SUMMARY OF WATER DATA FOR THE JANZEN RECHARGE INVESTIGATION, SCOTT COUNTY, KANSAS, 1980-86

By Lloyd E. Stullken

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CONVERSION TABLE

For those readers interested in metric units, the inch-pound units used in this report can be converted to the International System of Unit (SI) using the following factors:

Multiply inch-pound unit	*By*	*To obtain SI unit*
inch	25.4	millimeter
foot	0.3048	meter
mile	1.609	kilometer
square mile (mi^2)	2.590	square kilometer
acre	4,047	square meter
acre-foot	1,233	cubic meter
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
foot per day	0.3048	meter per day

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

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ABSTRACT

The U.S. Geological Survey, in cooperation with the Western Kansas Groundwater Management District No. 1, established data-collection instrumentation around an earthen dam in Scott County, west-central Kansas. The dam was located on an ephemeral drainage to monitor water storage behind the dam, precipitation, and ground-water levels in the vicinity. This report briefly describes the site and summarizes the data collected at that site from May 1980 through September 1986,when data collection was discontinued.

The dam is capable of impounding 300 acre-feet of water at the level of the emergency spillway, draining to 24 acre-feet of water at the level of the principal spillway. The reservoir behind the dam receives surface-water runoff from a drainage area of about 8,000 acres. Water storage behind the dam occurred three times during the period of data collection, but water never reached the level of the principal spillway.

INTRODUCTION

Artificial recharge to an aquifer is one way to replenish the diminishing supply of ground water in western Kansas. In an area where surface water is limited, investigations of aquifer recharge may use artificial storage to catch and provide a water source. In the investigation described in this report, Western Kansas Groundwater Management District No. 1 sponsored construction of an earthen dam on a tributary to Ladder Creek in the NW1/4 of section 11, T. 17 S., R. 34 W., northeastern Scott County (fig. 1). Construction was under the supervision and to the specifications of the U.S. Department of Agriculture, Soil Conservation Service. Included in the investigation were hree ground-water observation wells around the perimeter of the water-storage area. A map of the study site is shown in figure 2.

The U.S. Geological Survey, in cooperation with the Western Kansas Groundwater Management District No. 1, completed data-collection instrumentation around the damsite in August 1982, to monitor water storage behind the dam, precipitation, and ground-water levels in the vicinity. This report briefly describes the site and summarizes the data collected at the site through September 1986, when data collection was discontinued.

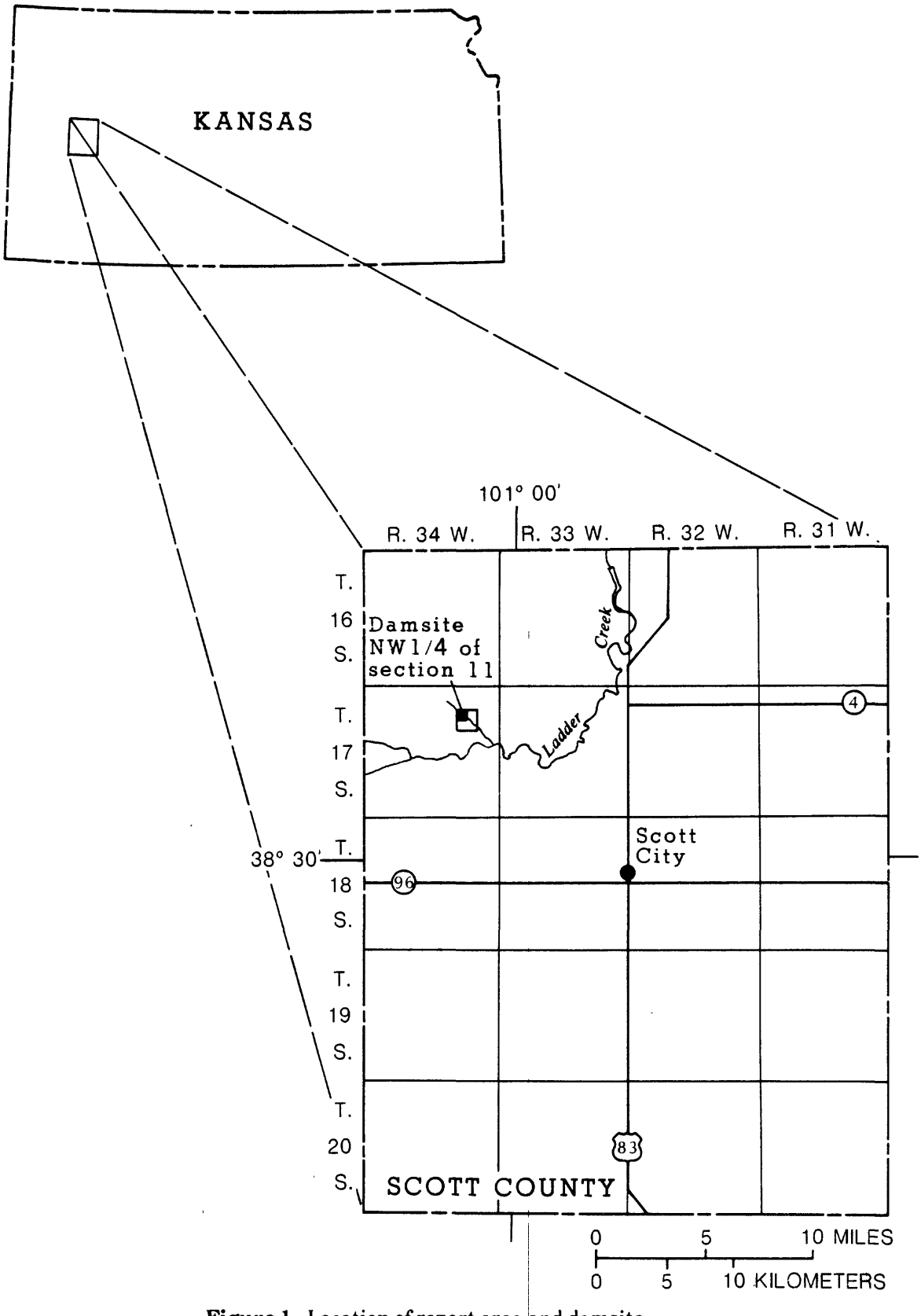

Figure 1. Location of report area and damsite.

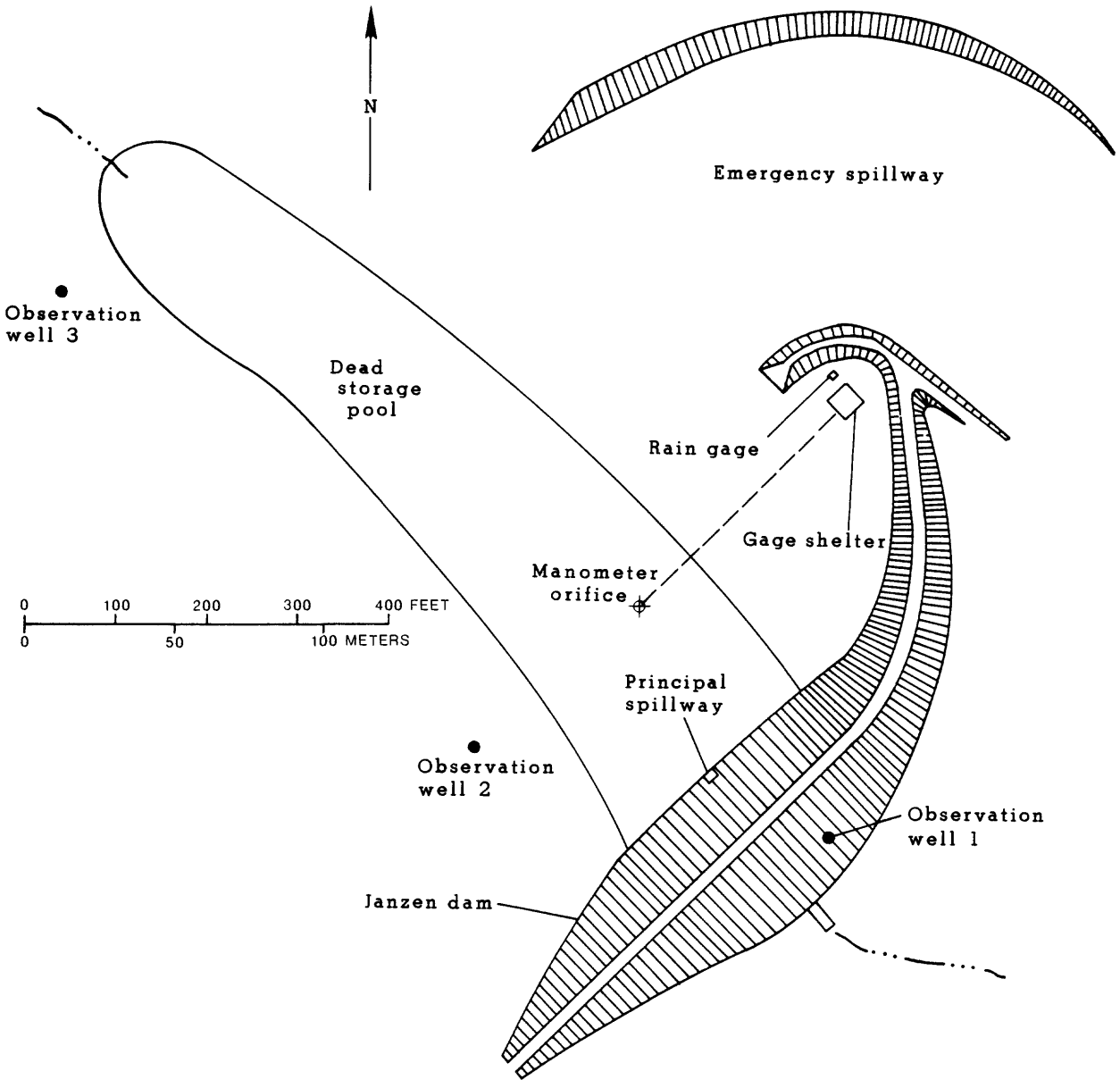

Figure 2. Location of data-collection instrumentation at damsite.

DESCRIPTION OF DAM AND RESERVOIR

The dam at Janzen is a compacted earthfill capable of storing about 24 acre-feet of water below the inlet to the principal spillway (36-inch corrugated metal pipe). It was constructed during the winter and spring of 1981-82. At the crest of the emergency spillway the structure impounds about 300 acre-feet of water. At that level the discharge through the principal spillway pipe would be about 113 ft^3/s (table 1). At the top of the dam, about 480 acre-feet of water would be impounded, and outflow would be about 5,000 ft^3/s.

Table 1. *Reservoir storage capacity*

[Modified from Wallace, 1981]

Elevations, in feet[1]			Storage (acre-feet)	Outflow (cubic feet per second)	Remarks
Above gage datum	Above sea level	Above dam datum			
4.1	3,060.3	26.5	0.0	--	
7.6	3,063.8	30.01	.08	--	
11.6	3,067.8	34.0	6.36	--	
15.6	3,071.8	38.0	18.92	--	
16.73	3,072.9	39.1	23.97	20.0	Crest of principal spillway.
17.2	3,073.4	39.6	--	2.6	
17.7	3,073.9	40.1	--	5.2	
18.2	3,074.4	40.6	--	8.6	
18.7	3,074.9	41.1	--	16.9	
19.2	3,075.4	41.6	--	25.3	
19.6	3,075.8	42.0	40.84	--	
19.7	3,075.9	42.1	--	33.7	
20.0	3,076.2	42.4	--	42.1	
22.1	3,078.3	44.5	--	81.5	
23.6	3,079.8	46.3	73.92	--	
25.25	3,081.4	47.62	--	89.7	
27.6	3,083.8	50.0	123.02	--	
29.19	3,085.4	51.56	--	99.1	
31.6	3,087.8	54.0	198.28	--	
33.1	3,089.3	55.5	--	107.7	
34.44	3,090.6	56.81	--	110.4	
35.6	3,091.8	58.0	306.48	112.8	Crest of emergency spillway.
36.1	3,092.3	58.5	--	196.1	
36.6	3,092.8	59.0	--	352.9	
37.1	3,093.3	59.5	--	666.5	
37.6	3,093.8	60.0	--	1,113.5	
38.6	3,094.8	61.0	--	2,334.3	
39.6	3,095.8	62.0	456.12	4,024.3	
40.1	3,096.3	62.5	478.56	5,060	Top of dam.

[1] Results of reference levels are shown in the "Supplemental Data" section. The tie between gage height and dam height is based on levels to the crest of the principal spillway pipe inlet.

[2] Computed prior to construction.

A borrow pit in the channel upstream from the dam accounts for the first 24 acre-feet or more of stored water. The pit, as left after construction, is a few feet deeper than construction plans indicate (Wallace, 1981), and storage volumes indicated in table 1 may be in error at the lower gage heights. The borrow pit is dug into the upper layers of the aquifer (Ogallala Formation), exposing a sand, silt, clay mixture which is, in places, cemented into nodules with lime to form caliche. The caliche layer is well above the water table in this area and is so resistant to weathering that it outcrops on eroded valley sides downstream.

Investigation plans of the U.S. Soil Conservation Service (Wallace, 1981) indicate a drainage area of 8,000 acres (12.5 mi^2) for this site, of which 3,680 acres (5.75 mi^2) is uncontrolled. The uncontrolled drainage area was used to design the principal spillway pipe. The plans describe the remainder of the watershed as... "pothole country which will contribute runoff only during high intensity storms." The dam itself is about 36 feet high and about 950 feet long, not including 325 feet of emergency-spillway width.

RESERVOIR WATER LEVELS

A standard 50-foot range mercury manometer, housed in a fiberglass shelter at the north end of the dam, was used to sense water levels in the reservoir through an orifice placed in the dead-storage pool. A graphic recorder, geared to the manometer, provided a continuous record of stage for periods when the pool level rose above the orifice at a gage height of 1.36 feet. Staff gages placed at intervals in the bank of the reservoir were used to independently determine reservoir water levels.

During the period of record, August 1982 to September 1986, the reservoir filled to above the orifice only three times. Once for 14 days from April 2 to 15, 1984, another for 10 days from April 30 to May 9, 1984, and a third time, for 3 days during February 20-22, 1985. The reservoir never filled to the level of the principal (lowest) spillway during the period of record; therefore, there were no losses from the impoundment to downstream surface flow.

Hourly gage heights for the three periods of reservoir storage are given in the "Supplemental Data" section and are plotted in hydrograph form in figure 3.

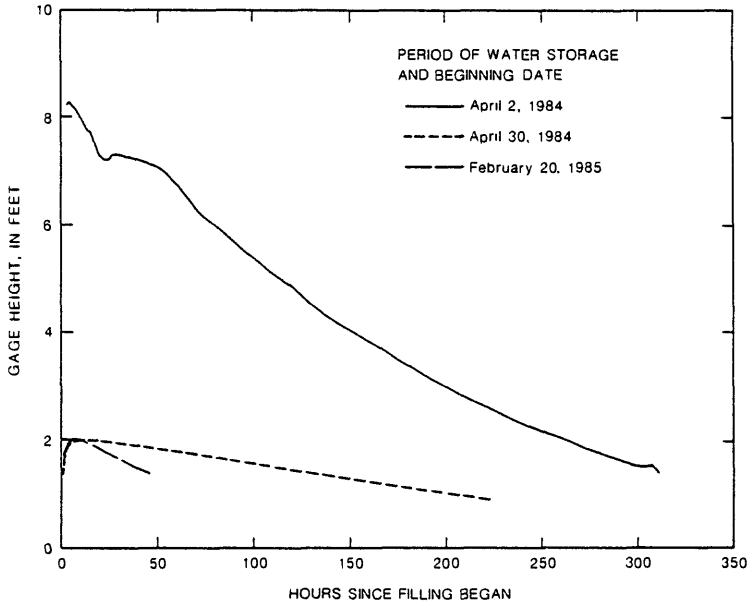

Figure 3. Reservoir gage heights during periods of water storage.

GROUND-WATER LEVELS

Observation well 1 (fig. 2) was fitted with a recorder to continuously monitor ground-water levels at the site. The well is cased with 4-inch polyvinyl-chloride pipe of which the lower 58.3 feet is perforated (Kelley, 1980). The driller's log and other recorded data for this well are reported in the "Supplemental Data." Initially, water levels in this well were recorded hourly by a punch-tape recorder that was driven by a float in the well. Compaction of the dam during construction caused a deflection of the upper part of the well casing, however, resulting in a poor float-to-recorder response. Because greater care in interpreting the record was necessary, the recorder was changed to a graphic continuous recorder.

Water levels in observation well 1 are shown in figure 4 for April 1 to May 31, 1984. Observation notes indicate that recorded response to water-level changes was poor during this time, and a correction was prorated from zero on day 5 (April 5) to -0.40 foot on day 39 (May 9) when the recorder was reset. The effect of this correction is an apparent gradual increase in water levels during that period, whereas the actual water-level changes may have occurred more sporadically.

Recorded water levels in observation well 1 are shown in figure 5 for every 5 days of the entire period of record.

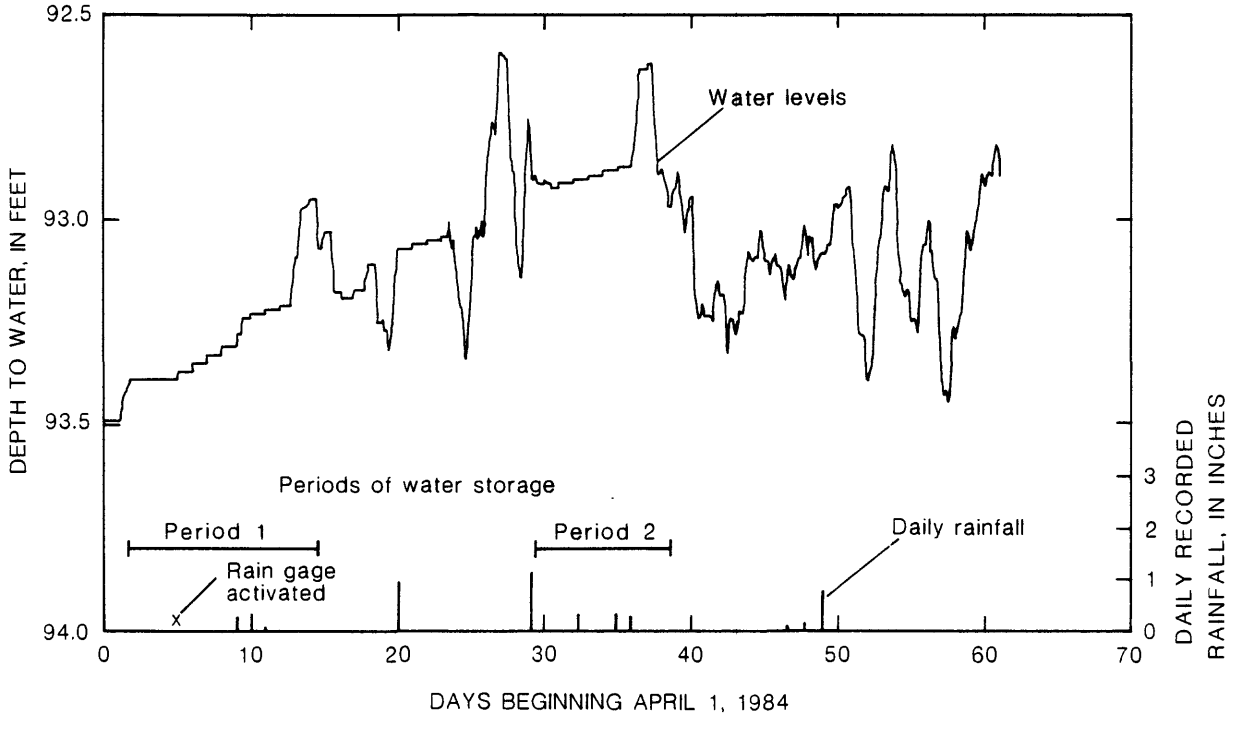

Figure 4. Water levels in observation well 1, April 1 to May 31, 1984.

Observation wells 2 and 3 (fig. 2) were cased with 2-inch polyvinyl-chloride pipe. Logs for these wells are presented in the "Supplemental Data" section. Water-level measurements at these wells were made by steel tape during site visits. A borehole directly across the valley from observation well 3 was abandoned at 26 feet because of lost circulation in a lime-rich zone of the aquifer only slightly lower than the bottom of the impoundment.

Water levels in all three observation wells, as measured during site visits, are documented in the "Supplemental Data" section and graphed in figure 6.

RAINFALL

Near the reservoir manometer shelter, a separate structure supported an 8-inch rain-collector funnel (fig. 2). A punch-tape recorder, with a 15-minute interval, was housed inside the structure and was driven by a float in a container into which the rain-collector funnel drained. The U.S. Geological Survey uses a computer program to read and translate the punch tape to accumulated rainfall and rainfall-intensity values. There were no overhead obstacles near the gage to disturb the collection of rainfall. A summary showing daily rainfall data is given in the "Supplemental Data" section. A bar graph showing daily rainfall greater than 0.1 inch is shown in figure 5 for comparison with groundwater levels. The rainfall recorder was not in operation during winter months.

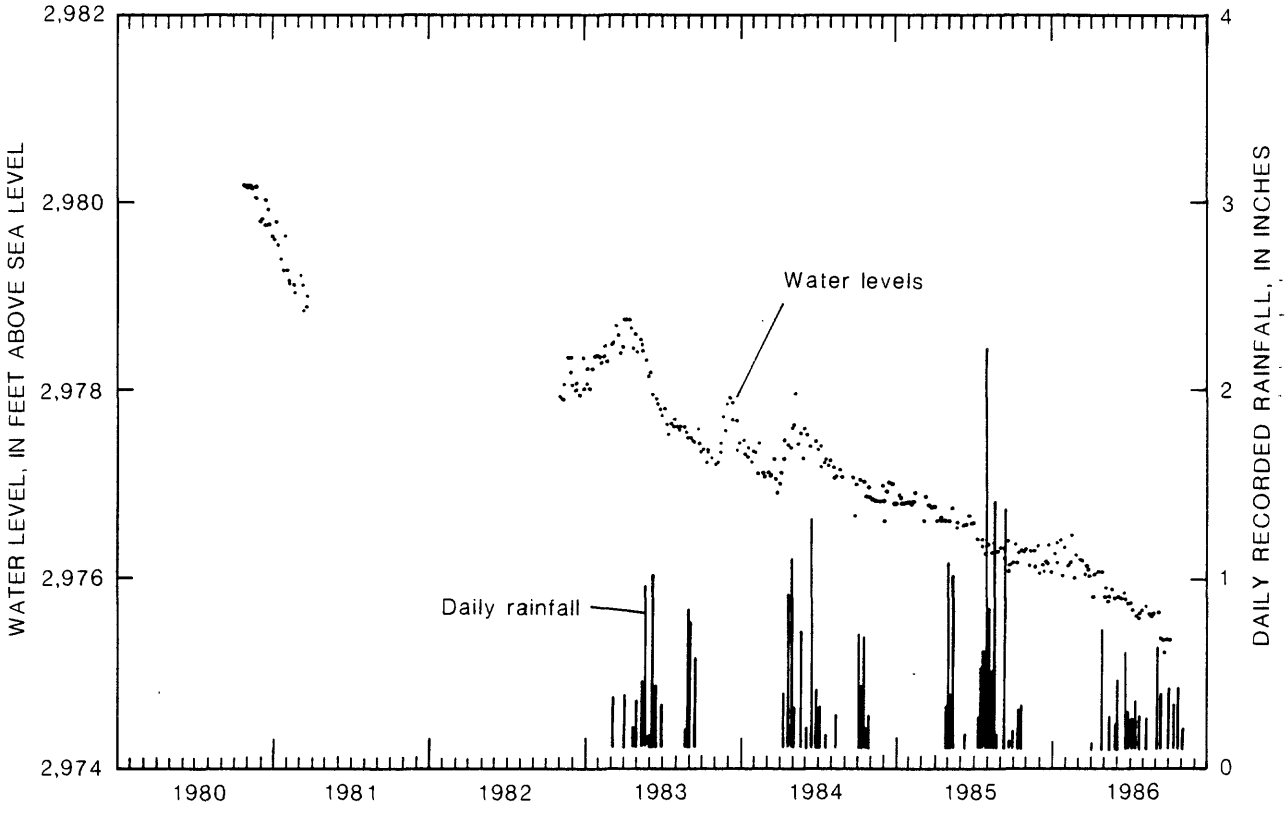

Figure 5. Five-day water levels in observation well 1 and recorded daily rainfall for period of record.

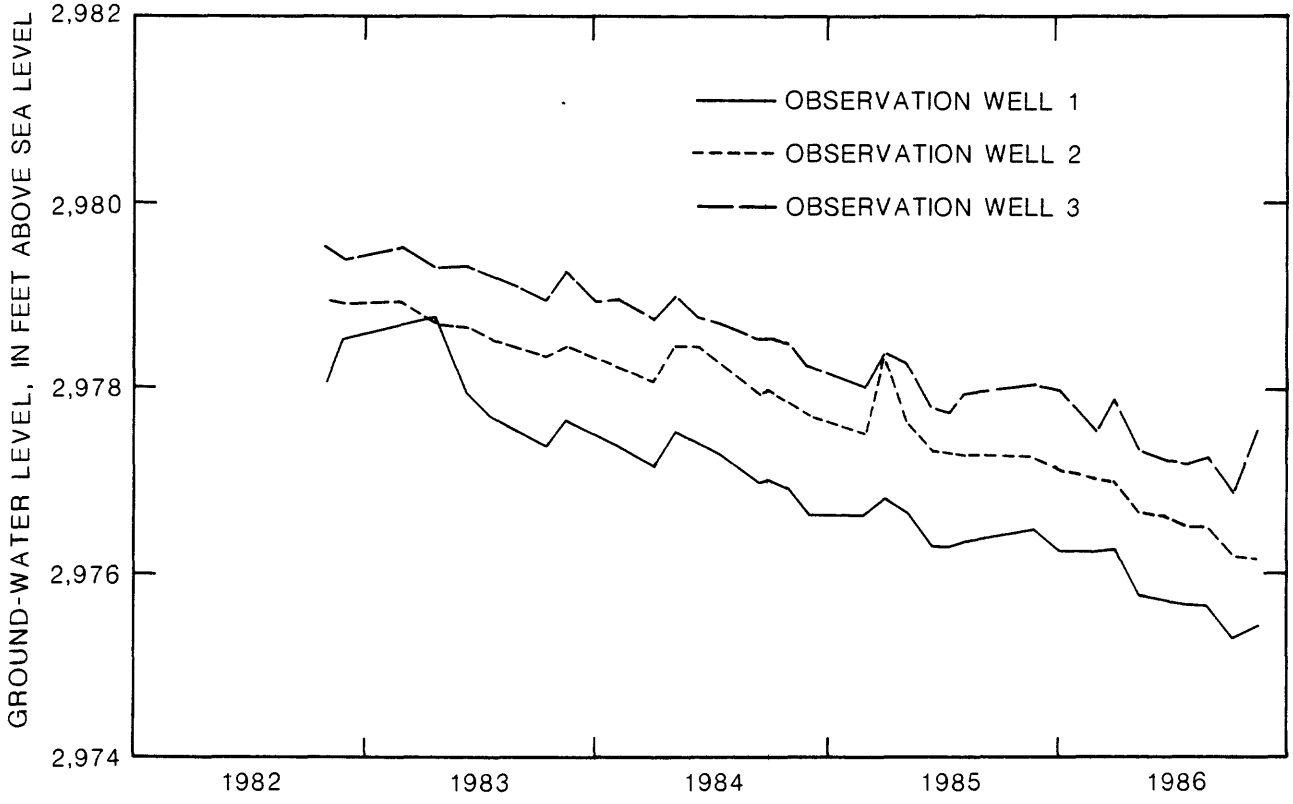

Figure 6. Water levels in observation wells at Janzen damsite.

SUMMARY

Construction of an earthen dam on a tributary to Ladder Creek in northeastern Scott County, Kansas, was sponsored by Western Kansas Groundwater Management District No. 1. The dam was built by the U.S. Soil Conservation Service (SCS) during the winter and spring of 1981-82. The dam collects surface drainage from 8,000 acres and is capable of impounding 24 acre-feet of dead storage and another 276 acre-feet of storage with uncontrolled spill through a 36-inch metal pipe. The SCS also drilled three deep observation wells around the periphery of the impoundment into the underlying aquifer.

From August 1982 to September 1986, the U.S. Geological Survey collected rainfall, reservoir-water level, and ground-water level data at the site to document the availability of water and the recharge resulting from the water impoundment. Rainfall was recorded at 15-minute intervals April to October each year. Reservoir pool level was monitored continuously all year as were ground-water levels in an observation well at the "toe" of the dam. Two other observation wells were measured monthly.

The dam impounded water three times--April 2-15, 1984, April 30 to May 9, 1984, and February 20-22, 1985. All storage was contained in the dead storage pool and therefore moved from the pool by either evaporation or infiltration. The partial reservoir filling of April 2-15, 1984, was the largest documented as the reservoir filled to a gage height of 8.29 feet (about 2 acre-feet) in a 5-hour period. The reservoir then began losing water at approximately 0.7 foot per day. During the reservoir filling of April 30 to May 9, 1984, the reservoir filled to a gage height of 2.01 feet (less than 1 acre-foot) and lost water at a much slower rate of about 0.1 foot per day. On February 20, 1985, the reservoir again filled to a gage height of 2.03 feet but lost water at a rate of 0.4 foot per day.

REFERENCES

Kelley, G.A., 1980, Detailed report of geologic investigations, Keith Janzen groundwater dam: U.S. Department of Agriculture, Soil Conservation Service Communication 40-16, 46 p.

Wallace, J.A., 1981, Janzen recharge dam, Scott County, Kansas: U.S. Department of Agriculture, Soil Conservation Service Project Plans, 12 sheets.

SUPPLEMENTAL DATA

Table 2. *Hourly reservoir gage heights, April 2-15, 1984, April 30 to May 9, 1984, and February 20-22, 1984*

[E indicates no record; gage height, in feet above the gage datum, is estimated based on adjacent recorded gage heights]

April 2, 1984		April 3, 1984		April 4, 1984		April 5, 1984		April 6, 1984	
Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)
0100	--	0100	7.94E	0100	7.24E	0100	6.79E	0100	5.88E
0200	--	0200	7.89E	0200	7.23E	0200	6.76E	0200	5.85E
0300	--	0300	7.82E	0300	7.22E	0300	6.71E	0300	5.83E
0400	--	0400	7.74E	0400	7.21E	0400	6.67E	0400	5.79E
0500	--	0500	7.76E	0500	7.20E	0500	6.62E	0500	5.76E
0600	--	0600	7.60E	0600	7.19E	0600	6.58E	0600	5.73E
0700	--	0700	7.52E	0700	7.18E	0700	6.53E	0700	5.70E
0800	--	0800	7.44E	0800	7.17E	0800	6.49E	0800	5.67E
0900	--	0900	7.36E	0900	7.16E	0900	6.44E	0900	5.64E
1000	--	1000	7.31E	1000	7.15E	1000	6.39E	1000	5.61E
1100	--	1100	7.24	1100	7.14E	1100	6.34	1100	5.85E
1200	--	1200	7.19	1200	7.13	1200	6.29	1200	5.54
1300	--	1300	7.19	1300	7.12	1300	6.25	1300	5.51
1400	1.36	1400	7.21	1400	7.11	1400	6.22	1400	5.47
1500	1.82	1500	7.24	1500	7.10	1500	6.18	1500	5.45
1600	1.82	1600	7.34	1600	7.08	1600	6.16	1600	5.42
1700	8.24	1700	7.33	1700	7.06	1700	6.13	1700	5.40
1800	8.29	1800	7.31E	1800	7.04	1800	6.10	1800	5.37
1900	8.26E	1900	7.30E	1900	7.01	1900	6.07	1900	5.34E
2000	8.22E	2000	7.29E	2000	6.97E	2000	6.04E	2000	5.31E
2100	8.19E	2100	7.28E	2100	6.94E	2100	6.01E	2100	5.28E
2200	8.14E	2200	7.27E	2200	6.91E	2200	5.98E	2200	5.25E
2300	8.09E	2300	7.26E	2300	6.87E	2300	5.95E	2300	5.23E
2400	8.02E	2400	7.25E	2400	6.82E	2400	5.92E	2400	5.20E

Table 2. *Hourly reservoir gage heights, April 2-15, 1984, April 30 to May 9, 1984, and February 20-22, 1984*--Continued

April 7, 1984		April 8, 1984		April 9, 1984		April 10, 1984		April 11, 1984	
Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)
0100	5.18E	0100	4.47E	0100	3.92E	0100	3.40E	0100	2.90E
0200	5.15E	0200	4.44E	0200	3.90E	0200	3.38E	0200	2.88E
0300	5.12E	0300	4.42E	0300	3.87E	0300	3.36E	0300	2.86E
0400	5.10E	0400	4.39E	0400	3.85E	0400	3.34E	0400	2.85E
0500	5.07E	0500	4.37E	0500	3.83E	0500	3.32E	0500	2.83E
0600	5.04E	0600	4.35E	0600	3.81E	0600	3.30E	0600	2.81E
0700	5.01E	0700	4.32E	0700	3.79E	0700	3.28E	0700	2.79E
0800	4.98E	0800	4.30E	0800	3.77E	0800	3.25E	0800	2.77E
0900	4.96E	0900	4.28E	0900	3.75E	0900	3.23E	0900	2.75E
1000	4.93E	1000	4.25	1000	3.72E	1000	3.21E	1000	2.73E
1100	4.90E	1100	4.23	1100	3.71E	1100	3.18E	1100	2.72
1200	4.88E	1200	4.21	1200	3.68E	1200	3.16E	1200	2.71
1300	4.85	1300	4.18	1300	3.66E	1300	3.14E	1300	2.69
1400	4.81	1400	4.15	1400	3.64E	1400	3.12E	1400	2.68
1500	4.79	1500	4.13	1500	3.62E	1500	3.10	1500	2.66
1600	4.76	1600	4.11	1600	3.60E	1600	3.09	1600	2.64
1700	4.73	1700	4.08	1700	3.58E	1700	3.06	1700	2.63
1800	4.69E	1800	4.06	1800	3.56E	1800	3.04	1800	2.62
1900	4.66E	1900	4.04	1900	3.53E	1900	3.02E	1900	2.60E
2000	4.63E	2000	4.02E	2000	3.51E	2000	3.00E	2000	2.58E
2100	4.60E	2100	4.00E	2100	3.49E	2100	2.98E	2100	2.56E
2200	4.57E	2200	3.98E	2200	3.47E	2200	2.96E	2200	2.55E
2300	4.54E	2300	3.96E	2300	3.44E	2300	2.94E	2300	2.53E
2400	4.50E	2400	3.94E	2400	3.42E	2400	2.92E	2400	2.51E

Table 2. *Hourly reservoir gage heights, April 2-15, 1984, April 30 to May 9, 1984, and February 20-22, 1984*--Continued

April 12, 1984		April 13, 1984		April 14, 1984		April 15, 1984	
Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)
0100	2.50E	0100	2.13E	0100	1.79E	0100	1.52E
0200	2.48E	0200	2.11E	0200	1.78E	0200	1.52E
0300	2.46E	0300	2.09E	0300	1.76E	0300	1.52E
0400	2.44E	0400	2.08E	0400	1.75E	0400	1.52E
0500	2.43E	0500	2.07E	0500	1.74E	0500	1.52E
0600	2.42E	0600	2.05E	0600	1.73E	0600	1.52E
0700	2.40E	0700	2.04E	0700	1.72E	0700	1.52E
0800	2.38E	0800	2.02E	0800	1.71E	0800	1.52E
0900	2.36E	0900	2.01E	0900	1.70E	0900	1.52E
1000	2.35	1000	2.00E	1000	1.68E	1000	1.41
1100	2.33	1100	1.98	1100	1.67	1100	1.40
1200	2.31	1200	1.97	1200	1.66	1200	1.39E
1300	2.30	1300	1.96	1300	1.65	1300	--
1400	2.29	1400	1.95	1400	1.64	1400	--
1500	2.28	1500	1.94	1500	1.63	1500	--
1600	2.26	1600	1.93	1600	1.62	1600	--
1700	2.25	1700	1.91	1700	1.60	1700	--
1800	2.23	1800	1.89	1800	1.59	1800	--
1900	2.21E	1900	1.88E	1900	1.58E	1900	--
2000	2.20E	2000	1.87E	2000	1.57E	2000	--
2100	2.18E	2100	1.85E	2100	1.55E	2100	--
2200	2.16E	2200	1.84E	2200	1.54E	2000	--
2300	2.15E	2300	1.82E	2300	1.53E	2300	--
2400	2.14E	2400	1.81E	2400	1.52E	2400	--

Table 2. *Hourly reservoir gage heights, April 2-15, April 30 to May 9, 1984, and February 20-22, 1984*--Continued

April 30, 1984 Time (24-hour)	April 30, 1984 Gage height (feet)	May 1, 1984 Time (24-hour)	May 1, 1984 Gage height (feet)	May 2, 1984 Time (24-hour)	May 2, 1984 Gage height (feet)	May 3, 1984 Time (24-hour)	May 3, 1984 Gage height (feet)	May 4, 1984 Time (24-hour)	May 4, 1984 Gage height (feet)
0100	--	0100	2.00E	0100	1.88E	0100	1.76E	0100	1.63E
0200	--	0200	1.99E	0200	1.87E	0200	1.75E	0200	1.62E
0300	--	0300	1.99E	0300	1.87E	0300	1.75E	0300	1.61E
0400	--	0400	1.98E	0400	1.86E	0400	1.74E	0400	1.61E
0500	--	0500	1.98E	0500	1.86E	0500	1.74E	0500	1.60E
0600	--	0600	1.97E	0600	1.85E	0600	1.74E	0600	1.60E
0700	--	0700	1.97E	0700	1.85E	0700	1.73E	0700	1.59E
0800	--	0800	1.96E	0800	1.84E	0800	1.73E	0800	1.59E
0900	1.37E	0900	1.95E	0900	1.84E	0900	1.72E	0900	1.58E
1000	1.87	1000	1.95E	1000	1.84	1000	1.72E	1000	1.57E
1100	1.90	1100	1.94E	1100	1.83	1100	1.72	1100	1.57
1200	1.93	1200	1.94	1200	1.82	1200	1.71	1200	1.56
1300	1.95	1300	1.93	1300	1.82	1300	1.71	1300	1.55
1400	1.98	1400	1.93	1400	1.81E	1400	1.70	1400	1.55
1500	1.99	1500	1.93	1500	1.81E	1500	1.69	1500	1.54
1600	2.00	1600	1.92	1600	1.80E	1600	1.69	1600	1.54
1700	2.01	1700	1.92	1700	1.80E	1700	1.69	1700	1.53
1800	2.01	1800	1.91E	1800	1.79E	1800	1.68	1800	1.52
1900	2.01	1900	1.91E	1900	1.79E	1900	1.67	1900	1.51
2000	2.01	2000	1.91E	2000	1.78E	2000	1.66E	2000	1.50E
2100	2.01	2100	1.90E	2100	1.78E	2100	1.65E	2100	1.50E
2200	2.01	2200	1.89E	2200	1.78E	2200	1.65E	2200	1.49E
2300	2.00E	2300	1.89E	2300	1.77E	2300	1.64E	2300	1.49E
2400	2.00E	2400	1.88E	2400	1.77E	2400	1.64E	2400	1.48E

Table 2. *Hourly reservoir gage heights, April 2-15, April 30 to May 9, 1984, and February 20-22, 1984*--Continued

May 5, 1984		May 6, 1984		May 7, 1984		May 8, 1984		May 9, 1984	
Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)
0100	1.47E	0100	1.34E	0100	1.22	0100	1.10E	0100	0.97E
0200	1.47E	0200	1.33E	0200	1.21	0200	1.09E	0200	.97E
0300	1.46E	0300	1.33E	0300	1.21	0300	1.08E	0300	.96E
0400	1.46E	0400	1.32E	0400	1.20	0400	1.08E	0400	.96E
0500	1.45E	0500	1.32E	0500	1.20	0500	1.07E	0500	.95E
0600	1.45E	0600	1.31E	0600	1.19	0600	1.07E	0600	.95E
0700	1.44E	0700	1.31E	0700	1.19	0700	1.06E	0700	.94E
0800	1.44E	0800	1.30E	0800	1.18	0800	1.06E	0800	.94E
0900	1.43E	0900	1.30E	0900	1.17	0900	1.05E	0900	.93E
1000	1.43E	1000	1.29E	1000	1.17	1000	1.05E	1000	.93E
1100	1.42E	1100	1.29E	1100	1.16	1100	1.04E	1100	.92E
1200	1.41	1200	1.28E	1200	1.16	1200	1.04E	1200	.92E
1300	1.40E	1300	1.28E	1300	1.16	1300	1.03E	1300	.91E
1400	1.39E	1400	1.27E	1400	1.15	1400	1.03E	1400	.91E
1500	1.39E	1500	1.27E	1500	1.15	1500	1.02E	1500	.90
1600	1.38E	1600	1.26E	1600	1.14	1600	1.02E	1600	--
1700	1.37E	1700	1.26E	1700	1.13	1700	1.01E	1700	--
1800	1.37E	1800	1.25E	1800	1.13	1800	1.01E	1800	--
1900	1.37E	1900	1.25E	1900	1.12	1900	1.00E	1900	--
2000	1.36E	2000	1.24E	2000	1.12	2000	1.00E	2000	--
2100	1.36E	2100	1.24E	2100	1.11	2100	.99E	2100	--
2200	1.35E	2200	1.23E	2200	1.11	2200	.99E	2200	--
2300	1.35E	2300	1.23E	2300	1.10	2300	.98E	2300	--
2400	1.34E	2400	1.22E	2400	1.10	2400	.98E	2400	--

Table 2. *Hourly reservoir gage heights, April 2-15, April 30 to May 9, 1984, and February 20-22, 1984*--Continued

February 20, 1985		February 21, 1985		February 22, 1985	
Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)	Time (24-hour)	Gage height (feet)
0100	--	0100	1.98	0100	1.55
0200	--	0200	1.96	0200	1.53
0300	--	0300	1.94	0300	1.51
0400	--	0400	1.92	0400	1.49
0500	--	0500	1.90	0500	1.47
0600	--	0600	1.89	0600	1.46
0700	--	0700	1.87	0700	1.44
0800	--	0800	1.86	0800	1.42
0900	--	0900	1.84	0900	1.41
1000	--	1000	1.82	1000	1.39
1100	--	1100	1.80	1100	1.37
1200	--	1200	1.78	1200	--
1300	--	1300	1.76	1300	--
1400	1.37	1400	1.75	1400	--
1500	1.65	1500	1.73	1500	--
1600	1.85	1600	1.71	1600	--
1700	1.95	1700	1.69	1700	--
1800	2.01	1800	1.67	1800	--
1900	2.03	1900	1.66	1900	--
2000	2.03	2000	1.64	2000	--
2100	2.03	2100	1.63	2100	--
2200	2.01	2200	1.61	2200	--
2300	1.99	2300	1.59	2300	--
2400	1.98	2400	1.57	2400	--

Table 3. *Hourly recorded depth to water in observation well 1, April 1 to May 31, 1984*

[Depths to water are in feet below land surface]

Date	Time											
	AM	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
	PM	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
Apr.		93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.48	93.49	93.49
1		93.49	93.49	93.49	93.49	93.49	93.49	93.49	93.49	93.49	93.49	93.49	93.49
Apr.		93.49	93.49	93.48	93.47	93.44	93.44	93.43	93.42	93.42	93.42	93.42	93.41
2		93.41	93.40	93.40	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39
Apr.		93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39
3		93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39
Apr.		93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39
4		93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39
Apr.		93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39
5		93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39	93.39
Apr.		93.37	93.37	93.37	93.37	93.37	93.37	93.37	93.37	93.37	93.37	93.37	93.37
6		93.37	93.37	93.37	93.37	93.37	93.37	93.37	93.37	93.37	93.37	93.37	93.37
Apr.		93.35	93.35	93.35	93.35	93.35	93.35	93.35	93.35	93.35	93.35	93.35	93.35
7		93.35	93.35	93.35	93.35	93.35	93.35	93.35	93.35	93.35	93.35	93.35	93.35
Apr.		93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33
8		93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33
Apr.		93.31	93.31	93.31	93.31	93.31	93.31	93.31	93.31	93.31	93.31	93.31	93.31
9		93.31	93.31	93.31	93.31	93.31	93.31	93.31	93.31	93.31	93.31	93.31	93.31
Apr.		93.29	93.28	93.28	93.28	93.28	93.28	93.28	93.27	93.26	93.25	93.24	93.24
10		93.24	93.24	93.24	93.24	93.24	93.24	93.24	93.24	93.24	93.24	93.24	93.24
Apr.		93.23	93.23	93.23	93.23	93.23	93.23	93.23	93.23	93.23	93.23	93.23	93.23
11		93.23	93.23	93.23	93.23	93.23	93.23	93.23	93.23	93.23	93.23	93.23	93.23
Apr.		93.22	93.22	93.22	93.22	93.22	93.22	93.22	93.22	93.22	93.22	93.22	93.22
12		93.22	93.22	93.22	93.22	93.22	93.22	93.22	93.22	93.22	93.22	93.22	93.22
Apr.		93.21	93.21	93.21	93.21	93.21	93.21	93.21	93.21	93.21	93.21	93.21	93.21
13		93.21	93.21	93.21	93.21	93.21	93.21	93.18	93.17	93.15	93.14	93.13	93.12
Apr.		93.10	93.09	93.09	93.09	93.08	93.08	93.05	93.02	93.00	92.98	92.97	92.97
14		92.97	92.97	92.97	92.97	92.97	92.97	92.97	92.97	92.96	92.96	92.96	92.96
Apr.		92.95	92.95	92.95	92.95	92.95	92.95	92.95	92.95	92.95	92.95	92.96	92.98
15		93.00	93.02	93.05	93.07	93.07	93.07	93.07	93.07	93.06	93.04	93.04	93.04

Table 3. *Hourly recorded depth to water in observation well 1, April 1 to May 31, 1984--* Continued

Date	Time	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
	AM	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
Apr.		93.03	93.03	93.03	93.03	93.03	93.03	93.03	93.03	93.03	93.04	93.06	93.08
16		93.10	93.12	93.14	93.17	93.18	93.18	93.18	93.18	93.18	93.18	93.18	93.18
Apr.		93.17	93.17	93.17	93.17	93.19	93.19	93.19	93.19	93.19	93.19	93.19	93.19
17		93.19	93.19	93.19	93.19	93.19	93.19	93.19	93.19	93.19	93.19	93.19	93.18
Apr.		93.17	93.17	93.17	93.17	93.17	93.17	93.17	93.17	93.17	93.17	93.17	93.17
18		93.17	93.17	93.17	93.17	93.17	93.17	93.17	93.15	93.14	93.14	93.13	93.13
Apr.		93.11	93.11	93.11	93.11	93.11	93.11	93.11	93.11	93.11	93.11	93.11	93.12
19		93.14	93.18	93.22	93.23	93.25	93.25	93.25	93.25	93.25	93.25	93.25	93.25
Apr.		93.24	93.26	93.27	93.27	93.27	93.27	93.27	93.27	93.30	93.32	93.31	93.31
20		93.31	93.30	93.26	93.28	93.26	93.21	93.19	93.15	93.13	93.13	93.11	93.09
Apr.		93.07	93.07	93.07	93.07	93.07	93.07	93.07	93.07	93.07	93.07	93.07	93.07
21		93.07	93.07	93.07	93.07	93.07	93.07	93.07	93.07	93.07	93.07	93.07	93.07
Apr.		93.06	93.06	93.06	93.06	93.06	93.06	93.06	93.06	93.06	93.06	93.06	93.06
22		93.06	93.06	93.06	93.06	93.06	93.06	93.06	93.06	93.06	93.06	93.06	93.06
Apr.		93.05	93.05	93.05	93.05	93.05	93.05	93.05	93.05	93.05	93.05	93.05	93.05
23		93.05	93.05	93.05	93.05	93.05	93.05	93.05	93.05	93.05	93.05	93.05	93.05
Apr.		93.04	93.04	93.04	93.04	93.04	93.04	93.04	93.04	93.04	93.04	93.04	93.04
24		93.00	93.00	93.03	93.05	93.06	93.07	93.06	93.05	93.05	93.05	93.07	93.10
Apr.		93.11	93.13	93.14	93.16	93.19	93.21	93.21	93.21	93.21	93.23	93.23	93.25
25		93.26	93.28	93.31	93.34	93.34	93.33	93.32	93.29	93.24	93.22	93.19	93.12
Apr.		93.09	93.06	93.04	93.04	93.04	93.04	93.02	93.01	93.01	93.02	93.04	93.05
26		93.05	93.04	93.04	93.01	93.00	93.02	93.04	93.04	93.04	93.02	93.02	92.97
Apr.		92.92	92.89	92.85	92.84	92.82	92.82	92.80	92.78	92.77	92.76	92.76	92.76
27		92.76	92.77	92.78	92.79	92.78	92.76	92.73	92.68	92.64	92.61	92.61	92.60
Apr.		92.59	92.59	92.60	92.60	92.60	92.61	92.61	92.61	92.61	92.61	92.64	92.68
28		92.74	92.76	92.79	92.83	92.85	92.86	92.88	92.88	92.88	92.88	92.90	92.91
Apr.		92.96	93.00	93.03	93.04	93.05	93.09	93.11	93.09	93.14	93.13	93.13	93.13
29		93.06	93.02	92.97	92.93	92.89	92.85	92.84	92.81	92.77	92.75	92.77	92.79
Apr.		92.80	92.84	92.88	92.90	92.90	92.90	92.90	92.90	92.90	92.89	92.89	92.90
30		92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91

Table 3. *Hourly recorded depth to water in observation well 1, April 1 to May 31, 1984--* Continued

Date	Time											
	AM	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
	PM	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
May		92.90	92.90	92.90	92.90	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91
1		92.92	92.92	92.92	92.92	92.92	92.92	92.92	92.92	92.92	92.92	92.92	92.92
May		92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91
2		92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91	92.91
May		92.90	92.90	92.90	92.90	92.90	92.90	92.90	92.90	92.90	92.90	92.90	92.90
3		92.90	92.90	92.90	92.90	92.90	92.90	92.90	92.90	92.90	92.90	92.90	92.90
May		92.89	92.89	92.89	92.89	92.89	92.89	92.89	92.89	92.89	92.89	92.89	92.89
4		92.89	92.89	92.89	92.89	92.89	92.89	92.89	92.89	92.89	92.89	92.89	92.89
May		92.88	92.88	92.88	92.88	92.88	92.88	92.88	92.88	92.88	92.88	92.88	92.88
5		92.88	92.88	92.88	92.88	92.88	92.88	92.88	92.88	92.88	92.88	92.88	92.88
May		92.87	92.87	92.87	92.87	92.87	92.87	92.87	92.87	92.87	92.87	92.87	92.87
6		92.87	92.87	92.87	92.87	92.87	92.87	92.87	92.87	92.87	92.87	92.86	92.85
May		92.83	92.83	92.81	92.80	92.78	92.78	92.77	92.73	92.70	92.64	92.64	92.63
7		92.63	92.63	92.63	92.63	92.63	92.63	92.63	92.63	92.63	92.63	92.63	92.63
May		92.62	92.62	92.62	92.62	92.62	92.62	92.64	92.66	92.67	92.69	92.71	92.74
8		92.79	92.81	92.84	92.87	92.88	92.89	92.89	92.89	92.89	92.89	92.88	92.88
May		92.87	92.87	92.88	92.90	92.90	92.91	92.91	92.91	92.91	92.93	92.95	92.97
9		92.97	92.97	92.97	92.97	92.96	92.94	92.93	92.93	92.92	92.92	92.92	92.92
May		92.90	92.88	92.88	92.88	92.88	92.90	92.92	92.95	92.97	92.99	93.00	93.01
10		93.02	93.03	93.03	93.03	93.02	93.01	92.98	92.97	92.97	92.97	92.97	92.95
May		92.94	92.94	92.94	93.00	93.08	93.11	93.15	93.16	93.18	93.21	93.22	93.24
11		93.24	93.24	93.23	93.22	93.21	93.20	93.20	93.20	93.20	93.22	93.23	93.23
May		93.23	93.23	93.23	93.23	93.23	93.23	93.23	93.23	93.24	93.25	93.25	93.25
12		93.25	93.23	93.20	93.18	93.17	93.16	93.16	93.16	93.15	93.17	93.18	93.18
May		93.18	93.18	93.18	93.18	93.18	93.18	93.19	93.21	93.24	93.28	93.32	93.32
13		93.32	93.31	93.30	93.28	93.26	93.24	93.24	93.24	93.24	93.25	93.27	93.28

Table 3. *Hourly recorded depth to water in observation well 1, April 1 to May 31, 1984--* Continued

Date	Time											
	AM	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
	PM	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
May		92.28	93.27	93.27	93.26	93.25	93.23	93.22	93.22	93.23	93.23	93.23	93.23
14		93.21	93.18	93.16	93.13	93.11	93.10	93.09	93.08	93.08	93.08	93.08	93.09
May		93.09	93.09	93.09	93.10	93.10	93.09	93.09	93.09	93.09	93.09	93.09	93.09
15		93.08	93.05	93.05	93.04	93.03	93.02	93.02	93.02	93.03	93.05	93.07	93.08
May		93.09	93.10	93.10	93.10	93.10	93.10	93.11	93.12	93.13	93.13	93.12	93.12
16		93.11	93.09	93.10	93.09	93.09	93.08	93.08	93.09	93.09	93.11	93.11	93.11
May		93.12	93.12	93.12	93.12	93.13	93.14	93.15	93.17	93.19	93.19	93.19	93.19
17		93.17	93.16	93.15	93.12	93.12	93.11	93.12	93.13	93.13	93.14	93.14	93.14
May		93.14	93.14	93.12	93.12	93.11	93.10	93.10	93.10	93.09	93.09	93.09	93.09
18		93.09	93.07	93.06	93.04	93.01	93.01	93.01	93.02	93.04	93.05	93.08	93.09
May		93.07	93.05	93.04	93.04	93.04	93.05	93.05	93.08	93.10	93.11	93.11	93.12
19		93.12	93.12	93.12	93.10	93.09	93.09	93.08	93.08	93.08	93.08	93.08	93.08
May		93.08	93.08	93.08	93.08	93.07	93.07	93.06	93.06	93.06	93.06	93.06	93.05
20		93.04	93.03	93.01	93.00	92.99	92.97	92.96	92.96	92.96	92.96	92.96	92.97
May		92.97	92.97	92.97	92.97	92.96	92.96	92.95	92.95	92.95	92.95	92.94	92.94
21		92.94	92.94	92.94	92.92	92.92	92.92	92.92	92.92	92.94	92.99	93.03	93.04
May		93.06	93.10	93.11	93.12	93.16	93.17	93.19	93.21	93.22	93.23	93.25	93.27
22		93.28	93.28	93.28	93.28	93.28	93.28	93.28	93.30	93.34	93.36	93.38	93.38
May		93.38	93.38	93.38	93.37	93.36	93.35	93.35	93.35	93.34	93.33	93.30	93.28
23		93.25	93.21	93.17	93.14	93.11	93.09	93.06	93.05	93.04	93.03	93.03	93.03
May		93.01	92.99	92.96	92.94	92.92	92.91	92.91	92.91	92.91	92.93	92.93	92.92
24		92.92	92.91	92.89	92.87	92.83	92.82	92.81	92.81	92.84	92.85	92.91	93.01
May		93.01	93.09	93.09	93.10	93.12	93.13	93.15	93.15	93.16	93.17	93.18	93.18
25		93.18	93.18	93.18	93.18	93.16	93.16	93.16	93.16	93.18	93.20	93.22	93.23
May		93.24	93.24	93.24	93.24	93.24	93.24	93.26	93.26	93.27	93.27	93.26	93.23
26		93.21	93.18	93.14	93.13	93.10	93.07	93.06	93.06	93.06	93.06	93.06	93.05
May		93.04	93.03	93.02	93.00	93.00	93.00	93.07	93.07	93.07	93.10	93.11	93.11
27		93.12	93.13	93.14	93.14	93.14	93.14	93.15	93.16	93.20	93.25	93.32	93.34

Table 3. *Hourly recorded depth to water in observation well 1, April 1 to May 31, 1984--* Continued

Date	Time											
	AM	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
	PM	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
May		93.37	93.39	93.40	93.41	93.42	93.41	93.41	93.41	93.43	93.44	93.44	93.44
28		93.43	93.41	93.37	93.34	93.31	93.28	93.27	93.26	93.26	93.27	93.28	93.29
May		93.28	93.27	93.26	93.25	93.25	93.24	93.24	93.23	93.23	93.22	93.20	93.17
29		93.14	93.11	93.09	93.07	93.05	93.03	93.02	93.02	93.02	93.03	93.05	93.07
May		93.07	93.07	93.06	93.04	93.04	93.03	93.02	93.02	93.01	93.00	92.99	92.99
30		92.99	92.97	92.95	92.93	92.91	92.89	92.89	92.89	92.89	92.89	92.90	92.91
May		92.91	92.91	92.90	92.89	92.88	92.88	92.88	92.89	92.89	92.89	92.89	92.89
31		92.89	92.88	92.87	92.85	92.84	92.83	92.81	92.81	92.83	92.85	92.88	92.90

Table 4. *Five-day recorded depths to water in observation well 1*

Date (month day/ year)	Depth to water (feet)	Date (month day/ year)	Depth to water (feet)	Date (month day/ year)	Depth to water (feet)	Date (month day/ year)	Depth to water (feet)	Date (month day/ year)	Depth to water (feet)	Date (month day/ year)	Depth to water (feet)
10/25/80	87.57	02/20/83	94.28	11/10/83	93.18	07/30/84	93.25	05/20/85	93.97	02/05/86	94.37
10/30/80	87.57	02/25/83	94.45	11/15/83	93.08	08/05/84	93.33	05/25/85	93.92	02/05/86	94.37
11/05/80	87.59	03/05/83	94.26	11/20/83	92.79	08/10/84	93.43	05/30/85	93.95	02/10/86	94.34
11/10/80	87.57	03/10/83	94.24	11/25/83	92.94	08/15/84	93.42	06/05/85	93.94	02/15/86	94.07
11/15/80	87.60	03/15/83	94.07	11/30/83	92.66	08/20/84	93.36	06/10/85	93.94	02/20/86	94.51
11/20/80	87.70	03/20/83	94.17	12/05/83	92.60	08/25/84	93.43	06/15/85	93.94	02/25/86	94.21
11/25/80	87.58	03/25/83	94.36	12/10/83	92.83	09/20/84	93.44	06/20/85	93.85	03/05/86	94.32
11/30/80	87.96	03/30/83	94.28	12/15/83	92.65	09/25/84	93.85	06/25/85	93.93	03/10/86	94.33
12/05/80	87.92	04/05/83	94.00	12/20/83	92.85	09/30/84	93.50	06/30/85	93.93	03/15/86	94.47
12/10/80	87.72	04/10/83	94.00	12/25/83	93.14	10/05/84	93.47	07/05/85	94.10	03/20/86	94.38
12/15/80	87.99	04/15/83	94.00	12/30/83	93.06	10/10/84	93.48	07/10/85	94.11	03/25/86	94.42
12/20/80	87.82	04/20/83	94.08	01/05/84	93.05	10/15/84	93.49	07/15/85	94.17	03/30/86	94.49
12/25/80	87.98	04/25/83	94.31	01/10/84	93.19	10/20/84	93.65	07/20/85	94.11	04/05/86	94.71
12/30/80	88.11	04/30/83	91.92[1]	01/15/84	93.22	10/25/84	93.55	07/25/85	94.26	04/10/86	94.47
01/05/81	88.14	05/05/83	92.11	01/20/84	93.14	10/30/84	93.66	07/30/85	94.15	04/15/86	94.45
01/10/81	87.95	05/10/83	91.97	01/25/84	93.27	11/05/84	93.69	08/05/85	94.16	04/20/86	94.44
01/15/81	88.20	05/15/83	92.03	01/30/84	93.16	11/10/84	93.70	08/10/85	94.24	04/25/86	94.44
01/20/81	88.36	05/20/83	92.11	02/05/84	93.17	11/15/84	93.70	08/15/85	94.14	04/30/86	94.71
01/25/81	88.48	05/25/83	92.20	02/10/84	93.39	11/20/84	93.70	08/20/85	94.20	05/05/86	94.63
01/30/81	88.11	05/30/83	92.37	02/15/84	93.08	11/25/84	93.53	08/25/85	94.23	05/10/86	94.76
02/05/81	88.48	06/05/83	92.33	02/20/84	93.39	11/30/84	93.70	08/30/85	94.19	05/15/86	94.70
02/10/81	88.59	06/10/83	92.56	02/25/84	93.43	12/05/84	93.90	09/05/85	94.20	05/20/86	94.64
02/15/81	88.63	06/15/83	92.60	03/05/84	93.40	12/10/84	93.59	09/10/85	94.32	05/25/86	94.73
02/20/81	88.62	06/20/83	92.66	03/10/84	93.42	12/15/84	93.50	09/15/85	94.12	05/30/86	94.71
02/25/81	88.71	06/25/83	92.72	03/15/84	93.24	12/20/84	93.51	09/20/85	94.44	06/05/86	94.72
03/05/81	88.51	06/30/83	92.78	03/20/84	93.46	12/25/84	93.72	09/25/85	94.36	06/10/86	94.73
03/10/81	88.64	07/05/83	92.71	03/25/84	93.60	12/30/84	93.72	09/30/85	94.35	06/15/86	94.68
03/15/81	88.90	07/10/83	92.87	03/30/84	93.49	01/05/85	93.63	10/05/85	94.16	06/20/86	94.75
03/20/81	88.86	07/15/83	92.98	04/05/84	93.39	01/10/85	93.67	10/10/85	94.35	06/25/86	94.79
03/24/81	88.75	07/20/83	92.86	04/10/84	93.24	01/15/85	93.71	10/15/85	94.23	06/30/86	94.77
11/05/82	94.82[1,2]	07/25/83	92.90	04/15/84	93.04	01/20/85	93.72	10/20/85	94.21	07/05/86	94.78
11/10/82	94.85	07/30/83	92.83	04/20/84	93.09	01/25/85	93.70	10/25/85	94.23	07/10/86	94.85
11/15/82	94.70	08/05/83	92.91	04/25/84	93.12	01/30/85	93.71	10/30/85	94.20	07/15/86	94.90
11/20/82	94.40	08/10/83	92.94	04/30/84	92.91	02/05/85	93.73	11/05/85	94.38	07/20/86	94.94
11/25/82	94.40	08/15/83	92.91	05/05/84	92.88	02/10/85	93.71	11/10/85	94.22	07/25/86	94.88

Table 4. *Five-day recorded depths to water in observation well 1*--Continued

Date (month day/ year)	Depth to water (feet)	Date (month day/ year)	Depth to water (feet)	Date (month day/ year)	Depth to water (feet)	Date (month day/ year)	Depth to water (feet)	Date (month day/ year)	Depth to water (feet)	Date (month day/ year)	Depth to water (feet)
11/30/82	94.56	08/20/83	92.91	05/10/84	92.55	02/15/85	93.61	11/15/85	94.22	07/30/86	94.85
12/05/82	94.70	08/25/83	92.96	05/15/84	93.08	03/05/85	93.90	11/20/85	94.40	08/05/86	94.82
12/10/82	94.76	08/30/83	93.02	05/20/84	92.97	03/10/85	93.64	11/25/85	94.18	08/10/86	94.90
12/15/82	94.68	09/05/83	93.02	05/25/84	93.23	03/15/85	93.74	11/30/85	94.45	08/15/86	94.88
12/20/82	94.81	09/10/83	93.05	05/30/84	92.91	03/20/85	93.75	12/05/85	94.37	08/20/86	94.91
12/25/82	94.41	09/15/83	93.06	06/05/84	92.99	03/25/85	93.76	12/10/85	94.45	08/25/86	94.88
12/30/82	94.73	09/20/83	92.93	06/10/84	93.11	03/30/85	93.75	12/15/85	94.35	08/30/86	94.88
01/05/83	94.68	09/25/83	93.09	06/15/84	93.10	04/05/85	93.90	12/20/85	94.36	09/05/86	94.88
01/10/83	94.53	09/30/83	93.16	06/20/84	93.06	04/10/85	93.87	12/25/85	94.17	09/10/86	95.15
01/15/83	94.73	10/05/83	93.14[1]	06/25/84	93.05	04/15/85	93.87	12/30/85	94.45	09/15/86	95.17
01/20/83	94.52	10/10/83	93.27	06/30/84	93.15	04/20/85	93.90	01/05/86	94.25	09/20/86	95.30
01/25/83	94.39	10/15/83	93.16	07/05/84	93.11	04/25/85	93.90	01/10/86	94.35	09/25/86	95.17
01/30/83	94.38	10/20/83	93.22	07/10/84	93.32	04/30/85	93.90	01/15/86	94.13	09/30/86	95.17
02/05/83	94.40	10/25/83	93.22	07/15/84	93.27	05/05/85	93.91	01/20/86	94.11		
02/10/83	94.45	10/30/83	93.30	07/20/84	93.22	05/10/85	93.77	01/25/86	94.49		
02/15/83	94.39	11/05/83	93.28	07/25/84	93.31	05/15/85	93.97	01/30/86	94.21		

[1] Measuring point changed at this time.

[2] No record March 24, 1981, to November 2, 1982.

Table 5. *Measurement of depths to water in observation wells 1, 2, and 3 made during site visits*

Date (month/ day/ year)	Depth to water (feet)	Remarks
		Well 1
05/30/80	87.99	--Measuring point = top of casing at 3,067.74 feet
07/24/80	87.33	above sea level, 4.2 feet above ground level.
10/22/80	87.63	--Installed analog-to-digital (punch-tape) recorder
11/21/80	87.57	(12-hour intervals).
12/24/80	87.69	
03/24/81	88.78	--Removed analog-to-digital (punch-tape) recorder.
04/29/81	88.25	
06/19/81	88.26	
08/20/81	88.96	
09/30/81	88.72	
11/05/81	88.85	
01/20/82	95.43	--Measuring point = top of casing at 3,074.74 feet above sea level, 11.2 feet above ground level (added 7 feet to casing).
03/20/82	95.77	
05/10/82	95.90	
08/02/82	96.12	
11/02/82	94.72	--Measuring point = top of casing at 3,072.74 feet
12/03/82	94.22	above sea level; installed analog-to-digital (punch-tape) recorder (1-hour interval).
03/01/83	[1]96.22	--Total depth noted on analog-to-digital recorder.
03/01/83	[1]89.54	--Measuring point = hole in casing at 3,070.52 feet
04/27/83	91.74	above sea level.
06/16/83	92.61	
07/20/83	92.86	
08/23/83	92.98	
10/17/83	93.17	
11/18/83	92.87	
01/06/84	93.06	
02/07/84	93.16	
04/05/84	93.39	
05/09/84	92.99	
06/12/84	93.12	

Table 5. *Measurement of depths to water in observation wells 1, 2, and 3 made during site visits*--Continued

Date (month/ day/ year)	Depth to water (feet)	Well 1 Remarks
07/16/84	93.24	--Analog-to-digital (punch-tape) recorder replaced
09/18/84	93.57	with strip recorder, 08/28/84.
10/02/84	93.53	--Measuring point = top of casing at 3,070.52 feet above sea level, well slug tested, okay.
11/02/84	93.63	
12/04/84	93.90	
03/04/85	93.90	
04/04/85	93.72	
05/09/85	93.88	
06/18/85	94.24	
07/15/85	94.26	
08/05/85	[1]94.19	
10/09/85	94.80	
11/25/85	94.05	
01/06/86	94.29	
03/06/86	94.31	
04/02/86	94.27	
05/12/86	94.78	
06/23/86	94.84	
07/25/86	94.87	
08/29/86	94.88	
10/06/86	95.24	
11/13/86	95.11	

Table 5. *Measurement of depths to water in observation wells 1, 2, and 3 made during site visits*--Continued

Date (month/ day/ year)	Depth to water (feet)	Well 2 Remarks
06/19/81	100.52	--Measuring point = top of casing at 3,080.88 feet above
08/20/81	101.30	sea level, 0.5 foot at ground level.
11/05/81	100.99	
01/20/82	101.00	--Measuring point = top of casing at 3,080.38 feet above
03/20/82	99.83	sea level, at ground level.
05/10/82	99.95	
08/02/82	100.12	
11/02/82	101.42	
12/03/82	101.50	
03/01/83	101.46	
04/27/83	101.71	
06/16/83	101.75	
07/20/83	101.87	
08/23/83	101.95	
10/17/83	102.06	
11/18/83	101.94	
01/06/84	102.08	
02/07/84	102.17	
04/05/84	102.33	
05/09/84	101.94	
06/12/84	101.94	
07/16/84	102.14	
09/18/84	102.47	
10/02/84	102.42	--Slug test, 2 1/2 hours later depth to water = 88.88 feet
11/02/84	[1]103.12	(slow but okay).
12/04/84	102.68	
03/04/85	102.89	
04/04/85	102.03	
05/09/85	102.76	
06/18/85	103.08	
07/15/85	[1]101.61	
08/05/85	103.13	
10/08/85	[1]103.76	
11/25/85	103.14	
01/06/86	103.28	

Table 5. *Measurement of depths to water in observation wells 1, 2, and 3 made during site visits*--Continued

Date (month/ day/ year)	Depth to water (feet)	Well 2 Remarks
03/06/86	103.39	
04/02/86	103.42	
05/12/86	103.74	
06/23/86	103.80	
07/25/86	103.90	
08/29/86	103.89	
10/06/86	104.20	
11/13/86	104.24	

Table 5. *Measurement of depths to water in observation wells 1, 2, and 3 made during site visits*--Continued

Date (month/ day/ year)	Depth to water (feet)	Well 3 Remarks
06/19/81	98.13	--Measuring point = top of casing at 3,078.79 feet
08/20/81	98.40	above sea level (0.8 foot above ground level, 2-inch casing).
11/05/81	99.39	
01/20/82	99.30	
03/20/82	98.75	
05/10/82	98.80	
08/02/82	97.30	
11/02/82	99.28	
12/03/82	99.41	
03/01/83	99.28	
04/27/83	99.51	
06/16/83	99.48	
07/20/83	99.60	
08/23/83	99.68	
10/17/83	99.88	
11/18/83	99.56	
01/06/84	99.87	
02/07/84	99.85	
04/05/84	100.05	
05/09/84	99.80	
06/12/84	100.04	
07/16/84	100.11	
09/18/84	100.29	
10/02/84	100.26	--Slug tested well, okay.
11/02/84	100.32	
12/04/84	100.58	
03/04/85	100.79	
04/04/85	100.41	
05/09/85	100.54	
06/18/85	101.02	
07/15/85	101.08	
08/05/85	100.86	
10/09/85	[1]99.16	
11/25/85	100.76	
01/06/86	100.84	

Table 5. *Measurement of depths to water in observation wells 1, 2, and 3 made during site visits*--Continued

Date (month/ day/ year)	Depth to water (feet)	Well 3 Remarks
03/06/86	101.28	
04/02/86	100.93	
05/12/86	101.49	
06/23/86	101.60	
07/25/86	101.62	
08/29/86	101.55	
10/06/86	101.94	
11/13/86	101.26	
05/12/86	94.78	
06/23/86	94.84	
07/25/86	94.87	
08/29/86	94.88	
10/06/86	95.24	
11/13/86	95.11	

[1] Measurement noticeably anomalous to others.

Table 6. *Summary of daily rainfall for 1983, in inches*

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	-	-	0	0.38	0.35	0.18	0	0	0	0	-	-
2	-	-	0	0	0	.14	0	0	0	0	-	-
3	-	-	0	0	0	0	0	0	0	0	-	-
4	-	-	0	0	.05	.04	0	0	.64	0	-	-
5	-	-	.37	0	0	1.02	0	0	.77	0	-	-
6	-	-	0	0	0	0	0	0	0	0	-	-
7	-	-	0	0	0	0	0	0	0	0	-	-
8	-	-	0	0	0	0	0	0	0	0	-	-
9	-	-	0	0	0	0	0	0	0	0	-	-
10	-	-	0	0	0	0	0	0	0	0	-	-
11	-	-	0	0	0	0	0	0	0	0	-	-
12	-	-	0	0	.37	.42	0	0	0	0	-	-
13	-	-	0	0	.45	0	0	0	0	0	-	-
14	-	-	0	.02	0	0	0	0	.58	0	-	-
15	-	-	0	0	0	0	0	0	0	0	-	-
16	-	-	0	0	0	0	0	0	0	0	-	-
17	-	-	0	0	0	0	0	0	0	[1]0	-	-
18	-	-	0	0	.04	0	0	0	0	-	-	-
19	-	-	0	0	.04	0	0	0	0	-	-	-
20	-	-	0	0	.96	0	0	0	0	-	-	-
21	-	-	0	.04	0	0	0	0	0	-	-	-
22	-	-	0	.21	0	0	0	.20	0	-	-	-
23	-	-	0	0	0	0	0	0	0	-	-	-
24	-	-	0	0	0	0	0	.09	0	-	-	-
25	-	-	0	0	0	.33	0	0	0	-	-	-
26	-	-	0	0	0	.24	0	0	0	-	-	-
27	-	-	0	0	.02	.13	0	.40	0	-	-	-
28	-	-	0	[1]0	0	0	0	.04	0	-	-	-
29	-		.16	.16	0	0	0	.84	0	-	-	-
30	-		0	.03	.14	0	0	0	0	-	-	-
31	-		.28		0		0	0		-		-
TOTAL	--	--	0.81	0.84	2.42	2.50	0.00	1.57	1.99	--	--	--

[1] Indicates partial day's record.

Table 7. *Summary of daily rainfall for 1984, in inches*

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	-	-	-	-	0	0.21	0.16	0	0	0	0	-
2	-	-	-	-	.25	0	0	0	.05	0	.02[1]	-
3	-	-	-	-	0	.04	0	.02	0	0	-	-
4	-	-	-	-	0	0	.32	0	0	.71	-	-
5	-	-	-	[1]0	.31	0	.08	0	0	0	-	-
6	-	-	-	0	.29	0	0	0	0	0	-	-
7	-	-	-	0	0	0	0	0	0	0	-	-
8	-	-	0	0	0	0	0	0	0	0	-	-
9	-	-	-	.23	[1]0	.04	0	.27	0	.43	-	-
10	-	-	-	.39	0	0	0	0	0	0	-	-
11	-	-	-	.06	0	0	0	0	0	0	-	-
12	-	-	-	0	0	0	0	0	0	0	-	-
13	-	-	-	0	0	1.32	0	0	0	0	-	-
14	-	-	-	0	0	0	0	0	.08	.46	-	-
15	-	-	-	0	0	.05	0	0	0	.02	-	-
16	-	-	-	0	0	.24	.11	0	0	.69	-	-
17	-	-	-	0	.09	0	.05	0	0	0	-	-
18	-	-	-	0	.14	0	.15	0	0	0	-	-
19	-	-	-	0	.72	0	0	0	0	0	-	-
20	-	-	-	.92	0	0	0	.03	0	.21	-	-
21	-	-	-	0	0	0	0	0	0	0	-	-
22	-	-	-	0	0	.04	0	0	0	0	-	-
23	-	-	-	0	0	0	0	0	0	0	-	-
24	-	-	-	0	0	0	0	0	0	0	-	-
25	-	-	-	0	0	.41	0	0	0	.27	-	-
26	-	-	-	0	0	0	0	0	0	0	-	-
27	-	-	-	0	0	0	0	0	0	0	-	-
28	-	-	-	0	0	0	0	0	0	0	-	-
29	-	-	-	1.11	0	0	0	0	0	0	-	-
30	-		-	0	0	0	0	0	0	0	-	-
31	-		-		0		0	0		0		-
TOTAL	--	--	--	2.71	1.80	2.35	0.87	0.32	0.13	2.79	0.02	--

[1] Indicates partial day's record.

Table 8. *Summary of daily rainfall for 1985, in inches*

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	-	-	-	0	0	0	0	0	0	0.02	0	-
2	-	-	-	0	0	0	.03	0	0	0	0	-
3	-	-	-	0	0	0	0	0	0	0	0	-
4	-	-	0[1]	0	0	.03	0	.85	0	0	0	-
5	-	-	0	0	.39	0	0	.02	0	0	0	-
6	-	-	0	0	.05	0	0	0	0	0	0	-
7	-	-	0	0	0	0	0	.26	0	0	0	-
8	-	-	0	0	0	0	0	0	0	.04	0	-
9	-	-	0	0	[1]0	.18	.26	0	0	0	0	-
10	-	-	0	0	.13	.07	0	0	.35	0	0	-
11	-	-	0	0	0	0	0	0	1.38	.31	0	-
12	-	-	0	0	0	0	0	0	.09	0	0	-
13	-	-	0	0	1.02	0	0	.17	.10	0	0	-
14	-	-	0	0	.24	0	.53	.52	0	0	0	-
15	-	-	0	0	0	0	0	0	0	0	.02	-
16	-	-	0	0	0	0	0	0	0	0	0	-
17	-	-	0	0	0	0	0	0	0	.34	0	-
18	-	-	0	0	0	0	0	1.42	.02	.05	0	-
19	-	-	0	.05	0	0	0	0	0	0	0	-
20	-	-	0	0	0	0	.62	0	.14	0	0	-
21	-	-	0	0	.03	0	0	0	.09	0	0	-
22	-	-	0	0	0	0	0	0	.05	0	0	-
23	-	-	0	0	0	0	0	.17	0	0	0	-
24	-	-	0	0	0	0	0	0	0	0	0	-
25	-	-	0	0	0	.02	0	0	0	0	[1]0	-
26	-	-	0	.32	0	0	0	0	0	0	-	-
27	-	-	0	0	0	0	0	0	0	0	-	-
28	-	-	-	0	0	0	0	0	.04	0	-	-
29	-		-	1.09	0	0	2.23	0	.20	0	-	-
30	-		-	.08	0	0	0	0	.04	0	-	-
31	-		-		0		0	0		0		-
TOTAL	--	--	--	1.54	1.86	0.30	3.67	3.41	2.50	0.76	0.02	--

[1]Indicates partial day's record.

Table 9. *Summary of daily rainfall for 1986, in inches*

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	-	-	-	-	0	0.13	0	0	0	0	0.17	-
2	-	-	-	[1]0	0	.47	0	0	.65	0	.21	-
3	-	-	-	.13	0	0	0	0	.23	0	0	-
4	-	-	-	0	0	0	0	.06	0	0	0	-
5	-	-	-	0	0	0	0	0	0	0	0	-
6	-	-	-	0	0	0	.27	0	0	0	0	-
7	-	-	-	0	0	0	0	0	0	0	0	-
8	-	-	-	0	0	0	0	0	0	0	0	-
9	-	-	-	0	0	.04	0	.26	0	0	0	-
10	-	-	-	0	0	.06	0	0	.40	0	0	-
11	-	-	-	0	0	0	0	0	.08	.34	0	-
12	-	-	-	0	[1]0	0	0	0	0	0	0	-
13	-	-	-	0	.27	0	.35	.03	0	0	[1]0	-
14	-	-	-	0	0	0	0	0	0	0	-	-
15	-	-	-	0	0	0	0	.03	0	0	-	-
16	-	-	-	0	0	0	0	0	0	0	0	-
17	-	-	-	0	0	0	0	0	0	0	0	-
18	-	-	-	0	0	0	0	0	0	0	0	-
19	-	-	-	0	0	0	0	0	0	0	0	-
20	-	-	-	0	0	.61	.10	[1] 0	0	.08	-	-
21	-	-	-	0	0	.10	0	-	0	.43	-	-
22	-	-	-	0	0	.30	.26	-	0	0	-	-
23	-	-	-	0	0	0	0	-	0	0	-	-
24	-	-	-	0	.05	0	0	-	0	0	-	-
25	-	-	-	0	0	0	0	-	0	0	-	-
26	-	-	-	.05	0	.29	0	-	0	0	-	-
27	-	-	-	.73	0	0	0	-	0	0	-	-
28	-	-	-	0	.24	0	0	-	.20	0	-	-
29	-		-	0	0	0	0	[1]0	.43	0	-	-
30	-		-	0	0	0	0	0	0	0	-	-
31	-		-		.12		0	0		0		-
TOTAL	--	--	--	0.91	0.68	2.00	0.98	0.38	1.99	0.85	0.38	--

[1] Indicates partial day's record.

Table 10. *Construction data for observation wells*

Observation well 1:

Alias: Hole 705 (construction plans), 17-34W-11BACD.

Drilled: November 8, 1979, with rotary drill, bentonite and revert mud.

Lithologic log (logged by R. H. Drees, U.S. Soil Conservation Service):

Depth, in feet below land surface	**Lithology**[1]
0.0 to 0.5	Clay, silt, stiff, brown
0.5 to 4.0	Silt, sand, light-brown to tan
4.0 to 23.0	Silt, sand, gravel, tan, limey, cemented zone at 19 feet
23.0 to 33.0	More silt and clay
33.0 to 55.0	Less silt and clay
55.0 to 88.0	Silt, sand, gravel
88.0 to 92.5	Caliche, hard to drill
92.5 to 128	Soft
128 to 146	Clay, silt, sand

Completion data: Hole reamed to 7-7/8 inches down to 146 feet. Placed 143 feet of 4-inch polyvinyl-chloride pipe in boring (lower 58.3 feet perforated). Annulus gravel packed from bottom to 10 feet, bentonite and clay to surface. Water level, 74.0 feet, November 15, 1979.

Table 10. *Construction data for observation wells--Continued*

Observation well 2:

Alias: Hole 704 (construction plans), 17-34W-11BACC.

Drilled: November 7, 1979, with rotary drill, bentonite and revert mud.

Lithologic log (logged by R. H. Drees, U.S. Soil Conservation Service):

Depth, in feet below land surface	**Lithology**[1]
0.0 to 0.6	Clay, silt, stiff, brown
0.6 to 4.0	Silt, clay, light-brown
4.0 to 40.0	Clay, silt, sand, with partially and well-cemented zones (caliche-like)
40.0 to 86.0	Slightly less "caliche" or hard zones
86.0 to 101.0	Hard, very limey (caliche)
101.0 to 135.2	Softer

Completion data: Placed 132 feet of 2-inch polyvinyl-chloride pipe in boring. Annulus gravel-packed from bottom to 5 feet, bentonite and clay to surface. Water level, 88.1 feet, November 8, 1979. Water level, 96.9 feet, November 9, 1979.

Table 10. *Construction data for observation wells*--Continued

Observation well 3:

Alias: Hole 703 (construction plans), 17-34W-11BBAC.

Drilled: November 6, 1979, with rotary drill, bentonite and revert mud.

Lithologic log (logged by R. H. Drees, U.S. Soil Conservation Service):

Depth, in feet below land surface	**Lithology**[1]
0.0 to 3.0	Clay
3.0 to 100.0	Clay, silt, sand, gravel, with caliche-like zones.
100.0 to 143.0	More silt and clay, less coarse sand and small gravel.
143.0 to 145.6	Drill action indicates Niobrara Formation, Smoky Hill Member.

Completion data: 143 feet of 2-inch polyvinyl-chloride pipe placed in boring, lower 50 feet slotted with hacksaw, approximately one slot per foot. Annulus gravel-packed from bottom to 5 feet, then bentonite and clay to surface. Water level, 94.0 feet, November 7, 1979. Water level, 96.3 feet, November 8, 1979. Water level, 96.6 feet, November 9, 1979.

[1] Author's note--Stratigraphic names but no lithology are noted in log. In this report, stratigraphic name is used as descriptor only.

Table 11. *Description of reference marks*

Reference mark	Description
RM-1	5/8-inch steel rod at south end of dam, 4 feet from southeast corner post in fenceline around trench silo 300 feet west of section line.
RM-2	Top of steel post near observation well 1 near center of downstream slope of dam.
RM-3	Top of fence post near shelter.
RM-4	3/8-inch bolt set vertically in concrete base of trash guard at north (left upstream) corner, 4 inches out from angle-iron corner post. Normally buried in dirt.
RM-4 alt	End of bolt on interior of lower rail of trash guard at principal spillway at inlet, left downstream corner.
	Range in gage height, in feet, on staff plates
RP-1	Lag bolt on lowest staff backing. 0.0 - 6.7
RP-2	Lag bolt on staff backing 2. 6.8 - 13.5
RP-3	Lag bolt on staff backing 3. 13.6 - 20.3
RP-4	Lag bolt on staff backing 4 (highest) 23.8 - 27.1
MP	Top of 4-inch casing, observation well 1--11.2 feet above land surface (May 10, 1982), hole in casing 2.23 feet lower used beginning December 3, 1982, casing cutoff on or about September 29, 1984, to install graphic recorder.
RPW2	Top of post near observation well 2--0.4 foot above ground level.
MP2	Top of 2-inch casing, observation well 2--even with land surface (August 2, 1982).
RPW3	Top of post near observation well 3--0.3 foot above ground level.
MP3	Top of 2-inch casing, observation well 3--0.5 foot above land surface (August 2, 1982).
Nail-in-post	is nail set vertically in post at west end of wire gate entrance to site at NE1/4 NE1/4 NW1/4 sec. 11, T. 17 S., R. 34 W.
Ctr-road	is center of east-west road at northeast corner of NE1/4 NE1/4 NW1/4 sec. 11,T. 17 S., R. 34 W. Pence SE U.S. Geological Survey 7.5-minute topographic quadrangle gives that location as 3,103 feet above sea level.
TBM-1	Dam construction mark--5/8-inch steel rod in center of crest of dam, about 90 feet northeast of southwest end of dam. Dam height, 56.20 feet above dam datum. Not found.
TBM-2	Dam construction mark--1/2-inch steel rod in northwest-southeast fenceline 200 feet southeast (downstream) of southwest end of dam. Dam height, 61.8 feet above dam datum. Not found.

Table 11. *Description of reference marks*--Continued

Reference mark	Description
	Crest of inlet--Dam height, 39.1 feet above dam datum (March 20, 1987, 16.73 feet gage height).
	Crest of emergency spillway--Dam height, 58.0 feet above dam datum (March 20, 1987, 35.8 feet gage height).
	Top of dam--Dam height, 62.5 feet dam datum (reportedly built a couple of feet higher by contractor?).

Table 12. *Summary of reference levels*

[Numbers are reference levels, in feet above gage datum]

Date of level run (month-day-year)	Reference marks[1]												Top of Orifice	Remarks
	RM-1	RM-2	RM-3	RM-4	RP-1	RP-2	RP-3	MP	MP-2	MP-3	RPW2	RPW3		
09-30-81	6.918							11.231						Top of casing observation well 1 about 11.2 feet above land surface, May 10, 1982, dam builtup around well in summer of 1982. Apparently, observation well 1 was extended 5.34 feet during this time.
08-16-82	6.938	[2]12.678	37.824										1.588	
08-26-82			37.824	16.861	2.000	8.070	14.900						1.513	
10-29-82	6.918	[2]12.678		16.861				[2]16.568	24.229	24.438	23.725	24.44		Nail-in-post = 50.264, Center-road = 46.832 (Center road = 3,103 feet above sea level). Separate line on summary indicates level run, lines not connected.
09-20-84														Observation well 1, top of casing lowered (cutoff) this date.
02-18-87	6.918	12.644	37.824	17.940 altitude	2.003	8.119	14.950	14.352 3,070.52	24.208 3,080.38	22.621 3,078.79	23.718 (Elevations in feet above sea level)	22.425	1.601	Original RM-4 not found.
03-20-87	6.918		37.824	17.940 altitude 16.794					24.200		22.590	23.178	22.418	Altitude PZF, inlet of tube = 16.73 (found original RM-4). Spillway floor = 35.8, Nail-in-post = 50.309, Center-road = 47.095 (levels to road to validate those of 10-29-82). High wind (15-30 miles per hour) but level sufficiently accurate to verify use of sea level determined 10-29-82 and elevations for observation well 3 determined 2-18-87.

Sea level: Levels on 10-29-82 indicate that RM-1 was 39.914 feet below center line of road north of site, which is 3,103 feet above sea level according to (U.S. Geological Survey 7.5-minute topographic quadrangle, Pence, SE). Datum of gage is, therefore, 3,103 feet - (39.91 + 6.92) = 3,056.17 feet.

[1] Reference marks described in table 11.

[2] Difference by carpenter level.