OILFIELD RESEARCH LABORATORIES
536 NORTH HIGHLAND - CHANUTE, KANSAS - PHONE HE1-2650

June 7, 1968

George Sheehan, Interests
Robert K. Butcher, Operator
510 Thompson Building
Tulsa, Oklahoma 74100

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Ellis Lease, Well No. 76, Greenwood County, Kansas, and submitted to our laboratory on June 3, 1968.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:bjo

1 c. - Tulsa, Oklahoma
3 c. - Madison, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company George Sheehan, Interests
George K. Butcher, Operator Lease Ellis Well No. 76

Location SE, SW, SW

Section 26 Twp. 23S Rge. 11E County Greenwood State Kansas

Name of Sand	Bartlesville
Top of Core	1885.0
Bottom of Core	1905.0
Top of Sand	1885.6
Bottom of Sand	1904.5
Total Feet of Permeable Sand	18.5
Total Feet of Floodable Sand	18.5

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 50	5.0	5.0
50 - 100	7.6	12.6
100 - 150	3.9	16.5
150 & above	2.0	18.5

Average Permeability Millidarcys	104.5
Average Percent Porosity	18.5
Average Percent Oil Saturation	28.9
Average Percent Water Saturation	45.3
Average Oil Content, Bbls./A. Ft.	393.
Total Oil Content, Bbls./Acre	7,461.
Average Percent Oil Recovery by Laboratory Flooding Tests	7.2
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	102.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,895.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	5,420.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

A fresh water mud was used as a circulating fluid in the coring of the sand in this well. The core was sampled by a representative of Oilfield Research Laboratories.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
1885.0 - 1885.5	Sandy shale.
1885.5 - 1889.7	Light brown coarse grained slightly calcareous sandstone with a few shale inclusions.
1889.7 - 1904.5	Light brown coarse grained slightly carbonaceous sandstone.
1904.5 - 1905.0	Hard brown and gray conglomerate.

Coring was started at a depth of 1885.0 feet in sandy shale and completed at 1905.0 feet in hard brown and gray comglomerate. This core shows a total of 19.0 feet of sandstone. For the most part, the pay is made up of light brown coarse grained slightly carbonaceous sandstone.

PERMEABILITY

For the sake of distribution, the core was divided into two sections. The weighted average permeability of the upper and lower sections is 104.1 and 108.3 millidarcys respectively; the overall average being 105.5 (See Table Table III). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile. The permeability of the sand varies from 11. to a maximum of 611. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly low weighted average percent oil saturation, namely, 28.9. The weighted average percent oil saturation of the upper and lower sections is 28.4 and 29.7 respectively. The weighted average percent water saturation of the upper and lower sections of 45.0 and 46.0 respectively; the overall average being 45.3 (See Table III). This gives an overall weighted average total fluid saturation of 74.2 percent. This low total fluid saturation indicates considerable fluid was lost during coring which was probably oil.

The weighted average oil content of the upper and lower sections is 377 and 421 barrels per acre foot respectively; the overall average being 393. The total oil content, as shown by this core, is 7,461 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

When taking into consideration, that the sand in the core has a fairly low oil saturation, it responded very well to laboratory flooding tests, as a total recovery of 1,895 barrels of oil per acre was obtained from 18.5 feet of sand. The weighted average percent oil saturation was reduced from 28.3 to 21.1, or represents an average recovery of 7.2 percent. The weighted average effective permeability of the samples is 9.02 millidarcys, while the average initial fluid production pressure is 11.9 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 19 samples tested, 18 produced water and all oil. This indicates that approximately 95 percent of the sand represented by these samples is good floodable pay sand. The tests also show that the sand has a rather wide

variation in effective permeability.

CONCLUSION

On the basis of the above data, we estimate that approximately 5,420 barrels of oil per acre can be recovered from the area, represented by this core, by efficient primary and waterflood operation. This is equivalent to an average of 293 barrels per acre foot. The following data and assumptions were used in calculating the above oil recovery value:

Original formation volume factor	1.17
Present formation volume factor	1.05
Irreducible water saturation, percent	33.0
Average porosity, percent	18.5
Oil saturation after flooding, percent	21.1
Performance factor	0.55
Net floodable pay sand, feet	18.5

This core shows a clean sand section having a fairly low oil saturation, a moderate water saturation and a good permeability. Chances are, considerable flushing of the sand occurred during the cutting of the same and this in turn would partly account for a lower oil and higher water saturations.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company George Sheehan, Interests
Robert K. Butcher, Operator Lease Ellis Well No. 76

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	1886.0	19.5	29	32	61	439	143.	1.1	1.1	483	157.25
2	1887.2	18.0	29	40	69	405	76.	1.1	2.2	445	83.60
3	1888.2	14.7	28	48	76	319	95.	1.0	3.2	319	76.00
4	1889.2	18.2	26	51	77	367	611.	1.0	4.2	367	611.00
5	1890.2	21.2	25	41	66	411	56.	1.0	5.2	411	56.00
6	1891.2	20.4	28	45	73	443	123.	1.0	6.2	443	123.00
7	1892.2	13.6	34	55	89	359	18.	1.0	7.2	359	18.00
8	1893.2	17.2	25	46	71	334	11.	1.0	8.2	334	11.00
9	1894.2	14.7	37	55	92	422	56.	1.0	9.2	422	56.00
10	1895.2	17.0	28	47	75	369	34.	1.0	10.2	369	34.00
11	1896.2	16.0	25	41	66	310	27.	1.0	11.2	310	27.00
12	1897.2	16.1	27	41	68	337	17.	1.0	12.2	337	17.00
13	1898.2	18.3	29	44	73	412	90.	1.0	13.2	412	90.00
14	1899.2	20.3	25	51	76	394	102.	1.0	14.2	394	102.00
15	1900.2	18.5	30	44	74	431	156.	1.0	15.2	431	156.00
16	1901.2	18.8	25	35	60	384	90.	0.5	15.7	192	45.00
F-16		18.5	34	-	-	488	-	0.5	16.2	244	-
17	1902.2	19.0	26	46	72	383	86.	1.0	17.2	383	86.00
18	1903.2	19.7	27	39	66	413	84.	1.0	18.2	413	84.00
19	1904.2	21.8	29	38	67	491	149.	0.8	19.0	393	119.20

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company George Sheehan, Interests
Robert K. Butcher, Operator Lease Ellis Well No. 76

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
1885.5 - 1897.7	12.2	104.1	1,269.85
1897.7 - 1904.5	6.3	108.3	682.20
1885.5 - 1904.5	18.5	105.5	1,952.05

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
1885.5 - 1897.7	12.2	17.2	28.4	45.0	377.	4,599.
1897.7 - 1904.5	6.8	20.8	29.7	46.0	421.	2,862.
1885.5 - 1904.5	19.2	18.5	28.9	45.3	393.	7,461.

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company George Sheehan, Interests
Robert K. Butcher, Operator Lease Ellis Well No. 76

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	1886.0	19.0	29	427	11	162	18	78	265	200	4.10	10
2	1887.2	18.4	29	415	9	129	20	76	286	387	24.20	5
3	1888.2	15.2	28	330	4	47	24	68	283	153	4.68	20
4	1889.2	18.2	26	367	8	113	18	82	254	221	23.20	5
5	1890.2	21.3	25	414	5	83	20	74	331	298	18.55	5
6	1891.2	20.8	28	452	10	161	18	76	291	221	10.80	10
7	1892.2	14.0	34	370	3	33	31	60	337	25	0.60	20
8	1893.2	17.7	25	344	5	69	20	79	275	71	2.10	15
9	1894.2	15.0	37	431	12	140	25	70	291	37	1.00	20
10	1895.2	17.4	28	377	7	94	21	69	283	37	1.20	20
11	1896.2	16.5	25	320	6	77	19	79	243	286	8.80	10
12	1897.2	16.5	27	346	7	90	20	78	256	204	6.10	10
13	1898.2	18.7	29	421	10	145	19	72	276	61	2.40	15
14	1899.2	20.7	25	401	5	80	20	73	321	298	20.28	5
15	1900.2	18.9	30	440	9	132	21	75	308	279	9.40	10
16	1901.3	18.5	34	488	4	57	30	67	431	0	0.05	30
17	1902.2	19.5	26	393	7	106	19	79	287	294	10.40	10
18	1903.2	20.0	27	419	7	109	20	71	310	180	6.80	10
19	1904.2	22.0	29	495	5	85	24	67	410	368	20.85	5

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 George Sheehan, Interests
George Butcher, Operator — Lease Ellis — Well No. 76

Depth Interval, Feet	1885.6 - 1897.7	1897.7 - 1904.5	1885.6 - 1904.5
Feet of Core Analyzed	12.2	6.3	18.5
Average Percent Porosity	17.5	19.8	18.3
Average Percent Original Oil Saturation	28.4	28.1	28.3
Average Percent Oil Recovery	7.3	7.0	7.2
Average Percent Residual Oil Saturation	21.1	21.1	21.1
Average Percent Residual Water Saturation	74.1	72.6	73.6
Average Percent Total Residual Fluid Saturation	95.2	93.7	94.7
Average Original Oil Content, Bbls./A. Ft.	384.	429.	399.
Average Oil Recovery, Bbls./A. Ft.	101.	104.	102.
Average Residual Oil Content, Bbls./A. Ft.	283.	325.	297.
Total Original Oil Content, Bbls./Acre	4,678.	2,713.	7,391.
Total Oil Recovery, Bbls./Acre	1,227.	668.	1,895.
Total Residual Oil Content, Bbls./Acre	3,451.	2,045.	5,496.
Average Effective Permeability, Millidarcys	8.83	9.39	9.02
Average Initial Fluid Production Pressure, p.s.i.	12.4	11.0	11.9

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