

April 26, 1952

Mr. Roy Ensminger
101½ West Main
Chanute, Kansas

Dear Sir:

Enclosed herewith is the report of the analysis of the 3" Rotary core taken from your Ensminger Lease, Well No. 1, Allen County, Kansas, and submitted to our laboratory on April 16, 1952.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:mm
c.c.

3-25-20E

Ensminger 1

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Roy Ensminger Lease Ensminger Well No. 1

Location NW 1/4, NE 1/4

Section 3 Twp. 25S Rge. 20E County Allen State Kansas

Name of Sand **Bartlesville**

Top of Core 818.00

Bottom of Core 841.40

Pay
Top of Sand 824.80

Bottom of Sand 838.60

Total Feet of Permeable Sand **(Analyzed)** 12.21

Total Feet of Floodable Sand **(Analyzed)** 10.71

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 100	2.11	2.11
100 - 150	1.50	3.61
150 - 200	2.55	6.16
200 - 250	2.39	8.55
250 & above	3.66	12.21

Average Permeability Millidarcys 191.31

Average Percent Porosity 21.26

Average Percent Oil Saturation 47.35

Average Percent Water Saturation 33.44

Average Oil Content, Bbls./A. Ft. 777.

Total Oil Content, Bbls./Acre 9,454.

Average Percent Oil Recovery by Laboratory Flooding Tests 16.38

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 269.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 3,040.

Total Calculated Oil Recovery, Bbls./Acre 2,800.

Packer Setting, Feet 825.0

Viscosity, Centipoises @

A. P. I. Gravity, degrees @ 60 °F

Elevation, Feet

The above averages are for that part of the cored section extending from the packer setting to the top of the cement plug.

Fresh water was used as the circulating fluid in the coring of the sand in this well.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
818.00 - 822.60	- Gray shale.
822.60 - 824.12	- Gray sandy shale.
824.12 - 824.80	- Brown fine grained laminated micaceous shaley sandstone.
824.80 - 827.21	- Dark brown fine grained micaceous sandstone.
827.21 - 827.60	- Gray sandy shale.
827.60 - 827.94	- Brown fine grained laminated micaceous shaley sandstone.
827.94 - 829.70	- Dark fine grained micaceous sandstone.
829.70 - 829.92	- Dark fine grained micaceous shaley sandstone.
829.92 - 832.80	- Dark brown fine grained micaceous sandstone.
832.80 - 833.00	- Dark brown fine grained micaceous shaley sandstone.
833.00 - 837.27	- Dark brown fine grained micaceous sandstone containing a shale break.
837.27 - 837.60	- Brown fine grained micaceous shaley sandstone.
837.60 - 838.15	- Dark brown fine grained micaceous sandstone.
838.15 - 838.27	- Dark brown fine grained micaceous shaley sandstone.
838.27 - 839.05	- Dark brown fine grained micaceous sandstone.
839.05 - 839.14	- Dark fine grained micaceous shaley sandstone.
839.14 - 840.40	- Soft gray shale.
840.40 - 841.40	- According to log, soft gray shale (Discarded at well).

Coring was started at a depth of 818.00 feet in gray shale and completed at 841.40 feet in soft gray shale. This core shows a total of 14.72 feet of sand. The pay is made up of fine grained micaceous 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 182.47 and 193.83 millidarcys respectively; while that of the pay sand, or that part of the cored section extending from the packer setting to the bottom of the sand, is 191.31 (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile.

PERCENT SATURATION & OIL CONTENT

The pay sand in this core shows a good weighted average percent oil saturation, namely, 47.35. The weighted average percent oil saturation of both the upper and lower sections is 47.43. The weighted average percent water saturation of the upper and lower sections is 31.04 and 35.99 respectively, while that of the pay sand is 33.44 (See Table IV). This gives an overall weighted average total fluid saturation of 80.79 percent. This comparatively low total fluid saturation indicates that an appreciable amount of fluid was lost during coring, which was probably oil.

In an effort to determine the degree of flushing of the sand during coring, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VII and VIII. From the data given in these tables and on the coregraph, it

is evident that considerable flushing of the sand did occur during coring, as for the most part, the zones of higher permeability have the lower chloride content. The low chloride content could also be due to the migration of fresh water through some old nearby abandoned well into the pay sand.

The weighted average oil content of the upper and lower sections is 779 and 774 barrels per acre foot respectively, while that of the pay sand is 777. The total oil content, as shown by this core, is 9,651 barrels per acre, of which 9,454 barrels are in the pay sand section (See Table IV).

LABORATORY FLOODING TESTS

The sand in this core responded very well to laboratory flooding tests, as a total recovery of 3,040 barrels of oil per acre was obtained from 11.32 feet of sand. The weighted average percent oil saturation was reduced from 46.58 to 30.20, or represents an average recovery of 16.38 percent. The weighted average effective permeability of the samples is 7.42 millidarcys, while the average initial fluid production pressure is 18.8 pounds per square inch (See Table VI).

By observing the data given in Table V, you will note that of the 15 samples tested, 12 produced water and 13 oil. This indicates that most of the sand represented by these samples is floodable. The tests also show that the sand has a wide variation in effective permeability.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 2,800 barrels of oil per acre, or an average of 261 barrels

per acre foot from the 10.71 feet of floodable sand analyzed. In calculating this recovery, an allowance was made for oil lost during coring, and it is assumed that the primary production and the true water saturation of the sand are 7 and 33 percent respectively.

In case you decide to use this well for an injection well, it is recommended that the hole be plugged back to a depth of 839.00 feet. Furthermore, it would be advisable to inject approximately 1,000 gallons of blending fluid (solvent) prior to water injection. Inasmuch as the oil produced on this property has a high viscosity, the use of the solvent would greatly increase the permeability of the sand to water a considerable distance from the shot hole by reducing the viscosity of the oil.

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SHOT RECOMMENDATION

Company **Roy Ensminger** Lease **Ensminger** Well No. **1**

<u>Depth Interval, Feet</u>	<u>Feet of Sand</u>	<u>Size of Shell Inches</u>	<u>Qts./Ft.</u>	<u>Total Quarts</u>
830.0 - 837.5	7.5	4.5	3.1	23.25

Recommended Packer Setting 825.0 feet.

Note: Plug hole back to 839.0 feet.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Roy Ensminger Lease Ensminger Well No. 1

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	824.86	13.	0.35	0.35	4.55
2	825.35	260.	0.40	0.75	104.00
3	825.77	190.	0.45	1.20	85.50
4	826.33	278.	0.60	1.80	166.80
5	826.80	256.	0.61	2.41	156.16
6	827.72	1.8	0.34	2.75	0.61
7	828.25	78.	0.56	3.31	43.68
8	828.75	258.	0.40	3.71	103.20
9	829.15	238.	0.45	4.16	107.10
10	829.56	91.	0.35	4.51	31.85
11	830.00	32.	0.38	4.89	12.16
12	830.60	156.	0.50	5.39	78.00
13	831.02	262.	0.45	5.84	117.90
14	831.53	199.	0.55	6.39	109.45
15	832.05	123.	0.50	6.89	61.50
16	832.60	332.	0.50	7.39	166.00
17	833.10	165.	0.50	7.89	82.50
18	833.83	273.	0.45	8.34	122.85
19	834.04	360.	0.35	8.69	126.00
20	834.54	208.	0.50	9.19	104.00
21	835.16	108.	0.55	9.74	59.40
22	835.60	113.	0.45	10.19	50.85
23	836.12	176.	0.55	10.74	95.70
24	836.73	232.	0.50	11.24	116.00
25	837.05	234.	0.29	11.53	67.86
26	837.67	232.	0.25	11.78	58.00
27	838.06	289.	0.30	12.08	86.70
28	838.56	61.	0.33	12.41	20.13
29	839.12	5.2	0.09	12.50	0.47

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company	Roy Ensminger	Lease	Ensminger	Well No.	1
Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.		
824.80 - 832.80	7.39	182.47	1,348.46		
833.00 - 839.14	5.11	193.83	990.46		
825.00 - 839.00	12.21	191.31	2,335.85		

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RESULTS OF SATURATION TESTS

TABLE III

Company Roy Ensminger Lease Ensminger Well No. 1

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
2	825.10	20.4	51.0	22.2	73.2	807	0.80	0.80	645
3	826.06	21.4	56.2	28.7	84.9	932	1.00	1.80	932
4	827.07	18.1	51.2	30.6	81.8	719	0.61	2.41	439
5	828.07	18.2	51.3	36.8	88.1	726	0.56	2.97	407
6	828.92	23.0	48.8	29.3	78.1	872	1.20	4.17	1,046
7	830.17	20.7	52.7	27.6	80.3	847	0.78	4.95	661
8	831.26	22.4	41.7	35.5	77.2	724	1.10	6.05	796
9	832.35	22.7	32.1	38.3	70.4	566	1.00	7.05	566
10	833.35	22.4	38.6	43.3	81.9	671	0.80	7.85	537
11	834.34	20.5	52.1	35.1	87.2	828	1.00	8.85	828
12	835.44	21.5	53.2	21.5	74.7	887	1.10	9.95	976
13	836.40	22.9	41.2	48.9	90.1	732	1.24	11.19	908
14	837.43	17.5	47.9	47.5	95.4	652	0.33	11.52	215
15	838.22	20.0	49.0	42.3	91.3	761	0.12	11.64	91
F-15	838.34	21.6	49.9	-	-	837	0.33	11.97	276
16	838.94	17.6	53.3	15.1	70.4	729	0.45	12.42	328
							Total	- - - -	9,651

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SUMMARY OF SATURATION TESTS

TABLE IV

Company Roy Ensminger Lease Ensminger Well No. 1

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
824.80 - 832.80	7.05	21.26	47.43	31.04	779	5,492
833.00 - 839.05	5.37	21.15	47.43	35.99	774	4,159
825.00 - 839.00	12.17	21.26	47.35	33.44	777	9,454

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RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Roy Ensminger

Lease Ensminger

Well No. 1

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.
			Percent	Bbls./A. Ft.	Percent	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
2	825.10	20.7	49.3	791	19.5	313	29.8	66.7	478	157	5.46	15
3	826.06	21.1	57.3	939	27.1	444	30.2	63.8	495	39	1.38	20
4	827.07	18.4	50.9	727	21.7	310	29.2	63.7	417	0	0.038	40
5	828.07	18.6	50.3	726	22.0	318	28.3	59.7	408	22	0.728	25
6	828.92	22.7	50.3	887	23.8	420	26.5	65.4	467	152	10.97	10
7	830.17	20.8	50.5	815	23.2	374	27.3	66.6	441	35	1.21	20
8	831.26	22.6	41.6	730	11.6	204	30.0	62.0	526	109	13.02	10
9	832.35	22.5	30.2	528	1.6	28	28.6	65.9	500	185	20.63	15
10	833.35	22.0	37.1	633	5.0	85	32.1	59.1	548	112	6.42	15
11	834.34	20.6	51.0	816	15.8	253	35.2	57.5	563	7	0.246	30
12	835.44	21.4	53.5	885	23.3	383	30.2	62.5	502	157	6.28	15
13	836.40	22.8	39.8	705	6.4	113	33.4	59.4	592	115	12.70	10
14	837.43	17.3	50.0	672	0.0	0	50.0	48.2	672	0	Imp.	50+
15	838.34	21.6	49.9	837	19.9	334	30.0	60.0	503	112	5.10	20
16	838.94	17.9	51.0	695	0.0	0	51.0	25.5	695	0	Imp.	50+

Notes: (1) cc - cubic centimeter.

(2) * - Volume of water recovered at the time of maximum oil recovery.

(3) ** - Determined by passing water through sample which still contains residual oil.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company	Roy Ensminger			Lease	Ensminger			Well No.	1		
Depth Interval, Feet	824.80 - 832.80			833.00 - 838.60			825.00 - 839.00				
Feet of Core Analyzed	7.05			4.47			11.32				
Average Percent Porosity	21.29			21.74			21.48				
Average Percent Original Oil Saturation	47.05			45.95			46.58				
Average Percent Oil Recovery	18.35			13.40			16.38				
Average Percent Residual Oil Saturation	28.70			32.55			30.20				
Average Percent Residual Water Saturation	64.38			59.73			62.50				
Average Percent Total Residual Fluid Saturation	93.08			92.28			92.70				
Average Original Oil Content, Bbls./A. Ft.	773.			771.			773.				
Average Oil Recovery, Bbls./A. Ft.	299.			222.			269.				
Average Residual Oil Content, Bbls./A. Ft.	474.			549.			504.				
Total Original Oil Content, Bbls./Acre	5,452.			3,448.			8,743.				
Total Oil Recovery, Bbls./Acre	2,109.			993.			3,040.				
Total Residual Oil Content, Bbls./Acre	3,343.			2,455.			5,703.				
Average Effective Permeability, Millidarcys	7.86			6.65			7.42				
Average Initial Fluid Production Pressure, p.s.i.	19.0			18.0			18.8				

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

Oil Field Research Laboratories
RESULTS OF WATER DIFFERENTIATION TESTS
TABLE VII

Company **Roy Ensminger** Lease **Ensminger** Well No. **1**

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Connate Percent Water Saturation Drilling & Foreign	Total
2	825.10	11,800		
3	826.06	13,500		
4	827.07	11,100		
5	828.07	14,300		
6	828.92	13,700		
7	830.17	19,400		
8	831.26	11,300		
9	832.35	5,340		
10	833.35	7,330		
11	834.34	16,700		
12	835.44	16,500		
13	836.40	5,160		
14	837.43	10,700		
15	838.22	15,200		
16	838.94	30,200		
Note: ppm - parts per million.				

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company Roy Ensminger Lease Roy Ensminger Well No. 1

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
824.80 - 832.80	12,321		
833.00 - 839.05	13,761		
825.00 - 839.00	12,867		

Note: ppm - parts per million.