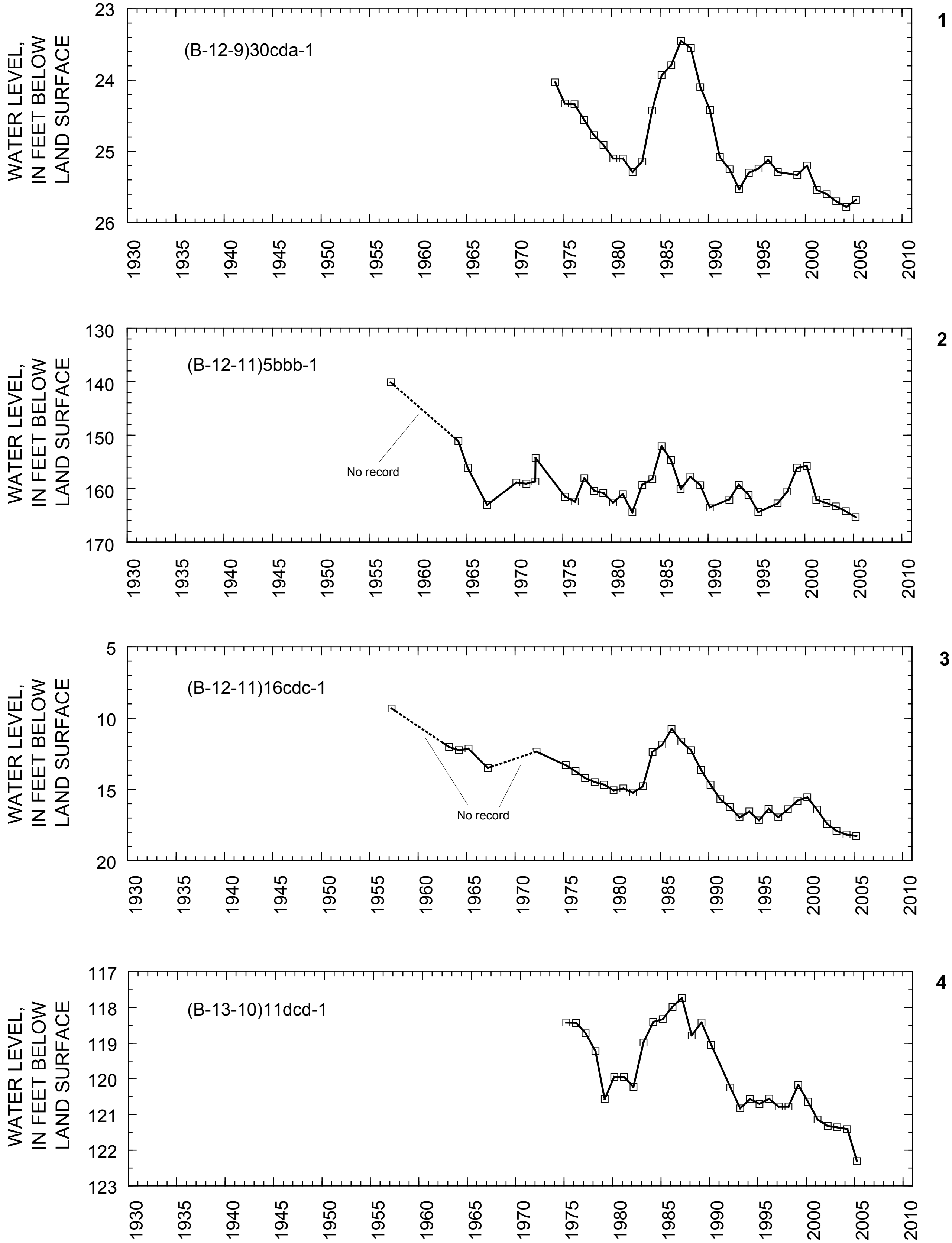


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Grouse Creek, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

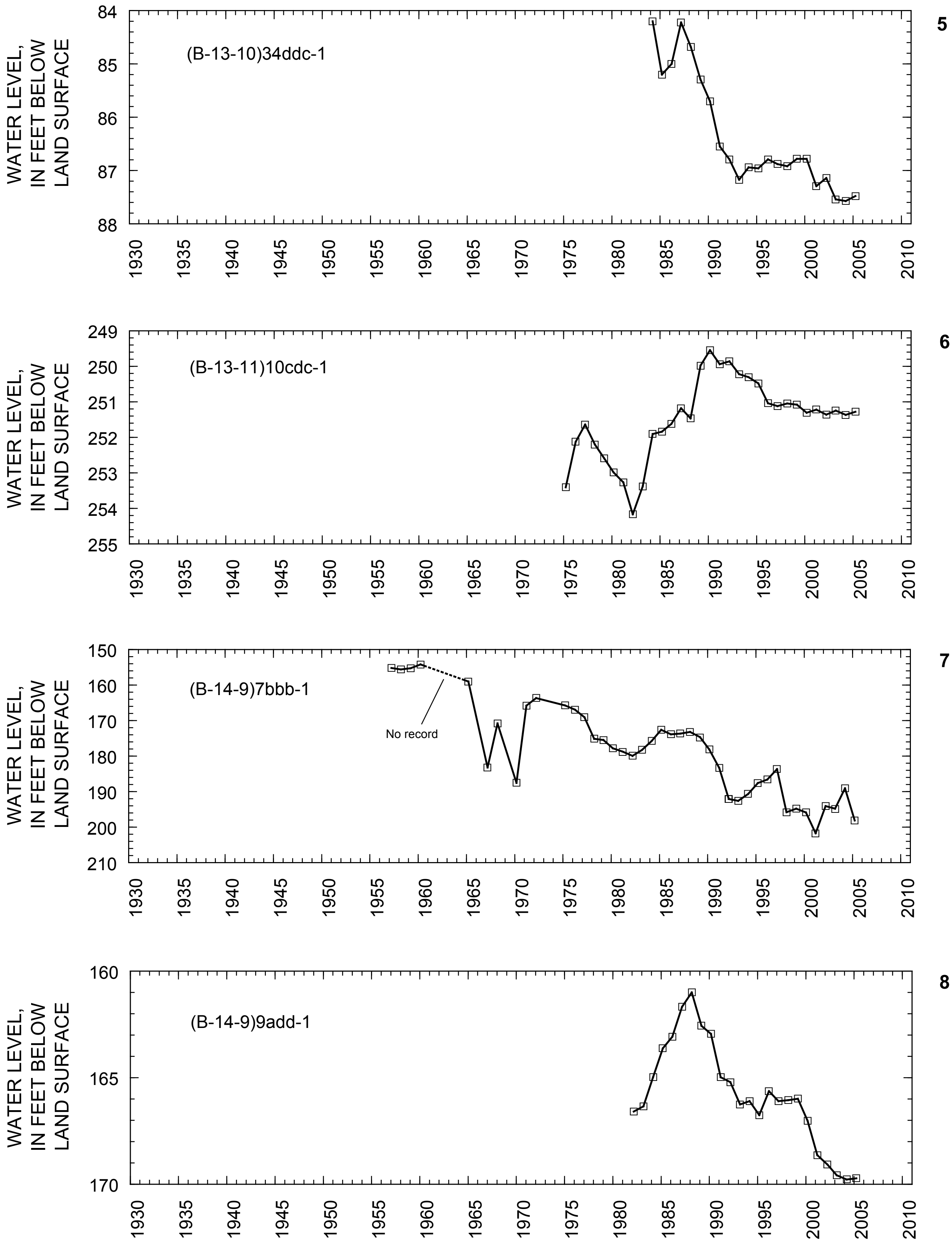


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Grouse Creek, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

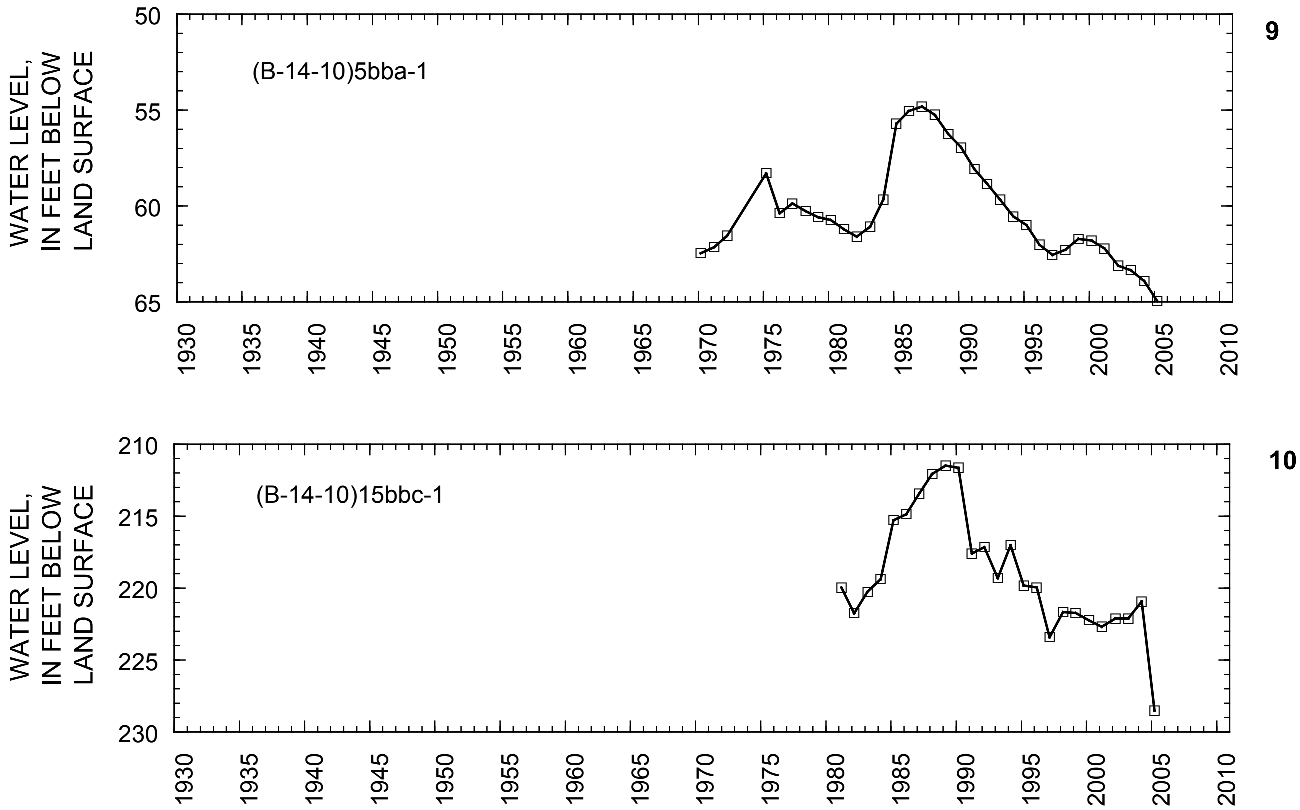


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Grouse Creek, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

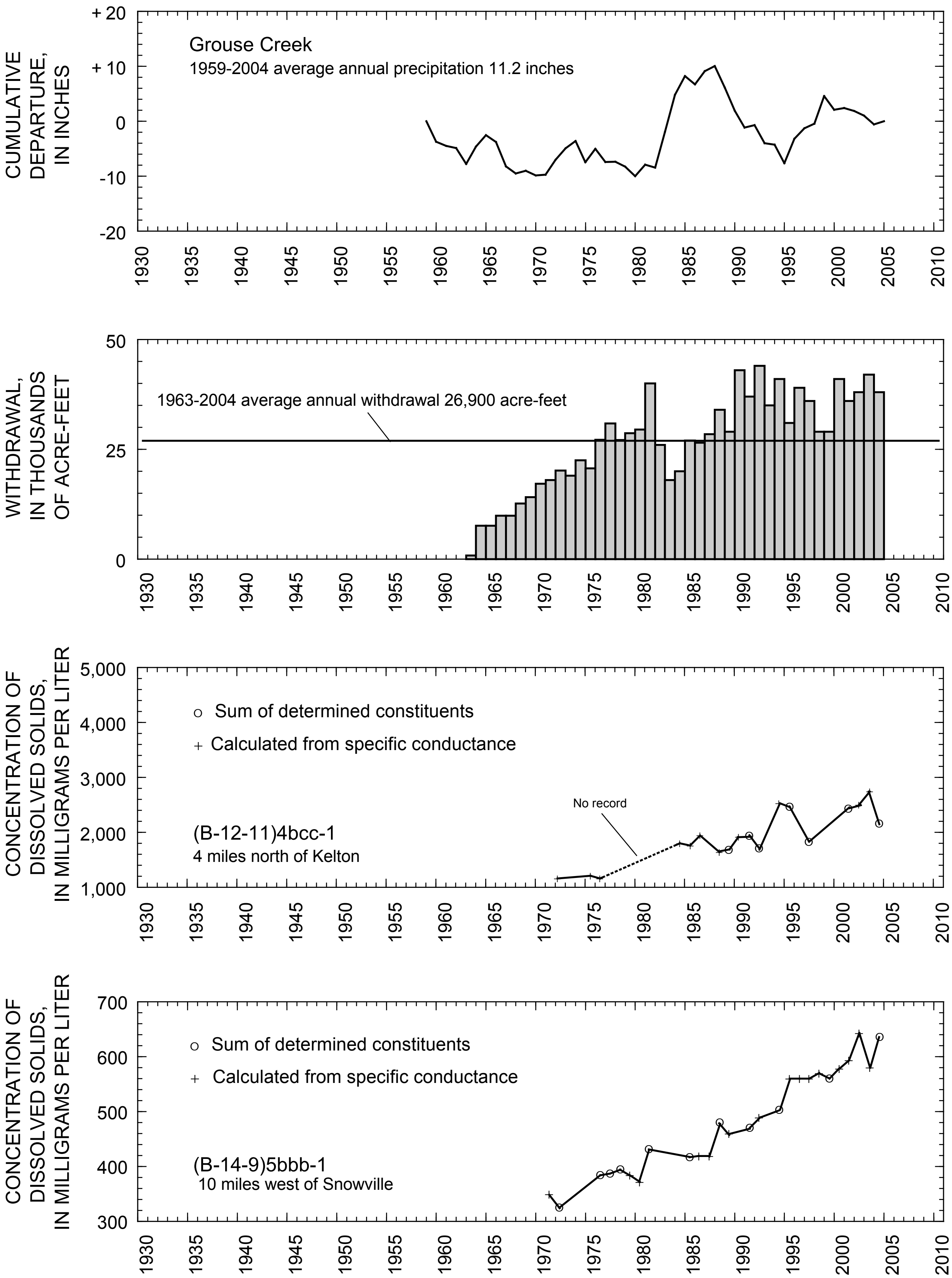


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Grouse Creek, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

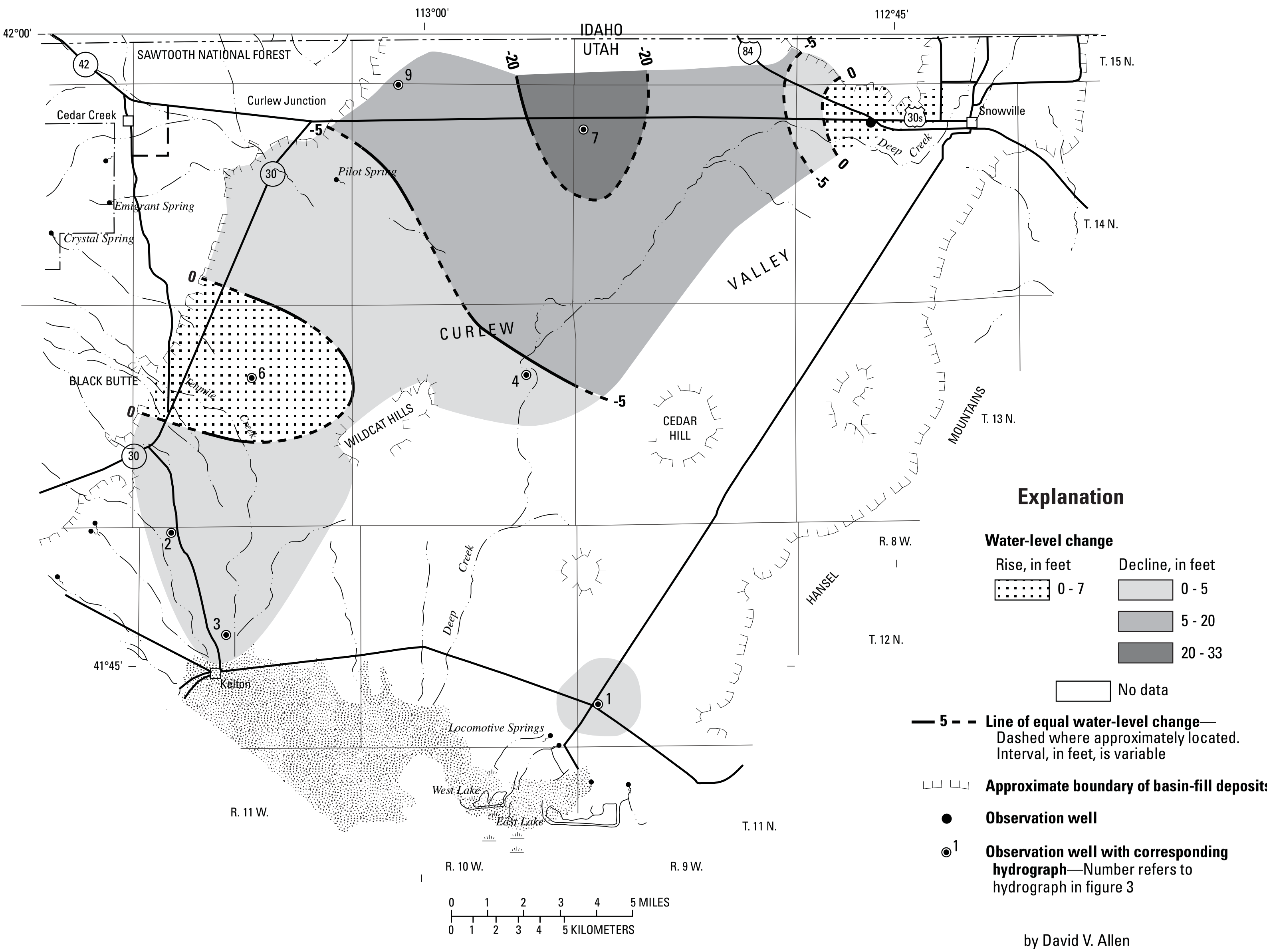


Figure 4. Map of Curlew Valley showing change of water level from March 1975 to March 2005.

CACHE VALLEY

By M.R. Danner

Cache Valley, as referred to in this report, covers about 450 square miles in Utah. Ground water occurs in unconsolidated deposits in the valley, under both water-table and artesian conditions. Recharge to the ground-water system occurs principally at the margins of the valley, and ground water moves toward the center of the valley and west toward Cache Junction.

Total estimated withdrawal of water from wells in Cache Valley in 2004 was about 27,000 acre-feet, which is the same as reported for 2003 and 1,000 acre-feet less than the average annual withdrawal for 1994-2003 (tables 2 and 3). Withdrawals decreased slightly for irrigation, and increased slightly for public supply and industrial use.

The location of wells in Cache Valley in which the water level was measured during March 2005 is shown in figure 5. The relation of the water level in selected observation wells to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1 is shown in figure 6.

Water levels throughout the valley generally rose from March 2004 to March 2005. From about 1935 to about 1983 water levels fluctuated with no apparent trend. Levels generally declined from 1985 to 1993, generally rose from 1993 to 1999, and generally declined from 1999 to 2004.

Total discharge of the Logan River (combined flow from the Logan River above State Dam, near Logan, and Logan, Hyde Park, and Smithfield Canal at Head, near Logan) during 2004 was about 112,600 acre-feet, which is 6,600 acre-feet less than the revised 2003 total of 119,200 acre-feet and 67,000 acre-feet less than the 1941-2004 average annual discharge.

Precipitation at Logan, Utah State University, was about 19.8 inches in 2004. This is about 3.7 inches more than for 2003 and about 1.2 inches more than the average annual precipitation for 1941-2004. The concentration of dissolved solids in water from well (A-13-1)29bcd-1 fluctuated during 1970-2004 with no apparent trend.

Water levels declined from March 1975 to March 2005 throughout Cache Valley in areas where data are available (fig. 7). The greatest decline, about 12.7 feet, was observed in a well about 1.5 miles south of Logan.

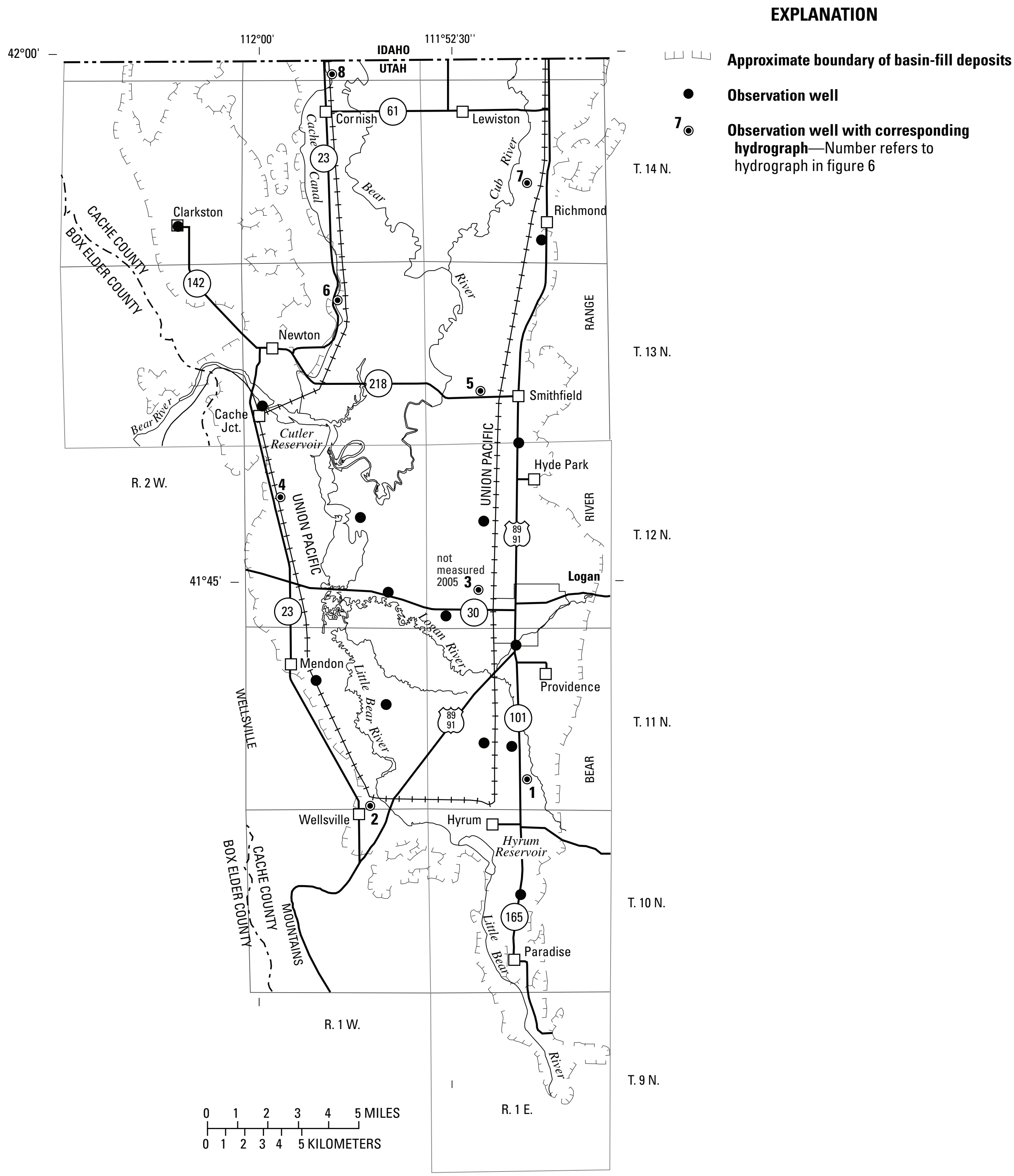


Figure 5. Location of wells in Cache Valley in which the water level was measured during March 2005.

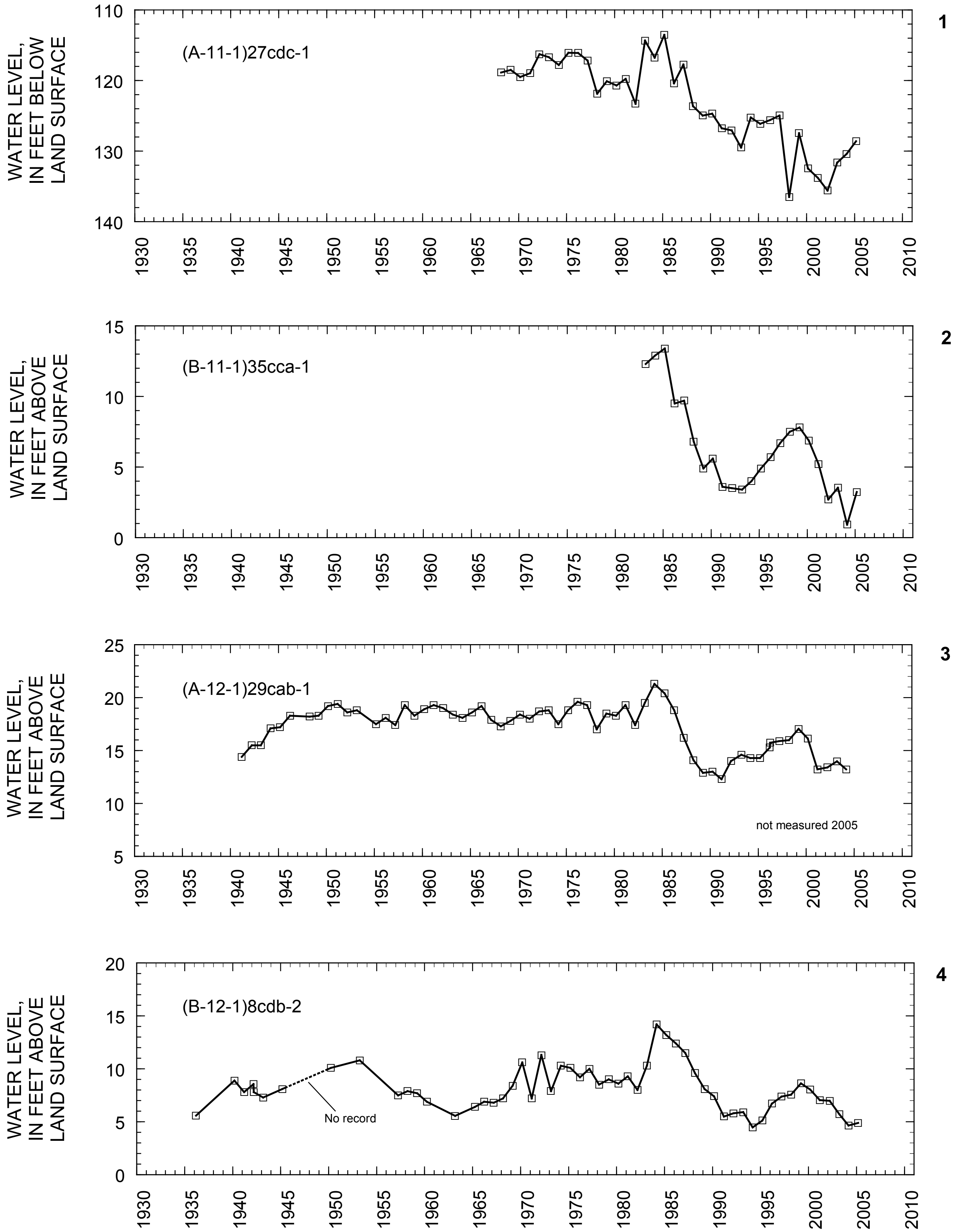


Figure 6. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1.

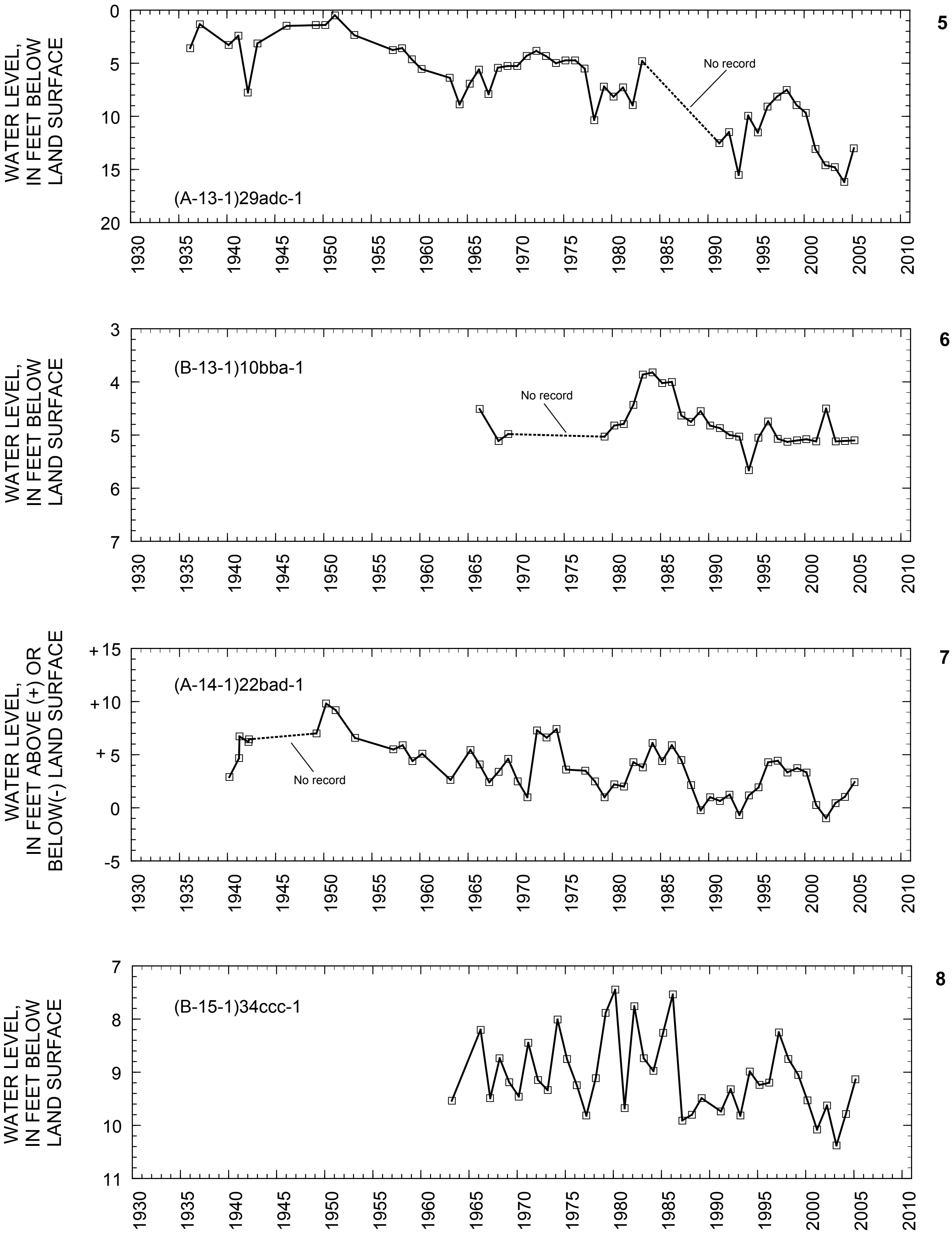
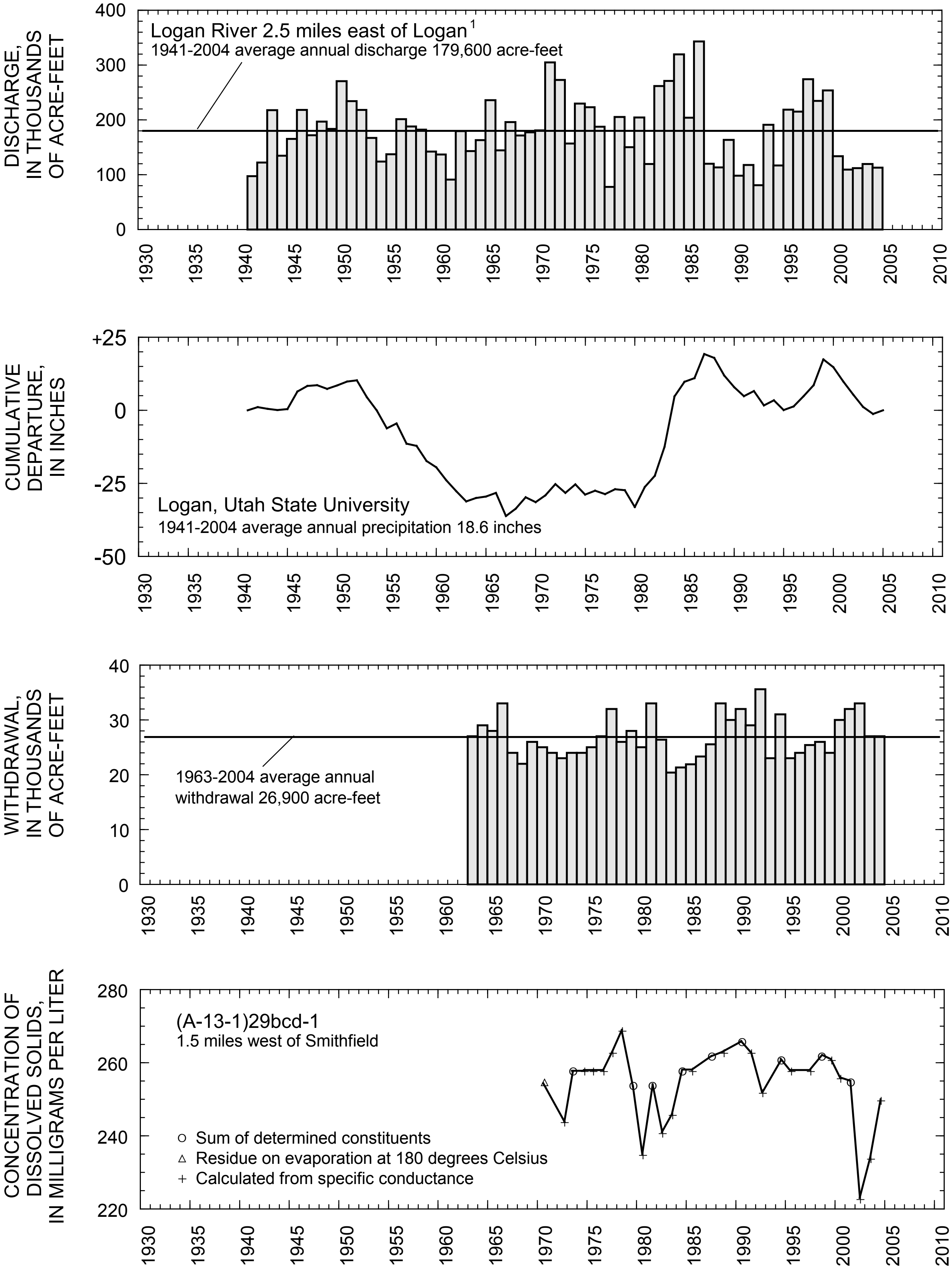


Figure 6. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1—Continued.



[1] Combined flow from Logan River above State Dam, near Logan, and Logan, Hyde Park, and Smithfield Canal at Head, near Logan.

Figure 6. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1—Continued.

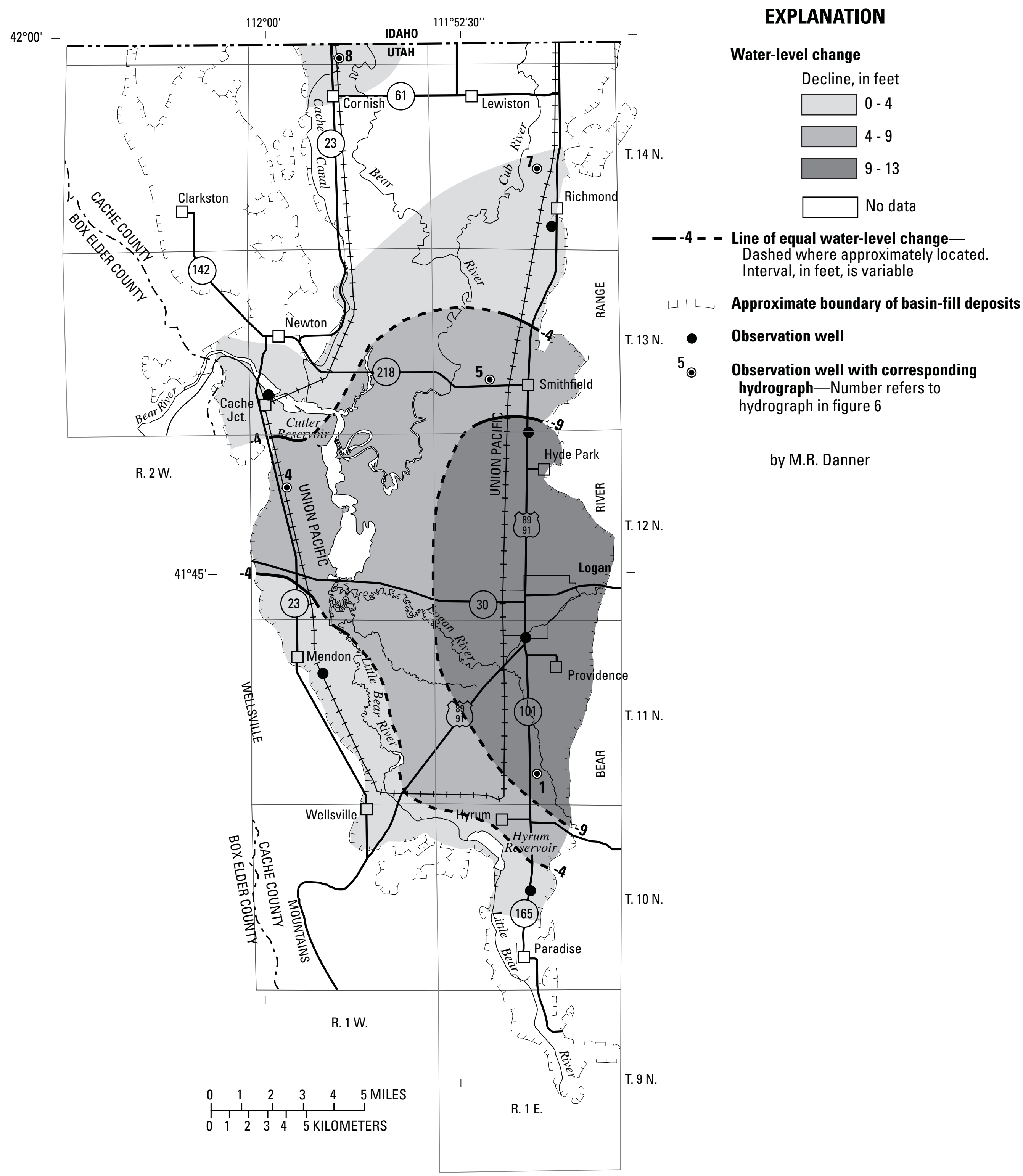


Figure 7. Map of Cache Valley showing change of water level from March 1975 to March 2005.

EAST SHORE AREA

By Vince Walzem

The East Shore area is in north-central Utah between the Wasatch Range and Great Salt Lake. Ground water occurs in unconsolidated deposits under both water-table and artesian conditions, but most of the water withdrawn by wells is from the artesian aquifers. Water enters the artesian aquifers along the east edge of the basin-fill deposits and generally moves westward toward Great Salt Lake.

Total estimated withdrawal of water from wells in the East Shore area in 2004 was about 46,000 acre-feet, which is 3,000 acre-feet less than was reported for 2003 and 10,000 acre-feet less than the average annual withdrawal for 1994-2003 (tables 2 and 3). Withdrawal for public supply was about 3,200 acre-feet less than in 2003. Withdrawal for irrigation was about 200 acre-feet less than in 2003.

The location of wells in the East Shore area in which the water level was measured during March 2005 is shown in figure 8. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1 is shown in figure 9.

Water levels generally declined from 1999-2005 throughout the area. Declines probably resulted from less recharge due to less-than-average precipitation and continued large withdrawals for public supply (table 3). Water levels have generally declined in most of the East Shore area from the mid-1950s to 2005.

Water levels generally declined from March 1975 to March 2005 in most of the East Shore area (fig. 10). The largest decline, about 36.7 feet, occurred in a well southeast of Kaysville. Rises of as much as about 10 feet occurred in small localized areas south of North Ogden, west of Plain City, and around Willard at the northern tip of the area. Rises are probably the result of decreased local pumping.

Precipitation at Ogden Pioneer Powerhouse in 2004 was about 20.5 inches, which is 1.1 inches less than the average annual precipitation for 1937-2004, and about 4.2 inches more than in 2003.

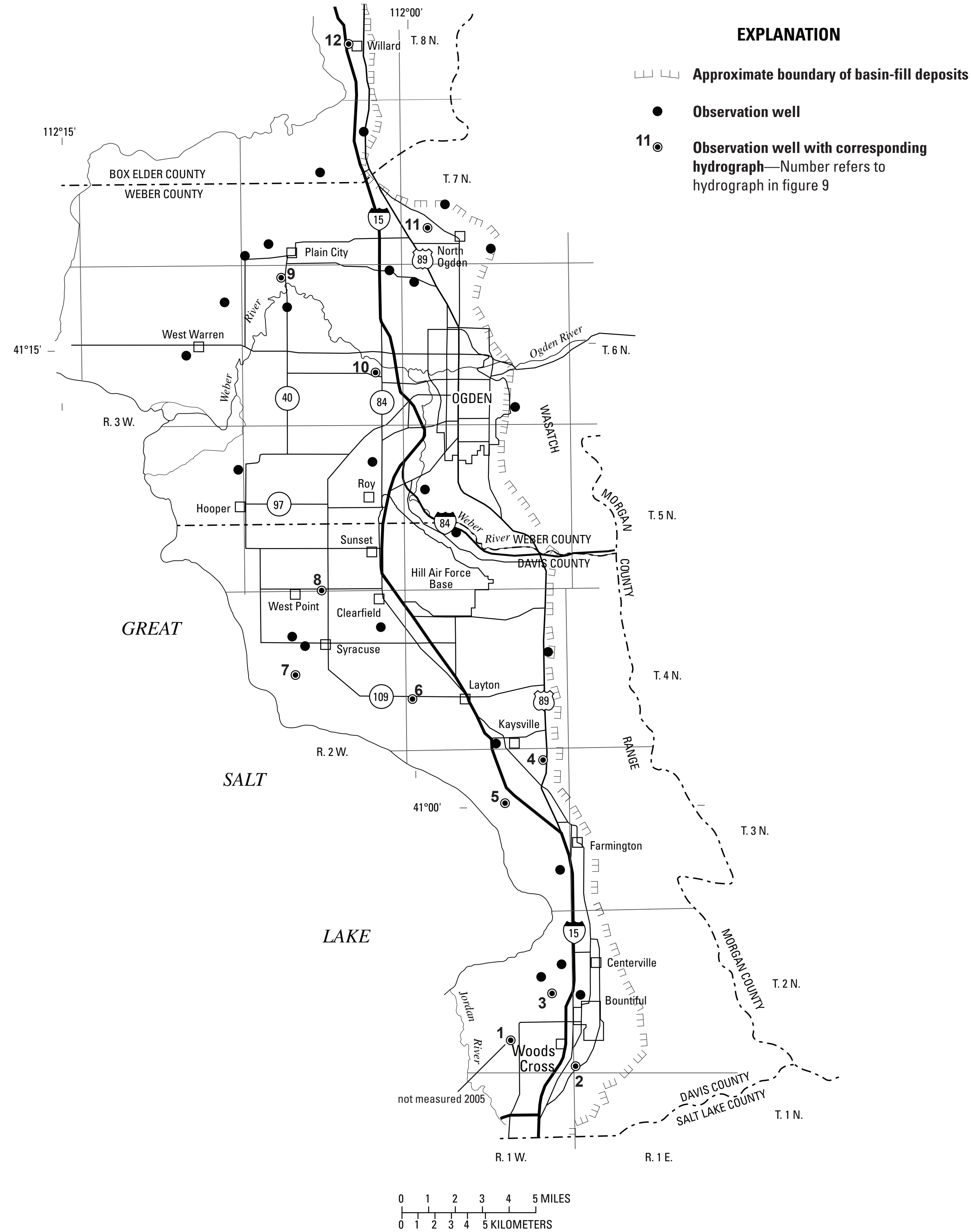


Figure 8. Location of wells in the East Shore area in which the water level was measured during March 2005.

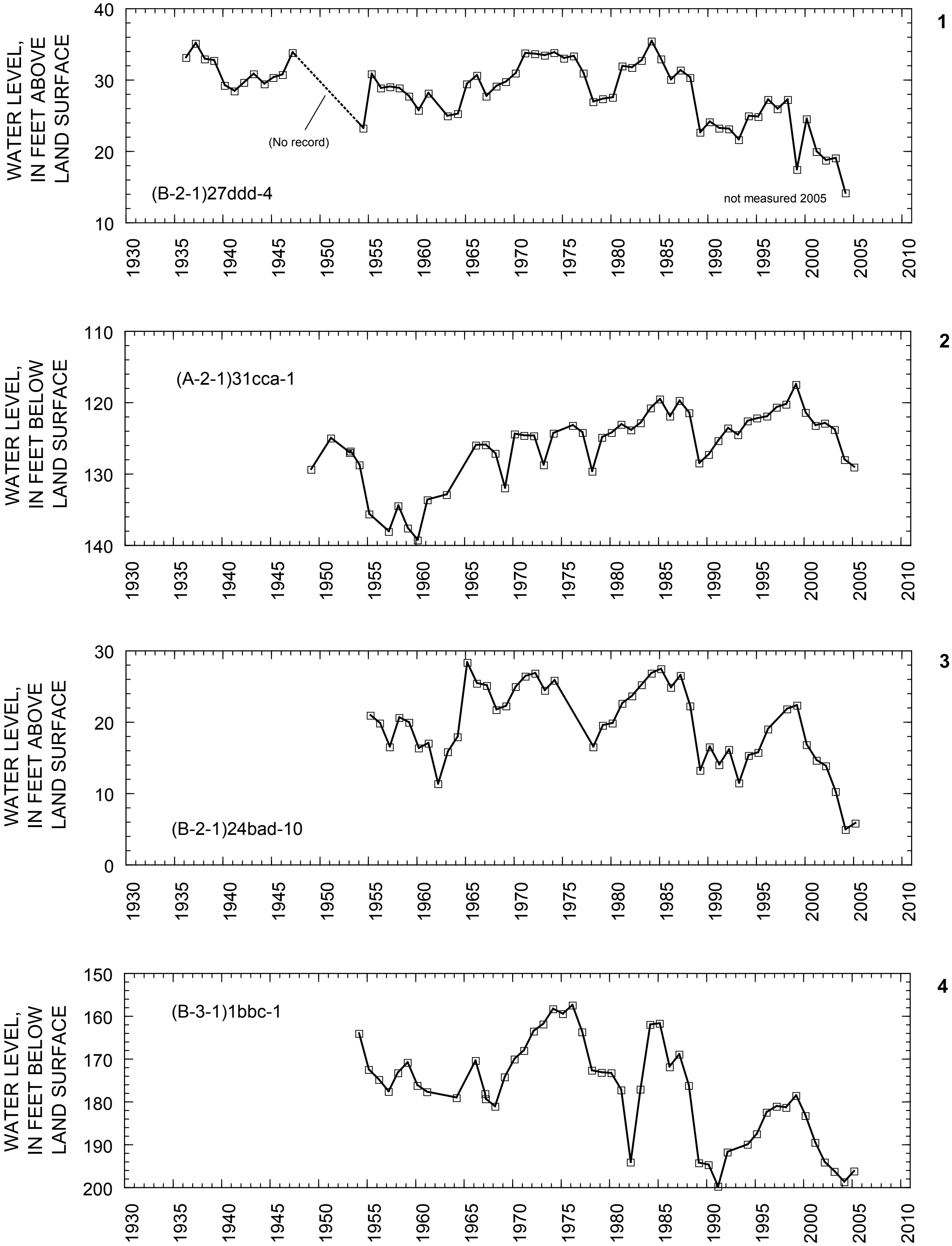


Figure 9. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1.

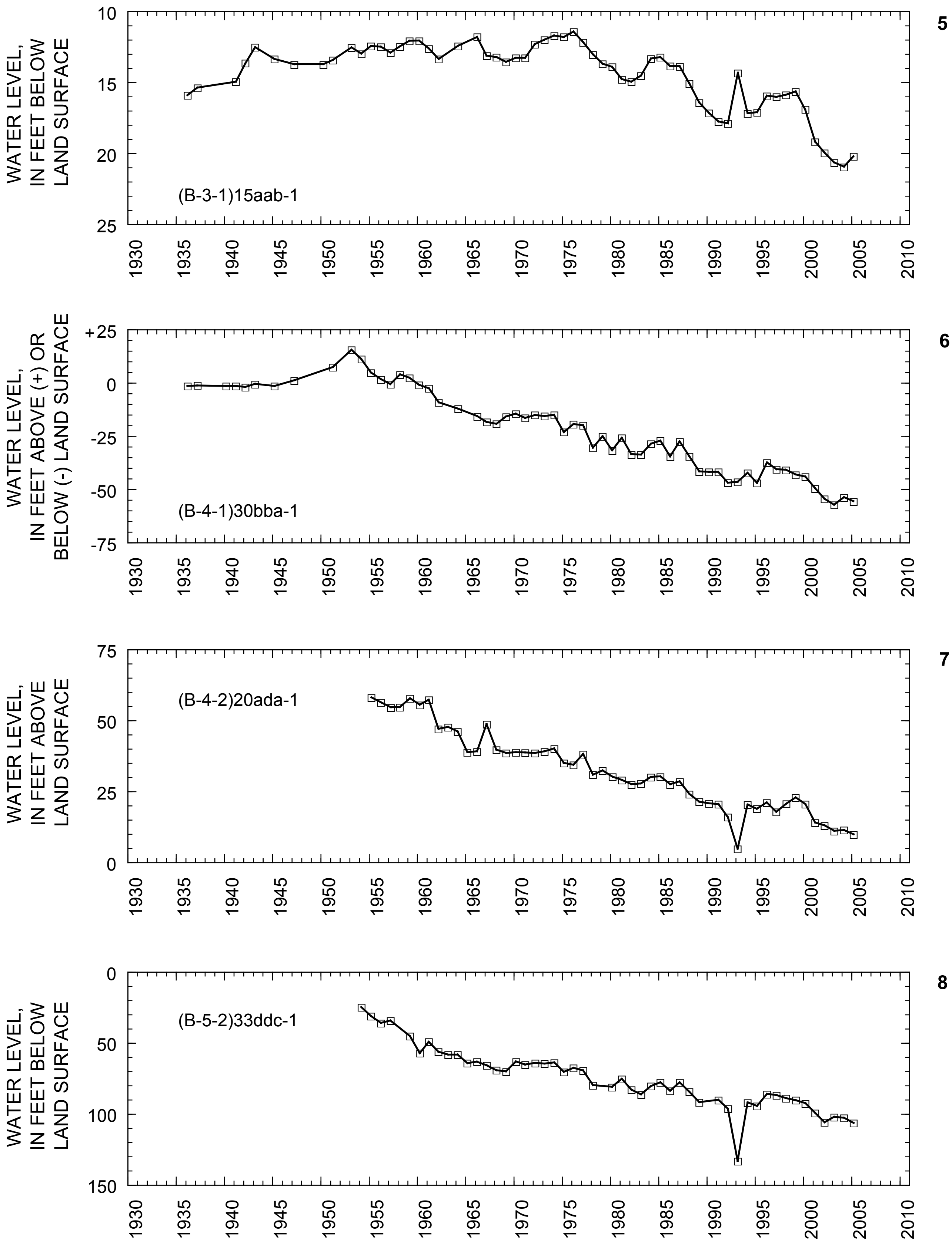


Figure 9. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1—Continued.

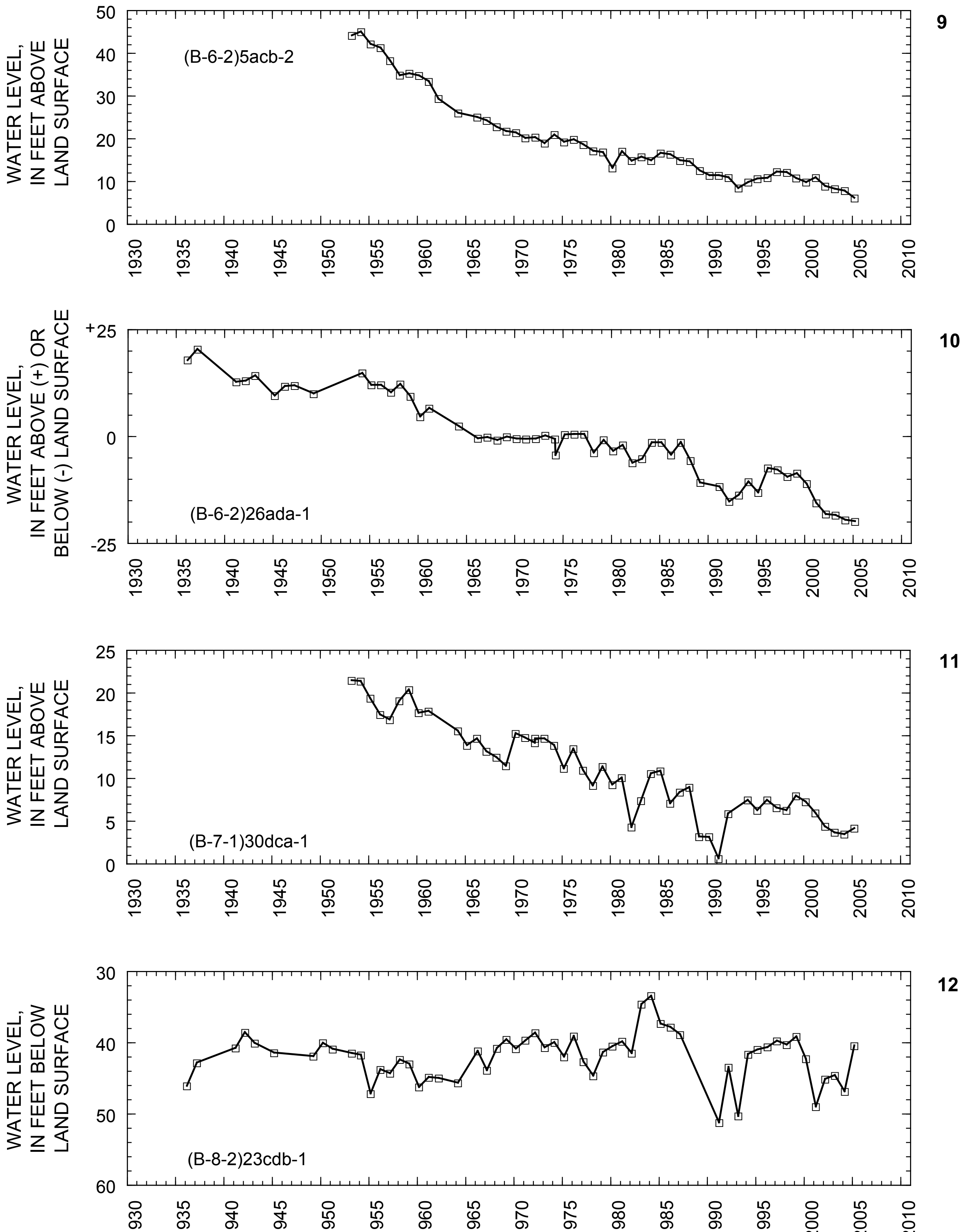


Figure 9. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1—Continued.

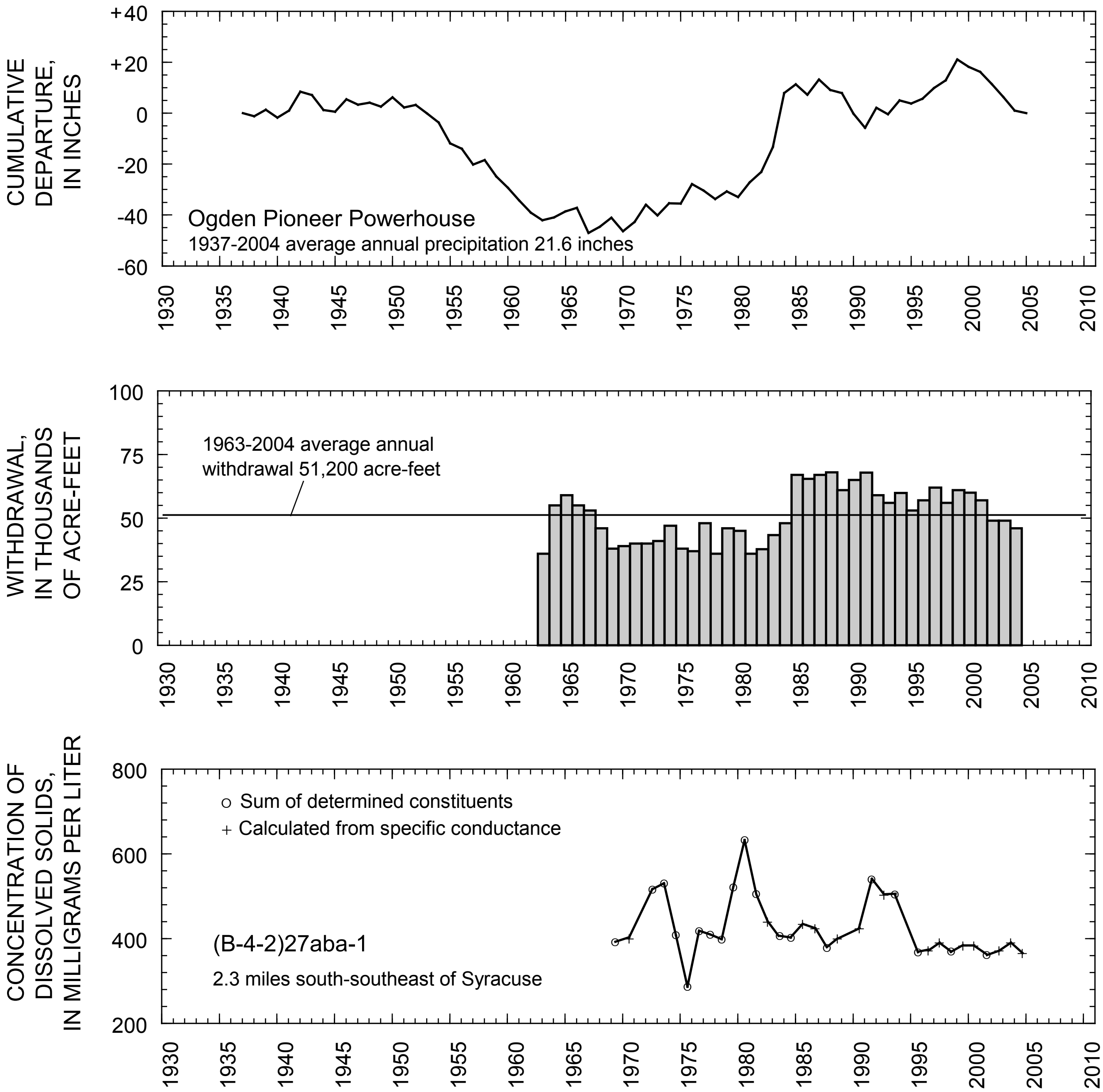


Figure 9. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1—Continued.

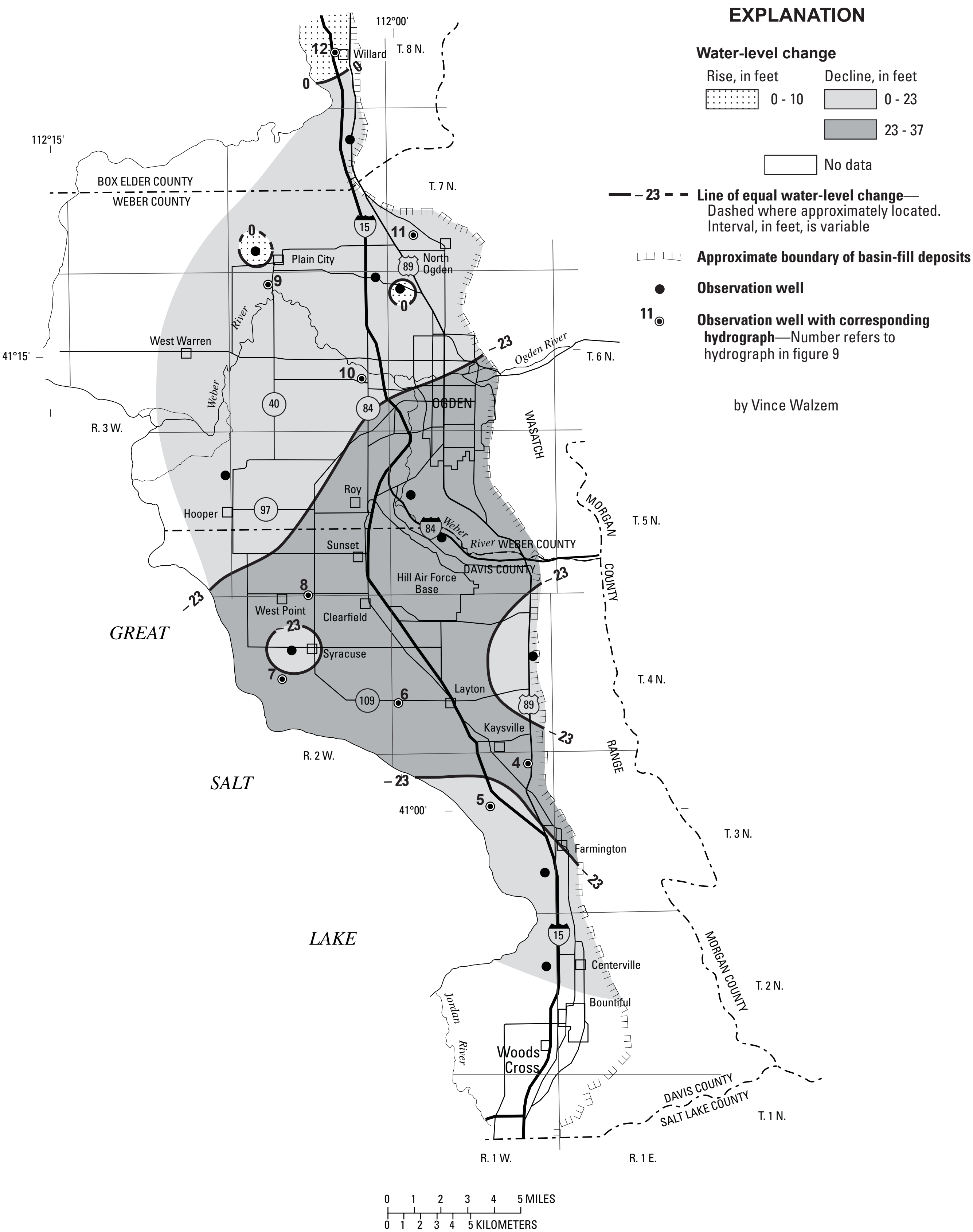


Figure 10. Map of the East Shore area showing change of water level from March 1975 to March 2005.

SALT LAKE VALLEY

By J.L. Cillessen

Salt Lake Valley covers about 400 square miles in the lowlands of Salt Lake County. Ground water occurs in unconsolidated deposits in the valley under water-table and artesian conditions. Recharge to the aquifers occurs mainly along the area where the mountains border the valley. In the southwest part of the valley, ground water moves from the base of the Oquirrh Mountains eastward toward the Jordan River. In the northwest part of the valley, the direction of movement is mostly toward Great Salt Lake. In the eastern half of the valley, ground water moves westward from the base of the Wasatch Range toward the Jordan River. The Jordan River drains both surface water and ground water from the valley.

Total estimated withdrawal of water from wells in Salt Lake Valley in 2004 was about 125,000 acre-feet, which is 5,000 acre-feet less than in 2003 and about 9,000 acre-feet less than the average annual withdrawal for 1994-2003 (tables 2 and 3). Withdrawal for public supply was about 75,900 acre-feet, which is 4,000 acre-feet less than the total for 2003. Withdrawal for industrial use was about 20,500 acre-feet, which is 300 acre-feet less than the total for 2003.

The location of wells in Salt Lake Valley in which the water level was measured during February or March 2005 is shown in figure 11. Estimated population of Salt Lake County, total annual withdrawal from wells, annual withdrawal for public supply, and average annual precipitation at Salt Lake City Weather Service Office (WSO) (International Airport) are shown in figure 12. Precipitation at Salt Lake City WSO during 2004 was about 14.4 inches, about 1.5 inches less than in 2003 and about 0.8 inch less than the average annual precipitation for 1931-2004.

The relation of the water level in selected observation wells completed in the principal aquifer to cumulative departure from average annual precipitation at Silver Lake near Brighton, and the relation of the water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well are shown in figure 13. Precipitation at Silver Lake near Brighton was about 40.4 inches in 2004, which is about 5.2 inches more than in 2003 and about 2.1 inches less than the average annual precipitation for 1931-2004.

Water levels rose from 2004 to 2005 in most of the observation wells in the principal aquifer of the Salt Lake Valley. The rises are probably the result of decreased withdrawals and increased precipitation and snowfall during the winter months. The water level in most of the observation wells was highest during 1985-87, which corresponds to a period of much-greater-than-average precipitation. Levels have generally declined since 1987, although substantial rises occurred in the northeastern parts of the valley from 1994 to 1999.

Water levels in the principal aquifer have mostly declined from spring 1975 to spring 2005 (fig. 14). The areas of greatest decline were south of Holladay and east of Midvale. The largest decline, about 53.1 feet, was observed in a well east of Midvale. The overall decline in water levels is probably due to increased withdrawals and less-than-average precipitation. Some rises in water levels were observed in the downtown area and in the northwestern part of the valley. The largest increase, about 3.7 feet, was observed in a well about 1.3 miles south-southeast of the center of Salt Lake City.

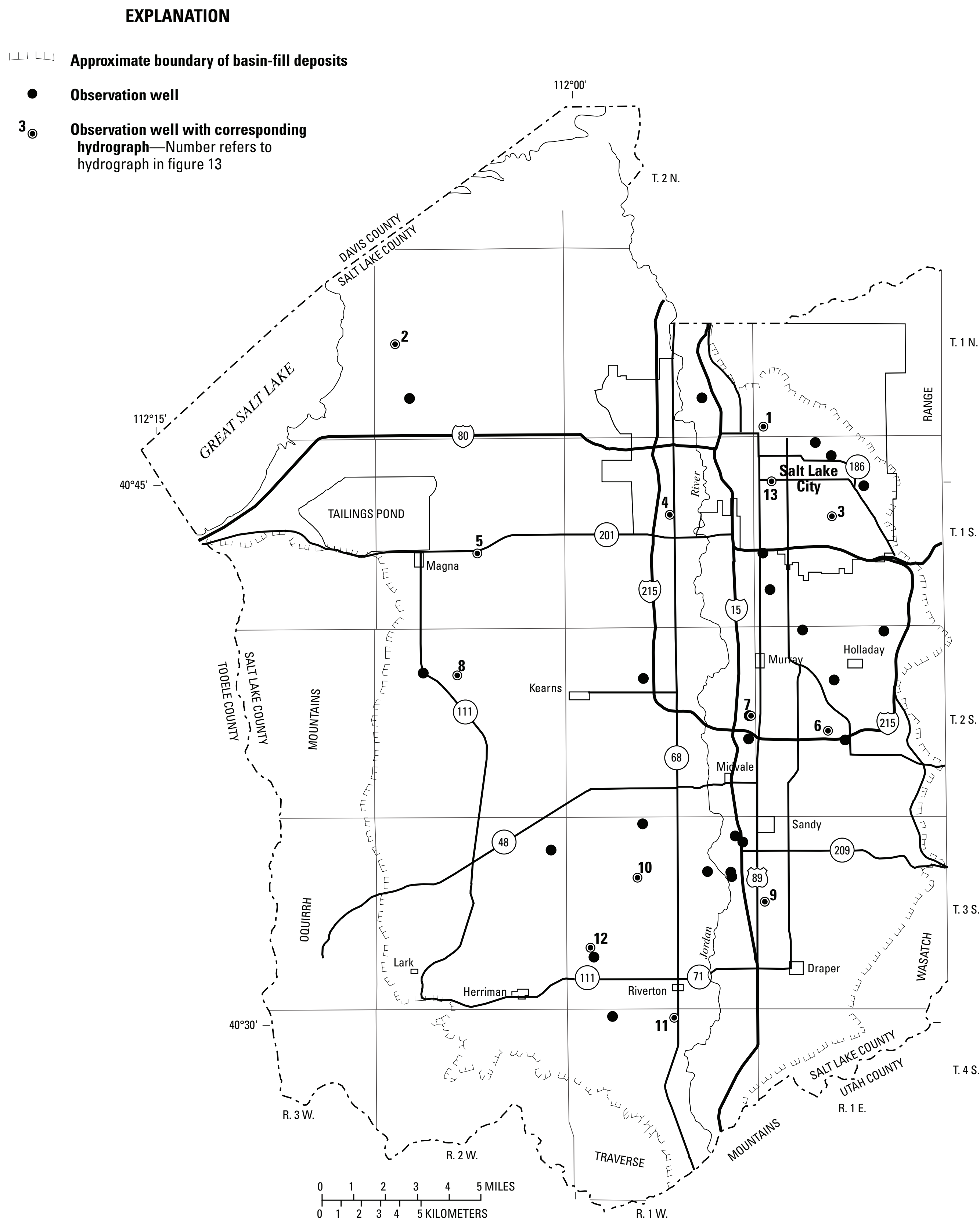


Figure 11. Location of wells in Salt Lake Valley in which the water level was measured during February or March 2005.

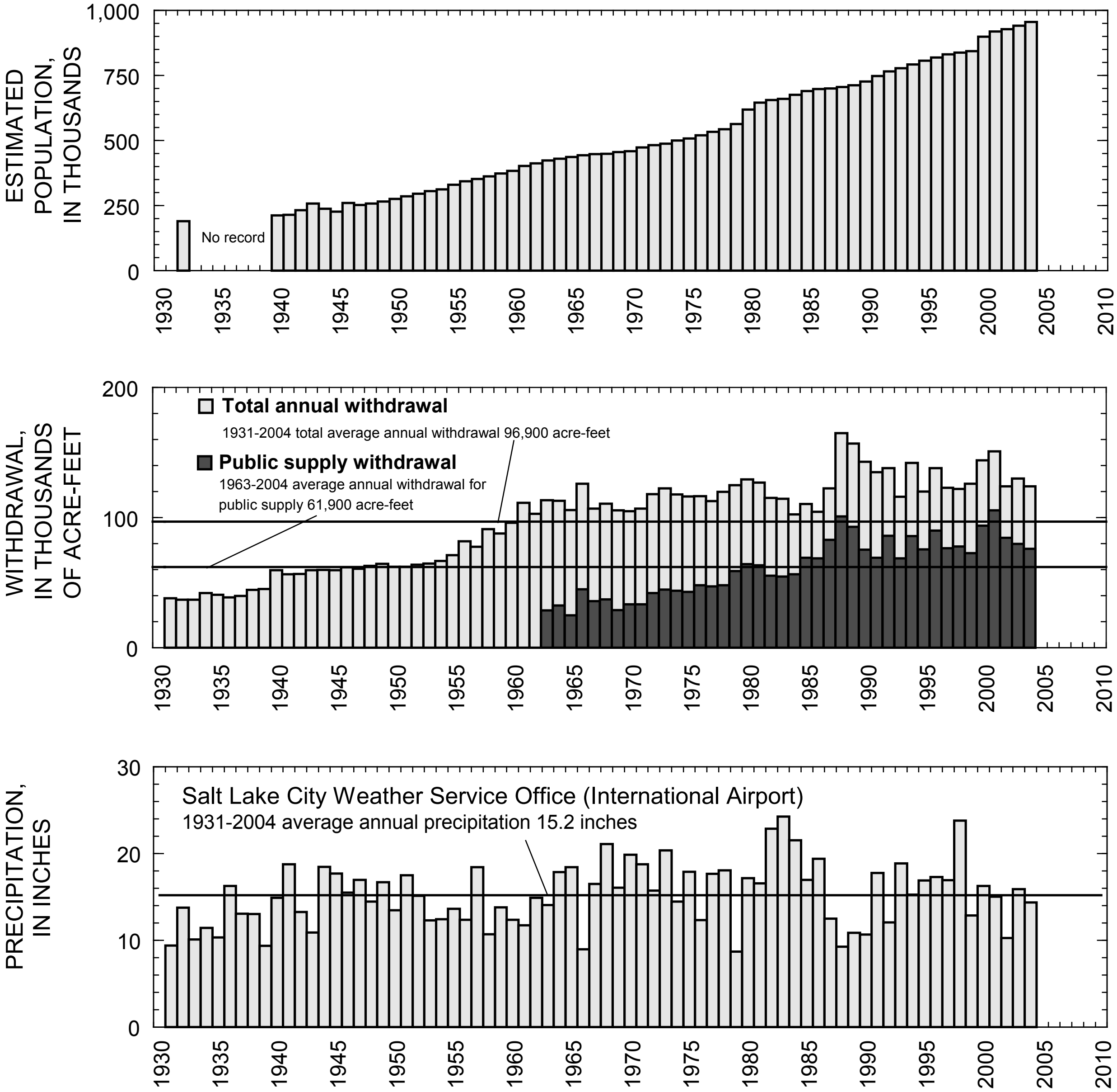


Figure 12. Estimated population of Salt Lake County, total annual withdrawal from wells, annual withdrawal for public supply, and average annual precipitation at Salt Lake City Weather Service Office (International Airport).

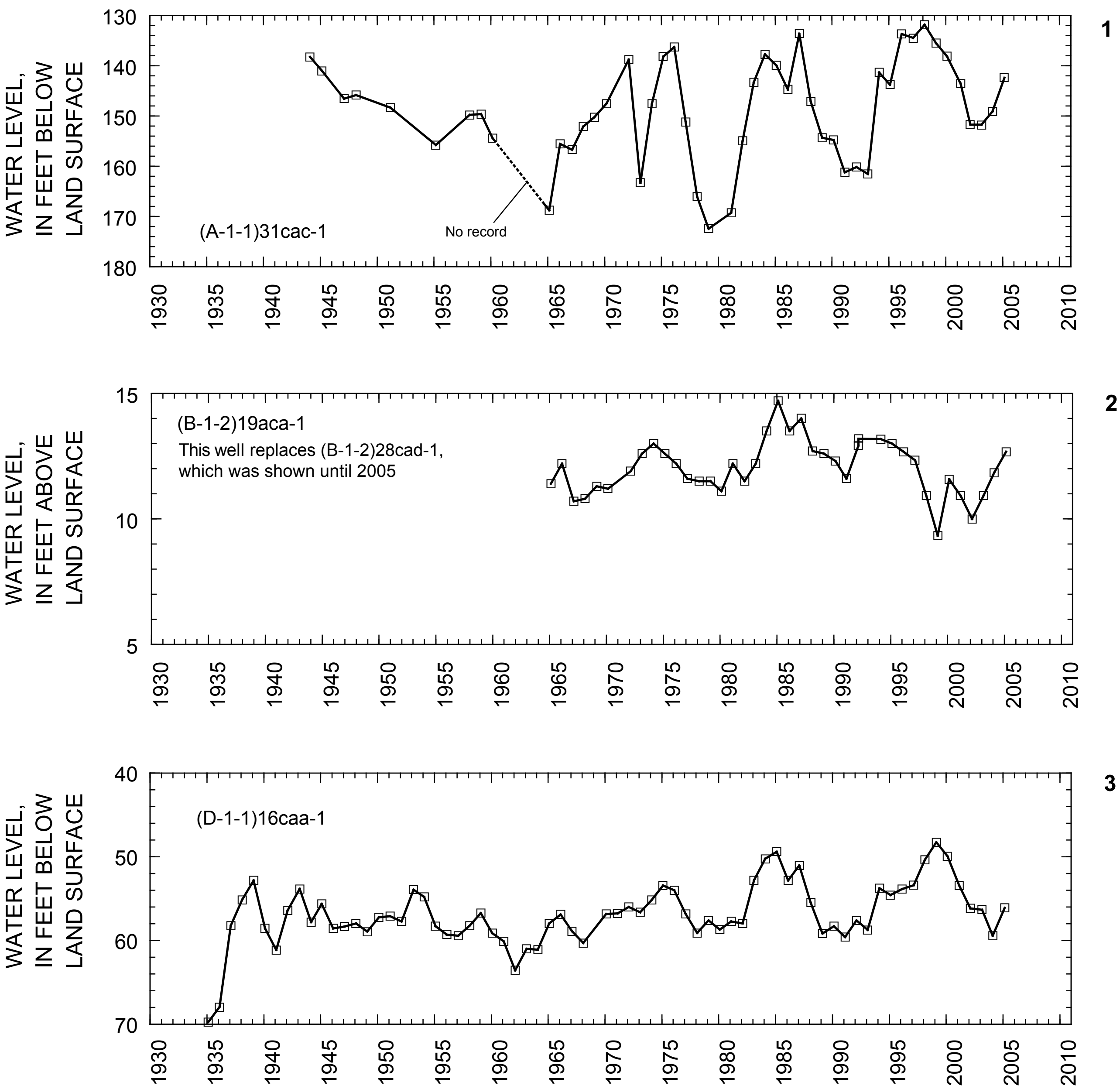


Figure 13. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake near Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well.

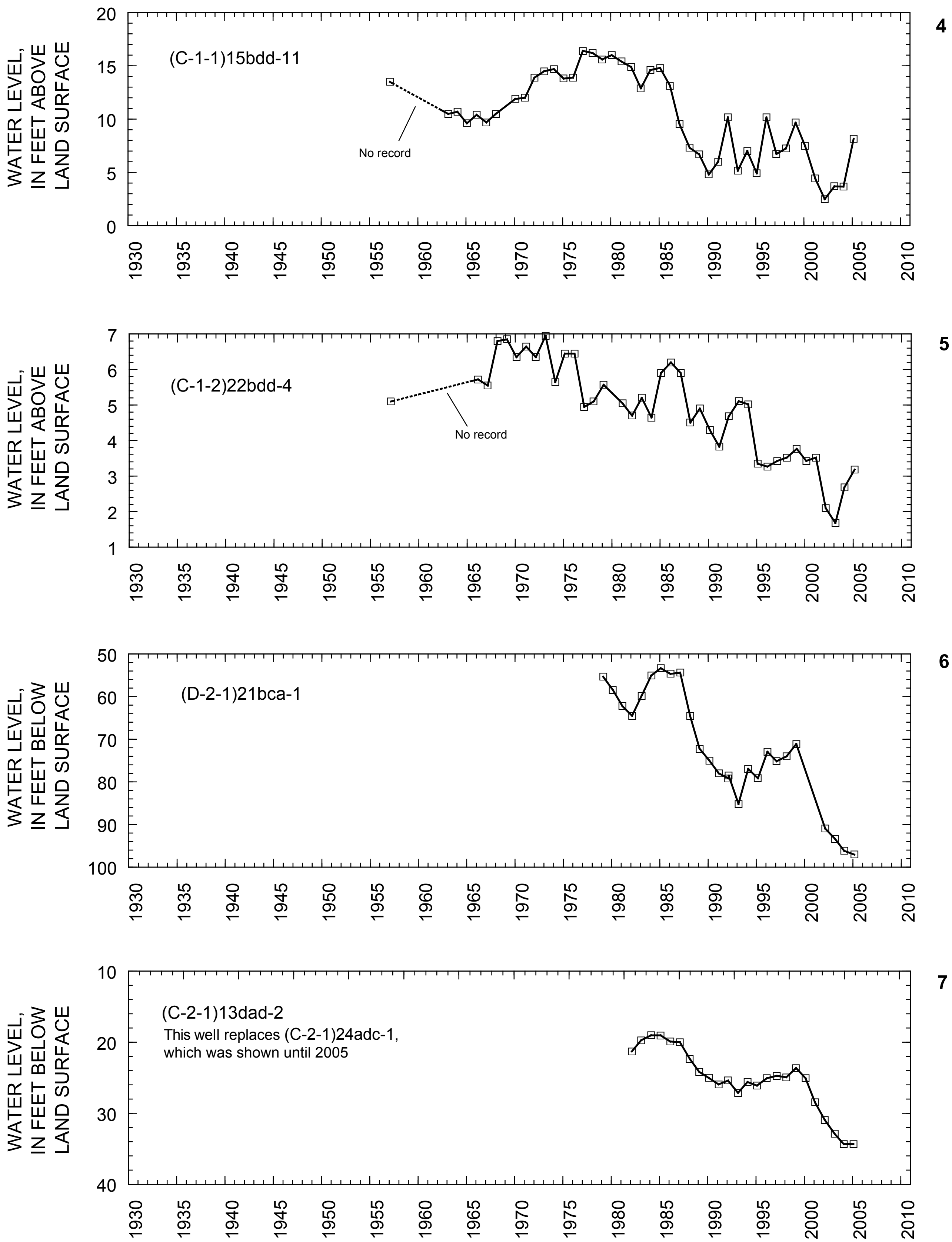


Figure 11. Location of wells in Salt Lake Valley in which the water level was measured during February or March 2005.

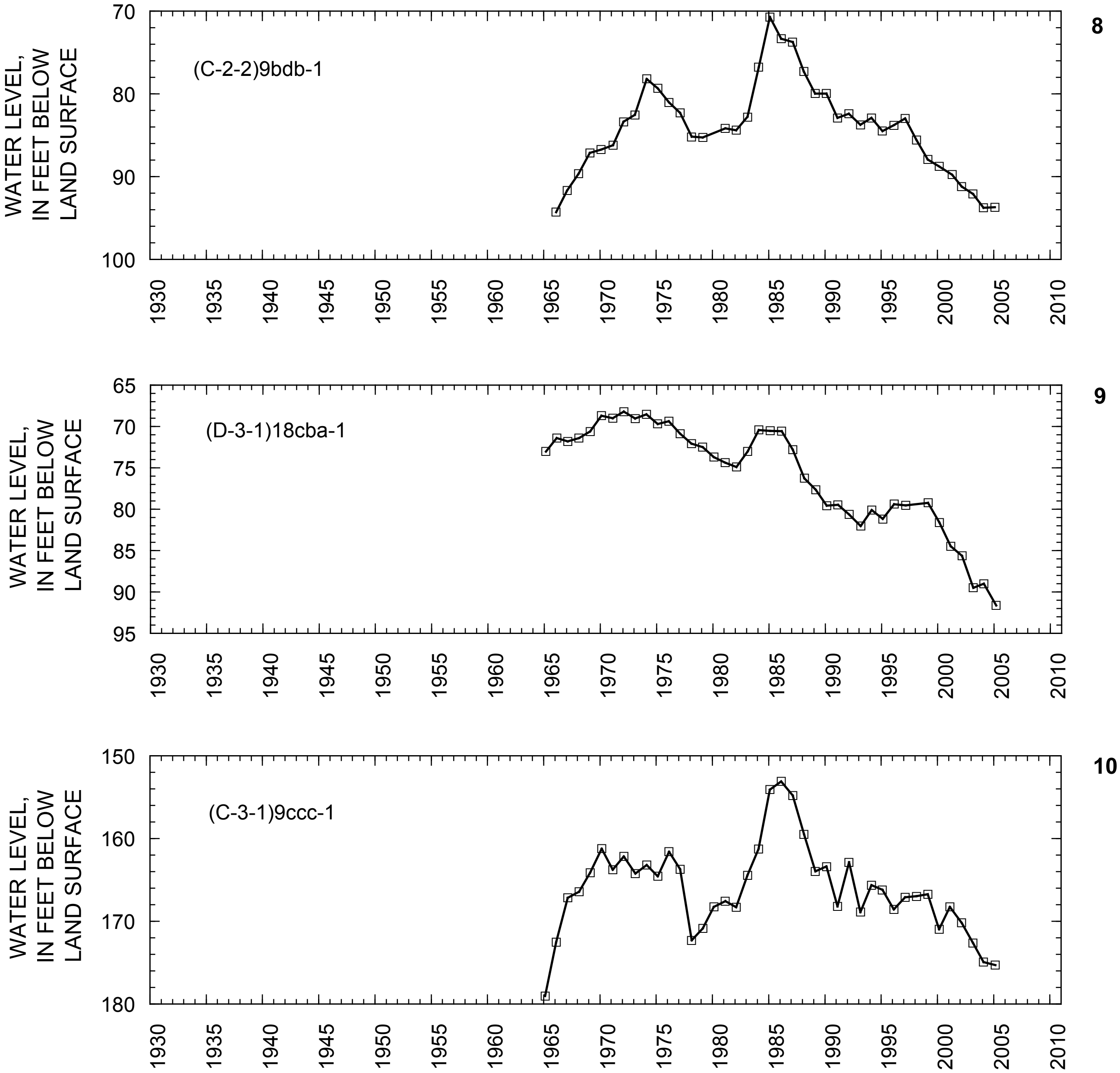


Figure 13. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake near Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well—Continued.

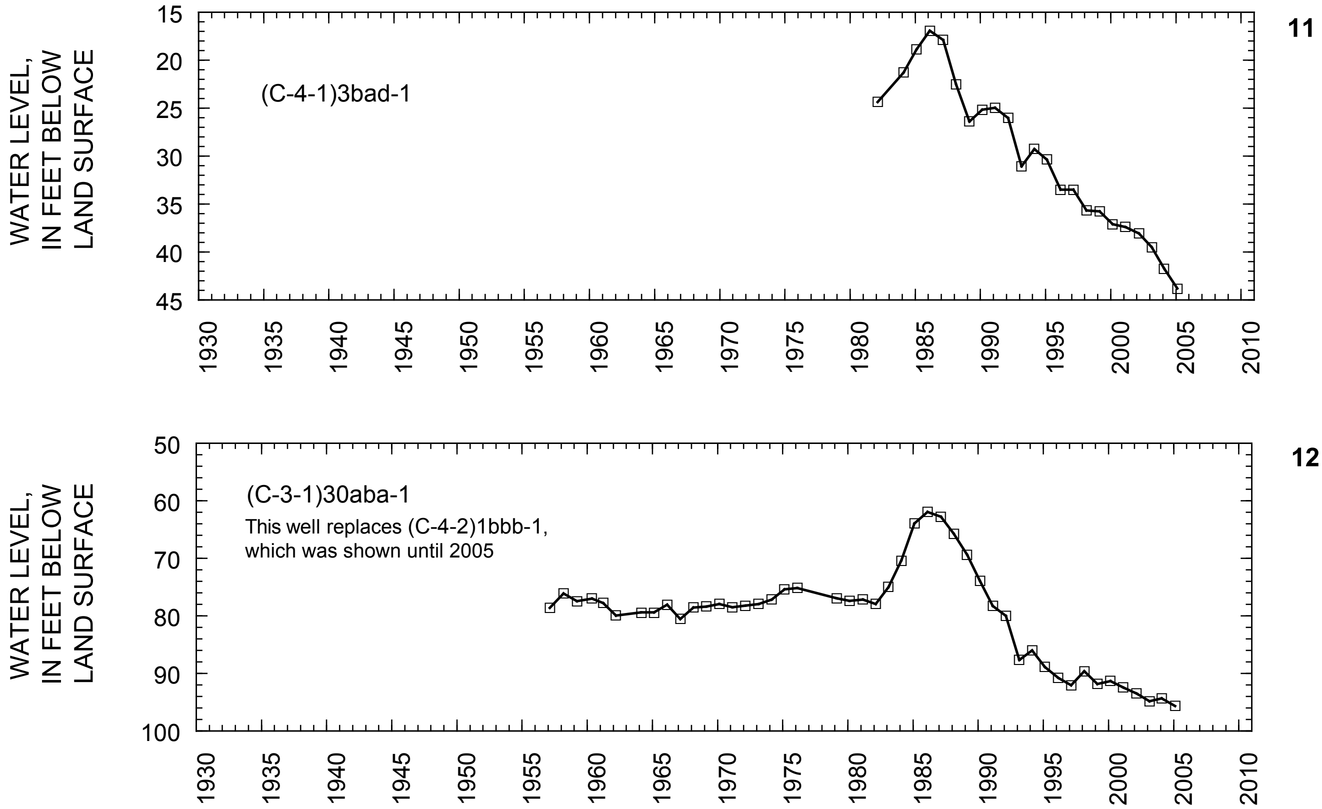


Figure 13. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake near Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well—Continued.

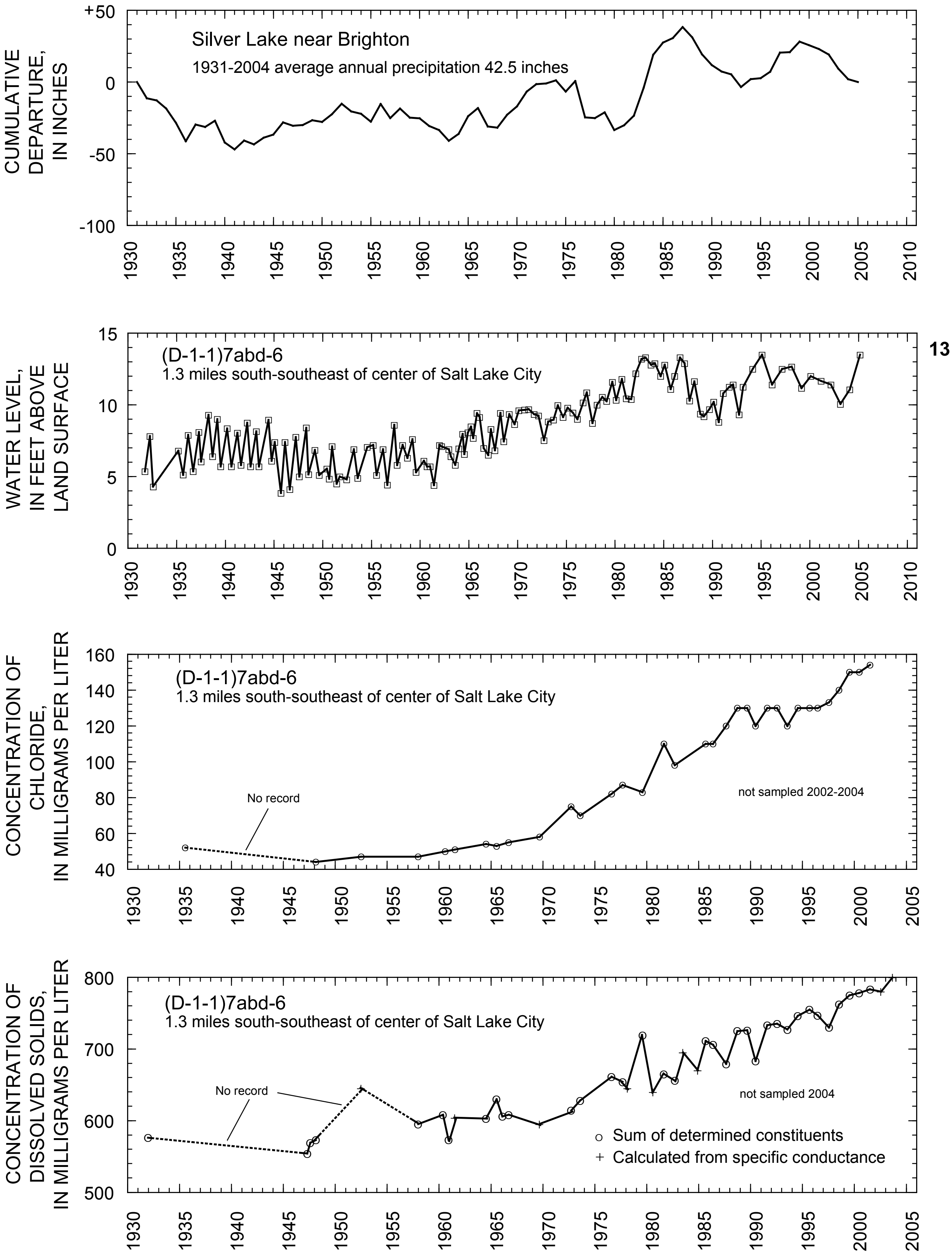


Figure 13. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake near Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well—Continued.

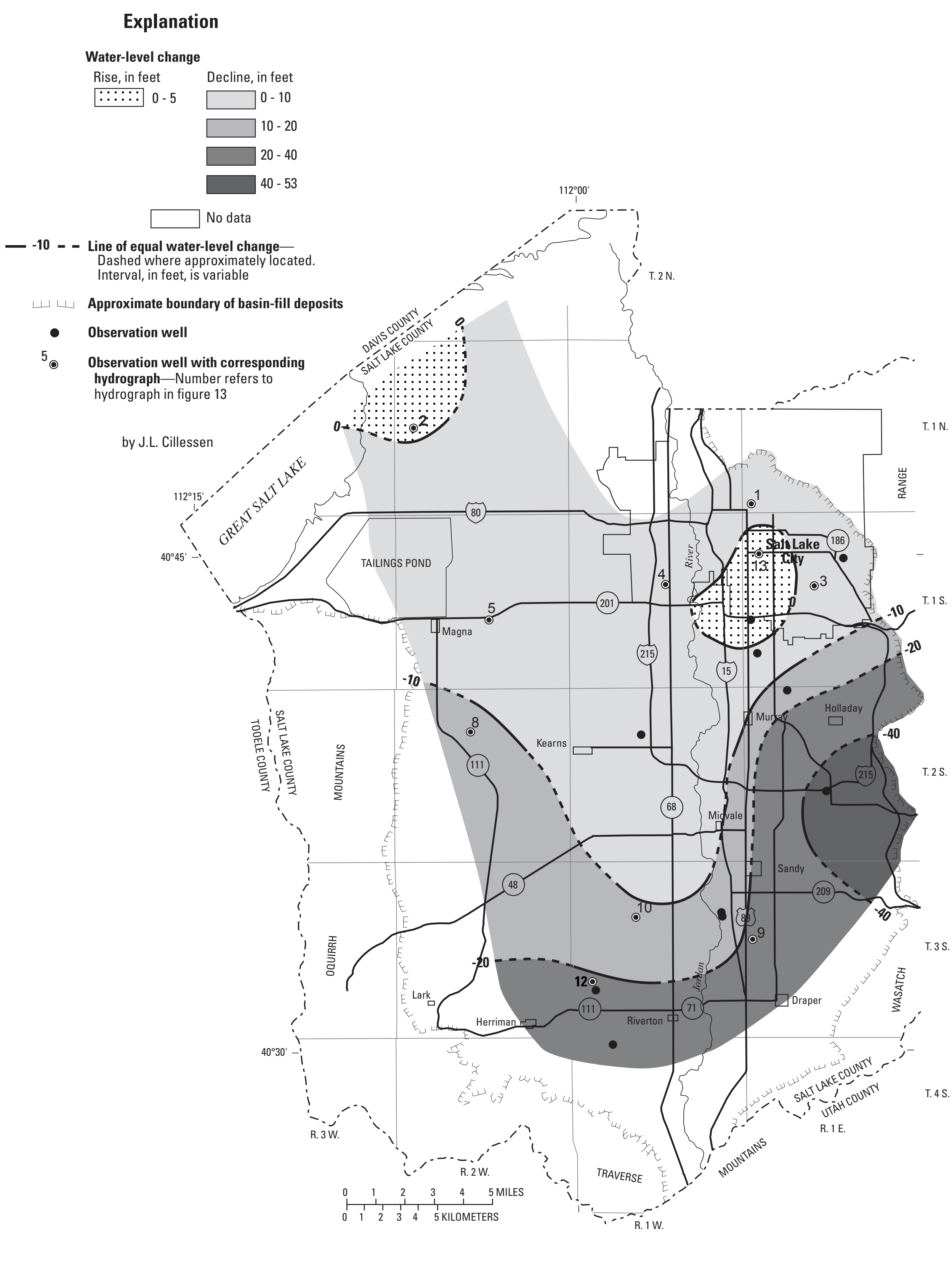


Figure 14. Map of Salt Lake Valley showing change of water level from spring 1975 to spring 2005.

TOOELE VALLEY

By T.A. Kenney

Tooele Valley is between the Stansbury Mountains and Oquirrh Mountains and extends from Great Salt Lake south to South Mountain. The total area of the valley is about 250 square miles.

Ground water occurs in the bedrock and unconsolidated deposits in Tooele Valley under both water-table and artesian conditions, but most of the water withdrawn by wells is from artesian aquifers in the unconsolidated deposits.

Total estimated withdrawal of water from wells in Tooele Valley in 2004 was about 21,000 acre-feet, which is about 1,000 acre-feet less than 2003 and 2,000 acre-feet less than the average annual withdrawal for 1994-2003 (tables 2 and 3). Withdrawal for irrigation was about 10,200 acre-feet, which is 400 acre-feet less than the withdrawal for 2003. Withdrawal for public supply was about 8,300 acre-feet, which is 1,100 acre-feet less than the withdrawal for 2003.

The location of wells in Tooele Valley in which the water level was measured during March 2005 is shown in figure 15. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Tooele and to annual withdrawal from wells is shown in figure 16. Precipitation during 2004 at Tooele was about 17.0 inches, which is about 1.5 inches more than in 2003 and about 0.7 inch less than the average annual precipitation for 1936-2004.

Water levels in wells in Tooele Valley generally declined in the east part and generally rose in the south and west parts from March 2004 to March 2005. The decline in water levels is probably a result of less-than-average precipitation. The rise in water levels is probably a result of decreased withdrawals for irrigation, municipal use, and industrial use.

Water levels generally rose in the north-central part and declined along the east and west parts of Tooele Valley from March 1975 to March 2005 (fig. 17). The largest rise, about 7.5 feet, occurred in a well about 2 miles west of Erda. The largest decline, about 14.7 feet, occurred in a well south of Grantsville.

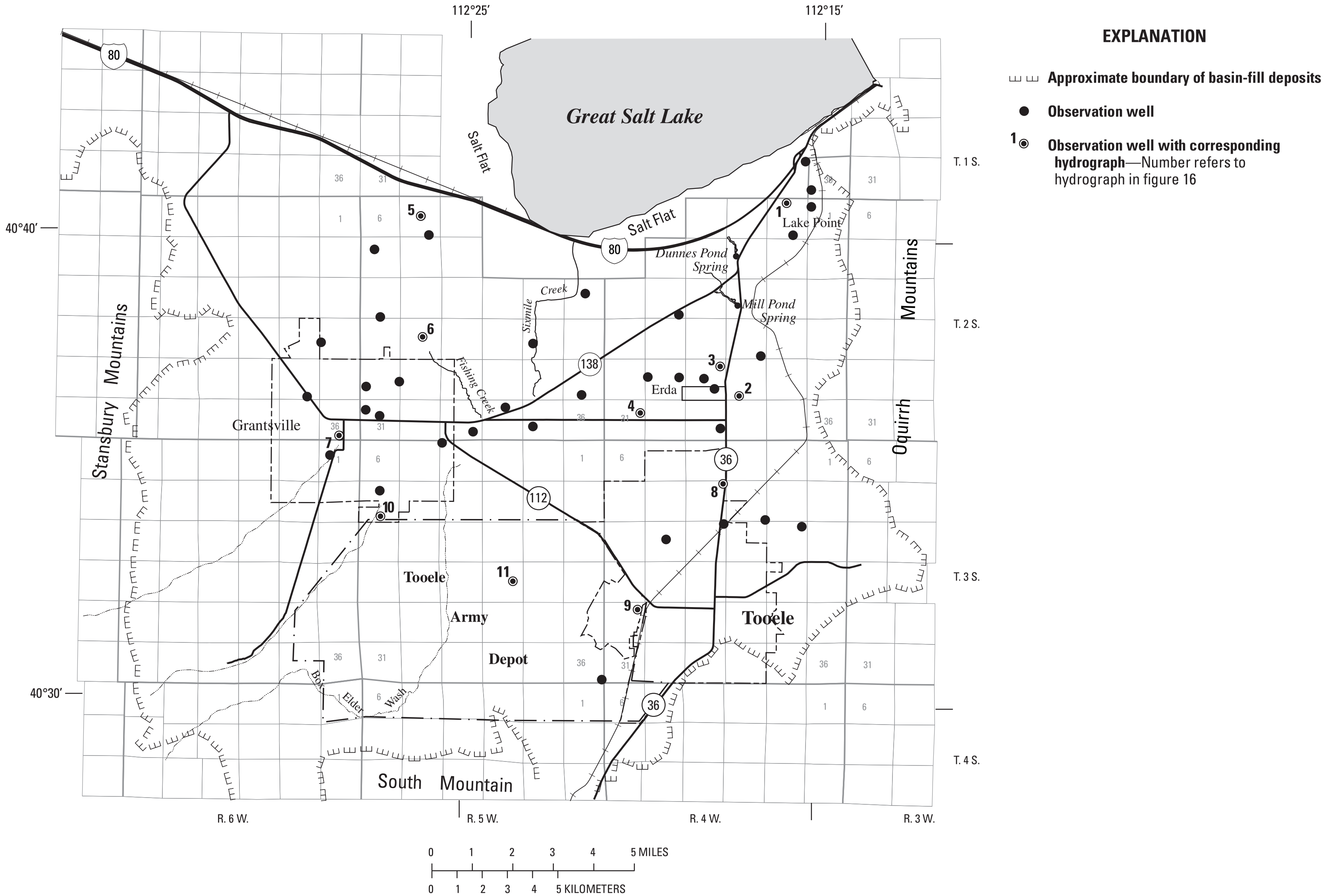


Figure 15. Location of wells in Tooele Valley in which the water level was measured during March 2005.

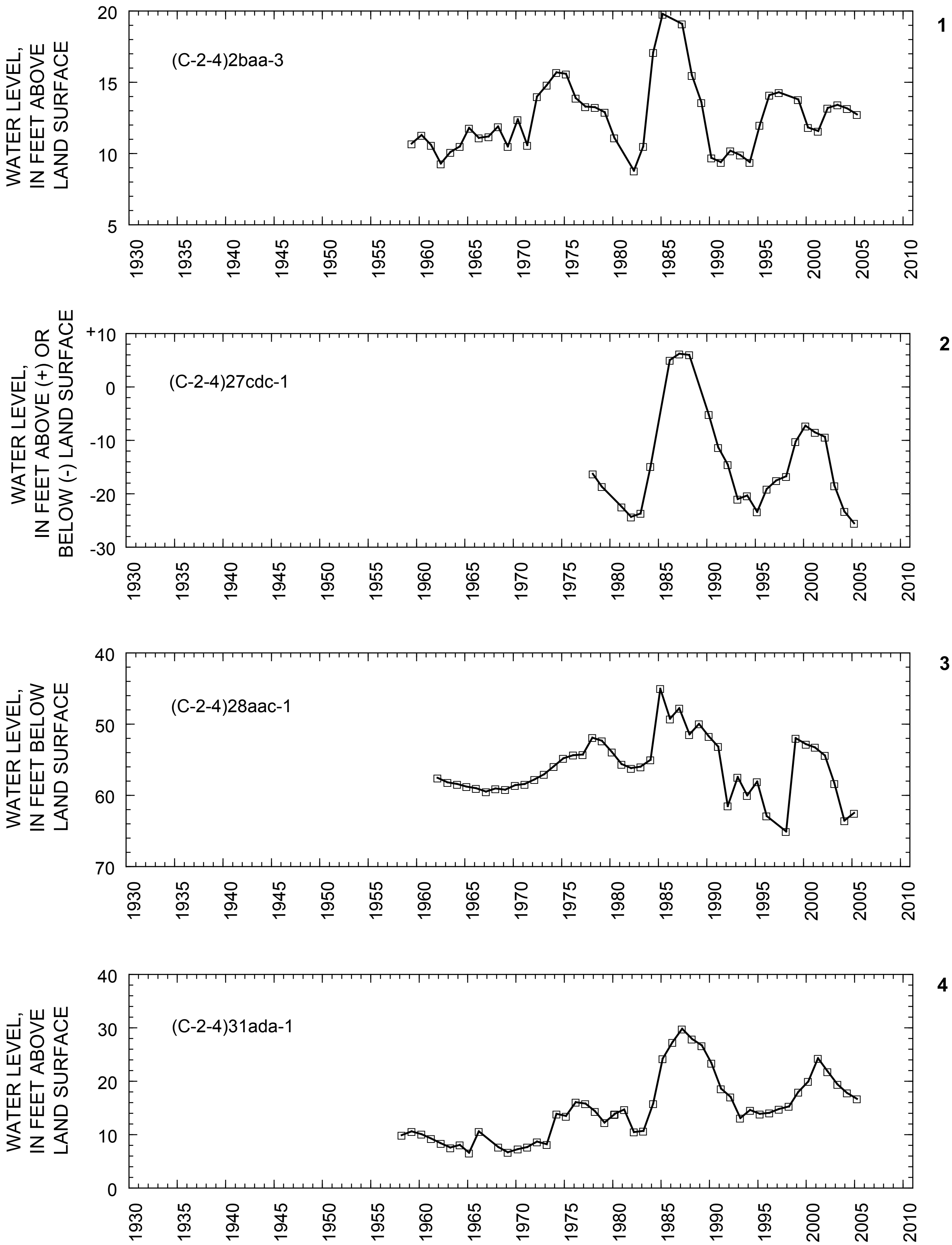


Figure 16. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele and to annual withdrawal from wells.

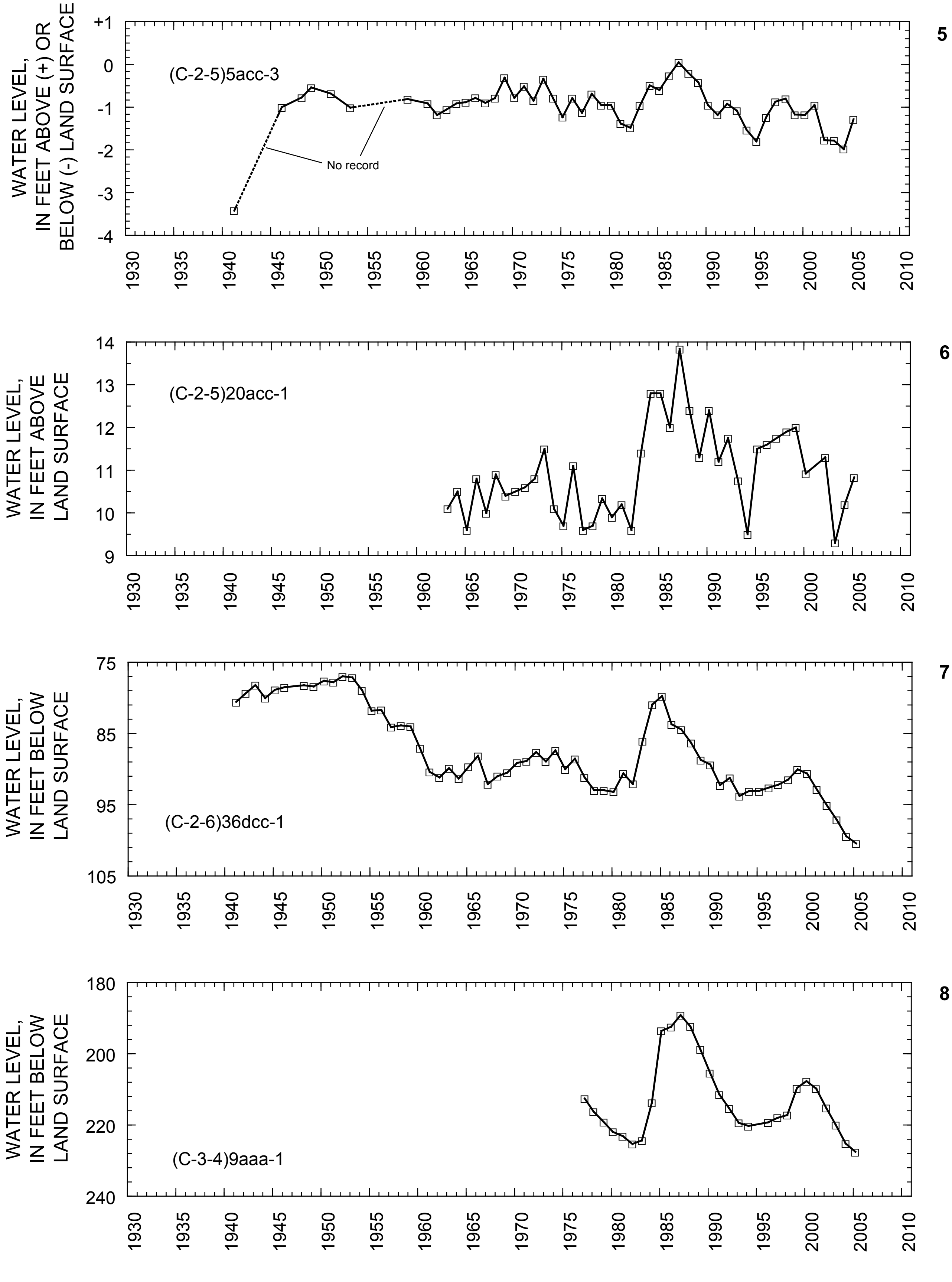
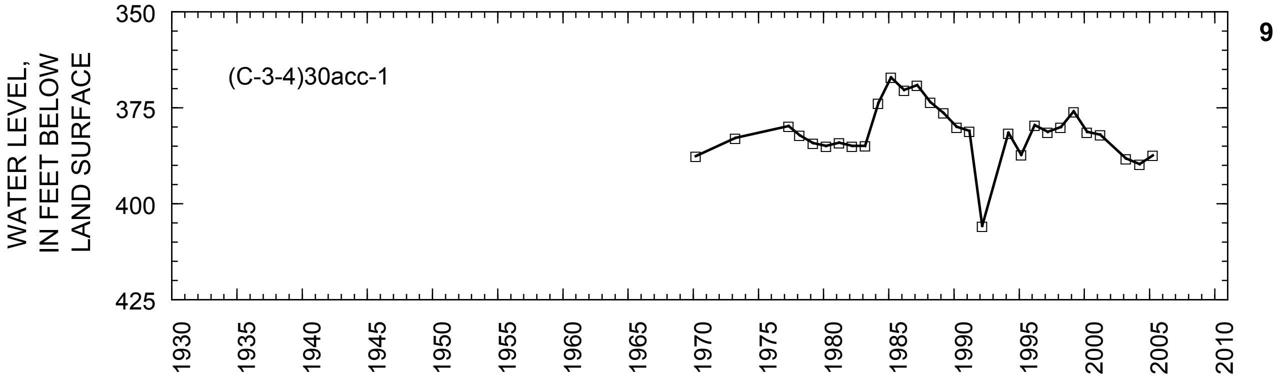
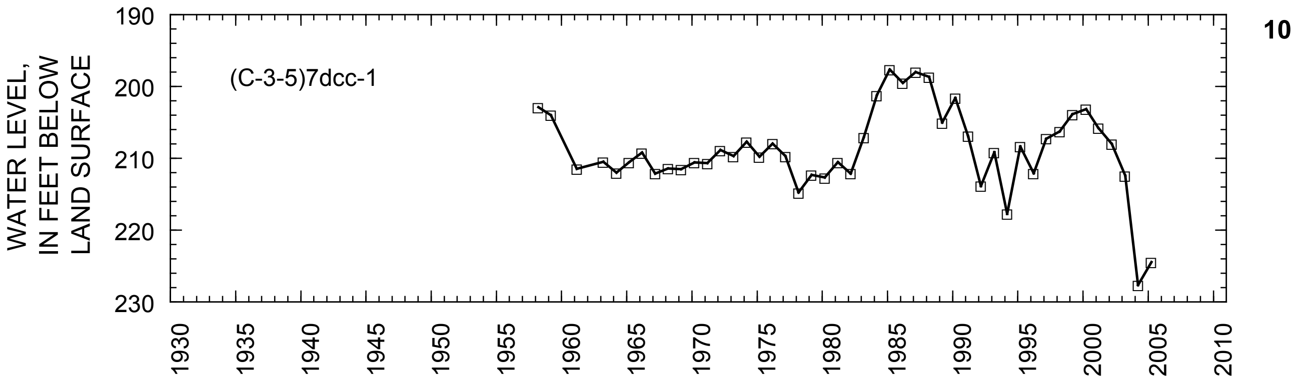


Figure 16. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele and to annual withdrawal from wells—Continued.





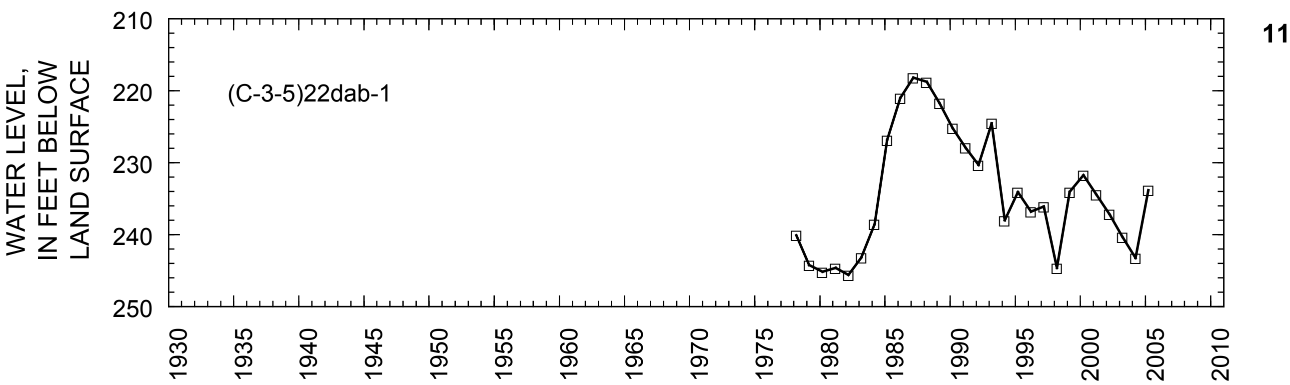


Figure 16. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele and to annual withdrawal from wells—Continued.

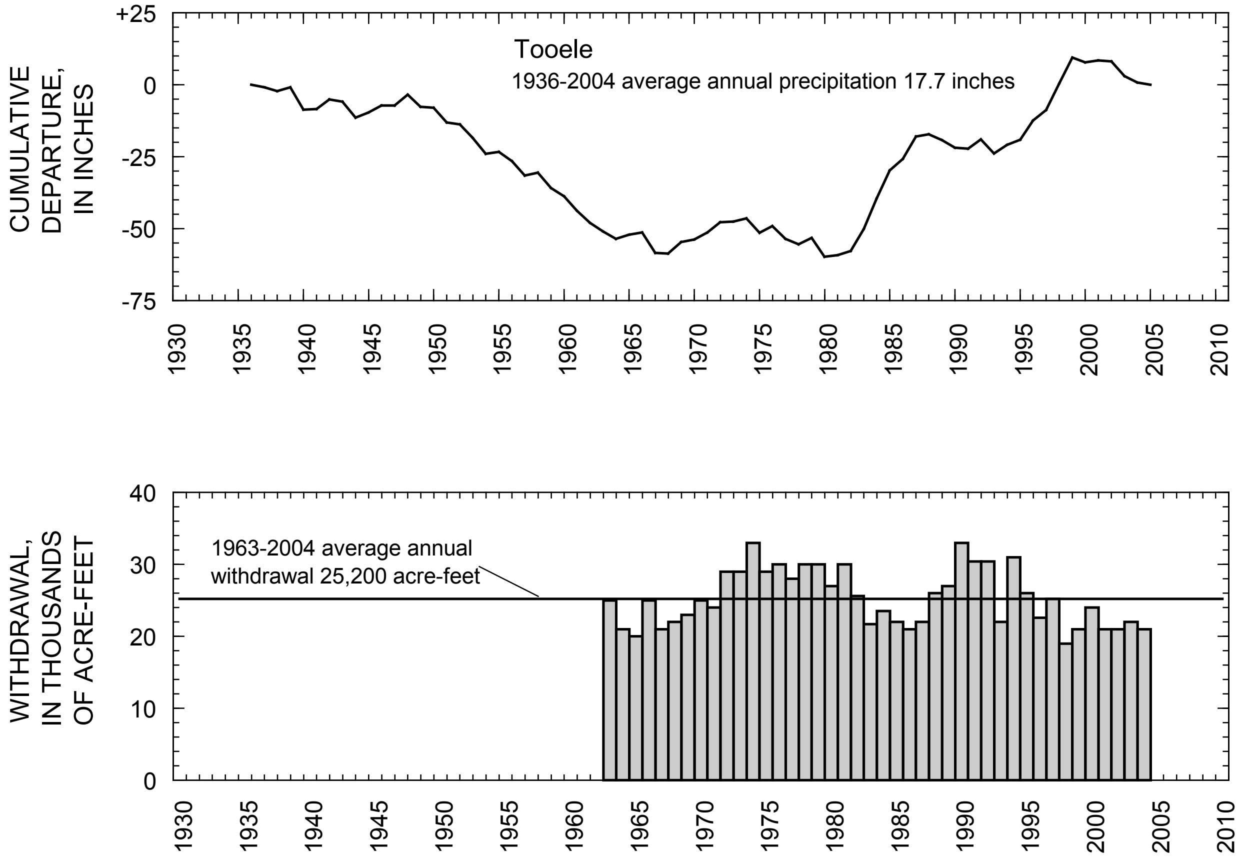


Figure 16. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele and to annual withdrawal from wells—Continued.

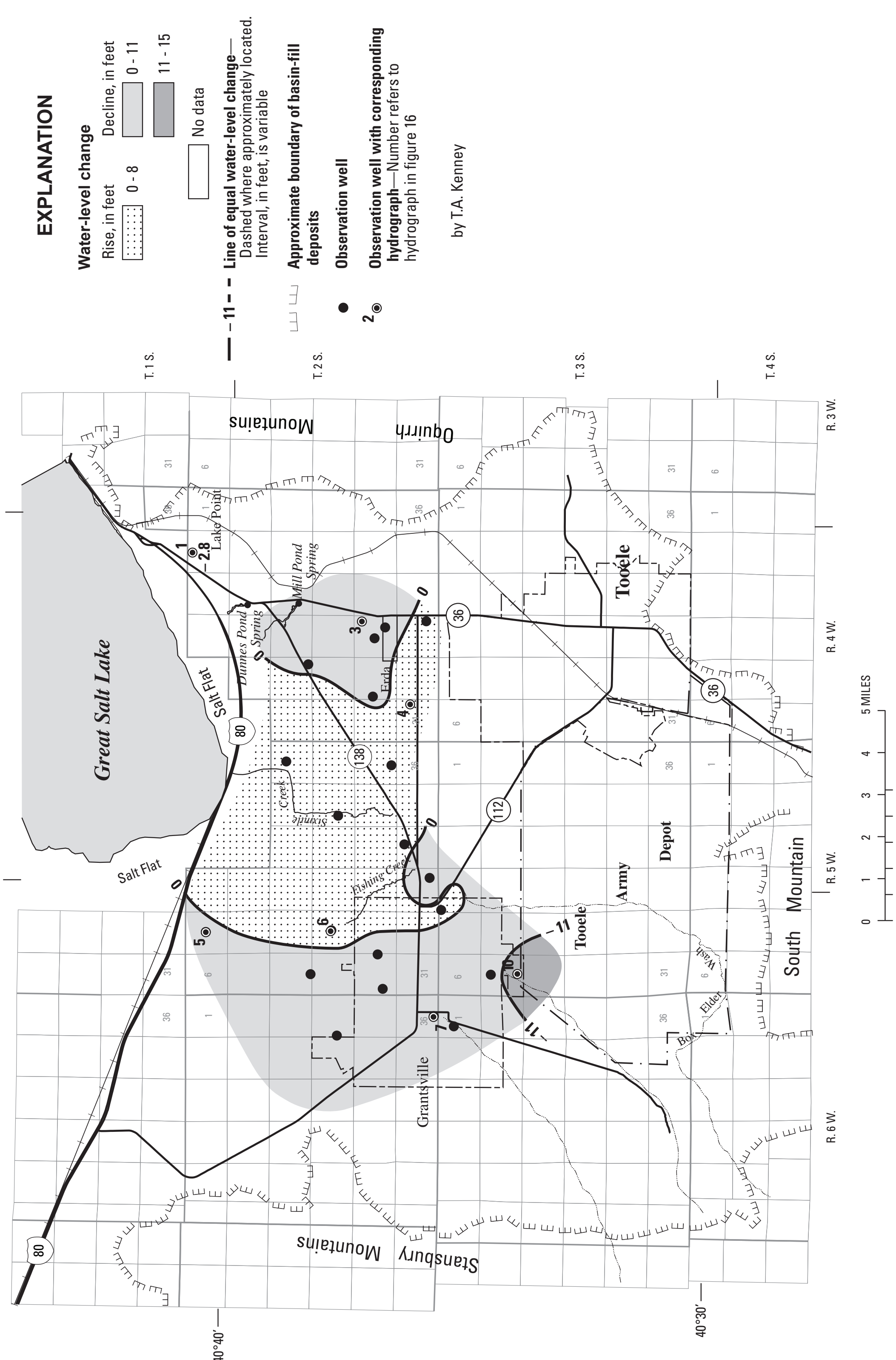


Figure 17. Map of Tooele Valley showing change of water level from March 1975 to March 2005.

UTAH AND GOSHEN VALLEY

By C.D. Wilkowske

Utah Valley is divided into two ground-water basins, northern and southern. Northern Utah Valley is the part of Utah Valley that is north of Provo Bay. Ground water occurs in unconsolidated basin-fill deposits in the valley. The principal ground-water recharge area for the basin fill is in the eastern part of the valley, along the base of the Wasatch Range.

Southern Utah Valley is the part of Utah Valley south of Provo and is bounded by the Wasatch Range, West Mountain, and the northern extension of Long Ridge. Goshen Valley is south of the latitude of Provo and is bounded by West Mountain, Long Ridge, and the East Tintic Mountains. Ground water in Utah and Goshen Valleys occurs in the alluvium under both water-table and artesian conditions, but most wells discharge from artesian aquifers.

Total estimated withdrawal of water from wells in Utah and Goshen Valleys in 2004 was about 128,000 acre-feet, which is 2,000 acre-feet less than the value for 2003, and 18,000 acre-feet more than the average annual withdrawal for 1994-2003 (tables 2 and 3). Ground water withdrawal in northern Utah Valley was about 88,600 acre-feet, which is 1,600 acre-feet less than the value for 2003; withdrawal in southern Utah Valley was about 30,200 acre-feet, which is 3,200 acre-feet less than in 2003; withdrawal in Goshen Valley was about 9,100 acre-feet, which is 2,500 acre-feet more than in 2003. The overall decrease in withdrawals was mainly due to decreased withdrawals for public supply.

Water levels in Goshen Valley and in the northern and southern parts of Utah Valley generally rose in the early 1980s. The rise corresponds to a period of greater-than-average precipitation and recharge from surface water. Water levels generally declined from 1985 to 1993 in Utah Valley and generally rose from 1993 to 1998. This rise resulted from greater-than-average precipitation during this period.

Water levels generally declined throughout Utah Valley from March 1999 to March 2005. Water levels in some wells reached their lowest level for their period of record, many dating back to 1935. Water levels in Goshen Valley also have continued to decline. This trend generally started in 1992. The decline in water levels is probably the result of continued large withdrawals from wells for irrigation.

The location of wells in Utah and Goshen Valleys in which the water level was measured during March 2005 is shown in figure 18. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells, is shown in figure 19. Discharge of Spanish Fork at Castilla in 2004 was 169,200 acre-feet, which is 2,000 acre-feet more than the 1933-2004 annual average. Precipitation at Silver Lake near Brighton in 2004 was about 40.6 inches, which is about 1.9 inches less than the 1931-2004 annual average and about 5.4 inches more than in 2003. Precipitation at Spanish Fork Powerhouse in 2004 was about 19.1 inches, which is about 0.4 inch less than the 1937-2004 annual average and about 0.5 inch less than in 2003.

Water levels from March 1975 to March 2005 generally declined in northern and southern Utah Valley, and in most of Goshen Valley (fig. 20). The declines in Utah Valley were probably the result of increased withdrawals for public supply. Water levels rose in an area north of Elberta and in a small area southeast of the town of Goshen from 1975 to 2005 (fig. 20). Land use in the central part of Goshen Valley is almost exclusively agricultural, and irrigation is done by pumped ground water. The water-level rises observed in this area are most likely due to decreases in local pumping. The water-level rise southeast of the town of Goshen was most likely caused by the closure of an orchard that used to be irrigated by ground water.

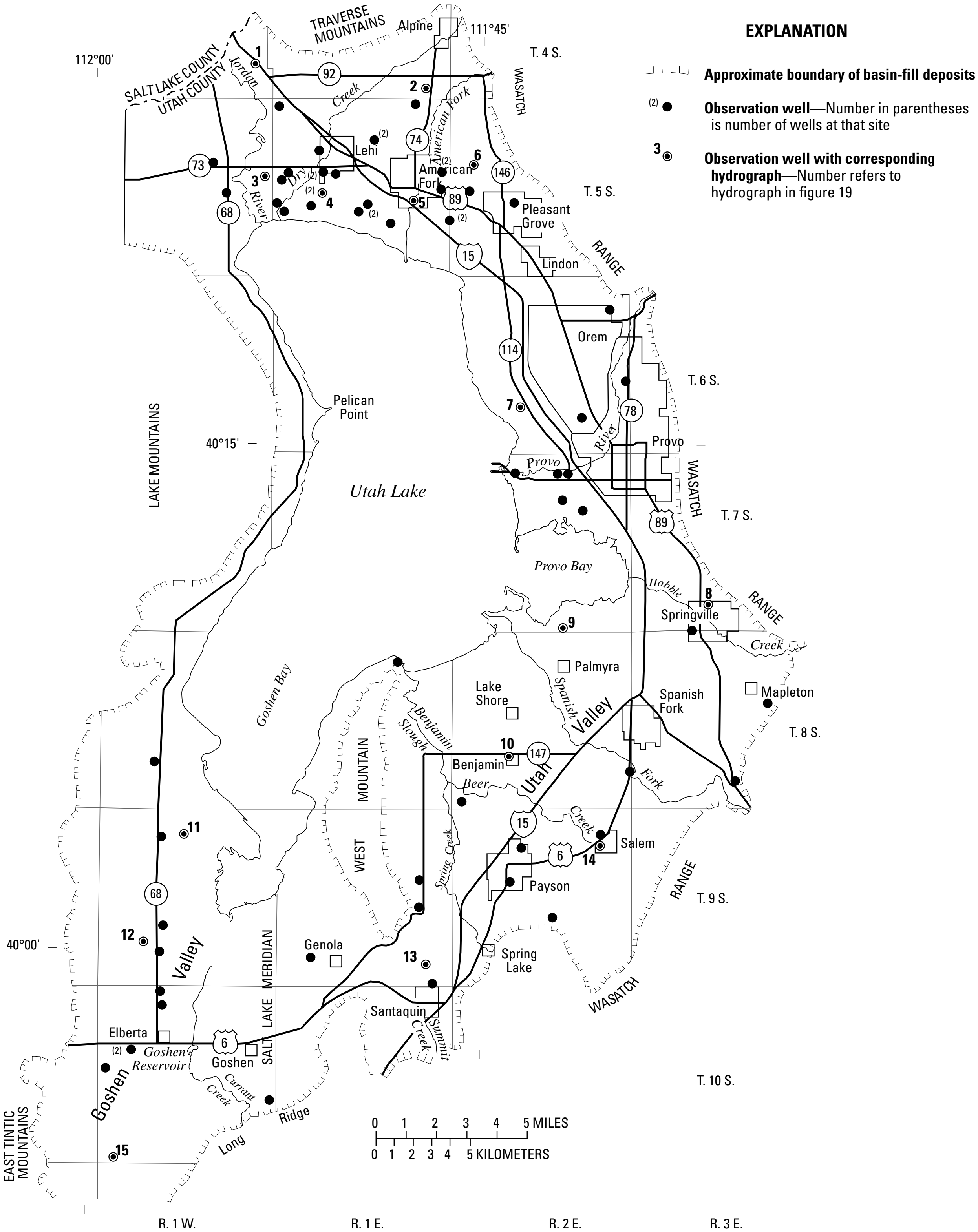


Figure 18. Location of wells in Utah and Goshen Valleys in which the water level was measured during March 2005.

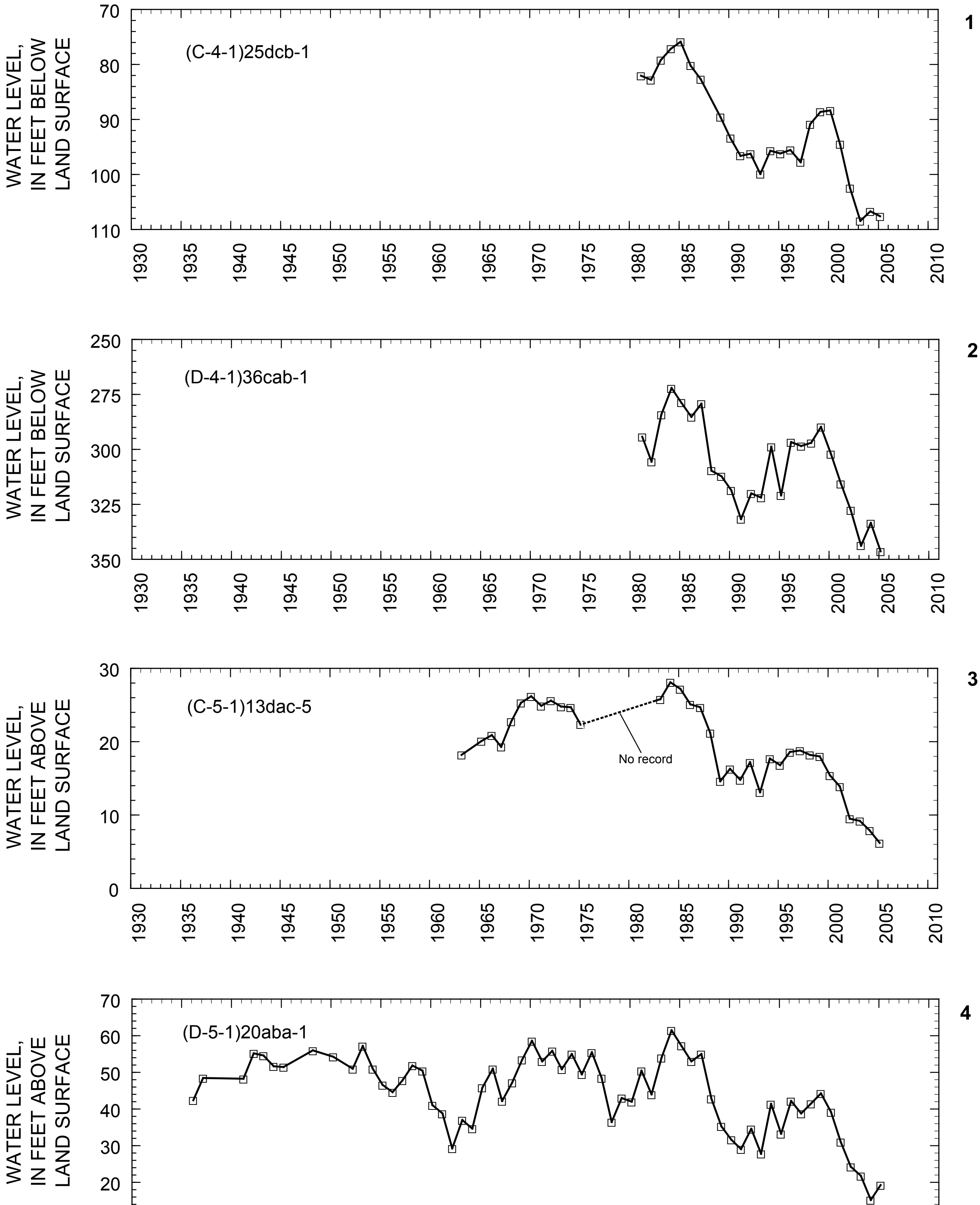


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells.

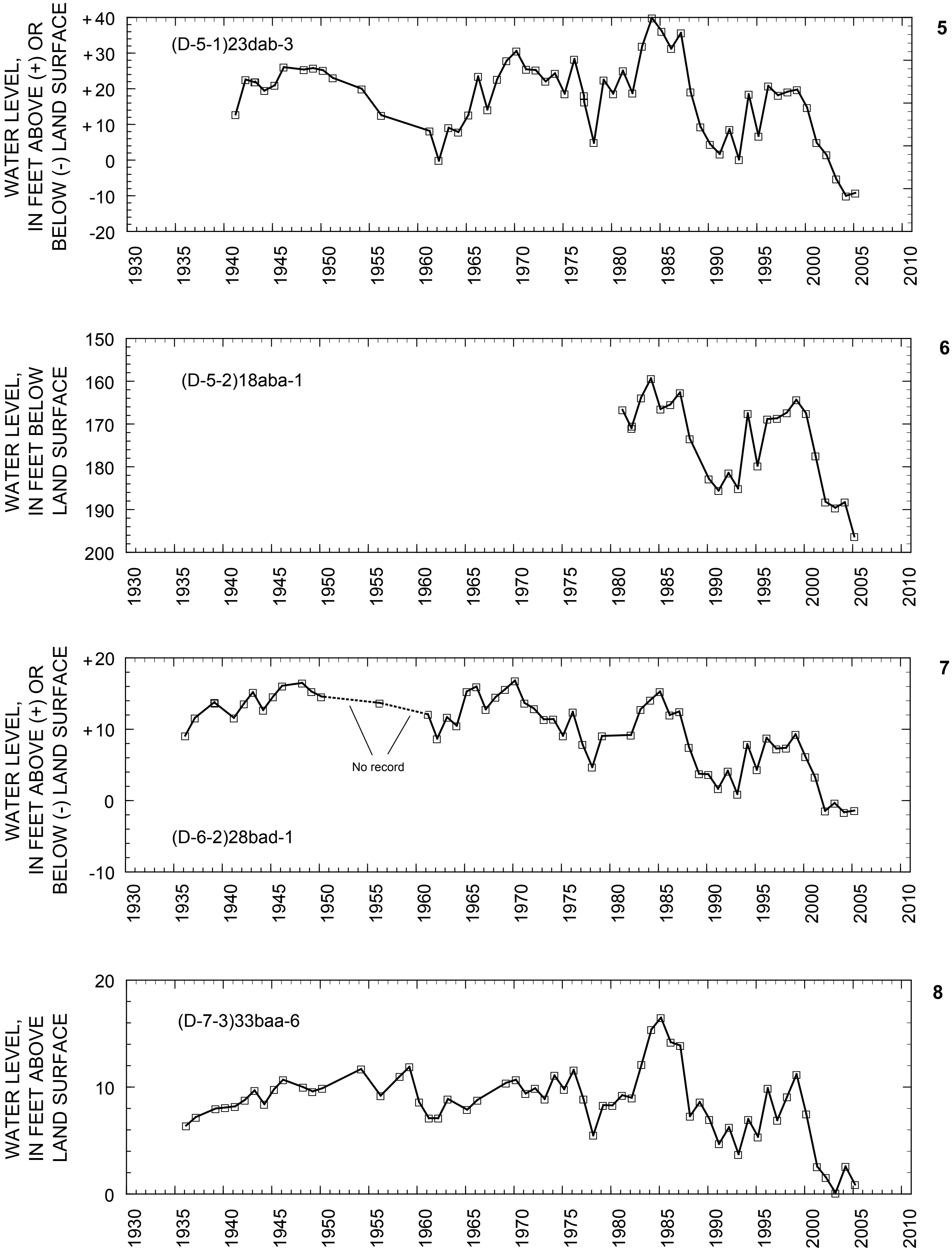


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

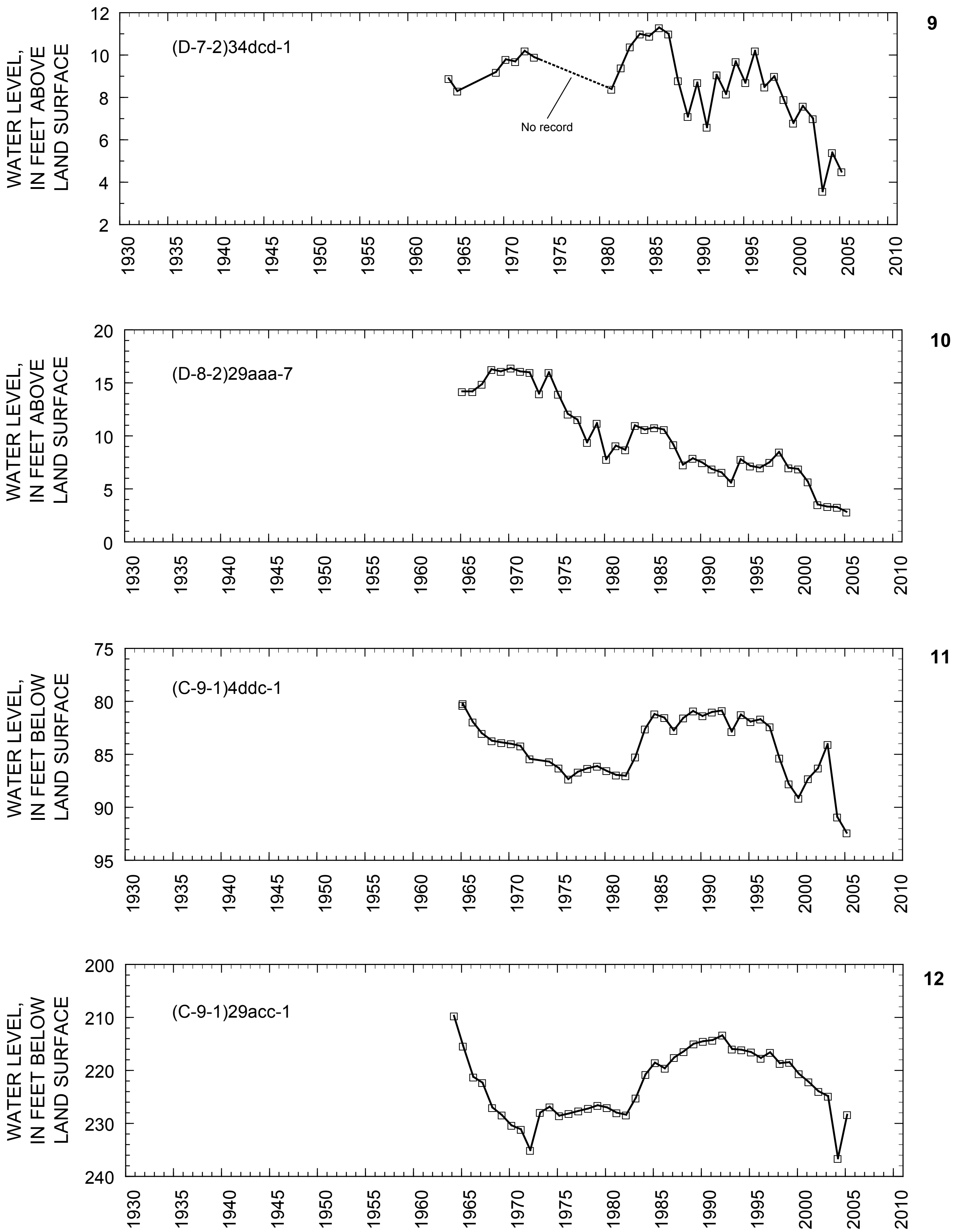


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

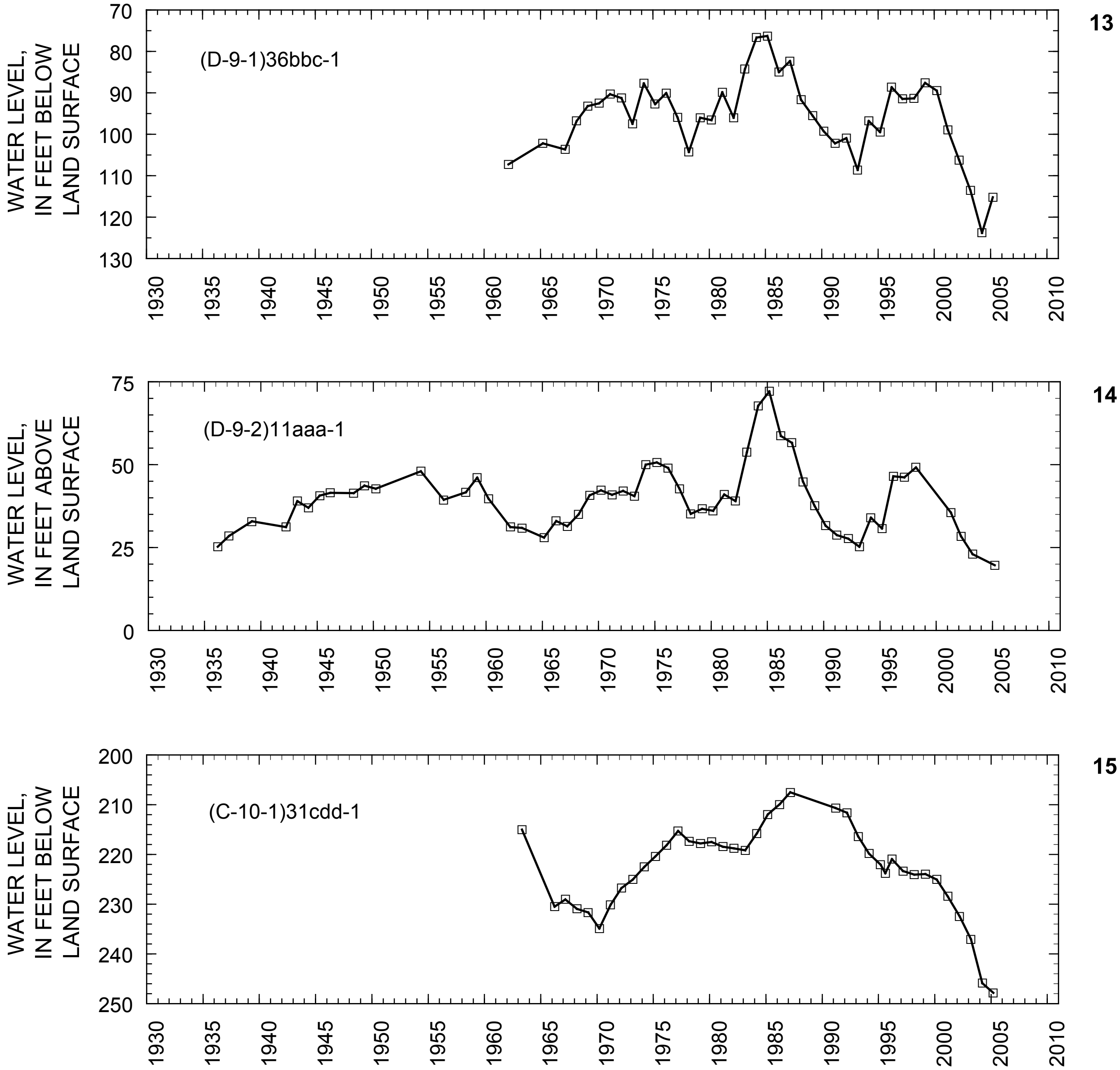


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

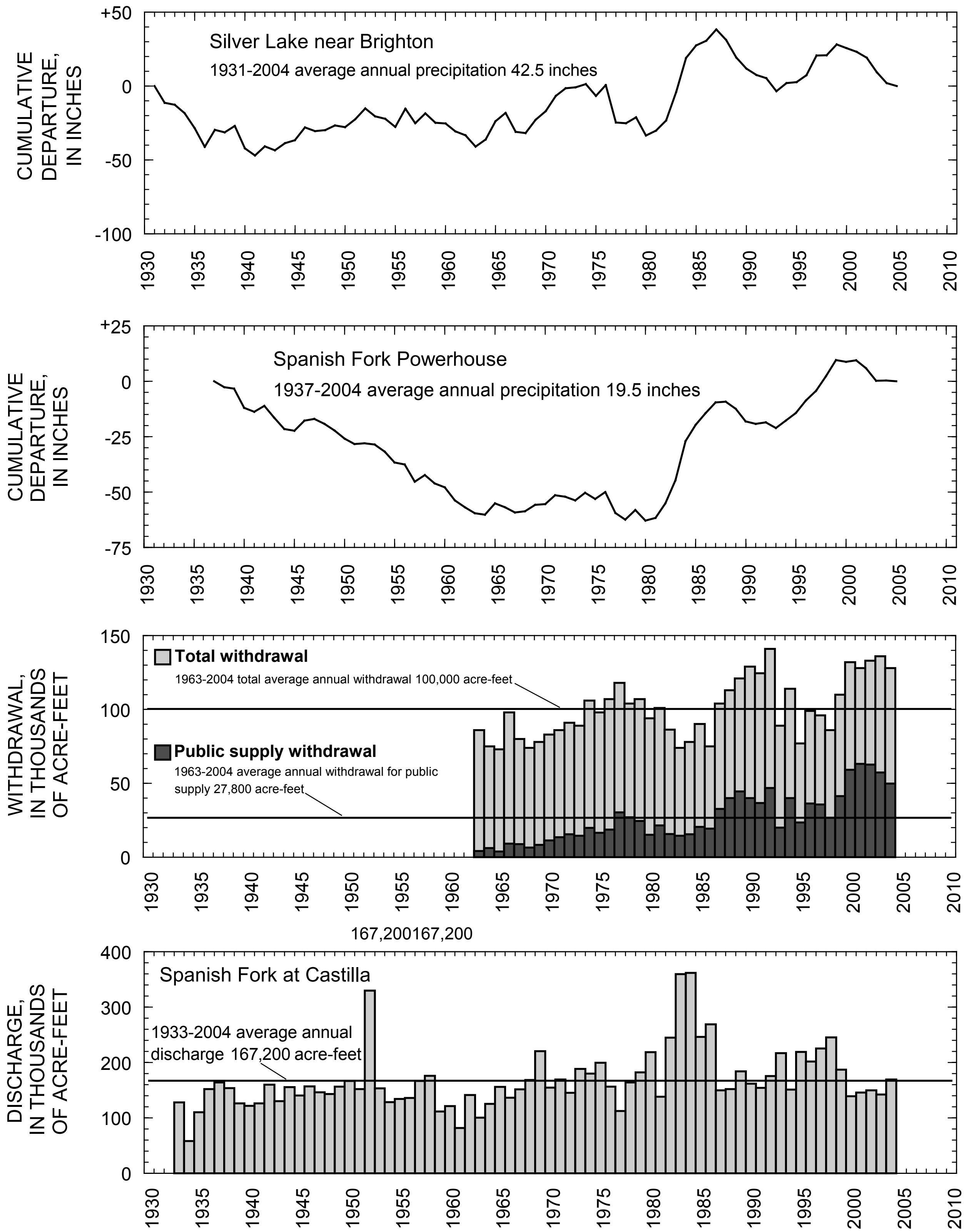


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

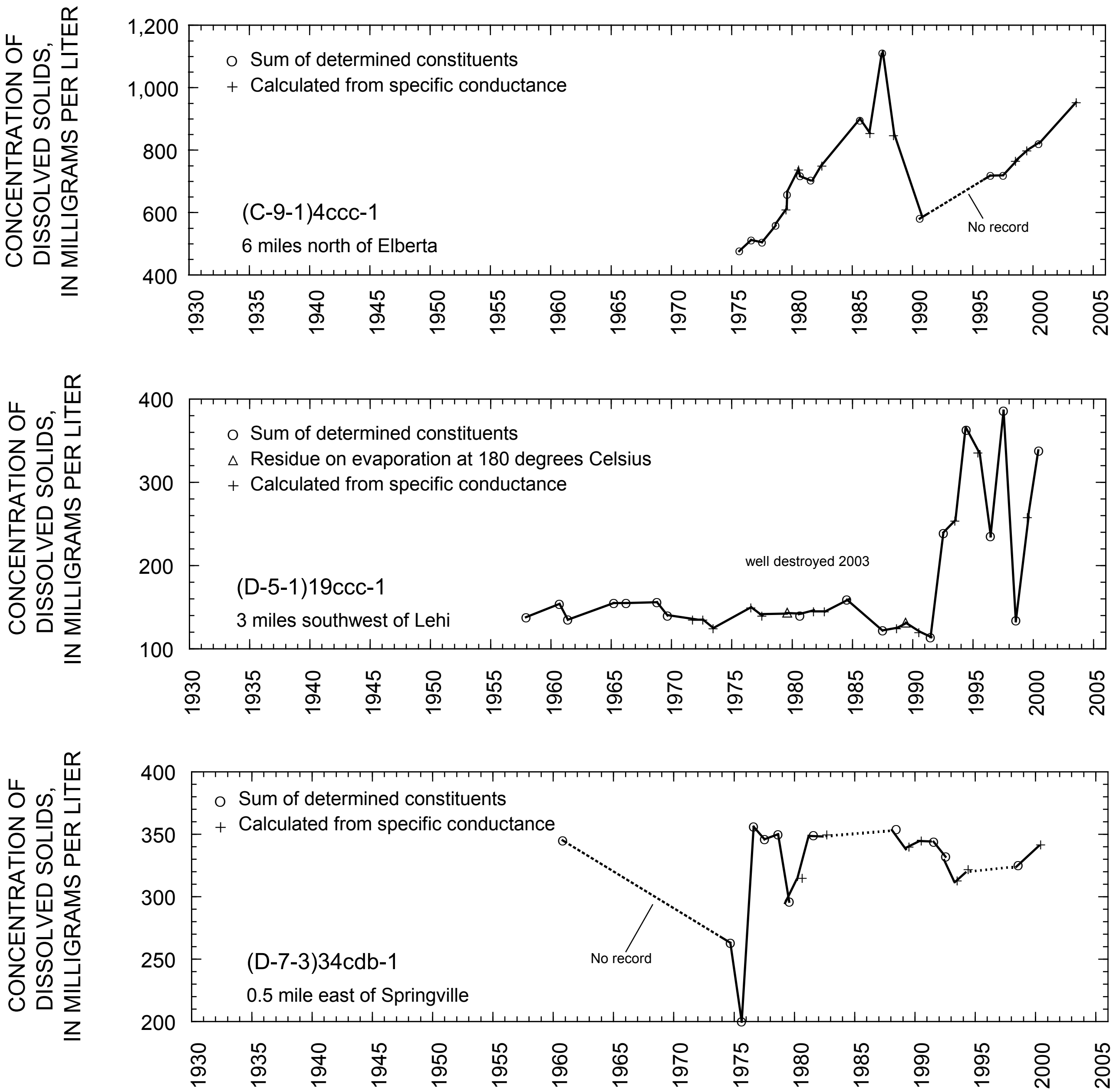


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake near Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

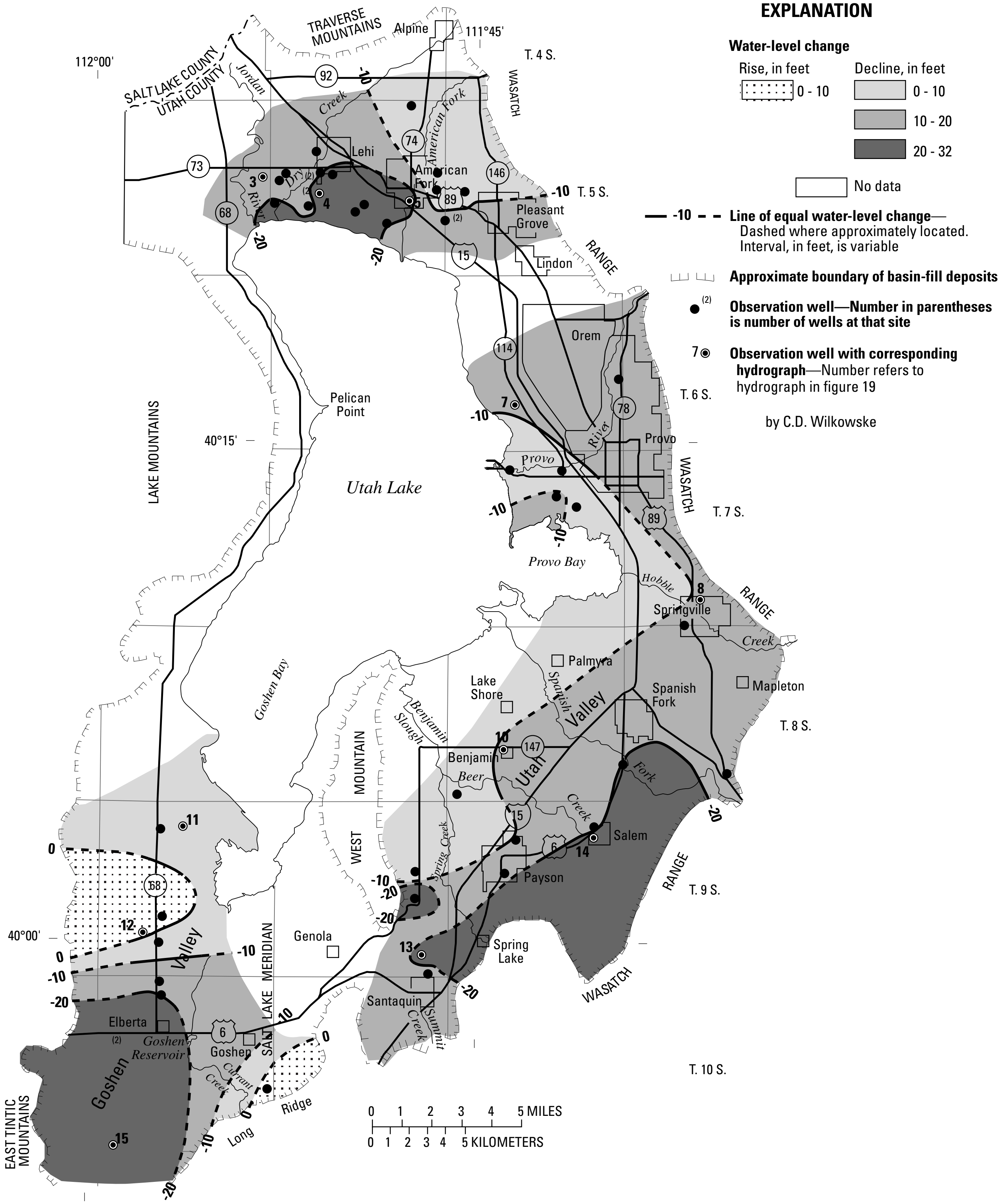


Figure 20. Map of Utah and Goshen Valleys showing change of water level from March 1975 to March 2005.

JUAB VALLEY

By R.J. Eacret

Juab Valley, which is about 30 miles long and averages about 4 miles wide, is in central Utah along the west side of the Wasatch Range and the San Pitch Mountains. The valley drains near both its northern and southern ends—in northern Juab Valley via Currant Creek into Utah Lake, and in southern Juab Valley via Chicken Creek into the Sevier River. The northern and southern parts of Juab Valley are separated topographically by Levan Ridge, a gentle rise near the midpoint of the valley floor.

Ground water in Juab Valley occurs in the unconsolidated basin-fill deposits. Most of the recharge to the ground-water reservoir occurs on the eastern side of the valley along the Wasatch Range and the San Pitch Mountains. Ground water moves to the lower part of the valley and to eventual discharge points at the northern and southern ends of the valley. The ground-water divide between the northern and southern parts of Juab Valley is near Levan Ridge.

Ground water occurs in the basin-fill deposits under both water-table and artesian conditions; artesian conditions are prevalent in the lower part of the valley. The greatest depths to water are along the eastern margin of the valley, where permeable alluvial fans extend from the mountains into the valley.

Total estimated withdrawal of water from wells in Juab Valley in 2004 was about 26,000 acre-feet, which is 1,000 acre-feet less than the amount reported for 2003 and 5,000 acre-feet more than the average annual withdrawal for 1994-2003 (tables 2 and 3).

Water levels from March 1999 to March 2005 generally declined in most of Juab Valley. The decline in water levels probably resulted from continued large withdrawals and less-than-average precipitation. Water levels in March generally rose from 1978 to their highest level in 1985. This rise corresponds to a period of greater-than-average precipitation during 1978-86. Water levels have generally declined since 1986, although there was a substantial rise from 1993 to 1999.

The location of wells in Juab Valley in which the water level was measured during March 2005 is shown in figure 21. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (D-13-1)7dbc-1 is shown in figure 22.

Water levels from March 1975 to March 2005 generally declined throughout Juab Valley (fig. 23). The largest decline, about 26.7 feet, was observed in a well west of Nephi.

Precipitation at Nephi during 2004 was about 12.7 inches, which is about 1.7 inches less than the average annual precipitation for 1935-2004, and about 0.1 inch more than in 2003. The concentration of dissolved solids in water from well (D-13-1)7dbc-1 fluctuated during 1964-2003, with no apparent trend.

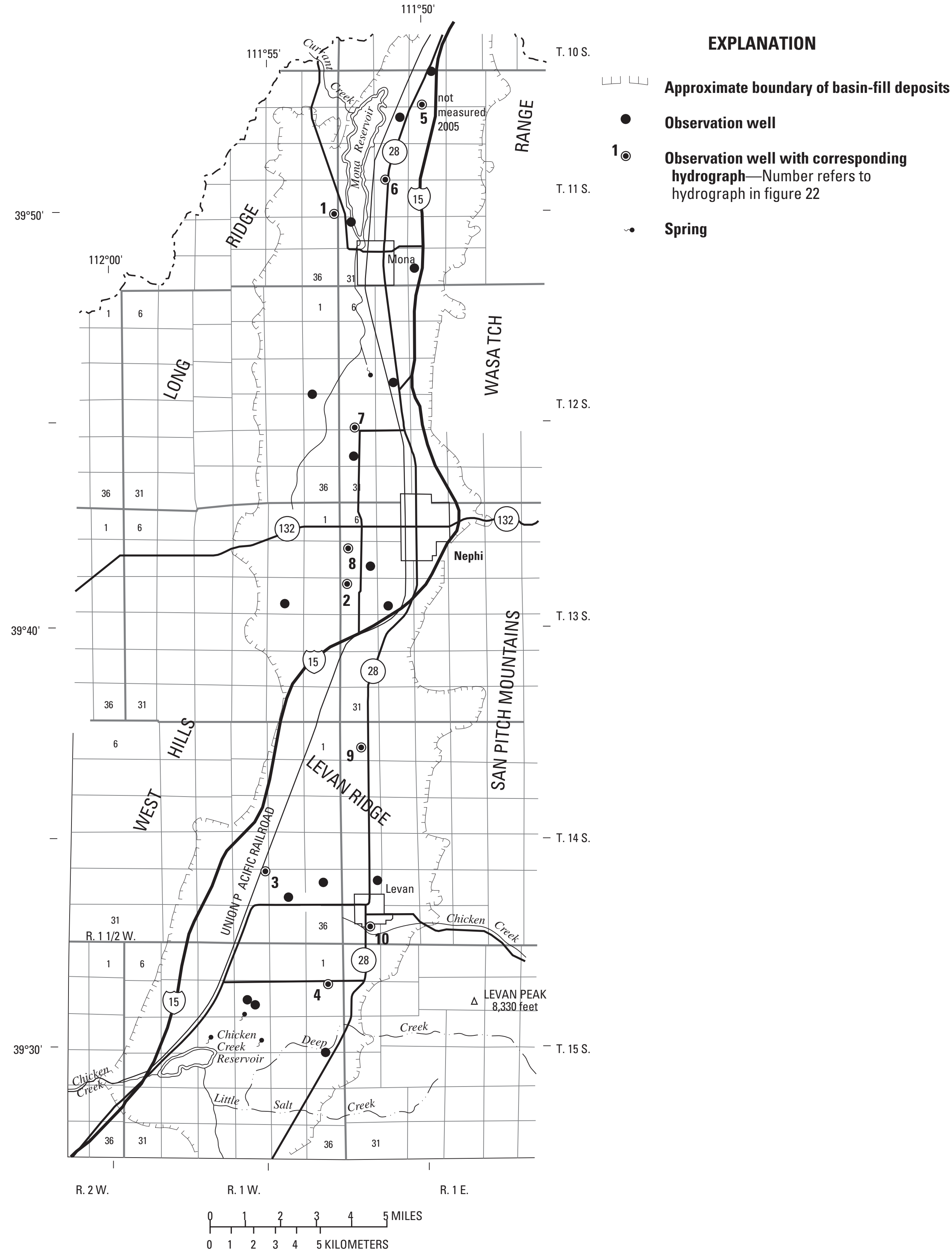


Figure 21. Location of wells in Juab Valley in which the water level was measured during March 2005.

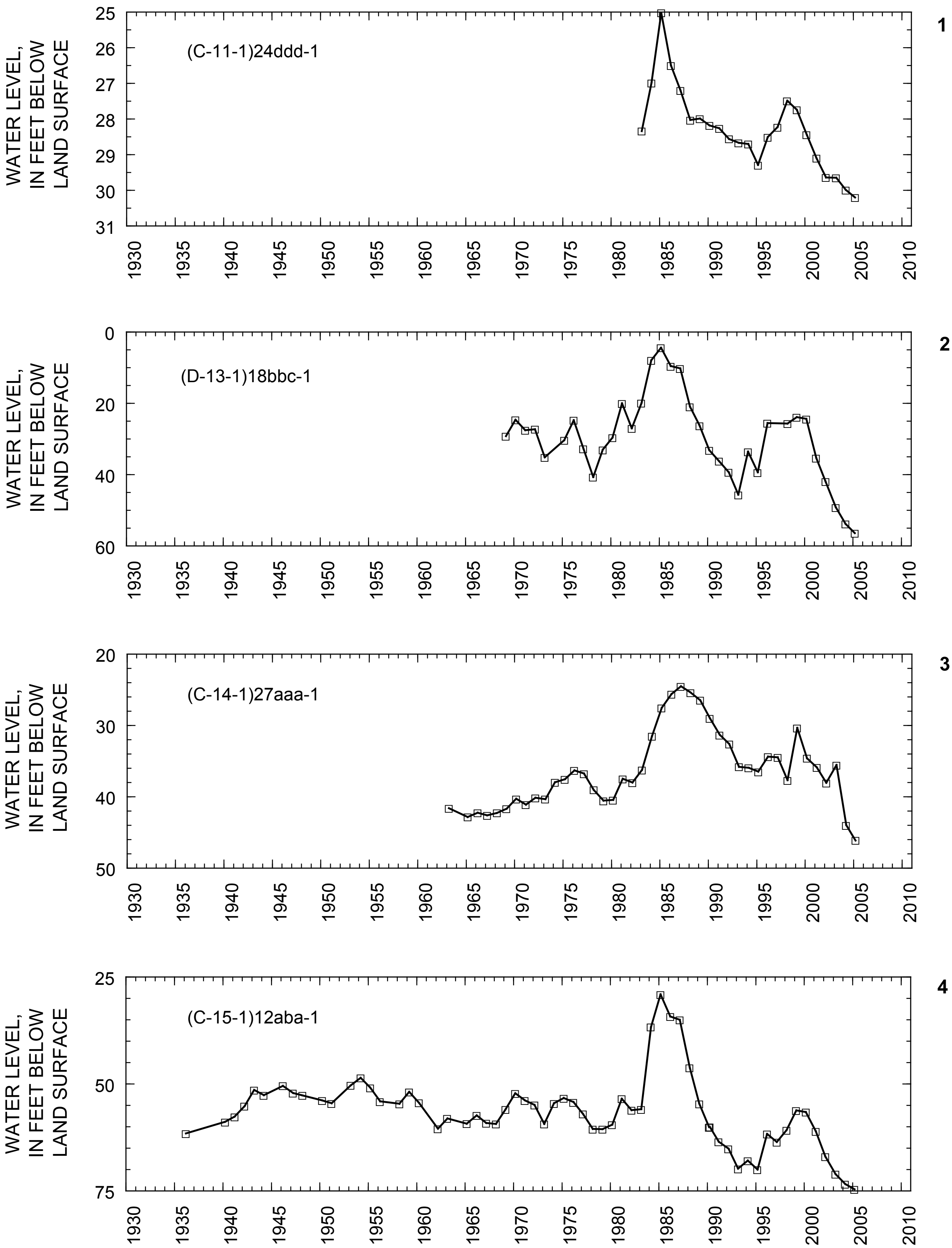


Figure 22. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (D-13-1)7dbc-1.

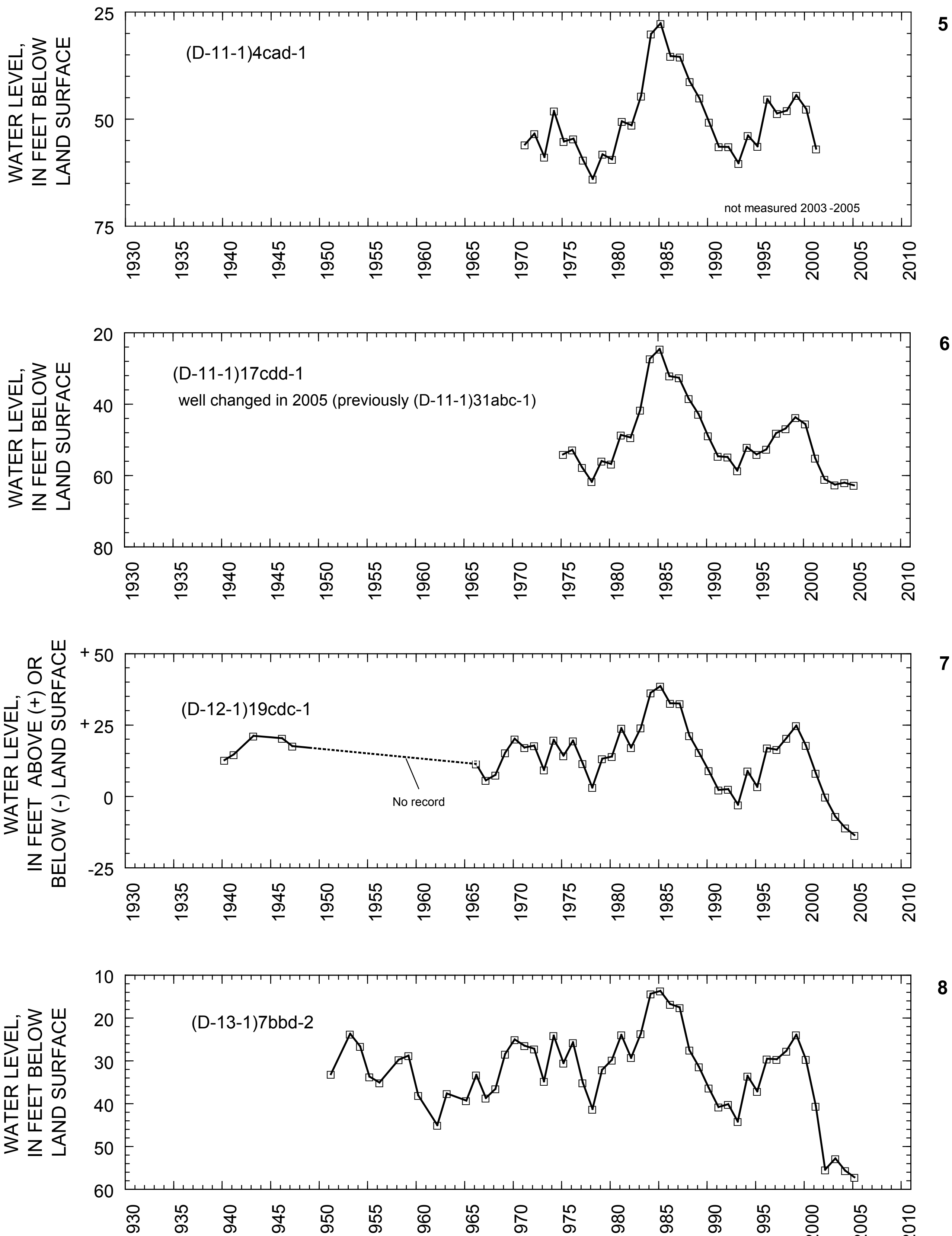
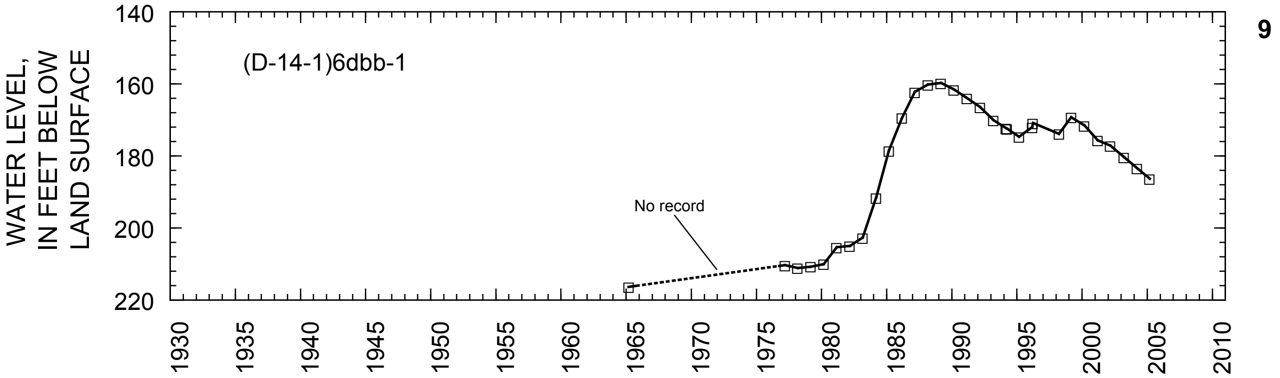


Figure 22. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (D-13-1)7dbc-1—Continued.



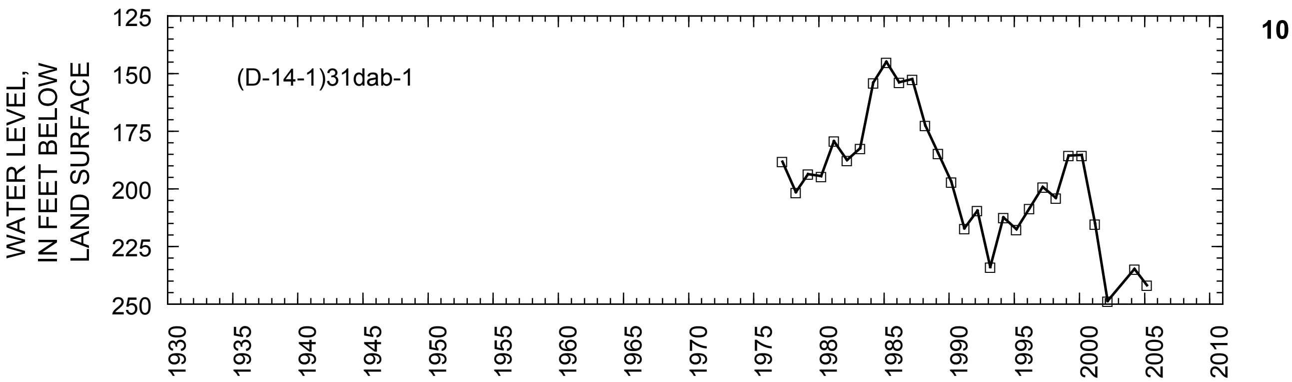


Figure 22. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (D-13-1)7dbc-1—Continued.

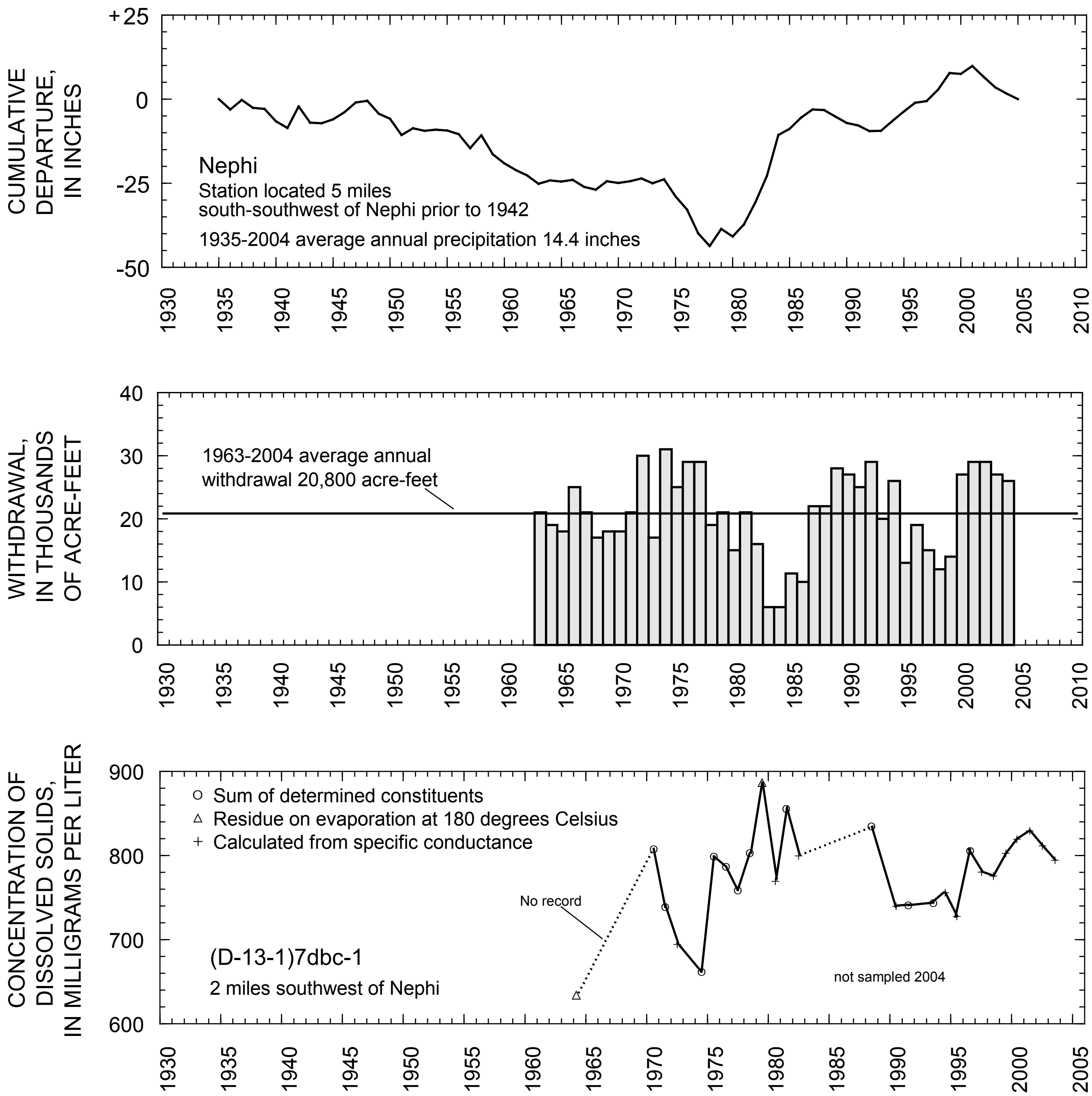


Figure 22. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (D-13-1)7dbc-1—Continued.

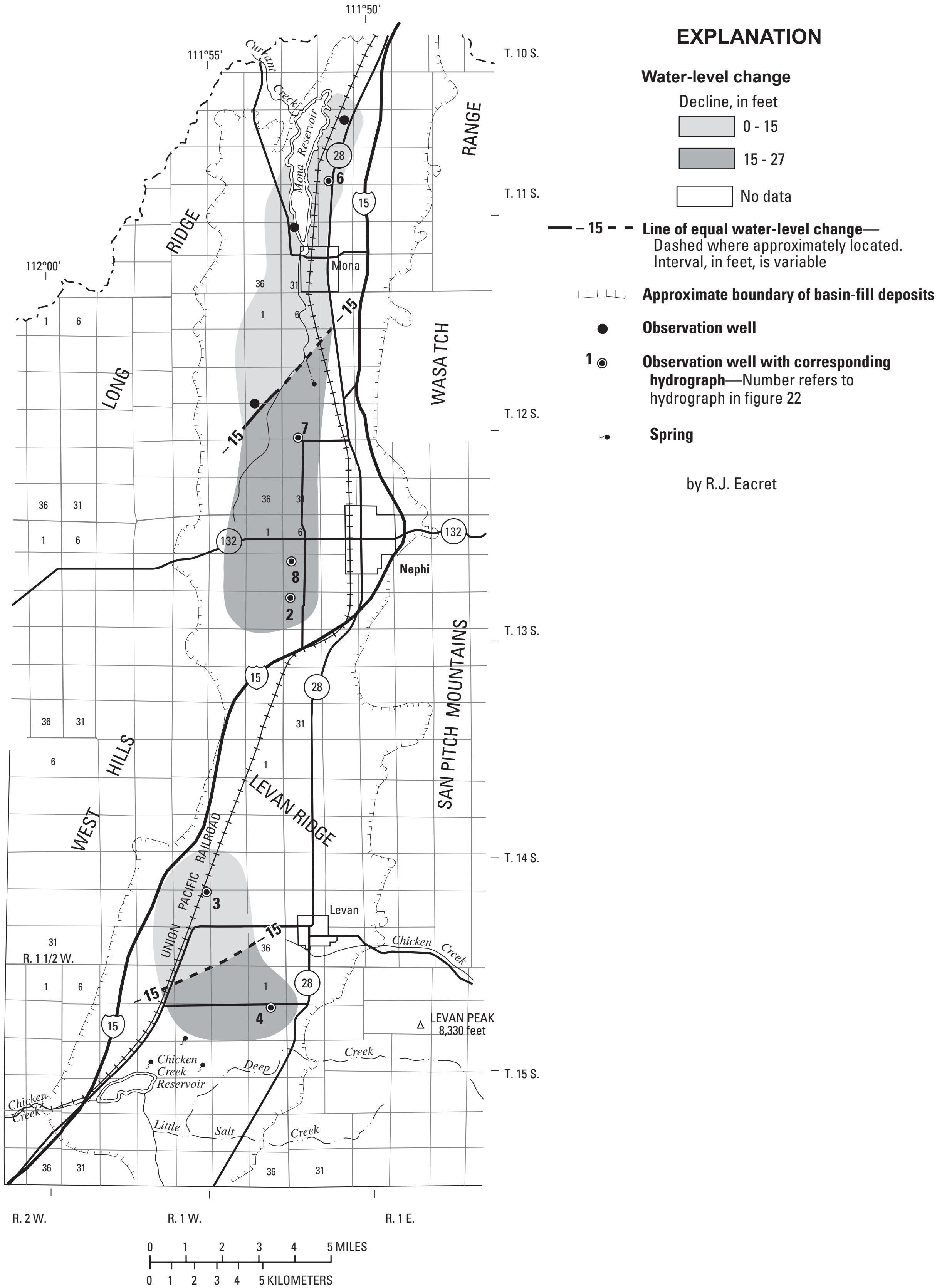


Figure 23. Map of Juab Valley showing change of water level from March 1975 to March 2005.

SEVIER DESERT

By Paul Downhour

The part of the Sevier Desert described here covers about 2,000 square miles. It is principally the broad, gently sloping area between the Canyon Mountains on the east and the Drum Mountains on the west. The Sevier River runs through the Sevier Desert and provides recharge to the aquifers. Ground water occurs in the Sevier Desert in unconsolidated deposits under water-table and artesian conditions. Most of the ground water is discharged from wells completed in either of two artesian aquifers—the shallow or deep artesian aquifer.

Total estimated withdrawal of water from wells in the Sevier Desert in 2004 was about 41,000 acre-feet, which is 13,000 acre-feet more than in 2003 and about 20,000 acre-feet more than the 1994-2003 average annual withdrawal (tables 2 and 3). The increase in total withdrawal from 2003 was mostly a result of increased withdrawal for irrigation.

The location of wells in the Sevier Desert in which the water level was measured during March 2005 is shown in figures 24 and 25. The relation of the water level in selected observation wells to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)18daa-1 is shown in figure 26. Water levels in both the shallow and deep aquifers in the Sevier Desert generally rose from 1980 to 1987, which corresponds to a period of greater-than-average precipitation and less-than-average withdrawal. Water levels in both aquifers began declining during 1987-90 and continued to decline until 1995. Levels generally rose or remained stable from about 1995 to 1999. Rises during this period probably resulted from decreased ground-water withdrawals due to greater-than-average precipitation, and more available surface water for irrigation. Water levels generally declined from March 1999 to March 2005, probably as a result of 4 years of less-than-average surface-water supplies and continued large withdrawals from wells.

Water levels generally declined in the shallow and deep artesian aquifers from March 1975 to March 2005 (figs. 27 and 28). Declines of nearly 21 feet in the shallow artesian aquifer occurred in the Oak City area, and declines of nearly 26 feet occurred in the deep artesian aquifer in the Delta area. The decline in water levels probably is the result of continued withdrawals of ground water. Rises in water levels in the shallow artesian aquifer occurred in the northwestern part of the area. The largest rise in the shallow artesian aquifer, about 7 feet, occurred in a well at the northern edge of the area, near Desert Mountain. Water levels in all wells in the deep aquifer declined.

Discharge of the Sevier River near Juab in 2004 was 87,000 acre-feet, 33,800 acre-feet less than the revised total of 120,800 acre-feet in 2003 and 94,000 acre-feet less than the long-term average (1935-2004). Precipitation at Oak City was about 14.9 inches in 2004, about 1.9 inches more than the 1935-2004 average annual precipitation and about 0.7 inch more than in 2003.

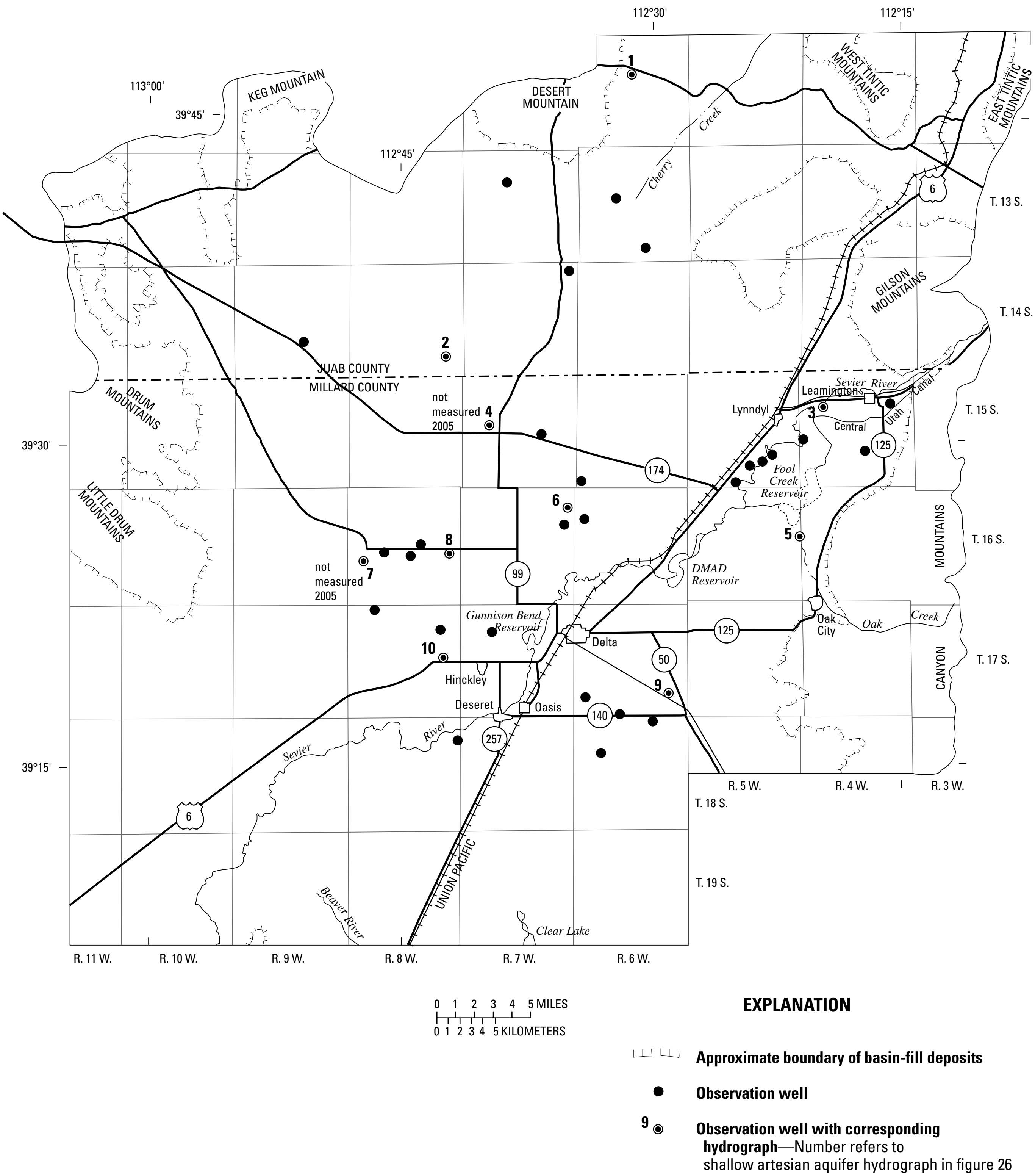


Figure 24. Location of wells in the shallow artesian aquifer in part of the Sevier Desert in which the water level was measured during March 2005.

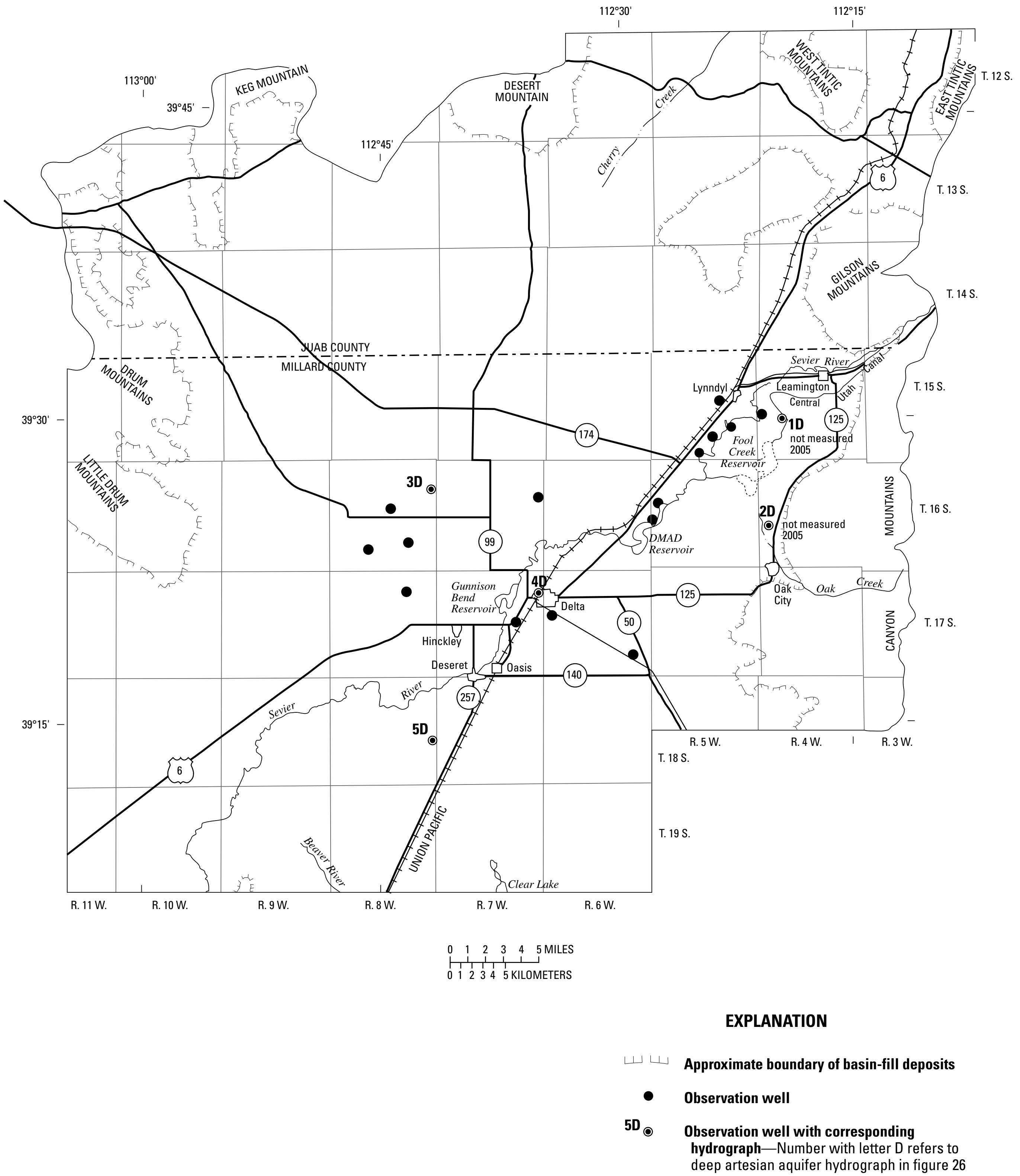


Figure 25. Location of wells in the deep artesian aquifer in part of the Sevier Desert in which the water level was measured during March 2005.

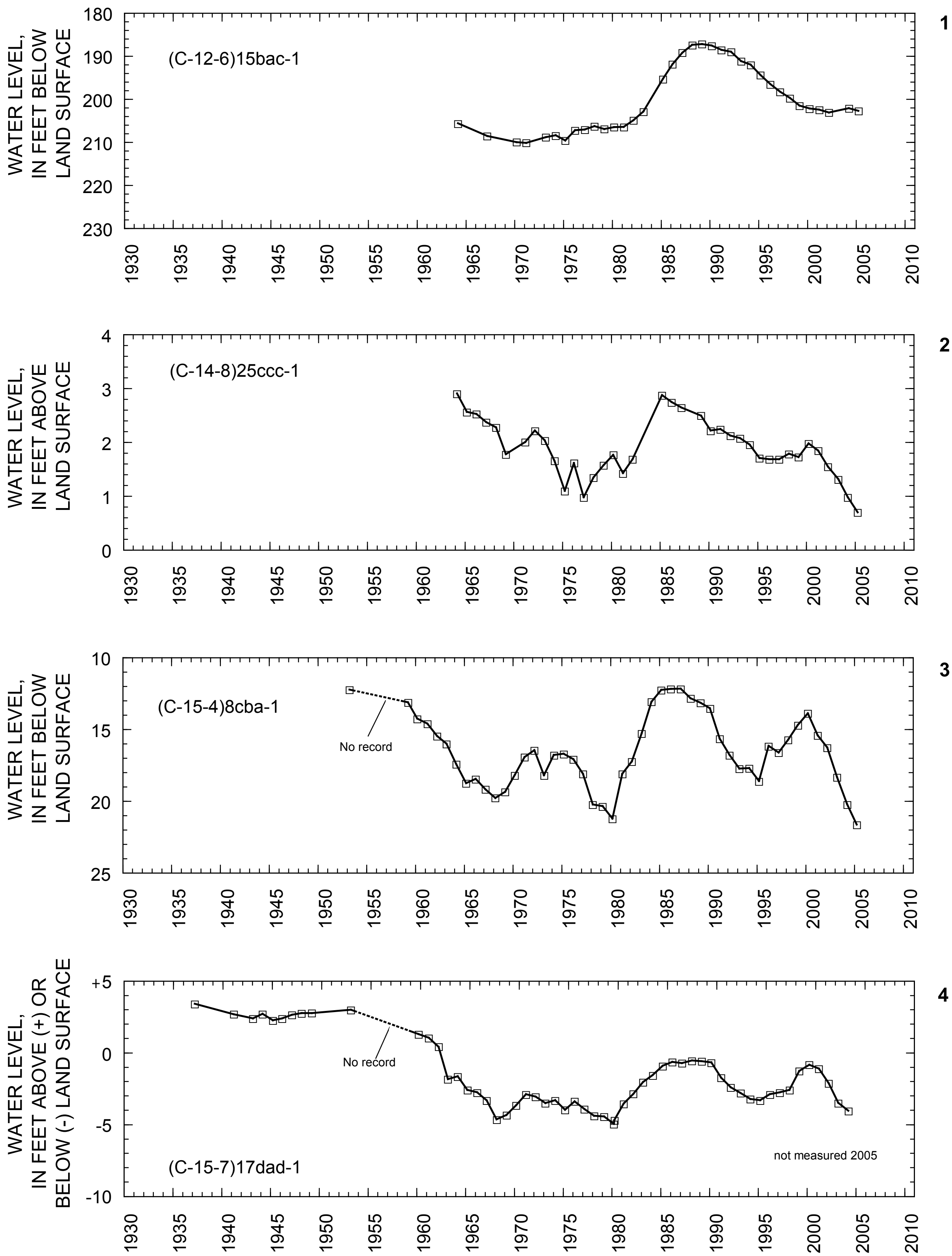


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)18daa-1.

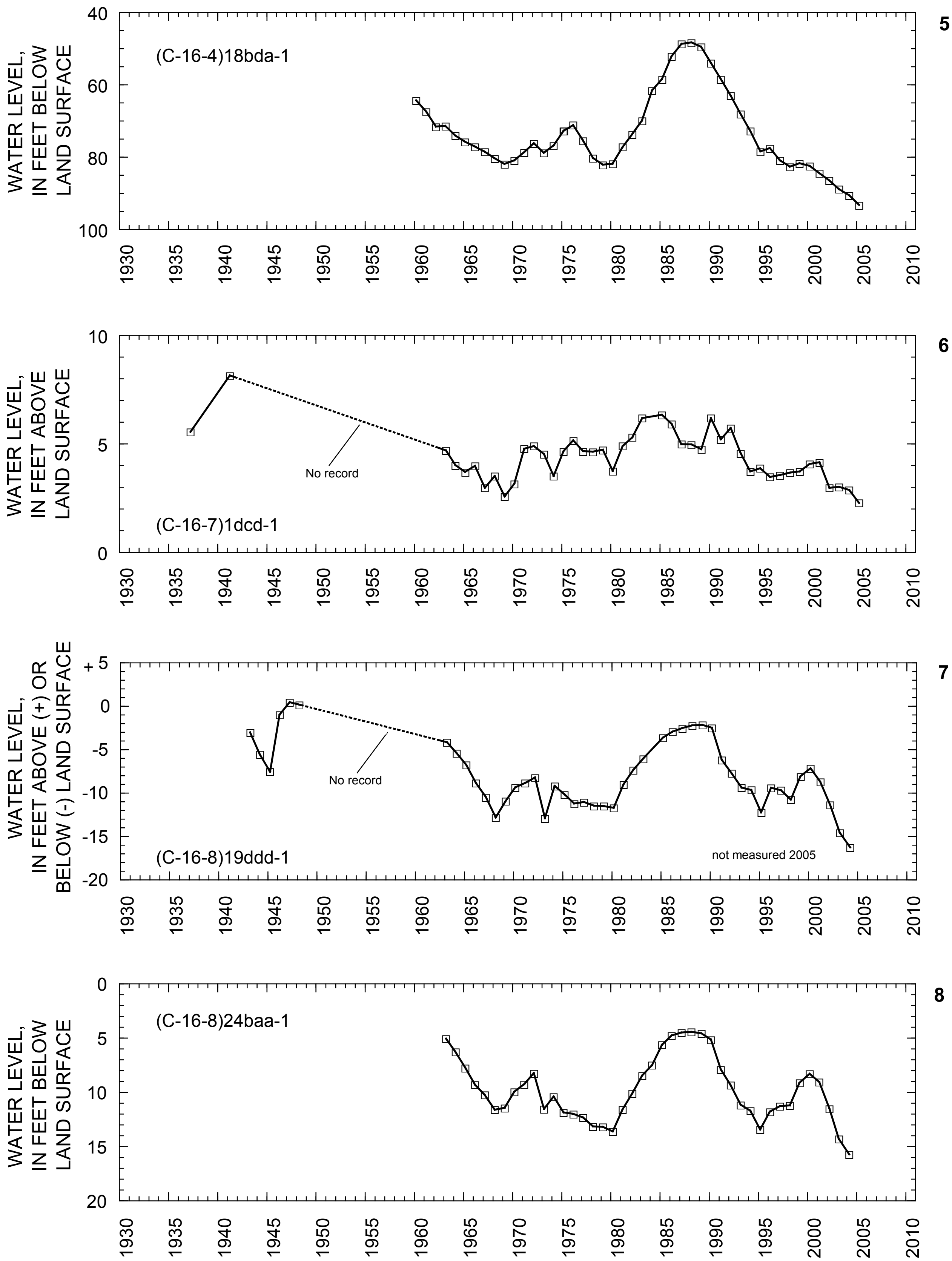


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)18daa-1—Continued.

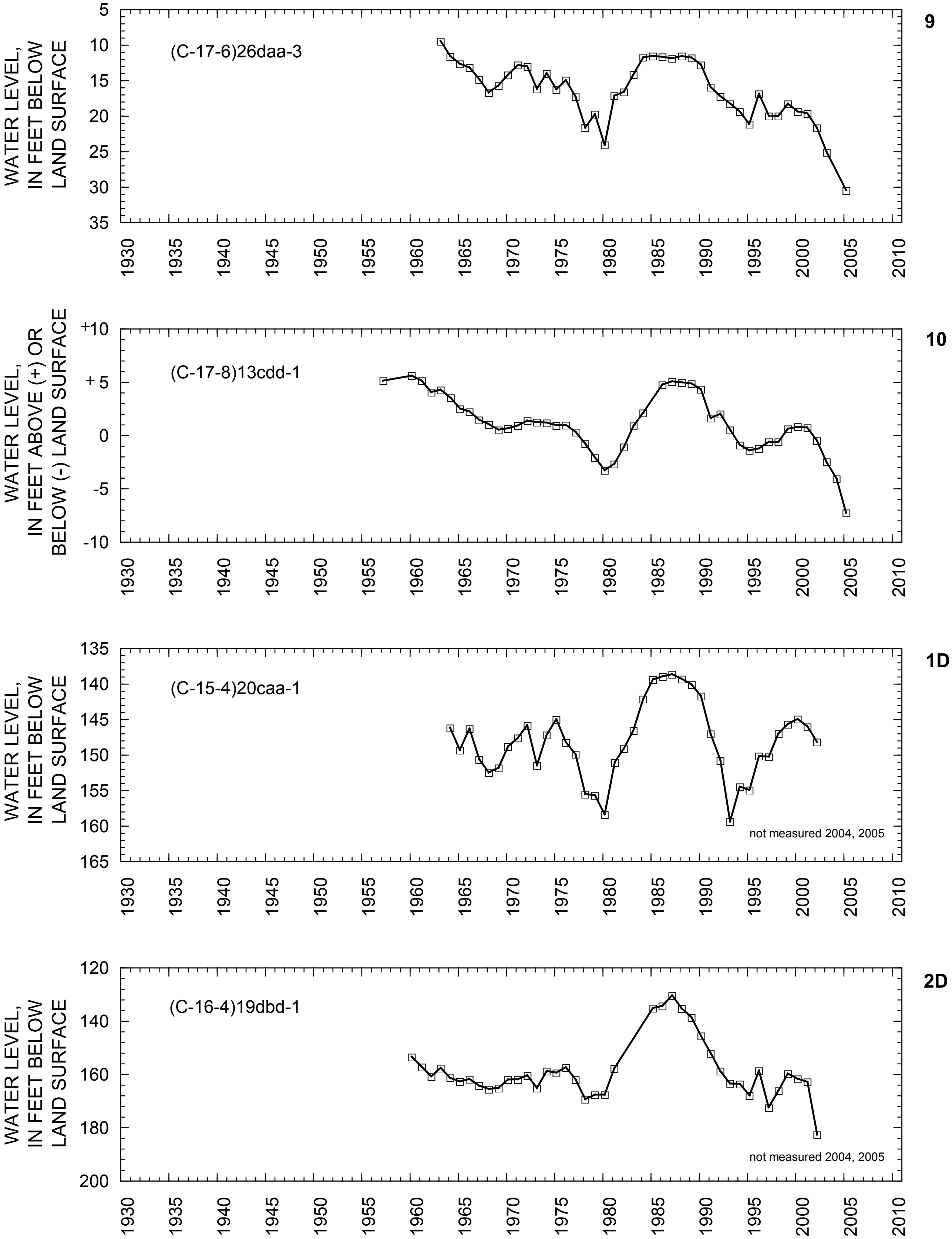


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)18daa-1—Continued.

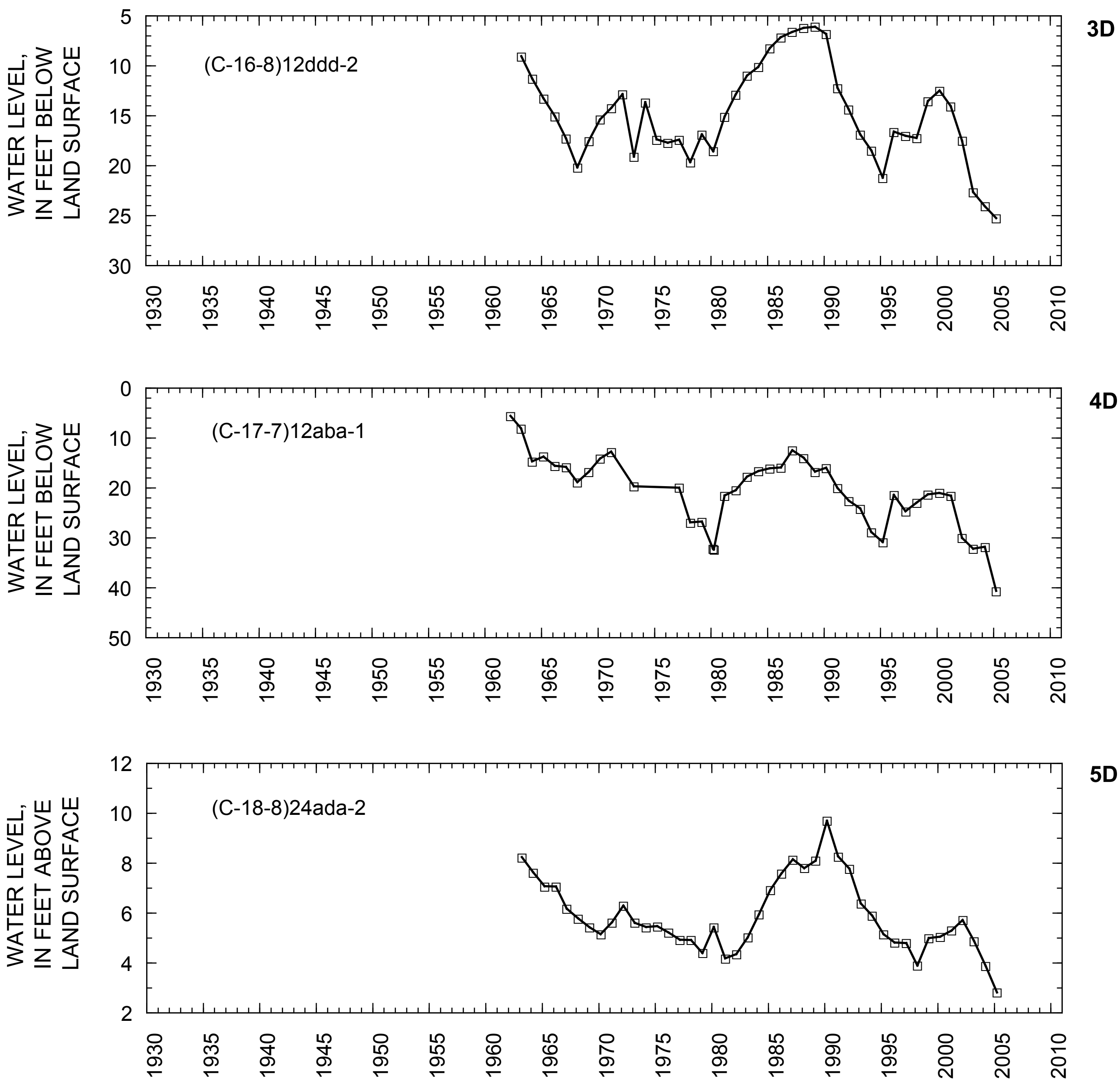


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)18daa-1—Continued.

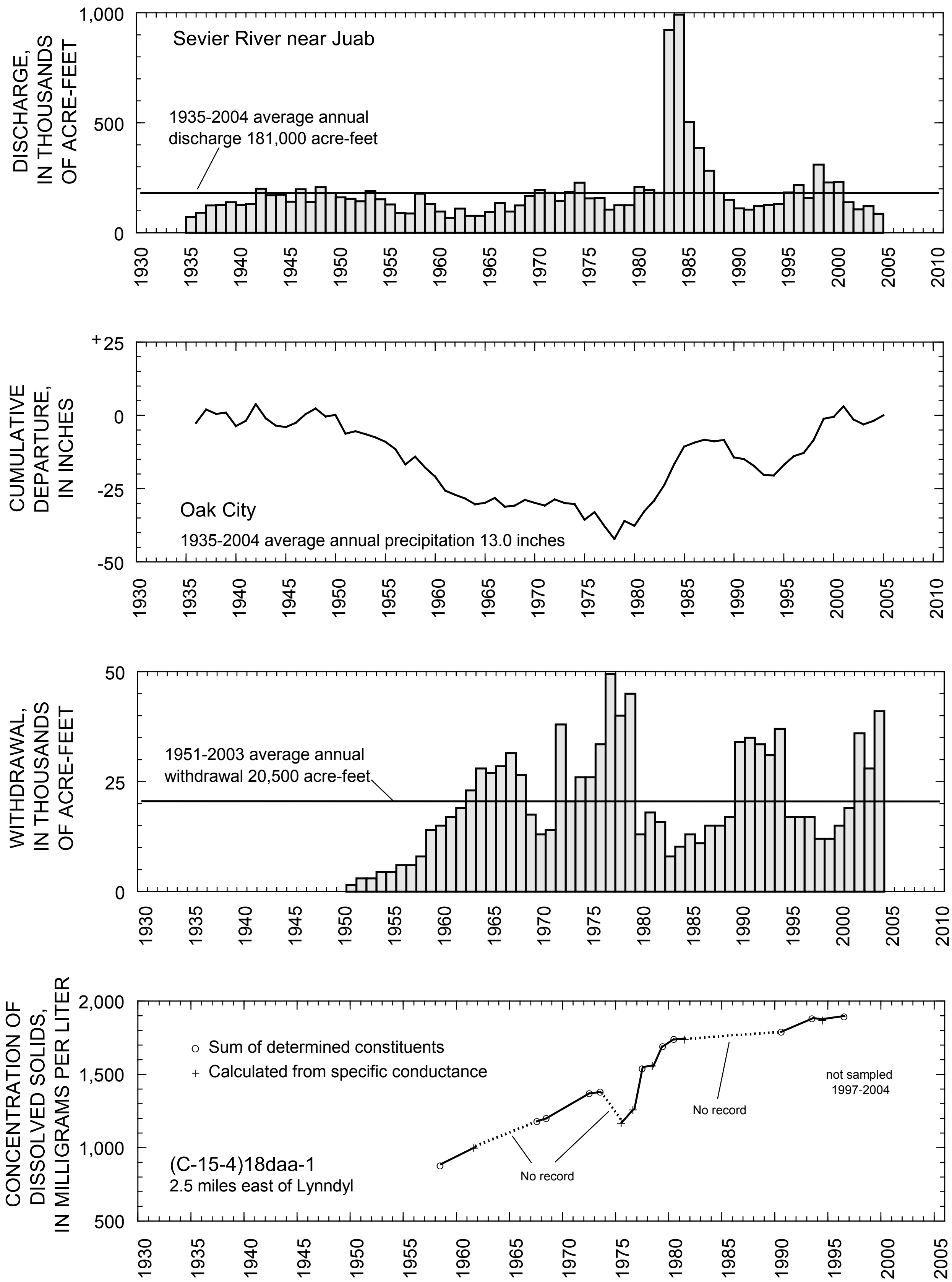


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)18daa-1—Continued.

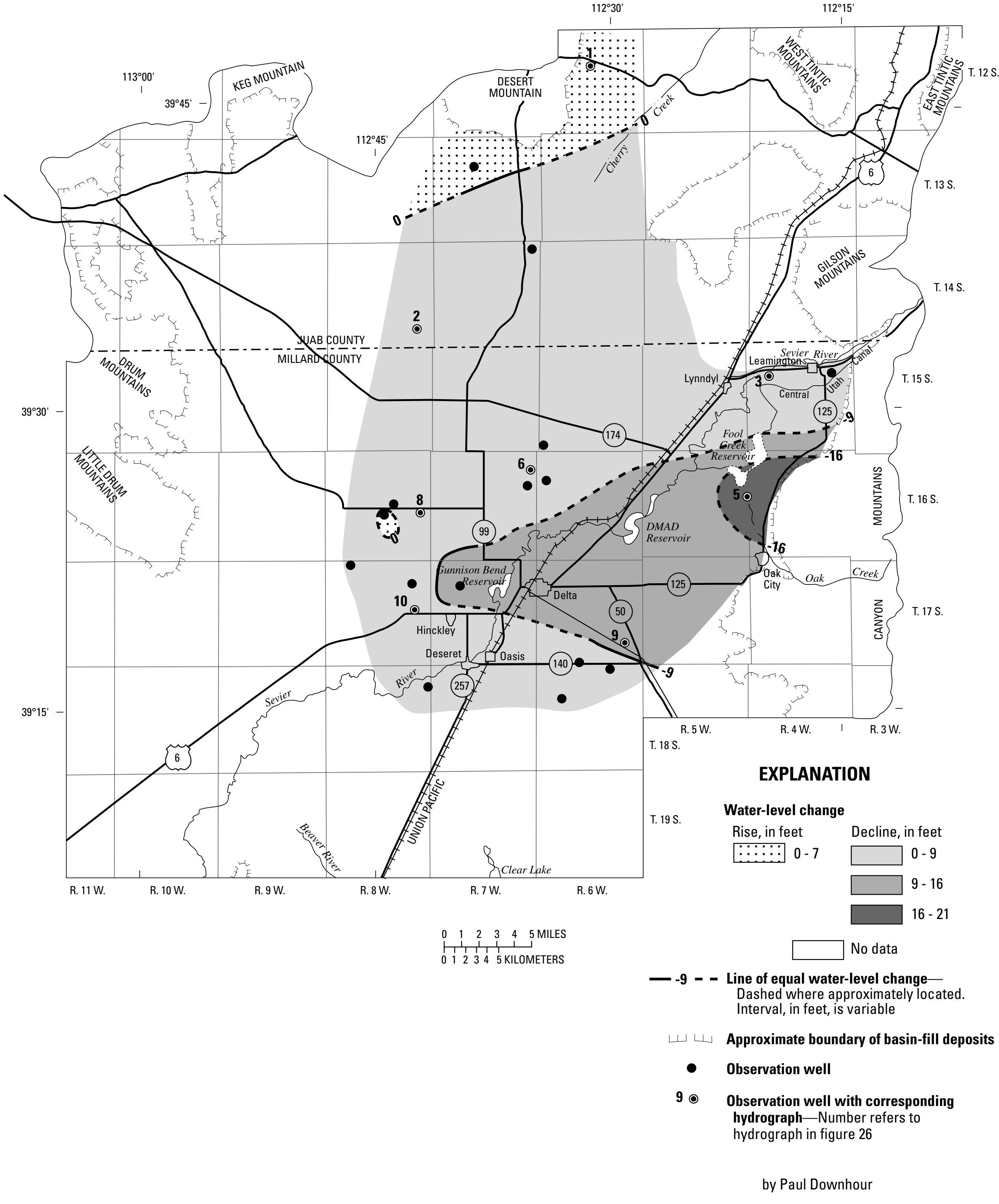


Figure 27. Map of Sevier Desert showing change of water level in the shallow artesian aquifer from March 1975 to March 2005.

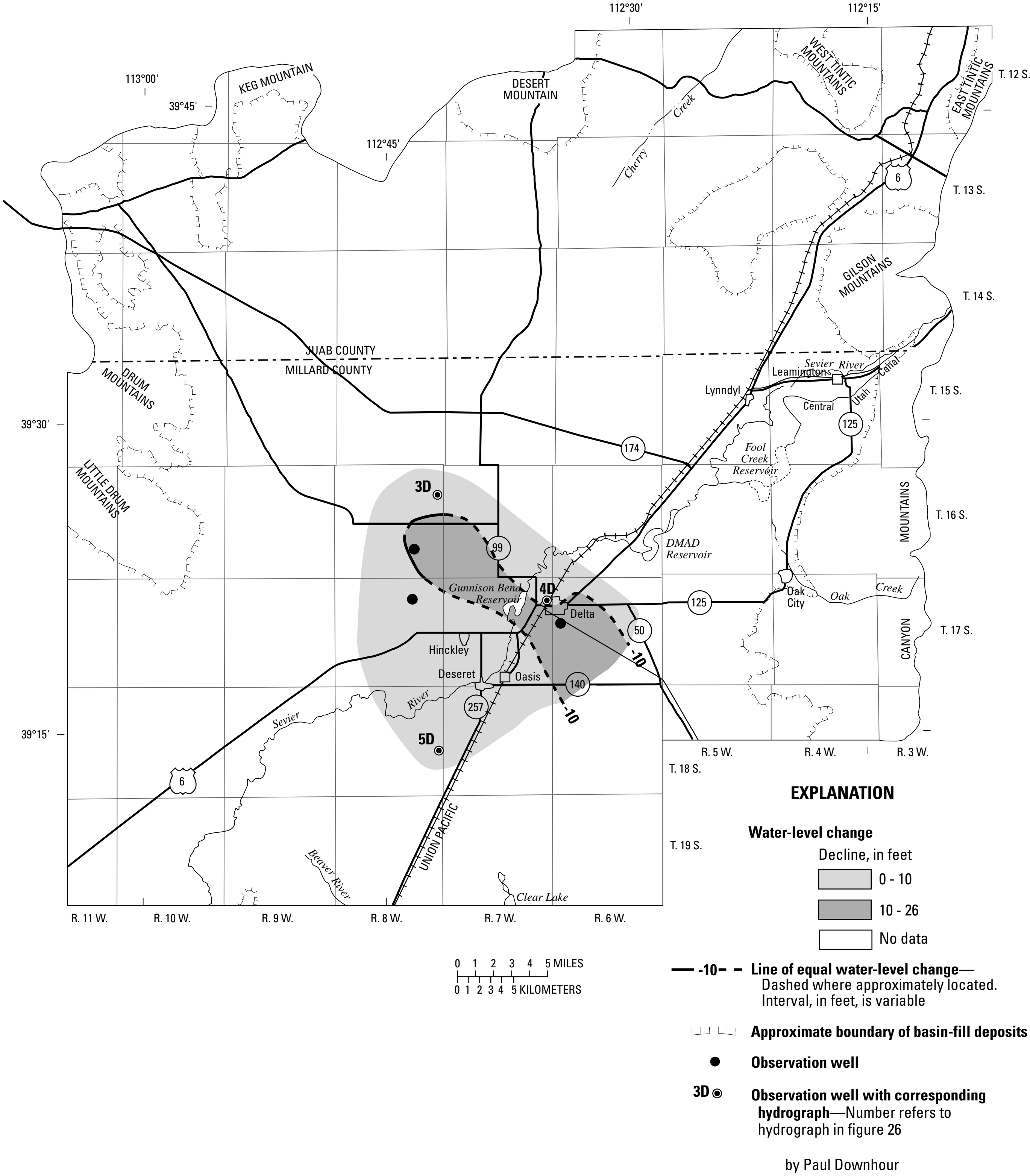


Figure 28. Map of Sevier Desert showing change of water level in the deep artesian aquifer from March 1975 to March 2005.

CENTRAL SEVIER VALLEY

By B.A. Slaugh

The central Sevier Valley is in south-central Utah, surrounded by the Sevier and Wasatch Plateaus to the east and the Tushar Mountains, Valley Mountains, and Pahvant Range to the west. Altitude ranges from 5,100 feet on the valley floor at the north end of the valley near Gunnison to about 12,000 feet in the Tushar Mountains.

Total estimated withdrawal of water from wells in the central Sevier Valley in 2004 was about 15,000 acre-feet, which is the same amount reported for 2003, and 2,000 acre-feet less than the average annual withdrawal for 1994-2003 (tables 2 and 3).

The location of wells in the central Sevier Valley in which the water level was measured during March 2005 is shown in figure 29. The relation of the water level in selected observation wells to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4 is shown in figure 30.

Water levels generally declined from March 2000 to March 2005 in the central Sevier Valley. Hydrographs for selected wells show that March water levels generally rose from about 1978 to 1985 and declined from 1985 to about 1993. Since 1993, water levels have fluctuated depending upon the amount and timing of precipitation and the potential for recharge from snowmelt runoff, but have declined since about 2000.

Water levels declined from March 1975 to March 2005 in most of the central Sevier Valley in areas where data are available (fig. 31). The greatest decline, about 18.1 feet, was observed in a well about 1 mile northeast of Richfield.

Discharge of the Sevier River at Hatch in 2004 was about 47,600 acre-feet. This is about 11,600 acre-feet more than the 36,000 acre-feet for 2003 and about 29,700 acre-feet less than the 1940-2004 average annual discharge.

Precipitation at Richfield was about 9.1 inches in 2004, which is about 1.0 inch more than the 1950-2004 average annual precipitation and about 2.2 inches more than in 2003. Concentration of dissolved solids in water from well (C-23-2)15dcb-4 decreased from about 600 milligrams per liter to about 400 milligrams per liter during 1987-95, which was about the concentration during 1955-59. The concentration of dissolved solids for 2004 was about 370 milligrams per liter.

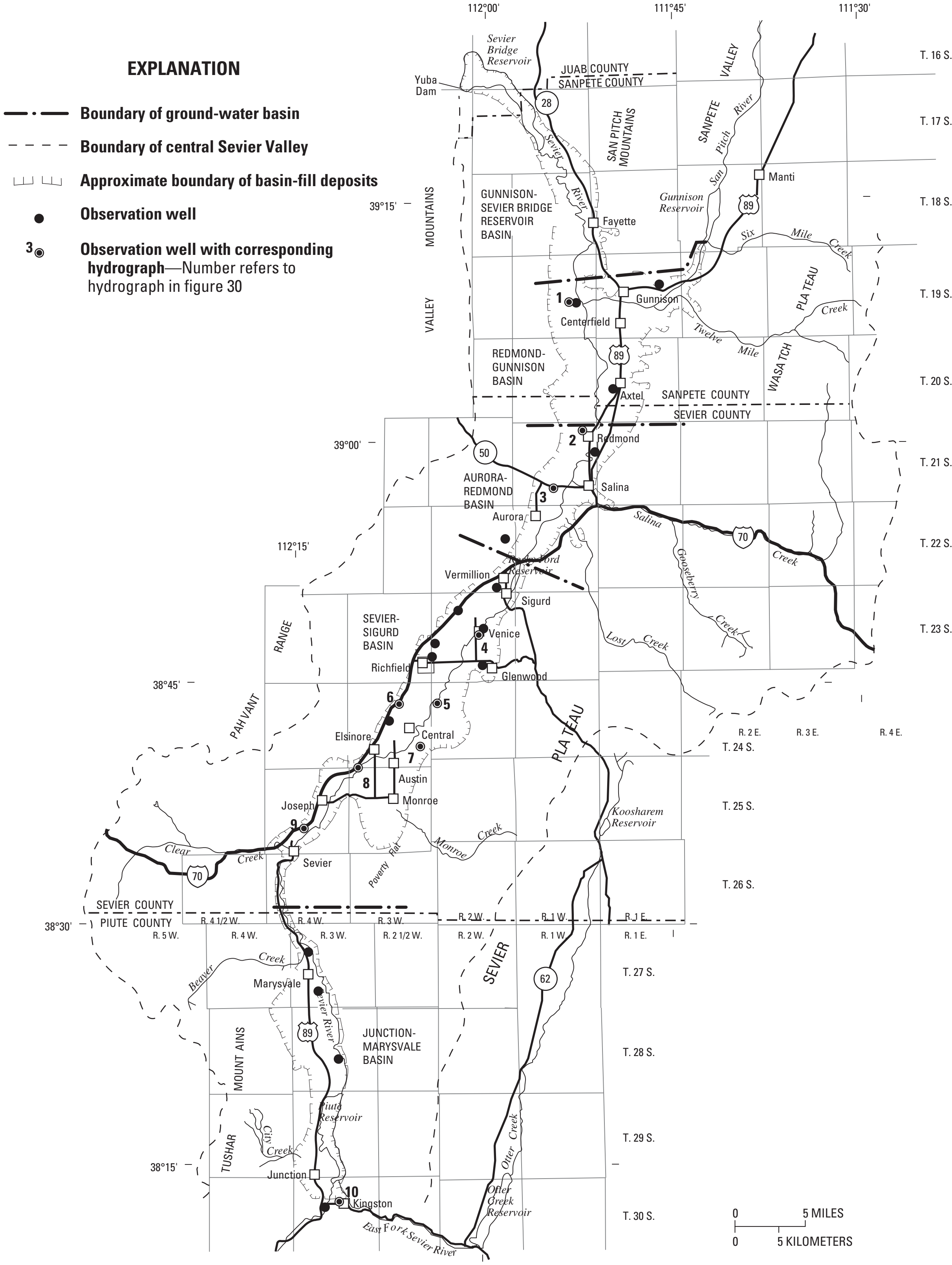


Figure 29. Location of wells in central Sevier Valley in which the water level was measured during March 2005.

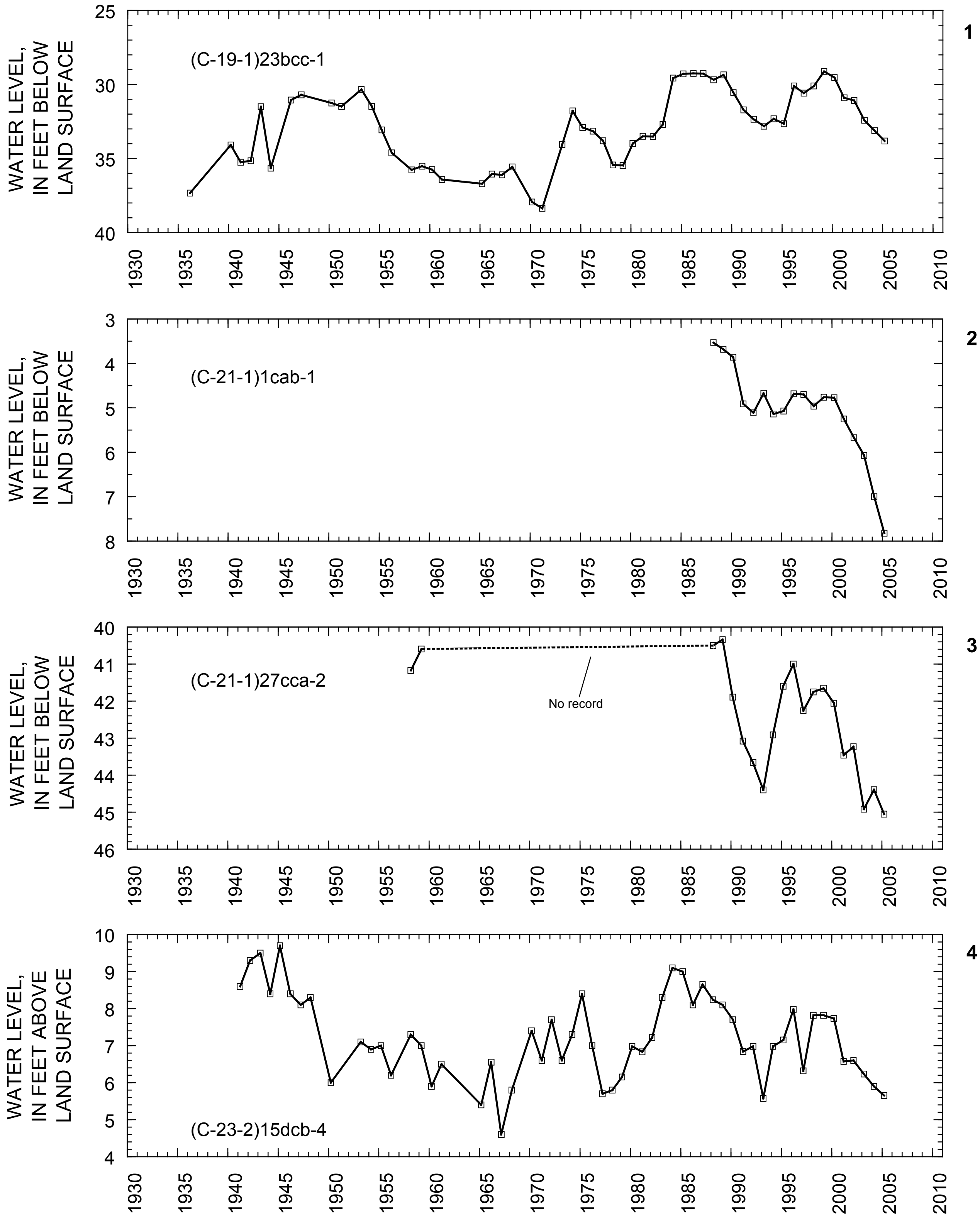


Figure 30. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4.

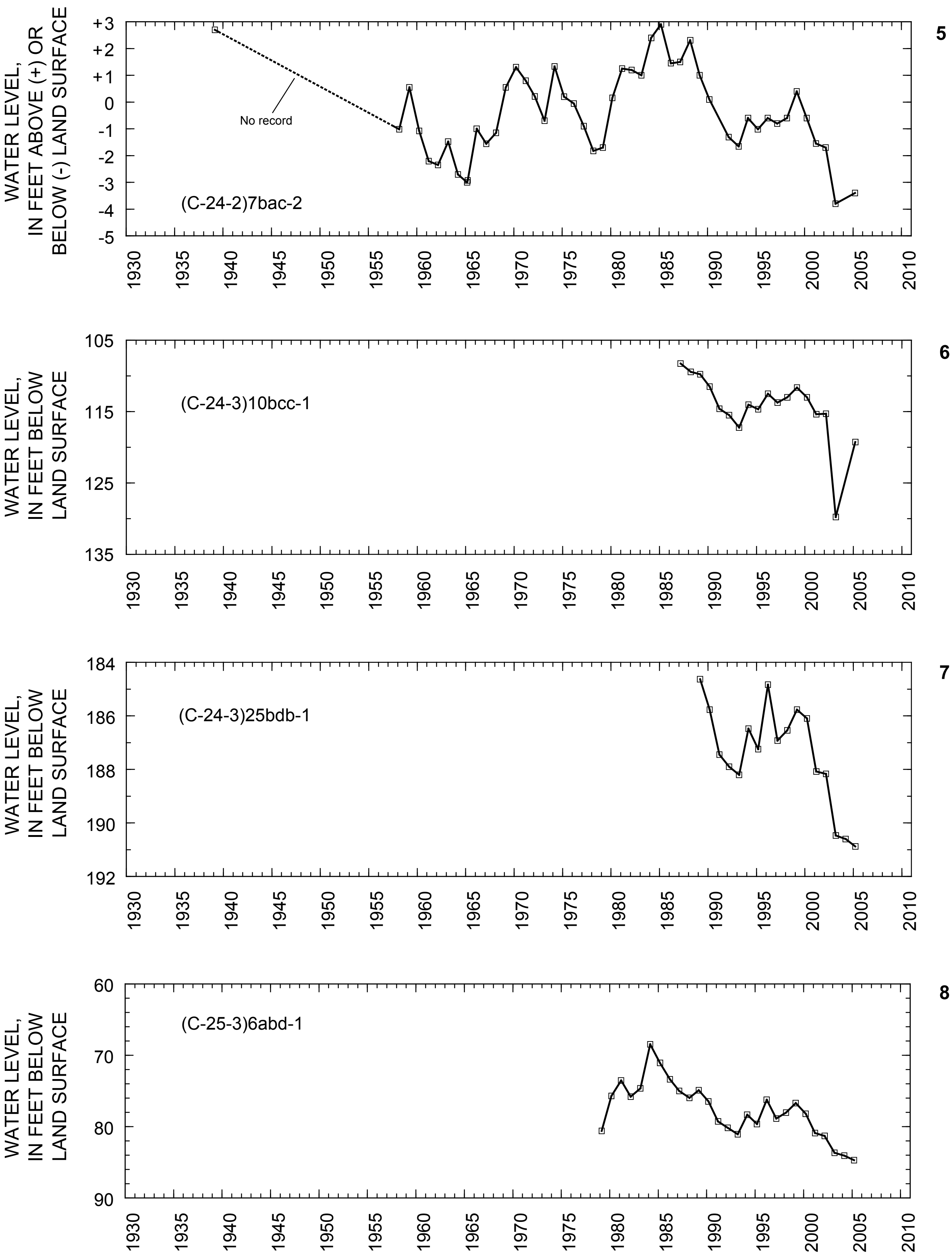
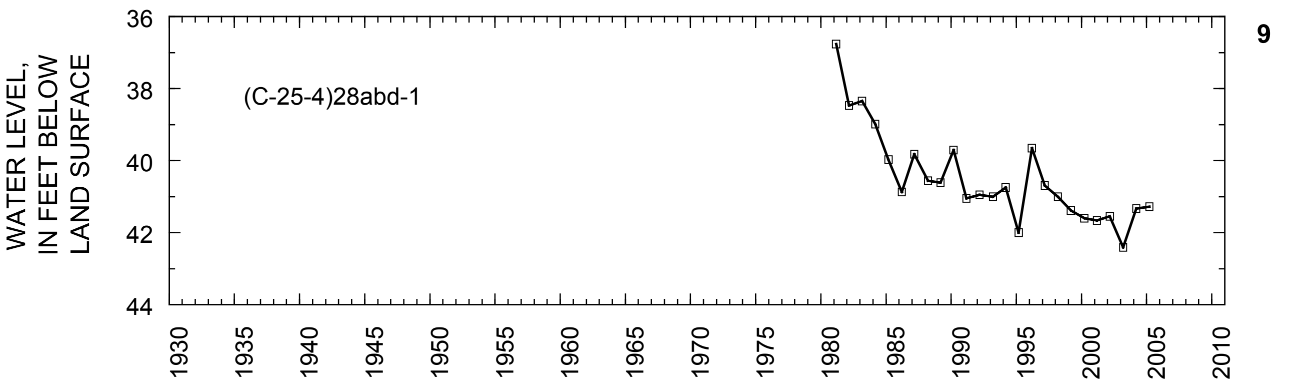


Figure 30. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4—Continued.



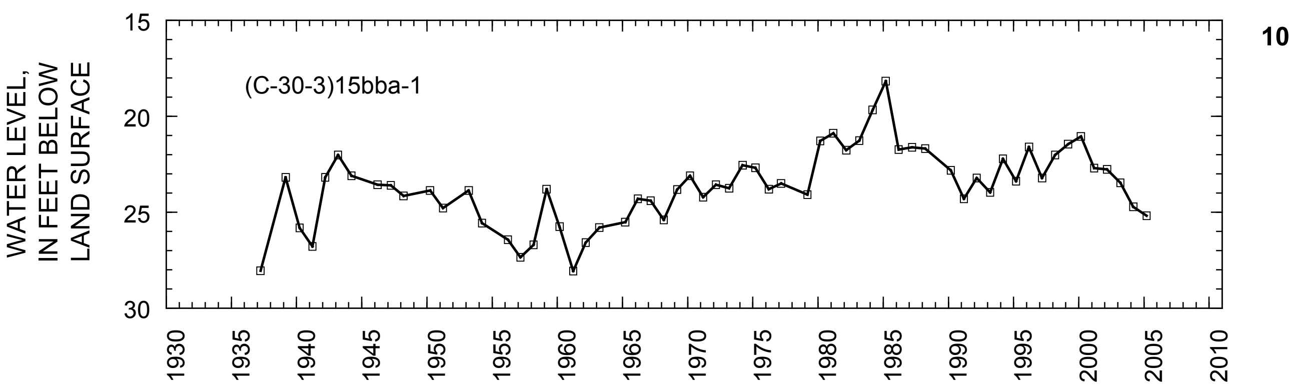


Figure 30. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4—Continued.

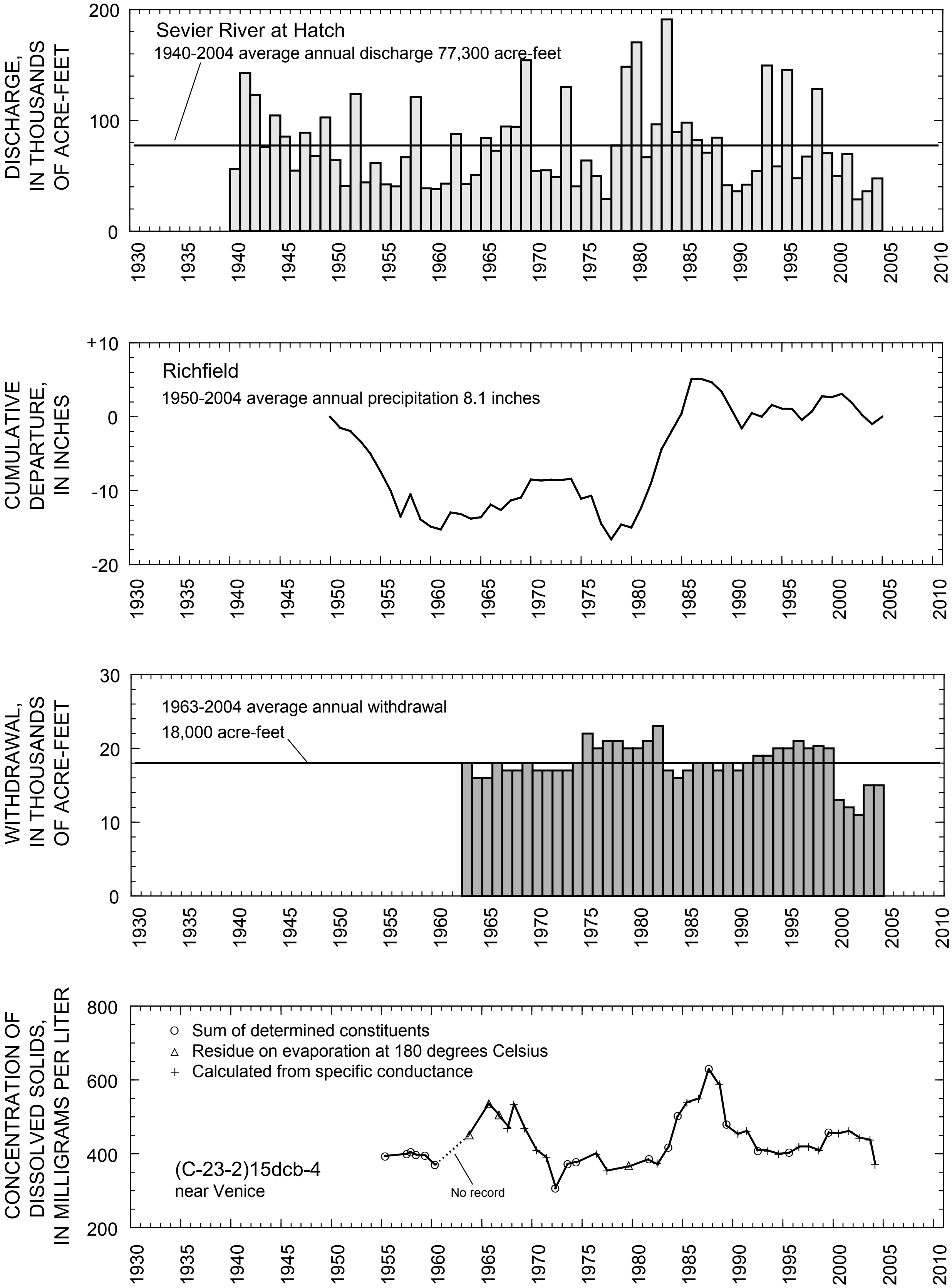


Figure 30. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4—Continued.

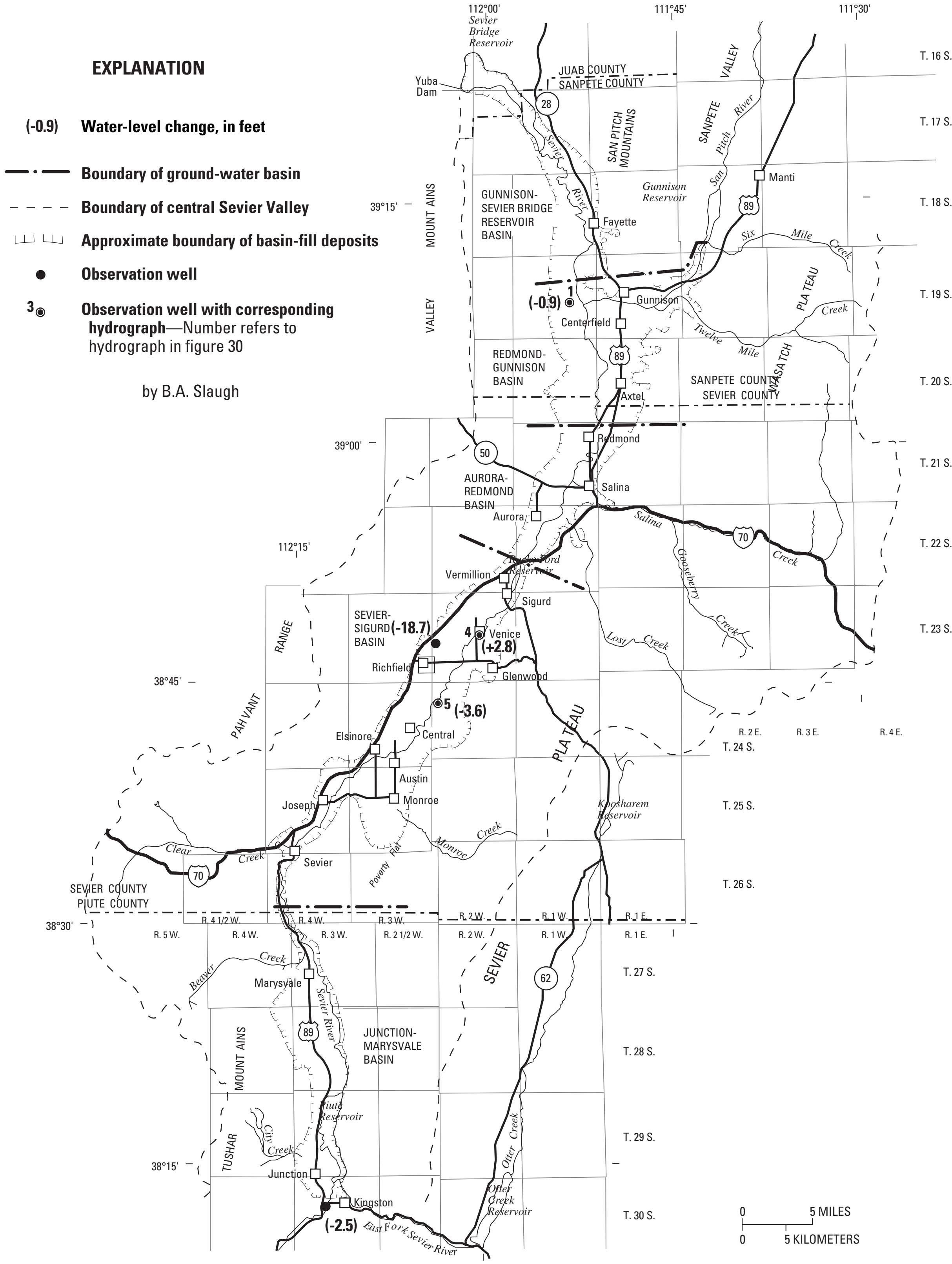


Figure 31. Map of central Sevier Valley showing change of water level from March 1975 to March 2005.

PAHVANT VALLEY

By R.L. Swenson

Pahvant Valley, in southeast Millard County, extends from the vicinity of McCornick on the north to Kanosh on the south, from the Pahvant Range and Canyon Mountains on the east and northeast to a low basalt ridge on the west. The area of the valley is about 300 square miles, and water drains to the valley from about 500 square miles of mountainous terrain. There is surface-water drainage from the southern part of the valley, south of the southern edge of Township 20 South. North of this line, the surface is an undulating plain covered with sand dunes from which there is little or no surface drainage.

Total estimated withdrawal of water from wells in Pahvant Valley in 2004 was about 85,000 acre-feet, which is about 1,000 acre-feet less than was reported in 2003 and 6,000 acre-feet more than the average annual withdrawal for 1994-2003 (tables 2 and 3). Withdrawal for irrigation in 2004 was about 84,000 acre-feet, which is 300 acre-feet less than was reported in 2003.

The location of wells in Pahvant Valley in which water levels were measured during March 2005 is shown in figure 32. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells is shown in figure 33.

Water levels generally declined in Pahvant Valley from March 2004 to March 2005. The declines probably are a result of decreased recharge and continued large withdrawals for irrigation. Local water-level rises were observed east of Holden, east and south of Hatton, and far west of Flowell. Water levels generally declined from the early 1950s until 1982 as a result of generally less-than-average precipitation and increased withdrawals. Water levels generally rose from 1982 to 1985 and generally were higher than in the early 1950s. The 1982-85 rises were the result of greater-than-average precipitation and decreased withdrawals for irrigation. Levels generally have declined since 1985 because of continued large withdrawals for irrigation.

Water levels from March 1975 to March 2005 generally declined throughout most of the valley with the exception of the southwestern part, where they rose (fig. 34). The declines probably are the result of continued large withdrawals. Declines of 70 feet or greater occurred east of McCornick. Rises in water levels occurred in the southwestern part of the valley. The largest rise, about 22 feet, occurred in a well southwest of Kanosh. Rises probably are the result of decreased local withdrawals.

Precipitation at Fillmore during 2004 was about 17.1 inches, which is about 2.0 inches more than the average annual precipitation for 1931-2004 and about 1.8 inches more than in 2003. The concentration of dissolved solids in water from wells near Flowell and west of Kanosh is shown in figure 33. The concentration of dissolved solids in water from well (C-21-5)7cdd-3, northwest of Flowell, has shown little change since 1983. The concentration of dissolved solids in water from well (C-23-6)8abd-1, west of Kanosh, generally has increased since the late 1950s.

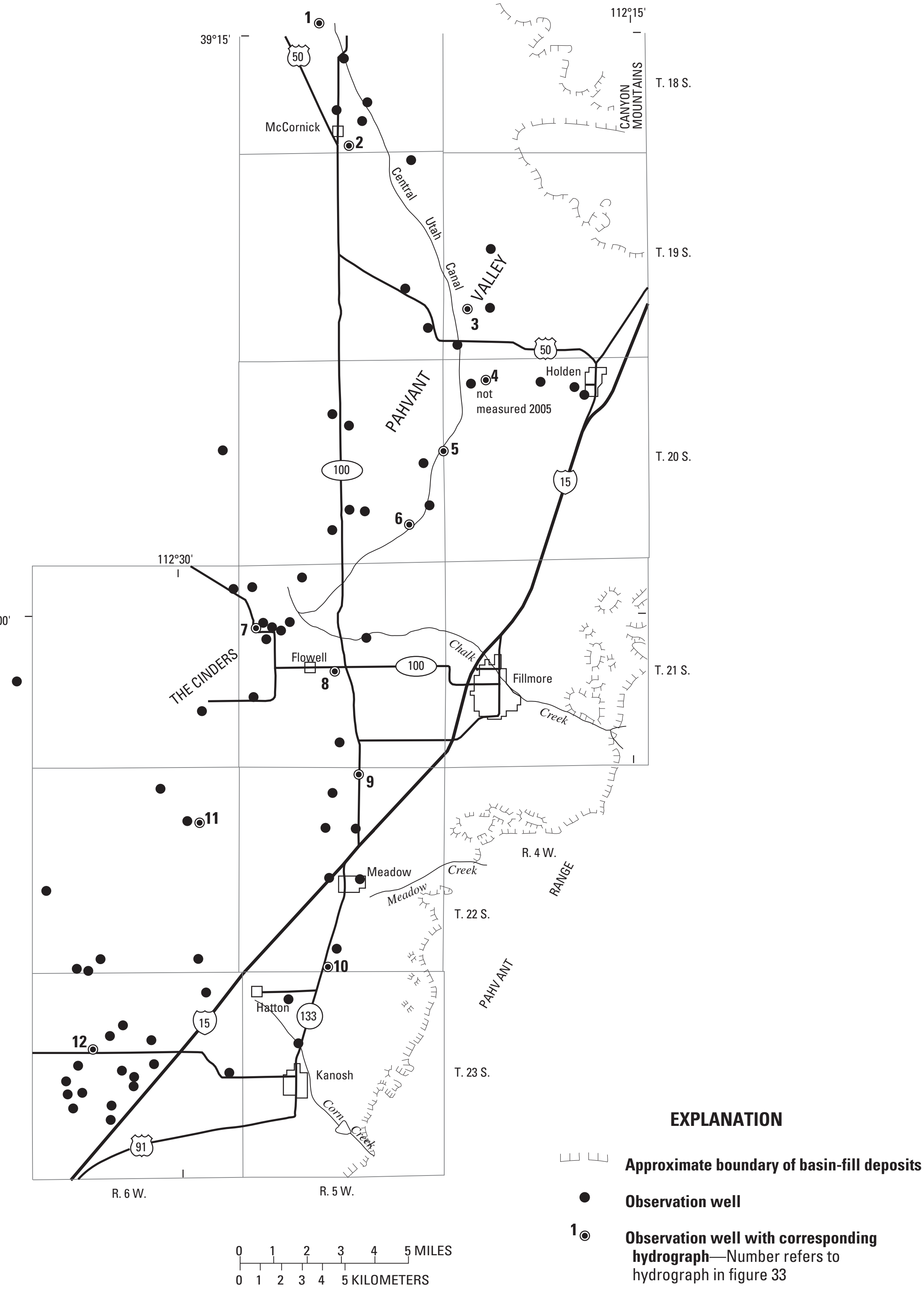


Figure 32. Location of wells in Pahvant Valley in which the water level was measured during March 2005.

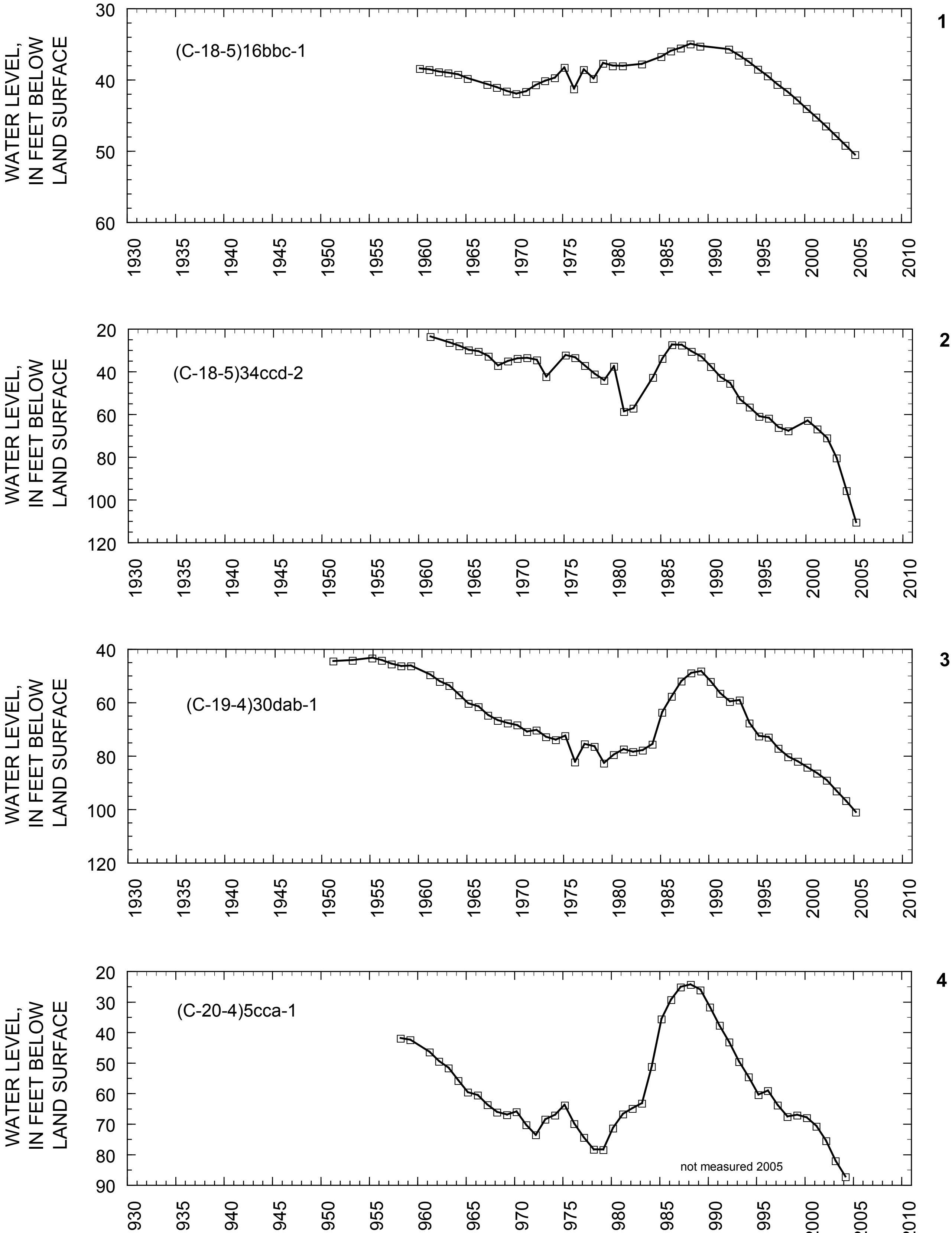


Figure 33. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

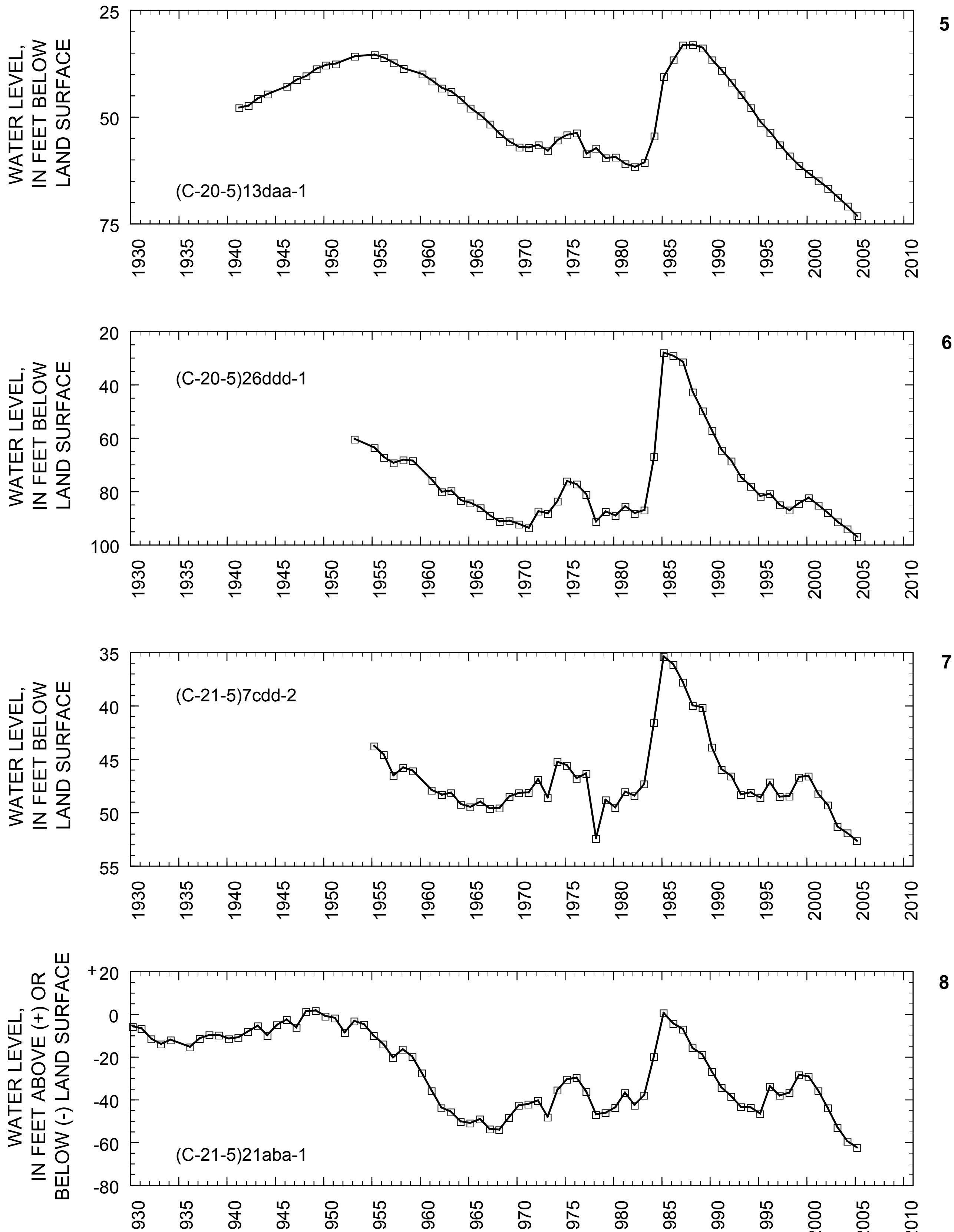
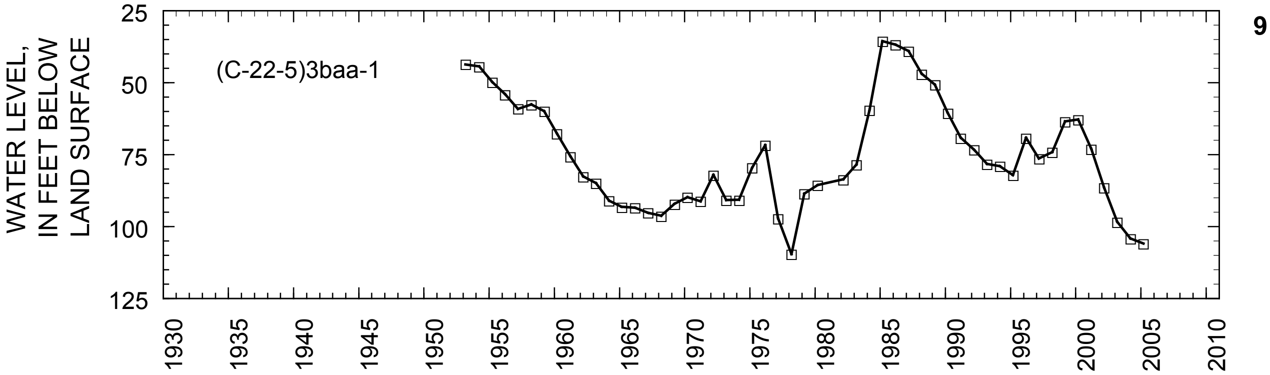
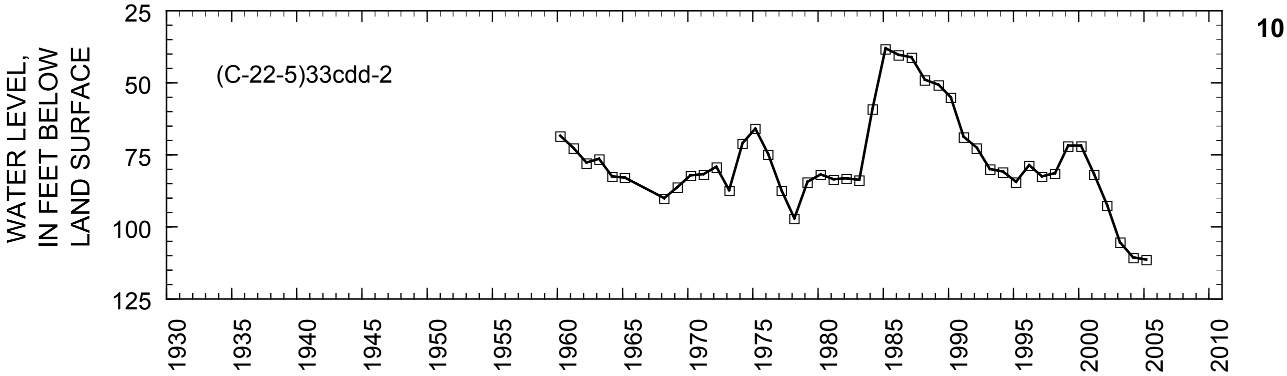
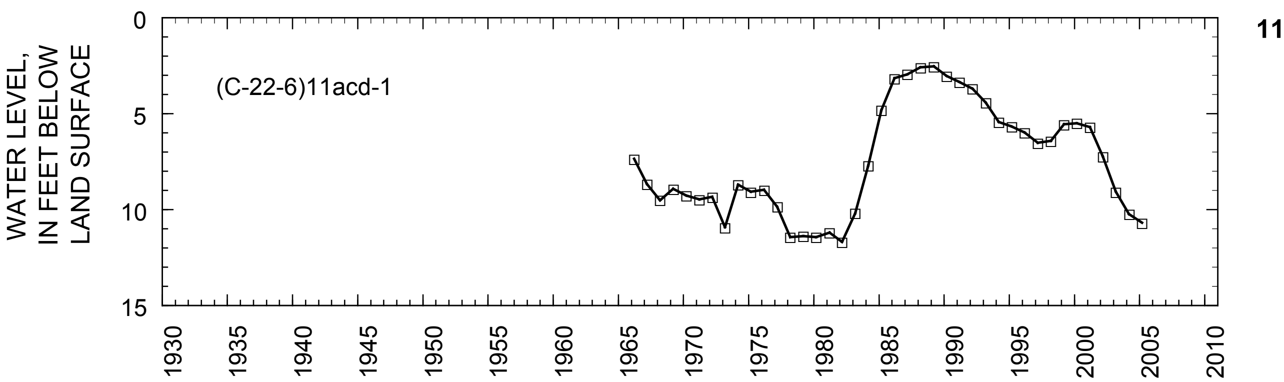


Figure 33. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells —Continued.







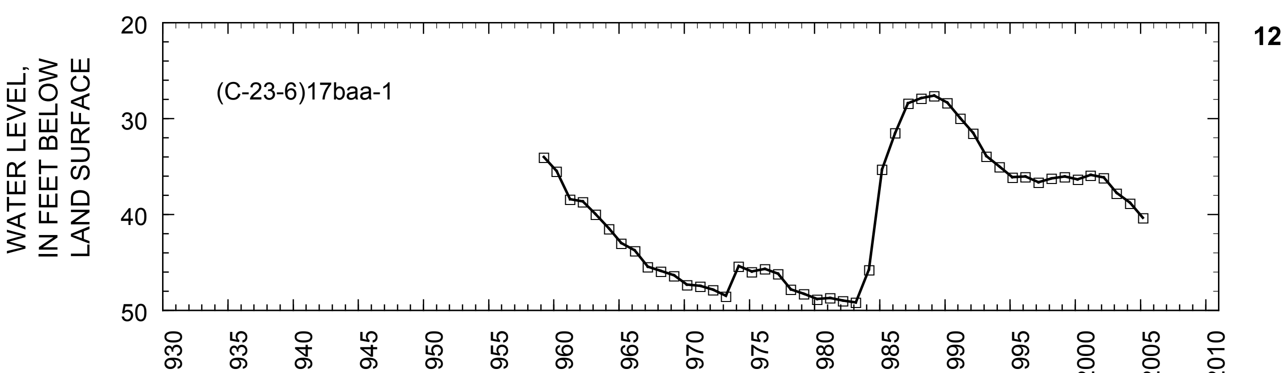


Figure 33. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

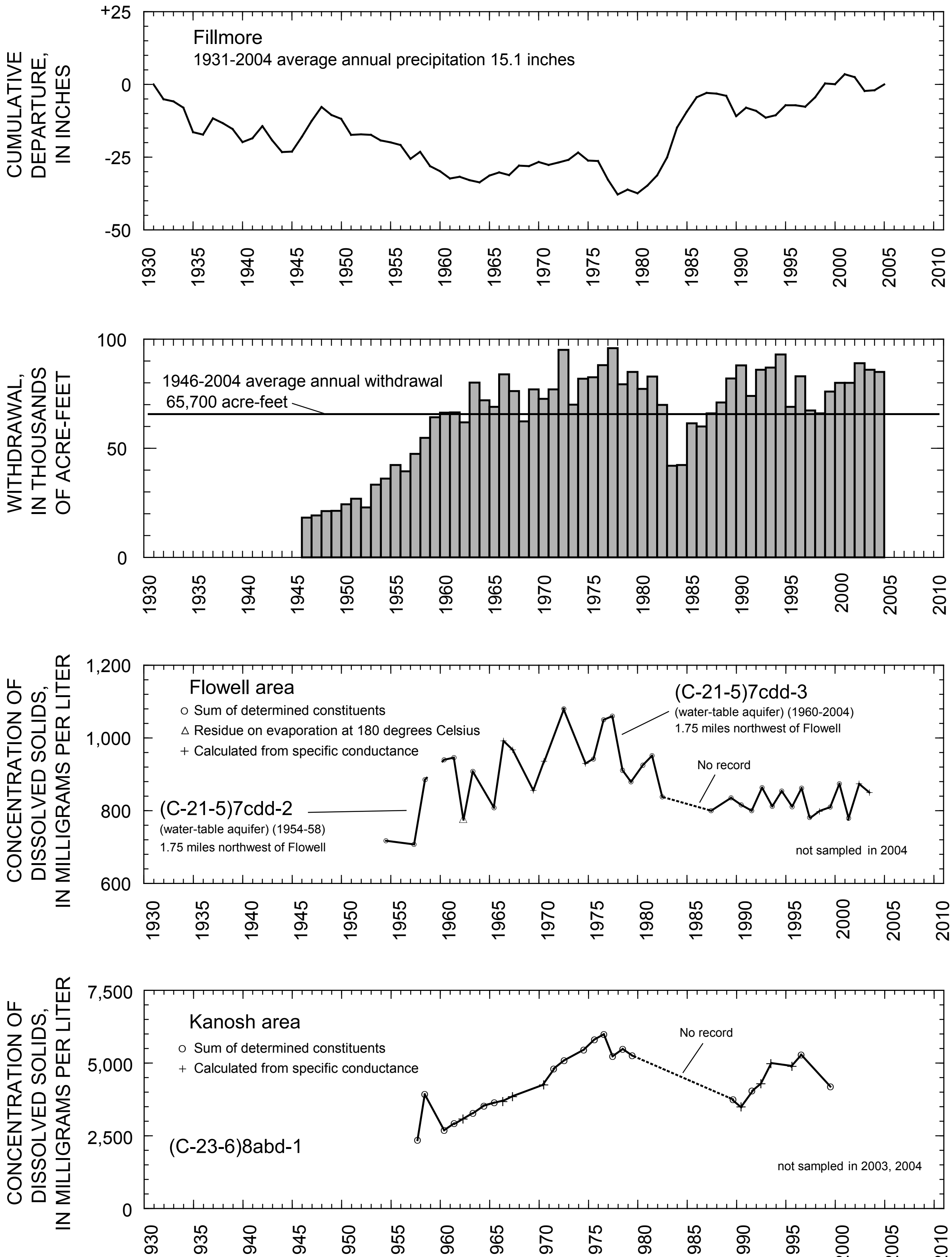


Figure 33. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

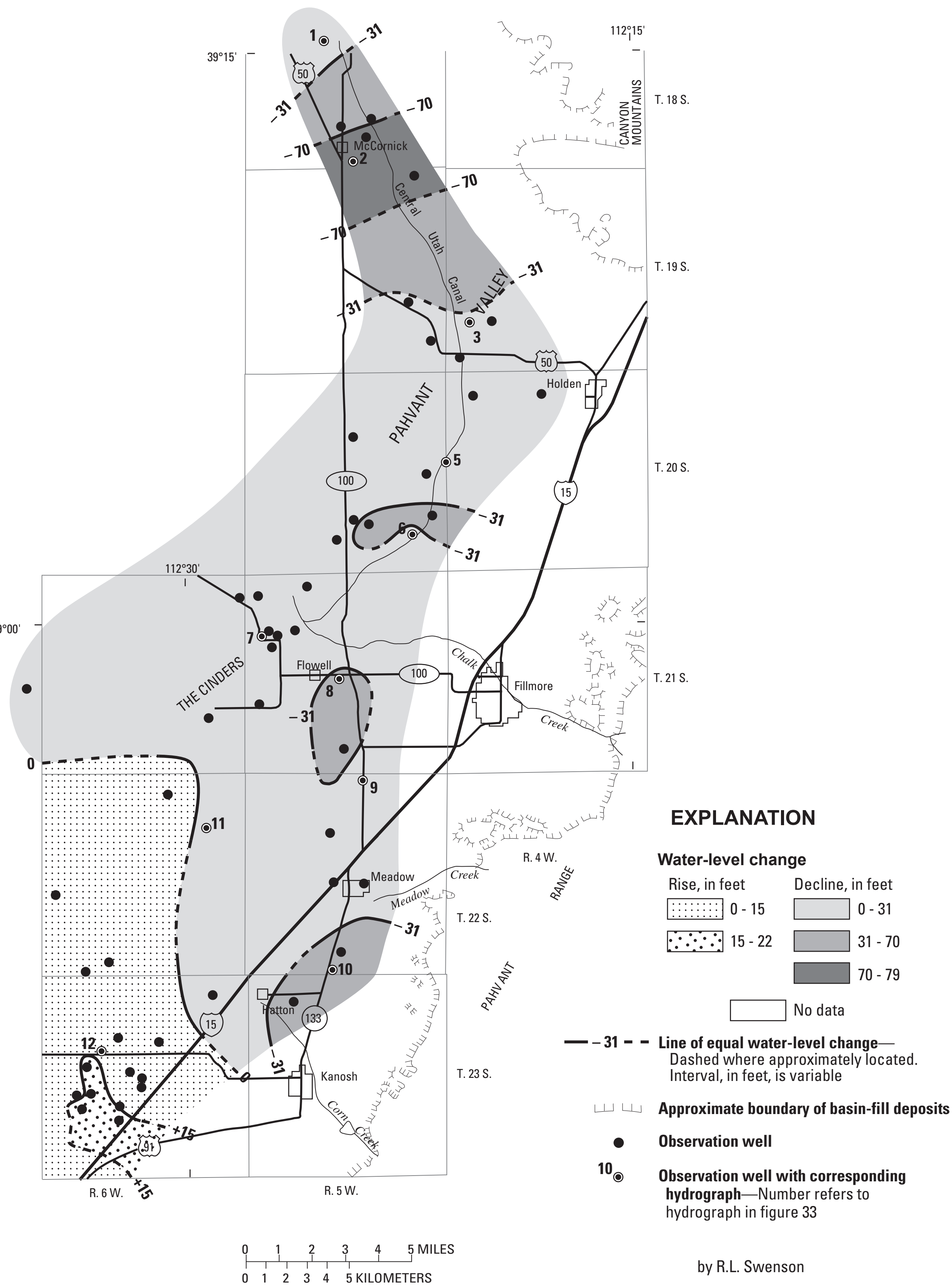


Figure 34. Map of Pahvant Valley showing change of water level from March 1975 to March 2005.

CEDAR VALLEY, IRON COUNTY

By J.H. Howells

Cedar Valley is in eastern Iron County, southwestern Utah. The valley covers about 170 square miles, from about Townships 34 South to 37 South and Ranges 10 West to 12 West. Ground water in Cedar Valley occurs in unconsolidated deposits, mostly under water-table conditions. The principal source of recharge to aquifers is water from Coal Creek, which seeps directly from the stream channel into the ground after being diverted for irrigation.

Total estimated withdrawal of water from wells in Cedar Valley in 2004 was about 40,000 acre-feet, which is about 1,000 acre-feet more than the value for 2003 and 5,000 acre-feet more than the average annual withdrawal for 1994-2003 (tables 2 and 3).

The location of wells in Cedar Valley, Iron County, in which the water level was measured during March 2005 is shown in figure 35. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells is shown in figure 36.

Ground-water levels generally declined from March 1999 to March 2005 in most of Cedar Valley. Water-level declines probably resulted from continued large withdrawals for irrigation and public supply. Water levels in wells in the northern part of Cedar Valley generally declined through 1992 and rose slightly during 1993-99. Water levels in the central and southern parts of the valley generally rose in the 1980s and generally have declined since 1989.

Precipitation at Cedar City Federal Aviation Administration Airport in 2004 was about 12.9 inches, which is about 3.8 inches more than in 2003 and about 2.2 inches more than the average annual precipitation for 1951-2004. The discharge of Coal Creek was about 19,700 acre-feet in 2004, which is 5,300 acre-feet more than in 2003, and 4,000 acre-feet less than the average annual discharge for 1936 and 1939-2004. The concentrations of dissolved solids in water from well (C-35-11)31dbd-1 ranged from about 350 to about 640 milligrams per liter.

Ground-water levels declined from March 1975 to March 2005 in most of Cedar Valley in areas for which data are available (fig. 37). The largest decline, about 36 feet, was observed in a well north of Enoch. The decline in water levels probably resulted from increased withdrawals for irrigation and public supply. A rise in water level occurred several miles northwest of Enoch.

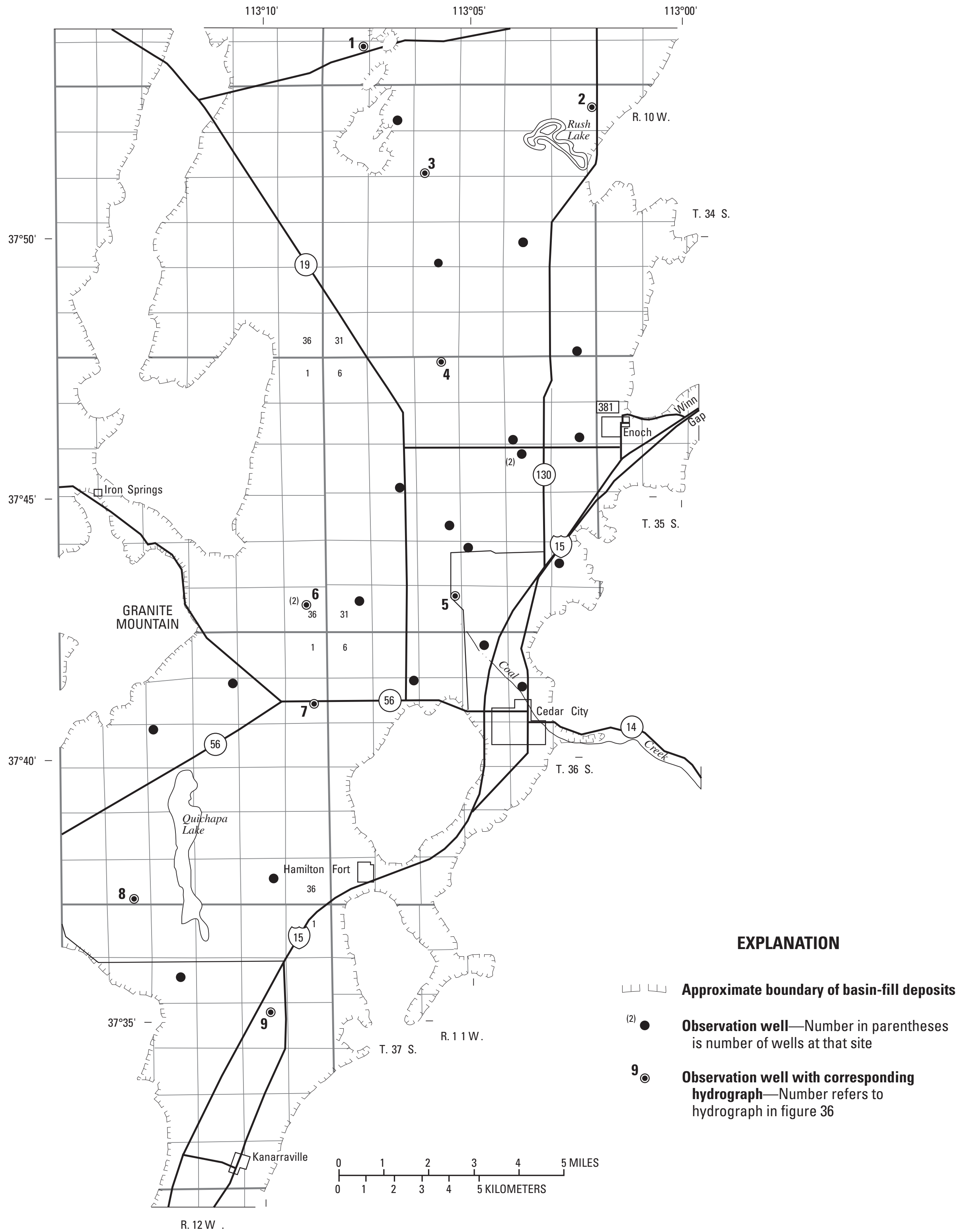


Figure 35. Location of wells in Cedar Valley, Iron County, in which the water level was measured during March 2005.

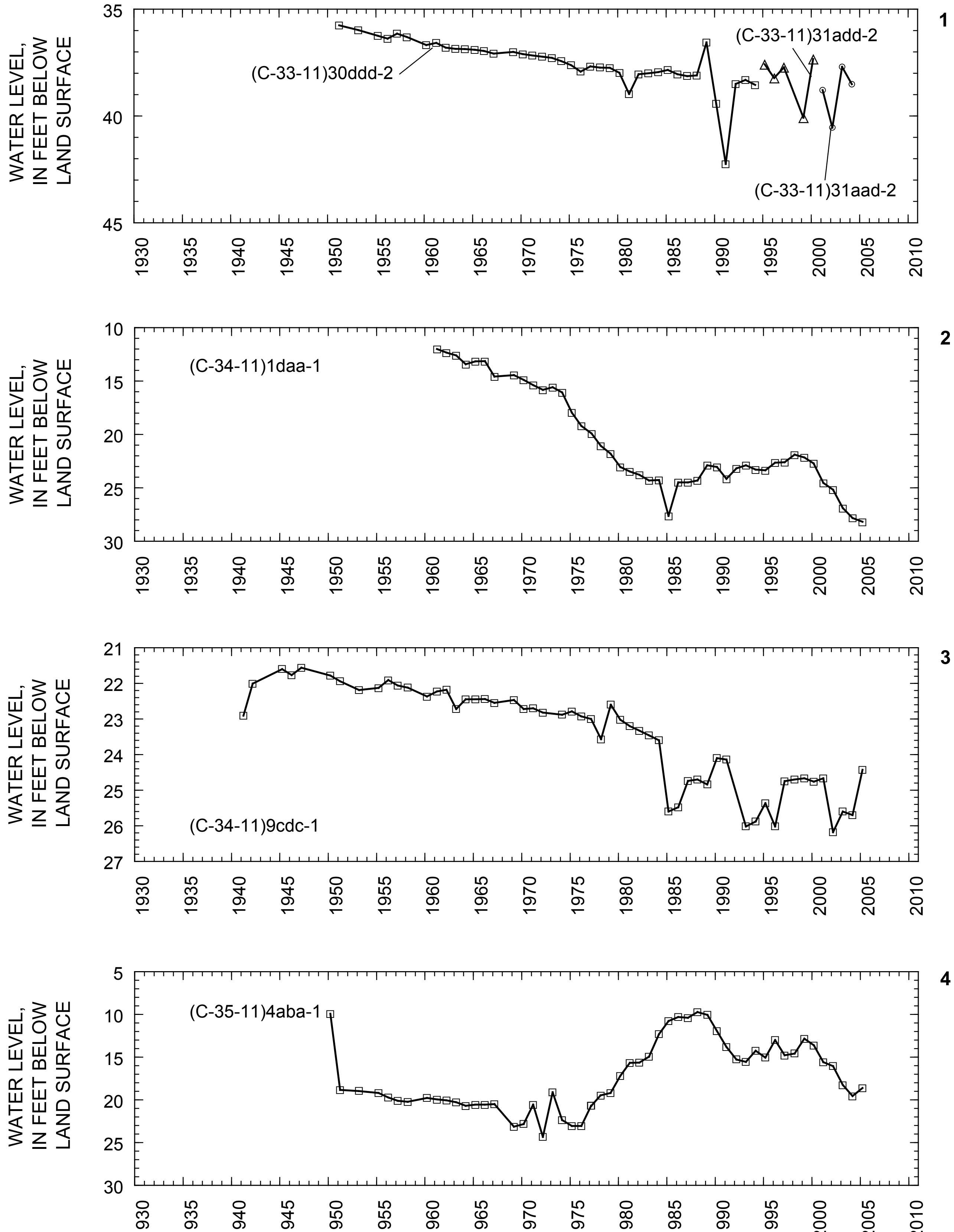


Figure 36. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

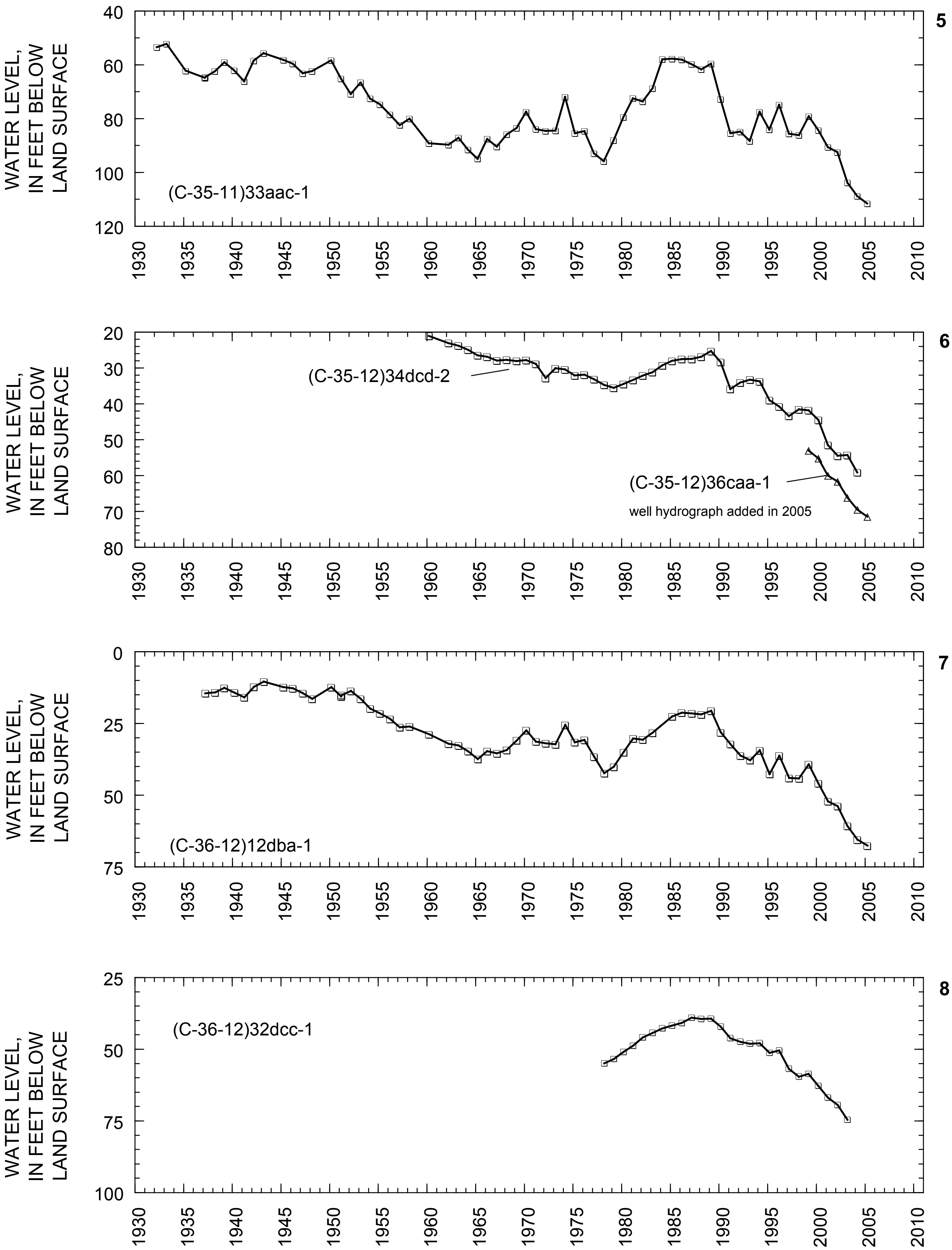


Figure 36. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

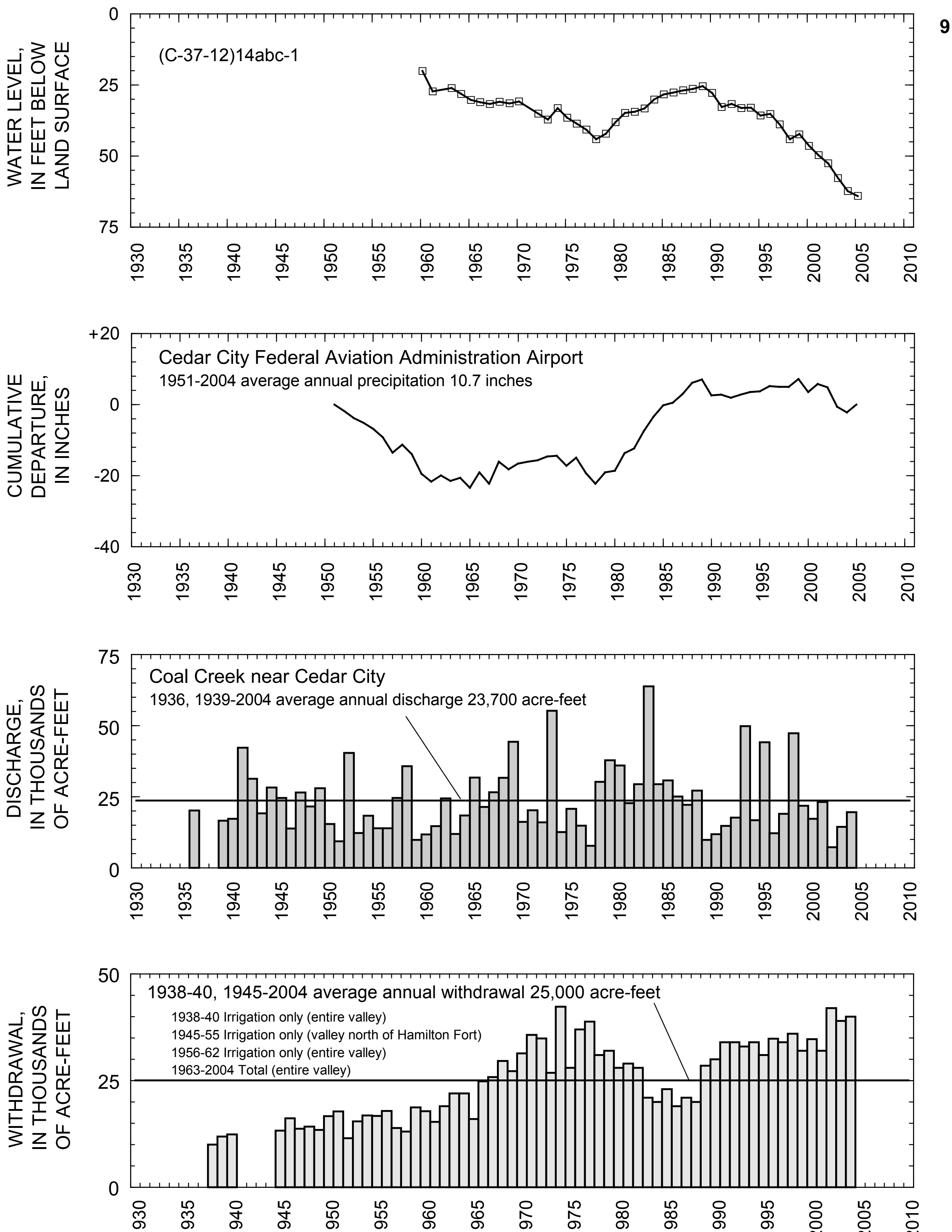


Figure 36. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

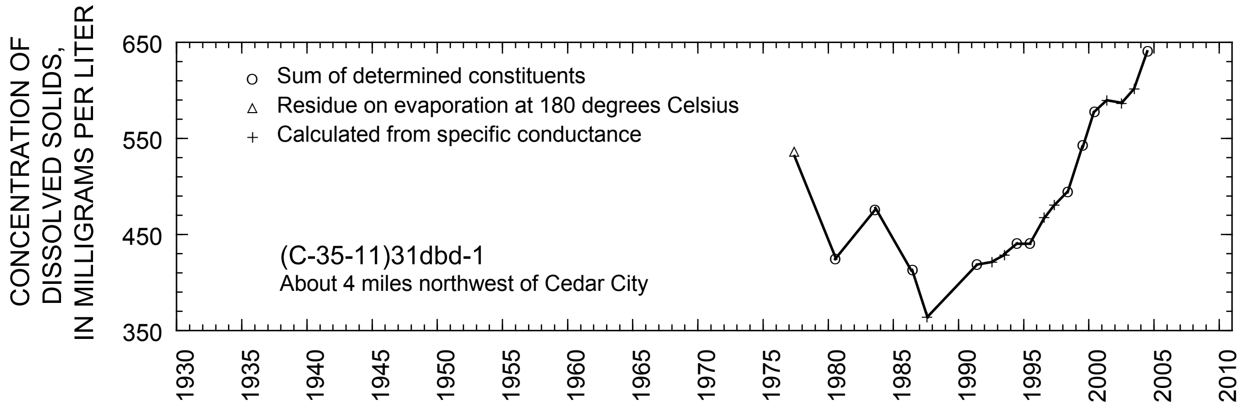


Figure 36. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

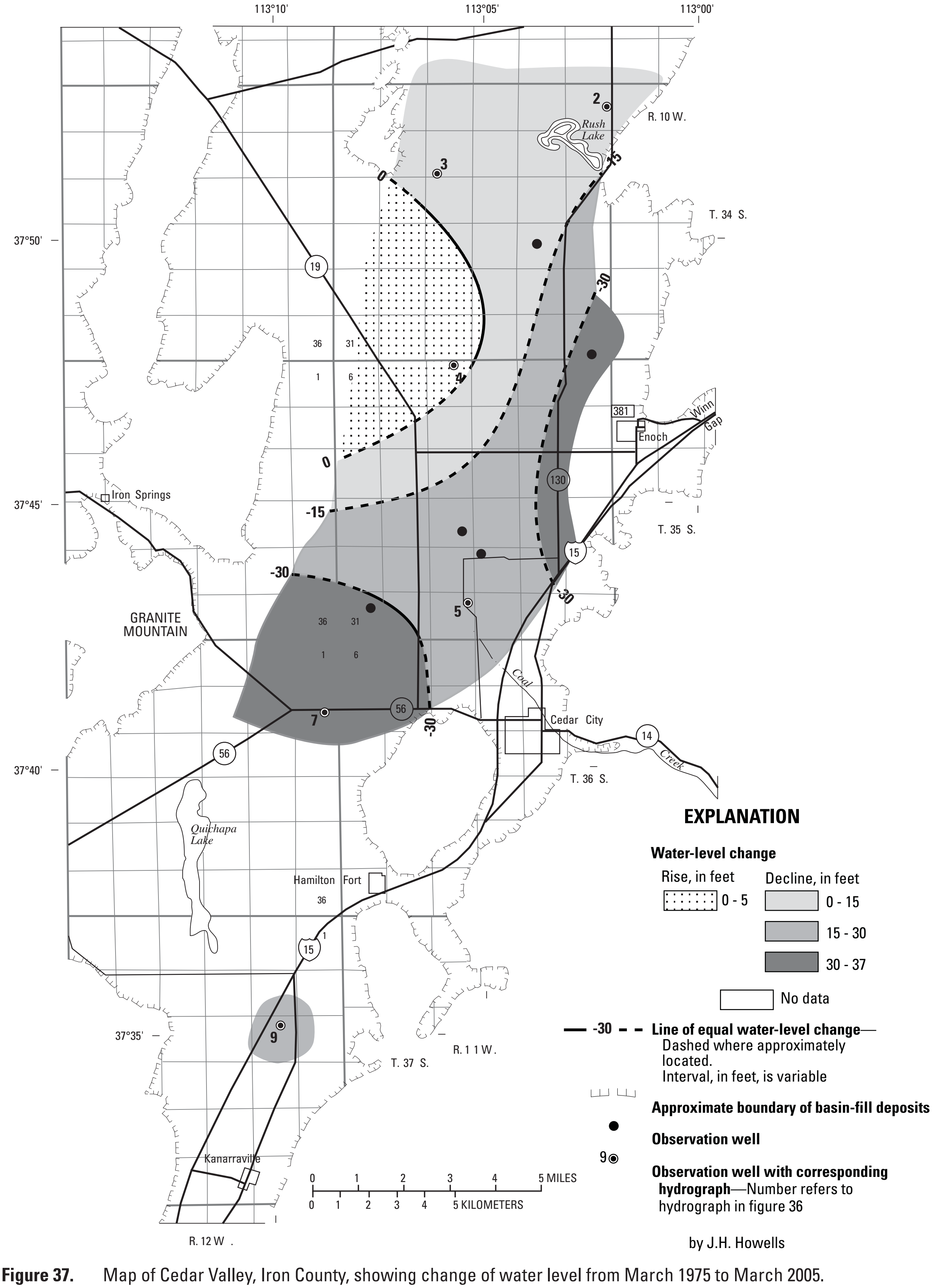


Figure 37. Map of Cedar Valley, Iron County, showing change of water level from March 1975 to March 2005.

PAROWAN VALLEY

By J.H. Howells

Parowan Valley is in northern Iron County, southwestern Utah. The valley covers about 160 square miles, between about Townships 32 South and 34 South and Ranges 7 West and 10 West. Ground water occurs in unconsolidated deposits under both water-table and artesian conditions.

Total estimated withdrawal of water from wells in Parowan Valley in 2004 was about 37,000 acre-feet, which is about 6,000 acre-feet more than was reported for 2003 and 7,000 acre-feet more than the average annual withdrawal for 1994-2003 (tables 2 and 3).

The location of wells in Parowan Valley in which the water level was measured during March 2005 is shown in figure 38. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1 is shown in figure 39.

Water levels declined from March 1999 to March 2005 in Parowan Valley. Declines probably resulted from continued large withdrawals for irrigation. Water levels in Parowan Valley generally have declined since 1950, although rises occurred during 1973-74, 1983-85, and 1996-99. The rises probably were the result of greater-than-average precipitation during those periods.

Precipitation at Cedar City Federal Aviation Administration Airport in 2004 was about 12.9 inches, which is about 2.2 inches more than the average annual precipitation for 1951-2004 and about 3.8 inches more than in 2003. The concentration of dissolved solids in water from well (C-33-8)31ccc-1 has shown little change since 1976 (fig. 39).

Water levels declined from March 1975 to March 2005 in all parts of Parowan Valley for which data are available (fig. 40). The largest decline, about 66 feet, occurred in a well northeast of Paragonah. The decline in water levels probably resulted from increased withdrawals for irrigation. Prior to 1975, annual withdrawals ranged from 7,000 to 30,000 acre-feet. Since 1975, withdrawals have ranged from 20,000 to 39,000 acre-feet.

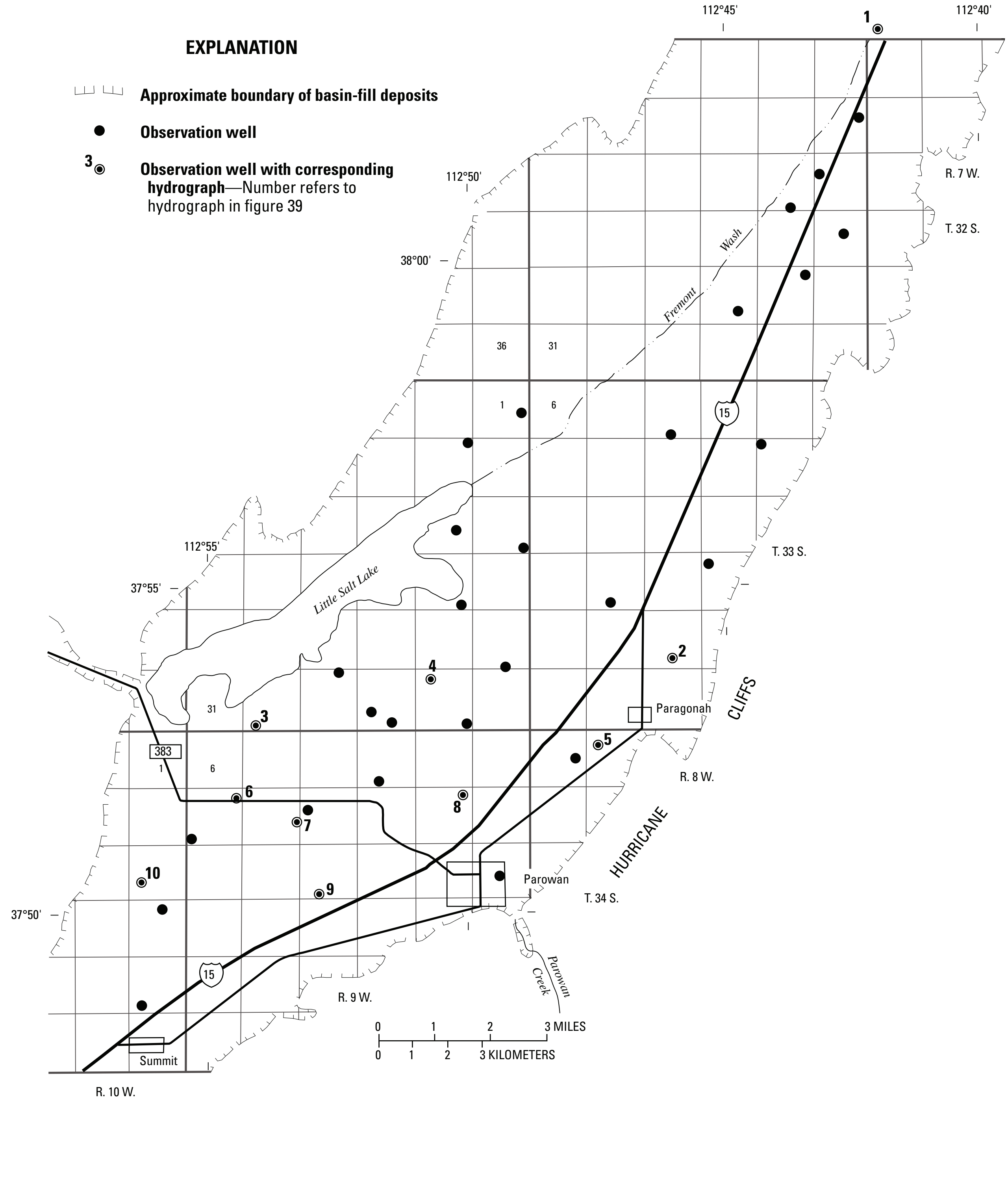


Figure 38. Location of wells in Parowan Valley in which the water level was measured during March 2005.

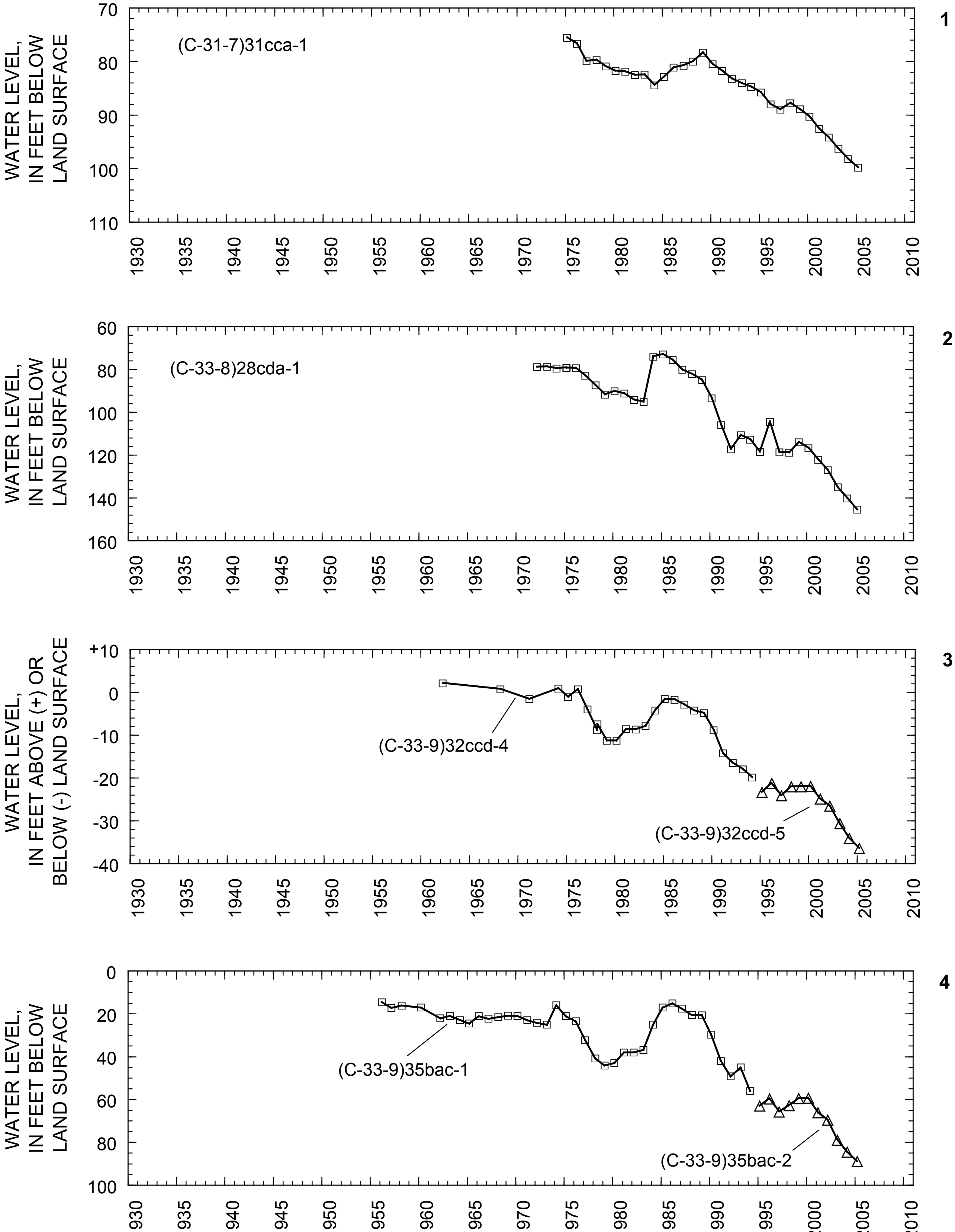


Figure 39. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1.

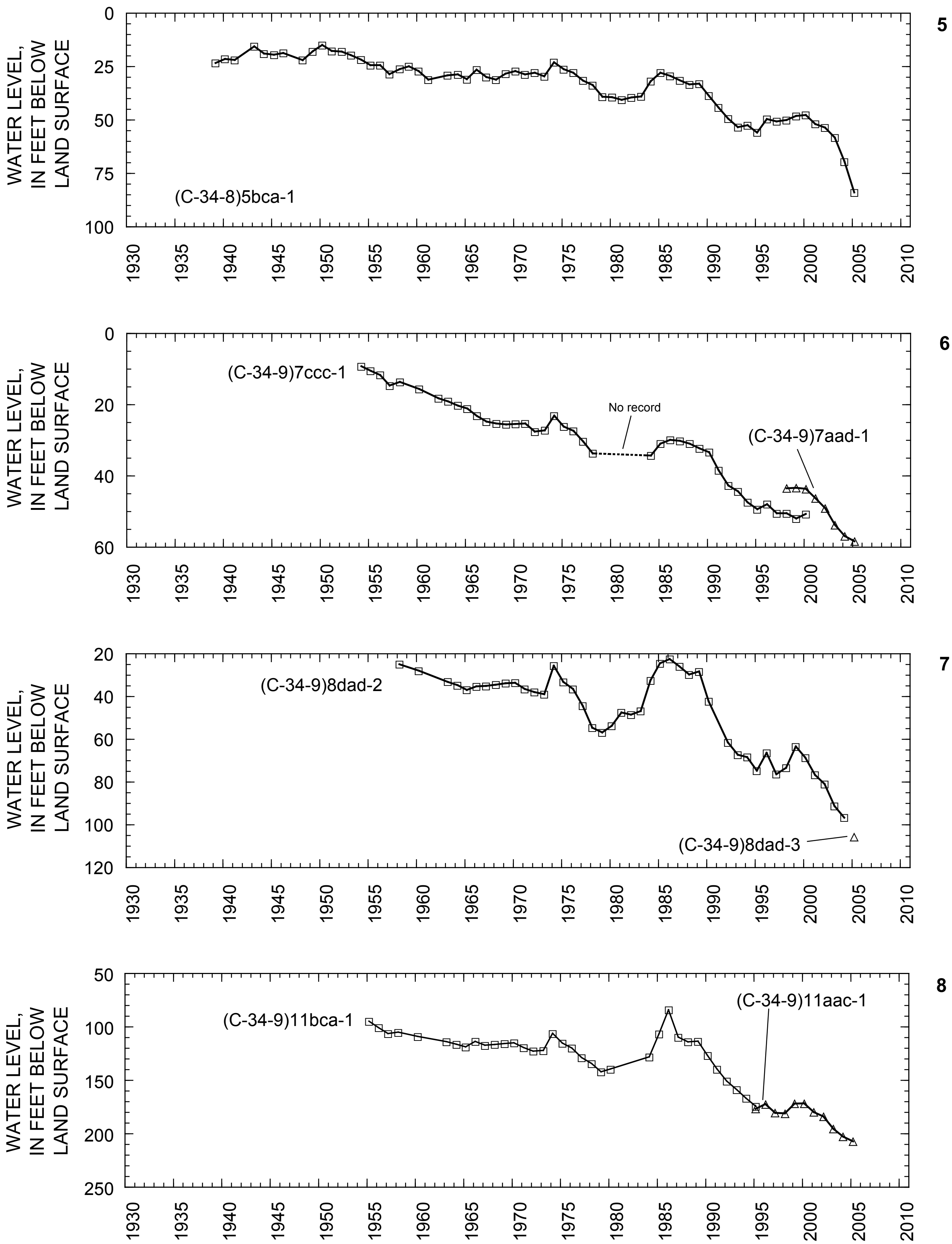
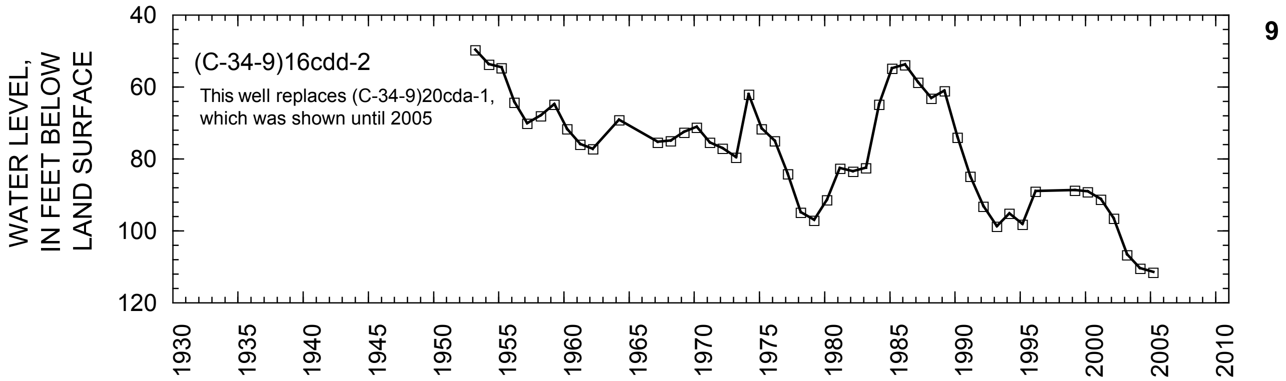


Figure 39. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1—Continued.



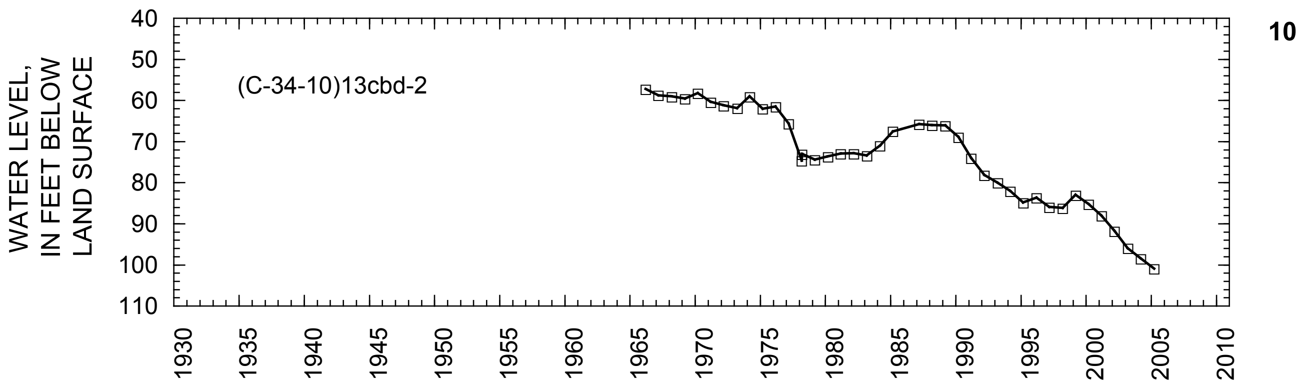


Figure 39. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1—Continued.

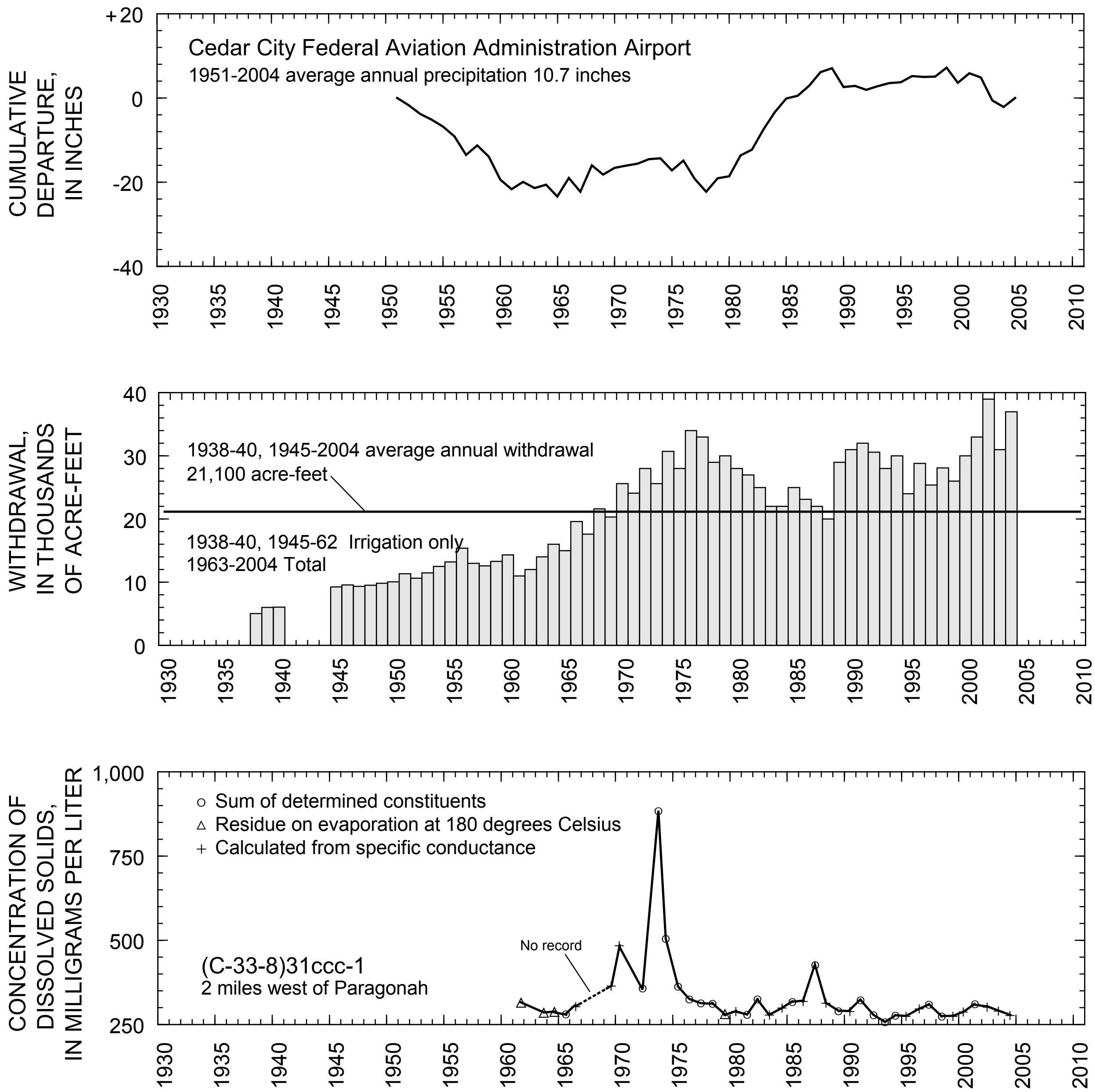


Figure 39. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1—Continued.

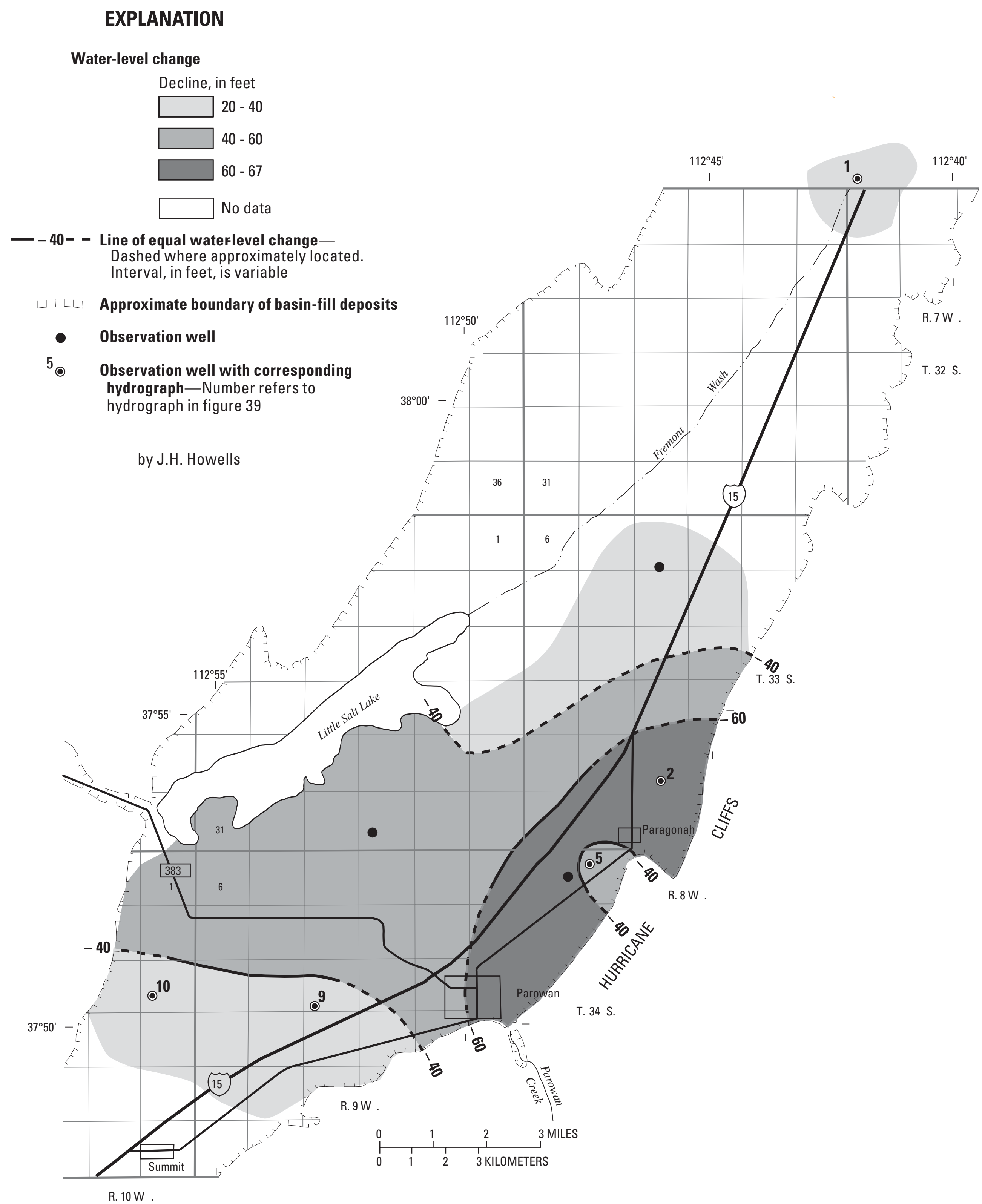


Figure 40. Map of Parowan Valley showing change of water level from March 1975 to March 2005.

ESCALANTE VALLEY

Milford Area

By B.A. Slaugh

The Milford area is in southwestern Utah in parts of Millard, Beaver, and Iron Counties, between about Townships 24 South and 31 South and Ranges 9 West and 14 West.

Total estimated withdrawal of water from wells in the Milford area of the Escalante Valley in 2004 was about 44,000 acre-feet, which is 6,000 acre-feet less than was reported for 2003 and 5,000 acre-feet less than the average annual withdrawal for 1994-2003 (tables 2 and 3). The decrease in withdrawals was mostly the result of decreased irrigation.

The location of 32 wells measured in the Milford area during March 2005 is shown in figure 41. The relation of the water level in selected observation wells to cumulative departure from the average annual precipitation at Black Rock, to annual discharge of the Beaver River at Rocky Ford Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-28-11)25dcd-1 is shown in figure 42.

Water levels generally have declined since the early 1950s in the south-central Milford area in response to the long-term effects of ground-water withdrawals. Water-level rises during 1983-85 resulted from greater-than-average precipitation during 1982-85 and increased recharge from record flow in the Beaver River during 1983-84.

Water levels generally declined from March 1975 to March 2005 throughout the Milford area in areas where data are available (fig. 43). The greatest decline, about 41 feet, was observed approximately 4 miles southeast of Milford.

Precipitation at Black Rock in 2004 was about 10.3 inches, about 3.5 inches more than in 2003 and about 1.3 inches more than the 1952-2004 average annual precipitation.

Discharge of the Beaver River at Rocky Ford Dam, near Minersville, in 2004 was about 8,500 acre-feet, which is 19,700 acre-feet less than the 1931-35, 1938-2004 average annual discharge. A gage operated for 89 years on the Beaver River at Rocky Ford Dam, near Minersville, was discontinued in 2003. Reservoir-release data are now provided by the State of Utah.

From 1950 to 1983, the concentration of dissolved solids in water from well (C-28-11)25dcd-1 increased from about 500 to almost 2,000 milligrams per liter. Since 1983, concentrations have decreased to about 560 milligrams per liter in 2004.

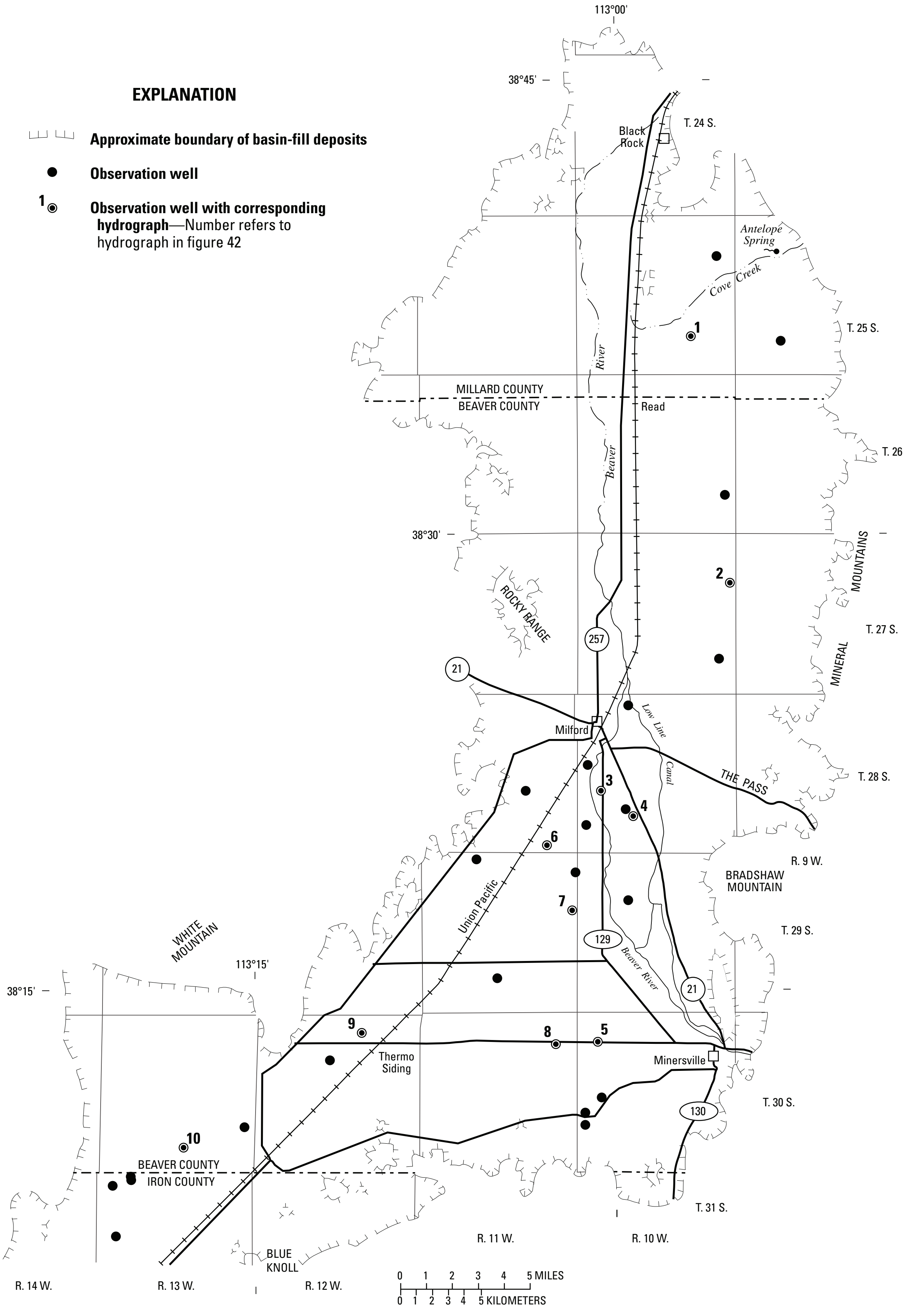


Figure 41. Location of wells in the Milford area in which the water level was measured during March 2005.

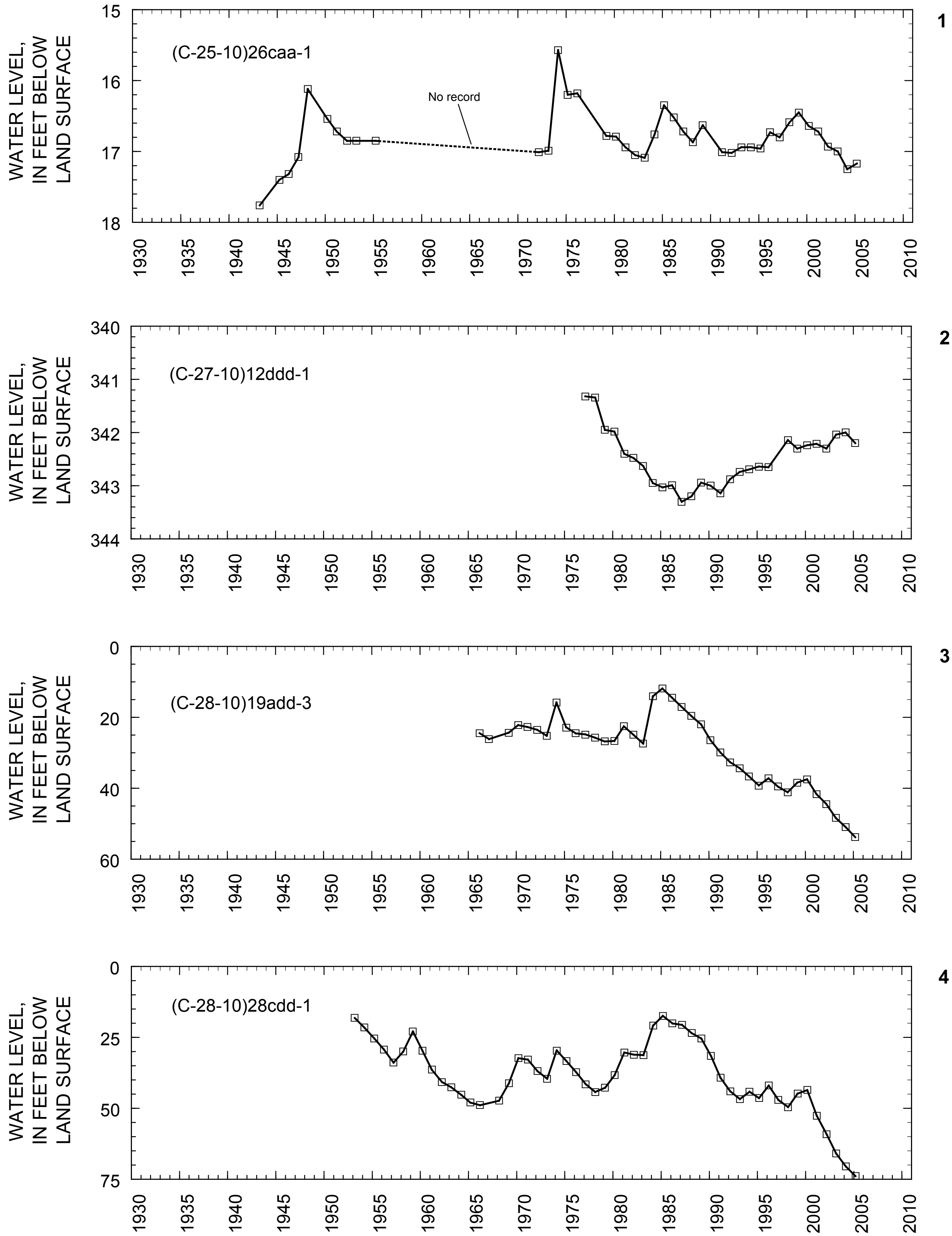
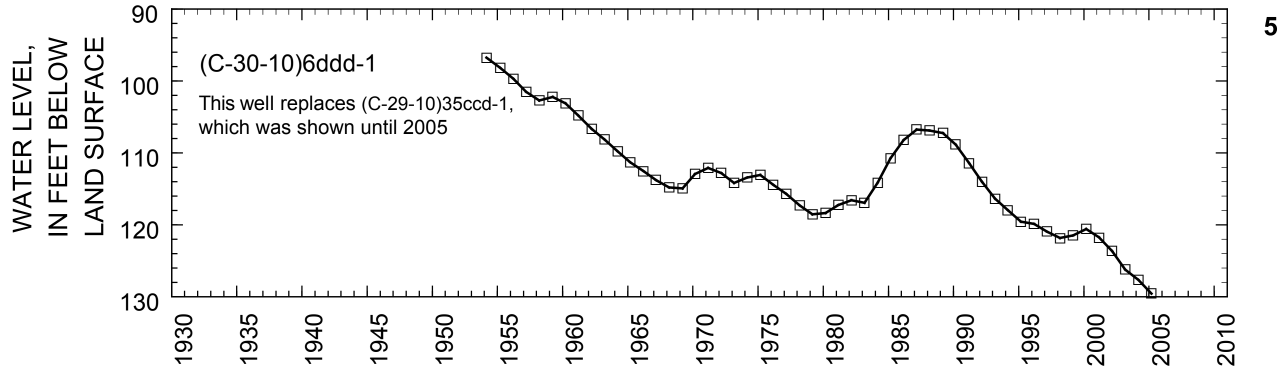
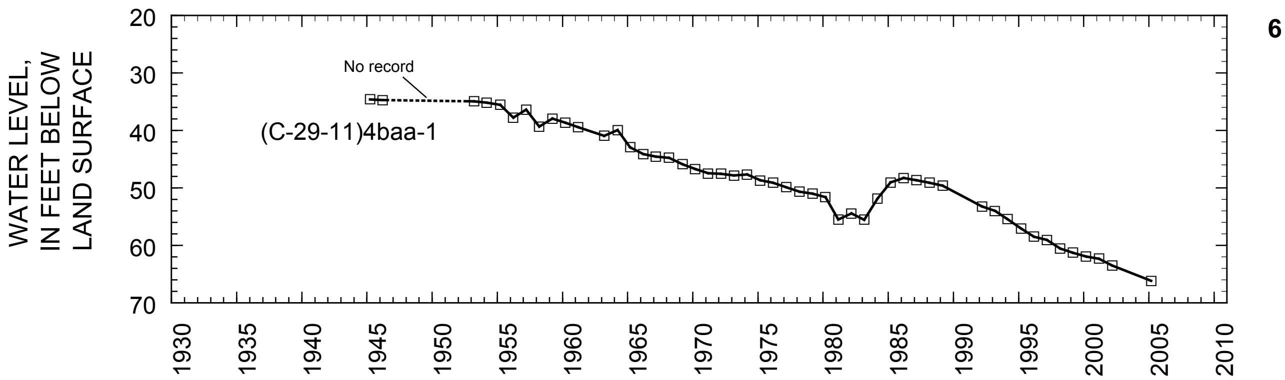
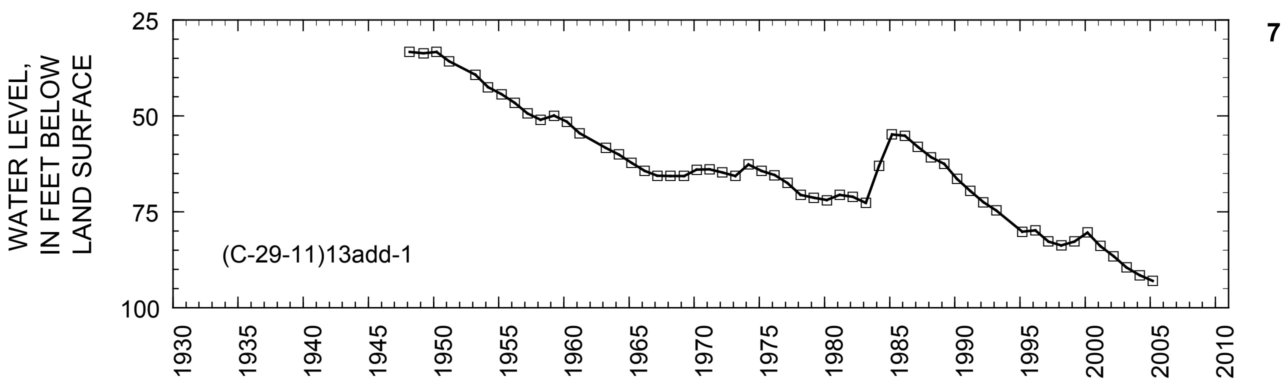


Figure 42. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-28-11)25dcd-1.







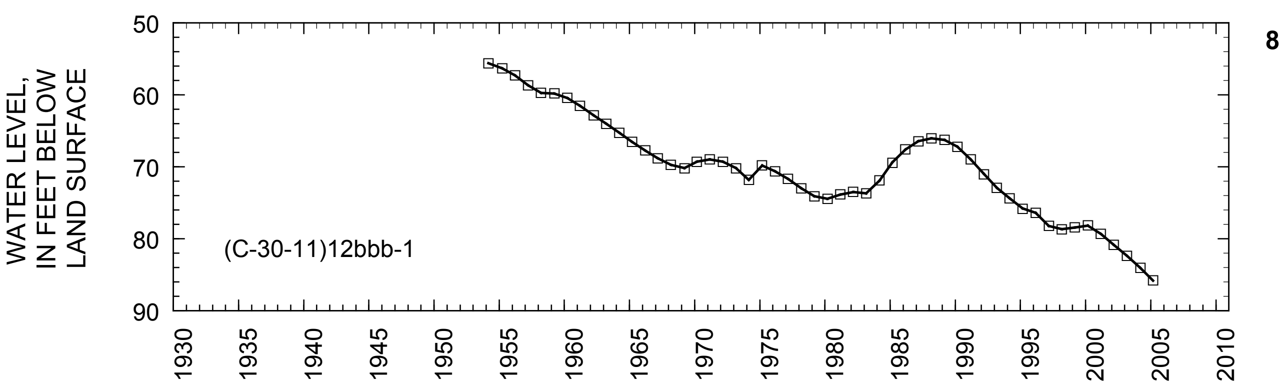


Figure 42. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-28-11)25dcd-1—Continued.

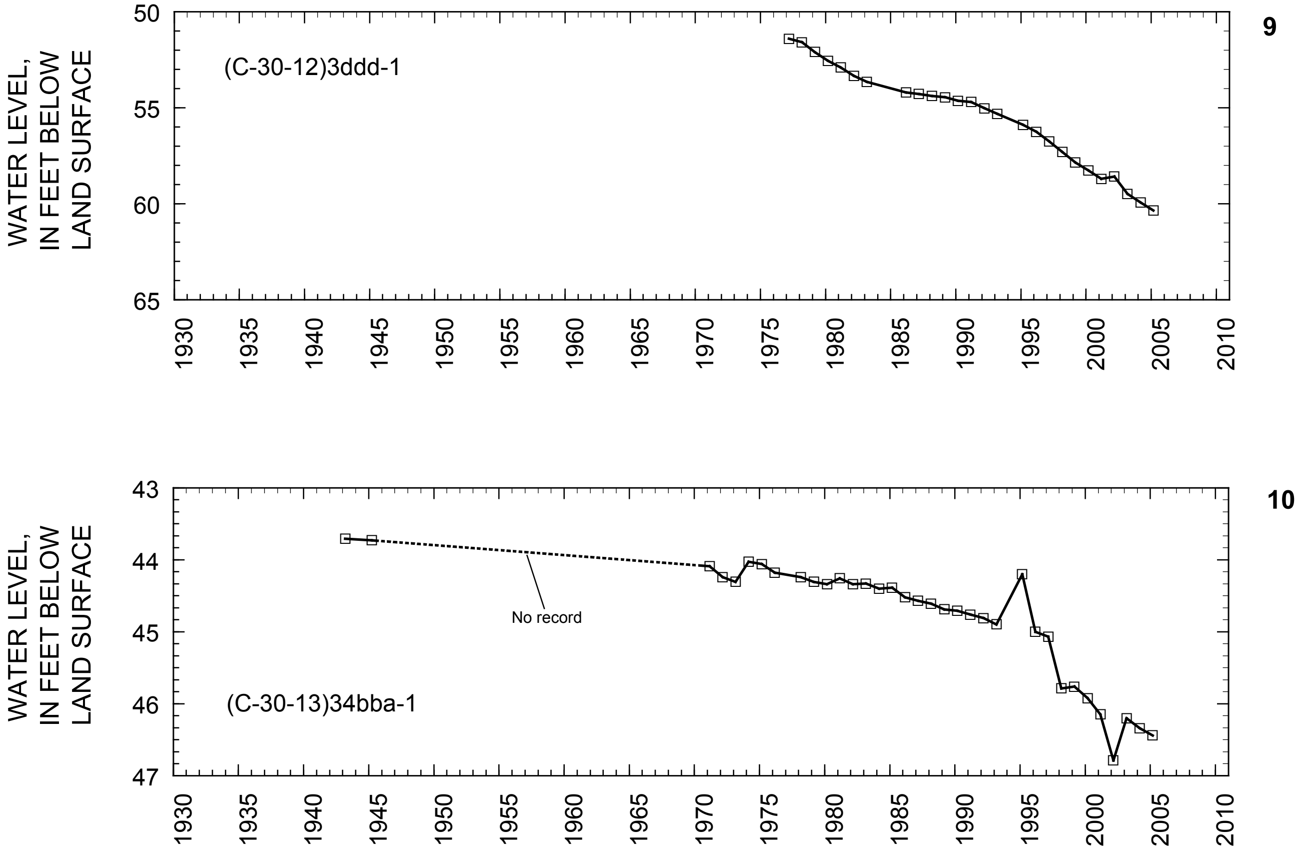
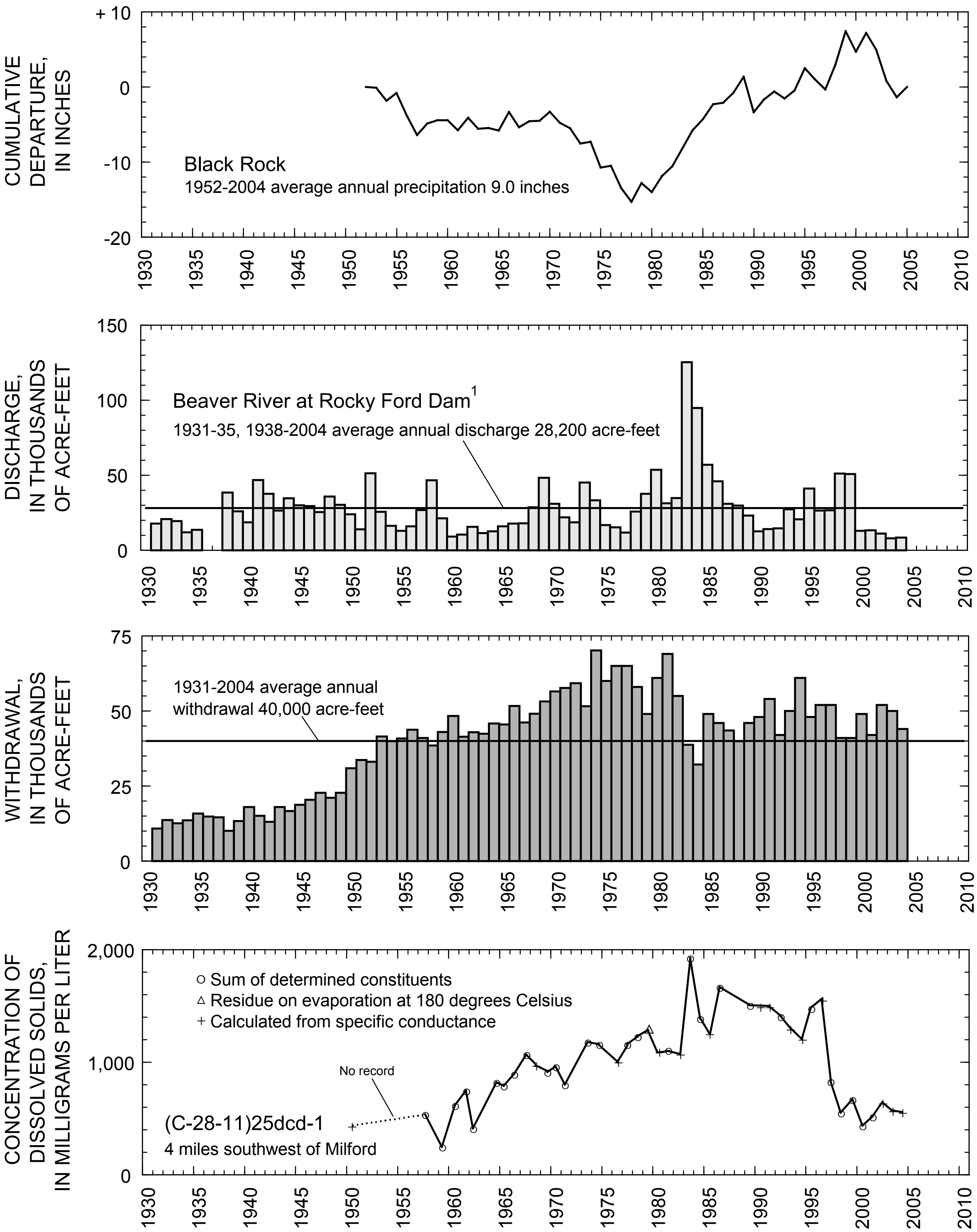


Figure 42. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-28-11)25dcd-1—Continued.



1 Gage discontinued in 2003. Reservoir release data subsequent to 2003 provided by State of Utah

Figure 42. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-28-11)25dcd-1—Continued.

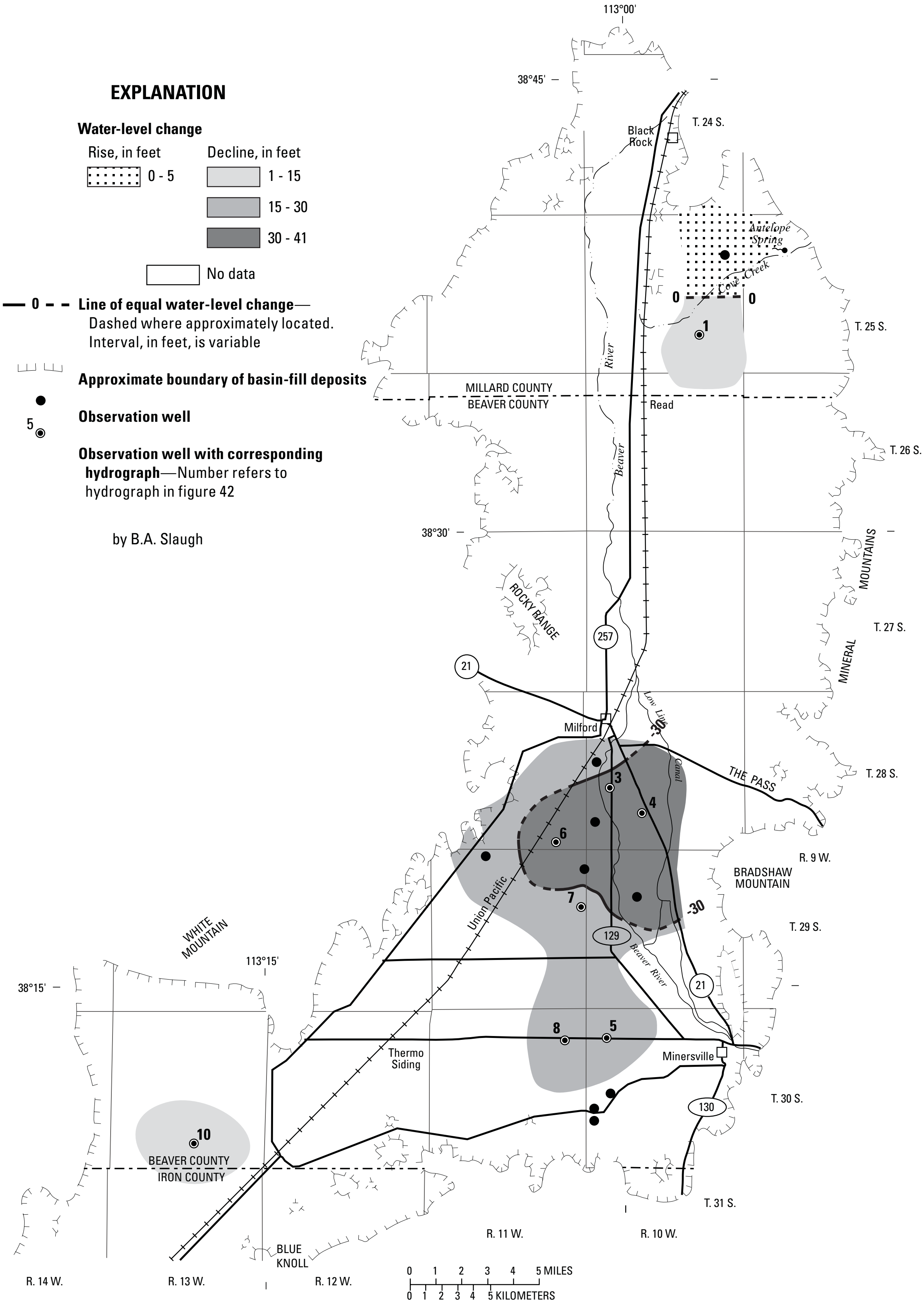


Figure 43. Map of the Milford area showing change of water level from March 1975 to March 2005.

ESCALANTE VALLEY

Beryl-Enterprise Area

By H.K. Christiansen

The Beryl-Enterprise area covers about 800 square miles in the southern end of Escalante Valley between about Townships 31 South and 37 South and Ranges 12 West and 18 West (fig. 44).

Total estimated withdrawal of water from wells in the Beryl-Enterprise area in 2004 was about 98,000 acre-feet, which is 6,000 acre-feet more than in 2003 and 14,000 acre-feet more than the average annual withdrawal for 1994-2003 (tables 2 and 3). The increase was mostly the result of increased withdrawals for irrigation.

The location of wells in the Beryl-Enterprise area in which the water level was measured during March 2005 is shown in figure 44. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2 is shown in figure 45.

Water levels in the Beryl-Enterprise area generally declined from March 2004 to March 2005. Water levels have declined steadily and consistently since 1950 and show little or no recovery during periods of greater-than-average precipitation. The declines are a result of continued large withdrawals for irrigation since 1950. A decline of about 119 feet since March 1948 is shown in well (C-36-16)29daa-1, about 5 miles northeast of Enterprise.

Precipitation at Enterprise in 2004 was about 19.0 inches, which is about 5.2 inches more than the average annual precipitation for 1955-2004 and about 6.4 inches more than in 2003. Concentration of dissolved solids in water from well (C-34-16)28dcc-2 has increased from about 460 milligrams per liter in 1967 to about 660 milligrams per liter in 2004.

Water levels declined from spring 1975 to spring 2005 in most of the Beryl-Enterprise area (fig. 46). Declines of as much as 71 feet occurred in an area northeast of Enterprise and west of Newcastle. The declines are the result of continued large withdrawals for irrigation. A water-level rise of about 15 feet was observed in a well just west of Enterprise near Pine Creek. Smaller rises of as much as 1 foot were observed northeast of Lund.

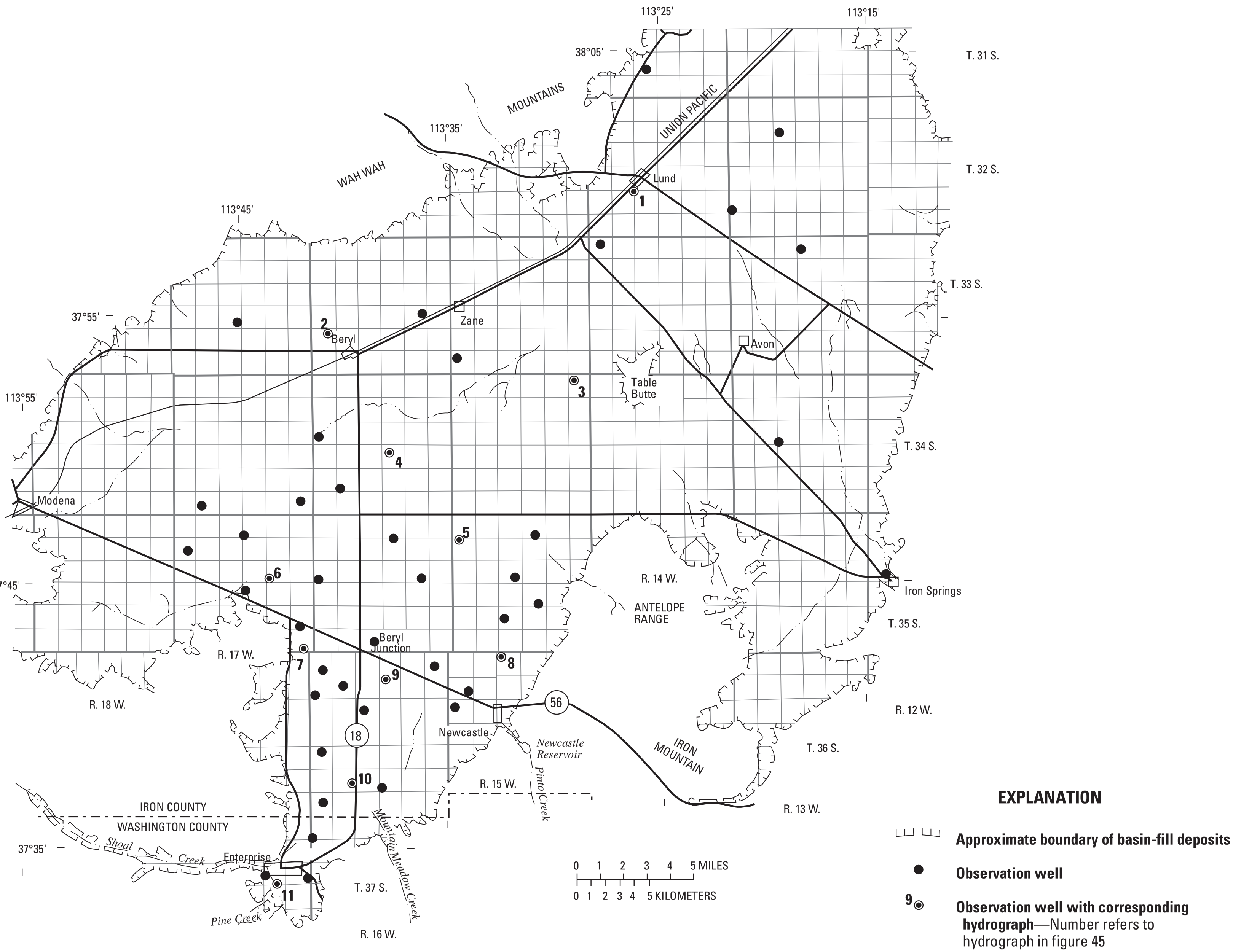


Figure 44. Location of wells in the Beryl-Enterprise area in which the water level was measured during March 2005.

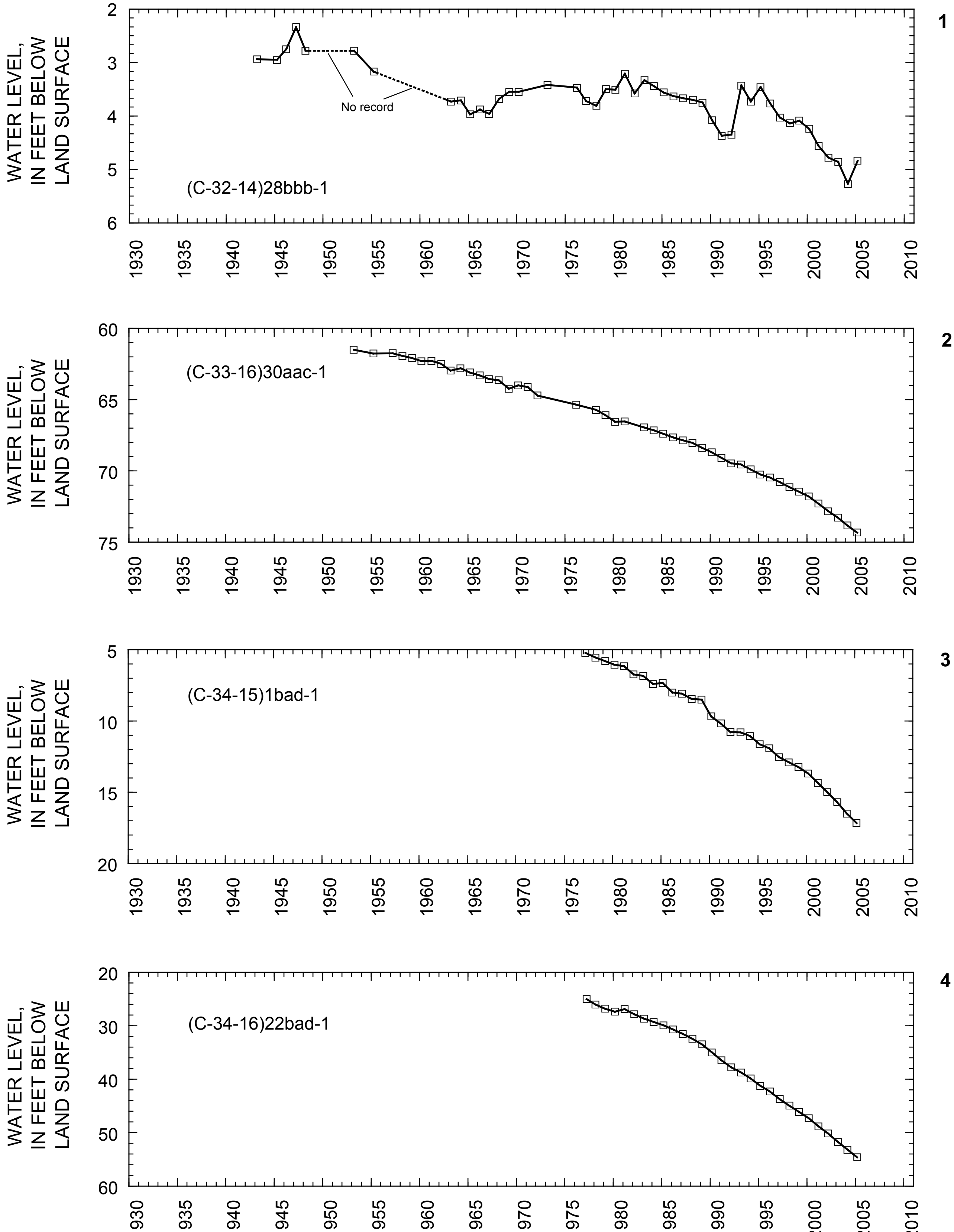


Figure 45. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2.

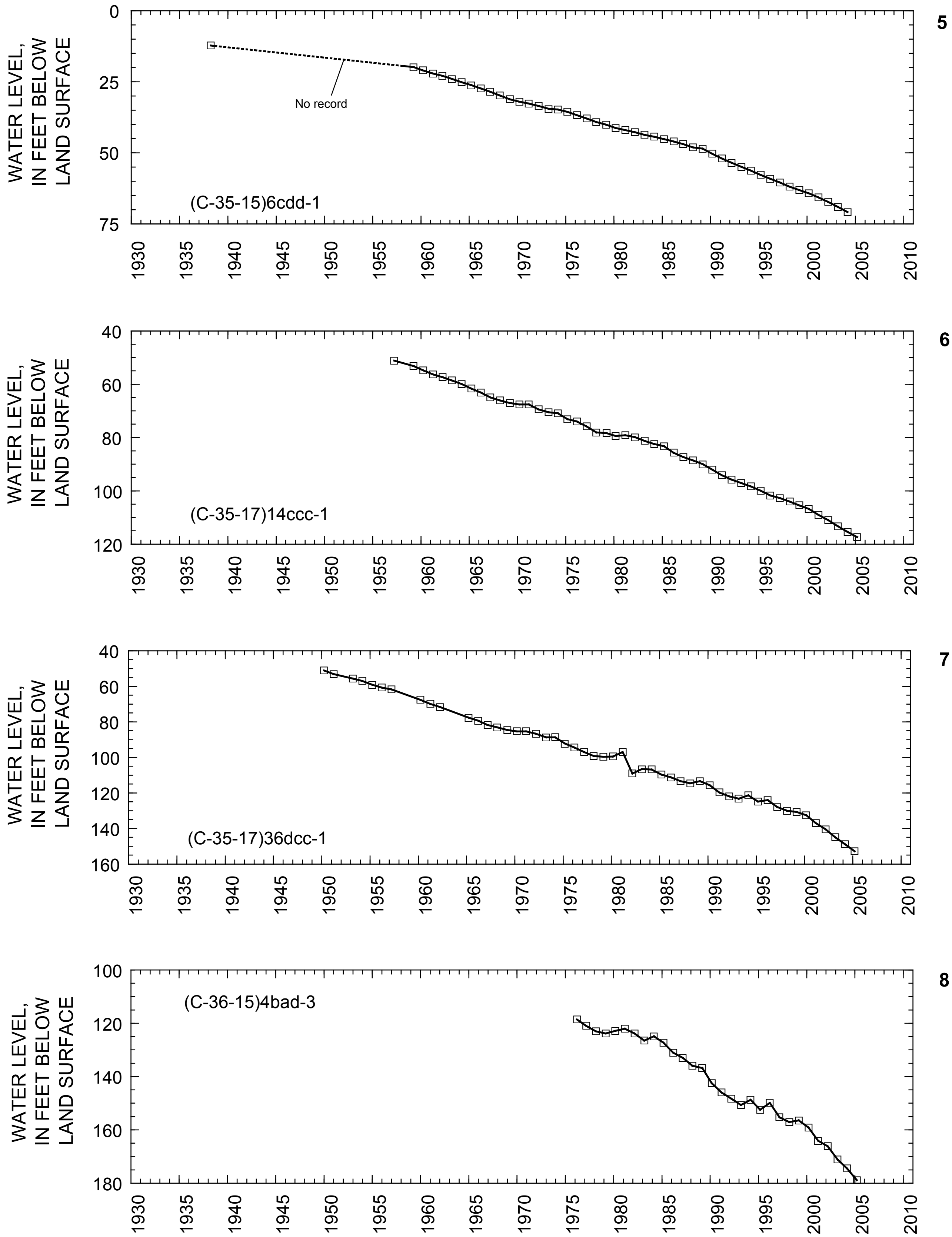


Figure 45. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2—Continued.

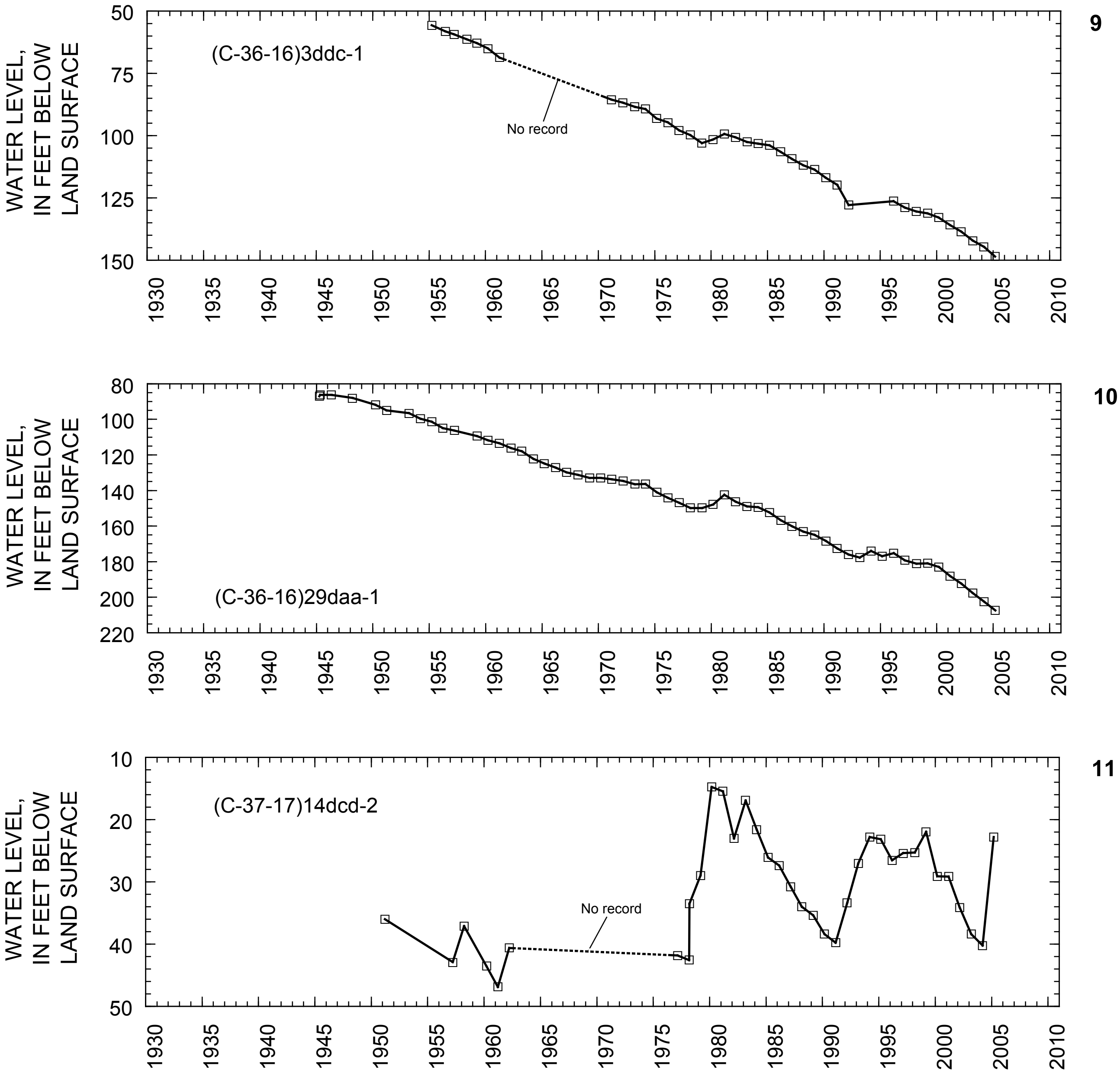


Figure 45. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2 —Continued.

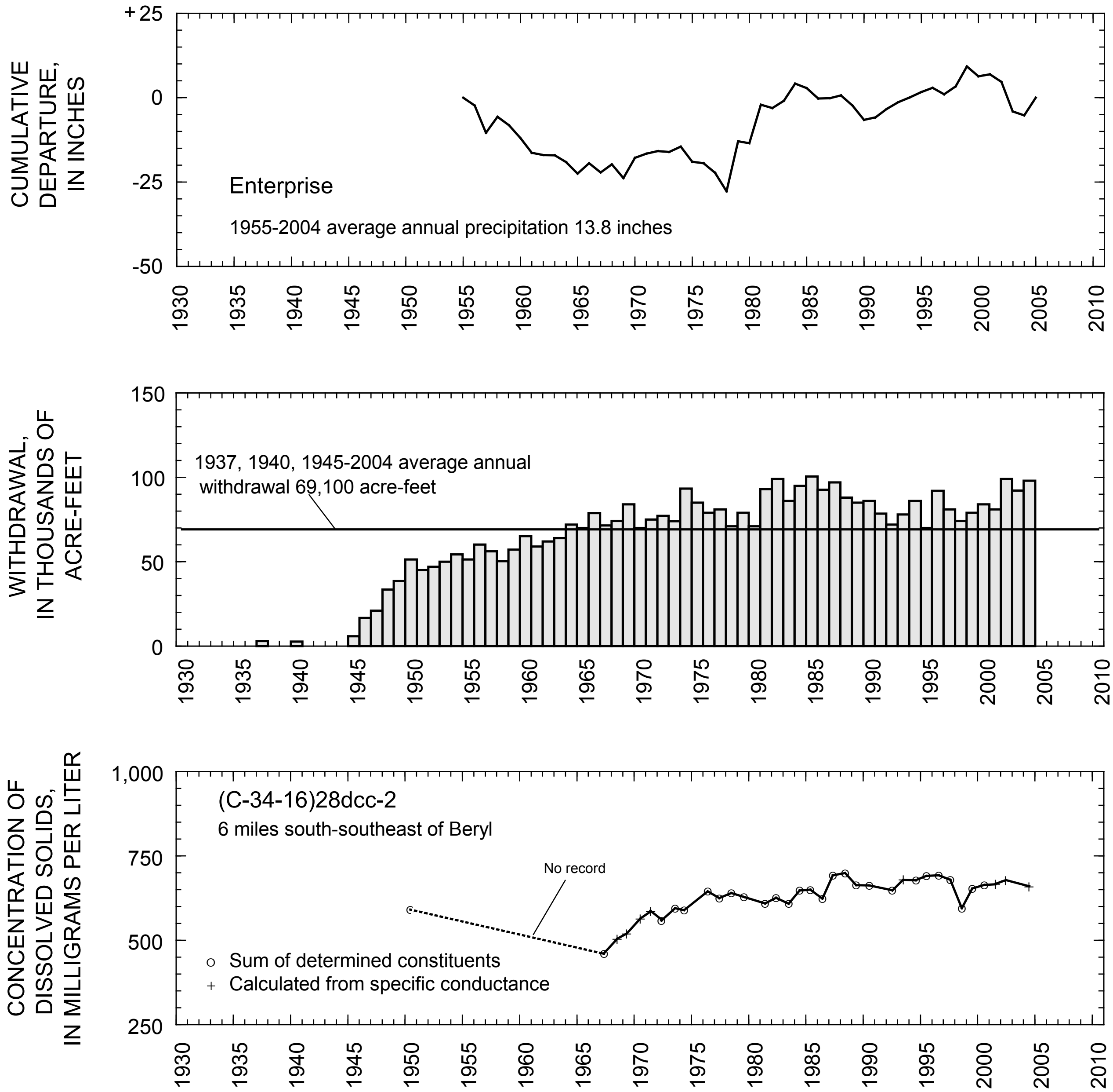


Figure 45. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2— Continued.

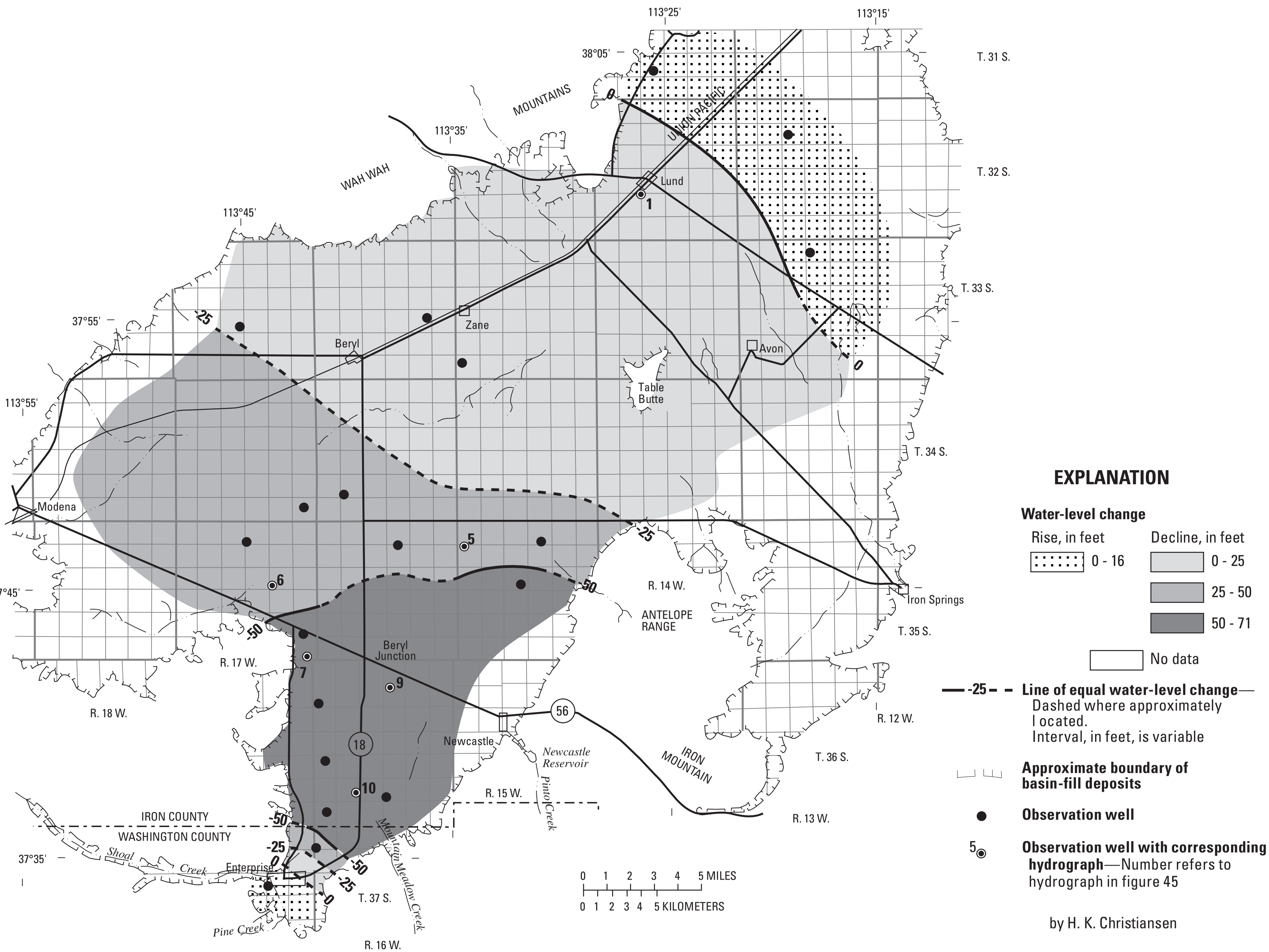


Figure 46. Map of the Beryl-Enterprise area showing change of water level from spring 1975 to spring 2005.

CENTRAL VIRGIN RIVER AREA

By H.K. Christiansen

The central Virgin River area is between the south end of the Pine Valley Mountains and the Hurricane Cliffs to the east and the Beaver Dam Mountains to the southwest. Major ground-water development includes water from valley-fill aquifers that is used primarily for irrigation and water from consolidated rock and valley fill that is used primarily for public supply. Most of the wells measured are near the Virgin and Santa Clara Rivers.

Total estimated withdrawal of water from wells in the central Virgin River area in 2004 was about 26,000 acre-feet, which is about 2,000 acre-feet less than in 2003 and 5,000 acre-feet more than the average annual withdrawal for 1994-2003 (tables 2 and 3). Withdrawal for irrigation decreased by about 1,200 acre-feet from 2003 to 2004. Withdrawal for industry in 2004 increased by about 60 acre-feet from 2003. Withdrawal for public supply was 1,800 acre-feet less than the 2003 amount. Withdrawal for domestic and stock use was about the same as in 2003.

The location of wells in the central Virgin River area in which the water level was measured during February 2005 is shown in figure 47. The relation of the water level in selected observation wells to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)17bdb-1 is shown in figure 48.

Water levels from February 2004 to February 2005 in the central Virgin River area generally rose in the Santa Clara River drainage and most of the Virgin River drainage. Water levels in the Fort Pearce Wash area (hydrographs 10 and 11, fig. 48) generally have declined since the mid-1980s. The declines are probably the result of increased withdrawals for irrigation and public supply.

Discharge of the Virgin River at Virgin in 2004 was about 110,100 acre-feet, which is 36,600 acre-feet more than the revised value of 73,500 acre-feet for 2003, and about 21,500 acre-feet less than the long-term average for 1931-70, 1979-2004. Precipitation at St. George in 2004 was about 11.3 inches, which is about 3.3 inches more than the average annual precipitation for 1947-2004 and about 5.5 inches more than in 2003. The concentration of dissolved solids in water from well (C-41-17)17bdb-1 indicates moderate fluctuation but little overall change since 1966.

Water-level changes from spring 1975 to spring 2005 are shown in figure 49. Water levels generally declined in the central Virgin River area in areas where data are available. One well, (C-42-16)22cba-1, southeast of Santa Clara, showed a rise in water level of about 5 feet.

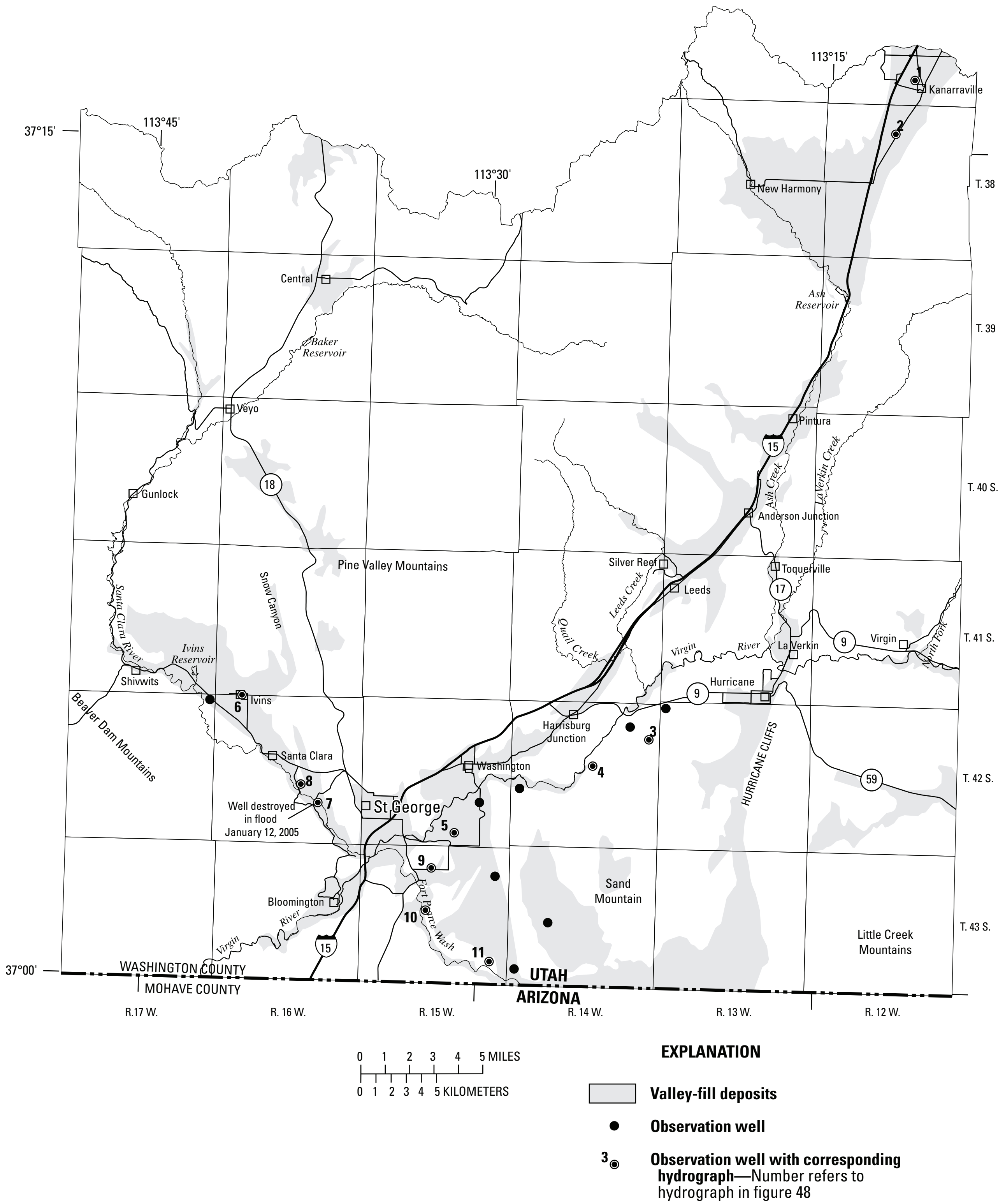


Figure 47. Location of wells in the central Virgin River area in which the water level was measured during February 2005.

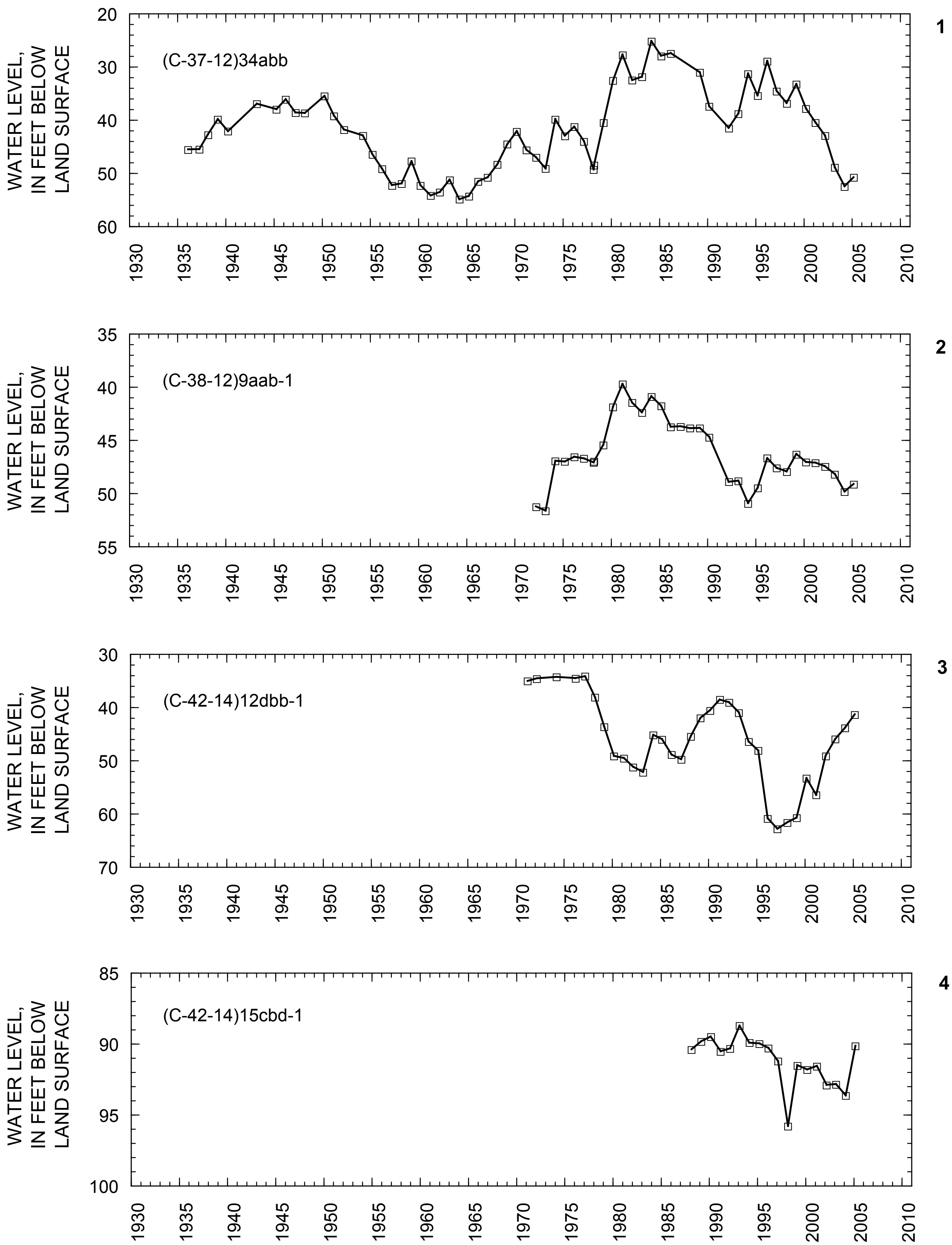


Figure 48. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)17bdb-1.

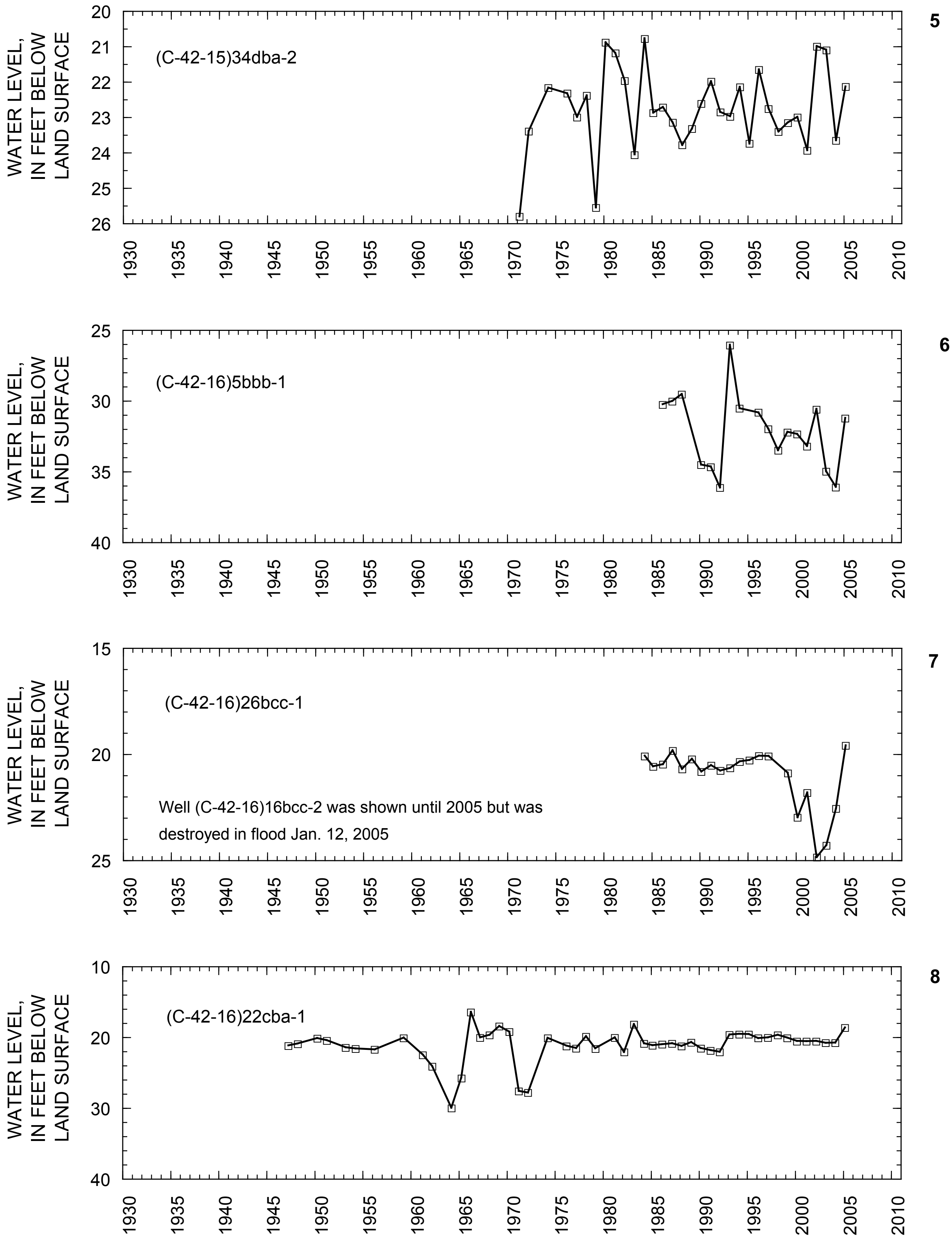
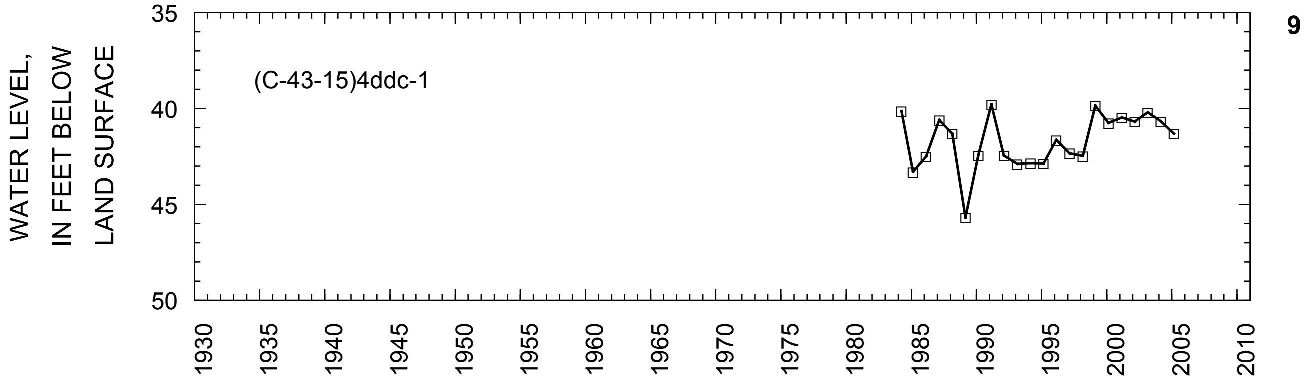
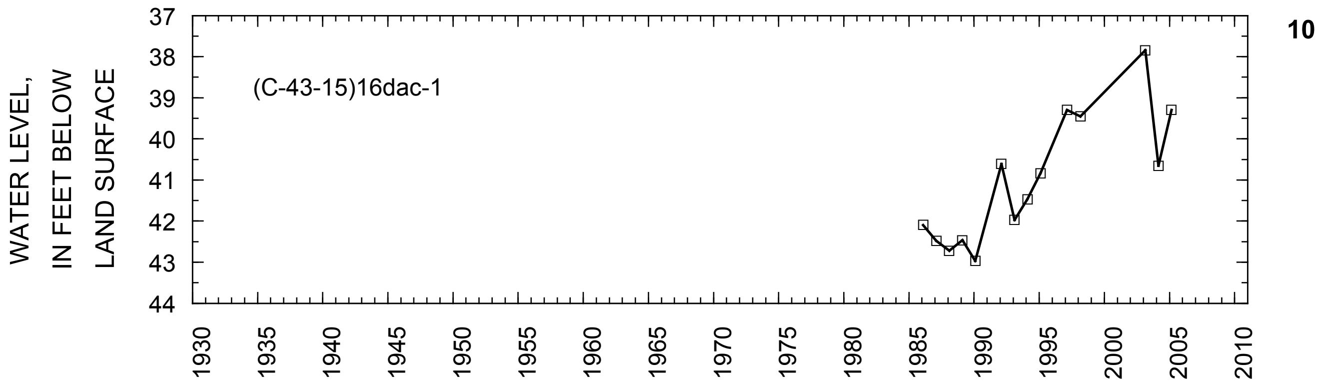


Figure 48. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)17bdb-1—Continued.





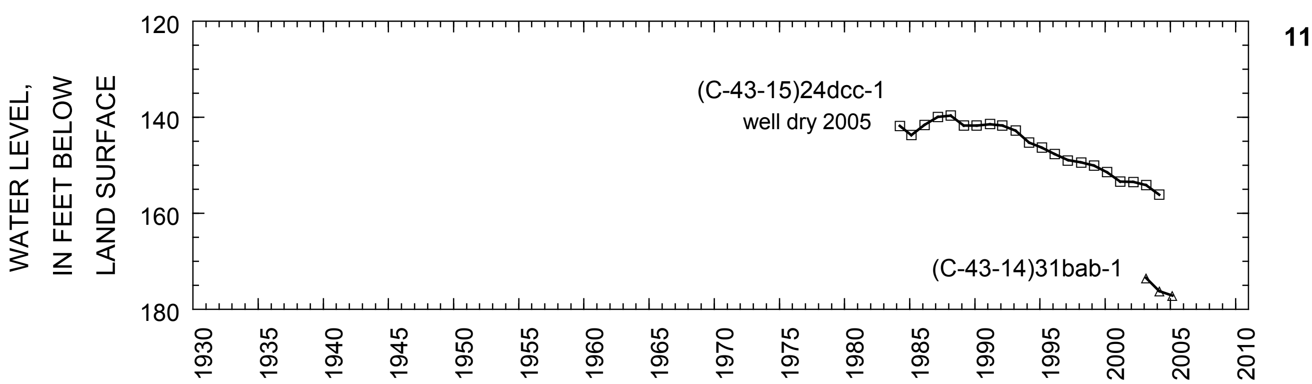


Figure 48. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)17bdb-1—Continued.

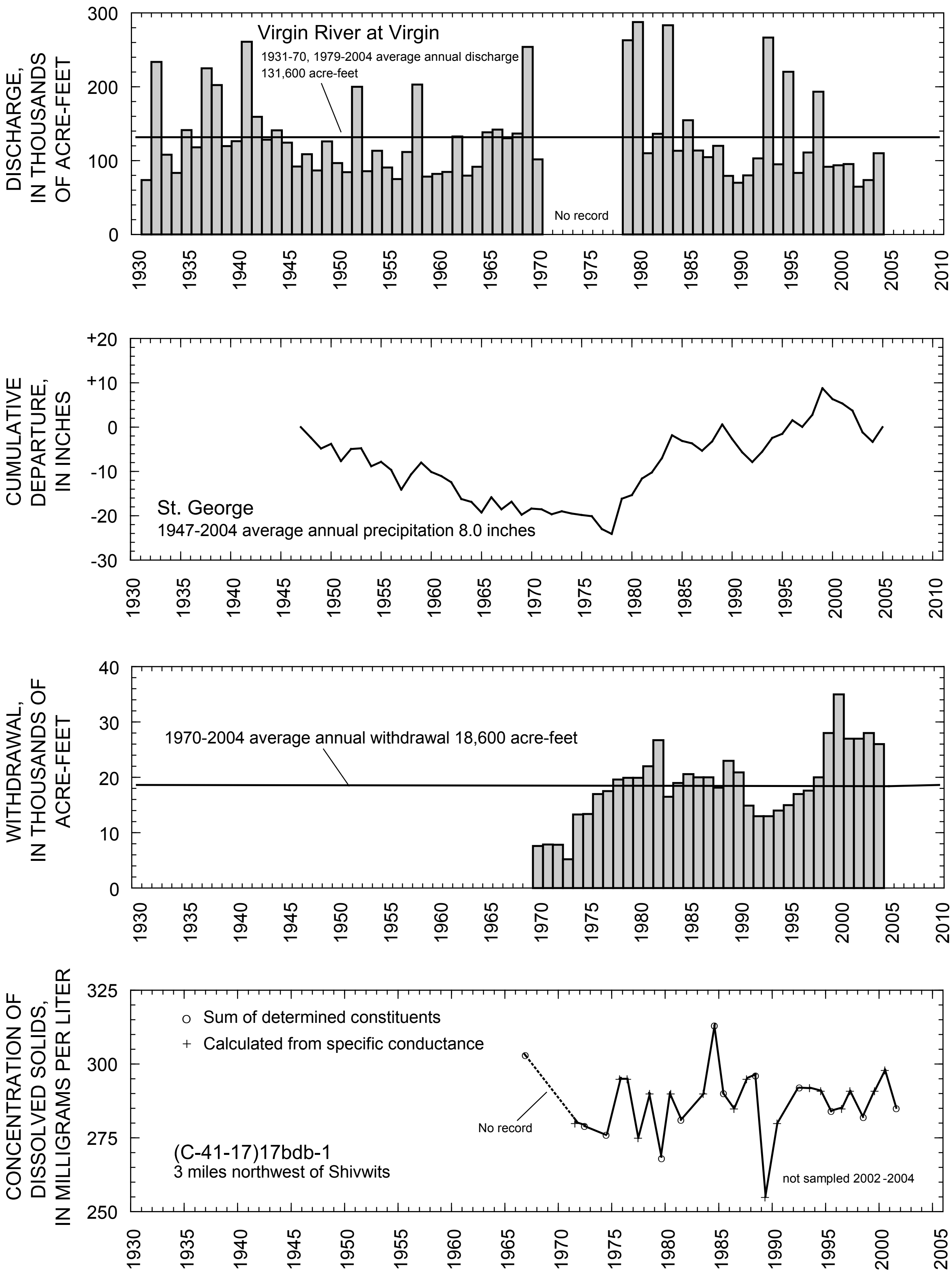


Figure 48. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)17bdb-1—Continued.

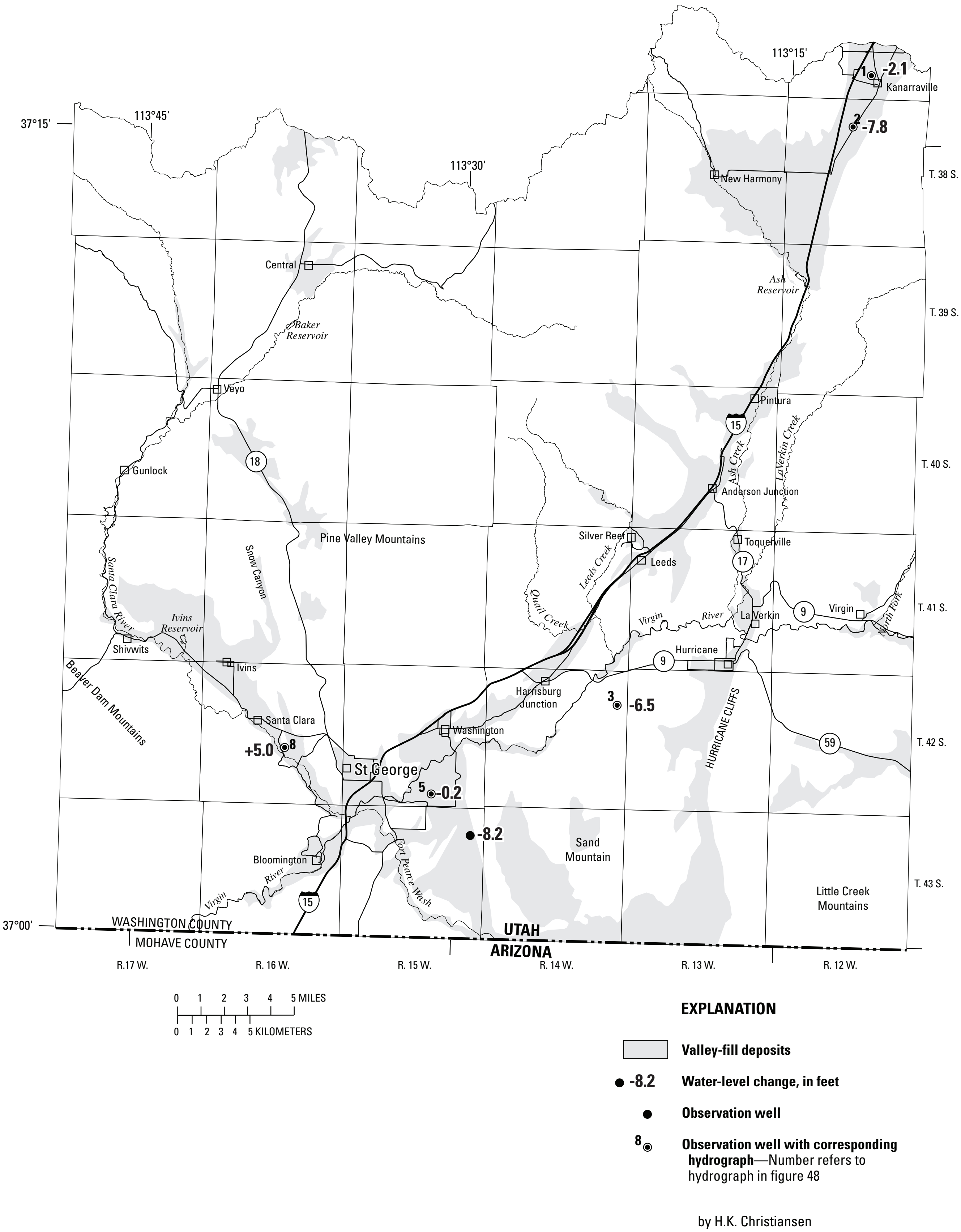


Figure 49. Map of central Virgin River area showing change of water level from spring 1975 to spring 2005.

OTHER AREAS

By M.J. Fisher

Total estimated withdrawal of water from wells in the areas of Utah listed below in 2004 was about 129,000 acre-feet, which is 1,000 acre-feet more than the estimate for 2003 and 15,000 acre-feet more than the average annual withdrawal for 1994-2003 (tables 2 and 3). In most of these areas, withdrawals in 2004 were nearly the same as or less than in 2003, except in Rush, Beaver, and Sanpete Valleys, where withdrawals increased.

The location of wells in Cedar Valley, Utah County, in which the water level was measured during March 2005 is shown in figure 50. The relation of the water level in observation wells in Cedar Valley, Utah County, to cumulative departure from average annual precipitation at Fairfield is shown in figure 51.

Water levels in selected wells in Cedar Valley generally rose during the 1970s. Water levels rose sharply from the early to mid-1980s as a result of greater-than-average precipitation, but generally have declined since the mid-1980s. Water levels declined in most of the wells from March 2004 to March 2005. The declines are probably the result of continued ground-water withdrawals and less-than-average precipitation.

Water levels in March 2005 were generally higher than those measured in March 1975 throughout Cedar Valley (fig. 52). The greatest rise was located in the area northeast of Fairfield. The rises probably resulted from decreased irrigation withdrawals and overall greater-than-average precipitation since 1976.

The location of wells in Sanpete Valley in which the water level was measured during March 2005 is shown in figure 53. The relation of the water level in selected observation wells in Sanpete Valley to cumulative departure from average annual precipitation at Manti is shown in figure 54.

Water levels in many of the selected wells in Sanpete County rose from the late 1970s to the mid-1980s as a result of greater-than-average precipitation and have varied since the mid-1980s, but overall have declined. Water levels rose slightly in most of the wells from March 2004 to March 2005. The rises probably resulted from increased recharge due to increased precipitation in 2004. Water levels generally declined from March 1975 to March 2005 throughout Sanpete Valley (fig. 55). The declines are probably the result of increased withdrawals for irrigation, industrial use, and public supply use.

The relation of the water level in wells in the remaining selected areas of Utah (see accompanying table) to cumulative departure from average annual precipitation at sites in or near those areas is shown in figure 56. Water levels rose slightly in most of the selected observation wells from March 2004 to March 2005. The rises probably resulted from greater-than-average precipitation in 2004 in most of those areas.

Number in figure 1	Area	Estimated withdrawal (acre-feet)					
		2004					2003 total (rounded)
		Irrigation	Industrial	Public supply	Domestic and stock	2004 total (rounded)	
1	Grouse Creek Valley	1,300	0	0	20	1,300	1,800
2	Park Valley	2,900	0	0	10	2,900	2,800
4	Malad-lower Bear River Valley	3,200	870	5,100	200	9,400	10,100
8	Ogden Valley	0	0	9,500	20	9,500	10,200
13	Rush Valley	5,900	170	280	30	6,400	5,000
14	Dugway area, Skull Valley, and Old River Bed	2,300	4,300	1,200	10	7,800	8,300
15	Cedar Valley, Utah County	2,200	0	2,900	40	5,100	4,900
20	Sanpete Valley	5,800	540	510	4,000	10,900	10,500
25	Snake Valley	13,100	0	70	50	13,200	16,100
27	Beaver Valley	12,900	20	550	430	13,900	11,200
	Remainder of State	12,900	16,200	17,000	2,500	48,600	46,600
Total (rounded)		62,500	22,100	37,100	7,300	129,000	128,000

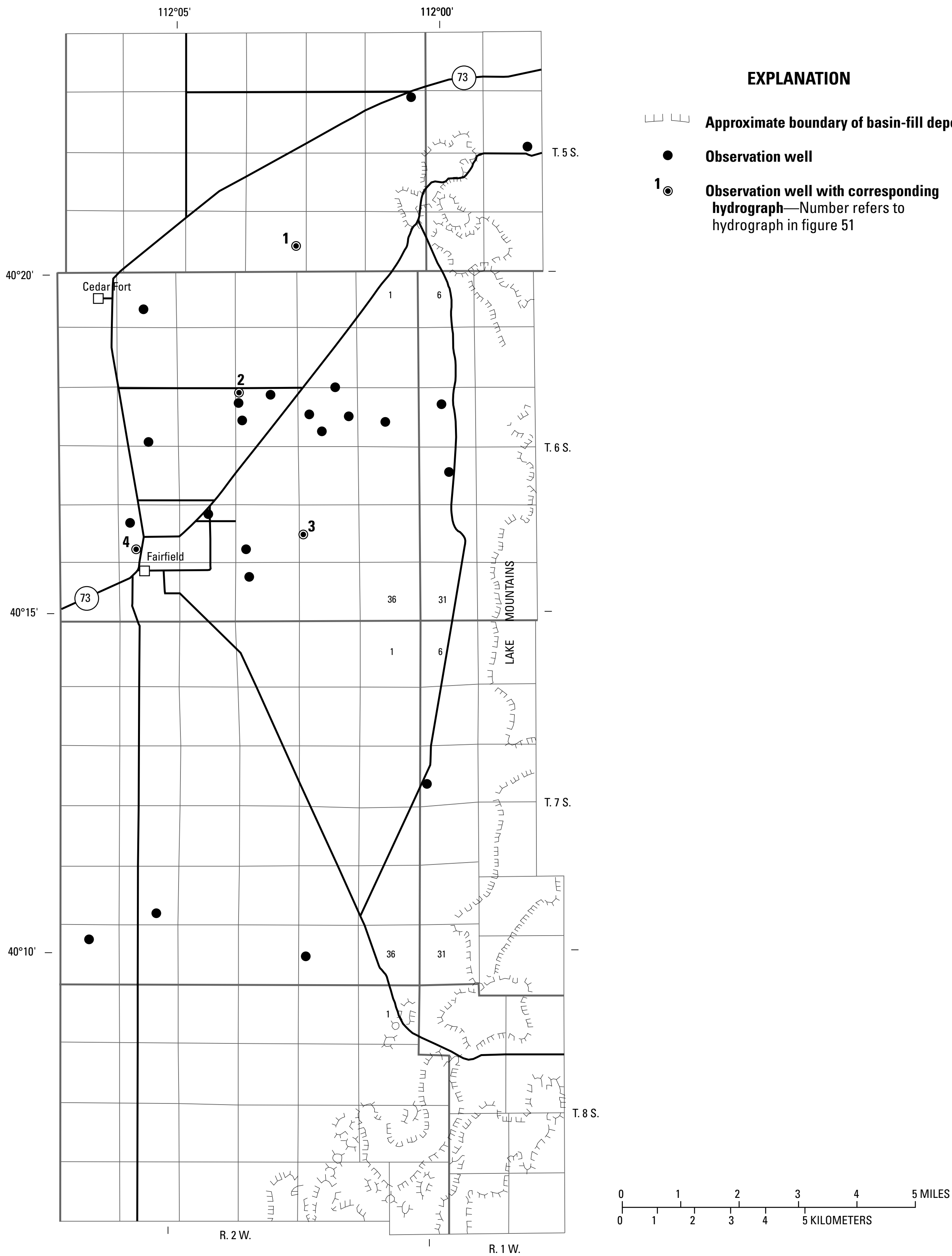


Figure 50. Location of wells in Cedar Valley, Utah County, in which the water level was measured during March 2005.

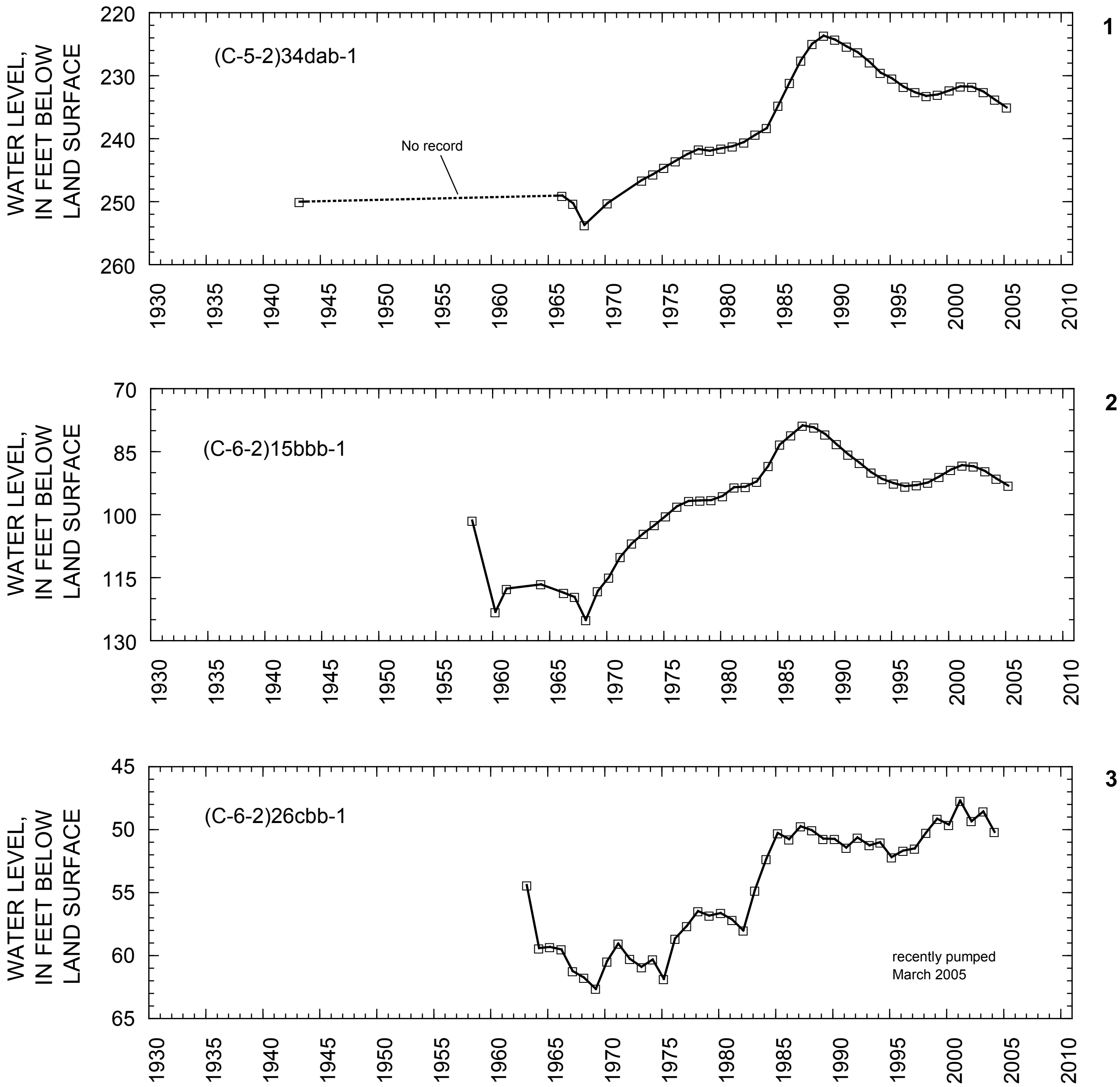


Figure 51. Relation of water level in selected wells in Cedar Valley, Utah County, to cumulative departure from average annual precipitation at Fairfield.

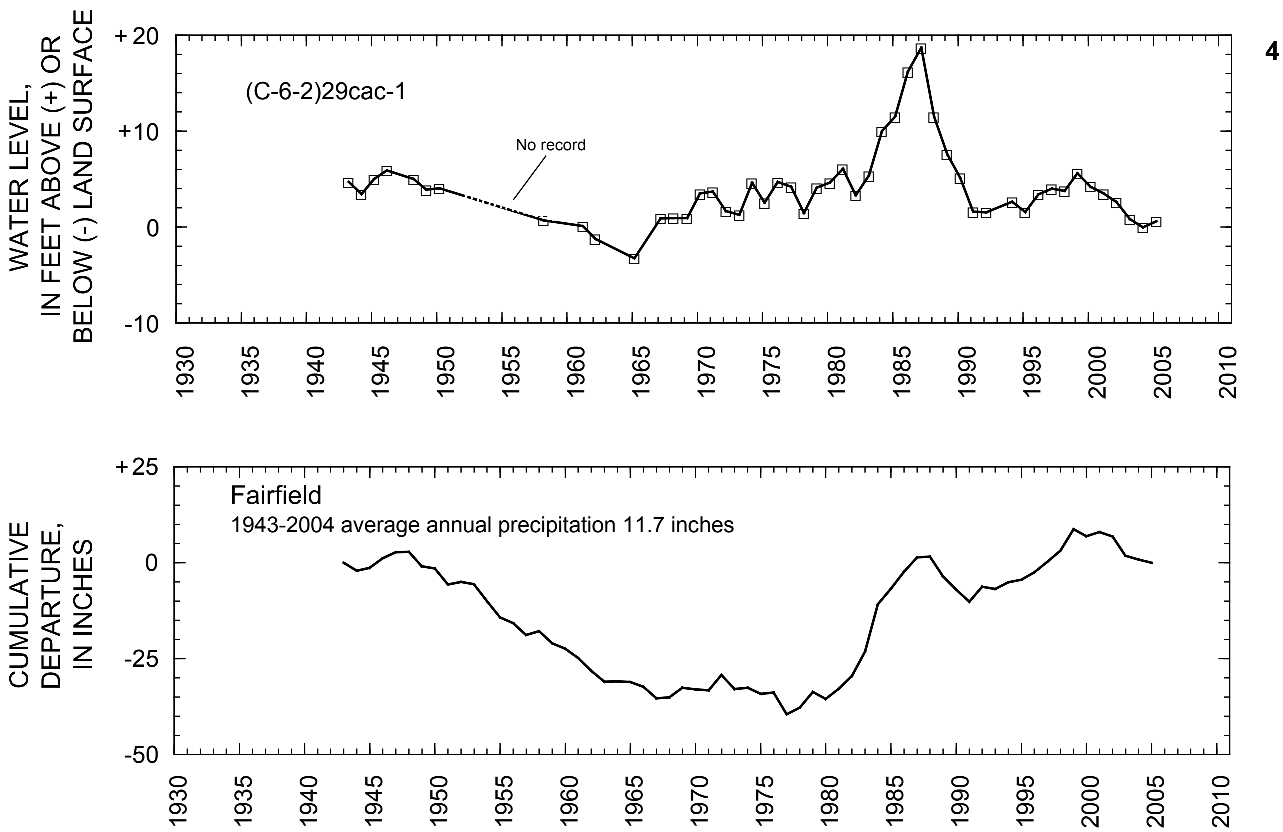


Figure 51. Relation of water level in selected wells in Cedar Valley, Utah County, to cumulative departure from average annual precipitation at Fairfield—Continued.

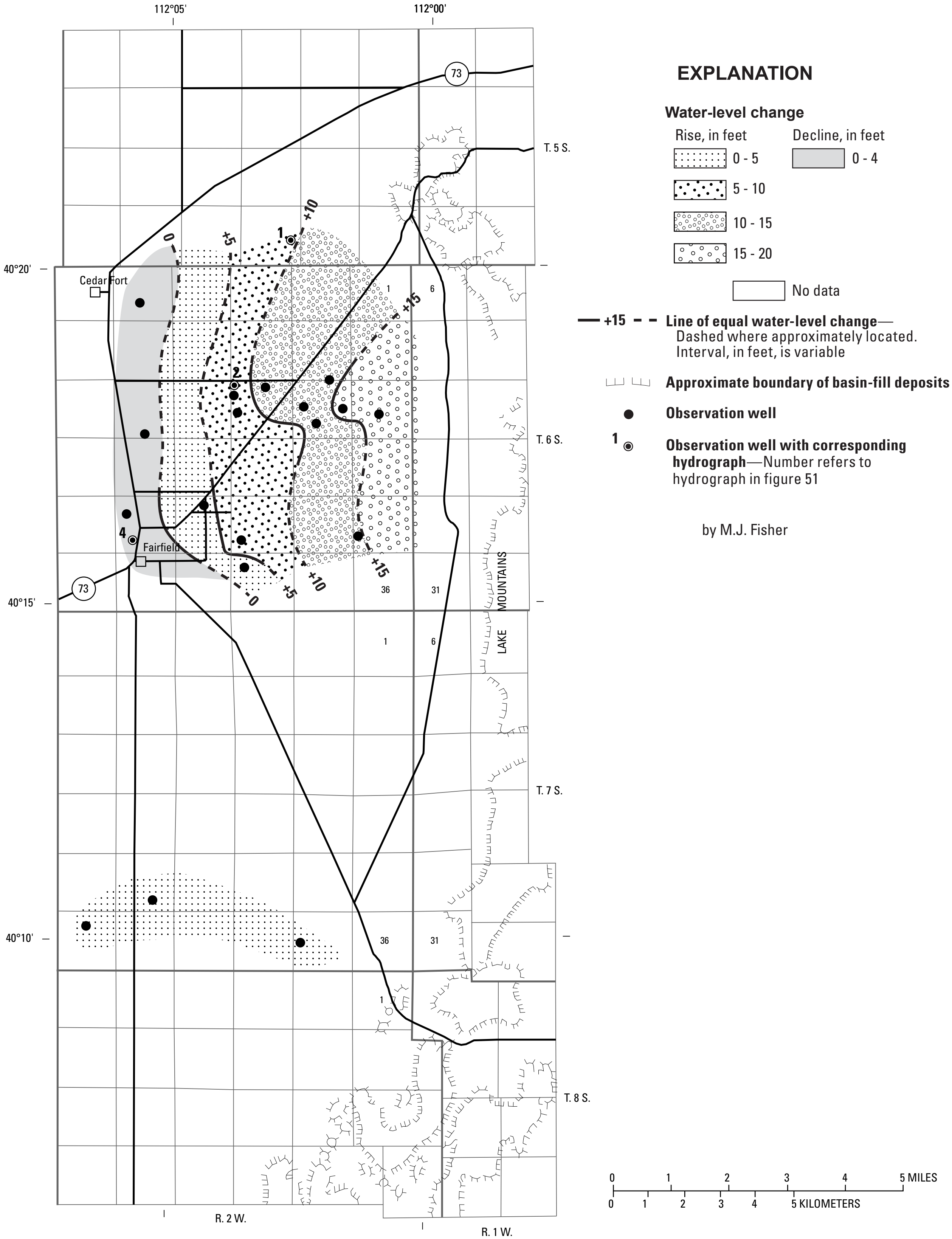


Figure 52. Map of Cedar Valley, Utah County, showing change of water level from March 1975 to March 2005.

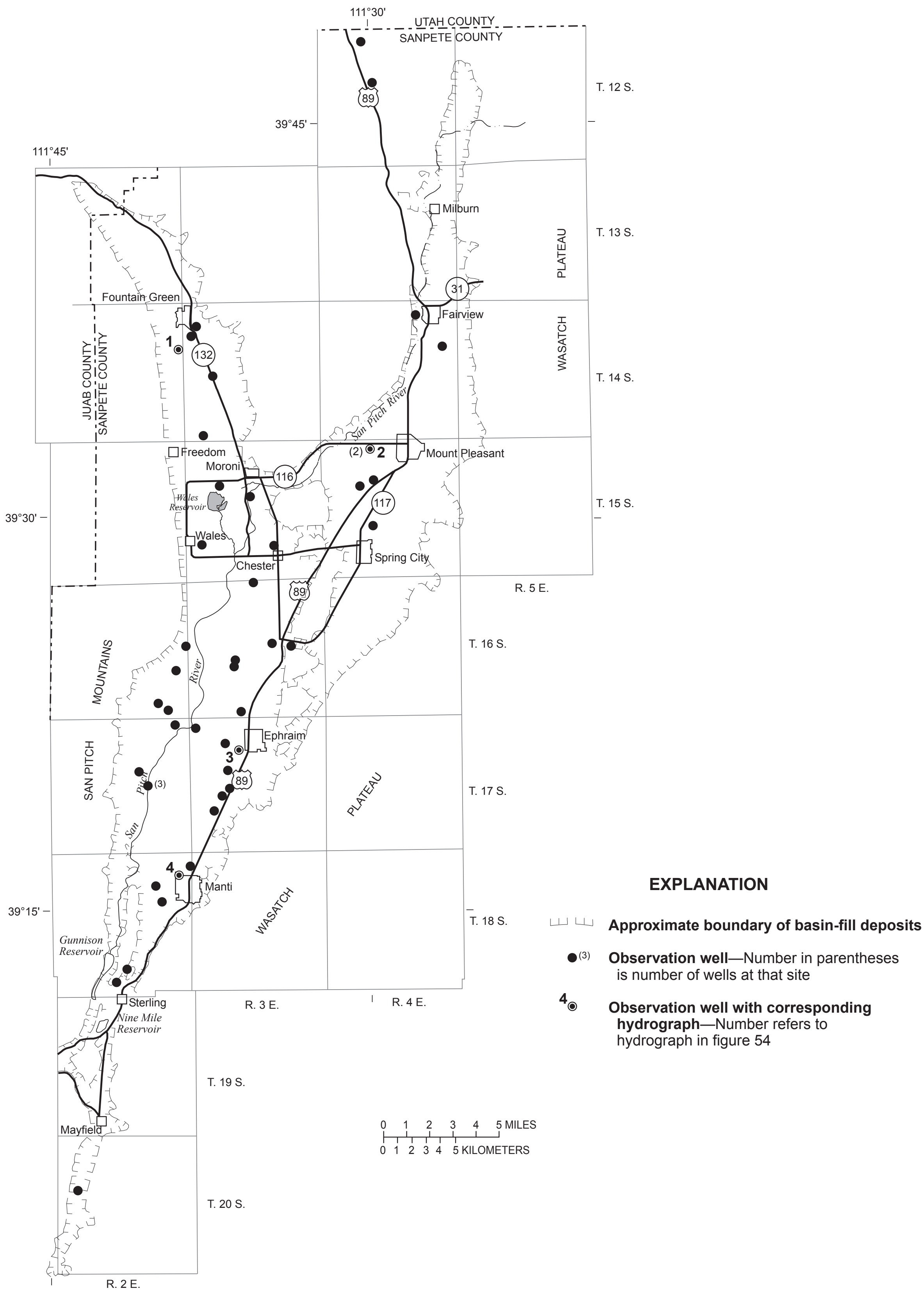


Figure 53. Location of wells in Sanpete Valley in which the water level was measured during March 2005.

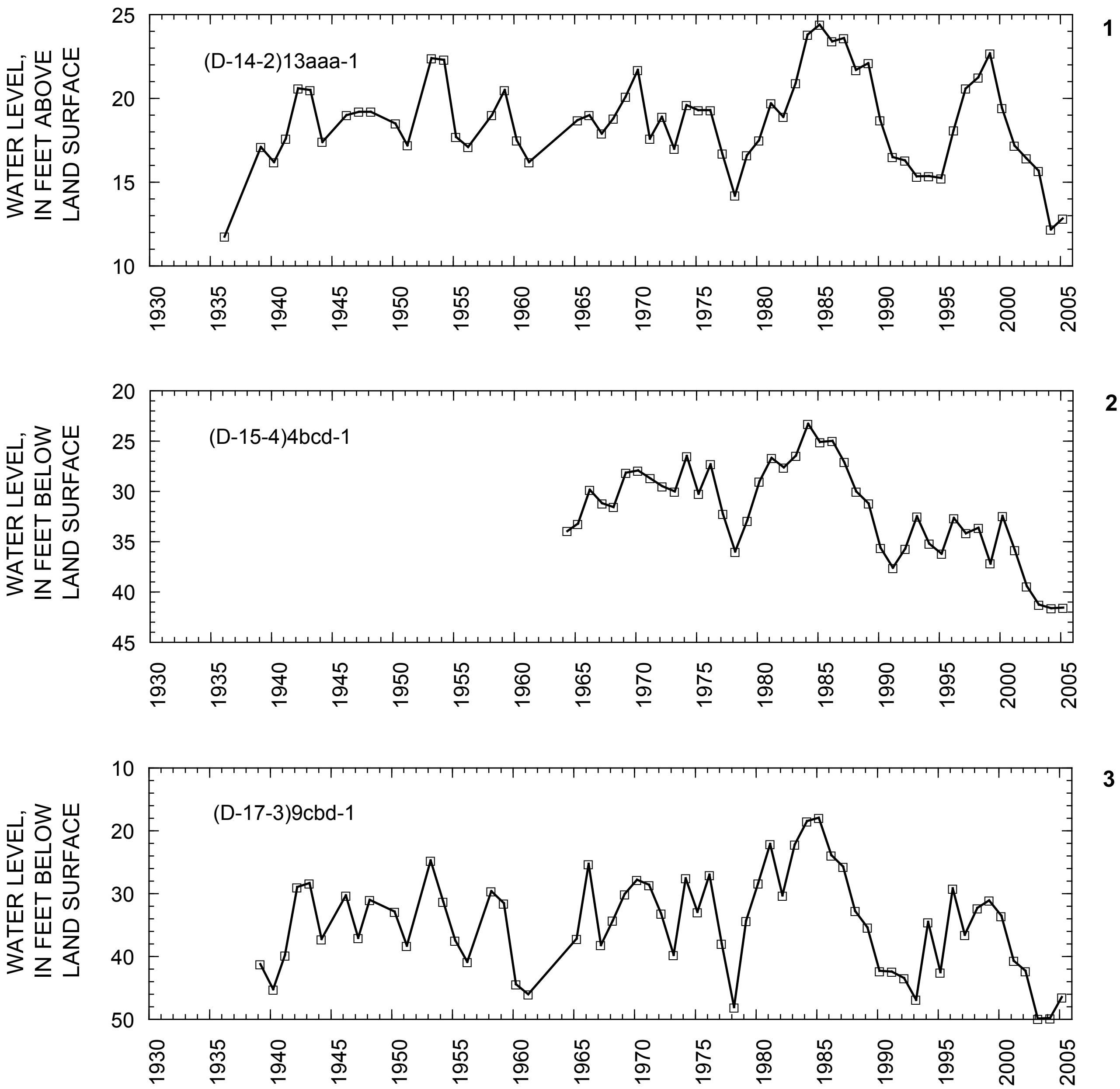


Figure 54. Relation of water level in selected wells in Sanpete Valley to cumulative departure from average annual precipitation at Manti.

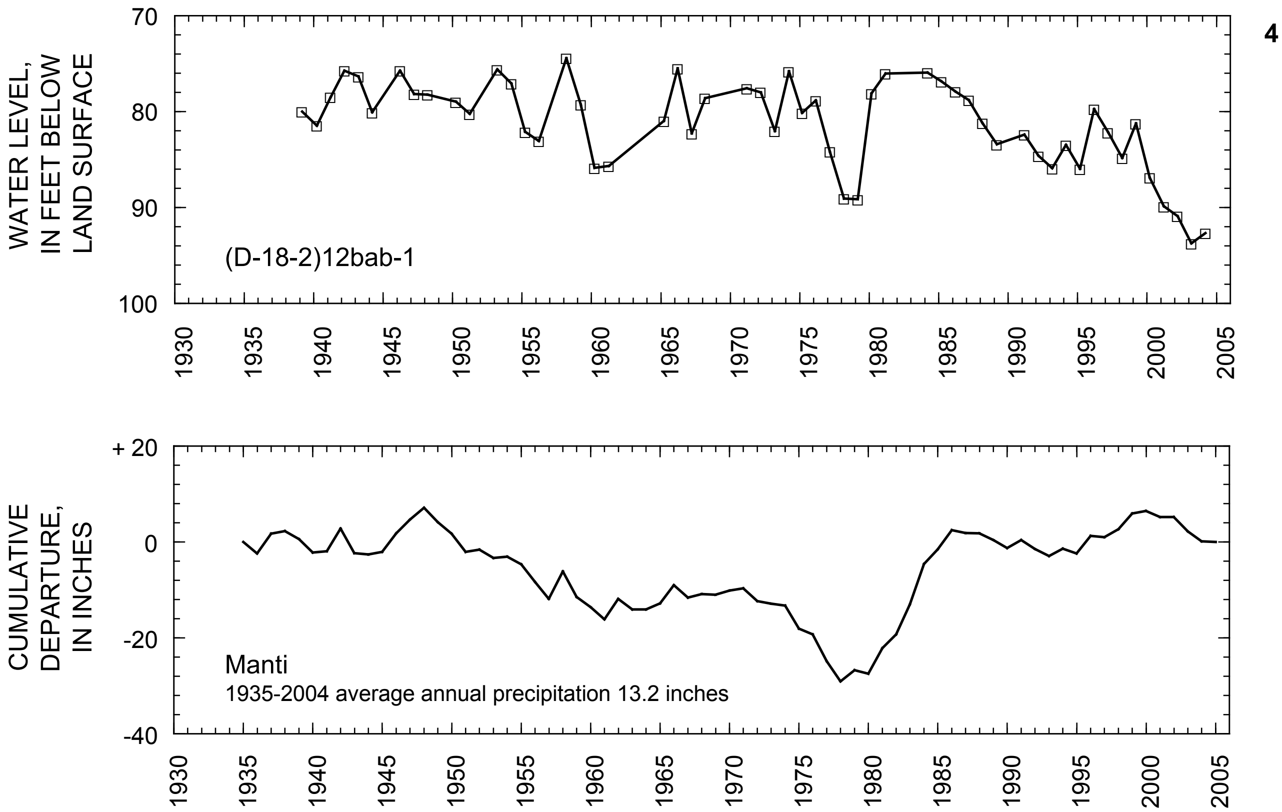


Figure 54. Relation of water level in selected wells in Sanpete Valley to cumulative departure from average annual precipitation at Manti—Continued.

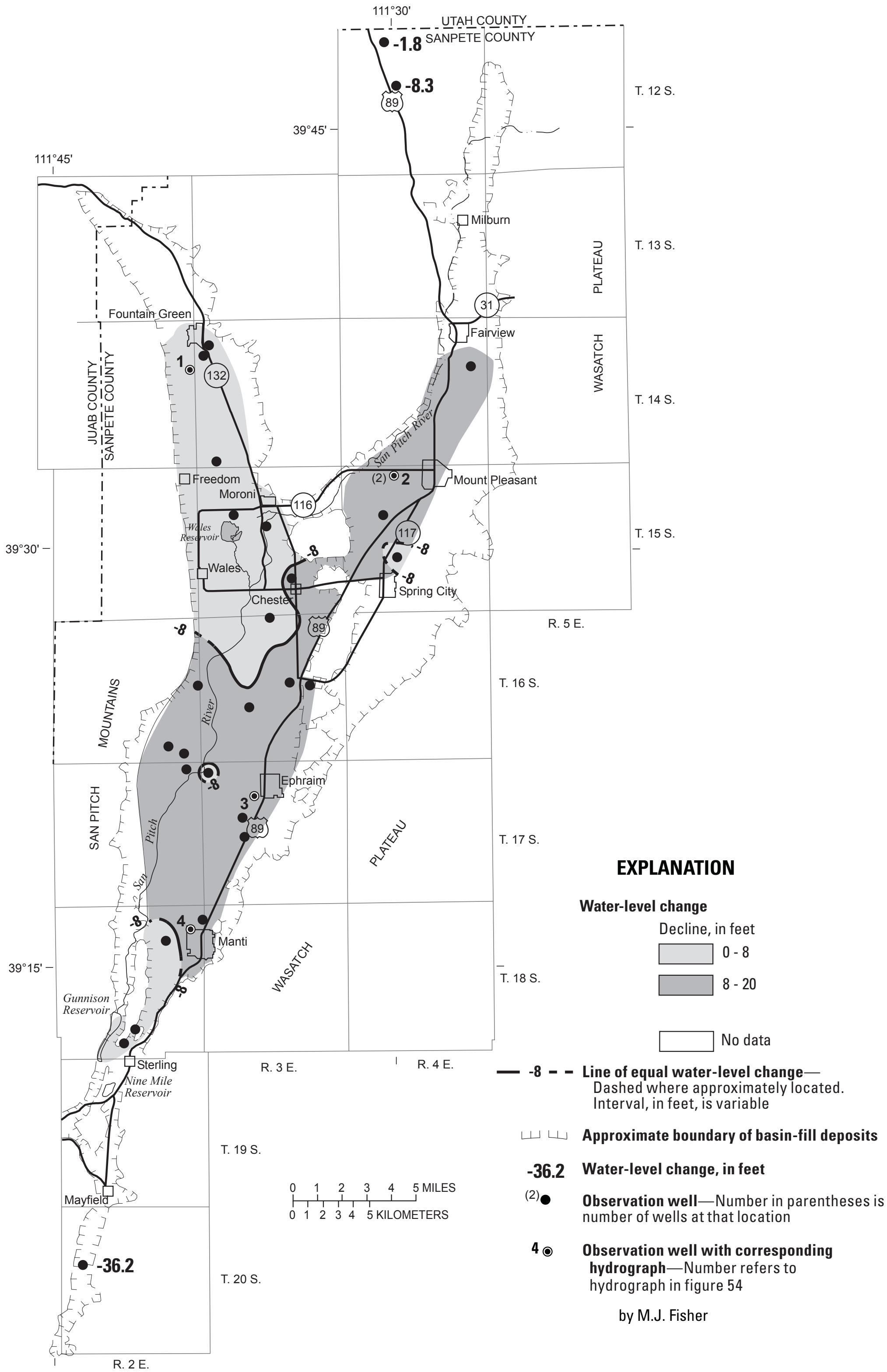


Figure 55. Map of Sanpete Valley showing change of water level from March 1975 to March 2005.

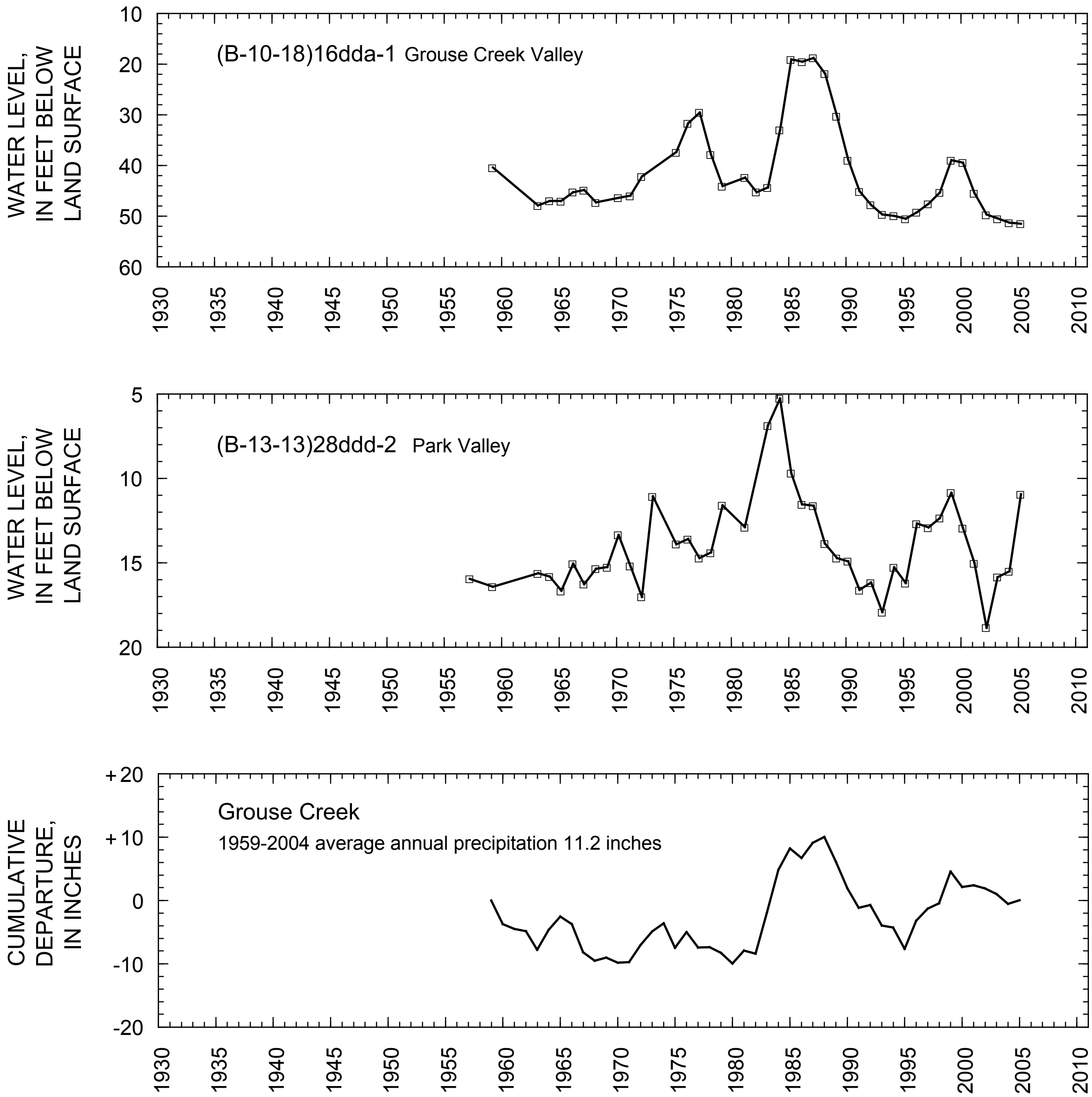


Figure 56. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.

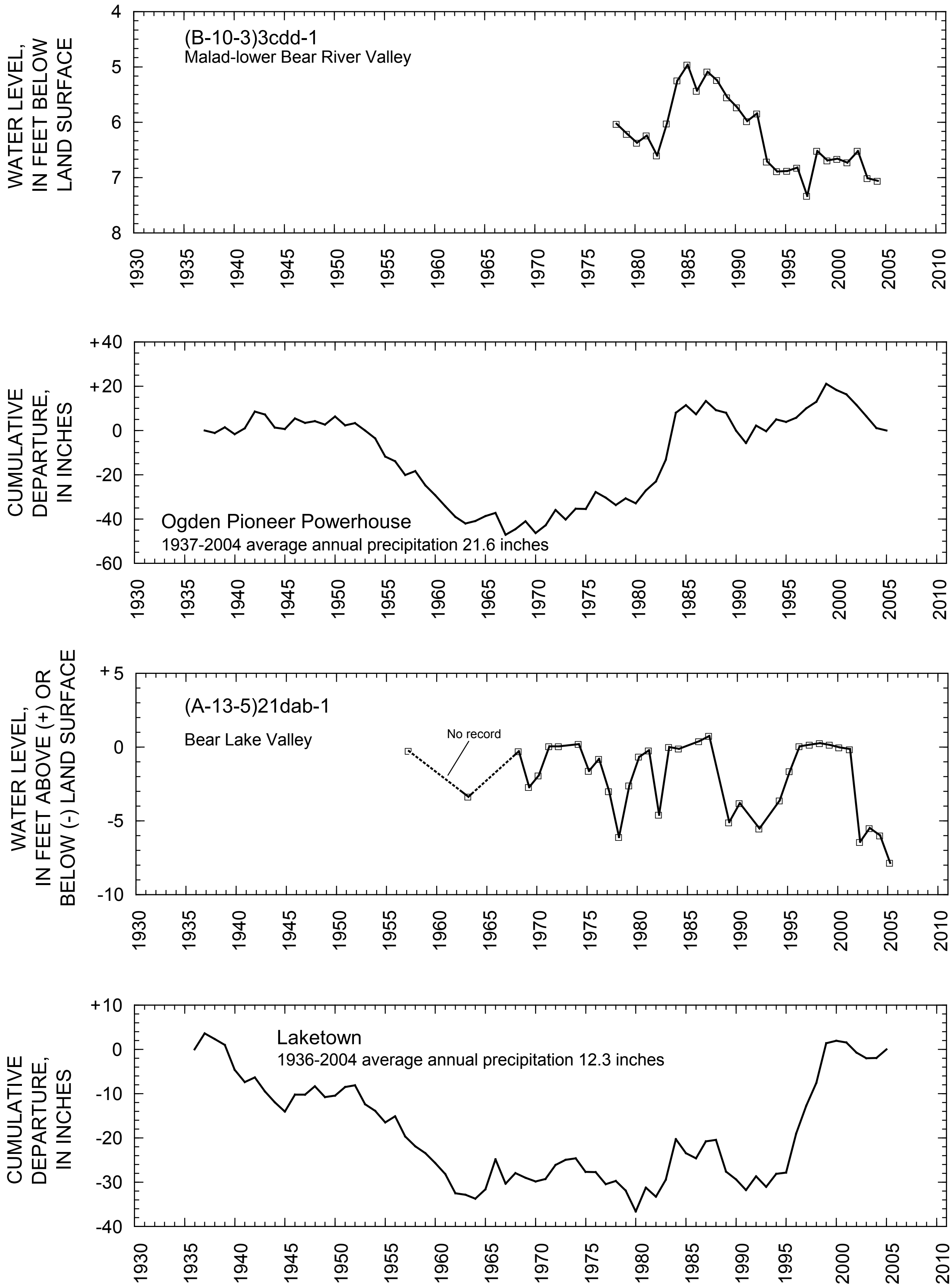


Figure 56. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

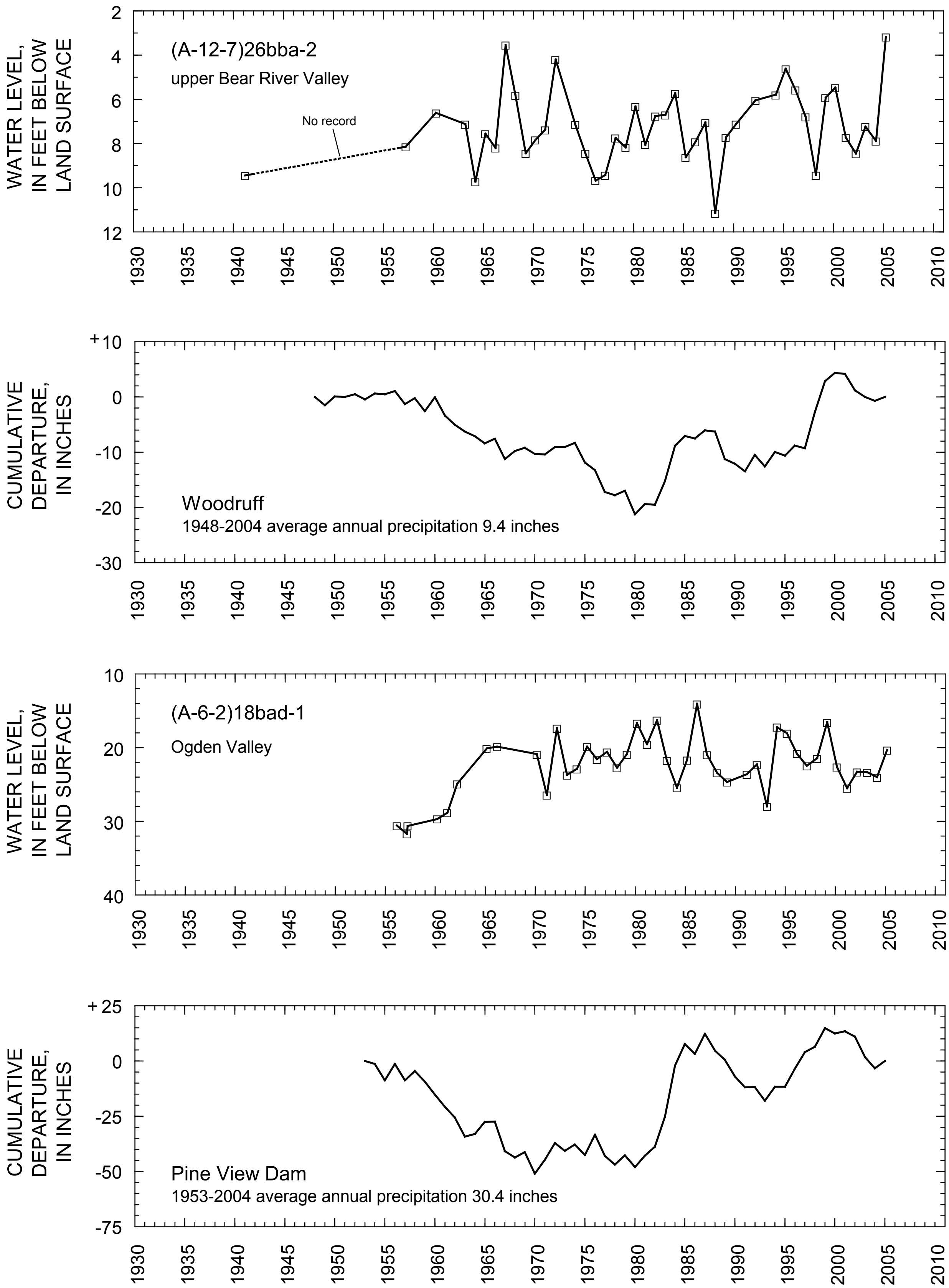


Figure 56. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

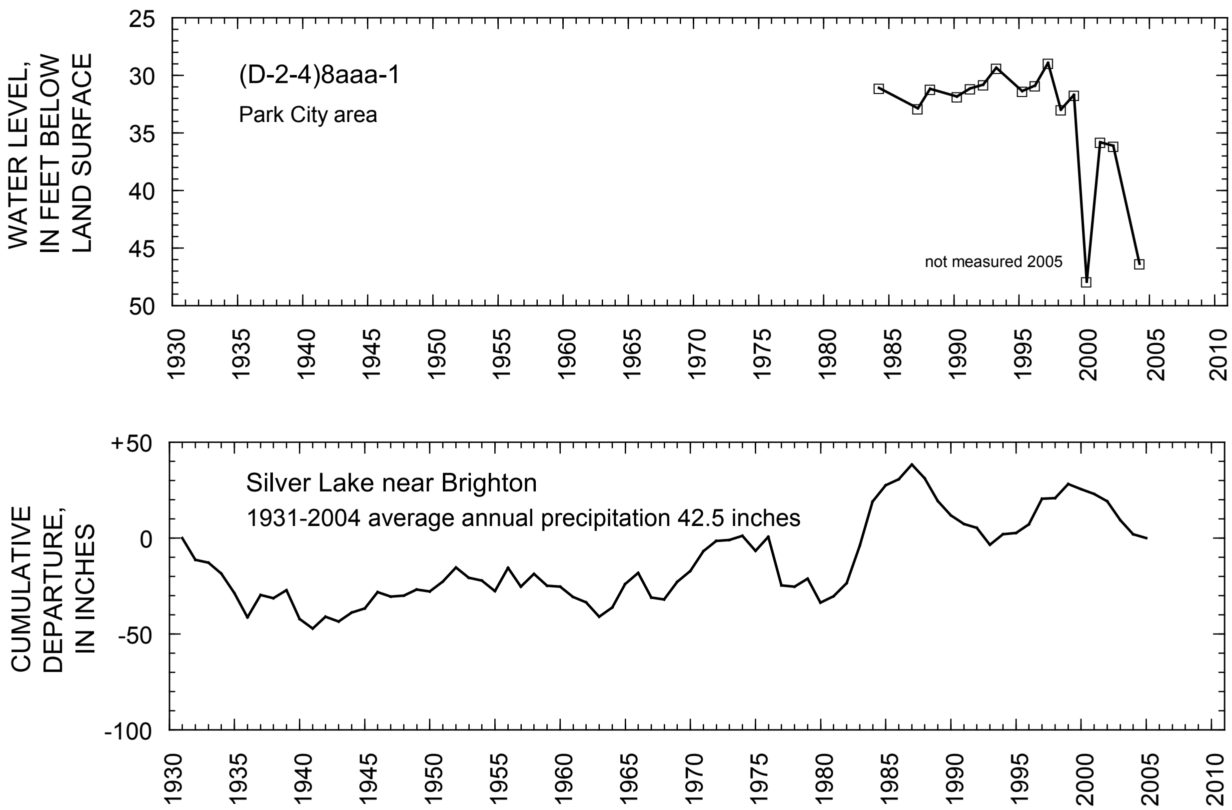


Figure 56. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

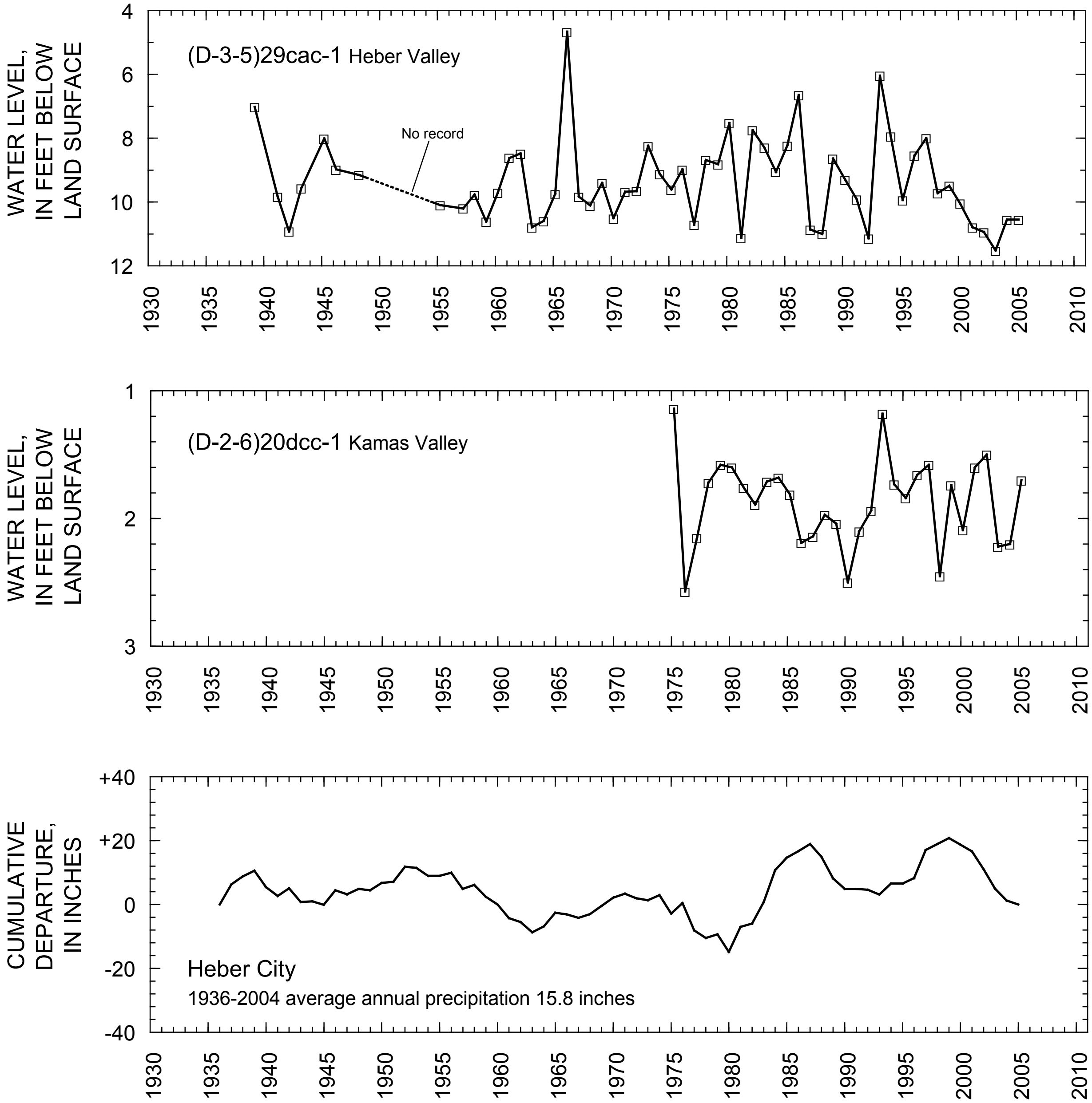


Figure 56. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

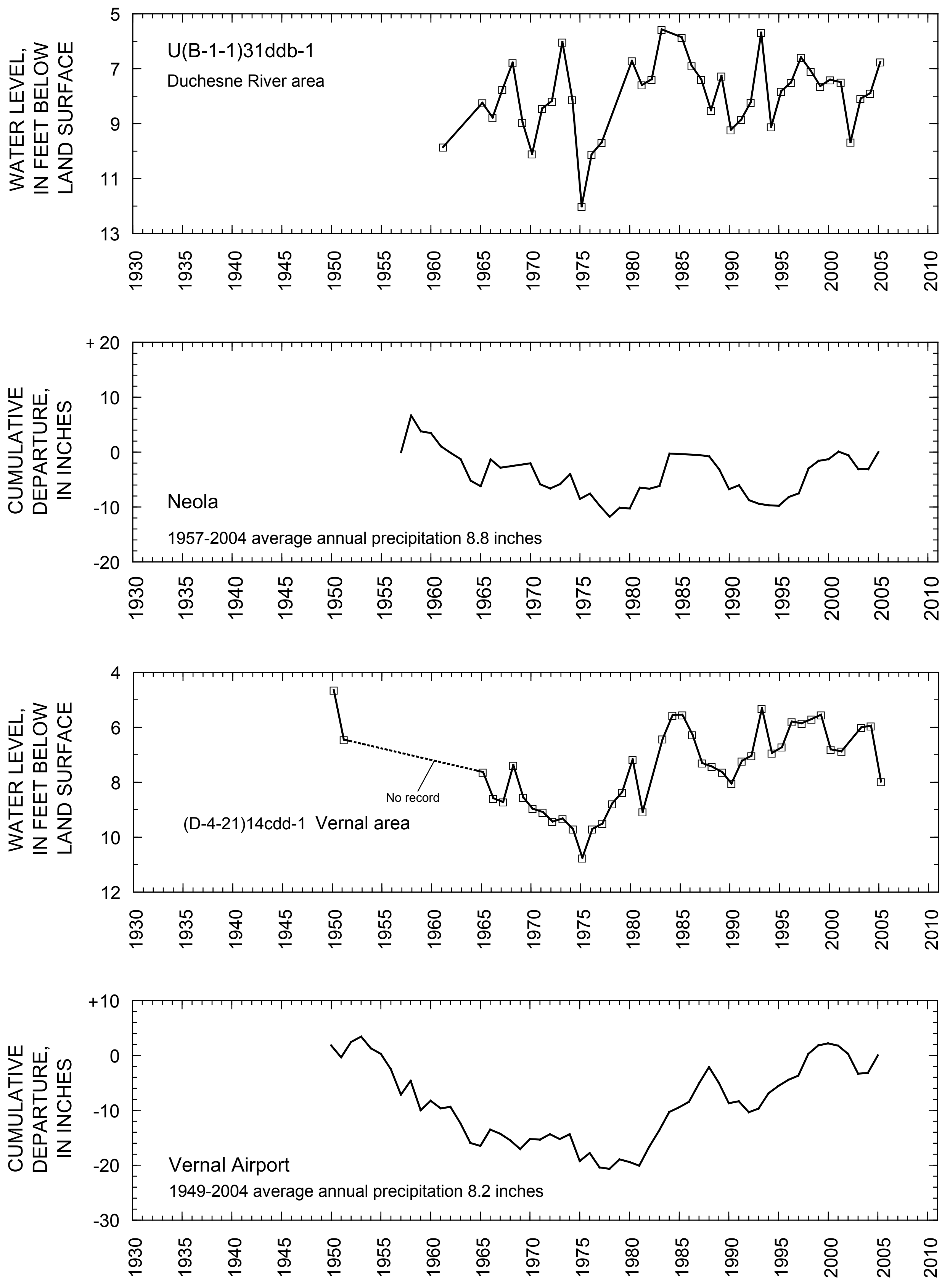


Figure 56. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

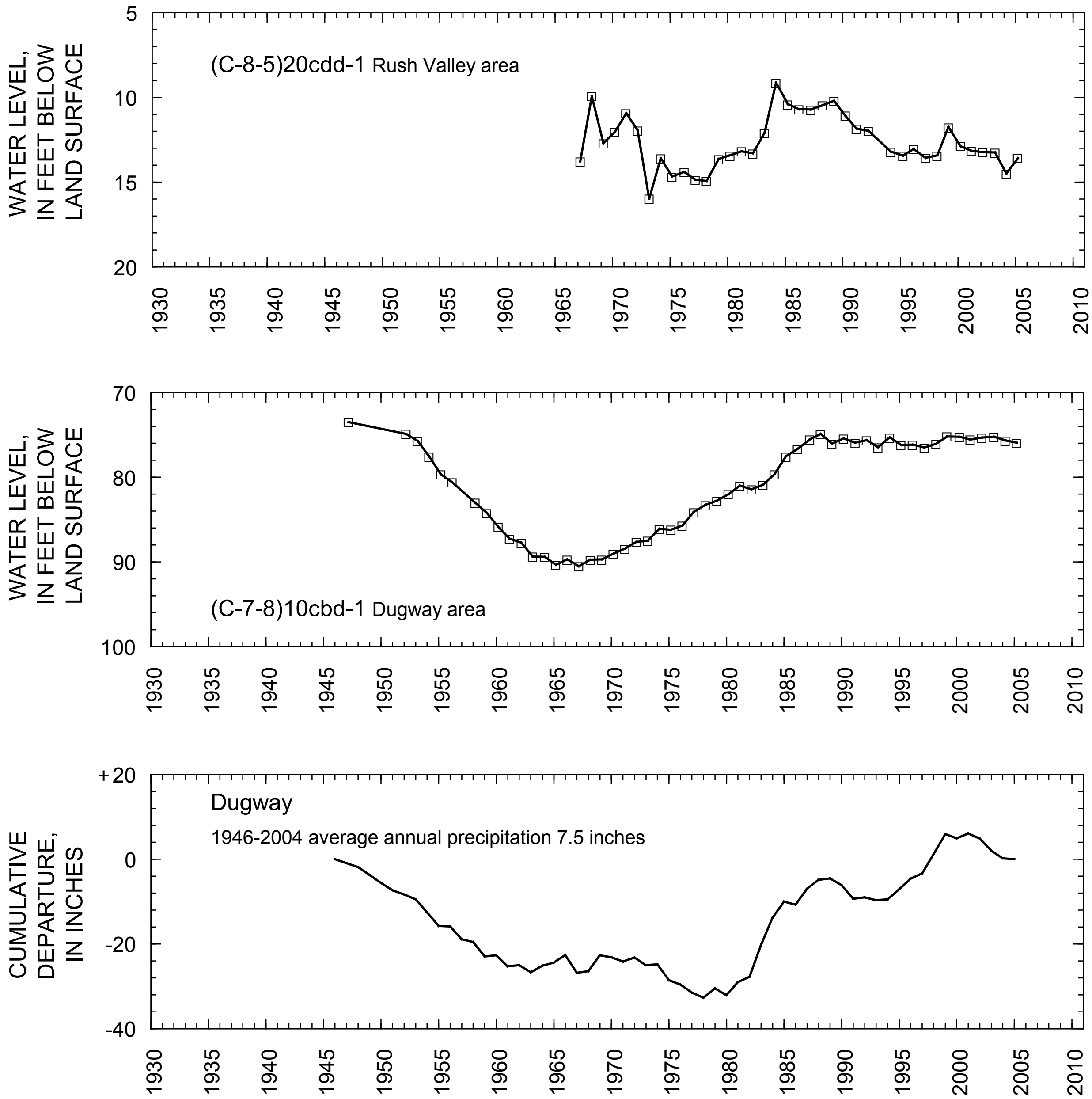


Figure 56. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

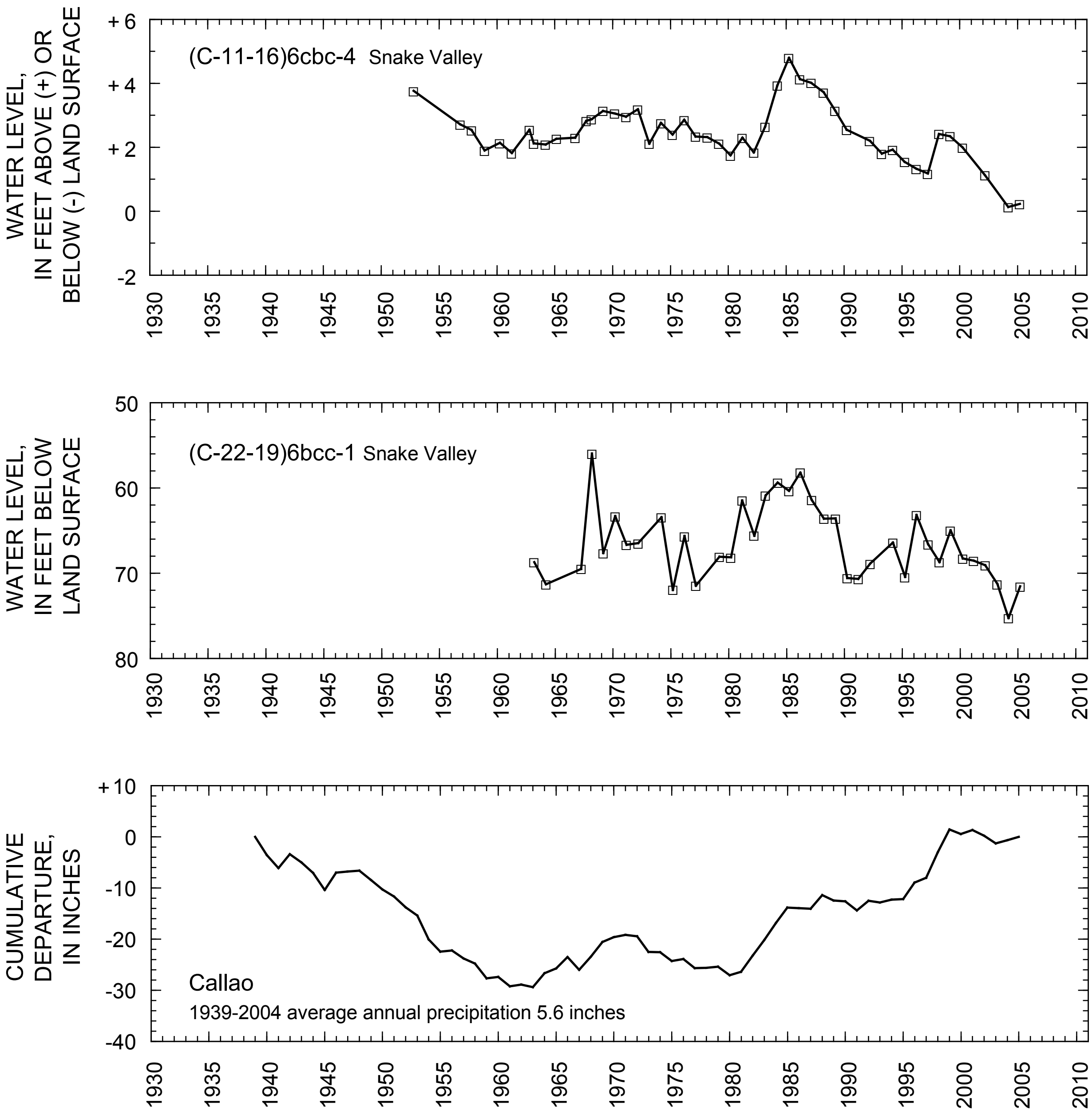


Figure 56. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

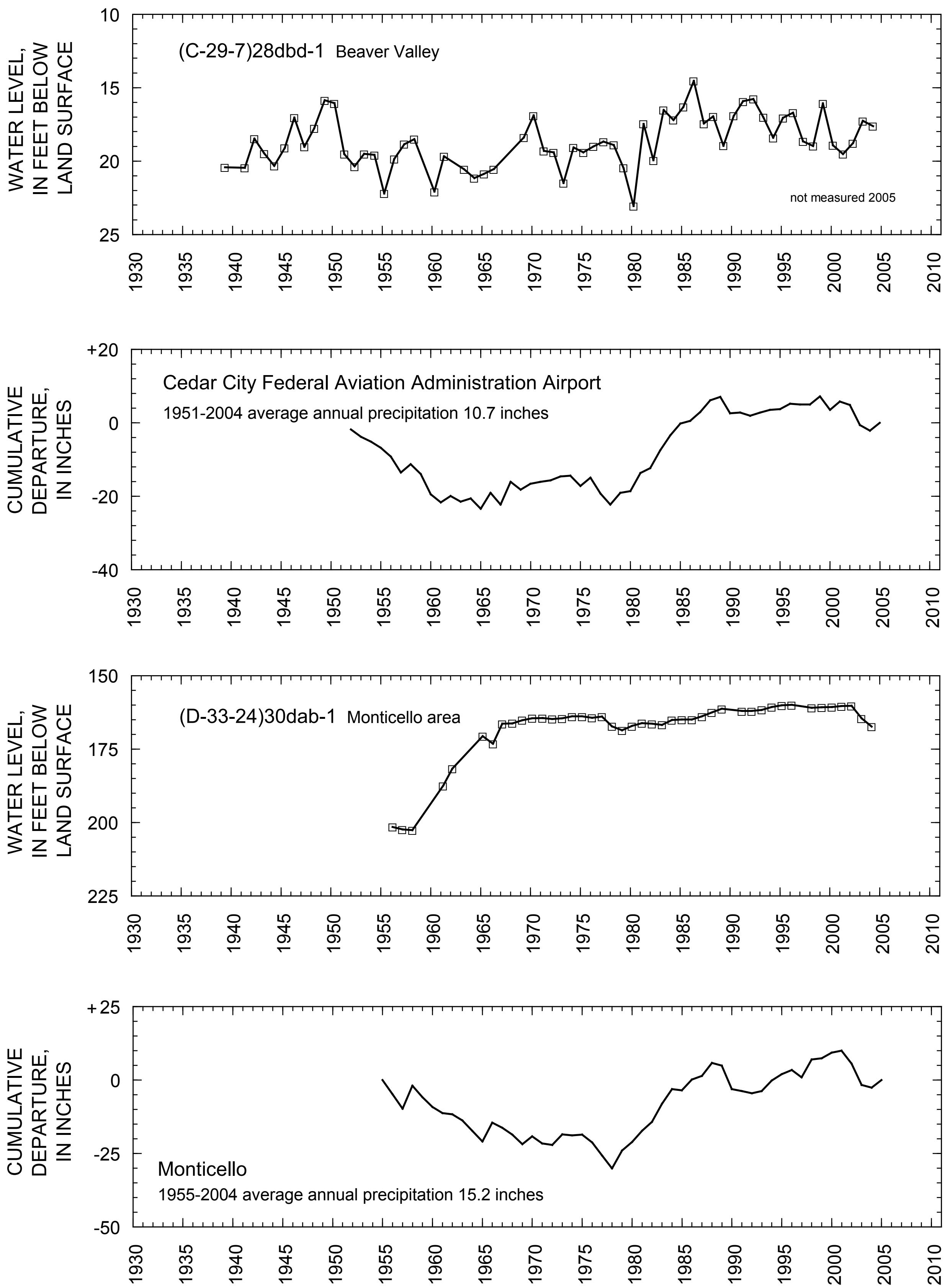


Figure 56. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

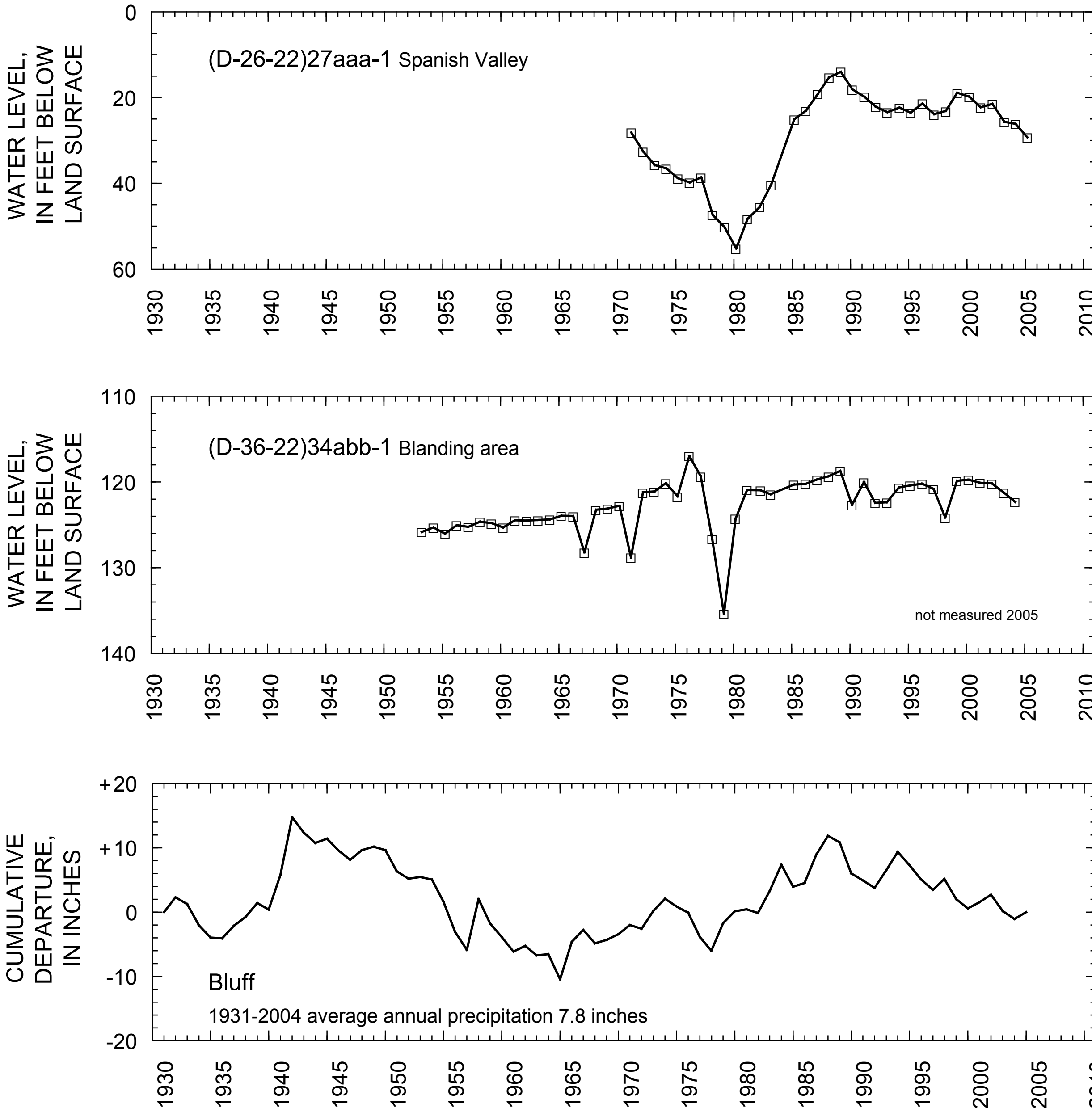


Figure 56. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

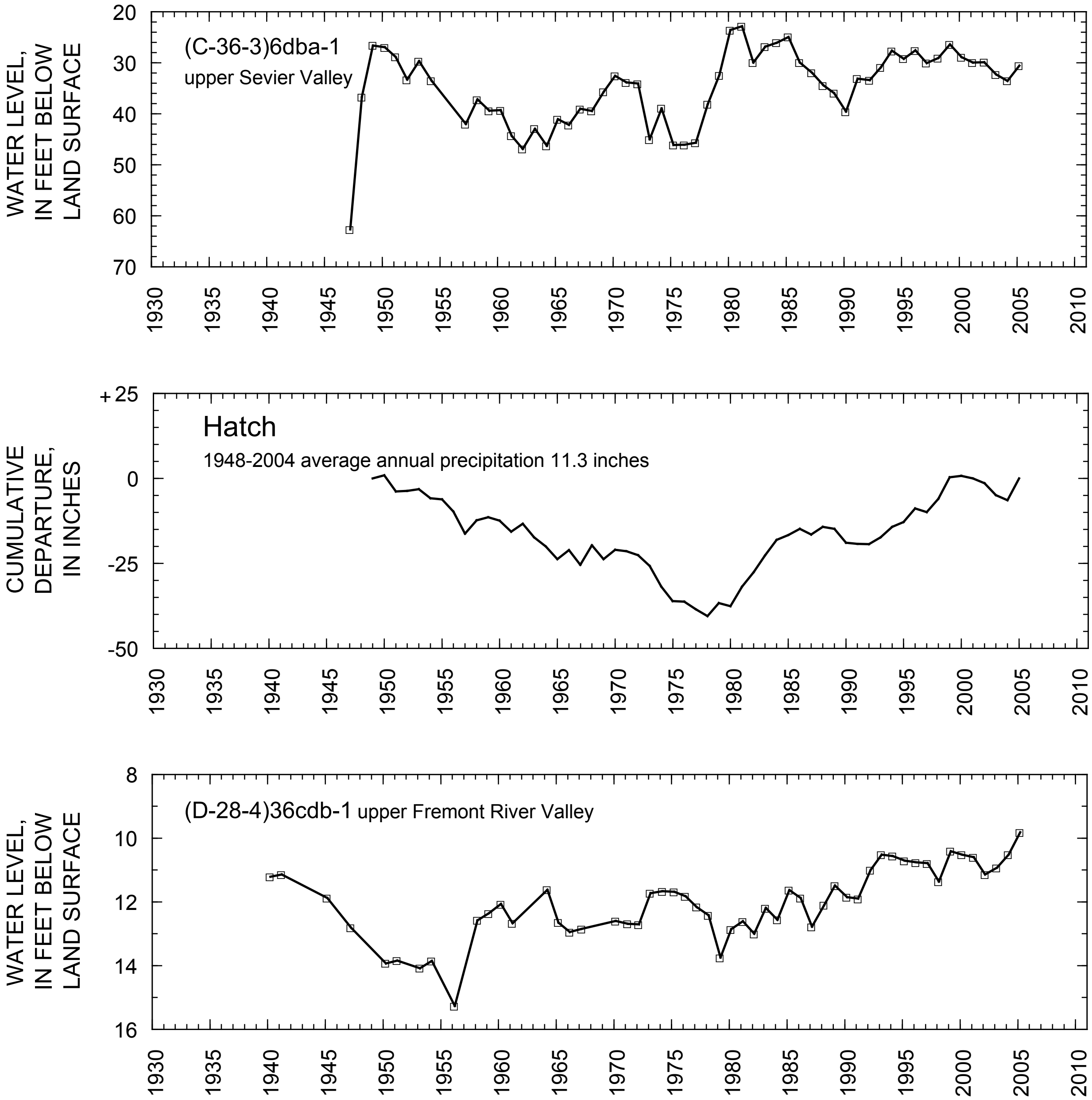


Figure 56. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

REFERENCES CITED

National Oceanic and Atmospheric Administration, 2004, Climatological data, Utah: Asheville, N.C., National Climatic Data Center, v. 106, no. 1-12 [variously paged].

Burden, C.B., and others, 2004, Ground-water conditions in Utah, Spring of 2004: Utah Division of Water Resources Cooperative Investigations Report No. 45, 120 p.