

OILFIELD RESEARCH LABORATORIES

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

March 20, 1982

M & M Drilling
Box 216
Mound City, Kansas 66056

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Jackson Lease, Well No. 4, located in Linn County, Kansas and submitted to our laboratory on March 17, 1982.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/kas

5 c to Mound City, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company M & M Drilling Lease Jackson Well No. 4
 Location _____
 Section 4 Twp. 20S Rge. 23E County Linn State Kansas

Elevation, Feet

	Peru	Squirrel
Name of Sand.....	281.0	437.0
Top of Core	310.4	440.5
Bottom of Core	281.0	* 437.5
Top of Sand * (Tested)	309.6	440.1
Bottom of Sand	19.9	2.6
Total Feet of Permeable Sand	4.2	0.
Total Feet of Floodable Sand		

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

PERU SAND

0 - 1	10.5	10.5
1 - 8	7.2	17.7
89 - 100	2.2	19.9

SQUIRREL SAND

0 - 7	2.6	2.6
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Average Permeability Millidarcys	11.9	2.5
Average Percent Porosity	16.5	14.3
Average Percent Oil Saturation	28.3	35.2
Average Percent Water Saturation.....	62.6	51.3
Average Oil Content, Bbls./ A. Ft.	367.	394.
Total Oil Content, Bbls./ Acre.....	10,312.	1,024.
Average Percent Oil Recovery by Laboratory Flooding Tests.....	9.9	0.
Average Oil Recovery by Laboratory Flooding Tests, Bbls./ A. Ft.	145.	0.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./ Acre	609.	0.
Total Calculated Oil Recovery, Bbls./ Acre.....	See "Cal. Rec." 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. The core was reported to be from a non-virgin area.

Since only the Peru sand responded to flooding susceptibility tests, calculated recovery is given for the Peru sand only.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
	<u>PERU SAND</u>
281.0 - 281.6	Brown slightly shaly sandstone.
281.6 - 286.2	Brown shaly sandstone with scattered gray shale partings.
286.2 - 287.0	Grayish brown very shaly sandstone.
287.0 - 287.8	Alternate layers gray shale and brown shaly sandstone.
287.8 - 290.0	Brown very shaly sandstone.
290.0 - 297.8	Grayish brown very shaly sandstone.
297.8 - 298.6	Brown slightly shaly sandstone.
298.6 - 299.1	Gray and brown laminated shale and sandstone.
299.1 - 300.3	Dark brown sandstone.
300.3 - 301.3	Brown slightly shaly sandstone.
301.3 - 302.0	Gray shale with brown sandstone partings.
302.0 - 304.2	Gray and brown laminated shale and sandstone.
304.2 - 305.0	Gray calcareous shaly sandstone.
305.0 - 309.6	Gray and brown laminated shale and sandstone.
309.6 - 310.4	Gray shale.

SQUIRREL SAND

437.0 - 437.5 Brown slightly shaly sandstone.
437.5 - 438.0 Brown slightly shaly sandstone with gray shale partings.
438.0 - 438.7 Brown slightly shaly sandstone.
438.7 - 440.1 Brown shaly sandstone with gray shale partings.
440.1 - 440.5 Gray shale.

LABORATORY FLOODING TESTSPERU SAND

The Peru sand in this core responded to laboratory flooding tests, as a total recovery of 609 barrels of oil per acre was obtained from 4.2 feet of sand. The weighted average percent oil saturation was reduced from 40.7 to 30.8, or represents an average recovery of 9.9 percent. The weighted average effective permeability of the samples is 3.51 millidarcys, while the average initial fluid production pressure is 30 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 29 samples tested, 4 produced water and oil, and 1 produced water only. This indicates that approximately 14 percent of the sand represented by these samples is floodable pay sand.

CALCULATED RECOVERYPERU SAND

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 830 barrels of oil per acre. This is an average recovery of 198 barrels per acre foot from 4.2 feet of floodable sand analyzed in this core.

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

Original formation volume factor, estimated	1.03
Reservoir water saturation, percent, estimated	40.0
Average porosity, percent	18.6
Oil saturation after flooding, percent	30.8
Performance factor, percent, estimated	50.0
Net floodable sand, feet	4.2

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company M & M Drilling

Lease

Jackson

Well No.

4

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.		
						PERU SAND					
1	281.5	16.9	23	68	91	302	5.4	0.6	0.6	181	3.24
2	282.5	14.8	26	70	96	299	0.71	1.4	2.0	419	0.99
3	283.6	17.0	21	67	88	277	0.54	1.0	3.0	277	0.54
4	284.4	16.2	29	68	97	365	0.38	1.0	4.0	365	0.38
5	285.4	16.6	29	44	73	373	0.95	1.2	5.2	448	1.14
6	286.3	15.1	19	76	95	223	Imp.	0.8	6.0	178	0.00
7	287.3	15.6	32	65	97	387	Imp.	0.8	6.8	310	0.00
8	288.4	10.7	34	61	95	282	0.80	1.2	8.0	338	0.96
9	289.5	15.9	35	46	81	432	1.5	1.0	9.0	432	1.50
10	290.6	16.7	29	61	90	376	Imp.	1.0	10.0	376	0.00
11	291.6	17.8	17	71	88	235	0.19	1.0	11.0	235	0.19
12	292.3	15.6	22	72	94	266	Imp.	1.0	12.0	266	0.00
13	293.5	15.6	25	64	89	303	Imp.	1.0	13.0	303	0.00
14	294.6	17.7	29	65	94	398	0.27	1.0	14.0	398	0.27
15	295.4	16.0	25	69	94	310	Imp.	1.0	15.0	310	0.00
16	296.6	16.3	34	63	97	430	0.48	1.0	16.0	430	0.48
17	297.6	15.5	13	85	98	156	Imp.	0.8	16.8	125	0.00
18	298.4	16.7	50	47	97	648	7.1	0.8	17.6	518	5.68
19	299.7	24.0	43	45	88	801	89.	1.2	18.8	961	106.80
20	300.5	16.5	37	56	93	474	6.6	1.0	19.8	474	6.60
21	301.4	15.5	28	65	93	337	0.35	0.7	20.5	236	0.25
22	302.4	19.9	39	50	89	602	2.5	1.0	21.5	602	2.50
23	303.6	16.0	35	59	94	434	4.3	1.2	22.7	521	5.16

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company			M & M Drilling			Lease		Jackson		Well No.		4	
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.				
24	304.8	11.3	12	84	96	105	Imp.	0.8	23.5	84	0.00		
25	305.7	16.7	25	66	91	324	0.84	1.0	24.5	324	0.84		
26	306.7	22.4	25	50	75	434	98.	1.0	25.5	434	98.00		
27	307.6	17.9	22	65	87	306	1.0	1.0	26.5	306	1.00		
28	308.4	13.5	23	71	94	241	Imp.	1.0	27.5	241	0.00		
29	309.5	15.2	31	58	89	366	2.0	0.6	28.1	220	1.20		
						SQUIRREL SAND							
30	437.7	15.2	36	37	73	425	2.8	0.5	0.5	213	1.40		
31	438.6	15.5	41	40	81	493	6.4	0.7	1.2	345	4.48		
32	439.5	13.4	32	62	94	333	0.36	1.4	2.6	466	0.50		

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company M & M Drilling Lease Jackson Well No. 4

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
<u>PERU SAND</u>			
281.0 - 297.8	10.4	0.93	9.69
297.8 - 304.2	5.9	21.5	126.99
304.2 - 309.6	3.6	28.1	101.04
281.0 - 309.6	19.9	11.9	237.72
<u>SQUIRREL SAND</u>			
437.5 - 440.1	2.6	2.5	6.38

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.
<u>PERU SAND</u>					
281.0 - 297.8	16.8	15.8	26.4	65.0	321
297.8 - 304.2	5.9	18.4	38.8	53.2	561
304.2 - 309.6	5.4	16.4	22.8	65.6	298
281.0 - 309.6	28.1	16.5	28.3	62.6	367
<u>SQUIRREL SAND</u>					
437.5 - 440.1	2.6	14.3	35.2	51.3	394

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

M & M Drilling

Jackson

Lease

Well No.

4

Company

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			
						PERU SAND					
1	281.5	17.1	23	305	0	0	23	69	0	Imp.	-
2	282.5	15.0	26	303	0	0	26	71	0	Imp.	-
3	283.6	17.2	21	280	0	0	21	66	0	Imp.	-
4	284.4	16.0	29	360	0	0	29	68	0	Imp.	-
5	285.4	16.1	30	375	0	0	30	44	0	Imp.	-
6	286.3	15.3	19	226	0	0	19	76	0	Imp.	-
7	287.3	15.5	32	385	0	0	32	64	0	Imp.	-
8	288.4	11.2	33	287	0	0	33	62	0	Imp.	-
9	289.5	16.0	35	434	0	0	35	47	0	Imp.	-
10	290.6	16.8	29	378	0	0	29	62	0	Imp.	-
11	291.6	17.6	17	232	0	0	17	72	0	Imp.	-
12	292.3	15.7	22	268	0	0	22	72	0	Imp.	-
13	293.5	15.5	25	301	0	0	25	64	0	Imp.	-
14	294.6	17.5	29	394	0	0	29	66	0	Imp.	-
15	295.4	15.5	26	313	0	0	26	68	0	Imp.	-
16	296.6	16.2	34	427	0	0	34	63	0	Imp.	-
17	297.6	15.7	13	158	0	0	13	85	0	Imp.	-
18	298.4	16.8	50	652	19	248	31	67	22	0.37	20
19	299.7	24.1	43	804	11	206	32	58	176	11.57	20
20	300.5	16.6	37	476	7	90	30	67	20	0.30	35
21	301.4	15.6	28	339	0	0	28	66	0	Imp.	-
22	302.5	19.8	39	599	0	0	39	51	0	Imp.	-
23	303.6	16.1	35	437	5	62	30	64	6	0.22	45

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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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company M & M Drilling Lesse Jackson Well No. 4

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.
			%	Bbbs./A. Ft.	%	Bbbs./A. Ft.	% Oil	% Water			
24	304.8	11.5	12	107	0	0	12	84	0	Imp.	-
25	305.7	16.8	25	326	0	0	25	67	0	Imp.	-
26	306.7	22.3	25	433	0	0	25	52	110	5.10	30
27	307.6	17.4	23	310	0	0	23	64	0	Imp.	-
28	308.4	13.7	23	244	0	0	23	71	0	Imp.	-
29	309.5	15.3	31	368	0	0	31	59	0	Imp.	-
						SQUIRREL SAND					
30	437.7	15.1	36	422	0	0	36	38	0	Imp.	-
31	438.6	15.0	42	489	0	0	42	40	0	Imp.	-
32	439.5	13.5	32	335	0	0	32	63	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

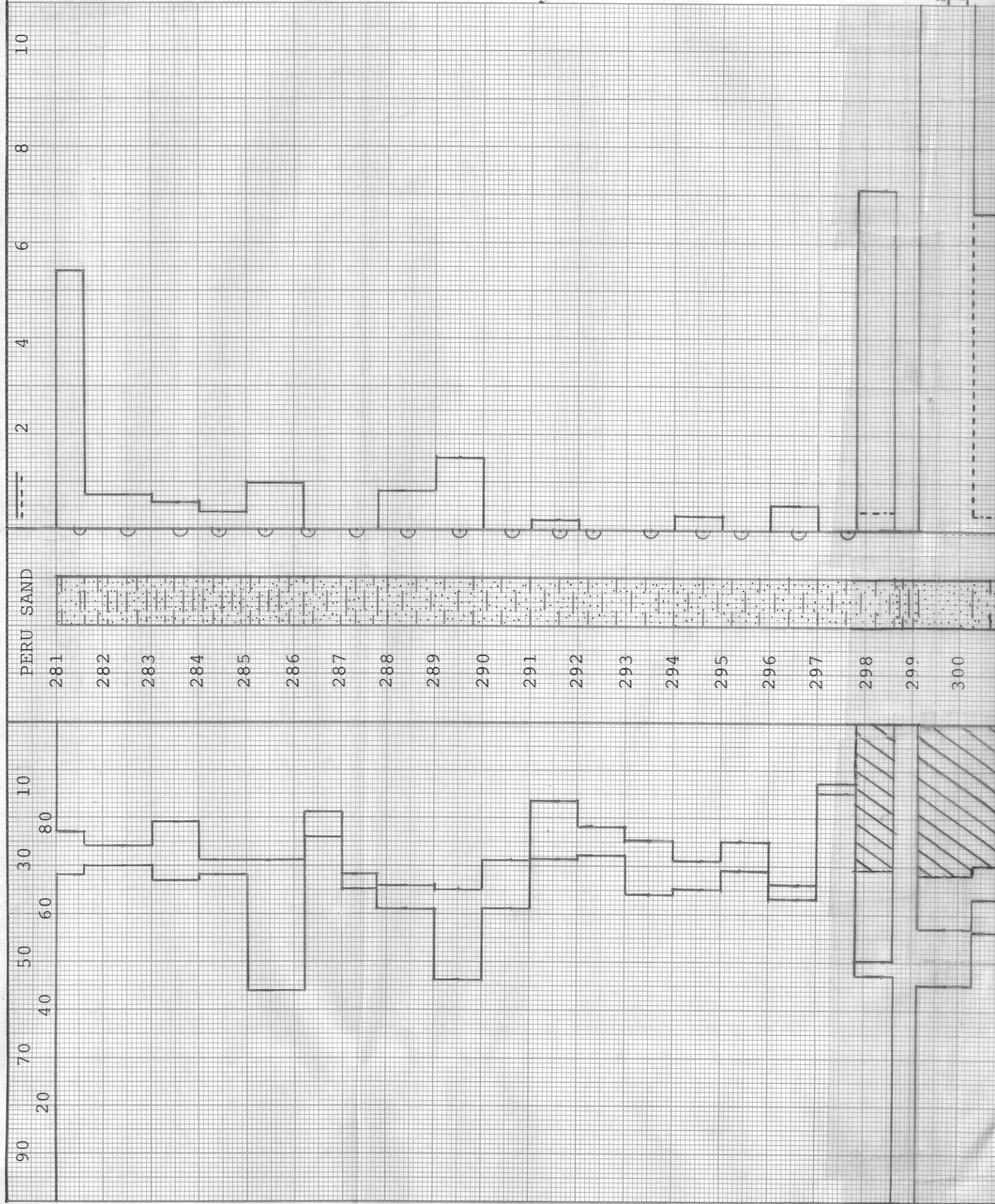
TABLE V

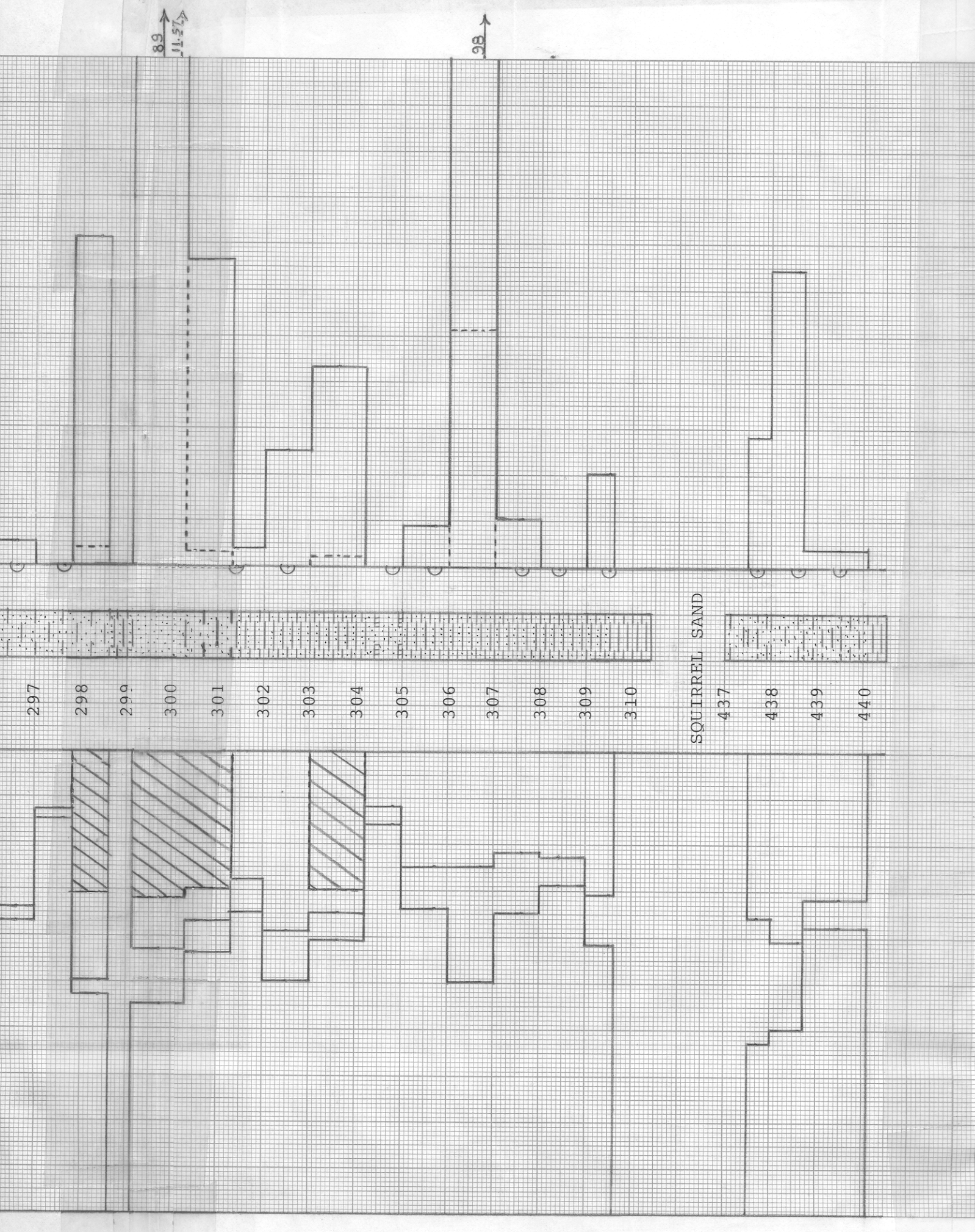
Company	M & M Drilling	Lease	Jackson	Well No.	4
			<u>PERU SAND</u>		
Depth Interval, Feet	297.8 - 304.2				
Feet of Core Analyzed	4.2				
Average Percent Porosity	18.6				
Average Percent Original Oil Saturation	40.7				
Average Percent Oil Recovery	9.9				
Average Percent Residual Oil Saturation	30.8				
Average Percent Residual Water Saturation	63.6				
Average Percent Total Residual Fluid Saturation	94.4				
Average Original Oil Content, Bbls./A. Ft.	592.				
Average Oil Recovery, Bbls./A. Ft.	145.				
Average Residual Oil Content, Bbls./A. Ft.	447.				
Total Original Oil Content, Bbls./Acre	2,486.				
Total Oil Recovery, Bbls./Acre	609.				
Total Residual Oil Content, Bbls./Acre	1,877.				
Average Effective Permeability, Millidarcys	3.51				
Average Initial Fluid Production Pressure, p.s.i.	30.				

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 MDS.





KEY:

 LAMINATED SANDSTONE AND SHALE

 SANDSTONE

 SHALY SANDSTONE

 SHALE

 CALCAREOUS SHALY SANDSTONE

 SHALE WITH SANDSTONE PARTINGS

 SHALY SANDSTONE WITH SHALE PARTINGS

 IMPERMEABLE TO WATER

 ALTERNATE LAYERS OF SHALE AND SHALY SANDSTONE

 FLOODPOT RESIDUAL OIL SATURATION

M & M DRILLING

JACKSON LEASE WELL NO. 4
LINN COUNTY, KANSAS

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./A.Ft.
281.0 - 297.8	16.8	15.8	26.4	65.0	0.93	
297.8 - 304.2	5.9	18.4	38.8	53.2	21.5	
304.2 - 309.6	5.4	16.4	22.8	65.6	28.1	
281.0 - 309.6	28.1	16.5	28.3	62.6	11.9	830 PRIMARY & WATERFLOODING
437.5 - 440.1	2.6	14.3	35.2	51.3	2.5	-

SQUIRREL SAND

OILFIELD RESEARCH LABORATORIES
MARCH, 1982
CHANUTE, KANSAS BL