OILFIELD RESEARCH LABORATORIES

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June 30, 1980

Rantoul Energy Corporation
Box 516
Hutchinson, Kansas 67501

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary cores taken from the Judson A Lease, Well No. 27, Franklin County, Kansas, and submitted to our laboratory on May 13, 1980.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/tem

5 c to Hutchinson, Kansas

# Oilfield Research Laboratories

## GENERAL INFORMATION & SUMMARY

Company Rantoul Energy Corporation Lease Judson A Well No. 27

Location –

Section 23 Twp. 17S Rge. 21E County Franklin State Kansas

Elevation, Feet - - - - - - - - - - - - - - - -

| | Peru | Squirrel |
|---|---|---|
| Name of Sand | | |
| Top of Core | 328.0 | 484.0 |
| Bottom of Core | 348.0 | 498.4 |
| Top of Sand | 328.0 | 484.0 |
| Bottom of Sand | 348.0 | 497.5 |
| Total Feet of Permeable Sand | 19.0 | 9.6 |
| Total Feet of Floodable Sand | 13.7 | 0.0 |

| Distribution of Permeable Sand: Permeability Range Millidarcys | Feet | Cum. Ft. |
|---|---|---|
| | PERU SAND | |
| 0 - 50 | 8.4 | 8.4 |
| 50 - 100 | 5.2 | 13.6 |
| 100 - 200 | 4.4 | 18.0 |
| 300 - 400 | 1.0 | 19.0 |
| | SQUIRREL SAND | |
| 0 - 10 | 6.8 | 6.8 |
| 20 - 30 | 1.0 | 7.8 |
| 40 - 50 | 1.8 | 9.6 |

| | | |
|---|---|---|
| Average Permeability Millidarcys | 80.2 | 12.6 |
| Average Percent Porosity | 18.1 | 16.5 |
| Average Percent Oil Saturation | 35.2 | 25.8 |
| Average Percent Water Saturation | 49.9 | 65.2 |
| Average Oil Content, Bbls./A. Ft. | 492. | 346. |
| Total Oil Content, Bbls./Acre | 9,353 | 3,732. |
| Average Percent Oil Recovery by Laboratory Flooding Tests | 10.2 | 0 |
| Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. | 164. | 0 |
| Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre | 2,249. | 0 |
| Total Calculated Oil Recovery, Bbls./Acre | See "Calculated Recovery" Section. | 0 |

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.

Since only the Peru Sand in this core responded to flooding susceptability tests, a calculated recovery is given for the Peru Sand only.

## FORMATION CORED

The detailed log of the formation cored is as follows:

| Depth Interval, Feet | Description |
|---|---|
| | PERU SAND |
| 328.0 - 335.1 | Brown calcareous sandstone. |
| 335.1 - 335.7 | Grayish brown limestone. |
| 335.7 - 339.9 | Brown calcareous sandstone. |
| 339.9 - 340.8 | Brown shaly slightly calcareous sandstone. |
| 340.8 - 342.2 | Brown calcareous sandstone. |
| 342.2 - 343.2 | Brownish gray limestone. |
| 343.2 - 344.3 | Brown and gray laminated calcareous sandstone and shale. |
| 344.3 - 347.3 | Brown calcareous sandstone. |
| 347.3 - 348.0 | Gray very shaly sandstone. |
| | SQUIRREL SAND |
| 484.0 - 486.2 | Brown sandstone. |
| 486.2 - 490.9 | Grayish brown shaly sandstone. |
| 490.9 - 492.0 | Brown and gray laminated sandstone and shale. |
| 492.0 - 492.6 | Brown sandstone. |
| 492.6 - 493.4 | Gray sandy shale. |
| 493.4 - 495.1 | Grayish brown very shaly sandstone. |

| | |
|---|---|
| 495.1 - 497.0 | Gray sandy shale. |
| 497.0 - 497.5 | Grayish brown very shaly sandstone. |
| 497.5 - 498.4 | Gray sandy shale. |

## LABORATORY FLOODING TESTS

### PERU SAND

The sand in this core responded to laboratory flooding tests, as a total recovery of 2,249 barrels of oil per acre was obtained from 13.7 feet of sand. The weighted average percent oil saturation was reduced from 35.8 to 25.6, or represents an average recovery of 10.2 percent. The weighted average effective permeability of the samples is 4.99 millidarcys, while the average initial fluid production pressure is 20.8 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 19 samples tested, 13 produced water and oil, and 4 samples produced water only. This indicates that approximately 68 percent of the sand represented by these samples is floodable pay sand.

## CALCULATED RECOVERY

### PERU 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 4,460 barrels of oil per acre. This is an average recovery of 325 barrels per acre foot from 13.7 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 | 20.1 |
| Oil saturation after flooding, percent | 25.6 |
| Performance factor, percent, estimated | 50.0 |
| Net floodable sand, feet | 13.7 |

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**RESULTS OF SATURATION & PERMEABILITY TESTS**

**TABLE 1-B**

Company Rantoul Energy Corporation Lease Judson A Well No. 27

| 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 | 328.5 | 14.1 | 32 | 48 | 80 | 350 | 92. | 1.0 | 1.0 | 350 | 92.00 |
| 2 | 329.5 | 14.7 | 37 | 46 | 83 | 422 | 63. | 1.0 | 2.0 | 422 | 63.00 |
| 3 | 330.5 | 21.7 | 27 | 59 | 86 | 455 | 63. | 1.0 | 3.0 | 455 | 63.00 |
| 4 | 331.5 | 21.6 | 35 | 45 | 80 | 587 | 79. | 1.0 | 4.0 | 587 | 79.00 |
| 5 | 332.5 | 24.8 | 30 | 48 | 78 | 577 | 169. | 1.0 | 5.0 | 577 | 169.00 |
| 6 | 333.5 | 14.3 | 39 | 36 | 75 | 433 | 153. | 1.0 | 6.0 | 433 | 153.00 |
| 7 | 334.5 | 13.7 | 37 | 46 | 83 | 393 | 19. | 1.1 | 7.1 | 432 | 20.90 |
| 8 | 335.5 | 7.1 | 41 | 57 | 98 | 226 | 2.3 | 0.6 | 7.7 | 136 | 1.38 |
| 9 | 336.5 | 14.8 | 35 | 35 | 70 | 402 | 384. | 1.0 | 8.7 | 402 | 384.00 |
| 10 | 337.5 | 12.2 | 35 | 46 | 81 | 331 | 18. | 1.0 | 9.7 | 331 | 18.00 |
| 11 | 338.5 | 20.7 | 27 | 41 | 68 | 434 | 141. | 1.0 | 10.7 | 434 | 141.00 |
| 12 | 339.5 | 24.2 | 40 | 52 | 92 | 751 | 84. | 1.2 | 11.9 | 901 | 100.80 |
| 13 | 340.5 | 24.1 | 35 | 55 | 90 | 654 | 0.33 | 0.9 | 12.8 | 589 | 0.30 |
| 14 | 341.5 | 16.5 | 43 | 49 | 92 | 550 | 137. | 1.4 | 14.2 | 770 | 191.80 |
| 15 | 343.5 | 24.4 | 44 | 51 | 95 | 833 | 0.56 | 1.1 | 15.3 | 916 | 0.62 |
| 16 | 344.5 | 17.4 | 25 | 70 | 95 | 338 | 13. | 1.0 | 16.3 | 338 | 13.00 |
| 17 | 345.5 | 20.6 | 37 | 51 | 88 | 591 | 21. | 1.0 | 17.3 | 591 | 21.00 |
| 18 | 346.8 | 16.3 | 40 | 53 | 93 | 506 | 12. | 1.0 | 18.3 | 506 | 12.00 |
| 19 | 347.5 | 14.7 | 23 | 69 | 92 | 262 | 0.19 | 0.7 | 19.0 | 183 | 0.13 |
| | | | | | | SQUIRREL SAND | | | | | |
| 1 | 484.5 | 22.1 | 32 | 54 | 86 | 549 | 46. | 1.2 | 1.2 | 659 | 55.20 |
| 2 | 485.5 | 23.5 | 28 | 58 | 86 | 511 | 22. | 1.0 | 2.2 | 511 | 22.00 |
| 3 | 486.5 | 15.8 | 27 | 67 | 94 | 331 | 2.0 | 1.0 | 3.2 | 331 | 2.00 |
| 4 | 487.5 | 13.4 | 21 | 72 | 93 | 218 | 1.7 | 1.0 | 4.2 | 218 | 1.70 |

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**RESULTS OF SATURATION & PERMEABILITY TESTS**

**TABLE 1-B**

Company Rantoul Energy Corporation Lease Judson A Well No. 27

| 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. | | |
| | | | | | | SQUIRREL SAND CONT. | | | | | |
| 5 | 488.5 | 19.1 | 41 | 44 | 85 | 608 | 5.1 | 1.0 | 5.2 | 608 | 5.10 |
| 6 | 489.5 | 13.9 | 30 | 67 | 97 | 324 | 0.85 | 1.0 | 6.2 | 324 | 0.85 |
| 7 | 490.8 | 12.9 | 11 | 84 | 95 | 110 | 8.3 | 0.7 | 6.9 | 77 | 5.81 |
| 8 | 491.5 | 14.0 | 26 | 70 | 96 | 282 | 2.4 | 1.1 | 8.0 | 310 | 2.64 |
| 9 | 492.5 | 14.8 | 26 | 59 | 85 | 299 | 42. | 0.6 | 8.6 | 179 | 25.20 |
| 10 | 493.5 | 13.3 | 3 | 94 | 97 | 31 | 0.42 | 1.0 | 9.6 | 31 | 0.42 |
| 11 | 494.5 | 15.5 | 29 | 63 | 92 | 349 | Imp. | 0.7 | 10.3 | 244 | 0.00 |
| 12 | 497.3 | 17.2 | 36 | 44 | 80 | 480 | Imp. | 0.5 | 10.8 | 240 | 0.00 |

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### SUMMARY OF PERMEABILITY & SATURATION TESTS

### TABLE III

Company Rantoul Energy Corporation Lease Judson A Well No. 27

| Depth Interval, Feet | Feet of Core Analyzed | Average Permeability, Millidarcys | Permeability Capacity Ft. x Md. |
|---|---|---|---|
| | | PERU SAND | |
| 328.0 - 337.7 | 9.7 | 107.6 | 1043.28 |
| 337.7 - 348.0 | 9.3 | 51.7 | 480.65 |
| 328.0 - 348.0 | 19.0 | 80.2 | 1523.93 |
| | | SQUIRREL SAND | |
| 484.0 - 497.5 | 9.6 | 12.6 | 120.92 |

| 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 |
|---|---|---|---|---|---|---|
| | | | PERU SAND | | | |
| 328.0 - 337.7 | 9.7 | 16.3 | 34.6 | 46.2 | 425 | 4,125 |
| 337.7 - 348.0 | 9.3 | 20.0 | 35.8 | 53.8 | 562 | 5,228 |
| 328.0 - 348.0 | 19.0 | 18.1 | 35.2 | 49.9 | 492 | 9,353 |
| | | | SQUIRREL SAND | | | |
| 484.0 - 497.5 | 10.8 | 16.5 | 25.8 | 65.2 | 346 | 3,732 |

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### RESULTS OF LABORATORY FLOODING TESTS

### TABLE IV

Company Rantoul Energy Corporation Lease Judson A Well No. 27

| 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. | | | |
| | | | | | | PERU SAND | | | | | | |
| 1 | 328.5 | 13.9 | 32 | 345 | 0 | 0 | 32 | 63 | 345 | 217 | 7.35 | 30 |
| 2 | 329.5 | 14.6 | 36 | 408 | 0 | 0 | 36 | 49 | 408 | 208 | 11.35 | 15 |
| 3 | 330.5 | 21.6 | 27 | 452 | 7 | 117 | 21 | 62 | 335 | 292 | 9.93 | 15 |
| 4 | 331.5 | 21.7 | 35 | 589 | 12 | 202 | 23 | 65 | 387 | 11 | 0.22 | 35 |
| 5 | 332.5 | 24.8 | 30 | 577 | 9 | 173 | 21 | 69 | 404 | 314 | 7.80 | 20 |
| 6 | 333.5 | 14.7 | 39 | 445 | 6 | 68 | 33 | 65 | 377 | 252 | 10.00 | 15 |
| 7 | 334.5 | 13.5 | 37 | 388 | 8 | 84 | 29 | 68 | 304 | 50 | 0.60 | 30 |
| 8 | 335.5 | 7.1 | 41 | 226 | 0 | 0 | 41 | 57 | 226 | 0 | Imp. | - |
| 9 | 336.5 | 14.7 | 35 | 399 | 0 | 0 | 35 | 64 | 399 | 100 | 1.65 | 25 |
| 10 | 337.5 | 12.3 | 35 | 334 | 0 | 0 | 35 | 61 | 334 | 345 | 5.62 | 25 |
| 11 | 338.5 | 21.1 | 27 | 442 | 7 | 115 | 20 | 62 | 327 | 356 | 18.49 | 10 |
| 12 | 339.5 | 24.1 | 40 | 748 | 20 | 374 | 20 | 62 | 374 | 282 | 3.45 | 15 |
| 13 | 340.5 | 24.0 | 35 | 652 | 12 | 223 | 23 | 73 | 429 | 446 | 6.00 | 15 |
| 14 | 341.5 | 16.8 | 43 | 560 | 13 | 169 | 30 | 68 | 391 | 142 | 2.55 | 20 |
| 15 | 343.5 | 24.6 | 44 | 840 | 15 | 286 | 29 | 66 | 554 | 368 | 5.47 | 15 |
| 16 | 344.5 | 17.7 | 25 | 343 | 3 | 41 | 22 | 76 | 302 | 27 | 0.37 | 35 |
| 17 | 345.5 | 20.9 | 37 | 600 | 7 | 113 | 30 | 67 | 487 | 93 | 1.42 | 20 |
| 18 | 346.8 | 16.4 | 40 | 509 | 10 | 127 | 30 | 68 | 382 | 32 | 0.30 | 25 |
| 19 | 347.5 | 15.0 | 22 | 256 | 0 | 0 | 22 | 70 | 256 | 0 | Imp. | - |
| | | | | | | SQUIRREL SAND | | | | | | |
| 1 | 484.5 | 22.3 | 32 | 554 | 0 | 0 | 32 | 65 | 554 | 328 | 20.00 | 10 |
| 2 | 485.5 | 23.0 | 29 | 517 | 0 | 0 | 29 | 68 | 517 | 361 | 7.80 | 15 |
| 3 | 486.5 | 16.0 | 27 | 335 | 0 | 0 | 27 | 70 | 335 | 22 | 0.30 | 40 |

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

### RESULTS OF LABORATORY FLOODING TESTS

### TABLE IV

Company Rantoul Energy Corporation Lease Judson A Well No. 27

| 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. | | | |
| | | | | | | SQUIRREL SAND CONT. | | | | | | |
| 4 | 487.5 | 13.5 | 21 | 220 | 0 | 0 | 21 | 74 | 220 | 0 | Imp. | - |
| 5 | 488.5 | 18.7 | 42 | 609 | 0 | 0 | 42 | 45 | 609 | 0 | Imp. | - |
| 6 | 489.5 | 14.0 | 30 | 326 | 0 | 0 | 30 | 67 | 326 | 0 | Imp. | - |
| 7 | 490.8 | 13.3 | 10 | 103 | 0 | 0 | 10 | 86 | 103 | 0 | Imp. | - |
| 8 | 491.5 | 14.3 | 25 | 277 | 0 | 0 | 25 | 72 | 277 | 0 | Imp. | - |
| 9 | 492.5 | 14.3 | 27 | 300 | 0 | 0 | 27 | 61 | 300 | 0 | Imp. | - |
| 10 | 493.5 | 13.5 | 4 | 42 | 0 | 0 | 4 | 89 | 42 | 0 | Imp. | - |
| 11 | 494.5 | 15.4 | 29 | 347 | 0 | 0 | 29 | 65 | 347 | 0 | Imp. | - |
| 12 | 497.3 | 17.0 | 36 | 475 | 0 | 0 | 36 | 46 | 475 | 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 Rantoul Energy Corporation Lease Judson A Well No. 27

| | | | |
|---|---|---|---|
| Depth Interval, Feet | 328.0 - 337.7 | 337.7 - 348.0 | 328.0 - 348.0 |
| Feet of Core Analyzed | 5.1 | 8.6 | 13.7 |
| Average Percent Porosity | 19.2 | 20.6 | 20.1 |
| Average Percent Original Oil Saturation | 33.9 | 36.9 | 35.8 |
| Average Percent Oil Recovery | 8.4 | 11.2 | 10.2 |
| Average Percent Residual Oil Saturation | 25.5 | 25.7 | 25.6 |
| Average Percent Residual Water Saturation | 65.8 | 67.6 | 66.9 |
| Average Percent Total Residual Fluid Saturation | 91.3 | 93.3 | 92.5 |
| Average Original Oil Content, Bbls./A. Ft. | 488. | 592. | 553. |
| Average Oil Recovery, Bbls./A. Ft. | 128. | 186. | 164. |
| Average Residual Oil Content, Bbls./A. Ft. | 360. | 406. | 389. |
| Total Original Oil Content, Bbls./Acre | 2,489. | 5,087. | 7,576. |
| Total Oil Recovery, Bbls./Acre | 652. | 1,597. | 2,249. |
| Total Residual Oil Content, Bbls./Acre | 1,837. | 3,490. | 5,327. |
| Average Effective Permeability, Millidarcys | 5.61 | 4.62 | 4.99 |
| Average Initial Fluid Production Pressure, p.s.i. | 23.0 | 19.4 | 20.8 |

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

WATER SAT., PERCENT ⟶ 90 70 50 30 10

⟵ OIL SAT., PERCENT 10 20 40 60 80

——— PERMEABILITY, IN MILLIDARCYs

– – – – EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS

40 80 120 160 200

4 8 12 16 20

PERU SAND

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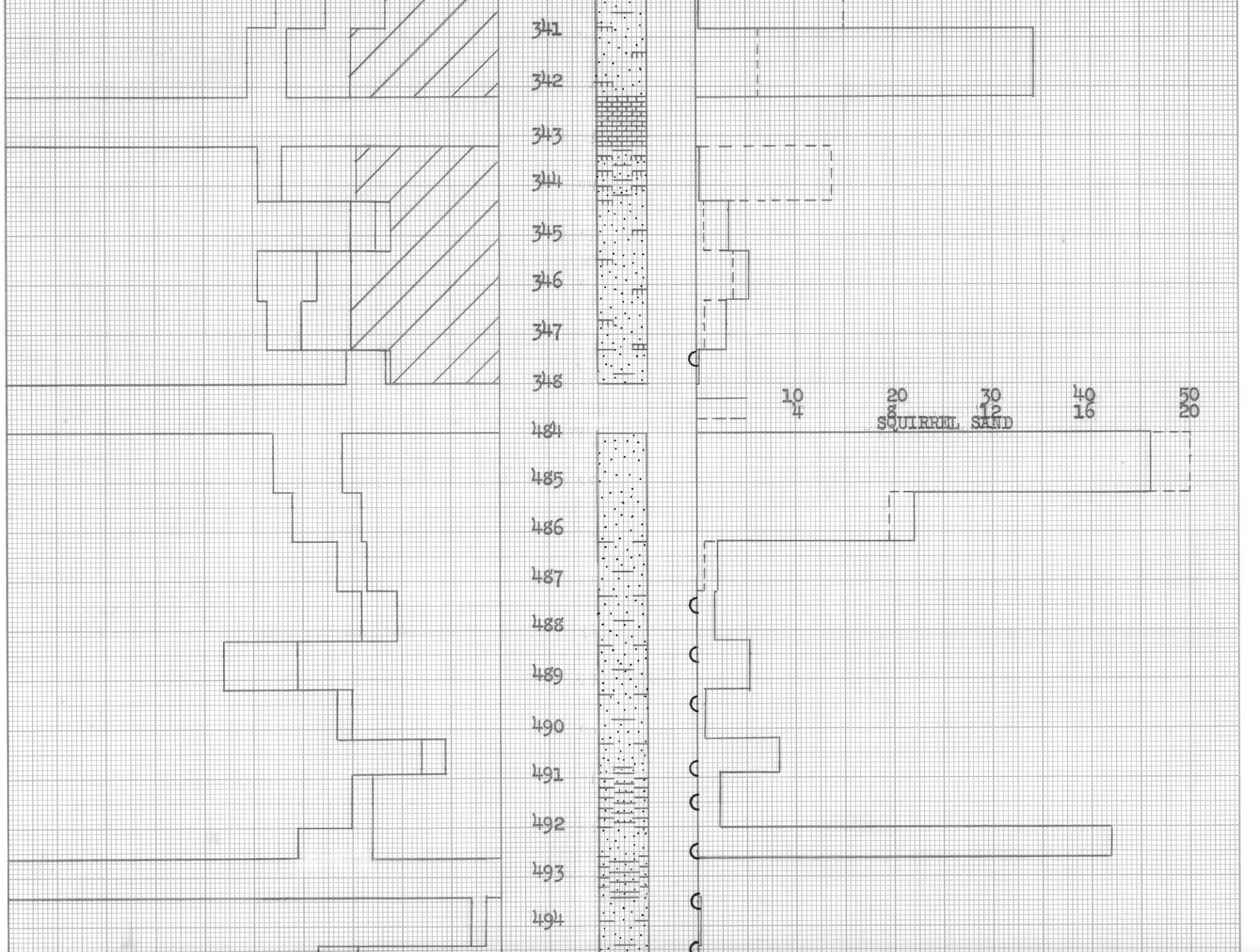
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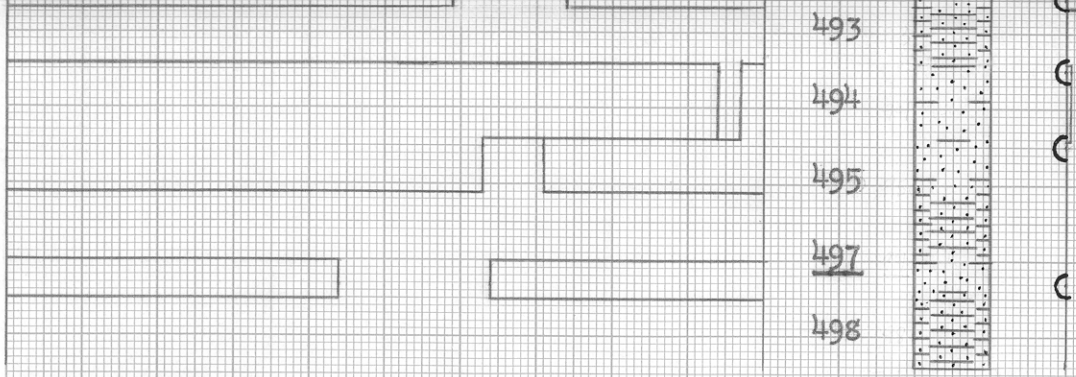
SQUIRREL SAND




KEY:

- CALCAREOUS SANDSTONE
- SHALY CALCAREOUS SANDSTONE
- SANDSTONE
- SHALY SANDSTONE
- FLOODPOT RESIDUAL OIL SATURATION
- LIMESTONE
- LAMINATED CALCAREOUS SANDSTONE & SHALE
- LAMINATED SANDSTONE & SHALE
- SANDY SHALE
- IMPERMEABLE TO WATER

# RANTOUL ENERGY CORP.

JUDSON A LEASE WELL NO. 27

FRANKLIN 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 |
|---|---|---|---|---|---|---|
| | | | PERU SAND | | | |
| 328.0 - 337.7 | 9.7 | 16.3 | 34.6 | 46.2 | 107.6 | |
| 337.7 - 348.0 | 9.3 | 20.0 | 35.8 | 53.8 | 51.7 | |
| 328.0 - 348.0 | 19.0 | 18.1 | 35.2 | 49.9 | 80.2 | 4,460 (PRIMARY & WATERFLOODING) |
| | | | SQUIRREL SAND | | | |
| 484.0 - 497.5 | 10.8 | 16.5 | 25.8 | 65.2 | 12.6 | - |