OILFIELD RESEARCH LABORATORIES
536 NORTH HIGHLAND - CHANUTE, KANSAS 66720 - PHONE (316) 431-2650

October 21, 1981

Graybol-Patton Company
Suite 301, Holarud Building
10 East 3rd Street
Tulsa, Oklahoma 74103

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Bates Lease, Well No. 5, located in Wilson County, Kansas.

The core was sampled and sealed in plastic bags by a representative of the client and was submitted to our laboratory on October 7, 1981.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/kas

5 c to Tulsa, Oklahoma

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Graybol-Patton Company Lease Bates Well No. 5

Location

Section 1 Twp. 29S Rge. 14E County Wilson State Kansas

Elevation, Feet	
Name of Sand	Bartlesville
Top of Core	1033.0
Bottom of Core	1051.8
Top of Sand	1033.0
Bottom of Sand	1051.8
Total Feet of Permeable Sand	18.3
Total Feet of Floodable Sand	16.5

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
1 - 5	3.9	3.9
25 - 50	4.3	8.2
60 - 100	4.6	12.8
115 - 170	2.5	15.3
200 - 380	3.0	18.3

Average Permeability Millidarcys	96.7
Average Percent Porosity	18.8
Average Percent Oil Saturation	39.6
Average Percent Water Saturation	31.2
Average Oil Content, Bbls./A. Ft.	573.
Total Oil Content, Bbls./Acre	10,485.
Average Percent Oil Recovery by Laboratory Flooding Tests	9.0
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	134.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	2,219.
Total Calculated Oil Recovery, Bbls./Acre	See "Calculated Recovery" Section

The core was sampled and the samples sealed in plastic bags by a representative of the client. Fresh water mud was used as a drilling fluid.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
1033.0 - 1034.2	Gray and brown laminated shale and sandstone.
1034.2 - 1036.0	Black slightly carbonaceous sandstone.
1036.0 - 1037.1	Dark brown slightly carbonaceous sandstone with some fine shale partings.
1037.1 - 1038.0	Grayish brown shaly sandstone.
1038.0 - 1038.4	Brown sandstone.
1038.4 - 1040.2	Brown shaly sandstone.
1040.2 - 1040.7	Brown sandstone.
1040.7 - 1041.2	Grayish brown shaly sandstone.
1041.2 - 1041.8	Light brown sandstone.
1041.8 - 1045.8	Brown sandstone.
1045.8 - 1051.8	Dark brown slightly carbonaceous sandstone with some shale nodules.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 2,219 barrels of oil per acre was obtained from 16.5 feet of sand. The weighted average percent oil saturation was reduced from 39.8 to 30.8, or represents an average recovery of 9.0 percent. The weighted average effective permeability of the samples is 14.47 millidarcys, while the average initial fluid production pressure is

18.8 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 19 samples tested, 17 produced water and oil, and 1 produced water only. This indicates that approximately 89 percent of the sand represented by these samples is floodable pay sand.

CALCULATED RECOVERY

It would appear from a study of the core data, that efficient primary and waterflood operations in the vicinity of this well should recover approximately 5,550 barrels of oil per acre. This is an average recovery of 336 barrels per acre foot from 16.5 feet of floodable sand analyzed in this core.

These recovery values were calculated using the following data and assumptions:

Original formation volume factor, estimated	1.05
Reservoir water saturation, percent, estimated	20.0
Average porosity, percent	19.1
Oil saturation after flooding, percent	30.8
Performance factor, percent, estimated	50.0
Net floodable sand, feet	16.5

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Graybol-Patton Company Lease Bates Well No. 5

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
1	1033.4	14.5	36	36	72	405	4.8	1.2	1.2	486	5.76
2	1034.4	17.6	46	25	71	628	49.	0.8	2.0	502	39.20
3	1035.4	18.7	33	22	55	479	97.	1.0	3.0	479	97.00
4	1036.4	16.8	35	31	66	456	34.	1.1	4.1	502	37.40
5	1037.4	12.8	51	37	88	506	2.4	0.9	5.0	455	2.16
6	1038.3	14.8	50	29	79	574	31.	0.4	5.4	230	12.40
7	1039.4	15.0	44	37	81	512	4.9	1.8	7.2	922	8.82
8	1040.4	21.9	30	33	63	510	116.	0.5	7.7	255	58.00
9	1041.5	18.7	41	18	59	595	61.	0.6	8.3	357	36.60
10	1042.4	24.0	34	38	72	633	125.	1.0	9.3	633	125.00
11	1043.3	23.3	40	33	73	723	203.	1.0	10.3	723	203.00
12	1044.6	18.9	33	26	59	484	301.	1.0	11.3	484	301.00
13	1045.4	26.0	45	28	73	908	377.	1.0	12.3	908	377.00
14	1046.4	21.8	46	38	84	778	26.	1.0	13.3	778	26.00
15	1047.5	19.5	41	24	65	620	97.	1.0	14.3	620	97.00
16	1048.4	18.9	34	30	64	499	74.	1.0	15.3	499	74.00
17	1049.6	16.1	49	29	78	612	43.	1.0	16.3	612	43.00
18	1050.2	21.0	30	29	59	489	167.	1.0	17.3	489	167.00
19	1051.4	19.2	37	37	74	551	60.	1.0	18.3	551	60.00

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Graybol-Patton Company Lease Bates Well No. 5

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
1033.0 - 1040.2	7.2	28.2	202.74
1040.2 - 1051.8	11.1	141.2	1567.60
1033.0 - 1051.8	18.3	96.7	1770.34

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
1033.0 - 1040.2	7.2	15.7	41.2	32.1	497	3,576
1040.2 - 1051.8	11.1	20.8	38.6	30.6	622	6,909
1033.0 - 1051.8	18.3	18.8	39.6	31.2	573	10,485

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Graybol-Patton Company Lease Bates Well No. 5

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	1033.4	14.6	36	408	0	0	36	40	408	28	0.94	40
2	1034.4	17.6	46	628	10	137	36	43	491	300	4.87	25
3	1035.4	18.8	33	481	2	29	31	42	452	258	10.49	15
4	1036.4	16.9	35	459	4	52	31	48	407	302	10.99	15
5	1037.4	12.8	51	506	12	119	39	54	387	238	21.24	15
6	1038.3	14.7	50	570	13	148	37	55	422	148	5.85	25
7	1039.4	14.9	44	509	7	81	37	48	428	82	1.33	35
8	1040.4	21.9	30	510	3	51	27	54	459	280	34.49	10
9	1041.5	18.2	42	593	0	0	42	20	593	0	Imp.	-
10	1042.4	24.0	34	633	8	149	26	53	484	208	18.59	15
11	1043.3	23.3	40	723	10	181	30	49	542	362	46.11	10
12	1044.6	18.7	33	479	5	73	28	61	406	538	5.32	15
13	1045.4	25.8	45	901	17	340	28	55	561	338	34.36	10
14	1046.4	21.6	46	771	18	302	28	61	469	192	25.86	10
15	1047.5	19.5	41	620	7	106	34	52	514	148	2.77	30
16	1048.4	19.0	34	501	5	74	29	58	427	318	6.82	25
17	1049.6	16.1	49	612	22	275	27	60	337	252	12.00	15
18	1050.2	20.8	30	484	4	65	26	52	419	340	16.11	15
19	1051.4	19.3	37	554	8	120	29	51	434	160	3.30	35

Notes: cc—cubic centimeter.

*—Volume of water recovered at the time of maximum oil recovery.

**—Determined by passing water through sample which still contains residual oil.

Oilfield Research Laboratories

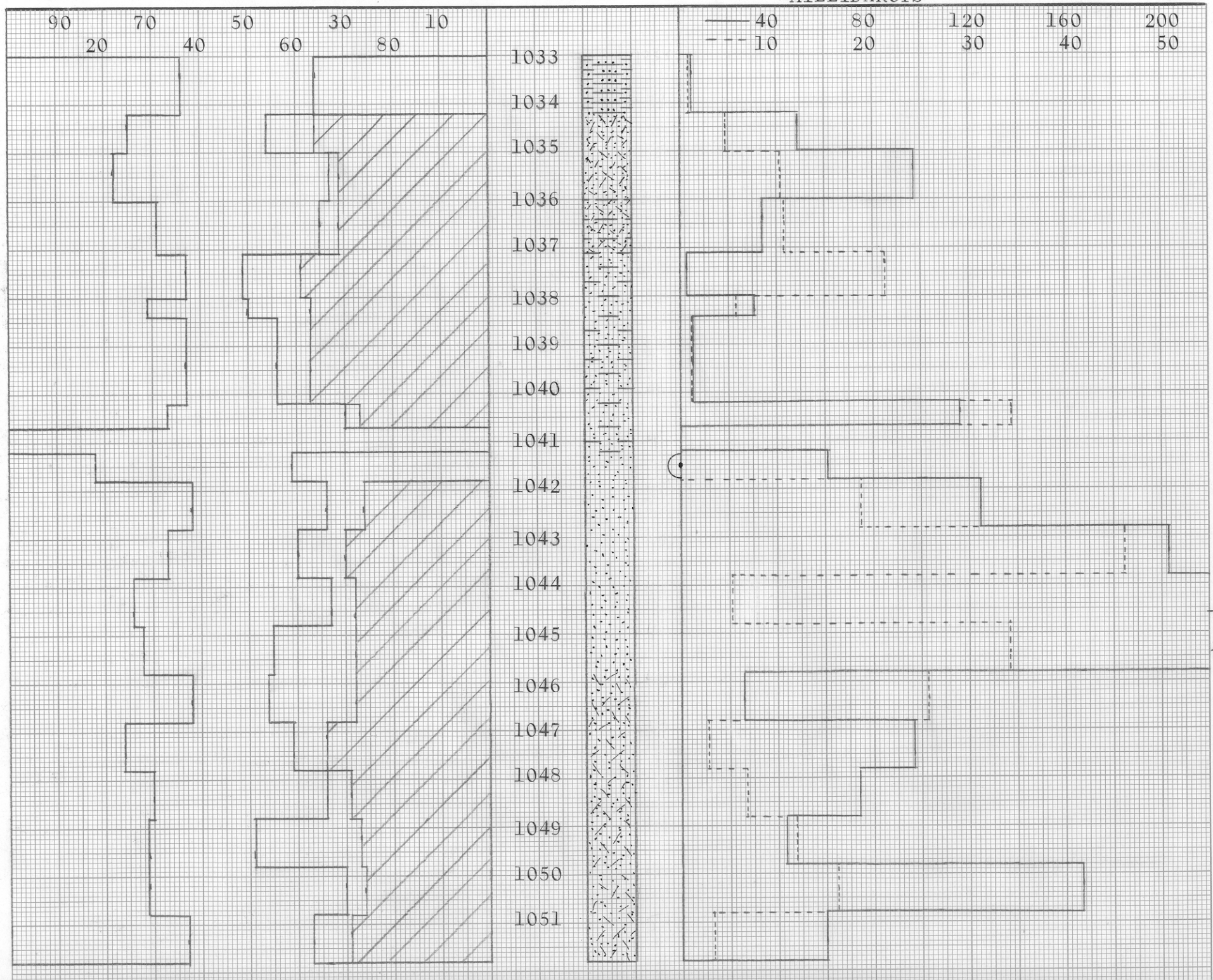
SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Graybol-Patton Company Lease Bates Well No. 5

Depth Interval, Feet	1033.0 - 1040.2	1040.2 - 1051.8	1033.0 - 1051.8
Feet of Core Analyzed	6.0	10.5	16.5
Average Percent Porosity	16.0	20.9	19.1
Average Percent Original Oil Saturation	42.3	38.5	39.8
Average Percent Oil Recovery	7.2	10.1	9.0
Average Percent Residual Oil Saturation	35.1	28.4	30.8
Average Percent Residual Water Saturation	47.7	55.1	52.4
Average Percent Total Residual Fluid Saturation	82.8	83.5	83.2
Average Original Oil Content, Bbls./A. Ft.	515.	622.	583.
Average Oil Recovery, Bbls./A. Ft.	85.	163.	134.
Average Residual Oil Content, Bbls./A. Ft.	430.	459.	449.
Total Original Oil Content, Bbls./Acre	3,088.	6,534.	9,622.
Total Oil Recovery, Bbls./Acre	509.	1,711.	2,219.
Total Residual Oil Content, Bbls./Acre	2,580.	4,823.	7,403.
Average Effective Permeability, Millidarcys	8.39	17.95	14.47
Average Initial Fluid Production Pressure, p.s.i.	21.7	17.3	18.8

NOTE: Only those samples which recovered oil were used in calculating the above averages.


WATER SAT., PERCENT
OIL SAT., PERCENT
PERMEABILITY, IN MILLIDARCYS
EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS
90 70 50 30 10
20 40 60 80
40 80 120 160 200
10 20 30 40 50
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
301
377

KEY:

- SANDSTONE
- SHALY SANDSTONE
- CARBONACEOUS SANDSTONE
- CARBONACEOUS SANDSTONE WITH SHALE PARTINGS
- LAMINATED SANDSTONE AND SHALE
- FLOODPOT RESIDUAL OIL SATURATION
- IMPERMEABLE TO WATER

GRAYBOL - PATTON COMPANY

BATES LEASE

WELL NO. 5

WILSON COUNTY, KANSAS

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE PERCENT POROSITY	AVG. OIL SATURATION PERCENT	AVG. WATER SATURATION PERCENT	AVERAGE PERMEABILITY, MILLIDARCYS	CALCULATED OIL RECOVERY BBLS. / ACRE
1033.0 - 1040.2	7.2	15.7	41.2	32.1	28.2	
1040.2 - 1051.8	11.1	20.8	38.6	30.6	141.2	
1033.0 - 1051.8	18.3	18.8	39.6	31.2	96.7	5550 (PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
OCTOBER, 1981

PDC