FLOWMETER ANALYSIS

COOPER CITY
CONCENTRATE DISPOSAL WELL
IW#1

On January 15, 2001 a packer was set @ approximately 1000' to evaluate the open hole flow using a dynamic flow rate of 650 GPM. The following plots were generated from logging data collected by the flowmeter tool.

Figure 1 is a quick look interpretation comparing the static down pass to the dynamic down pass. It shows a very gradual separation between the static and dynamic passes above 1970, indicating flow above this depth, with virtually no flow present below 1970'.

Figure 2 is the percent flow analysis of the dynamic pass. It reaffirms the quick look presentation and shows a linear increase in flow extending from 1970' up to 1150'. The only deviation from this pattern is in the 100' interval between 1650' and 1750'. The reduction in flow during this interval is most likely due to the increased flow volume caused by the washout shown on the caliper curve. An even more prominent washout is observed from 1075'-1200'. The apparent decrease in flow above 1150' can be attributed to this change in borehole volume.
Roughly 50% of the total flow is being produced below a depth of 1400'.
An additional 25% of flow is achieved between 1100' and 1400'. The remaining 25% of flow appears to be developed between 1000' and 1100'.

Figure 3 is the total flow analysis of the dynamic pass. It is the similar to the percent flow graph except that it is expressed in gpm.

Cooper City IW

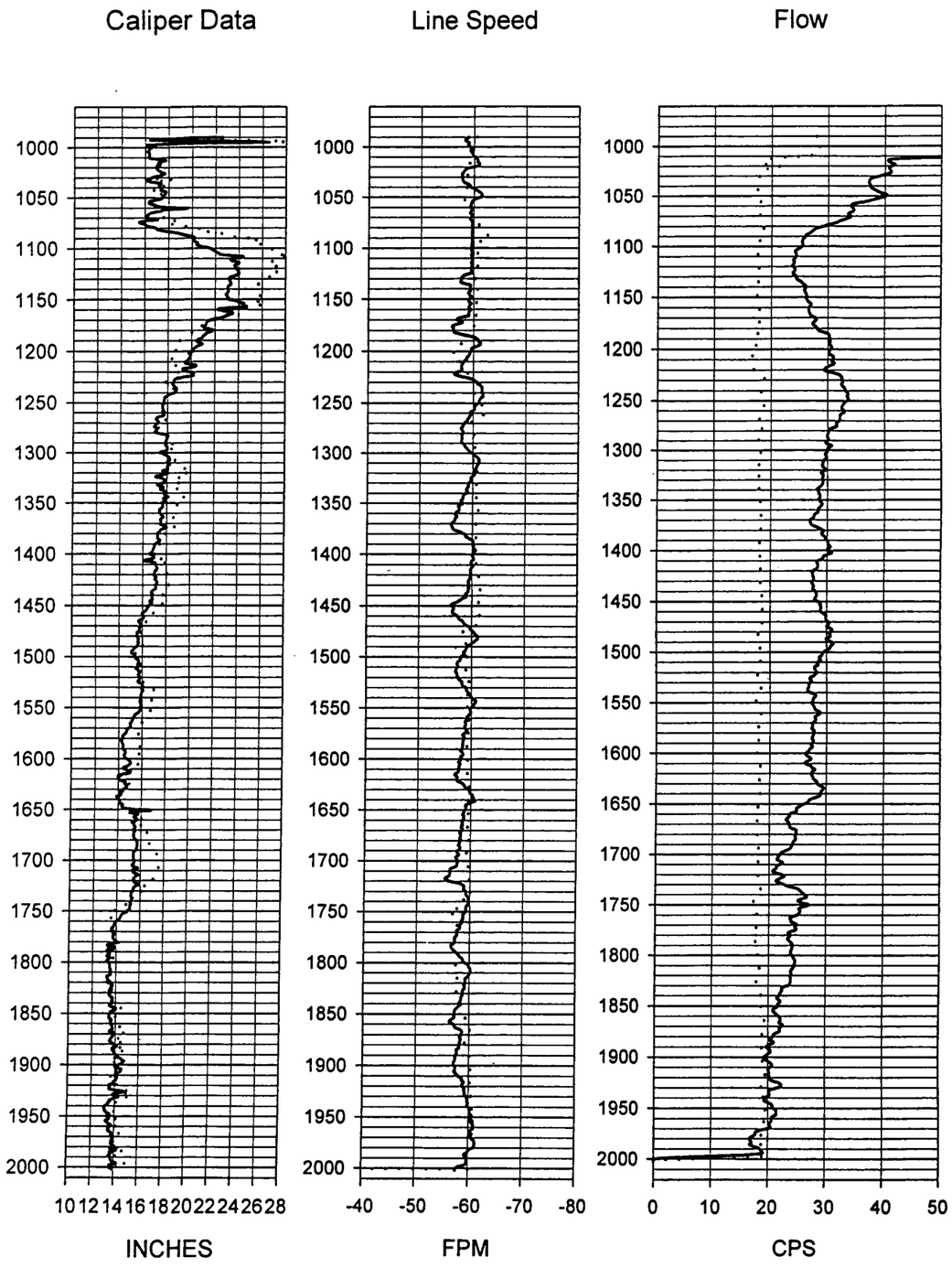


FIG 1

Cooper City IW

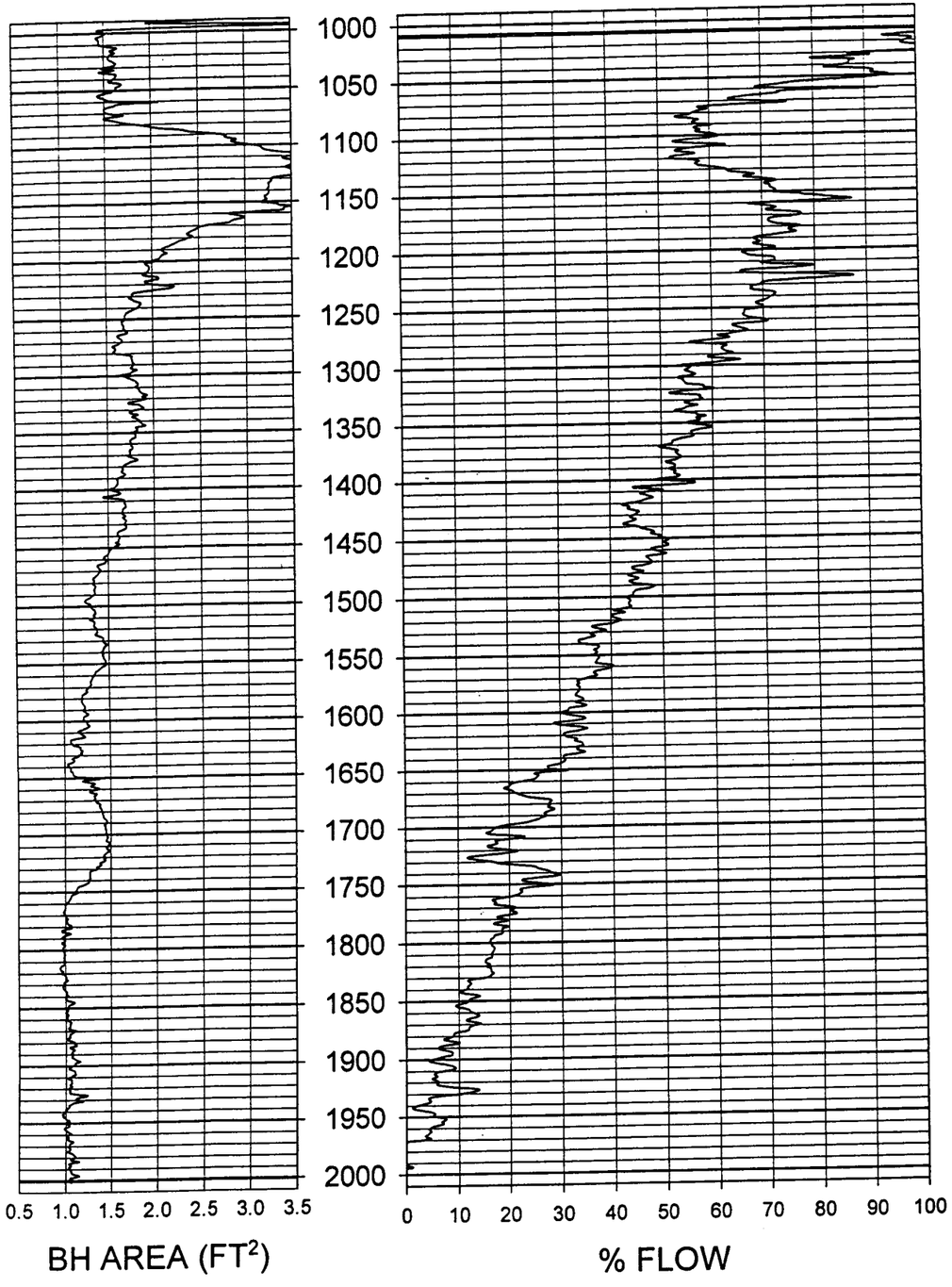


FIG 2

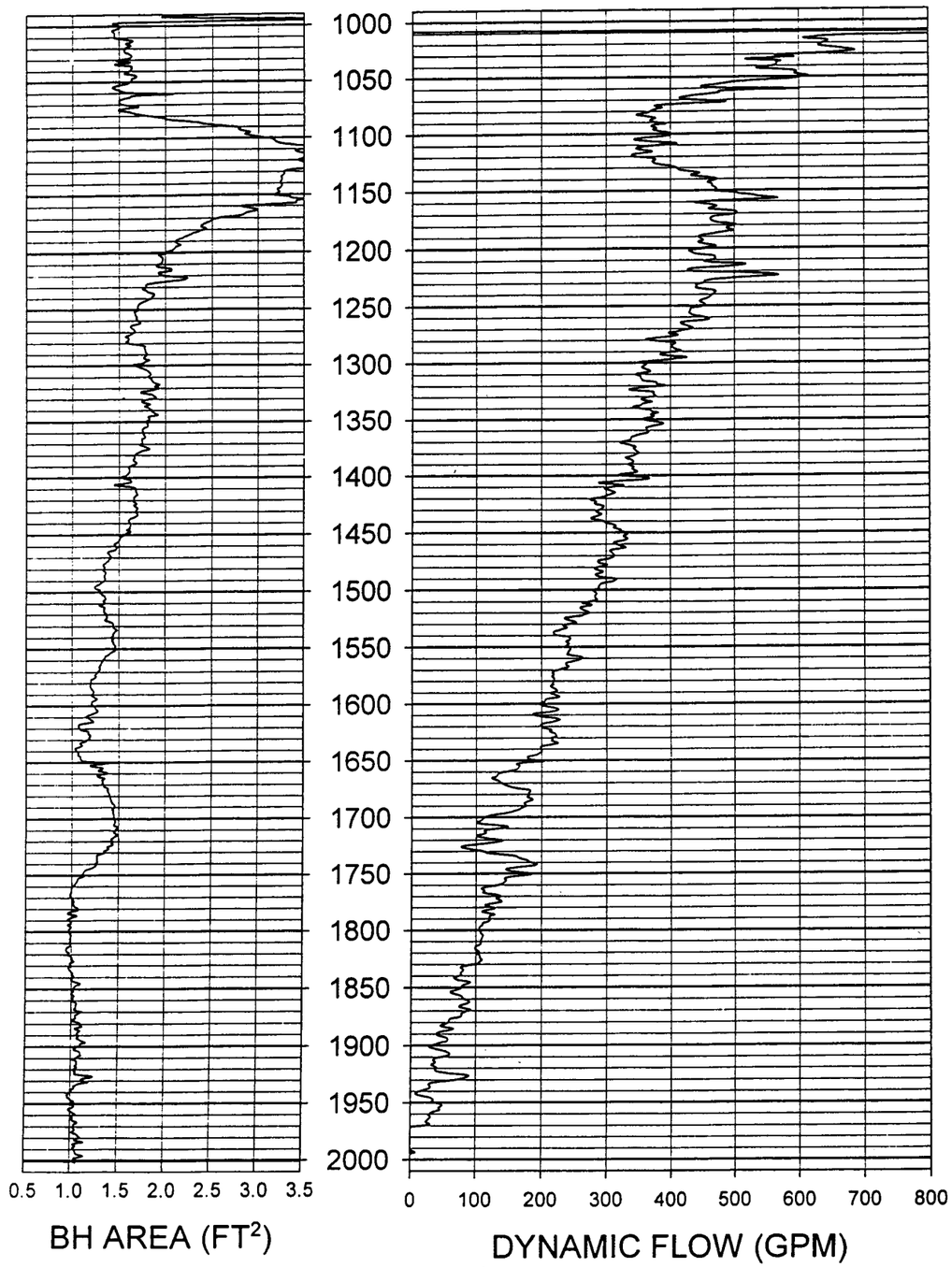
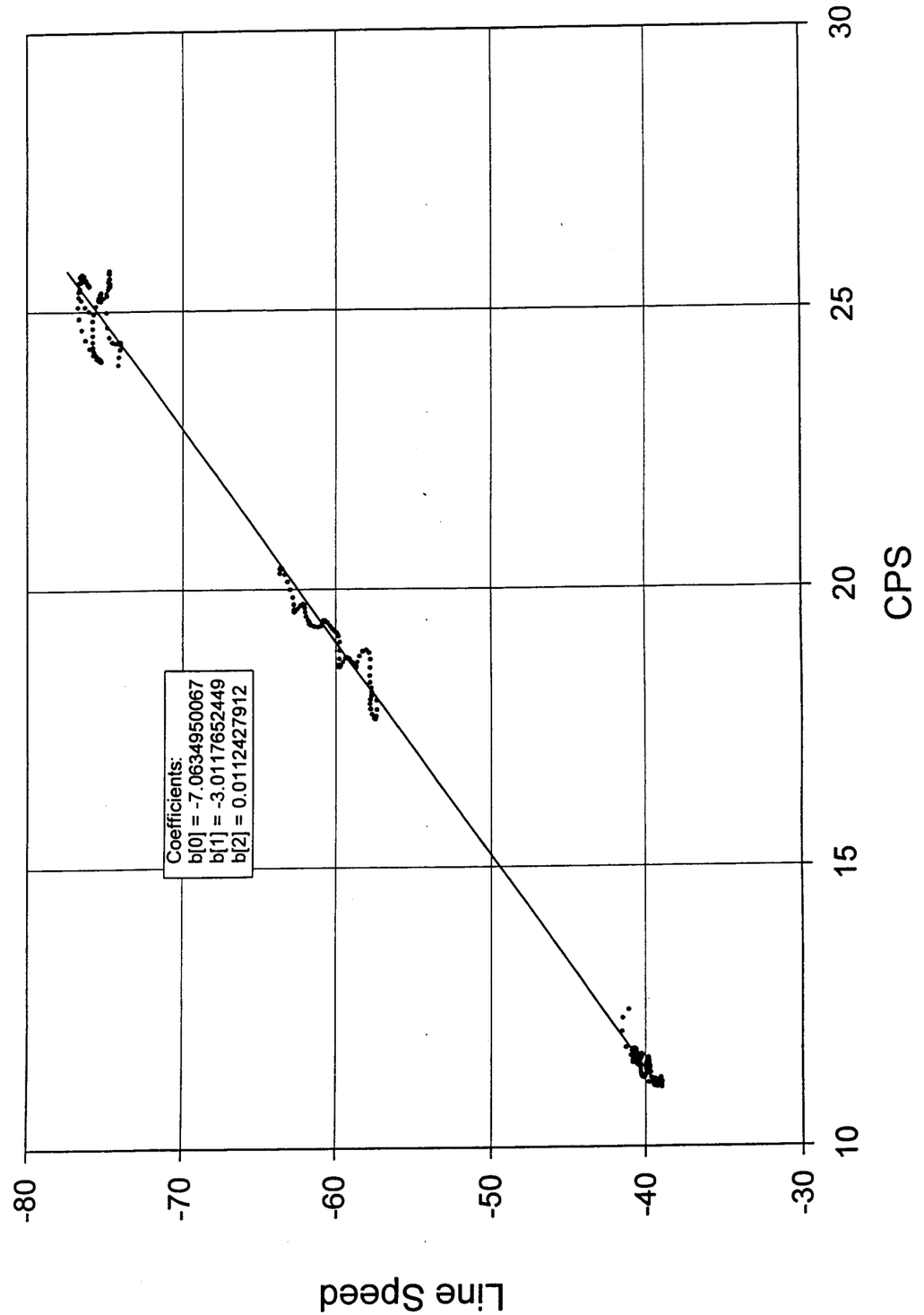

Cooper City IW
1000
1050
1100
1150
1200
1250
1300
1350
1400
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900
1950
2000
0.5 1.0 1.5 2.0 2.5 3.0 3.5
BH AREA (FT²)
0 100 200 300 400 500 600 700 800
DYNAMIC FLOW (GPM)

FIG 3


CCIW Down Cals
Coefficients:
b[0] = -7.0634950067
b[1] = -3.0117652449
b[2] = 0.0112427912
-80
-70
-60
-50
-40
-30
Line Speed
10
15
20
25
30
CPS

TABLES

Table 1
Core Depths

Core #	Depth* (feet bpl)
1	1700-1715
2	1780-1800
3	1830-1847
4	1880-1895
5	1930-1944
6	1980-1995
7	2200-2210.5
8	2275-2285
9	2445-2458
10	2519-2531
11	2735-2745
12	2790-2802

*bpl – below pad level

Table 2
Hydraulic Conductivity Derived from Cores

	Interval	Horizontal	Vertical
Core #7	2205.7-2206.2	4.3×10^{-4}	2.7×10^{-4}
	2207.2-2207.7	3.2×10^{-4}	2.8×10^{-4}
	2210.2-2210.5	2.0×10^{-10}	8.2×10^{-6}
Core #8	2276.2-2276.8	3.9×10^{-10}	1.7×10^{-9}
	2277.3-2277.8	1.1×10^{-6}	5.5×10^{-7}
	2279.4-2279.8	2.3×10^{-7}	1.0×10^{-7}
	2281.2-2281.8	--	8.2×10^{-8}
Core #9	2450.2-2450.5 (A)	-	9.9×10^{-6}
	2450.2-2450.5 (B)	--	2.9×10^{-5}
	2452.8-2453.6	1.4×10^{-5}	1.0×10^{-5}
	2454.0-2454.4	8.9×10^{-7}	5.8×10^{-7}
	2456.0-2456.4	1.3×10^{-5}	1.7×10^{-5}
Core #10	2520.2-2520.7	1.5×10^{-4}	1.4×10^{-4}
	2525.6-2526.3	1.6×10^{-3}	2.8×10^{-4}
	2528.3-2528.9	1.9×10^{-4}	1.5×10^{-4}
	2529.4-2529.9	1.8×10^{-4}	1.2×10^{-4}
Core #11	2740.7-2741.1	3.0×10^{-4}	2.9×10^{-4}
	2743.8-2744.1	3.6×10^{-7}	2.1×10^{-5}
Core #12	2759.9-2796.6	9.4×10^{-5}	8.2×10^{-5}
	2799.3-2800.0	1.2×10^{-3}	7.8×10^{-4}
	2801.2-2801.7	3.5×10^{-4}	4.1×10^{-4}

Table 3
Packer Test Development

Depth (feet bpl)	Well	Air Development		Pump Development	
		Time (min)	Rate (gpm)	Time (min)	Rate (gpm)
1660 – 1710 d	IW-1	105	100	195	79
1763 – 1779 d	IW-1	88	325	382	80
1800 – 1850 d	IW-1	139	180	150	80
1900 – 1959s	MW-1	90	9	365	105
1950 – 1966 d	IW-1	95	100	362	75
2269 – 2285 d	IW-1	690	7	435	14
2515 – 2531 d	IW-1	540	14	375	10
2724 – 2740 d	IW-1	945	10	360	9
2794 – 2810 d	IW-1	270	20	195	21

d = Straddle packer.
s = Single packer.

Table 4
Hydraulic Conductivity Derived from Packer Tests

ell	Pumping Rate (gpm)	Maximum Drawdown (feet)	Drawdown Hydraulic Conductivity (cm/sec)	Drawdown Transmissivity (gpd/ft)	Recovery Hydraulic Conductivity (cm/sec)	Recovery Transmissivity (gpd/ft)
1	9	114.6	9.3×10^{-5}	31.8	6.0×10^{-5}	20.6
1	19	139.5	1.4×10^{-4}	47.7	1.3×10^{-4}	45.6
	18	198.6	9.2×10^{-5}	31.6	8.2×10^{-5}	27.9
	14	143.1	1.1×10^{-4}	37.3	1.1×10^{-4}	36.9

Table 5
Water Quality Analysis from Packer Tests

Depth Interval (feet)	Well	Ammonia (mg/l)	Chloride (mg/l)	Conductivity (umhos/cm)	Total Kjeldahl Nitrogen (mg/l)	Sulfate (mg/l)	TDS (mg/l)
60 – 1710	IW-1	0.57	2,400	7,190	0.74	495	5,170
53 – 1779	IW-1	0.52	6,000	42,800	0.99	365	10,800
00 – 1850	IW-1	0.68	10,500	27,500	<0.05	370	27,500
0 – 1950	MW-1	0.05	15,500	38,200	0.82	680	27,400
0 – 1966	IW-1	<0.05	17,200	42,200	<0.05	950	31,400
9 – 2285	IW-1	0.52	20,500	42,800	0.69	2,490	32,300
5 – 2531	IW-1	0.05	20,500	36,700	0.12	2,660	38,450
4 – 2740	IW-1	<0.05	22,000	36,700	0.13	2,830	35,600
4 - 2810	IW-1	0.08	21,000	36,200	0.11	2,720	35,040