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MEMORANDUM ON THE WATER-SUPPLY WELLS AT BIGGS AIR FORCE BASE, EL PASO, TEXAS

By

Edward R. Leggat

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U. S. Geological Survey
GW-Albuquerque

Prepared for
U. S. Army, Corps of Engineers

Open-file Report

1960

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MEMORANDUM ON THE WATER-SUPPLY WELLS AT BIGGS AIR FORCE BASE, EL PASO, TEXAS

INTRODUCTION

During March and April 1957, a brief investigation was made at the request of the U. S. Army, Corps of Engineers, Albuquerque District, to determine the cause for the decline in the performances of the wells used at Biggs Air Force Base, El Paso, Texas. The investigation included a general survey of the existing wells, pumping schedules, and records of pumpage and water levels.

Appreciation is expressed for the cooperation of personnel of the Corps of Engineers, particularly to H. B. Norain and H. Wortman. In addition, the Layne-Texas Co., the C. L. North Co., and Mr. C. F. Gill of the El Paso Public Service Board were helpful in supplying data not available in the files of Biggs Air Force Base. A considerable amount of data used in this report are published in Water-Supply Paper 1426 of the Geological Survey.

PRESENT WATER SUPPLY

Biggs Air Force Base at El Paso, Texas is northeast of the main cantonment of Fort Bliss and generally northeast of the intersection of Fred Wilson and Airport Roads. (See fig. 1.) The water supply for the

Figure 1.--Location of production wells, possible test-well sites, and test wells in the vicinity of Biggs Air Force Base, Texas.

base is obtained from two wells, V-8 (Biggs Field No. 2) and V-10 (Biggs Field No. 1), (fig. 1), except in cases of emergency when it is supplemented by water purchased from the city of El Paso. During 1956 the consumption of water at Biggs Air Force Base was 315,156,000 gallons, an average of about 860,000 gallons a day.

Wells V-8 and V-10 were drilled in April 1951 to a depth of 780 feet and were completed with gravel envelopes and wire-wrapped screens. The screen openings have a width of 0.76 mm (millimeter) and the gravel ranges in size from 16 to 18 mm (5/8 to 3/4 inch).

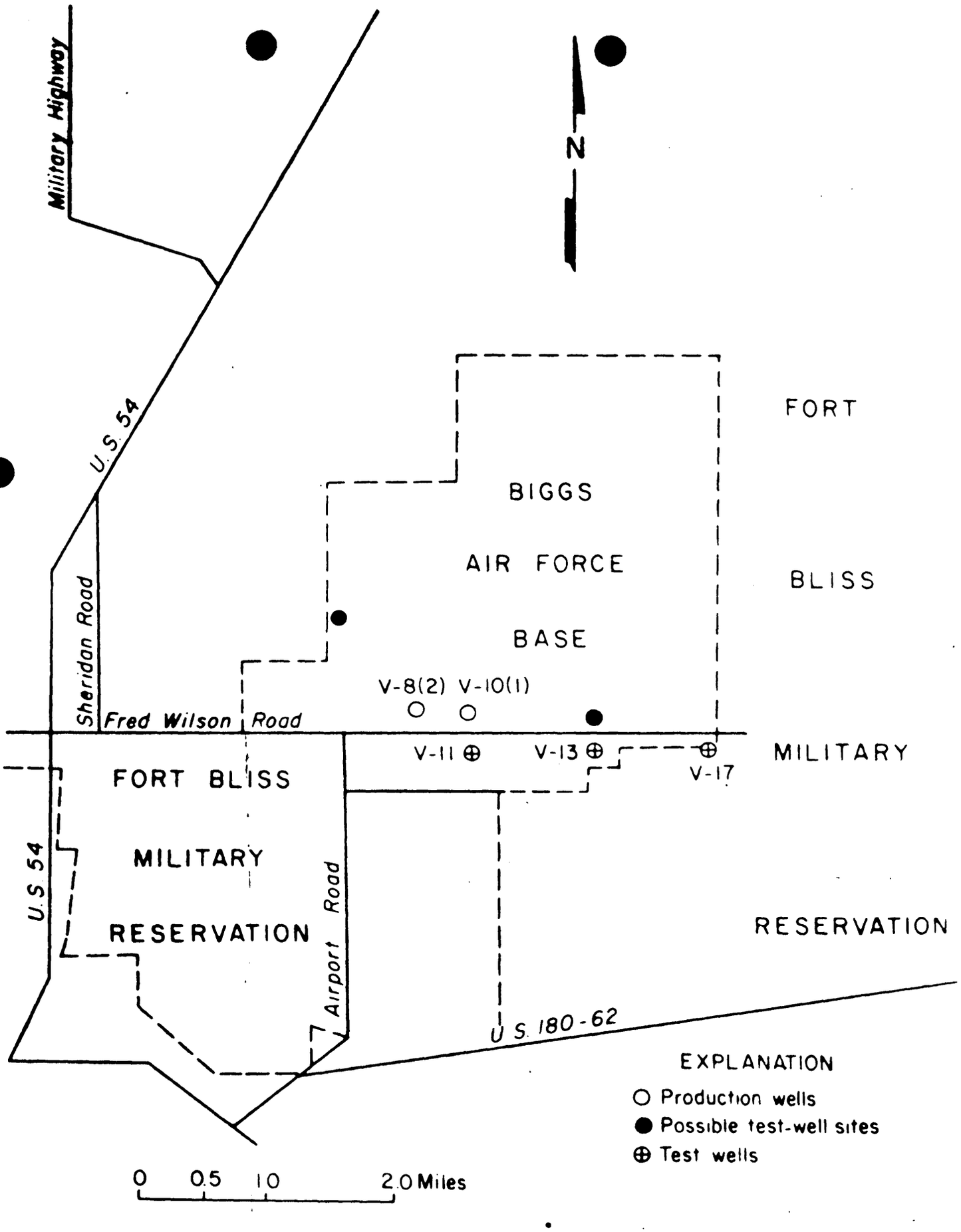

FIGURE 1.- Locations of production wells, possible test-well sites, and test wells in the vicinity of Biggs Air Force Base, Tex.

From the time the wells were completed, excessive quantities of sand were pumped, especially during the early part of periods of pumping. This required that the water be delivered directly to ground storage tanks to avoid clogging the distribution system with sand; thus, the storage tanks were used as sand traps. In 1952 the wells were changed from automatic control to manual operation in order to permit more continuous operation of the pump and to reduce the amount of sand pumped. The water pumped in excess of demand was returned down the non-operating well. The wells continued to produce appreciable quantities of sand, however, the performances of the wells declined. The initial performance tests showed that wells V-8 and V-10 yielded 1,100 and 1,020 gpm (gallons per minute) with specific capacities of 30 and 38 gpm per foot of drawdown, respectively. Figures 2 and 3 show graphically the changes in the

Figure 2.--Yields of wells and effects of rehabilitation, 1951-57, Biggs Air Force Base, Texas.

Figure 3.--Specific capacities of wells and effects of rehabilitation, 1951-57, Biggs Air Force Base, Texas.

yields and specific capacities of the wells since their installation in 1951. They show that rehabilitation of the wells, which included cleaning of sand, backwashing, and replacement of worn pump impellers, resulted in only temporary improvement and failed to restore the wells to their original performance level.

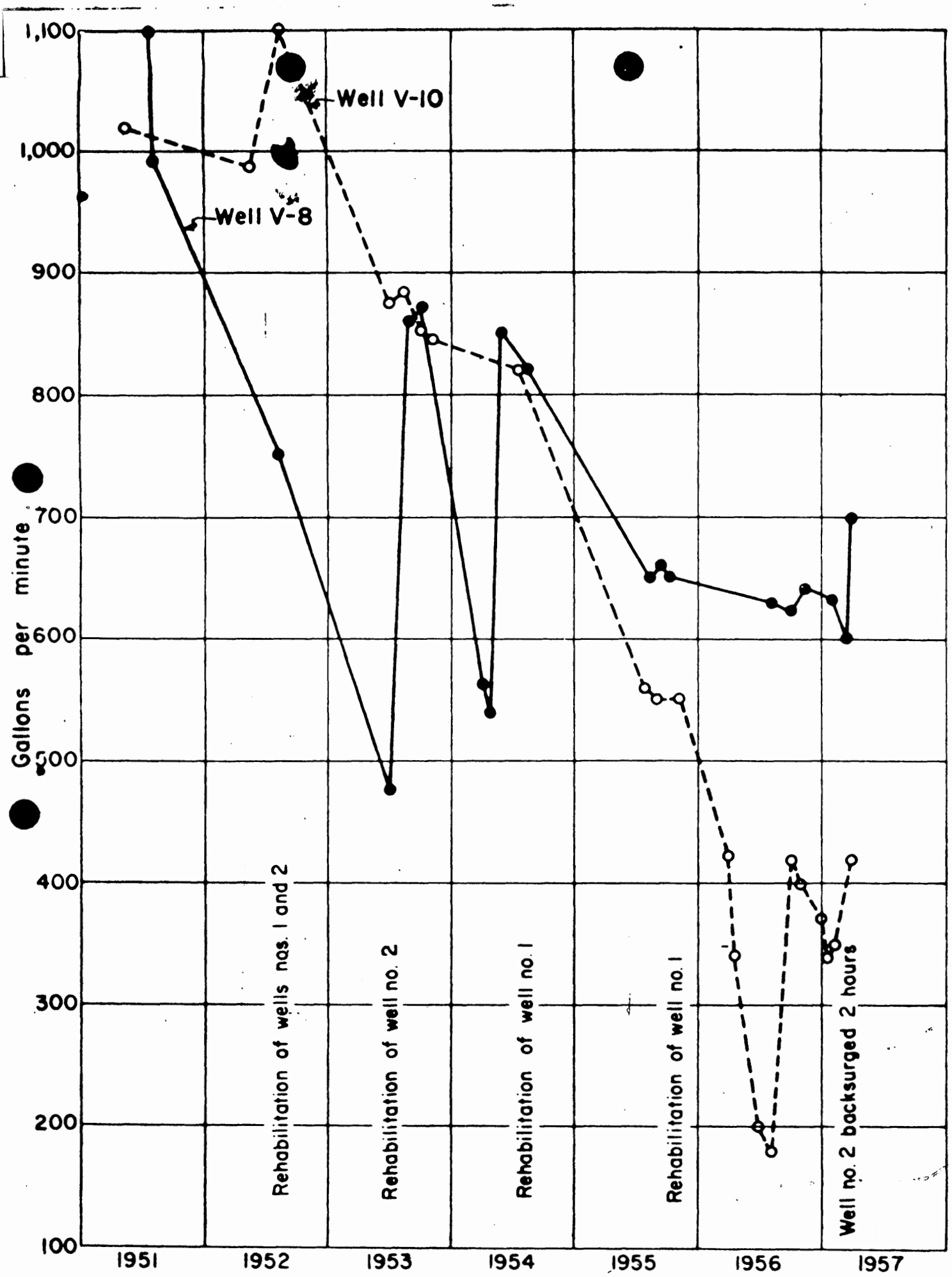

FIGURE 2.- Yields of wells and effects of rehabilitation, 1951-57, Biggs Air Force Base Tex.

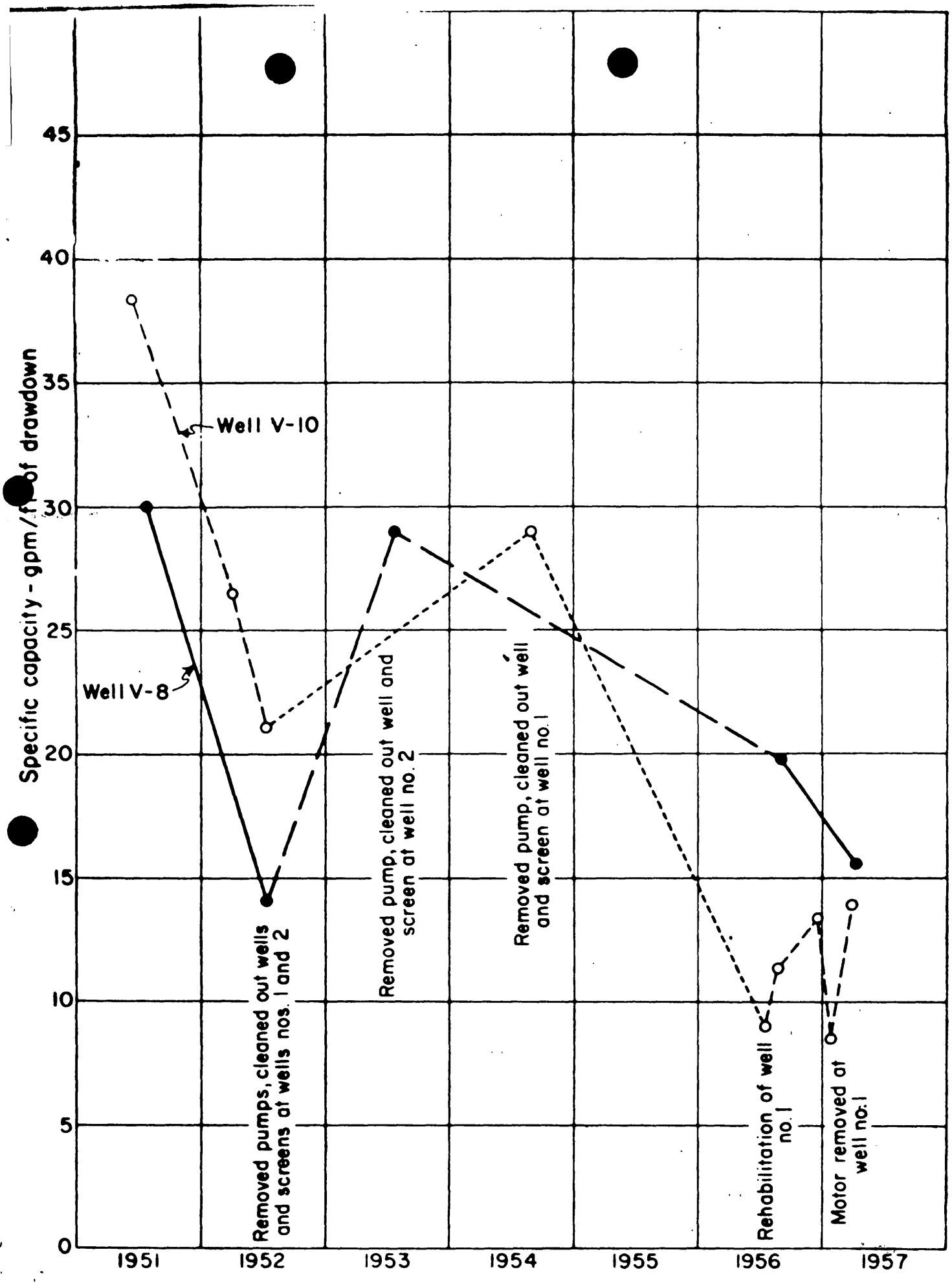

FIGURE 3.- Specific capacities of wells and effects of rehabilitation, 1951-57, Biggs Air Force Base Tex.

During the period January 1951 to January 1957, the water level in well V-11 (fig. 1) declined about 11 feet, or less than 2 feet a year. This small decrease (about 2 percent) in the saturated thickness of the aquifer penetrated indicates that the decline in the performances of wells V-8 and V-10 is to only a minor extent the result of reduction in thickness of the contributing section of the aquifer, and probably is chiefly due to the clogging of the gravel packs and screens by sand.

The mechanical analyses of nine sand samples from rotary drill cuttings taken from well V-10 between depths of 274 and 735 feet were averaged to produce the grain-size distribution curve shown in figure 4.

Figure 4.--Size-distribution curves of sand from well V-10.

The graph also shows the grain-size distribution curve of the sand pumped from well V-10 and the size of screen openings and gravel pack used in the well. These records indicate that the gravel is too coarse to effectively screen the sand.

Much of the sanding problem probably could have been avoided by the use of fine gravel or coarse sand in the pack. The purpose of the sand or gravel pack is to allow the use of larger size screen openings than would be possible if no gravel pack were used, and to increase the effective diameter of the well. The gravel pack thus screens out the coarser sand and forms a support for the water-bearing materials. The size of the gravel used in the pack should bear a definite relationship to that of the formation material.

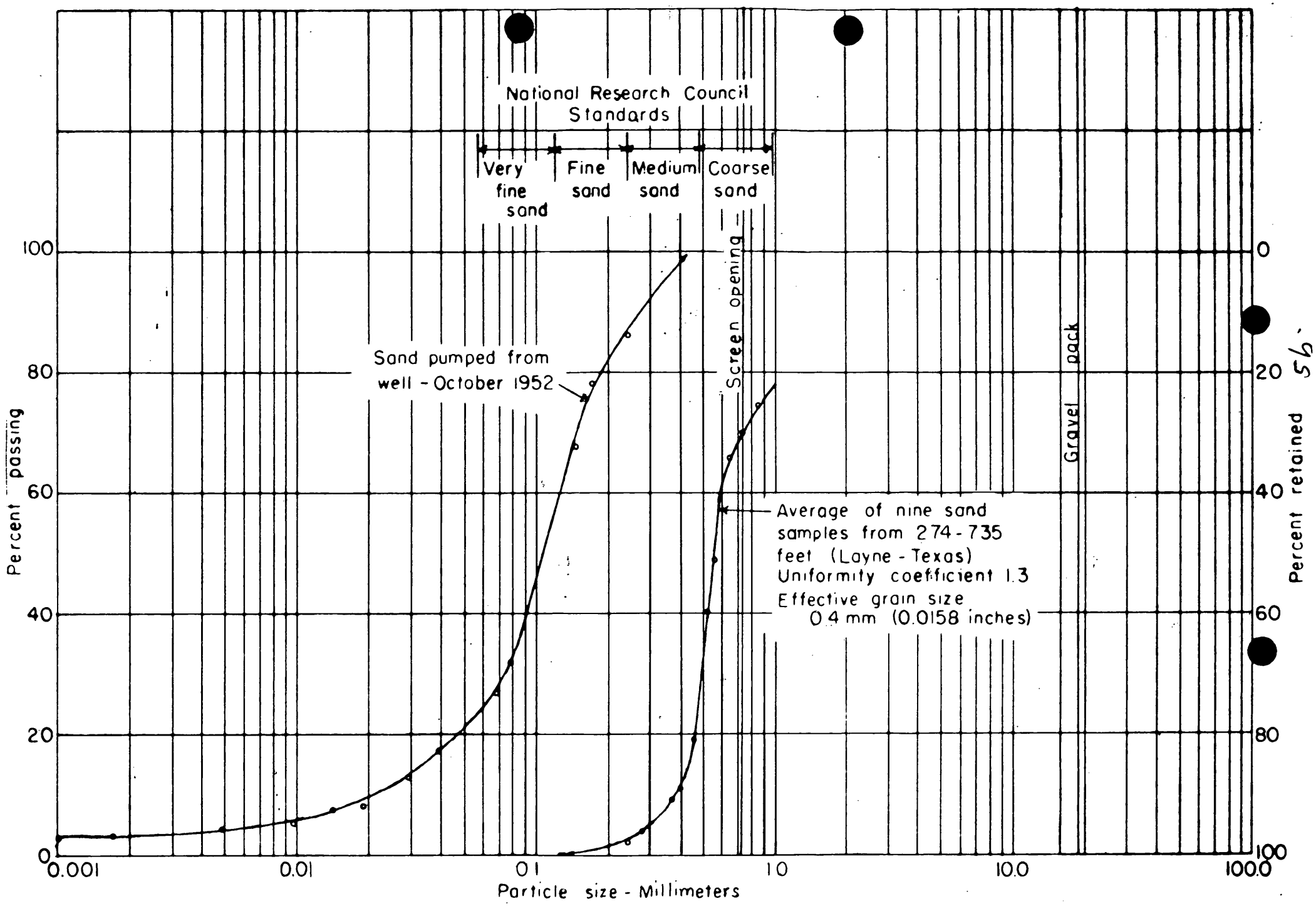

FIGURE 4.-Size distribution curves of sand from well V-10.

FUTURE DEVELOPMENT

Except when there are breakdowns, wells V-8 and V-10 supply the minimum needs of the Biggs Air Force Base. However, during the summer, daily peak demand exceeds the yields of the wells, and the supply of water in storage is seriously depleted. At these times, restrictions are imposed against watering shrubs and grass. Because of the relative frequency of cleaning the wells and removing the pumps for repair, it is apparent that the present water supply does not afford a satisfactory margin of safety and that probably an additional well should be drilled.

Although this investigation did not specifically include a survey of locations for additional wells, it is probable that a well capable of yielding at least 800 gpm can be obtained within the limits of Biggs Field. Two tentative sites for new wells (fig. 1) are suggested: One mile east of well V-10 where the depth to the base of the fresh-water sand in nearby test wells V-13 and V-17 is about 800 and 875 feet, respectively, and another 1 mile northwest of well V-8 on the west side of Biggs Field. However, the latter site is under consideration for a well by the U. S. Army at Fort Bliss.

CONCLUSIONS

The yields and specific capacities of wells V-8 and V-10 at Biggs Air Force Base have decreased considerably since 1951. Excessive quantities of sand have been pumped, which required the delivery of water directly to existing ground storage tanks to avoid clogging the distribution system. The wells, which were changed from automatic to manual operation, continue to produce sand for a short period after the pump is turned on.

The periodic rehabilitation of wells has failed to restore the wells to their original performance levels; at best, the yields of the wells have been improved only temporarily.

The decline in the performances of the wells probably is due to the sanding up of the gravel packs and possibly the screens. Most of the trouble is caused by the use of gravel that is too large to retain a significant part of the sand. Because of the large size of the gravel, backwashing of the wells is ineffective. A possible solution to the problem is to remove the soreens and gravel packs from the wells and to replace them with screens and gravel suited to the formation material as determined by a mechanical analysis of the sand obtained during the process of underreaming. On completion of this program, the wells should be redeveloped and exhaustive tests should be made to determine the quantity of sand pumped and the specific capacities of the wells.

Regardless of whether the rehabilitative program is followed, it is probable that an additional well will be necessary, especially if expansion of base facilities or increase of personnel is contemplated.

Complete records of each well should be maintained and periodic measurements should be made of the yield, pumping level, and static level. A measuring pipe at least a half inch in diameter should be attached to the casing in each well and in any new well to be drilled. This pipe would provide for more accurate determinations of the water level. Also, consideration might be given to include performance tests in future contracts for rehabilitative work on wells.

Table 1.--Record of selected wells in the vicinity of Biggs Air Force Base, El Paso, Texas

No.	Owner or name	Driller	Year completed	Depth of well (ft)	Diameter (in.)	Depth to water		Yield		Drawdown (ft)	Use of water 1/	Remarks
						Below land-surface datum (ft)	Date of measurement	Rate G.P.M.	Date of measurement			
V- 8	Biggs Air Force Base No. 2	Layne-Texas Co.	1951	780	24, 16, 10	265 261 260	6/29/51 6/30/52 8/29/56	992 750 620 700	7/ 6/51 7/ 2/52 8/29/56 3/--/57	33 53 31 46	P	Wire-wrapped screen opposite sands from 299-762 feet. Pump set at 350 feet.
V-10	Biggs Air Force Base No. 1	do.	1951	780	24, 16, 10	262 254 256.2 262 259 259	5/ 8/51 6/30/52 3/23/54 8/ 6/56 2/27/57 3/14/57	1,212 1,100 600 480 370 350 420	5/ 8/51 7/ 2/52 8/ 6/56 8/10/56 12/--/56 1/17/57 3/14/57	32 53 67 42 27 30 30	P	Wire-wrapped screen opposite sands from 308-766 feet. Pump removed July 9, 1956; reinstalled August 6, 1956. Pump set at 350 feet.
V-11	City of El Paso	H. M. Stanley	1936	600	2	244.1 243.1 246.2 247.7 254.9 258.4	7/16/36 1/22/43 1/31/49 1/22/51 1/22/55 1/23/57				T	Test well.
V-13	do.	C. R. Jensen	1938	1,131							N	Test well. Electric log indicates fresh-water sands extend to 780 feet.
V-17	do.	do.	1939	1,097							N	Test well. Electric log indicates fresh-water sands extend to 875 feet.

1/ N, none; P, public supply; T, test.