OILFIELD RESEARCH LABORATORIES

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

15-037-20465

March 31, 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-134, and submitted to our laboratory on March 4, 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-134

Location –

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

Elevation, Feet	–
Name of Sand	–
Top of Core	176.0
Bottom of Core	242.9
Top of Sand	176.0
Bottom of Sand (Tested)	231.0
Total Feet of Permeable Sand (Tested)	34.0
Total Feet of Floodable Sand (Tested)	15.0

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 – 50	9.9	9.9
50 – 100	6.6	16.5
100 – 200	7.5	24.0
200 – 300	4.0	28.0
300 & Above	6.0	34.0

Average Permeability Millidarcys	157.0
Average Percent Porosity	21.4
Average Percent Oil Saturation	41.6
Average Percent Water Saturation	41.7
Average Oil Content, Bbls./A. Ft.	711.
Total Oil Content, Bbls./Acre	25,961.
Average Percent Oil Recovery by Laboratory Flooding Tests	7.4
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	143.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	2,142.
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
176.0 - 184.0	Dark brown sandstone.
184.0 - 188.2	Gray and brown laminated sandstone and shale.
188.2 - 194.0	Brown sandstone.
194.0 - 194.9	Gray sandy shale
194.9 - 195.9	Brown sandstone.
195.9 - 196.5	Gray sandy shale.
202.0 - 202.8	Gray carbonaceous sandstone.
202.8 - 204.3	Gray laminated sandstone and shale.
204.3 - 204.9	Brown slightly shaly sandstone.
204.9 - 205.7	Gray sandy shale.
205.7 - 206.9	Brown shaly sandstone.
206.9 - 208.1	Brown sandstone.
208.1 - 213.2	Dark brown carbonaceous sandstone.
213.2 - 216.6	Brown sandstone.
216.6 - 217.3	Grayish brown sandy shale.
217.3 - 219.2	Brown sandstone.
219.2 - 220.6	Black carbonaceous sandstone.
220.6 - 221.3	Gray calcareous fossiliferous shale.
221.3 - 222.2	Brown sandstone.
223.0 - 224.0	Brown and gray laminated sandstone and shale.
224.0 - 225.5	Grayish brown shaly sandstone.

Depth Interval, Feet	Description
225.5 - 237.0	Gray laminated sandstone and shale.
237.0 - 242.9	Gray sandy shale.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 2,142 barrels of oil per acre was obtained from 15.0 feet of sand. The weighted average percent oil saturation was reduced from 49.1 to 41.7, or represents an average recovery of 7.4 percent. The weighted average effective permeability of the samples is 10.59 millidarcys, while the average initial fluid production pressure is 21.3 pounds per square inch (See Table V).

By observing the data given in Table IV you will note that of the 26 samples tested, 8 produced water and oil, and 10 samples produced water only. This indicates that approximately 31 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 6,240 barrels of oil per acre. This is an average recovery of 416 barrels per acre foot from 15.0 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 / 19.0
Average porosity, percent	23.5
Oil saturation after flooding, percent	41.7 / 43.0
Performance factor, percent, estimated	50.0
Net floodable sand, feet	15.0 / 8.0

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - S-11 Well No. HCO-134

5419.2 532.9 "A" = 19 1/9 11 1177 82 2946.11

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	176.7	22.5	48	14	62	838	203	2.0	2.0	1676	406.00
3	178.8	24.6	59	16	75	1126	305.	2.0	4.0	2252	610.00
5	180.6	28.7	62	18	80	1381	764.	2.0	6.0	2762	1528.00
7	182.6	28.0	48	28	76	1043	305.	2.0	8.0	2086	610.00
9	188.4	17.4	49	48	97	661	54.	1.8	9.8	1190	97.20
11	190.4	19.1	41	53	94	608	137.	2.0	11.8	1216	274.00
13	192.6	24.6	36	46	82	687	247.	2.0	13.8	1374	494.00
15	195.4	24.5	33	42	75	627	80.	1.0	14.8	627	80.00
16	202.5	21.2	46	36	82	757	49.	0.8	15.6	606	39.20
17	204.5	15.8	38	48	86	466	14.	0.6	16.2	280	8.40
18	206.5	22.9	33	48	81	586	8.7	1.2	17.4	703	10.44
20	208.5	24.3	54	28	82	1018	74.	1.9	19.3	1934	140.60
22	210.3	24.5	43	35	78	817	153.	2.0	21.3	1634	306.00
24	212.3	23.7	40	38	78	736	163.	1.2	22.5	883	195.60
26	214.6	21.5	44	37	81	734	39.	1.8	24.3	1321	70.20
29	217.5	21.8	37	46	83	626	89.	1.9	26.2	1189	169.10
31	219.5	24.2	38	42	80	713	127.	1.4	27.6	998	177.80
33	221.5	23.0	31	56	87	553	127.	0.9	28.5	498	114.30
34	223.5	13.5	36	60	96	377	0.87	1.0	29.5	377	0.87
35	224.8	18.8	36	48	84	525	0.64	1.0	30.5	525	0.64
36	225.3	15.5	23	71	94	277	Imp.	0.5	31.0	139	0.00
37	226.5	11.2	31	67	98	269	2.0	1.5	32.5	404	3.00
38	227.4	15.5	38	51	89	457	Imp.	1.0	33.5	457	0.00
39	228.5	13.1	39	57	96	396	2.8	1.0	34.5	396	2.80
40	229.5	16.7	12	80	92	156	1.1	1.0	35.5	156	1.10
41	230.5	16.3	22	64	86	278	Imp.	1.0	36.5	278	0.00

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease – Well No. HCO-134

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
176.0 - 192.0	11.8	298.8	3,525.20
192.0 - 220.6	15.8	107.1	1,691.34
221.3 - 231.0	6.4	19.2	122.71
176.0 - 231.0	34.0	157.0	5,339.25

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
176.0 - 192.0	11.8	23.5	51.2	29.2	948	11,182
192.0 - 220.6	15.8	23.1	40.7	39.9	731	11,549
221.3 - 231.0	8.9	15.6	30.2	61.4	363	3,230.
176.0 - 231.0	36.5	21.4	41.6	41.7	711	25,961

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

ompany Hickory Creek Oil Company Lease - Well No. HCO-134

epth Interval, Feet	176.0 - 192.0	192.0 - 220.6	176.0 - 220.6
eet of Core Analyzed	11.8	3.2	15.0
verage Percent Porosity	23.7	22.7	23.5
verage Percent Original Oil Saturation	51.2	41.4	49.1
verage Percent Oil Recovery	8.6	3.1	7.4
verage Percent Residual Oil Saturation	42.6	38.3	41.7
verage Percent Residual Water Saturation	51.0	56.6	52.2
verage Percent Total Residual Fluid Saturation	93.6	94.9	93.9
verage Original Oil Content, Bbls./A. Ft.	954.	724.	905.
verage Oil Recovery, Bbls./A. Ft.	167.	54.	143.
verage Residual Oil Content, Bbls./A. Ft.	787.	670.	762.
otal Original Oil Content, Bbls./Acre	11,260.	2,317.	13,577.
otal Oil Recovery, Bbls./Acre	1,970.	172.	2,142.
otal Residual Oil Content, Bbls./Acre	9,290.	2,145.	11,435.
verage Effective Permeability, Millidarcys	12.51	3.49	10.59
verage Initial Fluid Production Pressure, p.s.i.	24.2	12.5	21.3

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

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - 5-22 Well No. HCO-134

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		960 Residual Saturation			Volume of Water Recovered cc*	153.53 Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	176.7	22.7	48	845	10	176	38	60	669	397	6.97	25
3	178.8	24.6	59	1126	16	305	43	50	821	280	15.00	25
5	180.6	28.8	62	1385	13	290	49	44	1095	118	17.69	25
7	182.6	28.4	48	1085	6	132	42	49	926	232	24.00	15
9	188.4	17.6	49	669	3	41	46	52	628	31	0.45	40
11	190.4	19.3	41	614	3	45	38	51	569	307	9.75	15
13	192.6	24.6	36	687	0	0	36	60	687	196	22.49	10
15	195.4	24.3	33	622	0	0	33	64	622	320	13.92	15
16	202.5	21.2	46	757	0	0	46	45	757	191	2.55	15
17	204.5	16.1	38	475	0	0	38	53	475	30	0.37	25
18	206.5	22.6	33	578	0	0	33	61	578	281	3.67	15
20	208.5	24.1	54	1010	0	0	54	40	1010	248	4.05	15
22	210.3	24.8	43	827	0	0	43	53	827	448	7.50	10
24	212.3	24.1	40	748	0	0	40	57	748	513	5.92	15
26	214.6	21.6	44	737	4	67	40	54	670	164	2.47	15
29	217.5	21.8	37	626	0	0	37	60	626	316	8.33	15
31	219.5	24.0	38	708	2	37	36	60	671	234	4.80	10
33	221.5	23.3	31	560	0	0	31	60	560	159	3.60	10
34	223.5	14.0	34	369	0	0	34	63	369	0	Imp.	-
35	224.8	18.5	37	531	0	0	37	52	531	0	Imp.	-
36	225.3	15.7	23	280	0	0	23	62	280	0	Imp.	-
37	226.5	11.2	31	278	0	0	31	67	278	0	Imp.	-
38	227.4	15.1	39	457	0	0	39	52	457	0	Imp.	-
39	228.5	13.2	39	399	0	0	39	58	399	0	Imp.	-
40	229.5	16.5	12	154	0	0	12	81	154	0	Imp.	-
41	230.5	16.5	22	282	0	0	22	68	282	0	Imp.	-

Notes: cc—cubic centimeter.

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

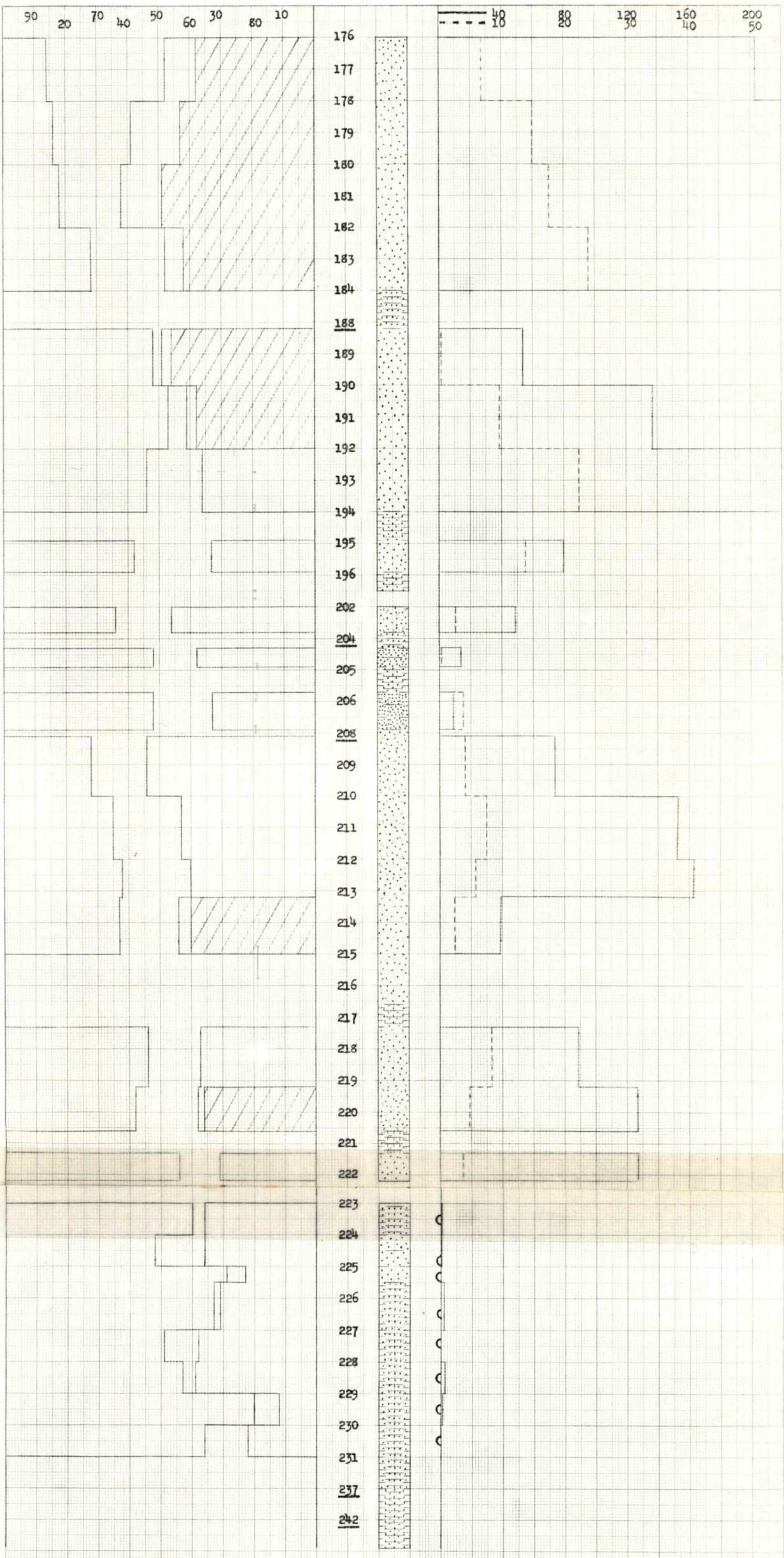
**—Determined by passing water through sample which still contains residual oil.

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WATER SAT .., PERCENT ⟶ ⟵ OIL SAT., PERCENT

——— PERMEABILITY, IN MILLIDARCYS
- - - - EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS



KEY:

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

HICKORY CREEK OIL COMPANY

— LEASE — COUNTY, — HCO - 134

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
176.0 - 192.0	11.8	23.5	51.2	29.2	298.8	
192.0 - 220.6	15.8	23.1	40.7	39.9	107.1	
221.3 - 231.0	8.9	15.6	30.2	61.4	19.2	
176.0 - 231.0	36.5	21.4	41.6	41.7	157.0	6,240 (PRIMARY & WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
MARCH, 1950. HR