

THREE HILLS PUMP TEST

NOVEMBER, 1967

SW - 27 - 31 - 24 - W4

by

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Research Council of Alberta
Edmonton, Alberta
November, 1967



Open file report
1967-04

018883

THREE HILLS PUMP TEST

NOVEMBER, 1967

Introduction

A constant rate test on Well No. 6, Town of Three Hills, was conducted by Reid, Crowther & Partners Ltd., Consulting Engineers. The test was run from November 2 to November 9, 1967 for a total of 168 hours; the pumping rate fluctuated between 44 igpm and 51 igpm, but remained between 44 igpm and 49.5 igpm for the greater part of the test. Regular water-level measurements were taken in the pumped well and in an observation well 90 feet north of the pumped well. A few measurements were taken in Well No. 7, located 1/2 mile ^{west} east of Well No. 6.

The average values of the aquifer coefficients as obtained from the time-drawdown relationships are as follows: transmissibility 2,750 igpd/ft (imperial gallons per day per foot); hydraulic conductivity 69 igpd/ft² (imperial gallons per day per square foot); storage coefficient 0.82×10^{-4} . The safe yield for Well No. 6 -- based on a production period of 20 years -- is estimated at 45 igpm. Due to interference between Wells No. 6 and No. 7, the safe yield of either well, when both wells are pumping simultaneously, can be estimated at 40 igpm.

Pertinent Data

Well No. 6 (pumped well)

Location: 1/4 mile north of southwest corner of Sec. 27, Tp. 31, R. 24, W. 4th Mer.

Completion date: August 31, 1967

Drilled by: J. Beagrie, Swallow, Alberta

Total depth: 151 feet

Well diameter: 10 inches

Casing: 0-85 feet - 8 5/8 inch O.D.

85-106 feet- 6 5/8 inch O.D.

106-151 feet- open hole

Pump setting: 146 feet

Stratigraphic log:	0- 12 feet	gumbo
	12- 50 feet	sandy clay
	50- 93 feet	sand
	93-106 feet	sand, gravel and boulder clay
	106-146 feet	sandstone, water bearing
	146-151 feet	shale

Static level: 50.88 feet

Well No. 6a

Location: 1/4 mile north of southwest corner of Sec. 27, Tp. 31, R. 24, W. 4th Mer.

90 feet north of Well No. 6

Completion date: November 1, 1967

Drilled by: Raymond

Total depth: 150 feet

Well diameter: 6 inches

Casing: 0-100.5 - 7 inch O.D.

100.5-150 - open hole

Stratigraphic log:	0- 2.5 feet	gumbo
	2.5- 29 feet	brownish yellow clay
	29- 67 feet	sandy grey clay
	67- 74 feet	sandy clay, a few pebbles
	74- 77 feet	grey clay
	77- 83 feet	coal, some blue shale chips, grey clay
	83- 92 feet	fine sandy clay
	92-138 feet	soft blue sandstone
	138-143 feet	blue shale
	143-150 feet	purple shale

Static level: 50.14 feet

Well No. 7

Location: 1/2 mile east and 3/8 mile north of southwest corner of Sec. 28, Tp. 31,

R. 24, W. 4th Mer.

Completion date: September 10, 1967

Drilled by: J. Beagrie, Swalwell, Alberta

Total depth: 170 feet

Diameter: 10 inches

Casing: Nil

Stratigraphic log:	0- 10 feet	gumbo
	10- 55 feet	sandy clay
	55-118 feet	shale
	118-168 feet	sandstone
	168-170 feet	shale

Static level: 70.44 feet

Water-Level Measurements

Well No. 6

Date	Time since pumping started	Time	Water level (feet)	Drawdown (feet)	Pumping rate (igpm)
Nov. 2/67	0 minutes	9.00 a.m.	50.68		
	1		62.20	11.32	46.5
	2		63.92	13.04	46.5
	3		64.69	13.81	46.5
	4		65.21	14.33	
	5		65.61	14.73	49.0
	6		65.96	15.08	
	7		66.58	15.70	50.0
	8		67.28	16.40	
	9		67.58	16.70	48
	10		67.88	17.00	50
	12		68.23	17.36	50
	15		68.66	17.78	50
	20		69.24	18.36	51
	25		69.63	18.75	51
	30		69.99	19.11	51
	40		70.80	19.92	50
	50		71.07	20.19	51
	60		71.33	20.45	51
	75		71.04	20.16	49
	90		71.11	20.23	49
	105		71.14	20.26	49
	120	11.00 a.m.	70.88	20.00	48
	150		70.49	19.61	46
	180	12.00 a.m.	70.21	19.33	46
	210		70.68	19.80	46
	240		70.86	19.98	46.5
	270		71.36	20.48	46.5
	6 hr.		71.45	20.57	45
	7		71.14	20.26	46
	8		70.81	19.93	46
	9		71.31	20.43	45
	10		71.55	20.67	46
	11		72.20	21.82	46.5
	12	9.00 p.m.	73.56	22.68	49.5
	13	10.00 pm	73.48	22.60	46.5
	14	11.00 p.m.	73.73	22.90	46.5

Well No. 6 (continued)

Date	Time since pumping started	Time	Water level (feet)	Drawdown (feet)	Pumping rate (l/gpm)
Nov. 3/67	16 hrs.	1.00 p.m.	73.50	22.62	46
	18		73.48	22.60	45
	20	5.00 a.m.	73.55	22.67	46
	22	7.00 a.m.	73.60	22.72	46.5
	24	9.00 a.m.	73.37	22.49	45
	26	11.00 a.m.	74.08	23.20	45
	28	1.00 p.m.	74.04	23.16	45
	30	3.00 p.m.	73.83	22.95	45
	32	5.00 p.m.	74.70	23.82	45
	36	9.00 p.m.	75.22	24.34	46
Nov. 4	42	3.00 a.m.	75.10	24.22	46
	48	9.00 a.m.	75.16	24.28	46
	54	3.00 p.m.	75.01	24.13	43.6
	60	9.00 p.m.	77.47	26.59	49.5
Nov. 5	66	3.00 a.m.	77.52	26.64	49.5
	72	9.00 a.m.	78.15	27.25	48
	78	3.00 p.m.	77.39	26.51	46.5
	84	9.00 p.m.	77.51	26.63	46
Nov. 6	90	3.00 a.m.	77.56	26.68	46.5
	96	9.00 a.m.	77.41	26.53	46.5
	102	3.00 p.m.	76.75	25.87	45
	108	9.00 p.m.	76.59	25.71	46
Nov. 7	114	3.00 a.m.	76.53	25.65	45
	120	9.00 a.m.	76.87	25.99	46
	126	3.00 p.m.	76.82	25.94	45
	132	9.00 p.m.	76.83	25.95	45
Nov. 8	138	3.00 a.m.	76.90	26.02	45
	144	9.00 a.m.	76.81	25.93	45
	150	3.00 p.m.	76.70	25.82	45
	156	9.00 p.m.	76.56	25.68	45
Nov. 9	162	3.00 a.m.	76.50	25.62	45
	168	9.00 a.m.	76.49	25.61	45

Well No. 6 - Recovery Data

Date	Time since pumping stopped	Time	Water level (feet)	Residual drawdown (feet)
Nov. 9/67	0	9.00 a.m.	76.49	25.61
	1 minute		64.46	13.58
	2		63.81	12.93
	3		63.31	12.43
	4		62.95	12.07
	5		62.66	11.78
	6		62.36	11.48
	7		62.20	11.32
	8		62.00	11.12
	9		61.84	10.96
	10		61.69	10.81
	12		61.40	10.52
	15		61.07	10.19
	20		60.60	9.72
	25		60.22	9.34
	30		59.92	9.04
	40		59.47	8.59
	50		59.10	8.22
	60		58.83	7.95
	75		58.48	7.60
	90		58.23	7.35
	105		58.00	7.12
	120		57.81	6.93
	150		57.49	6.61

Well No. 6a

Date	Time since pumping started	Time	Water level (feet)	Drawdown (feet)
Nov. 2/67	0 minutes	9.00 a.m.	50.14	0
	1		50.75	.61
	2		51.17	1.03
	3		51.70	1.56
	4		52.30	2.16
	5		53.28	3.14
	6		53.56	3.42
	7		53.67	3.53
	8		53.71	3.57
	9		53.79	3.65
	10		53.87	3.73
	12		53.96	3.82
	15		54.50	4.36
	20		55.26	5.12
	25		55.16	5.02
	30		56.18	6.04
	40		56.86	6.72
	50		57.39	7.23
	60		57.78	7.64
	75		58.23	8.09
	90		58.46	8.32
	105		58.68	8.54
	120		58.84	8.70
	150		59.01	8.87
	180		59.13	8.99
	210		59.30	9.16
	240		59.49	9.35
	270		59.54	9.40
	300		59.79	9.64
	6 hrs.		60.26	10.12
	7		60.53	10.39
	8		60.81	10.67
	9		60.65	10.41
	10		60.76	10.62
	11		61.03	10.89
	12		61.68	11.54
	13		61.75	11.59
	14		61.77	11.63

Well No. 6a (continued)

Date	Time since pumping started	Time	Water level (feet)	Drowdown (feet)
Nov. 3	16		61.94	11.80
	18		62.18	12.04
	20		62.25	12.11
	22		62.50	12.36
	24		62.40	12.26
	26		62.67	12.53
	28		62.75	12.61
	30	3.00 p.m.	62.75	12.64
	32	5.00 p.m.	62.91	12.77
	36	9.00 p.m.	63.44	13.30
Nov. 4	42	3.00 a.m.	63.55	13.41
	48	9.00 a.m.	63.78	13.64
	54	3.00 p.m.	63.76	13.62
	60	9.00 p.m.	64.71	14.57
Nov. 5	66	3.00 a.m.	64.93	14.79
	72	9.00 a.m.	65.15	15.01
	78	3.00 p.m.	65.08	14.94
	84	9.00 p.m.	65.18	15.04
Nov. 6	90	3.00 a.m.	65.28	15.14
	96	9.00 a.m.	65.24	15.10
	102	3.00 p.m.	65.01	14.87
	108	9.00 p.m.	64.96	14.82
Nov. 7	114	3.00 a.m.	64.98	14.86
	120	9.00 a.m.	65.03	14.91
	126	3.00 p.m.	65.10	14.96
	132	9.00 p.m.	65.16	15.02
Nov. 8	138	3.00 a.m.	65.21	15.07
	144	9.00 a.m.	65.18	15.04
	150	3.00 p.m.	65.17	15.03
	156	9.00 p.m.	65.09	14.95
Nov. 9	162	3.00 a.m.	65.05	14.91
	168	9.00 a.m.	65.02	14.88

Well No. 6a - Recovery Data

Date	Time since pumping stopped	Time	Water level (feet)	Residual drawdown (feet)
Nov. 9/67	0	9.00 a.m.	65.02	14.88
	1 minutes		64.18	14.04
	2		63.69	13.55
	3		63.26	13.12
	4		62.89	12.75
	5		62.69	12.55
	6		62.46	12.32
	7		62.20	12.06
	8		62.01	11.87
	9		61.84	11.70
	10		61.67	11.53
	12		61.35	11.21
	15		60.45	10.31
	20		60.40	10.26
	25		59.98	9.84
	30		59.62	9.48
	40		59.50	9.36
	50		58.67	8.53
	60		58.33	8.19
	75		57.95	7.81
	90		57.65	7.51
	105		57.39	7.25
	120		57.17	7.03
	150		56.83	6.69
	180			
	210			
	240			
	300			

Well No. 7

Date	Time since pumping started	Time	Water level (feet)	Drawdown (feet)
Nov. 2/67		8.25 a.m.	70.41	0
Nov. 3	1405 minutes	8.25 a.m.	72.92	2.51
Nov. 4	2845	8.25 a.m.	74.18	3.77
Nov. 5	4286	8.26 a.m.	75.19	4.78
Nov. 6	5725	8.25 a.m.	75.78	5.37
Nov. 7	7165	8.25 a.m.	76.02	5.61
Nov. 8	8605	8.25 a.m.	76.21	5.80

Analysis of Pump Test Data

A. Pumped well, drawdown data

Drawdown (feet) is plotted against the logarithm of time (minutes) in figure 1. The first part of the curve shows a nearly linear trend and can be used to calculate the transmissibility of the aquifer; the average pumping rate Q (see Fig. 2) during this period was approximately 50 igpm (imperial gallons per minute). The transmissibility (T) is calculated using the modified Theis formula:

$$T = \frac{264 \times Q}{\Delta s}$$

where Δs = the drawdown in feet per log cycle and $T = \frac{264 \times 50}{5} = 2,640$ igpd/ft (imperial gallons per day per foot). The safe yield of the well for sustained pumping over a period of 20 years is estimated by extrapolating the straight line of figure 1 to 20 years $\simeq 10^7$ minutes. The extrapolation gives the drawdown after 20 years if the well was pumped at the same rate (50 igpm) as during the test. Drawdown (20 years) = $11.6 + 7 \times 5.0 = 46.6$ feet. Assuming that the drawdown is proportional to the pumping rate, the total available drawdown at the well (42 feet) determines the safe pumping rate:

$$\text{Safe pumping rate} = \frac{42}{46.6} \times 50 = 45 \text{ igpm.}$$

B. Pumped well, recovery data

The recovery data of the pumped well (No. 6) were used to calculate the transmissibility. Values of the residual drawdown were plotted against the logarithm of the ratio, time since pumping started/time since pumping stopped (Fig. 5). A transmissibility of 3,130 igpd/ft was calculated.

C. Observation Well No. 6a

The logarithm of the drawdown is plotted against the logarithm of time in figure 3. To calculate the transmissibility and storage coefficient (S) of the aquifer, the Theis equation is used. The formulas used and the actual calculations are shown in figure B. The values of T and S calculated are, respectively: 2,930 igpd/ft and 1.13×10^{-4} . The last observations seem to indicate a levelling off of the drawdown after $t = 6,000$ minutes. Assuming this to be due to leakage, B, the leakage factor is found to be 9,000 feet. K' , the vertical conductivity of the overlying confining bed, can be estimated from

$$B = \sqrt{T b' / K'}$$

where b' is the thickness of the confining bed; substituting 100 feet for b' , $K' = 0.0036$ igpd/ft.

D. Observation Well No. 7

Drawdown data for observation well No. 7 are plotted in figure 4. The aquifer coefficients are calculated using the Theis method as under B; the values of T and S thus obtained are, respectively: 2,500 igpd/ft and 0.48×10^{-4} .

Levelling off of the drawdown towards the end of the test again indicates leakage through the overlying confining beds; B is found to be 8,800 feet, $K' = 0.0032$ igpd/ft.

E. Interference between wells No. 6 and No. 7

Table 1 summarizes the values of the aquifer coefficients obtained from the diverse data.

Table 1.

Data	T (lgpd/ft)	S	B (feet)	K' (lgpd/ft ²)
Well No. 6, drawdown	2,640	-	-	-
Well No. 6, recovery	3,130	-	-	-
Well No. 6a, drawdown	2,930	1.13×10^{-4}	9,000	0.0036
Well No. 7, drawdown	2,292	0.51×10^{-4}	8,800	0.0032
Average	2,750	0.82×10^{-4}	8,900	0.0034

Using the average values of T, S, and B to calculate the Interference drawdown caused in Well No. 7 by continuous pumping of well No. 6 at one igpm, we find

$$s_{\text{(Interference)}} = 0.12 \text{ feet/igpm.}$$

E. Safe yield of Wells No. 6 and No. 7 pumping simultaneously

The self-caused drawdown after 20 years was calculated for Well No. 6 as 45.6 feet at a pumping rate of 50 igpm, which equals 0.93 feet/igpm. Assuming that the well loss at Well No. 7 is the same as at Well No. 6, the total drawdown at either well when both wells are pumping at 1 igpm is then $0.93 + 0.12 = 1.05 \text{ ft/igpm}$. Dividing this into the available drawdown (42 feet) gives a safe pumping rate of 40 igpm or a combined yield of 80 igpm.

Summary and Remarks

The maximum safe yield of Well No. 6 is estimated at 45 igpm; when both wells No. 6 and No. 7 are pumped, interference between the two wells caused the safe yield of each well to be substantially less. The safe yield for each well is estimated as 40 igpm, or a total production of 80 igpm. Both estimates are based on sustained pumping for 20 years at that rate.

The aquifer constants calculated from the time-drawdown relationships

Investigated are:

Transmissibility: 2,750 igpd/ft

Hydraulic conductivity: 69 igpd/ft²

Storage coefficient: 0.82×10^{-4}

Leakage factor: 8,900 feet

Vertical hydraulic conductivity of the overlying bed: .003 igpd/ft²

The estimates presented in this report are possibly subject to error. The amount of 45 igpm can be withdrawn from Well No. 6 for a period of twenty years only, under favorable conditions. In actual practice, the yield may be found to be considerably less. If Well No. 6 (or any other well) is developed as a production well, its performance should be observed carefully.

November 16, 1967.



Figure 1. Pumping Well No. 6 - drawdown

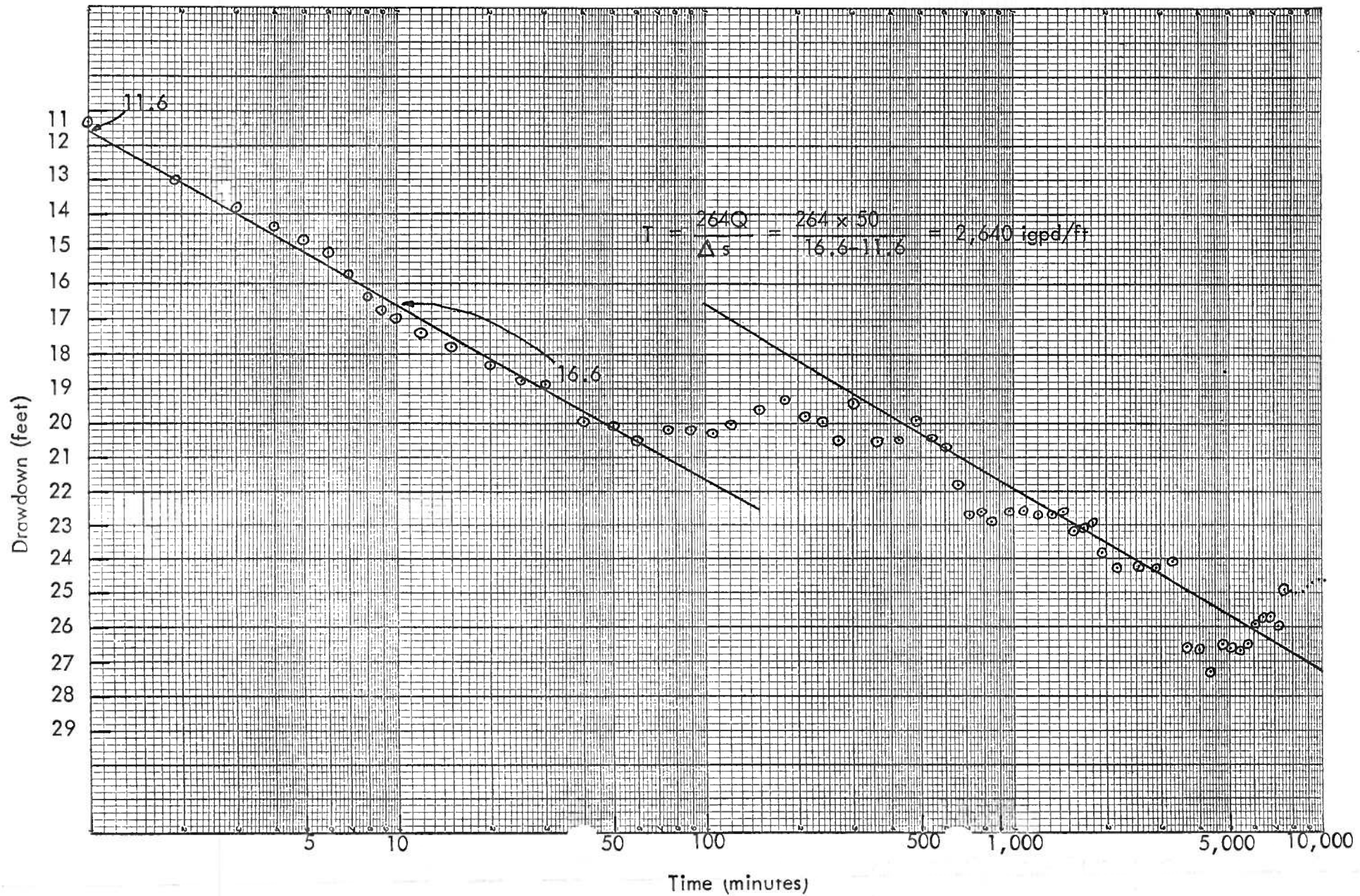


Figure 2. Well No. 6 - pumping rate

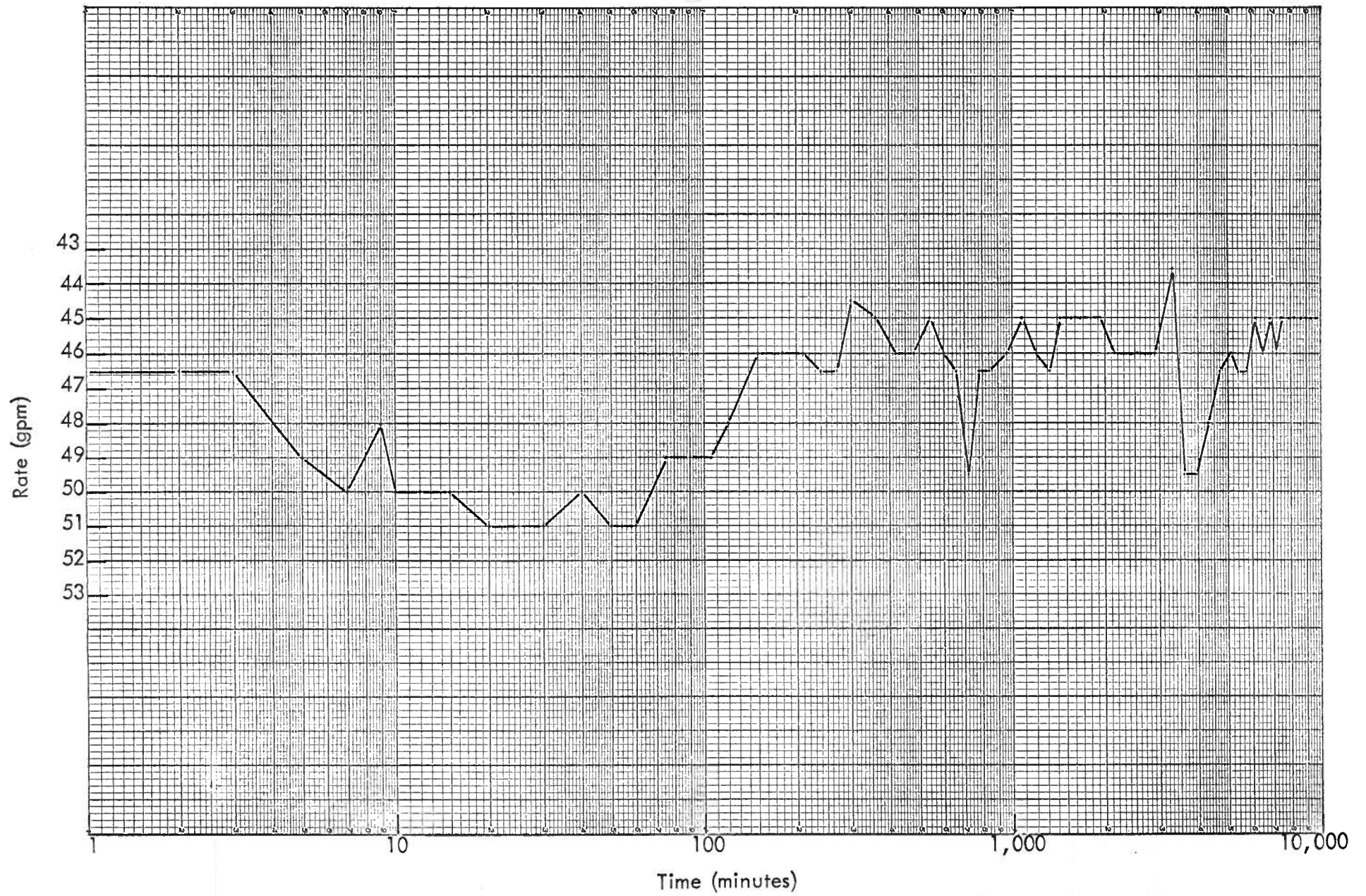


Figure 3. Observation Well No. 6 - 90 feet north of pumping well No. 6

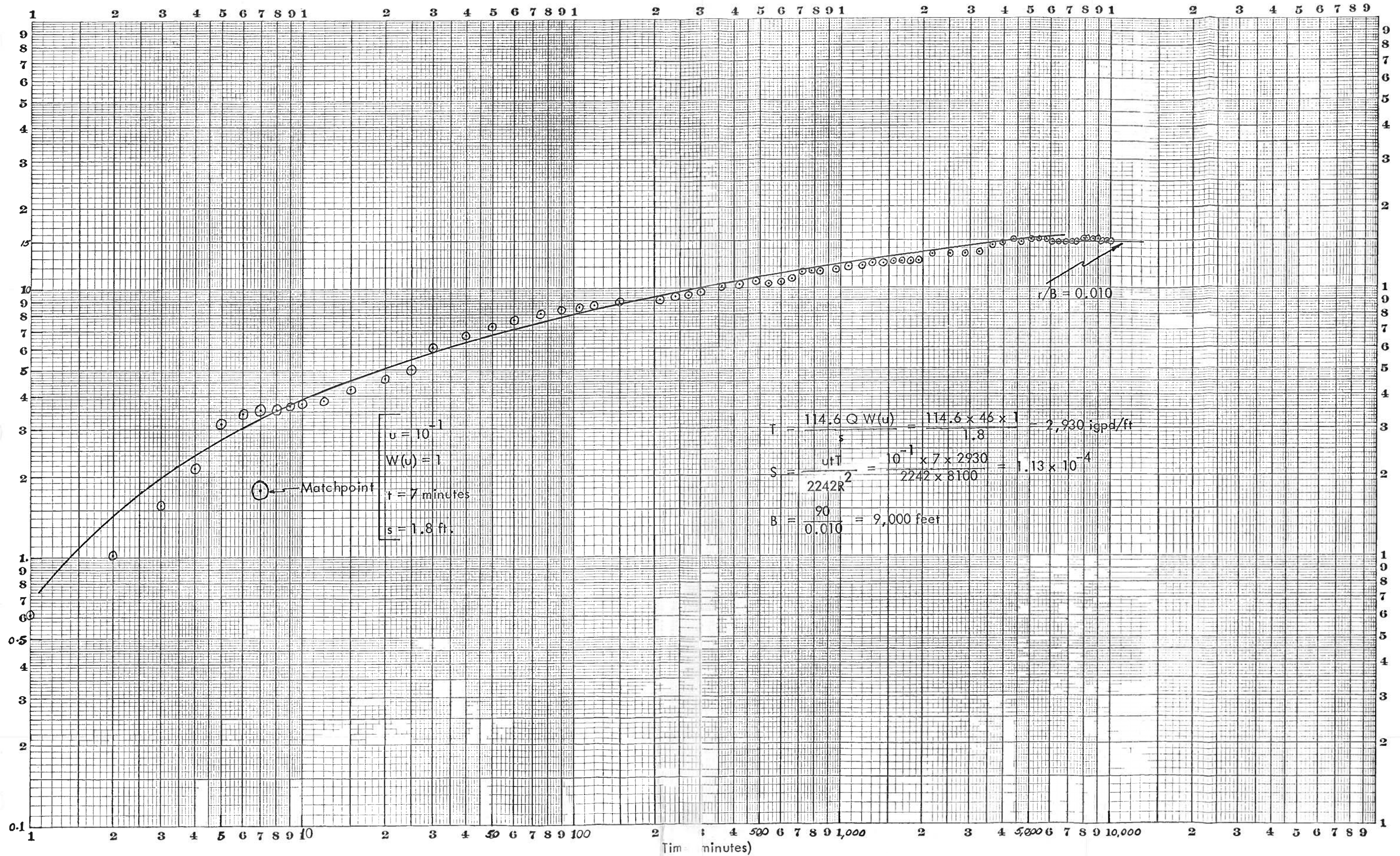




Figure 4. Well No. 7
 $R = 2,640$ feet

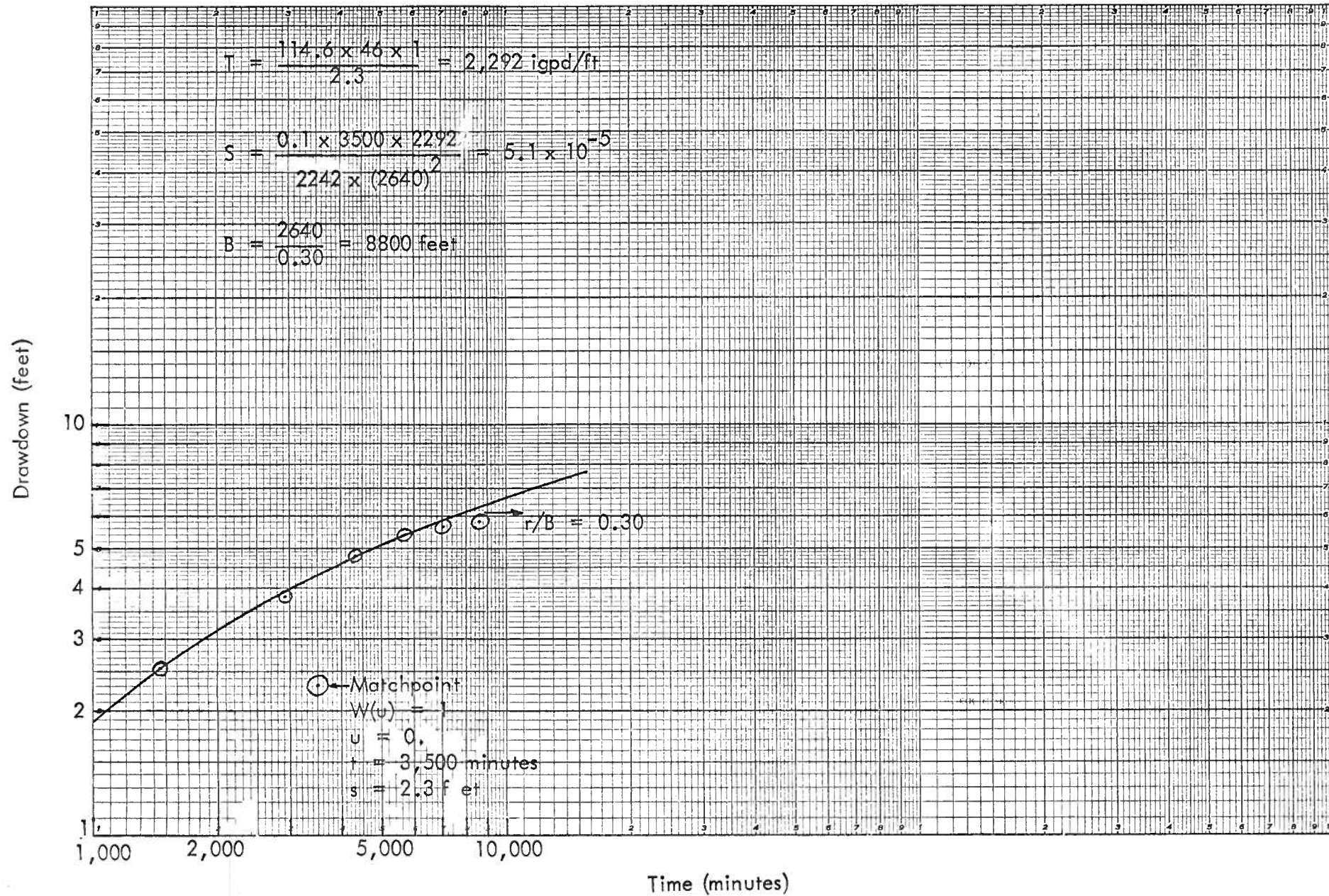
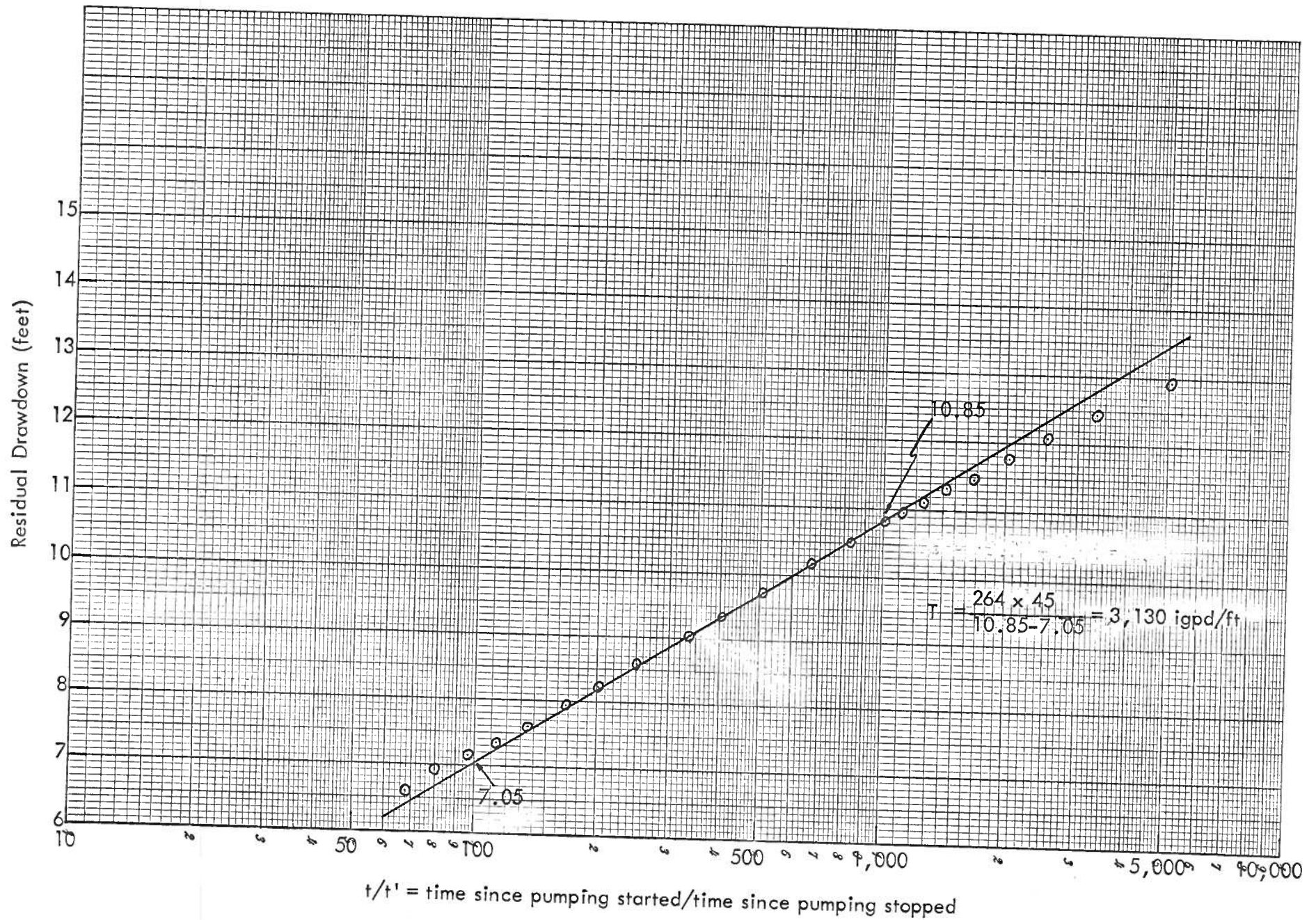
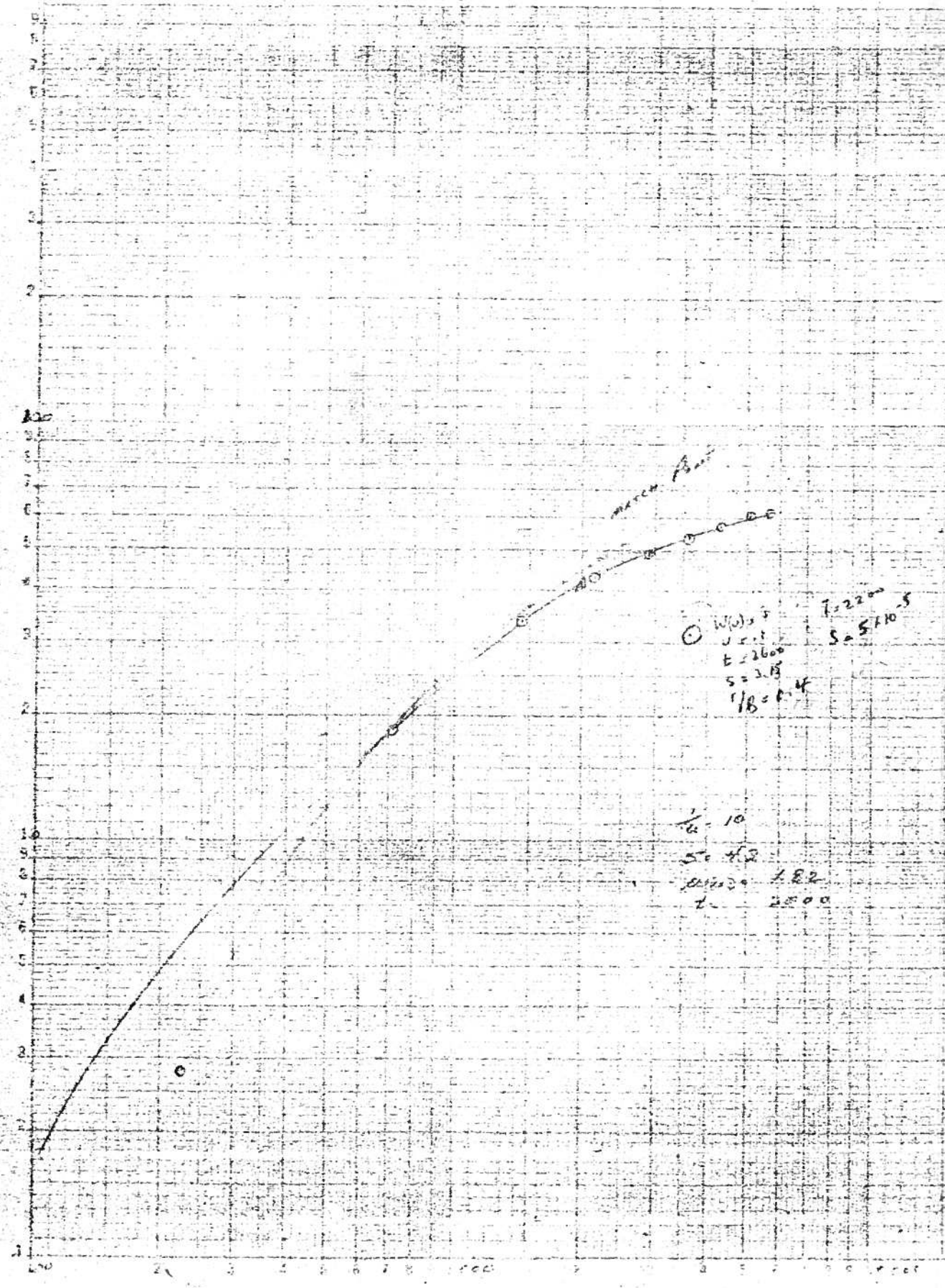


Figure 5. Recovery Well No. 6



LOG LOGARITHMIC 47 7523
 25 0 0000 0000
 00000 00000000

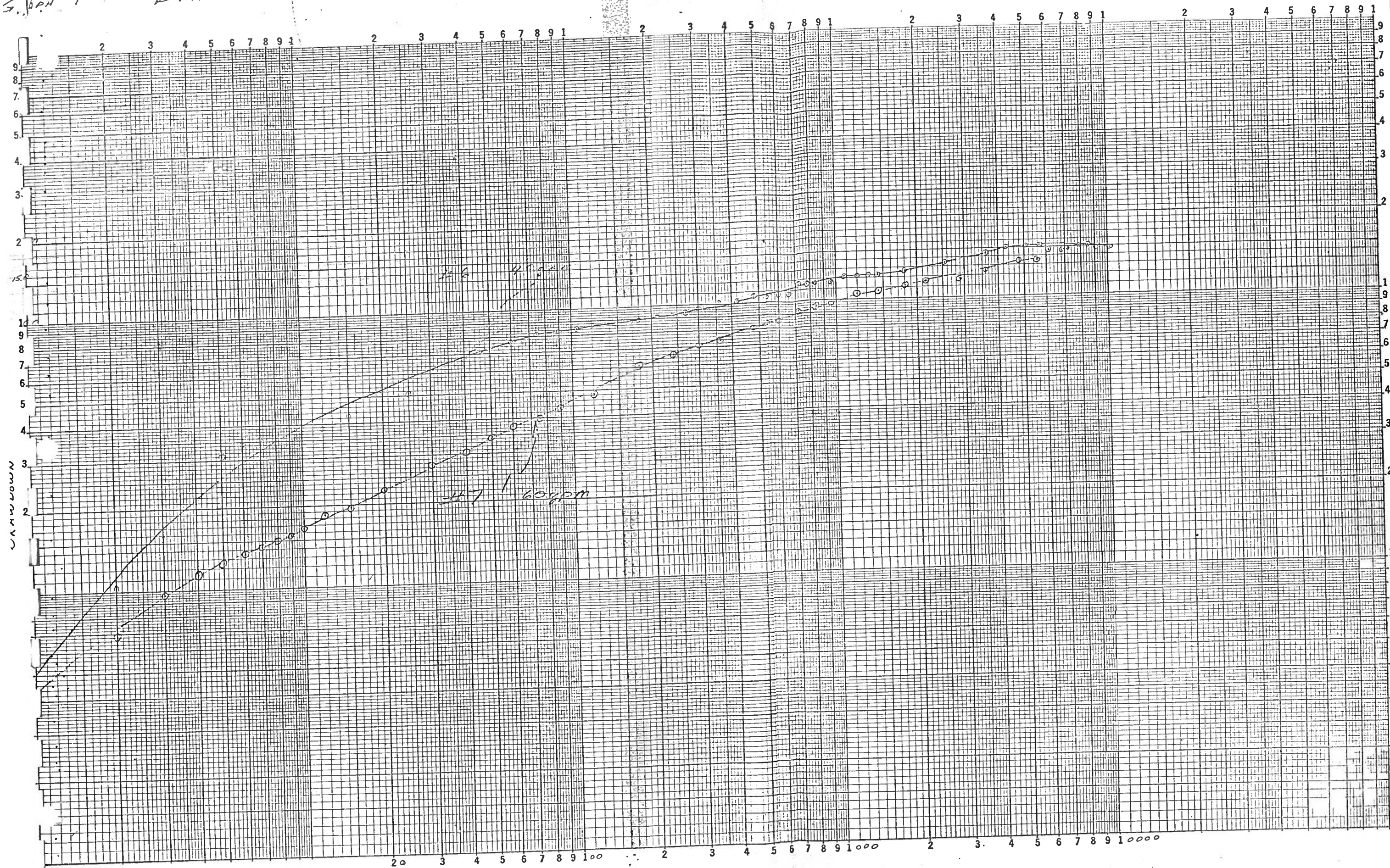


$$T = \frac{11.6 \times 60 \times 1.82}{42} = 2980 \times 801/14$$

$$S = \frac{1 \times 2000 \times 2980}{2242 \times (2640)} = 3.81104$$

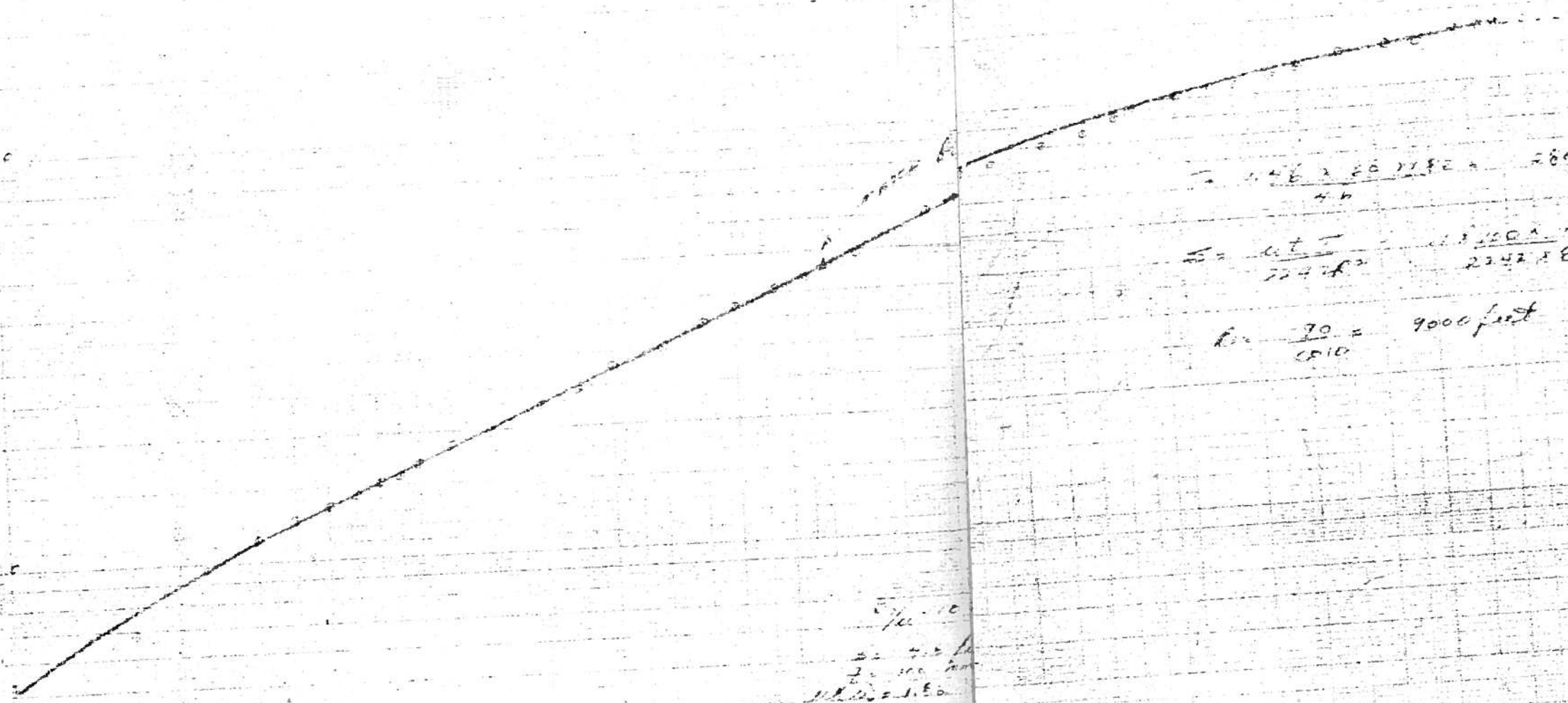
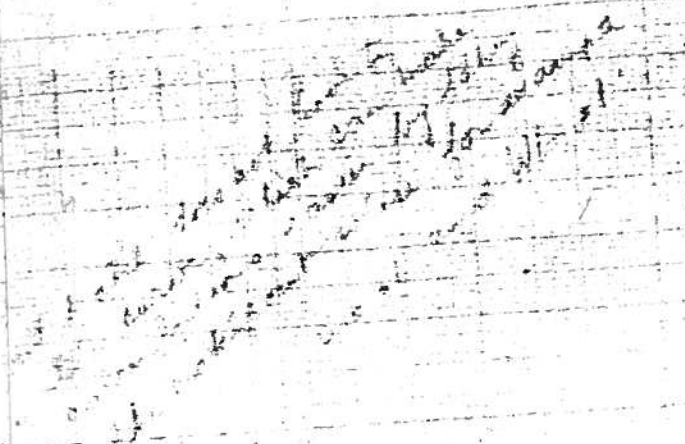
$$B = \frac{2640}{7} = 5700$$

S. 1 6PM 1 DRAWDOWN vs TIME #6 WELL + #7



AND STARTED IN MINUTES

OBSERVATION WZ 7



$$T = 1.46 \times 10^{11} \text{ s} = 2800 \text{ years}$$

$$E = \frac{4\pi}{3} \times 10^{31} \text{ ergs} = 1.5 \times 10^{31} \text{ ergs}$$

$$R = \frac{70}{100} = 9000 \text{ feet}$$

Fig. 10
 $z = 4.5 \text{ km}$
 $z = 100 \text{ km}$
 $1000 = 1.50$

57 7523
 1950
 EXHIBIT (FRT)

DESIGNER

PEK

CHECKED BY

Three Mills Test #67-2
ON PUMP TEST FILE 014
REID, CROWTHER & PARTNERS LIMITED
CONSULTING ENGINEERS
SW-28-31-24-W4

PAGE No.

DATE

PROJECT No. 8636

WELL.

7. WELL.

DATE	INTERVAL	TIME	READING	DRAW DOWN	TIME PER 45 gal.	RATE gpm
6/14/67	0	9.00 AM	71.95		62	44
	1 MINUTE		77.40	5.45	46	59
	2		80.00	8.05	46	59
	3		82.00	10.05	46	59
	4		82.28	10.33	46	59
	5		82.44	10.49	46	59
	6		82.58	10.63	46	59
	7		82.67	10.72	46	59
	8		82.72	10.77	46	59
	9		82.76	10.81	46	59
	10		82.82	10.87	46	59
	12		82.96	11.01	46	59
	15		83.03	11.08	45	60
	20		83.97	12.02	45	60
	25		83.86	11.91		
	30		86.20	14.25	42	64
	40		84.03	12.08	48	56
	50		85.65	13.70	42	67
	60		85.25	13.30	46	59
	75		85.55	13.60	46	59
	90		85.79	13.84	45	60
	105		86.38	14.43	45	60
	120		86.08	14.13	45	60
	150		86.65	14.70	45	60
	180	12.00 PM.	88.85	16.90	42	64
	210		89.60	17.65	43	63
	240		88.54	16.59	45	60
	300		88.44	16.49	46	59
	6 hrs	3.00 PM	88.81	16.86	46	59
	7		90.01	18.06	44	61
	8		89.71	17.76	46	59
	9		90.53	18.58	45	60
	10		89.65	17.70	46	59
	11		90.63	18.68	45	60

243-0715

DESIGNER

PEK.

REID, CROWTHER & PARTNERS LIMITED

PAGE No.

DATE

CHECKED BY

CONSULTING ENGINEERS

PROJECT No.

8636

WELL #7

DATE	INTERVAL	TIME	READING	DRAW DOWN	TIME PER 45 gal	RATE g.p.m.
0014/67	13	10.00 PM.	91.46	19.51	45	60
	14		91.61	19.66	46	59
0015/67	15	12.00 A.M.	91.15	19.20	46.5	59
	16	1.00 AM	92.65	20.70	42	63
	18		92.51	20.56	45	60
	20		92.43	20.48	46	59
	22		91.41	19.46	46	59
	24 1440	9.00 AM.	92.31	20.36	45	60
	26 1660		93.12	21.17	45	60
	28 1880	1.00 AM	94.09	22.14	45	60
	30 1800		92.11	20.16	45	60
	32 1920		94.02	22.07	45	60
	34 2040		94.12	22.17	45	60
	36 2160	9.00 PM	94.25	22.30	45	60
	40 2400		94.08	22.13	45	60
	44 2640		94.43	22.42	45	60
	48 2880	9.00 AM	93.87	21.92	45	60
	52 3120		95.35	23.40	45	60
	56 3360		95.10	23.15	45	60
	60 3600	9.00 PM	95.43	23.39	45	60
	64 3840	1.00 AM	94.91	22.96	45	60
	68 4080		95.51	23.56	46	59
	72 4320	9.00 AM	96.21	24.26	45	60
	76 4560	1.00 PM	95.84	23.89	45	60
	80 4800		97.02	25.07	45	60
	84 5040		96.58	24.63	45	60
	88 5280		96.35	24.40	45	60
	92 5520		96.44	24.49	45	60
0018/67	96 5760	9.00 AM	96.35	24.40	45	60
	100 6000		96.64	24.69	45	60

DESIGNER PER
 CHECKED BY _____

REID, CROWTHER & PARTNERS LIMITED
 CONSULTING ENGINEERS

PAGE No. _____
 DATE _____
 PROJECT No. 8636

DATE	WELL INTERVAL	#7 is 90' Time	OBSERVATION WELL #6 EAST OF WELL #6 DRAW		TIME PER 45 gal	RATE gpm
			READING	DOWN		
0014/67	0	9.00 AM.	68.18	0		
	1		68.71	.53		
	2		68.86	.68		
	3		69.15	.97		
	4		69.31	1.13		
	5		69.43	1.25		
	6		69.52	1.34		
	7		69.60	1.42		
	8		69.69	1.51		
	9		69.76	1.58		
	10		69.84	1.66		
	12		69.96	1.88		
	15		70.15	1.97		
	20		70.46	2.28		
	25		70.64	2.46		
	30		70.96	2.78		
	40		71.22	3.04		
	50		71.64	3.46		
	60		71.94	3.76		
	75		72.26	4.08		
	90		72.57	4.39		
	105		72.91	4.73		
	120		73.12	4.94		
	150	11.30 AM	74.20	more this reading		
	180	12.00 PM.	74.21	6.03		
	210		74.71	6.53		
	240		74.84	6.66		
	300		75.21	7.03		
	6 hrs.	3.00 PM	75.61	7.43		
	7		76.02	7.84		
	8		76.27	8.09		
	9		76.63	8.45		
	10		76.70	8.52		
	11		77.02	8.84		

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CONSULTING ENGINEERS

PAGE No. _____

DATE _____

PROJECT No. 8636

WELL.

#7 OBSERVATION WELL.

DATE	INTERVAL	TIME	READING	DRAW DOWN	TIME PER 45 sec	DATE
14/67	13 hrs.	10.00 AM	77.56	9.38		
	14		77.75	9.57		
15/67	15	12.00 AM	77.81	9.63		
	16	1.00 AM	78.02	9.84		
	18	3.00 AM	78.28	10.10		
	20	5.00 AM	78.58	10.40		
	22	7.00 AM	78.41	10.23		
	24	9.00 AM	78.91	10.73		
	26	11.00 AM	79.09	10.91		
	28	1.00 PM	79.18	11.00		
	30	3.00 PM	79.26	11.08		
	32	5.00 PM	79.61	11.43		
	34	7.00 PM	79.78	11.60		
	36	9.00 PM	79.94	11.76		
	40	1.00 AM	80.03	11.85		
	44	5.00 AM	80.48	12.30		
	48	9.00 AM	80.09	11.91		
	52		80.71	12.53		
	56		80.82	12.64		
	60	9.00 PM	80.93	12.75		
	64	1.00 AM	80.72	12.54		
	68	5.00 AM	80.80	12.62		
	72	9.00 AM	81.18	13.00		
	76	1.00 PM	81.31	13.13		
	80	5.00 PM	81.65	13.47		
	84	9.00 PM	81.78	13.60		
	88	1.00 AM	81.75	13.57		
	92	5.00 AM	81.77	13.59		
	96	9.00 AM	81.80	13.62		
	100	1.00 PM	81.74	13.56		

DESIGNER LFK

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CONSULTING ENGINEERS

PAGE No. _____

DATE _____

PROJECT No. 8636

DATE	WELL	#	OBSERVATION	RECOVERY	RATE gpm
	INTERVAL	TIME	READING	DRAW DOWN	TIME Per 45 gal
11/8/67	0	100 PM	81.74	0	
	1 minute		81.02	.72	
	2		80.85	.89	
	3		80.69	1.05	
	4		80.59	1.15	
	5		80.46	1.28	
	6		80.37	1.37	
	7		80.26	1.48	
	8		80.15	1.59	
	9		80.11	1.63	
	10		80.06	1.68	
	12		79.98	1.76	
	15		79.72	2.02	
	20		79.46	2.28	
	25		79.25	2.49	
	30		79.01	2.73	
	40		78.71	3.03	
	50		78.28	3.46	
	60		78.11	3.63	
	75		77.88	3.86	
	90		77.52	4.22	
	105		77.21	4.53	
	120		76.95	4.79	
	150		76.65	5.09	
	180		76.13	5.61	
	210		75.91	5.83	
	240		75.57	6.17	
	270		75.33	6.41	
	300		75.41	6.33 x	
	6 hrs		74.61	7.13	
	7		74.22	7.52	
	8		73.86	7.88	
	9		73.67	8.07	
	10		73.43	8.31	
	11		73.11	8.55	

DESIGNER P. K.

REID, CROWTHER & PARTNERS LIMITED

PAGE No. 2/2

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CONSULTING ENGINEERS

DATE _____

PROJECT No. E.636WELL #7 OBSERVATION RECOVERY

DATE	INTERVAL	TIME	READING	DRAW DOWN	TIME PER 45gal	RATE gpm
J 19/67	12	1.00 AM.	72.78	8.96		
	13		72.55	9.19		
	14		72.19	9.55		
	15		72.01	9.73		
	16		71.85	9.89		
	18		71.25	10.49		
	20		71.12	10.62		
	22.	11.00 PM	70.79	10.95		

ORIGINAL 68.18

DESIGNER PEK

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PAGE No. _____

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CONSULTING ENGINEERS

DATE _____

PROJECT No. 8636

WELL # 7 RECOVERY

CASE NO. 4172

DATE	INTERVAL	TIME ^{1/4}	READING	DRAW-DOWN	TIME PER 45 gal	RATE gpi
13018/67	0		96.64	24.69	res. ad.	
	1 minute	6001	85.21	11.43	13.26	
	2	3001	84.95	11.69	13.00	
	3	2001	84.76	11.88	12.81	
	4	1501	84.60	12.04	12.65	
	5	1201	84.46	12.18	12.51	
	6	1001	84.32	12.32	12.37	
	7	858	84.23	12.41	12.28	
	8	751	84.14	12.50	12.19	
	9	668	84.05	12.59	12.10	
	10	601	83.98	12.66	12.03	
	12	501	83.86	12.78	11.91	
	15	401	83.66	12.98	11.71	
	20	301	83.39	13.25	11.44	
	25	241	83.18	13.46	11.23	
	30	201	82.97	13.67	11.02	
	40	151	82.61	14.03	10.66	
	50	121	82.32	14.32	10.37	
	60	101	82.03	14.61	10.08	
	75	81	81.67	14.97	9.72	
	90	68	81.40	15.24	9.49	
	105	58	81.12	15.52	9.21	
	120	51	80.87	15.77	8.92	
	150	41	80.41	16.23	8.46	
	180	34	79.95	16.69	8.00	
	210	30	79.70	16.94	7.75	
	240	26	79.43	17.21	7.48	
	270	23	79.16	17.48	7.21	
	300	21	78.89	17.75	6.94	
	6 hrs	17.5	78.41	18.23	6.46	
	7	15.3	78.02	18.62	6.07	
	8	13.5	77.70	18.94	5.75	
	9	12.1	77.37	19.27	5.42	

DESIGNER

JFK

REID, CROWTHER & PARTNERS LIMITED

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PROJECT No.

86.36

WELL #7

RECOVERY

DATE	INTERVAL	TIME	READING	DRAW DOWN	TIME PER 45 gal. res. ad.	RATI gpm
	11		76.80 71.95	19.84	4.85	
	12	9.3	76.52	20.12	4.57	
	13		76.35	20.29	4.40	
	14	8.1	76.11	20.53	4.16	
	15		75.81 71.95	20.83	3.86	
	16	7.2	75.65	20.99	3.70	
	18		75.28 71.95	21.36	3.33	
	20	6.	74.95	21.67	3.00	
	22		74.58	22.06		
	24	5	74.28 71.95	22.36	2.33	
	25					
	28					
	30					
	32					

ORIGINAL 71.95

DESIGNER EFK
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REID, CROWTHER & PARTNERS LIMITED
CONSULTING ENGINEERS

PAGE No. _____
DATE Nov 21/67
PROJECT No. 8636

#6 DRAWDOWN Due TO
PUMPING WELL #7 60 RPM

DATE	TIME	MINUTES	READING	DRAWDOWN
Nov 14/67	8.10 AM.		48.68	0
Nov 14/67	11.55 AM.	225	48.96	.28'
Nov 14/67	8.10 PM.	720	50.55	1.87'
Nov 15/67	8.10 AM	1440	52.11	3.43'
Nov 15/67	8.10 PM	2160	53.05	4.37'
Nov 16/67	8.10 AM	2880	53.61	4.93'
Nov 16/67	8.10 PM	3600	54.12	5.44
Nov 17/67	8.10 AM.	4320	54.53	5.85
Nov 17/67	8.10 PM	5040	54.79	6.11
Nov 18/67	8.10 AM.	5760	54.88	6.20
Nov 21/67	12.15 PM	6480	47.98	- .70

Water Well Driller's Report

Reg. No. 4 Driller Raymond Loun
 Owner of Well Town of Three Hills
 Address Three Hills Well Completed Nov 8/67
 LSD: 1/4 Sec. Twp. Rge. W Invoice No.
 Depth: Diameter: 6"

Casing: ft. of in O.D. Set at ft. from surface.

Casing: ft. of in O.D.

Drive Shoe: No casing Yes No

Perforation: ft. of in O.D. Casing slotted with
 in. x in slots at ft. intervals, alternating on
 sides; or

Inside Casing has lower end Bullnosed Yes No

Inside Casing has: J Slot Thread up at ft.
 from surface.

Observation Hole No 7 WATER OCCURRENCES AND TESTS:

- Water at 121 ft. to 188 ft. Rose to 76.7 ft. below surface.
 Bailed at 20 g.p.m. for 30 minutes; hours.
 Draw down to 26.57 ft. in minutes; hours.
 Bailed off bottom at ft. in minutes; hours.
 Recovered to ft. in minutes; hours.
- Water at ft. to ft. Rose to ft. below surface.
 Bailed at g.p.m. for minutes; hours.
 Draw down to ft. in minutes; hours.
 Bailed off bottom at ft. in minutes; hours.
 Recovered to ft. in minutes; hours.

QUALITY OF WATER:

Color: None Red Brown Other
 Odor: None Gas Sulphur Other
 Turbidity: Clear Silty Sandy Cloudy
 Type: Soft Medium Hard Hard
 Impurities: Iron Alkali Sulphate Other
 Use: Domestic Stock Industrial Town
 Other

Was Water Supply Satisfactory? Yes No

If No, give reason

Remarks:

STRATAGRAPHIC LOG

From ft.	To ft.	Description
0	2	Grumbo
2	24	Yellow clay
24	33	Yellow Brownish clay
33	42	Brown shale
42	49	Dark Brown shale
49	50	Carbonaceous shale
50	58	Grey shale
58	60	Coal
60	72.5	Grey shale
72.5	77	Blue shale
77	80	Sandy blue shale
80	87	Soft blue bent sandstone
87	89	Carbonaceous shale
89	103	Grey shale
103	116	Blue grey shale
116	121	Grey shale
121	132	Bent blue S.S.
132	140	Soft blue S.S.
140	148.5	very hard fine blue S.S.
148	156	Soft blue S.S.
156	156 1/4	Hard blue S.S.
156 1/4	163	Soft blue S.S.
163	163 1/2	Hard blue S.S.
163 1/2	174	soft blue S.S.
174	180	Soft blue S.S.
180	188	Bent Soft blue S.S.
188	190	Blue shale

Well Bottomed in:

Shale Sandstone Coal

Loose Sand Gravel

Depth to Top of Bedrock 33

#7 M.F. 113

545

$$T = \frac{264.3}{45} = \frac{264.3}{5.37} = 27.3' \text{ 120d/ft}$$

530

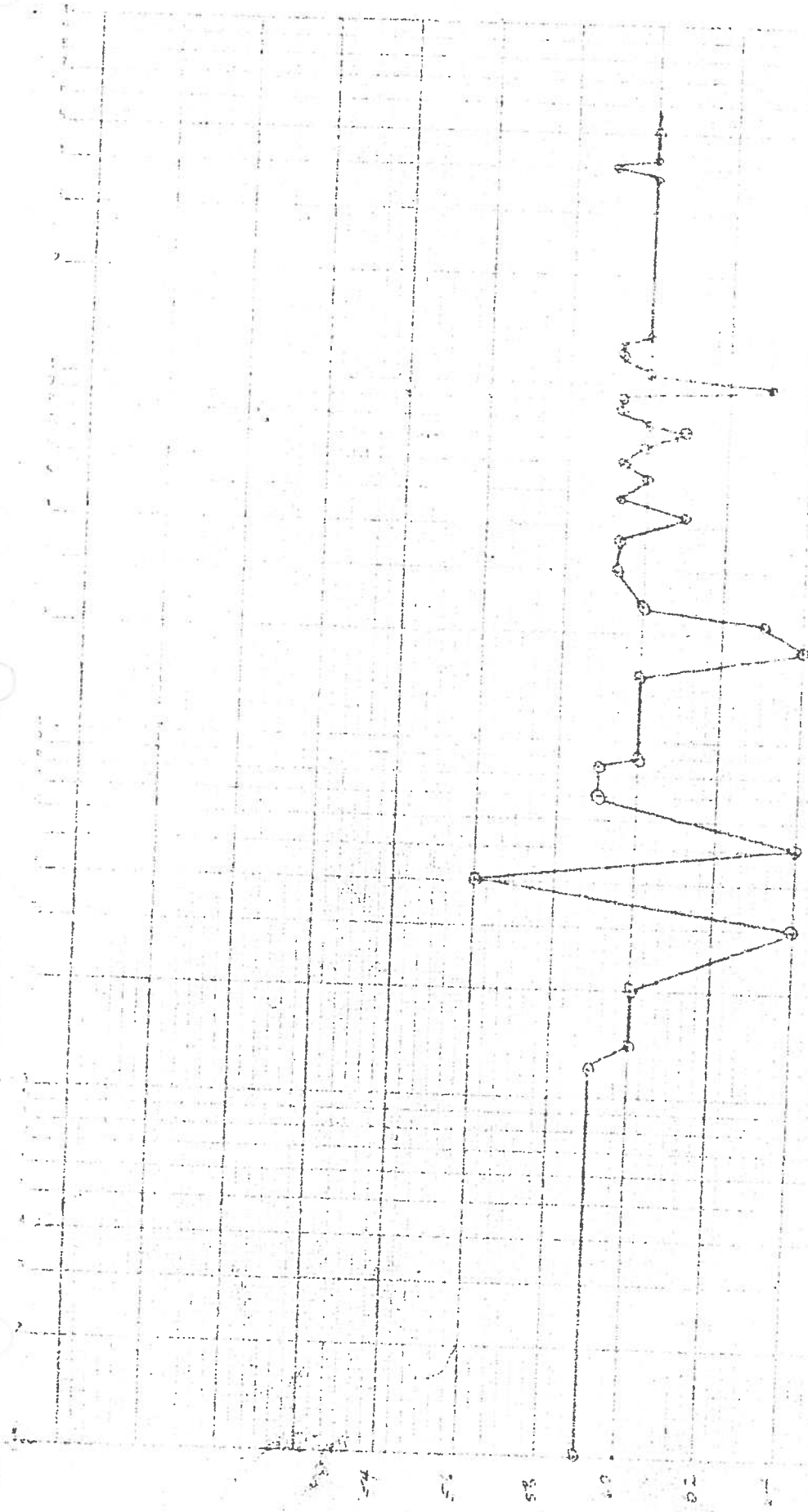
SAFE PUMPING RATE

55 gpm FOR 20 YEARS

SLUDGEM FUEL AB-E 43'

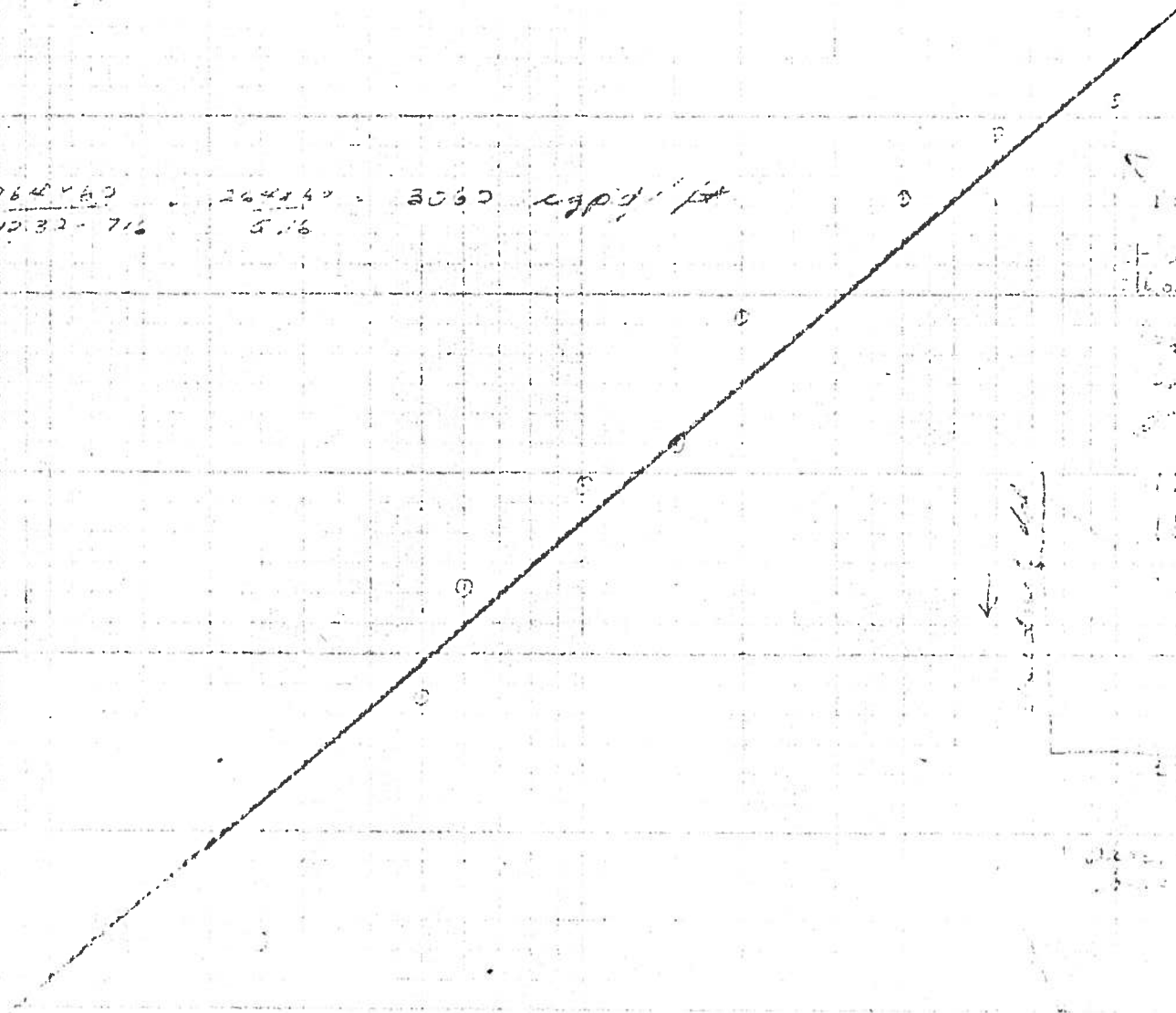
$$423 - 5130 = 4233'$$

SAFE PUMPING RATE $\frac{4300 \times 100}{4233} = 67 \text{ gpm}$



PRODUCTION WELL No 7

264460 264440 3060 2900 ft
1032-716 5.16



It is the horizontal distance that is plotted against

log time, and the vertical distance is plotted, including the

stable well makes no

1000

$\frac{1}{2} =$ time since pumping started, time since pumping stopped