Ground Water in the Raft River Basin, Idaho With Special Reference To Irrigation Use, 1956-60

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1619-CC

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By M. J. MUNDORFF *and* H. G. SISCO

CONTRIBUTIONS TO THE HYDROLOGY OF THE UNITED STATES

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GROUND WATER IN THE RAFT RIVER BASIN, IDAHO—WITH SPECIAL REFERENCE TO IRRIGATION USE, 1956–60

By M. J. MUNDORFF and H. G. SISCO

ABSTRACT

In the Raft River basin in south-central Idaho, ground-water withdrawals for irrigation have more than doubled since 1955, when data were compiled for a comprehensive report on the area. The present report summerizes data on the ground-water use and changes in the water regimen during the intervening 5 years. Water levels have declined 10 to 20 feet in the areas of heaviest pumping and 3 to 5 feet throughout the remainder of the area. These water-level declines are related to increased ground-water pumpage and below-normal precipitation in the basin. The total pumpage during the 1960 irrigation season is estimated to be about 127,000 acre-feet, of which about half was consumed by crops or evaporated. The remainder returned to the aquifer.

Irrigation development is acting to reduce the amount of underflow out of the basin. The water table can be lowered considerably more before underflow from the basin would be reduced substantially.

INTRODUCTION

A comprehensive investigation of the water resources of the Raft River basin (fig. 1) was made by the U.S. Geological Survey during the period 1948–55 in cooperation with the Idaho Department of Reclamation. The results of that investigation are given in a report by Nace and others (1961).

The use of ground water in the basin has continued to increase subsequent to the end of the data-collection period (1955) for the report just mentioned. The rapidly expanding water use, declining water levels, interference between some wells, and the general increased competition for ground water have been cause for concern to water users, the Raft River Rural Electric Cooperative, Inc., the Bureau of Land Management, the Federal Land Bank, and others. More than 9,000 acres of public land have been withdrawn under desert-entry and homestead applications, and applications are on file with the Bureau of Land Management for about 18,000 to 20,000 additional acres.

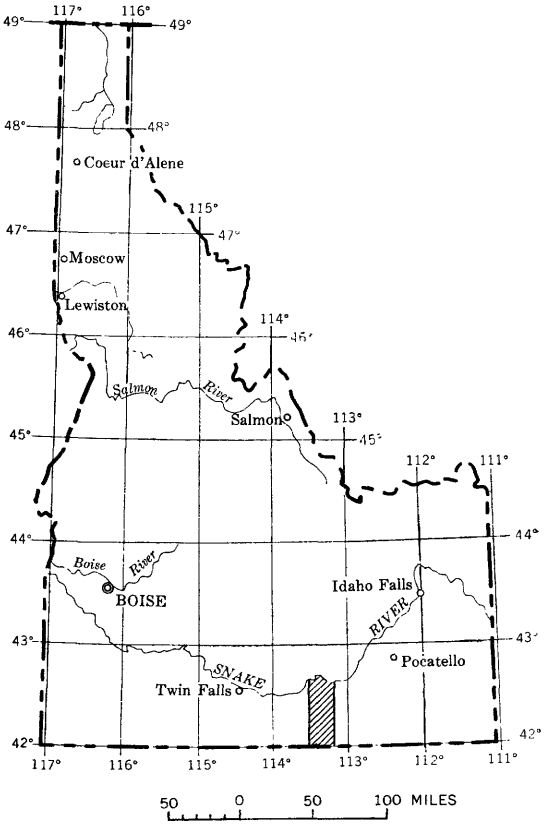

FIGURE 1.—Index map of Idaho showing location of area.

Because of the need for information on development and changes in the water regimen subsequent to 1955, the Geological Survey made a brief investigation in the basin in 1960–61. This investigation included bringing up to date the irrigation-well inventory (pl. 1 and table 4), measuring water levels in the new wells, remeasuring water levels in some of the older wells, expanding the observation-well network, and obtaining and compiling information on ground-water pumpage. This report gives the results of the investigation.

WELL-NUMBERING SYSTEM

The well-numbering system used in Idaho indicates the locations of wells within the official rectangular subdivisions of the public lands, with reference to the Boise base line and meridian. The first two segments of a number designate the township and range. The third segment gives the section number, followed by two letters and a numeral, which indicate the quarter section, the quarter-quarter sec-

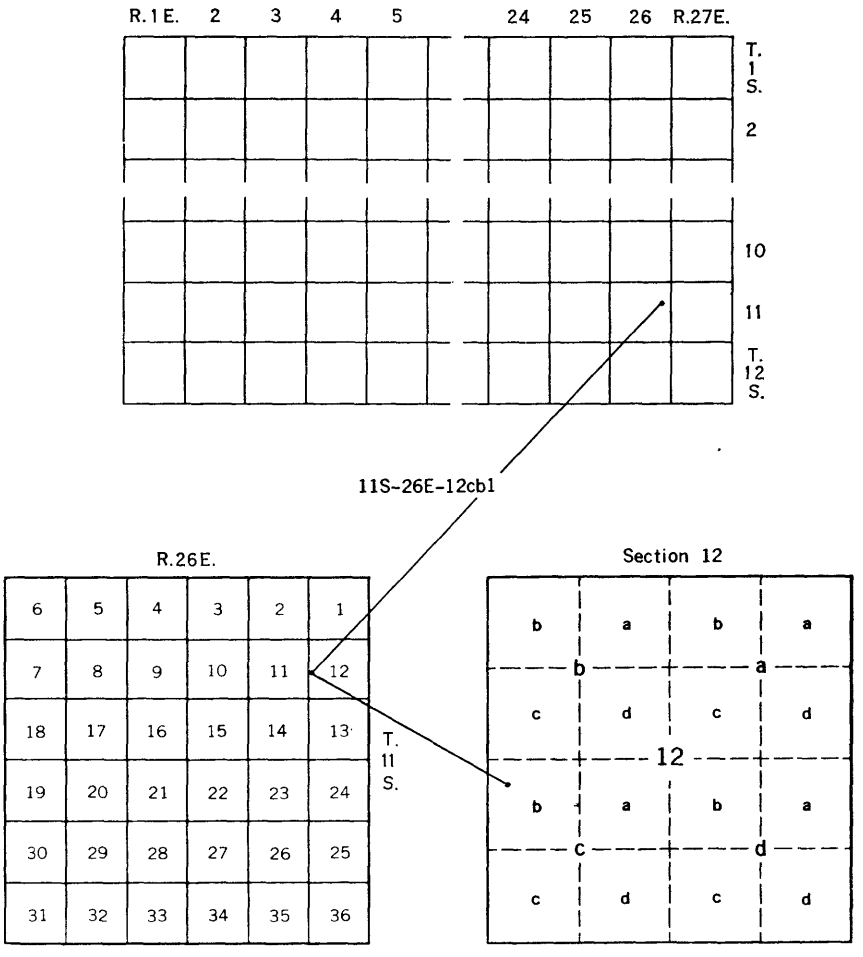

FIGURE 2.—Sketch of well-numbering system.

tion or 40-acre tract, and the serial number of the well within the tract. Quarter sections are lettered a, b, c, and d in counterclockwise order, from the northeast quarter of each section (fig. 2). Within the quarter sections, 40-acre tracts are lettered in the same manner. Well 11S–26E–12cb1 is in the NW¼SW¼ sec. 12, T. 11 S., R. 26 E. and is the well first visited in that tract.

GROUND-WATER USE

Ground-water use was estimated primarily from power-consumption data furnished by the Raft River Rural Electric Cooperative, Inc. Static water levels and drawdowns were used to obtain total lift or head. Some of the measurements were made in 1960 and 1961;

others several to 10 years ago, and adjustments were made to compensate for the decline in the water table in recent years. Adjustments also were made for seasonal changes in water levels. Ground-water pumpage was computed for each well from measured or estimated total head and the power consumed.

On the basis of measurements from 30 wells in May 1961, relating pump discharge to power consumption, an efficiency of 52 percent (wire to water) was assumed.

Withdrawals from individual wells were computed for 1958 and 1960 and are summarized by township and range in table 1. Time did not permit computing individual well pumpage for 1956, 1957, and 1959. However, a figure for total pumpage was obtained by using the total power consumption and relating it to the pumpage-power consumption ratios determined for 1958 and 1960. Power consumption and ground-water pumpage for the period 1948–60 are shown in figure 3.

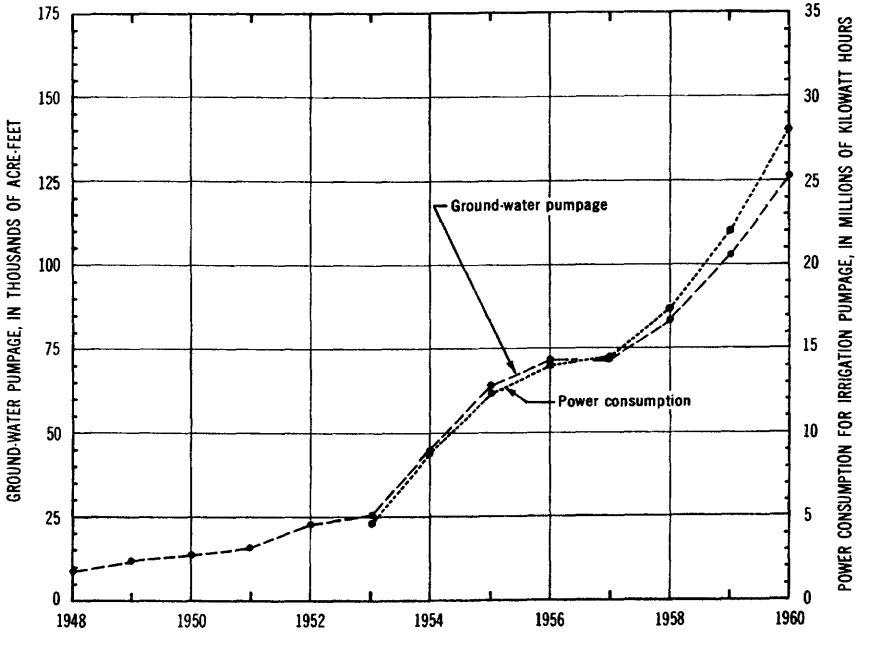

FIGURE 3.—Ground-water pumpage in Raft River basin.

CHANGES IN THE WATER TABLE

The changes in water levels in the basin are shown by periodic measurements of water levels in 14 observation wells in the basin and occasional remeasurement of water levels in other wells previously measured. Water levels in 38 wells measured in previous years were

TABLE 1.—*Estimated yearly pumpage in acre-feet, from wells in Raft River basin, 1956–60*

Township (south)	Range (east)	1956	1957	1958	1959	1960
10	25	----------	----------	400	----------	800
10	26	----------	----------	2, 200	----------	3, 200
10	27	----------	----------	1, 150	----------	3, 100
10	28	----------	----------	5, 000	----------	5, 100
11	26	----------	----------	9, 700	----------	15, 500
11	27	----------	----------	13, 400	----------	20, 400
11	28	----------	----------	2, 000	----------	11, 700
12	26	----------	----------	7, 800	----------	8, 800
12	27	----------	----------	2, 700	----------	4, 200
12	28	----------	----------	650	----------	1, 300
13	26	----------	----------	1, 800	----------	6, 200
13	27	----------	----------	10, 400	----------	16, 500
13	28	----------	----------	80	----------	650
14	27	----------	----------	16, 300	----------	24, 000
15	24	----------	----------	1, 000	----------	2, 150
15	25	----------	----------	0	----------	700
15	26	----------	----------	2, 500	----------	4, 000
15	27	----------	----------	5, 100	----------	6, 400
16	24	----------	----------	400	----------	1, 400
16	25	----------	----------	650	----------	550
16	26	----------	----------	370	----------	50
16	27	----------	----------	160	----------	240
Total (rounded)		71, 500	72, 000	84, 000	103, 000	127, 000
Power used (kilowatt hours)		14,000,000	14,500,000	17,500,000	22,000,000	28,000,000

remeasured in March 1961. A comparison of the 1961 measurements and earlier measurements is given in table 2. Because not all measurements were made at the same time of the year, adjustments for seasonal water-level changes were required before a valid comparison could be made. Prior to 1952, hydrographs of observation wells and occasional water-level measurements indicated, except for seasonal changes, little net change in the water table. Therefore, 1960 and 1961 water-level measurements were compared with pre-1952 measurements (last column, table 2). The water level in nearly all wells remeasured declined from a few feet to more than 20 feet. The level in two wells rose slightly; however, the measurements were made at different seasons of the year, and the seasonal adjustment required may have been more than was used in the table.

Lines of equal change in water level are shown on plate 1.

Hydrographs of the 14 observation wells are given in figures 4 to 17. Study of the hydrographs shows that the decline of the water table generally was most rapid during two periods, 1954–55 and 1959–60, which were both periods of scant precipitation and, presumably, little ground-water recharge.

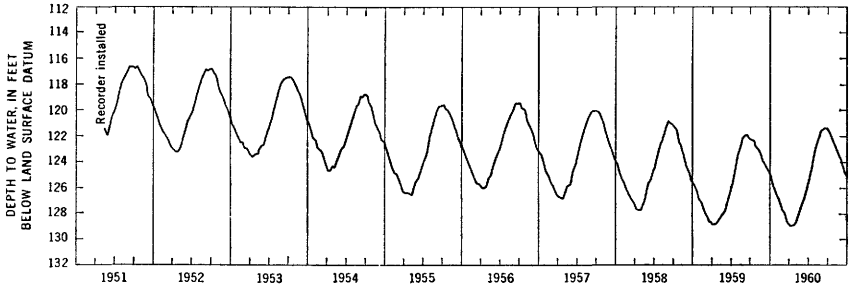

FIGURE 4.—Hydrograph of well 9S-25E-23db1.

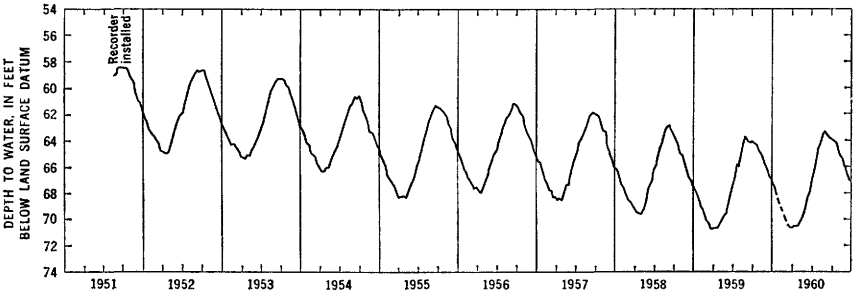

FIGURE 5.—Hydrograph of well 9S-26E-7bc1.

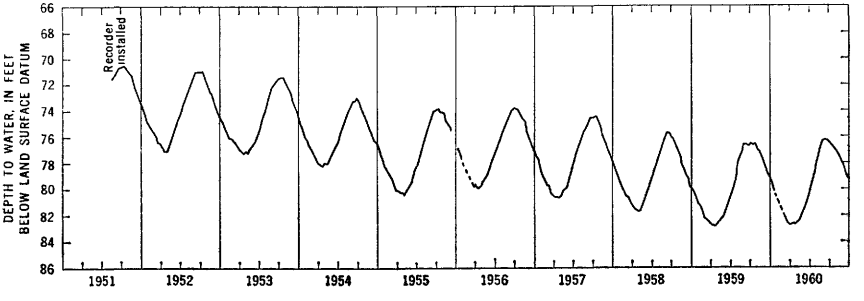

FIGURE 6.—Hydrograph of well 9S-26E-10aa1.

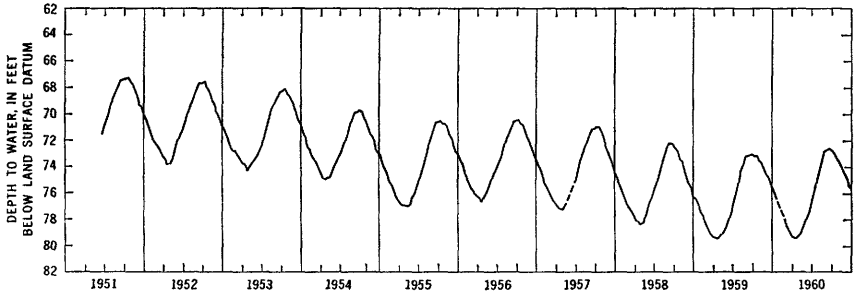

FIGURE 7.—Hydrograph of well 9S-26E-10dd1.

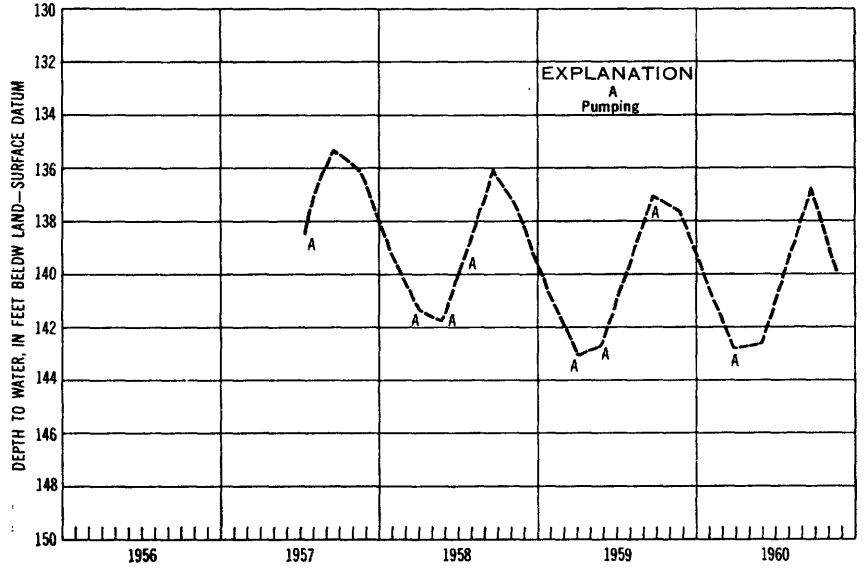

FIGURE 8.—Hydrograph of well 9S-26E-13cc1.

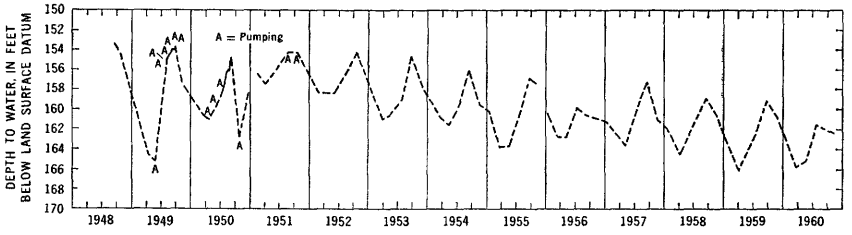

FIGURE 9.—Hydrograph of well 10S-25E-10ba1.

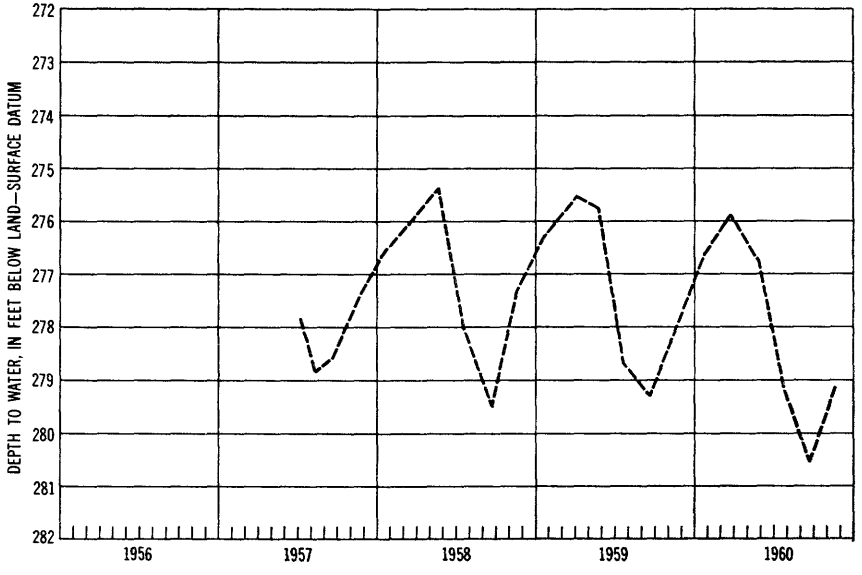

FIGURE 10.—Hydrograph of well 10S-26E-34ba2.

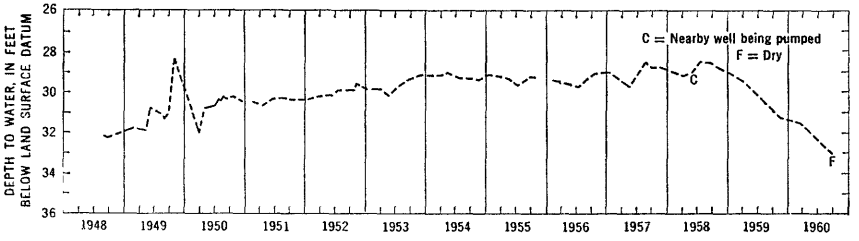

FIGURE 11.—Hydrograph of well 11S-26E-26cc1.

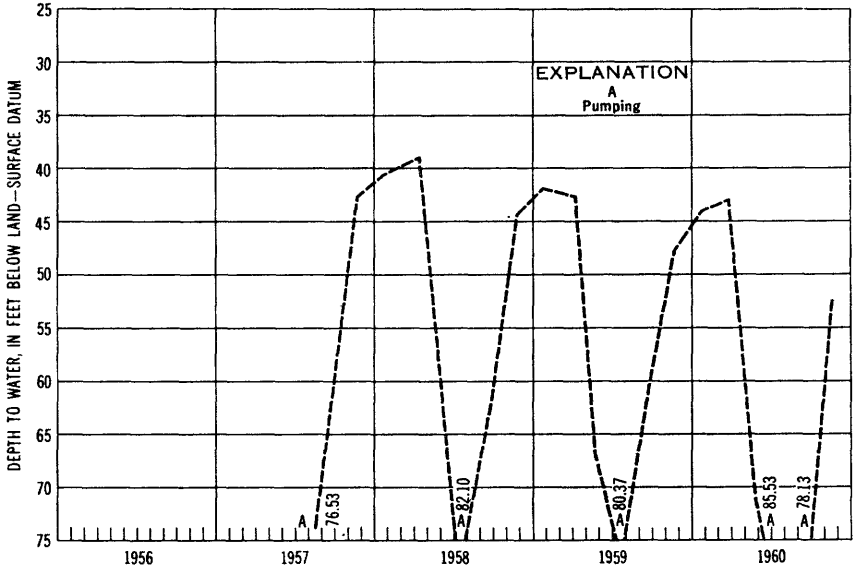

FIGURE 12.—Hydrograph of well 12S-26E-2ac1.

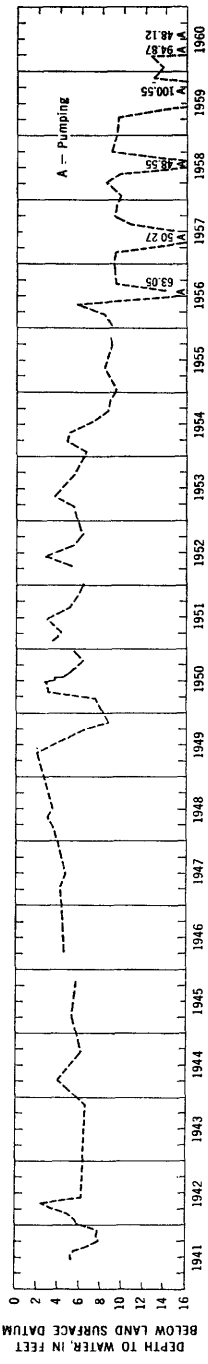

FIGURE 13.—Hydrograph of well 13S-26E-24aa1.

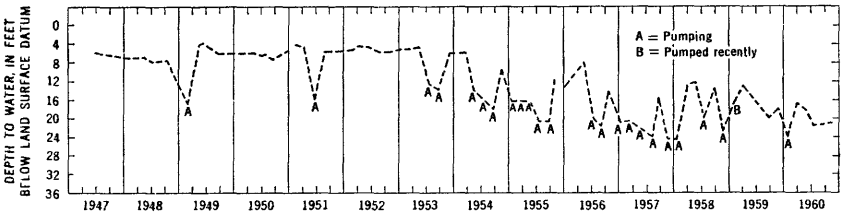

FIGURE 14.—Hydrograph of well 13S–27E–30bd1.

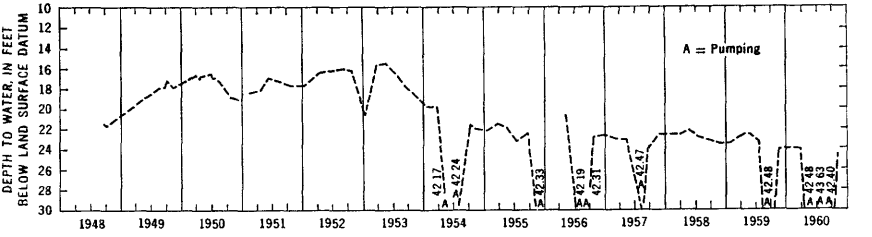

FIGURE 15.—Hydrograph of well 14S–27E–33ca1.

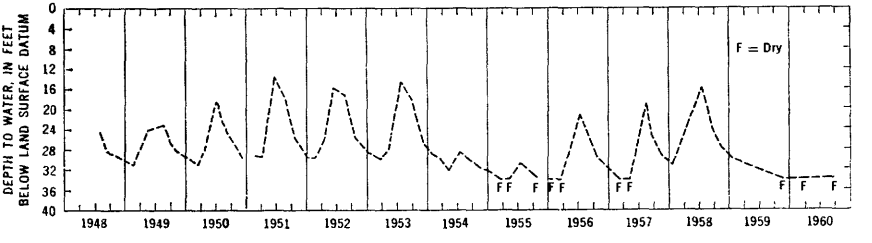

FIGURE 16.—Hydrograph of well 15S–25E–6ab1.

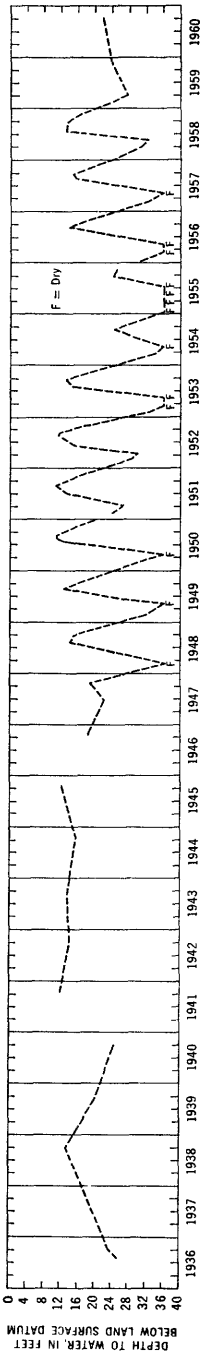

FIGURE 17.—Hydrograph of well 16S-27E-26ba1.

CHEMICAL QUALITY OF GROUND WATER

The report by Nace and others (1961, p. 76) included chemical analysis of water from five wells and a discussion of the suitability of the water for irrigation. Subsequently, 19 water samples were collected and analyzed by the Bureau of Reclamation and the Geological Survey as a part of the investigation of the ground-water resources of the Snake River basin by the two agencies (Mundorff and others, 1960). Analyses of the samples are given in table 3.

Some of the water sampled has a high to very high salinity hazard (Nace and others, 1961, p. 78), but more than half had only a medium salinity hazard. Sodium hazard generally is low.

In general, the ground water sampled is satisfactory for irrigation of most crops, where applied on well-drained soils.

CONCLUSIONS

The water table has declined generally throughout the Raft River basin during the past decade. Delcines of 10 to 20 feet are general in the areas of heaviest pumpage (pl. 1). A 3- to 5-foot decline has generally occurred in much of the basin away from centers of pumping, and at least part of this decline is related to below-normal precipitation in the basin and consequent reduced recharge during two periods, 1954–55 and 1959–60.

By use of an assumed value for specific yield of the materials dewatered by decline of the water table and by computation of the volume of material dewatered by using the lines of equal change in water level (pl. 1), the quantity of water removed from storage during the period can be computed. If one assumes a specific yield of 25 percent, which seems reasonable for sand and gravel, the estimated depletion of ground water in storage is roughly 400,000 acre-feet. Total ground-water pumpage during the period 1948–60, based on Nace and others (1961, table 18, p. 79) and table 1 of this report, was about 670,000 acre-feet. As perhaps only half the water pumped is consumed by crops or is evaporated and as the other half returns to the aquifer, the computations indicate that the water consumed has come chiefly from storage.

The general decline of the water table and flattening of the hydraulic gradient throughout the valley indicates that outflow from the valley has been reduced somewhat. However, this reduction probably is due, in part, to the below-normal recharge to the valley in 1954–55 and 1959–60.

A conservative estimate by Nace and others (1961) of unused and uncommitted underflow from the basin in 1955 was 140,000 acre-feet. Ground-water pumpage doubled between 1955 and 1960, so that unused and uncommitted underflow has been greatly reduced. Use of

the precipitation-water yield relation developed in the report by Mundorff and others (1960) gives a water yield for the Raft River basin of about 320,000 acre-feet before irrigation development. Deducting irrigation use leaves perhaps 200,000 acre-feet of unused and uncommitted underflow annually from the basin as of 1955, a considerably larger amount than that estimated by Nace and others (1961, p. 80).

Regardless of whether the underflow was 140,000 or 200,000 acre-feet annually in 1955, increased withdrawals since that time are acting to reduce the underflow. Reduction of underflow requires reducing 1 of the following 3 factors: (1) Hydraulic gradient, (2) transmissibility, or (3) the product of transmissibility multiplied by the hydraulic gradient. To effect a reduction in underflow of one-fourth, for example, would require reducing 1 of the 3 factors by one-fourth, and this would result in considerable dewatering of the aquifer and lowing of the water table—perhaps by one-fourth of the saturated thickness of the aquifer, which may be several hundred feet. Thus a water-table decline of 50 to 100 feet may be required to intercept effectively one-fourth of the underflow. However, it is presumed that about twice this amount of water would be pumped, because roughly half would return to the aquifer.

REFERENCES

Mundorff, M. J., Crosthwaite, E. G., and Kilburn, Chabot, 1960, Ground water for irrigation in the Snake River basin, Idaho: U.S. Geol. Survey open-file rept., 204 p., 60 figs.

Nace, R. L., and others, 1961, Water resources of the Raft River basin, Idaho-Utah: U.S. Geol. Survey Water-Supply Paper 1587, 138 p., 6 pls.

TABLE 2.—*Changes in water levels in wells, Raft River basin, 1948–61*

[Depths to water are in feet below land-surface datum]

Well	Period from 1948 through 1952				1959		1960		1961		Change in water level, in feet, pre-1953 to 1961
	Depth to water (feet)	Date	Depth to water (feet)	Date (1952)	Depth to water (feet)	Date	Depth to water (feet)	Date	Depth to water (feet)	Date	
10S–25E–10ba1	160.6	3–21–50	158.4	Feb. 29	166.1	Apr. 2	165.9	Mar. 24	165.8	Mar. 23	−5.2
			[1] (159.0)	Mar. 30							
10S–26E–34ba2					275.5	do	275.9	do	276.3	do	
36bb1			187.0	Oct. 22					181.0	do	
			[1] (184.0)								+3.0
10S–27E–26da1	24.8	8–11–50	24.7	Oct. 19					27.5	do	−2.7
35ac1	23.5	9–22–48	24.2	do	30.4	Aug. 12	30.9	Aug. 10	29.8	do	−6.3
11S–26E–12ab1	118.6	8–7–50	117.6	Nov. 5					117.9	Mar. 24	+0.7
13bb1			72.7	do					88.1	do	−14.3
26cc1	32.0	3–21–50	30.2	Feb. 29	29.4	Apr. 2	31.6	Mar. 24	Dry 33 ft	do	
27cd1							45.4	Aug. 12	41.7	do	
11S–27E–10aa1	5.6	7–19–50	5.6	Oct. 19					9.7	do	−4.1
15bb1			33.1	do					36.4	Mar. 23	−3.3
22cb2			41.7	Oct. 15					55.4	do	−13.7
28bb1	34.3	8–11–50	32.8	Nov. 5			52.7	Aug. 17	50.9	do	−16.6
31dd1			11.7	Aug. 12					22.0	Mar. 24	−10.3
33dd1			70.1	do					87.9	do	−17.8
35ad1			110.9	Oct. 15					128.5	do	−17.6
12S–26E–2ac1			32.0	Nov. 6	42.7	Apr. 2	43.0	Mar. 24	46.6	do	−16.6
			[1] (29.0)	March							−17.6
											−22.4
13bc2			29.8	Nov. 7					47.7	Apr. 15	
			[1](25.3)	Mar. 30							
24ac1	6.5	4–21–50							26.0	Mar. 24	−19.5
12S–27E–19ca2			14.1	Oct. 16					29.1	do	−15.0
30bc1	5.2	7–12–50	11.2	Nov. 6					14.9	do	−9.7
13S–26E–1cc1	22.2	8–10–49	23.7	do					32.6	do	−10.4
13ba2	12.0	4–21–50	14.4	do					13.0	do	−1.0
24aa1	7.5	3–21–50	5.2	Apr. 18	9.5	Apr. 2	12.6	Mar. 24			[2] −5.1
13S–27E–18bd1	5.8	6–27–50	9.0	Nov. 6					15.6	Mar. 24	−9.8
29bc1			13.5	Oct. 21					24.3	Apr. 15	−10.8
30bd1	5.8	3–21–50	4.3	Apr. 18	13.0	Apr. 2	16.7	Mar. 24	19.8	Mar. 24	−14.0
32cb1	22.8	4–20–50	11.7	Oct. 21					27.5	do	−4.7

See footnotes at end of table.

TABLE 2.—*Changes in water levels in wells, Raft River basin, 1948–61*—Continued

[Depths to water are in feet below land-surface datum]

Well	Period from 1948 through 1952				1959		1960		1961		Change in water level, in feet, pre-1953 to 1961
	Depth to water (feet)	Date	Depth to water (feet)	Date (1952)	Depth to water (feet)	Date	Depth to water (feet)	Date	Depth to water (feet)	Date	
14S–27E–6ad1	13.4	4–20–50	12.8	Nov. 4					30.6	Mar. 24	−17.2
9bb1	17.0	do	16.2	do					29.9	Apr. 14	−12.9
16cc1			10.1	Oct. 20					21.2	do	−12.2
			[1] (9.0)	Mar. 20							
17cc1			13.6	Nov. 4					26.1	Mar. 25	−12.5
29da1			12.1	do					17.2	do	−5.1
33ca1	16.8	4–22–50	16.5	Apr. 18	22.8	Apr. 2	24.1	Mar. 24	24.1	do	−7.3
15S–26E–24cd1			11.0	Nov. 3					15.9	Apr. 14	−5.9
15S–27E–8bb1			[1] (10.0)	Mar. 30					24.2	Mar. 25	
19cc1			30.5	Nov. 3					38.5	Apr. 14	−10.0
			[1] (28.5)	March							
16S–27E–26ba1	31.9	3–21–50	29.8	Apr. 18	28.0	Apr. 2			Dry at 35.0	Mar. 25	

[1] Corrected for seasonal change on basis of hydrographs of other wells in area.
[2] Change during period pre-1953–1960

TABLE 3.—*Chemical analyses, in parts per million, of ground water from the Raft River basin, Idaho*

[Analyses by U.S. Bur. of Reclamation, region 1, Boise, Idaho, except as noted. Quantities rounded in accordance with practice of U.S. Geol. Survey]

Well	Date of collection	Temperature (°F)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Phosphate (PO_4)	Boron (B)	Hardness as $CaCO_3$		Percent sodium	Sodium-adsorption ratio	Residual sodium carbonate	Specific conductance (micromhos at 25° C)	pH
																Calcium, magnesium	Noncarbonate					
9S–25E–26dc1	4–30–59	54			45	21	66	10	181	28	132	0.5	0.6	0.32	0.12	199	51	40	2.04	0.00	767	7.8
10S–26E–36bb1	do	54			88	19	100	10	248	37	221	.6	.0	.0	.12	297	94	41	2.53	.00	1,130	7.5
10S–26E–36dc1	do	53			82	18	63	10	189	43	172	.4	2.5	.06	.0	280	125	32	1.65	.00	959	7.6
10S–26E–36dc2	do	54			77	26	84	10	232	33	208	.3	.0	.0	.10	300	110	37	2.12	.00	1,060	7.5
10S–28E–6dc1	do	58			42	16	17	4	197	20	32	.4	.6	.0	.36	172	10	20	.58	.00	421	7.9
10S–28E–19cb1	do	60			55	20	18	10	229	22	48	.3	1.9	.0	.08	220	32	15	.53	.00	538	7.6
11S–26E–10da1	do	58			50	9	69	12	133	22	144	.5	.0	.0	.08	163	54	46	2.34	.00	749	7.5
11S–26E–12ab1	do	53			251	39	200	8	254	282	548	.6	44	.0	.20	786	578	35	3.10	.00	2,600	7.3
11S–26E–12cb1	do	53			65	11	56	8	168	30	127	.5	.0	.0	.08	206	68	36	1.19	.00	739	7.3
11S–26E–25cc1	do	52			81	17	86	10	210	31	193	.5	.0	.06	.20	270	98	40	2.28	.00	993	7.1
11S–26E–26dc1	do	52			423	49	271	6	204	347	988	.5	1.2	1.3	.24	1,260	1,090	32	2.36	.00	3,760	7.2
11S–26E–35cc [1]	8–26–57	56	52	0.03	74	12	32	4.8	171	33	94	.3	.6	------	------	234	94	22	.91	------	648	7.5
11S–27E–34cb1	4–30–59	62			43	16	62	8	202	23	98	1.6	.0	.0	.08	173	8	42	2.05	.00	675	7.9
11S–28E–6ab1	4–30–56	60			62	22	21	8	222	20	67	.2	2.5	.0	.08	246	65	15	.58	.00	598	7.7
12S–26E–11dc1	4–30–59	54			49	17	40	8	193	36	85	.5	.0	.0	.08	194	36	30	1.27	.00	630	7.5
12S–26E–13bc2	do	54			60	10	46	6	203	27	78	.4	.0	.0	.10	192	26	33	1.42	.00	616	7.3
12S–27E–29dc1	do	50			83	13	118	10	282	46	179	.7	.0	.0	.12	259	28	49	3.22	.00	1,100	7.2
12S–27E–31cd1	do	50			65	10	100	10	270	38	131	.8	.6	.0	.04	204	0	50	2.13	.00	908	7.2
13S–27E–16ad1 [1]	8–27–57	65	70	------	40	13	21	8.8	157	16	44	.3	.6	------	------	135	25	22	.74	------	429	7.8

[1] Analysis by U.S. Geol. Survey.

TABLE 4.—*Records of irrigation wells in the Raft River basin, Idaho*

Depth of well: Depths are given in feet below land surface.
Depth to water: Reported depths are given in feet; measured depths are given in feet and tenths. All depths are below land surface.
Total lift: Figures in parentheses are estimated from nearby wells. Correction made for changes in water levels.
Pump horsepower: For wells pumped in 1960, horsepower rating is for 1960; for other pumps it is horsepower of the pump at last visit.

[*Data reported by owner, user, or company testing pump, and well. †Measurement by Idaho Dept. of Reclamation]

Well	Owner and (or) lessee	Year drilled	Depth of well (feet)	Diameter casing (inches)	Discharge (gpm)	Date	Depth to water (feet)	Date	Drawdown (feet)	Total lift (feet)	Pump horsepower
10S-25E-21aa1	Declo Land Co	1954	*200	22	*1,080	1954	160.2	11-6-56		(300)	100
21bd1	do	1954	*448	22-12	*1,800	1955	209	Spring 1955	115	324	150
10S-26E-28dd1	L. D. Anderson (Am. Invest. Co.).		384	20			267	9-3-55		(300)	150
33dd1	Arabella Anderson and Floyd Morris.	1955	426	20	*1,800	Aug. 1955	269.1	8-12-59		(300)	150
35ab1	Rex Cole	1959	375	16	*2,070	1959	160	1959	70	230	150
36bb2	Meinrad Werner	1953	*356	14-12	†1,550	6-10-60	122	1953		(200)	150
36da1	Philip Wheeler	1958	*375	18-16	*1,400	1960	125	1960	*26	*150	75
36dc2	Max Stamm	1952	*335	12	†1,120	6-6-57	124.9	10-22-52	20	150	75
10S-27E-2ab1	Charles Dunn	1950	136	16	765	12-20-50	39.5	10-19-52	90	135	30
2cb1	Harry F. Dunn	1952	299	18	*1,250	1952	30.3	10-19-52	*50	*85	100
24cb1	Harold Johnson	1942	*120	16	650	7-19-50	18	9-16-48		(50)	15
26da1	George Harrell	1948	105	16	*1,100	1948	27.5	3-23-61	*35	65	30
31da1	Cotterel Land Co	1959	*205	18	*3,600	1959	110	1959	*20	130	200
35ac1	Fred Hill	1948	132	14	*900	1948	29.8	3-23-61	*70	94	30
10S-28E-6ac1	Luke Sonner	1953	*351	16	†2,650	8-17-56	40	8-17-56	40	80	75
6ba1	Barson Bros	1948	*211	18			16.0	11-4-52			Propane
6dc1	Luke Sonner	1950	*324	16	†1,120	8-17-56	36	9-16-48	88	135	60
18db1	Woodbury Bros	1953	*200	16	†1,870	9-3-54	48	9-3-54	*52	100	75
19bb1	Leland Woodbury		*200	18	†2,400	6-18-57	19.8	4-11-61	*55	85	75
19cb1	Harold Johnson	1948	122		*1,350	9-16-48	29	10-19-52	30	59	60
11S-26E-1cb1	Cotterel Land Co	1959	*300	18			120	Apr. 1959		(165)	150
1da1	do	1959	*300	18	*3,600	1959	120	1959	45	165	150
2dc1	B. L. Hofman, Ivan Schrenk	1954	*261	16-12	*1,000	8-11-55	152	Dec. 1954	26	178	100
3cc1	Raymond King	1958	*381	16	*1,980	Feb. 1957	175.0	3-24-61	54	230	125
10ca1	Cold Creek Ranch	1959	*256	22-16	*2,020	1960	164	1959	20	184	150
10db1	Matthews Bros	1955	*351	22-18-16	*2,750	6-1-56	116	1955	49	165	150
12ab1	H. C. Matthews	1950	*250	20	*2,800	8-10-55	117.9	3-24-61	34	152	150
12cb1	G. S. Matthews	1950	*190	16	*2,400	7-29-50	110.5	11-5-52	17	138	125
13bb1	D. C. Adams	1950	*355	12	1,100	8-16-60	88.1	3-24-61	30	128	75
13bb2	do		400	20-16	†2,200		†100		14	125	125
14cd1	Cold Creek Ranch	1957	*330	18	*2,025	8-11-60	*130	Apr. 1957	70	200	100
21ab1	Cline Preston	1960								(120)	75
21db2	do	1954	400	16			59	Apr. 1954		(100)	30
22ab1	John L. Holyoak	1954	300	16-14	*1,380	8-12-55	86	1954		(110)	60
22ac1	do									(110)	50

25bc1	George H. Sanders	1954	*320				59.5	8-12-60	*40	*60	60
25cc1	J. R. Simplot	1952	*258	20	*1,600	7-21-54	30	Spring 1952	*100	*140	40
26bb2	William Hepworth		305	16	*1,450	8-16-56				(80)	60
26bd1	do		260	16	*1,250	8-16-56	40	Aug. 1956		(80)	60
26dc1	J. R. Simplot	1953	*260	20	*900	8-12-55	27	Aug. 1955	*100	*135	40
27bb1	Martin F. Sanders	1953	*402	16	*1,800	May 1953	60	May 1953	*30	*100	60
27cc1	O. A. Powers	1950	350	20	*830	8-31-54	47.3	8-13-52	47	110	100
28ab1	Martin F. Sanders	1954	*256	16	*1,400	8-11-55	81.3	8-12-60		(120)	50
34ac2	Gordon Construction Co			18			78.6	8-15-60		(120)	60
35bc1	J. R. Simplot	1949	277	18	†1,170	7-21-54	32.2	11-6-52		(80)	40
35cc1	Robert Simplot		*270	12	1,240	8-16-52	36.1	11-6-52		(80)	30
35cc2	do		*275	14	1,230	7-8-50	35.9	11-6-52			
35dc2	J. J. McElhinney		*245	16	†1,570	6-10-60	28.5	11-6-52	32	80	40
11S-27E-1dd2	Taylor Land Co	1957	*375	20	*2,250	June 1959	176	Winter 1957	36	220	150
3da1	Lazy F C Ranch	1948	125	16	†2,050	7-22-54	5.2	10-19-52	35	55	30
4db1	Cotterel Land Co	1958	*402	18			90	5-3-58		(160)	150
6ba1	do	1958	*185	18	*3,600	4-10-58	110	4-10-58	50	160	200
7ba1	H. C. Matthews	1960	200	20	*1,800	May 1960	100			(150)	100
12ad1	Taylor Land Co	1957	*500	20-18	*1,600	Mar. 1957	183	Mar. 1957	90	275	150
12dd2	do	1955	*376	20	*2,160	8-10-55	167	Jan. 1955	81	255	150
15bb1	Lazy F C Ranch	1952	*135	20	*500		36.4	3-23-61	55	91	30
16ad1	Richard L. Pendelton	1957	*345	16-14	*1,150	Mar. 1957	41.0	3-23-61	92	133	Propane
26ad1	Todd Kuwana	1960	*270	20			115	Apr. 1960	(55)	(170)	125
26bd1	do	1958	*403	20						(140)	100
26cd1	Parr Bros	1957	*370	20	*2,880	8-16-60	98	Oct. 1956	44	150	150
26dd1	Todd Kuwana	1957	*422	20	*1,800	8-16-60	100	Oct. 1957		(150)	100
28cc1	Bailey Bros	1955	*235	20	*1,125	8-9-55	45	Apr. 1955	45	100	50
28cd1	do	1953	*220	20	†1,107	8-11-55	70	8-9-55	30	110	60
28da1	do									(100)	60
28dd1	do	1953	*265	20	†1,320	8-11-55	60	Spring 1954		(100)	60
30ab1	Raft River Cattle Co	1959	*300	18-16	*3,600	8-13-60	32.4	8-13-60	30	62	75
31dd1	H. Schodde	1951	*185	20	†1,320	8-10-55	20.2	3-24-61	30	55	30
32ad1	Parr Bros	1954	*200	20	*1,800	8-10-55	45	Mar. 1954	41	95	75
32dd1	Kenneth Henderson	1955	*270	20	*1,800	Aug. 1955	74.9	8-16-60		(120)	Propane
33ad1	Bailey Bros	1955	*260	20	*1,800	8-9-55	70	Apr. 1955		(100)	125
33dd1	Parr Bros	1952	*208	20	†1,170	8-11-55	87.9	3-24-61		(100)	50
34bd1	do	1954	*266	20	†1,620	8-11-55	80	Feb. 1954		(100)	75
34cd1	do	1950	391	20	†1,440	8-11-55	85.0	10-15-52	25	110	125
35ad1	do	1952	*200	20	†1,170	8-11-55	128.5	3-24-61		(150)	125
35bd1	do	1954	*320	20	†1,480	8-11-55	104	Spring 1955		(140)	75
35dd1	Roper Investment Co									(150)	125
36ad1	do	1950	*248	20	†2,700	7-4-57	180.2	8-16-52		(200)	200
36dd1	do	1955	*232	20	†1,850	7-4-57	172	Summer 1955		(190)	150
11S-28E-6ba1	Taylor Land Co	1953	*325	18	*1,910	8-10-55	136	Fall 1953		(160)	125
18dd1	do	1957	*477	20	*2,450	June 1959	196	Mar. 1957		(250)	200
12S-26E-1bb1	Alva Temple	1950	188	14	†940	7-9-52	22.8	11-6-52	22	60	25
1bc1	Verl Chesley	1949	184	14	†940	7-9-52	21.0	11-6-52	10	45	25
1cc1	John Kobe	1952	*230	20-16	†1,440	8-12-59	20.3	10-23-52	15	50	40
2ac1	Gordon Hansen	1950	*197	20	†1,300	7-9-52	46.6	3-24-61	40	85	30
2bc1	J. R. Simplot	1952	*290	20-18-16	940	8-16-52	40.6	10-23-52		(85)	50
2bc2	Robert Simplot & J. R. Simplot.	1952	*248	20	†1,200	7-21-54	37	7-21-54	74	120	60
2cc2	Lester V. Tannehill	1956	204	20	†1,030	4-7-59	36	Mar. 1957	34	80	40

TABLE 4.—*Records of irrigation wells in the Raft River basin, Idaho*—Continued

Well	Owner and (or) lessee	Year drilled	Depth of well (feet)	Diameter casing (inches)	Discharge (gpm)	Date	Depth to water (feet)	Date	Drawdown (feet)	Total lift (feet)	Pump horsepower
12S-26E-11bb1	M. L. Tannehill	1952	*220	18	†900	8-16-56	40.4	8-13-52	60	110	50
11bd1	O. A. Power	1954	*205	20	†1,450	8-31-54	35	Mar. 1954	30	75	50
11cc1	O. A. Power and Joe W. Wells.	1955	*340	18-16	†1.300	6-10-60	55	June 1955	60	115	125
11dc1	O. A. Power	1956	*245	16	†1,300	8-1-57	37	Apr. 1956	60	100	75
12cc2	John P. Kobe	1954	*202	20	*1,440	8-9-55	28	Mar. 1954	40	75	60
13bc2	Hall and Thompson	1950	*350	14-12	1,320	9-15-50	29.8	11-7-52	23	60	30
24ac1	Deward Hall	1949	33	48	†486	7-20-54	25.9	3-24-61	10	36	
24ac2	do	1957	*144	16	*630	8-23-60	26	Apr. 1957	30	60	15
25cd2	R. J. Harper	1945	*565	14	†1,660	5-26-53	4.4	9-9-49		(40)	25
36ab2	Douglas Harper	1955	*158	16	†990	7-8-58	19	May 1955	56	80	30
12S-27E-4ad1	Harold L. Larson	1953	*287	16	†1,250	8-10-55	100	Winter 1953	10	120	50
7cc1	Raft River Cattle Co									(80)	100
19ca1	do	1952	*150	20	†1,080	5-16-56	15.0	10-16-52	14	45	30
19ca3	do	1959	*300	20-18	†3,150	Spring 1959	40	Spring 1959	35	75	7½
30bc1	Mrs. W. E. Williams	1955	*156	16	†1,550	6-9-60	14.9	3-24-61	50	65	30
30cd1	D. Tracy	1955	*170	16	†990	7-8-58	8.0	11-6-52		(60)	20
30dc2	Alice Neddo	1955	88	18	†650	5-7-59	18	May 1955	66	84	20
31db1	R. C. Wake	1955	62	18	*1,125	8-9-55	12	Apr. 1955	30	52	20
12S-28E-30ca1	I. M. Harris	1954	485	14-10			186.1	4-12-61		(240)	75
30cc1	do	1956	540	16-14			182.6	4-12-61	57	240	100
33cd2	Dean Compton	1955	600	14	†1,150	7-29-58	215	Summer 1955	65	280	100
13S-26E-1db1	Taylor Bros	1945	*1,400	16-8			Flowing	11-6-52		(30)	30
1dc1	Harvey Wight	1931	23	48	495	9-7-49	6.8	11-6-52		(22)	10
12db3	Malta Ward, Church of the Latter Day Saints.	1955	*106	16			12	July 1955		(30)	5
13ba1	Blaine Wight	1939	*281	12-10	640	9-6-50	14.5	11-6-52		(50)	40
13ba2	Walter R. Hill	1935	*300	12	526	9-27-50	13.0	3-24-61		(50)	30
13ca1	Mrs. E. J. Nye		214	16			14.2	11-5-52		(110)	40
13cc1	Leo W. Beyler		*500	16-12-10-8	*1,300	6-10-59	12	Aug. 1955	88	110	40
13dc1	Mrs. E. J. Nye		*170	16	†260	7-21-54	12.6	11-6-52		(110)	40
14ca1	L. D. Hall		16	36	†460	8-2-50	9.7	11-5-52		(15)	5
20db1	Grover Ward			18						(75)	30
22ad1	James R. Hitt	1960	*400	18-14-10	*1,800	July 1960	70	July 1960	66	136	75
22cb1	Shirley Hitt and William W. Hitt.	1955	350	16-12-10	†1,820	5-18-56	20	5-18-56	86	106	40
23cb1	Wallace Ward	1950	495	14-12-10	†1,270	6-6-57	12.5	10-21-52		(100)	40
24aa1	Paul Rentmeister	1929	*225	18	*1,350	July 1956	12.6	3-24-60	60	73	60
26aa1	Fred Gardiner	1949	350	16	*800	1950	15.3	4-22-50	85	110	30
13S-27E-2dc1	Lester Thompson	1958	*1,400	20	*2,850	1959	135	Winter 1958	135	270	200
6ac1	R. C. Wake	1956	*112	16	*1,100	Dec. 1956	14	Dec. 1956		(80)	25
6bc1	R. J. Harper	1931	27	84	†810	7-25-52	17.3	11-6-52	12	25	7½
6cc3	Alice Neddo	1955	355	16-14	*2,700	Apr. 1960	10	Apr. 1955	86	106	75

6db1	Richard Kossman	1959	*250	16-12	*1,200	Dec. 1959	15.4	8-18-60	50	65	20
7aa1	Malta Cemetary	1958	*50	10			23.8	8-19-60		(40)	7½
7ad1	Jay E. Wake	1955	*50	18	*900		13	Mar. 1955	34	47	15
7cc4	Raft River Cattle Co	1959	*500	20-16	*2,250	Aug. 1959	30	Aug. 1959	60	90	75
7dd1	Parke Bros	1960	*84		*1,400	Feb. 1960	10	Feb. 1960		(50)	30
14dc1	Lester Thompson	1960	*1,000	20	*3,150	Aug. 1960	105	Winter 1960	145	250	200
16ad1	do	1957	*1,017	20-12	*4,000	Fall, 1957	90	Fall 1957	100	190	200
18bd1	Grant Hitt	1945		36	†900	8-1-51	15.6	3-24-61	20	35	10
18db1	Grant Hitt and Glen Parke	1955	*28	54	†1,400	6-5-57	7	Feb. 1955	8	25	15
18dd1	J. Deward Hall	1955	*78	16	*900	8-8-55	5	Mar. 1955		(40)	10
19da1	Leonard Hall			16			19.8	8-25-60		(30)	15
19dc1	Jesse M. Pierce			36	*650	8-25-60	16	8-25-60	8	24	7½
19dd1	John A. Pierce	1952	60	46-24	†1,440	5-8-59	6.4	10-21-52	17	40	20
29bc1	Dean E. Rodgers	1947	27	48	†720	10-27-49	5.9	10-21-52		(25)	10
29dd3	Buddy Ward	1952	75	16	†800	7-9-58	14	Spring 1952	26	55	15
30bc1	John A. Pierce	1956	*300	20-18	†900	7-9-58	20	Fall 1956	30	63	50
30bd1	Mrs. A. D. Pierce	1940	28	72	1,180	7-24-50	19.8	3-24-61	8	27	10
30bd2	John A. Pierce	1959	*400	12-10	*1,350	Aug. 1959	24.6	8-24-60	55	80	15
30da1	Roger Neddo	1947	28	72	870	6-22-50	8.4	11-4-52	8	25	30
30dc1	Mrs. Willis Sears	1956		77	990	6-26-50				(30)	10
30dd1	Mrs. A. D. Pierce	1949	*400	20-18	†2,200	5-8-59	14.1	11-4-52	53	80	60
31da2	D. Jay Harper	1957	*300	16-14	*1,570	Apr. 1957	20	Mar. 1957	80	100	50
32ba1	Earnest T. Merrill	1955	*150	16	*540	May 1955	12	May 1955		(50)	25
32bb2	do	1950	*286	16	†1,530	7-11-58	9.9	11-4-52		(50)	40
32cb1	Dean E. Rodgers	1947	(*)	48-16	†990	10-27-49	27.5	3-24-61		(50)	25
32cb2	do	1952	*286	16	*540	Spring 1952	10.3	10-21-52	50	75	25
32db1	Wayne Newcomb		*500		†720	5-8-59	13.7	11-4-52	72	100	50
33cb1	Charles L. Hall	1940								(60)	30
13S-28E-3dd1	Arthur Schorzman	1959	*374	16	*1,700		145	Spring, 1961	40	185	100
7dd1	U.S. Bur. Land Management.			10						(200)	20
14S-27E-4cd1	Lester Thompson	1954	*615	20-12			25	1957		(120)	125
5ca1	Vance T. Smith									(80)	40
6ad1	Lano E. Elison	1948	95	16	642	9-12-49	30.6	3-24-61		(50)	10
6bb1	J. H. Thompson	1960	265	16	*1,800	8-23-60	12.9	11-5-52		(60)	50
6cc1	Eldon N. Chandler	1955	275	16-12	†1,800	6-9-60	42	July 1955	30	60	Propane
6db1	Lana A. Elison	1948	*180	16-14	†450	8-1-51	13.3	11-4-52	6	35	40
6dc1	Elmo Ellson	1956	300	16-14	*1,900	July 1956	25	July 1956	59	84	50
7bd1	Floyd Bell	1949	38	16	464	6-22-50	14.6	11-4-52		(40)	50
7dc1	Vance T. Smith	1954	*150	16	†765	5-18-56	*20		20	40	20
7dd1	do		60	18	540		14.9	11-4-52		(40)	20
8ae1	William Dilg	1951	67	16	*405	8-13-52	19.6	8-13-52	45	75	15
8ad1	Lester Thompson	1952	*719	24-8			24.4	8-5-55		(125)	125
8bb1	Dale Smith	1950	70	16			10.7	11-4-52			
8bb2	Raft River Stake	1957	255	16-14	*2,250	1959	39.4	4-14-61	72	111	50
8cb1	Don Shaw	1955	135	16	†1,020	6-5-57	*16	6-5-57	58	74	30
8cc1	Malta Land & Irrigation Co	1960	305	16			25	1960		(90)	50
9bb1	Lester Thompson	1949	180	16	650	6-30-50	29.9	4-14-61		(90)	30
9bd1	do	1953	*800	20-16	*1,080	8-5-55	*20	1953		(120)	125
9cd1	R. D. Thompson (Lester Thompson).	1953	*585	24-14	*1,080	8-5-55	*20	Winter, 1953		(100)	40
9cd2	do	1953	500	16	*1,080	8-5-55	*20	1953		(110)	75
16cc1	T. A. Arnold	1952	69	24	†875	7-20-54	10.1	10-20-52	52	72	20

TABLE 4.—*Records of irrigation wells in the Raft River basin, Idaho*—Continued

Well	Owner and (or) lessee	Year drilled	Depth of well (feet)	Diameter casing (inches)	Discharge (gpm)	Date	Depth to water (feet)	Date	Drawdown (feet)	Total lift (feet)	Pump horsepower
14S-27E-16cd1	Carl Neiwirth and T. A. Arnold.	1953	135	30-20	†1,400	7-20-54	*35	Spring, 1953	50	85	30
16dd1	do	1954	285	20	†1,160	7-20-54	*47	Mar. 1954	90	145	50
17ba1	Frank C. Lee	1955	130	16	†729	6-6-57	*18	Mar. 1955	62	85	25
17bd2	Edwin Paskett	1955	160	16	*630	Mar. 1955	*18	do	82	110	30
17ca1	W. R. Bronson	1955	200	18	†639	6-9-60	*16	July 1955		(100)	30
17cc1	Malta Land & Irrigation Co.	1938	116	16			26.1	3-25-61		(80)	30
17cc5	do		29	48	225	6-22-50	12.1	11-4-52		(25)	5
18dd1	Milton Neddo	1955	*200	16	†1,400	6-9-60	*33	June 1955	57	100	50
20ac1	Lester Thompson									(100)	125
20ba1	Charles Warr	1952	*70	16	†477	7-21-54	8.5	7-21-54	50	65	25
20bc1	J. W. Barrett		*125	16	†1,300	*1954				(70)	30
20cd1	Lorenzo Tracy	1955	150	16	†720	7-9-58	12	7-9-58	88	100	30
29ab1	Lawrence R. Jardine			18	747	6-30-50	9.1	11-4-52		(50)	20
29ca3	Val Jones and Glenn L. Jones.	1955	160	16	*1,440	Mar. 1955	*20	Mar. 1955		(80)	30
30aa1	Glenn L. Jones	1952	118	48	1,060	8-15-60	10.8	11- 5-52	67	*90	30
32bd1	James Van Komen	1954	107	18	*720		19.1	8- 3-55	50	69	20
32cc1	Shirley Barrett	1950	285	16-12	†1,450	4-2-58	*18	4-2-58	47	*65	30
33ca1	Harold Oman		*265	12	*675	1952	22.6	11-22-57		(60)	20
15S-24E-13ca1	Owen Jones									(60)	75
27da1	Wallace C. Taylor	1955	*350	14	*585	Nov. 1955	*43	Nov. 1955	112	165	30
15S-25E-7cb2	O. W. Ward									(80)	40
15S-26E-7ba1	Wesley Ward									(100)	75
13da1	do									(80)	40
23aa1	Ben Schmidt	1957	360	16-12	†1,110	7-18-56	42				
23bb1	do		*414	8	†400	5-26-40	Flowing	4-14-61		No pump	Diesel.
23dd1	Alvin Newbold	1948	*540	16	†920	7-9-52	Flowing	4-24-50		(25)	15
24ba1	Orvil Udy	1945	*265	16	1,600	7-31-51	11.2	11-3-52	*30	51	40
24bc1	Boyd Booth	1938	*153		387	9-5-50	33.8	11-4-52		(65)	20
24cd1	W. L. Hawkins	1935	*233	16-10	954	9-5-50	11.0	11-3-52	*30	56	40
24dc1	Lester Hawkins (Booth)	1958	*240	16	*2,700	Mar. 1958	30	Mar. 1958		(100)	50
27dc1	Marlin Booth (Tobin)	1952	*215	12	†1,230	7-21-54	*18	Winter 1952	*55	85	40
33bb1	do	1948	*505	20	*585	9-13-48	11.3	10-24-52	*86	110	7½
15S-27E-6ab1	Vincent B. Tobin	1953	*270	16-8	†1,300	5-17-56	*38	Mar. 1953	60	110	50
6ad1	do	1954	*254	28	†1,960	5-17-56	28.2	8-2-55	60	100	60
6dd1	do	1956	*402	16	*2,800	Oct. 1956	*24	Oct. 1956	128	155	100
7db1	Frank Olsen	1951	*220	16	†1,470	6-5-57	21	6-5-57	54	80	40
8bb1	Ray D. Olson	1954	165	16	*1,125	Mar. 1954	24.2	3-25-61		(70)	30
8cb1	R. M. Jones	1955	207	16	†868	5-8-59	*30	May 1959		50	30
8db1	Ray D. Olson	1955	*200	16	†1,260	5-7-59	37.9	8-2-55		(70)	30
18ac1	Albert P. Smith		*285	14	576	9-5-50	38.4	10-20-52	25	75	30
18bc1	Marlin H. Booth	1950	*262	14	†1,020	5-26-53	40.4	11-3-52	140	190	50
18bd1	do	1936	*250	14	688	9-5-50	25.8	11-3-52		(150)	25
18ca1	Thomas Mills	1951	*320	14-8	†1,350	5-17-56	37.4	11-3-52		(150)	60

19ba1	Oscar Edlund	1957	*203	16	†580	6-9-60	30	July 1957	20	50	15
19cc1	do		*400	12-8	601	6-5-57	30.5	11-3-52	78	120	40
20cb3	Lewis Gunnell, Jr	1952	360	14-10	†1,100	8-27-58	29.2	10-20-52		(100)	40
29ac1	L. J. Gunnell	1948	166	16-10	†837	8-12-55	8.2	11-3-52	77	95	30
16S-24E-12aa3	John Ward	1950	*137	16			9.4	9-1-50		(100)	50
12bd1	do	1947	*220	12-10	810	9-7-50	25	4-19-50	140	165	40
12cb1	Earnest Jensen	1938	*264	10-6	250	9-9-48	34.4	9-7-50			
12cc1	Jensen Bros. (Elbert Durfee)	1949	*253	14			14.5	9-1-50		(100)	10
12c	Elbert Durfee									(100)	30
16S-25E-7ca1	Neil Durfee									(50)	40
16S-26E-11bd1	Wesley Ward (Roscoe)									(100)	50
16S-27E-3ad1	Harold Jones	1953	*398	20	†783	5-7-59				(100)	30