OILFIELD RESEARCH LABORATORIES

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

January 11, 1980

Hickory Creek Oil Company
1128 Main Street
Parsons, Kansas 67357

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from Well No. HCO-85, and submitted to our laboratory on December 13, 1979.

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

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Hickory Creek Oil Company Lease – Well No. HCO-85

Location –

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

Name of Sand	–
Top of Core	166.0
Bottom of Core	204.0
Top of Sand	166.0
Bottom of Sand	204.0
Total Feet of Permeable Sand	33.0
Total Feet of Floodable Sand	24.7

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 – 10	3.3	3.3
10 – 50	6.9	10.2
50 – 100	13.2	23.4
100 & Above	9.6	33.0

Average Permeability Millidarcys	84.0
Average Percent Porosity	21.2
Average Percent Oil Saturation	50.1
Average Percent Water Saturation	28.9
Average Oil Content, Bbls./A. Ft.	837.
Total Oil Content, Bbls./Acre	27,609.
Average Percent Oil Recovery by Laboratory Flooding Tests	12.8
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	221.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	5,453.
Total Calculated Oil Recovery, Bbls./Acre	See "Calculated Recovery" Section.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

This 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
166.0 - 167.8	Brown and gray laminated sandstone and shale.
167.8 - 170.5	Gray sandy shale.
170.5 - 172.4	Brown slightly shaly sandstone.
172.4 - 173.2	Gray and light brown laminated shale and sandstone.
173.2 - 174.0	Gray sandy shale.
174.0 - 174.4	Light brown shaly sandstone.
174.4 - 181.6	Brown sandstone.
181.6 - 182.6	Light brown shaly sandstone.
182.6 - 187.1	Brown sandstone.
187.1 - 187.9	Gray and brown laminated shale and sandstone.
187.9 - 188.3	Gray shale.
188.3 - 190.0	Gray and light brown laminated shale and sandstone.
190.0 - 192.3	Brown sandstone.
192.3 - 192.8	Gray and light brown laminated shale and sandstone.
192.8 - 195.0	Brown sandstone.
195.0 - 195.4	Light brown shaly sandstone.
195.4 - 200.6	Brown sandstone.

Depth Interval, Feet	Description
200.6 - 200.7	Gray laminated shaly sandstone.
200.7 - 201.6	Brown sandstone.
201.6 - 201.8	Gray laminated shaly sandstone.
201.8 - 204.0	Brown sandstone.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 5,453 barrels of oil per acre was obtained from 24.7 feet of sand. The weighted average percent oil saturation was reduced from 54.8 to 42.0, or represents an average recovery of 12.8 percent. The weighted average effective permeability of the samples is 6.62 millidarcys, while the average initial fluid production pressure is 22.5 pounds per square inch (See Table V).

Please note that the coregraph now presents residual oil saturation instead of recovery, as in the past.

CALCULATED RECOVERY

The results of the laboratory testing of this core indicate that efficient primary and waterflooding operations in the vicinity of this well should recover approximately 8,570 barrels of oil per acre. This is an average recovery of 347 barrels per acre foot from the 24.7 feet of floodable sand analyzed in this core.

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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 / 22.8
Average porosity, percent	21.9 / 21.6
Oil saturation after flooding, percent	42.0 / 39.6
Performance factor, percent, estimated	45.0
Net floodable pay sand, feet	24.7 / 16.0

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease – D25 Well No. HCO-85

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	166.5	21.1	38	37	75	622	31.	1.0	1.0	622	31.00
2	167.5	17.2	35	57	92	467	36.	0.8	1.8	374	28.80
3	170.6	14.3	47	50	97	521	11.	0.5	2.3	261	5.50
4	171.5	19.7	55	28	83	841	30.	1.0	3.3	841	30.00
5	172.2	16.6	52	45	97	670	60.	0.4	3.7	268	24.00
6	173.1	13.2	4	85	89	41	16.	0.8	4.5	33	12.80
7	174.5	20.4	51	32	83	807	79.	0.6	5.1	484	47.40
8	175.5	24.6	65	15	80	1241	245.	1.0	6.1	1241	245.00
9	176.5	23.9	57	15	72	1057	166.	1.0	7.1	1057	166.00
10	177.5	22.9	60	13	73	1066	107.	1.0	8.1	1066	107.00
11	178.5	22.9	66	10	76	1173	180.	1.0	9.1	1173	180.00
12	179.5	24.2	59	12	71	1108	211.	1.0	10.1	1108	211.00
13	180.5	22.5	59	17	76	1030	73.	1.0	11.1	1030	73.00
14	181.5	21.9	63	16	79	1070	16.	0.6	11.7	642	9.60
15	182.5	15.3	53	35	88	629	2.8	1.0	12.7	629	2.80
16	183.5	18.6	66	31	97	952	87.	1.4	14.1	1333	121.80
17	184.5	24.0	60	15	75	1117	179.	1.0	15.1	1117	179.00
18	185.5	22.9	60	15	75	1066	138.	1.0	16.1	1066	138.00
19	186.5	22.6	55	17	72	964	74.	1.1	17.2	1060	81.40
20	187.5	19.0	64	12	76	943	66.	0.8	18.0	754	52.80
21	188.5	18.9	65	21	86	953	0.24	0.7	18.7	667	0.17
22	189.5	15.1	21	52	73	246	2.6	1.0	19.7	246	2.60
23	190.5	22.0	53	21	74	905	54.	1.0	20.7	905	54.00
24	191.5	22.0	60	24	84	1024	48.	1.2	21.9	1229	57.60
25	192.5	20.6	27	31	58	432	10.	0.6	22.5	259	6.00
26	193.5	23.2	53	23	76	954	83.	1.2	23.7	1145	99.60
27	194.5	22.7	52	29	81	916	75.	1.0	24.7	916	75.00
28	195.5	21.1	51	29	80	835	66.	0.6	25.3	501	39.60
29	196.5	21.7	47	28	75	791	66.	1.0	26.3	791	66.00

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - D25 Well No. HCO-85

6691.4 754.1 1071 2878.64

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.		
30 198	197.5	22.3	46	34	80	796	89.	1.0	27.3	796	89.00
31 199	198.5	21.9	47	34	81	799	151.	1.0	28.3	799	151.00
32 200	199.5	21.9	43	32	75	731	46.	1.0	29.3	731	46.00
33 201	200.5	23.7	40	34	74	736	111.	0.6	29.9	442	66.60
34 202	201.5	23.5	40	35	75	729	82.	0.9	30.8	656	73.80
35 203	202.5	21.8	39	35	74	660	62.	1.2	32.0	792	74.40
36 204	203.5	23.9	31	52	83	575	125.	1.0	33.0	575	125.00

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease – Well No. HCO-85

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
166.0 - 173.2	4.5	29.4	132.10
174.4 - 187.9	13.5	119.7	1,614.80
188.3 - 204.0	15.0	68.4	1,026.37
166.0 - 204.0	33.0	84.0	2,773.27

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
166.0 - 173.2	4.5	17.6	37.4	49.2	534	2,399
174.4 - 187.9	13.5	21.8	60.1	18.3	1019	13,760
188.3 - 204.0	15.0	21.6	45.0	32.2	764	11,450
166.0 - 204.0	33.0	21.2	50.1	28.9	837	27,609

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

D25

Company Hickory Creek Oil Company Lease ----- Well No. HCO-85

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	166.5	21.4	38	631	5	83	33	62	548	302	4.50	20
2	167.5	17.5	35	475	5	68	30	67	407	16	0.23	35
3	170.6	14.0	49	532	0	0	49	50	532	0	Imp.	-
4	171.5	20.1	55	858	20	312	35	55	546	45	0.53	15
5	172.2	17.0	52	686	14	185	38	56	501	61	0.82	25
6	173.1	13.4	7	73	0	0	7	87	73	0	Imp.	-
7	174.5	20.9	51	827	7	113	44	49	714	132	1.95	25
8	175.5	24.2	65	1220	23	432	42	54	788	205	3.75	15
9	176.5	23.9	57	1057	16	297	41	50	760	203	13.51	10
10	177.5	22.4	60	1043	13	226	47	49	817	297	11.68	10
11	178.5	23.4	66	1198	30	545	36	56	653	220	16.07	10
12	179.5	24.3	59	1112	24	452	35	57	660	397	25.70	10
13	180.5	22.8	59	1044	24	425	35	59	619	401	10.40	20
14	181.5	22.2	63	1085	21	362	42	49	723	291	7.50	20
15	182.5	15.7	52	633	0	0	52	37	633	0	Imp.	-
16	183.5	18.9	66	968	20	293	46	52	675	358	9.88	20
17	184.5	24.2	60	1126	17	319	43	51	807	184	9.39	20
18	185.5	23.0	60	1071	22	392	38	56	678	205	10.30	10
19	186.5	22.1	55	943	12	206	43	52	737	346	10.40	20
20	187.5	18.8	64	933	18	263	46	48	670	74	2.10	25
21	188.5	18.8	64	933	0	0 15.7	64	24	933	0	Imp.	-
22	189.5	15.4	21	251	0	0 NP	21	54	251	0	Imp.	-
23	190.5	21.7	53	892	4	67	49	48	825	81	2.40	25
24	191.5	22.5	60	1047	11	192	49	38	855	61	1.65	30
25	192.5	21.1	29	475	0	0	29	53	475	10	0.30	50
26	193.5	22.9	53	942	5	89	48	46	853	85	3.00	30
27	194.5	23.2	52	936	5	90	47	50	846	94	3.30	30
28	195.5	20.9	51	827	3	49	48	42	778	19	0.45	40
29	196.5	21.2	47	773	3	49	44	49	724	46	1.20	30

H_2O

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

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

D25

Company Hickory Creek Oil Company Lease ----- Well No. HCO-85

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.			
30	197.5	22.8	46	814	4	71	42	53	743	117	4.35	30
31	198.5	21.6	47	788	2	34	45	49	754	184	6.15	25
32	199.5	21.7	43	724	2	34	41	56	690	40	1.20	35
33	200.5	23.3	40	723	0	0	40	54	723	317	10.00	15
34	201.5	23.2	42	756	0	0	42	50	756	244	7.79	15
35	202.5	21.8	39	660	0	0	39	54	660	136	4.20	20
36	203.5	24.0	31	577	0	0	31	64	577	324	9.01	15

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 Hickory Creek Oil Company Lease - Well No. HCO-85

Depth Interval, Feet	166.0 - 173.2	174.4 - 187.9	188.3 - 204.0	166.0 - 204.0
Feet of Core Analyzed	3.2	12.5	9.0	24.7
Average Percent Porosity	19.5	22.4	22.2	21.9
Average Percent Original Oil Saturation	44.3	60.9	50.5	54.8
Average Percent Oil Recovery	10.8	19.3	4.6	12.8
Average Percent Residual Oil Saturation	33.5	41.6	45.9	42.0
Average Percent Residual Water Saturation	60.4	52.7	47.9	52.0
Average Percent Total Residual Fluid Saturation	93.9	94.3	93.8	94.0
Average Original Oil Content, Bbls./A. Ft.	670.	1053.	868.	936.
Average Oil Recovery, Bbls./A. Ft.	164.	338.	79.	221.
Average Residual Oil Content, Bbls./A. Ft.	506.	715.	789.	715.
Total Original Oil Content, Bbls./Acre	2,143.	13,154.	7,809.	23,106.
Total Oil Recovery, Bbls./Acre	523.	4,219.	711.	5,453.
Total Residual Oil Content, Bbls./Acre	1,620.	8,935.	7,098.	17,653.
Average Effective Permeability, Millidarcys	1.73	10.69	2.72	6.62
Average Initial Fluid Production Pressure, p.s.i.	23.8	16.5	30.6	22.5

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

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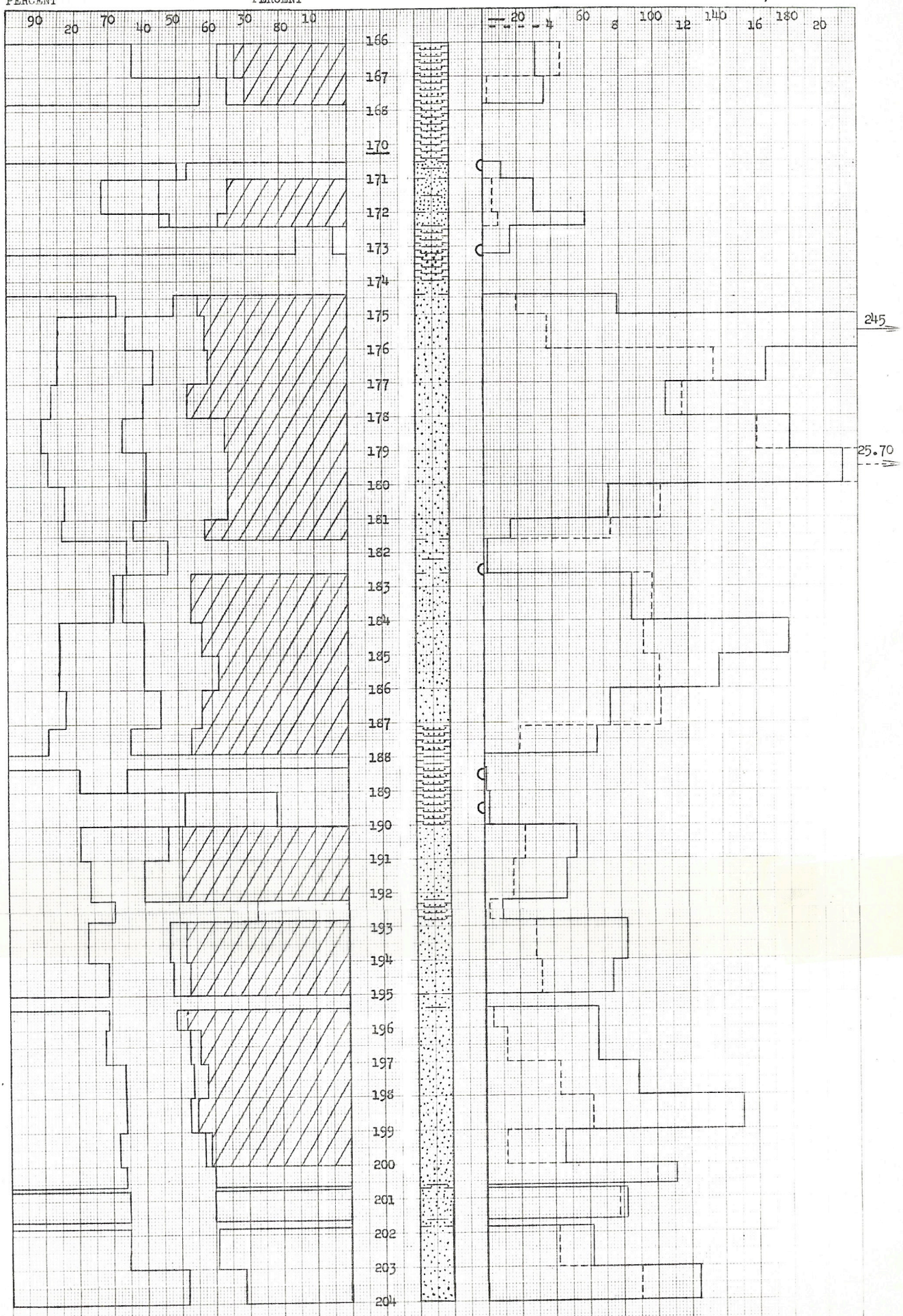
WATER SAT., PERCENT → ← OIL SAT., PERCENT

PERMEABILITY, IN MILLIDARCYS

EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS



KEY:

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

HICKORY CREEK OIL COMPANY

— LEASE — COUNTY, — WELL NO. HCO - 85

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
166.0 - 173.2	4.5	17.6	37.4	49.2	29.4	
174.4 - 187.9	13.5	21.8	60.1	18.3	119.7	
188.3 - 204.0	15.0	21.6	45.0	32.2	68.4	
166.0 - 204.0	33.0	21.2	50.1	28.9	84.0	8570 (PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
JANUARY, 1950 HR