SPECIAL CORE ANALYSIS REPORT

FOR

KANSAS LAND INVESTMENT, INC.
WOODHEAD NO. 11 WELL
DOUGLAS COUNTY, KANSAS

7304 EAST 38th STREET TULSA, OKLAHOMA 74145 • 918/664-9071

CORE LABORATORIES, INC.

July 20, 1984

Kansas Land Investment, Inc.
222 East 4th
Ottawa, Kansas 66067

Attention: Mr. James L. Mietchen

Subject: Special Core Analysis Test
Woodhead No. 11 Well
Douglas County, Kansas
CLI File: 3404-301-84039

Gentlemen:

A letter from Kansas Land Investment, Inc. dated June 6, 1984 and signed by Mr. Mietchen requested the Special Core Analysis Laboratory of Core Laboratories, Inc. in Tulsa to perform a waterflood susceptibility test on one sample from the subject well.

One unpreserved core segment from the Woodhead No. 11 Well was received on May 10, 1984 from Kansas Land Investment, Inc. One horizontal core plug 1-inch in diameter was drilled from 672.2 feet, depth with a diamond core bit using soltrol as the bit lubricant. The hydrocarbons were extracted from the plug in a toluene reflux centrifuge apparatus. Inorganic salts were leached with methanol in the same apparatus. After drying at 180°F overnight, the permeability to air and Boyle's Law porosity (using helium as the gaseous medium) were determined. Permeability to air, porosity and a lithological description are presented on Page 1.

The sample was evacuated and pressure saturated with synthesized formation brine using the composition listed on Page 2. The mobile fluids in the sample were displaced with a refined mineral oil having a viscosity of approximately 120 cp at 76°F. Then the effective permeability to oil at initial brine saturation was determined. The synthesized formation brine was used as the displacing phase for the unsteady-state water-oil relative permeability test, and incremental volumes of water and oil production were measured as a function of time.

Production data from the unsteady-state water-oil relative permeability test were used to calculate waterflood susceptibility characteristics for the sample using an oil viscosity of 53 cp at 77°F. A summary of the

water-oil relative permeability test is presented on Page 3. Water-flood susceptibility data are presented in tabular form on Page 4 and in graphic form on Page 5.

Thank you for this opportunity to be of service.

Sincerely,

CORE LABORATORIES, INC.

John C. Evanoff
Laboratory Manager
Special Core Analysis

JCE:KC:reh

7 cc: Addressee

IDENTIFICATION AND LITHOLOGICAL DESCRIPTION OF SAMPLES

KANSAS LAND INVESTMENT, INC.
SQUIRREL SAND FORMATION
DOUGLAS COUNTY, KANSAS

WOODHEAD NO. 11 WELL

Sample Identification	Depth, feet	Permeability to Air, millidarcys	Porosity, percent	Lithological Description
3	672.2	103	24.1	SST: lt gry, mod ind, med gr, wl srtd, sl calc, mica, pyr

SIMULATED BRINE COMPOSITION

Constituents	Concentration, gm/L
Sodium Chloride (NaCl)	35.737
Calcium Chloride ($CaCl_2$)	7.091
Magnesium Chloride ($MgCl_2 \cdot H_2O$)	3.596
Sodium Sulfate (Na_2SO_4)	0.067

The brine composition was prepared from the following analysis:

Kansas Land Investment, Inc.
Squirrel Sand Formation
Douglas County, Kansas

Woodhead No. 11 Well

Constituent	Concentration, gm/L	Constituent	Concentration, gm/L
Sodium	14.10	Chloride	26.40
Calcium	1.96	Sulfate	0.045
Magnesium	0.43		

SUMMARY OF WATER-OIL RELATIVE PERMEABILITY TEST RESULTS

KANSAS LAND INVESTMENT, INC.
SQUIRREL SAND FORMATION
DOUGLAS COUNTY, KANSAS

WOODHEAD NO. 11 WELL

Sample I.D.	Depth, feet	Permeability to Air, millidarcys	Porosity, percent	Initial Conditions: Water Saturation, percent pore space	Initial Conditions: Effective Permeability to Oil, millidarcys	Terminal Conditions: Oil Saturation, percent pore space	Terminal Conditions: Effective Permeability to Water, millidarcys	Oil Recovered: percent pore space	Oil Recovered: percent oil in place
3	672.2	103	24.1	36.0	45	30.8	23	33.2	51.9

WATERFLOOD PERFORMANCE FROM RELATIVE PERMEABILITY

KANSAS LAND INVESTMENT, INC.
SQUIRREL SAND FORMATION
DOUGLAS COUNTY, KANSAS

WOODHEAD NO. 11 WELL

Water Input, pore volumes	Cumulative Oil Recovery, percent pore space	Instant Water Cut, percent
0.090	* 9.0	----
0.136	10.5	68.3
0.285	13.7	85.3
0.847	18.1	95.4
1.74	20.7	97.9
2.33	21.8	98.5
3.57	23.2	99.1
11.2	26.7	99.7
31.0	30.0	99.9
62.4	33.6	99.9

*Breakthrough recovery

Company Kansas Land Investment, Inc. Formation Squirrel Sand
Well Woodhead No. 11 County Douglas
Field State Kansas

SAMPLE NO. 3