OILFIELD RESEARCH LABORATORIES

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

15-037-20445

Februabry 11, 1980

Hickory Creek Oil Company
P.O. Box 379
Parsons, Kansas 67357

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from Well No. HCO-102, and submitted to our laboratory on January 11, 1980.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/kas
4 c to Parsons, Kansas
1 c to Chanute, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Hickory Creek Oil Company Lease – Well No. HCO-102

Location –

Section – Twp. – Rge. – County – State –

Elevation, Feet	–
Name of Sand	–
Top of Core	164.0
Bottom of Core	202.5
Top of Sand	164.0
Bottom of Sand	202.5
Total Feet of Permeable Sand	29.3
Total Feet of Floodable Sand	13.0

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 – 5	8.5	8.5
5 – 50	13.8	22.3
50 – 100	2.9	25.2
100 – 200	1.0	26.2
200 – 450	3.1	29.3

Average Permeability Millidarcys	60.7
Average Percent Porosity	18.8
Average Percent Oil Saturation	40.0
Average Percent Water Saturation	41.0
Average Oil Content, Bbls./A. Ft.	612.
Total Oil Content, Bbls./Acre	20,303.
Average Percent Oil Recovery by Laboratory Flooding Tests	13.0
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	223.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	2,895.
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.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
164.0 - 171.5	Brown and gray laminated sandstone and shale.
171.5 - 175.4	Gray sandy shale.
175.4 - 183.8	Brown sandstone.
183.8 - 185.7	Light brown calcareous shaly sandstone.
185.7 - 187.3	Brown sandstone.
187.3 - 187.5	Gray sandy shale.
187.5 - 188.0	Brown sandstone.
188.0 - 188.3	Gray sandy shale.
188.3 - 189.8	Brown shaly sandstone.
189.8 - 190.2	Gray sandy shale.
190.2 - 191.7	Brown shaly sandstone.
191.7 - 202.5	Brown sandstone.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 2,898 barrels of oil per acre was obtained from 13.0 feet of sand. The weighted average percent oil saturation was reduced from 49.6 to 36.6, or represents an average recovery of 13.0 percent. The weighted average effective permeability of the samples is 7.97 millidarcys, while the average initial fluid production pressure is 20.6 pounds per square inch (See Table V).

HILLER 28

By observing the data given in Table IV, you will note that of the 20 samples tested, 9 produced water and oil, and 6 samples produced water only. This indicates that approximately 45 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 5,490 barrels of oil per acre. This is an average recovery of 422 barrels per acre foot from 13.0 feet of floodable sand analyzed in this core.

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

Original formation volume factor, estimated	1.03
Reservoir water saturation, percent, estimated	10.0 / 18.5
Average porosity, percent	21.4 / 22.5
Oil saturation after flooding, percent	36.6 / 36.7
Performance factor, percent, estimated	50.0
Net floodable sand, feet	13.0 / 9.0

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - H28 Well No. HCO-102

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	~~164.5~~	15.9	39	52	91	481	0.84	2.0	2.0	962	1.68
3	~~166.5~~	14.5	15	66	81	169	Imp.	2.0	4.0	338	0.00
5	~~168.5~~	16.6	35	59	94	451	1.0	2.0	6.0	902	2.00
7	170.5	18.4	60	33	93	857	2.2	1.5	7.5	1286	3.30
9	175.5	24.1	54	13	67	1010	178.	1.0	8.5	1010	178.00
11	177.3	24.5	55	13	68	1045	288.	1.6	10.1	1672	460.80
12	178.5	22.1	52	18	70	892	413.	1.5	11.6	1338	619.50
14	180.5	21.4	53	23	76	880	60.	1.5	13.1	1320	90.00
15	181.5	20.3	53	22	75	835	40.	1.4	14.5	1169	56.00
17	183.5	23.5	58	22	80	1057	77.	1.4	15.9	1480	107.80
18	~~184.5~~	~~6.3~~	26	56	82	127	Imp.	1.9	17.8	241	0.00
20	186.4	15.2	40	56	96	472	25.	1.6	19.4	755	40.00
22	188.5	22.4	35	33	68	608	5.0	1.5	20.9	912	7.50
24	190.5	20.1	49	38	87	764	3.9	1.5	22.4	1146	5.85
26	192.5	18.6	41	46	87	592	10.	2.3	24.7	1362	23.00
28	194.5	21.9	35	38	73	595	29.	2.0	26.7	1190	58.00
30	196.5	21.5	30	44	74	500	18.	2.0	28.7	1000	36.00
32	198.5	20.7	36	43	79	578	22.	2.0	30.7	1156	44.00
34	200.5	17.2	34	50	84	454	14.	1.0	31.7	454	14.00
36	202.3	17.1	23	62	85	305	16.	1.5	33.2	610	32.00

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease – Well No. HCO-102

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
164.0 - 171.5	5.5	1.3	6.98
175.4 - 183.8	8.4	180.0	1512.10
183.8 - 202.5	15.4	16.9	260.35
164.0 - 202.5	29.3	60.7	1779.43

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
164.0 - 171.5	7.5	16.2	35.7	53.8	465	3,488
175.4 - 183.8	8.4	22.6	54.2	18.7	951	7,989
183.8 - 202.5	17.3	18.2	34.9	46.3	510	8,826
164.0 - 202.5	33.2	18.8	40.0	41.0	612	20,303

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - H28 Well No. HCO-102

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	164.5	15.9	39	481	0	0	39	53	481	0	Imp.	-
3	166.5	14.7	15	171	0	0	15	66	171	0	Imp.	-
5	168.5	17.1	35	465	0	0	35	40	465	3	0.22	45
7	170.5	18.1	60	843	0	0	60	38	843	0	Imp.	-
9	175.5	23.8	54	997	19	351	35	54	646	362	25.70	15
11	177.3	24.4	55	1041	16	303	39	51	738	302	22.49	10
12	178.5	22.4	52	904	16	278	36	51	626	158	15.84	10
14	180.5	21.3	53	876	18	297	35	59	579	85	1.57	15
15	181.5	20.3	53	835	16	252	37	57	583	176	3.45	20
17	183.5	23.3	58	1048	20	362	38	56	686	194	4.12	20
18	184.5	6.5	26	131	0	0	26	66	131	0	Imp.	-
20	186.4	15.7	40	487	6	73	34	58	414	163	3.00	25
22	188.5	22.2	35	603	4	69	31	59	534	12	0.15	25
24	190.5	20.0	49	760	5	78	44	52	682	11	0.15	45
26	192.5	18.6	41	592	0	0	41	54	592	0	Imp.	-
28	194.5	22.0	35	597	0	0	35	59	597	272	4.05	20
30	196.5	21.2	30	493	0	0	30	63	493	99	1.57	25
32	198.5	20.6	36	576	0	0	36	57	576	30	0.30	25
34	200.5	17.4	34	459	0	0	34	59	459	15	0.15	40
36	202.3	17.5	23	313	0	0	23	75	313	13	0.15	45

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.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Hickory Creek Oil Company Lease – Well No. HCO-102

Depth Interval, Feet	175.4 - 183.8	183.8 - 202.5	175.4 - 202.5
Feet of Core Analyzed	8.4	4.6	13.0
Average Percent Porosity	22.6	19.2	21.4
Average Percent Original Oil Saturation	54.2	41.3	49.6
Average Percent Oil Recovery	17.4	5.0	13.0
Average Percent Residual Oil Saturation	36.8	36.3	36.6
Average Percent Residual Water Saturation	54.6	56.4	55.2
Average Percent Total Residual Fluid Saturation	91.4	92.7	91.8
Average Original Oil Content, Bbls./A. Ft.	949.	614.	831.
Average Oil Recovery, Bbls./A. Ft.	305.	73.	223.
Average Residual Oil Content, Bbls./A. Ft.	644.	541.	608.
Total Original Oil Content, Bbls./Acre	7,969.	2,823.	10,792.
Total Oil Recovery, Bbls./Acre	2,558.	337.	2,895.
Total Residual Oil Content, Bbls./Acre	5,411.	2,486.	7,897.
Average Effective Permeability, Millidarcys	11.71	1.14	7.97
Average Initial Fluid Production Pressure, p.s.i.	15.0	31.7	20.6

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

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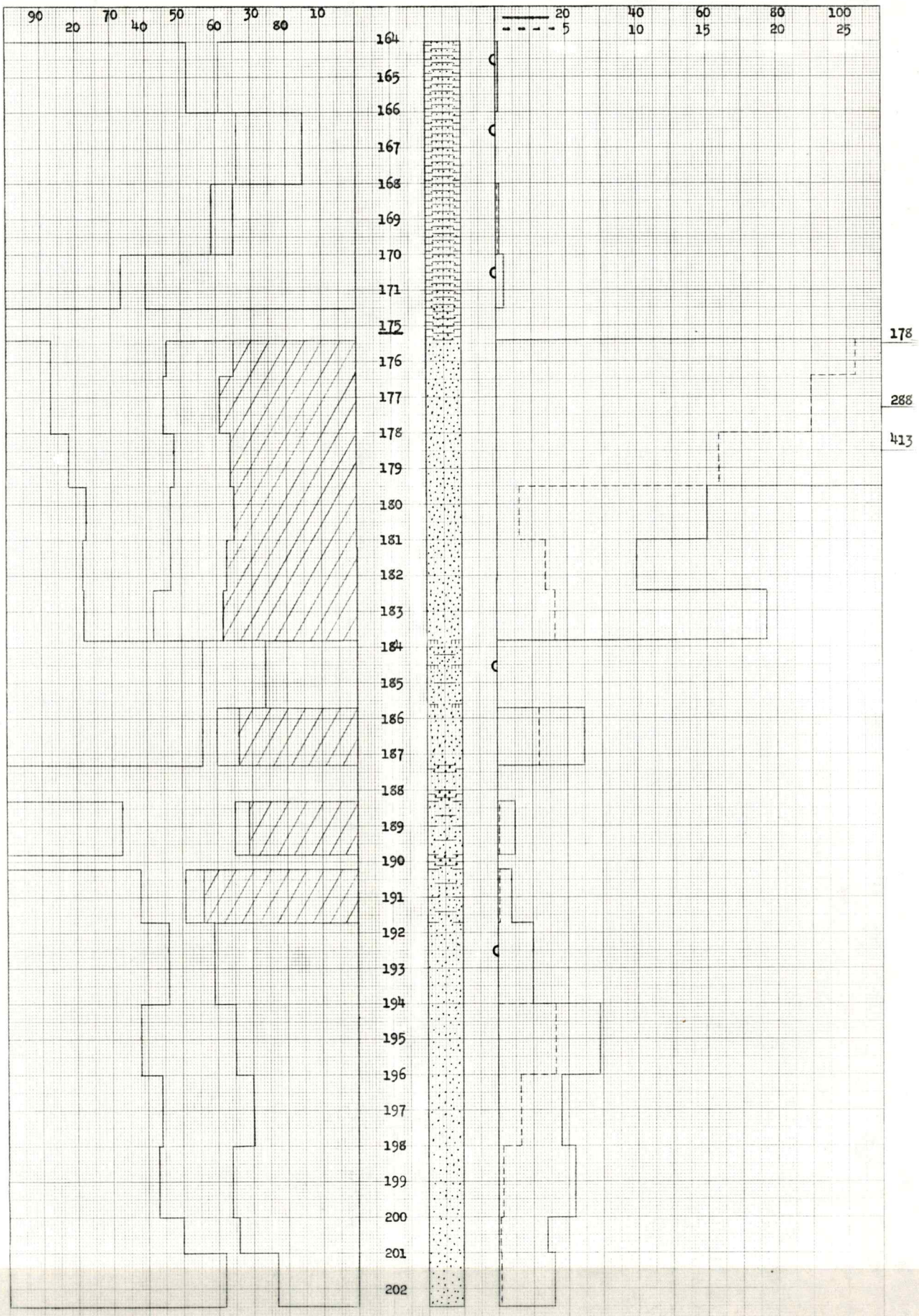
WATER SAT., PERCENT → ← OIL SAT., PERCENT

PERMEABILITY, IN MILLIDARCYS

EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS



KEY:

- SANDSTONE
- SHALY SANDSTONE
- SANDY SHALE
- IMPERMEABLE TO WATER
- CALCAREOUS SHALY SANDSTONE
- LAMINATED SANDSTONE AND SHALE
- FLOODPOT RESIDUAL OIL SATURATION

HICKORY CREEK OIL COMPANY

— LEASE WELL NO. HCO - 102

— COUNTY, —

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
164.0 - 171.5	7.5	16.2	35.7	53.8	1.3	
175.4 - 183.8	8.4	22.6	54.2	18.7	180.0	
183.8 - 202.5	17.3	18.2	34.9	46.3	16.9	
164.0 - 202.5	33.2	18.8	40.0	41.0	60.7	5,490 (PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
FEBRUARY, 1950. HR