AQUIFER CHARACTERISTICS AT THE LANTANA SANITARY LANDFILL

Post, Buckley, Schuh & Jernigan, Inc.
ENGINEERS, ARCHITECTS and PLANNERS

6850 SW 40th STREET, MIAMI, FLORIDA 33155
TELEPHONE: 305/661-7275 · TELEX: 808435

September 26, 1985

Dr. Patrick Gleason,
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33402

Dear Pat:

I am sending you the enclosed information following your interest in our pump test results at the Lantana Sanitary Landfill as expressed at our meeting of September 4, 1985 at your office.

Please find enclosed the complete data set and accompanying graphs used in the determination of the aquifer characteristics of the lower zone of the surficial aquifer system at the Lantana Sanitary Landfill. The pump test was carried out on August 20 and 21, 1985. We installed a turbine pump within an 8-inch discharge well and measured water levels in two 2-inch observation wells located in the northeast corner of the Lantana Sanitary Landfill. The two observation wells are located west of the discharge well, at distances of 50 feet (i.e. Observation Well 1) and 200 feet (i.e. Observation Well 2). The pump test was conducted with a time-weighted average discharge of 446 gallons per minute for a period of 24 hours.

The water levels in the discharge well were difficult to read during the drawdown phase of the pump test because the turbine pump interfered with the measuring tape. Water level variations were encountered in both observation wells during the 24 hours of pumping. The variations were not a direct result of the pumping, but are believed to have been a result of nearby well withdrawals from the lower zone of the surficial aquifer system.

Both the drawdown and recovery data for each well were analyzed by means of the Hantush Type Curve Solution for nonsteady radial flow in an infinite leaky aquifer. The short duration of the test did not justify the use of Boulton's Delayed Yield Type Curves, nor did the data appear to exhibit a delayed yield phenomenon. I have also included the graphical plots of the straight line method for both observation wells during the recovery phase, for your interest. The transmissivity data for these straight line plots are similar to the type curve results shown in Table 1.

A summary of the aquifer characteristics for the lower zone of the surficial aquifer system is shown in Table 1. The transmissivity for the lower zone in the vicinity of the Lantana Sanitary Landfill is 450,000 gpd/ft., with a storage coefficient of 3×10^{-5} and a leakage coefficient of 3×10^{-4} days.$^{-1}$

I hope these data are useful to you in your ongoing evaluation of the surficial aquifer system in Palm Beach County. We look forward to obtaining from you a copy of the aquifer characteristics for the surficial aquifer system in Palm Beach County as discussed at our meeting of September 4. If you should have any questions, please do not hesitate to give me a call at your convenience.

Very truly yours,
POST, BUCKLEY, SCHUH & JERNIGAN INC.

J. David Wallace P.E.
Senior Engineer

m:G-31/H
22-102.11

Enclosures

cc: Tom Keith (w/enc.)
Dave Deans (w/o enc.)

Table 1

SUMMARY OF AQUIFER CHARACTERISTICS

AT LANTANA SANITARY LANDFILL

Well	Method of Analysis	Transmissivity T(gpd/ft)	Storage Coefficient S	Leakage Coefficient L(days^{-1})
		DRAWDOWN		
Discharge Well		*Insufficient Data		
Obs. Well 1	Type Curve	300,800	1.88×10^{-5}	2.57×10^{-4}
Obs. Well 2	Type Curve	538,220	6.10×10^{-5}	1.15×10^{-4}
		RECOVERY		
Discharge Well	Type Curve	387,400		
Obs. Well 1	Type Curve	**284,100** = 287.74	1.52×10^{-5}	1.52×10^{-3}
	Recovery Test	404,800	-	-
Obs. Well 2	Type Curve	464,800	1.47×10^{-5}	3.98×10^{-4}
	Recovery Test	**547,900** = 554.91	-	-
Calculated Weighted Average		450,000 =	3.00×10^{-5}	3.00×10^{-4}

*Operation of Turbine Pump in Discharge Well limited capability of obtaining sufficient good quality data from this well for analysis.

m:G-31/I

Table C-1

PUMP TEST RECORDS

Date	Time (Hr:Min:Sec)	Discharge Well (DW) Depth to Water from ToC (feet)	Discharge Well (DW) Manometer Tube Reading (inches)	Discharge Well (DW) Calculated Flow (gpm)	Observation Well 1 Depth to Water from ToC (feet)	Observation Well 2 Depth to Water from (ToC (feet)	Remarks
8/20/85	8:49:00	-	-	-	-	5.71	
	9:00:00	-	-	-	4.81	-	
	9:05:00	-	-	-	4.80	-	
	9:10:40	6.06	-	-	-	-	
	9:27:00	-	-	-	4.82	-	
	9:35:00	-	-	-	4.83	-	
	10:15:00	-	-	-	4.85	5.77	
	10:18:00	6.05	-	-	-	-	
	15:52:00	5.90	-	-	4.84	5.68	
	15:53:00	-	-	-	-	5.68	
	15:57:00	-	-	-	4.83	-	
	15:58:00	5.98	-	-	-	-	
	15:58:30	-	-	-	-	-	Pumping Started
	15:58:41	-	-	-	5.95	-	
	15:58:48	-	-	-	-	5.79	
	15:59:00	-	-	-	6.24	-	
	15:59:07	-	-	-	-	6.00	
	15:59:24	-	-	-	6.76	-	
	15:59:45	-	-	-	-	6.05	Discharge Valve Closed
	15:59:51	-	-	-	6.70	-	
	16:00:11	-	-	-	-	6.02	
	16:00:25	-	-	-	6.20	-	
	16:00:38	-	-	-	-	6.00	
	16:00:51	-	-	-	6.22	-	
	16:01:10	-	-	-	-	6.01	
	16:01:15	-	-	-	6.26	-	
	16:01:38	-	-	-	6.28	-	

Table C-1 (Continued)

Date	Time (Hr:Min:Sec)	Discharge Well (DW) Depth to Water from ToC (feet)	Discharge Well (DW) Manometer Tube Reading (inches)	Discharge Well (DW) Calculated Flow (gpm)	Observation Well 1 Depth to Water from ToC (feet)	Observation Well 2 Depth to Water from (ToC (feet)	Remarks
8/20/85	16:01:50	-	-	-	-	6.01	
	16:01:58	-	-	-	6.29	-	
	16:02:20	-	-	-	6.31	5.98	
	16:02:42	-	-	-	6.31	-	
	16:02:55	-	-	-	-	6.00	
	16:03:04	-	-	-	6.32	-	
	16:03:25	-	-	-	-	5.96	
	16:03:30	-	-	-	6.32	-	
	16:03:57	-	-	-	-	6.00	
	16:04:25	-	-	-	-	6.01	
	16:04:30	-	-	-	6.36	-	
	16:05:00	-	-	-	-	6.01	
	16:05:30	-	-	-	6.36	6.03	
	16:06:00	-	-	-	-	6.00	
	16:06:33	-	-	-	-	6.02	
	16:07:30	-	-	-	6.42	6.30	
	16:08:15	-	-	-	-	6.28	
	16:10:30	-	-	-	6.43	6.30	
	16:12:30	-	-	-	-	6.30	
	16:13:00	-	49.0	444	-	-	
	16:14:38	-	-	-	-	6.30	
	16:14:50	-	-	-	6.46	-	
	16:16:35	-	-	-	-	6.34	
	16:17:30	-	-	-	6.48	-	
	16:18:35	-	-	-	-	6.34	
	16:20:30	-	-	-	6.50	-	
	16:22:30	-	49.0	444	-	-	
	16:23:30	-	-	-	-	6.35	
	16:24:30	-	-	-	6.50	-	
	16:28:00	8.39	-	-	-	-	

Table C-1 (Continued)

Date	Time (Hr:Min:Sec)	Discharge Well (DW) Depth to Water from ToC (feet)	Discharge Well (DW) Manometer Tube Reading (inches)	Discharge Well (DW) Calculated Flow (gpm)	Observation Well 1 Depth to Water from ToC (feet)	Observation Well 2 Depth to Water from (ToC (feet)	Remarks
8/20/85	16:28:39	-	-	-	-	6.29	
	16:32:00	8.32	-	-	-	-	
	16:33:30	-	49.1	444	-	6.33	
	16:36:00	-	-	-	6.46	-	
	16:38:30	-	49.0	444	-	-	
	16:40:00	8.60	-	-	-	-	
	16:42:13	-	-	-	-	6.38	
	16:44:50	-	-	-	6.48	-	
	16:46:30	-	49.2	445	-	-	
	16:50:15	-	-	-	-	6.39	
	16:51:00	8.38	-	-	-	-	
	16:52:30	-	-	-	6.45	-	
	16:55:30	-	49.2	445	-	-	
	16:58:38	-	-	-	-	6.39	
	16:59:00	8.84	-	-	-	-	
	17:01:05	-	-	-	6.45	-	
	17:03:30	-	49.2	445	-	-	
	17:08:42	-	-	-	-	6.40	
	17:11:00	-	-	-	6.49	-	
	17:12:00	8.39	-	-	-	-	
	17:13:30	-	49.2	445	-	-	
	17:18:36	-	-	-	-	6.41	
	17:20:00	8.37	-	-	-	-	
	17:22:50	-	-	-	6.42	-	
	17:26:30	-	49.3	445	-	-	
	17:26:30	-	49.3	445	-	-	
	17:28:51	-	-	-	-	6.42	
	17:29:00	8.43	-	-	-	-	
	17:31:03	-	-	-	6.40	-	
	17:32:30	-	49.3	445	-	-	
	17:38:44	-	-	-	-	6.45	

Table C-1 (Continued)

Date	Time (Hr:Min:Sec)	Discharge Well (DW) Depth to Water from ToC (feet)	Discharge Well (DW) Manometer Tube Reading (inches)	Discharge Well (DW) Calculated Flow (gpm)	Observation Well 1 Depth to Water from ToC (feet)	Observation Well 2 Depth to Water from (ToC (feet)	Remarks
8/20/85	17:41	8.40	-	-	6.48	-	
	17:45	-	49.4	446	-	-	
	17:49	-	-	-	6.39	-	
	17:50	8.41	-	-	-	-	
	17:54	-	49.4	446	-	6.43	
	18:01	8.40	-	-	-	-	
	18:43	-	-	-	6.51	-	
	18:45	-	49.4	446	-	-	
	18:47	-	-	-	-	6.47	
	18:50	8.38	-	-	-	-	
	19:17	8.46	-	-	-	-	
	19:18	-	50.9	453	-	-	Discharge Valve Closed Slightly
	19:20	-	-	-	-	6.48	
	19:24	-	-	-	6.58	-	
	19:39	-	48.8	443	-	-	
	19:45	-	-	-	-	-	Water Sample
	19:54	8.49	-	-	-	-	
	19:56	-	-	-	-	6.49	
	19:58	-	-	-	6.55	-	
	19:59	-	49.0	444	-	-	
	20:41	8.46	-	-	-	-	
	20:43	-	-	-	6.56	-	
	20:47	-	-	-	-	6.47	
	20:51	-	50.2	449	-	-	
	21:00	-	-	-	-	-	Water Sample
	21:40	8.49	-	-	-	-	
	21:42	-	-	-	6.58	-	
	21:45	-	-	-	-	6.51	
	21:50	-	51.0	453	-	-	Discharge Valve Closed Slightly
	21:51	-	48.8	443	-	-	

Table C-1 (Continued)

Date	Time (Hr:Min:Sec)	Discharge Well (DW) Depth to Water from ToC (feet)	Discharge Well (DW) Manometer Tube Reading (inches)	Discharge Well (DW) Calculated Flow (gpm)	Observation Well 1 Depth to Water from ToC (feet)	Observation Well 2 Depth to Water from (ToC (feet)	Remarks
8/20/85	22:35	8.45	-	-	-	-	
	22:37	-	-	-	6.59	-	
	22:39	-	-	-	-	6.51	
	22:44	-	48.8	443	-	-	
	22:45	-	-	-	-	-	Water Sample
	23:42	8.47	-	-	-	-	
	23:45	-	-	-	6.60	-	
	23:49	-	-	-	-	6.52	
	23:53	-	49.2	445	-	-	
8/21/85	00:42	8.46	-	-	-	-	
	00:45	-	-	-	6.58	-	
	00:48	-	-	-	-	6.50	
	00:53	-	49.1	444	-	-	
	00:54	-	-	-	-	-	Water Sample
	01:40	8.42	-	-	-	-	
	01:43	-	-	-	6.59	-	
	01:46	-	-	-	-	6.50	
	01:51	-	49.3	445	-	-	
	01:53	-	-	-	-	-	Water Sample
	02:42	8.45	-	-	-	-	
	02:50	-	-	-	6.56	-	
	02:55	-	-	-	-	6.50	
	03:00	-	49.4	446	-	-	
	03:40	8.50	-	-	-	-	
	03:44	-	-	-	6.55	-	
	03:48	-	-	-	-	6.50	
	03:52	-	49.6	446	-	-	
	03:57	-	-	-	-	-	Water Sample
	04:38	8.50	-	-	-	-	
	04:41	-	-	-	6.59	-	

Table C-1 (Continued)

Date	Time (Hr:Min:Sec)	Discharge Well (DW) Depth to Water from ToC (feet)	Discharge Well (DW) Manometer Tube Reading (inches)	Discharge Well (DW) Calculated Flow (gpm)	Observation Well 1 Depth to Water from ToC (feet)	Observation Well 2 Depth to Water from (ToC (feet)	Remarks
8/21/85	04:45	-	49.3	445	-	-	
	04:48	-	-	-	-	6.50	
	05:45	8.48	-	-	-	-	
	05:48	-	-	-	6.60	-	
	05:52	-	-	-	-	6.50	
	06:00	-	49.3	445	-	-	
	06:02	-	-	-	-	-	Water Sample
	06:40	-	49.8	447	-	-	
	07:58	8.40	-	-	-	-	
	08:02	-	-	-	6.70	-	
	08:05	-	-	-	-	6.55	
	08:10	-	49.9	448	-	-	
	08:15	-	-	-	-	-	Water Sample
	08:20	-	-	-	6.70	-	
	08:25	8.40	-	-	-	-	
	09:02	8.30	-	-	-	-	
	09:05	-	-	-	6.75	-	
	09:10	-	-	-	-	6.65	
	09:12	-	49.8	447	-	-	
	10:15	8.43	-	-	-	-	
	10:17	-	-	-	-	6.64	
	10:19	-	-	-	6.71	-	
	10:24	-	49.8	447	-	-	
	10:27	-	-	-	-	-	Water Sample
	10:58	8.39	-	-	-	-	
	11:02	-	-	-	-	6.62	
	11:04	-	-	-	6.71	-	
	11:07	-	49.7	447	-	-	
	11:59	8.41	-	-	-	-	
	12:01	-	-	-	6.72	-	

Table C-1 (Continued)

Date	Time (Hr:Min:Sec)	Discharge Well (DW) Depth to Water from ToC (feet)	Discharge Well (DW) Manometer Tube Reading (inches)	Discharge Well (DW) Calculated Flow (gpm)	Observation Well 1 Depth to Water from ToC (feet)	Observation Well 2 Depth to Water from (ToC (feet)	Remarks
8/21/85	12:04	-	-	-	-	6.62	
	12:07	-	49.7	447	-	-	
	12:11	-	-	-	-	-	Water Sample
	13:00	8.41	-	-	-	-	
	13:02	-	-	-	6.75	-	
	13:05	-	-	-	-	6.64	
	13:09	-	49.8	447	-	-	
	14:04	8.48	-	-	-	-	
	14:06	-	-	-	6.74	-	
	14:08	-	-	-	-	6.67	
	14:12	-	49.8	447	-	-	
	14:13	-	-	-	-	-	Water Sample
	15:03	8.49	-	-	-	-	
	15:05	-	-	-	6.75	-	
	15:06	-	-	-	-	6.66	
	15:10	-	49.7	447	-	-	
	15:15	-	-	-	-	-	Water Sample
	15:47	8.51	-	-	-	-	
	15:48	-	49.6	446	-	-	
	15:50	-	-	-	6.75	-	
	15:55	-	-	-	6.75	-	
	15:57	-	-	-	-	6.68	
	15:58:30	-	-	-	-	-	Recovery Started
	15:58:40	-	-	-	5.76	-	
	15:58:50	-	-	-	-	6.40	
	15:58:58	-	-	-	5.52	-	
	15:59:16	-	-	-	5.42	-	
	15:59:30	-	-	-	-	6.10	
	15:59:37	-	-	-	5.38	-	
	15:59:56	-	-	-	5.32	-	

Table C-1 (Continued)

Date	Time (Hr:Min:Sec)	Discharge Well (DW) Depth to Water from ToC (feet)	Discharge Well (DW) Manometer Tube Reading (inches)	Discharge Well (DW) Calculated Flow (gpm)	Observation Well 1 Depth to Water from ToC (feet)	Observation Well 2 Depth to Water from (ToC (feet)	Remarks
8/21/85	16:00:00	6.70	-	-	-	6.05	
	16:00:15	-	-	-	5.34	-	
	16:00:32	-	-	-	-	6.00	
	16:00:40	-	-	-	5.32	-	
	16:01:00	-	-	-	-	5.99	
	16:01:08	-	-	-	5.29	-	
	16:01:30	-	-	-	5.28	-	
	16:01:35	-	-	-	-	5.99	
	16:02:00	-	-	-	5.24	5.97	
	16:02:30	-	-	-	5.23	-	
	16:02:34	-	-	-	-	5.97	
	16:03:00	-	-	-	5.21	5.97	
	16:03:30	-	-	-	5.20	5.95	
	16:04:00	-	-	-	5.19	5.93	
	16:04:34	-	-	-	-	5.93	
	16:05:00	-	-	-	5.16	-	
	16:05:07	-	-	-	-	5.93	
	16:06:00	-	-	-	5.15	5.90	
	16:06:42	-	-	-	-	5.90	
	16:07:30	-	-	-	5.13	5.88	
	16:08:03	-	-	-	-	5.88	
	16:08:38	-	-	-	-	5.88	
	16:09:15	-	-	-	-	5.88	
	16:10:30	-	-	-	5.10	-	
	16:11:00	6.36	-	-	-	-	
	16:11:36	-	-	-	-	5.85	
	16:12:00	6.35	-	-	-	-	
	16:13:38	-	-	-	5.07	5.76	
	16:17:00	-	-	-	5.06	-	
	16:17:45	-	-	-	-	5.72	
	16:18:30	-	-	-	5.05	-	

Table C-1 (Continued)

Date	Time (Hr:Min:Sec)	Discharge Well (DW) Depth to Water from ToC (feet)	Discharge Well (DW) Manometer Tube Reading (inches)	Discharge Well (DW) Calculated Flow (gpm)	Observation Well 1 Depth to Water from ToC (feet)	Observation Well 2 Depth to Water from (ToC (feet)	Remarks
8/21/85	16:19:38	-	-	-	-	5.70	
	16:22:00	-	-	-	-	5.75	
	16:23:30	-	-	-	5.02	5.75	
	16:24:00	6.20	-	-	-	-	
	16:25:42	-	-	-	-	5.76	
	16:28:30	-	-	-	5.02	5.64	
	16:31:00	6.19	-	-	-	-	
	16:38:30	-	-	-	5.02	-	
	16:46:30	6.19	-	-	-	5.87	
	16:50:00	-	-	-	-	5.85	
	16:52:30	-	-	-	5.00	-	
	16:56:00	6.14	-	-	-	-	
	16:58:30	-	-	-	-	5.84	
	17:01:30	-	-	-	4.99	-	
	17:07:30	6.13	-	-	-	-	
	17:10:30	-	-	-	-	5.84	
	17:12:30	-	-	-	4.95	-	
	17:18:30	6.11	-	-	-	-	
	17:23:30	-	-	-	-	5.81	
	17:25:30	-	-	-	4.94	-	
	17:44	6.09	-	-	-	-	
	17:45	-	-	-	4.94	-	
	17:47	-	-	-	-	5.81	
	18:12	6.09	-	-	-	-	
	18:14	-	-	-	4.95	-	
	18:17	-	-	-	-	5.82	
	18:40	6.07	-	-	-	-	
	18:42	-	-	-	4.93	-	
	18:45	-	-	-	-	5.79	

m:H-28/AA

Table D-1

DRAWDOWN s (feet)

TIME AFTER PUMP STARTED t (MINS.)	DISCHARGE WELL (DW)	OBSERVATION WELL NO. 1 (50' from DW)	OBSERVATION WELL NO. 2 (200' from DW)	COMMENTS
0.00	0.00	0.00	0.00	
0.18	-	1.12	-	
0.30	-	-	0.11	Average discharge rate was 446 gpm
0.50	-	1.41	-	
0.62	-	-	0.32	
0.90	-	1.93	-	
1.25	-	-	0.37	
1.35	-	1.87	-	
1.68	-	-	0.34	
1.92	-	1.37	-	
2.13	-	-	0.32	
2.35	-	1.39	-	
2.67	-	-	0.33	
2.75	-	1.43	-	
3.13	-	1.45	-	
3.33	-	-	0.33	
3.47	-	1.46	-	
3.83	-	1.48	0.30	
4.20	-	1.48	-	
4.42	-	-	0.32	
4.57	-	1.49	-	
4.92	-	-	0.28	
5.00	-	1.49	-	
5.45	-	-	0.32	
5.92	-	-	0.33	
6.00	-	1.53	-	
6.50	-	-	0.33	
7.00	-	1.53	0.35	
7.50	-	-	0.32	
8.05	-	-	0.34	
9.00	-	1.59	0.62	
9.75	-	-	0.60	
12.00	-	1.60	0.62	
14.00	-	-	0.62	
16.13	-	-	0.62	
16.33	-	1.63	-	
18.08	-	-	0.66	
19:00	-	1.65	-	
20.08	-	-	0.66	

Table D-1 (Continued)

DRAWDOWN s (feet)

TIME AFTER PUMP STARTED t (MINS.)	DISCHARGE WELL (DW)	OBSERVATION WELL NO. 1 (50' from DW)	OBSERVATION WELL NO. 2 (200' from DW)	COMMENTS
22.00	-	1.67	-	
25.00	-	-	0.67	
26.00	-	1.67	-	Average Discharge Rate was 446 gpm
29.50	2.41	-	-	
30.15	-	-	0.61	
33.50	2.34	-	-	
35.00	-	-	0.65	
37.50	-	1.63	-	
41.50	2.62	-	-	
43.72	-	-	0.70	
46.33	-	1.65	-	
51.75	-	-	0.71	
52.50	2.40	-	-	
54.00	-	1.62	-	
60.13	-	-	0.71	
60.50	2.86	-	-	
62.58	-	1.62	-	
70.20	-	-	0.72	
72.50	-	1.66	-	
73.50	2.41	-	-	
80.10	-	-	0.73	
81.50	2.39	-	-	
84.33	-	1.59	-	
90.35	-	-	0.74	
90.50	2.45	-	-	
92.55	-	1.57	-	
100.2	-	-	0.77	
102.5	2.42	1.65	-	
110.5	-	1.56	-	
111.5	2.43	-	-	
115.5	-	-	0.75	
122.5	2.42	-	-	
164.5	-	1.68	-	
168.5	-	-	0.79	
171.5	2.40	-	-	
198.5	2.48	-	-	
201.5	-	-	0.80	
205.5	-	1.75	-	
235.5	2.51	-	-	

Table D-1 (Continued)

DRAWDOWN s (feet)

TIME AFTER PUMP STARTED t (MINS.)	DISCHARGE WELL (DW)	OBSERVATION WELL NO. 1 (50' from DW)	OBSERVATION WELL NO. 2 (200' from DW)	COMMENTS
237.5	-	-	0.81	
239.5	-	1.72	-	
282.5	2.48	-	-	Average Discharge Rate was 446 gpm
284.5	-	1.73	-	
288.5	-	-	0.79	
341.5	2.51	-	-	
343.5	-	1.75	-	
346.5	-	-	0.83	
396.5	2.47	-	-	
398.5	-	1.76	-	
400.5	-	-	0.83	
463.5	2.49	-	-	
466.5	-	1.77	-	
470.5	-	-	0.84	
523.5	2.48	-	-	
526.5	-	1.75	-	
529.5	-	-	0.82	
581.5	2.44	-	-	
584.5	-	1.76	-	
587.5	-	-	0.82	
643.5	2.47	-	-	
651.5	-	1.73	-	
656.5	-	-	0.82	
701.5	2.52	-	-	
705.5	-	1.72	-	
709.5	-	-	0.82	
759.5	2.52	-	-	
762.5	-	1.76	-	
769.5	-	-	0.82	
826.5	2.50	-	-	
829.5	-	1.77	-	
833.5	-	-	0.82	
959.5	2.42	-	-	
963.5	-	1.87	-	
966.5	-	-	0.87	
981.5	-	1.87	-	
986.5	2.42	-	-	
1023.	232	-	-	
1026.	-	1.92	-	

Table D-1 (Continued)

DRAWDOWN s (feet)

TIME AFTER PUMP STARTED t (MINS.)	DISCHARGE WELL (DW)	OBSERVATION WELL NO. 1 (50' from DW)	OBSERVATION WELL NO. 2 (200' from DW)	COMMENTS
1031.	-	-	0.97	
1096.	2.45	-	-	
1098.	-	-	0.96	Average Discharge Rate was 446 gpm
1100.	-	1.88	-	
1139.	2.41	-	-	
1143.	-	-	0.94	
1145.	-	1.88	-	
1200.	2.43	-	-	
1202.	-	1.89	-	
1205.	-	-	0.94	
1261.	2.43	-	-	
1263.	-	1.92	-	
1266.	-	-	0.96	
1325.	2.50	-	-	
1327.	-	1.91	-	
1329.	-	-	0.99	
1384.	2.51	-	-	
1386.	-	1.92	-	
1387.	-	-	0.98	
1428.	2.53	-	-	
1431.	-	1.92	-	
1436.	-	1.92	-	
1438.	-	-	1.00	

m:H-28/BB

Post, Buckley, Schuh & Jernigan, Inc.
CONSULTING ENGINEERS and PLANNERS

MATCH POINT DATA
$1/u = 10^5$
$L(u,v) = 1$
$s = 0.17$ FT.
$t = 42$ MINS.

① $T = \frac{Q}{4\pi} \times \frac{L(u,v)}{s}$

$T = \frac{(446.2 \times 1440) \times 1.0}{4\pi \times 0.17}$

$T = 300{,}770$ gpd/ft.

② $S = \frac{4Tut}{7.48(r^2)}$

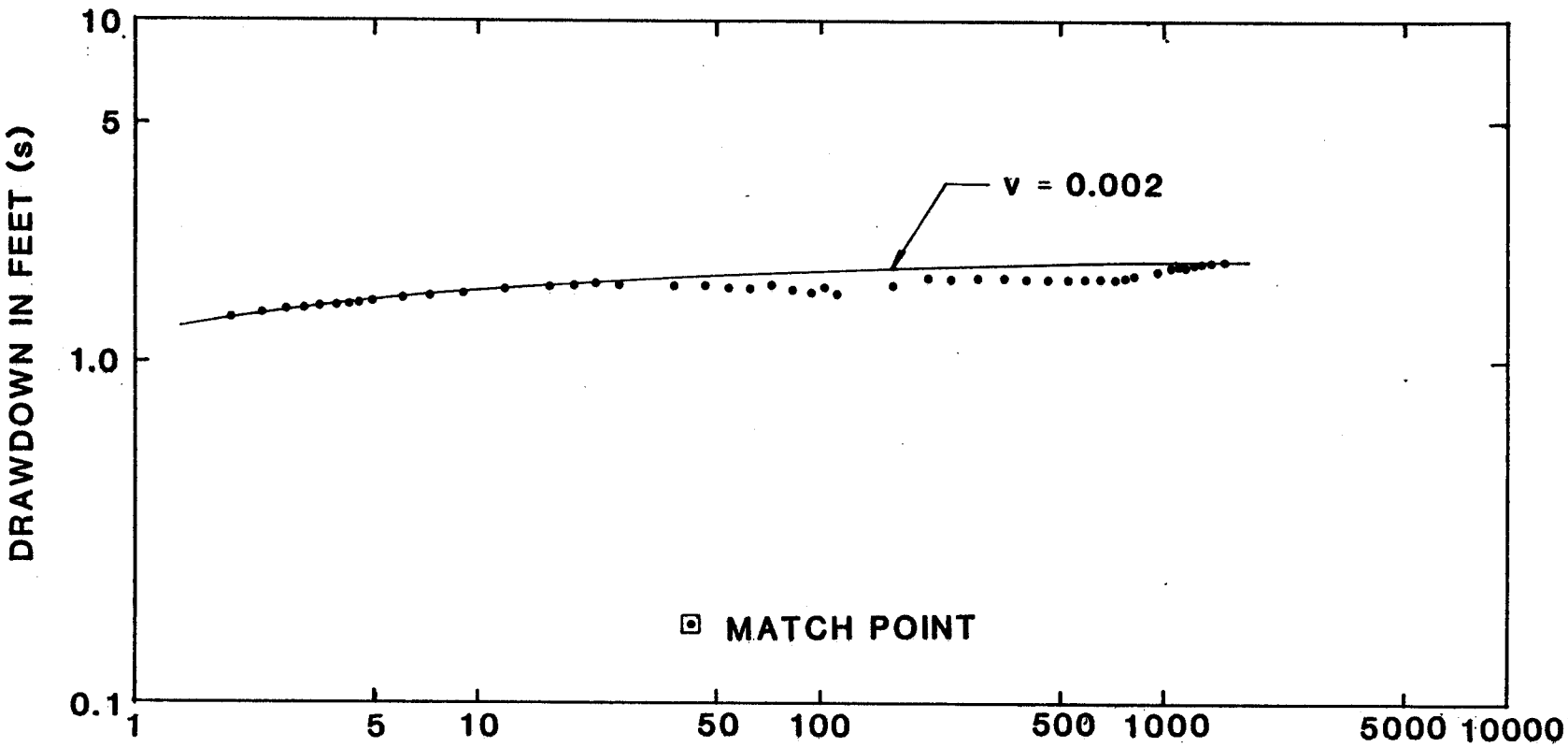
$S = \frac{4 \times 300{,}770 \times 42}{1440 \times 7.48 \times 10^5 \times 50^2}$

$S = 1.876 \times 10^{-5}$

③ $L = 4T\frac{v^2}{r^2}$

$L = \frac{4 \times 300{,}770 \times 0.002^2}{7.48 \times 50^2}$

$L = 2.57 \times 10^{-4}$ days^{-1}



TYPE CURVE SOLUTION FOR OBSERVATION WELL No. 1 (DRAWDOWN)

Post, Buckley, Schuh & Jernigan, Inc.
CONSULTING ENGINEERS and PLANNERS

MATCH POINT DATA $1/u = 10^3$

$L(u,v) = 1$

$s = 0.095$ FT.

$t = 12.2$ MIN.

① $T = \frac{Q}{4\pi} \times \frac{L(u,v)}{s}$

$T = \frac{(446.2 \times 1440) \times 1.0}{4\pi \times 0.095}$

$T = 538{,}220$ gpd/ft

② $S = \frac{4Tut}{7.48(r^2)}$

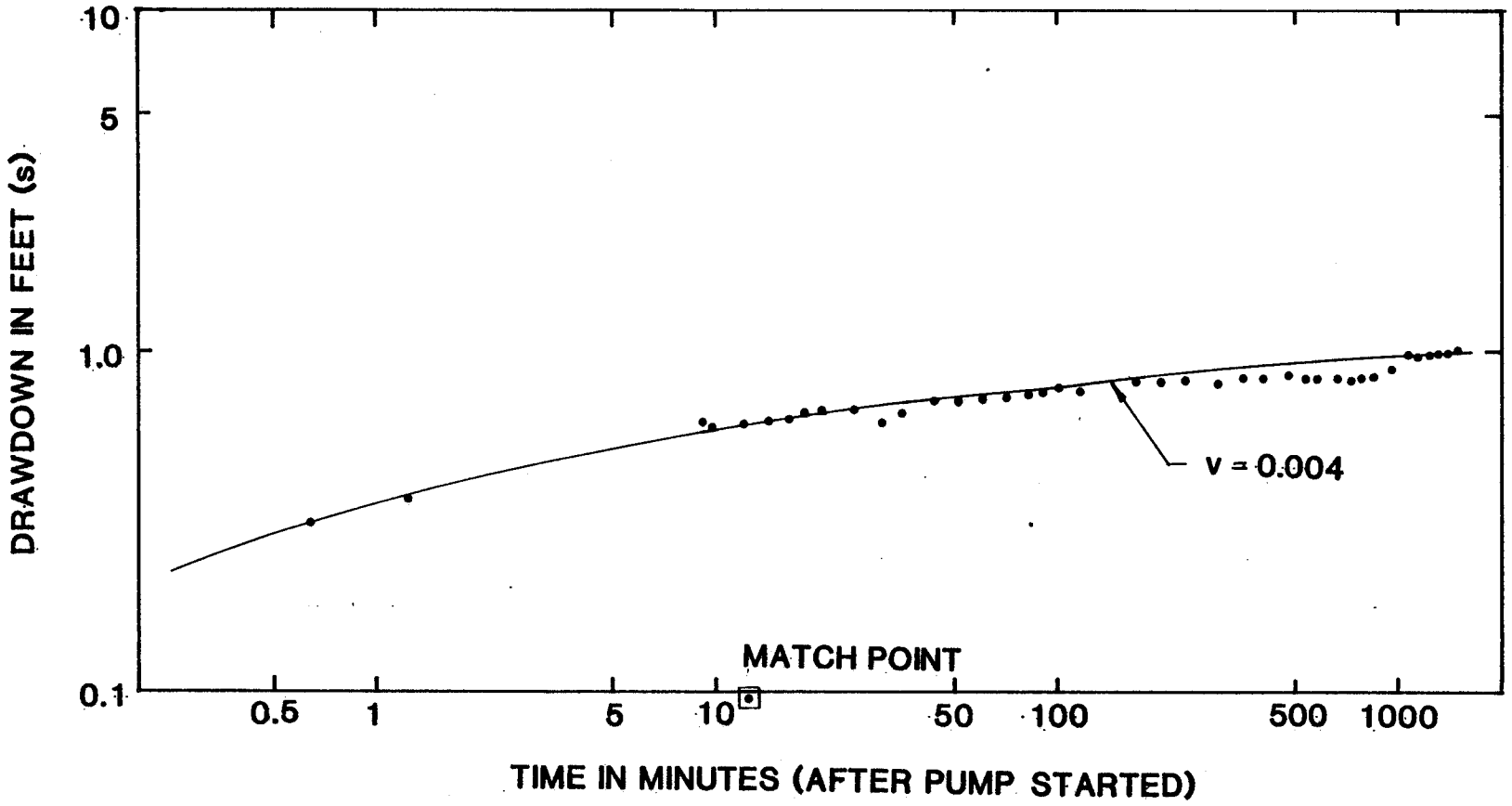
$S = \frac{4 \times 538{,}220 \times 12.2}{7.48 \times 200^2 \times 10^3 \times 1440}$

$S = 6.1 \times 10^{-5}$

③ $L = 4T\frac{v^2}{r^2}$

$L = \frac{4 \times 538220 \times 0.004^2}{7.48 \times 200^2}$

$L = 1.15 \times 10^{-4}$ days^{-1}



TYPE CURVE SOLUTION FOR OBSERVATION WELL No. 2 (DRAWDOWN)

Table D-2

RESIDUAL DRAWDOWNS s' (feet)

TIME AFTER PUMP STOPPED t (MINS.)	DISCHARGE WELL (DW)	OBSERVATION WELL NO. 1 (50' from DW)	OBSERVATION WELL NO. 2 (200' from DW)	COMMENTS
0.00	0.00	0.00	0.00	Started Recovery
0.17	-	0.99	-	
0.33	-	-	0.28	
0.47	-	1.23	-	
0.77	-	1.33	-	
1.00	-	-	0.58	
1.12	-	1.37	-	
1.43	-	1.43	-	
1.50	1.81	-	0.63	
1.75	-	1.41	-	
2.03	-	-	0.68	
2.17	-	1.43	-	
2.50	-	-	0.69	
2.63	-	1.46	-	
3.00	-	1.47	-	
3.08	-	-	0.69	
3.50	-	1.51	0.71	
4.00	-	1.52	-	
4.07	-	-	0.71	
4.50	-	1.54	0.71	
5.00	-	1.55	0.73	
5.50	-	1.56	0.75	
6.07	-	-	0.75	
6.50	-	1.59	-	
6.62	-	-	0.75	
7.50	-	1.60	0.78	
8.20	-	-	0.78	
9.00	-	1.62	0.80	
9.55	-	-	0.80	
10.13	-	-	0.80	
10.75	-	-	0.80	
12.00	-	1.65	-	
12.50	2.15	-	-	
13.10	-	-	0.83	
13.50	2.16	-	-	
15.13	-	1.68	0.92	
18.50	-	1.69	-	
19.25	-	-	0.96	
20.00	-	1.70	-	

Table D-2 (Continued)

RESIDUAL DRAWDOWNS s' (feet)

TIME AFTER PUMP STOPPED t (MINS.)	DISCHARGE WELL (DW)	OBSERVATION WELL NO. 1 (50' from DW)	OBSERVATION WELL NO. 2 (200' from DW)	COMMENTS
21.13	-	-	0.98	
23.50	-	-	0.93	
25.00	-	1.73	0.93	
25.50	2.31	-	-	
27.20	-	-	0.92	
30.00	-	1.73	1.04	
32.50	2.32	-	-	
40.00	-	1.73	-	
48.00	2.32	-	0.81	
51.50	-	-	0.83	
54.00	-	1.75	-	
57.50	2.37	-	-	
60.00	-	-	0.84	
63.00	-	1.76	-	
69.00	2.38	-	-	
72.00	-	-	0.84	
74.00	-	1.80	-	
80.00	2.40	-	-	
85.00	-	-	0.87	
87.00	-	1.81	-	
106.0	242	-	-	
107.0	-	1.81	-	
109.0	-	-	0.87	
134.0	2.42	-	-	
136.0	-	1.82	-	
139.0	-	0	0.88	
162.0	244	-	-	
164.0	-	1.84	-	
167.0	-	-	0.91	

m:H-28/CC

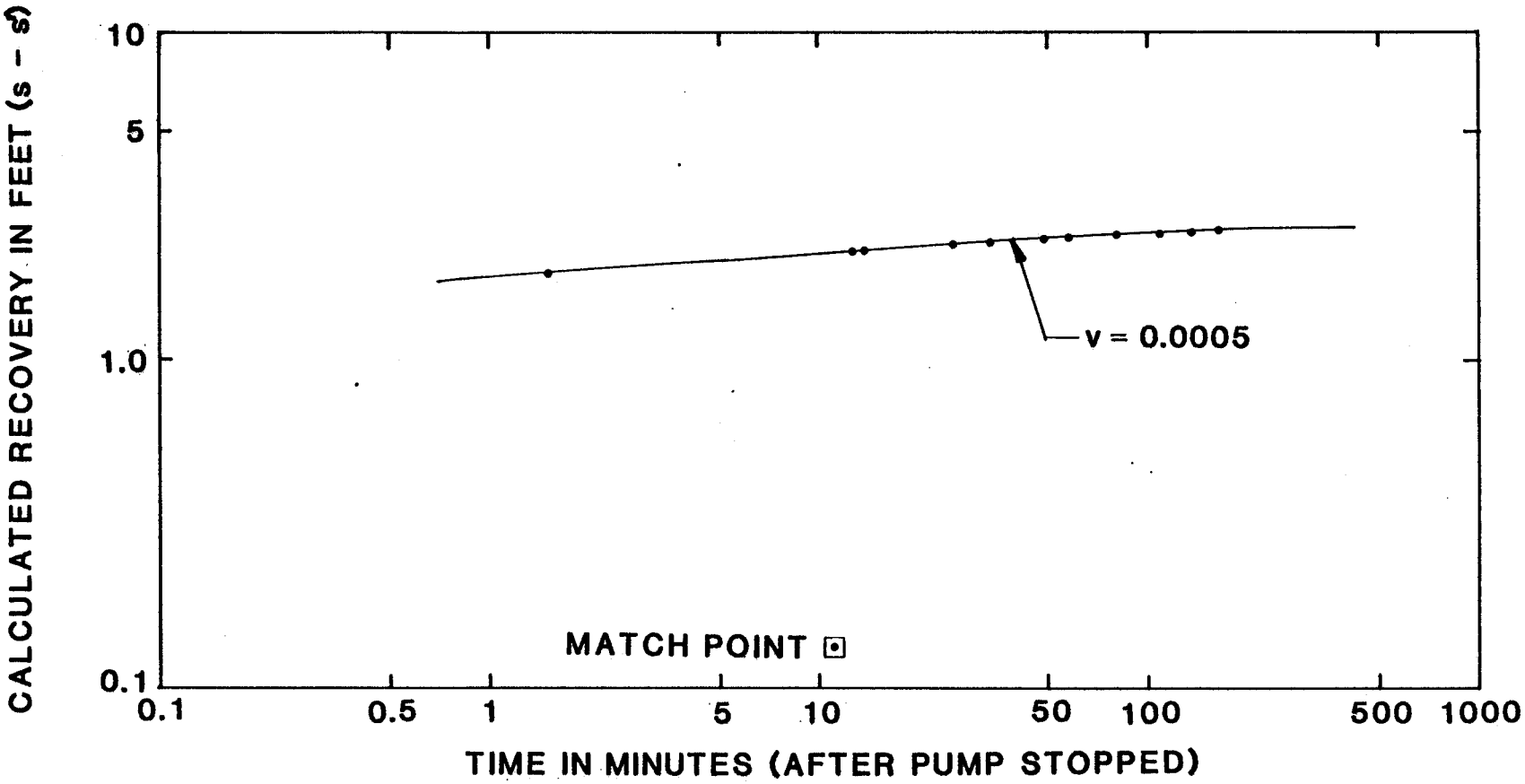
Post, Buckley, Schuh & Jernigan, Inc.
CONSULTING ENGINEERS and PLANNERS

MATCH POINT DATA
$1/u = 10^7$
$L(u,v) = 1$
$v = 0.0005$
$s = 0.132$
$t = 11.2$

$$T = \frac{Q}{4\pi} \times \frac{L(u,v)}{s}$$

$$T = \frac{(446.2 \times 1440) \times 1.0}{4\pi \times 0.132}$$

$T = 387{,}354$ gpd/ft.



TYPE CURVE SOLUTION FOR DISCHARGE WELL (RECOVERY)

Post, Buckley, Schuh & Jernigan, Inc.
CONSULTING ENGINEERS and PLANNERS

MATCH POINT DATA

$1/u = 10^{-5}$

$S = 0.18$

$t = 36$

$L(u,v) = 1.0$

$v = 0.005$

① $T = \frac{Q}{4\pi} \times \frac{L(u,v)}{s}$

$T = \frac{(446.2 \times 1440) \times 1.0}{4\pi \times 0.18}$

$T = 284{,}060$ gpd/ft

② $S = \frac{4Tut}{7.48r^2}$

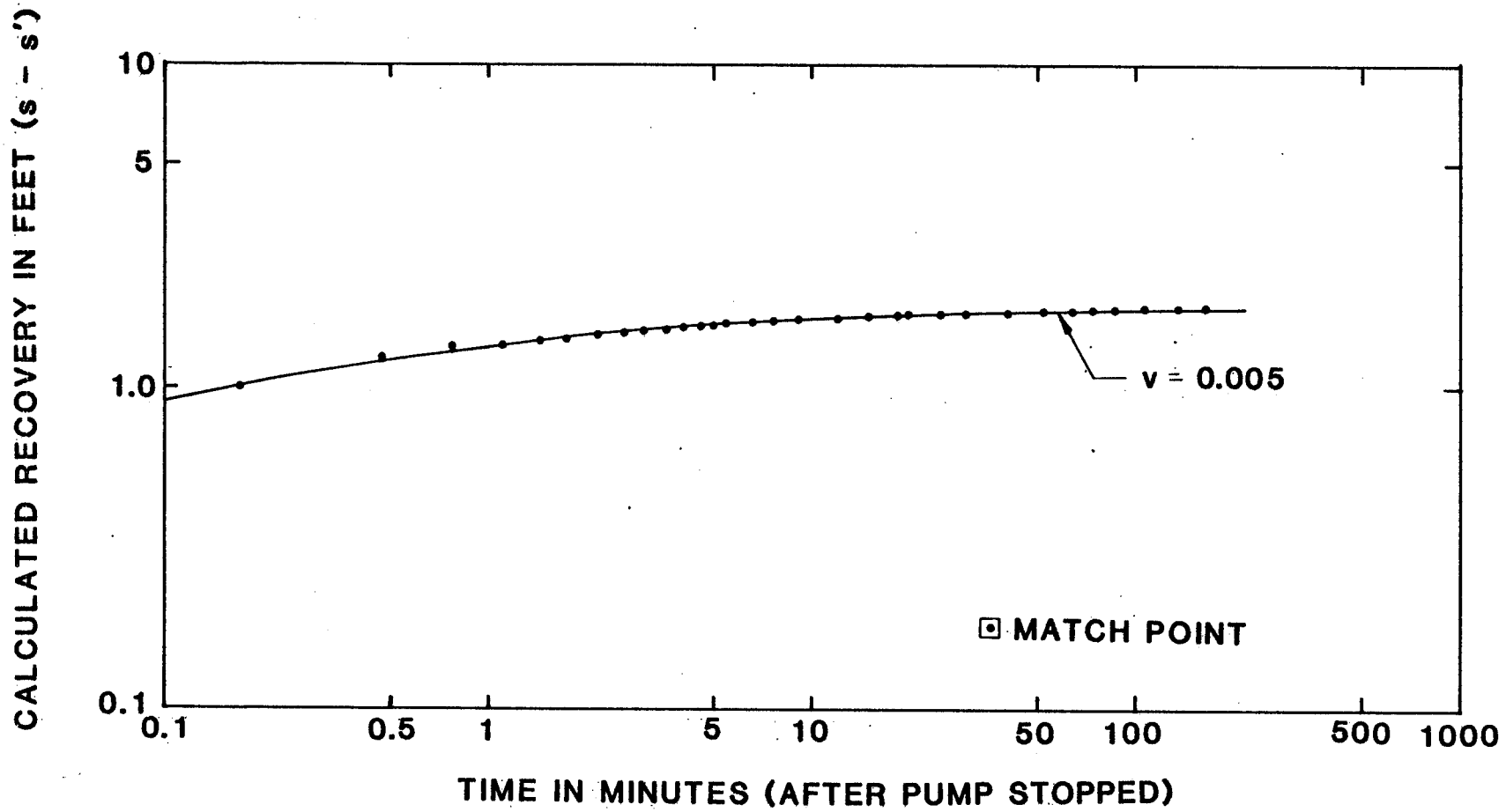
$S = \frac{4 \times 284{,}060 \times 36 \times 10^{-5}}{7.48 \times 1440 \times 50^2}$

$S = 1.52 \times 10^{-5}$

③ $L = 4T\frac{v^2}{r^2}$

$L = \frac{4 \times 284{,}060 \times 0.005^2}{50^2 \times 7.48}$

$L = 1.52 \times 10^{-3}$ days^{-1}



TYPE CURVE SOLUTION FOR OBSERVATION WELL No. 1 (RECOVERY)

Post, Buckley, Schuh & Jernigan, Inc.
CONSULTING ENGINEERS and PLANNERS

MATCH POINT DATA

$L(u,v) = 1.0$

$1/u = 10^3$

$s = 0.11$ ft.

$t = 34$ min.

① $T = \frac{Q}{4\pi} \times \frac{L(u,v)}{s}$

$T = \frac{(446.2 \times 1440) \times 1.0}{4\pi \times 0.11}$

$T = 464{,}825$ gpd/ft.

② $S = \frac{4Tut}{7.48r^2}$

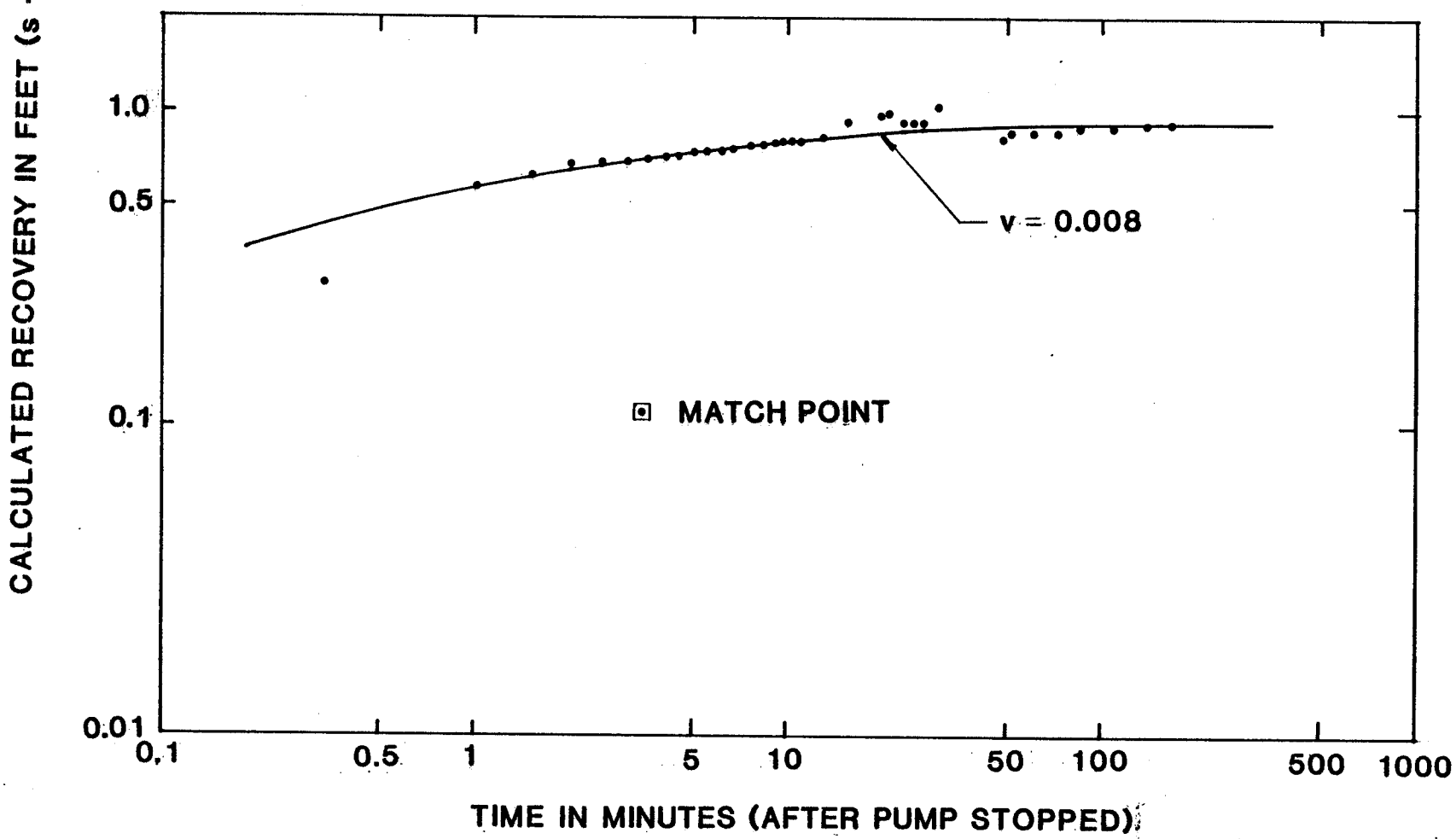
$S = \frac{4 \times 464{,}825 \times 10^{-3} \times 34}{1440 \times 7.48 \times 200^2}$

$S = 1.467 \times 10^{-5}$

③ $L = 4T\frac{v^2}{r^2}$

$L = \frac{4 \times 464{,}825 \times 0.008^2}{7.48 \times 200^2}$

$L = 3.98 \times 10^{-4}$ days^{-1}



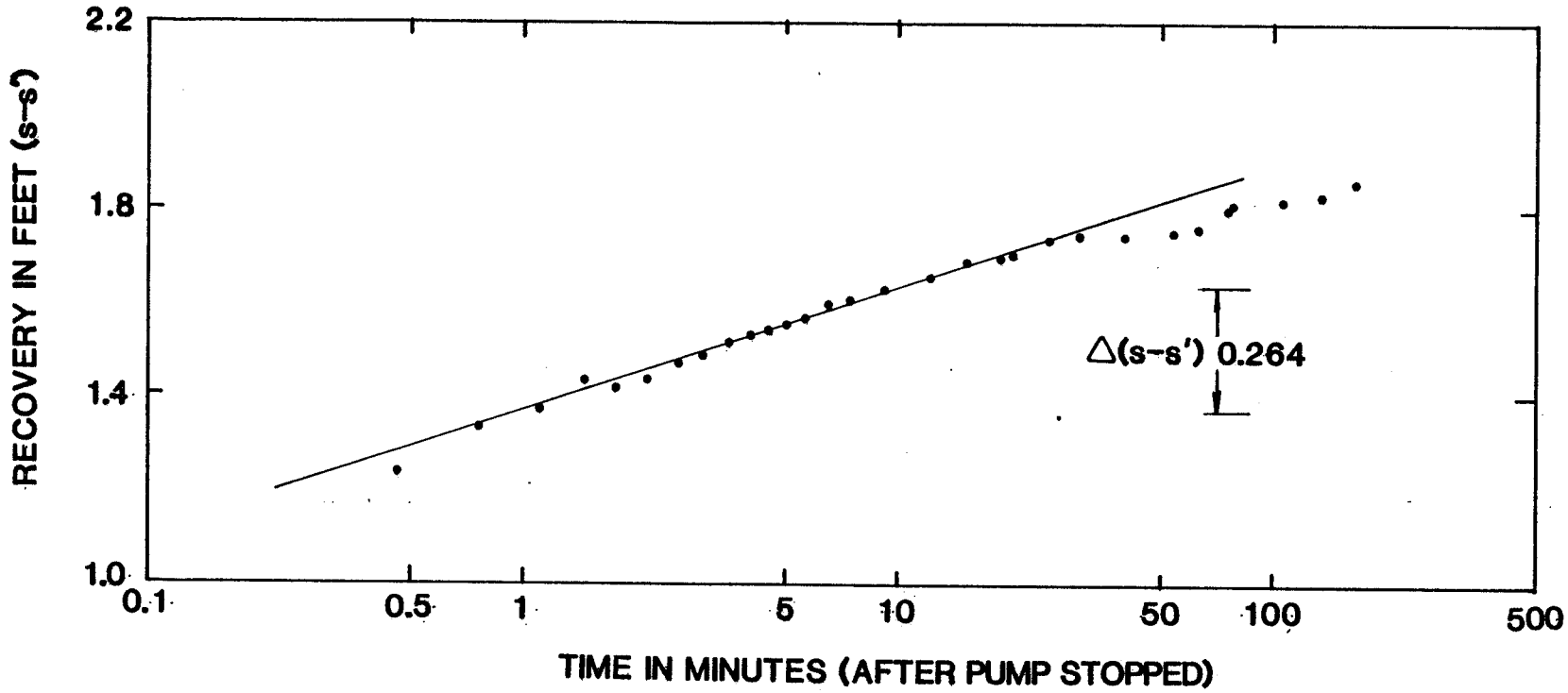
TYPE CURVE SOLUTION FOR OBSERVATION WELL No. 2 (RECOVERY)

Post, Buckley, Schuh & Jernigan, Inc.
CONSULTING ENGINEERS and PLANNERS

$$T = \frac{264(Q)}{\Delta s}$$

$$T = \frac{264 \times 446.2}{0.264}$$

$$T = 446{,}200 \text{ gpd/ft.}$$



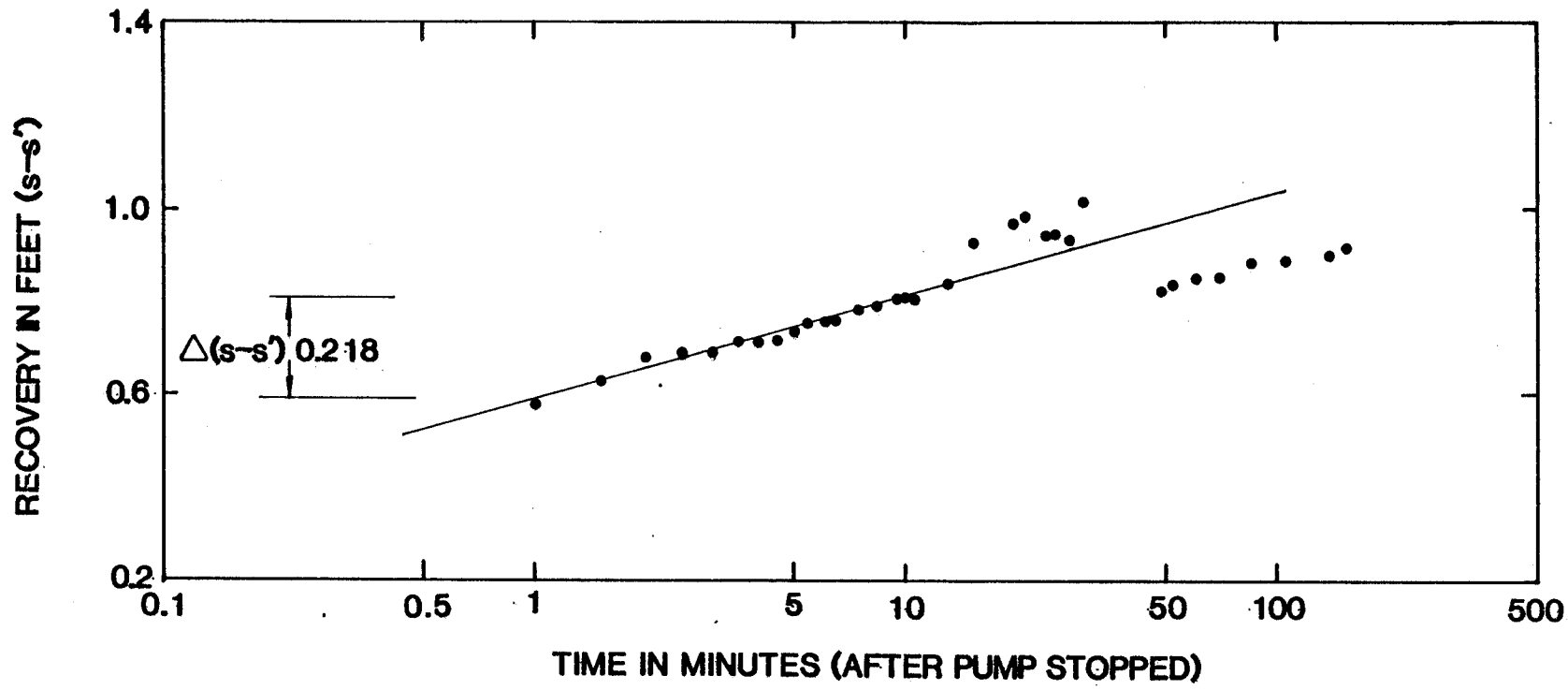
STRAIGHT LINE SOLUTION FOR OBSERVATION WELL No. 1 (RECOVERY)

Post, Buckley, Schuh & Jernigan, Inc.
CONSULTING ENGINEERS and PLANNERS

$$T = \frac{264\,(Q)}{\Delta s}$$

$$T = \frac{264 \times 446.2}{0.218}$$

$$T = 540{,}350 \text{ gpd/ft.}$$



STRAIGHT LINE SOLUTION FOR OBSERVATION WELL No. 2 (RECOVERY)

Table D-3

RECOVERY TEST METHOD TABULATION

TIME SINCE PUMP STARTED t (MINS.)	TIME SINCE PUMP STOPPED t' (MINS.)	RATIO t/t'	RECOVERY s-s' (FEET) (50' from DW) OBSERVATION WELL #1	RECOVERY s-s' (FEET) (200' from DW) OBSERVATION WELL #2	COMMENTS
1440.00	0.00	-	1.92	1.00	Started Recovery
1440.17	0.17	8,641.0	0.93	-	
1440.33	0.33	4,321.0	-	0.72	
1440.47	0.47	3,086.7	0.69	-	
1440.77	0.77	1,871.1	0.59	-	
1441.00	1.00	1,441.0	-	0.42	
1441.12	1.12	1,286.7	0.55	-	
1441.43	1.43	1,008.0	0.49	-	
1441.50	1.50	961.0	-	0.37	
1441.75	1.75	823.9	0.51	-	
1442.03	2.03	710.4	-	0.32	
1442.17	2.17	665.6	0.49	-	
1442.50	2.50	577.0	-	0.31	
1442.63	2.63	548.5	0.46	-	
1443.00	3.00	481.0	0.45	-	
1443.08	3.08	468.5	-	0.31	
1443.50	3.50	412.4	0.41	0.29	
1444.00	4.00	361.0	0.40	-	
1444.07	4.07	354.8	-	0.29	
1444.50	4.50	321.0	0.38	0.29	
1445.00	5.00	289.0	0.37	0.27	
1445.50	5.50	262.8	0.36	0.25	
1446.07	6.07	238.2	-	0.25	
1446.50	6.50	222.5	0.33	-	
1446.62	6.62	218.5	-	0.25	
1447.50	7.50	193.0	0.32	0.22	
1448.20	8.20	176.6	-	0.22	
1449.00	9.00	161.0	0.30	0.20	
1449.55	9.55	151.8	-	0.20	
1450.13	10.13	143.2	-	0.20	
1450.75	10.75	134.9	-	0.20	
1452.00	12.00	121.0	0.27	-	
1452.50	12.50	116.2	-	-	
1453.10	13.10	110.9	-	0.17	
1453.50	13.50	107.7	-	-	
1455.13	15.13	96.2	0.24	0.08	
1458.50	18.50	78.8	0.23	-	
1459.25	19.25	75.8	-	0.04	
1460.00	20.00	73.0	0.22	-	

Table D-3 (Continued)

RECOVERY TEST METHOD TABULATION

TIME SINCE PUMP STARTED t (MINS.)	TIME SINCE PUMP STOPPED t' (MINS.)	RATIO t/t'	RECOVERY s-s' (FEET) (50' from DW) OBSERVATION WELL #1	RECOVERY s-s' (FEET) (200' from DW) OBSERVATION WELL #2	COMMENTS
1461.13	21.13	69.1	-	0.02	
1463.50	23.50	62.3	-	0.07	
1465.00	25.00	58.6	0.19	0.07	
1465.50	25.50	57.5	-	-	
1467.20	27.20	53.9	-	0.08	
1470.00	30.00	49.0	0.19	-0.04	
1472.50	32.50	45.3	-	-	
1480.00	40.00	37.0	0.19	-	
1488.00	48.00	31.0	-	0.19	
1491.50	51.50	28.9	-	0.17	
1494.00	54.00	27.7	0.17	-	
1497.50	57.50	26.0	-	-	
1500.00	60.00	25.0	-	0.16	
1503.00	63.00	23.9	0.16	-	
1509.00	69.00	21.9	-	-	
1512.00	72.00	21.0	-	0.16	
1514.00	74.00	20.5	0.12	-	
1520.00	80.00	19.0	-	-	
1525.00	85.00	17.9	-	0.13	
1527.00	87.00	17.6	0.11	-	
1546.00	106.0	14.6	-	-	
1547.00	107.0	14.5	0.11	-	
1549.00	109.0	14.2	-	0.13	
1574.00	134.0	11.7	-	-	
1576.00	136.0	11.6	0.10	-	
1579.00	139.0	11.4	-	0.12	
1602.00	162.0	9.9	-	-	
1604.00	164.0	9.8	0.08	-	
1607.00	167.0	9.6	-	0.09	

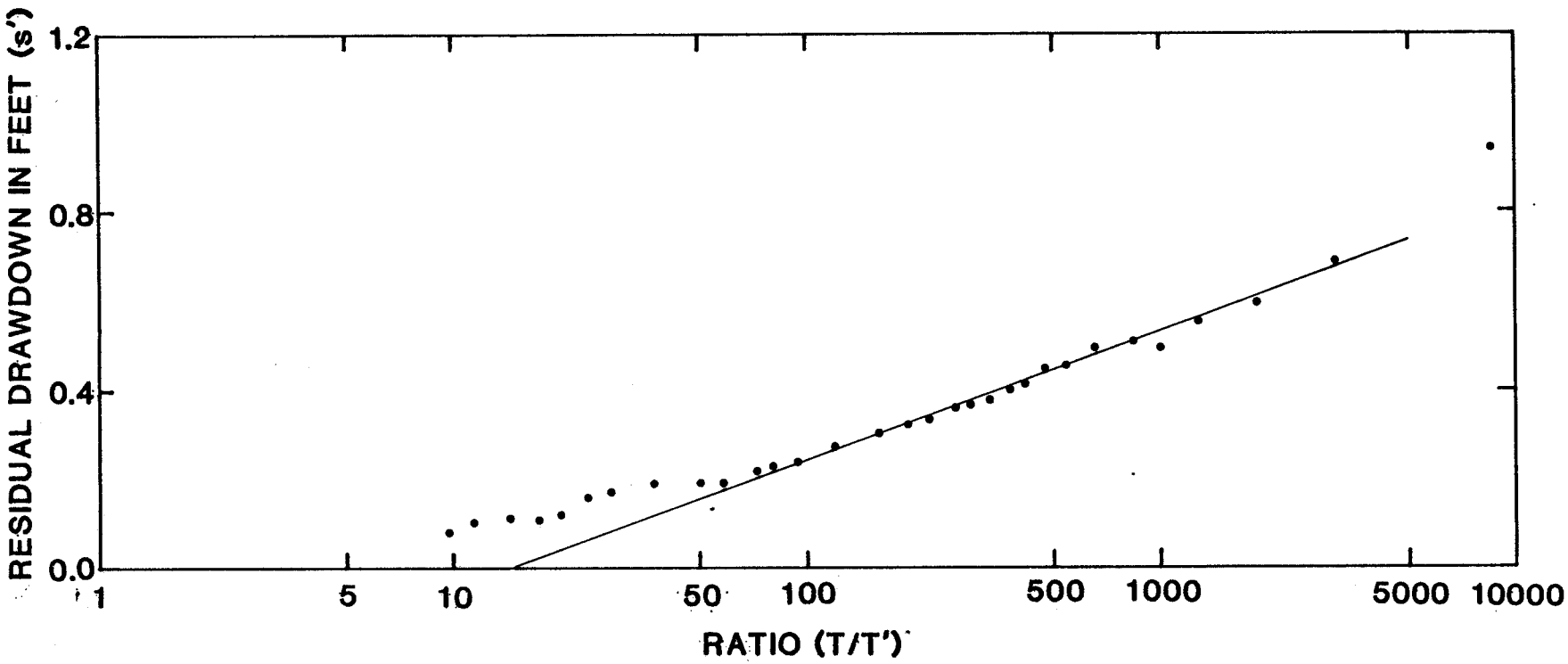
m:H-28/DD

Post, Buckley, Schuh & Jernigan, Inc.
CONSULTING ENGINEERS and PLANNERS

$$T = \frac{264\,(Q)}{\Delta s'}$$

$$T = \frac{264 \times 446.2}{0.291}$$

$$T = 404{,}800 \text{ gpd/ft.}$$



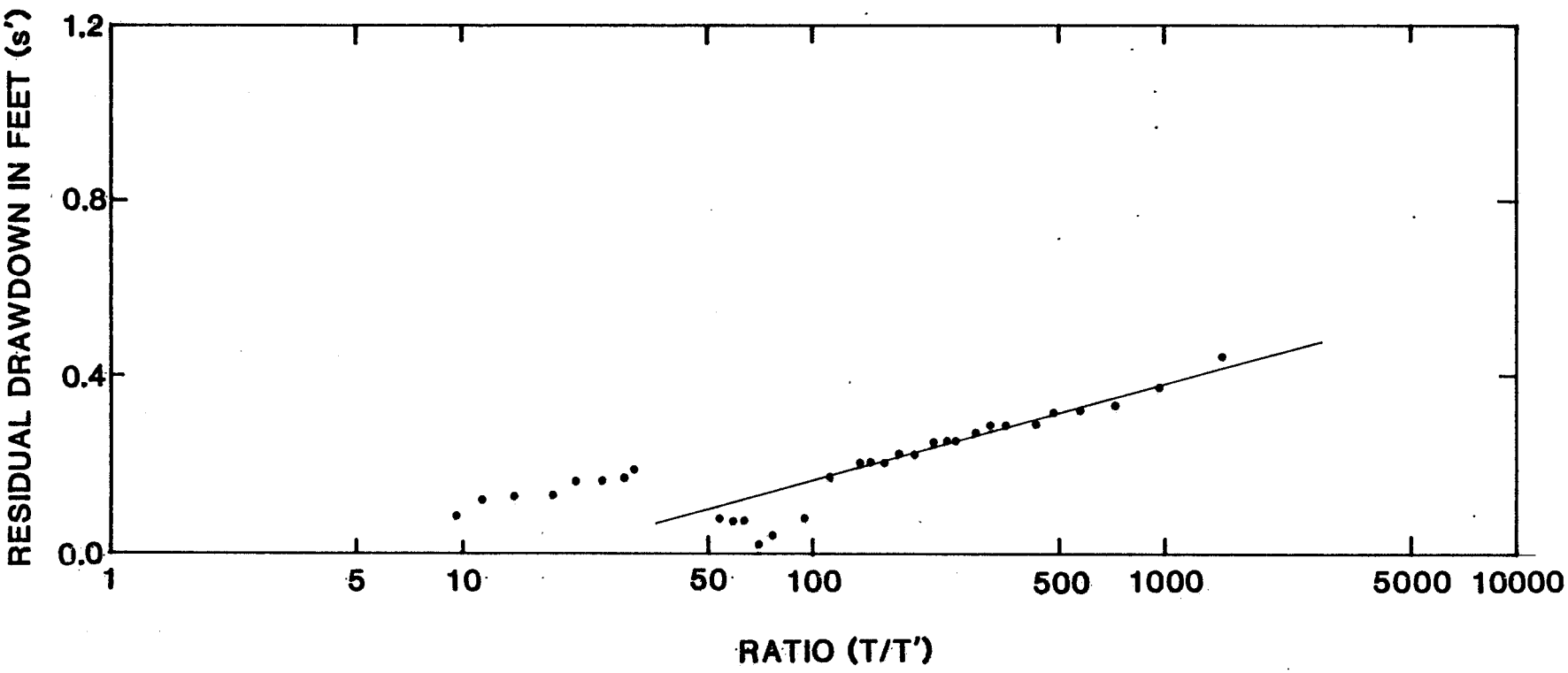
RECOVERY TEST METHOD FOR OBSERVATION WELL No. 1

Post, Buckley, Schuh & Jernigan, Inc.
CONSULTING ENGINEERS and PLANNERS

$$T = \frac{264\,(Q)}{\Delta s'}$$

$$T = \frac{264 \times 446.2}{0.215}$$

$$T = 547{,}900 \text{ gpd/ft.}$$



RECOVERY TEST METHOD FOR OBSERVATION WELL No. 2

BARKER, OSHA & ANDERSON, INC.
ENGINEERS · PLANNERS
860 U.S. HIGHWAY ONE
NORTH PALM BEACH, FLORIDA 33408
305/626-4653

Dan,
here's some
test data
from Lantana,
Jeff Cobbs

December 19, 1983

Mr. Rick Parella
Public Works Director
Greynolds Circle
Town of Lantana, FL 33462

Re: Pumpage Tests, Well No. 5
Contract 80-1047, Division III

Dear Mr. Parella:

Transmitted herewith for your information and records are the results and anlysis of the aquifer/well performance tests conducted December 5, 1983, under the above Contract in conjunction with the construction of the new public water supply Well No. 5.

This information should prove useful to you in comparing future to original performance of this well, and inevaluating the performance of other wells in the Lantana system.

Very truly yours,

BARKER, OSHA & ANDERSON, INC.

James H. Angel
Project Engineer

JHA/pc

cc: Robert Cameron, Town Administrator
Andy Williams, Water Plant Superintendent
George Cook, Alsay-Pippin Corporation
Pat Gleason, SFWMD

BARKER, OSHA & ANDERSON, INC.
ENGINEERS · PLANNERS

AQUIFER/WELL PERFORMANCE TEST
TOWN OF LANTANA WELLFIELD
DECEMBER 5, 1983

I. ACCOMPANYING SKETCHES

PLATE I - Site Sketch
PLATE II - Distance/Drawdown Graph (Test)
PLATE III - Time/Drawdown Graph (Test)
PLATE IV - Well No. 5 Performance Graph
PLATE V - Distance/Drawdown Graph (Typical)
Drillers log

II. DESCRIPTION OF OBSERVED WELLS

NO. 5 (New Well): 12" Casing, 12"/.030" SS continuous slot screen, 40' long, set between 55' and 95' depth, naturally developed.
NO. 4 18" outer casing and borehole, 12" inner casing, 12"/.060" continuous slot screen, 30' long, set between 50' and 80' depth, gravel packed.
Test Well: 2" cemented casing, .030" continuous slot screen, set between 70' and 80' depth, gravel packed (6" dia. Borehole).

III TESTS & ANALYSES

Flow Measurement: 10" orifice and site tube
Drawdown: #5: Electric probe
Test Well & #4: Photographed air gage and timer.
Rates: Test #1: 2 hours @ 2040 GPM
Test #2: 20 minutes successively @ 1108, 1540, 2000, 2518 GPM

Method: Walton, Groundwater Resource Evlauation (1970), Sections 3.8, 4.6 and 5.1

IV. AQUIFER CHARACTERISTICS

Type: Leaky Artesian

Transmissivity: 467,000 gpd/ft = 62,400 sq ft/day

Storativity: .00047

Leakance (P'/m'): 10.6 gpd/sq ft = 1.4 ft/day

V. WELL NO. 5 PERFORMANCE

(See Plates IV & V)

Extrapolated from variable rate pumpage tests, Well No. 5 indicated a drawdown in the casing of 1.9 feet when pumped at the design rate of 1000 gpm, which would be typical of a 24" diameter well (as opposed to the 12" diameter as constructed) when compared with theoretical aquifer performance, thus indicating satisfactory development of the formation adjacent to the screen. The average "well loss constant" (C) at stepped rates between 1100 and 2500 gpm computes to be 0.065. Using the equation

$$Sw = CQ^2$$

where Sw is the well head loss in feet, C is the well loss Constant, and Q is the discharge rate in cu ft/sec, the well loss at 100 gpm computes as follows:

$$Sw = .065 \times (1000/449)^2 = .32 \text{ ft}$$

The well efficiency at 1000 gpm computes as follows; where E = efficiency, Sc = casing drawdown, and Sw = well loss:

$$E = (Sc-Sw)/Sc$$
$$= (1.90-.32)/1.90$$
$$= .83 = 83\%$$

The inference may be drawn that Well No. 5 reacts with the aquifer as would be expected of a 24" diameter well that is 83% efficient, when pumped at the design rate of 1000 gpm.

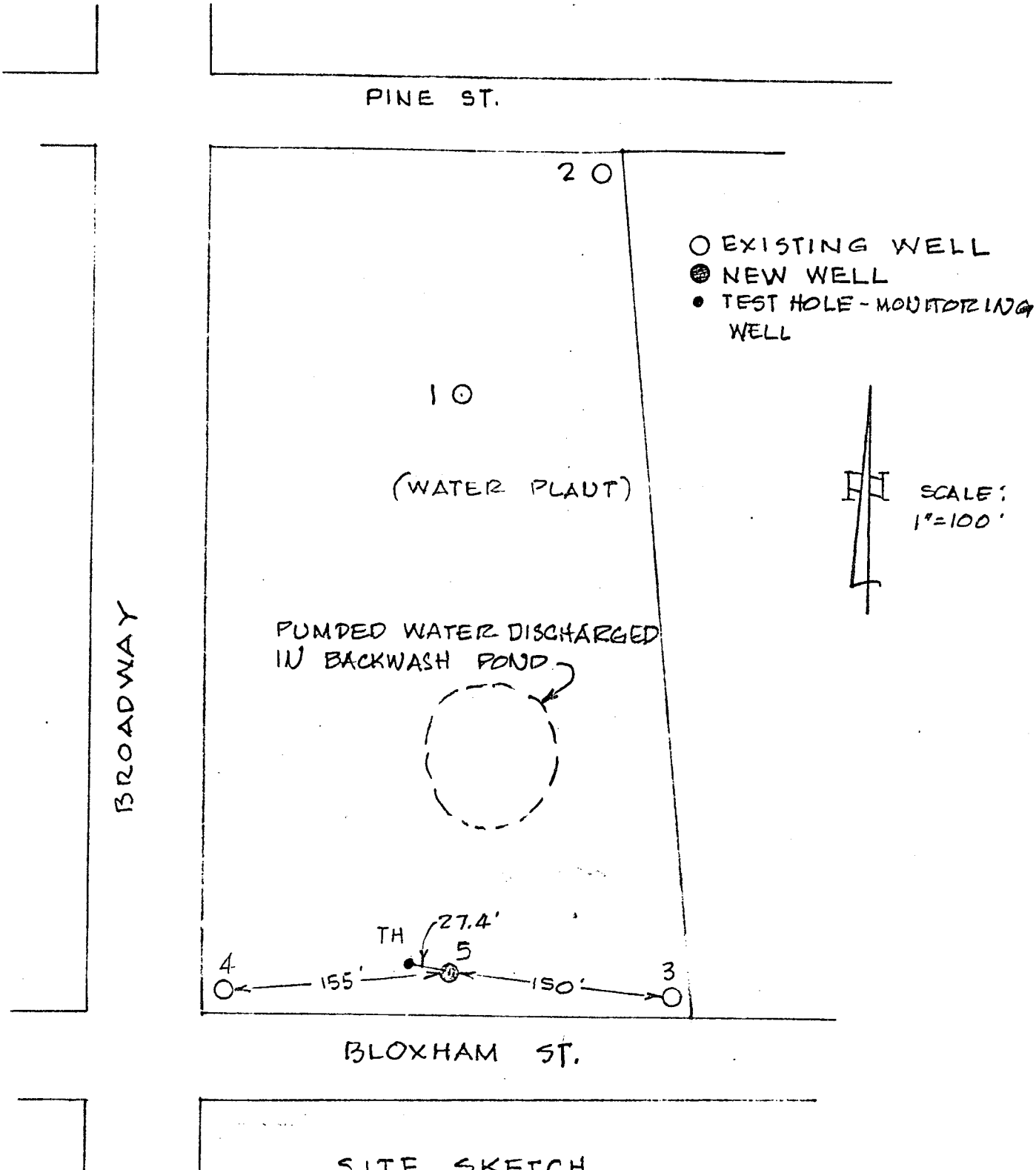
VI. REMARKS

1. All tests indicate that the steady state (constant drawdown) is achieved in about 15 to 20 minutes at pumping rates between 1000 and 2500 gpm.

2. Due to the relatively high leakance of the aquitard, it is possible that after as little as 12 to 24 hours continuous pumping, the reaction would begin to convert to that of a "water table" aquifer, and some further drawdown (in the pumped well) would occur with

continued pumping. However, after 10 days of continuous pumping at 1000 gpm, the additional drawdown is estimated to be less than one foot, and is therefore not significant insofar as the design pumping head is concerned.

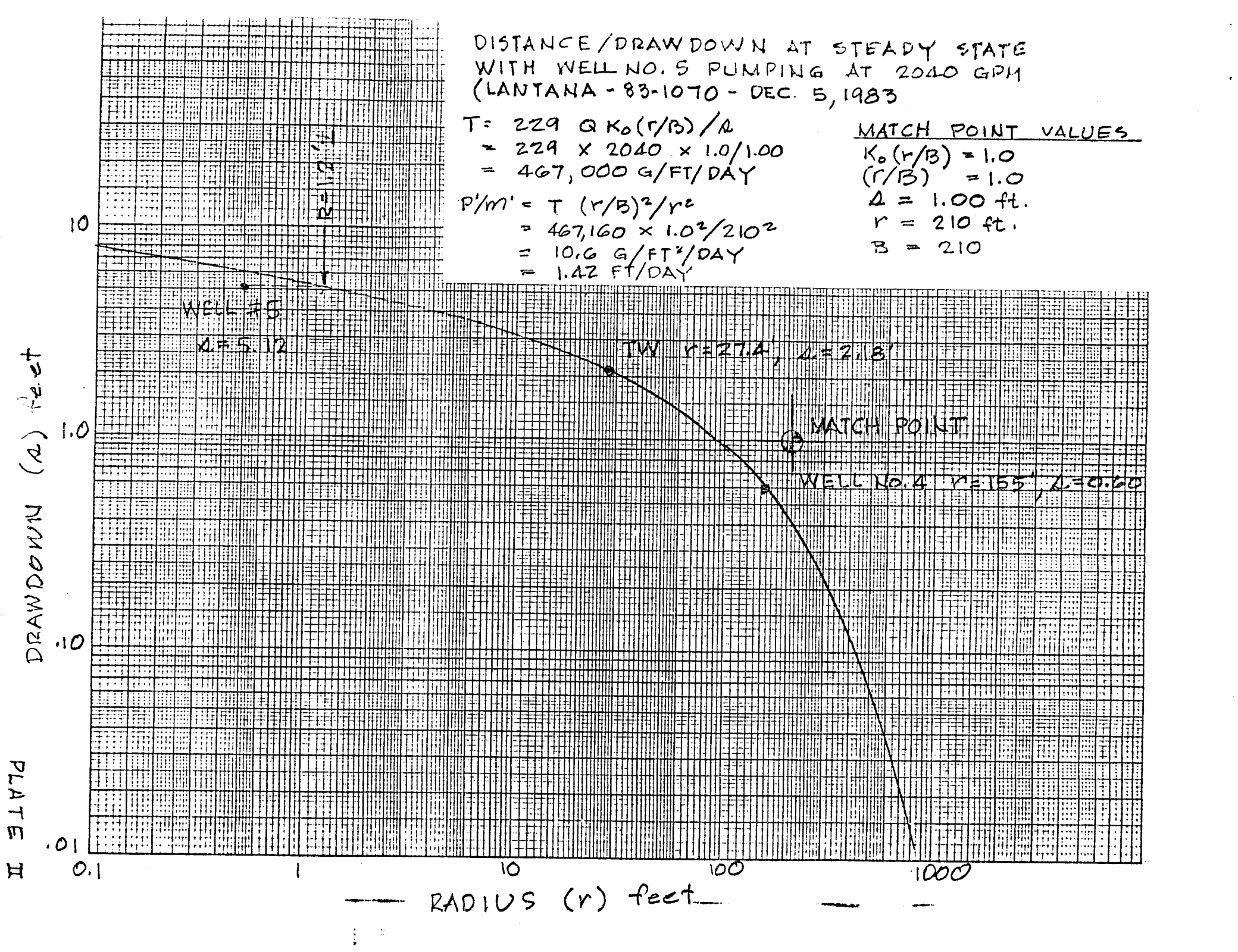
3. Interference between Well No. 5 and other wells is negligible. For example, when Well No. 4 is pumped simultaneously with Well No. 5, each at 1000 gpm, the drawdown increase in each well at the steady state is about 0.3 feet (3½ inches). (See Plate V).

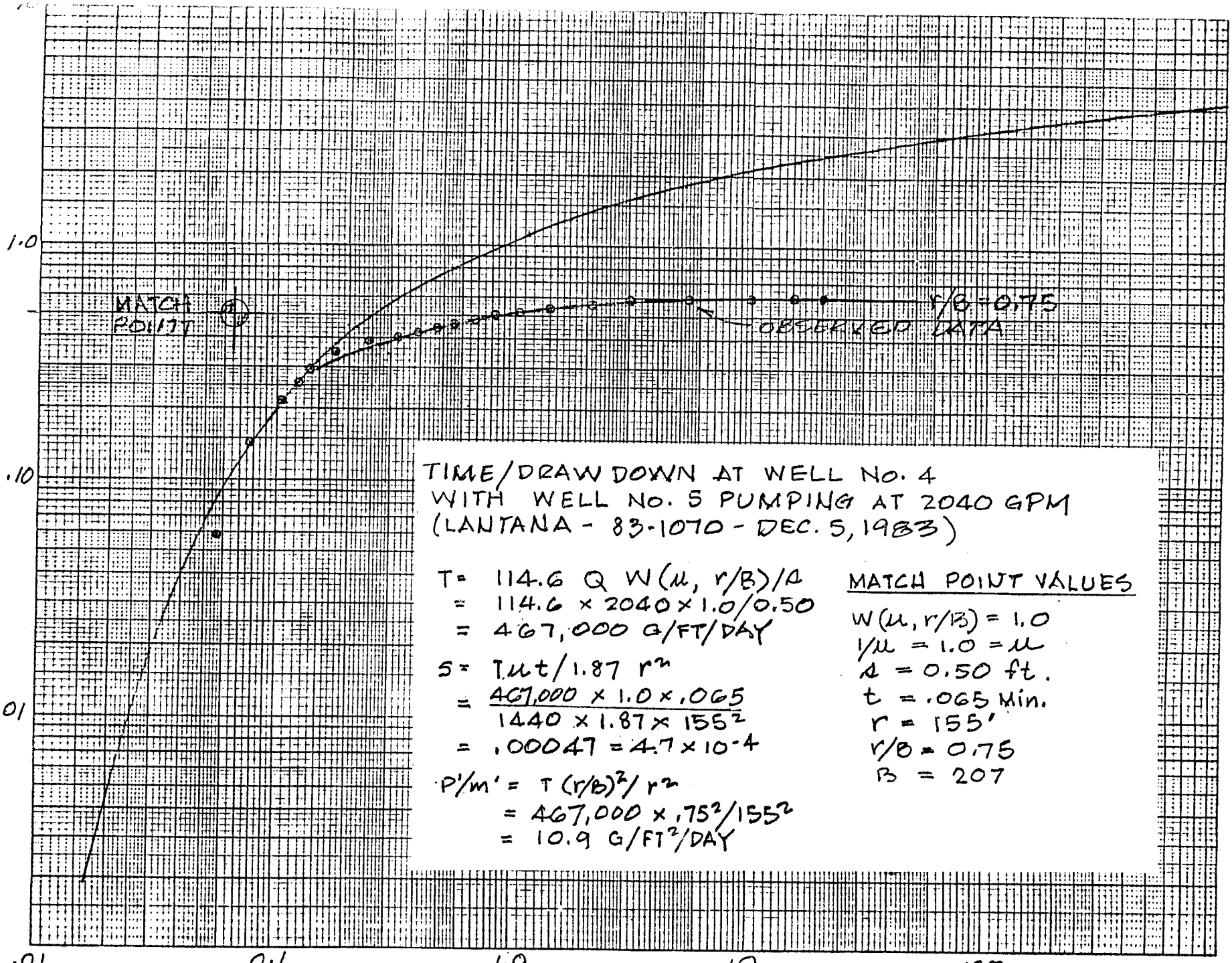


SITE SKETCH

AQUIFER/WELL PERFORMANCE TEST, DECEMBER 5, 1982

PLATE I


DISTANCE/DRAWDOWN AT STEADY STATE
WITH WELL NO. 5 PUMPING AT 2040 GPM
(LANTANA - 83-1070 - DEC. 5, 1983
T = 229 Q K₀(r/B)/Δ
= 229 × 2040 × 1.0/1.00
= 467,000 G/FT/DAY
P'/m' = T (r/B)²/r²
= 467,160 × 1.0²/210²
= 10.6 G/FT²/DAY
= 1.42 FT/DAY
MATCH POINT VALUES
K₀(r/B) = 1.0
(r/B) = 1.0
Δ = 1.00 ft.
r = 210 ft.
B = 210
R=1.0
WELL #5
Δ=5.12
TW r=27.4', Δ=2.8'
MATCH POINT
WELL NO.4 r=155', Δ=0.60
10
1.0
.10
.01
0.1
1
10
100
1000
DRAWDOWN (Δ) Feet
RADIUS (r) feet
PLATE II



TIME/DRAW DOWN AT WELL No. 4
WITH WELL No. 5 PUMPING AT 2040 GPM
(LANTANA - 83-1070 - DEC. 5, 1983)

$T = 114.6\ Q\ W(u, r/B)/s$
$= 114.6 \times 2040 \times 1.0/0.50$
$= 467{,}000$ G/FT/DAY

$S = Tut/1.87\ r^2$
$= \frac{467{,}000 \times 1.0 \times .065}{1440 \times 1.87 \times 155^2}$
$= .00047 = 4.7 \times 10^{-4}$

$P'/m' = T(r/B)^2/r^2$
$= 467{,}000 \times .75^2/155^2$
$= 10.9$ G/FT^2/DAY

MATCH POINT VALUES

$W(u, r/B) = 1.0$
$1/u = 1.0 = u$
$s = 0.50$ ft.
$t = .065$ Min.
$r = 155'$
$r/B = 0.75$
$B = 207$

PLATE III

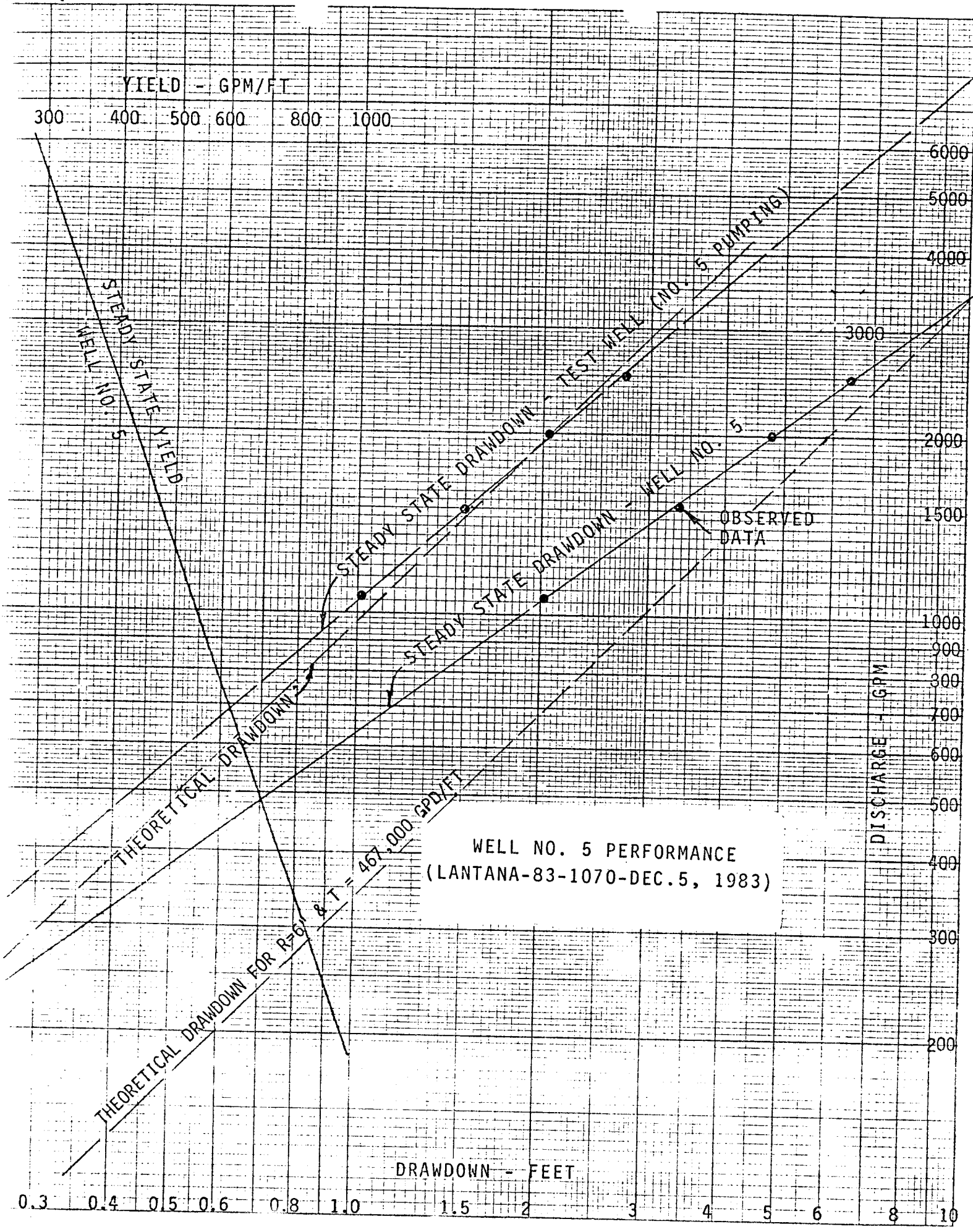

YIELD - GPM/FT
300
400
500
600
800
1000
STEADY STATE YIELD - WELL NO. 5
TEST WELL (NO. 5 PUMPING)
STEADY STATE DRAWDOWN
STEADY STATE DRAWDOWN - WELL NO. 5
OBSERVED DATA
THEORETICAL DRAWDOWN
THEORETICAL DRAWDOWN FOR R=6' & T = 467,000 GPD/FT
WELL NO. 5 PERFORMANCE
(LANTANA-83-1070-DEC.5, 1983)
DISCHARGE - GPM
6000
5000
4000
3000
2000
1500
1000
900
800
700
600
500
400
300
200
DRAWDOWN - FEET
0.3
0.4
0.5
0.6
0.8
1.0
1.5
2
3
4
5
6
8
10

PLATE IV

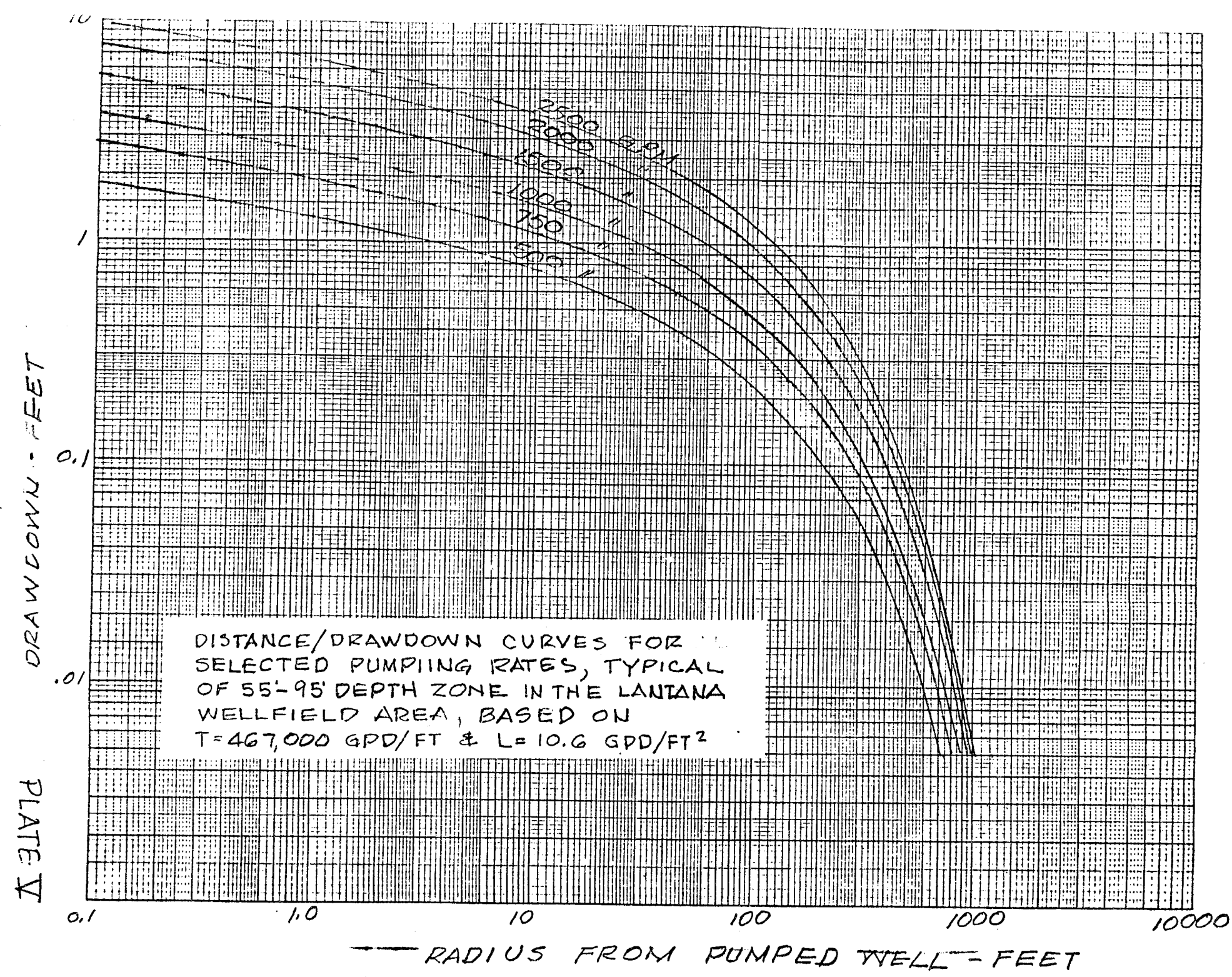

10
1
0.1
.01
DRAWDOWN - FEET
2500 GPM
2000 "
1500 "
1000 "
750 "
500 "
0.1
1.0
10
100
1000
10000
RADIUS FROM PUMPED WELL - FEET
DISTANCE/DRAWDOWN CURVES FOR SELECTED PUMPIING RATES, TYPICAL OF 55'-95' DEPTH ZONE IN THE LANTANA WELLFIELD AREA, BASED ON T=467,000 GPD/FT & L=10.6 GPD/FT²

PLATE X

ALSAY – PIPPIN CORPORATIO

Date: 11-3-83

WELL LOG

1. Owner CITY OF LANTANA 2. Location WATER PLANT
3. Type Const. MUD ROTARY 4. Casing 2" PVC SCH 40
5. Screen, Gravel, Etc. 5' OF 2" PVC. SCREEN .030 SLOT, 19 BGS 620 GRAVE 70' BOTTOM OF SCREEN
6. Total Depth 102 7. Jet Head _____ 8. Static Level _____

From	To	Formation
0	5	TOP SOIL SAND
5	10	WHITE SAND
10	15	YELLOW SAND
15	20	YELLOW & ORANGE SAND
20	28	COURSE QUARTZ SAND WITH YELLOW & ORANGE SAND
28	30	SANDSTONE & SAND
30	35	SAND STONE, QUARTZ SAND
35	40	WHITE SANDSTONE WITH SOME SHELL
40	45	SAND STONE, SAND
45	50	SANDSTONE, SAND
50	55	CAVITY
55	60	CEMENTED SAND STONE W/ SHELL AND QUARTZ
60	65	SANDSTONE, SHELL, QUARTZ
65	70	SAND STONE, SHELL, QUARTZ
70	75	CEMENTED SANDSTONE W SHELL AND QUARTZ
75	84	WHITE LIMESTONE, SOME SANDSTONE
84	90	CEMENTED SANDSTONE WHITE LIMESTONE.
90	95	SANDSTONE & LIMESTON
95	102½	CEMENTED SANDSTONE LIMESTONE

9. Total Chlorides (ppm) _____ 10. Iron _____ 11. Ph _____ 12. Hardness _____

Remarks: LOST CIRCULATION AT 28' 40' AND 50' TO 75'

Driller (s):
JERRY R HICKMAN
Jerry R Hickman