Supply well for Dona Ana Range Camp,
Dona Ana County, New Mexico

By

Gene C. Doty (Dory)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Albuquerque, New Mexico

Supply well for Dona Ana Range Camp, Dona Ana County, New Mexico

By

Gene C. Doty

Open file report

Prepared for U.S. Army, Corps of Engineers, Albuquerque District

April 1967

67-84

Contents

Illustrations

Tables

Supply well for Dona Ana Range Camp, Dona Ana County, New Mexico

By

Gene C. Doty

Introduction

Dona Ana Range Camp is a military encampment and troop-training area on the Fort Bliss military reservation in Dona Ana County, New Mexico. A single water well has supplied an adequate quantity of water for the facility for several years; however, an increased use of the area is planned and an additional water-supply well is required for domestic use and fire protection. This report is submitted in fulfillment of an agreement between the U.S. Army, Corps of Engineers, Albuquerque District and the U.S. Geological Survey wherein the Survey agreed to furnish drilling specifications, monitor drilling operations and supply technical advice to the Corps of Engineers during drilling operations.

The location of Dona Ana Range Camp is shown in figure 1. For information on the general geology, hydrology, and geography of the area, the reader is referred to Texas Board of Water Engineers Bulletin 5615.

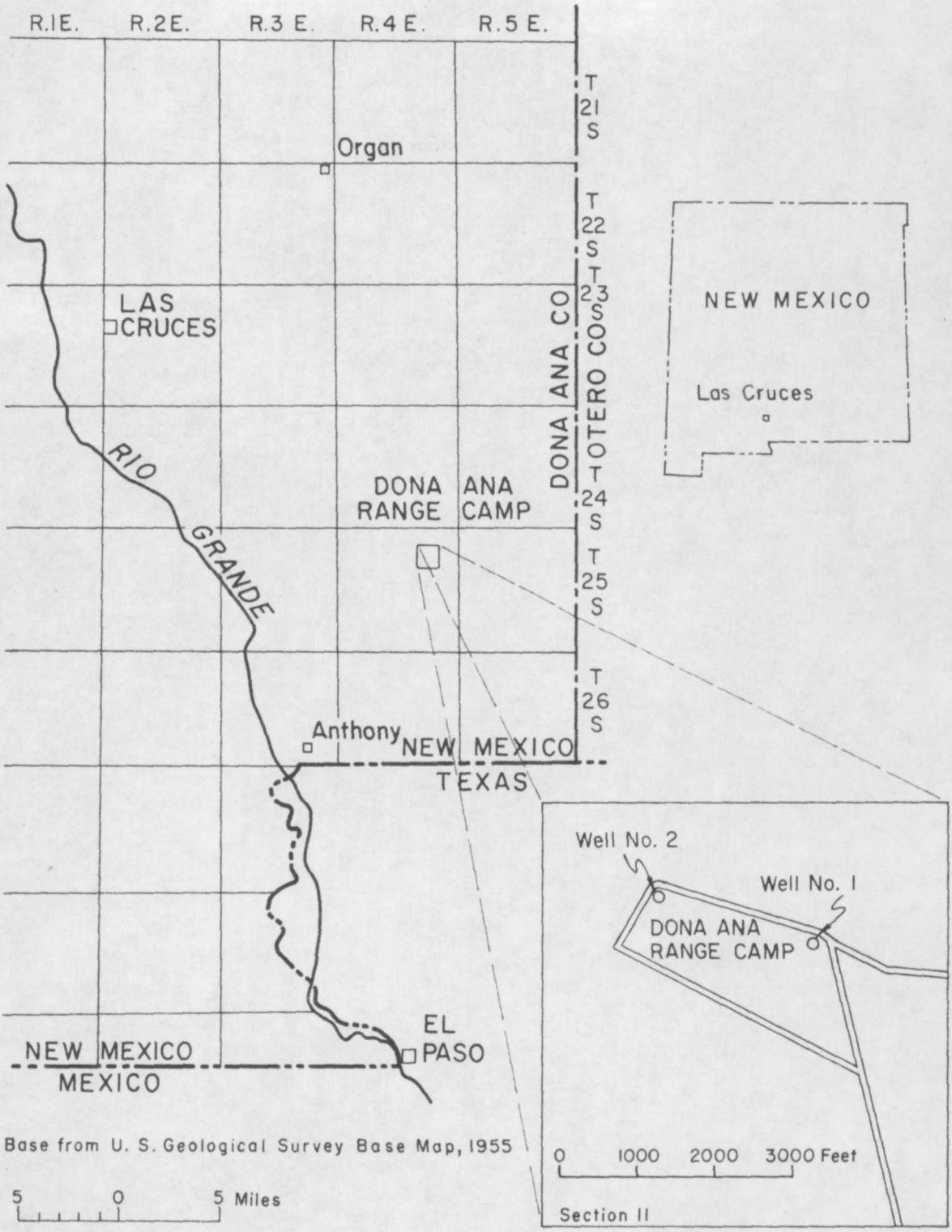

Figure 1.--Location of Dona Ana Range Camp, and water well sites at the Camp, Dona Ana County, New Mexico

Information on the existing supply well, shown as well 1 on figure 1, was obtained from Mr. Marvin Davis, U.S. Geological Survey, El Paso, Texas, (oral communication). Well 1 was drilled in 1959 by the Cass Drilling Co. of El Paso, Texas, a few feet from an older well that is reported in Bulletin 5615. Well 1 was drilled by the hydraulic rotary method to a depth of 799 feet and was cased with 10-inch diameter casing to 785 feet; the casing was perforated with mill-cut slots from 360 to 785 feet. The well is of gravel envelope construction and was initially test pumped at 642 gpm (gallons per minute) with about 19 feet of drawdown.

The record of drilling and well construction for well 2 is included in table 1, and a description of the drill cuttings samples is included in table 2. Records of chemical analyses of water samples collected during drilling and test pumping are included in table 3.

Drilling and testing procedures

An oil field drilling rig of the hydraulic-rotary type was moved in and an 8-inch diameter pilot hole was drilled to a depth of 448 feet. The pilot hole was then cased with 410 feet of temporary 5-inch diameter casing, with the lowermost 27 feet of the casing slotted with torch-cut perforations. The drilling rig was not equipped for bailing, so an auxiliary service rig was used to obtain a water sample by bailing inside the temporary casing. Sand locked the temporary casing in the pilot hole and it became necessary to wash over the casing string in order to remove it from the hole. The pilot hole was then deepened to a depth of 807 feet, electric logs were run (figs. 2 and 3) and a water sample was collected from the bottom of the hole.

To collect the bottom-hole water sample, several unsuccessful attempts were made to isolate the lower part of the pilot hole with a bottom-set expansion packer. A hydraulically inflatable packer was then used and water for the sample was removed with a bailer by the auxiliary service rig.

The pilot hole was reamed to a depth of 360 feet and an 18-inch diameter gravel-conductor pipe was cemented in place. The hole below the conductor pipe was then reamed to a diameter of 18 inches to total depth and a 10-inch diameter service casing installed. The gravel envelope was then emplaced hydraulically by a water-well subcontractor.

The oil field rig was moved from the location and bailing and surging development of the well was accomplished by the auxiliary service rig. During the bailing the gravel pack lowered about 39 feet. The test pump was then installed by another subcontractor after the bailing unit moved from the location.

The rate of development pumping specified by the contract required pump bowls of such large diameter that little clearance remained between the bowls and the casing; this condition presented a hazard if much sand entered the well during development and restricted water movement in the casing. Permission to decrease the pumping rate during development was granted by the Corps of Engineers and the contractor installed smaller pump bowls and column pipe.

The well was developed by surging and pumping with the test pump for about 68 hours. Sand content of the pumped water, measured in an Imhoff cone, ranged from 3.5 milliliters per liter immediately after surging during the first few hours of development pumping, to a trace at the end of development. During development the well was pumped at rates ranging from 225 gpm to 413 gpm. The water-level drawdown at three different rates of pumping is shown in figure 4. The depth to water was measured by the pump crew with an electric tape and the measurements probably are not more accurate than to the nearest foot.

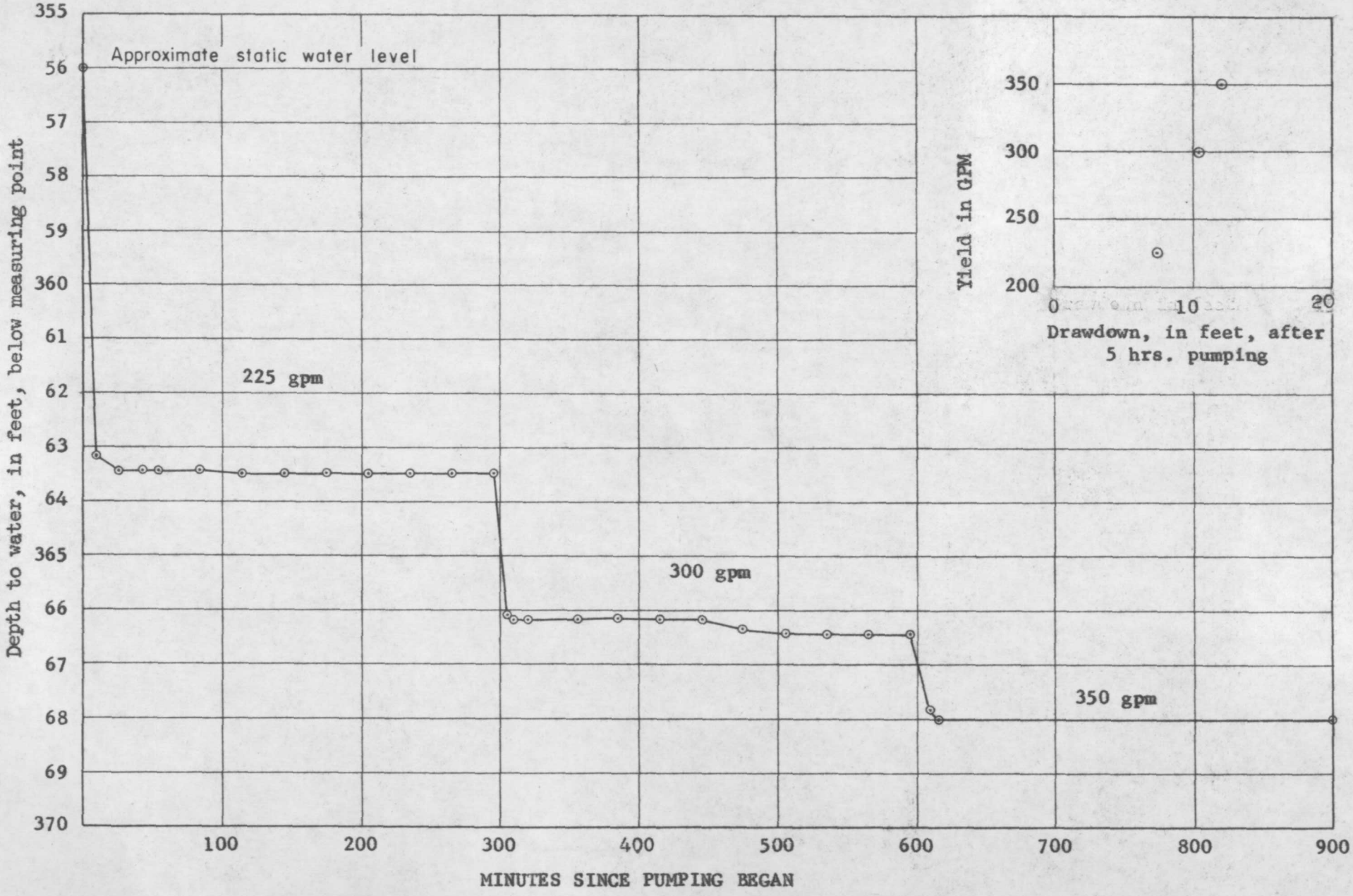

Figure 4.--Hydrograph of step-pumping test of Dona Ana Range Camp well No. 2, October 10, 1966

The well was not pumped for 24 hours prior to the 24 hour constant-rate aquifer test. During the 24 hour aquifer test the well discharge was maintained as closely as possible at 350 gpm and the depth to water was measured with an electric tape by the Survey. These data are plotted on figures 5 and 6. Pump discharge was measured with a 4-inch diameter orifice plate in a 6-inch diameter discharge pipe. Barometric pressure was measured with an aneroid barometer during the time water-level measurements were made and was found to be relatively stable except for a diurnal fluctuation of about 0.13 inch of mercury.

Data from the drawdown part at the aquifer test (fig. 5) are distorted by fluctuations in water level resulting from small fluctuations in pump discharge. The coefficient of transmissibility (T) has been computed as shown on the plot to be about 170,000 gallons per day per foot. The data from the recovery part of the test (fig. 6) plots smoother than the drawdown data but does not conform to the theoretical straight line. The coefficient of transmissibility, computed from the recovery data plot as shown, is about 170,000 gallons per day per foot.

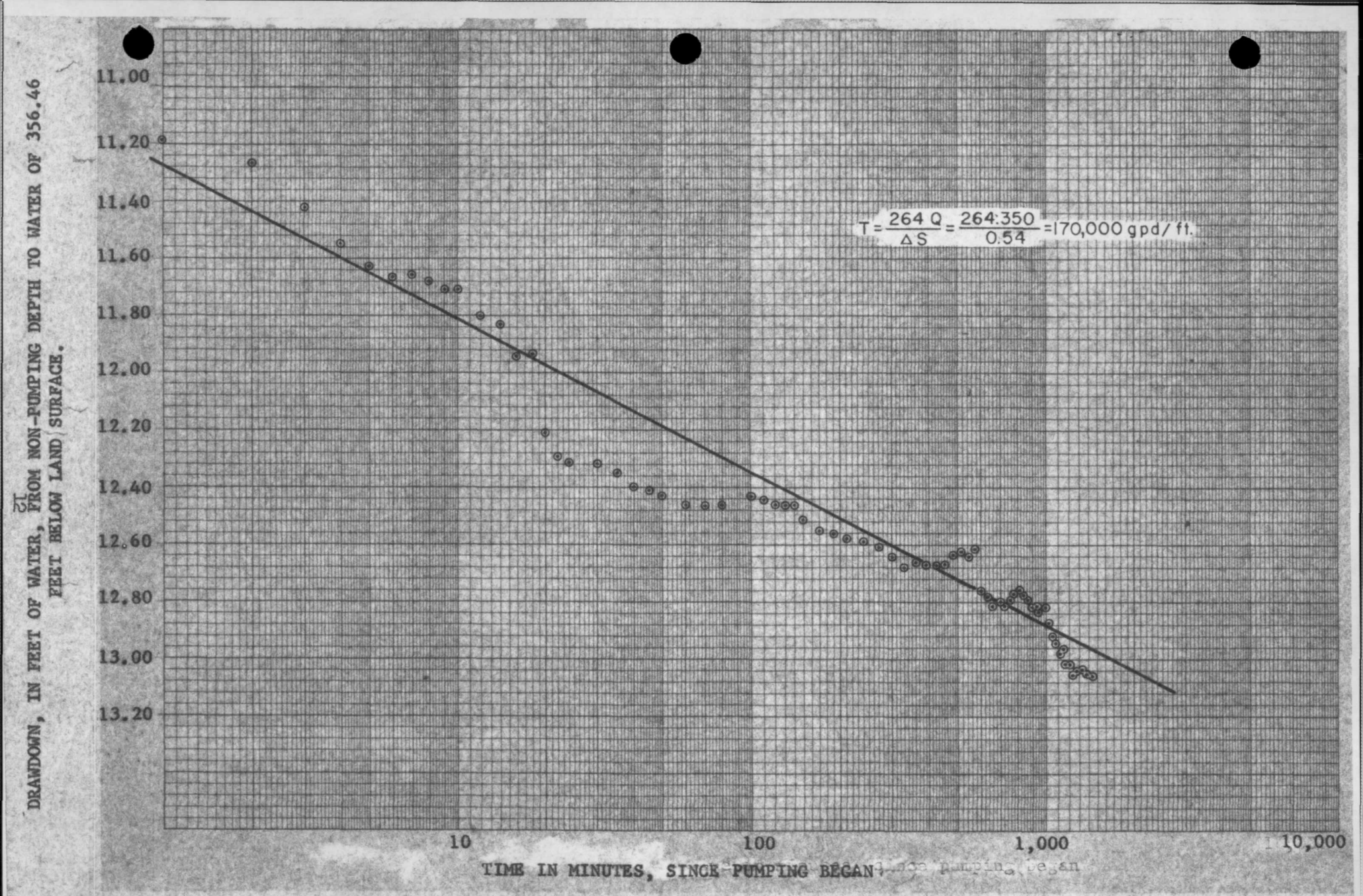

Figure 5.--Water-level drawdown plot, Dona Ana Range Camp well No. 2, October 12, 1966.

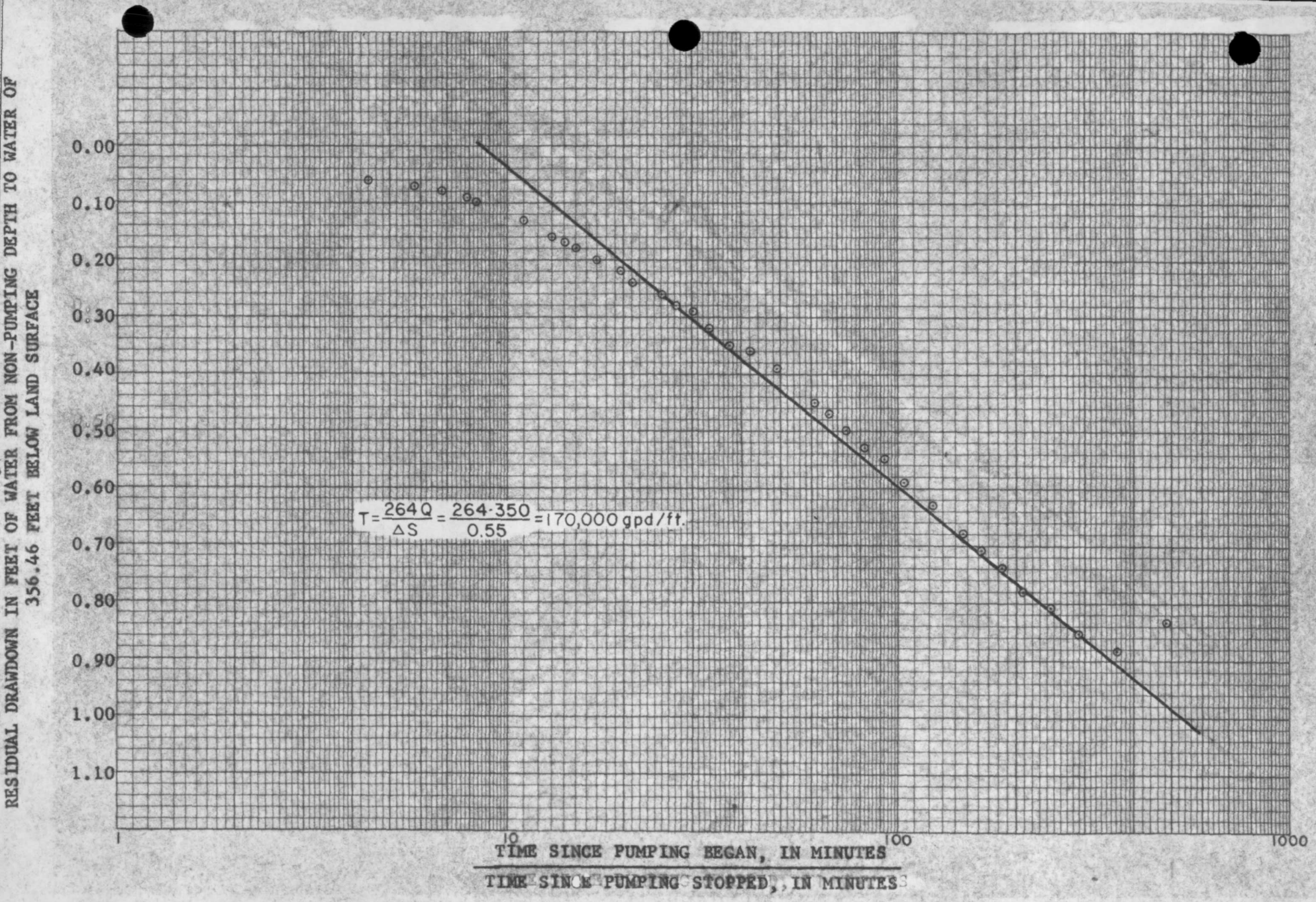

Figure 6.--Plot of recovery test date, Dona Ana Range Camp well No. 2, October 13, 1966.

Conclusion and recommendations

Dona Ana Range Camp well No. 2 was drilled and tested in accordance with contract specifications. Use of an oil field drilling rig and specialty service units for various phases of the work is unusual to normal water well drilling practices, and probably was costly to the prime contractor. Workmanship was good, however, and the time schedule required by the contract was maintained.

The supply well should yield the required amount (250 gpm) of good quality, sand-free water. The aquifer characteristics are not well defined by the aquifer data but the available data suggests that the aquifer is capable of supplying more than the required amount of water with a small drawdown. The coefficient of storage cannot be determined from the aquifer test data because an observation well other than the pumped well was not available, but the particle size of the drill cuttings and the thickness of saturation suggest that a large volume of water, in proportion to the required amount, is available to the well.

The chemical quality (see table 3) of the water from the well is good and is within U.S. Public Health Service (1962) recommended limits for the constituents analyzed. The water is similar in quality to that from well No. 1, although slightly lower in fluoride and chloride. The water is low in total dissolved solids, but must be classified as hard by current national standards.

Construction of additional wells at Dona Ana Range Camp, if required, should incorporate several items of information obtained from drilling of well No. 2. Larger casing should be used because the larger casing is easier to work in during development of the well and the yield of a well in this area is more likely to be limited by the size of the pump that can be installed in the casing rather than by aquifer characteristics. A gravel envelope similar in particle-size distribution to that used in well No. 2 should be used in future wells to prevent sand from entering the casing.

Future wells should be situated west of the present wells to take advantage of any increase in particle size of the unconsolidated sediments that may exist toward the source area of the sediments on the fan slope. The pilot hole of any future well should be drilled several hundred feet deeper than the planned completion depth of the well to determine whether or not saline water underlies the well field area.

Reference cited

Knowles, D. B., and Kennedy, R. A., 1956, Ground water resources of the Hueco bolson, northeast of El Paso, Texas: Texas Board Water Engineers * Bull 5615, 266 p.; also 1958, U.S. Geol. Survey Water Supply Paper 1426, 186 p (1959).

U.S. Public Health Service, 1962, Drinking water standards, Public Health Serv., Pub. No. 956, U.S. Govt. Printing Office, 61p.

---

*Name of agency changed to Texas Water Commission January 30, 1962.

Table 1 .--Record of Dona Ana Range Camp well No. 2

Location: SW¼NE¼NW¼ sec. 11, T. 25 S., R. 4 E., Dona Ana County, N. Mex.

Latitude: 32°09'07"

Longitude: 106°30'30"

Altitude: Land surface altitude 4,102 feet above mean sea level, interpolated from USGS topographic map.

Depth: Pilot hole and completed well 800 feet (below land surface).

Date completed: October 12, 1966 (test pumped)

Drilling contractor: Joe Melton Drilling Co., Midland, Texas for Metz Construction Co.

Drilling method: Hydraulic rotary

Casing and well record: Pilot hole drilled with 7 7/8-inch bit to 800 feet July 29 to August 18, 1966; hole reamed to 18-inch diameter to 360-foot depth August 30 to September 6, 1966; 18-inch conductor casing cemented in at 360 feet September 7, 1966; pilot hole reamed to 18-inch diameter to total depth September 12 to 15, 1966 and cement plug set on bottom. Blank 10-inch casing was installed from ground level to 360 feet with 442 feet of 10-inch, mill slotted 1/8 X 3 inch casing below blank casing; 448 feet of 1 1/2-inch gage line was installed outside the 10-inch casing and welded into the slotted casing with a gentle bend. Approximately 41 yards of gravel composed of 75 percent 1/8 to 3/8-inch diameter and 25 percent 1/32 to 1/8-inch diameter particles was hydraulically emplaced September 17 and 18, 1966 to form a gravel envelope. The well was developed by bailing with a tight-fitting bailer and surging and pumping with a test pump.

Table 1 .--Record of Dona Ana Range Camp well

No. 2 - Concluded

Well completion record: Concrete well head set and production pump installed.

Geologic source and yield: Water obtained from sand and gravel bolson deposits. Well test pumped for 24 hours at 350 gallons per minute with 13 feet of drawdown. Prepumping depth to water 356.96 feet below top of gage line approximately 0.5 feet above ground level.

Formation logs: (1) Sample description (2) Microlog and electric log.

Water samples: See table 3 .

Table 2.--Sample description log of Dona Ana Range Camp well No. 2

(All depths are referenced to the rotary bushing 7.3 feet above ground level)

Material	Depth interval (feet)
Sand, reddish tan, gravel to 20 mm (millimeters) diameter, and some tan clay	0- 10
Sand and gravel to 15 mm diameter; all particles are well rounded to angular, poorly sorted, and are comprised of quartz, pink feldspar, and acid igneous extrusive rocks	10- 15
Gravel, granule to pebble, well rounded to angular, poorly sorted, mixed composition and sand	15- 35
Sand, very coarse to very fine, angular to well rounded, poorly sorted, mixed composition and granule size gravel	35- 45
Sand and gravel as in interval 35-45 and some silt to clay size material	45- 60
Sand and gravel as in interval 35-45 and clay	60- 85
Sand, very fine to very coarse, angular to well rounded, poorly sorted, mostly quartz and mixed igneous rocks; some granule size gravel	85-130
Gravel, granule, rounded to angular, mixed composition, and some sand	130-155
Gravel and sand as in interval 130-155 and a little clay	155-195

Table 2 .--Sample description log of Dona Ana Range Camp well No. 2 - Continued

Material	Depth interval (feet)
Gravel and sand as in interval 130-155	195-245
Gravel, pebble to 21 mm diameter, rounded to angular, poorly sorted, mixed composition	245-275
Gravel as in interval 245-275 and sand	275-285
Gravel, to 15 mm diameter, as in interval 245-275, clay and sand	285-305
Clay, tan, and gravel to 40 mm diameter, and some sand	305-310
Gravel to 25 mm diameter as in interval 245-275, clay, and some sand	310-340
Sand, medium, and gravel to 20 mm diameter	340-345
Gravel, to 30 mm diameter, as in interval 245-275, sand and clay	345-365
Sand, very fine to very coarse, angular to well rounded, poorly sorted, mostly quartz, and gravel to 17 mm diameter; trace of clay in interval 380-390	365-390
Sand, as in interval 365-390, and granule gravel	390-405
Gravel, granule, and sand	405-410
Sand, as in interval 365-390 and granule gravel	410-455
Gravel, granule, sand and trace of clay	455-465

Table 2.--Sample description log of Dona Ana Range Camp well No. 2 - Continued

Material	Depth interval (feet)
Sand, coarse to very fine, angular to well rounded, poorly sorted, mostly quartz, clean	465-490
Sand, very coarse to very fine, otherwise as in interval 465-490, and granule gravel	490-520
Sand, very coarse to very fine, otherwise as in interval 465-490	520-550
Sand, as in interval 520-550, tan clay and granule gravel	550-555
Clay, tan and some white, sand, and some granule gravel	555-560
Gravel, granule, sand, and clay	560-570
Sand, as in interval 520-550, granule gravel and clay-	570-580
Gravel, granule, well rounded to angular, fairly well sorted, mixed composition, sand and trace of clay --	580-590
Sand, as in interval 520-550, granule gravel and a trace of clay	590-600
Sand, very coarse to very fine, well rounded to angular, poorly sorted, mostly quartz, few granule size particles and trace of clay	600-670
Gravel, granule, and sand	670-675
Clay, tan, granule gravel, and sand	675-695
Sand, as in interval 520-550, granule gravel and clay-	695-710

Table 2.--Sample description log of Dona Ana Range Camp well No. 2 - Concluded

Material	Depth interval (feet)
Gravel, granule, sand and clay	710-715
Sand, very coarse to very fine, angular to well rounded, poorly sorted, mixed composition, granule gravel and trace of tan clay	715-740
Gravel, granule, clay and sand	740-750
Sand, granule gravel, gravel and clay as in interval 715-740	750-807

Table 3.--Chemical analyses of water from Dona Ana Range Camp well No. 2.

Analyses by Geological Survey, United States Department of the Interior
(parts per million)

36631

	2/	3/	4/			
Date of collection	8/6/66	8/26/66	10/13/66			
Silica (SiO_2)			32			
Iron (Fe), dissolved 1/			0.08			
Iron (Fe), total			0.16			
Manganese (Mn), dissolved 1/			--			
Manganese (Mn), total			--			
Calcium (Ca)			44			
Magnesium (Mg)			17			
Sodium (Na)			63			
Potassium (K)			--			
Bicarbonate (HCO_3)			244			
Carbonate (CO_3)			0			
Sulfate (SO_4)	59	58	59			
Chloride (Cl)	37	24	35			
Fluoride (F)			0.5			
Nitrate (NO_3)			4.8			
Dissolved solids						
Sum			375			
Residue on evaporation at 180°C			375			
Hardness as $CaCO_3$			180			
Non-carbonate			0			
Specific conductance (micromhos at 25°C)	696	635	605			
pH			7.5			
Color			--			
Temperature °F	82	85	85			

1/In solution at time of analysis.
2/Collected with bailer when hole was 448 feet deep. Blank pipe 0 to 383 feet, slotted pipe 383 to 410 feet.
3/Collected with bailer when hole was 807 feet deep (total depth). Blank pipe 0 to 669 feet, slotted pipe 669 to 673 feet.
4/Collected from pump discharge when well was test pumped. Total depth 807 feet.