

OILFIELD RESEARCH LABORATORIES

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

IS-037-20444

February 15, 1980

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

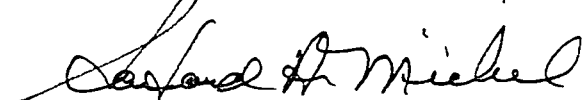
Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from Well No. HCO-108, and submitted to our laboratory on January 18, 1980.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES


Sanford A. Michel

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

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GENERAL INFORMATION & SUMMARY

Company Hickory Creek Oil Company Lease Well No. HCO-108

Location

Section Twp. Rge. County State

Elevation, Feet

Name of Sand

Top of Core 173.0

Bottom of Core 191.7

Top of Sand 173.0

Bottom of Sand 191.5

Total Feet of Permeable Sand 16.8

Total Feet of Floodable Sand 14.3

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
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0 - 50	1.5	1.5
100 - 200	7.9	9.4
200 - 300	2.0	11.4
300 - 600	5.4	16.8

Average Permeability Millidarcys 251.2

Average Percent Porosity 22.2

Average Percent Oil Saturation 48.2

Average Percent Water Saturation 30.0

Average Oil Content, Bbls./A. Ft. 862.

Total Oil Content, Bbls./Acre 14,484.

Average Percent Oil Recovery by Laboratory Flooding Tests 11.3

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 207.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 2,966.

Total Calculated Oil Recovery, Bbls./Acre

See "Calculated
Recovery" Section.

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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:

<u>Depth Interval, Feet</u>	<u>Description</u>
173.0 - 181.2	Brown sandstone with fine carbonaceous partings.
181.2 - 181.6	Gray sandy shale.
181.6 - 184.2	Brown sandstone with fine carbonaceous partings.
184.2 - 185.5	Gray sandy shale.
185.5 - 191.0	Brown sandstone.
191.0 - 191.5	Light brown and gray laminated sandstone and shale.
191.5 - 191.7	Gray sandy shale.

LABORATORY FLOODING TESTS

The upper portion of the sand in this core responded well, relative to the lower portion of the sand, to laboratory flooding tests, as a total overall recovery of 2,966 barrels of oil per acre was obtained from 14.3 feet of sand. The weighted average percent oil saturation was reduced from 53.7 to 42.4, or represents an average recovery of 11.3 percent. The weighted average effective permeability of the samples is 15.88 millidarcys, while the average initial fluid production pressure is 20.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 10 samples tested, 8 produced water and oil, and

2 samples produced water only. This indicates that approximately 80 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a relatively high and uniform permeability profile.

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 5,830 barrels of oil per acre. This is an average recovery of 408 $\frac{1}{2}$ barrels per acre foot from 14.3 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 / 19.0
Average porosity, percent	23.4 / 24.3
Oil saturation after flooding, percent	42.4 / 43.2
Performance factor, percent, estimated	✓ 50.0
Net floodable sand, feet	14.3 / 11.0

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - HLD Well No. HCO-108

Sample No.	Depth, Feet X	Effective Porosity Percent X	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill. X	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water X	Total			Ft.	Cum. Ft.		
169											
1	173.5	25.2	62	12	74	1212	233.	2.0	2.0	2424	466.00
3	175.5	20.4	47	31	78	744	518.	2.0	4.0	1488	1036.00
5	177.5	23.1	56	20	76	1004	424.	2.0	6.0	2008	848.00
7	179.5	24.0	62	16	78	1154	174.	2.2	8.2	2539	382.80
180											
9	181.7	27.1	56	16	72	1177	443.	1.4	9.6	1648	620.20
11	183.5	25.5	49	26	75	969	114.	1.2	10.8	1163	136.80
12	185.6	21.0	46	35	81	749	50.	1.5	12.3	1124	75.00
14	187.5	21.3	47	35	82	777	121.	2.0	14.3	1554	242.00
16	189.5	16.0	20	63	83	248	169.	2.0	16.3	496	338.00
18	191.3	14.6	7	87	94	79	149.	0.5	16.8	40	74.50
	<u>1825.1</u>	<u>218.2</u>		<u>341</u>			<u>2395</u>				

1-5 = 19
= 19
87

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease - Well No. HCO-108

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
173.0 - 181.2	8.2	333.3	2732.80
181.6 - 191.5	8.6	172.9	1486.50
173.0 - 191.5	16.8	251.2	4219.30

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
173.0 - 181.2	8.2	23.2	56.9	19.3	1,032	8,459
181.6 - 191.5	8.6	21.2	40.0	40.2	701	6,025
173.0 - 191.5	16.8	22.2	48.2	30.0	862	14,484

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - H12 Well No. HCO-108

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	173.5	25.5	62	1227	25	495	37	50	732	156	20.62	20	
3	175.5	20.6	47	751	10	160	37	56	591	132	2.55	25	
5	177.5	23.2	56	1008	13	234	43	56	774	323	29.24	10	
7	179.5	24.0	62	1154	20	372	42	49	782	245	14.78	15	
9	181.7	26.8	56	1164	2	42	54	37	1122	237	26.99	15	
11	183.5	25.7	49	977	3	60	66	43	917	264	30.00	15	
12	185.6	21.3	46	760	3	50	43	51	710	137	3.00	30	
14	187.5	21.1	47	769	5	82	42	50	687	124	2.17	30	
16	189.5	16.3	20	253	0	0	20	78	253	209	10.00	20	
18	191.3	14.5	7	79	0	0	7	90	79	252	14.99	20	
								S _{OR} = 43.2		371		154.24	

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	Lease			Well No.
Hickory Creek Oil Company	—			HCO-108
Depth Interval, Feet	173.0 - 181.2	181.6 - 191.5	173.0 - 191.5	
Feet of Core Analyzed	8.2	6.1	14.3	
Average Percent Porosity	23.3	23.4	23.4	
Average Percent Original Oil Saturation	56.9	49.2	53.7	
Average Percent Oil Recovery	17.1	3.4	11.3	
Average Percent Residual Oil Saturation	39.8	45.8	42.4	
Average Percent Residual Water Saturation	52.7	45.9	49.8	
Average Percent Total Residual Fluid Saturation	92.5	91.7	92.2	
Average Original Oil Content, Bbls./A. Ft.	1,038.	899.	978.	
Average Oil Recovery, Bbls./A. Ft.	317.	61.	207.	
Average Residual Oil Content, Bbls./A. Ft.	721.	838.	771.	
Total Original Oil Content, Bbls./Acre	8,510.	5,480.	13,990.	
Total Oil Recovery, Bbls./Acre	2,596.	370.	2,966.	
Total Residual Oil Content, Bbls./Acre	5,914.	5,110.	11,024.	
Average Effective Permeability, Millidarcys	16.75	13.55	15.88	
Average Initial Fluid Production Pressure, p.s.i.	17.5	22.5	20.0	

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

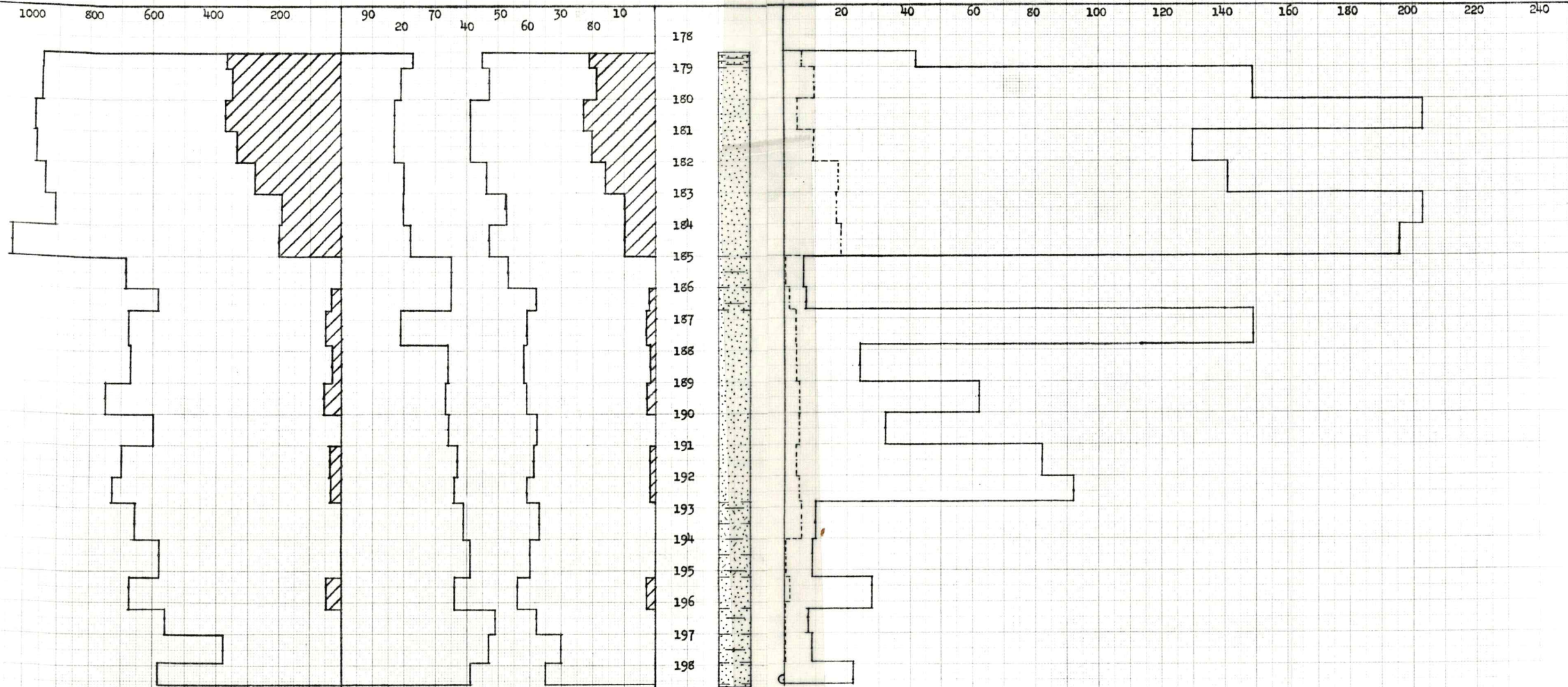
OIL CONTENT,
BBL./A. FT.

WATER SAT.,
PERCENT

OIL SAT.,
PERCENT

AIR PERMEABILITY, IN MILLIDARCS

EFFECTIVE PERMEABILITY, IN MILLIDARCS



H53509

KEY:
 FLOOD POT RECOVERY
 SANDSTONE

SHALY SANDSTONE
 CARBONACEOUS SHALY SANDSTONE

LAMINATED SANDSTONE AND SHALE
 ○ IMPERMEABLE TO WATER

HICKORY CREEK OIL COMPANY

LEASE

COUNTY, ---

WELL NO. HCO-47

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE PERCENT POROSITY	AVG. OIL SATURATION PERCENT	AVG. WATER SATURATION PERCENT	AVG. OIL CONTENT BBL./A. FT.	TOTAL OIL CONTENT BBL./ACRE	AVG. AIR PERMEABILITY MILLIDARCS	CALCULATED OIL RECOVERY, BBL./ACRE
178.5 - 185.0	6.5	23.0	54.4	21.0	966	6,271	160.8	
185.0 - 198.6	13.6	20.6	39.6	36.5	635	8,638	39.2	
178.5 - 198.6	20.1	21.6	44.4	31.5	744	14,909	78.4	5,100 (PRIMARY & WATERFLOODING)

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 CHANUTE, KANSAS
 OCTOBER, 1979 HL