

Warden Aquifer Test

At the request of the Eastern Regional Office, an aquifer test was conducted June 3-5, 1977 at Warden. The purpose of the test was to determine the transmissivity and storage values of the basalt aquifer by observing the drawdown and recovery of two municipal wells 690 feet apart. The aquifer parameters determined from the test then would be used to determine the potential well interference to the municipal well from a new irrigation well nearby.

The pumping schedule of the two municipal wells were controlled before the test to allow water levels in both wells to stabilize. Well 5 was shut off at 8 p.m. Thursday. Well 4 was started an hour later and pumped continuously until 12:30 a.m. Saturday when well 4 was shut off and the recovery test began. Water-level recovery was measured in both wells for nearly 6½ hours. At 6:55 a.m. Saturday, well 4 began pumping and drawdown measured in both wells until 7:30 a.m. Sunday when the test ended.

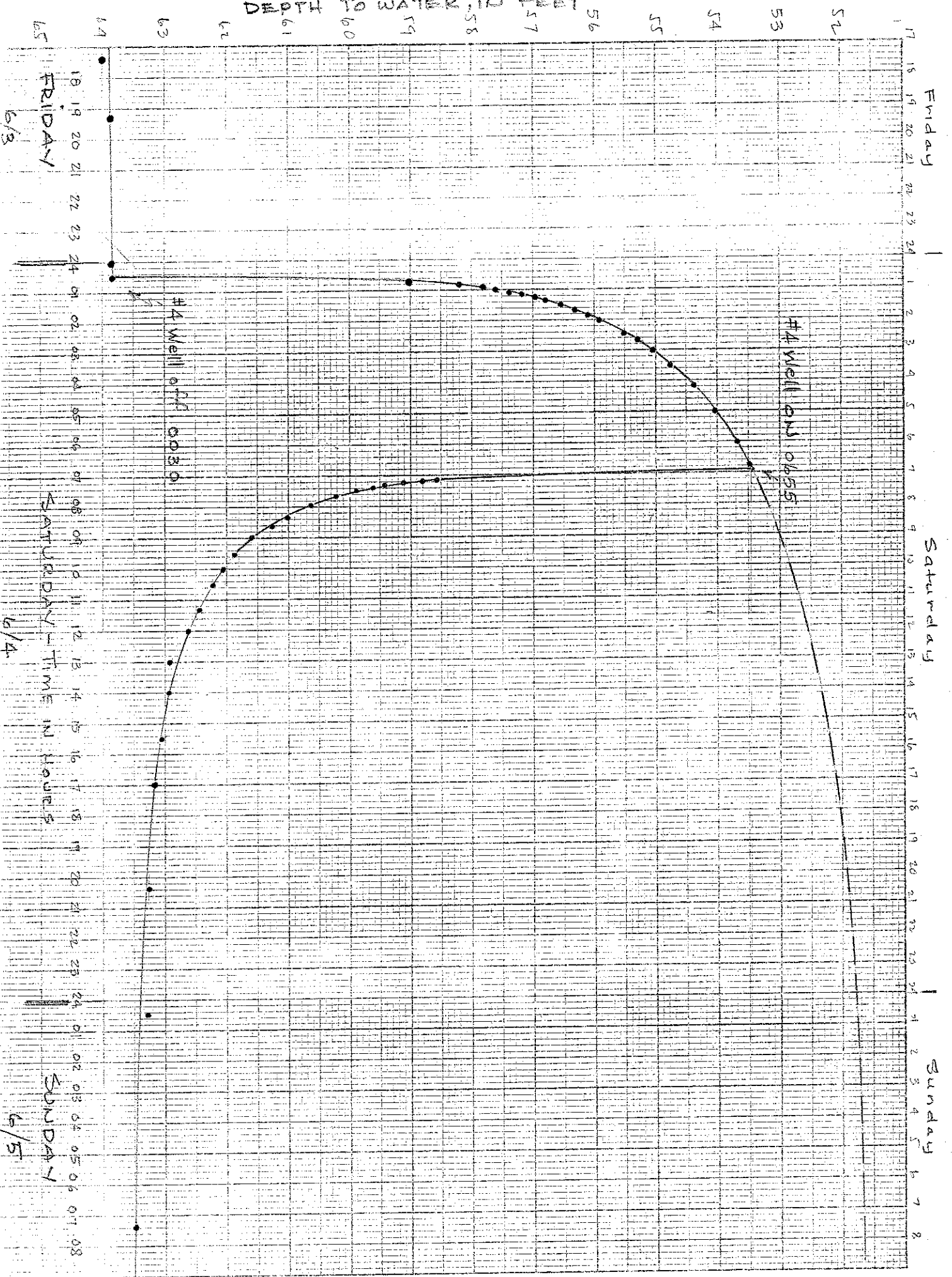
The recovery and drawdown measurements for municipal wells 5 and 4 are tabulated in Tables 1 and 2. The discharge of well 4 measured during the test (Table 3) averaged 1250 gpm. The actual recovery and drawdown are extrapolated from the curves plotted from recovery and drawdown measurements of well 5 (Figure 1). The measurements for well 4 were unreliable and not plotted due to cascading water during the drawdown period. The semi-log and log-log plot of drawdown and recovery of well 5 show comparable values of transmissivity and

storage (Figures 2, 3, 4). The average value computed by both methods indicate an apparent transmissivity of about 80,000 gpd/ft. and storage of 3×10^{-5} for the basalt aquifer. The small storage results from short-term pumping, and on water-level projections based on long-term pumping, the storage value is increased to account for more complete drainage of the aquifer.

The drawdown data in Figures 2 and 3 show a definite change in slope of the curve after 500 minutes, indicating, in this case, a recharge source. Possible recharge sources include recharge from the East Low Canal located only a few hundred feet north and west of wells 4 and 5, recharge induced from a high-head zone in the basalt when water levels are drawn down (A high-head zone between 355-61 feet deep is described in the drillers log of well 5), or a combination of the two. The rate or amount of recharge cannot be determined by available data.

To calculate well interference as a result of long-term pumping, the aquifer transmissivity is 80,000 gpd/ft and storage is increased from 3×10^{-5} to 1×10^{-4} . The projected well interference on Warden well 5 from a 1200 gpm irrigation well, 2500 feet away, pumping cyclically 5 days on and 2 days off for 150 days is about 14 feet. The interference from periodic pumping of Warden well 4 during this same period is about 11 feet. Without considering the effect of recharge, the maximum well interference at Warden well 5 totals 25 feet.

FIGURE 1. -- Drawdown & Recovery of Warden # 5 Well



5245

FIGURE 2.- SEMI-LOG PLOT OF DRAWDOWN AND RECOVERY

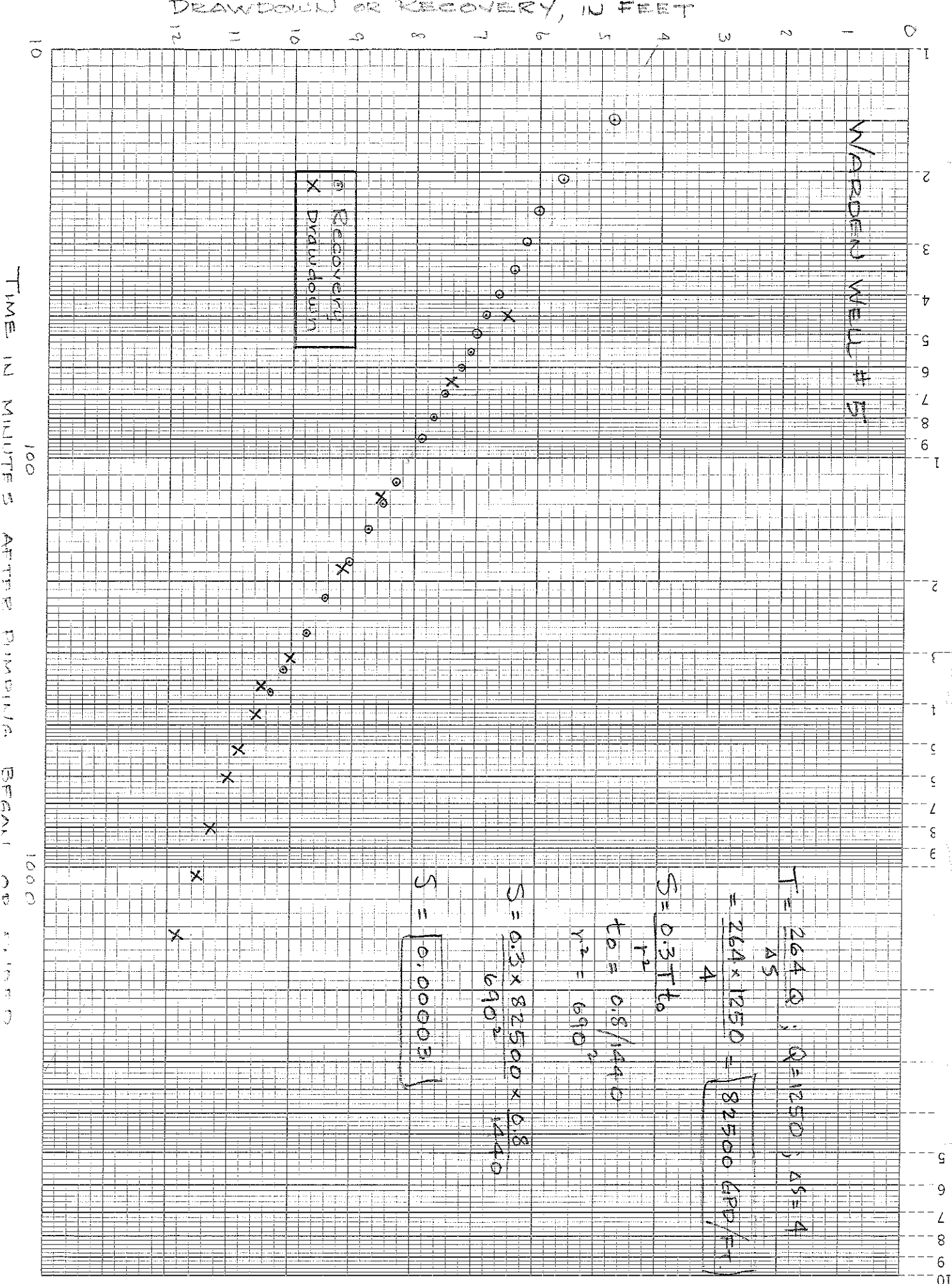


FIGURE 3.-- LOG-LOG PLOT OF DRAWDOWN

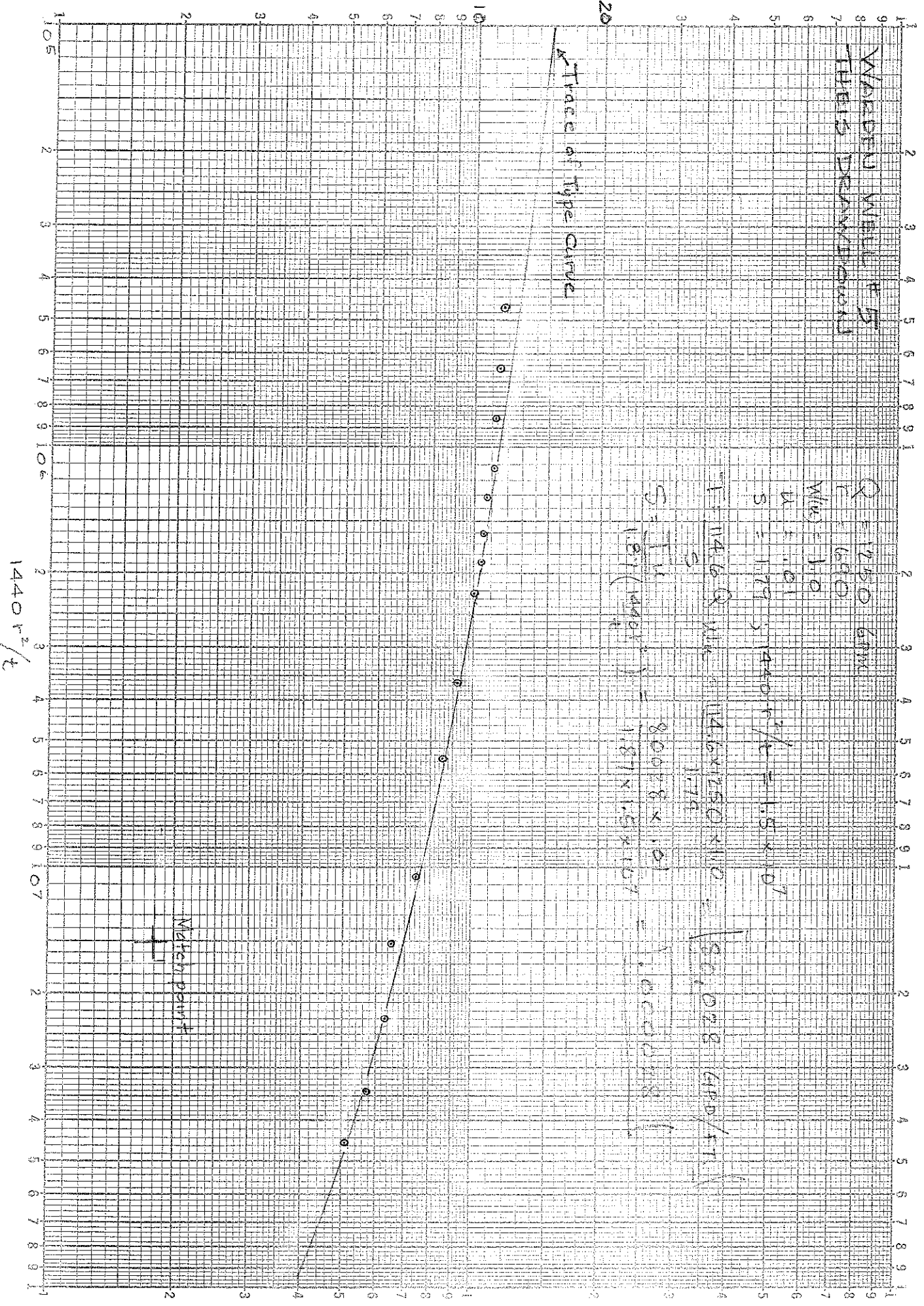


FIGURE 4.-- Log-Log Plot of Recovery

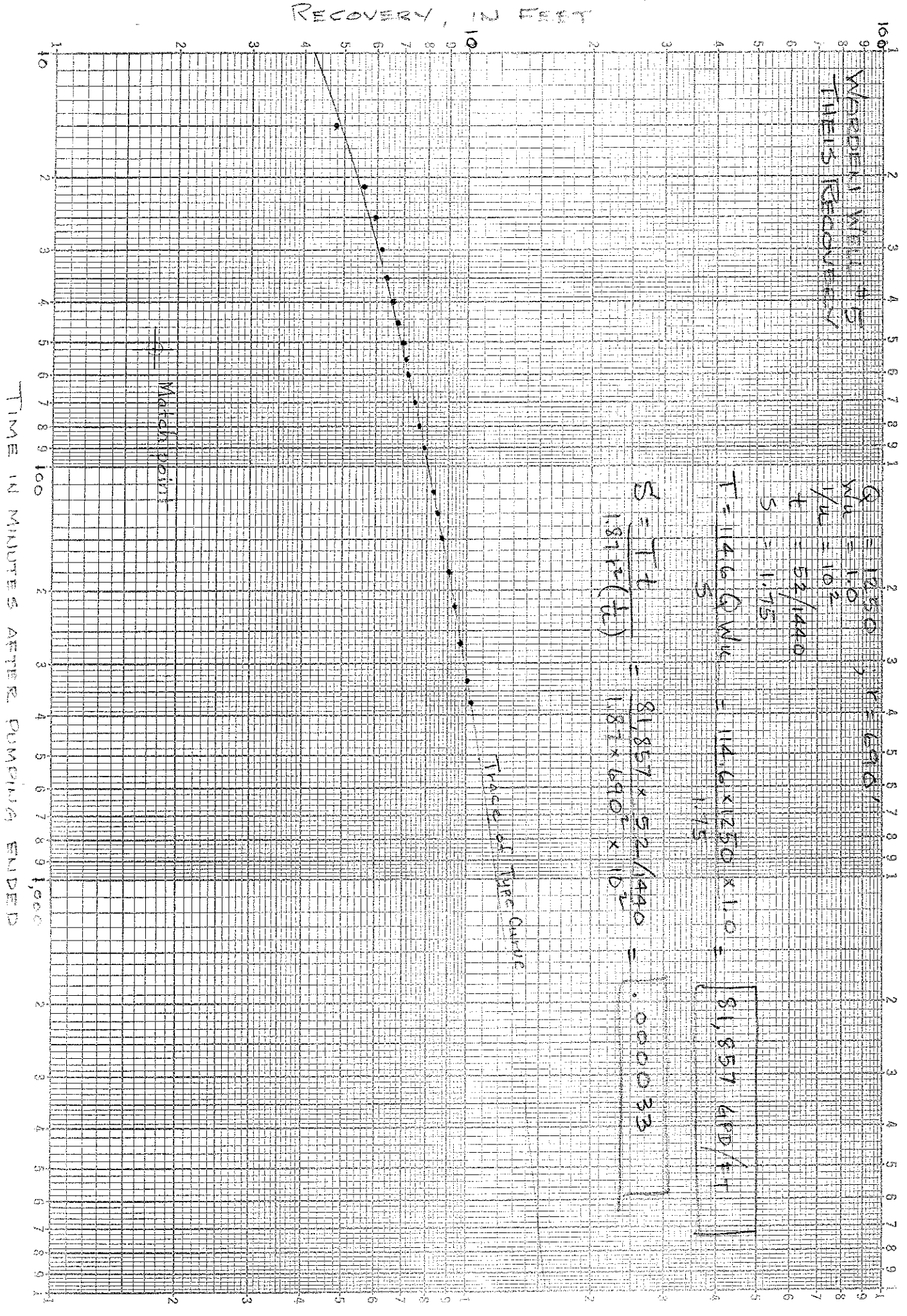


TABLE 1.- RECOVERY & DRAWDOWN WELL 5

Department of Ecology



DEPARTMENT OF ECOLOGY
WATER RESOURCES DIVISION
OLYMPIA, WASHINGTON 98504

AQUIFER TEST

Sheet 1 of 3

Owner Town of Warden Location 17/30-16D Well No. #5
 Date 6/3-5/77 Meas. by HT + JL Test _____ County Grant
 Meas. point Top pipe 1.0' above LSD Elev. Meas. Point _____
 Meas. equipment E-Tape
 DTW o _____ t_o _____ Q 1250 GPM r 690'

Date	Hour	Water level			s (ft)	t (Min)	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
6/3	1720			64.0				
	1915			63.8				
	2400			63.8				
6/4	0030			63.8	0	0	#4 pump off	
	0045			59.0	4.8	15	(Recovery)	
	0051			58.2	5.6	21		
	0055			57.8	6.0	25		
	0100			57.6	6.2	30		
	0105			57.4	6.4	35		
	0110			57.15	6.65	40		
	0115			56.95	6.85	45		
	0120			56.80	7.00	50		
	0125			56.70	7.10	55		
	0130			56.55	7.25	60		
	0140			56.30	7.50	70		
	0150			56.10	7.70	80		
	0200			55.90	7.90	90		
	0225			55.50	8.30	115		
	0240			55.28	8.52	130		
	0300			55.05	8.75	150		
	0330			54.75	9.05	180		
	0410			54.35	9.45	220		
6/4	0500			54.03	9.77	270		



AQUIFER TEST

Owner Town of Warden Location 17/30-16D Well No. #5
 Date 6/3-5/77 Meas. by HT + JL Test _____ County Grant
 Meas. point _____ Elev. Meas. Point ✓
 Meas. equipment E-Tape
 DTW o t_o Q r

Date	Hour	Water level			s (FT)	t (MIN)	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
6/4	0600			53.67	10.13	330	(Recovery)	
	0645			53.47	10.33	375	1	
	0655			53.45	0	0	#4 pump on	
	0710			58.55	5.10	15	(Drawdown)	
	0712			58.80		17	4.03	
	0715			59.10	5.75	20	3.43	
	0720			59.39		25	2.74	
	0725			59.60	6.35	30	2.29	
	0730			59.86		35	1.96	
	0740			60.20	6.56	45	1.52	
	0750			60.43		55	1.25	
	0800			60.62	7.42	65	1.05	
	0820			61.00		85	8.07×10^6	
	0840			61.25		105	6.53	
	0900			61.57	8.57	125	5.48	
	0935			61.87		160	4.28	
	1003			62.04	9.19	188	3.65	
	1030			62.17		215	3.19	
	1119			62.42		264	2.60	
	1203			62.61	10.06	308	2.23	
	1257			62.91	10.46	362	1.89	
	1400			62.92	10.57	425	1.61	
6/4	1535			63.05	10.85	520	1.32	



AQUIFER TEST

Owner Town of Warden Location 17/30-16D Well No. #5
 Date 6/3-5/77 Meas. by HT + JL Test _____ County Grant
 Meas. point _____ Elev. Meas. Point _____ ✓
 Meas. equipment E-Tape
 DTW _o _____ _t _____ _o _____ _q _____ _r _____

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
6/4	1700			63.17	11.07	605	1.13×10^6	(Drawdown)
	2020			63.23	11.33	805	8.52×10^5	
6/5	0030			63.25	11.50	1055	6.50	
	0725			63.48	11.83	1470	4.66	End of test.

TABLE 2.- RECOVERY & DRAWDOWN WELL 4

Department of Ecology



Reported 7

WATER RESOURCES DIVISION
OLYMPIA, WASHINGTON 98504

Airline 236 #4
Airline 252 #5

ACTUAL = 207.96

AQUIFER TEST

Sheet 1 of 3

Pumping well

Airline PSI
66 #152.46

STATIC W/L
55.5

Airline Length
207.96

Airline Reading
AT 1730 hrs
137.6

Airline PSI
1730 hr
32 PSI
73'

207.96
73.00
134.96

Owner _____ Location _____ Well No. #4

Date 6/3 Meas. by JL + HT Test _____ County _____

Meas. point _____ Elev. Meas. Point _____

Meas. equipment _____

DTW t_0 _____ t _____

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
6/3	1730			137.6				
✓	1910			135.0				
✓	2400			135.0				
6/4	0030			136.3			Pump off 0030	
✓	0038			59.2		8	Recovery	
✓	0040			58.5		10		
✓	0055			57.0		25		
✓	0100			56.5		30		
✓	0105			56.2		35		
	0115			55.9		45		
	0125			55.5		55		
	0135			55.25		65		
	0145			55.00		75		
	0155			54.87		85		
	0205			54.70		95		
	0225			54.36		115		
	0245			54.03		135		
	0305			53.8		155		
	0335			53.5		185		
	0405			53.2		215		
	0505			52.75		275		
6/4	0600			52.35		330		
*	0750			56.15		440		

20 ✓
20 ✓
20 ✓
30 ✓
30 ✓
1
1

* -4' on short tape

-4' correction

0650
SIX 070-37

1



AQUIFER TEST

Pump well Sheet 2 of 3

Owner CITY OF WARDEN Location _____ Well No. # 4
 Date 6-4-77 Meas. by H.T. & J.L. EACO Test _____ County _____
 Meas. point _____ Elev. Meas. Point _____
 Meas. equipment _____
 DTW \circ _____ t_0 _____ Q _____ r _____
 Drawdown

-4 correction

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
6/4	0655	Pump	on			0		
6/4	0708	133.8	-4	129.8		13		
	0710	137.0	-4	133.0			→ AS THIS WAS AN INITIAL READING IT IS POSSIBLE IT IS IN ERROR (J.M.L.) 15	
	0715	136.85	-4	132.85		20		
	0720	136.53	-4	132.53		25		
	0725	136.85	-4	132.85		30		
	0730	136.85	-4	132.85		35		
	0740	137.85	-4	133.85		45		
	0745	137.35	-4	133.35		50		
	0750	137.35	-4	133.35		55		
	0755	137.2	-4	133.25		60		
	0800	137.3	-4	133.25		65		
	0810	137.6	-4	133.6		75		
	0820	137.9	"	133.9		85		
	0830	137.8	"	133.8		95		
	0840	138.62	"	134.62		105		
	0850	138.65	"	134.65		115		
	0900	138.60	"	134.60		125		
	0910	138.88	"	134.88		135		
	0930	138.85	"	134.85		155		
	1000	139.05	"	135.05		185		
	1030	139.24	"	135.24		215		
	1115	140.00	"	136.00		260		



AQUIFER TEST

Owner _____ Location _____ Well No. #4
 Date _____ Meas. by _____ Test _____ County _____
 Meas. point _____ Elev. Meas. Point _____
 Meas. equipment _____
 DTW \circ _____ t_o _____ Q D/D _____ r _____

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
1200		140.30	-4	136.80		305		
0100	1300	141.18	-4	137.18		365		
0200	1400	142.12	-4	138.12		425		
0330	1530	144.20	-4	140.20		515		
0500	1700	144.2	-4	137.2		605		
2025		139.0	-	135.0		810		
0032		137.53	-	133.53		1062		
0730		137.25	-4	133.25		1475		

6/5
6/5

136.43

TABLE 3.

PUMP DISCHARGE MEASUREMENT WELL 4

METHOD Sparling meter

DATE	TIME	READING (10 x FT ³)	DISCHARGE (GPM)	REMARKS
6/3	1925	—	1275	170 ft ³ / min
1	2355	—	1246	200 ft ³ / 1.2 min
6/4	0730	382-412	1282	300 " / 1.75 "
	1030	485-505	1264	200 " / 1.18 "
	1155	795-815	1282	200 " / 1.17 "
	1305	980-1000	1264	200 " / 1.18 "
	1355	850-870	1264	200 " / " "
	1530	443-463	1264	200 " / " "
	1700	940-960	1246	200 " / 1.2 "
6/5	2025	374-394	1230	200 " / 1.22 "
1	0730	—	1230	200 " / " "
				Average discharge = 1250 GPM

Warden Test 6/3-5/77

Department of Ecology



DEPARTMENT OF ECOLOGY
WATER RESOURCES DIVISION
OLYMPIA, WASHINGTON 98504

AQUIFER TEST

Sheet _____ of _____

Owner _____ Location 17/30-16D Well No. #5
 Date _____ Meas. by HT Test _____ County _____
 Meas. point 1.0' above floor @ Grand level Elev. Meas. Point _____
 Meas. equipment E-Tape
 DTW 0 t_0 _____ #4 1250 GPM. r 690'

64
5
300
30
270

60

Date	Hour	Water level			s	t'	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
6/3	1720			64.0			#4 Pump on	
✓	1915			63.8			" " "	
✓	2400			63.8	0	0	Pump off @ 0030	
6/4	0045			59.0	4.8	15	$t/t=0 = 1650 \text{ min.}$ $t/t = 9.09 \times 10^{-3}$	
✓	0051			58.2	5.6	21	1.26×10^{-2}	
✓	0055			57.8	6.0	25	1.49	
✓	0100			57.6	6.2	30	1.79	
✓	0105			57.4	6.4	35	2.08	
✓	0110			57.15	6.65	40	2.37	
✓	0115			56.95	6.85	45	2.65	
✓	0120			56.80	7.00	50	2.94	
✓	0125			56.70	7.10	55	3.23	
✓	0130			56.55	7.25	60	3.51	
✓	0140			56.30	7.50	70	4.07 9.79×10^6	
✓	0150			56.10	7.70	80	4.62	
✓	0200			55.90	7.90	90	5.17	
✓	0225			55.50	8.30	115	6.52	
✓	0240			55.28	8.52	130	7.30	
✓	0300			55.05	8.75	150	8.33	
✓	0330			54.75	9.05	180	9.84	
✓	0410			54.35	9.45	220	1.18×10^{-1}	
✓	0500			54.03	9.77	270	1.41	
✓	0600			53.67	10.13	330	1.67	

Recovered

133 (1)

5500



AQUIFER TEST

Sheet 3 of _____

AIRLINE LEAKS

Owner _____ Location 17/30-16D Well No. #5

Date _____ Meas. by _____ Test _____ County _____

Meas. point _____ Elev. Meas. Point _____

Meas. equipment _____

DTW _o _____ _{t_o} _____ q 1250 r 690'

Drawdown

80PSI
+
148.08
+
WL 63.25
+
211.33
→ AIRLINE LENGTH

Date	Hour	Water level			s	t	$\frac{1440r^2}{t}$	Remarks
		Held	Wet	Depth (DTW)				
6/4	1700			63.17	11.07	605	1.13×10^6	
6/4	2020			63.23	11.33	805	8.52×10^5	
6/5	0030			63.25	11.50	1055	6.50	
(LAST) →	0725			63.48	11.83	1470	4.66	LAST Reading