

OILFIELD RESEARCH LABORATORIES

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

March 20, 1981

James E. Russell Petroleum, Inc.
P. O. Box 2618
Abilene, Texas 79604

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Minckley B, Section 3 Lease, Well No. 40, located in Anderson County, Kansas and submitted to our laboratory on February 6, 1981.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/kas

3 c to Abilene, Texas
3 c to Chanute, Kansas

Oilfield Research Laboratories
GENERAL INFORMATION & SUMMARY

Company James E. Russell Petroleum, Inc. Lease Minckley B., Sec. 3, 40
 Location 2420' SNL & 660' EWL SE ¼
 Section 3 Twp. 23S Rge. 19E County Anderson State Kansas

Elevation, Feet Datum: Mean Sea Level (Ground Level) 1080.0
 Name of Sand Squirrel
 Top of Core 714.0
 Bottom of Core 732.3
 Top of Sand (Tested) 715.8
 Bottom of Sand 723.9
 Total Feet of Permeable Sand 6.4
 Total Feet of Floodable Sand 4.3

| Distribution of Permeable Sand: Permeability Range Millidarcys | Feet | Cum. Ft. |
|--|------|----------|
| 0 - 5 | 2.1 | 2.1 |
| 5 - 10 | 2.2 | 4.3 |
| 30 - 50 | 2.1 | 6.4 |

Average Permeability Millidarcys 16.5
 Average Percent Porosity 16.3
 Average Percent Oil Saturation 39.9
 Average Percent Water Saturation 36.8
 Average Oil Content, Bbls./A. Ft. 504.
 Total Oil Content, Bbls./Acre 3,681.
 Average Percent Oil Recovery by Laboratory Flooding Tests 3.2
 Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 43.
 Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 185.
 Total Calculated Oil Recovery, Bbls./Acre

See "Calculated Recovery"
Section

The core was sampled by a representative of Oilfield Research Laboratories. Fresh water mud was used as a drilling fluid. The core was from a non-virgin area.

FORMATION CORED

The detailed log of the formation cored is as follows:

| <u>Depth Interval, Feet</u> | <u>Description</u> |
|---------------------------------|---|
| 714.0 - 714.6 | Shale, gray, sandy. |
| 714.6 - 715.8 | Sandstone and shale, gray, laminated. |
| 715.8 - 717.0 | Sandstone and shale, brown and gray, laminated. |
| 717.0 - 717.9 | Sandstone, brown, shaly. |
| 717.9 - 719.2 | Sandstone, brown, slightly shaly. |
| 719.2 - 721.3 | Sandstone, brown. |
| 721.3 - 722.1 | Shale, gray, sandy. |
| 722.1 - 723.9 | Sandstone and shale, brown and gray, laminated. |
| 723.9 - 732.3 | Shale, gray, sandy. |

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 185 barrels of oil per acre was obtained from 4.3 feet of sand. The weighted average percent oil saturation was reduced from 39.7 to 36.5, or represents an average recovery of 3.2 percent. The weighted average effective permeability of the samples is 3.63 millidarcys, while the average initial fluid production pressure is 33.8 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 7 samples tested, 4 produced water and oil. This indicates that approximately 57 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 1,290 barrels of oil per acre. This is an average recovery of 301 barrels per acre foot from 4.3 feet of floodable sand analyzed in this core.

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

| | |
|--|------|
| Original formation volume factor, estimated | 1.05 |
| Reservoir water saturation, percent, estimated | 20.0 |
| Average porosity, percent | 17.8 |
| Oil saturation after flooding, percent | 36.5 |
| Performance factor, percent, estimated | 55.0 |
| Net floodable sand, feet | 4.3 |

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company James E. Russell Petroleum, Inc. Lease Minckley B, Sec. 3 Well No. 40

| 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 | 716.4 | 14.7 | 45 | 35 | 513 | 2.6 | 1.2 | 1.2 | 616 | 3.12 |
| 2 | 717.5 | 17.2 | 39 | 24 | 520 | 4.1 | 0.9 | 2.1 | 468 | 3.69 |
| 3 | 718.8 | 15.3 | 40 | 39 | 475 | 8.7 | 1.3 | 3.4 | 618 | 11.31 |
| 4 | 719.4 | 15.5 | 41 | 44 | 493 | 31. | 1.0 | 4.4 | 493 | 31.00 |
| 5 | 720.5 | 21.7 | 38 | 28 | 640 | 47. | 1.1 | 5.5 | 704 | 51.70 |
| 6 | 722.6 | 18.9 | 40 | 31 | 587 | 5.4 | 0.9 | 6.4 | 528 | 4.86 |
| 7 | 723.5 | 10.4 | 35 | 57 | 282 | Imp. | 0.9 | 7.3 | 254 | 0.00 |

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company James E. Russell Petroleum, Inc. Lease Minckley B, Sec. 3 Well No. 40

| Depth Interval, Feet | Feet of Core Analyzed | Average Permeability, Millidarcys | Permeability Capacity Ft. x Md. |
|-------------------------|--------------------------|---|---------------------------------------|
| 715.8 - 723.9 | 6.4 | 16.5 | 105.68 |

| Depth Interval, Feet | Feet of Core Analyzed | Average Percent Oil Saturation | Average Percent Water Saturation | Average Oil Content Bbl./A. Ft. | Total Oil Content Bbls./Acre |
|-------------------------|--------------------------|--------------------------------------|--|---------------------------------------|------------------------------------|
| 715.8 - 723.9 | 7.3 | 39.9 | 36.8 | 504 | 3,681 |

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company James E. Russell Petroleum, Inc. Lease Minckley B, Sec. 3 Well No. 40

| 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 | 716.4 | 15.0 | 44 | 512 | 0 | 0 | 44 | 38 | 0 | Imp. | - |
| 2 | 717.5 | 17.1 | 39 | 517 | 0 | 0 | 39 | 27 | 0 | Imp. | - |
| 3 | 718.8 | 15.3 | 40 | 475 | 3 | 36 | 37 | 51 | 12 | 0.67 | 45 |
| 4 | 719.4 | 15.4 | 41 | 490 | 4 | 48 | 37 | 60 | 230 | 4.80 | 25 |
| 5 | 720.5 | 21.9 | 38 | 646 | 2 | 34 | 36 | 50 | 206 | 8.50 | 20 |
| 6 | 722.6 | 19.0 | 40 | 590 | 4 | 59 | 36 | 46 | 18 | 0.66 | 45 |
| 7 | 723.5 | 10.1 | 36 | 282 | 0 | 0 | 36 | 56 | 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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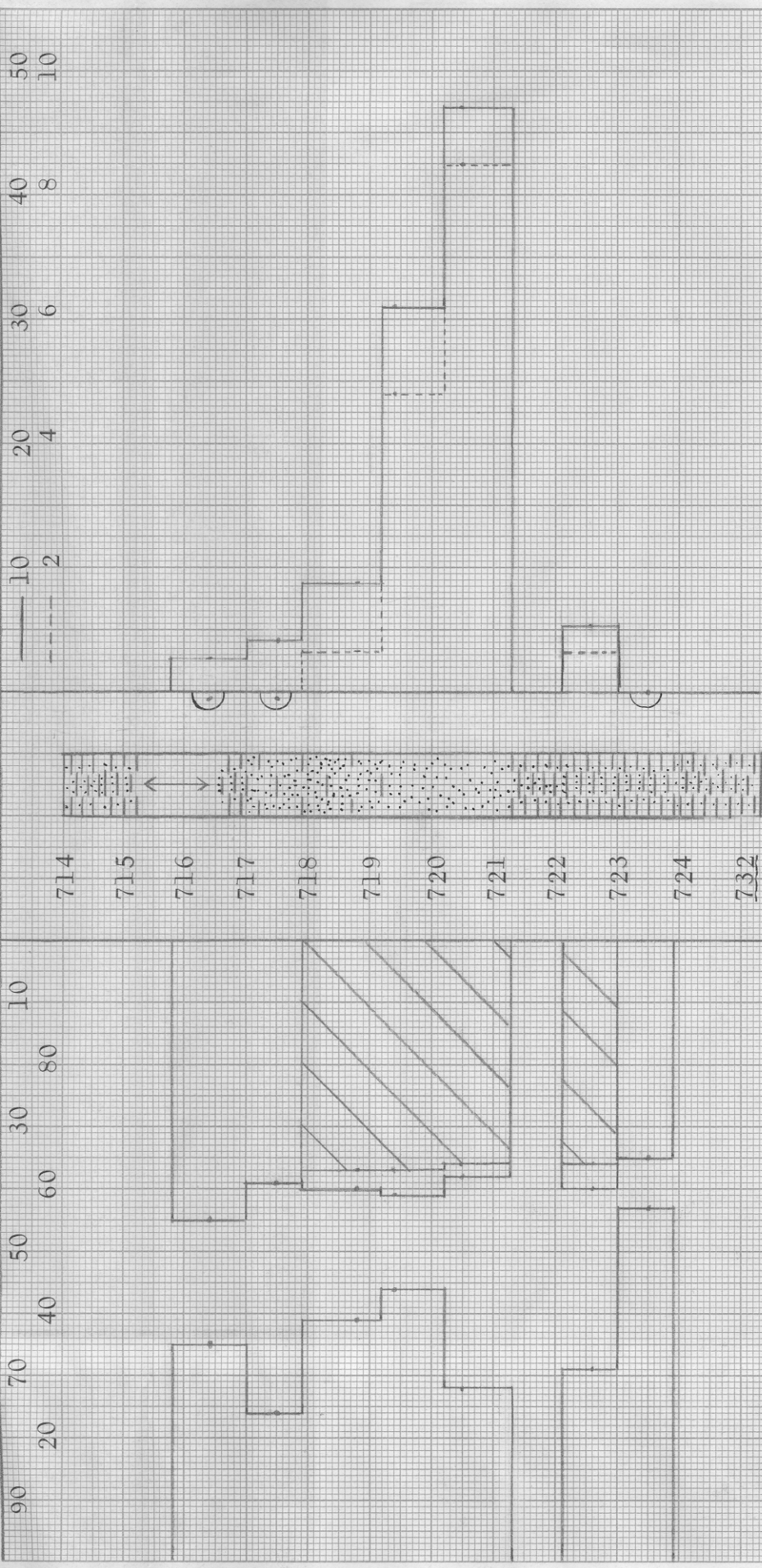
SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

| | | | | | |
|---|----------------------------------|-------|--------------------|----------|----|
| Company | James E. Russell Petroleum, Inc. | Lease | Minckley B, Sec. 3 | Well No. | 40 |
| Depth Interval, Feet | 715.8 - 723.9 | | | | |
| Feet of Core Analyzed | 4.3 | | | | |
| Average Percent Porosity | 17.8 | | | | |
| Average Percent Original Oil Saturation | 39.7 | | | | |
| Average Percent Oil Recovery | 3.2 | | | | |
| Average Percent Residual Oil Saturation | 36.5 | | | | |
| Average Percent Residual Water Saturation | 51.8 | | | | |
| Average Percent Total Residual Fluid Saturation | 88.3 | | | | |
| Average Original Oil Content, Bbls./A. Ft. | 546. | | | | |
| Average Oil Recovery, Bbls./A. Ft. | 43. | | | | |
| Average Residual Oil Content, Bbls./A. Ft. | 503. | | | | |
| Total Original Oil Content, Bbls./Acre | 2,349. | | | | |
| Total Oil Recovery, Bbls./Acre | 185. | | | | |
| Total Residual Oil Content, Bbls./Acre | 2,164. | | | | |
| Average Effective Permeability, Millidarcys | 3.63 | | | | |
| Average Initial Fluid Production Pressure, p.s.i. | 33.8 | | | | |

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

PERCENT ———><—— PERCENT
 - - - - - EFFECTIVE PERMEABILITY TO WATER, IN
 MILLIDARCY



KEY:
 SANDSTONE
 SANDY SHALE
 FLOODPOT RESIDUAL OIL SATURATION ○

SHALY SANDSTONE
 LAMINATED SANDSTONE AND SHALE
 IMPERMEABLE TO WATER

JAMES E. RUSSELL PETROLEUM, INC.
 MINCKLEY "B", SEC. 3 LEASE
 ANDERSON COUNTY, KANSAS
 WELL NO. 40

DEPTH INTERVAL FEET OF CORE AVERAGE WATER AVERAGE CALCULATED

FLOODPOT RESIDUAL OIL SATURATION IMPERMEABLE TO WATER

JAMES E. RUSSELL PETROLEUM, INC.

MINCKLEY "B", SEC. 3 LEASE

WELL NO. 40

ANDERSON COUNTY, KANSAS

| DEPTH INTERVAL, FEET | FEET OF CORE ANALYZED | AVERAGE PERCENT POROSITY | AVG. OIL SATURATION PERCENT | AVG. WATER SATURATION PERCENT | AVERAGE PERMEABILITY, MILLIDARCS | CALCULATED OIL RECOVERY BBLs. / ACRE |
|----------------------|-----------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|--------------------------------------|
|----------------------|-----------------------|--------------------------|-----------------------------|-------------------------------|----------------------------------|--------------------------------------|

| | | | | | | |
|---------------|-----|------|------|------|------|------|
| 715.8 - 723.9 | 7.3 | 16.3 | 39.9 | 36.8 | 16.5 | 1290 |
|---------------|-----|------|------|------|------|------|

ELEVATION, FEET - DATUM: MEAN SEA LEVEL (GROUND LEVEL) 1080.0

OILFIELD RESEARCH LABORATORIES
 CHANUTE, KANSAS
 MARCH, 1981