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

September 18, 1981

Glenn Caldwell
P. O. Box 42
Garnett, Kansas 66032

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Nickell Lease, Well No. 10, located in Linn County, Kansas and submitted to our laboratory on September 4, 1981.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/kas

5 c to Garnett, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Glenn Caldwell Lease Nickell Well No. 10

Location 500' FEL & 150' FSL N½ NW¼

Section 22 Twp. 20S Rge. 22E County Linn State Kansas

Elevation, Feet	
Name of Sand	Squirrel
Top of Core	507.0
Bottom of Core	545.0
Top of Sand	507.0
Bottom of Sand	544.0
Total Feet of Permeable Sand	27.2
Total Feet of Floodable Sand	12.4

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	9.3	9.3
10 - 20	6.2	15.5
20 - 30	6.8	22.3
30 - 50	2.8	25.1
70 - 75	1.4	26.5
150 & Above	0.7	27.2

Average Permeability Millidarcys	23.0
Average Percent Porosity	18.2
Average Percent Oil Saturation	33.4
Average Percent Water Saturation	45.0
Average Oil Content, Bbls./A. Ft.	475.
Total Oil Content, Bbls./Acre	14,871.
Average Percent Oil Recovery by Laboratory Flooding Tests	9.9
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	153.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,893.
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:

Depth Interval, Feet	Description
507.0 - 511.2	Grayish light brown shaly sandstone.
511.2 - 515.1	Alternate layers gray shale and light brown sandstone.
515.1 - 515.5	Gray shale.
515.5 - 517.2	Light brown sandstone.
517.2 - 517.8	Grayish light brown shaly sandstone.
517.8 - 518.8	Gray shaly sandstone.
518.8 - 519.3	Light brown sandstone.
519.3 - 520.1	Gray shale.
520.1 - 521.6	Grayish light brown shaly sandstone.
521.6 - 524.2	Alternate layers gray and brown shale and sandstone.
524.2 - 526.3	Grayish light brown very shaly sandstone.
526.3 - 526.7	Gray and brown laminated shale and sandstone.
526.7 - 527.4	Grayish light brown shaly sandstone.
527.4 - 528.0	Gray shale.
528.0 - 529.3	Brown sandstone.
529.3 - 530.3	Gray shale.
530.3 - 530.6	Grayish light brown shaly sandstone.
530.6 - 532.1	Gray shale.
532.1 - 532.0	Grayish light brown shaly sandstone.
532.0 - 533.0	Brown sandstone.
533.0 - 533.3	Gray shale.

533.3 - 533.7	Brown sandstone.
533.7 - 534.5	Gray and brown laminated shale and sandstone.
534.5 - 538.4	Brown sandstone.
538.4 - 538.8	Gray shale.
538.8 - 540.4	Brown sandstone.
540.4 - 541.0	Gray shale.
541.0 - 541.6	Brown sandstone.
541.6 - 543.0	Grayish light brown shaly sandstone.
543.0 - 544.0	Grayish light brown sandstone.
544.0 - 545.0	Gray shale.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 1,893 barrels of oil per acre was obtained from 12.4 feet of sand. The weighted average percent oil saturation was reduced from 42.9 to 33.0, or represents an average recovery of 9.9 percent. The weighted average effective permeability of the samples is 1.90 millidarcys, while the average initial fluid production pressure is 28.5 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 36 samples tested, 13 produced water and oil, and 4 produced water only. This indicates that approximately 36 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 3,710 barrels of oil per acre. This is an average recovery of 299 barrels per acre foot from 12.4 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	25.0
Average porosity, percent	19.7
Oil saturation after flooding, percent	33.0
Performance factor, percent, estimated	50.0
Net floodable sand, feet	12.4

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Glenn Caldwell Lease Nickell Well No. 10

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	507.5	15.6	17	76	93	206	3.1	1.0	1.0	206	3.10
2	508.5	15.7	16	74	90	195	6.7	1.0	2.0	195	6.70
3	509.5	14.0	25	69	94	272	Imp.	1.0	3.0	272	0.00
4	510.7	18.4	39	45	84	557	8.0	1.2	4.2	668	9.60
5	511.7	20.7	40	34	74	642	18.	0.9	5.1	578	16.20
6	512.6	23.0	29	38	67	518	28.	1.0	6.1	518	28.00
7	513.6	19.8	30	43	73	461	22.	1.0	7.1	461	22.00
8	514.8	20.4	46	32	78	728	25.	1.0	8.1	728	25.00
9	515.7	18.5	40	34	74	574	17.	0.9	9.0	517	15.30
10	516.5	18.1	51	33	84	716	21.	0.8	9.8	573	16.80
11	517.5	16.1	46	49	95	575	1.1	0.6	10.4	345	0.66
12	519.2	18.9	23	47	70	337	18.	0.5	10.9	169	9.00
13	520.2	13.7	41	41	82	436	Imp.	1.0	11.9	436	0.00
14	521.4	13.3	11	80	91	114	0.17	0.5	12.4	57	0.09
15	522.4	19.7	48	29	77	734	15.	1.6	14.0	1174	24.00
16	523.4	22.0	34	34	68	580	30.	1.0	15.0	580	30.00
17	524.4	18.7	52	28	80	754	4.9	1.0	16.0	754	4.90
18	525.3	19.0	38	40	78	560	8.9	1.1	17.1	616	9.79
19	526.4	17.5	17	59	76	231	31.	0.4	17.5	92	12.40
20	527.3	11.4	19	74	93	160	Imp.	0.7	18.2	112	0.00
21	528.3	22.2	10	56	66	172	39.	0.6	18.8	103	23.40
22	529.2	21.8	28	29	57	474	153.	0.7	19.5	332	107.10
23	530.4	18.6	10	56	66	144	7.5	0.3	19.8	43	2.25
24	531.3	13.6	18	77	95	190	4.7	0.8	20.6	152	3.76

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Glenn Caldwell Lease Nickell Well No. 10

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.		
25	532.5	20.4	23	42	65	364	27.	1.0	21.6	364	27.00
26	533.5	20.2	31	32	63	486	71.	0.4	22.0	194	28.40
27	534.3	16.4	58	24	92	738	1.7	0.8	22.8	590	1.36
28	535.3	20.4	55	21	76	870	72.	1.0	23.8	870	72.00
29	536.2	21.2	44	31	75	724	22.	1.0	24.8	724	22.00
30	537.3	20.1	39	39	78	608	17.	0.9	25.7	547	15.30
31	538.2	20.7	2	52	54	32	27.	1.0	26.7	32	27.00
32	539.5	22.3	39	29	68	675	46.	0.8	27.5	540	36.80
33	540.3	19.7	21	49	70	321	12.	0.8	28.3	257	9.60
34	541.5	18.1	27	51	78	379	13.	0.6	28.9	227	7.80
35	542.6	11.6	29	64	93	261	Imp.	1.4	30.3	365	0.00
36	543.6	12.9	48	36	84	480	9.4	1.0	31.3	480	9.40

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Glenn Caldwell Lease Nickell Well No. 10

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
507.0 - 521.6	10.4	14.7	152.45
521.6 - 544.0	16.8	28.2	474.26
507.0 - 544.0	27.2	27.2	626.71

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
507.0 - 521.6	12.4	17.7	32.9	49.0	462	5,723
521.6 - 544.0	18.9	18.5	33.8	42.3	484	9,148
507.0 - 544.0	31.3	18.2	33.4	45.0	475	14,871

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Glenn Caldwell Lease Nickell Well No. 10

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	507.5	15.7	17	207	0	0	17	77	207	0	Imp.	-
2	508.5	15.2	17	200	0	0	17	74	200	0	Imp.	-
3	509.5	14.0	25	272	0	0	25	70	272	0	Imp.	-
4	510.7	18.9	38	557	0	0	38	47	557	0	Imp.	-
5	511.7	20.5	40	636	0	0	40	36	636	0	Imp.	-
6	512.6	23.1	29	520	2	36	27	58	484	138	3.60	25
7	513.6	19.9	30	463	3	46	27	58	417	24	0.33	35
8	514.8	20.3	46	734	15	236	31	65	488	14	0.22	35
9	515.7	18.7	40	580	8	116	32	51	464	30	0.60	30
10	516.5	18.1	51	716	20	281	31	57	435	50	1.20	30
11	517.5	16.2	46	578	10	126	36	50	452	12	0.22	35
12	519.2	19.2	22	328	0	0	22	64	328	0	Imp.	-
13	520.2	13.4	40	416	0	0	40	42	416	0	Imp.	-
14	521.4	13.2	11	113	0	0	11	81	113	0	Imp.	-
15	522.4	19.8	48	737	9	138	39	46	599	32	0.60	30
16	523.4	21.8	34	575	4	68	30	49	507	12	0.15	40
17	524.4	18.8	52	758	0	0	52	29	758	0	Imp.	-
18	525.3	19.1	38	563	0	0	38	42	563	0	Imp.	-
19	526.4	17.4	17	229	0	0	17	73	229	50	0.60	25
20	527.3	11.5	19	170	0	0	19	74	170	0	Imp.	-
21	528.3	22.4	10	174	0	0	10	75	174	180	5.40	25
22	529.2	21.7	28	471	0	0	28	55	471	20	0.33	35
23	530.4	18.5	10	144	0	0	10	58	144	0	Imp.	-
24	531.3	13.2	19	195	0	0	19	77	195	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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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Glenn Caldwell Lease Nickell Well No. 10

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.			
25	532.5	20.5	23	366	0	0	23	44	366	0	Imp.	-
26	533.5	20.2	31	486	0	0	31	33	486	0	Imp.	-
27	534.3	16.5	58	742	8	102	50	44	640	24	0.45	40
28	535.3	20.6	55	879	21	336	34	62	543	194	5.70	20
29	536.2	21.3	44	727	12	198	32	58	529	348	8.70	20
30	537.3	20.1	39	608	10	156	29	54	452	42	0.75	10
31	538.2	20.6	2	32	0	0	2	54	32	0	Imp.	-
32	539.5	22.3	39	675	9	156	30	60	519	50	0.90	20
33	540.3	19.8	21	323	0	0	21	59	323	0	Imp.	-
34	541.5	18.0	27	377	0	0	27	56	377	10	0.20	50
35	542.6	11.2	30	261	0	0	30	63	261	0	Imp.	-
36	543.6	13.1	47	478	0	0	47	39	478	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.

Oilfield Research Laboratories

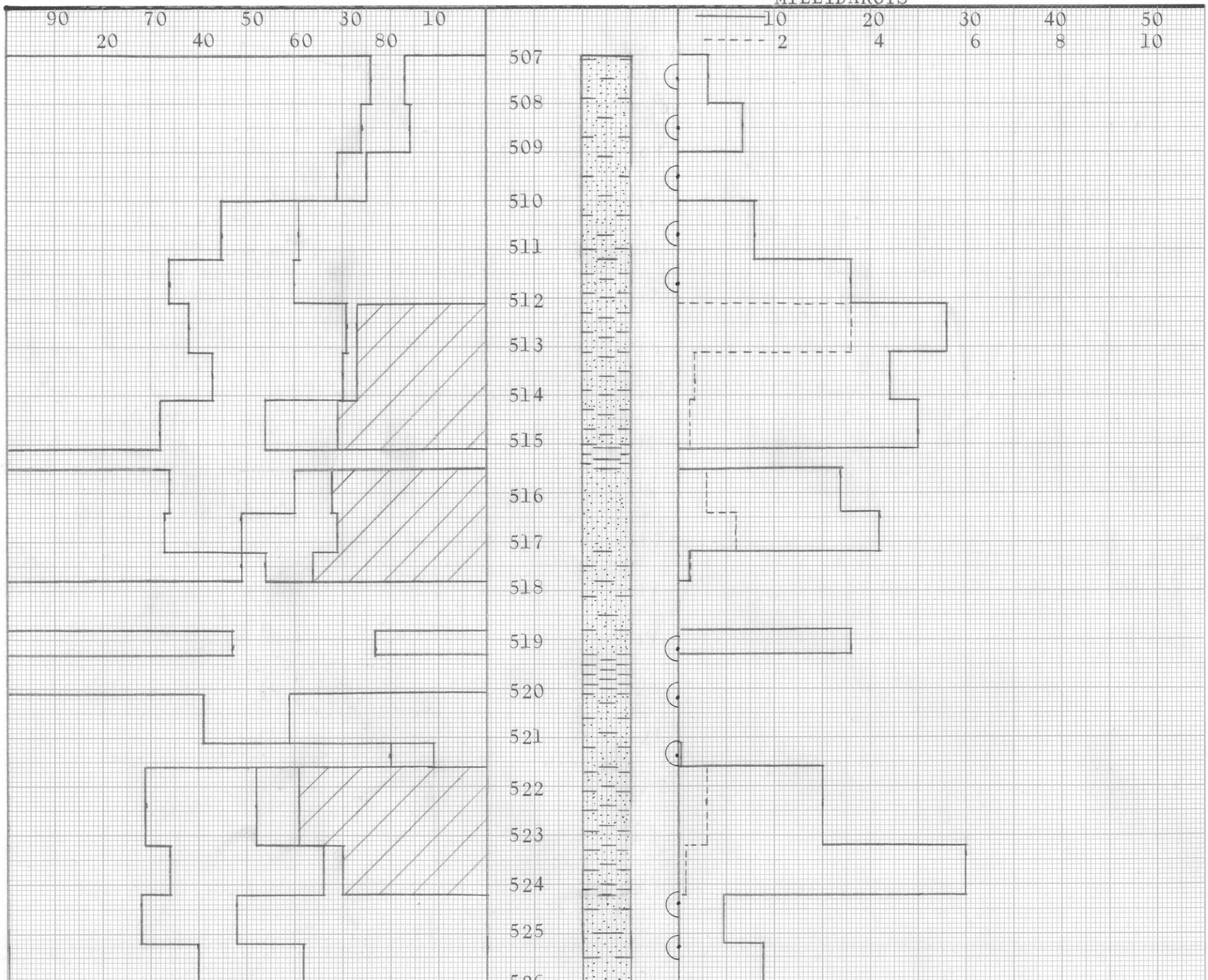
SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Glenn Caldwell Lease Nickell Well No. 10

Depth Interval, Feet	507.0 - 521.6	521.6 - 544.0	507.0 - 544.0
Feet of Core Analyzed	5.3	7.1	12.4
Average Percent Porosity	16.3	20.5	18.7
Average Percent Original Oil Saturation	39.5	45.4	42.9
Average Percent Oil Recovery	9.3	10.4	9.9
Average Percent Residual Oil Saturation	30.2	35.0	33.0
Average Percent Residual Water Saturation	57.1	52.7	54.6
Average Percent Total Residual Fluid Saturation	87.3	87.7	87.6
Average Original Oil Content, Bbls./A. Ft.	594.	710.	661.
Average Oil Recovery, Bbls./A. Ft.	136.	165.	153.
Average Residual Oil Content, Bbls./A. Ft.	458.	545.	508.
Total Original Oil Content, Bbls./Acre	3,149.	5,041.	8,190.
Total Oil Recovery, Bbls./Acre	723.	1,170.	1,893.
Total Residual Oil Content, Bbls./Acre	2,426.	3,871.	6,297.
Average Effective Permeability, Millidarcys	1.1	2.4	1.9
Average Initial Fluid Production Pressure, p.s.i.	31.7	25.7	28.5

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
90 70 50 30 10
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10 20 30 40 50
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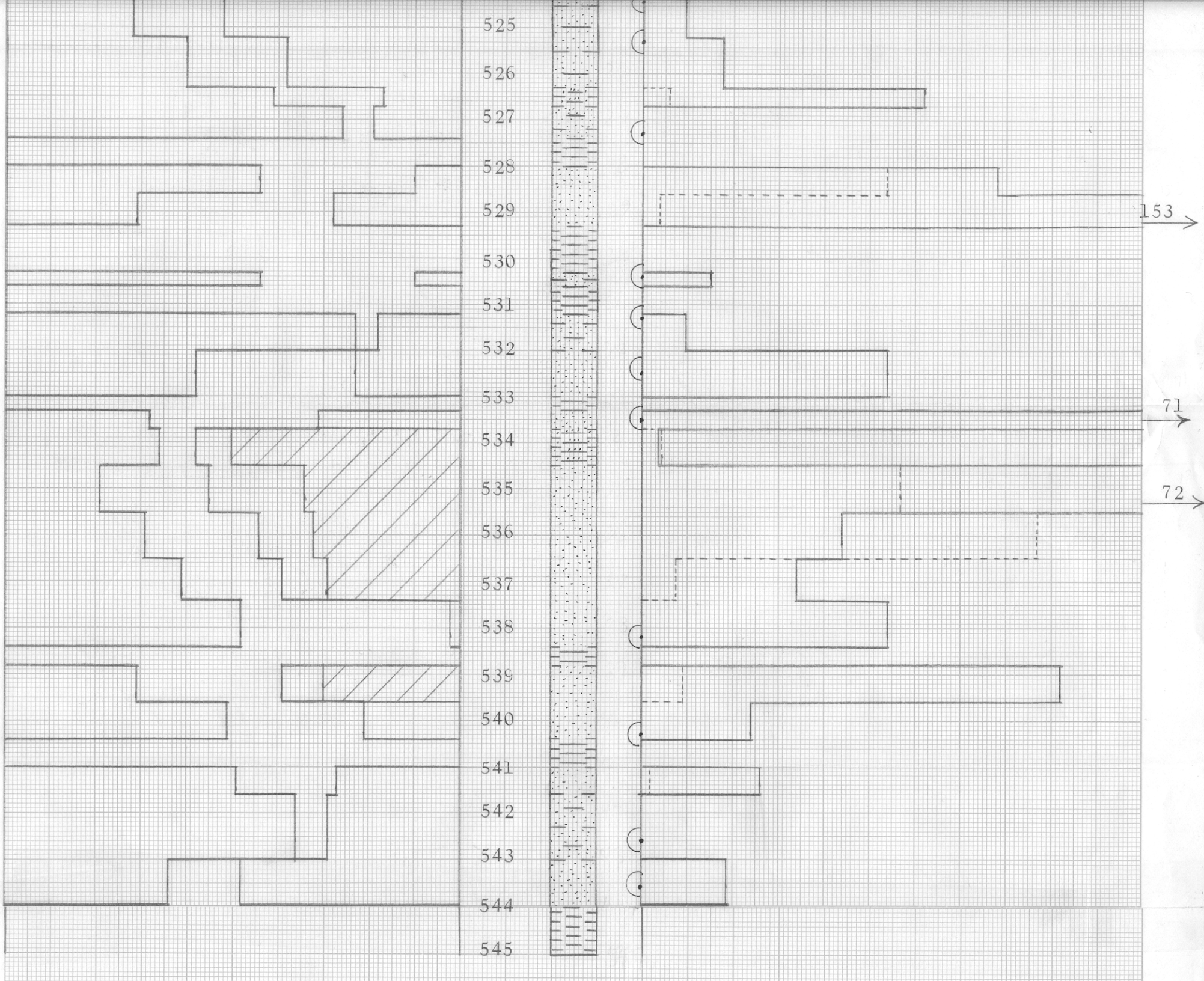
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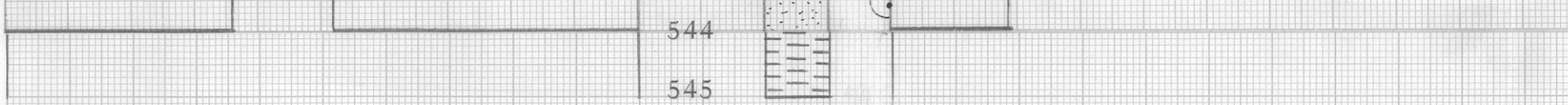

KEY:

- SANDSTONE
- SHALE
- SHALY SANDSTONE
- LAMINATED SANDSTONE AND SHALE
- ALTERNATE LAYERS OF SANDSTONE AND SHALE
- FLOODPOT RESIDUAL OIL SATURATION
- IMPERMEABLE TO WATER

GLENN CALDWELL

NICKELL LEASE — WELL NO. 10

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. / ACRE
507.0 - 521.6	12.4	17.7	32.9	49.0	14.7	
521.6 - 544.0	18.9	18.5	33.8	42.3	28.2	
507.0 - 544.0	31.3	18.2	33.4	45.0	27.2	3710 (PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
SEPTEMBER, 1981 PDC