

OILFIELD RESEARCH LABORATORIES

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December 7, 1982

Lincoln 77
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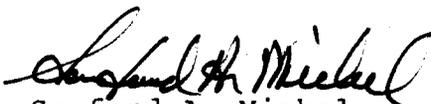
Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Murray Lease, Well No. 10-A, located in Coffey County, Kansas and submitted to our laboratory on December 2, 1982.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES


Sanford A. Michel

SAM/rmc

4 c to Lincoln, Nebraska
1 c to Topeka, Kansas

Oilfield Research Laboratories
GENERAL INFORMATION & SUMMARY

Company Lincoln 77 Lease Murray Well No. 10-A
 Location 1805' EWL & 2010' SNL
 Section 13 Twp. 23S Rge. 16E County Coffey State Kansas

Elevation, Feet

Name of Sand..... Lower Squirrel

Top of Core 936.0

Bottom of Core 954.4

Top of Sand (Tested) 937.0

Bottom of Sand 951.0

Total Feet of Permeable Sand 13.1

Total Feet of Floodable Sand 10.2

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
9 - 25	3.2	3.2
25 - 40	5.2	8.4
40 - 63	4.7	13.1

Average Permeability Millidarcys 36.3

Average Percent Porosity 21.1

Average Percent Oil Saturation 53.4

Average Percent Water Saturation..... 29.4

Average Oil Content, Bbls./A. Ft..... 877.

Total Oil Content, Bbls./Acre..... 11,490.

Average Percent Oil Recovery by Laboratory Flooding Tests..... 17.3

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 283.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 2,891.

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

See "Calculated Recovery"
Section

-2-

The core was sampled and the samples sealed in plastic bags by a representative of the client. Fresh water mud was used as a drilling fluid. The core was reported to be from a non-virgin area.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
936.0 - 937.0	Grayish brown very shaly sandstone.
937.0 - 938.5	Brown sandstone.
938.5 - 939.7	Brown slightly shaly sandstone with scattered fine gray shale partings.
939.7 - 941.6	Brown sandstone with scattered fine gray shale partings.
941.6 - 945.0	Brown sandstone.
945.0 - 951.0	Dark brown sandstone.
951.0 - 954.4	Gray slightly sandy shale.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 2,891 barrels of oil per acre was obtained from 10.2 feet of sand. The weighted average percent oil saturation was reduced from 59.6 to 42.3, or represents an average recovery of 17.3 percent. The weighted average effective permeability of the samples is 1.82 millidarcys, while the average initial fluid production pressure is 21.4 pounds per square inch (See Table V).

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By observing the data given in Table IV, you will note that of the 14 samples tested, 11 produced water and oil, and 2 produced water only. This indicates that approximately 79 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 3,660 barrels of oil per acre. This is an average recovery of 359 barrels per acre foot from 10.2 feet of floodable sand analyzed in this core.

These recovery values were calculated using the following data and assumptions:

Original formation volume factor, estimated	1.05
Reservoir water saturation, percent, estimated	10.0
Average porosity, percent	21.3
Oil saturation after flooding, percent	42.3
Performance factor, percent, estimated	50.0
Net floodable sand, feet	10.2

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Lincoln 77 Lease Murray Well No. 10-A

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	937.3	20.1	28	59	87	437	23.	1.0	437	23.00	
2	938.3	20.3	42	33	75	661	27.	0.5	331	13.50	
3	939.2	18.7	32	61	93	464	9.9	1.2	557	11.88	
4	940.8	22.2	46	38	84	792	35.	1.0	792	35.00	
5	941.7	22.8	37	32	69	655	47.	0.7	459	32.90	
6	942.6	20.9	51	28	79	827	28.	0.7	579	19.60	
7	943.6	20.9	48	34	82	778	31.	1.0	778	31.00	
8	944.3	22.5	47	30	77	820	58.	1.0	820	58.00	
9	945.3	22.3	56	19	75	969	52.	1.0	969	52.00	
10	946.5	21.1	72	14	86	1179	44.	1.0	1179	44.00	
11	947.2	20.9	73	18	91	1184	23.	1.0	1184	23.00	
12	948.5	21.3	70	10	80	1157	33.	1.0	1157	33.00	
13	949.3	18.7	68	14	82	987	36.	1.0	987	36.00	
14	950.3	22.9	71	18	89	1261	62.	1.0	1261	62.00	

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Lease	Well No.							
Lincoln 77	Murray	10-A							
Depth Interval, Feet	Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content, Bbl./A. Ft.	Total Oil Content, Bbls./Acre
937.0 - 945.0	937.0 - 945.0	7.1	31.7	224.88	21.0	40.8	41.2	669	4,753
945.0 - 951.0	945.0 - 951.0	6.0	41.7	250.00	21.2	68.3	15.5	1,123	6,737
937.0 - 951.0	937.0 - 951.0	13.1	36.3	474.88	21.1	53.4	29.4	877	11,490

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Well No. 10-A

Murray

Lease

Company Lincoln 77

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			
1	937.3	20.4	28	443	0	0	28	65	286	2.70	10
2	938.3	20.3	42	661	10	157	32	56	250	2.50	10
3	939.2	19.2	31	462	0	0	31	64	350	3.15	10
4	940.8	22.3	46	796	8	138	38	60	176	1.87	10
5	941.7	22.7	37	652	0	0	37	33	0	Imp.	-
6	942.6	20.8	51	823	18	290	33	53	18	0.33	40
7	943.6	20.9	48	778	8	130	40	57	98	1.20	20
8	944.3	22.4	47	817	9	156	38	60	286	4.20	15
9	945.3	22.3	56	969	11	190	45	50	136	2.10	15
10	946.5	21.2	72	1184	26	428	46	51	160	2.70	20
11	947.2	20.8	73	1178	29	468	44	49	16	0.30	25
12	948.5	21.2	70	1151	25	411	45	51	32	0.50	25
13	949.3	18.6	68	981	23	331	45	53	10	0.23	35
14	950.3	23.0	71	1267	20	357	51	47	256	3.97	20

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

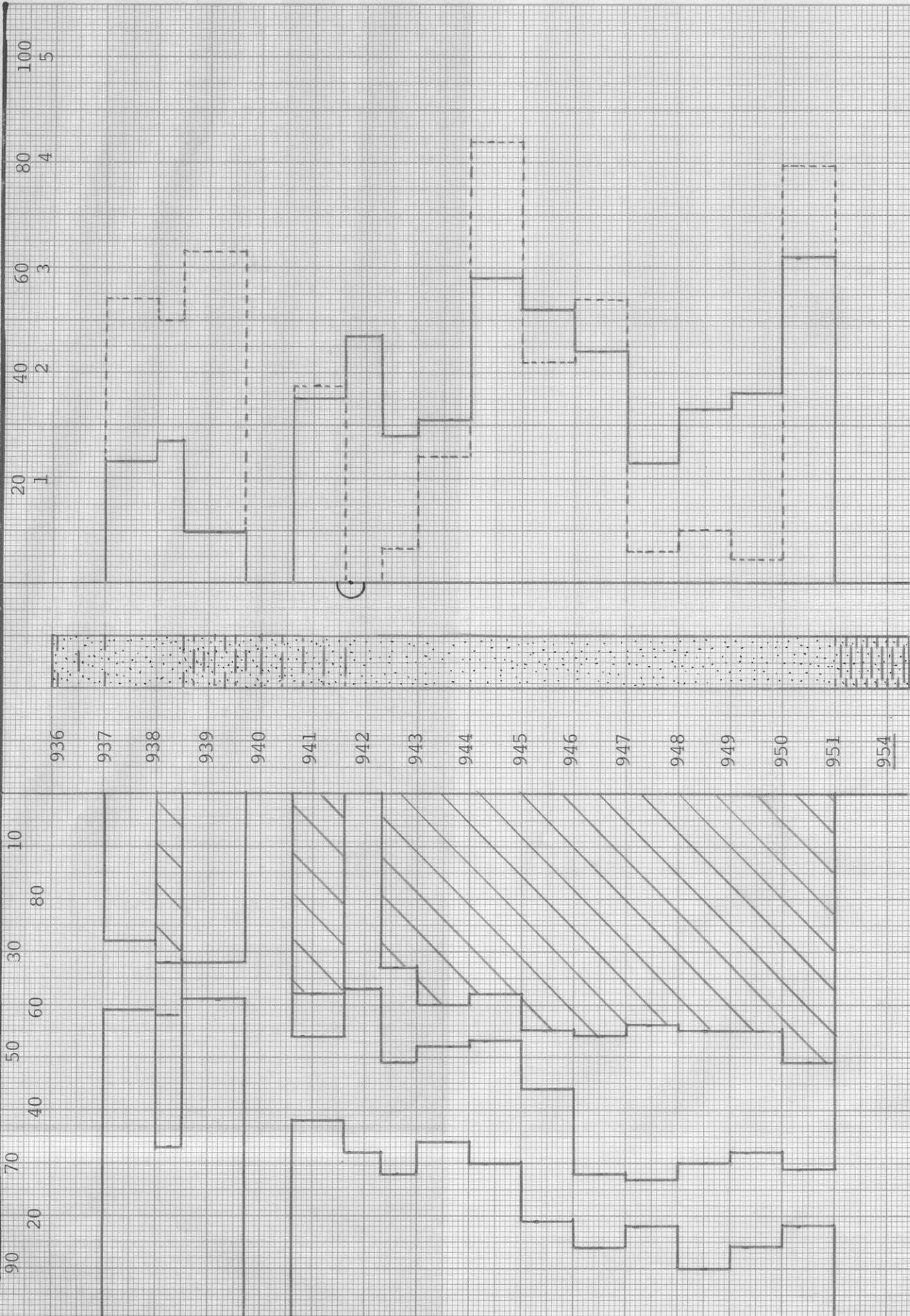
Company	Lease	Murray	Well No.
Lincoln 77	937.0 - 945.0	945.0 - 951.0	10-A 937.0 - 951.0
Feet of Core Analyzed	4.2	6.0	10.2
Average Percent Porosity	21.5	21.2	21.3
Average Percent Original Oil Saturation	47.0	68.3	59.6
Average Percent Oil Recovery	10.1	22.3	17.3
Average Percent Residual Oil Saturation	36.9	46.0	42.3
Average Percent Residual Water Saturation	57.6	50.2	53.2
Average Percent Total Residual Fluid Saturation	94.5	96.2	95.5
Average Original Oil Content, Bbls./A. Ft.	785.	1,122.	983.
Average Oil Recovery, Bbls./A. Ft.	168.	364.	283.
Average Residual Oil Content, Bbls./A. Ft.	617.	758.	700.
Total Original Oil Content, Bbls./Acre	3,298.	6,730.	10,028.
Total Oil Recovery, Bbls./Acre	706.	2,185.	2,891.
Total Residual Oil Content, Bbls./Acre	2,592.	4,545.	7,137.
Average Effective Permeability, Millidarcys	2.08	1.63	1.82
Average Initial Fluid Production Pressure, p.s.i.	19.0	23.3	21.4

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

WATER SAT.,
PERCENT

OIL SAT.,
PERCENT

PERMEABILITY, IN MILLIDARCYS
EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS



KEY:



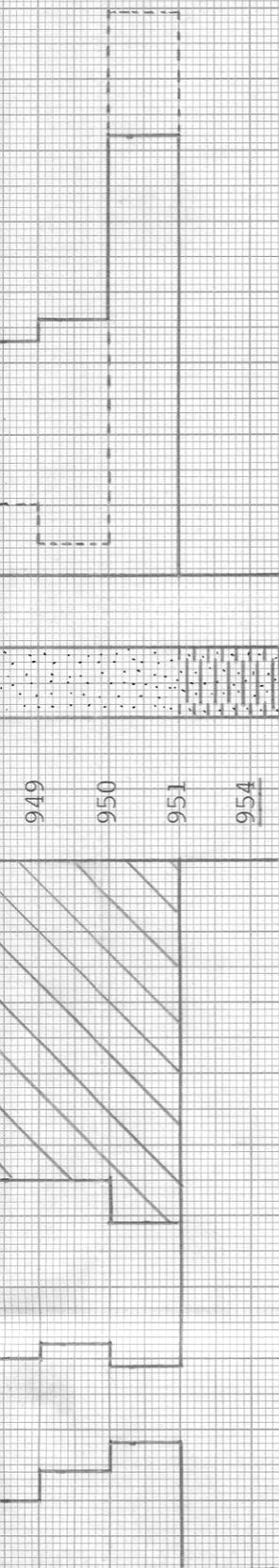
SANDSTONE



SANDY SHALE



SHALY SANDSTONE



KEY:



SANDSTONE



SANDSTONE WITH SHALE PARTINGS



IMPERMEABLE TO WATER



SANDY SHALE



SHALY SANDSTONE



SHALY SANDSTONE WITH SHALE PARTINGS



FLOODPOT RESIDUAL OIL SATURATION

LINCOLN 77

MURRAY LEASE

COFFEY COUNTY, KANSAS

WELL NO. 10-A

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
937.0 - 945.0	7.1	21.0	40.8	41.2	31.7	
945.0 - 951.0	6.0	21.2	68.3	15.5	41.7	
937.0 - 951.0	13.1	21.1	53.4	29.4	36.3	
						36.60
						(PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
 CHANUTE, KANSAS
 DECEMBER, 1982
 PDC