

OILFIELD RESEARCH LABORATORIES

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

March 22, 1982

Ponderay International, Inc.
Drawer "D"
Chanute, Kansas 66720

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Tom Erbe A Lease, Well No. 1, located in Wilson 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 Chanute, Kansas

- REGISTERED ENGINEERS -

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

Oilfield Research Laboratories
GENERAL INFORMATION & SUMMARY

Company Ponderay International, Inc. Lease Tom Erbe A Well No. 1
 Location SW $\frac{1}{4}$
 Section 18 Twp. 29S Rge. 17E County Wilson State Kansas

Elevation, Feet

Name of Sand.....	Cattleman
Top of Core	790.0
Bottom of Core	844.3
Top of Sand	790.0
Bottom of Sand (Tested)	844.0
Total Feet of Permeable Sand	35.2
Total Feet of Floodable Sand (Tested)	5.8

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	12.0	12.0
5 - 10	3.5	15.5
10 - 50	12.2	27.7
50 - 100	6.5	34.2
100 - 150	1.0	35.2

Average Permeability Millidarcys	27.7
Average Percent Porosity	15.7
Average Percent Oil Saturation	26.5
Average Percent Water Saturation	58.2
Average Oil Content, Bbls./A. Ft.	339.
Total Oil Content, Bbls./Acre	14,930.
Average Percent Oil Recovery by Laboratory Flooding Tests	5.8
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	78.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	454.

Total Calculated Oil Recovery, Bbls./Acre..... See "Calculated Recovery"
 Section

The core was sampled in the laboratory after being delivered by the client. The core was reported to be from a virgin area.

At the request of the client, sample numbers 17 through 23 inclusive, were subjected to flooding susceptibility tests. Therefore, the calculated recovery is for the footage represented by these samples only (depth interval 811.0 through 817.8).

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
790.0 - 791.0	Gray and brown finely laminated shale and sandstone.
791.0 - 791.8	Brown slightly shaly sandstone.
791.8 - 792.3	Brown sandstone.
792.3 - 796.6	Grayish brown very shaly sandstone.
796.6 - 797.6	Brown shaly sandstone.
797.6 - 799.3	Gray very shaly sandstone.
799.3 - 799.6	Grayish brown very shaly sandstone.
799.6 - 801.4	Gray very shaly sandstone.
801.4 - 801.7	Grayish brown very shaly sandstone.
801.7 - 802.5	Gray very shaly sandstone.
802.5 - 803.0	Brown very shaly sandstone.
803.0 - 803.5	Brown shaly sandstone with fine gray shale partings.
803.5 - 805.2	Gray shale.
805.2 - 806.0	Brown shaly sandstone with gray shale partings.
806.0 - 807.0	Brown slightly shaly sandstone.
807.0 - 808.0	Gray shale.
808.0 - 809.4	Gray and brown laminated micaceous shale and sandstone.

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809.4 - 809.6	Grayish brown shaly sandstone.
809.6 - 811.0	No core.
811.0 - 817.8	Brown sandstone.
817.8 - 818.6	Brown slightly calcareous sandstone with gray shale nodules.
818.6 - 819.9	Brown shaly sandstone with gray shale inclusions.
819.9 - 821.5	Gray very shaly sandstone.
821.5 - 822.4	Brown conglomeratic sandstone.
822.4 - 824.0	Brown sandstone.
824.0 - 825.0	Grayish brown slightly calcareous very shaly sandstone.
825.0 - 825.3	Brown slightly calcareous sandstone with gray shale inclusions.
825.3 - 826.1	Grayish brown very shaly sandstone.
826.1 - 826.8	Brown sandstone.
826.8 - 828.0	Brown shaly sandstone with gray shale nodules.
828.0 - 829.9	Brown sandstone with gray shale partings.
829.9 - 830.7	Grayish brown very shaly sandstone.
830.7 - 834.4	Brown shaly sandstone with shale partings and shale nodules.
834.4 - 840.0	Brown sandstone.
840.0 - 840.8	Brown sandstone with gray shale nodules.
840.8 - 842.3	Brown sandstone.
842.3 - 844.0	Light brown sandstone.
844.0 - 844.3	Grayish brown very shaly sandstone.

LABORATORY FLOODING TESTS

(Depth Interval 811.0' through 817.8').

The sand in this core responded to laboratory flooding tests, as a total recovery of 454 barrels of oil per acre was obtained from 5.8 feet of sand. The weighted average percent oil saturation was reduced from 36.5 to 30.7, or represents an average recovery of 5.8 percent. The weighted average effective permeability of the samples is 0.43 millidarcys, while the average initial fluid production pressure is 40.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 7 samples tested, 6 produced water and oil, and 1 sample produced water only. This indicates that approximately 86 percent of the sand represented by these samples is floodable pay sand.

CALCULATED RECOVERY

(Depth Interval 811.0' through 817.8').

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 1,200 barrels of oil per acre. This is an average recovery of 207 barrels per acre foot from 5.8 feet of floodable sand analyzed in this core.

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

Original formation volume factor, estimated	1.07
Reservoir water saturation, percent, estimated	40.0
Average porosity, percent	17.5
Oil saturation after flooding, percent	30.7
Performance factor, percent, estimated	60.0
Net floodable sand, feet	5.8

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

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	790.7	14.6	17	59	193	1.3	1.0	1.0	193	1.30
2	791.6	15.9	29	44	358	6.4	0.8	1.8	286	5.12
3	792.2	16.6	27	46	348	17.	0.5	2.3	174	8.50
4	793.4	11.4	13	76	115	1.2	1.5	3.8	173	1.80
5	794.3	14.0	9	71	98	0.42	1.3	5.1	127	0.55
6	795.2	11.8	11	83	101	Imp.	1.5	6.6	152	0.00
7	796.8	16.4	33	44	420	1.6	0.5	7.1	210	0.80
8	797.5	14.7	28	41	319	0.98	0.5	7.6	160	0.49
9	798.4	10.6	9	84	74	Imp.	1.7	9.3	126	0.00
10	799.4	10.5	19	78	155	Imp.	0.3	9.6	47	0.00
11	800.4	12.2	8	89	76	Imp.	1.8	11.4	137	0.00
12	801.6	14.0	23	68	250	0.69	0.3	11.7	75	0.21
13	802.6	14.3	31	67	344	0.42	0.5	12.2	172	0.21
14	803.4	13.8	36	62	385	0.16	0.5	12.7	193	0.08
15	805.7	14.4	32	62	358	0.27	0.8	13.5	286	0.22
16	806.5	18.0	33	48	461	6.1	1.0	14.5	461	6.10
17	811.6	18.4	32	48	457	19.	1.0	15.5	457	19.00
18	812.6	17.3	37	48	497	17.	1.0	16.5	497	17.00
19	813.7	16.3	38	55	481	13.	1.0	17.5	481	13.00
20	814.7	17.4	36	54	486	20.	1.0	18.5	486	20.00
21	815.8	16.9	49	47	642	22.	1.0	19.5	642	22.00
22	816.4	18.8	35	43	511	36.	1.0	20.5	511	36.00
23	817.4	16.7	42	50	544	30.	0.8	21.3	435	24.00
24	818.5	12.3	22	74	210	1.0	0.8	22.1	168	0.80

Company Ponderay International, Inc.

Lease

Tom Erbe A

Well No.

1

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

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TABLE 1-B

Company Ponderay International, Inc. Lease Tom Erbe A Well No. 1

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.		
25	819.5	11.0	29	65	94	247	Imp.	1.3	321	0.00
26	821.8	13.2	31	53	84	318	4.4	24.3	286	3.96
27	822.7	19.4	28	50	78	421	35.	24.9	253	21.00
28	823.4	19.5	29	46	75	439	52.	25.9	439	52.00
29	825.2	13.7	42	41	83	446	16.	26.2	134	4.80
30	826.4	14.4	32	50	82	358	23.	26.9	251	16.10
31	827.7	14.5	35	50	85	394	3.6	28.1	473	4.32
32	828.5	17.1	19	56	75	252	11.	29.1	252	11.00
33	829.3	16.3	37	48	85	468	10.	30.0	421	9.00
34	830.6	11.7	18	64	82	163	0.52	30.8	130	0.42
35	831.4	14.4	24	65	89	268	Imp.	32.1	348	0.00
36	832.4	11.6	30	68	98	270	Imp.	33.1	270	0.00
37	833.5	12.7	11	67	78	108	0.45	34.5	151	0.63
38	834.5	15.0	42	55	97	489	22.	35.1	293	13.20
39	835.8	22.4	31	40	71	539	97.	36.1	539	97.00
40	836.5	21.7	27	46	73	455	90.	37.1	455	90.00
41	837.5	22.5	25	46	71	436	74.	38.1	436	74.00
42	838.4	21.7	26	43	69	438	59.	39.1	438	59.00
43	839.5	19.1	37	47	84	548	41.	40.1	548	41.00
44	840.4	16.3	37	57	94	468	6.0	40.9	374	4.80
45	841.7	21.5	30	45	75	500	99.	42.4	750	148.50
46	842.4	16.8	36	54	90	469	11.	43.1	328	7.70
47	843.6	22.9	22	54	76	391	141.	44.1	391	141.00

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company		Ponderay International, Inc.		Lease	Tom Erbe A	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	
790.0 - 807.0	14.5	13.5	18.4	68.9	205	2,972	
811.0 - 817.8	6.8	17.4	38.3	49.3	516	3,509	
817.8 - 834.4	13.2	14.2	26.5	58.4	295	3,897	
834.4 - 844.0	9.6	20.5	30.5	47.9	474	4,552	
790.0 - 844.0	44.1	15.7	26.5	58.2	339	14,930	

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
790.0 - 807.0	9.2	2.8	25.38
811.0 - 817.8	6.8	22.2	151.00
817.8 - 834.4	9.6	12.9	124.03
834.4 - 844.0	9.6	70.4	676.20
790.0 - 844.0	35.2	27.7	976.61

Oilfield Research Laboratories
RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Ponderay International, Inc.										Lease		Tom Erbe A		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.						
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water				Bbls./A. Ft.					
17	811.6	18.3	32	454	3	43	29	66	411	24	0.30	50					
18	812.6	17.3	37	497	6	81	31	65	416	19	0.42	45					
19	813.7	16.2	38	478	6	75	32	66	403	14	0.15	40					
20	814.7	17.5	36	489	5	68	31	65	421	18	0.22	40					
21	815.8	16.9	49	642	0	0	49	47	642	20	0.15	45					
22	816.4	18.7	35	508	5	73	30	62	435	27	0.37	35					
23	817.4	16.8	42	547	11	143	31	64	404	67	1.05	30					

Company Ponderay International, Inc. Lease Tom Erbe A Well No. 1

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

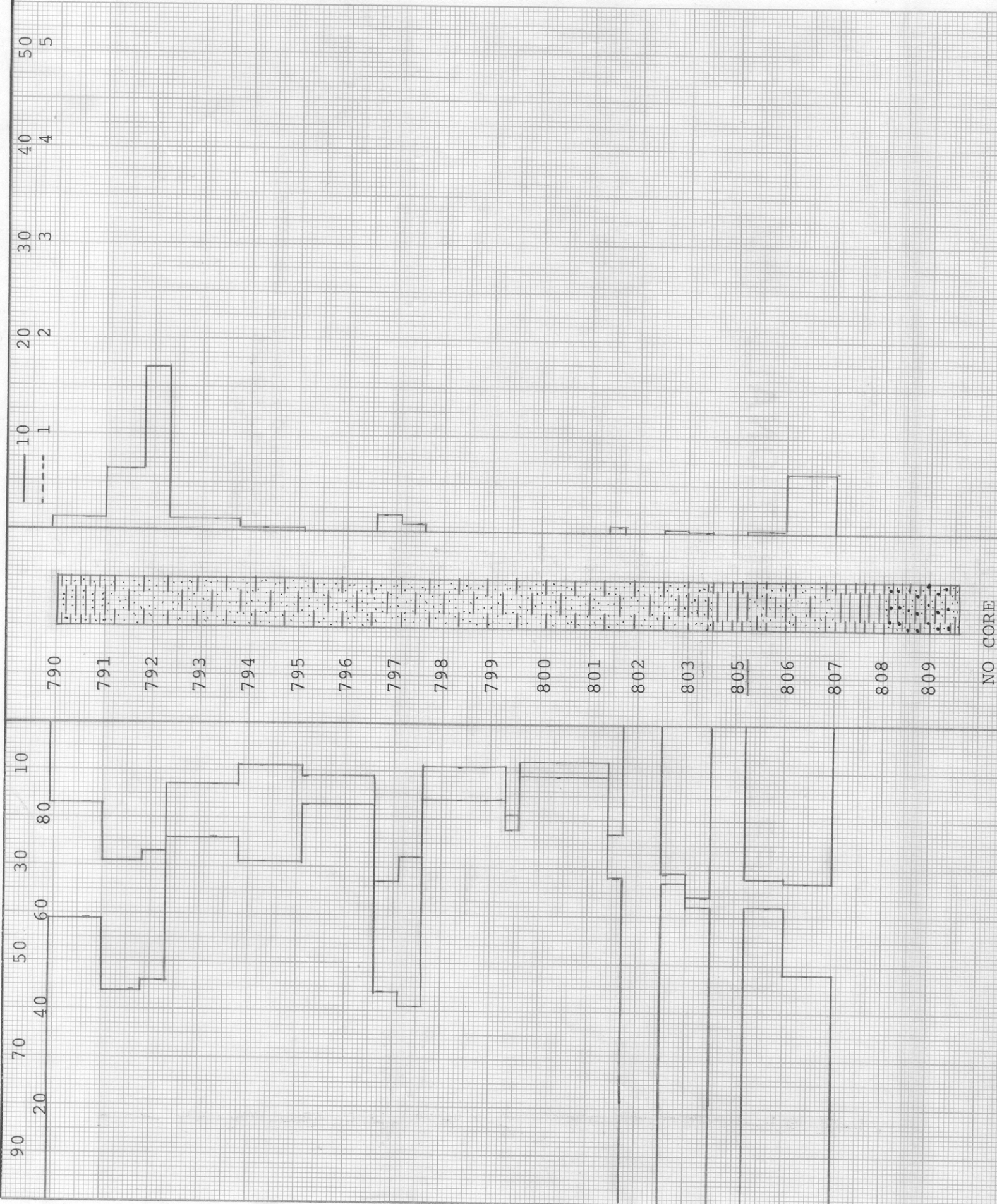
Company	Ponderay International, Inc.	Lease	Tom Erbe A	Well No.	1
Depth Interval, Feet	811.0 - 817.8				
Feet of Core Analyzed	5.8				
Average Percent Porosity	17.5				
Average Percent Original Oil Saturation	36.5				
Average Percent Oil Recovery	5.8				
Average Percent Residual Oil Saturation	30.7				
Average Percent Residual Water Saturation	64.7				
Average Percent Total Residual Fluid Saturation	95.4				
Average Original Oil Content, Bbls./A. Ft.	494.				
Average Oil Recovery, Bbls./A. Ft.	78.				
Average Residual Oil Content, Bbls./A. Ft.	416.				
Total Original Oil Content, Bbls./Acre	2,869.				
Total Oil Recovery, Bbls./Acre	454.				
Total Residual Oil Content, Bbls./Acre	2,415.				
Average Effective Permeability, Millidarcys	0.43				
Average Initial Fluid Production Pressure, p.s.i.	40.0				

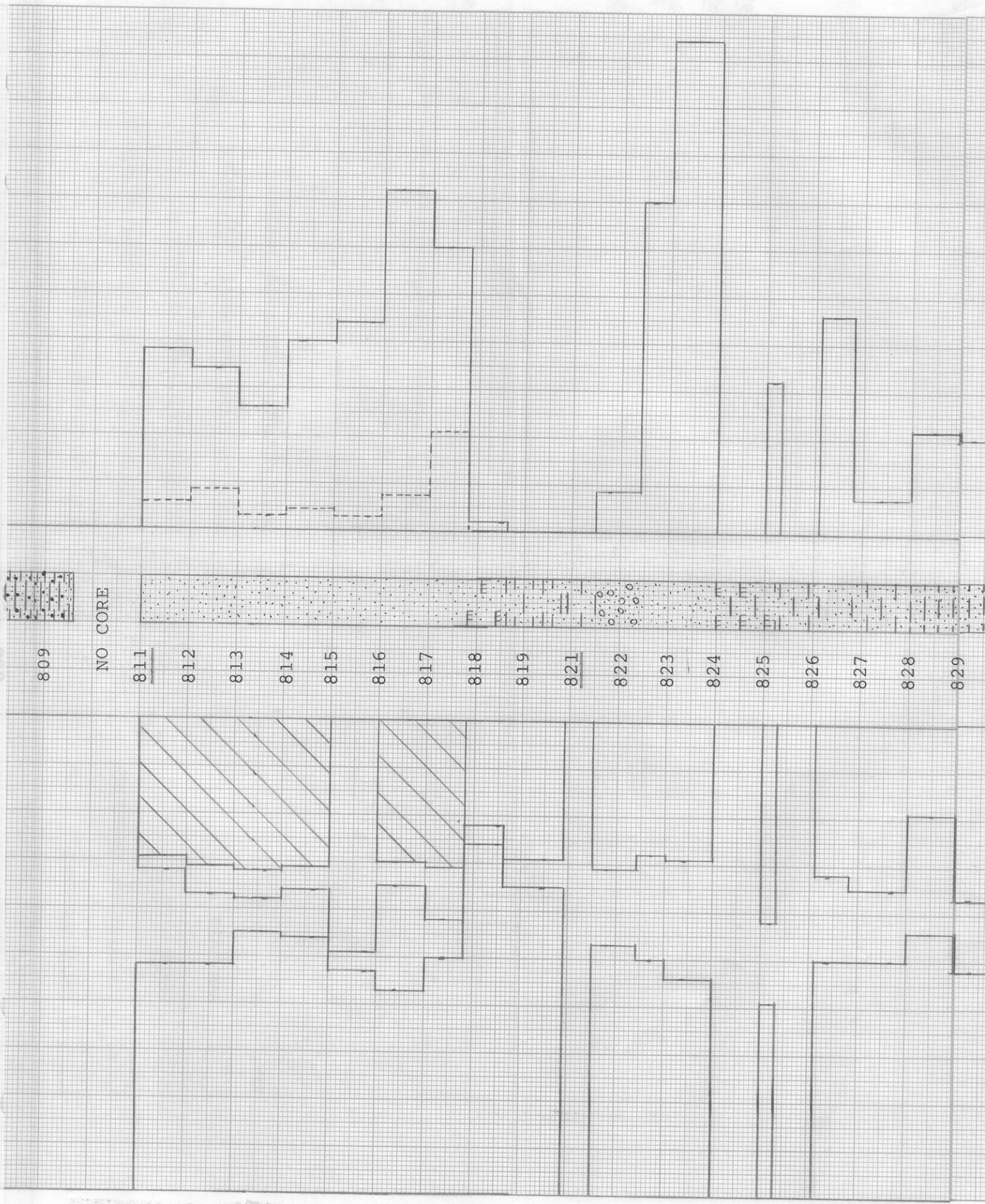
NOTE: Only those samples which recovered oil were used in calculating the above averages.

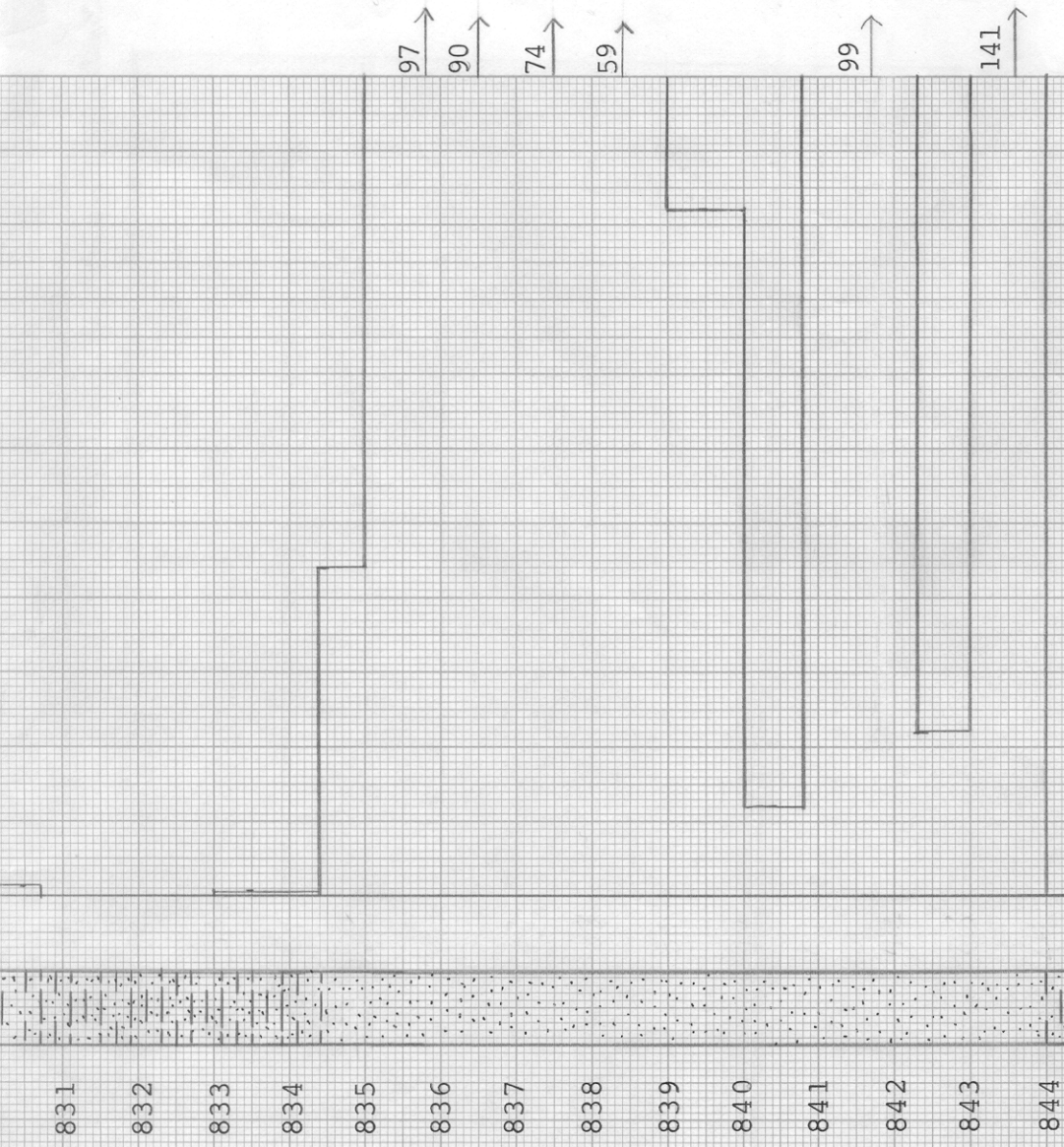
PERCENT

PERCENT

--- EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCY







831
832
833
834
835
836
837
838
839
840
841
842
843
844

KEY:



SANDSTONE



SHALE



CONGLOMERATIC SANDSTONE



SHALY SANDSTONE



UNSATURATED SANDSTONE AND SHALE

FLOODPOT RESIDUAL OIL SATURATION



LAMINATED MICACEOUS SANDSTONE AND SHALE

PONDERAY INTERNATIONAL, INC.

TOM ERBE A LEASE

WILSON COUNTY, KANSAS

WELL NO. 1

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
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790.0 - 807.0	14.5	13.5	18.4	68.9	2.8	
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811.0 - 817.8	6.8	17.4	38.3	49.3	22.2	
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817.8 - 834.4	13.2	14.2	26.5	58.4	12.9	
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834.4 - 844.0	9.6	20.5	30.5	47.9	70.4	
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790.0 - 844.0	44.1	15.7	26.5	58.2	27.7	
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1200
(PRIMARY AND
WATERFLOODING)
DEPTH INTERVAL
811.0 - 817.8

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
MARCH, 1982
PDC