MASTER

ORO-4889-14

FINAL REPORT

INVESTIGATIONS ON THE GEOPRESSURE ENERGY
RESOURCE OF SOUTHERN LOUISIANA

ERDA CONTRACT EY-76-S-05-4889

PETROLEUM ENGINEERING DEPARTMENT
LOUISIANA STATE UNIVERSITY
BATON ROUGE, LOUISIANA

APRIL 15, 1977

Master

ORO-4889-14

FINAL REPORT

INVESTIGATIONS ON THE GEOPRESSURE ENERGY

RESOURCE OF SOUTHERN LOUISIANA

ERDA CONTRACT NO. EY-76-S-05-4889

DISCLAIMER

This book was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Murray F. Hawkins, Jr., Project Manager
Petroleum Engineering Department
Louisiana State University
Baton Rouge, Louisiana

April 15, 1977

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

TABLE OF CONTENTS

Overview.....	1
Task I - Data Aquisition.....	5
Fig. 1-A - Map of study area.....	7
Fig. 1-B - Data collection form.....	8
Data form instructions.....	9
Consultants interpretations of instructions.....	12
Task II - Data Storage, Retrieval and Analysis.....	13
Table II-A - General statistics.....	13
Figs. II-B through II-F - Data histograms.....	15
Fig. II-G - Location map of 40 blocks.....	22
Tables II-H through II-Q - Distribution by block and depth interval of mud weight and sand count.....	23
Estimates of the geopressure resource.....	33
Tables II-R through II-Z(2) - Distribution of energy by block, depth interval and type of energy.....	38
Task III - Computer Map Presentation of Data.....	48
Fig. III-A - Location map of six USGS quadrangles covering study area.....	50
Figs. III-B through III-CCC - Maps showing distribu- tion of mud weight and sand count by depth intervals in each of six quadrangles.....	53
Figs. III-DDD through III-GGG - Maps of southern Louisiana showing areal distribution of the product of sand count and excess mud weight.....	107

Task IV - Detailed Geologic Mapping.....	110
Fig. IV-A - Location map of 8 aquifers mapped in detail.....	112
Fig. IV-B - Summary data on 8 aquifers mapped in detail.....	113
Fig. IV-C - Location map of 55 prospective areas.....	114
Fig. IV-D - Fault map of Southern Louisiana.....	115
Fig. IV-E - Areal extent and location by Parish, Township and Range, of all mapped and unmapped prospects.....	116
Newton prospect - discussion, maps and cross sections.....	118
South Midland prospect - discussion, maps and cross sections.....	123
West Lake Arthur prospect - discussion, maps and cross sections.....	132
West Lockport prospect - discussion, maps and cross sections.....	139
West Maurice prospect - discussion, maps and cross sections.....	146
South White Lake prospect - discussion, maps and cross sections.....	154
Big Mouth Bayou prospect - discussion, maps and cross sections.....	161
Southeast Pecan Island prospect - discussion, maps and cross sections.....	172

FINAL REPORT
INVESTIGATIONS ON THE GEOPRESSURE ENERGY
RESOURCE OF SOUTHERN LOUISIANA

History

Sometime during 1972 it came to the attention of the project manager of these investigations that there was some interest in the geopressured sandstone aquifers of coastal Texas as a possible source of energy and potable water. Prior to that time he had assigned John M. Parmigiano an M. S. thesis topic on the use of cluster wells, specifically with regard to production from the very shallow (500 feet) oil reservoir of the Emraude Field in Offshore Nigeria. As energy production from geopressured aquifers appeared to present another use for cluster wells, as indeed it does, Parmigiano's thesis was enlarged to include this application.

Parmigiano's thesis "Geohydraulic Energy from Geopressured Aquifers" was completed in May 1973. In addition to treating the cluster well topic, this thesis first presented the basic theory from which the flow rate and surface pressure could be calculated as a function of time for one or more wells tapping a common geopressured aquifer. The theory and equations presented were based on recognized reservoir engineering principles for petroleum reservoirs. From the flow rate and well head pressure it was simple to calculate the available hydraulic horsepower as a function of time; and from the flow rate, the rate of natural gas production and the geothermal production rate, from a knowledge of the dissolved natural gas content of the water and aquifer temperature, respectively. This body of knowledge was presented in an extended form by Dr. William J. Bernard of Louisiana State University's Petroleum Engineering Department at the First Geopressured Geothermal Energy Conference held in Austin, Texas June 2-4, 1975, in a paper "Reservoir Mechanics

of Geopressured Aquifers".

As the results of Parmigiano's thesis indicated energy production in the megawatt range per well, assuming conversion only of the geohydraulic energy into electricity, a group of engineering and geology faculty at LSU was formed to look further into this source of energy. Subsequently in March, 1974 a preliminary research proposal was submitted to the RANN division of NSF and in December 1974 a modified form of the proposal was submitted. It was in this form that ERDA awarded an 18-month contract for \$158,400 beginning May 1975, later extended to December 15, 1975 with no additional funding and still later extended to March 15, 1976 with an additional funding of \$20,000. This is the final report on these investigations.

Objectives and Results

The primary aims of the investigations were three-fold: (a) to estimate the total energy in the geopressured sandstone strata of southern Louisiana, including state-owned offshore waters, with a breakdown of the separate contributions of geohydraulic energy, geothermal energy and natural gas; (b) to locate one or more geopressured aquifers with bulk sandstone volumes of the order of one trillion cubic feet; and (c) to test the validity of the research methods in achieving these aims. It is the happy conclusion of these investigations that all three objectives have been reached with what the investigators feel is at a very satisfactory level. The total energy in the sandstone geopressured aquifers underlying this area is estimated at 34.3 quadrillion BTU or quads, of which 1.2 quads is geohydraulic energy, 19.5 geothermal and 13.6 natural gas. These are "raw" energy figures, i.e., with no allowance for recovery efficiency, conversion or utilization. The total amounts to the equivalent of about 6 billion barrels of oil. The natural gas content of the geopressured water is estimated at 13.6 trillion cubic feet.

The reader is cautioned to realize that these figures tell only the estimated total energy in place and that at this point very little is known about (a) the rate at which geopressured energy could be produced and (b) the fraction of the total geopressured energy resource which occurs in aquifers which are large enough to warrant drilling even one well which would produce for say ten years at a sufficiently high volume rate to be of economic interest. Indeed, it is to be inferred from the general geology of southern Louisiana, that much of this geopressured water is contained in aquifers far too small to justify the drilling and completion of a single well, much less a cluster of wells. Other precautions on the validity and use of these figures are given in the discussion of the Task II work.

In these investigations eight large geopressured aquifers have been located and mapped. In addition 55 prospective areas have been identified from the sand count and pressure maps which warrant detailed geologic study to ascertain the limits and volumes of geopressured aquifers in these areas. It is a recommendation of these investigations that consideration be given to funding a study of some or all of these 55 areas.

From the preceding paragraphs it appears obvious that the methods used in these investigations have proved to be more than reasonably successful. Thus all objectives of these studies are believed to be realized.

Organization and Management

The investigations were divided into four tasks, two of which were accomplished by personnel of the Louisiana Department of Conservation, employed on an extra compensation basis and the other two by personnel of the Petroleum Engineering and Geology Departments of Louisiana State University.

Task I-Data Acquisition was under the direction of the State Geologist, Mr. Leo W. Hough. Using several professional

geologists of the Department of Conservation on nights, week-ends and holidays, this task comprised the inspection of some 10,000 electrical well logs in the files of the Department of Conservation which were made available at no charge for these studies. Data on some 5,964 wells were taken, the details of which are given later in this report.

Task II - Data Storage, Retrieval and Analysis was under the direction of Dr. William J. Bernard of the Petroleum Engineering Department. It was his concern to see that the data obtained in Task I was entered into the data base. This included card punching and verification and the preparation of tapes were also used by Dr. Bernard to provide several kinds of statistical analyses of the data, as explained and presented in a later section.

Task III - Computer Mapping was under the direction of Dr. Donald W. Kupfer of the Geology Department. Using the tapes on the data base from Task II, this part of the investigations provided three kinds of computer maps to be discussed and presented in a later section.

Task IV - Detailed Geologic Studies was also under the direction of Mr. Leo W. Hough, again using professional geologists of the Conservation Department to make structure and isopachous maps and geologic cross sections of large geopressured aquifers located using the maps of Task III. In a later section the detailed geology is presented on eight large aquifers and also a map showing the location of 55 other prospective areas which may contain one or more large aquifers.

TASK I-DATA ACQUISITION

The area selected for these studies is shown in Fig. I-A. It includes substantially all of the known geopressure area of onshore Louisiana and those offshore areas under state jurisdiction. From some 10,000 wells drilled in this area a total of 5,964 were selected as significant to the study. Most of these wells were dry holes but the total included one representative well from each of the some 700 producing and abandoned oil and/or gas fields in the area.

Figure I-B shows the data collection form used. Following Fig. I-B are "Data Form Instructions" and "Consultants Interpretations of Instructions" which define the type and manner in which data was taken. The principal data desired were the depths and thicknesses of each sand or suite of sands and the mud weight used to drill that sand. It is important to realize that the sands were determined from the electric log, primarily the Self Potential log, and that these logs are unable to differentiate between sands of very high and very low permeability. Therefore many of the sands may have permeabilities much too low to be of practical interest in the production of geopressured water.

At this point it may be well to explain that although temperature data was taken, very little use was made of these data. The reason for this is that the ultimate aim of these and subsequent researches, is the location of large, geopressured aquifers. The larger and more overpressured these aquifers are, the better; for these are two very important parameters which determine the production rate and total volume of water which can be spontaneously expelled. Temperature, although of considerable interest in the evaluation of aquifers, is of secondary importance.

One unforeseen problem in this work was the determination of latitudes and longitudes for a large number of the wells. This involved locating these wells on base maps from their township, range and section and the location within a section. This problem was one of the reasons for which a time extension was requested as well as additional funding for detailed geologic studies, because appreciable funds had to be assigned to a cartographer to obtain the well coordinates.

Fig. I-A. Area of study.

GEOPRESSURE RESOURCE EVALUATION

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
WELL SERIAL NUMBER		WELL IDENTIFICATION															SECTION		TOWNSHIP		RANGE		COUNTY OR PARISH					STATE		ANALYST INITIALS		DATE																																															
																														MO		DAY		YR																																													

WELL SERIAL NUMBER		TOTAL DEPTH		LATITUDE		LONGITUDE		TOP OF TRANSITION ZONE, FEET		BOTTOM OF TRANSITION ZONE, FEET		DETECTION METHOD		IF NO GEOPRESSURE		ELEVATION		YEAR DRILLED		FW OR WC	
				DEGREES MINUTES		DEGREES MINUTES								MAX. DEPTH °F							

	CARD NO.	WELL SERIAL NUMBER	LOGGING RUN								LOGGING RUN											
			DEPTH	MUD WT.	BHT - °F	R _m of BHT	R _{ml} of BHT	MUD TYPE	DEPTH		MUD WT.	BHT - °F	R _m of BHT	R _{ml} of BHT	MUD TYPE							
3	1																					
3	2																					
3	3																					
3	4																					

	CARD NO.	WELL SERIAL NUMBER	INTERVAL		NET SAND, FT.	SP m.v.	L	INTERVAL		NET SAND, FT.	SP m.v.	L	INTERVAL		NET SAND, FT.	SP m.v.	L
			TOP	BOTTOM				TOP	BOTTOM				TOP	BOTTOM			
4	1																
4	2																
4	3																
4	4																
4	5																
4	6																
4	7																

ALL ENTRIES SHOULD BE RIGHT JUSTIFIED IN THE DATA FIELD

Fig. I-B. Data collection form.

GEOPRESSURE RESOURCE EVALUATION
DATA FORM INSTRUCTIONS

DEFINITION OF GEOPRESSURE

1. No analysis on well logs with total depth(TD) less than 7000 feet, regardless of mud weight.
2. If mud weight is 12.0 ppg or greater and TD is less than 9000 feet, record data from 7000 feet to TD.
3. If mud weight is 12.0 ppg or greater and the first logging run was made at a depth greater than 9000 feet, record data from 9000 feet to TD.
4. If mud weight is less than 12.0 ppg and TD is greater than 7000 feet, this is considered "no geopressure". Data recording for a "no geopressure" well is described in the "DATA DEFINITION" section.

DATA DEFINITION

Self explanatory data descriptions on the data coding form will not be further described in this section.

CARD TYPE 1

WELL SERIAL NUMBER - serial number given the well by the Louisiana Conservation Department. In Texas, some other unique number will have to be used.

WELL IDENTIFICATION - for example, oil company name, well name, well number, etc.

DATE - date that log analysis was made.

CARD TYPE 2

LATITUDE, LONGITUDE - degrees are in integer numbers and minutes are in tenths. Example: DEGREES=87, MINUTES=46.8.

TOP OF TRANSITION ZONE, BOTTOM OF TRANSITION ZONE - if the geopressure transition zone can be determined, enter the information. Otherwise, leave blank.

DETECTION METHOD - the method used to establish transition zone
 M - determined by change in mud weight from one logging run to the next.

L - determined by logging parameters.

BLANK - transition zone not determined.

IF NO GEOPRESSURE - if no geopressure zone is found, as defined in the section "DEFINITION OF GEOPRESSURE", record the maximum depth of the well and the maximum bottom hole temperature. Card Types 3 and 4 are omitted if no geopressure is found.

ELEVATION - well elevation

FW or WC: FW - field well: generally the deepest well in a producing field or adjacent to a producing field.

WC - wild cat.

CARD TYPE 3

Not to be filled out if no geopressure zone was found.

DEPTH - depth reached in logging run

MUD WT. - mud density, pounds per gallon

BHT - °F - bottom hole temperature

R_m at BHT - mud resistivity at bottom hole temperature, ohm-meters.

R_{mf} at BHT - mud filtrate resistivity at bottom hole temperature, ohm-meters.

MUD TYPE - W-water base

O-oil base(entirely oil)

E-emulsion(oil and water)

N-none of the above

CARD TYPE 4

Not to be filled out if no geopressure was found.

INTERVAL - the log analyst will break the geopressured zone into intervals of his choice. Intervals should be relatively large when they contain insignificant sand zones. Intervals should be relatively small when fairly significant sand zones are present. A sand of fifty or more feet of thickness should be considered as an interval in itself.

NOMENCLATURE

WELL SERIAL NUMBER - serial number given the well by the Louisiana Conservation Department. In Texas, some other unique number will have to be used.

LATITUDE, LONGITUDE - degrees are in integer numbers and minutes are in tenths. Example: DEGREES = 87, MINUTES = 46.8.

DETECTION METHOD - the method used to establish the position of the transition zone.

M - determined by change in mud weight from one logging run to the next.

L - determined by logging parameters.

OTHER SOURCES OF INFORMATION:

SO - Sonic log

TD - Thermal Decay Time log

DE - Density log

MI - Micro log

NE - Neutron log

IN - Induction log

GR - Gamma Ray log

LA - Laterolog

DEPTH - depth reached in logging run.

MUD WT. - density of mud in lbs/gal

°F - recorded temperature at DEPTH

MUD RESIST. - ohm-meters measured at temperature, °F

MUD TYPE: W - water base

E - Emulsion

O - oil base

N - None of the above

DATA FORM INSTRUCTIONS, page 3/3

INTERVAL - The log analyst will break the geopressured zone into intervals of his choice. Intervals should be relatively large when they contain insignificant sand zones. Intervals should be relatively small when fairly significant sand zones are present. A sand of fifty or more feet of thickness should be considered as an interval in itself.

NET SAND - the total sand count in the interval.

SP - The average SP deflection of the sands within an interval.

L - dominant lithology, other than sand.

S - Shale

M - Limey Shale

L - Limestone

O - Other

A - Anhydrite

CONSULTANTS INTERPRETATIONS OF INSTRUCTIONS

Record all wells on Geo pressure sheet whether Geopressured or not. If well does not indicate Geo pressure record well identifying data. A well is not considered in geopressure range if a mud weight of less than 12 lbs. was used.

Wells drilled less than 7,000 feet will not be considered. But record well identification information on Geopressure data sheet.

If the well total depth or a log run is deeper than 9,000 feet(10,000: 11,000: or 12,000 feet) and 12 lbs. mud or more was used record geopressure data up to 9,000 feet.

A well having a total depth of 9,000 feet or less and drilled with 12 lbs. or more mud record geopressure data up to 7,000 feet.

Column 79 and 80 will be used to record whether the well under investigation is a field or wildcat well. In column 80 indicate by the letter "F" if a field well and "W" is a wildcat.

Transition zone to be considered and filled in on Geo data sheet if analysisist can detect the zone - otherwise leave blank.

Example of intervals to be considered: A sand-shale interval of 300 - 500 feet should be considered recorded; however, sands of 50 or more feet should be considered as an interval.

When recording intervals in very(predominately) shaley sections of the log consider this example: If the log shows 300-500 feet of shale then a 50 foot sand then 300-500 feet of shale then 40-50 feet of sand then more shale- Record the shale interval, then the sand interval, then the shale interval, then the sand interval.

In section two(2) of the data sheet omit the "other source information" column until further notice from M. Hawkins.

If in section four(4) you need more space to record interval(top and bottom) write on last line continued on the next sheet. Do not forget to rewrite the identifying well data on any supplemental sheet.

Area to consider in the investigation lies between highway 190 and the shore line(Chapman line).

Data from Confidential logs should be recorded on data sheet, but indicate in upper margin of data sheet that the log is confidential. We will get a ruling on this point later.

TASK II-DATA STORAGE, RETRIEVAL AND ANALYSIS

Data taken from the electric logs by the geologic consultants were transferred to some 40,000 punched cards. After verification the data were edited by the computer to flag any obvious errors. The resulting corrected information was stored on magnetic tape and made up what has been and will be referred to as the "data base". This data base was used for the statistical analyses of Task II and for the preparation of computer maps of Task III. It was also used to make estimates of the total geopressure energy in southern Louisiana as well as the distribution of this energy throughout the area, to be discussed in this section.

TABLE II-A

GENERAL STATISTICS ON WELLS IN DATA BASE

Wells in data base: 5,964
Geopressured wells: 3,626 (61%)

For geopressured wells:

Shallowest well: 7,504 ft
Deepest well: 25,600 ft
Average depth: 12,980 ft

Maximum temperature: 428°F
Average temperature
for 12,087 logging runs: 209°F

Maximum mud weight used: 22.0 ppg
Average mud weight
for 12,298 logging runs: 14.7 ppg

Maximum sand in one well: 2,955 ft
Average sand per well: 434 ft

The statistical displays presented in this section were obtained from the data base by the use of a computer program "SAS" (Statistical Analysis System). SAS is widely used, being supported by over 100 universities, government agencies and private companies. It was developed at North Carolina State University and is basically designed for statistical analysis and editing of data. Table II-A gives some of the general statistics of almost 6,000 wells in the data base.

SAS was used to produce Figs. II-B through II-F. These histograms give a general impression of the geopressure resource in southern Louisiana by showing the distributions of mud weight, total well depth, total feet of sand and temperatures for the geopressured wells(only). Figure II-F is a plot of logged depth versus temperature in which points labelled A represent one observation, B two observations etc. and Z, 26 or more observations.

FIG. II-B

FIG. II-C

GEOPRESSURED WELLS

HISTOGRAM OF TOTDEPTH

FIG. II-D

FIG. II-E

BOTTOM HOLE TEMPERATURE

FIG. II-F

TEMPERATURE VS. DEPTH, GEOPRESSURE

PLOT OF DEPTH+TEMP LEGEND: A = 1 OBS , R = 2 OBS , ETC

Statistical distribution of Mud Weights and Sand Count

Figure II-G is a map which shows the 40 blocks into which the study area was divided for the presentation of statistical data. These blocks lie between 89 and 94 degrees longitude west and between 29 and 31 degrees latitude north. Each block is 0.5 degrees by 0.5 degrees.

Tables II-H through II-Q show the distribution of mud weight and sand count in each of the 40 blocks (block numbers in column far right) and within each of seven depth intervals, namely 0-10, 10-12, 12-14, 14-16, 16-18, 18-20 and 20-30 K feet. These were prepared as an aid to locating places where it is presumably more advantageous to look for the more interesting geopressured aquifers.

In the tables "NON-GEOP" indicates the number of wells drilled to a total depth within the depth bracket indicated without using mud weight greater than 12 ppg. In the other columns the number of wells may be somewhat misleading in that one well may have several entries in the tables. For example, a single well that used 10 ppg mud to drill to 13,000 feet and 15 ppg mud to drill from 13,000 to 17,000 feet would cause five (5) entries in the table, representing:

1. One well from 0-10K feet using 9-12 ppg mud.
2. One well from 10-12K feet using 9-12 ppg mud.
3. One well from 12-14K feet using 14-16 ppg mud.
4. One well from 14-16K feet using 14-16 ppg mud.
5. One well from 16-18K feet using 14-16 ppg mud.

It is noted in the above example that where mud weight changes in any depth interval, the heavier weight is used.

The data labelled "AVG SAND COUNT-FEET" also needs some explanation because it represents the average feet of sand encountered by all wells that fully penetrated that depth bracket. For example, a well drilled to a total depth of 15K feet would have a sand count entry for 10-12K and 12-14K feet but none for the 14-16K feet depth interval. Wells that encountered no geopressured strata have no sand count entry

because sand count data was not taken on these wells. These tables were generated by a Fortran program that utilized sorted and edited data sets that were generated by the SAS program.

LOUISIANA

FIG. II-G

INVESTIGATIONS ON THE GEOPRESSURE ENERGY
RESOURCE OF SOUTHERN LOUISIANA

TASK II DATA STORAGE, RETRIEVAL
AND ANALYSIS

INDEX MAP FOR STATISTICAL STUDY OF
WELLS BY DEPTH BRACKET AND MUD WEIGHT

TABLE II-H

LONGITUDE *****	LATITUDE *****	DEPTH *****	NUMBER OF WELLS *****						AVG. SAND COUNT-Feet *****	BLOCK *****
			NCN-GEOP	9-12 PPG	12-14 PPG	14-16 PPG	16-18 PPG	18+ PPG		
			*****	*****	*****	*****	*****	*****		
89.0-89.5	29.0-29.5	0 - 10000	62.	17.	112.	19.	5.	1.	*****	1
89.0-89.5	29.0-29.5	10000 - 12000	12.	12.	92.	27.	7.	1.	230.5	1
89.0-89.5	29.0-29.5	12000 - 14000	0.	0.	16.	17.	18.	2.	164.3	1
89.0-89.5	29.0-29.5	14000 - 16000	0.	0.	2.	5.	11.	3.	100.9	1
89.0-89.5	29.0-29.5	16000 - 18000	0.	0.	0.	2.	6.	0.	29.6	1
89.0-89.5	29.0-29.5	18000 - 20000	0.	0.	0.	1.	0.	0.	0.0	1
89.0-89.5	29.0-29.5	20000 - 30000	0.	0.	0.	0.	1.	0.	*****	1
89.0-89.5	29.5-30.0	0 - 10000	151.	151.	47.	6.	4.	0.	*****	2
89.0-89.5	29.5-30.0	10000 - 12000	0.	10.	22.	1.	12.	0.	153.2	NNNN
89.0-89.5	29.5-30.0	12000 - 14000	1.	1.	0.	0.	8.	0.	159.8	NNNN
89.0-89.5	29.5-30.0	14000 - 16000	1.	1.	0.	0.	7.	0.	130.3	NNNN
89.0-89.5	29.5-30.0	16000 - 18000	0.	0.	0.	0.	3.	0.	19.5	NNNN
89.0-89.5	29.5-30.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	NNNN
89.0-89.5	29.5-30.0	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	2
89.0-89.5	30.0-30.5	0 - 10000	3.	1.	0.	1.	0.	0.	*****	3
89.0-89.5	30.0-30.5	10000 - 12000	0.	0.	0.	1.	0.	0.	0.0	NNNN
89.0-89.5	30.0-30.5	12000 - 14000	0.	0.	0.	0.	0.	0.	0.0	NNNN
89.0-89.5	30.0-30.5	14000 - 16000	0.	0.	0.	0.	0.	0.	0.0	NNNN
89.0-89.5	30.0-30.5	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0	NNNN
89.0-89.5	30.0-30.5	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	NNNN
89.0-89.5	30.0-30.5	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	3
89.0-89.5	30.5-31.0	0 - 10000	0.	0.	0.	0.	0.	0.	*****	4
89.0-89.5	30.5-31.0	10000 - 12000	0.	0.	0.	0.	0.	0.	0.0	NNNN
89.0-89.5	30.5-31.0	12000 - 14000	0.	0.	0.	0.	0.	0.	0.0	NNNN
89.0-89.5	30.5-31.0	14000 - 16000	0.	0.	0.	0.	0.	0.	0.0	NNNN
89.0-89.5	30.5-31.0	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0	NNNN
89.0-89.5	30.5-31.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	NNNN
89.0-89.5	30.5-31.0	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	4

TABLE II-I

LONGITUDE *****	LATITUDE *****	DEPTH *****	NUMBER OF WELLS *****						AVG. SAND COUNT- FEET *****	BLOCK *****
			NCA-GLOP	9-12 PPG	12-14 PPG	14-16 PPG	16-18 PPG	18+ PPG		
89.5-90.0	29.0-29.5	0 - 10000	39.	4.	80.	11.	6.	0.	*****	5
89.5-90.0	29.0-29.5	10000 - 12000	0.	4.	76.	11.	7.	0.	363.7	5
89.5-90.0	29.0-29.5	12000 - 14000	0.	2.	58.	12.	5.	0.	346.7	5
89.5-90.0	29.0-29.5	14000 - 16000	0.	1.	15.	18.	8.	3.	259.1	5
89.5-90.0	29.0-29.5	16000 - 18000	0.	0.	4.	4.	14.	1.	143.5	5
89.5-90.0	29.0-29.5	18000 - 20000	0.	0.	0.	1.	3.	3.	38.4	5
89.5-90.0	29.0-29.5	20000 - 30000	0.	0.	0.	0.	2.	0.	*****	5
89.5-90.0	29.5-30.0	0 - 10000	154.	71.	83.	22.	9.	0.	*****	6
89.5-90.0	29.5-30.0	10000 - 12000	39.	47.	75.	23.	11.	0.	173.0	6
89.5-90.0	29.5-30.0	12000 - 14000	0.	2.	21.	15.	12.	2.	170.8	6
89.5-90.0	29.5-30.0	14000 - 16000	0.	0.	1.	5.	8.	0.	71.1	6
89.5-90.0	29.5-30.0	16000 - 18000	0.	0.	0.	1.	5.	0.	137.1	6
89.5-90.0	29.5-30.0	18000 - 20000	0.	0.	0.	1.	2.	0.	158.1	6
89.5-90.0	29.5-30.0	20000 - 30000	0.	0.	0.	0.	1.	0.	*****	6
89.5-90.0	30.0-30.5	0 - 10000	23.	0.	11.	3.	0.	0.	*****	7
89.5-90.0	30.0-30.5	10000 - 12000	0.	0.	11.	3.	0.	0.	175.6	7
89.5-90.0	30.0-30.5	12000 - 14000	0.	0.	2.	2.	1.	0.	181.9	7
89.5-90.0	30.0-30.5	14000 - 16000	0.	0.	1.	1.	0.	0.	104.3	7
89.5-90.0	30.0-30.5	16000 - 18000	0.	0.	1.	0.	0.	0.	0.0	7
89.5-90.0	30.0-30.5	18000 - 20000	0.	0.	1.	0.	0.	0.	0.0	7
89.5-90.0	30.0-30.5	20000 - 30000	0.	0.	1.	0.	0.	0.	*****	7
89.5-90.0	30.5-31.0	0 - 10000	0.	0.	0.	0.	0.	0.	*****	8
89.5-90.0	30.5-31.0	10000 - 12000	0.	0.	0.	0.	0.	0.	0.0	8
89.5-90.0	30.5-31.0	12000 - 14000	0.	0.	0.	0.	0.	0.	0.0	8
89.5-90.0	30.5-31.0	14000 - 16000	0.	0.	0.	0.	0.	0.	0.0	8
89.5-90.0	30.5-31.0	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0	8
89.5-90.0	30.5-31.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	8
89.5-90.0	30.5-31.0	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	8

TABLE II-J

LONGITUDE *****	LATITUDE *****	DEPTH *****	NUMBER OF WELLS *****					AVG. SAND COUNT-Feet *****	BLOCK *****
			NON-GEOP *****	9-12 PPG *****	12-14 PPG *****	14-16 PPG *****	16-18 PPG *****	18+ PPG *****	
90.0-90.5	29.0-29.5	0 - 10000	36.	31.	84.	12.	3.	0.	***** 9
90.0-90.5	29.0-90.5	10000 - 12000	0.	29.	85.	11.	3.	0.	267.5 9
90.0-90.5	29.0-90.5	12000 - 14000	0.	20.	82.	14.	9.	1.	246.5 9
90.0-90.5	29.0-90.5	14000 - 16000	0.	4.	31.	19.	15.	2.	164.5 9
90.0-90.5	29.0-90.5	16000 - 18000	0.	2.	9.	5.	10.	2.	140.6 9
90.0-90.5	29.0-90.5	18000 - 20000	0.	0.	2.	4.	2.	0.	154.6 9
90.0-90.5	29.0-90.5	20000 - 30000	0.	0.	1.	1.	1.	0.	***** 9
90.0-90.5	29.5-30.0	0 - 10000	153.	67.	83.	17.	4.	0.	***** 10
90.0-90.5	29.5-30.0	10000 - 12000	29.	54.	85.	18.	4.	0.	153.3 10
90.0-90.5	29.5-30.0	12000 - 14000	0.	6.	45.	15.	16.	3.	100.5 10
90.0-90.5	29.5-30.0	14000 - 16000	0.	0.	0.	3.	13.	2.	83.3 10
90.0-90.5	29.5-30.0	16000 - 18000	0.	0.	0.	0.	3.	0.	12.4 10
90.0-90.5	29.5-30.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0 10
90.0-90.5	29.5-30.0	20000 - 30000	0.	0.	0.	0.	0.	0.	***** 10
90.0-90.5	30.0-30.5	0 - 10000	59.	0.	8.	2.	3.	0.	***** 11
90.0-90.5	30.0-30.5	10000 - 12000	0.	0.	8.	2.	3.	0.	98.6 11
90.0-90.5	30.0-30.5	12000 - 14000	0.	0.	0.	0.	2.	0.	0.0 11
90.0-90.5	30.0-30.5	14000 - 16000	0.	0.	0.	0.	1.	0.	0.0 11
90.0-90.5	30.0-30.5	16000 - 18000	0.	0.	0.	0.	1.	0.	0.0 11
90.0-90.5	30.0-30.5	18000 - 20000	0.	0.	0.	0.	1.	0.	0.0 11
90.0-90.5	30.0-30.5	20000 - 30000	0.	0.	0.	0.	0.	0.	***** 11
90.0-90.5	30.5-31.0	0 - 10000	1.	0.	0.	0.	0.	0.	***** 12
90.0-90.5	30.5-31.0	10000 - 12000	0.	0.	0.	0.	0.	0.	0.0 12
90.0-90.5	30.5-31.0	12000 - 14000	0.	0.	0.	0.	0.	0.	0.0 12
90.0-90.5	30.5-31.0	14000 - 16000	0.	0.	0.	0.	0.	0.	0.0 12
90.0-90.5	30.5-31.0	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0 12
90.0-90.5	30.5-31.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0 12
90.0-90.5	30.5-31.0	20000 - 30000	0.	0.	0.	0.	0.	0.	***** 12

TABLE II-K

LONGITUDE *****	LATITUDE *****	DEPTH *****	NUMBER OF WELLS *****						AVG. SAND COUNT-Feet *****	BLOCK *****
			NCN-GLDP	9-12 PPG	12-14 PPG	14-16 PPG	16-18 PPG	18+ PPG		
90.5-91.0	29.0-29.5	0 - 10000	50.	0.	113.	15.	11.	0.	*****	13
90.5-91.0	29.0-29.5	10000 - 12000	0.	0.	110.	16.	12.	0.	213.3	13
90.5-91.0	29.0-29.5	12000 - 14000	0.	0.	92.	19.	20.	0.	219.1	13
90.5-91.0	29.0-29.5	14000 - 16000	0.	0.	26.	16.	42.	2.	133.8	13
90.5-91.0	29.0-29.5	16000 - 18000	0.	0.	8.	5.	23.	3.	104.0	13
90.5-91.0	29.0-29.5	18000 - 20000	0.	0.	2.	0.	4.	3.	59.8	13
90.5-91.0	29.0-29.5	20000 - 30000	0.	0.	0.	0.	1.	1.	*****	13
90.5-91.0	29.5-30.0	0 - 10000	138.	56.	241.	31.	39.	4.	*****	14
90.5-91.0	29.5-30.0	10000 - 12000	47.	53.	241.	31.	39.	4.	222.3	14
90.5-91.0	29.5-30.0	12000 - 14000	17.	18.	149.	33.	66.	7.	140.0	14
90.5-91.0	29.5-30.0	14000 - 16000	2.	2.	5.	7.	60.	13.	125.8	14
90.5-91.0	29.5-30.0	16000 - 18000	1.	1.	1.	1.	11.	13.	50.9	14
90.5-91.0	29.5-30.0	18000 - 20000	0.	0.	0.	0.	4.	1.	7.4	14
90.5-91.0	29.5-30.0	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	14
90.5-91.0	30.0-30.5	0 - 10000	73.	7.	55.	9.	3.	0.	*****	15
90.5-91.0	30.0-30.5	10000 - 12000	0.	4.	52.	9.	3.	0.	129.3	15
90.5-91.0	30.0-30.5	12000 - 14000	0.	0.	11.	5.	3.	0.	57.6	15
90.5-91.0	30.0-30.5	14000 - 16000	0.	0.	0.	0.	0.	0.	246.1	15
90.5-91.0	30.0-30.5	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0	15
90.5-91.0	30.0-30.5	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	15
90.5-91.0	30.0-30.5	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	15
90.5-91.0	30.5-31.0	0 - 10000	0.	0.	0.	0.	0.	0.	*****	16
90.5-91.0	30.5-31.0	10000 - 12000	0.	0.	0.	0.	0.	0.	0.0	16
90.5-91.0	30.5-31.0	12000 - 14000	0.	0.	0.	0.	0.	0.	0.0	16
90.5-91.0	30.5-31.0	14000 - 16000	0.	0.	0.	0.	0.	0.	0.0	16
90.5-91.0	30.5-31.0	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0	16
90.5-91.0	30.5-31.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	16
90.5-91.0	30.5-31.0	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	16

TABLE II-L

LONGITUDE *****	LATITUDE *****	DEPTH *****	NUMBER OF WELLS *****						AVG. SAND COUNT-Feet *****	BLOCK *****
			NCN-GLOP	9-12 PPG	12-14 PPG	14-16 PPG	16-18 PPG	18+ PPG		
91.0-91.5	29.0-29.5	0 - 10000	47.	0.	56.	23.	7.	0.	*****	17
91.0-91.5	29.0-29.5	10000 - 12000	0.	0.	57.	23.	6.	0.	258.2	17
91.0-91.5	29.0-29.5	12000 - 14000	0.	0.	40.	30.	11.	0.	278.9	17
91.0-91.5	29.0-29.5	14000 - 16000	0.	0.	14.	14.	16.	1.	173.0	17
91.0-91.5	29.0-29.5	16000 - 18000	0.	0.	2.	3.	10.	0.	62.0	17
91.0-91.5	29.0-29.5	18000 - 20000	0.	0.	0.	0.	2.	1.	81.6	17
91.0-91.5	29.0-29.5	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	17
91.0-91.5	29.5-30.0	0 - 10000	100.	33.	174.	30.	39.	1.	*****	18
91.0-91.5	29.5-30.0	10000 - 12000	29.	31.	174.	30.	39.	1.	332.1	18
91.0-91.5	29.5-30.0	12000 - 14000	21.	22.	148.	32.	51.	1.	225.7	18
91.0-91.5	29.5-30.0	14000 - 16000	5.	5.	42.	28.	59.	3.	176.9	18
91.0-91.5	29.5-30.0	16000 - 18000	2.	2.	1.	9.	41.	3.	103.9	18
91.0-91.5	29.5-30.0	18000 - 20000	0.	0.	0.	0.	10.	1.	83.0	18
91.0-91.5	29.5-30.0	20000 - 30000	0.	0.	0.	0.	3.	1.	*****	18
91.0-91.5	30.0-30.5	0 - 10000	161.	0.	128.	35.	20.	2.	*****	19
91.0-91.5	30.0-30.5	10000 - 12000	1.	0.	121.	36.	19.	2.	203.5	19
91.0-91.5	30.0-30.5	12000 - 14000	1.	0.	46.	20.	28.	3.	152.2	19
91.0-91.5	30.0-30.5	14000 - 16000	0.	0.	7.	4.	6.	1.	82.5	19
91.0-91.5	30.0-30.5	16000 - 18000	0.	0.	0.	0.	4.	2.	19.7	19
91.0-91.5	30.0-30.5	18000 - 20000	0.	0.	0.	0.	0.	1.	5.5	19
91.0-91.5	30.0-30.5	20000 - 30000	0.	0.	0.	0.	0.	1.	*****	19
91.0-91.5	30.5-31.0	0 - 10000	7.	0.	2.	1.	0.	0.	*****	20
91.0-91.5	30.5-31.0	10000 - 12000	0.	0.	2.	1.	0.	0.	20.7	20
91.0-91.5	30.5-31.0	12000 - 14000	0.	0.	1.	1.	0.	0.	238.2	20
91.0-91.5	30.5-31.0	14000 - 16000	0.	0.	0.	2.	0.	0.	104.7	20
91.0-91.5	30.5-31.0	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0	20
91.0-91.5	30.5-31.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	20
91.0-91.5	30.5-31.0	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	20

TABLE II-M

LONGITUDE *****	LATITUDE *****	DEPTH *****	NUMBER OF WELLS *****						AVG. SAND COUNT- FEET *****	BLOCK *****
			NCN-GEOP	9-12 PPG	12-14 PPG	14-16 PPG	16-18 PPG	18+ PPG		
91.5-92.0	29.0-29.5	0 - 10000	6.	0.	13.	4.	1.	0.	*****	21
91.5-92.0	29.0-29.5	10000 - 12000	0.	0.	13.	1.	0.	0.	325.5	21
91.5-92.0	29.0-29.5	12000 - 14000	0.	0.	12.	3.	2.	0.	324.9	21
91.5-92.0	29.0-29.5	14000 - 16000	0.	0.	0.	3.	5.	2.	189.0	21
91.5-92.0	29.0-29.5	16000 - 18000	0.	0.	0.	0.	4.	0.	91.0	21
91.5-92.0	29.0-29.5	18000 - 20000	0.	0.	0.	0.	1.	0.	0.0	21
91.5-92.0	29.0-29.5	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	21
91.5-92.0	29.5-30.0	0 - 10000	63.	0.	101.	9.	14.	2.	*****	22
91.5-92.0	29.5-30.0	10000 - 12000	1.	0.	99.	9.	14.	2.	276.1	22
91.5-92.0	29.5-30.0	12000 - 14000	1.	0.	83.	12.	18.	1.	210.2	22
91.5-92.0	29.5-30.0	14000 - 16000	0.	0.	26.	12.	25.	4.	137.0	22
91.5-92.0	29.5-30.0	16000 - 18000	0.	0.	5.	5.	13.	3.	63.7	22
91.5-92.0	29.5-30.0	18000 - 20000	0.	0.	0.	1.	6.	1.	68.9	22
91.5-92.0	29.5-30.0	20000 - 30000	0.	0.	0.	0.	1.	2.	*****	22
91.5-92.0	30.0-30.5	0 - 10000	146.	0.	123.	32.	27.	1.	*****	23
91.5-92.0	30.0-30.5	10000 - 12000	0.	0.	118.	31.	29.	0.	142.2	23
91.5-92.0	30.0-30.5	12000 - 14000	0.	1.	50.	29.	39.	1.	81.7	23
91.5-92.0	30.0-30.5	14000 - 16000	0.	0.	3.	5.	20.	3.	54.8	23
91.5-92.0	30.0-30.5	16000 - 18000	0.	0.	0.	1.	4.	1.	11.1	23
91.5-92.0	30.0-30.5	18000 - 20000	0.	0.	0.	0.	0.	0.	0.1	23
91.5-92.0	30.0-30.5	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	23
91.5-92.0	30.5-31.0	0 - 10000	11.	0.	11.	12.	1.	0.	*****	24
91.5-92.0	30.5-31.0	10000 - 12000	0.	0.	10.	13.	1.	0.	76.4	24
91.5-92.0	30.5-31.0	12000 - 14000	0.	0.	3.	13.	3.	0.	141.5	24
91.5-92.0	30.5-31.0	14000 - 16000	0.	0.	0.	8.	3.	0.	185.2	24
91.5-92.0	30.5-31.0	16000 - 18000	0.	0.	0.	1.	1.	0.	21.7	24
91.5-92.0	30.5-31.0	18000 - 20000	0.	0.	0.	0.	0.	0.	35.0	24
91.5-92.0	30.5-31.0	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	24

TABLE II-N

LONGITUDE *****	LATITUDE *****	DEPTH *****	NUMBER OF WELLS *****						AVG. SAND COUNT- FEET *****	BLOCK *****
			NGN-GEOP	9-12 PPG	12-14 PPG	14-16 PPG	16-18 PPG	18+ PPG		
92.0-92.5	29.0-29.5	0 - 10000	0.	0.	1.	0.	0.	0.	*****	25
92.0-92.5	29.0-29.5	10000 - 12000	0.	0.	1.	0.	0.	0.	446.0	25
92.0-92.5	29.0-29.5	12000 - 14000	0.	0.	1.	0.	0.	0.	332.9	25
92.0-92.5	29.0-29.5	14000 - 16000	0.	0.	0.	0.	1.	0.	429.1	25
92.0-92.5	29.0-29.5	16000 - 18000	0.	0.	0.	0.	1.	0.	144.4	25
92.0-92.5	29.0-29.5	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	25
92.0-92.5	29.0-29.5	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	25
92.0-92.5	29.5-30.0	0 - 10000	74.	0.	147.	7.	11.	1.	*****	26
92.0-92.5	29.5-30.0	10000 - 12000	0.	0.	147.	7.	11.	1.	264.2	26
92.0-92.5	29.5-30.0	12000 - 14000	0.	0.	120.	14.	16.	2.	138.7	26
92.0-92.5	29.5-30.0	14000 - 16000	0.	0.	14.	19.	36.	4.	134.5	26
92.0-92.5	29.5-30.0	16000 - 18000	0.	0.	0.	3.	19.	7.	79.8	26
92.0-92.5	29.5-30.0	18000 - 20000	0.	0.	0.	1.	5.	5.	39.7	26
92.0-92.5	29.5-30.0	20000 - 30000	0.	0.	0.	0.	2.	1.	*****	26
92.0-92.5	30.0-30.5	0 - 10000	124.	0.	235.	30.	18.	2.	*****	27
92.0-92.5	30.0-30.5	10000 - 12000	0.	0.	215.	32.	21.	2.	140.9	27
92.0-92.5	30.0-30.5	12000 - 14000	0.	0.	14.	36.	100.	2.	107.4	27
92.0-92.5	30.0-30.5	14000 - 16000	0.	0.	0.	6.	71.	4.	84.8	27
92.0-92.5	30.0-30.5	16000 - 18000	0.	0.	0.	0.	26.	4.	63.6	27
92.0-92.5	30.0-30.5	18000 - 20000	0.	0.	0.	0.	5.	2.	62.4	27
92.0-92.5	30.0-30.5	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	27
92.0-92.5	30.5-31.0	0 - 10000	18.	0.	13.	7.	0.	0.	*****	28
92.0-92.5	30.5-31.0	10000 - 12000	0.	0.	12.	7.	0.	0.	44.8	28
92.0-92.5	30.5-31.0	12000 - 14000	0.	0.	2.	3.	3.	0.	106.4	28
92.0-92.5	30.5-31.0	14000 - 16000	0.	0.	0.	1.	2.	0.	127.7	28
92.0-92.5	30.5-31.0	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0	28
92.0-92.5	30.5-31.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	28
92.0-92.5	30.5-31.0	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	28

TABLE II-O

LONGITUDE *****	LATITUDE *****	DEPTH *****	NUMBER OF WELLS *****						AVG. SAND COUNT-Feet *****	BLOCK *****
			NON-GEOP *****	9-12 PPG *****	12-14 PPG *****	14-16 PPG *****	16-18 PPG *****	18+ PPG *****		
92.5-93.0	29.0-29.5	0 - 10000	0.	0.	0.	0.	0.	0.	*****	29
92.5-93.0	29.0-29.5	10000 - 12000	0.	0.	0.	0.	0.	0.	0.0	29
92.5-93.0	29.0-29.5	12000 - 14000	0.	0.	0.	0.	0.	0.	0.0	29
92.5-93.0	29.0-29.5	14000 - 16000	0.	0.	0.	0.	0.	0.	0.0	29
92.5-93.0	29.0-29.5	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0	29
92.5-93.0	29.0-29.5	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	29
92.5-93.0	29.0-29.5	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	29
92.5-93.0	29.5-30.0	0 - 10000	54.	0.	111.	17.	34.	0.	*****	30
92.5-93.0	29.5-30.0	10000 - 12000	0.	0.	104.	18.	36.	1.	182.6	30
92.5-93.0	29.5-30.0	12000 - 14000	0.	0.	56.	12.	46.	0.	134.2	30
92.5-93.0	29.5-30.0	14000 - 16000	0.	0.	12.	8.	39.	4.	165.3	30
92.5-93.0	29.5-30.0	16000 - 18000	0.	0.	2.	0.	20.	8.	101.5	30
92.5-93.0	29.5-30.0	18000 - 20000	0.	0.	0.	1.	4.	2.	54.3	30
92.5-93.0	29.5-30.0	20000 - 30000	0.	0.	0.	0.	2.	0.	*****	30
92.5-93.0	30.0-30.5	0 - 10000	104.	0.	185.	20.	14.	0.	*****	31
92.5-93.0	30.0-30.5	10000 - 12000	1.	0.	132.	29.	21.	0.	107.3	31
92.5-93.0	30.0-30.5	12000 - 14000	0.	0.	2.	15.	78.	0.	90.2	31
92.5-93.0	30.0-30.5	14000 - 16000	0.	0.	0.	3.	33.	4.	83.4	31
92.5-93.0	30.0-30.5	16000 - 18000	0.	0.	0.	2.	8.	1.	29.9	31
92.5-93.0	30.0-30.5	18000 - 20000	0.	0.	0.	0.	1.	0.	60.6	31
92.5-93.0	30.0-30.5	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	31
92.5-93.0	30.5-31.0	0 - 10000	2.	0.	18.	4.	1.	0.	*****	32
92.5-93.0	30.5-31.0	10000 - 12000	0.	0.	13.	4.	1.	0.	44.9	32
92.5-93.0	30.5-31.0	12000 - 14000	0.	0.	1.	4.	2.	0.	186.0	32
92.5-93.0	30.5-31.0	14000 - 16000	0.	0.	0.	0.	4.	0.	167.7	32
92.5-93.0	30.5-31.0	16000 - 18000	0.	0.	0.	0.	2.	0.	62.5	32
92.5-93.0	30.5-31.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	32
92.5-93.0	30.5-31.0	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	32

TABLE II-P

LONGITUDE *****	LATITUDE *****	DEPTH *****	NUMBER OF WELLS *****						AVG. SAND COUNT-Feet *****	BLOCK *****
			NCN-GEOP *****	9-12 PPG *****	12-14 PPG *****	14-16 PPG *****	16-18 PPG *****	18+ PPG *****		
93.0-93.5	29.0-29.5	0 - 10000	0.	0.	0.	0.	0.	0.	*****	33
93.0-93.5	29.0-29.5	10000 - 12000	0.	0.	0.	0.	0.	0.	0.0	33
93.0-93.5	29.0-29.5	12000 - 14000	0.	0.	0.	0.	0.	0.	0.0	33
93.0-93.5	29.0-29.5	14000 - 16000	0.	0.	0.	0.	0.	0.	0.0	33
93.0-93.5	29.0-29.5	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0	33
93.0-93.5	29.0-29.5	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	33
93.0-93.5	29.0-29.5	20000 - 30000	0.	0.	0.	0.	0.	0.	0.0	33
93.0-93.5	29.5-30.0	0 - 10000	47.	0.	116.	14.	33.	0.	*****	34
93.0-93.5	29.5-30.0	10000 - 12000	0.	0.	92.	20.	45.	0.	239.6	34
93.0-93.5	29.5-30.0	12000 - 14000	0.	0.	11.	16.	71.	0.	218.1	34
93.0-93.5	29.5-30.0	14000 - 16000	0.	0.	0.	7.	40.	1.	85.9	34
93.0-93.5	29.5-30.0	16000 - 18000	0.	0.	0.	0.	10.	1.	16.9	34
93.0-93.5	29.5-30.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	34
93.0-93.5	29.5-30.0	20000 - 30000	0.	0.	0.	0.	0.	0.	0.0	34
93.0-93.5	30.0-30.5	0 - 10000	159.	0.	133.	41.	15.	1.	*****	35
93.0-93.5	30.0-30.5	10000 - 12000	0.	0.	61.	41.	33.	1.	137.1	35
93.0-93.5	30.0-30.5	12000 - 14000	0.	0.	7.	13.	33.	2.	113.0	35
93.0-93.5	30.0-30.5	14000 - 16000	0.	0.	0.	2.	12.	1.	100.1	35
93.0-93.5	30.0-30.5	16000 - 18000	0.	0.	0.	0.	3.	0.	82.3	35
93.0-93.5	30.0-30.5	18000 - 20000	0.	0.	0.	0.	2.	0.	51.5	35
93.0-93.5	30.0-30.5	20000 - 30000	0.	0.	0.	0.	1.	0.	0.0	35
93.0-93.5	30.5-31.0	0 - 10000	54.	0.	14.	2.	0.	0.	*****	36
93.0-93.5	30.5-31.0	10000 - 12000	0.	0.	10.	2.	0.	0.	134.0	36
93.0-93.5	30.5-31.0	12000 - 14000	0.	0.	3.	2.	1.	0.	106.7	36
93.0-93.5	30.5-31.0	14000 - 16000	0.	0.	0.	0.	1.	0.	7.1	36
93.0-93.5	30.5-31.0	16000 - 18000	0.	0.	0.	0.	1.	0.	0.0	36
93.0-93.5	30.5-31.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	36
93.0-93.5	30.5-31.0	20000 - 30000	0.	0.	0.	0.	0.	0.	0.0	36

TABLE II-Q

LONGITUDE *****	LATITUDE *****	DEPTH *****	NUMBER OF WELLS *****						AVG. SAND COUNT-Feet *****	BLOCK *****
			NON-GEOP *****	9-12 PPG *****	12-14 PPG *****	14-16 PPG *****	16-18 PPG *****	18+ PPG *****		
93.5-94.0	29.0-29.5	0 - 10000	0.	0.	6.	1.	0.	0.	*****	37
93.5-94.0	29.0-29.5	10000 - 12000	0.	0.	2.	2.	0.	0.	451.8	37
93.5-94.0	29.0-29.5	12000 - 14000	0.	0.	2.	0.	2.	0.	152.7	37
93.5-94.0	29.0-29.5	14000 - 16000	0.	0.	0.	1.	0.	0.	150.0	37
93.5-94.0	29.0-29.5	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0	37
93.5-94.0	29.0-29.5	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	37
93.5-94.0	29.0-29.5	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	37
93.5-94.0	29.5-30.0	0 - 10000	16.	0.	50.	16.	15.	0.	*****	38
93.5-94.0	29.5-30.0	10000 - 12000	1.	0.	27.	19.	20.	0.	239.0	38
93.5-94.0	29.5-30.0	12000 - 14000	0.	0.	11.	13.	20.	0.	170.5	38
93.5-94.0	29.5-30.0	14000 - 16000	0.	0.	2.	3.	19.	0.	115.9	38
93.5-94.0	29.5-30.0	16000 - 18000	0.	0.	0.	0.	2.	0.	23.3	38
93.5-94.0	29.5-30.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.4	38
93.5-94.0	29.5-30.0	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	38
93.5-94.0	30.0-30.5	0 - 10000	92.	0.	29.	9.	5.	0.	*****	39
93.5-94.0	30.0-30.5	10000 - 12000	0.	0.	2.	15.	9.	0.	102.7	39
93.5-94.0	30.0-30.5	12000 - 14000	0.	0.	0.	0.	2.	0.	94.0	39
93.5-94.0	30.0-30.5	14000 - 16000	0.	0.	0.	0.	1.	0.	11.5	39
93.5-94.0	30.0-30.5	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0	39
93.5-94.0	30.0-30.5	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	39
93.5-94.0	30.0-30.5	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	39
93.5-94.0	30.5-31.0	0 - 10000	33.	0.	1.	0.	0.	0.	*****	40
93.5-94.0	30.5-31.0	10000 - 12000	0.	0.	1.	0.	0.	0.	0.0	40
93.5-94.0	30.5-31.0	12000 - 14000	0.	0.	0.	0.	0.	0.	0.0	40
93.5-94.0	30.5-31.0	14000 - 16000	0.	0.	0.	0.	0.	0.	0.0	40
93.5-94.0	30.5-31.0	16000 - 18000	0.	0.	0.	0.	0.	0.	0.0	40
93.5-94.0	30.5-31.0	18000 - 20000	0.	0.	0.	0.	0.	0.	0.0	40
93.5-94.0	30.5-31.0	20000 - 30000	0.	0.	0.	0.	0.	0.	*****	40

Estimate of the Geopressure Resource

Tables II-R through II-Z present estimates of the magnitude of the geopressed resource for each of the forty previously defined 0.5 x 0.5 degree blocks. A description of the tabular entries and the assumptions used in the calculations are as follows:

TOTAL WATER PRODUCTION

This is the volume of water in cubic feet that would be produced if the total resource were to be produced from its existing pressure down to a hydrostatic head equivalent to 9.0 ppg. The equation used for this calculation is:

$$W_p = A \phi h f c D (0.433) (\rho_m - 9) / 8.33$$

where:

W_p = water produced, ft³

A = study area size in block, ft²

ϕ = porosity, fraction

h = thickness, feet

c = system pore volume compressibility, psi⁻¹

D = depth, feet

ρ_m = mud weight, lbs/gallon

f = number of wells in block that used the above mud weight ÷ number of total wells in that block. This information was obtained from the data presented in Tables II-H through II-Q. This number represents the fraction of sand volume in the block that was drilled using the above mentioned mud weight.

For these studies porosity was assumed uniform at 20 percent and a system compressibility of 20×10^{-6} psi⁻¹ was used. It is important to realize that a system compressibility of 10×10^{-6} psi⁻¹ would cut all of the volume and energy figures in half.

TOTAL GAS PRODUCTION

This is the volume of solution gas in SCF that would be produced with the water if the water contains the maximum amount of gas in the aquifer. The amounts of solution gas were obtained as a function of pressure from the data of Culberson and McKetta using a subsurface temperature of 200°F. The equation used for the calculation is:

$$G_p = W_p (R_{si} + R_{sf}) / (2 \times 5.615)$$

where:

G_p = gas produced, SCF

W_p = water produced, ft³

R_{si} = solution gas at initial pressure, SCF/bbl

R_{sf} = solution gas at final or abandonment pressure, SCF/bbl.

This equation uses the water production calculated in the previous equation. It assumes that the solution gas varies linearly with pressure between the initial pressure and a final pressure equal to hydrostatic at 9.00 ppg, and that the average solution gas is $(R_{si} + R_{sf})/2$.

GEOHERMAL ENERGY PRODUCTION

This represents the heat content of the produced water down to an assumed lower temperature of 120°F. It was also assumed that the producing temperature of the water was defined by:

$$T = 70 + 0.012 \cdot D$$

The equation used for the calculation is:

$$\text{Thermal BTU} = 62.4 \cdot W_p \cdot (T - 120)$$

where:

W_p = water produced, ft³

T = surface producing temperature, °F

D = depth, feet

GEOHYDRAULIC ENERGY PRODUCTION

This is the energy represented by the volume-pressure product of the produced water. The pressure used for the calculation is the average of the initial surface producing pressure and the final surface producing pressure (assumed to be zero). The equation used was:

$$\text{Hydraulic BTU} = \frac{(0.001285) (0.433) (144) W_p D (\rho_m - 9)}{(2) (8.33)}$$

where:

W_p = water produced, ft^3

D = depth, feet

ρ_m = mud weight, lbs/gallon

This calculation assumes a linear relationship between cumulative water production and aquifer pressure and that water production ceases when aquifer pressure reaches the equivalent of a hydrostatic head caused by 9.00 ppg fluid in the well. The calculation also neglects all friction, both that in the aquifer and that in the flow string to the surface. It is therefore optimistic but still serves as an order of magnitude figure.

NATURAL GAS ENERGY

This is the energy generated by burning the natural gas assuming a heat of combustion of 1000 BTU/SCF.

CONCLUSIONS

Table II-Z2 shows the total energy of the 40 blocks to be about 34 quadrillion BTU or 34 quads. This is roughly equivalent to 6 billion barrels of oil, about the reserve of the Prudhoe Bay Field, Alaska, and represents about 5 months supply of all U.S. energy at its current rate of usage. The table also shows the division on the 34 quads among the three kinds of energy, namely, 1.2 quads from geohydraulic energy, 19.5 quads from geothermal and 13.6 quads from natural gas.

The energy estimates are believed to be optimistic on a number of counts. Primary of these is the assumption that all of the geopressured water will be produced, when it is certain that an appreciable portion of the water occurs in aquifers too small to warrant the drilling of a well and/or in aquifers whose permeability and other characteristics will restrict production rates to uneconomical levels. Also no economic limits have been placed producing rates, i.e., it is assumed that a well initially flowing at say 50,000 barrels per day will remain on production until it reaches essentially zero BPD. It is also true that aquifer pressures inferred from drilling mud weights (densities), particularly in the older wells, tend to be considerably higher than the minimum mud weight required to keep wells under control. In modern drilling practice the mud weight is usually kept much closer to the minimum weight needed. In the case of geohydraulic energy, as pointed out previously, pressure losses due to friction in the rock and production tubing or casing were neglected.

On the other hand it is possible that contribution to water influx from the adjacent shales to the producing sand strata may be appreciable. Another favorable factor is that in the evaluation of the resource, depth intervals, e.g., 12-14K feet, were counted as productive only if the well penetrated it entirely.

In addition to favorable and unfavorable factors affecting the estimates of the geopressure resource, there is some uncertainty in many of the data. In particular, little is known about the actual solution gas in geopressured waters and about the effective pore volume compressibilities of geopressured sandstones. Saturation values for natural gas in water have been assumed for these estimates and a rock compressibility of $20 \times 10^{-6} \text{ psi}^{-1}$, as compared with normal compressibilities usually less than half this figure.

Estimates of the geopressure resource in each of the forty blocks indicate the resource is not uniformly distributed. In fact ten of the forty blocks contain 80 percent of the resource as indicated from wells drilled to date. Some of the blocks showing little resource have been sampled by very few wells and could actually contain sizeable resources. In others, very little is known about the deeper horizons, which could also contain sizeable resources. Some of the parishes which contain an appreciable amount of the geopressure resource are: Assumption, Cameron, Iberia, Iberville, Jefferson, Lafourche, Plaquemines, St. Martin, St. Mary, Terrebonne and Vermillion.

TABLE II-R

GEOPRESSURE ENERGY RESOURCE OF SOUTHERN LOUISIANA

LONGITUDE	LATITUDE	DEPTH	WATER MM CU FT	GAS MM SCF	THERMAL MMM BTU	HYDRAULIC MMM BTU	GAS MMM BTU	TOTAL MMM BTU	BLOCK NUMBER
89.0-89.5	29.0-29.5	10000-12000	55342	215298	283171	14701	219298	517170	1
89.0-89.5	29.0-29.5	12000-14000	73542	353360	486438	30939	353360	870737	1
89.0-89.5	29.0-29.5	14000-16000	62174	348978	504352	34969	348978	888299	1
89.0-89.5	29.0-29.5	16000-18000	0	0	0	0	0	0	1
89.0-89.5	29.0-29.5	18000-20000	0	0	0	0	0	0	1
----- TOTALS -----			191058	921636	1273961	80609	921636	2276206	
89.0-89.5	29.5-30.0	10000-12000	0	0	0	0	0	0	2
89.0-89.5	29.5-30.0	12000-14000	0	0	0	0	0	0	2
89.0-89.5	29.5-30.0	14000-16000	0	0	0	0	0	0	2
89.0-89.5	29.5-30.0	16000-18000	0	0	0	0	0	0	2
89.0-89.5	29.5-30.0	18000-20000	0	0	0	0	0	0	2
----- TOTALS -----			0	0	0	0	0	0	
89.0-89.5	30.0-30.5	10000-12000	0	0	0	0	0	0	3
89.0-89.5	30.0-30.5	12000-14000	0	0	0	0	0	0	3
89.0-89.5	30.0-30.5	14000-16000	0	0	0	0	0	0	3
89.0-89.5	30.0-30.5	16000-18000	0	0	0	0	0	0	3
89.0-89.5	30.0-30.5	18000-20000	0	0	0	0	0	0	3
----- TOTALS -----			0	0	0	0	0	0	
89.0-89.5	30.5-31.0	10000-12000	0	0	0	0	0	0	4
89.0-89.5	30.5-31.0	12000-14000	0	0	0	0	0	0	4
89.0-89.5	30.5-31.0	14000-16000	0	0	0	0	0	0	4
89.0-89.5	30.5-31.0	16000-18000	0	0	0	0	0	0	4
89.0-89.5	30.5-31.0	18000-20000	0	0	0	0	0	0	4
----- TOTALS -----			0	0	0	0	0	0	

TABLE II-S

GEOPRESSURE ENERGY RESOURCE OF SOUTHERN LOUISIANA

LONGITUDE	LATITUDE	DEPTH	WATER MM CU FT	GAS MM SCF	THERMAL MMM BTU	HYDRAULIC MMM BTU	GAS MMM BTU	TOTAL MMM BTU	BLOCK NUMBER
89.5-90.0	29.0-29.5	10000-12000	0	0	0	0	0	0	5
89.5-90.0	29.0-29.5	12000-14000	0	0	0	0	0	0	5
89.5-90.0	29.0-29.5	14000-16000	97324	522738	789495	45566	522737	1357797	5
89.5-90.0	29.0-29.5	16000-18000	73903	456249	710177	44916	456248	1211341	5
89.5-90.0	29.0-29.5	18000-20000	0	0	0	0	0	0	5
-----	TOTALS	-----	171227	978987	1499672	90482	978985	2569138	
89.5-90.0	29.5-30.0	10000-12000	0	0	0	0	0	0	6
89.5-90.0	29.5-30.0	12000-14000	76085	361079	503259	30254	361078	894592	6
89.5-90.0	29.5-30.0	14000-16000	0	0	0	0	0	0	6
89.5-90.0	29.5-30.0	16000-18000	0	0	0	0	0	0	6
89.5-90.0	29.5-30.0	18000-20000	0	0	0	0	0	0	6
-----	TOTALS	-----	76085	361079	503259	30254	361078	894592	
89.5-90.0	30.0-30.5	10000-12000	0	0	0	0	0	0	7
89.5-90.0	30.0-30.5	12000-14000	0	0	0	0	0	0	7
89.5-90.0	30.0-30.5	14000-16000	0	0	0	0	0	0	7
89.5-90.0	30.0-30.5	16000-18000	0	0	0	0	0	0	7
89.5-90.0	30.0-30.5	18000-20000	0	0	0	0	0	0	7
-----	TOTALS	-----	0	0	0	0	0	0	
89.5-90.0	30.5-31.0	10000-12000	0	0	0	0	0	0	8
89.5-90.0	30.5-31.0	12000-14000	0	0	0	0	0	0	8
89.5-90.0	30.5-31.0	14000-16000	0	0	0	0	0	0	8
89.5-90.0	30.5-31.0	16000-18000	0	0	0	0	0	0	8
89.5-90.0	30.5-31.0	18000-20000	0	0	0	0	0	0	8
-----	TOTALS	-----	0	0	0	0	0	0	

TABLE II-T

GEOPRESSURE ENERGY RESOURCE OF SOUTHERN LOUISIANA

LONGITUDE	LATITUDE	DEPTH	WATER MM CU FT	GAS MM SCF	THERMAL MMM BTU	HYDRAULIC MMM BTU	GAS MMM BTU	TOTAL MMM BTU	BLOCK NUMBER
90.0-90.5	29.0-29.5	10000-12000	0	0	0	0	0	0	9
90.0-90.5	29.0-29.5	12000-14000	69476	315062	459541	21917	315062	796520	9
90.0-90.5	29.0-29.5	14000-16000	72646	386176	589300	32449	386176	1007925	9
90.0-90.5	29.0-29.5	16000-18000	78361	476867	753021	44934	476866	1274821	9
90.0-90.5	29.0-29.5	18000-20000	0	0	0	0	0	0	9
----- TOTALS -----			220483	1178105	1801862	99300	1178104	3079266	
90.0-90.5	29.5-30.0	10000-12000	0	0	0	0	0	0	10
90.0-90.5	29.5-30.0	12000-14000	40421	189743	267362	15261	189744	472366	10
90.0-90.5	29.5-30.0	14000-16000	0	0	0	0	0	0	10
90.0-90.5	29.5-30.0	16000-18000	0	0	0	0	0	0	10
90.0-90.5	29.5-30.0	18000-20000	0	0	0	0	0	0	10
----- TOTALS -----			40421	189743	267362	15261	189744	472366	
90.0-90.5	30.0-30.5	10000-12000	0	0	0	0	0	0	11
90.0-90.5	30.0-30.5	12000-14000	0	0	0	0	0	0	11
90.0-90.5	30.0-30.5	14000-16000	0	0	0	0	0	0	11
90.0-90.5	30.0-30.5	16000-18000	0	0	0	0	0	0	11
90.0-90.5	30.0-30.5	18000-20000	0	0	0	0	0	0	11
----- TOTALS -----			0	0	0	0	0	0	
90.0-90.5	30.5-31.0	10000-12000	0	0	0	0	0	0	12
90.0-90.5	30.5-31.0	12000-14000	0	0	0	0	0	0	12
90.0-90.5	30.5-31.0	14000-16000	0	0	0	0	0	0	12
90.0-90.5	30.5-31.0	16000-18000	0	0	0	0	0	0	12
90.0-90.5	30.5-31.0	18000-20000	0	0	0	0	0	0	12
----- TOTALS -----			0	0	0	0	0	0	

TABLE II-U

GEOPRESSURE ENERGY RESOURCE OF SOUTHERN LOUISIANA

LONGITUDE	LATITUDE	DEPTH	WATER MM CU FT	GAS MM SCF	THERMAL MMM BTU	HYDRAULIC MMM BTU	GAS MMM BTU	TOTAL MMM BTU	BLOCK NUMBER
90.5-91.0	29.0-29.5	10000-12000	0	0	0	0	0	0	13
90.5-91.0	29.0-29.5	12000-14000	0	0	0	0	0	0	13
90.5-91.0	29.0-29.5	14000-16000	79726	435446	646736	40145	435446	1122326	13
90.5-91.0	29.0-29.5	16000-18000	76878	476296	738766	47379	476295	1262440	13
90.5-91.0	29.0-29.5	18000-20000	0	0	0	0	0	0	13
----- TOTALS -----			156604	911742	1385502	87524	911741	2384766	
90.5-91.0	29.5-30.0	10000-12000	54379	217054	278246	15073	217095	510413	14
90.5-91.0	29.5-30.0	12000-14000	53677	252537	355041	20487	252537	628065	14
90.5-91.0	29.5-30.0	14000-16000	87544	497021	710157	51437	497021	1258615	14
90.5-91.0	29.5-30.0	16000-18000	43293	281678	416029	31925	281678	729632	14
90.5-91.0	29.5-30.0	18000-20000	0	0	0	0	0	0	14
----- TOTALS -----			238893	1248330	1759473	118922	1248331	3126725	
90.5-91.0	30.0-30.5	10000-12000	0	0	0	0	0	0	15
90.5-91.0	30.0-30.5	12000-14000	0	0	0	0	0	0	15
90.5-91.0	30.0-30.5	14000-16000	0	0	0	0	0	0	15
90.5-91.0	30.0-30.5	16000-18000	0	0	0	0	0	0	15
90.5-91.0	30.0-30.5	18000-20000	0	0	0	0	0	0	15
----- TOTALS -----			0	0	0	0	0	0	
90.5-91.0	30.5-31.0	10000-12000	0	0	0	0	0	0	16
90.5-91.0	30.5-31.0	12000-14000	0	0	0	0	0	0	16
90.5-91.0	30.5-31.0	14000-16000	0	0	0	0	0	0	16
90.5-91.0	30.5-31.0	16000-18000	0	0	0	0	0	0	16
90.5-91.0	30.5-31.0	18000-20000	0	0	0	0	0	0	16
----- TOTALS -----			0	0	0	0	0	0	

TABLE II-V

GEOPRESSURE ENERGY RESOURCE OF SOUTHERN LOUISIANA

LONGITUDE	LATITUDE	DEPTH	WATER MM CU FT	GAS MM SCF	THERMAL MMM BTU	HYDRAULIC MMM BTU	GAS MMM BTU	TOTAL MMM BTU	BLOCK NUMBER
91.0-91.5	29.0-29.5	10000-12000	0	0	0	0	0	0	17
91.0-91.5	29.0-29.5	12000-14000	0	0	0	0	0	0	17
91.0-91.5	29.0-29.5	14000-16000	59101	319335	479429	28410	319335	827173	17
91.0-91.5	29.0-29.5	16000-18000	0	0	0	0	0	0	17
91.0-91.5	29.0-29.5	18000-20000	0	0	0	0	0	0	17
----- TOTALS -----			59101	319335	479429	28410	319335	827173	
91.0-91.5	29.5-30.0	10000-12000	88455	354983	452604	25239	354983	832825	18
91.0-91.5	29.5-30.0	12000-14000	78799	365973	521210	28222	365973	915404	18
91.0-91.5	29.5-30.0	14000-16000	96217	523561	780510	47687	523561	1351757	18
91.0-91.5	29.5-30.0	16000-18000	77841	487321	748015	49945	487320	1285279	18
91.0-91.5	29.5-30.0	18000-20000	0	0	0	0	0	0	18
----- TOTALS -----			341312	1731838	2502339	151093	1731837	4385265	
91.0-91.5	30.0-30.5	10000-12000	67003	268331	342843	18898	268331	630071	19
91.0-91.5	30.0-30.5	12000-14000	69222	328503	457859	27524	328502	813886	19
91.0-91.5	30.0-30.5	14000-16000	46467	251630	376937	22555	251630	651122	19
91.0-91.5	30.0-30.5	16000-18000	0	0	0	0	0	0	19
91.0-91.5	30.0-30.5	18000-20000	0	0	0	0	0	0	19
----- TOTALS -----			182692	848464	1177639	68977	848463	2095079	
91.0-91.5	30.5-31.0	10000-12000	0	0	0	0	0	0	20
91.0-91.5	30.5-31.0	12000-14000	0	0	0	0	0	0	20
91.0-91.5	30.5-31.0	14000-16000	0	0	0	0	0	0	20
91.0-91.5	30.5-31.0	16000-18000	0	0	0	0	0	0	20
91.0-91.5	30.5-31.0	18000-20000	0	0	0	0	0	0	20
----- TOTALS -----			0	0	0	0	0	0	

TABLE II-W

GEOPRESSURE ENERGY RESOURCE OF SOUTHERN LOUISIANA

LONGITUDE	LATITUDE	DEPTH	WATER MM CU FT	GAS MM SCF	THERMAL MMM BTU	HYDRAULIC MMM BTU	GAS MMM BTU	TOTAL MMM BTU	BLOCK NUMBER
91.5-92.0	29.0-29.5	10000-12000	0	0	0	0	0	0	21
91.5-92.0	29.0-29.5	12000-14000	0	0	0	0	0	0	21
91.5-92.0	29.0-29.5	14000-16000	0	0	0	0	0	0	21
91.5-92.0	29.0-29.5	16000-18000	0	0	0	0	0	0	21
91.5-92.0	29.0-29.5	18000-20000	0	0	0	0	0	0	21
----- TOTALS -----			0	0	0	0	0	0	
91.5-92.0	29.5-30.0	10000-12000	86886	345964	444576	23730	345964	814270	22
91.5-92.0	29.5-30.0	12000-14000	81468	374064	538863	27500	374063	940426	22
91.5-92.0	29.5-30.0	14000-16000	78398	426274	635966	38728	426274	1100967	22
91.5-92.0	29.5-30.0	16000-18000	47088	292017	452494	29131	292018	773643	22
91.5-92.0	29.5-30.0	18000-20000	0	0	0	0	0	0	22
----- TOTALS -----			293840	1438319	2071899	119089	1438319	3629306	
91.5-92.0	30.0-30.5	10000-12000	0	0	0	0	0	0	23
91.5-92.0	30.0-30.5	12000-14000	37850	179752	250357	15100	179752	445208	23
91.5-92.0	30.0-30.5	14000-16000	37798	212148	306621	21255	212148	540024	23
91.5-92.0	30.0-30.5	16000-18000	0	0	0	0	0	0	23
91.5-92.0	30.0-30.5	18000-20000	0	0	0	0	0	0	23
----- TOTALS -----			75648	391900	556978	36355	391900	985232	
91.5-92.0	30.5-31.0	10000-12000	0	0	0	0	0	0	24
91.5-92.0	30.5-31.0	12000-14000	0	0	0	0	0	0	24
91.5-92.0	30.5-31.0	14000-16000	0	0	0	0	0	0	24
91.5-92.0	30.5-31.0	16000-18000	0	0	0	0	0	0	24
91.5-92.0	30.5-31.0	18000-20000	0	0	0	0	0	0	24
----- TOTALS -----			0	0	0	0	0	0	

TABLE II-X

GEOPRESSURE ENERGY RESOURCE OF SOUTHERN LOUISIANA

LONGITUDE	LATITUDE	DEPTH	WATER MM CU FT	GAS MM SCF	THERMAL MMM BTU	HYDRAULIC MMM BTU	GAS MMM BTU	TOTAL MMM BTU	BLOCK NUMBER
92.0-92.5	29.0-29.5	10000-12000	0	0	0	0	0	0	25
92.0-92.5	29.0-29.5	12000-14000	0	0	0	0	0	0	25
92.0-92.5	29.0-29.5	14000-16000	0	0	0	0	0	0	25
92.0-92.5	29.0-29.5	16000-18000	0	0	0	0	0	0	25
92.0-92.5	29.0-29.5	18000-20000	0	0	0	0	0	0	25
----- TOTALS -----			0	0	0	0	0	0	
92.0-92.5	29.5-30.0	10000-12000	78311	306716	400703	19398	306716	726817	26
92.0-92.5	29.5-30.0	12000-14000	51896	235997	343259	16628	235997	595884	26
92.0-92.5	29.5-30.0	14000-16000	84566	466181	685999	44257	466181	1196436	26
92.0-92.5	29.5-30.0	16000-18000	0	0	0	0	0	0	26
92.0-92.5	29.5-30.0	18000-20000	0	0	0	0	0	0	26
----- TOTALS -----			214773	1008894	1429961	80283	1008894	2519137	
92.0-92.5	30.0-30.5	10000-12000	43736	172883	223787	11452	172883	408122	27
92.0-92.5	30.0-30.5	12000-14000	61632	303138	407655	28659	303138	739451	27
92.0-92.5	30.0-30.5	14000-16000	0	0	0	0	0	0	27
92.0-92.5	30.0-30.5	16000-18000	0	0	0	0	0	0	27
92.0-92.5	30.0-30.5	18000-20000	0	0	0	0	0	0	27
----- TOTALS -----			105368	476021	631442	40111	476021	1147573	
92.0-92.5	30.5-31.0	10000-12000	0	0	0	0	0	0	28
92.0-92.5	30.5-31.0	12000-14000	0	0	0	0	0	0	28
92.0-92.5	30.5-31.0	14000-16000	0	0	0	0	0	0	28
92.0-92.5	30.5-31.0	16000-18000	0	0	0	0	0	0	28
92.0-92.5	30.5-31.0	18000-20000	0	0	0	0	0	0	28
----- TOTALS -----			0	0	0	0	0	0	

TABLE II-Y

GEOPRESSURE ENERGY RESOURCE OF SOUTHERN LOUISIANA

LONGITUDE	LATITUDE	DEPTH	WATER MM CU FT	GAS MM SCF	THERMAL MMM BTU	HYDRAULIC MMM BTU	GAS MMM BTU	TOTAL MMM BTU	BLOCK NUMBER
92.5-93.0	29.0-29.5	10000-12000	0	0	0	0	0	0	29
92.5-93.0	29.0-29.5	12000-14000	0	0	0	0	0	0	29
92.5-93.0	29.0-29.5	14000-16000	0	0	0	0	0	0	29
92.5-93.0	29.0-29.5	16000-18000	0	0	0	0	0	0	29
92.5-93.0	29.0-29.5	18000-20000	0	0	0	0	0	0	29
----- TOTALS -----			0	0	0	0	0	0	
92.5-93.0	29.5-30.0	10000-12000	57423	233138	293822	17433	233138	544392	30
92.5-93.0	29.5-30.0	12000-14000	0	0	0	0	0	0	30
92.5-93.0	29.5-30.0	14000-16000	97503	542604	790947	53017	542604	1386567	30
92.5-93.0	29.5-30.0	16000-18000	0	0	0	0	0	0	30
92.5-93.0	29.5-30.0	18000-20000	0	0	0	0	0	0	30
----- TOTALS -----			154926	775742	1084769	70450	775742	1930959	
92.5-93.0	30.0-30.5	10000-12000	0	0	0	0	0	0	31
92.5-93.0	30.0-30.5	12000-14000	0	0	0	0	0	0	31
92.5-93.0	30.0-30.5	14000-16000	0	0	0	0	0	0	31
92.5-93.0	30.0-30.5	16000-18000	0	0	0	0	0	0	31
92.5-93.0	30.0-30.5	18000-20000	0	0	0	0	0	0	31
----- TOTALS -----			0	0	0	0	0	0	
92.5-93.0	30.5-31.0	10000-12000	0	0	0	0	0	0	32
92.5-93.0	30.5-31.0	12000-14000	0	0	0	0	0	0	32
92.5-93.0	30.5-31.0	14000-16000	0	0	0	0	0	0	32
92.5-93.0	30.5-31.0	16000-18000	0	0	0	0	0	0	32
92.5-93.0	30.5-31.0	18000-20000	0	0	0	0	0	0	32
----- TOTALS -----			0	0	0	0	0	0	

TABLE II-Z(1)

GEOPRESSURE ENERGY RESOURCE OF SOUTHERN LOUISIANA

LONGITUDE	LATITUDE	DEPTH	WATER MM CU FT	GAS MM SCF	THERMAL MMM BTU	HYDRAULIC MMM BTU	GAS MMM BTU	TOTAL MMM BTU	BLOCK NUMBER
93.0-93.5	29.0-29.5	10000-12000	0	0	0	0	0	0	33
93.0-93.5	29.0-29.5	12000-14000	0	0	0	0	0	0	33
93.0-93.5	29.0-29.5	14000-16000	0	0	0	0	0	0	33
93.0-93.5	29.0-29.5	16000-18000	0	0	0	0	0	0	33
93.0-93.5	29.0-29.5	18000-20000	0	0	0	0	0	0	33
----- TOTALS -----			0	0	0	0	0	0	
93.0-93.5	29.5-30.0	10000-12000	0	0	0	0	0	0	34
93.0-93.5	29.5-30.0	12000-14000	63173	311528	417854	29690	311527	759071	34
93.0-93.5	29.5-30.0	14000-16000	0	0	0	0	0	0	34
93.0-93.5	29.5-30.0	16000-18000	0	0	0	0	0	0	34
93.0-93.5	29.5-30.0	18000-20000	0	0	0	0	0	0	34
----- TOTALS -----			63173	311528	417854	29690	311527	759071	
93.0-93.5	30.0-30.5	10000-12000	52055	213919	266354	16815	213939	497108	35
93.0-93.5	30.0-30.5	12000-14000	64003	314552	423340	29679	314591	767611	35
93.0-93.5	30.0-30.5	14000-16000	0	0	0	0	0	0	35
93.0-93.5	30.0-30.5	16000-18000	0	0	0	0	0	0	35
93.0-93.5	30.0-30.5	18000-20000	0	0	0	0	0	0	35
----- TOTALS -----			116058	528531	689694	46494	528530	1264719	
93.0-93.5	30.5-31.0	10000-12000	0	0	0	0	0	0	36
93.0-93.5	30.5-31.0	12000-14000	0	0	0	0	0	0	36
93.0-93.5	30.5-31.0	14000-16000	0	0	0	0	0	0	36
93.0-93.5	30.5-31.0	16000-18000	0	0	0	0	0	0	36
93.0-93.5	30.5-31.0	18000-20000	0	0	0	0	0	0	36
----- TOTALS -----			0	0	0	0	0	0	

TABLE II-Z(2)

GEOPRESSURE ENERGY RESOURCE OF SOUTHERN LOUISIANA

LONGITUDE	LATITUDE	DEPTH	WATER MM CU FT	GAS MM SCF	THERMAL MMM BTU	HYDRAULIC MMM BTU	GAS MMM BTU	TOTAL MMM BTU	BLOCK NUMBER
93.5-94.0	29.0-29.5	10000-12000	0	0	0	0	0	0	37
93.5-94.0	29.0-29.5	12000-14000	0	0	0	0	0	0	37
93.5-94.0	29.0-29.5	14000-16000	0	0	0	0	0	0	37
93.5-94.0	29.0-29.5	16000-18000	0	0	0	0	0	0	37
93.5-94.0	29.0-29.5	18000-20000	0	0	0	0	0	0	37
----- TOTALS -----			0	0	0	0	0	0	
93.5-94.0	29.5-30.0	10000-12000	0	0	0	0	0	0	38
93.5-94.0	29.5-30.0	12000-14000	0	0	0	0	0	0	38
93.5-94.0	29.5-30.0	14000-16000	0	0	0	0	0	0	38
93.5-94.0	29.5-30.0	16000-18000	0	0	0	0	0	0	38
93.5-94.0	29.5-30.0	18000-20000	0	0	0	0	0	0	38
----- TOTALS -----			0	0	0	0	0	0	
93.5-94.0	30.0-30.5	10000-12000	0	0	0	0	0	0	39
93.5-94.0	30.0-30.5	12000-14000	0	0	0	0	0	0	39
93.5-94.0	30.0-30.5	14000-16000	0	0	0	0	0	0	39
93.5-94.0	30.0-30.5	16000-18000	0	0	0	0	0	0	39
93.5-94.0	30.0-30.5	18000-20000	0	0	0	0	0	0	39
----- TOTALS -----			0	0	0	0	0	0	
93.5-94.0	30.5-31.0	10000-12000	0	0	0	0	0	0	40
93.5-94.0	30.5-31.0	12000-14000	0	0	0	0	0	0	40
93.5-94.0	30.5-31.0	14000-16000	0	0	0	0	0	0	40
93.5-94.0	30.5-31.0	16000-18000	0	0	0	0	0	0	40
93.5-94.0	30.5-31.0	18000-20000	0	0	0	0	0	0	40
----- TOTALS -----			0	0	0	0	0	0	
----- GRAND TOTALS -----			2701662	13620154	19533095	1193304	13620187	34346573	

TASK III-COMPUTER MAP PRESENTATION OF THE DATA

In addition to the statistical analyses of the information contained in the data base which were presented in the charts and tables of Task II, the proposed research method included plans for some maps which would hopefully delineate areas within depth intervals which have higher sand counts and were drilled with higher mud weights. These areas would hopefully be ones in which the search for larger and more overpressured aquifers would be more profitable.

It should be realized that the maps presented in this section have significant limitations because of the generally low well density and because, even given adequate well density, the sand count in a given depth interval is inherently a discontinuous parameter owing to the general limited areal extent of the sands and to the generally large vertical displacements by faulting. This same limitation, but to a lesser degree, also applies to the mud weight (pressure) maps.

Because of the above limitations two things should be realized in the interpretation and use of these maps. One, the extent of areas in any depth interval with high sand counts and/or high mud weights, is in no way to be construed as indicative of the area of a single, hydraulically connected sand body. Two, and somewhat conversely to the former, areas with low sand count and/or lower mud weights may still contain aquifers of sufficient size and overpressure to be of interest. Thus, although these maps have significant limitations, they have been and will be useful in the exploration effort. It has been debated among the researchers whether there are other ways of utilizing the data which might increase its value in the exploration effort. The con-

census is that, owing to the nature of the data, the tables and charts of Task II and the maps of Task III exploit rather completely the information to be extracted.

The maps presented in this section show separately the distribution of sand count and mud weight in each of four depth bracket intervals. In addition there is one set of maps which show the distribution of a parameter which is the product of the sand count and the overpressure. These are discussed in the following.

Sand Count and Mud Weight Maps

The sand count and mud weight distributions are presented in 48 maps covering six areas for each of four depth intervals 10-12, 12-14, 14-16 and 16-18K feet. The data rather clearly indicate that there is little expectation of finding a suitable geopressured aquifer at a depth less than 10,000 feet and the data below 18,000 feet is too sparse for meaningful interpretation. The area of this investigation is included within the six U.S. Geological Survey quadrangle topographic maps designated as Lake Charles, Port Arthur, Baton Rouge, New Orleans, Mobile and Breton Sound. These are shown in the location map of Fig. III-A. Copies of the quadrangle maps are presented along with and to the same scale as the sand count and mud weight maps. The sand count and mud weight maps were produced using the SYMAP program developed by H. T. Fisher at Northwestern University with modifications by Harvard University.

The mud weight maps show the distribution of geopressure using six symbols. Wells penetrating depth intervals using 14 to 15 pound per gallon mud are shown with the lightest shading, with progressively darker shading for 15-16, 16-17, 17-18, 18-19 and 19-plus pounds per gallon. Although there were usually wells in all areas which were drilled through one or more of the depth intervals with a mud weight less than 14 ppg, they were not used in the construction of these maps because geopressures less than that indicated by 14 ppg mud are of doubtful significance as prospective producing aquifers.

Fig. III-A. Location map for U.S.G.S. quadrangles and study area shown shaded.

Where more than one mud weight was used within a depth interval, the highest value was used. Well locations are shown on each map by numbers which are circled for easier identification. The numbers indicate the mud weight used for that well in that depth interval, as explained in the legend on each map. The symbol "S" indicates two wells were drilled so close to each other that their numbers would have been printed over each other.

The pressure is related to the mud weight by the formula:

$$P = 0.052 \times D \times \rho$$

where P is the pressure in pounds per square inch, D is the depth in feet and ρ is the mud density (weight) in pounds per gallon.

The distribution of the percent sand or sand count is displayed on a series of maps for the same depth intervals as for mud weight. The lowest sand count in percent is zero to 10 percent, or up to 200 feet of sand as indicated by the S.P. logs in the given 2000 foot depth interval. This range is given the lightest shading with increasingly darker shading for percentages of 10-20, 20-30, 30-40 and 50-and-above. As with the mud weights, the circled numbers indicate well locations and they also indicate the percent sand for that well in the depth interval, according to the legend on each map. As explained in Task II, sand counts are used in the plots only if the well completely penetrated a depth interval. Thus a well drilled to a total depth of 17,900 feet, for example, would have no entry on the 16-18K foot sand count map.

In both the mud weight and sand count maps, some symbol is placed in all of the area south of the northern limit (see Fig. I-A) and within Louisiana boundaries. In many of these regions there is little well control and map indications of mud weight or sand count in areas some distance from the nearest well(s) have little or no meaning. This comment is generally of greater importance with the deeper intervals owing to the generally decreasing well densities with depth.

Maps Weighted for Sand Count and Mud Weight

Because pressure as reflected in mud weight and density of the resource as reflected in sand count, are two very important parameters which define the resource, four contour maps were prepared which used as a parameter numbers which were proportional to the product of the sand count and the excess mud weight (over 14 ppg). Each of these maps cover the entire area of the study for the 10-12, 12-14, 14-16 and 16-18K foot depth intervals. These maps were generated using a general purpose, spline-function contouring program of the LSU Department of Geology.

Seven ranges of both mud weight and sand count were selected, and numerical values zero through six were assigned to these ranges as indicated in the table. Sand counts are in feet in each 2000 foot depths interval.

<u>Mud Weight</u>		<u>Sand Count</u>	
<u>Range</u>	<u>Value</u>	<u>Range</u>	<u>Value</u>
0-14 ppg	0	No Sand	0
14-15	1	Up to 100 feet	1
15-16	2	100 - 200	2
16-17	3	200 - 400	3
17-18	4	400 - 600	4
18-19	5	600 - 900	5
19 plus	6	900 plus	6

Using these numerical values, each well in each depth interval was assigned a "factor" which is the product of the two numerical values, with a range of the "factor" from zero to 6 times 6, or 36. A contour interval of 3 was selected. The following table gives a suggested qualitative evaluation of areas having a given "factor".

<u>Factor</u>	<u>Quality</u>
0-3	Very poor to poor
3-6	Marginal
6-9	Good
9-12	Very good
12-15	Excellent
15-36	Outstanding

The specific utility of these maps has not been established. In some depth intervals they appear to indicate some trends or fairways to which special attention should be given in the exploration effort. Both the separate mud weight and sand count maps as well as the weighted contour maps are presented in the following pages.

Prepared by the Army Map Service (AMS), Corps of Engineers, U.S. Army, Washington, D.C. Compiled in 1954 by planographic methods. Coastal hydrography compiled from USCGS Charts, 1940-52. Horizontal and vertical control by USGS and USCGS. Photographic field annotated 1953. Minor corrections by U.S. Geological Survey, 1962.

100,000 foot grid based on Mississippi coordinate system, east zone. Alabama coordinate system, west zone, and Louisiana coordinate system, south zone.

10,000 foot grid based on Universal Transverse Mercator grid lines, zone 16, shown in blue.

Approximate road alignment

LEGEND

ROAD DATA 1953 PARTIALLY REVISED 1962

Figures in red denote approximate distances in miles between cities.

POPULATED PLACES

Over 500,000
100,000 to 500,000
25,000 to 100,000
5,000 to 25,000
1,000 to 5,000
Less than 1,000

RAILROADS

Standard gauge
Narrow gauge
Interurban
Country branch
Part of observation
Horse-drawn streetcar
Streetcar
Streetcar in use

BOUNDARIES

International
State
County
Part of observation
Horse-drawn streetcar
Streetcar
Streetcar in use

LANDMARKS

Landmark: School, Church, Other
Depth curve in feet
Land of foreign power
Rock: Awash, Sunken
Fortification
Intermittent or dry stream
Marsh or swamp

SYMBOLS

Landmark: School, Church, Other
Depth curve in feet
Land of foreign power
Rock: Awash, Sunken
Fortification
Intermittent or dry stream
Marsh or swamp

Scale 1:50,000

CONTOUR INTERVAL 50 FEET
WITH SUPPLEMENTARY CONTOURS AT 25-FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION

FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON 25, D. C.

LOCATION DIAGRAM FOR NH 16-4

RELIABILITY DIAGRAM

MAP ROOM
SCHOOL OF GEOLOGY
LOUISIANA STATE UNIVERSITY

TOPOGRAPHIC MAP
LAND GRANT BOUNDARY

SECTIONED TOWNSHIP

MOBILE, ALA., MISS., LA.

GEOPRESSURE ENERGY RESOURCE

of

SOUTHERN LOUISIANA

E.R.D.A. Contract No. E- (40-1)-4889

54

Contour of Mud Weights from 10,000 to 12,000 feet.

MOBILE, ALA.; MISS.; LA. QUADRANGLE

-----	14 - 15
+++++	15 - 16
xyxyxyxyxy	16 - 17
0000000000	17 - 18
0000000000	18 - 19
0000000000	over 19 pounds

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- § Superimposed Data

GEOPRESSURE ENERGY RESOURCE

55

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E.-(40-1)-4889

Contour of Percent Sand from 10,000 to 12,000 feet.

MOBILE, ALA.; MISS.; LA. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- 5 Superimposed Data

of

SOUTHERN LOUISIANA

ER.DA. Contract No. E.-(40-1)-4889

Contour of Mud Weights from 12,000 to 14,000 feet.

MOBILE, ALA.; MISS.; LA. QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

GEOPRESSURE ENERGY RESOURCE
of
SOUTHERN LOUISIANA

57

E.R.D.A. Contract No. E-(40-1)-4889

Contour of Percent Sand from 12,000 to 14,000 feet.

MOBILE, ALA.; MISS.; LA. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

LOCATION MAP

GEOPRESSURE ENERGY RESOURCE
of
SOUTHERN LOUISIANA
E.R.D.A. Contract No. E-(40-1)-4889

Contour of Mud Weights from 14,000 to 16,000 feet.
MOBILE, ALA.; MISS.; LA. QUADRANGLE

[Pattern]	14 - 15
[Pattern]	15 - 16
[Pattern]	16 - 17
[Pattern]	17 - 18
[Pattern]	18 - 19
[Pattern]	over 19 pounds

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

GEOPRESSURE ENERGY RESOURCE

60

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E.-(40-1)-4889

Contour of Mud Weights from 16,000 to 18,000 feet.

MOBILE, ALA.; MISS.; LA. QUADRANGLE

	14 - 15
	15 - 16
	16 - 17
	17 - 18
	18 - 19
	over 19 pounds

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- o Superimposed Data

LOCATION MAP

Contour of Percent Sand from 16,000 to 18,000 feet.

MOBILE, ALA.; MISS.; LA. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ③ Data Point
- s Superimposed Data

Prepared by the Army Map Service (TNG), Corps of Engineers, U.S. Army, Washington, D.C. Completed in 1957 from United States Overseas Series 1:62,500, 1:50,000, and 1:31,250, 1955-56. Planimetric detail revised by photogrammetric methods. Horizontal and vertical control by U.S.G.S. USGS/USACE, NAC and Louisiana Geologic Survey. Map field checked 1957, limited revision by U.S. Geological Survey 1966.

100,000-foot grid based on Louisiana coordinate system, south zone.

10,000-meter Universal Transverse Mercator grid ticks, zone 16 shown in blue.

LEGEND

ROAD DATA 1957 PARTIALLY REVISED 1966

Figures in red denote approximate distances in miles between stars.

POPULATED PLACES

Over 500,000

100,000 to 500,000

25,000 to 100,000

5,000 to 25,000

1,000 to 5,000

Under 1,000

RAILROADS

Single track

Double or multiple track

Standard gauge

Narrow gauge

BOUNDARIES

State

County

Parish

Unincorporated area

Spot elevation in feet

LAND USE

Landplane airport

Landing area

Seaplane airport

Power line

Park or recreation

Horizontal light

Spot elevation in feet

LANDMARKS

Landmarks, School, Church, Other

Depth curve in feet

Limit of dune, reef

Rocks, Mean Sea Level

Foreshore flat, Mangrove

Intermittent or dry stream

Marsh or swamp

Scale 1:250,000

0 5 10 15 20 25 30 Statute Miles

0 5 10 15 20 25 30 Nautical Miles

0 5 10 15 20 25 Kilometers

MAXIMUM ELEVATION LESS THAN 50 FEET

TRANSVERSE MERCATOR PROJECTION

1985 MAGNETIC DECLINATION FROM TRUE NORTH FOR THIS SHEET VARIES FROM 14° 10' WEST TO 14° 30' WEST. EASTERLY FOR THE CENTER OF THE SHEET CLOSE TO 44° 30' WEST. WESTERLY FOR THE CENTER OF THE SHEET CLOSE TO 44° 30' WEST.

FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR WASHINGTON, D.C. 20242

LOCATION DIAGRAM

Map of the Gulf of Mexico showing the location of Breton Sound, Louisiana, within the state and its relation to the Gulf of Mexico.

RELIABILITY DIAGRAM

Map of the Gulf of Mexico showing the location of Breton Sound, Louisiana, within the state and its relation to the Gulf of Mexico.

MAP ROOM

SCHOOL OF GEOSCIENCE

LOUISIANA STATE UNIVERSITY

TOWNSHIP OR RANGE LINE

LAND GRANT BOUNDARY

SECTIONIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36

BRETON SOUND, LOUISIANA

1957

UNITED STATES GEOLOGICAL SURVEY, WASHINGTON, D.C. 20540

GEOPRESSURE ENERGY RESOURCE
of
SOUTHERN LOUISIANA
ER.DA. Contract No. E. (40-1) 4889
Contour of Mud Weights from 10,000 to 12,000 feet.
BRETON SOUND, LA. QUADRANGLE

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- o Superimposed Data

GEOPRESSURE ENERGY RESOURCE

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E. (40-1) 4889

Contour of Mud Weights from 12,000 to 14,000 feet.

BRETON SOUND, LA. QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- 5 Superimposed Data

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E. (40-1) 4889

Contour of Percent Sand from 12,000 to 14,000 feet.

BRETON SOUND, LA. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ③ Data Point
- 5 Superimposed Data

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E. (40-1)-4889

Contour of Mud Weights from 14,000 to 16,000 feet.

BRETON SOUND, LA. QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

⑤ Data Point

s Superimposed Data

LOCATION MAP

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E - (40-1) - 4889

Contour of Percent Sand from 14,000 to 16,000 feet.

BRETON SOUND, LA. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- 5 Superimposed Data

SYMAP

Contour of Mud Weights from 16,000 to 18,000 feet.

BRETON SOUND, LA. QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- S Superimposed Data

GEOPRESSURE ENERGY RESOURCE

70

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E. (40-1)-4889

Contour of Percent Sand from 16,000 to 18,000 feet.

BRETON SOUND, LA. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ③ Data Point
- 5 Superimposed Data

Prepared by the Army Map Service (AMS), Corps of Engineers, U.S. Army, Washington, D.C. Compiled in 1964 by photogrammetric methods. Aerial photography field annotated 1954. Horizontal and vertical control by USGS, USGS/USC, Louisiana Highway Commission, Mississippi River Commission and Louisiana Geological Survey. Map not first checked. Limited revision by the Geological Survey 1961.

100,000-foot grid based on Louisiana coordinate system, south zone 10,000-meter Universal Transverse Mercator grid ticks, zone 15, shown in blue.

LEGEND

ROAD DATA 1960

Figures in red denote major roads in miles between stars

POPULATED PLACES

Over 500,000
100,000 to 500,000
25,000 to 100,000
5,000 to 25,000
1,000 to 5,000
Less than 1,000

RAILROADS

Standard gauge
Narrow gauge
SOUNDINGS
International
State
Parish County
Park or reservation

LANDMARKS

Landmark: School, Church, Other, etc.
Horizontal control point
Spot elevation in feet
Marsh or swamp
Intermittent or dry stream
Power line

WATER

Water: Lake, River, Bay, Sound, etc.
Marsh or swamp
Intermittent or dry stream
Power line

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No.E.-(40-1)-4889

Contour of Mud Weights from 10,000 to 12,000 feet.

BATON ROUGE, LA.; MISS. QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

LOCATION MAP

Contour of Percent Sand from 10,000 to 12,000 feet.

BATON ROUGE, LA.; MISS. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

⑤ Data Point

s Superimposed Data

LOCATION MAP

BATON ROUGE, LA.; MISS. QUADRANGLE.

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

⑤ Data Point

5 Superimposed Data

SOUTHERN LOUISIANA

E.R.D.A. Contract No. E.- (40-1)-4889

Contour of Percent Sand from 12,000 to 14,000 feet.

BATON ROUGE, LA.; MISS. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- 5 Superimposed Data

Contour of Mud Weights from 14,000 to 16,000 feet.

BATON ROUGE, LA.: MISS. QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- 5 Superimposed Data

Contour of Percent Sand from 14,000 to 16,000 feet.

BATON ROUGE, LA.; MISS. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

Contour of Mud Weights from 16,000 to 18,000 feet.

BATON ROUGE, LA.; MISS. QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- 5 Superimposed Data

GEOPRESSURE ENERGY RESOURCE

of
SOUTHERN LOUISIANA

79

E.R.D.A. Contract No. E.- (40-1)-4889

Contour of Percent Sand from 16,000 to 18,000 feet.

BATON ROUGE, LA.; MISS. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ③ Data Point
- s Superimposed Data

GEOPRESSURE ENERGY RESOURCE
of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E. (40-1)-4889

Contour of Mud Weights from 10,000 to 12,000 ft.
NEW ORLEANS QUADRANGLE

-----	14 - 15
+++++	15 - 16
xxxxx	16 - 17
ooooo	17 - 18
	18 - 19
	over 19 pounds

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ③ Data Point
- s Superimposed Data

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E-(40-1)-4889

Contour of Percent Sand from 10,000 to 12,000 feet.

NEW ORLEANS, LA. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

⑤ Data Point

5 Superimposed Data

Contour of Mud Weights from 12,000 to 14,000 feet.

NEW ORLEANS QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- S Superimposed Data

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E-(40-1)-4889

Contour of Percent Sand from 12,000 to 14,000 feet.

NEW ORLEANS, LA. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

⑤ Data Point

s Superimposed Data

Contour of Mud Weights from 14,000 to 16,000 feet.

NEW ORLEANS QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ③ Data Point
- s Superimposed Data

of
SOUTHERN LOUISIANA
E.R.D.A. Contract No. E-(40-1)-4889
Contour of Percent Sand from 14,000 to 16,000 feet.
NEW ORLEANS, LA. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E-(40-1)-4889

Contour of Mud Weights from 16,000 to 18,000 feet.
NEW ORLEANS QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- 5 Superimposed Data

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E- (40-1) - 4889

Contour of Percent Sand from 16,000 to 18,000 feet.

NEW ORLEANS, LA. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E.-(40-1)-4889

Contour of Mud Weights from 10,000 to 12,000 feet.

LAKE CHARLES, LA.; TEXAS QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

Contour of Percent Sand from 10,000 to 12,000 feet.

LAKE CHARLES, LA.; TEXAS QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E.-(40-1)-4889

Contour of Mud Weights from 12,000 to 14,000 feet.

LAKE CHARLES, LA.; TEXAS QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- 5 Superimposed Data

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E. (40-1)-4889

Contour of Percent Sand from 12,000 to 14,000 feet.

LAKE CHARLES, LA.; TEXAS QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

Contour of Mud Weights from 14,000 to 16,000 feet.

LAKE CHARLES, LA.; TEXAS QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E.-(40-1)-4889

Contour of Percent Sand from 14,000 to 16,000 feet.

LAKE CHARLES, LA.; TEXAS QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

of
SOUTHERN LOUISIANA

ER.DA. Contract No. E. (40-1)-4889

Contour of Mud Weights from 16,000 to 18,000 feet.

LAKE CHARLES, LA.; TEXAS QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ③ Data Point
- s Superimposed Data

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E.- (40-1)-4889

Contour of Percent Sand from 16,000 to 18,000 feet.

LAKE CHARLES, LA.; TEXAS QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ③ Data Point
s Superimposed Data

PORT ARTHUR, TEXAS; LOUISIANA
1958
UNITED REVISION 1964

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E-(40-1)-4889

Contour of Mud Weights from 10,000 to 12,000 feet.

PORT ARTHUR, TEXAS; LA. QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

③ Data Point

S Superimposed Data

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ③ Data Point
- 5 Superimposed Data

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E-(40-1)-4889

Contour of Mud Weights from 12,000 to 14,000 feet.

PORT ARTHUR, TEXAS; LA. QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- 5 Superimposed Data

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

E.R.D.A. Contract No. E.-(40-1)-4889

PORT ARTHUR, TEXAS; LA. QUADRANGLE

in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

Contour of Percent Sand from 14,000 to 16,000 feet.

PORT ARTHUR, TEXAS; LA. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

⑤ Data Point

s Superimposed Data

Contour of Mud Weights from 16,000 to 18,000 feet.

PORT ARTHUR, TEXAS; LA. QUADRANGLE

C.I. = 1 pound mud

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- 5 Superimposed Data

GEOPRESSURE ENERGY RESOURCE

of
SOUTHERN LOUISIANA

E.R.D.A. Contract No. E-(40-1)-4889

Contour of Percent Sand from 16,000 to 18,000 feet.

PORT ARTHUR, TEXAS; LA. QUADRANGLE

C.I. = 10 percent sand

Contours computer generated with SYMAP Program, Harvard University,
in the computer graphics section, School of Geoscience, Louisiana State University.

- ⑤ Data Point
- s Superimposed Data

GEOPRESSURE ENERGY RESOURCE
of
SOUTHERN LOUISIANA
E.R.D.A. Contract No. E-(40-1)-4889
SAND AND MUD
(Combined and Weighted)
10,000 to 12,000 feet.

(Based on levels from 0 to 36. Above level 9 is very favorable -- see text for details)

TASK IV-DETAILED GEOLOGIC STUDIES

Mapped Geopressure Aquifers

A primary expectation of these studies was the location of one or more aquifers of such size and overpressure so as to be of possible practical interest. It is pleasant to report that in this investigation eight prospective areas were identified which the SYMAPs indicated to be ones which had high sand counts and in which wells required heavy muds to control the subsurface pressures. In addition to these favorable attributes these eight areas had relatively high density of wildcat wells which afford deep subsurface control and favorable sand development below the top of geopressure.

These prospects occur in the parishes in the western part of the state, namely, Acadia, Cameron, Calcasieu, Jefferson Davis and Vermilion Parishes. The location of these prospects is shown on the map of Fig. IV-A and a summary of the pertinent data is given in Fig. IV-B. In Fig. IV-B the prospects are listed in the approximate order of increasing value based on a consideration of sand volume, sand thickness, permeability and degree of overpressure. These prospects are discussed separately at the end of this section along with the presentation of structure maps on the top and base of the productive sand(s), isopach maps from which sand volumes were determined by planimetering and cross sections.

Additional Areas of Interest

In addition to the location and mapping of eight large geopressured aquifers, the geologic consultants gave some attention to the identification of other areas which might contain aquifers of interest. All of these 55 areas are located south of Township 6S, and are located in areas of well density sufficiently high so as to afford reasonably good subsurface control. Figure IV-C shows the location of

the 55 areas and Fig. IV-E lists these areas with locations and the approximate areas with geopressured well control.

The south Louisiana Middle and Lower Miocene geopressure trends, in which these prospective areas occur, range in width from 50 to 70 miles northward of the Louisiana southern boundary. This coastal area is underlain by a sedimentary section which ranges from 40,000 to 60,000 feet and contains approximately 150,000 cubic miles of sediments. These trends are in and part of the Gulf Coast geosyncline. Pre Miocene depocenters were in South Texas but during Miocene time the depocenter had shifted to South Louisiana.

The prospective areas lie within a geologic province in which large, normal, down-to-the-coast growth faults are common. Figure IV-D is a fault map of the area. These faults range in throw from a few feet to several thousands of feet. The throws of regional growth faults are fairly constant over long distances. Faults of this type generally have dips of 30 to 70 degrees, averaging about 53 degrees in the shallower beds and decreasing generally with depth. Local growth faults also dot the area, but they are confined to a single structural unit or complex, such as anticlines. The prospective geopressured aquifers will be found between the regional echelon growth faults which traverse the area and strike in a general east-west direction as seen in Fig. IV-D.

Discussion of Mapped Geopressure Aquifers

In the following pages a discussion is presented of the eight geopressure aquifers which have been located. Structure and isopach maps and cross sections are presented for each aquifer.

Figure IV-A Location of Mapped Prospects

FIGURE IV-B
SUMMARY OF DATA FOR PROSPECTS

<u>Name of Prospect</u>	<u>Area Sq. Mi.</u>	<u>Geopressure Interval Ft.</u>	<u>Maximum Net Sand Thickness Ft.</u>	<u>Average Net Sand Thickness Ft.</u>	<u>Bulk Sand Volume 10⁹ Cu. Ft.</u>	<u>Porosity Percent</u>	<u>Permeability Md.</u>	<u>Interval Range of Temperature Degrees F*</u>	<u>Mud Weight Lb./Gal.</u>
Newton	11	110- 430	325	165	49	30	Up to 1,000	183-205	12.4-15.9
S. Midland	24	730	300	150	78	30.7	413	210-284	15.4-18.3
W. Lake Arthur	24	1,930	380	190	140	25	500 av.	215-270	13.5-18.0
W. Lockport	27	440- 650	430	100	128	NA	NA	211-219	15.9-17.8
W. Maurice	42	800-1,390	315	200	262	25.5	125	202-306	15.5-18.3
S. White Lake	51	2,100	700	350	368	26	100-300 E	245-312	10.5-17.7
Big Mouth Bayou	60	850	365	183	429	25-27	180 E	185-220	12.0-17.6
SE Pecan Island	67	800-1,420	825	400	856	20	Up to 1,400	245-292	17.2-18.1

* - Uncorrected

E - Estimate

NA - Not Available

Av - Average

Figure IV-C

Figure IV-D

FIGURE IV-E

AREAS WHICH HAVE BEEN MAPPED AS GEOPRESSURED PROSPECTS

<u>Area Number</u>	<u>Parish</u>	<u>Approximate Location</u> <u>Twp. & Rge.</u>		<u>Size of Area with</u> <u>Geopressured well</u> <u>control (Sq. Mi.)</u>
1*	Calcasieu	10S	10W	27
2*	Vermilion	17S	1E	67
3*	Vermilion & Cameron	15S	2W	51
4*	Cameron	14S	5W	60
5*	Acadia	10S	1W	24
6*	Jefferson Davis	10S	5W	24
7*	Vermilion	11S	3E	42
8*	Calcasieu	8S	8W	11

AREAS FOR FUTURE STUDY WHICH HAVE GEOPRESSURED WELL CONTROL

9	Cameron	12S	7W	45
10	Cameron	Block 12		90
11	Cameron	Block 9		27
12	Cameron	Block 26		54
13	Cameron	12S	3W	30
14	Vermilion	12S	1E	96
15	Vermilion	14S	3E	48
16	Vermilion	14S	4E	72
17	Iberville	9S	13E	48
18	Lafayette	10S	5E	36
19	St. Martin	11S	6E	84
20	Iberia	13S	7E	60
21	Iberia & St. Mary	12S	9E	49
22	St. Martin & Assumption	13S	12E	42
23	St. Mary	14S	9E	60
24	Iberia & St. Mary	14S	6E	55
25	St. Mary	16S	8E	28
26	St. Mary	16S	10E	96
27	St. Martin	15S	13E	54
28	St. Mary	18S	12E	40
29	St. Mary	Block 16		54
30	Terrebonne	20S	12E	132
31	Iberia	Block 3		60
32	St. James & Assumption	13S	15E	72
33	St. James & St. John the Baptist	13S	18E	72
34	Lafourche	14S	17E	40
35	St. Charles	13S	21E	48
36	St. Charles & Jefferson	14S	22E	36
37	St. Charles & Jefferson	16S	22E	30
38	Lafourche	16S	19E	30
39	Terrebonne & Lafourche	16S	16E	84
40	Terrebonne	18S	15E	48

(Continued)

FIGURE IV-E
(Continued)

<u>Area Number</u>	<u>Parish</u>	<u>Approximate Location</u>		<u>Size of Area with Geopressed well control (Sq. Mi.)</u>
		<u>Twp.</u>	<u>& Rge.</u>	
41	Terrebonne	19S	17E	40
42	Lafourche	19S	20E	36
43	Jefferson	19S	24E	25
44	Lafourche	20S	21E	40
45	St. Bernard	14S	15E	180
46	St. Bernard	15S	14E	36
47	St. Bernard	15S	16E	36
48	St. Bernard	16S	15E	36
49	St. Bernard & Plaquemines	17S	25E	80
50	Plaquemines	19S	25E	42
51	Plaquemines	20S	27E	20
52	St. Bernard & Plaquemines	19S	17E	50
53	Plaquemines	21S	31E	36
54	Plaquemines	22S	21E	32
55	Terrebonne	Ship Shoal Block 46		54
56	Terrebonne	22S	16E	35
57	Terrebonne	18S	17E	30
58	Lafourche	20S	23E	24
59	Plaquemines	S. Pass Block 21		32
60	Plaquemines	Main Pass Block 66		21
61	Plaquemines	Main Pass Block 14		24
62	St. Bernard	Chandeleur Sound Block 56		36
63	Terrebonne	S. Timbalier Block 13		35

* Areas 1-8 have been mapped in detail. Maps prepared as part of ERDA Grant AT (40-1) 4889.

NEWTON PROSPECT

Calcasieu Parish, Louisiana
Townships 8 and 9 South and Ranges 8 and 9 West

This prospect area was selected for detail study owing to the density of wildcat wells affording deep subsurface structural control, the relatively high bottom hole temperatures, the consistently heavy mud used, and the favorable sand property and permeability well below the top of the geopressure.

The Hackberry Zone of Lower Miocene geologic age was selected for detailed geologic study because correlation within this interval is reliable and the majority of the wells drilled in this area penetrated the entire section. The prospect covers an area of approximately 11 square miles. The following listed geologic maps and cross sections, Exhibits 1-4, were prepared using information from the 8 wells listed in Exhibit 5.

- Exh. 1. Structure Map: Top of Hackberry Zone
- Exh. 2. Structure Map: Base of Hackberry Zone
- Exh. 3. Net Sand Isopach Map: Hackberry Zone
- Exh. 4. Cross Section A-A' (South-North)
- Exh. 5. List of wells used in study of prospect

GEOLOGY OF THE STUDY AREA -- As shown on the structure map, the prospect area is a southeasterly dipping monocline with local structural nosing in several areas. No faults were found at the Hackberry Zone depth within the immediate prospect area.

As shown on Exhibit 3, the thickest Hackberry Zone sand accumulation was found to be located in Sections 29, 30 and 31, T8S, R8W and Section 6, T9S, R8W. A South-North stratigraphic cross section (A-A') (Exh. 4) shows the nature of the sand distribution within the study area.

The Hackberry Zone consists of alternating sand and shales within an overall interval varying in thickness from

zero to 325 feet; for an average thickness of approximately 165 feet.

The Hackberry Zone in all of the eight wells was found to be geopressured. Mud weights used to drill the Zone ranged from 12.4 to 25.9 ppg, and temperatures ranged from 183 to 205°F (uncorrected) within the Hackberry Zone.

The prospect area is located within the old depleted Newton Field. The discovery well for the field was the Apache Oil Corporation, Dorothy E. Carter #1 well located in Sec. 31, T8S, R8W. The well produced a cumulative total of 5,556 barrels of oil and 3,387 m.c.f. of casinghead gas. The well was perforated in a thin sand just above the Hackberry Zone (9,745-50'). Bottom hole pressure in this well was reported to be 7300 psi; this calculates to be approximately 2950 psi of geopressure.

The Hackberry Zone sands appear very porous and permeable. Near the study area (Gillis-English Bayou Field) sand porosities are reported to average approximately 30.0% and permeabilities range up to 1000 md. Using the net sand isopach map (Exh. 3) the Hackberry Zone within the prospect area contains approximately 48.5 billion cubic feet of net sand.

R9W

R8W

T8S

T9S

R9W

R8W

T8S

LEGEND

- 95403 Serial No.
 O Well Loc.
 12,000' Total Depth
 10,000' Base Interval
 (Measured Depth)

EXHIBIT 2

NEWTON PROSPECT AREA
 STRUCTURE MAP ON BASE OF HACKBERRY ZONE
 CONTOUR INTERVAL: 100 FEET
 SCALE: 1" = 3,000'

T9S

R9W

R8W

A 5. 4. 3. 2. 1. A'

CROSS SECTION A-A'
 NEWTON PROSPECT
 CALCASIEU PH., LOUISIANA
 HORIZ. SC. 1"= 2,000'

EXHIBIT 4

1. Glasscock (SN69706)
 Goldsmith Farms #4 U. #1
 Sec. 20 T8S R8W
2. Calif. Co. (SN61857)
 Weber Carter et al #1
 Sec. 29 T8S R8W
3. Apache Oil Corp. (SN112588)
 Dorothy Carter #1
 Sec. 31 T8S R8W
4. Sun Oil Co. (SN105151)
 Prater #1
 Sec. 6 T9S R9W
5. Sun Oil Co. (SN100814)
 M.E. Damon #1
 Sec. 6 T9S R9W

WELLS USED IN THE STUDY OF THE
NEWTON PROSPECT

1. Lee Bros.; Glasscock-Chapman
J. A. Miller #2
SN 101285
Sec. 19 T8S R8W
2. Glasscock
Goldsmith Farms #4 U. #1
SN 69706
Sec. 20 T8S R8W
3. Continental Oil
J. A. Bel et al #1
SN 57427
Sec. 28 T8S R8W
4. California Co.
Weber Carter et al #1
SN 61857
Sec. 29 T8S R8W
5. Apache Oil Corp.
Dorothy Carter #1
SN 112588
Sec. 31 T8S R8W
6. Shell Oil Co.
Lake Charles Naval Stores #1
SN 68504
Sec. 36 T8S R9W
7. Sun Oil Co.
M. E. Damon #1
SN 100814
Sec. 6 T9S R9W
8. Sun Oil Co.
Prater #1
SN 105151
Sec. 6 T9S R9W

SOUTH MIDLAND PROSPECT

Acadia Parish, Louisiana

Township 10 South and Ranges 1 East and 1 and 2 West

This prospect was selected for study because a reasonable density of wildcat wells provided deep subsurface control. It is located adjacent to the Midland Field to the north and the Crowley Field to the northeast. The Marginulina texana Sand (Lower Miocene Frio Formation), in which a large aquifer occurs, is a mappable, reliable geologic unit extending throughout the study area. It should be noted that geopressure also occurs in this area in sands below the Marginulina texana Sand, but there is insufficient geologic data to map or estimate its extent. The prospect covers an area of 24 square miles.

The following detailed geologic maps and cross sections were prepared using information on the 25 wells listed in Exhibit 6.

- Exh. 1. Structure Map: Top Marginulina texana Sand
- Exh. 2. Structure Map: Base Marginulina texana Sand
- Exh. 3. Net Sand Isopach: Marginulina texana Sand
- Exh. 4. Cross Section A-A' (West-East)
- Exh. 5. Cross Section B-B' (North-South)
- Exh. 6. List of wells used in study of prospect

The Marginulina texana Sand aquifer described in the exhibits is a porous and permeable sand body ranging from zero to 300 feet in net thickness within an overall interval of 730 feet. Published information on this sand in the Midland Field to the north indicates an average porosity of 30.7 percent and an average permeability of 413 md.

The Marginulina texana Sand, being located well below the top of geopressure, was found to be geopressured in all 25 wells used in the study. Mud weights used to drill this sand ranged from 15.4 to 18.3 ppg and temperatures ranged from 210 to 284°F (uncorrected). Using the net sand isopach map (Exh. 3), the total sand volume of the aquifer is 77.7 billion cubic feet.

Ex. No. 2
Base of Marginulina Texana (Middle Frío)
Contour Interval: 100'

A

Atlantic Ref.
Wild No. 2
Sec. 19-10S-1W

S. W. Gas
Wild No. 1
Sec. 20-10S-1W

Superior Oil
La. Prod. No. 1
Sec. 21-10S-1W

Continental
L. St. Ores No. 1
Sec. 23-10S-1W

Inexco Oil
Hoffpaulr No. 1
Sec. 25-10S-1W

Prairie Prod.
Freeland No. 1
Sec. 32-10S-1E

A'

EX. NO. 4

Hor. Scale 1" = 3000'

SOUTH MIDLAND PROSPECT

B

Gen. Am. Oil
Brooks No. 1
Sec. 18-10S-1E

Badger Oil
Manuel No. 1
Sec. 24-10S-1W

Continental
L. St. Ores No. 1
Sec. 23-10S-1W

Royal Resources
First Natl. Farms No. 1
Sec. 27-10S-1W

Inexco Oil
Woods No. 1
Sec. 28-10S-1W

Un. Oil of Cal.
Faitel No. 1
Sec. 32-10S-1W

B'

EXHIBIT 6

WELLS USED IN STUDY OF THE
SOUTH MIDLAND PROSPECT

General Am. Oil Co.	Edwin L. Cox	Inexco Oil Co.
Brooks Est. #1	B. Holder Bacon #1	Woods #1
SN 135343	SN 119951	SN 137631
Sec. 18 T10S R1E	Sec. 19 T10S R1W	Sec. 28 T10S R1W
Pan Am	Atlantic	Inexco Oil Co.
J. C. Freeland #1	Wild #1	Hoffpauir #1
SN 60515	SN 85214	SN 137630
Sec. 29 T10S R1E	Sec. 19 T10S R1W	Sec. 25 T10S R1W
Prairie Prod. Co.	Atlantic	Union Oil of Calif.
C. J. Freeland #1	Wild #4	Feitel #1
SN 115862	SN 91144	Sec. 32 T10S R1W
Sec. 32 T10S R1E	Sec. 19 T10S R1W	Badger Oil Corp.
Atlantic	Atlantic	W.A. Manuel #1
Pearl Cowan #1	Wild #2	SN 145124
SN 39476	SN 78216	Sec. 24 T10S R1W
Sec. 18 T10S R1W	Sec. 19 T10S R1W	Franks Petro. Inc.
Royal Resources Corp.	Edwin L. Cox	Wild #1
First Natl. Farms #1	B. Holder Bacon #1	SN 147669
SN 131022	SN 119951	Sec. 17 T10S R1W
Sec. 27 T10S R1W	Sec. 19 T10S R1W	Anadarko Prod. Co.
Tex. Intl. Petro.	Atlantic	Crawford C#1
Sarver #1	Wild #6	SN 135070
SN 139450	SN 131838	Sec. 72 T10S R1W
Sec. 27 T10S R1E	Sec. 19 T10S R1W	Watson Oil Corp.
Amarex, Inc.	Atlantic	Crawford #1
Acadia Ph. P. Jury #1	Acadia Ph. P. Jury #1	SN 140122
SN 148301	SN 80867	Sec. 72 T10S R2W
Sec. 21 T10S R1W	Sec. 20 T10S R1W	Drilling & Expl. Co.
Superior Oil Co.	Southwest Gas	Cowen #1
La. Prod. Corp. #1	Wild #1	Sec. 34 T10S R1W
SN 112671	SN 59295	
Sec. 21 T10S R1W	Sec. 20 T10S R1W	
Tidewater Oil Co.	Midwest Oil Corp.	
A. Broussard #1	Hamic #1	
SN 67727	SN 94324	
Sec. 14 T10S R1W	Sec. 31 T10S R1W	

WEST LAKE ARTHUR PROSPECT

Jefferson Davis Parish, Louisiana

Portions of Townships 10 and 11 South and Ranges 4 and 5 West

This prospect area was selected for detail study due to the high density of wildcat wells affording subsurface structural control, the high bottom hole temperature, the consistently heavy drilling fluids used and the favorable sand properties below the top of the geopressure.

The Marginulina howei zone (Base of Middle Miocene) was selected for detailed geologic study because correlation is reliable in the area. The base of the interval mapped is the Lower Camerina Zone (top of the Lower Miocene) which is also a reliable correlation zone. The prospect covers an area of approximately 24 square miles. The following listed geologic maps and cross sections, Exhibits 1-4, were prepared using information from 33 wells listed in Exhibit 5.

- Exh. 1. Structure Map: Top of Marginulina howei zone (Anahuac)
- Exh. 2. Structure Map: Base of Lower Camerina Zone (Frio)
- Exh. 3. Net Sand Isopach Map
- Exh. 4. Cross Section A-A' (West-East)
- Exh. 5. List of wells used in study of prospect

GEOLOGY OF THE PROSPECT AREA -- The prospect is a Northeast-Southwest trending accumulation of sediments bounded on the North and South by regional growth faults trending in the same direction. The prospect covers an area of 51 square miles. The thickest net sand accumulation, 400 feet, is found in the central Northern portion of the structure on the downthrown side of the North bounding fault. The West-East cross section A-A' shows the geopressured interval to have a maximum thickness of 1,930 feet consisting of alternating sands and shales. Mud weights used to drill the zone ranged from 13.5 to 18.0 ppg. Temperatures ranged from 215 to 270°F (uncorrected). Sands in the area have an average porosity of 25% and permeabilities average 500 millidarcies. The net sand isopach map shows that the prospect area contains 140.2 billion cubic feet of net sand.

Jefferson Davis Parish, La.

EXHIBIT NO. 1
Structure Map on top of
the Marginulina howei zone (Anahuac)
Scale: 1"=3000'

Legend
 47598= Well Serial Number
 ○ = Well Location
 11,100= Top of contoured Interval
 F/13,340= Fault Cut

EXHIBIT NO. 1
Structure Map on top of
the Marginulina howei zone (Anahuac)
Scale: 1"=3000'

WEST LAKE ARTHUR PROSPECT
Portions of T-10S-4W, T-10S-5W
T-11S-4W and T-11S-5W
Jefferson Davis Parish, La.

EXHIBIT NO. 2
Structure Map on the base
of the Lower Camarina zone (Frio)
Scale: 1"=3000'

T-11S-R4W

WEST LAKE ARTHUR PROSPECT
 Portions of T-10S-4W, T-10S-5W
 T-11S-4W and T-11S-5W
 Jefferson Davis Parish, La.

EXHIBIT 3
 WEST LAKE ARTHUR PROSPECT
 JEFFERSON DAVIS PARISH, LA.
 NET SAND ISOPACH MAP
 C.I. = 50'

WEST LAKE ARTHUR PROSPECT
Portions of T-10S-4W, T10S-5W
T-11S-4W and T-11S-5W
Jefferson Davis Parish, La.

EXHIBIT 5

WELLS USED IN THE STUDY OF THE
WEST LAKE ARTHUR PROSPECT

Buttes Gas & Oil
M. A. Hughes #1
SN 129402
Sec. 27 T10S R4W

Union Tex. Petro.
M. C. Hughes #B-5
SN 57713
Sec. 27 T10S R4W

Benedum Trees Oil
N. Mallet #1
SN 54852
Sec. 27 T10S R4W

Sun Oil Co.
E. A. Greer #1
SN 92975
Sec. 29 T10S R4W

Emerald Oil Co.
I. Hebert #1
SN 115828
Sec. 30 T10S R4W

Lone Star Prod. Co.
L. E. Lejeune #1
SN 141479
Sec. 31 T10S R4W

Humble Oil & Refg.
E. E. Wild #1
SN 47598
Sec. 32 T10S R4W

Union Tex. Petro.
Broussard #1
SN 53716
Sec. 33 T10S R4W

Union Tex. Petro.
M. Hughes #B-1
SN 53436
Sec. 34 T10S R4W

Union Tex. Petro.
P. A. Mallet #1
SN 56157
Sec. 34 T10S R4W

Union Tex. Petro.
Broussard #B-1
SN 59884
Sec. 34 T10S R4W

Union Tex. Petro.
Mallet #2
SN 60503
Sec. 34 T10S R4W

Humble-Gulf
Hawthorne #X-1
SN 63677
Sec. 35 T10S R5W

Argo Oil Corp.
L. P. Benoit #1
SN 74166
Sec. 36 T10S R5W

Hawthorne-Chevron
I. Bertrand #2
SN 128967
Sec. 3 T11S R4W

Apache Expl. Corp.
I. Bertrand #1
SN 141081
Sec. 3 T11S R4W

Union O & G of La.
W. J. Broussard #B-1
SN 56994
Sec. 4 T11S R4W

Lujon Oil Co.
C. Gay #1
SN 93520
Sec. 6 T11S R4W

(CONTINUED)

WELLS USED IN THE STUDY OF THE
WEST LAKE ARTHUR PROSPECT

(CONTINUED)

The California Co.
O. Aguiillard #1
SN 76402
Sec. 6 T11S R4W

The California Co.
J. L. Conner #1
SN 95312
Sec. 9 T11S R4W

Continental Oil Co.
Niblett #1
SN 23548
Sec. 1 T11S R5W

Sun Oil Co.
Niblett #2
SN 36225
Sec. 2 T11S R5W

Miss. River Fuel
A. L. Hoke #1
SN 81221
Sec. 1 T11S R5W

Whitestone Petro.
R. Doucet #1
SN 106449
Sec. 1 T11S R5W

Anadarko Prod. Co.
Freeland #A-1
SN 134628
Sec. 2 T11S R5W

S. Hammonds
Hawthorne #1
SN 104082
Sec. 2 T11S R5W

Humble Oil & Ref.
H. E. Hawthorne #1
SN 53650
Sec. 2 T11S R5W

Gulf Ref. Co.
United Life & Acc. Ins. Co. #1
SN 62229
Sec. 9 T11S R5W

Argo Oil Corp.
J. E. Freeland #1
SN 62140
Sec. 11 T11S R5W

Ada Expl. Corp.
Petitjean #1
SN 128274
Sec. 13 T11S R5W

Coastal States Gas Prod. Co.
United Life & Acc. Ins. Co. #1
SN 108664
Sec. 15 T11S R5W

Coastal States Gas Prod. Co.
S. C. Andrus #1
SN 102105
Sec. 16 T11S R5W

Sohio Petro. Co.
F. Nunez #1
SN 77029
Sec. 16 T11S R5W

WEST LOCKPORT PROSPECT

Calcasieu Parish, Louisiana
Townships 10 South and Ranges 9 and 10 West

This area was selected for study because a reasonably high density of wildcat wells provided deep subsurface structural control. In addition it was noted as an area requiring high mud weights (15.9 to 17.8 ppg) and with favorable sand occurrence well below the top of geopressure.

The Nodosaria blanpedi Sand (Lower Frio) was selected for mapping because correlation within the entire area is believed to be reliable and because many of the wells penetrated the entire sand. The prospect covers an area of 27 square miles. The following listed geologic maps and cross sections, Exhibits 1-5, were prepared from the twelve wells listed in Exhibit 6.

- Exh. 1. Structure Map: Top Nodosaria blanpedi
- Exh. 2. Structure Map: Base Nodosaria blanpedi
- Exh. 3. Net Sand Isopach of Nodosaria blanpedi
- Exh. 4. Cross Section A-A' (West-East)
- Exh. 5. Cross Section B-B' (North-South)
- Exh. 6. List of wells used in study of prospect

The Nodosaria blanpedi Sand consists of a permeable and porous sequence which ranges from zero to 430 net feet within the study area, with an average thickness of about 100 feet net. The sand was geopressed in all wells, being located some 1000 feet below top of geopressure. Temperatures ranged from 211 to 295°F (corrected) and excess pressure over hydrostatic ranged from 3728 to 5225 psi.

The area studied contains in excess of 128 billion cubic feet of Nodosaria blanpedi sands, which included only those sands within the mapped interval. There are additional geopressed zones both up and down the hole for which no estimate has been made. No porosity or permeability data has been located for this prospect.

WELLS IN A-A' CROSS SECTION

1. W.T. Burton Ind.
Spiller #1
SN 97745
Sec. 19 T10S R10W	4. Calif. Co.
R.E. Moss #1
SN 69473
Sec. 12 T10S R10W
2. W.T. Burton Ind.
Am. Oil & Sulphur #1
SN 94002
Sec. 17 T10S R10W	5. Austral Oil
S.L. 2865 #1
SN 63754
Sec. 15 T10S R9W
3. Union Sulphur & Oil
Hunter #2
SN 45827
Sec. 15 T10S R10W	

EXHIBIT 4
WEST LOCKPORT PROSPECT
CROSS-SECTION A-A' (WEST-EAST)
HORIZONTAL SCALE: 1"=3,000'

EXHIBIT 6

WELLS USED IN THE STUDY OF THE
WEST LOCKPORT PROSPECT

Quintana Petro.
S. H. Jones #1
SN 59903
Sec. 6 T10S R9W

Austral Oil
S. L. 2865 #1
SN 63754
Sec. 15 T10S R9W

Austral Oil
Williams #1
SN 61840
Sec. 21 T10S R9W

Coastal States
Stream #1
SN 131803
Sec. 28 T10S R9W

Union Sulphur
Am Oil & Sulphur #1
SN 50424
Sec. 5 T10S R10W

Gulf Oil
Am. Oil & Sulphur #1
SN 66933
Sec. 8 T10S R10W

Falcon Seaboard
Bel Est. #1
SN 99671
Sec. 10 T10S R10W

Union Sulphur
Hunter, Inc. #1
SN 44391
Sec. 10 T10S R10W

Calif. Co.
Moss et al #1
SN 69473
Sec. 12 T10S R10W

Union Sulphur
Hunter #2
SN 45827
Sec. 15 T10S R10W

W. T. Burton Lnd.
Spiller #1
SN 97745
Sec. 19 T10S R10W

W. T. Burton
Am. Oil & Sulphur #1
SN 94002
Sec. 17 T10S R10W

WEST MAURICE PROSPECT

Vermilion Parish, Louisiana
Township 11 South and Ranges 2, 3 and 4 East

This prospect area was selected for detailed study because of the density of wildcat wells affording deep subsurface structural control, the high bottom hole temperatures, the consistently heavy muds used, and the favorable sand porosity and permeability well below the top of the geopressure. The prospect covers an area of 40 square miles.

The Upper Frio Zone was selected because correlation within this interval is reliable and the majority of the wells drilled in this area penetrated the entire Frio section. The following listed geologic maps and cross sections, Exhibits 1-5, were prepared using information from the 16 wells listed in Exhibit 6.

- Exh. 1. Structure Map: Top of Upper Frio
- Exh. 2. Structure Map: Base of Upper Frio
- Exh. 3. Isopach Map: Upper Frio Net Sand
- Exh. 4. Cross Section: A-A' (West-East)
- Exh. 5. Cross Section: B-B' (South-North)
- Exh. 6. List of wells used in study of prospect

GEOLOGY OF STUDY AREA -- The Upper Frio Zone was chosen for detailed geologic study because correlation is reliable in the area. As shown on the structure map, the area is highly faulted; to what extent the faults are sealing was not determined. No faults were found with large enough displacement to completely fault out the entire Upper Frio interval.

At the type locality (T8S R4W, Jefferson Davis Parish, La) the Upper Frio consists of massive beds of coarse-grained sand and shale with a more or less persistent central shale bed. The latter is presumed to have been deposited in an outer neritic environment; the massive sands and thin shales indicate deposition in the littoral and inner neritic environments. The sediments and fossils assume a more marine

character downdip, while the reverse is true in the updip direction. Within the study area, sand porosities are reported to average 25.5% and permeabilities average 125 md.

As shown on Exhibit 3, the thickest Upper Frio Sand accumulation was found to be on the downthrown side of a large east-west trending, south dipping growth fault (Fault A). A west-east stratigraphic cross section (A-A') (Exh. 4) and a south-north stratigraphic cross section shows the nature of the sand distribution within the study area (B-B') (Exh. 5).

The Upper Frio Zone consists of alternating sands and shales within an overall interval varying in thickness from 800 feet to 1,390 feet within the study area. Sands within this interval range in thickness from zero to 315 feet, for an average thickness of approximately 200 feet.

The Upper Frio Zone in all of the sixteen wells was found to be geopressured, being located several thousand feet below the top of the geopressure. Mud weights used to drill the Upper Frio section ranged from 15.5 to 18.3 ppg, temperatures from 202 to 306°F (uncorrected) within the Upper Frio interval. Using the net sand isopach (Exh. 3) the Upper Frio interval within the prospect area contains approximately 262.2 billion cubic feet of net sand.

EXHIBIT NO. 1

STRUCTURE MAP
TOP OF UPPER FRIO
C.I. = 100'

LEGEND

94063 Serial No.
 O Well Loc.
 12,000' Total Depth
 16,000' Top Interval
 (Measured Depth)

WEST MAURICE PROSPECT
 T-11S-R2E & T-11S-R4E
 Scale 1" = 3000'
 VERMILION PARISH, LA.

STRUCTURE MAP
BASE OF UPPER FRIO
C.I. = 100'

WEST MAURICE PROSPECT
T-11S-R2E & T-11S-R4E
SCALE-1"=3000'
VERMILION PARISH, LA..

EXHIBIT NO. 3
NET SAND ISOPACH MAP
UPPER FRIO
C.I. = 50'

- LEGEND
- 95064 Serial No.
 - Well Loc.
 - 12,000' Total Depth
 - 200' Net Sand Value
 - E. Est. Value

WEST MAURICE PROSPECT
T-11S-R2E & T-11S-R4E
SCALE-1"=3000'
VEVILION PARISH, LA.

A 1 2 3 4 5 6 7 A'

B

1

2

3

4

5

B'

- 1- FOREST OIL CORP.
E. ST. 11V NO. 1
SEC. 32-11S-3E
2- PASSIE HUNT TRUST
N. FREDERICK NO. 1
SEC. 28-11S-3E
3- CROWN CENTRAL PETRO.
N. BROUSSARD NO. 1
SEC. 20-11S-3E

- 4- J.P. OWEN
A.C. TRAHAN NO. 1
SEC. 9-11S-3E
5- CONTINENTAL OIL CO.
J. MANES NO. 1
SEC. 6-11S-3E

EXHIBIT 5

CROSS SECTION B-B' (SOUTH - NORTH)
WEST MAURICE PROSPECT
VERMILION PARISH, LOUISIANA
HORIZONTAL SCALE: 1" = 3,000'

EXHIBIT NO. 6

WEST MAURICE PROSPECT

LIST OF WELLS USED IN PROJECT

1. Calif. Co. (SN 78821)
Vermillion Parish Sch. Bd. #1
Sec. 16-T11S-R3E
2. Texaco, Inc. (SN 111653)
A. H. Broussard #1
Sec. 12-T11S-R3E
3. Continental Oil Co. (SN 63394)
Jewell Manes #1
Sec. 6-T11S-R3E
4. Quintana Petrol. Corp. (SN 121472)
F. O. Trahan #1
Sec. 24-T11S-R3E
5. J. P. Owen (SN 123994)
N. D. Mire #1
Sec. 15-T11S-R2E
6. Sun Oil Co. (SN 78294)
Simon #1
Sec. 19-T11S-R3E
7. Seaboard Oil Co. (SN 66264)
Villien #1
Sec. 11-T11S-R3E
8. Hassie Hunt Trust (SN 72081)
R. Baudion Un. #1
Sec. 23-T11S-R3E
9. Forest Oil Corp. (SN 135068)
E. Stelly #1
Sec. 32-T11S-R3E
10. Hassie Hunt Trust (SN 69749)
N. Prejean #1
Sec. 28-T11S-R3E
11. Calif. Co. (SN 85911)
E. L. Simon #1
Sec. 14-T11S-R2E
12. Southern Minerals Corp. (SN 125528)
E. Langlinais #1
Sec. 17-T11S-R3E
13. Kern County Land Co. (SN 92247)
F. T. Hunter #1
Sec. 14-T11SOR2E
14. J. P. Owen-Sinclair-Tenneco (SN 119684)
A. C. Trahan #1
Sec. 9-T11S-R3E
15. Crown Central Petro. Corp. (SN 62287)
N. Broussard #1
Sec. 20-T11S-R3E
16. Texaco, Inc. (SN 88337)
P. B. Vincent #1
Sec. 12-T11S-R3E

SOUTH WHITE LAKE PROSPECT

Cameron and Vermilion Parishes, Louisiana
Townships 15, 16 and 17 South and Ranges 1, 2 and 3 West

This prospect area was selected because of the favorable number of wildcat wells providing deep subsurface structural control on zones below the top of the geopressure. The prospect is located on the downthrown side of an east-west trending down to the south growth fault (Fault A) and covers an area of 51 square miles.

For purposes of this report, the Discorbis "B" zone of Upper Miocene geologic age was selected as the mapping horizon. The Discorbis "B" zone described in the following exhibits contains porous and permeable sand bodies ranging in thickness from zero to approximately seven hundred feet in net sand thickness within an overall interval of approximately 2,100 feet. Published information on Upper Miocene sands near the subject area indicates sand porosities of approximately 26%. Permeabilities are estimated to be in the range of 100 to 300 md.

As stated above, maps and calculations were prepared using only data from sands within the Discorbis "B" zone. It should be noted that additional geopressured sands other than those within the Discorbis "B" zone underlie the prospect area. No estimate was made for areal extent or volume for these sands because of the limited time for the project. These deep sands merit further study.

The following detailed geologic maps and cross sections, Exhibits 1-4, were prepared using information on the 14 wells listed in Exhibit 5.

- Exh. 1. Structure Map: Top Discorbis "B" zone
- Exh. 2. Structure Map: Base Discorbis "B" zone
- Exh. 3. Net Sand Isopach Map: Discorbis "B" zone
- Exh. 4. Cross Section A-A' (East-West)
- Exh. 5. List of wells used in study of prospect

Of particular note would be that several wells in the Constance Bayou Field area of the prospect were drilled into the upper portion of the Discorbis "B" Zone using muds less than 12.0 ppg. However the only well in this area penetrating the entire Discorbis "B" Zone interval (Superior Oil Co., S. L. 2039, Well No. 5; Sec. 23 T16S R3W) used mud weights in excess of 12.0 ppg., throughout the overall zone. This could possibly indicate that the upper portion of the Discorbis "B" Zone ($\pm$ 500 feet of interval) located in the western portion of the prospect might not presently contain geopressured sands. This phenomenon could be caused by or related to gas production in Constance Bayou Field from within the Discorbis "B" Zone. Whether or not the remainder of the prospect has been affected by this production could not be determined. If this prospect is selected as a candidate for drilling, engineering studies should be made before a final decision is made.

Mud weights used to drill the Discorbis "B" Zone ranged from 10.5 ppg (Constance Bayou Field Area) to 17.7 ppg, and temperatures ranged from 245 to 312°F (uncorrected). Using the net sand isopach map (Exh. 3), the total sand volume of the aquifer is 367.7 billion cubic feet.

A

BASE DISCORBIS "B" ZONE

HORIZONTAL SCALE: 1" = 3,000'

4

EXHIBIT NO. 4
SOUTHERN OIL CO. LAND REPORT

CROSS SECTION A-A' (EAST-WEST)

5

6

A'

1. Union Tex. Petro. Co.
Tr. L.O. Miller #1
Sec. 27 T15S R2E
2. Oil & Gas Ventures Inc.
S. Miller #1
Sec. 34 T15S R2E
3. Exchange Oil & Gas
L. A. Miller #1
Sec. 2 T16S R2E
4. Union Oil Co. of Calif.
S/L 4231 #1
Sec. 8 T16S R2E
5. Superior Oil Co.
Rockefeller S/L 2039 #P
Sec. 24 T16S R3E
6. Superior Oil Co.
Rockefeller S/L 2039 #5
Sec. 23 T16S R3E

EXHIBIT NO. 5

SOUTH WHITE LAKE PROSPECT

WELLS USED IN STUDY

1. Union Texas Petro. Corp.
Dr. M. O. Miller No. 1
Sec. 27-15S-2W
2. Union Oil Co. of Calif.
S/L 4082 No. 1
Sec. 32-15S-2W
3. Oil & Gas Futures, Inc.
S. Miller No. 1
Sec. 34-15S-2W
4. Exchange Oil & Gas Corp.
H. A. Miller No. 1
Sec. 2-16S-2W
5. Union Oil Co. of Calif.
S/L 4231 No. 1
Sec. 8-16S-2W
6. Superior Oil Co.
S/L 2039 Nos 1, 2, 4, 5 & 7
Sec. 23-16S-3W
7. Superior Oil Co.
S/L 2039 No. 6 and 8
Sec. 24-16S-3W
8. Superior Oil Co.
S/L 2039 No. 9
Sec. 26-16S-3W
9. Pan Am Petro. Corp.
S/L 4210 No. 1
Sec. 35-16S-3W

BIG MOUTH BAYOU PROSPECT

Cameron Parish, Louisiana
Township 14 South and Ranges 4, 5 and 6 West

This prospect area is located in the southern and western most parish in the State, Cameron. The Structure Map, Exhibit No. 1, includes parts of three townships located in the southern part of the east half of Cameron Parish. There are several prolific oil and gas fields east and south of the prospect area. The fields, Grand Cheniere, Go Around Bayou, Twin Island, South Pecan Lake and Pecan Lake are distinct geologic features separated from the prospect area by major faults. Little Cheniere field, depleted, is north and west of the area and is upthrown to the major down to the coast fault which forms the northern boundary of the mapped area. There is one additional two-well depleted field, Big Mouth Bayou, located in the southwest part of the area. The prospect covers an area of approximately 60 square miles. The following listed geologic maps and cross sections, Exhibits 1-5, were prepared using information from the 62 wells listed in Exhibit 6.

- Exh. 1. Structure Map: Top Robulus chambersi
- Exh. 2. Isopach Map: Robulus chambersi interval net sand
- Exh. 3. Isopach Map: Siphonina davisii interval net sand
- Exh. 4. Stratigraphic Section A-A' (West-East)
- Exh. 5. Stratigraphic Section B-B' (West-East)
- Exh. 6. List of wells used in study of prospect

GEOLOGY OF THE STUDY AREA -- Big Mouth Bayou Prospect lies between two major regional growth-fault systems. The north bounding fault strikes more or less east-west, however, in the vicinity of section 12, T14S, R6W, the fault turns to the southwest. The south bounding fault may be described as striking east-west. These two bounding faults are normal down to the coast (south) with throws of about 400-500 feet at Robulus time. The faults grow considerably with depth

and have several hundred more feet of throw in the older beds. The smaller relief faults are all of the normal type and have throws of 110-200 feet. Exhibit No. 1, structure map on the top of the *Robulus chambersi* indicates structural highs on the east and west. The western high reflects a good positive area with 1600 feet of relief. Faults of 100-200 feet of throw traverses the western anomaly but the faults lack throws sufficient to act as sealing barriers to the geothermal intervals isopached (Exhibit Nos. 2 and 3). The high on the eastern portion of the prospect area exhibits about 300-400 feet of closure and is closely associated with the large complexly faulted geologic anomaly which has several distinct smaller geologic features that are all oil and gas bearing. The producing reservoirs in the Grand Cheniere, Go Around Bayou, and Twin Island fields are separated from the prospect area by the large south bounding fault. The large north-south fault forming the eastern boundary of the geothermal area is the sealing barrier between the prospect area and the producing gas field to the east, Pecan Lake.

STRATIGRAPHY -- The sedimentary sequence within the geothermal-geopressured strata lying between the major bounding faults to the north and south are interbedded sandstone and shale bodies which do not exhibit any appreciable thickening within the prospect area. The *Planulina* Zone, which is a prolific gas bearing section in Southwest Louisiana is not productive on the Big Mouth Bayou prospect area. Above the *Planulina* section is younger sequences, *Siphonina davisii* and *Robulus chambersi*, of alternating thick continental to littoral sandstone and brackish-water shale. The pre *Planulina* sequence is predominantly outer-metric shale deposits with interbedded lenticular sandstone. Exhibit No. 5 is a stratigraphic cross section depicting the pre *Planulina* sediments. The oldest strata penetrated within the prospect area probably is of Middle Miocene (Anahuac) age.

CONCLUSION -- Exhibit No. 2, an isopach map of the Robulus chambersi interval, contains approximately 356.7 billion cubic feet of net sand with a maximum thickness of 225 feet. The Robulus chambersi interval is about 500 feet thick with good sand development. The porosity is in the range of 26-27 per cent and a visual analysis of the electrical logs indicates that sands within the interval is well developed and the permeability is estimated to be 150-200 md. The formation temperature averages between 185 to 190°F (uncorrected). It is inconclusive as to whether this interval is geopressured because a few of the wells drilled through the interval were drilled with mud weights less than twelve pounds per gallon. Engineering studies will be needed to determine this.

Exhibit No. 3 is an isopach map of the Siphonina davisii section and contains some 72.5 billion cubic feet of net sand with a maximum thickness of 140 feet. The siphonina davisii interval is approximately 350 feet thick and is not as extensively developed as the younger isopached sediments. The sand development was found to be fairly good and the permeability should be comparable to that of the younger Robulus Zone. The average permeability is about 180 and the porosity ranges from 25 to 26 percent. The temperature for the Siphonina interval ranges from 195 to 220°F (uncorrected). The mud weight used to drill through the interval ranged from 12.5 to 17.6 ppg averaging out at about 16.2. There are approximately 9.8 million acre feet or 429.2 billion cubic feet of net sand in both mapped intervals.

EXHIBIT NO. 1 STRUCTURE MAP

BIG MOUTH BAYOU
PROSPECT
DATUM ROBULUS CHAMBERS
CONTOUR INTERVAL 100'
SCALE=3000'

LEGEND

132857=SERIAL NO.
15539 = TOTAL DEPTH
10390= MAP DATUM
NDE = NOT DEEP ENOUGH
NL = NO LOG

BIG MOUTH BAYOU LAKE
PROSPECT
ISOPACHOUS MAP
NET SAND
ROBUSUS CHAMBERSI INTERVAL 500'
CONTOUR INTERVAL 20'

SCALE
3000' 6000'

LEGEND
75868 = SERIAL NO.
15353 = TOTAL DEPTH
190 NET SAND

EXHIBIT NO. 3

A

Gulf Interstate &
Tenn. Gas
Mermentau Min.Ld. No. 1
Sec. 32-14S-6W

California Co.
Mermentau Min. Ld. No. 1
Sec. 29-14S-5W

DATUM

Bradco & Belco
Mermentau Min.Ld. No. 3
Sec. 21-14S-5W

MIDDLE

Franks Petro.
Miami Corp. No. 1
Sec. 11-14S-5W

MIOCENE

Shell Oil Co.
Miami Corp. No. B-1
Sec. 16-14S-4W

MARKER

Humble Oil
Vinc. & Welsh No. 1
Sec. 21-14S-4W

Shell Oil Co.
Miami Corp. No. A-1
Sec. 27-14S-4W

Superior Oil Co.
Miami Corp. No. B-13
Sec. 25-14S-4W

A'

DEPTH BELOW DATUM

200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600

EXHIBIT NO. 4

BIG MOUTH BAYOU

STRATIGRAPHIC SECTION A -- A'

SCALE

HORIZONTAL - NONE

VERTICAL -

0
200'

WELLS USED IN STUDY OF THE
BIG MOUTH BAYOU PROSPECT

1. The Superior Oil Co.
La. State Lse. 3016 No. 1
Sec. --, T14S, R4W
SN 75868
2. Hassie Hunt Trust
S/L 5082 No. 1
Sec. --, T14S, R4W
SN 132857
3. W. B. Jayred
Miami Corp. #C-1
Sec. 15, T14S, R4W
SN 37740
4. Shell Oil Company
Miami Corporation B-1
Sec. 16, T14S, R4W
SN 108007
5. Humble Oil & Refg. Co.
Vincent & Welsh, Inc. &
J. A. Banham #1
Sec. 21-T14S-R4W
SN 47019
6. Lamar Hunt
Miami Corporation "B" No. 1
Sec. 21, T14S, R4W
SN 126050
7. Terra Resources, Inc.
Miami Corporation No. 1
Sec. 22, T14S, R4W
SN 138867
8. Ashland Oil & Refg. Co.
Miami Corp. No. 1
Sec. 22, T14S, R4W
SN 111258
9. Union Oil Co. of California
Miami Corporation No. G-1
Secs. 14 & 23, T14S, R4W
SN 126782
10. The Superior Oil Company
Miami Corporation B No. 13
Sec. 25, T14S, R4W
SN 103887
11. Shell Oil Co.
Miami Corp. No. A-1
Sec. 27, T14S, R4W
SN 105235
12. Exchange Oil & Gas Co.
Miami Corp. "C" No. 2
Sec. 27, T14S, R4W
SN 123164
13. Exchange Oil & Gas Co.
Miami Corp. C No. 1
Sec. 28, T14S, R4W
SN 121571
14. Humble Oil & Refg. Co.
Miami Corp. "N" #2
Sec. 29, T14S, R4W
SN 88223
15. Roberts & Whitson Petr., Inc.
Miami Corp. B No. 1
Sec. 30, T14S, R4W
SN 123974
16. Roberts & Whitson Pet., Inc.
Miami Corp. A-3
Sec. 31, T14S, R4W
SN 126599
17. Texas Crude, Inc.
Miami Corp. No. 1
Sec. 31, T14S, R4W
SN 141819
18. Kerr Mc Gee Oil Ind., Inc.
Miami Corp. #4
Sec. 31, T14S, R4W
SN 108284
19. Kerr McGee Oil Inds. &
Monterey Oil Co.
Miami Corp. #1
Sec. 32, T14S, R4W
SN 57743
20. Humble Oil & Refg. Co.
Miami Corp. N-1
Sec. 32, T14S, R4W
SN 48404

(cont'd)

EXHIBIT NO.6 - BIG MOUTH BAYOU (cont'd)

21. Kerr McGee Oil Ind.
Miami Corp. Well #2
Sec. 33, T14S, R4W
SN 60682	32. Roussel & Brown
Miami Corp. #1
Sec. 8, T14S, R5W
SN 51383
22. Kerr McGee Oil Inds., Inc.
Miami Corp. #3
Sec. 34, T14S, R4W
SN 80964	33. Austral Oil Co., Inc.
Miami Corp. "5910" Well #1
Sec. 8, T14S, R5W
SN 74757
23. Humble Oil & Refg. Co.
Miami Corp. No. N-3
Sec. 34, T14S, R4W
SN 101785	34. Southern Natural Gas Co.
Miami Corp. "C" No. 1
Sec. 9, T14S, R5W
SN 113562
24. Quintana Prod. Co.
Miami Corp. A #1
Sec. 34, T14S, R4W
SN 140173	35. Superior Oil Co.
Miami Corp. "E" #1
Sec. 9, T14S, R5W
SN 31270
25. Hope Natural Gas Co.
Miami Corp. #1
Sec. 35, T14S, R4W
SN 75142	36. Franks Petr. Corp.
Miami Corp. No. 1
Sec. 11, T14S, R5W
SN 130435
26. Hope Natural Gas Co.
Miami Corp. #2
Sec. 35, T14S, R4W
SN 77365	37. Humble O & R Co.
Cameron Sch. Brd B#1
Sec. 16, T14S, R5W
SN 29129
27. McCord-Goodrich Oil Co. &
Edwin L. Cox
Miami Corp. No. 1
Sec. 36, T14S, R4W
SN 138480	38. Phillips Petr. Co.
Mermentau Well #1
Sec. 17, T14S, R5W
SN 29778
28. Dyco Petr. Corp.
Miami Corp. No. 1
Sec. 36, T14S, R4W
SN 149693	39. Southern Natural Gas Co.
Mermentau Mineral & Land #1
Sec. 17, T14S, R5W
SN 18666
29. The Superior Oil Co.
Miami Corp. "S" No. 10
Sec. 36, T14S, R4W	40. Texas Crude Oil Co.
Mermentau Mineral & Land #2
Sec. 18, T14S, R5W
SN 79510
30. Midwest Oil Corp. et al
Miami Corp. No. A-1
Sec. 4, T14S, R5W
SN 132111	41. Gulf Refg. Co.
Mermentau Mineral & Land #A-1
Sec. 18, T14S, R5W
SN 39774
31. Bonanza International
Gabriel Richard No. 1
Sec. 6, T14S, R5W
SN 144300	42. Texas Crude Oil Co. &
Union Oil of Calif.
Mermentau Land & Mineral #1
Sec. 19, T14S, R5W
SN 63517

(cont'd)

43. Union Oil of California
Mermentau Land & Mineral #1
Sec. 20, T14S, R5W
SN 52159
44. Pan American Petr. Corp.
Mermentau Mineral & Land Co, Inc. #1
Sec. 20, T14S, R5W
SN 74506
45. Bradco & Belco
Mermentau Mineral & Land Co #3
Sec. 21, T14S, R5W
46. The California Co.
Mermentau Mineral & Lnd. Co. #1
Sec. 29, T14S, R5W
SN 104363
47. Occidental Petr. Corp.-Cabot Corp.
Mermentau Mineral & Lnd Co. No. 1
Sec. 32, T14S, R5W
SN 121674
48. Belco Petroleum Corp.
Mermentau Lnd & Mineral Co. #1
Sec. 33, T14S, R5W
SN 130801
49. McCormick Oil & Gas Co.
S. Miller No. 1
Sec. 35, T14S, R5W
SN 131525
50. Kilroy Co. of Texas-H. Hurt et al
D. Y. Doland No. 1
Sec. 36, T14S, R5W
SN 114986
51. Denex, Inc.
Mermentau Min. Land Co. #1
Sec. 13, T14S, R6W
SN 152479
52. Sundance Oil Co.
Miami Corp. No. A-1
Sec. 12, T14S, R6W
SN 146933
53. Gulf Refg. Co.
Mermentau Min. & Land Co. #2
Sec. 13, T14S, R6W
SN 42184
54. Kerr-McGee Oil Inds., Inc.
Mermentau Min. & Lnd Co. #2
Sec. 13, T14S, R6W
SN 83026
55. Union Oil Co. of Calif.
Mermentau Mineral #2
Sec. 13, T14S, R6W
SN 60601
56. Union Oil Co. of Calif.
Benoit #1
Sec. 13, T14S, R6W
SN 55978
57. Tribal Oil Co.
N. American Land #1
Sec. 18, T14S, R6W
SN 146893
58. H. L. Hunt
Mermentau Min. & Lnd Co. #1
Sec. 23, T14S, R6W
SN 122701
59. Skelly Oil Co. & Mallard Expl.
Mermentau Min. No. 1
Sec. 23, T14S, R6W
SN 143114
60. Clegg & Hunt
Mermentau Mins. & Lnd Co. #1
Sec. 24, T14S, R6W
SN 76593
61. Gulf Interstate Eng. Co. &
Tennessee Gas
Mermentau Mineral Lnd Co.
Sec. 32, T14S, R6W
SN 61029
62. Amoco Prod. Co.
Mermentau Mineral & Lnd Co. A-
Sec. 32, T14S, R6W
SN 139285

SOUTHEAST PECAN ISLAND PROSPECT

Vermilion Parish, Louisiana
Townships 16 and 17 South and Ranges 1 West, 1, 2 and 3 East
Portions of Vermilion Offshore Area

This prospect area was selected for detail study due to the density of wildcat wells affording deep subsurface control, the high bottom hole temperatures, the consistently heavy muds, and the favorable sand properties well below the top of the geopressure.

The LF-F Zone of Lower Miocene (Frio) geologic age was selected for study because correlation within this interval is reliable and the majority of the wells drilled in this area penetrated the entire zone. The following listed geologic maps and cross sections, Exhibits 1-5, were prepared using information from the 27 wells in Exhibit 6.

- Exh. 1. Structure Map: Top LF-F Zone
- Exh. 2. Structure Map: Base of LF-F Zone
- Exh. 3. Net Sand Isopach Map: LF-F Zone
- Exh. 4. Cross Section A-A' (South-North West end prospect)
- Exh. 5. Cross Section B-B' (South-North East end prospect)
- Exh. 6. List of Wells used in study of prospect

The structure maps show that the prospect is located between two generally trending East-West regional down to the South growth faults. The prospect is only moderately faulted and covers an area of 67 square miles.

As shown by the net sand isopach map, the thickest LF-F Zone sand accumulation was found to be south of Fault A. Two North-South stratigraphic cross sections show the nature of sand distribution within the study area. Sand porosities near the prospect area average 20% and permeabilities range up to 1400 md.

The LF-F Zone consists of alternating sands and shales within an overall interval varying in thickness from 800 to 1420 feet within the study area. Sands within this

interval range in thickness from zero to 825 feet, for an average thickness of approximately 400 feet per well.

The LF-F Zone in all of the 27 wells was found to be geopressured. Mud weights used to drill the LF-F Zone ranged from 17.2 to 18.1 ppg; and temperatures ranged from 245 to 292°F (uncorrected). Using the net sand isopach map the LF-F Zone within the prospect area contains approximately 856.2 billion cubic feet of net sand.

EXHIBIT 2
SOUTHEAST PECAN ISLAND PROSPECT
VERMILION PARISH, LOUISIANA
STRUCTURE MAP - BASE OF LF-F ZONE
Scale: 1" = 3,000'
C. I. = 100'

LEGEND	
94560	Serial No.
O	Well Loc.
12,000'	Total Depth
15,000'	Base Interval
	(Measured Depth)
N.D.E.	Not Deep Enough
E.	Est. Value

R 1 E

R 2 E

R 3 E

A

1

2

3

4

A'

1. Ocean Drilg. (SN 136970)
S. L. 3843, #3
Vermilion Blk. 6
2. Humble Oil (SN 129033)
VUA, #1
Sec. 16 T17S R1E
3. Humble Oil (SN 121502)
Humble Fee #26
Sec. 8 T17S R1E
4. Humble Oil (SN 93647)
Exxon Fee #23
Sec. 4 T17S R1E

EXHIBIT 4

CROSS SECTION A-A' (SOUTH-NORTH)
SOUTHEAST PECAN ISLAND PROSPECT
VERMILION PARISH, LOUISIANA
HORIZONTAL SCALE: 1" = 3,000'

B

1

2

TOP LF-F ZONE

3

4

5

B'

1. Ocean Drilg. (SN 93061)
S. L. 3844, #1
Vermilion Blk. 8
2. Kilroy Co. (SN 90820)
Mc Ilhenny Est. #C-1
Sec. 20 T17S R2E
3. Humble Oil (SN 133084)
Simmons #1
Sec. 15 T17S R2E
4. Sinclair Oil (SN 74698)
Mc Ilhenny #1
Sec. 10 T17S R2E
5. Union Texas (SN 142442)
La. Furs #1
Sec. 3 T17S R2E

BASE LF-F ZONE

EXHIBIT 5

CROSS SECTION B-B' (SOUTH-NORTH)
SOUTHEAST PECAN ISLAND PROSPECT
VERMILION PARISH, LOUISIANA
HORIZONTAL SCALE: 1" = 3,000'

WELLS USED IN THE SE PECAN ISLAND PROSPECT
VERMILLION PARISH

1. Stone Oil Corp (148544)
Audubon Society-Simmons #2
Sec. 26 T16S R2E
2. J. P. Owen (SN 88319)
La. Furs #G1
Sec. 29 T16S R2E
3. Union Oil Of Calif. (SN 84876)
La. Furs #J2
Sec. 32 T16S R2E
4. Union Oil of Calif. (133365)
La. Furs #C12
Sec. 33 T16S R2E
5. Signal Petro. (SN 146080)
Simmons #2
Sec. 35 T16S R2E
6. Tidewater Oil (SN 73745)
Mc Ilhenny #B-1
Sec. 36 T16S R2E
7. Consolidated Gas (SN 127279)
Nicks Lake #1
Sec. 30 T16S R3E
8. Pan Am (SN 100857)
National Audubon Society #1
Sec. 31 T16S R3E
9. Humble Oil (SN 93647)
Humble Fee #23
Sec. 4 T17S R1E
10. Humble Oil (SN 127308)
Humble Fee #31
Sec. 7 T17S R1E
11. Humble Oil (SN 121502)
Humble Fee #26
Sec. 8 T17S R1E
12. Humble Oil (SN 129033)
VUA; #1
Sec. 16 T17S R1E
13. Quintana (SN 148421)
S. L. 5900, #1
Sec. 24 T17S R1E
14. Union Oil Calif. (SN 120860)
Simmons #C-1
Sec. 2 T17S R2E
15. Union Texas (SN 142442)
La. Furs #1
Sec. 3 T17S R2E
16. Sinclair Oil (SN 74698)
Mc Ilhenny #1
Sec. 10 T17S R2E
17. Humble Oil (SN 133084)
Simmons #1
Sec. 15 T17S R2E
18. Kilroy Co. of Texas (SN 90820)
Mc Ilhenny Est. #C-1
Sec. 20 T17S R2E
19. A. H. Bruner (SN 81603)
National Audubon Society #1
Sec. 4 T17S R3E
20. Kilroy Co. of Texas (SN 96311)
White #B-1
Sec. 5 T17S R3E
21. Ocean Drilg. (SN 136970)
S. L. 3843, #3
Vermillion Blk. 6
22. Ocean Drilg. (SN 95463)
S. L. 3843, #1
Vermillion Blk. 6

(cont'd)

EXHIBIT 6

(continuation)

SE PECAN ISLAND PROSPECT

- 23. Humble Oil (SN76450)
S. L. 3510, #1
Vermilion Blk. 8
- 24. Ocean Drlg. (SN93061)
S. L. 3844, #1
Vermilion Blk. 8
- 25. Exchange Oil (SN 141332)
S. L. 5902, #1
Vermilion Blk. 13
- 26. Amoco (SN 139360)
S. L. 861, #7
Vermilion Blk. 14
- 27. Pan Am (SN 108990)
S. L. 862, #5
Vermilion Blk. 15