

OILFIELD RESEARCH LABORATORIES

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

November 16, 1981

L & L Oil Company
P. O. Box 13
Benedict, Kansas 66741

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Leonard Westhoff Lease, Well No. 3-A, located in Crawford County, Kansas and submitted to our laboratory on November 4, 1981.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/mkf

5 c to Benedict, Ks.

- REGISTERED ENGINEERS -

CORE ANALYSIS - WATER ANALYSIS - REPRESSURING ENGINEERING - SURVEYING & MAPPING - PROPERTY EVALUATION & OPERATION

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GENERAL INFORMATION & SUMMARY

Company L & L Oil Company Lease Leonard Westhoff Well No. 3-A
 Location 160' FNL & 510' FWL NE $\frac{1}{4}$
 Section 31 Twp. 28S Rgc. 22E County Crawford State Kansas

Elevation, Feet

Name of Sand..... BARTLESVILLE

Top of Core 395.0

Bottom of Core 414.0

Top of Sand 395.0

Bottom of Sand 414.0

Total Feet of Permeable Sand 16.5

Total Feet of Floodable Sand 7.4

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	7.1	7.1
10 - 25	3.7	10.8
25 - 57	5.7	16.5

Average Permeability Millidarcys 20.1

Average Percent Porosity 15.9

Average Percent Oil Saturation 32.5

Average Percent Water Saturation 50.4

Average Oil Content, Bbls./A. Ft. 413.

Total Oil Content, Bbls./Acre 7,633.

Average Percent Oil Recovery by Laboratory Flooding Tests 8.1

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 113.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 839.

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. Fresh water mud was used as a drilling fluid.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval,</u> <u>Feet</u>	<u>Description</u>
395.0 - 400.8	Grayish brown shaly sandstone.
400.8 - 402.4	Brown sandstone.
402.4 - 402.9	Gray shale.
402.9 - 410.7	Brown sandstone.
410.7 - 414.0	Grayish brown shaly sandstone.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 839 barrels of oil per acre was obtained from 7.4 feet of sand. The weighted average percent oil saturation was reduced from 38.5 to 30.4, or represents an average recovery of 8.1 percent. The weighted average effective permeability of the samples is 2.65 millidarcys, while the average initial fluid production pressure is 31.3 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 19 samples tested, 8 produced water and oil. This indicates that approximately 42 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 2120 barrels of oil per acre. This is an average recovery of 287 barrels per acre foot from 7.4 feet of floodable sand analyzed in this core.

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

Original formation volume factor, estimated	1.04
Reservoir water saturation, percent, estimated	30.0
Average porosity, percent	18.2
Oil saturation after flooding, percent.	30.4
Performance factor, percent, estimated	55.0
Net floodable sand, feet	7.4

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company L & L Oil Comapny Lease Leonard Westhoff Well No. 3-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			Ft.	Cum. Ft.		
1	395.5	11.6	10	87	90	1.8	1.0	1.0	90	1.80
2	396.4	10.2	18	80	142	Imp.	1.0	2.0	142	0.00
3	397.4	14.7	41	44	468	0.31	1.0	3.0	468	0.31
4	398.4	10.1	22	75	172	Imp.	1.0	4.0	172	0.00
5	399.4	14.2	4	77	44	0.78	1.0	5.0	44	0.78
6	400.5	16.2	36	45	452	9.2	0.8	5.8	362	7.36
7	401.6	19.4	37	37	557	24.	0.9	6.7	501	21.60
8	402.3	18.6	34	37	491	31.	0.7	7.4	344	21.70
9	403.4	19.0	32	46	472	23.	0.8	8.2	378	18.40
10	404.5	17.9	15	61	208	28.	1.0	9.2	208	28.00
11	405.6	18.6	39	37	563	42.	1.0	10.2	563	42.00
12	406.5	18.7	46	32	667	56.	1.0	11.2	667	56.00
13	407.4	17.9	35	32	486	49.	1.0	12.2	486	49.00
14	408.6	16.4	44	45	560	12.	1.0	13.2	560	12.00
15	409.5	16.1	38	13	475	50.	1.0	14.2	475	50.00
16	410.5	15.4	55	35	657	13.	1.0	15.2	657	13.00
17	411.7	15.4	37	54	442	1.9	1.3	16.5	575	2.47
18	412.4	16.1	44	50	550	4.2	1.0	17.5	550	4.20
19	413.5	16.8	30	62	391	3.5	1.0	18.5	391	3.50

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company L & L Oil Company Lease Leonard Westhoff Well No. 3-A

Depth Interval, Feet	Feet of Core Analyzed	Average Porosity	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
395.0 - 400.8	3.8	12.7	21.3	220	1,278
400.8 - 410.7	9.4	17.7	37.7	515	4,839
410.7 - 414.0	3.3	16.0	37.0	459	1,516
395.0 - 414.0	16.5	15.9	32.5	413	7,633

Average
Permeability,
Millidarcys

2.7
33.2
3.1
20.1

Permeability
Capacity
Ft. x Md.

10.25
311.70
10.17
332.12

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company L. & L Oil Company Lease Leonard Westhoff Well No. 3-A

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	395.5	11.7	10	91	0	0	10	88	0	Imp.	-
2	396.4	10.7	17	141	0	0	17	81	0	Imp.	-
3	397.4	14.8	41	471	0	0	41	45	0	Imp.	-
4	398.4	10.6	21	173	0	0	21	76	0	Imp.	-
5	399.4	14.1	4	44	0	0	4	79	0	Imp.	-
6	400.5	16.3	36	455	0	0	36	46	0	Imp.	-
7	401.6	19.6	37	563	2	30	35	42	70	1.71	35
8	402.3	18.7	34	493	3	44	31	48	112	1.65	35
9	403.4	19.2	32	477	4	60	28	51	40	0.67	30
10	404.5	17.8	15	207	0	0	15	69	0	Imp.	-
11	405.6	18.8	39	569	11	160	28	56	226	3.82	30
12	406.5	18.9	46	674	15	220	31	55	214	4.87	20
13	407.4	18.1	35	491	6	84	29	53	108	2.63	50
14	408.6	16.7	44	570	10	130	34	56	74	1.27	30
15	409.5	16.3	38	481	11	139	27	57	174	3.75	20
16	410.5	15.2	55	649	0	0	55	36	0	Imp.	-
17	411.7	15.3	37	439	0	0	37	55	0	Imp.	-
18	412.4	16.0	44	546	0	0	44	51	0	Imp.	-
19	413.5	16.3	31	392	0	0	31	62	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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SUMMARY OF LABORATORY FLOODING TESTS

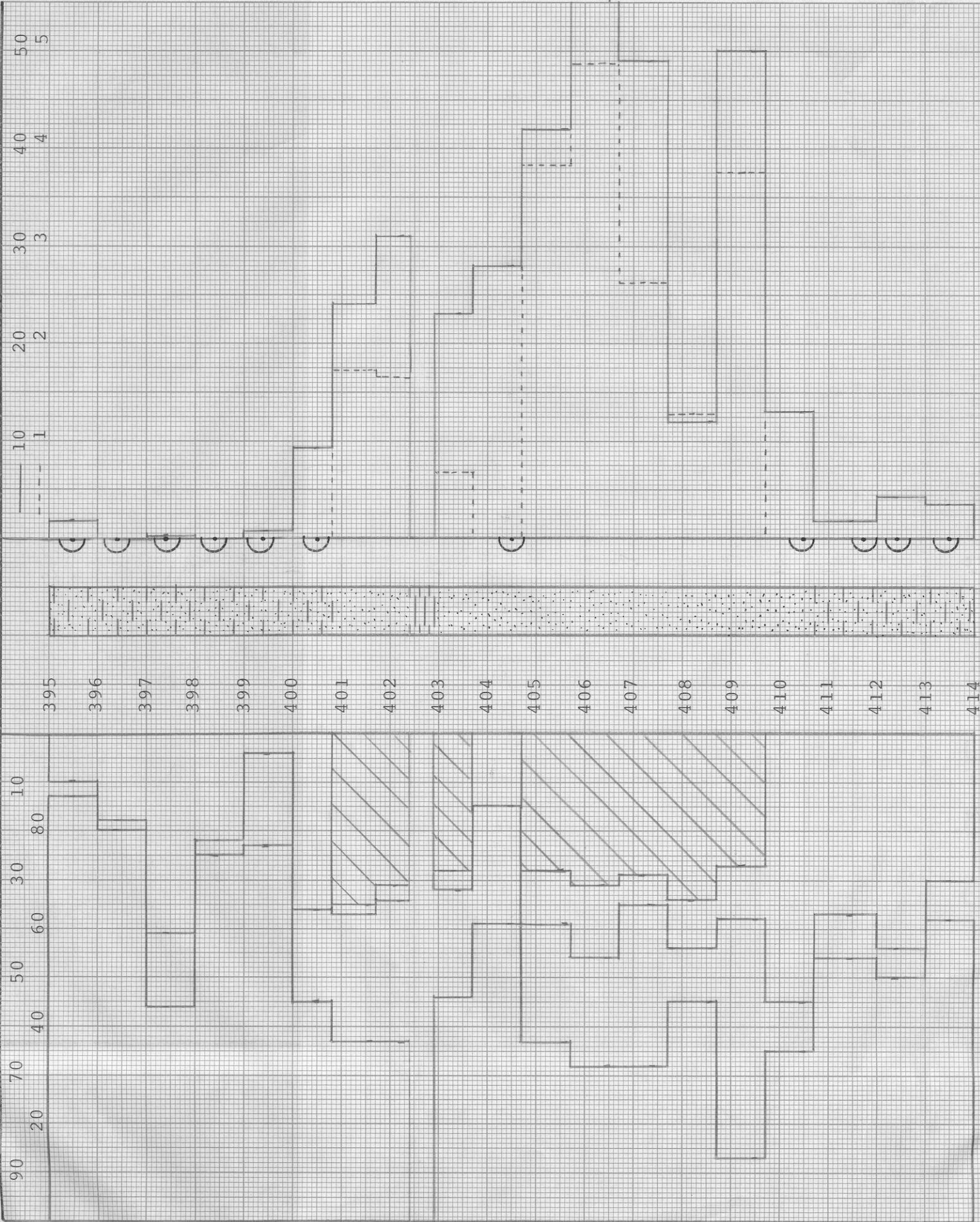
TABLE V

Company	L & L Oil Company	Lease	Leonard Westhoff	Well No.	3-A
Depth Interval, Feet	400.8 - 410.7				
Feet of Core Analyzed	7.4				
Average Percent Porosity	18.2				
Average Percent Original Oil Saturation	38.5				
Average Percent Oil Recovery	8.1				
Average Percent Residual Oil Saturation	30.4				
Average Percent Residual Water Saturation	52.6				
Average Percent Total Residual Fluid Saturation	83.0				
Average Original Oil Content, Bbls./A. Ft.	543.				
Average Oil Recovery, Bbls./A. Ft.	113.				
Average Residual Oil Content, Bbls./A. Ft.	430.				
Total Original Oil Content, Bbls./Acre	4,019.				
Total Oil Recovery, Bbls./Acre	839.				
Total Residual Oil Content, Bbls./Acre	3,180.				
Average Effective Permeability, Millidarcys	2.65				
Average Initial Fluid Production Pressure, p.s.i.	31.3				

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

PERMEABILITY, IN MILLIDARCYS
EFFECTIVE PERMEABILITY TO WATER, IN
MILLIDARCYS

WATER SAT., PERCENT
OIL SAT., PERCENT



56

412
413
414

KEY:



SANDSTONE



IMPERMEABLE TO WATER



SHALE



SHALY SANDSTONE



FLOODPOT RESIDUAL OIL SATURATION

L & L OIL COMPANY

LEONARD WESTHOFF LEASE

CRAWFORD COUNTY, KANSAS

WELL NO. 3-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
395.0 - 400.8	5.8	12.7	21.3	68.8	2.7	
400.8 - 410.7	9.4	17.7	37.7	37.3	33.2	
410.7 - 414.0	3.3	16.0	37.0	55.2	3.1	
395.0 - 414.0	18.5	15.9	32.5	50.4	20.1	2120 (PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
NOVEMBER, 1981
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