CASE 6470: PHILLIPS PETROLEUM COMPANY FOR APPROVAL OF INFILL DRILLING, LEA COUNTY, NEW MEXICO

CASE NO.

6470

APPLICATION,

TRANSCRIPTS,

SMALL EXHIBITS,

ETC.

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:

CASE NO. 6470
Order No. R-5971

APPLICATION OF PHILLIPS PETROLEUM COMPANY FOR WELLHEAD PRICE CEILING CATEGORY DETERMINATION, LEA COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This matter came on for hearing at 9 a.m. on February 28, 1979, at Santa Fe, New Mexico, before Examiner Richard L. Stamets.

NOW, on this 9th day of April, 1979, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Division has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Phillips Petroleum Company, seeks a determination pursuant to the Federal Energy Regulatory Commission Regulations, Section 271.305(b), that ten specific wells proposed to be drilled in applicant's East Vacuum Grayburg-San Andres Unit Area on existing proration units in the Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, are necessary to effectively and efficiently drain a portion of the reservoir covered by each of the proration units which cannot be effectively and efficiently drained by any existing well within that proration unit.

(3) That the applicant, Phillips Petroleum Company, further seeks a unit-wide determination pursuant to the Federal Energy Regulatory Commission Regulations, Section 271.305(b), that each subsequent infill well, in addition to the original ten wells, is necessary to effectively and efficiently drain oil and gas reserves from a portion of the reservoir covered by the proration

unit involved which cannot be effectively and efficiently drained by any existing well within the proration unit.

(4) That the standard spacing unit in the Vacuum Grayburg-San Andres Pool is 40 acres and the applicant proposes to infill drill a substantial part or all of said Unit Area on 20-acre spacing.

(5) That the Division, after notice and hearing of the evidence presented in Case No. 6366, previously entered its Order No. R-5871 on November 27, 1978, approving applicant's East Vacuum Grayburg-San Andres Unit Agreement for the development and operation of a portion of the Vacuum Grayburg-San Andres Pool, finding that the unitized management, operation and further development of that portion of said pool, as proposed, is necessary in order to carry out secondary recovery operations and to substantially increase ultimate recovery of oil and associated gas from the pool, and that the proposed method of operation will prevent waste and result in increased recovery of substantially more oil and associated gas from the pool than would otherwise be recovered as a result of the unit operations.

(6) That the Division, after notice and hearing of the evidence presented in Case No. 6367, entered its Order No. R-5897 on January 16, 1979, approving institution of a pressure maintenance project in the East Vacuum Grayburg-San Andres Unit, based on a finding that such pressure maintenance project will result in the production of hydrocarbons from tracts within the unit that would not otherwise be recovered, and said order also approved unorthodox well locations for the wells listed in Finding No. (7) below as exceptions to existing well spacing regulations.

(7) That at the hearing of the instant case on February 28, 1979, evidence was presented that established that the infill drilling in the East Vacuum Grayburg-San Andres Unit Area of the wells listed below is necessary to effectively and efficiently drain that portion of the reservoir covered by the proration unit upon which each respective well is located which cannot be effectively and efficiently drained by any existing well within the proration unit, and that such wells will recover natural gas and other hydrocarbons that will not otherwise be recovered by any other well within the East Vacuum Grayburg-San Andres Unit or within the proration unit involved. The subject wells are as follows:

Tract No.	Well No.	Location		Unit	Section
3229	005	1110'S	1290'W	M	32
2801	004	1310'S	1330'E	O	28
2801	002	1140'S	1310'W	M	28
3328	002	1310'S	1160'W	M	33
3202	003	1180'N	1480'E	B	32
2739	005	1330'S	1360'W	K	27
3456	005	1030'N	1410'W	C	34
3333	004	1380'N	1280'E	H	33
3308	003	1150'N	1510'W	C	33
3202	001	1330'S	1310'E	I	32

all in Township 17 South, Range 35 East, NMPM, Lea County, New Mexico.

(8) That the evidence presented demonstrated that the drilling and completion of the above ten infill wells and approximately 102 subsequent infill wells should result in the production of an additional 4.054 billion cubic feet of gas from the proration units involved, which gas would not otherwise be recovered from the proration units.

(9) That each of the above ten infill wells and each of the subsequent infill wells to be drilled in the East Vacuum Grayburg-San Andres Unit Area is necessary to effectively and efficiently drain a portion of the reservoir covered by the proration unit on which such well is located which cannot be effectively and efficiently drained by any existing well within the proration unit.

(10) That in order to permit the drainage of a portion of the reservoir underlying the proration units on which the ten infill wells described in Finding No. (7) above, and the subsequent infill wells described in Finding No. (8) above, are located and which cannot be efficiently and effectively drained by any existing well thereon, the previously approved infill drilling authority should be ratified as an exception to the standard well spacing requirements for said Vacuum Grayburg-San Andres Pool.

IT IS THEREFORE ORDERED:

(1) That the authorization of Phillips Petroleum Company to drill its infill wells as listed in Finding No. (7) of this order, the unorthodox locations of which have heretofore been approved by Division Order No. R-5897, be and the same hereby is ratified and confirmed. The ratification and affirmation of the infill drilling by this Order is an exception to applicable

well spacing requirements and is necessary to permit the drainage of a portion of the reservoir covered by the existing proration units underlying each of the subject wells which cannot effectively and efficiently be drained by any existing wells on such proration units.

(2) That each of the above infill wells and each additional infill well approved by the Division or by the Division Director as provided for by Division Order No. R-5897 shall be an exception to applicable well spacing requirements and is necessary to permit the drainage of a portion of the reservoir covered by the existing proration unit underlying each of such wells which cannot effectively and efficiently be drained by any existing wells on such proration units.

(3) That jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

JOE D. RAMEY
Director

fd/

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

JERRY APODACA
GOVERNOR

NICK FRANKLIN
SECRETARY

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501
(505) 827-2434

April 9, 1979

Re: CASE NO. 6470
ORDER NO. R-5971

Mr. Tom Kellahin
Kellahin & Kellahin
Attorneys at Law
Post Office Box 1769
Santa Fe, New Mexico

Applicant:

Phillips Petroleum Company

Dear Sir:

Enclosed herewith are two copies of the above-referenced Division order recently entered in the subject case.

Yours very truly,

JOE D. RAMEY
Director

JDR/fd

Copy of order also sent to:

Hobbs OCC x
Artesia OCC x
Aztec OCC

Other

Received
3-27-79
RLS

PHILLIPS PETROLEUM COMPANY

EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

EXHIBIT NO. 4-A, CASE NO. 6470

1. The following is a tabulation of the volumes and percentages of the original oil-in-place calculations from the Engineering-Geological Committee Report, November, 1977 (Exhibit No. 4, Case No. 6470). Specific references to the report are shown in parenthesis.

   a. Original oil-in-place = 296,986,842 barrels. (p.10 & Table I, p.4)

   b. Ultimate primary oil reserves = 78,000,000 barrels. (p.10 & Table I, p.4)

   c. Secondary oil reserves:

      40-acre spacing = 29,000,000 barrels. (p.3)

      Percent of original oil-in-place = 9.8 percent.

      20-acre spacing = 40,794,740 barrels. (Table I, p.4)

      Percent of original oil-in-place = 13.7 percent.

   d. Increase in recovery of original oil-in-place due to infill drilling:

      20-acre: Percent of original oil-in-place = 13.7 percent
      less 40-acre: Percent of original oil-in-place = -9.8 percent
      Due to infill drilling 3.9 percent (p.11)

   e. Volume of additional oil reserves due to infill drilling:

      296,986,842 x .039 = 11,582,487 barrels.

      Rounded off to 11,582,000 barrels. (Exhibit No. 7, Case No. 6470)

   Note: The slight differences in volumes are the result of calculating the estimated secondary reserves for individual 40-acre proration units (p.12), rounding off the results and summating for the unit totals.

2. Increased gas reserves associated with the additional oil to be recovered by the infill drilling were determined as follows:

   Under reservoir conditions, gas is dissolved in the oil. The amount of gas dissolved in the oil is a function of the reservoir pressure. Attachment No. I is a graphic presentation of the laboratory determined pressure-volume relationships for the Grayburg-San Andres reservoir, Vacuum Field. (Note: This same graph is Exhibit "B" to Order No. R-5897, Pressure Maintenance Project Order for the East Vacuum Grayburg-San Andres Unit which is Exhibit No. 3 to subject Case No. 6470.) The gas solubility curve is shown in red.

The volume of increased gas reserves associated with the additional oil to be recovered by the infill drilling is based on an average reservoir pressure of 700 psi. The solution gas-oil ratio at 700 psig is 350 standard cubic feet per stock tank barrel of oil, as shown in green on Attachment No. I.

The gas volume is calculated:

11,582,000 barrels oil x 350 cu.ft. per barrel = 4,053,700,000 cu.ft.

Rounded off to 4.054 billion cubic feet. (Exhibit No. 7, Case No. 6470)

3. The following is a discussion of the methods used and the results obtained for confirmation of the estimated 3.9 percent increase in recovery of original oil-in-place for the subject unit due to infill drilling on 20-acre spacing.

The Shell Oil Company operated Denver Unit, Wasson San Andres Field, is geologically similar to the East Vacuum Grayburg-San Andres Unit. (Refer to p.11 and Table III of Exhibit No. 4, Case No. 6470.) Shell is a working interest owner in the East Vacuum Grayburg-San Andres Unit and was a member of the Engineering-Geological Committee.

The committee credited infill drilling with 3.9 percent increased recovery of the original oil-in-place based on geological and engineering studies by Shell (p.11). Subsequent experience from infill drilling by Shell and other operators has confirmed that increased recovery of original oil-in-place on the order of four percent is a realistic minimum value for reservoirs of this type.

a. Encountering discontinuous intervals of porosity.

To determine the continuity present in the East Vacuum Grayburg-San Andres reservoir, the correlations and amount of net feet of porosity were analyzed by individual zones. The wells and zones used in this study are those shown on Exhibit No. 11, Case No. 6470, and on the detailed cross-sections, Exhibits Nos. 14, 15, and 16, Case No. 6470.

The percent of continuous pay was calculated between wells and plotted as a function of horizontal distance between wells. Attachment No. II defines continuous pay and includes an example calculation.

The data were plotted on the same graph with the Shell Denver Unit, Wasson San Andres curve of percent continuous pay, Attachment No. III. The percent deviation from Shell's curve (blue) to each East Vacuum Grayburg-San Andres data point was calculated. The average deviation of 15.3 percent was plotted at the average horizontal distance between wells of 3,323 feet and a line drawn to 100 percent continuous pay at zero distance. This line becomes the percent continuous pay for the East Vacuum Grayburg-San Andres Unit (red line).

Attachment No. IV is an expanded scale of this percent continuous pay line. The percent continuous pay at 1,320 feet (minimum distance between wells on 40-acre spacing) is 91.6 percent and at 933 feet (minimum distance between wells on 20-acre spacing) is 94.1 percent. The increase in percent continuous pay of 2.5 percent is the amount of additional recovery of the original oil-in-place as a result of encountering discontinuous intervals of porosity by infill drilling on 20-acre spacing.

b. Improving recovery efficiency.

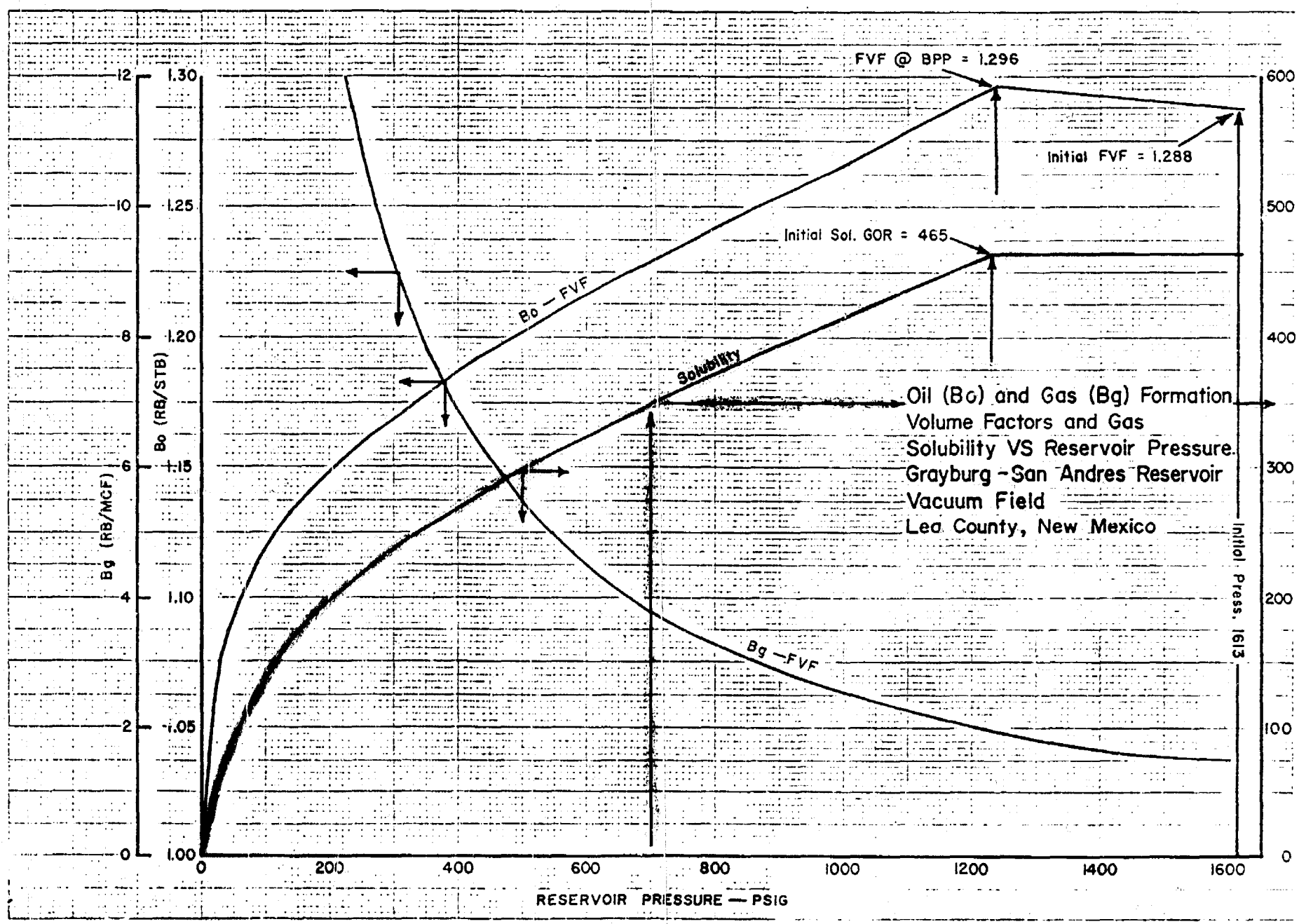
Utilizing the same wells and individual zones as in the analysis of continuous pay, the recovery efficiency between wells was calculated and analyzed. The recovery efficiencies are expressed as a percent and plotted as a function of horizontal distance between wells. Attachment No. V defines recovery efficiency and includes an example calculation.

Attachment No. VI is a plot of the recovery efficiency with minimum and maximum curves shown. Attachment No. VII is an expanded scale of the two curves. The minimum increase in recovery efficiency due to infill drilling on 20-acre spacing is 3.75 percent (87.25 percent for 20 acres less 83.50 percent for 40 acres). The maximum increase could be as much as 10.9 percent (62.15 percent for 20 acres less 51.25 percent for 40 acres).

As discussed in the testimony associated with Exhibit No. 17, Case No. 6470, the increase in recovery efficiency is applicable to both primary and secondary reserves. The Engineering-Geological Committee concluded that a total of 40 percent recovery of the original oil-in-place could be obtained for this type of reservoir, including primary and secondary with infill drilling (p.11). Of this 40 percent, 2.5 percent is gained from encountering discontinuous pay. (Discussed above.) The increase in recovery efficiency is applicable to the remaining 37.5 percent. This results in an increase in total recovery efficiency due to infill drilling of 1.4 percent, minimum. (37.5 percent x .0375) The maximum could be as much as 4.1 percent (37.5 percent x .109).

4. The total increase due to infill drilling, as stated in Exhibit No. 7, Case No. 6470, is 3.9 percent of the original oil-in-place. Of this total, 2.5 percent comes from encountering discontinuous intervals of porosity and 1.4 percent from the improvement in recovery efficiency.

K•E 10 X 10 TO INCH 7 X 10 INCHES
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ATTACHMENT NO. 1

EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

PERCENT CONTINUOUS PAY

Percent continuous pay between two wells is the ratio of effective porous rock volume to the total porous rock volume. This relationship, expressed mathematically, is:

$$\text{Percent continuous pay (between two wells)} = \frac{\Sigma\, h \text{ avg. connected}}{\Sigma\, h \text{ avg. total}} \times 100$$

where "Σ h avg. connected" is the summation of the individual zones average net thickness of the zones connected between wells and "Σ h avg. total" is the summation of the individual zones average net thickness of total zones in either well.

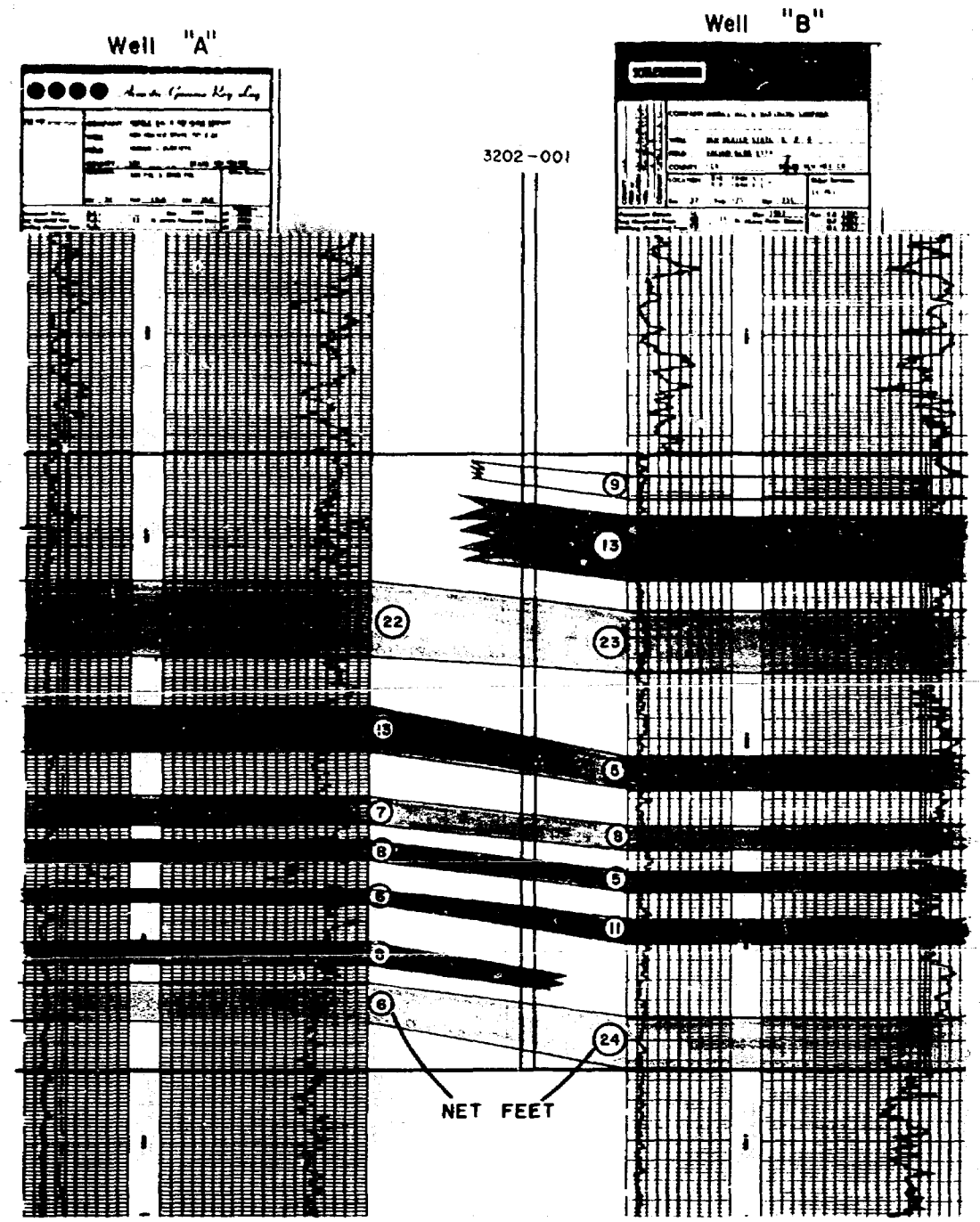
Example Calculation--Percent continuous pay between Wells "A" and "B".

Well "A" is Exxon's New Mexico State "K" No. 20 and Well "B" is Exxon's New Mexico State "K" No. 18. (See Cross-section B-B', Exhibit No. 15, Case No. 6470.) Horizontal distance between Wells "A" and "B" = 2,400 feet. Refer to Attachment No. II-A for specific cross-section of these two wells with net feet shown.

Zone	Well "A" Net Feet	Well "B" Net Feet	h Avg. Connected	h Avg. Total
Yellow	0	9	0	4.5
Green	0	13	0	6.5
Orange	22	23	22.5	22.5
Light Blue	13	5	9.0	9.0
Red	7	8	7.5	7.5
Brown	8	5	6.5	6.5
Purple	6	11	8.5	8.5
Dark Blue	8	0	0	4.0
Gray	6	24	15.0	15.0
Summation			69.0	84.0

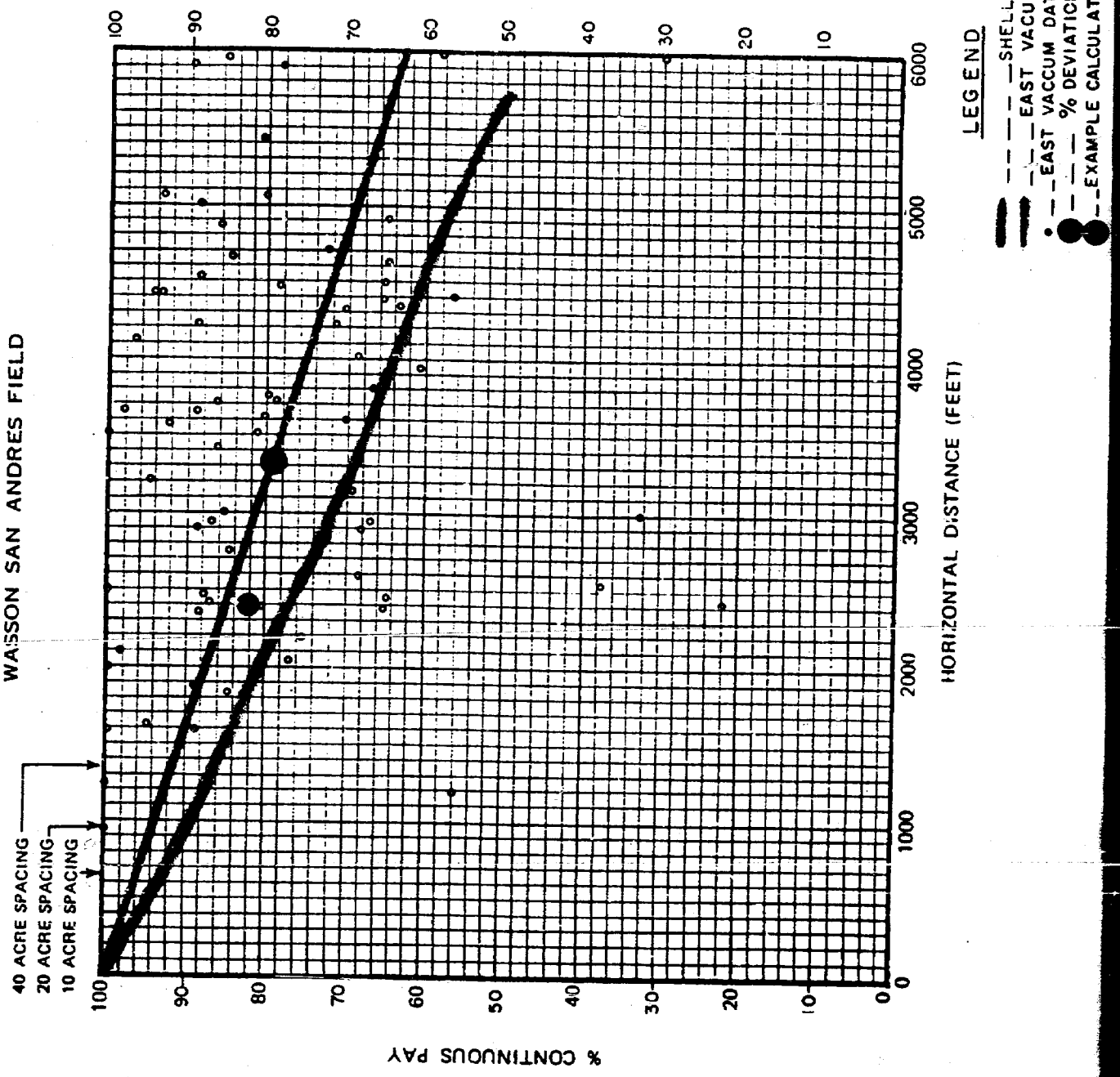
Percent continuous pay = $\frac{69}{84} \times 100 = 82.1$ percent. (Plotted in green, Attachment No. III.)

EAST VACUUM GRAYBURG - SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO



ATTACHMENT NO. III

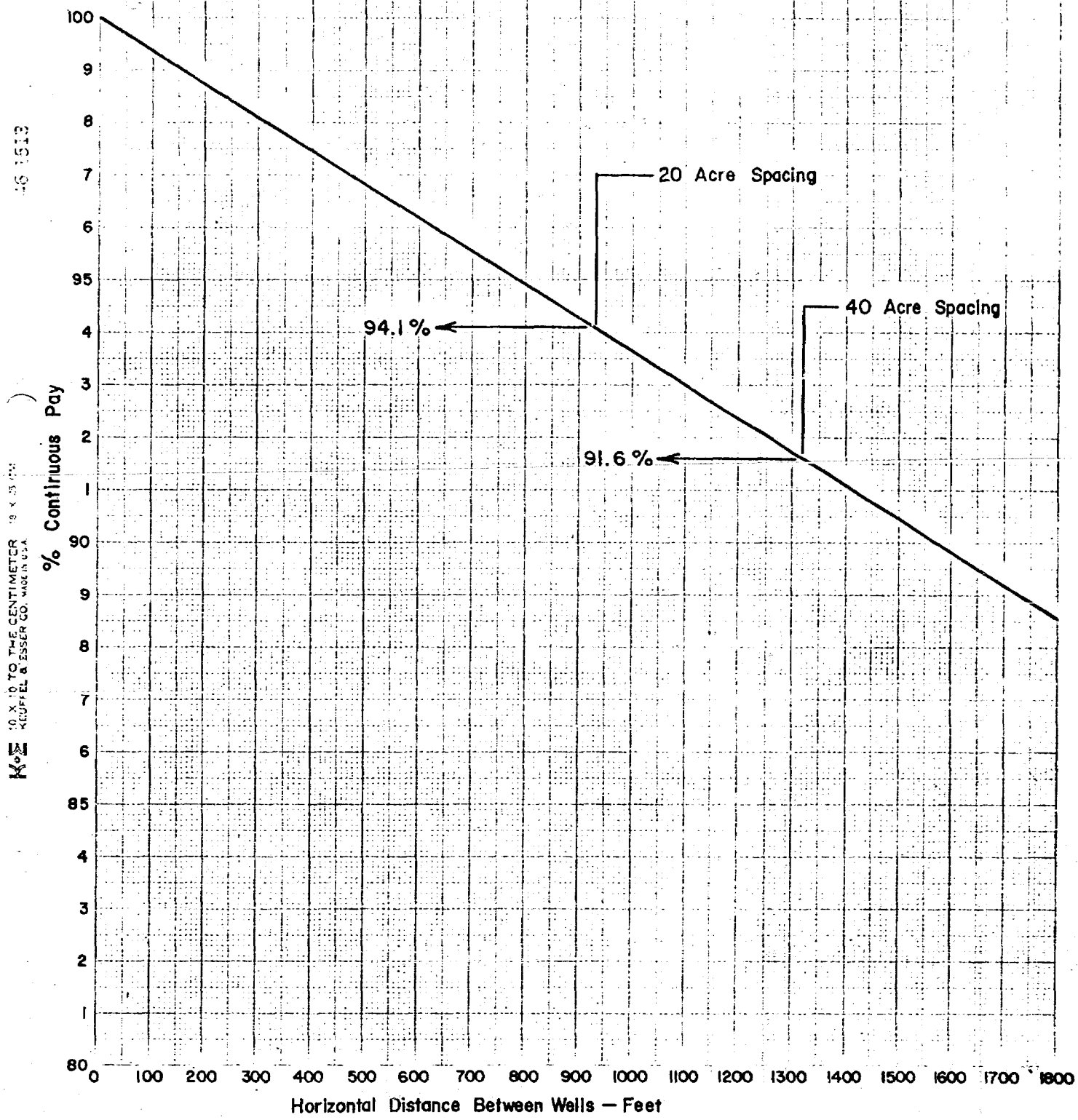
EAST VACUUM GRAYBURG - SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO
% CONTINUOUS PAY VS HORIZONTAL DISTANCE



PAY CONTINUITY OVER DISTANCE

WASSON SAN ANDRES FIELD

EAST VACUUM GRAYBURG - SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO
% CONTINUOUS PAY VS HORIZONTAL DISTANCE



-6 1513

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EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

RECOVERY EFFICIENCY

Recovery efficiency between wells is the relationship of the net feet of porosity present in individual zones and shows the effect of differences in the net feet between wells. This illustrates the degree of heterogeneity present within this particular reservoir.

Expressed mathematically as:

$$\text{Percent recovery efficiency} = \left(1 - \frac{\Sigma \Delta h}{\Sigma h \text{ max.}}\right) 100$$

where "$\Sigma \Delta h$" is the summation of the difference in net feet of individual zones and "Σh max." is the summation of the maximum net feet of individual zones in either well.

Example Calculation--Percent recovery efficiency between Wells "A" and "B".

Wells "A" and "B" and the net feet of each zone are the same as the example of percent continuous pay as shown on Attachment No. II-A.

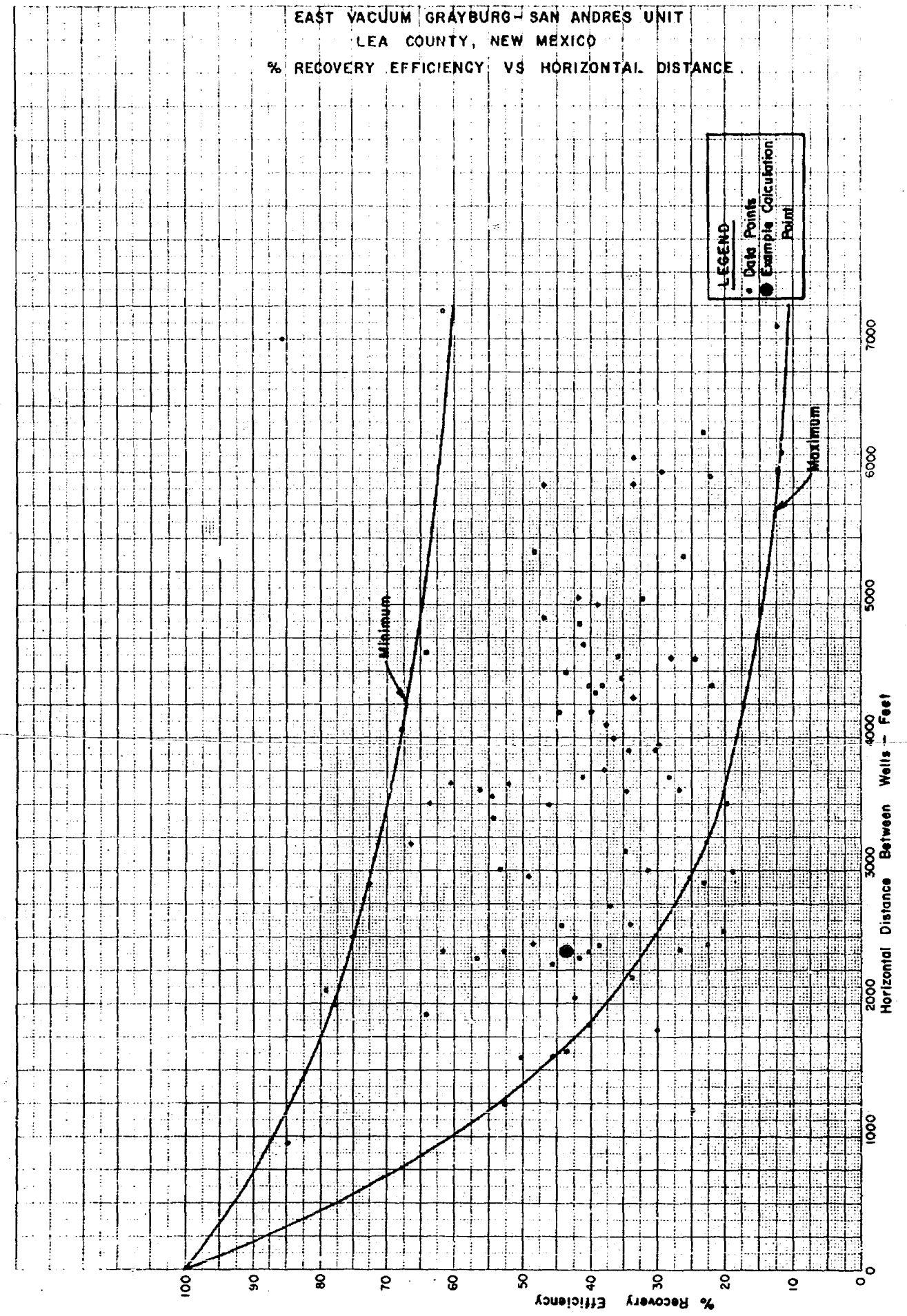
Zone	Well "A" Net Feet	Well "B" Net Feet	Δh	h max.
Yellow	0	9	9	9
Green	0	13	13	13
Orange	22	23	1	23
Light Blue	13	5	8	13
Red	7	8	1	8
Brown	8	5	3	8
Purple	6	11	5	11
Dark Blue	8	0	8	8
Gray	6	24	18	24
Summation			66	117

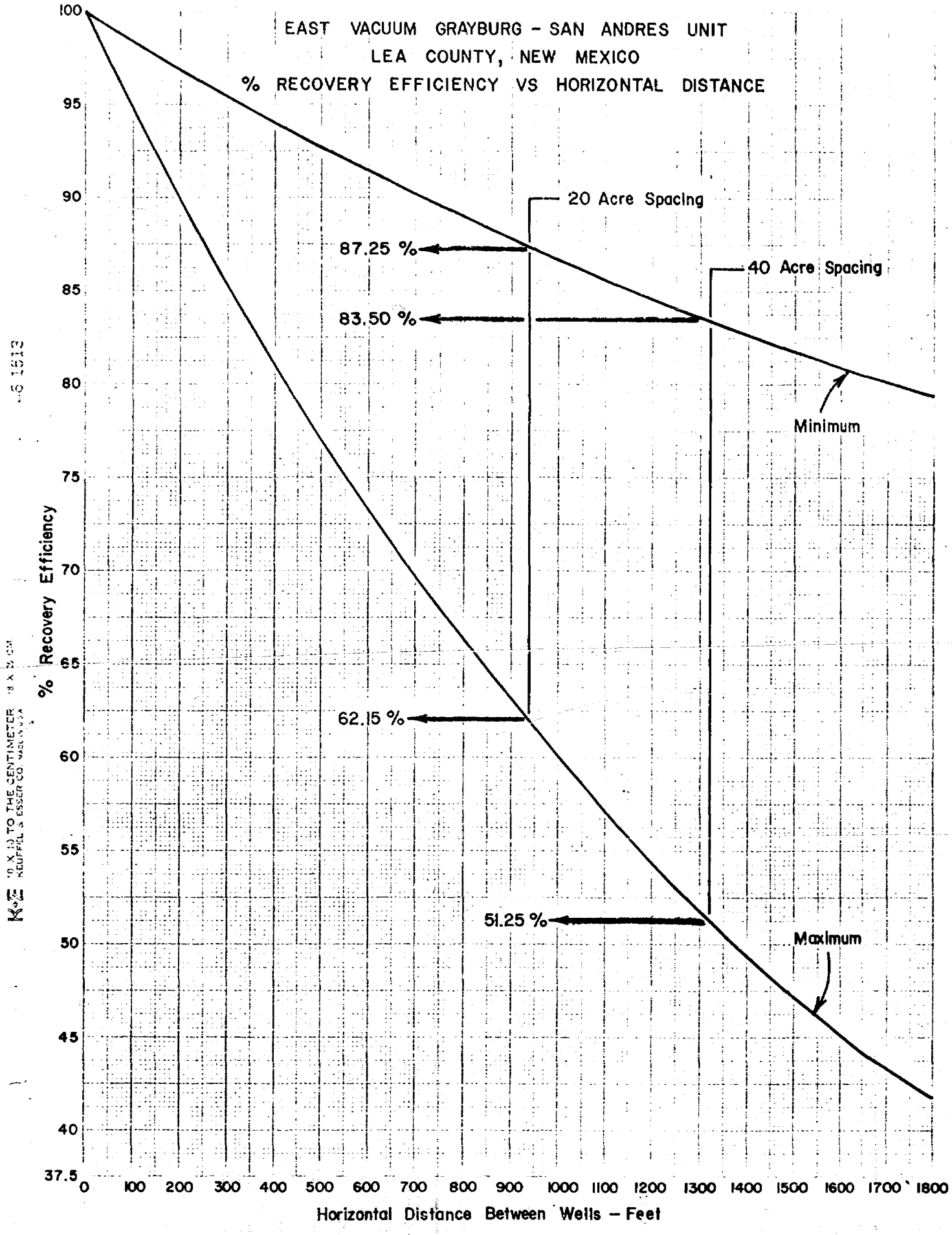
$$\text{Percent recovery efficiency} = \left(1 - \frac{66}{117}\right) 100$$

$$= (1 - .564)\ 100$$

= 43.6 percent. (Plotted in green, Attachment No. VI.)

EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO
% RECOVERY EFFICIENCY VS HORIZONTAL DISTANCE.




EAST VACUUM GRAYBURG - SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO
% RECOVERY EFFICIENCY VS HORIZONTAL DISTANCE
20 Acre Spacing
40 Acre Spacing
87.25 %
83.50 %
62.15 %
51.25 %
Minimum
Maximum
% Recovery Efficiency
Horizontal Distance Between Wells – Feet
100
95
90
85
80
75
70
65
60
55
50
45
40
37.5
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800

REFERENCES

1. "Application of Phillips Petroleum Company for Approval of Infill Drilling," Examiner hearing testimony before New Mexico Oil Conservation Division presented by Phillips Petroleum Company, February 28, 1979, Case No. 6470.

2. Driscoll, Vance J.: "Recovery Optimization Through Infill Drilling Concepts, Analysis and Field Results," paper SPE 4977 presented at the SPE-AIME 49th Annual Fall Meeting, Houston, Texas, October 6-9, 1974.

3. George, C. J., and Stiles, L. H.: "Improved Techniques for Evaluating Carbonate Waterfloods in West Texas," Journal of Petroleum Technology (November, 1978) 1547-1554.

4. Ghauri, W. K., Osborne, A. F., and Magnuson, W. L.: "Changing Concepts in Carbonate Waterflooding, West Texas Denver Unit Project--An Illustrative Example," Journal of Petroleum Technology (June, 1974) 595-606.

5. Stiles, L. H.: "Optimizing Waterflood Recovery in a Mature Waterflood, the Fullerton Clearfork Unit," paper SPE 6198 presented at the SPE-AIME 51st Annual Fall Technical Conference and Exhibition, New Orleans, Louisiana, October 3-6, 1976.

6. "Application for Waterflood Response Allowable for Wasson Denver Unit," hearing testimony before Texas Railroad Commission presented by Shell Oil Company, March 21, 1972, Docket 8-A-61677.

PHILLIPS PETROLEUM COMPANY

EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

EXHIBIT NO. 4-A, CASE NO. 6470

1. The following is a tabulation of the volumes and percentages of the original oil-in-place calculations from the Engineering-Geological Committee Report, November, 1977 (Exhibit No. 4, Case No. 6470). Specific references to the report are shown in parenthesis.

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   b. Ultimate primary oil reserves = 78,000,000 barrels. (p.10 & Table I, p.4)

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      40-acre spacing = 29,000,000 barrels. (p.3)

      Percent of original oil-in-place = 9.8 percent.

      20-acre spacing = 40,794,740 barrels. (Table I, p.4)

      Percent of original oil-in-place = 13.7 percent.

   d. Increase in recovery of original oil-in-place due to infill drilling:

      20-acre: Percent of original oil-in-place = 13.7 percent
      less 40-acre: Percent of original oil-in-place = -9.8 percent

      Due to infill drilling 3.9 percent (p.11)

   e. Volume of additional oil reserves due to infill drilling:

      296,986,842 x .039 = 11,582,487 barrels.

      Rounded off to 11,582,000 barrels. (Exhibit No. 7, Case No. 6470)

   Note: The slight differences in volumes are the result of calculating the estimated secondary reserves for individual 40-acre proration units (p.12), rounding off the results and summating for the unit totals.

2. Increased gas reserves associated with the additional oil to be recovered by the infill drilling were determined as follows:

   Under reservoir conditions, gas is dissolved in the oil. The amount of gas dissolved in the oil is a function of the reservoir pressure. Attachment No. I is a graphic presentation of the laboratory determined pressure-volume relationships for the Grayburg-San Andres reservoir, Vacuum Field. (Note: This same graph is Exhibit "B" to Order No. R-5897, Pressure Maintenance Project Order for the East Vacuum Grayburg-San Andres Unit which is Exhibit No. 3 to subject Case No. 6470.) The gas solubility curve is shown in red.

The volume of increased gas reserves associated with the additional oil to be recovered by the infill drilling is based on an average reservoir pressure of 700 psi. The solution gas-oil ratio at 700 psig is 350 standard cubic feet per stock tank barrel of oil, as shown in green on Attachment No. I.

The gas volume is calculated:

11,582,000 barrels oil x 350 cu.ft. per barrel = 4,053,700,000 cu.ft.

Rounded off to 4.054 billion cubic feet. (Exhibit No. 7, Case No. 6470)

3. The following is a discussion of the methods used and the results obtained for confirmation of the estimated 3.9 percent increase in recovery of original oil-in-place for the subject unit due to infill drilling on 20-acre spacing.

The Shell Oil Company operated Denver Unit, Wasson San Andres Field, is geologically similar to the East Vacuum Grayburg-San Andres Unit. (Refer to p.11 and Table III of Exhibit No. 4, Case No. 6470.) Shell is a working interest owner in the East Vacuum Grayburg-San Andres Unit and was a member of the Engineering-Geological Committee.

The committee credited infill drilling with 3.9 percent increased recovery of the original oil-in-place based on geological and engineering studies by Shell (p.11). Subsequent experience from infill drilling by Shell and other operators has confirmed that increased recovery of original oil-in-place on the order of four percent is a realistic minimum value for reservoirs of this type.

a. Encountering discontinuous intervals of porosity.

To determine the continuity present in the East Vacuum Grayburg-San Andres reservoir, the correlations and amount of net feet of porosity were analyzed by individual zones. The wells and zones used in this study are those shown on Exhibit No. 11, Case No. 6470, and on the detailed cross-sections, Exhibits Nos. 14, 15, and 16, Case No. 6470.

The percent of continuous pay was calculated between wells and plotted as a function of horizontal distance between wells. Attachment No. II defines continuous pay and includes an example calculation.

The data were plotted on the same graph with the Shell Denver Unit, Wasson San Andres curve of percent continuous pay, Attachment No. III. The percent deviation from Shell's curve (blue) to each East Vacuum Grayburg-San Andres data point was calculated. The average deviation of 15.3 percent was plotted at the average horizontal distance between wells of 3,323 feet and a line drawn to 100 percent continuous pay at zero distance. This line becomes the percent continuous pay for the East Vacuum Grayburg-San Andres Unit (red line).

Attachment No. IV is an expanded scale of this percent continuous pay line. The percent continuous pay at 1,320 feet (minimum distance between wells on 40-acre spacing) is 91.6 percent and at 933 feet (minimum distance between wells on 20-acre spacing) is 94.1 percent. The increase in percent continuous pay of 2.5 percent is the amount of additional recovery of the original oil-in-place as a result of encountering discontinuous intervals of porosity by infill drilling on 20-acre spacing.

b. Improving recovery efficiency.

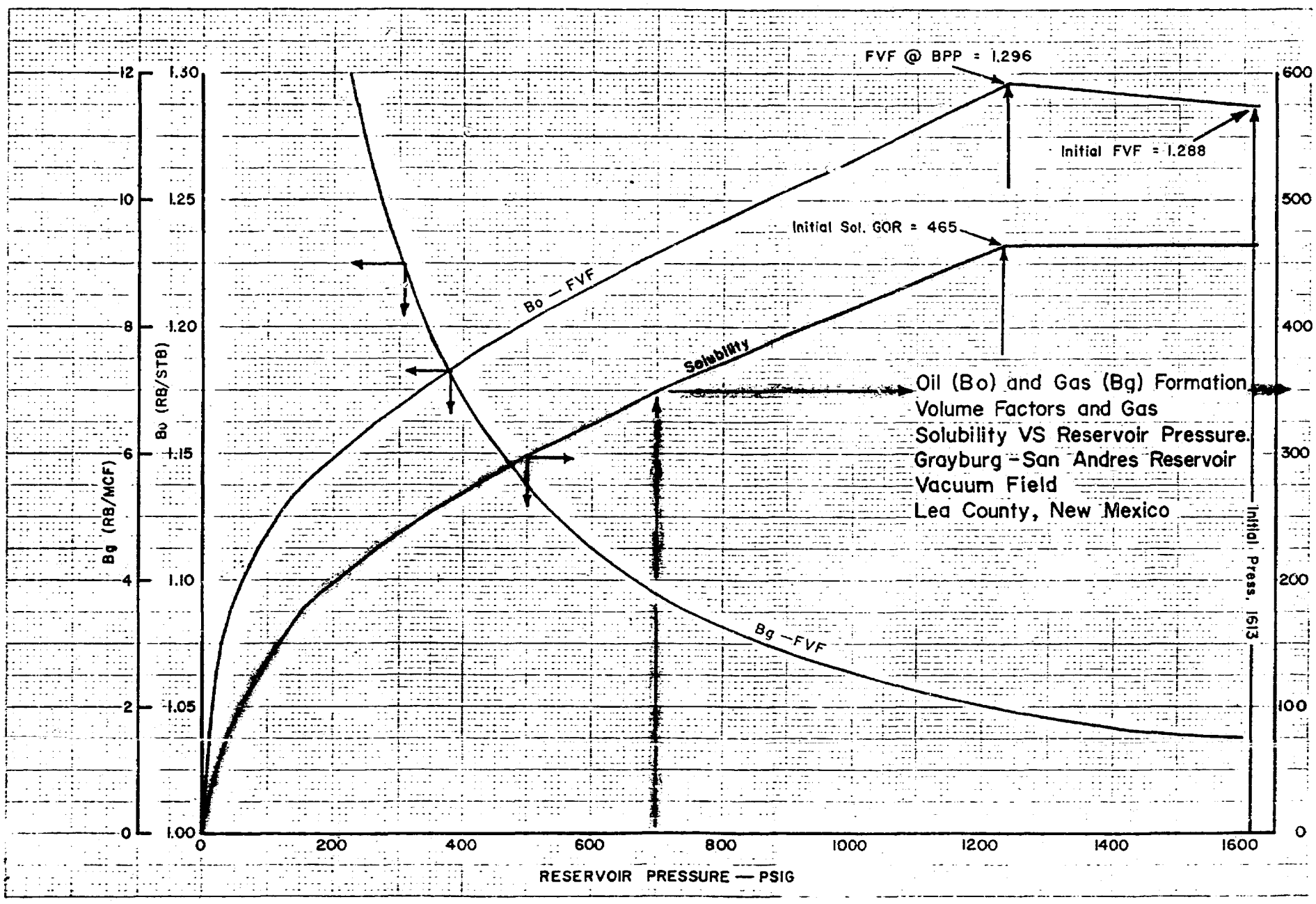
Utilizing the same wells and individual zones as in the analysis of continuous pay, the recovery efficiency between wells was calculated and analyzed. The recovery efficiencies are expressed as a percent and plotted as a function of horizontal distance between wells. Attachment No. V defines recovery efficiency and includes an example calculation.

Attachment No. VI is a plot of the recovery efficiency with minimum and maximum curves shown. Attachment No. VII is an expanded scale of the two curves. The minimum increase in recovery efficiency due to infill drilling on 20-acre spacing is 3.75 percent (87.25 percent for 20 acres less 83.50 percent for 40 acres). The maximum increase could be as much as 10.9 percent (62.15 percent for 20 acres less 51.25 percent for 40 acres).

As discussed in the testimony associated with Exhibit No. 17, Case No. 6470, the increase in recovery efficiency is applicable to both primary and secondary reserves. The Engineering-Geological Committee concluded that a total of 40 percent recovery of the original oil-in-place could be obtained for this type of reservoir, including primary and secondary with infill drilling (p.11). Of this 40 percent, 2.5 percent is gained from encountering discontinuous pay. (Discussed above.) The increase in recovery efficiency is applicable to the remaining 37.5 percent. This results in an increase in total recovery efficiency due to infill drilling of 1.4 percent, minimum. (37.5 percent x .0375) The maximum could be as much as 4.1 percent (37.5 percent x .109).

4. The total increase due to infill drilling, as stated in Exhibit No. 7, Case No. 6470, is 3.9 percent of the original oil-in-place. Of this total, 2.5 percent comes from encountering discontinuous intervals of porosity and 1.4 percent from the improvement in recovery efficiency.

K+E 10 X 10 TO ½ INCH 5 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



ATTACHMENT NO. I

EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

PERCENT CONTINUOUS PAY

Percent continuous pay between two wells is the ratio of effective porous rock volume to the total porous rock volume. This relationship, expressed mathematically, is:

$$\text{Percent continuous pay (between two wells)} = \frac{\Sigma\, h \text{ avg. connected}}{\Sigma\, h \text{ avg. total}} \times 100$$

where "Σ h avg. connected" is the summation of the individual zones average net thickness of the zones connected between wells and "Σ h avg. total" is the summation of the individual zones average net thickness of total zones in either well.

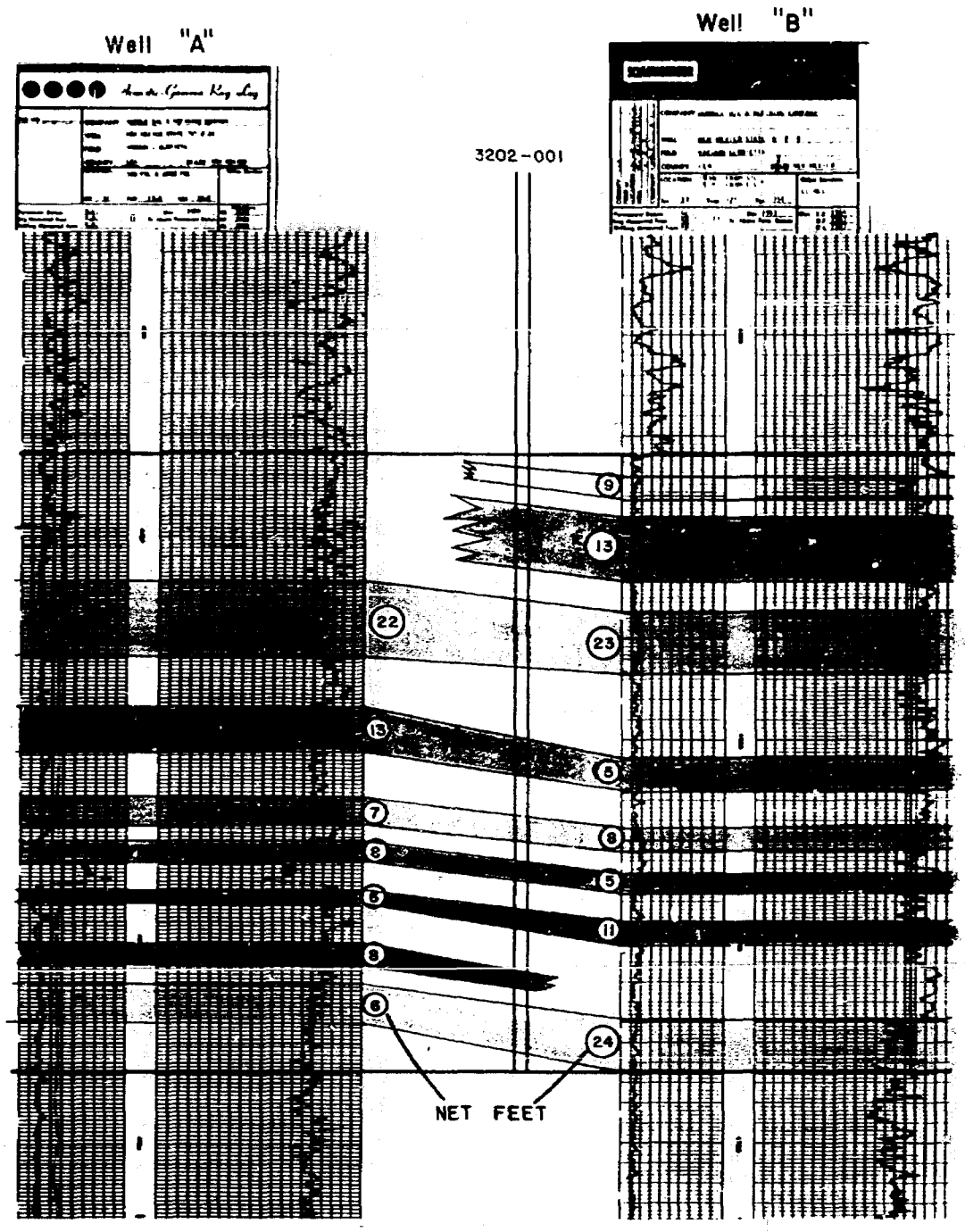
Example Calculation--Percent continuous pay between Wells "A" and "B".

Well "A" is Exxon's New Mexico State "K" No. 20 and Well "B" is Exxon's New Mexico State "K" No. 18. (See Cross-section B-B', Exhibit No. 15, Case No. 6470.) Horizontal distance between Wells "A" and "B" = 2,400 feet. Refer to Attachment No. II-A for specific cross-section of these two wells with net feet shown.

Zone	Well "A" Net Feet	Well "B" Net Feet	h Avg. Connected	h Avg. Total
Yellow	0	9	0	4.5
Green	0	13	0	6.5
Orange	22	23	22.5	22.5
Light Blue	13	5	9.0	9.0
Red	7	8	7.5	7.5
Brown	8	5	6.5	6.5
Purple	6	11	8.5	8.5
Dark Blue	8	0	0	4.0
Gray	6	24	15.0	15.0
Summation			69.0	84.0

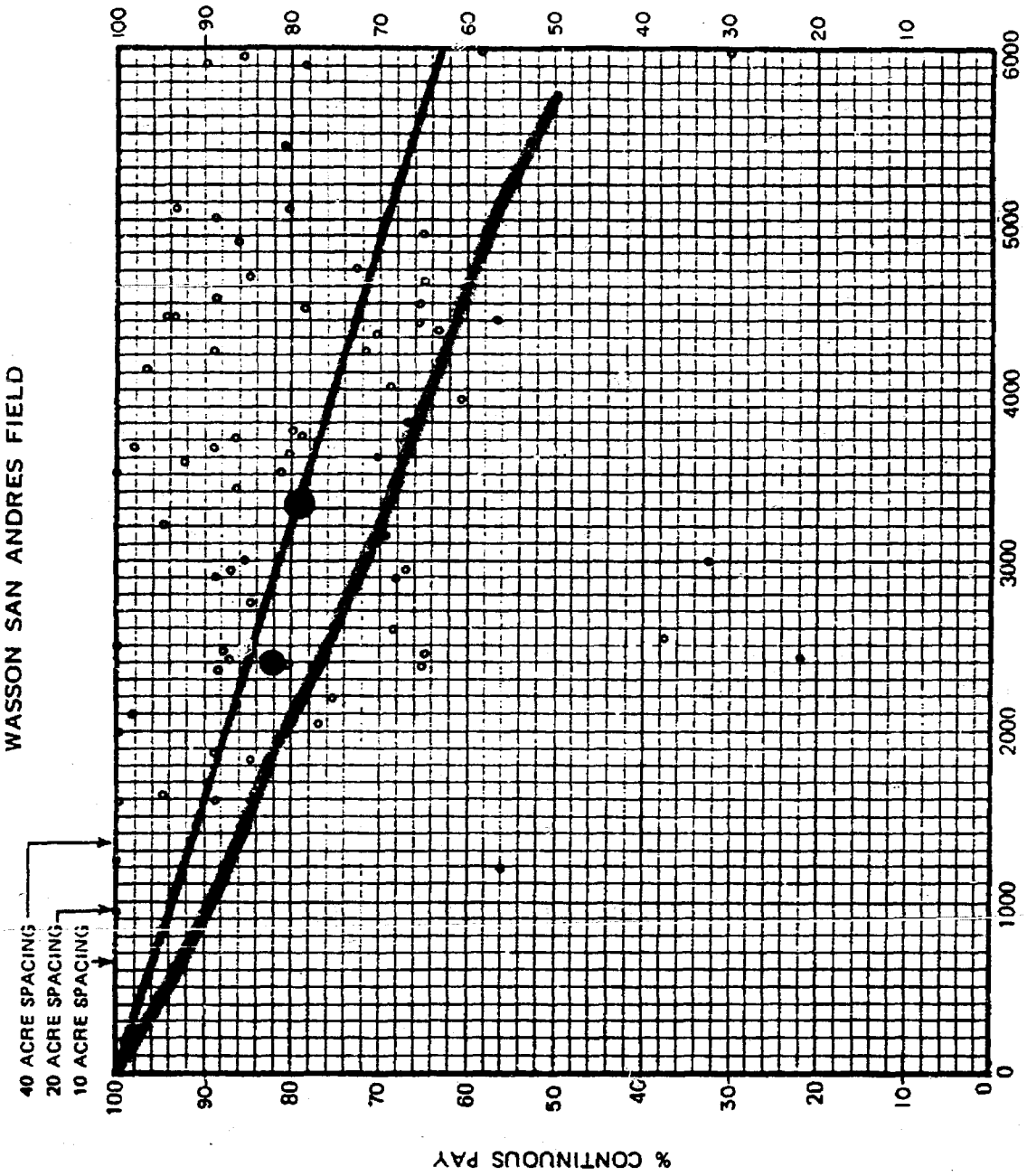
Percent continuous pay = $\frac{69}{84} \times 100 = 82.1$ percent. (Plotted in green, Attachment No. III.)

EAST VACUUM GRAYBURG - SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO



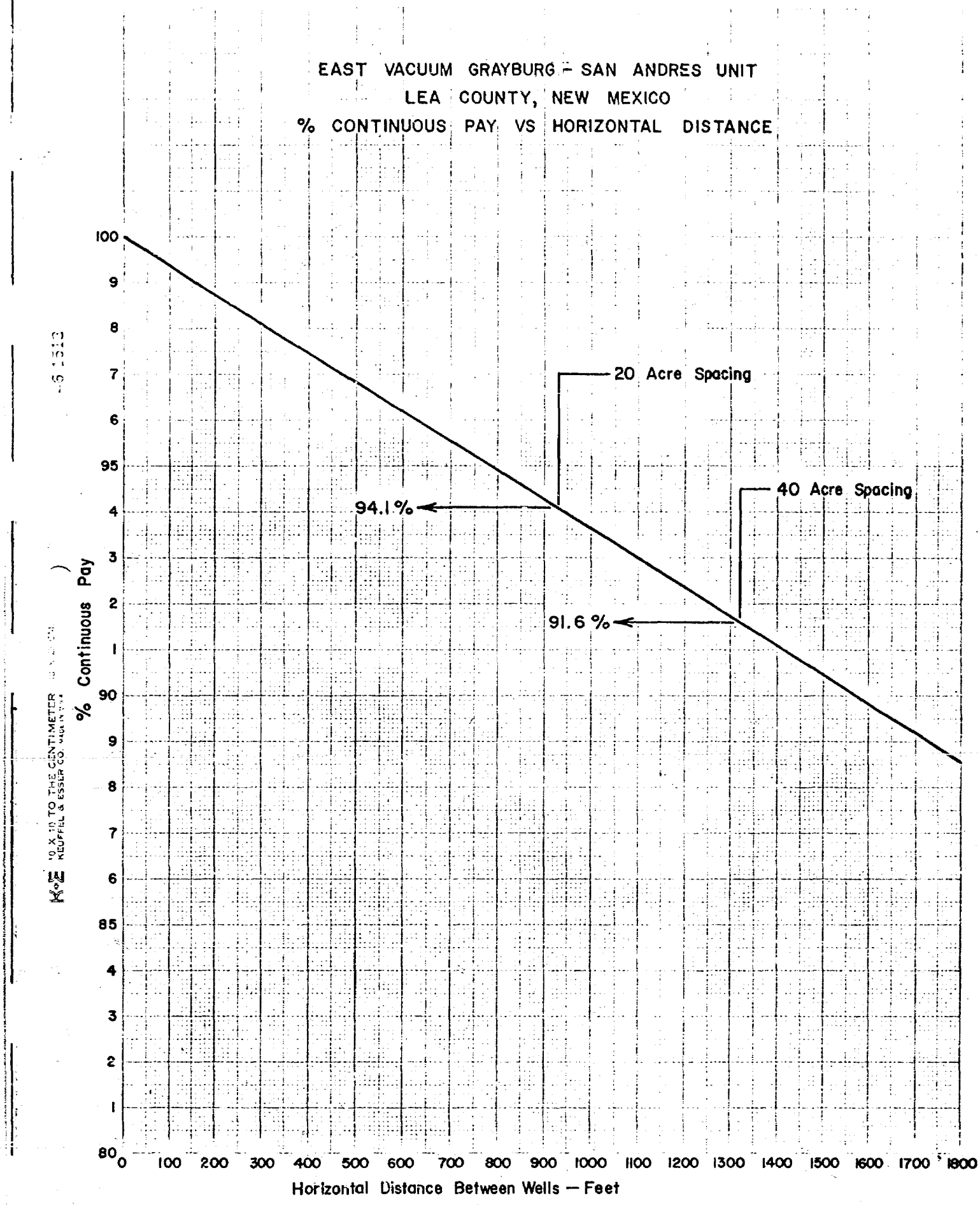
ATTACHMENT NO. III

EAST VACUUM GRAYBURG - SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO
% CONTINUOUS PAY VS HORIZONTAL DISTANCE



PAY CONTINUITY OVER DISTANCE

WASSON SAN ANDRES FIELD


EAST VACUUM GRAYBURG - SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO
% CONTINUOUS PAY VS HORIZONTAL DISTANCE
20 Acre Spacing
40 Acre Spacing
94.1%
91.6%
% Continuous Pay
100
9
8
7
6
95
4
3
2
1
90
9
8
7
6
85
4
3
2
1
80
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
Horizontal Distance Between Wells — Feet

EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

RECOVERY EFFICIENCY

Recovery efficiency between wells is the relationship of the net feet of porosity present in individual zones and shows the effect of differences in the net feet between wells. This illustrates the degree of heterogeneity present within this particular reservoir.

Expressed mathematically as:

$$\text{Percent recovery efficiency} = \left(1 - \frac{\Sigma \Delta h}{\Sigma h \text{ max.}}\right) 100$$

where "$\Sigma \Delta$ h" is the summation of the difference in net feet of individual zones and "Σh max." is the summation of the maximum net feet of individual zones in either well.

Example Calculation--Percent recovery efficiency between Wells "A" and "B".

Wells "A" and "B" and the net feet of each zone are the same as the example of percent continuous pay as shown on Attachment No. II-A.

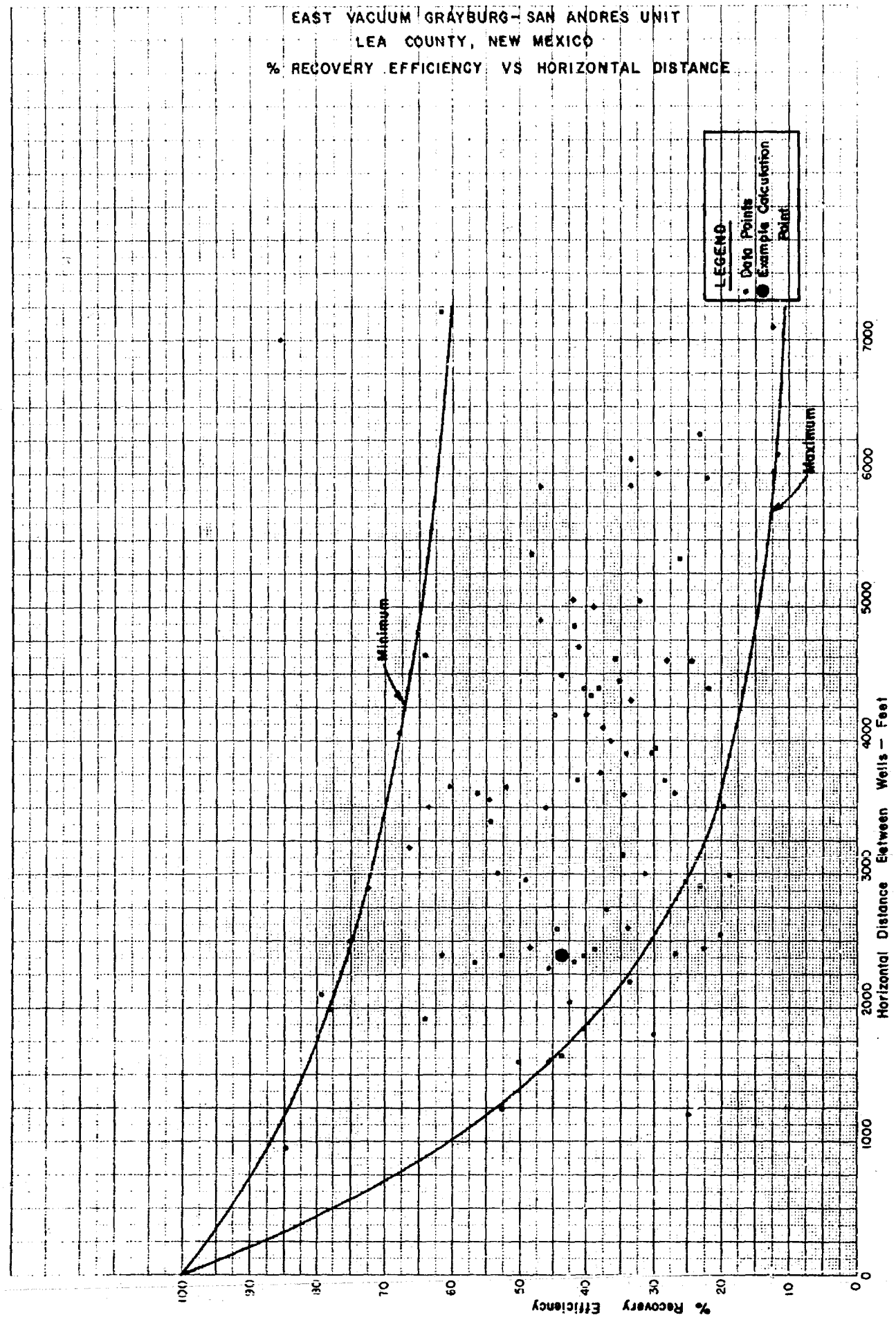
Zone	Well "A" Net Feet	Well "B" Net Feet	Δh	h max.
Yellow	0	9	9	9
Green	0	13	13	13
Orange	22	23	1	23
Light Blue	13	5	8	13
Red	7	8	1	8
Brown	8	5	3	8
Purple	6	11	5	11
Dark Blue	8	0	8	8
Gray	6	24	18	24
Summation			66	117

$$\text{Percent recovery efficiency} = \left(1 - \frac{66}{117}\right) 100$$

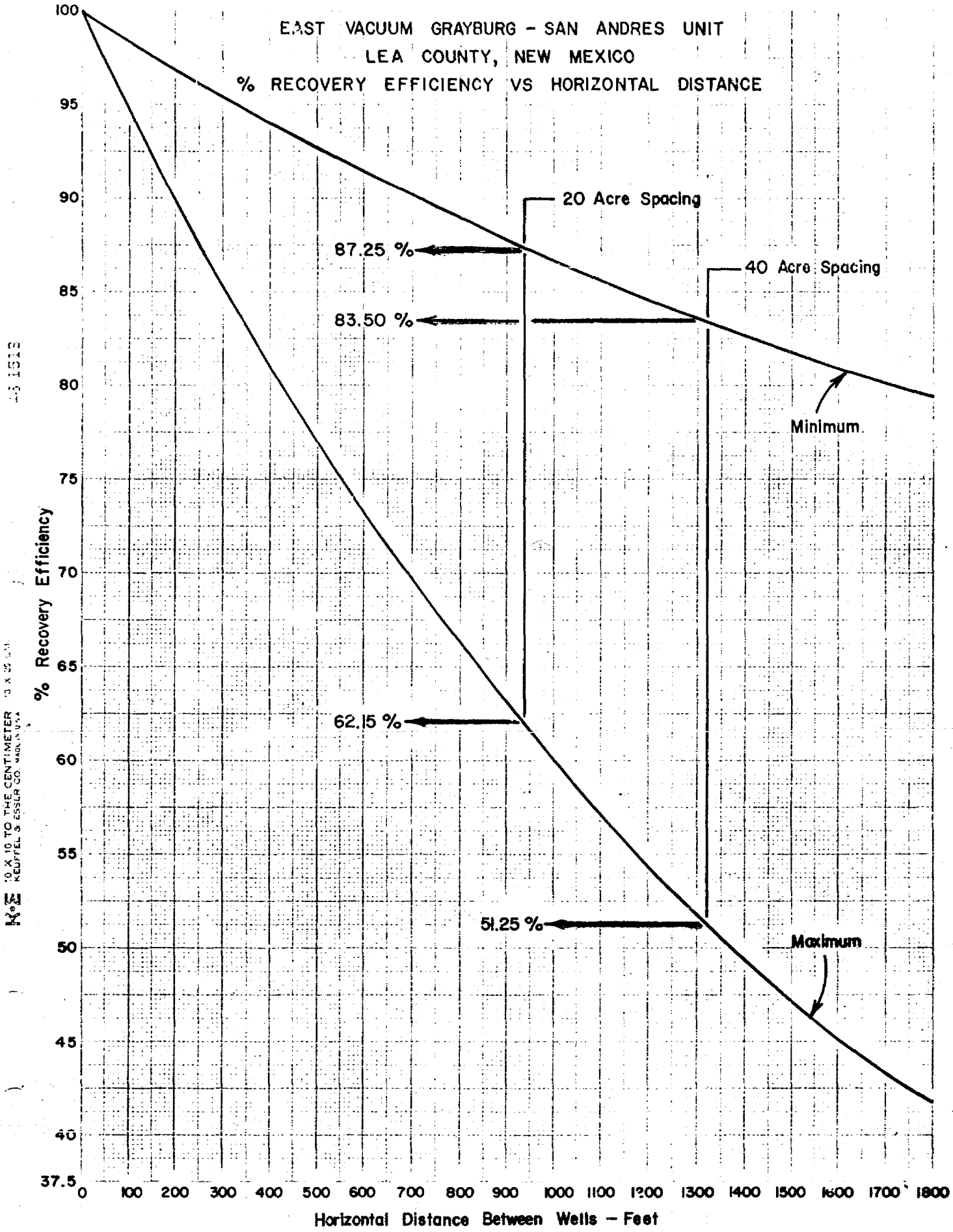
$$= (1 - .564)\ 100$$

= 43.6 percent. (Plotted in green, Attachment No. VI.)

EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO
% RECOVERY EFFICIENCY VS HORIZONTAL DISTANCE



ATTACHMENT NO. VII



REFERENCES

1. "Application of Phillips Petroleum Company for Approval of Infill Drilling," Examiner hearing testimony before New Mexico Oil Conservation Division presented by Phillips Petroleum Company, February 28, 1979, Case No. 6470.

2. Driscoll, Vance J.: "Recovery Optimization Through Infill Drilling Concepts, Analysis and Field Results," paper SPE 4977 presented at the SPE-AIME 49th Annual Fall Meeting, Houston, Texas, October 6-9, 1974.

3. George, C. J., and Stiles, L. H.: "Improved Techniques for Evaluating Carbonate Waterfloods in West Texas," Journal of Petroleum Technology (November, 1978) 1547-1554.

4. Ghauri, W. K., Osborne, A. F., and Magnuson, W. L.: "Changing Concepts in Carbonate Waterflooding, West Texas Denver Unit Project--An Illustrative Example," Journal of Petroleum Technology (June, 1974) 595-606.

5. Stiles, L. H.: "Optimizing Waterflood Recovery in a Mature Waterflood, the Fullerton Clearfork Unit," paper SPE 6198 presented at the SPE-AIME 51st Annual Fall Technical Conference and Exhibition, New Orleans, Louisiana, October 3-6, 1976.

6. "Application for Waterflood Response Allowable for Wasson Denver Unit," hearing testimony before Texas Railroad Commission presented by Shell Oil Company, March 21, 1972, Docket 8-A-61677.

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AREA CODE 505

March 9, 1979

Mr. Richard Stamets
Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87501

Re: NMOCD Case No. 6366

Dear Dick:

In accordance with your request, please find enclosed a first draft of a porposed order in Phillip's application for infill drilling.

By copy of this letter, I am sending this draft to Mr. Joe Peacock of Phillips for his further comments.

For your information, Phillips is preparing the additional information you requested concerning the calculations made to support their testimony that an additional 4.054 billion cubic feet of gas would be recovered.

I would appreciate you awaiting this information and any comments I may receive from Phillips concerning the proposed order.

Please call me if you have any questions.

Very truly yours,

/s/ W. Thomas Kellahin

W. Thomas Kellahin

WTKeps

Enclosure

cc: Mr. Joe Peacock

Std spacing where recovered from? Vols in 8 11 ? The same ?

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:

CASE NO. 6366
ORDER NO. _____

THE APPLICATION OF PHILLIPS PETROLEUM COMPANY FOR WELL-HEAD PRICE CEILING CATEGORY DETERMINATION, LEA COUNTY, NEW MEXICO

ORDER OF THE DIVISION

BY THE DIVISION:

This matter came on for hearing at 9:00 a.m., on February 28, 1979, at Santa Fe, New Mexico, before Examiner Richard Stamets.

NOW, on this _____ day of _____, 1979, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Division has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Phillips Petroleum Company, seeks a determination pursuant to the Federal Energy Regulatory Commission Rules, Part 271.305, that ten specific wells proposed to be drilled in applicant's East Vacuum Grayburg-San Andres Unit area on existing proration units, are necessary to effectively and efficiently drain a portion of each of the proration units which cannot be effectively and efficiently drained by any existing well within the proration units.

(3) That the applicant, Phillips Petroleum Company, further seeks a unit wide determination pursuant to the Federal Energy Regulatory Commission Rules, Part 271.305, that each subsequent infill well, in addition to the original ten wells, are each necessary to effectively and efficiently drain oil and gas reserves from a portion of the reservoir covered by the proration unit which cannot be effectively and efficiently drained by any existing well within the proration unit.

(4) Applicant Phillips Petroleum Company further seeks in the alternative, a determination of wellhead price ceiling category pursuant to F.E.R.C. Regulation, Part 271.305 (c) that, based upon a review of the records of the Division prior to the commencement of the drilling of any well for which this determination is sought, that the Division explicitly found that the drilling of the subject wells was necessary to effectively and efficiently drain a portion of the reservoir covered by the proration units involved which could not be effectively and efficiently drained by any existing well within the proration unit, or that the Division implicitly made such a finding and the record developed before the Division before commencement of drilling would support an explicit finding that the drilling of the wells was necessary to effectively and efficiently drain a portion of the reservoir covered by the proration units which could not be effectively and efficiently drained by any existing well within each of the subject proration units.

(5) That the Division, after notice and hearing at which evidence was presented, entered its Order No. R-5871

on November 17, 1978 approving applicant's East Vacuum Grayburg-San Andres Unit Agreement for the development and operation of a portion of the Vacuum-Grayburg-San Andres Pool, finding that the unitized management, operation and further development of that portion of said pool, as proposed, is necessary in order to carry out secondary recovery operations and to substantially increase ultimate recovery of oil and associated gas from the pool, and that the proposed method of operation will prevent waste and result in increased recovery of substantially more oil and associated gas from the pool than would otherwise be recovered, and that the unit agreement makes allocation of gas produced with the oil recovered as a result of the unit operations.

(6) That by its Order No. R-5897, entered January 16, 1979, the Division approved institution of a pressure maintenance project in the East Vacuum Grayburg-San Andres Unit, based on a finding that such pressure maintenance project will result in the production of hydrocarbons from tracts within the unit that would not otherwise be recovered, which order approved unorthodox well locations for the wells listed below as an exception to existing well spacing regulations.

(7) At the hearing in this case, February 28, 1978, evidence was presented that established that the infill drilling of the wells listed below in its East Vacuum Unit Area is necessary to effectively and efficiently drain that portion of the proration units upon which each respective well is located which is not presently being drained by any existing well, and that such wells will recover natural gas and other hydrocarbons that will not otherwise be recovered by any well within the unit or on the proration units involved. The subject wells are as follows:

Tract No.	Well No.	Location		Unit	Section
3229	005	1110'E	1290'W	M	32
2801	004	1310'S	1330'E	O	28
2801	002	1140'S	1310'W	N	28
3328	002	1310'S	1160'W	M	33
3202	003	1180'N	1480'E	B	32
2739	005	1330'S	1380'W	K	27
3456	005	1030'N	1410'W	C	34
3333	004	1380'N	1280'E	H	33
3308	003	1150'N	1510'W	C	33
3202	001	1330'S	1310'E	I	32

all in Township 17 South, Range 35 East, NMPM, Lea County, New Mexico.

(8) That the evidence presented demonstrated that the drilling and completion of the above infill wells should result in the production of an additional 4.054 billion cubic feet of gas from the proration units involved which gas would not otherwise be recovered from the proration units.

(9) That such additional wells will result in the subject proration units being more efficiently and economically drained.

(10) That based upon a review of the Division's records related to the area and producing formation involved, as provided by Part 271.305 (c), F.E.R.C. Regulations Implementing the Natural Gas Policy Act of 1978, The Division finds that the infill wells to be drilled for the total unit area are necessary for the production of gas from the units involved which would not otherwise be recovered from the proration units, and such additional recovery should reasonably be expected to amount to 4.054 billion cubic feet of additional

gas that could not be recovered by any other wells on the proration units.

(11) That in order to permit the drainage of a portion of the reservoir covered by the proration units underlying the above wells which cannot be effectively and efficiently drained by the existing well or wells on the units, the infill wells are necessary and should be approved as infill wells under the provisions of F.E.R.C. rules, Part 271.305 and 271.305 (c) as requested.

IT IS THEREFORE ORDERED:

(1) That the authorization of Phillips Petroleum Company to drill its infill wells as listed in Finding No. 6 of this order, the unorthodox locations of which have heretofore been approved by Division Order No. R-5897 be and the same hereby is ratified and confirmed.

(2) That the ratification and affirmation of the infill drilling by this Order is an exception to applicable well spacing requirements and is necessary to permit the drainage of a portion of the reservoir covered by the existing proration units underlying each of the subject wells which cannot efficiently and economically be drained by any existing wells on such proration units.

(3) That the applicant, Phillips Petroleum Company, is hereby authorized to drill each additional infill well to a total of 57 wells approved by Division Order No. R-5897 as an exception to applicable well spacing requirements and is necessary to permit the drainage of a portion of the reservoir covered by the existing proration units underlying each of the subject wells which cannot efficiently and economically be drained by any existing wells on such proration units.

(4) That jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

JOE D. RAMEY
Director

SALLY WALTON BOYD
CERTIFIED SHORTHAND REPORTER
1010 Paseo Blanco (505) 471-2465
Santa Fe, New Mexico 87501

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
State Land Office Building
Santa Fe, New Mexico
28 February 1979

EXAMINER HEARING

IN THE MATTER OF:

Application of Phillips Petroleum Company for approval of infill drilling, Lea County, New Mexico. CASE 6470

BEFORE: Richard L. Stamets

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Oil Conservation Division: Lynn Teschendorf, Esq.
Legal Counsel for the Division
State Land Office Bldg.
Santa Fe, New Mexico 87503

For the Applicant: W. Thomas Kellahin, Esq.
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I N D E X

RALPH J. ROPER

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Recross Examination by Mr. Stamets 15

KEN S. BLANCHARD

Direct Examination by Mr. Kellahin 17

Cross Examination by Mr. Stamets 25

WILLIAM J. MUELLER

Direct Examination by Mr. Kellahin 27

E X H I B I T S

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Applicant Exhibit Two, Order R-5871 5

Applicant Exhibit Three, Order R-5897 7

Applicant Exhibit Four, Report 8

Applicant Exhibit Four-A, Report 9

Applicant Exhibit Five, Statement 10

Applicant Exhibit Six, Statement 10

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E X H I B I T S CONT'D

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All Exhibits admitted on

page 31.

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MR. STAMETS: We'll call next Case 6470.

MS. TESCHENDORF: Case 6470. Application of Phillips Petroleum Company for approval of infill drilling, Lea County, New Mexico.

MR. KELLAHIN: Tom Kellahin of Santa Fe, New Mexico, appearing on behalf of the applicant, and I have three witnesses to be sworn.

MR. STAMETS: I'd like for all witnesses to stand and be sworn at this time, please.

(Witnesses sworn.)

RALPH J. ROPER

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Would you please state your name, by whom you're employed, and in what capacity?

A. I'm Ralph Roper, employed by Phillips Petroleum in their Odessa office, as a Reservoir Engineer.

Q. Mr. Roper, have you previously testified before the Oil Conservation Division?

A. Yes, sir.

Q. And in your capacity as a reservoir engineer

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have you made a study of this particular application?

A. Yes.

MR. KELLAHIN: We tender Mr. Roper as an expert.

MR. STAMETS: He's considered qualified.

Q. (Mr. Kellahin continuing.) Would you please refer to Exhibit Number One and explain to the Examiner what you're seeking to accomplish?

A. Exhibit One is a plat of the unit area of the East Vacuum-Grayburg-San Andres Unit, Lea County, New Mexico.

The unit is outlined in green on this plat. The red circles indicate the locations of the initial ten wells to be drilled and the blue circles indicate the remaining infill drilling during the remainder of the first year, which will be 1979 and 1980 drilling program.

The area of the plat shaded in yellow is the area that is involved or associated with the first ten wells to be drilled.

Q. What's the purpose of this application, Mr. Roper?

A. The purpose of the application is to qualify the infill drilling wells in regard to the NGPA gas pricing, plus additional wells within the unit area.

Q. Please refer to Exhibit Number Two and

identify it.

A. Exhibit Number Two is the statutory unitization order, Order No. R-5871, Case Number 6366, dated November, 1978, for the statutory unitization of this unit.

Q. Are there any particular findings in that order that are material to the case today?

A. Yes, sir, we'd like to refer to Finding Number Six that states, that the unitized management, operation, and further development of the subject portion of the Vacuum-Grayburg-San Andres Pool, as proposed, is reasonably necessary in order to effectively carry on secondary recovery operations and to substantially increase the ultimate recovery of oil from the pool.

And Finding Number Seven, that the proposed unitized method of operation, as applied to the East Vacuum-Grayburg-San Andres Unit area is feasible, will prevent waste, and will result with reasonable profitability -- probability, excuse me -- in the increased recovery of substantially more oil from the pool than would otherwise be recovered.

Q. Would you refer to Exhibit Number Three and identify it?

A. Exhibit Number Three is the pressure maintenance project order by the Division, Order No. R-5897, Case Number 6367, dated January 16th, 1979.

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[illegible]
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Q. Are there any particular findings in that order to which you'd like to draw the Examiner's attention?

A. In particular, Finding Number Seven, that all of the wells referred in Findings Numbers Three, Five, and Six above, being 59 injection wells at unorthodox locations, and 54 producing wells at unorthodox locations, together with the currently completed producing wells in the unit area, will provide a thorough and efficient sweep of hydrocarbons throughout the unitized area, and will result in recovery of otherwise unrecoverable oil, thereby preventing waste.

Q. Did you testify at either one of the hearings on the pressure maintenance or the statutory unitization case?

A. Yes, sir, and particularly the pressure maintenance case.

Q. All right. With regards to that hearing and the current hearing, did you prepare or review the Engineering-Geological Report submitted?

A. Yes.

Q. Is that currently marked as Exhibit Number Four in this case?

A. Yes, it is.

MR. STAMETS: At this point I'd like to ask if the wells listed in Finding Number Five of Order R-5897

are the ten wells that are the subject of today's case?

A. Yes, with the -- due to primarily the topographical location when the wells were staked, they have been moved slightly and in some cases changes the tract number, the footage locations, or the proration unit letter, but they are the same ten wells, just in slightly different locations.

MR. STAMETS: I presume you've got a list of those with the new locations?

A. Yes.

MR. KELLAHIN: The new locations are filed with the application, set forth in the application.

MR. STAMETS: Okay.

A. Right, those are the current correct locations.

MR. STAMETS: All right. Very good, thank you.

Q. (Mr. Kellahin continuing.) Let's go to Exhibit Number Five, if you please, and identify that for me.

A. If I may put in a little bit of background at this point, that by the Unit Operating Agreement for the unit, we had to solicit working interest owner approval to represent the working interest owners here today, and we submitted a ballot to the owners on February 9th, 1979,

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and as of yesterday approval in the amount of 86.6 percent with no disapprovals have been received from the partners, and the Unit Operating Agreement specifies 65 percent approval is necessary.

And as a part of our ballot and as a reply to the ballot, Exhibit Number Five is a statement from Exxon expressing their support for the position that we have here today.

Q. And Exhibit Number Six?

A. This is a statement from Chevron, again supporting our application here.

Q. And with regards to Exhibit Number Four, the Engineering Study, have you prepared a summary of pertinent portions of that study with regards to this particular case?

A. Yes.

Q. I show you what has been marked as Exhibit Number Seven and ask you what that is?

A. Exhibit Number Seven is a statement that supplies the necessity and the results of the infill drilling in this particular unit.

Q. Please read that aloud.

A. "East Vacuum Grayburg-San Andres Unit, Lea County, New Mexico, Necessity and Results of Infill Drilling.

Each infill well is necessary to effectively and efficiently drain oil and gas reserves from a portion

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of the reservoir covered by the proration unit which cannot be effectively and efficiently drained by any existing well within the proration unit.

For the total unit area, infill drilling on 20-acre spacing will result in the recovery of 11,582,000 barrels of oil not recoverable with 40-acre spacing. The solution gas associated with this oil will be 4.054 billion cubic feet.

The increased recovery will be 3.9 percent of the original oil in place. This percent increase is comparable to published results applicable to geologically similar carbonate reservoirs under waterflood in the general area of Vacuum Field.

The infill drilling and the overall development plan conform to the current industry concepts for effective and efficient carbonate waterflooding. The infill drilling will increase oil and associated gas recovery due primarily to, one, encountering discontinuous intervals of porosity, and two, improving waterflood areal and vertical sweep efficiency."

Q. The opinions expressed in Exhibit Number Seven are your own, are they, Mr. Roper?

A. Yes.

MR. STAMETS: Mr. Roper, how many wells are you talking about there when you say infill drilling on

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20-acre spacing will recover an additional 11,000,000 barrels?

A. That is for the entire unit area as shown on the Exhibit One. That amounts to 113 wells.

MR. STAMETS: Thank you.

Q. (Mr. Kellahin continuing.) Please refer to Exhibit Number Eight and identify it.

A. Exhibit Number Eight is a plot of the production expected in the unit area. The red upper curve is the total barrels per day expected with water injection and infill drilling. And the green outlined curve is the amount anticipated under continued primary operations.

And the volume represented under the red curve, represents approximately 49,000,000 barrels total.

The area under the green curve represents about 9,000,000 barrels.

The difference in 40,000,000 is the -- of 40,000,000 barrels is the result of the infill drilling and the water injection.

The 11,582,000 barrels from the infill drilling represents approximately 23.6 percent of the total anticipated production under the red curve, or approximately 29 percent of the increased 40,000,000 between the two curves.

Q. Does this decline curve represent the entire

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project or any one particular phase?

A. This would be the total project.

Q. Including Phases One, Two, and Three?

A. Yes, sir.

Q. Please refer to Exhibit Number Nine and identify it.

A. Exhibit Number Nine is, or are, as the case may be, copies of the C-101, Application for Permit to Drill, and C-102, Well Location and Acreage Dedication Plat, for each of the first ten wells, and these also reflect the locations as shown in the application.

Q. That concludes your exhibits, does it?

A. Yes, sir.

Q. Were Exhibits One through Nine prepared by you directly or compiled under your direction?

A. They were compiled. Some of them, of course, were Commission Hearings and results, and so forth.

Q. Mr. Roper, based upon your study of the exhibits presented today, in your opinion will the ten new wells be necessary to effectively and efficiently drain that portion of the proration unit which cannot now be drained by the existing wells?

A. Yes.

MR. KELLAHIN: That concludes our examination of Mr. Roper.

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CROSS EXAMINATION

BY MR. STAMETS:

Q. Mr. Roper, how did you arrive at this additional recovery resulting from the infill drilling of 11-1/2 million barrels?

A. This was from the Engineering and Geological Report, Exhibit Four in this hearing, and it was the work of an engineering committee, making out the major working interest owners of the unit area, and that was the arrived at figure in that report.

Q. What page is Exhibit Four on?

Oh, all of this is Exhibit Four?

A. Yes, all of the entire thing is Exhibit Four.

Q. All right. Is there any particular part of this where the infill drilling -- the data on the infill drilling was particularly set out?

A. Yes, sir, it's under the discussion section, the next to the last paragraph on page eleven.

MR. STAMETS: Let's go off the record a minute.

(There followed a discussion off the record.)

MR. STAMETS: Mr. Kellahin, do you have anything else?

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MR. KELLAHIN: Yes.

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Mr. Roper, let me ask you with regards to the increased recoveries in here, can you pull out that portion of the reserves that are attributed to the associated gas producing?

A. If I understand your question, that there will be gas associated with this additional oil recovery, based on the solution gas/oil ratio of the -- at the present reservoir pressure, which amounts to -- as referenced I believe in Exhibit Number Seven -- for the 11,582,000 barrels of oil, the solution gas associated with this will be 4.054 billion cubic feet.

MR. KELLAHIN: I have no other questions of Mr. Roper.

(There followed a discussion off the record.)

MR. STAMETS: Let's go back on the record, Sally.

RECROSS EXAMINATION

BY MR. STAMETS:

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Q. And I will ask Mr. Roper, where is the evidence as to this 11.5 million barrels and 4 billion cubic feet of gas? Where is the evidence that has been presented that demonstrates that that will be or should be produced?

A. The actual Engineering - Geological Report, as I said earlier, references that, in that it was determined by the Committee.

The backup data, support data, for it is not in the Engineering - Geological Report.

Q. Will that be presented?

MR. KELLAHIN: With the Examiner's permission, we will have to submit that at a later date, if we might do it simply by mail.

MR. STAMETS: Okay, that --

MR. KELLAHIN: Can we do that?

MR. STAMETS: -- will be fine. You'll appreciate our hesitancy on all these things, because we're trying to do it right and not get anybody short-changed on these NGPA things.

MS. TESCHENDORF: Can we give that an exhibit number, Tom?

MR. KELLAHIN: Yes.

MR. STAMETS: Yeah, how about Four-A.

Okay, are there any other questions of Mr. Roper? He may be excused.

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KEN S. BLANCHARD

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Would you state your name and occupation?

A. Kenneth S. Blanchard, Geologist with Phillips.

Q. Mr. Blanchard, have you previously testified before the Division?

A. No, I have not.

Q. Would you summarize for the Examiner your educational background and your employment experience?

A. I have a Bachelor's and Master's degree in geology from the University of Oklahoma in '50 and '51. I have worked as a geologist for Phillips Petroleum for twenty-seven years, and I have worked the Permian Basin area, which includes West Texas and southeast New Mexico for nineteen years, and during that time I have supervised the geological phase of drilling wells, probably as many as fifty wells in the Vacuum Maljamar area for Phillips.

MR. KELLAHIN: We tender Mr. Blanchard as an expert.

MR. STAMETS: He's considered qualified.

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Q. (Mr. Kellahin continuing.) Would you refer to Exhibit Number Ten and identify that?

A. Exhibit Ten is an orientation map and the yellow colore at the top of it shows the area we're talking about. It identifies the Delaware Basin, the Midland Basin, and the Central Basin Platform, various other provences.

I'd like to call your attention to the reef trends that go around these basins, and specifically the reef trend that crosses along the shelf between the Delaware Basin and the Chaves-Lea Basin. That particular one we're showing here in this exhibit is the famous Abo Reef trend, which has been a prolific reef, dolomite reef producer.

You might refresh yourselves a little bit on what we're talking about when we say a reef, because it will be pertinent, maybe, at a future testimony in this part of the phase. We're talking about an offshore deposition of coral and shells, or sometimes sand, and as it is deposited along the shoreline, you have transgressive and regressive seas, and it results in irregular deposition. You might say discontinuous deposition of the beds, especially from seaward to shelfward, towards the sea and back from the reef towards land.

They're usually deposited as limestone, but they very frequently become dolotomized by magnesium in the sea water and this will cause cavernous and fracturing

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due to the rocks shrinkage when they dolotomize.

The Vacuum-San Andres dolomite is this type of rock. It probably was deposited as limestone and then became a dolomite, and I think -- I'm sure every geologist this day calls it dolomite rock.

Q. All right, sir, if you'll refer to Exhibit Number Eleven and identify it.

A. Exhibit Number Eleven is really a reference map that I want to use when I present some cross sections through the line of the proposed first ten wells.

I have included on this exhibit the structural contours on top of the San Andres dolomite, actually to make the exhibit more clear. It's mapped on a 50-foot interval and it shows from water/oil contact to the highest point of the dolomite reef, about 350 to 400 feet.

The green -- this is indicated in the legend -- the green squares represent the control wells, which we had good porosity log data along, and we tried to put these along as close as we could to the proposed ten wells.

The red circles, by the way, are the proposed wells as were listed in the previous testimony.

Q. Look at Exhibit Number Twelve and identify that.

A. We might look at Exhibit Twelve and Thirteen together. They are similar. One is a -- well, Exhibit

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Twelve is a north-south cross section, and EXhibit Thirteen is an east-west.

These are not the cross sections, now, I'm referring to on the reference map. These were extracted from Exhibit Four that we presented earlier, the Engineering Geological Committee Report. And they go, as is shown here, completely across the field itself.

They both show steep slope characteristics, typical of reef deposition. They also show clearly the discontinuity of the porous productive beds. The white on this cross section being what we call rock that's porous enough to be productive. Then the dark is the dense dolomite.

I guess we go on to the next one -- next three exhibits, and in looking at these, which are general sections, the next three exhibits that I'm going to present will -- we should examine one at a time because they are detailed sections.

Q. Let's look at Exhibit Number Fourteen and have you describe that.

A. Okay, as we look at this Exhibit Fourteen we need to keep Exhibit Eleven in front of us.

Generally, this exhibit shows more clearly what happens in a reef-type reservoir and it does show more closely what is happening in the area of the proposed wells.

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Looking -- well, these electric logs, this is A/A prime, and that would be the uppermost cross section. You'll note the cross sections all trend southwest-northeast, and this is the uppermost one.

These are porosity logs and we tried to obtain the latest type log available. In other words, a lot of these control wells that we have logs on won't be current San Andres producers, because we did not have adequate up-to-date porosity logs; however, they will fall in the same 40-acre proration unit or nearby of the proposed well.

If you start on the lefthand side of this exhibit -- well, I might say something about the colors. In general you'll notice that we have colored what we believe are the porosity zones, and we used a 6 percent cutoff as a minimum producing zone in porosity; 6 percent cutoff in porosity.

The colors are here so as to try to distinguish where these zones come in and then they disappear and then come in again.

The first tract -- the first well on Tract 32, 29, this is Well No. 5, will fall in the same 40-acre proration unit as the first well on my exhibit on the lefthand side. And you can see that there is strong evidence that there are two zones, the yellow and the blue, disappear between these two control logs, so that this well,

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if it's drilled in this position, would catch hydrocarbons that would be trapped in between these two control wells.

Some of the zones you'll notice are continuous across.

Moving on over to Tract 3202, Well 3, we didn't actually have a control log that had adequate porosity log in that same 40-acre unit, but you can see where it lies in there between the third and fourth well on the cross section. Again, it falls in where two zones, possibly three zones, if you count the yellow and the green and the brown, are not continuous.

Over on the righthand side of this exhibit you're going now towards the north side and which you're getting closer to the back reef side, and you're going to lose some zones when you do that.

Only there's two zones showing pretty continuous the last three wells, but I have drawn in there what could happen when we drill the 2801-2. It's possible here and in some other portions in these exhibits, that we can drill a well and pick up a zone that was not in either of the control wells on both sides.

We just might continue on each one of these.

Q Let's look at Exhibit Fifteen.

MR. STAMETS: Mr. Blanchard, I presume you made that last statement by looking at Exhibit Number Twelve

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which shows there are tighter zones and more discontinuity on the back side of the reef as you move to the north.

A. Yes.

MR. STAMETS: Okay, thank you.

A. Right. Exhibit Fifteen shows cross section B/B prime and there are three wells that fall, oh, practically directly in line, proposed wells of this cross section.

Looking at 3202-1, it falls in between these two control wells and in the same 40-acre unit as the second well on the cross section. I refer to these as first, second, third well, because it is difficult to read these after you've reduced them to workable size. But again, we have several porosity zones, a few continuous, but then we have three that apparently lose their porosity or productivity.

Continuing on over to 3308-3, the zones are thinning here, but again it is evident to me that we're going to lose -- we're losing four zones, possibly.

2801, which is between the last two control wells, falls in -- 2801 Number Four, falls in the same 40-acre proration unit as the next to the last control well.

So on this exhibit, actually, we have two wells that fall in the same 40-acre unit as where we had a log showing the rock character in the zone, porosity.

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I'd like to call your attention to the third well on the cross section. You'll notice at the bottom there that there's a porosity development right above the water/oil contact and apparently it goes below the water and disappears on both sides of this log, this control well, and again, we would pick up something in 3308-3. That would be a zone that might not get drained in this present pattern.

Exhibit Number Sixteen is a continuation of showing the rock porosity. It's cross section C/C prime. It has two wells practically on the section, two proposed wells, then two that fall off it slightly.

3328-2 is in the same 40-acre unit as the first well on the cross section.

Now this particular location are zones that are continuous. There'll be some cases where apparently the zone -- but you do have thinning, and then when you have thinning, you could lose some of your ability to drain the rock zone completely.

3333-4, again only there we can show thinning zones, except at the bottom, the zone in green coming from the right to the left will go below the water/oil contact.

Going to 2739 Number Five, the last proposed well on this section, to the best of our calculations we

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would lose four zones, at least, going between those two control wells, so it would be necessary to drill this well to get the hydrocarbons from the zones that are pinching out.

I'd like to summarize these three detailed sections by saying that they clearly show that additional wells are necessary to efficiently and effectively drain this reservoir, or these 40-acre proposed units, and although we have confined this work to the ten locations that we are proposing now, I would anticipate that the future locations would encounter the same type of rock character, and you would have discontinuity of your porosity in the other wells that we are going to drill in the future as well as these ten.

MR. KELLAHIN: That concludes our examination of Mr. Blanchard.

CROSS EXAMINATION

BY MR. STAMETS:

Q. Mr. Blanchard, if Phillips did not get into this infill drilling program and went ahead and waterflooded this zone, what would happen to the oil that is found in the ends of some of these zones? Let's take for example the pink zone on Exhibit Number Sixteen.

A. Are you talking about over in the -- on the

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righthand side of the exhibit?

Q. Yes.

A. Well, it undoubtedly, in my mind, would be trapped in that zone beyond the control well, because you've lost your porosity and permeability. It goes up dip there, which is an ideal situation for -- to be trapped in there and you would not be able to recover it.

Q. Okay. Have you made any calculations yourself on how much oil would be -- how much oil and gas would be recovered because of the infill program?

A. No, sir, I haven't, but I've tried to confine myself to the geological -- as a geological witness, and left that to the engineering witnesses.

Q. So your exhibits are primarily designed to show us why, not necessarily how much.

A. Yes. Right.

MR. STAMETS: Are there any other questions of this witness? He may be excused.

MR. KELLAHIN: One last witness.

I've got one more question. Mr. Blanchard, I don't know if I asked you, were Exhibits Ten through --

A. Ten through Sixteen.

MR. KELLAHIN: -- Sixteen were prepared by you? Were they, sir?

A. They were prepared by me and under my super-

vision.

MR. KELLAHIN: Okay.

WILLIAM J. MUELLER

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Would you please state your name and occupation, and by whom you're employed?

A. My name is William J. Mueller. I'm the North Area Reservoir Engineering Supervisor for Phillips Petroleum Company in the Odessa area.

Q. Mr. Mueller, have you previously testified before the Division and had your qualifications as an expert witness accepted and made a matter of record?

A. Yes.

MR. KELLAHIN: We tender Mr. Mueller as an expert witness.

MR. STAMETS: He is considered qualified.

Q. (Mr. Kellahin continuing.) Would you please refer to Exhibit Number Seventeen and tell us what this is?

A. Exhibit Seventeen is going to show what a

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typical schematic cross section with a lot of discontinuity, and how the engineering is applied to justify the infill drilling to get the oil. And I'd like to say, start off really by making some statements first.

First, that every individual infill drilling location proposed in the East Vacuum Grayburg-San Andres Unit will definitely result in a more effective and efficient recovery of the oil reserves and its associated solution gas currently underlying the 40-acre developed proration unit than can be effectively and efficiently drained by the current well completions on these 40 acres.

That we do plan to produce initially every infill well we drill. Subsequently down the line next year, half of the east will be converted to water injection, but each initial infill drilled well will be produced or production tested.

That every anticipated result from infill drilling yields additional recovery of oil with its associated gas for the entire 40-acre developed unit area.

The one and only justification for infill drilling is the more effective and efficient recovery of the oil reserves and their associated solution gas in this unit area.

This little typical cross section will show -- fold back the top, take the infill well out, and you can

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show that although we don't have as much discontinuity as shown -- typified here, I do want to show what happens in each of the zones due to discontinuity without the infill well.

If you put the infill well in here by flipping the little red overlay over there, you can see that the top zone, were the hydrocarbon porosity extended beyond one well but not quite to the second well, both it could not be flooded, and if it had been pressure depleted, there could be secondary reserves swept into this area, such as you not only don't get your secondary, but you leave a lot of secondary there, without the infill well being present.

But in the zone that's continuous between the two producers here, the infill well just permits another point into that zone, and we know from current performance of carbonate reservoirs and flooding, that the more producers and the more injectors we have in these, the higher our injection rates are and the higher our producing rates are, and with the higher producing rates, you are able to take your unit and your waterflood to a higher water cut at an economic limit, and at the higher water cut, of course, you leave less residual oil in the reservoir.

But looking at the little zones on your blue here, where you have a porosity-permeability deterioration in one way or the other, you can see that, again, these

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behave similar to the yellow zone; that oil that is swept by either of the other two producers can be trapped into these porosity and permeability pinchouts.

But on the red zone, where the zone is much greater in one well than in the other, you can see that you have an imbalance of -- I guess you're going to say a hydrocarbon pore volume, that is -- the reserve is much greater than the net pay existing in the wellbore.

But, again, on the little blue zone I showed the one stray zone you may find that exists between none of the wells out there, and the zone that dips below the oil/water contact, here again an infill well gives you another point of production in that and thus it extends the areal recovery efficiency for that zone.

With the infill wells we will have a much greater reservoir volumetric recovery that will have improvement in both areal recovery efficiency, and vertical recovery efficiency just because of more feet of pay exposed and more boreholes.

That also with these new wells we will, of course, obtain some additional current, modern reservoir evaluation logs, and that -- which ultimately, of course, is going to give us more oil, too, because it will help us to better understand and plan our flood.

That's really all I came for.

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MR. KELLAHIN: I move the introduction of Exhibits One through Seventeen.

MR. STAMETS: These exhibits will be admitted.

MR. KELLAHIN: That concludes our presentation.

MR. STAMETS: Any questions of this witness? He may be excused.

Anything further in this case?

The case will be taken under advisement.

(Hearing concluded.)

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REPORTER'S CERTIFICATE

I, SALLY W. BOYD, a court reporter, DO HEREBY CERTIFY that the foregoing and attached Transcript of Hearing before the Oil Conservation Division was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability, knowledge, and skill, from my notes taken at the time of the hearing.

Sally W. Boyd
Sally W. Boyd, C.S.R.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 6420 heard by me on 2-28 1979.

Richard L. Stamets, Examiner
Oil Conservation Division

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STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
State Land Office Building
Santa Fe, New Mexico
28 February 1979

EXAMINER HEARING

IN THE MATTER OF:

Application of Phillips Petroleum Company for approval of infill drilling, Lea County, New Mexico. CASE 6470

BEFORE: Richard L. Stamets

TRANSCRIPT OF HEARING

A P P E A R A N C E S

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All Exhibits admitted on page 31.

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MR. STAMETS: We'll call next Case 6470.

MS. TESCHENDORF: Case 6470. Application of Phillips Petroleum Company for approval of infill drilling, Lea County, New Mexico.

MR. KELLAHIN: Tom Kellahin of Santa Fe, New Mexico, appearing on behalf of the applicant, and I have three witnesses to be sworn.

MR. STAMETS: I'd like for all witnesses to stand and be sworn at this time, please.

(Witnesses sworn.)

RALPH J. ROPER

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you please state your name, by whom you're employed, and in what capacity?

A I'm Ralph Roper, employed by Phillips Petroleum in their Odessa office, as a Reservoir Engineer.

Q Mr. Roper, have you previously testified before the Oil Conservation Division?

A Yes, sir.

Q And in your capacity as a reservoir engineer

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have you made a study of this particular application?

A. Yes.

MR. KELLAHIN: We tender Mr. Roper as an expert.

MR. STAMETS: He's considered qualified.

Q. (Mr. Kellahin continuing.) Would you please refer to Exhibit Number One and explain to the Examiner what you're seeking to accomplish?

A. Exhibit One is a plat of the unit area of the East Vacuum-Grayburg-San Andres Unit, Lea County, New Mexico.

The unit is outlined in green on this plat. The red circles indicate the locations of the initial ten wells to be drilled and the blue circles indicate the remaining infill drilling during the remainder of the first year, which will be 1979 and 1980 drilling program.

The area of the plat shaded in yellow is the area that is involved or associated with the first ten wells to be drilled.

Q. What's the purpose of this application, Mr. Roper?

A. The purpose of the application is to qualify the infill drilling wells in regard to the NGPA gas pricing, plus additional wells within the unit area.

Q. Please refer to Exhibit Number Two and

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identify it.

A. Exhibit Number Two is the statutory unitization order, Order No. R-5871, Case Number 6366, dated November, 1978, for the statutory unitization of this unit.

Q. Are there any particular findings in that order that are material to the case today?

A. Yes, sir, we'd like to refer to Finding Number Six that states, that the unitized management, operation, and further development of the subject portion of the Vacuum-Grayburg-San Andres Pool, as proposed, is reasonably necessary in order to effectively carry on secondary recovery operations and to substantially increase the ultimate recovery of oil from the pool.

And Finding Number Seven, that the proposed unitized method of operation, as applied to the East Vacuum-Grayburg-San Andres Unit area is feasible, will prevent waste, and will result with reasonable profitability -- probability, excuse me -- in the increased recovery of substantially more oil from the pool than would otherwise be recovered.

Q. Would you refer to Exhibit Number Three and identify it?

A. Exhibit Number Three is the pressure maintenance project order by the Division, Order No. R-5897, Case Number 6367, dated January 16th, 1979.

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Q. Are there any particular findings in that order to which you'd like to draw the Examiner's attention?

A. In particular, Finding Number Seven, that all of the wells referred in Findings Numbers Three, Five, and Six above, being 59 injection wells at unorthodox locations, and 54 producing wells at unorthodox locations, together with the currently completed producing wells in the unit area, will provide a thorough and efficient sweep of hydrocarbons throughout the unitized area, and will result in recovery of otherwise unrecoverable oil, thereby preventing waste.

Q. Did you testify at either one of the hearings on the pressure maintenance or the statutory unitization case?

A. Yes, sir, and particularly the pressure maintenance case.

Q. All right. With regards to that hearing and the current hearing, did you prepare or review the Engineering-Geological Report submitted?

A. Yes.

Q. Is that currently marked as Exhibit Number Four in this case?

A. Yes, it is.

MR. STAMETS: At this point I'd like to ask if the wells listed in Finding Number Five of Order R-5897

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are the ten wells that are the subject of today's case?

A. Yes, with the -- due to primarily the topographical location when the wells were staked, they have been moved slightly and in some cases changes the tract number, the footage locations, or the proration unit letter, but they are the same ten wells, just in slightly different locations.

MR. STAMETS: I presume you've got a list of those with the new locations?

A. Yes.

MR. KELLAHIN: The new locations are filed with the application, set forth in the application.

MR. STAMETS: Okay.

A. Right, those are the current correct locations.

MR. STAMETS: All right. Very good, thank you.

Q. (Mr. Kellahin continuing.) Let's go to Exhibit Number Five, if you please, and identify that for me.

A. If I may put in a little bit of background at this point, that by the Unit Operating Agreement for the unit, we had to solicit working interest owner approval to represent the working interest owners here today, and we submitted a ballot to the owners on February 9th, 1979,

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are the ten wells that are the subject of today's case?

A. Yes, with the -- due to primarily the topographical location when the wells were staked, they have been moved slightly and in some cases changes the tract number, the footage locations, or the proration unit letter, but they are the same ten wells, just in slightly different locations.

MR. STAMETS: I presume you've got a list of those with the new locations?

A. Yes.

MR. KELLAHIN: The new locations are filed with the application, set forth in the application.

MR. STAMETS: Okay.

A. Right, those are the current correct locations.

MR. STAMETS: All right. Very good, thank you.

Q. (Mr. Kellahin continuing.) Let's go to Exhibit Number Five, if you please, and identify that for me.

A. If I may put in a little bit of background at this point, that by the Unit Operating Agreement for the unit, we had to solicit working interest owner approval to represent the working interest owners here today, and we submitted a ballot to the owners on February 9th, 1979,

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and as of yesterday approval in the amount of 86.6 percent with no disapprovals have been received from the partners, and the Unit Operating Agreement specifies 65 percent approval is necessary.

And as a part of our ballot and as a reply to the ballot, Exhibit Number Five is a statement from Exxon expressing their support for the position that we have here today.

Q. And Exhibit Number Six?

A. This is a statement from Chevron, again supporting our application here.

Q. And with regards to Exhibit Number Four, the Engineering Study, have you prepared a summary of pertinent portions of that study with regards to this particular case?

A. Yes.

Q. I show you what has been marked as Exhibit Number Seven and ask you what that is?

A. Exhibit Number Seven is a statement that supplies the necessity and the results of the infill drilling in this particular unit.

Q. Please read that aloud.

A. "East Vacuum Grayburg-San Andres Unit, Lea County, New Mexico, Necessity and Results of Infill Drilling.

Each infill well is necessary to effectively and efficiently drain oil and gas reserves from a portion

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of the reservoir covered by the proration unit which cannot be effectively and efficiently drained by any existing well within the proration unit.

For the total unit area, infill drilling on 20-acre spacing will result in the recovery of 11,582,000 barrels of oil not recoverable with 40-acre spacing. The solution gas associated with this oil will be 4.054 billion cubic feet.

The increased recovery will be 3.9 percent of the original oil in place. This percent increase is comparable to published results applicable to geologically similar carbonate reservoirs under waterflood in the general area of Vacuum Field.

The infill drilling and the overall development plan conform to the current industry concepts for effective and efficient carbonate waterflooding. The infill drilling will increase oil and associated gas recovery due primarily to, one, encountering discontinuous intervals of porosity, and two, improving waterflood areal and vertical sweep efficiency."

Q The opinions expressed in Exhibit Number Seven are your own, are they, Mr. Roper?

A Yes.

MR. STAMETS: Mr. Roper, how many wells are you talking about there when you say infill drilling on

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20-acre spacing will recover an additional 11,000,000 barrels?

A. That is for the entire unit area as shown on the Exhibit One. That amounts to 113 wells.

MR. STAMETS: Thank you.

Q. (Mr. Kellahin continuing.) Please refer to Exhibit Number Eight and identify it.

A. Exhibit Number Eight is a plot of the production expected in the unit area. The red upper curve is the total barrels per day expected with water injection and infill drilling. And the green outlined curve is the amount anticipated under continued primary operations.

And the volume represented under the red curve, represents approximately 49,000,000 barrels total.

The area under the green curve represents about 9,000,000 barrels.

The difference in 40,000,000 is the -- of 40,000,000 barrels is the result of the infill drilling and the water injection.

The 11,582,000 barrels from the infill drilling represents approximately 23.6 percent of the total anticipated production under the red curve, or approximately 29 percent of the increased 40,000,000 between the two curves.

Q. Does this decline curve represent the entire

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project or any one particular phase?

A. This would be the total project.

Q. Including Phases One, Two, and Three?

A. Yes, sir.

Q. Please refer to Exhibit Number Nine and identify it.

A. Exhibit Number Nine is, or are, as the case may be, copies of the C-101, Application for Permit to Drill, and C-102, Well Location and Acreage Dedication Plat, for each of the first ten wells, and these also reflect the locations as shown in the application.

Q. That concludes your exhibits, does it?

A. Yes, sir.

Q. Were Exhibits One through Nine prepared by you directly or compiled under your direction?

A. They were compiled. Some of them, of course, were Commission Hearings and results, and so forth.

Q. Mr. Roper, based upon your study of the exhibits presented today, in your opinion will the ten new wells be necessary to effectively and efficiently drain that portion of the proration unit which cannot now be drained by the existing wells?

A. Yes.

MR. KELLAHIN: That concludes our examination of Mr. Roper.

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CROSS EXAMINATION

BY MR. STAMETS:

Q. Mr. Roper, how did you arrive at this additional recovery resulting from the infill drilling of 11-1/2 million barrels?

A. This was from the Engineering and Geological Report, Exhibit Four in this hearing, and it was the work of an engineering committee, making out the major working interest owners of the unit area, and that was the arrived at figure in that report.

Q. What page is Exhibit Four on?

Oh, all of this is Exhibit Four?

A. Yes, all of the entire thing is Exhibit Four.

Q. All right. Is there any particular part of this where the infill drilling -- the data on the infill drilling was particularly set out?

A. Yes, sir, it's under the discussion section, the next to the last paragraph on page eleven.

MR. STAMETS: Let's go off the record a minute.

(There followed a discussion off the record.)

MR. STAMETS: Mr. Kellahin, do you have anything else?

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MR. KELLAHIN: Yes.

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Mr. Roper, let me ask you with regards to the increased recoveries in here, can you pull out that portion of the reserves that are attributed to the associated gas producing?

A. If I understand your question, that there will be gas associated with this additional oil recovery, based on the solution gas/oil ratio of the -- at the present reservoir pressure, which amounts to -- as referenced I believe in Exhibit Number Seven -- for the 11,582,000 barrels of oil, the solution gas associated with this will be 4.054 billion cubic feet.

MR. KELLAHIN: I have no other questions of Mr. Roper.

(There followed a discussion off the record.)

MR. STAMETS: Let's go back on the record, Sally.

RECROSS EXAMINATION

BY MR. STAMETS:

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Q And I will ask Mr. Roper, where is the evidence as to this 11.5 million barrels and 4 billion cubic feet of gas? Where is the evidence that has been presented that demonstrates that that will be or should be produced?

A The actual Engineering - Geological Report, as I said earlier, references that, in that it was determined by the Committee.

The backup data, support data, for it is not in the Engineering - Geological Report.

Q Will that be presented?

MR. KELLAHIN: With the Examiner's permission, we will have to submit that at a later date, if we might do it simply by mail.

MR. STAMETS: Okay, that --

MR. KELLAHIN: Can we do that?

MR. STAMETS: -- will be fine. You'll appreciate our hesitancy on all these things, because we're trying to do it right and not get anybody short-changed on these NGPA things.

MS. TESCHENDORF: Can we give that an exhibit number, Tom?

MR. KELLAHIN: Yes.

MR. STAMETS: Yeah, how about Four-A.

Okay, are there any other questions of Mr. Roper? He may be excused.

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KEN S. BLANCHARD

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Would you state your name and occupation?

A. Kenneth S. Blanchard, Geologist with Phillips.

Q. Mr. Blanchard, have you previously testified before the Division?

A. No, I have not.

Q. Would you summarize for the Examiner your educational background and your employment experience?

A. I have a Bachelor's and Master's degree in geology from the University of Oklahoma in '50 and '51. I have worked as a geologist for Phillips Petroleum for twenty-seven years, and I have worked the Permian Basin area, which includes West Texas and southeast New Mexico for nineteen years, and during that time I have supervised the geological phase of drilling wells, probably as many as fifty wells in the Vacuum Maljamar area for Phillips.

MR. KELLAHIN: We tender Mr. Blanchard as an expert.

MR. STAMETS: He's considered qualified.

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Q (Mr. Kellahin continuing.) Would you refer to Exhibit Number Ten and identify that?

A Exhibit Ten is an orientation map and the yellow colore at the top of it shows the area we're talking about. It identifies the Delaware Basin, the Midland Basin, and the Central Basin Platform, various other provences.

I'd like to call your attention to the reef trends that go around these basins, and specifically the reef trend that crosses along the shelf between the Delaware Basin and the Chaves-Lea Basin. That particular one we're showing here in this exhibit is the famous Abo Reef trend, which has been a prolific reef, dolomite reef producer.

You might refresh yourselves a little bit on what we're talking about when we say a reef, because it will be pertinent, maybe, at a future testimony in this part of the phase. We're talking about an offshore deposition of coral and shells, or sometimes sand, and as it is deposited along the shoreline, you have transgressive and regressive seas, and it results in irregular deposition. You might say discontinuous deposition of the beds, especially from seaward to shelfward, towards the sea and back from the reef towards land.

They're usually deposited as limestone, but they very frequently become dolotomized by magnesium in the sea water and this will cause cavernous and fracturing

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due to the rocks shrinkage when they dolotomize.

The Vacuum-San Andres dolomite is this type of rock. It probably was deposited as limestone and then became a dolomite, and I think -- I'm sure every geologist this day calls it dolomite rock.

Q. All right, sir, if you'll refer to Exhibit Number Eleven and identify it.

A. Exhibit Number Eleven is really a reference map that I want to use when I present some cross sections through the line of the proposed first ten wells.

I have included on this exhibit the structural contours on top of the San Andres dolomite, actually to make the exhibit more clear. It's mapped on a 50-foot interval and it shows from water/oil contact to the highest point of the dolomite reef, about 350 to 400 feet.

The green -- this is indicated in the legend -- the green squares represent the control wells, which we had good porosity log data along, and we tried to put these along as close as we could to the proposed ten wells.

The red circles, by the way, are the proposed wells as were listed in the previous testimony.

Q. Look at Exhibit Number Twelve and identify that.

A. We might look at Exhibit Twelve and Thirteen together. They are similar. One is a -- well, Exhibit

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Twelve is a north-south cross section, and EXhibit Thirteen is an east-west.

These are not the cross sections, now, I'm referring to on the reference map. These were extracted from Exhibit Four that we presented earlier, the Engineering Geological Committee Report. And they go, as is shown here, completely across the field itself.

They both show steep slope characteristics, typical of reef deposition. They also show clearly the discontinuity of the porous productive beds. The white on this cross section being what we call rock that's porous enough to be productive. Then the dark is the dense dolomite.

I guess we go on to the next one -- next three exhibits, and in looking at these, which are general sections, the next three exhibits that I'm going to present will -- we should examine one at a time because they are detailed sections.

Q Let's look at Exhibit Number Fourteen and have you describe that.

A Okay, as we look at this Exhibit Fourteen we need to keep Exhibit Eleven in front of us.

Generally, this exhibit shows more clearly what happens in a reef-type reservoir and it does show more closely what is happening in the area of the proposed wells.

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Looking -- well, these electric logs, this is A/A prime, and that would be the uppermost cross section. You'll note the cross sections all trend southwest-northeast, and this is the uppermost one.

These are porosity logs and we tried to obtain the latest type log available. In other words, a lot of these control wells that we have logs on won't be current San Andres producers, because we did not have adequate up-to-date porosity logs; however, they will fall in the same 40-acre proration unit or nearby of the proposed well.

If you start on the lefthand side of this exhibit -- well, I might say something about the colors. In general you'll notice that we have colored what we believe are the porosity zones, and we used a 6 percent cutoff as a minimum producing zone in porosity; 6 percent cutoff in porosity.

The colors are here so as to try to distinguish where these zones come in and then they disappear and then come in again.

The first tract -- the first well on Tract 32, 29, this is Well No. 5, will fall in the same 40-acre proration unit as the first well on my exhibit on the lefthand side. And you can see that there is strong evidence that there are two zones, the yellow and the blue, disappear between these two control logs, so that this well,

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if it's drilled in this position, would catch hydrocarbons that would be trapped in between these two control wells.

Some of the zones you'll notice are continuous across.

Moving on over to Tract 3202, Wall 3, we didn't actually have a control log that had adequate porosity log in that same 40-acre unit, but you can see where it lies in there between the third and fourth well on the cross section. Again, it falls in where two zones, possibly three zones, if you count the yellow and the green and the brown, are not continuous.

Over on the righthand side of this exhibit you're going now towards the north side and which you're getting closer to the back reef side, and you're going to lose some zones when you do that.

Only there's two zones showing pretty continuous the last three wells, but I have drawn in there what could happen when we drill the 2601-2. It's possible here and in some other portions in these exhibits, that we can drill a well and pick up a zone that was not in either of the control wells on both sides.

We just might continue on each one of these.

Q Let's look at Exhibit Fifteen.

MR. STAMETS: Mr. Blanchard, I presume you made that last statement by looking at Exhibit Number Twelve,

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which shows there are tighter zones and more discontinuity on the back side of the reef as you move to the north.

A Yes.

MR. STAMETS: Okay, thank you.

A Right. Exhibit Fifteen shows cross section B/B prime and there are three wells that fall, oh, practically directly in line, proposed wells of this cross section.

Looking at 3202-1, it falls in between these two control wells and in the same 40-acre unit as the second well on the cross section. I refer to these as first, second, third well, because it is difficult to read these after you've reduced them to workable size. But again, we have several porosity zones, a few continuous, but then we have three that apparently lose their porosity or productivity.

Continuing on over to 3308-3, the zones are thinning here, but again it is evident to me that we're going to lose -- we're losing four zones, possibly.

2801, which is between the last two control wells, falls in -- 2801 Number Four, falls in the same 40-acre proration unit as the next to the last control well.

So on this exhibit, actually, we have two wells that fall in the same 40-acre unit as where we had a log showing the rock character in the zone, porosity.

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I'd like to call your attention to the third well on the cross section. You'll notice at the bottom there that there's a porosity development right above the water/oil contact and apparently it goes below the water and disappears on both sides of this log, this control well, and again, we would pick up something in 3308-3. That would be a zone that might not get drained in this present pattern.

Exhibit Number Sixteen is a continuation of showing the rock porosity. It's cross section C/C prime. It has two wells practically on the section, two proposed wells, then two that fall off it slightly.

3328-2 is in the same 40-acre unit as the first well on the cross section.

Now this particular location are zones that are continuous. There'll be some cases where apparently the zone -- but you do have thinning, and then when you have thinning, you could lose some of your ability to drain the rock zone completely.

3333-4, again only there we can show thinning zones, except at the bottom, the zone in green coming from the right to the left will go below the water/oil contact.

Going to 2739 Number Five, the last proposed well on this section, to the best of our calculations we

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would lose four zones, at least, going between those two control wells, so it would be necessary to drill this well to get the hydrocarbons from the zones that are pinching out.

I'd like to summarize these three detailed sections by saying that they clearly show that additional wells are necessary to efficiently and effectively drain this reservoir, or these 40-acre proposed units, and although we have confined this work to the ten locations that we are proposing now, I would anticipate that the future locations would encounter the same type of rock character, and you would have discontinuity of your porosity in the other wells that we are going to drill in the future as well as these ten.

MR. KELLAHIN: That concludes our examination of Mr. Blanchard.

CROSS EXAMINATION

BY MR. STAMETS:

Q. Mr. Blanchard, if Phillips did not get into this infill drilling program and went ahead and waterflooded this zone, what would happen to the oil that is found in the ends of some of these zones? Let's take for example the pink zone on Exhibit Number Sixteen.

A. Are you talking about over in the -- on the

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righthand side of the exhibit?

Q. Yes.

A. Well, it undoubtedly, in my mind, would be trapped in that zone beyond the control well, because you've lost your porosity and permeability. It goes up dip there, which is an ideal situation for -- to be trapped in there and you would not be able to recover it.

Q. Okay. Have you made any calculations yourself on how much oil would be -- how much oil and gas would be recovered because of the infill program?

A. No, sir, I haven't, but I've tried to confine myself to the geological -- as a geological witness, and left that to the engineering witnesses.

Q. So your exhibits are primarily designed to show us why, not necessarily how much.

A. Yes. Right.

MR. STAMETS: Are there any other questions of this witness? He may be excused.

MR. KELLAHIN: One last witness.

I've got one more question. Mr. Blanchard, I don't know if I asked you, were Exhibits Ten through --

A. Ten through Sixteen.

MR. KELLAHIN: -- Sixteen were prepared by you? Were they, sir?

A. They were prepared by me and under my super-

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vision.

MR. KELLAHIN: Okay.

WILLIAM J. MUELLER

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Would you please state your name and occupation, and by whom you're employed?

A. My name is William J. Mueller. I'm the North Area Reservoir Engineering Supervisor for Phillips Petroleum Company in the Odessa area.

Q. Mr. Mueller, have you previously testified before the Division and had your qualifications as an expert witness accepted and made a matter of record?

A. Yes.

MR. KELLAHIN: We tender Mr. Mueller as an expert witness.

MR. STAMETS: He is considered qualified.

Q. (Mr. Kellahin continuing.) Would you please refer to Exhibit Number Seventeen and tell us what this is?

A. Exhibit Seventeen is going to show what a

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typical schematic cross section with a lot of discontinuity, and how the engineering is applied to justify the infill drilling to get the oil. And I'd like to say, start off really by making some statements first.

First, that every individual infill drilling location proposed in the East Vacuum Grayburg-San Andres Unit will definitely result in a more effective and efficient recovery of the oil reserves and its associated solution gas currently underlying the 40-acre developed proration unit than can be effectively and efficiently drained by the current well completions on these 40 acres.

That we do plan to produce initially every infill well we drill. Subsequently down the line next year, half of the east will be converted to water injection, but each initial infill drilled well will be produced or production tested.

That every anticipated result from infill drilling yields additional recovery of oil with its associated gas for the entire 40-acre developed unit area.

The one and only justification for infill drilling is the more effective and efficient recovery of the oil reserves and their associated solution gas in this unit area.

This little typical cross section will show -- fold back the top, take the infill well out, and you can

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show that although we don't have as much discontinuity as shown -- typified here, I do want to show what happens in each of the zones due to discontinuity without the infill well.

If you put the infill well in here by flipping the little red overlay over there, you can see that the top zone, were the hydrocarbon porosity extended beyond one well but not quite to the second well, both it could not be flooded, and if it had been pressure depleted, there could be secondary reserves swept into this area, such as you not only don't get your secondary, but you leave a lot of secondary there, without the infill well being present.

But in the zone that's continuous between the two producers here, the infill well just permits another point into that zone, and we know from current performance of carbonate reservoirs and flooding, that the more producers and the more injectors we have in these, the higher our injection rates are and the higher our producing rates are, and with the higher producing rates, you are able to take your unit and your waterflood to a higher water cut at an economic limit, and at the higher water cut, of course, you leave less residual oil in the reservoir.

But looking at the little zones on your blue here, where you have a porosity-permeability deterioration in one way or the other, you can see that, again, these

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behave similar to the yellow zone; that oil that is swept by either of the other two producers can be trapped into these porosity and permeability pinchouts.

But on the red zone, where the zone is much greater in one well than in the other, you can see that you have an imbalance of -- I guess you're going to say a hydrocarbon pore volume, that is -- the reserve is much greater than the net pay existing in the wellbore.

But, again, on the little blue zone I showed the one stray zone you may find that exists between none of the wells out there, and the zone that dips below the oil/water contact, here again an infill well gives you another point of production in that and thus it extends the areal recovery efficiency for that zone.

With the infill wells we will have a much greater reservoir volumetric recovery that will have improvement in both areal recovery efficiency, and vertical recovery efficiency just because of more feet of pay exposed and more boreholes.

That also with these new wells we will, of course, obtain some additional current, modern reservoir evaluation logs, and that -- which ultimately, of course, is going to give us more oil, too, because it will help us to better understand and plan our flood.

That's really all I came for.

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MR. KELLAHIN: I move the introduction of Exhibits One through Seventeen.

MR. STAMETS: These exhibits will be admitted.

MR. KELLAHIN: That concludes our presentation.

MR. STAMETS: Any questions of this witness? He may be excused.

Anything further in this case?

The case will be taken under advisement.

(Hearing concluded.)

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REPORTER'S CERTIFICATE

I, SALLY W. BOYD, a court reporter, DO HEREBY CERTIFY that the foregoing and attached Transcript of Hearing before the Oil Conservation Division was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability, knowledge, and skill, from my notes taken at the time of the hearing.

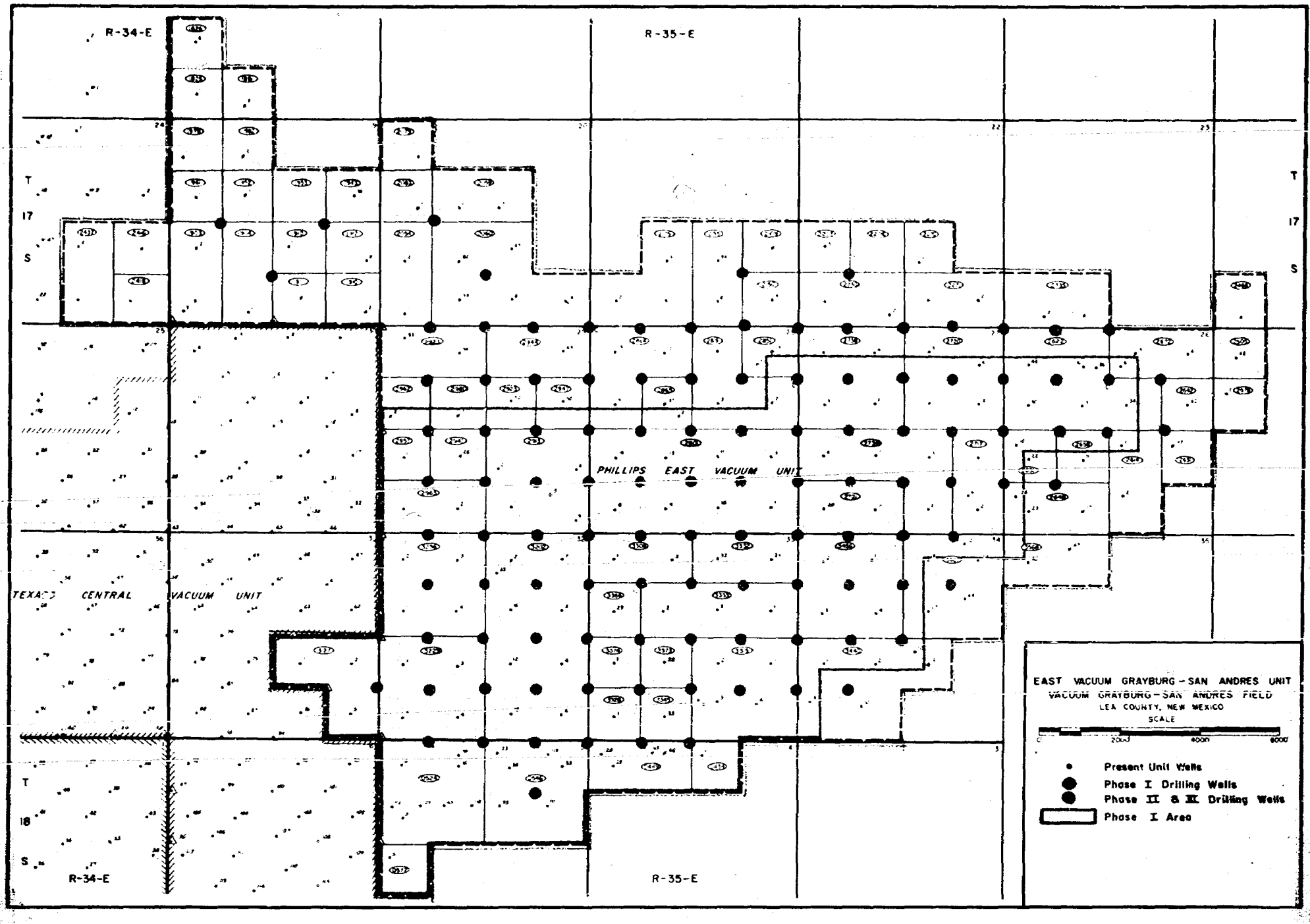
Sally W. Boyd, C.S.R.

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I do hereby certify that the foregoing is a complete record of the proceedings in the examiner hearing of Case No. 6470, heard by me on 2-28, 19 82.

Richard A. Stamets, Examiner
Oil Conservation Division

C-170 Ex 1


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R-35-E
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EAST VACUUM GRAYBURG - SAN ANDRES UNIT
VACUUM GRAYBURG - SAN ANDRES FIELD
LEA COUNTY, NEW MEXICO
SCALE
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Present Unit Wells
Phase I Drilling Wells
Phase II & III Drilling Wells
Phase I Area

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

Ex 2

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:

CASE NO. 6366
Order No. R-5871

APPLICATION OF PHILLIPS PETROLEUM COMPANY FOR STATUTORY UNITIZATION, LEA COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 9 a.m. on October 25, 1978, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 27th day of November, 1978, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Division has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Phillips Petroleum Company, seeks the statutory unitization, pursuant to the "Statutory Unitization Act," Sections 65-14-1 through 65-14-21, NMSA, 1953 Compilation, of 7,025.3 acres, more or less, of State lands, being a portion of the Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, and approval of the plan of unitization and the proposed operating plan.

(3) That the proposed unit area would be designated the East Vacuum Grayburg-San Andres Unit Area; that the vertical limits of said unit area would be the subsurface formation commonly known as the Grayburg-San Andres formation identified between the depths of 4,050 feet (103 feet sub-sea) and 5,050 feet (1103 feet sub-sea) on the Lane Wells Acoustilog, Run No. 1, dated April 14, 1964, in Exxon's New Mexico State "K" Well No. 19, located in the SE/4 SE/4 of Section 28, Township 17 South, Range 35 East, NMPM, Lea County, New Mexico, and is to include all subsurface points throughout the Unit area correlative to those identified depths, and that the unit area would comprise the following described lands:

TOWNSHIP 17 SOUTH, RANGE 34 EAST, NMPM
Section 24: SE/4

TOWNSHIP 17 SOUTH, RANGE 35 EAST, NMPM
Section 18: W/2 SW/4 and SE/4 SW/4
Section 19: W/2, S/2 NE/4, and SE/4
Section 20: W/2 NW/4, SE/4 NW/4, SW/4, SW/4 NE/4, W/2 SE/4 and SE/4 SE/4
Section 21: SW/4 SW/4, E/2 SW/4, and SE/4
Section 22: SW/4, W/2 SE/4, and SE/4 SE/4
Section 23: S/2 SW/4
Section 24: SW/4 SW/4
Section 25: W/2 NW/4
Section 26: N/2, SW/4, W/2 SE/4, and NE/4 SE/4
Sections 27, 28, and 29: All
Section 31: N/2 SE/4 and SE/4 SE/4
Sections 32 and 33: All
Section 34: N/2, SW/4, and NW/4 SE/4
Section 35: N/2 NW/4

TOWNSHIP 18 SOUTH, RANGE 35 EAST, NMPM
Section 4: N/2 NW/4 and NW/4 NE/4
Section 5: N/2 and NW/4 SW/4

(4) That the portion of the Vacuum Grayburg-San Andres Pool proposed to be included in the aforesaid East Vacuum Grayburg-San Andres Unit Area has been reasonably defined by development.

(5) That the applicant proposes to institute a pressure maintenance project for the secondary recovery of oil and gas in the proposed unit area.

(6) That the unitized management, operation and further development of the subject portion of the Vacuum Grayburg-San Andres Pool, as proposed, is reasonably necessary in order to effectively carry on secondary recovery operations and to substantially increase the ultimate recovery of oil from the pool.

(7) That the proposed unitized method of operation as applied to the East Vacuum Grayburg-San Andres Unit Area is feasible, will prevent waste, and will result with reasonable probability in the increased recovery of substantially more oil from the pool than would otherwise be recovered.

(8) That the estimated additional costs of such operations will not exceed the estimated value of the additional oil so recovered plus a reasonable profit.

(9) That such unitization and adoption of the proposed unitized method of operation will benefit the working interest owners and royalty owners of the oil and gas rights within the East Vacuum Grayburg-San Andres Unit Area.

(10) That the applicant has made a good faith effort to secure voluntary unitization within the Vacuum Grayburg-San Andres Pool.

(11) That the participation formula contained in the unitization agreement allocates the produced and saved unitized hydrocarbons to the separately owned tracts in the unit area on a fair, reasonable and equitable basis, and protects the correlative rights of all owners of interest within the unit area.

(12) That applicant's Exhibits Nos. 1 and 2 in this case, being the Unit Agreement and the Unit Operating Agreement should be incorporated by reference into this order.

(13) That applicant's Exhibit No. 2 in this case, being the Unit Operating Agreement, should be amended by the addition thereto of Exhibit "G", being applicant's Exhibit No. 13 in this case and entitled "Business Ethics Policy Compliance."

(14) That the Statutory Unitization of the East Vacuum Grayburg-San Andres Unit Area, in conformance to the above findings, will prevent waste and protect correlative rights and should be approved.

IT IS THEREFORE ORDERED:

(1) That the East Vacuum Grayburg-San Andres Unit Agreement, covering 7025.3 acres, more or less, of State lands in the Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, is hereby approved for statutory unitization pursuant to the Statutory Unitization Act, Sections 65-14-1 through 65-14-21, NMSA, 1953 Compilation.

(2) That the lands covered by said East Vacuum Grayburg-San Andres Unit Agreement shall be designated the East Vacuum Grayburg-San Andres Unit Area and shall comprise:

TOWNSHIP 17 SOUTH, RANGE 34 EAST, NMPM
Section 24: SE/4

TOWNSHIP 17 SOUTH, RANGE 35 EAST, NMPM

Section 18: W/2 SW/4 and SE/4 SW/4
Section 19: W/2, S/2 NE/4, and SE/4
Section 20: W/2 NW/4, SE/4 NW/4, SW/4, SW/4 NE/4, W/2 SE/4, and SE/4 SE/4
Section 21: SW/4 SW/4, E/2 SW/4 and SE/4
Section 22: SW/4, W/2 SE/4, and SE/4 SE/4
Section 23: S/2 SW/4
Section 24: SW/4 SW/4
Section 25: W/2 NW/4
Section 26: N/2, SW/4, W/2 SE/4, and NE/4 SE/4
Sections 27, 28, and 29: All
Section 31: N/2 SE/4 and SE/4 SE/4
Sections 32 and 33: All
Section 34: N/2, SW/4, and NW/4 SE/4
Section 35: N/2 NW/4

TOWNSHIP 18 SOUTH, RANGE 35 EAST, NMPM

Section 4: N/2 NW/4 and NW/4 NE/4
Section 5: N/2 and NW/4 SW/4

(3) That the vertical limits of the East Vacuum Grayburg-San Andres Unit Area shall be the Grayburg-San Andres formation identified between the depths of 4,050 feet (103 feet sub-sea) and 5,050 feet (1103 feet sub-sea) on the Lane Wells Acoustilog, Run No. 1, dated April 14, 1964, in Exxon's New Mexico State "K" Well No. 19, located in the SE/4 SE/4 of Section 28, Township 17 South, Range 35 East, NMPM, Lea County, New Mexico, and is to include all subsurface points throughout the Unit area correlative to those identified depths.

(4) That applicant's Exhibit No. 1 in this case, being the East Vacuum Grayburg-San Andres Unit Agreement, is hereby incorporated by reference into this order.

(5) That applicant's Exhibit No. 2 in this case, being the East Vacuum Grayburg-San Andres Unit Operating Agreement, as amended by the addition thereto of "Exhibit G, Business Ethics Policy Compliance," being applicant's Exhibit No. 13 in this case, is hereby incorporated by reference into this order.

(6) That the East Vacuum Grayburg-San Andres Unit Agreement and the East Vacuum Grayburg-San Andres Unit Operating Agreement provide for unitization and unit operation of the subject portion of the Vacuum Grayburg-San Andres Pool upon terms and conditions that are fair, reasonable and equitable and include:

an allocation to the separately owned tracts in the unit area of all the oil and gas that is produced from the unit area and is saved, being the production that is not used in the conduct of operations on the unit area or not unavoidably lost;

a provision for the credits and charges to be made in the adjustment among the owners in the unit area for their respective investments in wells, tanks, pumps, machinery, materials and equipment contributed to the unit operations;

a provision governing how the costs of unit operations including capital investments shall be determined and charged to the separately owned tracts and how said costs shall be paid including a provision providing when, how, and by whom the unit production allocated to an owner who does not pay the share of the costs of unit operations charged to such owner, or the interest of such owner, may be sold and the proceeds applied to the payment of such costs;

a provision for carrying any working interest owner on a limited, carried or net-profits basis, payable out of production, upon such terms and conditions determined by the Division Director to be just and reasonable, and allowing an appropriate charge for interest for such service payable out of such owner's share of production, provided that any nonconsenting working interest owner being so carried shall be deemed to have relinquished to the unit operator all of its operating rights and working interest in and to the unit until his share of the costs, service charge and interest are repaid to the unit operator;

a provision designating the unit operator and providing for the supervision and conduct of the unit operations, including the selection, removal or substitution of an operator from among the working interest owners to conduct the unit operations;

a provision for a voting procedure for the decision of matters to be decided by the working interest owners in respect to which each working interest owner shall have a voting interest equal to its unit participation; and

the time when the unit operation shall commence and the manner in which, and the circumstances under which, the operations shall terminate and for the settlement of accounts upon such termination;

and are therefore hereby adopted.

(7) That this order shall not become effective unless and until the appropriate ratification provisions of Section 65-14-8, NMSA, 1953 Compilation, are complied with.

(8) That if the persons owning the required percentage of interest in the unit area as set out in Section 65-14-8, NMSA, 1953 Compilation, do not approve the plan for unit operations within a period of six months from the date of entry of this order, this order shall cease to be of further force and effect and shall be revoked by the Division, unless the Division shall extend the time for ratification for good cause shown.

(9) That the persons owning the required percentage of interest in the unit area have approved the plan for unit operations and the interests of all persons in the unit are unitized whether or not such persons have approved the plan of unitization in writing.

(10) That jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

JOE D. RAMEY
Director

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STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

Ex 2

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
DIVISION FOR THE PURPOSE OF
CONSIDERING:

CASE NO. 6367
Order No. R-5897

APPLICATION OF PHILLIPS PETROLEUM
COMPANY FOR A PRESSURE MAINTENANCE
PROJECT, LEA COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 9 a.m. on October 25, 1978, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 16th day of January, 1979, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Division has jurisdiction of this cause and the subject matter thereof.

(2) That by Division Order No. R-5871 dated November 27, 1978, statutory unitization was approved for the East Vacuum Grayburg-San Andres Unit Area, Lea County, New Mexico.

(3) That the applicant herein, Phillips Petroleum Company, seeks authority to institute a pressure maintenance project on the aforesaid East Vacuum Grayburg-San Andres Unit Area, Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, by the injection of water into the San Andres formation through 59 wells, 31 of which would be drilled in 1979 during Phase II of the Project Development Program and 28 of which would be drilled in 1980 during Phase III of the Development Program.

(4) Applicant further seeks the designation of a project area for said pressure maintenance project and the promulgation of special rules and regulations governing said project including special allowable provisions.

(5) That for Phase I of the Project Development Program, applicant proposes to drill during 1979 ten producing wells at unorthodox locations as specified below:

TRACT NO.	WELL NO.	LOCATION	UNIT	SECTION
3229	005	1310' FSL and 1310' FWL	M	32
3202	001	1310' FSL and 1330' FEL	O	32
3202	003	1330' FNL and 1330' FEL	G	32
3328	002	1310' FSL and 1310' FWL	M	33
3366	001	1330' FNL and 1310' FWL	E	33
3333	004	1330' FNL and 1330' FEL	G	33
3456	005	1330' FNL and 1310' FWL	E	34
2801	002	1310' FSL and 1310' FWL	M	28
2801	004	1310' FSL and 1330' FEL	O	28
2721	001	1310' FSL and 1310' FWL	M	27

all in Township 17 South, Range 35 East, NMPM, Lea County, New Mexico.

(6) That during Phase II of the Development Program applicant proposes to drill 18 additional producing wells, all at unorthodox locations, and during Phase III of the Program applicant proposes to drill 26 additional producing wells, also at unorthodox locations.

(7) That all of the wells referred to in Findings Nos. (3), (5) and (6) above, being 59 injection wells at unorthodox locations and 54 producing wells at unorthodox locations, together with the currently completed producing wells in the Unit Area, will provide a thorough and efficient sweep of hydrocarbons throughout the unitized area, and will result in the recovery of otherwise unrecoverable oil, thereby preventing waste.

(8) That the above-described injection and producing wells, some of which would be at unorthodox locations along the unit boundaries in accordance with lease-line agreements with operators of offsetting lands, will not impair but will protect correlative rights.

(9) That the applicant's request for the designation of a Pressure Maintenance Project for the East Vacuum Grayburg-San Andres Unit Area, and for the promulgation of special rules and regulations governing said project, is in the interest of conservation and should be approved, subject to certain provisions.

(10) That the project area should consist of those proration units within the boundary of the East Vacuum Grayburg-San Andres Unit upon which is located an injection well and any directly or diagonally offsetting proration unit which contains a producing well.

(11) That the total project area allowable should be equal to the sum of the basic project area allowable plus the water injection credit allowable.

(12) That the basic project area allowable should be equal to 80 barrels of oil per day times the number of developed 40-acre proration units in the project area.

(13) That the water injection credit allowable should be based on the following formula:

$$\text{Water Injection Credit Allowable} = \left[\frac{\text{net water injected}}{\text{basic project area allowable voidage}}\right] \times \text{basic project area allowable}$$

and should be calculated in accordance with Exhibits "A" and "B" attached hereto and by reference made a part hereof.

(14) That the project area allowable should be produced from the wells within the project area in any proportion provided that any proration unit situated on the boundary of said East Vacuum Unit which proration unit is not directly or diagonally offset by a San Andres injection well outside the Unit or on the Unit boundary should not be permitted to produce in excess of 80 barrels of oil per day.

(15) That each of the newly drilled production or injection wells in the project should be equipped with surface casing set at approximately 350 feet and cemented to the surface and with "production" casing set at total depth, approximately 4900 feet.

(16) That the "production" casing on each of said newly drilled wells should be cemented to the surface, except that in any well in which an intermediate casing string has been run to below the top of the Yates formation and cemented to the surface, the "production" casing may be cemented back into the base of the intermediate casing string.

(17) That injection should be accomplished through tubing installed in a packer set within 100 feet of the uppermost perforation. The injection tubing should be corrosion protected by a non-reactive internal lining or coating. The casing-tubing

annulus in each injection well should be filled with an inert fluid and a surface pressure gauge or approved leak detection device should be attached to the annulus.

(18) The injection wells or system should be equipped with a pressure control device or acceptable substitute which will limit the surface injection pressure to no more than 0.2 psi per foot of depth to the uppermost perforation. Provision should be made for the Division Director to administratively authorize a pressure limitation in excess of the above upon showing by the Unit Operator that such higher pressure will not result in fracturing of the confining strata.

(19) All wells within the project area should be equipped with risers or in some other acceptable manner as to facilitate the periodic testing of the bradenhead for pressure or fluid production.

(20) That provision should be made for the Division Director to authorize placing wells on injection and the drilling of injection wells and additional producing wells at orthodox and unorthodox locations anywhere within the Unit Area without notice and hearing, provided that no unorthodox location is closer than ten feet to a quarter-quarter section line nor closer than 330 feet to the unit boundary, unless such well located closer than 330 feet to the unit boundary is covered by a lease-line agreement with the operator of the lands offsetting such well or the owner of the offsetting lands has waived objection to such location in writing.

(21) That there are a number of wells within the East Vacuum Grayburg-San Andres Unit Area and on lands offsetting the unit area which have previously been plugged and abandoned in a manner which may permit waters injected into the San Andres formation to escape into other formations, including the Salado formation and the shallow fresh water-bearing formations unless remedial action is taken on said wells prior to injection in their near vicinity.

(22) That there are a number of wells within the East Vacuum Grayburg-San Andres Unit Area and on lands offsetting the unit area which penetrate the Vacuum Grayburg-San Andres Pool and are completed in deeper pay zones, but which are cased and cemented in such a manner as may permit the escape of waters injected into the San Andres formation into other formations as described above.

(23) That those wells referred to in Findings Nos. (21) and (22) above which are inadequately plugged and abandoned or are inadequately cased and cemented, or are suspected of being so, include, but are not necessarily limited to, the wells listed in Exhibit "C" attached hereto and by reference made a part hereof.

(24) That no injection at greater than hydrostatic pressure should be made into the Grayburg or San Andres formation in any well in the East Vacuum Grayburg-San Andres Unit Area within one-half mile of any well listed on Exhibit "C" attached hereto until remedial action has been taken on such well to ensure that it will not serve as an avenue of escape for injected waters or until tests have been conducted on such well or other evidence concerning such well has been presented, all establishing to the satisfaction of the Supervisor of the Hobbs District Office of the Division that remedial work on such well is unnecessary.

IT IS THEREFORE ORDERED:

(1) That the applicant, Phillips Petroleum Company, is hereby authorized to institute and operate a pressure maintenance project in the East Vacuum Grayburg-San Andres Unit Area, Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, by the injection of water into the San Andres formation through certain wells which will be administratively approved for water injection at some later date by the Division Director.

(2) That said project shall be designated the East Vacuum Unit Pressure Maintenance Project.

(3) That the following unorthodox locations are hereby approved for new producing wells which are to be drilled by the unit operator during Phase I of the Project Development Program:

TRACT NO.	WELL NO.	LOCATION	UNIT	SECTION
3229	005	1310' FSL and 1310' FWL	M	32
3202	001	1310' FSL and 1330' FEL	O	32
3202	003	1330' FNL and 1330' FEL	G	32
3328	002	1310' FSL and 1310' FWL	M	33
3366	001	1330' FNL and 1310' FWL	E	33
3333	004	1330' FNL and 1330' FEL	G	33
3456	005	1330' FNL and 1310' FWL	E	34
2801	002	1310' FSL and 1310' FWL	M	28
2801	004	1310' FSL and 1330' FEL	O	28
2721	001	1310' FSL and 1310' FWL	M	27

all in Township 17 South, Range 35 East, NMPM, Lea County, New Mexico.

(4) That Special Rules and Regulations governing the East Vacuum Unit Pressure Maintenance Project are hereby promulgated as follows:

SPECIAL RULES AND REGULATIONS
FOR THE
EAST VACUUM UNIT PRESSURE MAINTENANCE PROJECT

RULE 1. The project area of the East Vacuum Unit Pressure Maintenance Project shall consist of those proration units within the boundaries of the East Vacuum Grayburg-San Andres Unit upon which is located an injection well and any directly or diagonally offsetting proration unit which contains a producing well.

RULE 2. The project area shall receive a project area allowable, and said project area allowable shall be the sum of the basic project area allowable plus the water injection credit allowable.

RULE 3. The basic project area allowable shall be equal to 80 barrels of oil per day times the number of developed 40-acre proration units in the project area.

RULE 4. The water injection credit allowable shall be contingent upon full reservoir voidage replacement of all produced fluids and shall be based upon the following formula:

$$\text{Water Injection Credit Allowable} = \left[\frac{\text{Net Water Injected}}{\text{Basic Project Area Allowable Reservoir Voidage}}\right]-1 \times \text{Basic Project Area Allowable}$$

The water injection credit allowable shall be calculated in accordance with the procedures and parameters depicted on Exhibits "A" and "B" to Order No. R-5897.

In no event shall the water injection credit allowable be less than zero, i.e., negative numbers derived from application of the above formula shall be ignored.

RULE 5. The weighted average project area reservoir pressure shall be determined prior to commencement of injection of water into the reservoir and at least annually thereafter. The weighted average project area pressure shall be determined from the pressures in at least ten representative wells selected by the unit operator and the Supervisor of the Hobbs District Office of the Division.

RULE 6. The project area allowable may be produced from the wells within the project area in any proportion provided, however, that any proration unit situated on the boundary of the East Vacuum Unit which proration unit is not directly or diagonally offset by a San Andres injection well outside said East Vacuum Unit or on the East Vacuum Unit boundary shall not be permitted to produce in excess of 80 barrels of oil per day.

RULE 7. Those wells within the East Vacuum Unit Area that are not included within the project area as defined above shall be prorated in accordance with the Rules and Regulations of the Division.

RULE 8. The Division Director shall have authority to approve, without notice and hearing, the drilling of wells at unorthodox locations anywhere within the unit boundary, provided however, no unorthodox location shall be closer than ten feet to any quarter-quarter section line, and provided further, that no such unorthodox location shall be closer than 330 feet to the outer boundary of the unit area, unless such well is covered by a lease-line agreement with the operator of the lands offsetting such well, and a copy of the lease-line agreement accompanies the application for such unorthodox location, or unless such offset operator has waived objection to the proposed unorthodox location in writing, and his waiver accompanies the application.

RULE 9. No well shall be placed on water injection in the East Vacuum Unit Area unless the Division Director has approved such well for injection. Applications for injection approval shall be filed in accordance with Rule 701 of the Division Rules and Regulations.

RULE 10. Each newly drilled injection or producing well shall be equipped with a minimum of 350 feet of surface casing and "production" casing run to total depth (approximately 4900 feet). All casing strings shall be cemented to the surface except that in any well in which an intermediate casing string has been run to below the top of the Yates formation and cemented to the surface, the "production" string may be cemented back into the base of the intermediate casing.

RULE 11. Injection shall be accomplished through tubing installed in a packer set within 100 feet of the uppermost perforation. The injection tubing shall be corrosion protected by a non-reactive internal lining or coating. The casing-tubing annulus in each injection well shall be filled with an inert fluid and a surface pressure gauge or approved leak detection device shall be attached to the annulus.

RULE 12. The injection wells or system shall be equipped with a pressure control device or acceptable substitute which will limit the surface injection pressure to no more than 0.2 psi per foot of depth to the uppermost perforation. The Division Director may administratively authorize a pressure limitation in excess of the above upon showing by the unit operator that such higher pressure will not result in fracturing of the confining strata.

RULE 13. All wells within the project area shall be equipped with risers or in some other acceptable manner as to facilitate the periodic testing of the bradenhead for pressure or fluid production.

RULE 14. The unit operator shall immediately notify the Supervisor of the Hobbs District Office of the Division of the failure of the tubing or packer in any of said injection wells, the leakage of water or oil from or around any producing well, the leakage of water or oil from or around any plugged and abandoned well within the project area, or any other evidence of fluid migration from the injection zone, and shall take such timely steps as may be necessary or required to correct such failure or leakage.

RULE 15. Each month the project operator shall submit to the Division a Pressure Maintenance Project Operator's Report, on a form prescribed by the Division, outlining thereon the data required and requesting allowables for each of the several wells in the Project as well as the total project area allowable.

RULE 16. The Division shall, upon review of the report and after any adjustments deemed necessary, calculate the allowable for the wells in the Project for the next succeeding month in accordance with these rules. The sum of the allowables so calculated shall be assigned to the Project and, except as provided under Rule 6 above, may be produced from the wells in the Project in any proportion.

IT IS FURTHER ORDERED:

(1) That no injection at greater than hydrostatic pressure shall be made into the Grayburg or San Andres formation in any well in the East Vacuum Grayburg-San Andres Unit Area within one-half mile of any well listed on Exhibit "C" attached hereto until remedial action has been taken on such well to ensure that it will not serve as an avenue of escape for injected waters, or until tests have been conducted on such well or other evidence concerning such well has been presented

establishing to the satisfaction of the Supervisor of the Hobbs District Office of the Division that remedial work on such well is unnecessary.

(2) That Order No. R-3150 which authorized a pilot waterflood project in this area is hereby rescinded.

(3) That jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

JOE D. RAMEY
Director

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EAST VACUUM GRAYBURG-SAN ANDRES UNIT
PRESSURE MAINTENANCE PROJECT

VACUUM GRAYBURG-SAN ANDRES POOL, LEA COUNTY, NEW MEXICO

WATER INJECTION CREDIT ALLOWABLE CALCULATION DATA

ATTACHMENT TO _____, 19__, REPORT

$$\text{Water Injection Credit Allowable} = \left[\frac{W_i - W_p}{BPAA \left[B_o + \left(\frac{R_p - R_s}{1{,}000} \right) B_g \right]} - 1 \right] BPAA$$

W_i = _____ = Average daily water injection, barrels per day, project area only.

W_p = _____ = Average daily water produced, barrels per day, project area only.

BPAA = _____ = Basic project area allowable, 80 bopd x _____ (number of developed 40-acre tracts in project area).

_____ = Weighted average project area reservoir pressure, psig, from _____, 19__, survey data.

B_o = _____ = Oil formation volume factor, reservoir barrels per stock tank barrel (Exhibit B).

R_p = _____ = Producing gas-oil ratio, cubic feet per barrel, project area only.

R_s = _____ = Solution gas-oil ratio, cubic feet per barrel (Exhibit B).

B_g = _____ = Gas formation volume factor, reservoir barrels per Mcf (Exhibit B).

Water injection credit allowable for _____, 19__, = _____ barrels of oil per day.

EXHIBIT "A"
ORDER NO. R-5897

Exhibit "H" Order No. R-5897

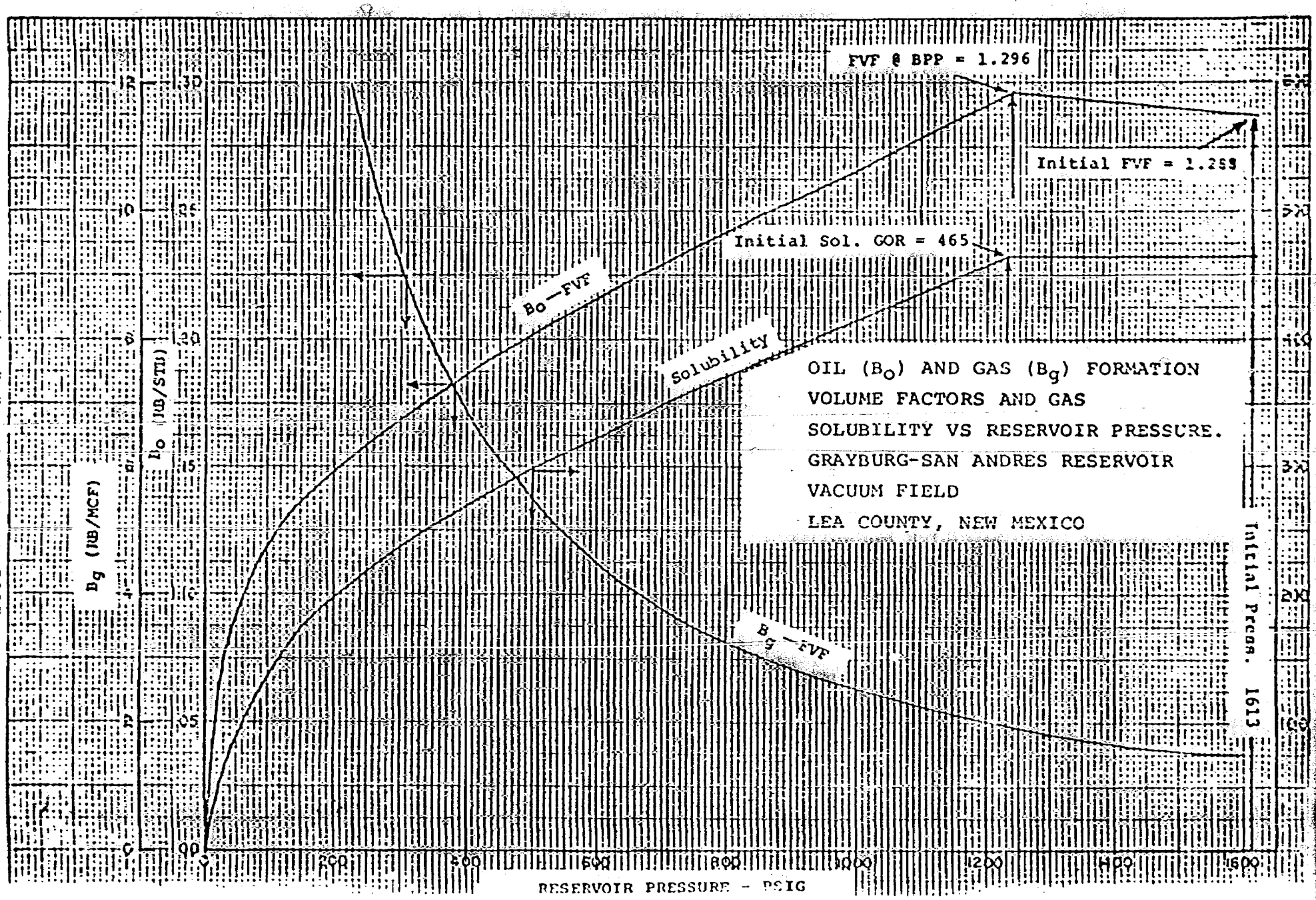


EXHIBIT "C"

WELLS SUSPECTED OF BEING INADEQUATELY PLUGGED AND ABANDONED OR INADEQUATELY CASED AND CEMENTED

OPERATOR	LEASE	WELL NO.	UNIT	SEC-TWP-RGE
Mobil	State P	7	P	22-17S-35E
Penrose	State	2	N	24-17S-35E
Phillips	Santa Fe	15	A	28-17S-35E
Phillips	Santa Fe	16	L	5-18S-35E
Phillips	Santa Fe	37	F	28-17S-35E
Phillips	Santa Fe	47	C	35-17S-35E
Shell	State U	1	C	3-18S-35E
Shell	State VAA	6	K	5-18S-35E
Shell	State C	1	I	24-17S-34E
Shell	State I	1	E	29-17S-35E
Shell	State S	1	I	21-17S-35E
Stoltz etal.	Abo	1	O	24-17S-35E
Zapata	Shell State	1	O	23-17S-35E
Barnett	State B	1	D	19-17S-35E
Jones	State	2	A	35-17S-35E
Penrose	Scarborough	1	C	25-17S-35E
Amoco	State CV	1	F	25-17S-35E
Amoco	State CV	4	L	25-17S-35E
Amoco	State CV	5	F	25-17S-35E
Chevron	State 6-34	4	J	34-17S-35E
Cities Service	State BJ	2	K	35-17S-35E
Crusader	State	1	E	20-17S-35E
Crusader	State	2	C	19-17S-35E
Crusader	State	3	N	18-17S-35E
Exxon	State J	1	M	19-17S-35E
Exxon	State J	2	L	19-17S-35E
Exxon	State AC	1	H	22-17S-35E
Great Western	State E	2	L	25-17S-35E
Marathon	Warn State	1	M	23-17S-35E
Amoco	State CV	2	E	25-17S-35E
Amoco	State CV	2-Y	E	25-17S-35E
Millard Deck	Carthay State	2	G	20-17S-35E
Exxon	State K	17	P	32-17S-35E
Marathon	Staplin State	1	L	20-17S-35E
Marathon	Warn State	1	B	4-18S-35E
Mobil	N.Vac.AboUnit	207	H	24-17S-34E
Pennzoil	Phillips State	1	A	28-17S-35E
Pennzoil	Phillips State	2	F	28-17S-35E
Phillips	Vac.AboUnit	6-68	H	34-17S-35E
Phillips	Vac.Abo Unit	1-9	J	27-17S-35E
Phillips	Vac.Abo Unit	7-3	P	27-17S-35E
Phillips	Vac.Abo Unit	7-4	I	27-17S-35E
Phillips	Vac.Abo Unit	9-5	H	33-17S-35E
Phillips	Vac.Abo Unit	13-2	E	4-18S-35E

OPERATOR	LEASE	WELL NO.	UNIT	SEC-TWP-RGE
Phillips	Vac.Abo Unit	14-3	N	5-18S-35E
Phillips	Vac.Abo Unit	14-4	L	5-18S-35E
Shell	State V	6	P	27-17S-35E
Shell	State K	1	O	19-17S-35E

EXHIBIT "C"
ORDER NO. R-5897

PHILLIPS PETROLEUM COMPANY

EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

EXHIBIT NO. 4-A, CASE NO. 6470

1. The following is a tabulation of the volumes and percentages of the original oil-in-place calculations from the Engineering-Geological Committee Report, November, 1977 (Exhibit No. 4, Case No. 6470). Specific references to the report are shown in parenthesis.

   a. Original oil-in-place = 296,986,842 barrels. (p.10 & Table I, p.4)

   b. Ultimate primary oil reserves = 78,000,000 barrels. (p.10 & Table I, p.4)

   c. Secondary oil reserves:

      40-acre spacing = 29,000,000 barrels. (p.3)

      Percent of original oil-in-place = 9.8 percent.

      20-acre spacing = 40,794,740 barrels. (Table I, p.4)

      Percent of original oil-in-place = 13.7 percent.

   d. Increase in recovery of original oil-in-place due to infill drilling:

      20-acre: Percent of original oil-in-place = 13.7 percent
      less 40-acre: Percent of original oil-in-place = -9.8 percent

      Due to infill drilling 3.9 percent (p.11)

   e. Volume of additional oil reserves due to infill drilling:

      296,986,842 x .039 = 11,582,487 barrels.

      Rounded off to 11,582,000 barrels. (Exhibit No. 7, Case No. 6470)

   Note: The slight differences in volumes are the result of calculating the estimated secondary reserves for individual 40-acre proration units (p.12), rounding off the results and summating for the unit totals.

2. Increased gas reserves associated with the additional oil to be recovered by the infill drilling were determined as follows:

   Under reservoir conditions, gas is dissolved in the oil. The amount of gas dissolved in the oil is a function of the reservoir pressure. Attachment No. I is a graphic presentation of the laboratory determined pressure-volume relationships for the Grayburg-San Andres reservoir, Vacuum Field. (Note: This same graph is Exhibit "B" to Order No. R-5897, Pressure Maintenance Project Order for the East Vacuum Grayburg-San Andres Unit which is Exhibit No. 3 to subject Case No. 6470.) The gas solubility curve is shown in red.

The volume of increased gas reserves associated with the additional oil to be recovered by the infill drilling is based on an average reservoir pressure of 700 psi. The solution gas-oil ratio at 700 psig is 350 standard cubic feet per stock tank barrel of oil, as shown in green on Attachment No. I.

The gas volume is calculated:

11,582,000 barrels oil x 350 cu.ft. per barrel = 4,053,700,000 cu.ft.

Rounded off to 4.054 billion cubic feet. (Exhibit No. 7, Case No. 6470)

3. The following is a discussion of the methods used and the results obtained for confirmation of the estimated 3.9 percent increase in recovery of original oil-in-place for the subject unit due to infill drilling on 20-acre spacing.

The Shell Oil Company operated Denver Unit, Wasson San Andres Field, is geologically similar to the East Vacuum Grayburg-San Andres Unit. (Refer to p.11 and Table III of Exhibit No. 4, Case No. 6470.) Shell is a working interest owner in the East Vacuum Grayburg-San Andres Unit and was a member of the Engineering-Geological Committee.

The committee credited infill drilling with 3.9 percent increased recovery of the original oil-in-place based on geological and engineering studies by Shell (p.11). Subsequent experience from infill drilling by Shell and other operators has confirmed that increased recovery of original oil-in-place on the order of four percent is a realistic minimum value for reservoirs of this type.

a. Encountering discontinuous intervals of porosity.

To determine the continuity present in the East Vacuum Grayburg-San Andres reservoir, the correlations and amount of net feet of porosity were analyzed by individual zones. The wells and zones used in this study are those shown on Exhibit No. 11, Case No. 6470, and on the detailed cross-sections, Exhibits Nos. 14, 15, and 16, Case No. 6470.

The percent of continuous pay was calculated between wells and plotted as a function of horizontal distance between wells. Attachment No. II defines continuous pay and includes an example calculation.

The data were plotted on the same graph with the Shell Denver Unit, Wasson San Andres curve of percent continuous pay, Attachment No. III. The percent deviation from Shell's curve (blue) to each East Vacuum Grayburg-San Andres data point was calculated. The average deviation of 15.3 percent was plotted at the average horizontal distance between wells of 3,323 feet and a line drawn to 100 percent continuous pay at zero distance. This line becomes the percent continuous pay for the East Vacuum Grayburg-San Andres Unit (red line).

Attachment No. IV is an expanded scale of this percent continuous pay line. The percent continuous pay at 1,320 feet (minimum distance between wells on 40-acre spacing) is 91.6 percent and at 933 feet (minimum distance between wells on 20-acre spacing) is 94.1 percent. The increase in percent continuous pay of 2.5 percent is the amount of additional recovery of the original oil-in-place as a result of encountering discontinuous intervals of porosity by infill drilling on 20-acre spacing.

b. Improving recovery efficiency.

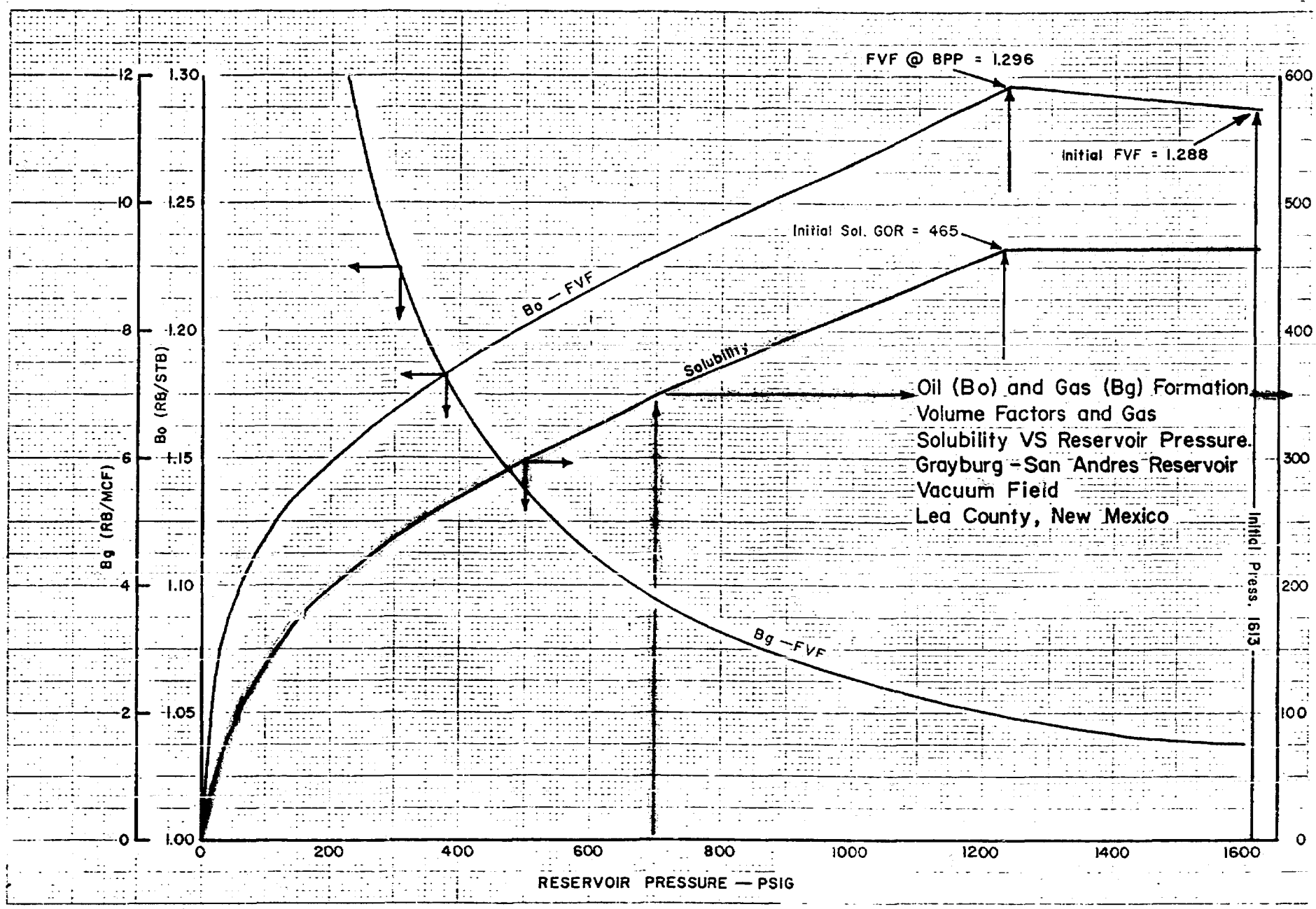
Utilizing the same wells and individual zones as in the analysis of continuous pay, the recovery efficiency between wells was calculated and analyzed. The recovery efficiencies are expressed as a percent and plotted as a function of horizontal distance between wells. Attachment No. V defines recovery efficiency and includes an example calculation.

Attachment No. VI is a plot of the recovery efficiency with minimum and maximum curves shown. Attachment No. VII is an expanded scale of the two curves. The minimum increase in recovery efficiency due to infill drilling on 20-acre spacing is 3.75 percent (87.25 percent for 20 acres less 83.50 percent for 40 acres). The maximum increase could be as much as 10.9 percent (62.15 percent for 20 acres less 51.25 percent for 40 acres).

As discussed in the testimony associated with Exhibit No. 17, Case No. 6470, the increase in recovery efficiency is applicable to both primary and secondary reserves. The Engineering-Geological Committee concluded that a total of 40 percent recovery of the original oil-in-place could be obtained for this type of reservoir, including primary and secondary with infill drilling (p.11). Of this 40 percent, 2.5 percent is gained from encountering discontinuous pay. (Discussed above.) The increase in recovery efficiency is applicable to the remaining 37.5 percent. This results in an increase in total recovery efficiency due to infill drilling of 1.4 percent, minimum. (37.5 percent x .0375) The maximum could be as much as 4.1 percent (37.5 percent x .109).

4. The total increase due to infill drilling, as stated in Exhibit No. 7, Case No. 6470, is 3.9 percent of the original oil-in-place. Of this total, 2.5 percent comes from encountering discontinuous intervals of porosity and 1.4 percent from the improvement in recovery efficiency.

KOE 10 X 10 TO INCH 5 X 10 INCHES
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ATTACHMENT NO. 1

EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

PERCENT CONTINUOUS PAY

Percent continuous pay between two wells is the ratio of effective porous rock volume to the total porous rock volume. This relationship, expressed mathematically, is:

$$\text{Percent continuous pay (between two wells)} = \frac{\Sigma\, h \text{ avg. connected}}{\Sigma\, h \text{ avg. total}} \times 100$$

where "Σ h avg. connected" is the summation of the individual zones average net thickness of the zones connected between wells and "Σ h avg. total" is the summation of the individual zones average net thickness of total zones in either well.

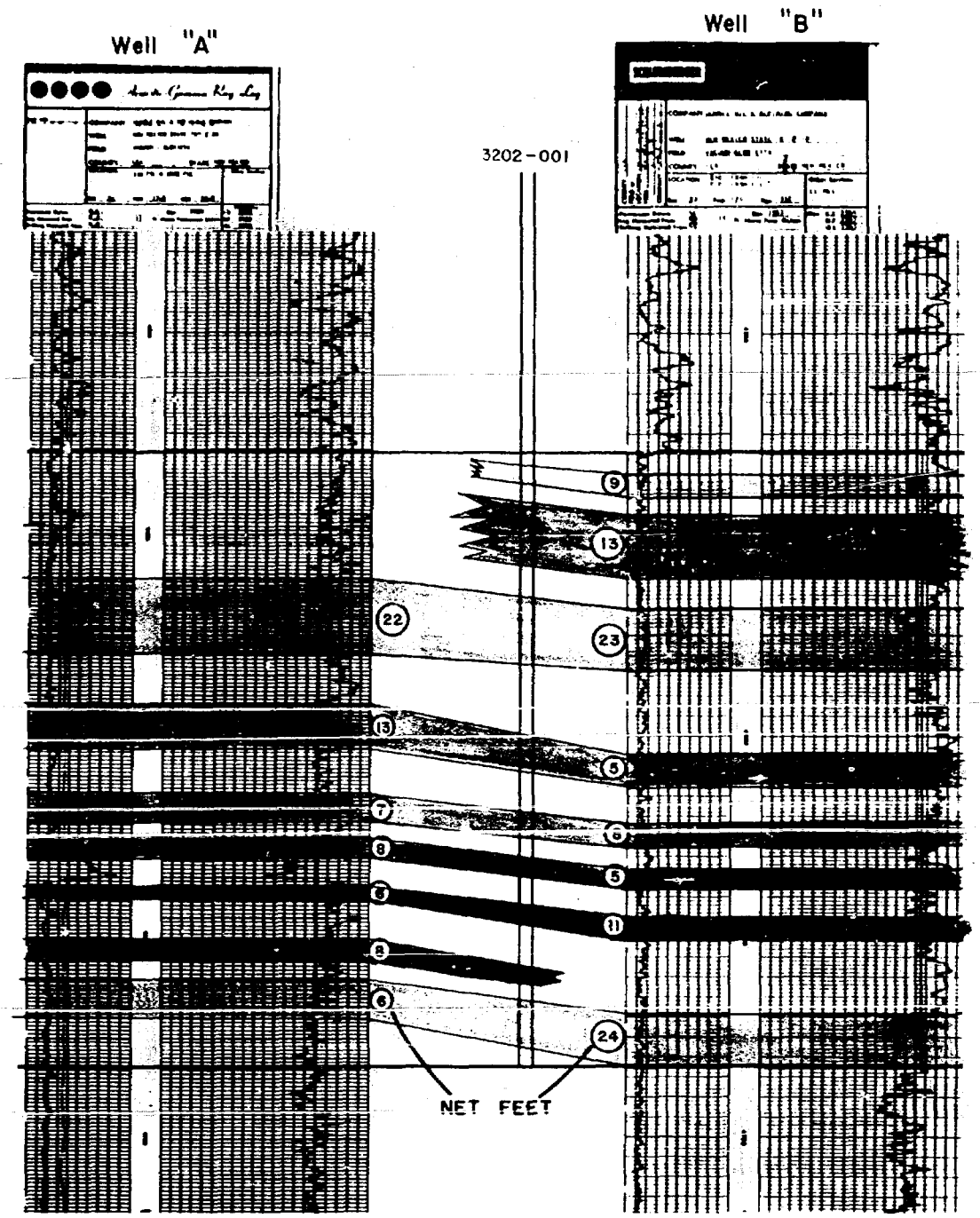
Example Calculation--Percent continuous pay between Wells "A" and "B".

Well "A" is Exxon's New Mexico State "K" No. 20 and Well "B" is Exxon's New Mexico State "K" No. 18. (See Cross-section B-B', Exhibit No. 15, Case No. 6470.) Horizontal distance between Wells "A" and "B" = 2,400 feet. Refer to Attachment No. II-A for specific cross-section of these two wells with net feet shown.

Zone	Well "A" Net Feet	Well "B" Net Feet	h Avg. Connected	h Avg. Total
Yellow	0	9	0	4.5
Green	0	13	0	6.5
Orange	22	23	22.5	22.5
Light Blue	13	5	9.0	9.0
Red	7	8	7.5	7.5
Brown	8	5	6.5	6.5
Purple	6	11	8.5	8.5
Dark Blue	8	0	0	4.0
Gray	6	24	15.0	15.0
Summation			69.0	84.0

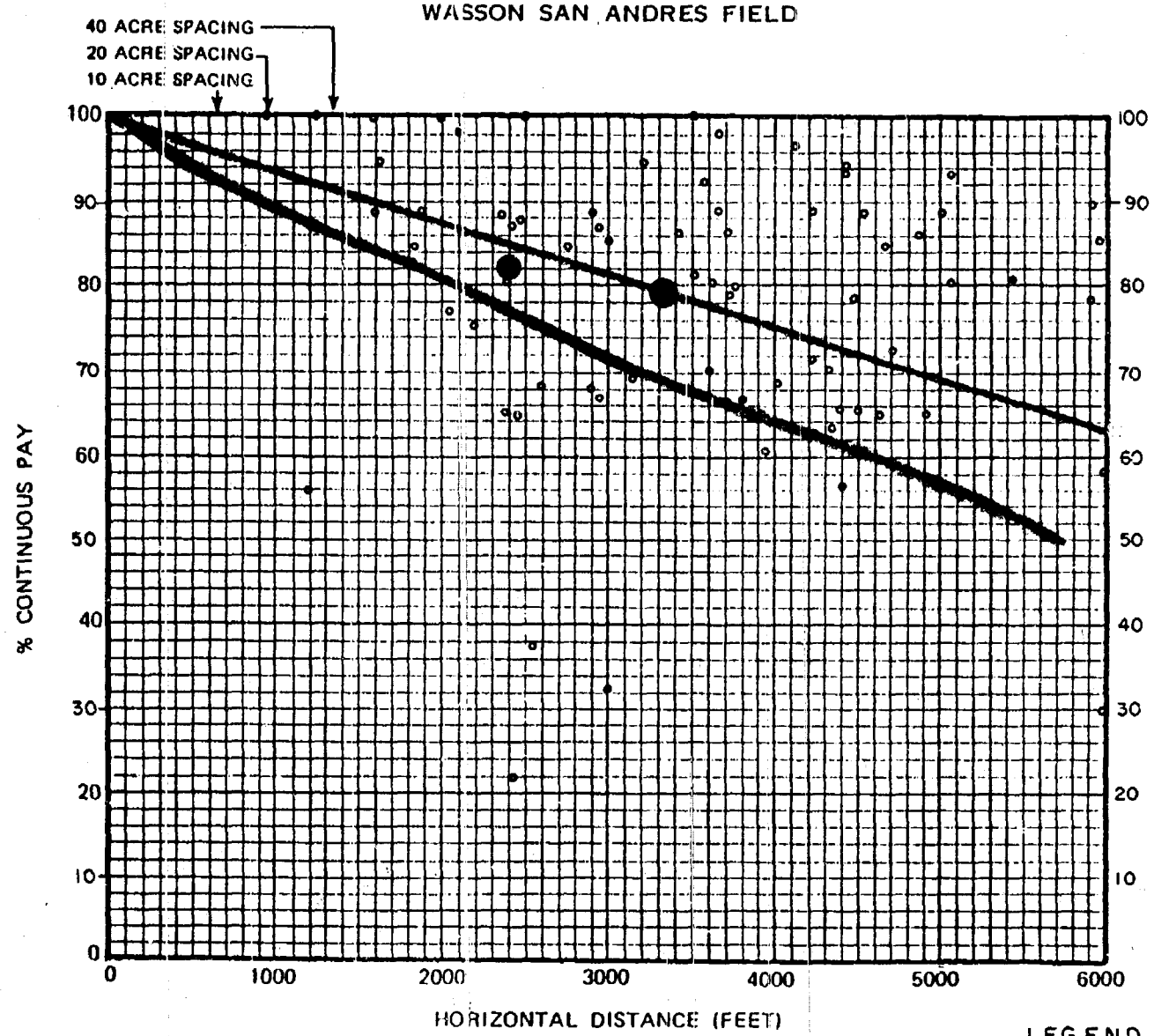
Percent continuous pay = $\frac{69}{84} \times 100 = 82.1$ percent. (Plotted in green, Attachment No. III.)

EAST VACUUM GRAYBURG - SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO



PAY CONTINUITY OVER DISTANCE

WASSON SAN ANDRES FIELD



EAST VACUUM GRAYBURG - SAN ANDRES UNIT

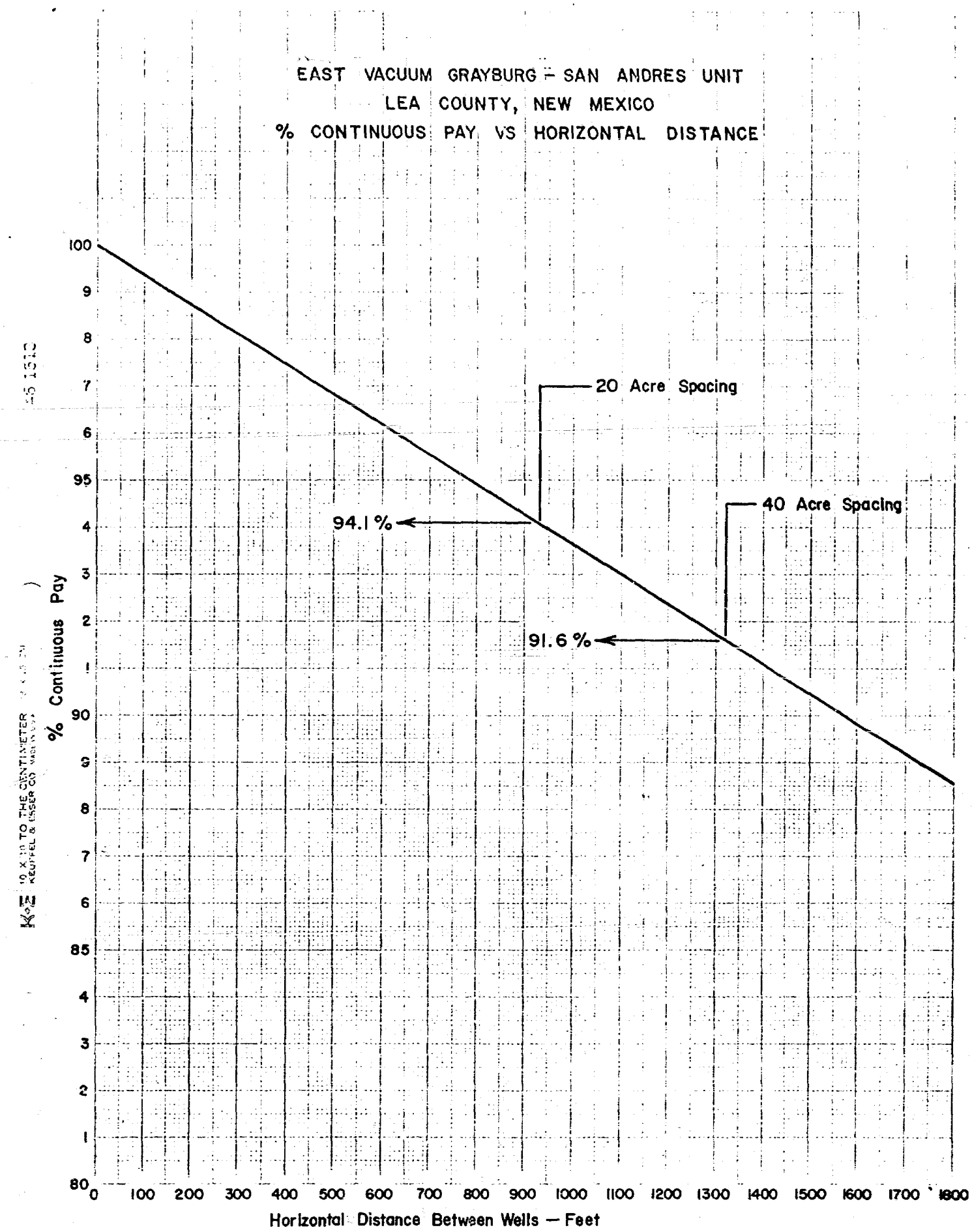
LEA COUNTY, NEW MEXICO

% CONTINUOUS PAY VS HORIZONTAL DISTANCE

ATTACHMENT NO. III

ATTACHMENT NO. IV

EAST VACUUM GRAYBURG - SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO
% CONTINUOUS PAY VS HORIZONTAL DISTANCE



EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

RECOVERY EFFICIENCY

Recovery efficiency between wells is the relationship of the net feet of porosity present in individual zones and shows the effect of differences in the net feet between wells. This illustrates the degree of heterogeneity present within this particular reservoir.

Expressed mathematically as:

$$\text{Percent recovery efficiency} = \left(1 - \frac{\Sigma \Delta h}{\Sigma h \text{ max.}}\right) 100$$

where "$\Sigma \Delta h$" is the summation of the difference in net feet of individual zones and "Σh max." is the summation of the maximum net feet of individual zones in either well.

Example Calculation--Percent recovery efficiency between Wells "A" and "B".

Wells "A" and "B" and the net feet of each zone are the same as the example of percent continuous pay as shown on Attachment No. II-A.

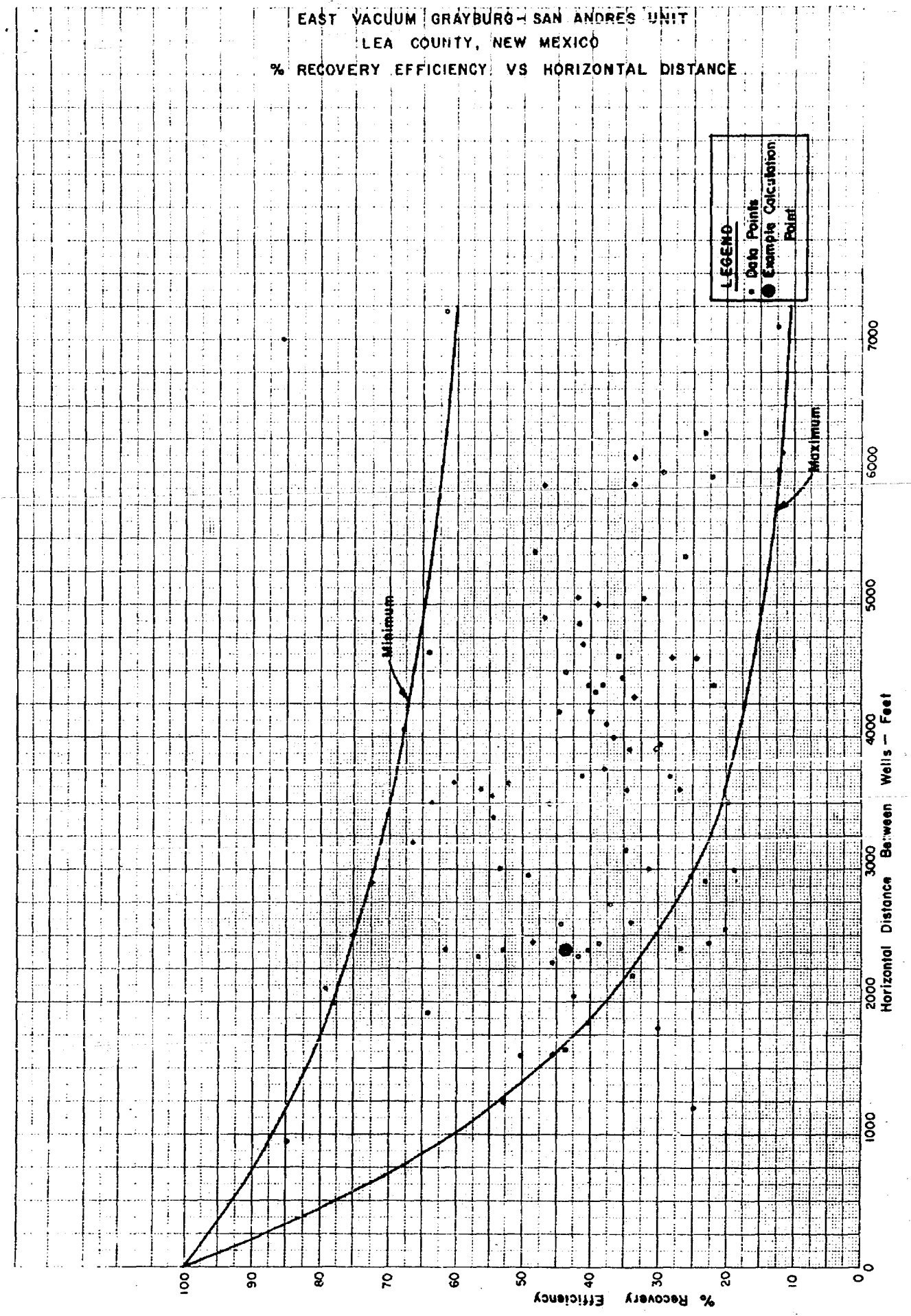
Zone	Well "A" Net Feet	Well "B" Net Feet	Δh	h max.
Yellow	0	9	9	9
Green	0	13	13	13
Orange	22	23	1	23
Light Blue	13	5	8	13
Red	7	8	1	8
Brown	8	5	3	8
Purple	6	11	5	11
Dark Blue	8	0	8	8
Gray	6	24	18	24
Summation			66	117

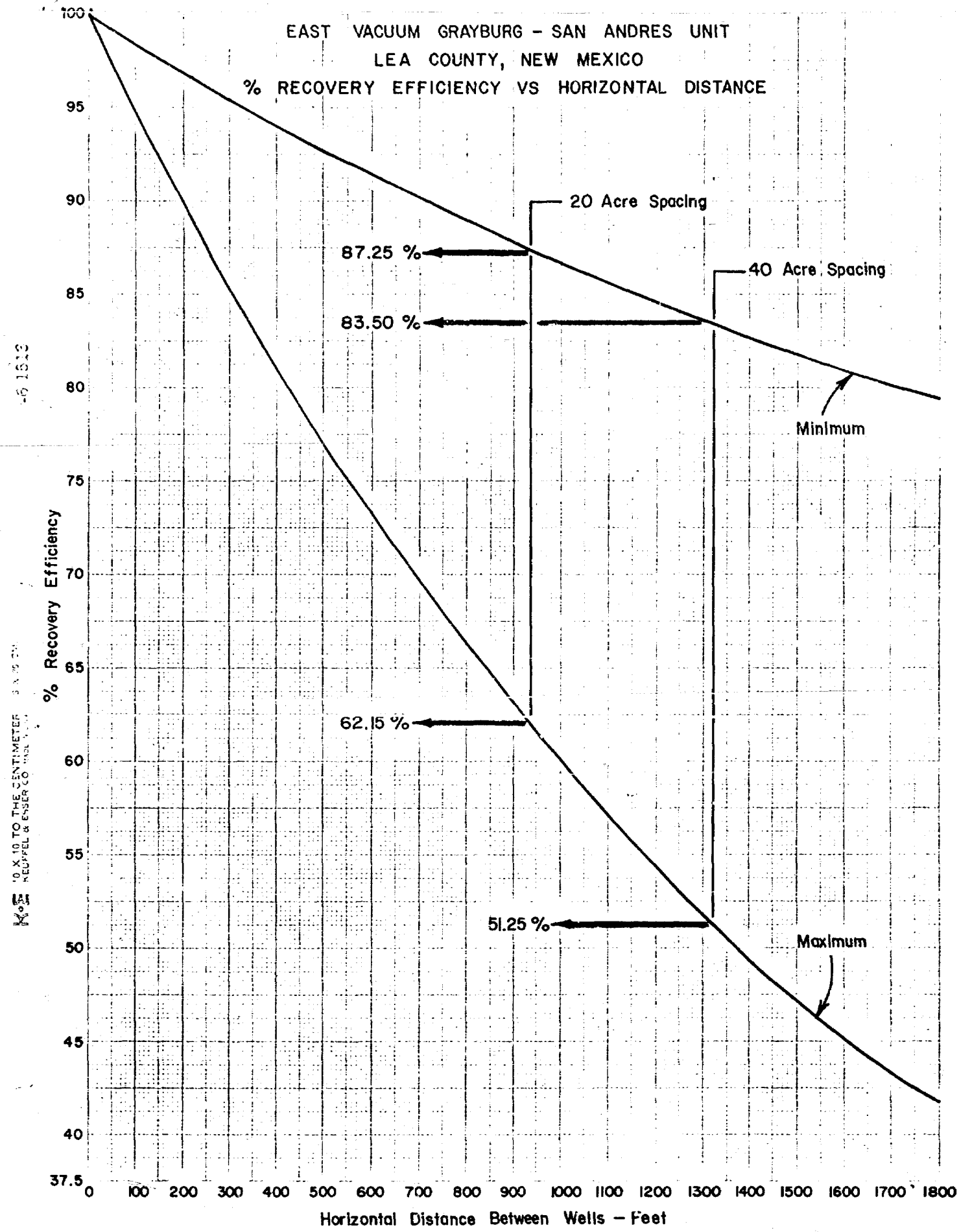
$$\text{Percent recovery efficiency} = \left(1 - \frac{66}{117}\right) 100$$

$$= (1 - .564)\ 100$$

= 43.6 percent. (Plotted in green, Attachment No. VI.)

EAST VACUUM GRAYBURG - SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO
% RECOVERY EFFICIENCY VS HORIZONTAL DISTANCE




EAST VACUUM GRAYBURG - SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO
% RECOVERY EFFICIENCY VS HORIZONTAL DISTANCE
20 Acre Spacing
40 Acre Spacing
87.25 %
83.50 %
62.15 %
51.25 %
Minimum
Maximum
% Recovery Efficiency
Horizontal Distance Between Wells — Feet
100
95
90
85
80
75
70
65
60
55
50
45
40
37.5
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800

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2. Driscoll, Vance J.: "Recovery Optimization Through Infill Drilling Concepts, Analysis and Field Results," paper SPE 4977 presented at the SPE-AIME 49th Annual Fall Meeting, Houston, Texas, October 6-9, 1974.

3. George, C. J., and Stiles, L. H.: "Improved Techniques for Evaluating Carbonate Waterfloods in West Texas," Journal of Petroleum Technology (November, 1978) 1547-1554.

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6. "Application for Waterflood Response Allowable for Wasson Denver Unit," hearing testimony before Texas Railroad Commission presented by Shell Oil Company, March 21, 1972, Docket 8-A-61677.

Ex 4

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED

LEA COUNTY, NEW MEXICO

ENGINEERING-GEOLOGICAL COMMITTEE REPORT

NOVEMBER, 1977

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* * * * *

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* * * * *

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* * * * *

INTRODUCTION

The purpose of this report is to present the findings of the Engineering-Geological Committee concerning the charges to it by the Working Interest Owners of the East Vacuum Grayburg-San Andres Unit, proposed, Lea County, New Mexico. For location, see Figure 1. The charges are listed below:

1. Construct an acceptable base map. (All unit maps in this report use the accepted base map.)
2. Define the vertical interval to be unitized in one or more representative well logs. (The recommended interval to be unitized is that interval of the Grayburg-San Andres correlative to the formations that exist in Exxon's New Mexico State "K" No. 19 from a depth of 4,050 feet to 5,050 feet RKB.)
3. Define the East Vacuum Grayburg-San Andres Unit area in cooperation with the Central Grayburg-San Andres Unit area being expedited by Texaco. (This area is shown on all unit maps in this report.)
4. Tabulate the following parameters by Tract and by Working Interest Owners:
   - A. Number of well bore completions and well bores available for recompletion.
   - B. Cumulative oil production.
   - C. Remaining primary reserves, taking into consideration the effect, if any, of natural water encroachment.
   - D. Ultimate primary reserves.
   - E. Current production for the most representative period.
   - F. Floodable acre-feet by tract and by zone, if possible.
   - G. Net hydrocarbon pore volume by tract and by zone, if possible.
   - H. Secondary reserves by tract and by zone, if possible.

I. Original oil-in-place by tract and by zone, if possible.

J. Any other parameters considered to be appropriate by the Engineering-Geological Committee. The committee added surface acres and net acre-feet to the parameters. (The committee agreed that it is not possible to determine parameters F through I by zone. With this exception, Table I fulfills this charge. Discussions of the method used to determine each of these parameters are presented in the appropriate section of this report.)

5. Investigate the sources and availability of water to be used for flooding. (There is an adequate source of water available for flooding. Details are in the Water Supply Section of this report.)

6. Develop a detailed plan for secondary recovery operations which will include associated economics containing a differential case between continued primary and waterflooding operations. (The proposed development plan calls for installing the necessary facilities, including drilling 127 water injection wells on a 40-acre, five-spot pattern between unitization date estimated to be October 1, 1978, and the end of 1981. More details are given in the Development Plan Section.)

CONCLUSIONS

From the study of the Grayburg-San Andres zone in the East Vacuum Unit, proposed, area, the Engineering-Geological Committee concludes that:

1. Secondary recovery by waterflooding is feasible in the San Andres reservoir and recovery is estimated to be 29.0 million barrels if conducted on the present 40-acre per well density using a five-spot pattern. The estimated recovery for 20-acre per well density under the same conditions is 40.8 million barrels. Incremental economics above primary and after income tax are:

	40-Acre Less Primary	20-Acre Less Primary
Investment, $M	11,358	31,742
Net Cash Flow, $M	75,158	131,156
Average Annual Rate of Return, percent	63	146
Number of Times Investment Returned	7.62	5.13
Payout, years	3.68	2.32
Present Value at 10 Percent, $M	37,725	83,584

2. Remaining recovery and economics favor the 20-acre per well density and a five-spot pattern. These profit indicators are:

	40-Acre 5-Spot	20-Acre 5-Spot	20-Acre Less 40-Acre
Recovery, MM barrels	38.1	49.8	11.7
Investment, $M	11,358	31,742	20,384
Net Cash Flow, $M	93,545	149,543	55,998
Average Annual Rate of Return, percent	151	234	298
Number of Times Investment Returned	9.24	5.71	3.75
Payout, years	2.60	2.04	1.88
Present Value at 10 Percent, $M	51,583	97,443	45,952

These economics were based on non-escalating costs and a constant lower and upper tier oil price of $5.25 per barrel and $12.00 per barrel, respectively.

3. That water injection into the Grayburg formation is not economically feasible.

RECOMMENDATIONS

The following recommendations are based on the foregoing conclusions:

1. Unitize the Grayburg-San Andres zone in the area shown as East Vacuum Grayburg-San Andres Unit, proposed, on the structure map, Figure 2.

2. Develop the waterflood on a 40-acre, five-spot pattern with 20-acre well spacing by drilling 127 water injection wells and installing the necessary surface facilities to operate the flood.

3. Limit water injection to the San Andres formation.

HISTORY

The Vacuum Field was discovered May 5, 1929, by Socony Vacuum Oil Company's Bridges State Well No. 1 located in Section 13, T-17-S, R-34-E, Lea County, New Mexico, as shown in Figure 2. Development began in 1939 and was virtually complete by the end of 1941 with 330 producing wells. There are currently 453 wells producing from the field.

The first waterflood project in the field was Mobil Oil Company's Bridges State lease that began in 1958. The Texaco West Vacuum Unit was formed in 1966. The first flood developed in the better quality reservoir rock was Texaco's Vacuum Grayburg-San Andres Unit in 1973. The latest flood in the field is Atlantic Richfield Company's State Vacuum Unit which was approved in 1977. Texaco's Central Vacuum Unit became effective October 1, 1977.

The proposed East Vacuum Grayburg-San Andres and Vacuum 35 Units are scheduled to begin development in 1978. When these units are developed, over 98 percent of the Vacuum Grayburg-San Andres Field will be under waterflood. Figure 3 is a map showing these units.

In both the Mobil Bridges State waterflood and the Texaco Vacuum and West Vacuum Units, injection into the Grayburg formation has caused premature water breakthrough with subsequent high water-oil ratio production. It is concluded that the reserve contribution of the Grayburg is of less value than the cost of handling the increased water required to flood it.

Behind casing surface water flows that are apparently related to water injection in the existing projects have recently developed over a wide area of the field. This has resulted in the New Mexico Oil Conservation Commission imposing more stringent regulations for waterflood units. These new regulations have been properly considered in the project analysis.

GEOLOGY

The Vacuum Grayburg-San Andres Field is located on the Artesia-Lovington uplift along the northern limit of the Delaware Basin. The San Andres zone is a dolomitized reef with excellent permeability in the fore-reef to the south, pinching out in the poor quality back-reef and lagoonal depositions to the north. This feature is shown in the north-south Cross-Section H-H', Figure 4. Figure 5 is a west-east cross-section for the unit. The only zones shown on these cross-sections are zones that can be correlated over large areas of the unit. They show clearly the zone discontinuity that cause wider well spacing to result in the recovery of less secondary reserves.

The San Andres structure, Figure 2, is an east-west trending anticline showing a closure of more than 400 feet above the original water-oil contact of -700 feet. Lithologically, the Grayburg formation consists of dense gray dolomite with some anhydrite. It contains interbedded dolomitic sand stringers. Log and core data indicate that this formation has a very small reserve. The San Andres formation consists of dense medium crystalline and oolitic dolomite, white to gray in color, with some anhydrite. The pay is a fine to medium crystalline oolitic dolomite with slight fracturing and some solution cavities. The cross-sections in Figures 4 and 5 show the productive intervals to consist of a series of permeable beds separated by impermeable strata. These strata extend over large areas of the field and serve as effective barriers to prevent cross-flow between the permeable beds.

The recommended unitized interval is the vertical interval that appears between a depth of 4,050 feet and 5,050 feet on the Lane Wells acoustic log, Run No. 1, dated April 14, 1964, on Exxon's New Mexico State "K" No. 19. This well is located 330 feet from south line and 330 feet from east line of Section 28, T-17-S, R-35-E, Lea County, New Mexico. The unitized interval is to include all subsurface points throughout the unit area between these identified correlative depths. This interval is shown in Figure 6.

RESERVOIR PERFORMANCE

The East Vacuum Grayburg-San Andres Unit can be divided into three areas of similar performance as shown in Figure 7--the north area of poor quality rock with low production rates, the east area where the production has been greatly influenced by water encroachment, and the south area where most of the proration units are still producing at top allowable rates.

Production and pressure histories are presented graphically for these three areas and the total unit in Figures 8, 9, and 10. Table II presents reservoir reserves and production data for these areas. Of particular interest is the fact that the average reservoir pressure history of the east area, shown in Figure 10, is very nearly the same as that of the south area even though water has displaced 36 percent of the initial hydrocarbon pore volume in the east area.

CORE DATA

Three sets of core data were analyzed to determine the reservoir rock properties. The first set, consisting of 1,283 core samples from 15 wells within the unit area and having a Dykstra-Parsons permeability variation constant of 0.87, was used to determine the porosity cutoff of six percent. This was done statistically by determining the porosity at which the median permeability was 0.1 millidarcy. The pore volume of samples with porosities equal to or greater than six percent having less than 0.1 millidarcy was approximately the same as that of samples with porosities less than six percent having greater than 0.1 millidarcy.

The second set was 196 core samples having porosities equal to or greater than six percent and taken from six continuous permeable zones within the unit area. The permeability variation constant ranged between 0.63 and 0.84 for the individual zones and was 0.78 for all zones. Weighted average permeability and porosity for these samples were 13.7 millidarcies and

10.9 percent respectively. A plot of porosity versus permeability from these samples is shown in Figure 11.

The third set of data was from Phillips' Santa Fe No. 128 in the northwest of northwest of Section 4, T-18-S, R-35-E, Lea County, New Mexico, which was cored to -766 feet in the San Andres. Relative permeability, flood pot, capillary pressure, and wetability analysis were made on these cores and used as a basis for many of the calculations in this report. Figure 12 shows the average oil and water relative permeability curves. The oil curve shows a residual oil saturation of 27 percent. The flood pot test showed a residual oil saturation of 28.7 percent when oil was displaced by formation water and 36.3 percent when oil was displaced by nitrogen gas. Average water saturation at a capillary pressure of 60 psig was 19 percent. Wetability tests showed the reservoir to be neutral.

COMPARISON OF CORE DATA TO SONIC LOG TRAVEL TIMES

Sonic logs were used to determine porosities. They were normalized by preparing histograms for each sonic log over the Grayburg interval and correcting them to correlate with Phillips' Santa Fe No. 128. The normalization correction varied from -5 to +5 microseconds per foot.

Matrix and fluid travel times were calculated by use of the Holgate* method for six wells in the study area on which adequate core data and reliable sonic logs were available. Figures 13 and 14 show the results of the study of the 816 feet of core porosities and sonic travel times from the six wells. This study resulted in the use of a Delta t_m of 46.4 and a Delta t_f of 131.4 to calculate the porosities from all sonic logs. The logs were digitized and a computer used to determine the porosity of each foot of formation.

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* Holgate, M. M.: "The Microlog as a Porosity Datum from the Neutron Log in Hills Field, Alberta." The Canadian Mining and Metallurgical Bulletin, July, 1960.

RESERVOIR FLUID DATA

Figure 15 shows the formation volume factor and solution gas-oil ratio as a function of reservoir pressure. These curves were constructed from combined reservoir samples from Phillips' Hale No. 1 and Santa Fe No. 1. The initial reservoir pressure of 1,613 psig was recorded by bottom-hole pressure gauges in 1938. The bubble-point pressure is the average of those determined from 37 wells in the unit by plotting cumulative oil production versus reservoir pressure. The minimum of these 37 bubble-point pressures was 1,150 psig and the maximum 1,290 with an average of 1,233 psig.

ORIGINAL WATER LEVEL DETERMINATION

Completion and production data from the unit indicate the original water level to have been approximately -700 feet. Phillips' Santa Fe No. 17 was completed open hole to -699 feet. Its initial production was water free, but in five months it was producing six barrels of water per day. This was the reason for using -700 feet as the water level. Recent electric log analysis on wells drilled in the 1960's in and around Section 35, T-17-S, R-34-E, confirm the -700 feet water level.

CONNATE WATER SATURATION

The curve shown in Figure 16 was used to determine the connate water saturation. Shell Oil Company prepared it from cores taken from their Denver Unit, Wasson Field, Gaines and Yoakum Counties, Texas. The average porosity by 40-acre proration unit, rather than average porosity in the well bore, was used to calculate the water saturation.

VOLUMETRIC CALCULATIONS

The isopachous map shown in Figure 17 and an isovol map were prepared from which a computer calculated the acre-feet and acre-porosity feet by 40-acre proration unit. Porosity, connate water saturation, and hydrocarbon pore volume were calculated from these data for each 40-acre unit. Original oil-in-place was calculated by multiplying the hydrocarbon pore volume by (7,758 ÷ 1.288).

PRIMARY RESERVES

Tarner material balance calculations for a depletion-type reservoir with producing characteristics similar to those of the East Vacuum Grayburg-San Andres Unit indicated a primary recovery factor of approximately 25 percent. Considering the water encroachment from the east, the primary recovery factor was estimated to be 26.3 percent. This resulted in an ultimate primary reserve for the total unit of 78 million barrels. Decline curves were used to determine the primary reserve by tract where possible. Appendix A shows the method used to allocate the rest.

WATER ENCROACHMENT

The pressures from Figure 10 show that water encroachment has not been fast enough to affect reservoir pressure. Water from the east edge of the field has, nonetheless, filled approximately one-eighth of the original hydrocarbon pore volume.

FLOODABLE ACRE-FEET BY TRACT

The floodable acre-feet and secondary reserves, by tract, were based on fractional flow calculations using mid-1972 well tests to determine the

water saturation. This method would not have been viable using well tests after 1972 because most of the operators began plugging back wells to reduce water production at that time. Percent floodable acre-feet were calculated from this saturation and are shown in Figure 18. Floodable acre-feet were calculated by multiplying the average percent remaining floodable acre-feet in each 40-acre proration unit by its acre-feet calculated from the isopachous map shown in Figure 17. Appendix B gives further information concerning the calculations.

SECONDARY RESERVES

A mathematical model study using a residual oil saturation of 35 percent showed that 44 percent of the original oil-in-place could be recovered by primary plus waterflood operations. An estimated recovery of 40 percent was used after a study of other San Andres floods in the Permian Basin showed that none had estimated recoveries as high as 44 percent. The predicted flood performance was obtained by a computer program using the Higgins-Leighton streamline channel flow method.

The San Andres flood with declining production and having reservoir characteristics most similar to the East Vacuum Unit is Shell's Denver Unit in Wasson Field, Gaines and Yoakum Counties, Texas. Table III shows the reservoir data for the two units. Shell's estimated recovery of primary plus secondary is only 35.3 percent for the Denver Unit, but the residual oil saturation for the unit is 40 to 45 percent compared to 35 percent for the East Vacuum Unit.

Shell estimates that reducing well spacing from 40 acres to 20 acres in their Denver Unit will increase the primary and secondary reserves by 3.9 percent of the original oil-in-place. The same increase is estimated for the East Vacuum Unit.

Texaco's Vacuum Grayburg-San Andres Unit began operation in 1973. Even though there is no accurate means of determining the recoverable reserves

at this time, the performance, shown in Figure 19, to date has been impressive. The isopachous map in Figure 20 and the cumulative production map as of January 1, 1973, Figure 21, shows the reservoir to be of similar quality to that of the south portion of the East Vacuum Grayburg-San Andres Unit. Figure 22, cumulative production as of January 1, 1977, shows the effect of increased production from the unit due to unitization.

The secondary reserves were determined for the total unit by subtracting the 78 million barrels of primary oil from 40 percent of the original oil-in-place. This total oil was allocated to each proration unit in proportion to the product of 15 percent of its initial oil-in-place and percent floodable acre-feet (Figure 18).

WATER SUPPLY

A Higgins-Leighton reservoir study showed that the maximum water injection rate will be 95,000 barrels per day. With the four-year development program, the maximum make-up water needed will be 69,000 barrels per day in 1981. Tabulated below are the sources available to supply this need.

Source	Barrels per Day
Phillips Petroleum Company water rights	28,362
Phillips (applied for water rights)	17,977
Rice Engineering (produced water)	10,000
Mobil Oil Corporation (probable)	8,000
Available in Section 36, T-16-S, R-34-E, if needed, from City of Carlsbad:	
4¢/barrel delivered at 50 psi	35,000
Total	99,339
Needed	69,000
Excess	30,339

Phillips will apply for other water rights in the area of the flood as soon as they become available.

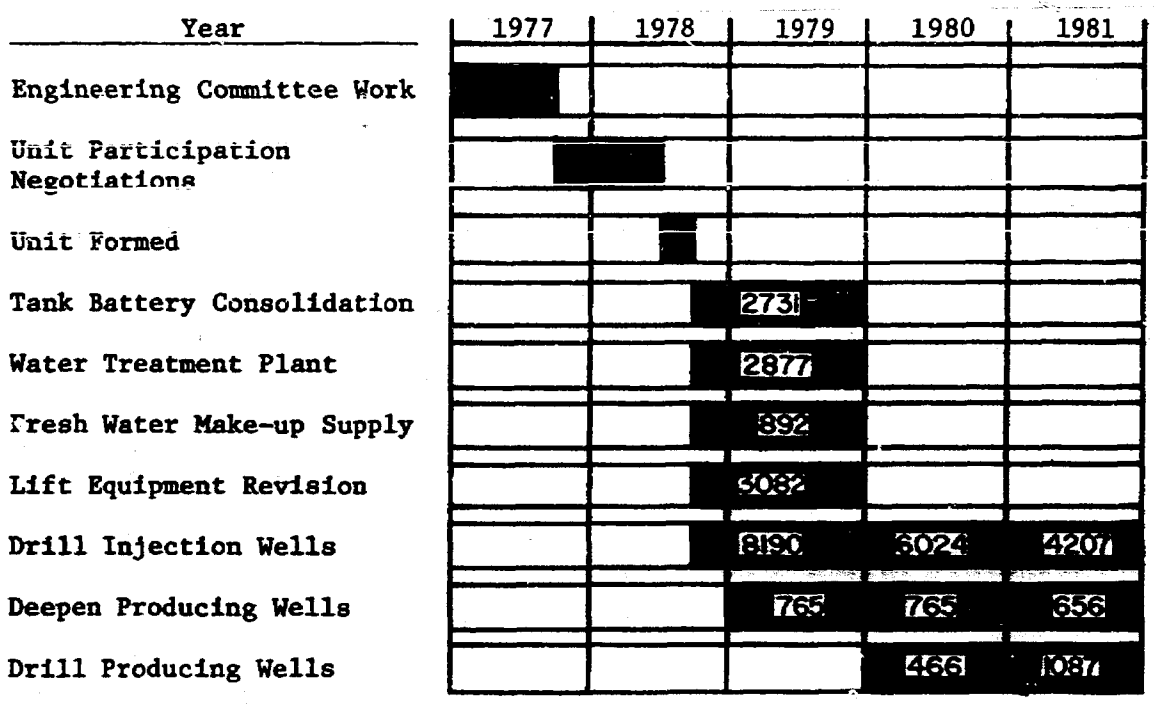
DEVELOPMENT PLAN

Facilities

Facilities necessary for waterflood operations in this unit are a consolidated tank battery, water supply wells and lines, water injection and treatment station with injection lines, 76 pumping units, 127 water injection wells, and 10 additional producing wells. Costs for the wells in the south portion include one resistivity and three porosity logs for each well, and coring six wells. Figure 23 shows the location of the major facilities.

Schedule

Figure 24 is a map showing the annual development by area. The wells to be cored are indicated by a semicircle. Time targets for the preunitization work and the installation of facilities are shown in the bar graph below along with the unescalated estimated cost of each project by year in thousands of dollars.



ECONOMICS

One set of differential economics was run which compared the 40-acre well spacing five-spot at a total primary and secondary recovery of 36.1 percent of the original oil-in-place with continued primary operations. The economics showed a payout of 3.68 years, number of times investment returned 7.62, average annual rate of return 63.3 percent, and a cash flow of 75.2 million dollars for an investment of 11.4 million dollars.

A differential economic analysis was run comparing continued primary operations and 20-acre well spacing five-spot waterflood with primary and secondary recovery of 40 percent of original oil-in-place. For an investment of 31.7 million dollars, the payout was 2.32 years, number of times investment returned 5.13, average annual rate of return 145.5 percent, and cumulative cash flow was 131.2 million dollars. Figure 25 shows cumulative cash flow for future primary plus secondary with infill drilling, future primary plus secondary without infill drilling, and future primary only.

The differential economics after Federal income tax between waterflooding with 20-acre well spacing less waterflooding with 40-acre well spacing are: investment, 20.4 million dollars; payout, 1.88 years; number of times investment returned, 3.75; average annual rate of return, 298 percent; and cash flow, 56 million dollars.

The forecasts from which these analyses were calculated were based on the following premises:

1. The maximum allowable from the unit will be 80 barrels of oil per day times the number of active producing and injection wells in the zone with a maximum number of wells of one per 20 acres (352).
2. The price of lower-tier and upper-tier oil will remain at $5.25 per barrel and $12.00 per barrel, respectively. The gas price will remain at 46¢ per Mcf.
3. The unit will be capable of producing the full allowable based on the proposed wells to be drilled.

4. Infill drilling will increase the recovery by 3.9 percent of the original oil-in-place.

Details of cost and production forecasts used for these analyses are shown in four tables presented in Appendix C.

PARTICIPATION PARAMETERS

The sources of participation parameters included in this report are as follows:

Parameter	Source
1. Current Production	New Mexico Oil and Gas Committee Reports.
2. Future Primary Reserves	See Pages 10 and 11 of this report.
3. Cumulative Production	New Mexico Oil and Gas Committee Reports.
4. Ultimate Primary Reserves	Sum of cumulative production and remaining primary reserves.
5. Acre-Feet of Net Pay	See Pages 8 and 10 of this report.
6. Hydrocarbon Pore Volume	See Page 10 of this report.
7. Original Oil-in-Place	See Page 10 of this report.
8. Secondary Oil Reserves	See Pages 10 and 11 of this report.
9. Floodable Acre-Feet	See Page 11 of this report.
10. Usable Well Bores	Working Interest Owners.
11. Surface Area Acres	Working Interest Owners.

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED
LEA COUNTY, NEW MEXICO

PARAMETERS, TRACT VALUES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume Ac.-Ft.	Original Oil-In-Place STBO	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Atlantic Richfield Company												
State B 1576	3203	38,728	760,200	2,568,914	3,329,100	33,919	3,121.7	18,802,910	2,971,068	33,919	4	160.00
State A DE	2204	3,474	40,900	583,946	624,800	1,540	133.0	801,098	124,254	1,540	2	80.00
State C DE	2403	2,018	7,100	144,383	151,500	1,490	136.0	819,168	127,056	1,490	1	40.00
State E DE	2402	6,726	131,800	328,259	460,100	1,904	106.9	643,890	58,326	1,120	2	80.00
State J DE	1908	526	9,200	100,945	110,100	3,099	263.2	1,585,331	245,892	3,099	1	80.00
State M DE	2906	12,950	269,200	1,746,219	2,015,400	9,431	897.6	5,406,507	838,573	9,430	4	160.00
State W DE	2606	7,167	36,900	659,138	696,100	6,488	533.1	3,211,017	79,239	1,060	2	80.00
Total		71,589	1,255,300	6,131,804	7,387,100	57,871	5,191.5	31,269,921	4,444,408	51,658	16	680.00
Chevron U.S.A., Inc.												
State 3-32	3202	47,719	588,600	2,558,660	3,147,300	19,434	1,692.5	10,194,421	1,469,654	18,027	4	160.00
State 4-27	2704	37,267	413,000	2,637,031	3,050,100	15,463	1,405.5	8,465,737	1,234,820	14,595	4	160.00
State 5-27	2702	10,908	74,600	1,908,711	1,983,400	7,064	665.7	4,009,706	621,923	7,064	4	160.00
State 6-34	3403	43,973	476,400	2,152,498	2,628,800	18,001	1,797.0	10,823,856	1,167,788	12,636	5	200.00
Total		139,867	1,552,600	9,256,900	10,809,600	59,962	5,560.7	33,493,720	4,494,185	52,322	17	680.00
Cities Service Company												
State K	2701	37,453	508,500	2,087,807	2,596,300	6,157	448.0	2,698,436	418,539	6,157	4	160.00
Crown Central Petroleum Corp.												
Shell State E 7259	2001	212	0	16,613	16,600	482	31.7	190,938	29,516	482	1	40.00
Shell State B 1398	1906	214	0	21,921	21,900	889	60.1	362,000	56,148	889	1	40.00
Total		426	0	38,534	38,500	1,371	91.8	552,938	85,764	1,371	2	80.00
Deck, Millard												
Carthay State	2003	1,451	16,600	123,357	140,000	88	6.7	40,357	6,132	86	2	80.00
Elk Oil Company (Old Crusader)												
Cities Service State 1	2002	0	0	65,834	65,834	469	22.9	137,933	21,394	469	0	40.00
Cities Service State 2	1803	0	0	6,841	6,841	743	42.7	257,195	39,095	728	0	40.00
Cities Service State 2	1901	0	0	21,774	21,774	970	59.0	355,374	55,120	970	0	40.00
Total		0	0	94,449	94,449	2,182	124.6	750,502	115,609	2,167	0	120.00

PARAMETERS, TRACT VALUES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume Ac.-Ft.	Original Oil-In-Place STBO	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Exxon Company, U.S.A.												
New Mexico State J	1909	0	0	182,968	183,000	3,215	282.2	1,699,773	263,643	3,214	0	75.38
New Mexico State K	2805	33,840	405,400	3,805,400	4,210,800	23,549	2,443.8	14,719,723	2,235,583	23,041	8	320.00
New Mexico State K	3201	94,207	1,167,700	5,111,800	6,279,400	49,517	4,964.2	29,900,825	4,336,220	46,427	8	320.00
Total		128,047	1,573,100	9,100,210	10,673,200	76,281	7,690.2	46,320,321	6,835,446	72,682	16	715.38
Getty Oil Company												
State BC	3308	14,677	190,100	654,313	844,400	6,854	801.6	4,828,271	748,886	6,854	1	40.00
State P	3302	21,221	240,600	1,292,834	1,533,400	5,846	576.4	3,471,826	538,495	5,845	2	80.00
Total		35,898	430,700	1,947,147	2,377,800	12,700	1,378.0	8,300,097	1,287,381	12,699	3	120.00
Great Western Drilling Company												
State E	2502	1,239	1,900	234,119	236,000	1,502	103.8	625,218	19,395	300	1	40.00
Bettis, Boyle and Stovall (Josaline Production Company)												
State C	1907	1,437	14,400	98,945	113,300	2,223	163.3	983,604	152,562	2,223	2	80.00
State F	2005	287	0	164,301	164,300	925	51.9	312,609	48,486	925	2	80.00
Total		1,724	14,400	263,246	277,600	3,148	215.2	1,296,213	201,048	3,148	4	160.00
Marathon Oil Company												
Staplin State A/C 2	1904	0	0	77,305	77,300	2,366	148.1	892,050	138,361	2,366	0	80.00
Warn State A/C 3	3304	26,914	376,800	1,863,901	2,240,700	17,291	1,882.6	11,339,449	1,745,292	17,157	3	120.00
Warn State A/C 5	0401	634	7,800	9,393	17,200	369	41.3	248,762	21,221	203	1	39.86
Total		27,548	384,600	1,950,599	2,335,200	20,026	2,072.0	12,480,261	1,904,874	19,726	4	239.86
Mobil Oil Corporation												
New Mexico "O"	1802	1,312	13,900	23,994	37,900	622	44.4	267,434	29,037	435	1	37.61
State K	3101	41,650	570,200	2,061,367	2,631,600	21,498	2,060.6	12,411,595	1,925,093	21,498	3	120.00
State K-6	1801	2,604	28,200	26,024	54,200	697	52.2	314,416	34,137	488	1	37.67
State L	2103	1,994	38,600	534,773	573,400	1,494	117.7	708,941	93,934	1,287	3	120.00
State M	3402	58,602	727,000	2,702,492	3,429,500	24,962	2,799.5	16,862,207	2,206,037	21,091	4	160.00
State N	1903	817	10,200	112,499	122,700	1,130	37.7	227,078	35,221	1,130	1	37.68
State O	3307	14,827	189,500	676,596	866,100	6,817	700.5	4,219,316	647,890	6,749	1	40.00
State P	2205	895	21,200	260,193	281,400	978	80.0	481,863	74,739	978	2	80.00
State P	2601	2,381	21,500	215,406	236,900	3,874	294.9	1,776,269	263,515	3,705	2	80.00
Total		125,082	1,620,300	6,613,344	8,233,700	62,072	6,187.5	37,269,119	5,309,603	57,361	18	712.96

PARAMETERS, TRACT VALUES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume Ac.-Ft.	Original Oil-In-Place STBO	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Pennzoil Company												
Phillips State 28	2801	638	6,300	46,248	52,500	1,219	141.1	849,886	131,821	1,219	1	40.00
Phillips State 28	2804	849	8,300	106,808	115,100	517	45.1	271,650	42,135	517	1	40.00
Total		1,487	14,600	153,056	167,600	1,736	186.2	1,121,536	173,956	1,736	2	80.00
Penrose Production Company												
Southern State	2404	33		19,411	19,400	783	49.8	299,960	40,942	689	1	40.00
Phillips Petroleum Company												
Santa Fe	0402	19,536	205,200	741,941	947,141	7,403	760.2	4,578,906	671,307	7,056	2	79.70
Santa Fe	0501	51,699	561,500	1,746,682	2,308,182	19,585	2,306.6	13,893,305	2,009,939	18,272	4	159.85
Santa Fe	0502	56,300	743,212	2,414,830	3,158,042	18,655	1,909.3	11,500,271	1,729,901	18,152	4	159.95
Santa Fe	1905	303	5,968	26,897	32,865	958	68.5	412,595	63,995	958	1	40.00
Santa Fe	2004	3,346	65,900	631,831	697,731	2,439	172.5	1,039,018	156,017	2,370	5	200.00
Santa Fe	2102	757	14,911	307,732	322,643	783	74.2	446,928	69,320	783	2	80.00
Santa Fe	2104	206	4,058	283,587	287,645	596	61.6	371,035	57,549	596	1	40.00
Santa Fe	2501	2,237	44,063	471,789	515,852	1,784	126.2	760,139	82,531	1,249	1	40.00
Santa Fe	2602	43,052	436,561	2,872,130	3,308,691	10,240	794.2	4,783,717	569,878	7,861	5	200.00
Santa Fe	2603	2,097	11,800	406,844	418,644	1,513	97.6	587,873	22,795	378	1	40.00
Santa Fe	2604	7,691	48,000	637,737	685,737	4,849	417.5	2,514,724	192,790	2,230	1	80.00
Santa Fe	2605	980	47,500	564,991	612,491	3,437	297.3	1,790,725	97,212	1,203	1	40.00
Santa Fe	2607	2,097	83,600	852,014	935,614	6,702	628.9	3,788,048	117,907	1,313	1	80.00
Santa Fe	2705	29,124	337,300	1,337,225	1,674,525	11,560	1,328.6	8,002,545	965,648	8,997	2	80.00
Santa Fe	2803	619	12,192	467,691	479,883	1,941	168.6	1,015,526	156,545	1,929	3	120.00
Santa Fe	2901	69	1,359	151,537	152,896	1,493	128.4	773,391	119,957	1,493	1	80.00
Santa Fe	2902	657	12,941	132,022	144,963	2,150	184.8	1,113,104	172,646	2,150	3	120.00
Santa Fe	2905	0	0	60,224	60,224	1,380	169.0	1,017,936	157,886	1,380	1	40.00
Santa Fe	2907	347	6,835	304,534	311,369	1,770	165.5	996,855	154,616	1,770	1	40.00
Santa Fe	3301	28,823	355,800	1,328,059	1,683,859	12,535	1,575.8	9,491,504	1,457,401	12,407	2	80.00
Santa Fe	3303	14,146	188,700	670,659	859,359	5,808	666.3	4,013,319	603,809	5,634	1	40.00
Santa Fe	3306	14,142	188,700	675,211	863,911	6,299	746.4	4,495,785	676,397	6,110	1	40.00
Santa Fe	3309	14,143	183,400	662,053	845,453	5,535	657.1	3,957,905	534,083	4,815	1	40.00
Santa Fe	3401	17,205	192,400	2,272,651	2,465,051	15,715	1,725.5	10,393,191	815,403	7,741	4	160.00
Santa Fe	3501	0	0	312,523	312,523	1,992	194.2	1,170,928	14,042	170	1	80.00
Total		309,576	3,751,900	20,333,394	24,085,500	147,122	15,425.0	92,909,273	11,669,574	117,017	50	2,159.50
Polaris Production Corporation												
Amerada State	2202	0	0	0	0	587	38.8	233,704	36,249	587	0	40.00
Amerada State	2203	997	9,100	259,374	268,474	300	15.6	93,963	14,574	300	1	40.00
Mobil State	2201	508	2,800	10,062	12,900	530	32.4	195,155	30,269	530	1	40.00
Total		1,505	11,900	269,436	281,374	1,417	86.8	522,822	81,092	1,417	2	120.00

PARAMETERS, TRACT VALUES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume Ac.-Ft.	Original Oil-In-Place STBO	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Shell Oil Company												
State C	2401	0	0	22,137	22,100	1,465	85.2	513,184	78,801	1,450	0	40.00
State F	2909	4,750	164,900	986,160	1,151,100	4,029	335.8	2,022,622	263,221	3,394	2	80.00
State H	2908	1,300	34,200	380,373	414,600	2,069	209.2	1,260,073	195,443	2,069	1	40.00
State I	2903	0	0	4,715	4,700	1,298	123.2	742,070	115,099	1,298	0	40.00
State K	1910	0	0	78,825	78,800	1,399	116.3	700,509	108,652	1,399	0	40.00
State N	2802	6,776	139,900	1,356,416	1,496,300	4,444	410.9	2,474,970	383,878	4,444	3	120.00
State S	2101	0	0	20,145	20,100	312	24.5	147,571	22,889	312	0	40.00
State T	3305	48,007	561,600	2,510,107	3,071,600	18,870	2,102.1	12,561,561	1,670,558	15,865	4	157.66
State V	2703	17,275	175,900	1,251,496	1,427,400	7,931	746.0	4,493,376	561,392	6,458	2	80.00
State VAA	0503	4,110	96,800	154,879	251,700	1,379	101.7	612,569	94,061	1,365	1	40.00
State VE	1902	0	0	0	0	735	48.1	289,720	43,140	706	0	40.00
Total		82,218	1,173,300	6,765,253	7,938,400	43,931	4,303.0	25,918,225	3,537,134	38,760	13	717.66
Sohio Petroleum Company												
Warn State	2301	1,279	33,600	258,170	291,800	1,710	114.9	692,076	103,607	1,648	2	80.00
Texaco Inc. (Crusader Texas State)												
State CG NCT-2	2904	0	0	16,538	16,500	806	70.7	425,847	66,051	806	0	40.00
GRAND TOTAL		966,122	12,343,300	65,656,774	78,000,000	500,865	49,306.4	296,986,842	40,794,740	441,750	157	7,025.36

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED
LEA COUNTY, NEW MEXICO

PARAMETERS, TRACT PERCENTAGES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume (Ac.-Ft.) & Original Oil-In-Place (STBO)	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Atlantic Richfield Company											
State B 1576	3203	4.009	6.159	3.913	4.268	6.772	6.331	7.283	7.678	2.548	2.277
State A DE	2204	.360	.331	.869	.801	.307	.270	.305	.349	1.274	1.139
State C DE	2403	.209	.058	.220	.194	.297	.276	.311	.337	.637	.569
State E DE	2402	.696	1.068	.500	.590	.380	.217	.143	.254	1.274	1.139
State J DE	1908	.054	.075	.154	.141	.619	.534	.603	.702	.637	1.139
State M DE	2906	1.340	2.181	2.660	2.584	1.883	1.820	2.056	2.135	2.548	2.277
State W DE	2606	.742	.299	1.004	.892	1.295	1.081	.194	.240	1.274	1.139
Total		7.410	10.171	9.340	9.470	11.553	10.529	10.895	11.695	10.192	9.679
Chevron U.S.A., Inc.											
State 3-32	3202	4.939	4.769	3.897	4.035	3.880	3.433	3.603	4.081	2.548	2.277
State 4-27	2704	3.857	3.346	4.016	3.910	3.087	2.851	3.027	3.304	2.548	2.277
State 5-27	2702	1.129	.604	2.907	2.543	1.410	1.350	1.525	1.599	2.548	2.277
State 6-34	3403	4.551	3.860	3.278	3.370	3.594	3.645	2.863	2.860	3.185	2.847
Total		14.476	12.579	14.098	13.858	11.971	11.279	11.018	11.844	10.829	9.678
Cities Service Company											
State K	2701	3.846	4.120	3.180	3.329	1.229	.909	1.026	1.394	2.548	2.277
Crown Central Petroleum Corp.											
Shell State E 7259	2001	.022		.025	.021	.096	.064	.073	.109	.637	.569
Shell State B 1398	1906	.022		.033	.028	.177	.122	.138	.201	.637	.569
Total		.044		.058	.049	.273	.186	.211	.310	1.274	1.138
Deck, Millard											
Carthay State	2003	.150	.134	.188	.179	.018	.014	.015	.019	1.274	1.139
Elk Oil Company (Old Crusader)											
Cities Service State 1	2002			.100	.084	.094	.046	.052	.106		.569
Cities Service State 2	1803			.010	.009	.148	.087	.096	.165		.569
Cities Service State 2	1901			.033	.028	.194	.120	.135	.220		.570
Total				.143	.121	.436	.253	.283	.491		1.708

PARAMETERS, TRACT PERCENTAGES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume (Ac.-Ft.) & Original Oil-In-Place (STBO)	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Exxon Company, U.S.A.											
New Mexico State J	1909			.279	.235	.642	.572	.646	.728		1.073
New Mexico State K	2805	3.503	3.284	5.795	5.398	4.702	4.958	5.480	5.216	5.095	4.556
New Mexico State K	3201	9.752	9.460	7.786	8.051	9.886	10.068	10.629	10.510	5.095	4.556
Total		13.255	12.744	13.860	13.684	15.230	15.598	16.755	16.454	10.190	10.185
Getty Oil Company											
State BC	3308	1.519	1.540	.997	1.083	1.368	1.626	1.836	1.552	.637	.569
State P	3302	2.197	1.949	1.969	1.966	1.167	1.169	1.320	1.323	1.274	1.139
Total		3.716	3.489	2.966	3.049	2.535	2.795	3.156	2.875	1.911	1.708
Great Western Drilling Company											
State E	2502	.128	.015	.357	.303	.300	.211	.048	.068	.637	.569
Bettis, Boyle and Stovall (Josaline Production Company)											
State C	1907	.149	.117	.151	.145	.444	.331	.374	.503	1.274	1.139
State F	2005	.030		.250	.211	.185	.105	.119	.209	1.274	1.139
Total		.179	.117	.401	.356	.629	.436	.493	.712	2.548	2.278
Marathon Oil Company											
Staplin State A/C 2	1904			.118	.099	.472	.300	.339	.536		1.139
Warn State A/C 3	3304	2.786	3.053	2.839	2.873	3.452	3.818	4.278	3.884	1.911	1.708
Warn State A/C 5	0401	.066	.063	.014	.022	.074	.084	.052	.046	.637	.567
Total		2.852	3.116	2.971	2.994	3.998	4.202	4.669	4.466	2.548	3.414
Mobil Oil Corporation											
New Mexico "O"	1802	.136	.113	.037	.049	.124	.090	.071	.098	.637	.536
State K	3101	4.311	4.620	3.140	3.374	4.292	4.179	4.719	4.865	1.911	1.708
State K-6	1801	.270	.228	.040	.069	.139	.106	.084	.110	.637	.536
State L	2103	.206	.310	.814	.735	.298	.239	.230	.291	1.911	1.708
State M	3402	6.066	5.890	4.116	4.397	4.984	5.678	5.408	4.774	2.548	2.277
State N	1903	.085	.083	.171	.157	.226	.076	.086	.256	.637	.537
State O	3307	1.535	1.535	1.031	1.110	1.361	1.421	1.588	1.528	.637	.569
State P	2205	.093	.172	.396	.361	.195	.162	.183	.221	1.274	1.139
State P	2601	.246	.174	.328	.304	.773	.598	.646	.839	1.274	1.139
Total		12.948	13.125	10.073	10.556	12.392	12.549	13.015	12.982	11.466	10.149

PARAMETERS, TRACT PERCENTAGES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume (Ac.-Ft.) & Original Oil-In-Place (STBO)	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Pennzoil Company											
Phillips State 28	2801	.066	.051	.070	.067	.243	.286	.323	.276	.637	.569
Phillips State 28	2804	.088	.067	.163	.148	.103	.091	.103	.117	.637	.569
Total		.154	.118	.233	.215	.346	.377	.426	.393	1.274	1.138
Penrose Production Company											
Southern State	2404	.003		.030	.025	.156	.101	.100	.156	.637	.569
Phillips Petroleum Company											
Santa Fe	0402	2.022	1.662	1.130	1.214	1.478	1.542	1.646	1.597	1.274	1.134
Santa Fe	0501	5.351	4.549	2.660	2.959	3.914	4.676	4.927	4.136	2.548	2.278
Santa Fe	0502	5.827	6.021	3.678	4.049	3.725	3.872	4.240	4.109	2.545	2.277
Santa Fe	1905	.031	.048	.041	.042	.191	.139	.157	.217	.637	.569
Santa Fe	2004	.346	.534	.962	.895	.487	.350	.382	.536	3.185	2.847
Santa Fe	2102	.078	.121	.469	.414	.156	.150	.170	.177	1.274	1.139
Santa Fe	2104	.021	.033	.432	.369	.119	.125	.141	.135	.637	.569
Santa Fe	2501	.232	.357	.719	.661	.356	.256	.202	.283	.637	.569
Santa Fe	2602	4.456	3.537	4.374	4.242	2.044	1.611	1.397	1.780	3.185	2.849
Santa Fe	2603	.217	.096	.620	.537	.302	.198	.056	.086	.637	.569
Santa Fe	2604	.796	.389	.971	.879	.968	.847	.473	.505	.637	1.139
Santa Fe	2605	.101	.385	.861	.785	.686	.603	.238	.272	.637	.569
Santa Fe	2607	.217	.677	1.298	1.200	1.338	1.275	.289	.297	.637	1.139
Santa Fe	2705	3.015	2.733	2.037	2.147	2.308	2.695	2.367	2.037	1.274	1.139
Santa Fe	2803	.064	.099	.712	.615	.388	.342	.384	.437	1.911	1.708
Santa Fe	2901	.007	.011	.231	.196	.298	.260	.294	.338	.637	1.139
Santa Fe	2902	.068	.105	.201	.186	.429	.375	.423	.487	1.911	1.708
Santa Fe	2905			.092	.077	.276	.343	.387	.312	.637	.569
Santa Fe	2907	.036	.055	.464	.399	.353	.336	.379	.401	.637	.569
Santa Fe	3301	2.983	2.883	2.023	2.159	2.503	3.196	3.573	2.809	1.274	1.139
Santa Fe	3303	1.464	1.529	1.021	1.102	1.160	1 351	1.480	1.275	.637	.569
Santa Fe	3306	1.464	1.529	1.028	1.108	1.258	1.514	1.658	1.383	.637	.569
Santa Fe	3309	1.464	1.486	1.008	1.084	1.105	1.333	1.309	1.090	.637	.569
Santa Fe	3401	1.781	1.559	3.461	3.160	3.138	3.500	1.999	1.752	2.548	2.277
Santa Fe	3501			.476	.401	.398	.394	.034	.038	.637	1.139
Total		32.041	30.398	30.969	30.880	29.378	31.283	28.605	26.489	31.847	30.741
Polaris Production Corporation											
Amerada State	2202					.117	.079	.089	.133		.569
Amerada State	2203	.103	.074	.395	.344	.060	.032	.036	.068	.637	.569
Mobil State	2201	.053	.023	.015	.017	.106	.066	.074	.120	.637	.569
Total		.156	.097	.410	.361	.283	.177	.199	.321	1.274	1.707

PARAMETERS, TRACT PERCENTAGES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume (Ac.-Ft.) & Original Oil-In-Place (STBO)	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Shell Oil Company											
State C	2401			.034	.028	.292	.173	.193	.328		.569
State F	2909	.492	1.336	1.502	1.476	.804	.681	.645	.768	1.274	1.139
State H	2908	.135	.277	.579	.532	.413	.424	.479	.468	.637	.569
State I	2903			.007	.006	.259	.250	.282	.294		.569
State K	1910			.120	.101	.279	.236	.266	.317		.569
State N	2802	.701	1.133	2.066	1.918	.887	.833	.941	1.006	1.911	1.708
State S	2101			.031	.026	.062	.050	.056	.071		.569
State T	3305	4.969	4.550	3.823	3.936	3.767	4.263	4.095	3.591	2.548	2.246
State V	2703	1.788	1.425	1.906	1.830	1.583	1.513	1.376	1.462	1.274	1.139
State VAA	0503	.425	.784	.236	.323	.275	.206	.231	.309	.637	.569
State VE	1902					.148	.098	.106	.160		.569
Total		8.510	9.505	10.304	10.176	8.769	8.727	8.670	9.774	8.281	10.215
Sohio Petroleum Company											
Ward State	2301	.132	.272	.393	.374	.341	.233	.254	.373	1.274	1.139
Texaco Inc. (Crusader Texas State)											
State CG NCT-2	2904			.025	.021	.161	.143	.162	.182		.569
GRAND TOTAL		100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED
LEA COUNTY, NEW MEXICO

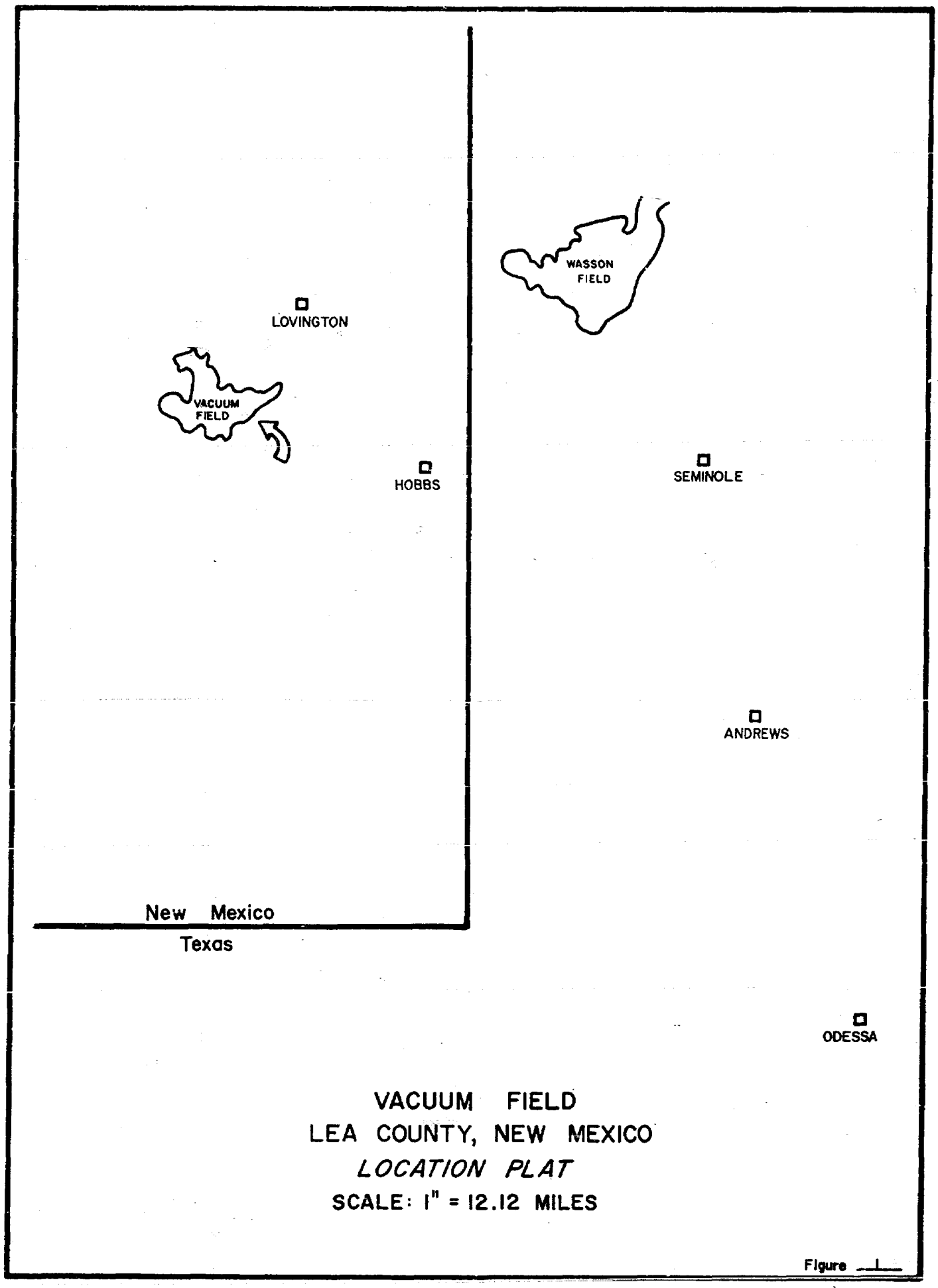
COMPARISON OF PARAMETERS BY AREA

Parameter	North Area	South Area	East Area	Total Area
Average Porosity, percent	10.0	12.4	11.8	11.7
Average Net Thickness, feet	33	127	78	71.3
Average Original Water Saturation, percent	18.6	15.0	15.8	15.9
Original Oil-in-Place, M barrels	59,138	167,341	70,508	296,987
Barrels/Acre	17,393	78,934	46,387	42,273
Cumulative Production 1-1-77, M barrels	18,037	30,717	16,903	65,657
Barrels/Acre	5,305	14,489	11,120	9,346
Remaining Primary 1-1-77, M barrels	2,409	7,971	1,963	12,343
Barrels/Acre	709	3,760	1,291	1,756
Ultimate Primary Recovery, M barrels	20,446	38,688	18,866	78,000
M Barrels/40-Acre Unit	241	730	496	444
Primary Recovery, Percent Original Oil-in-Place	34.6	23.1	26.8	26.3
Total 40-Acre Proration Units	85	53	38	176
Proration Units Producing Top Allowable December, 1976	0	36	7	43
Water Encroachment, Percent Original Hydrocarbon Pore Volume	2.8	4.1	36.0	11.4
Last Half 1976 Production, Barrels/Day/40-Acre Unit	10.6	60.9	29.3	29.8

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED
LEA COUNTY, NEW MEXICO

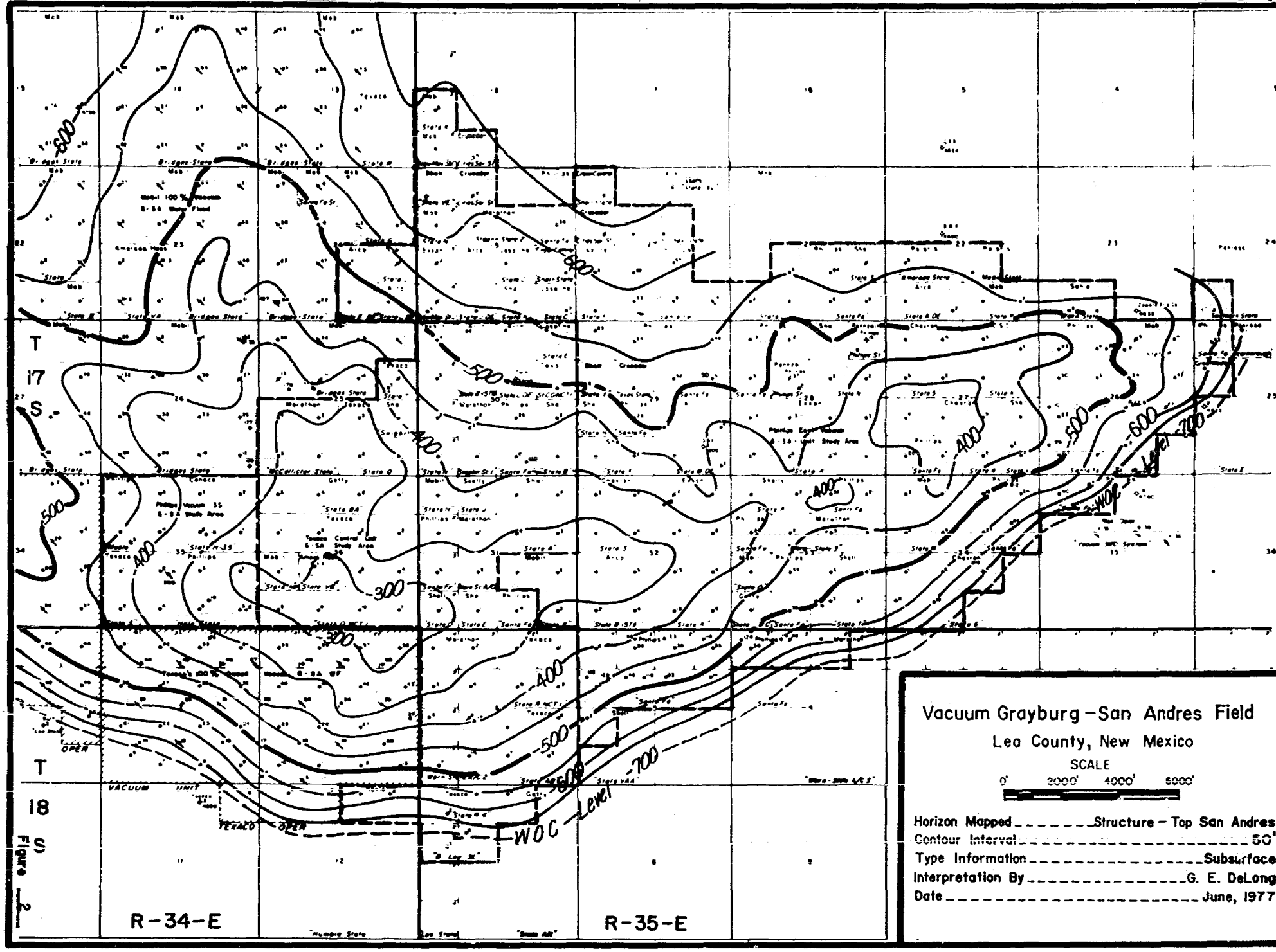
PROJECT COMPARISON OF EAST VACUUM UNIT TO DENVER UNIT

Project	East Vacuum Grayburg-San Andres Unit, Proposed	Shell Oil Company Denver Grayburg-San Andres Unit
Depth, feet	4,400	5,100
Type Formation	Dolomite	Dolomite
Bottom-Hole Temperature, °F.	101	105
Original Bottom-Hole Pressure, psig	1,613	1,805
Net Pay, feet	71	129
Porosity, percent	11.7	12.0
Permeability, Md.	11.0	3.5
Area, acres	7,025	27,850
Connate Water, percent	15.9	15.0
Original Oil Formation Volume Factor	1.288	1.312
Initial Solution Gas-Oil Ratio, cubic feet/stock tank barrel	465	588
Initial Viscosity of Oil, centipoise	0.80	0.97
Gravity, °API	35	33
Original Oil-in-Place, MM barrels	297	2,166
Ultimate Primary, MM barrels	78	354
Estimated Secondary, MM barrels	41	410
Total, MM barrels	119	764
Recovery to Date, MM barrels	66	595
Flood Pot Residual Oil Saturation, percent	30	40 to 45
Percent of Original Oil Recovered after Waterflood (estimate)	40.0	35.3
Original Gas Cap	No	Yes



VACUUM FIELD
LEA COUNTY, NEW MEXICO
LOCATION PLAT
SCALE: 1" = 12.12 MILES

Figure 1



Vacuum Grayburg-San Andres Field

Lea County, New Mexico

SCALE

0' 2000' 4000' 6000'

Horizon Mapped ..... Structure - Top San Andres

Contour Interval ..... 50'

Type Information ..... Subsurface

Interpretation By ..... G. E. DeLong

Date ..... June, 1977

Figure 2

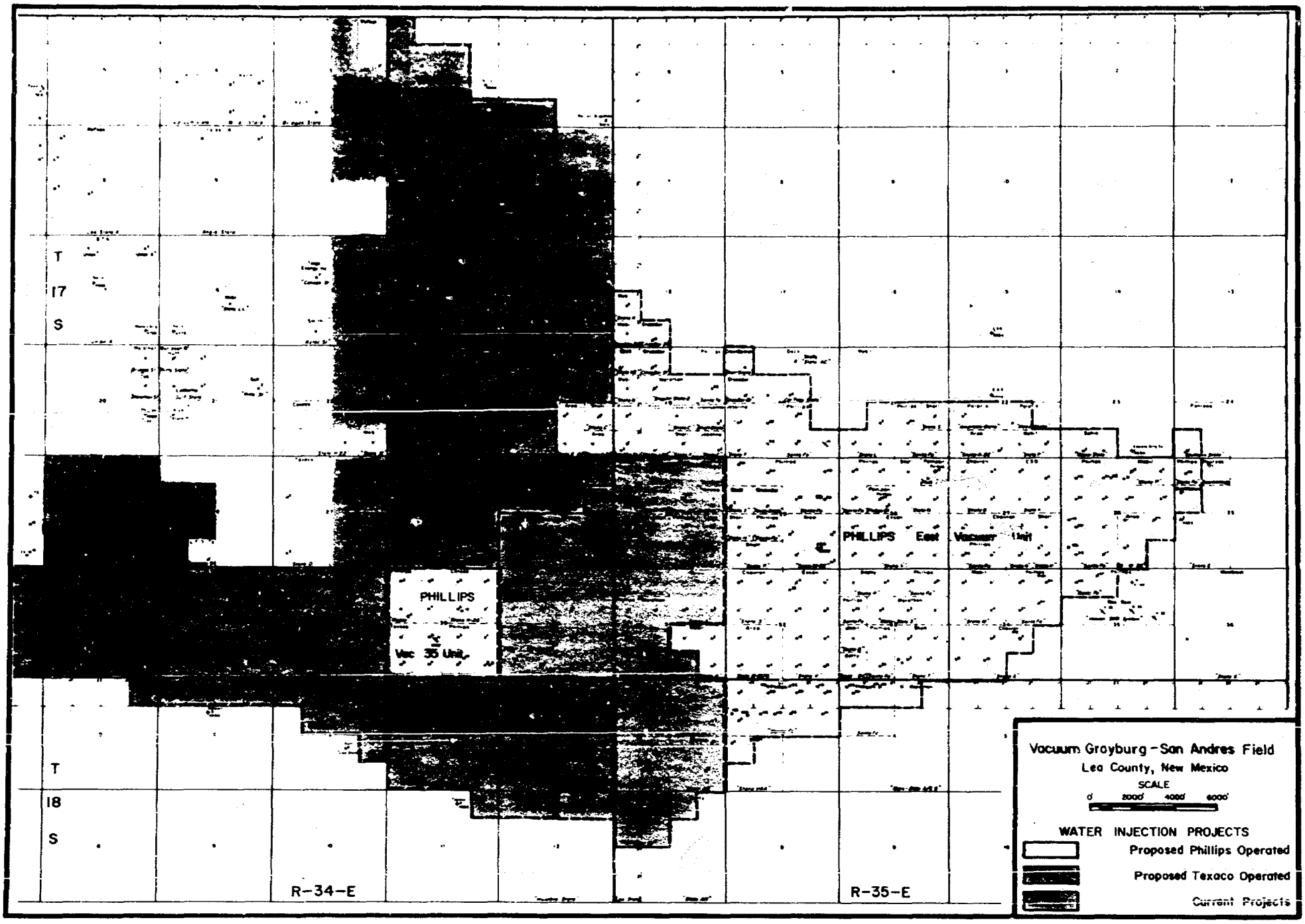
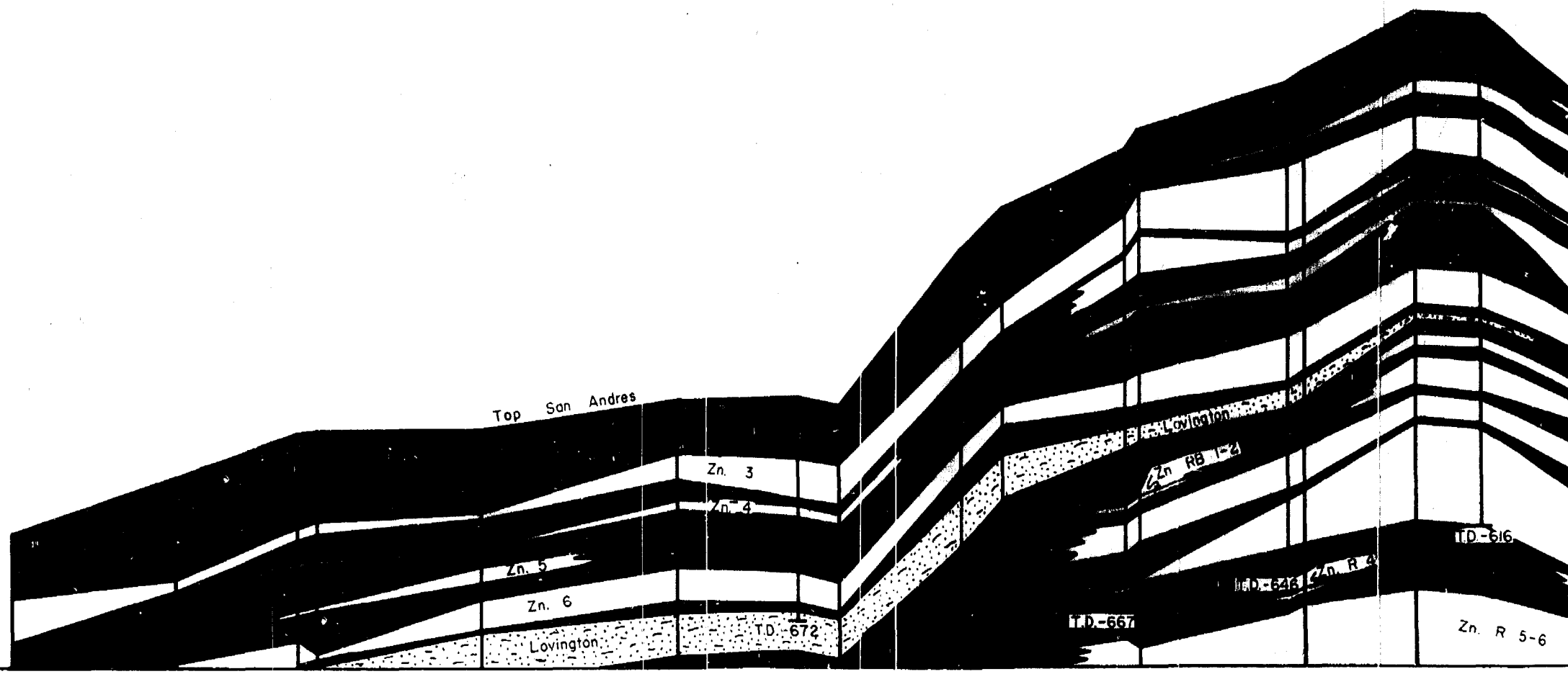

T
17
S
T
18
S
R-34-E
R-35-E
PHILLIPS
Vac 35 Unit
PHILLIPS East Vacuum Unit
Vacuum Groyburg - San Andres Field
Lea County, New Mexico
SCALE
0 2000' 4000' 6000'
WATER INJECTION PROJECTS
Proposed Phillips Operated
Proposed Texaco Operated
Current Projects

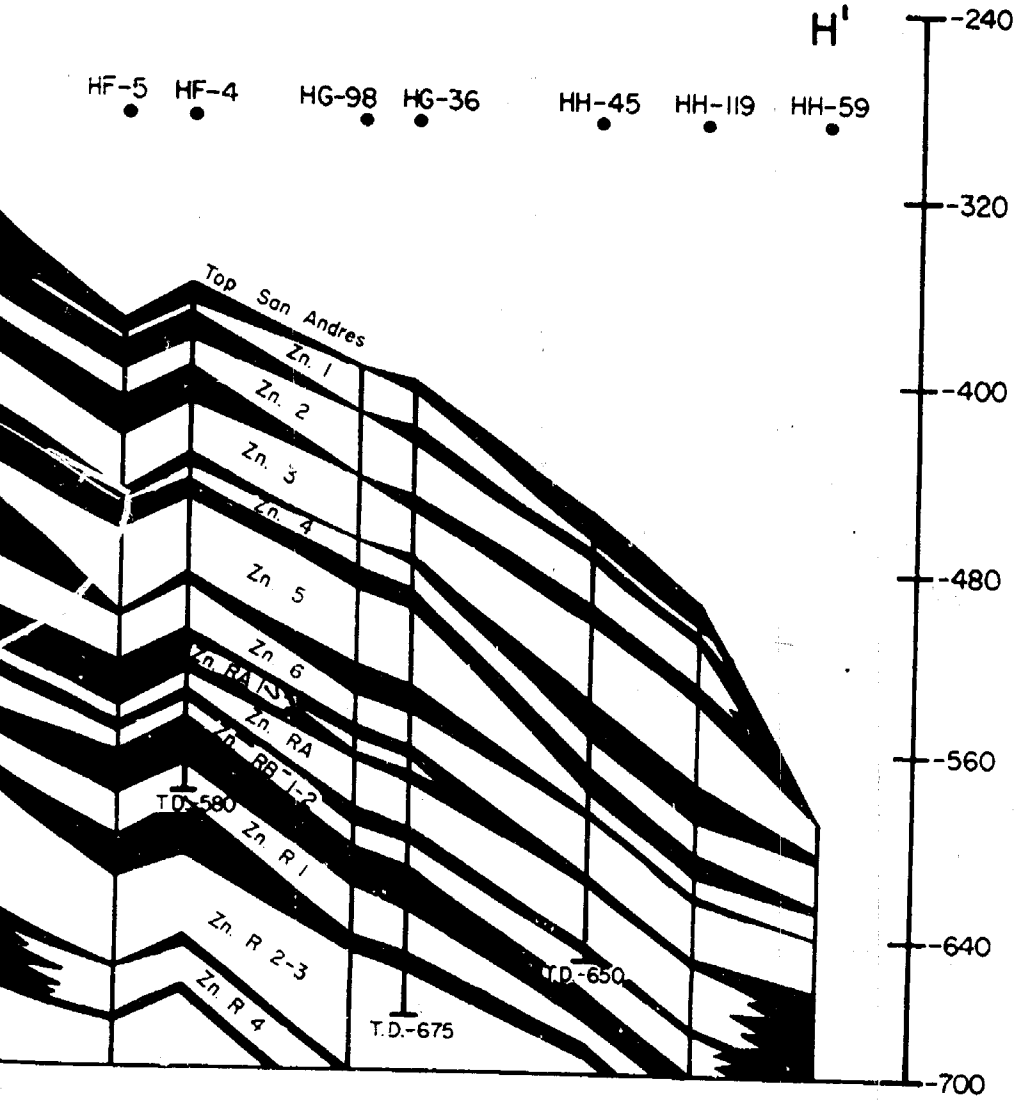
Figure 3

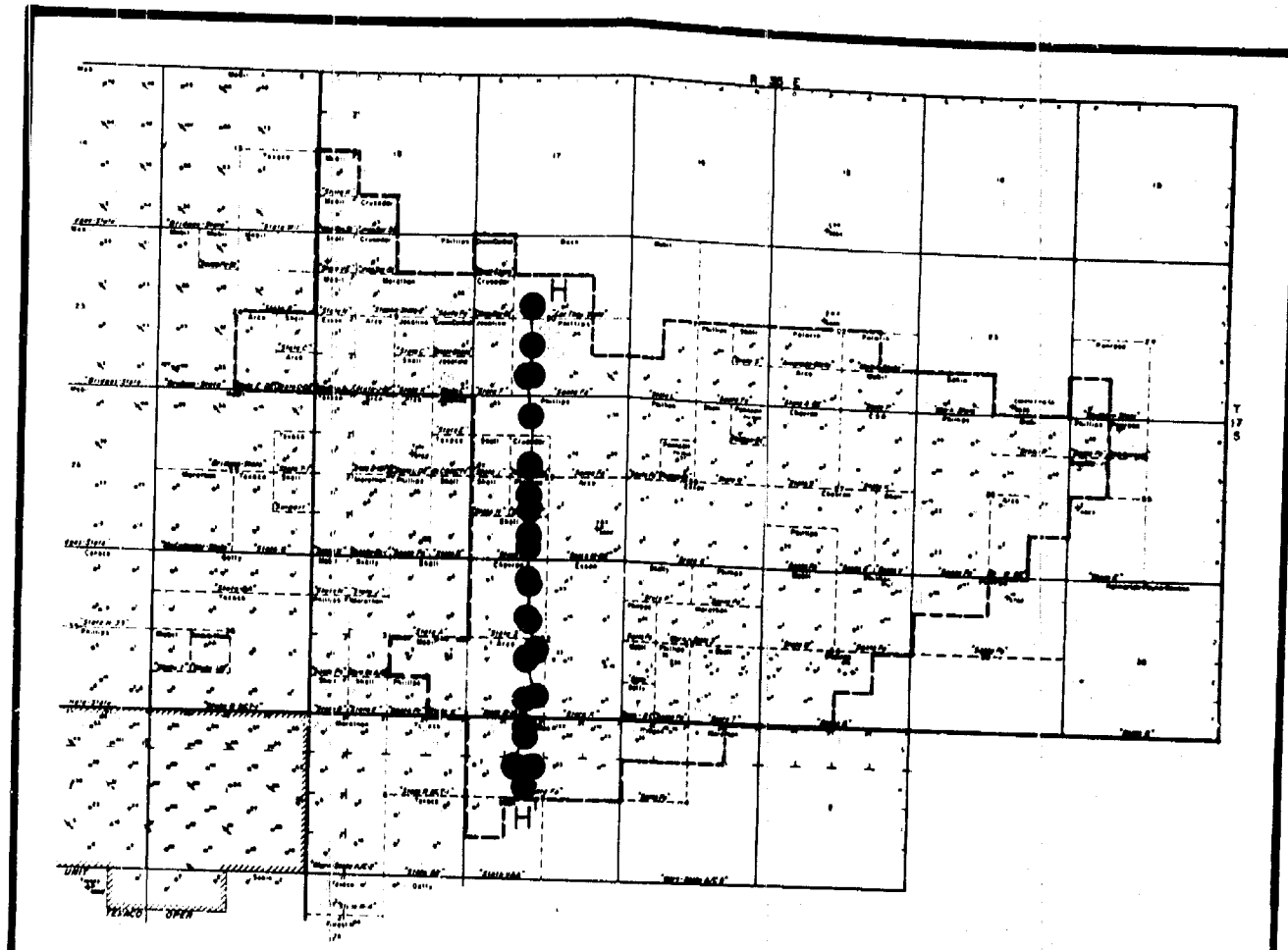
H

H5-1 H6-82 H7-53 H7-125 H8-54 H9-1 HA-26 HA-103 HB-2 HB-4 HC-3 HC-7 HD-4 HD-5 HE-6 HE-3

-240
-320
-400
-480
-560
-640
-700



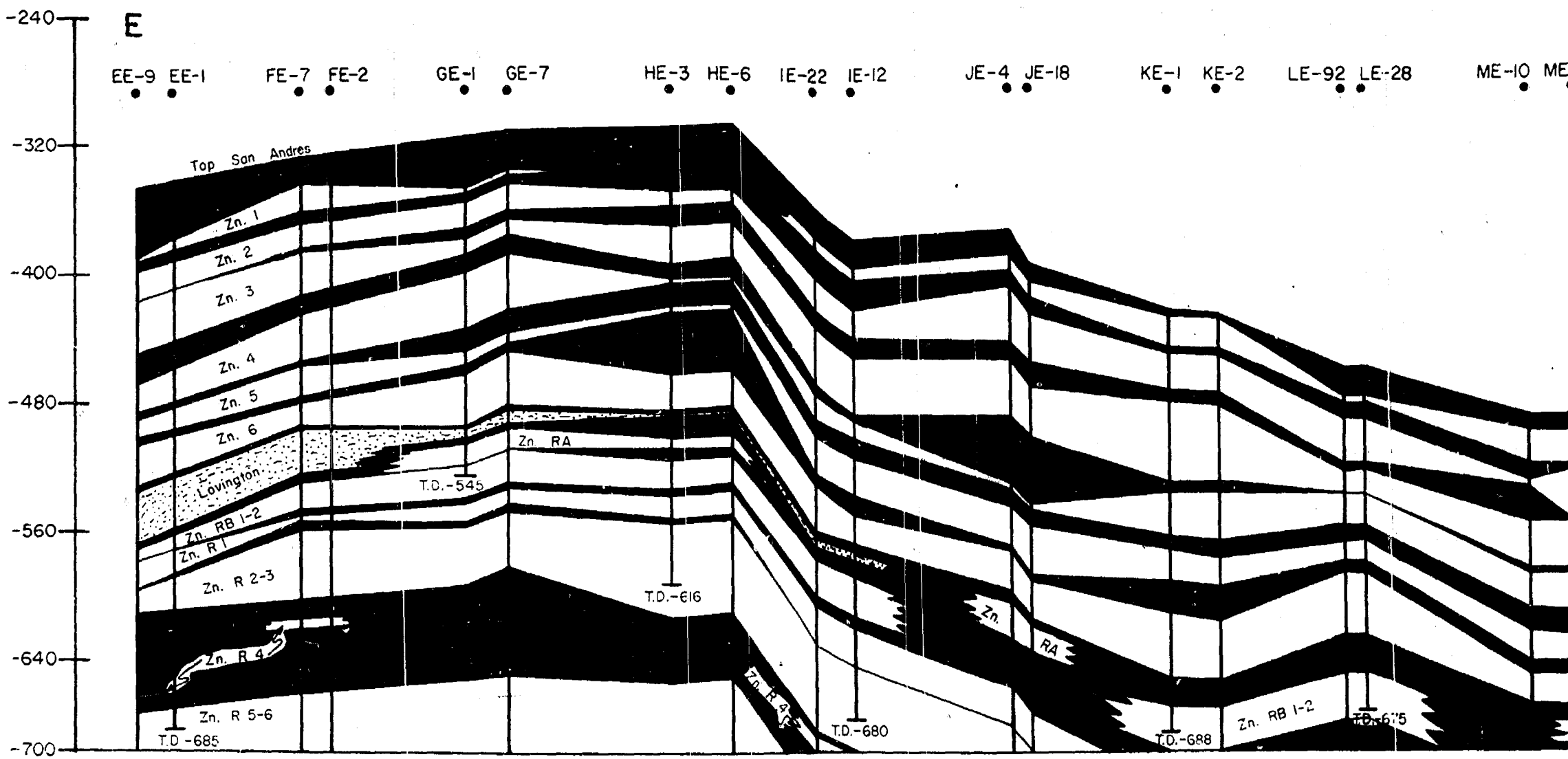


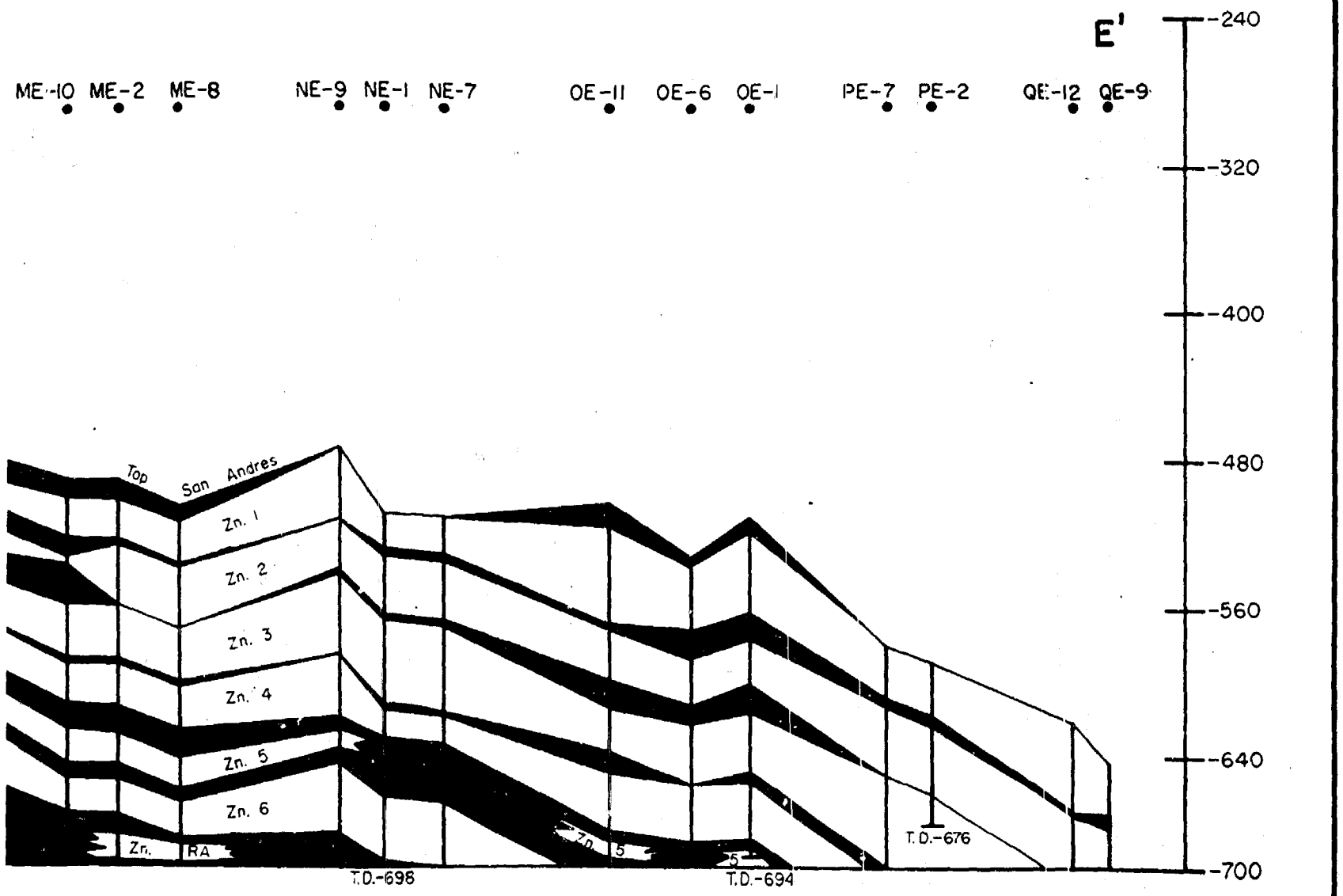


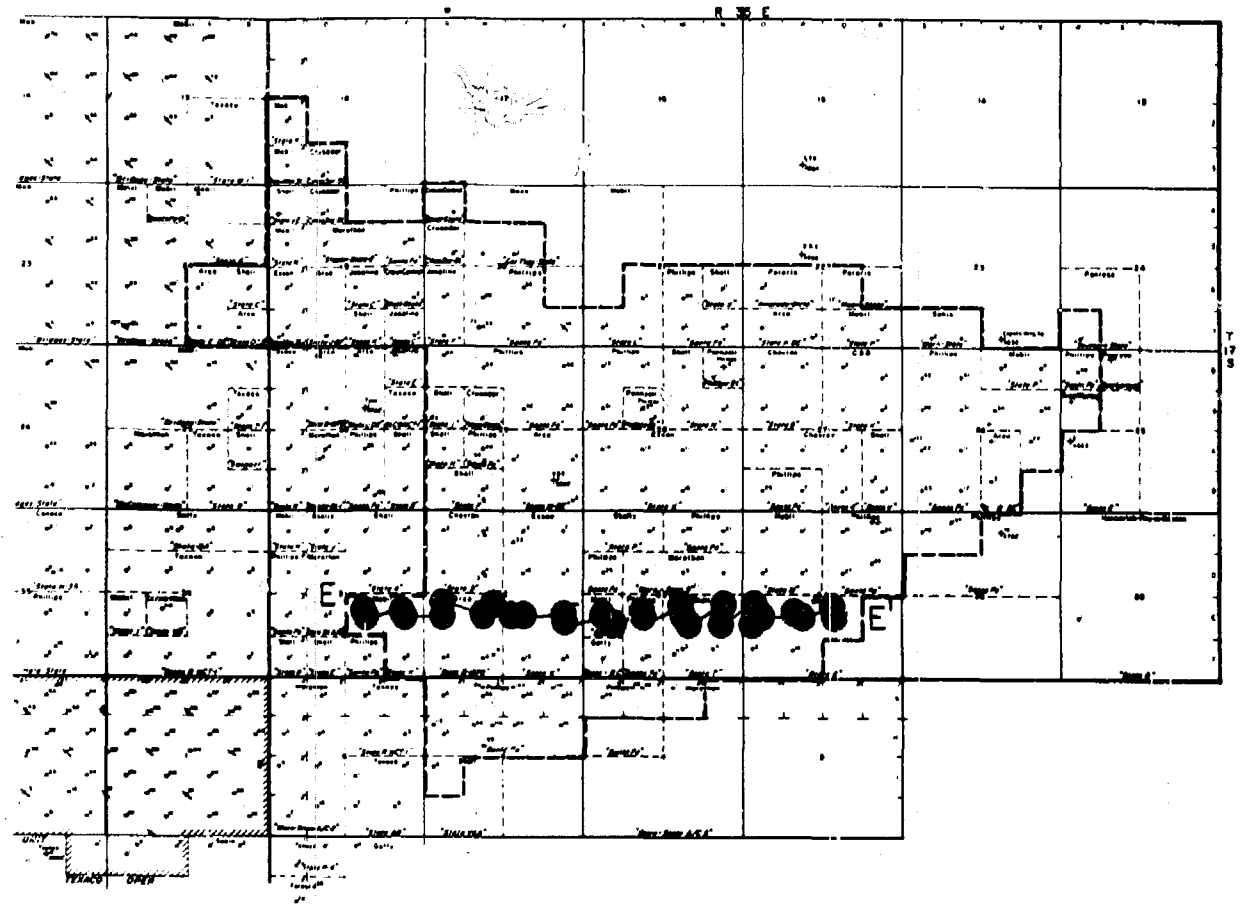
LINE OF CROSS SECTION

NORTH--SOUTH CROSS SECTION H--H'
EAST VACUUM GRAYBURG-SAN ANDRES FIELD
LEA CO., NEW MEXICO

Figure


E
-240
-320
-400
-480
-560
-640
-700
EE-9
EE-1
FE-7
FE-2
GE-1
GE-7
HE-3
HE-6
IE-22
IE-12
JE-4
JE-18
KE-1
KE-2
LE-92
LE-28
ME-10
Top San Andres
Zn. 1
Zn. 2
Zn. 3
Zn. 4
Zn. 5
Zn. 6
Lovington
Zn. RB 1-2
Zn. R 1
Zn. R 2-3
Zn. R 4
Zn. R 5-6
T.D -685
Zn. RA
T.D.-545
T.D.-616
Zn. R 4
T.D.-680
Zn.
RA
T.D.-688
Zn. RB 1-2
T.D.-675


E'
ME-10
ME-2
ME-8
NE-9
NE-1
NE-7
OE-11
OE-6
OE-1
PE-7
PE-2
QE-12
QE-9
-240
-320
-400
-480
-560
-640
-700
Top San Andres
Zn. 1
Zn. 2
Zn. 3
Zn. 4
Zn. 5
Zn. 6
Zn. RA
Zn. 5
T.D.-698
T.D.-694
T.D.-676

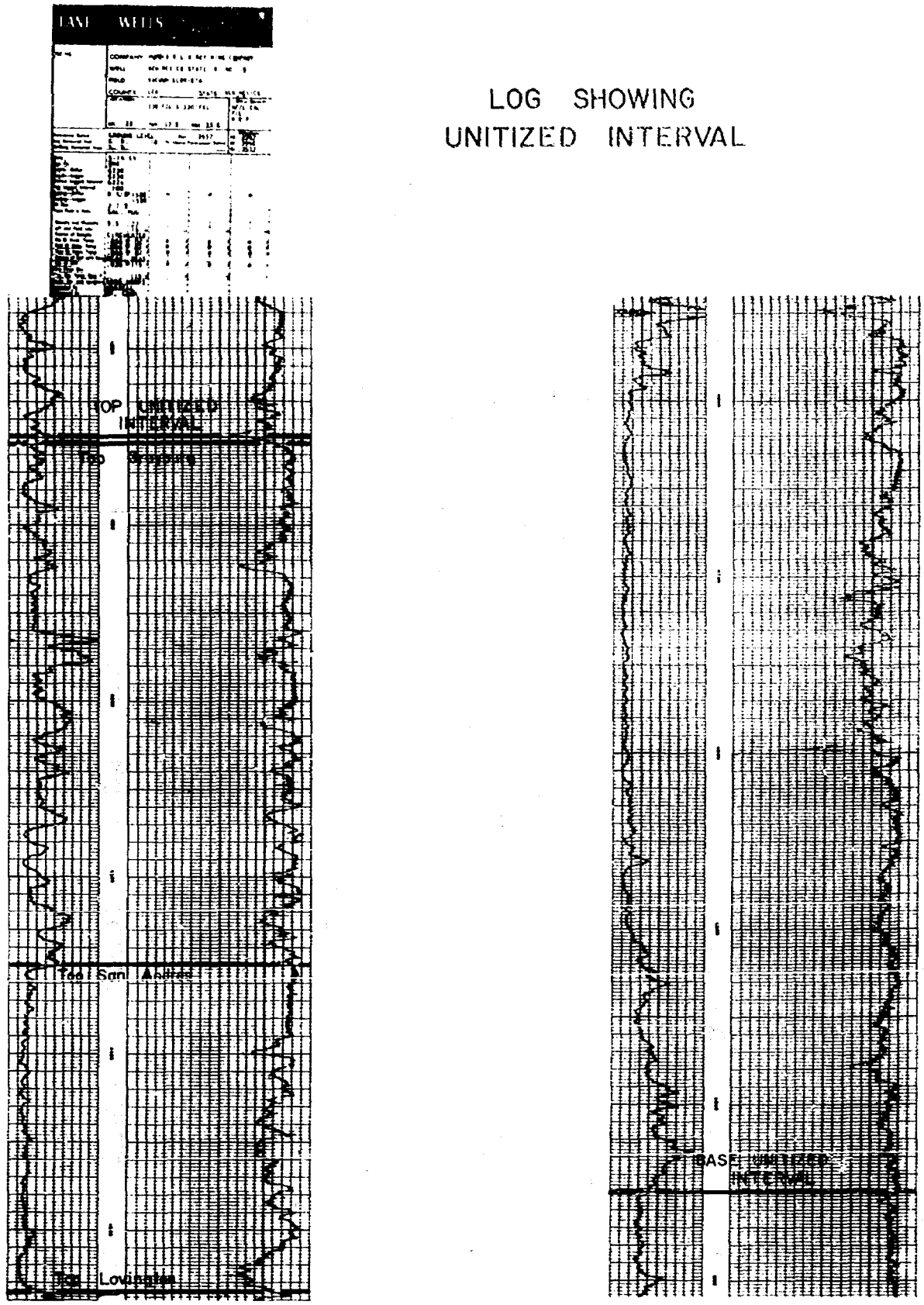


LINE OF CROSS SECTION

WEST-EAST CROSS SECTION E-E'
EAST VACUUM GRAYBURG-SAN ANDRES FIELD
LEA CO., NEW MEXICO

Figure 5

LOG SHOWING
UNITIZED INTERVAL



The unitized interval will be the vertical interval that appears between a depth of 4050' and 5050' on the Lane wells acoustic log Run #1, dated 4-14-64 on the Humble Oil and Refining Company New Mexico State "K" #19. This well is located 330' FSL, 330' FEL, Sec. 28, Township 17 South, Range 35 East, Lea County, New Mexico. The unitized interval is to include all subsurface points throughout the unit area between these identified correlative depths.

Figure 6

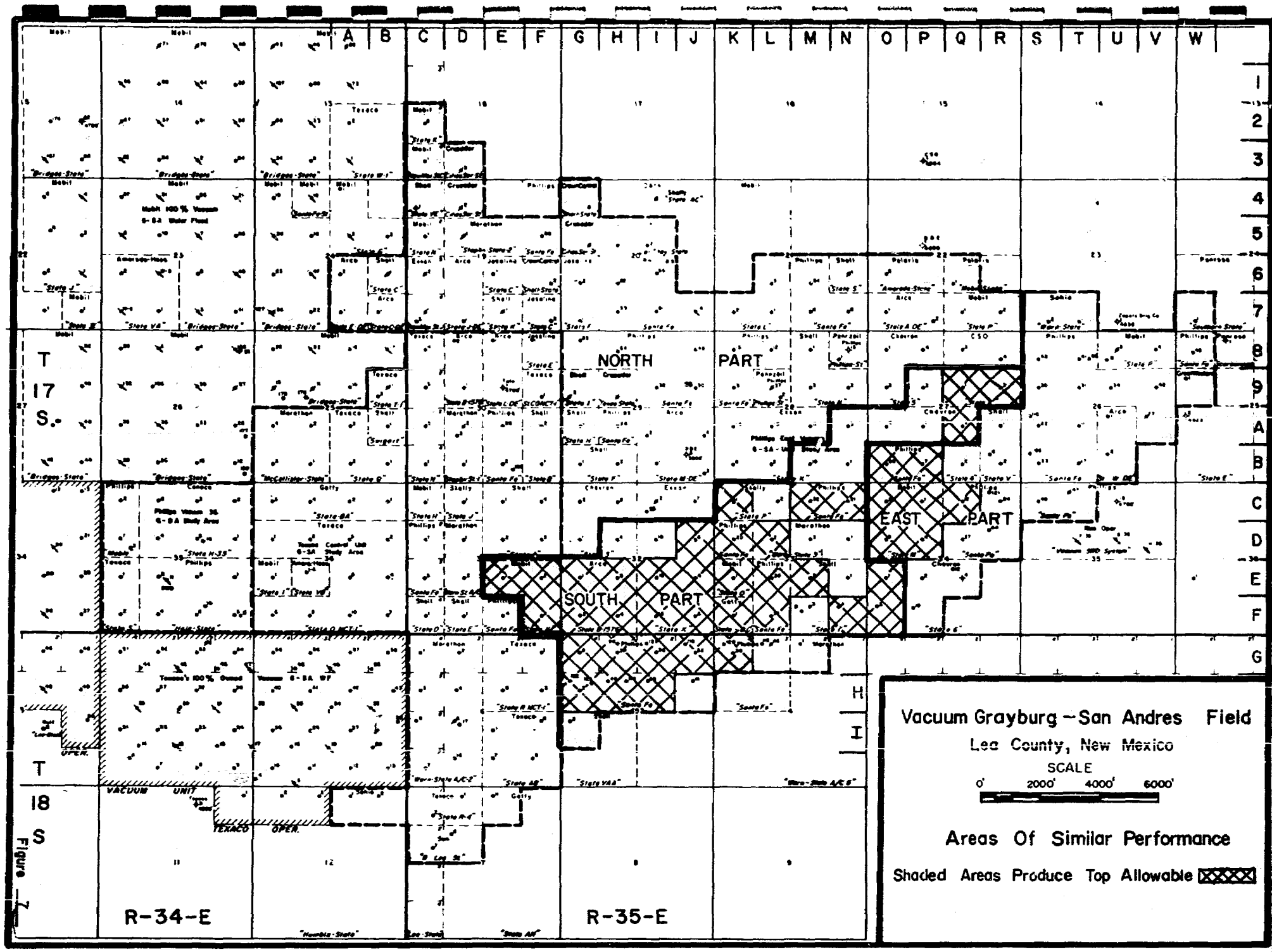

A B C D E F G H I J K L M N O P Q R S T U V W
1 2 3 4 5 6 7 8 9 A B C D E F G H I
T 17 S.
T 18 S
NORTH PART
EAST PART
SOUTH PART
VACUUM UNIT
TEXACO
OPEN
R-34-E
R-35-E
Vacuum Grayburg – San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
Areas Of Similar Performance
Shaded Areas Produce Top Allowable

Figure 7

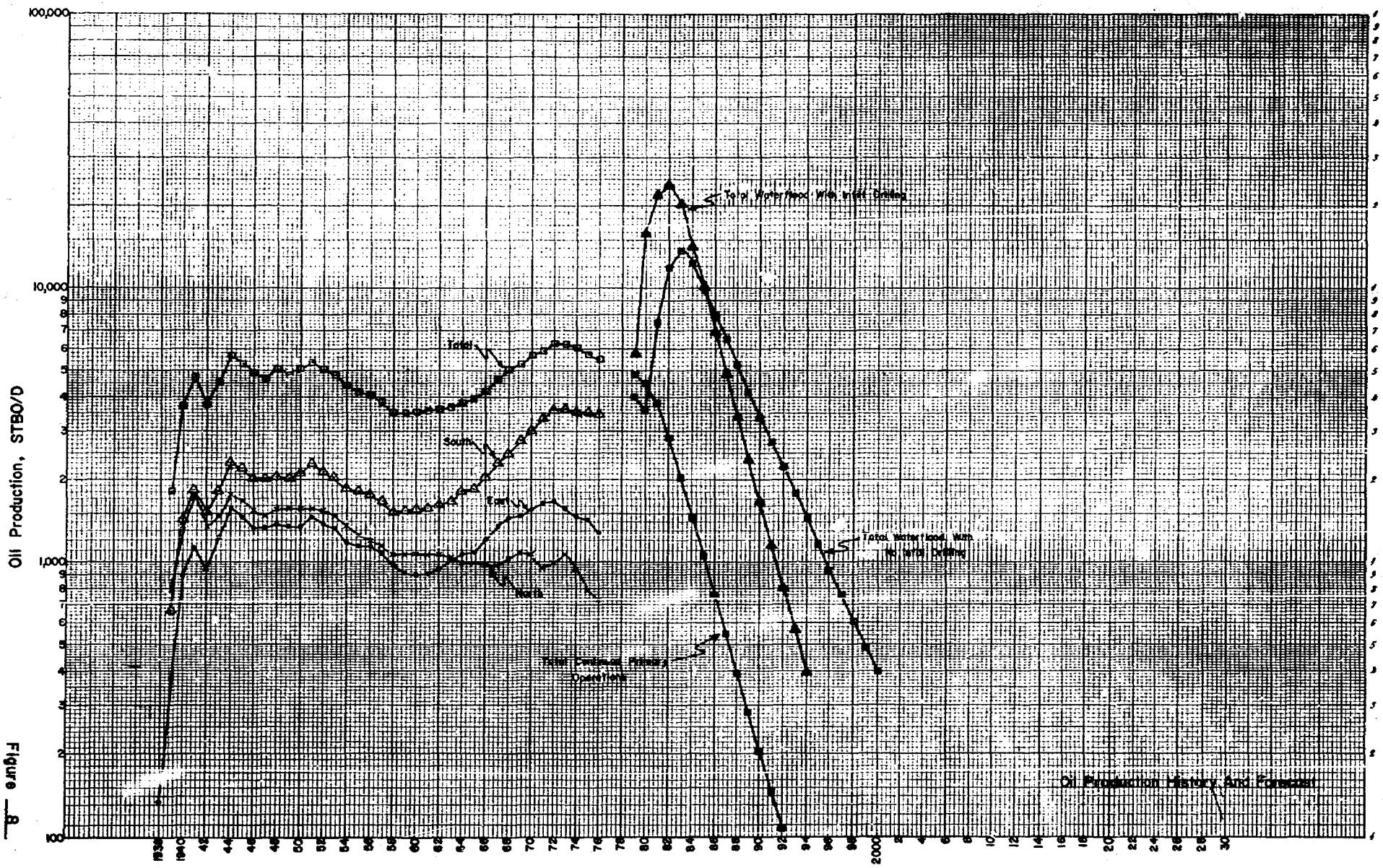

Oil Production, STBO/D
100,000
10,000
1,000
100
Total
South
East
North
Total Primary Primary Operations
Total Waterflood With Infill Drilling
Total Waterflood Without Infill Drilling
Oil Production History And Forecast
1938
1940
2000

Figure 8

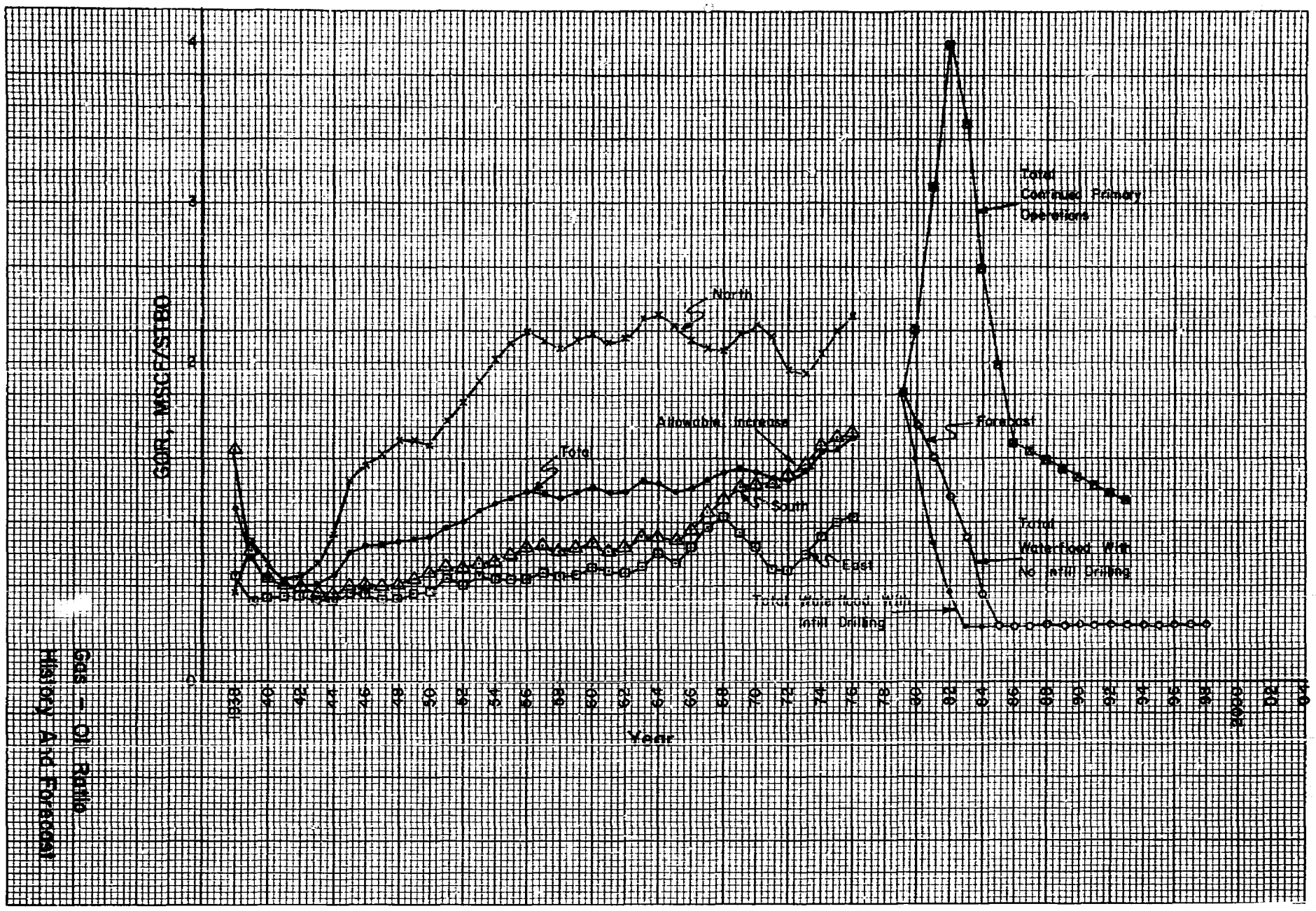

GOR, MSCF/STBO
Year
North
Total
South
East
Allowable Increase
Forecast
Total Waterflood With No Infill Drilling
Total Continued Primary Operations
Total Waterflood With Infill Drilling
Cousin
Oil Rate
Acc. Forecast

Figure 9

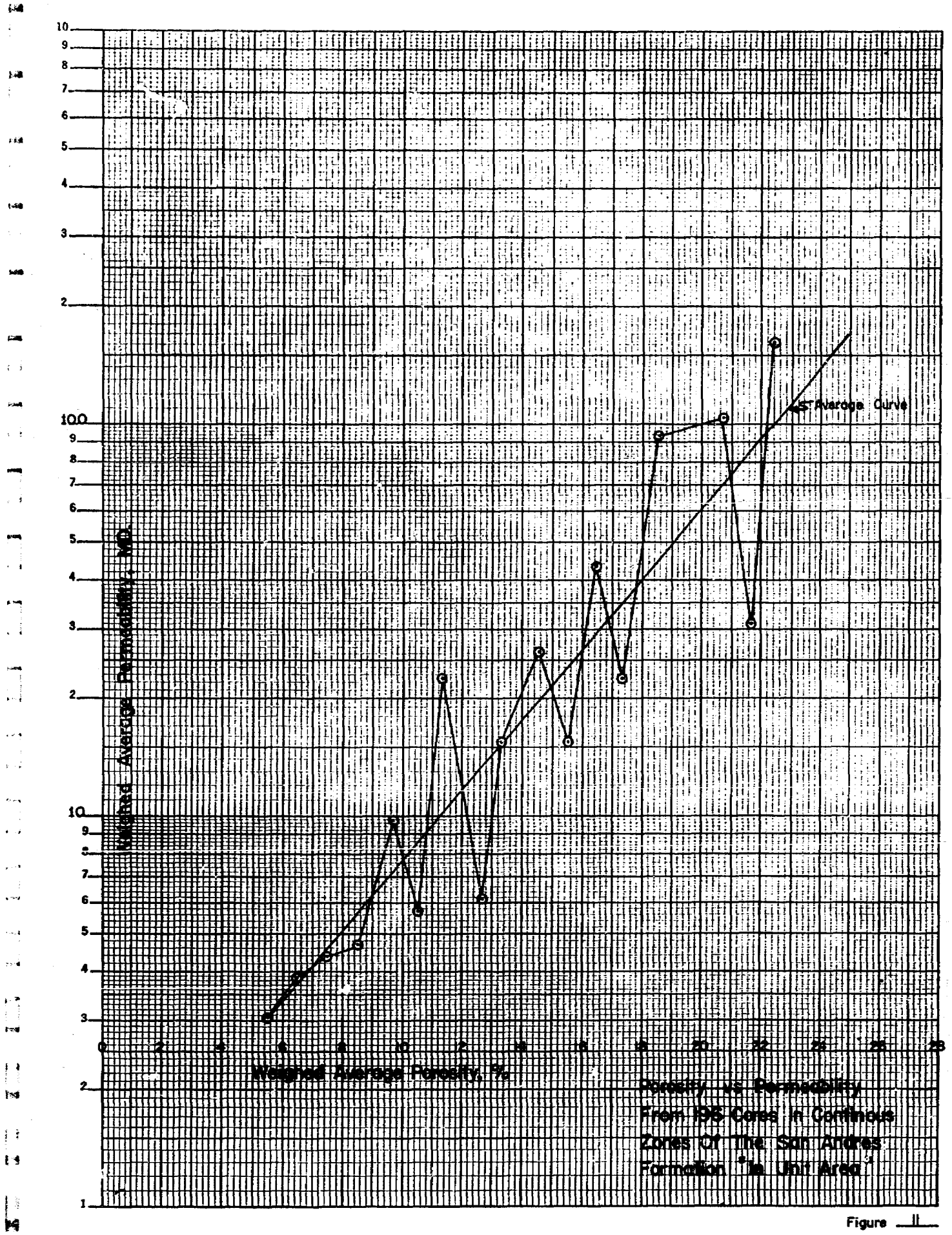

Weighted Average Permeability, MD.
Weighted Average Porosity, %
1ST Average Curve
Porosity vs Permeability
From 195 Cores In Continous
Zones Of The San Andres
Formation In Unit Area

Figure II

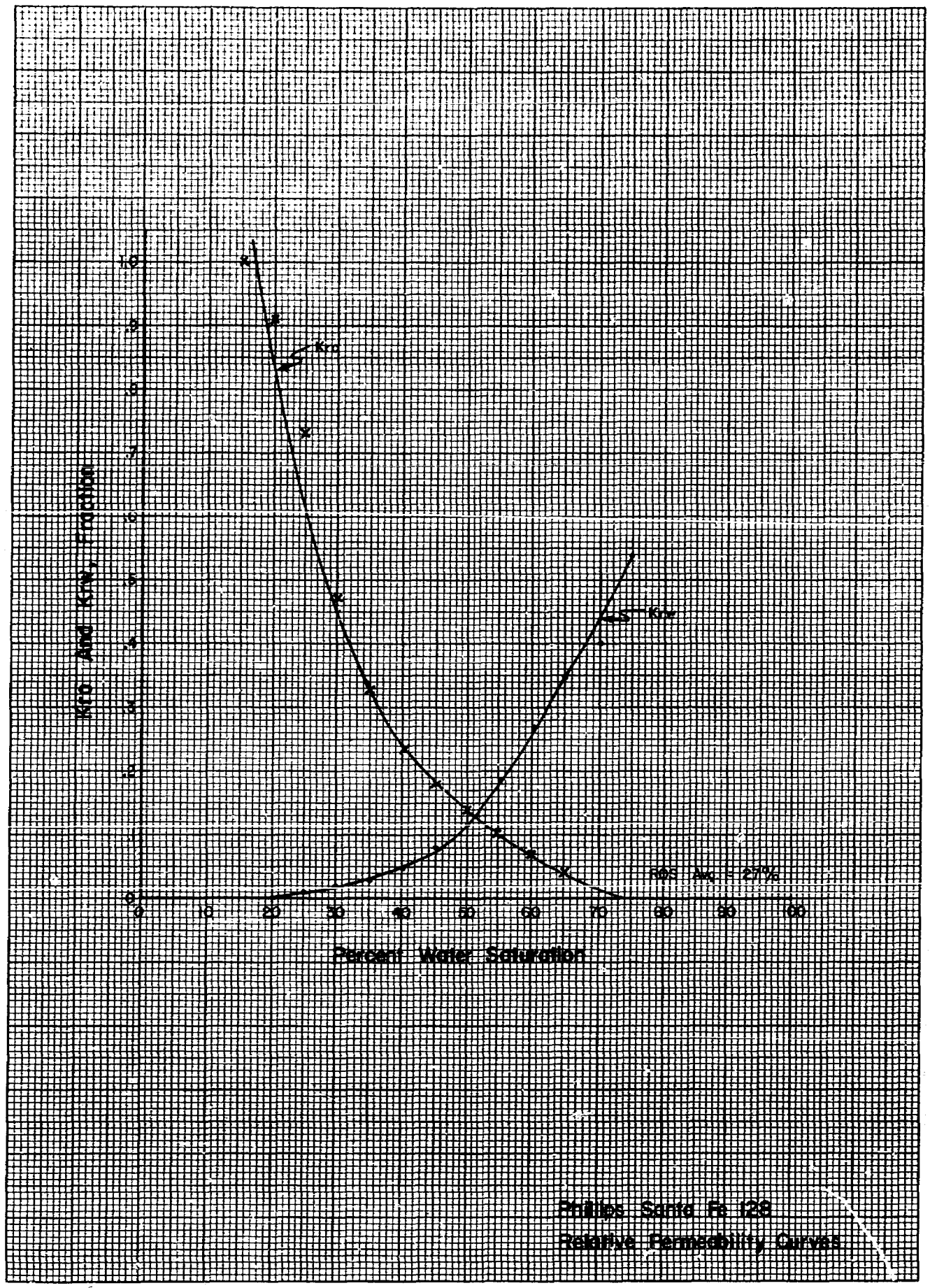
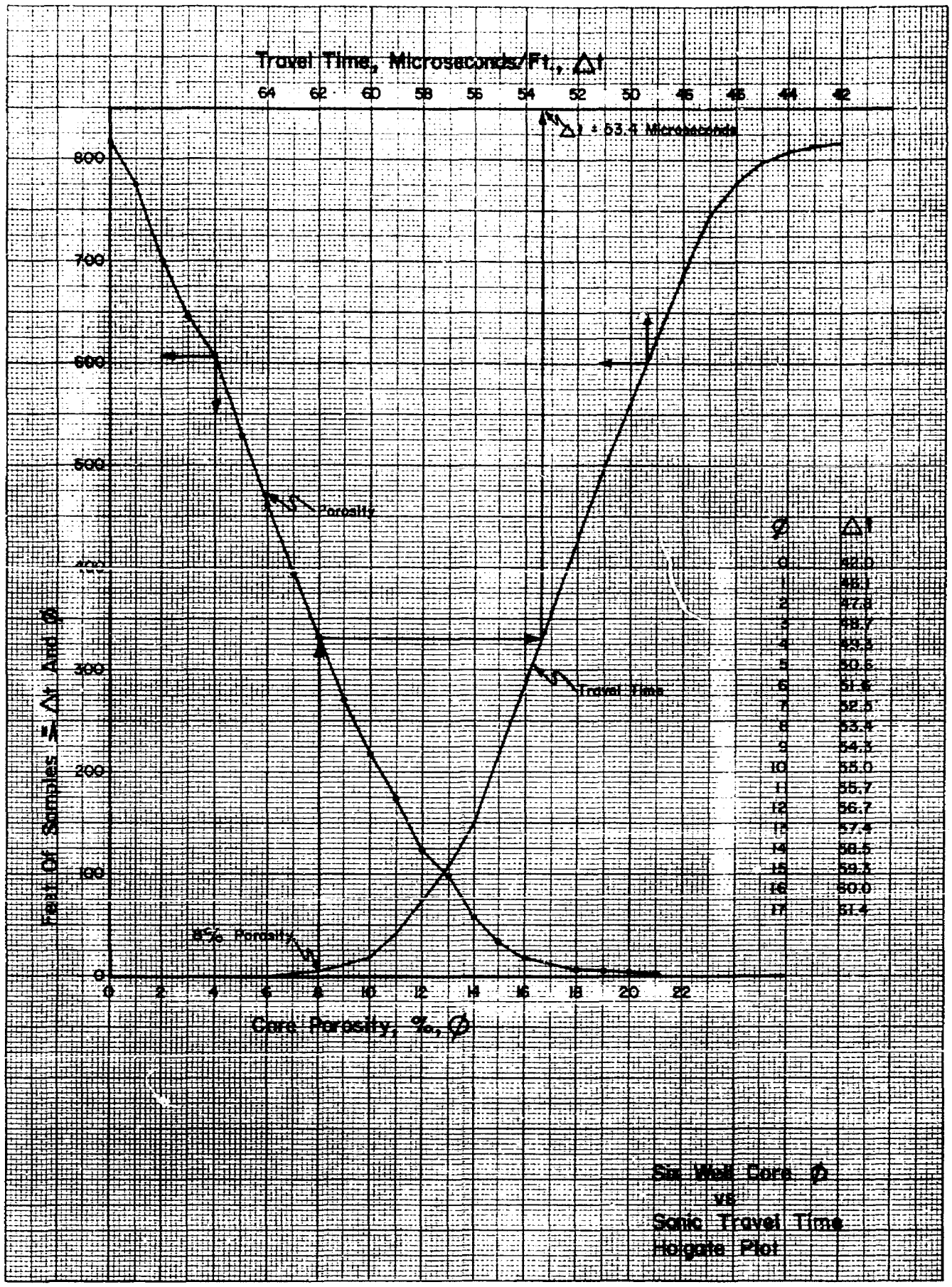

Krw And Kro, Fraction
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
Kro
Krw
Krw Max = 27%
0
10
20
30
40
50
60
70
80
90
100
Percent Water Saturation
Phillips Santa Fe 128
Relative Permeability Curves

Figure 12



Six Well Core Ø
vs
Sonic Travel Time
Hogate Plot

Figure 13

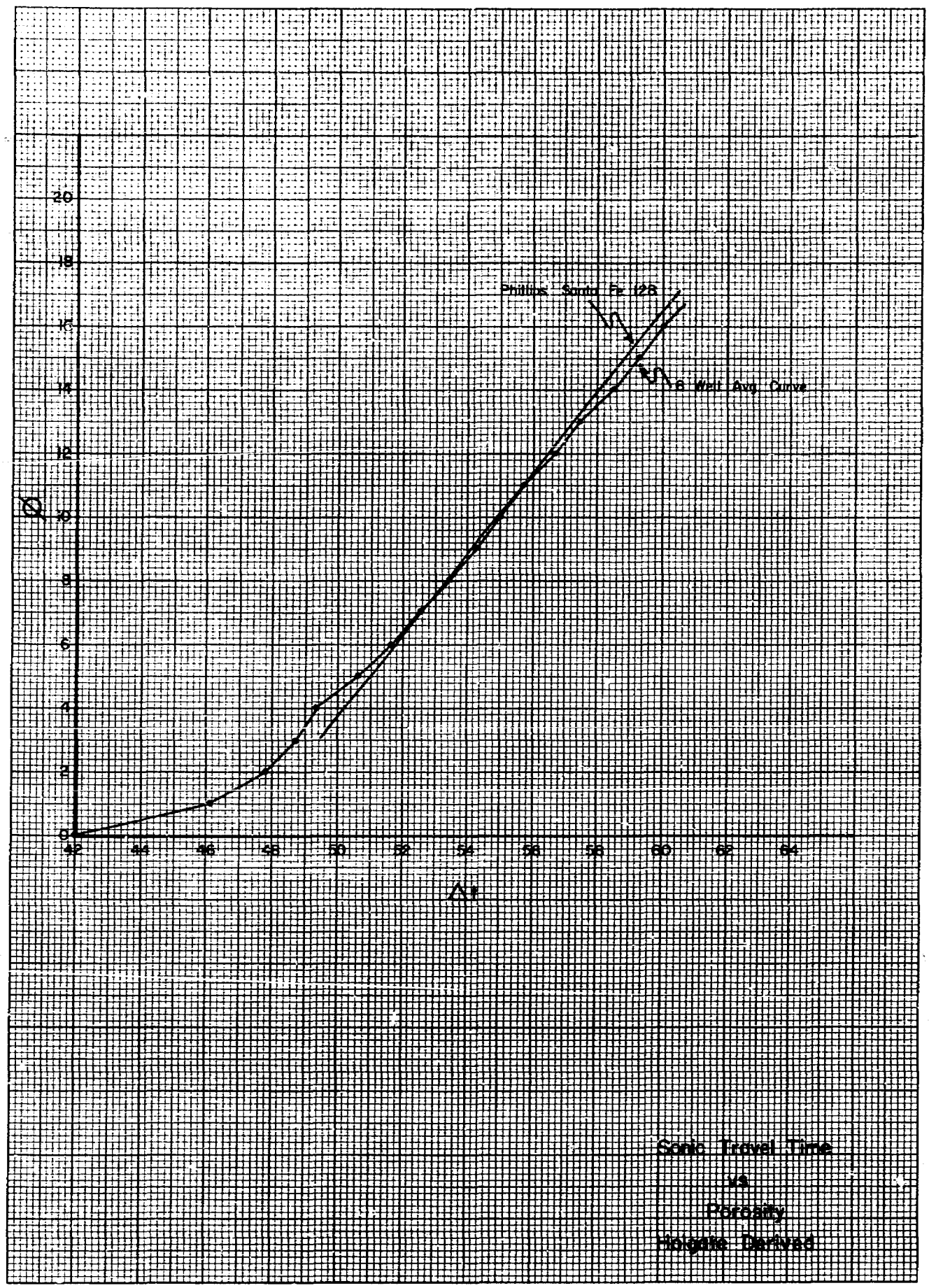

Phillips Santa Fe #28
6 Well Avg. Curve
20
18
16
14
12
10
8
6
4
2
0
42
44
46
48
50
52
54
56
58
60
62
64
Δt
Sonic Travel Time
vs.
Porosity
Hoigate Derived

Figure 14

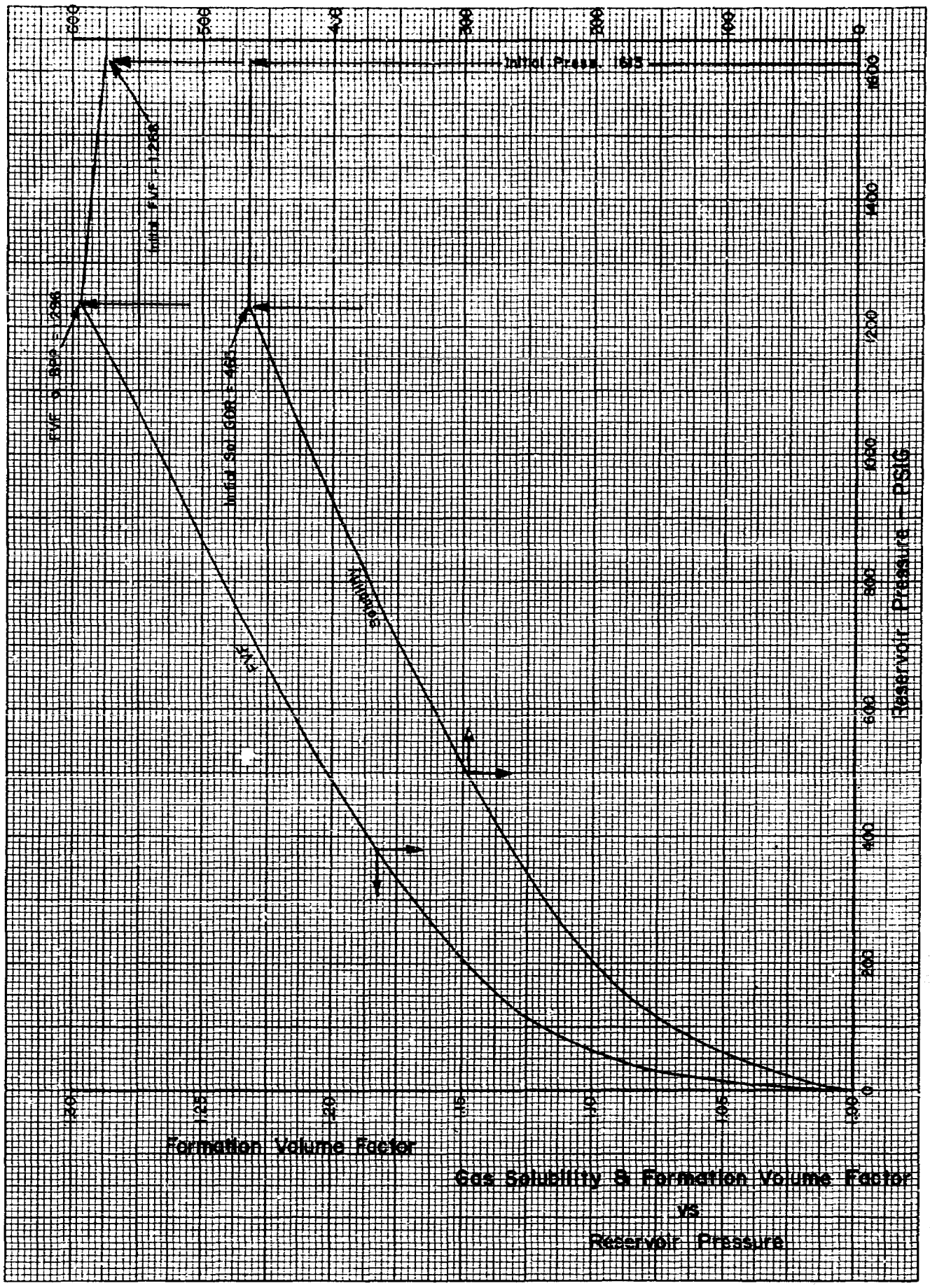
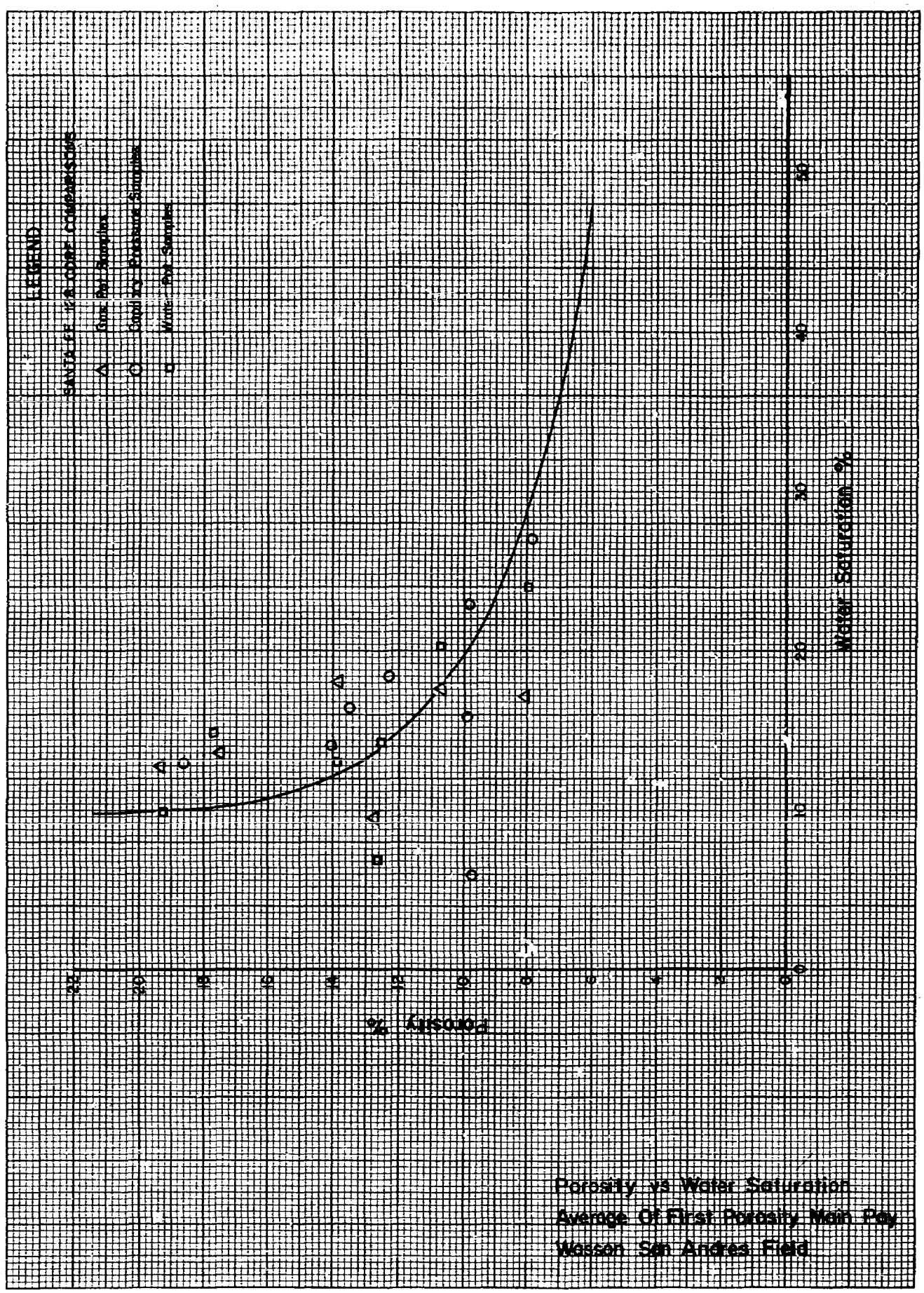
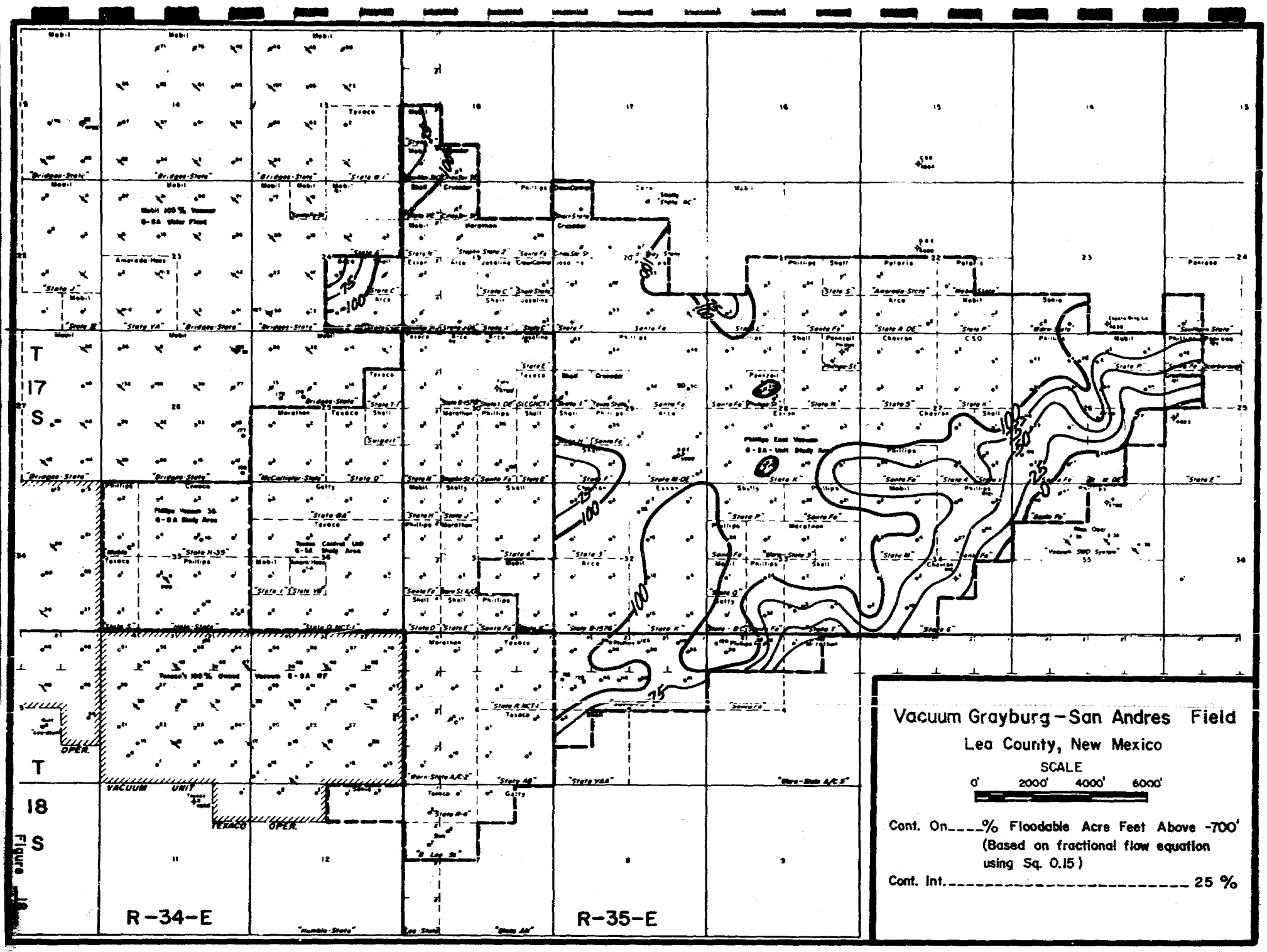

Gas – Oil Ratio – Cu. Ft./Bbl.
Initial Press. 695
Initial F.V.F. = 1.286
F.V.F. @ 300 = 1.286
Initial Sol. GOR = 485
Solubility
F.V.F.
Reservoir Pressure – PSIG
Formation Volume Factor
Gas Solubility & Formation Volume Factor
vs
Reservoir Pressure

Figure 15



Porosity vs Water Saturation
Average Of First Porosity Main Pay
Wasson San Andres Field

Figure 16


T
17
S
T
18
S
R-34-E
R-35-E
VACUUM UNIT
OPER.
TEXACO
OPER.
Vacuum Grayburg – San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
Cont. On____% Floodable Acre Feet Above -700'
(Based on fractional flow equation
using Sq. 0.15)
Cont. Int.---------- 25 %

Figure

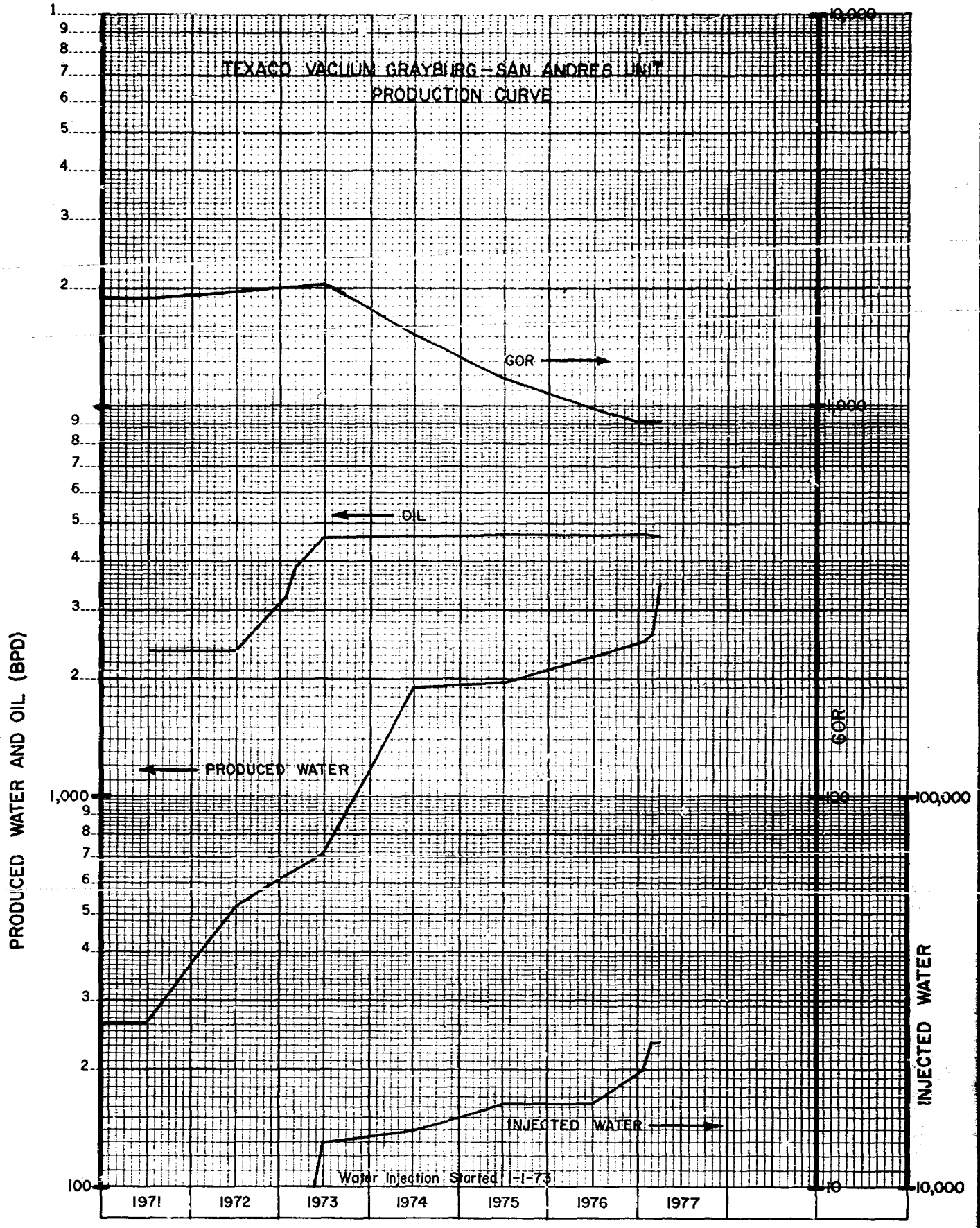
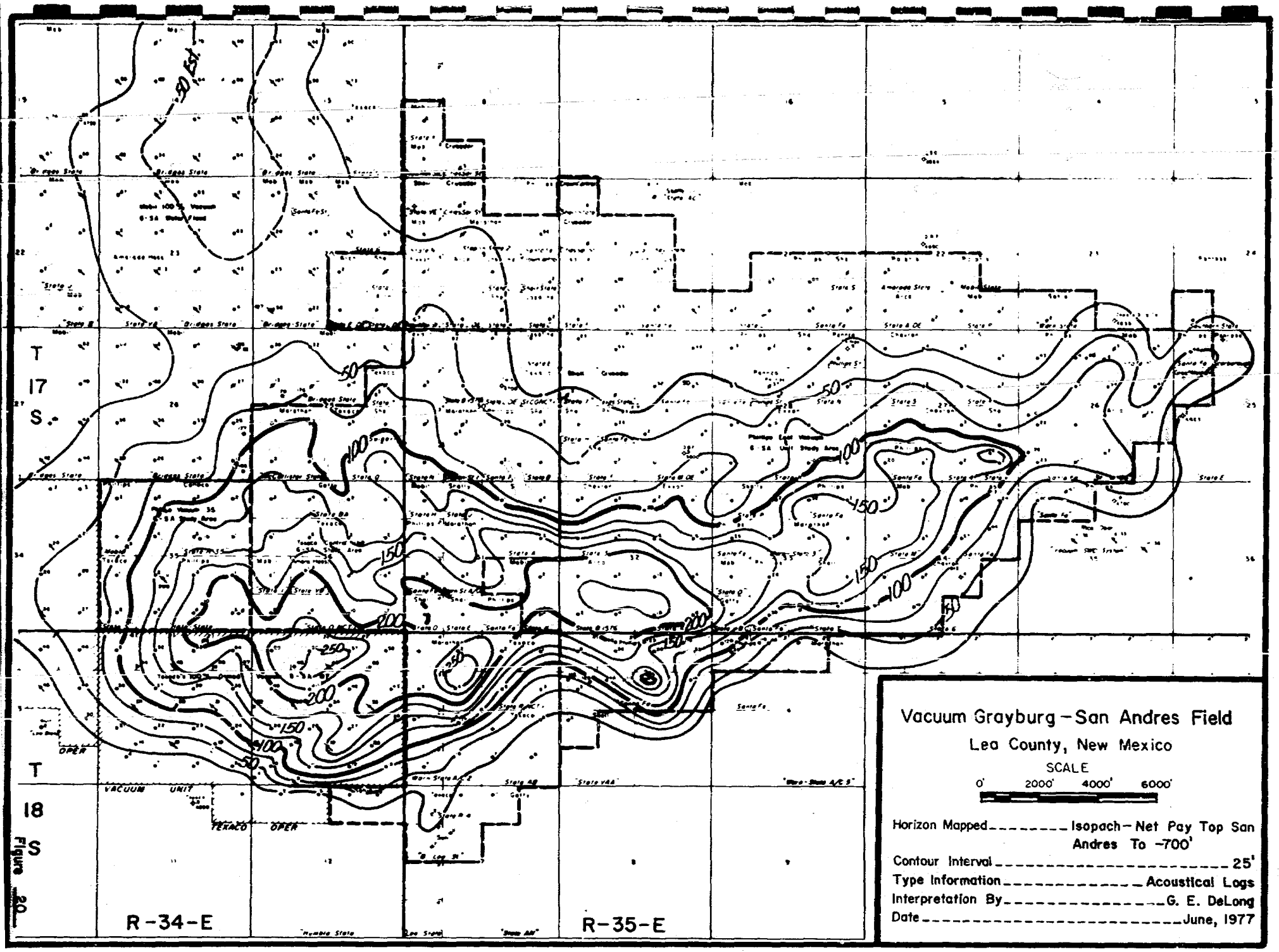

TEXACO VACUUM GRAYBURG – SAN ANDRES UNIT
PRODUCTION CURVE
PRODUCED WATER AND OIL (BPD)
GOR
INJECTED WATER
GOR
OIL
PRODUCED WATER
INJECTED WATER
Water Injection Started 1-1-73
1,000
100
10,000
1971
1972
1973
1974
1975
1976
1977

Figure 19



Vacuum Grayburg – San Andres Field

Lea County, New Mexico

SCALE

0' 2000' 4000' 6000'

Horizon Mapped ..... Isopach – Net Pay Top San Andres To -700'

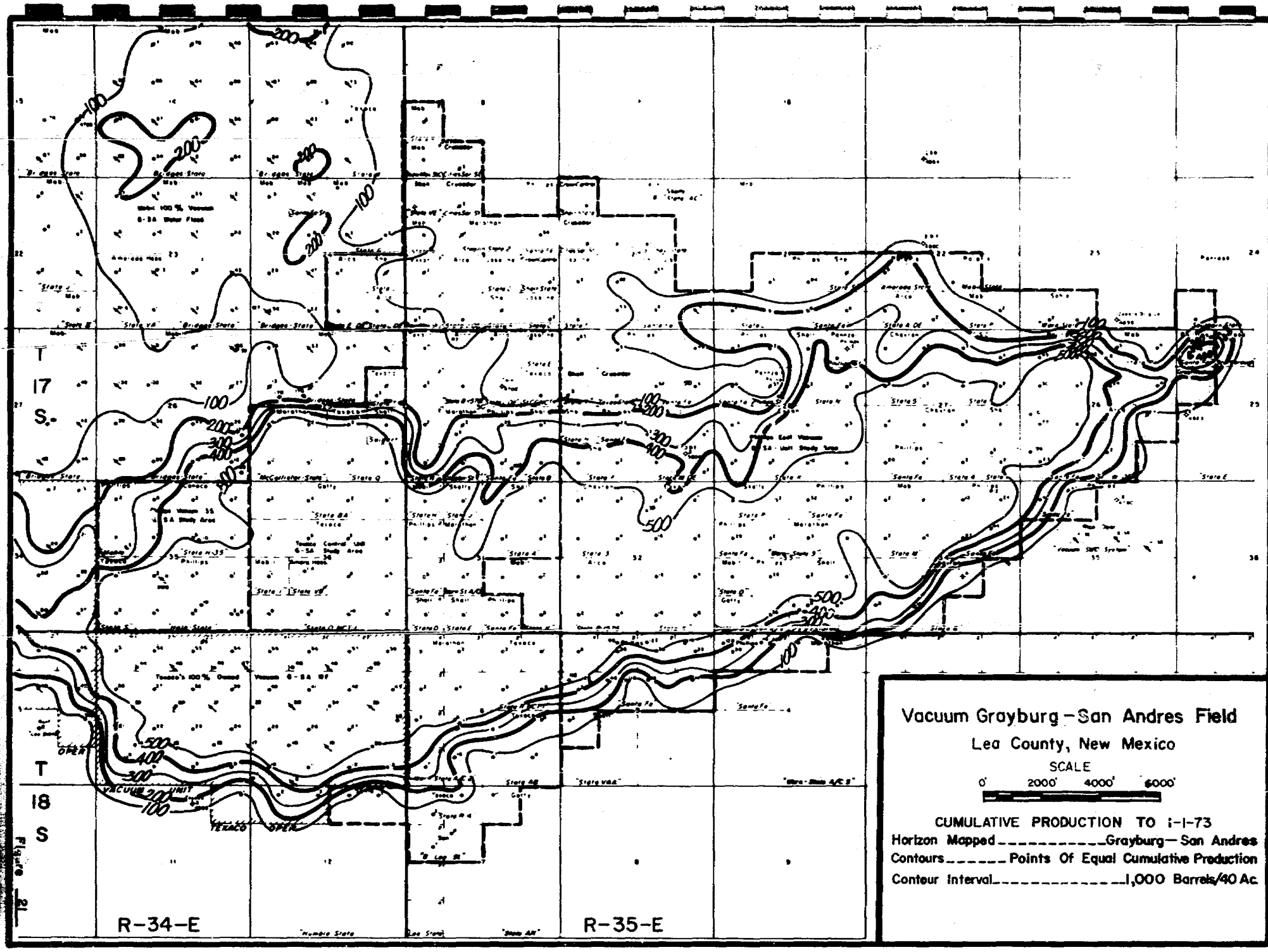
Contour Interval ..... 25'

Type Information ..... Acoustical Logs

Interpretation By ..... G. E. DeLong

Date ..... June, 1977

Figure 20


T
17
S.
T
18
S
R-34-E
R-35-E
100
200
300
400
500
OPEN
TEXACO
VACUUM UNIT
Vacuum Grayburg - San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
CUMULATIVE PRODUCTION TO 1-1-73
Horizon Mapped ---------- Grayburg - San Andres
Contours ------ Points Of Equal Cumulative Production
Conteur Interval ---------- 1,000 Barrels/40 Ac.

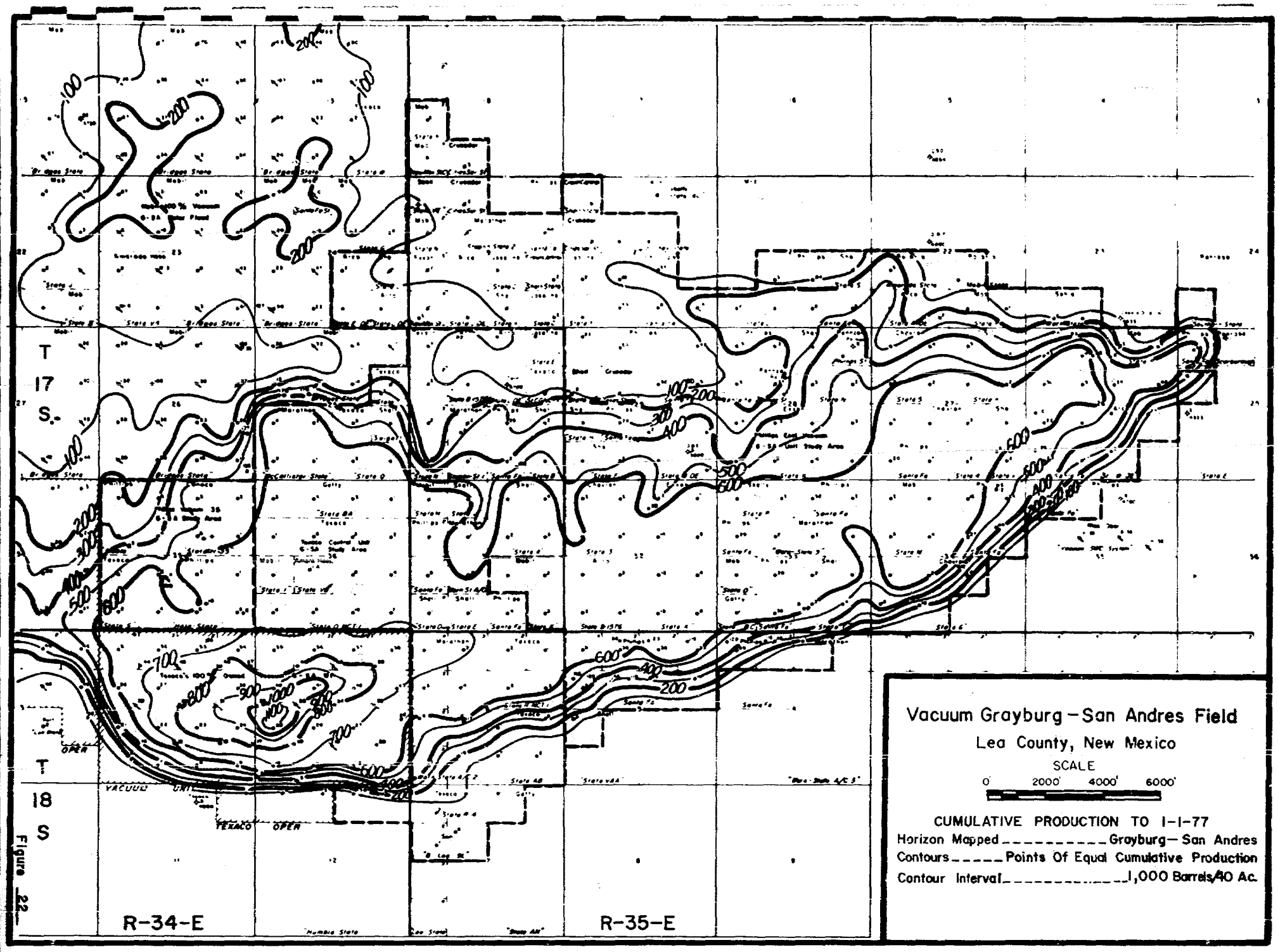

T
17
S.
T
18
S
R-34-E
R-35-E
VACUUM UNIT
TEXACO OPER
Humble State
Lea State
"State AB"
Vacuum Grayburg – San Andres Field
Lea County, New Mexico
SCALE
0 2000' 4000' 6000'
CUMULATIVE PRODUCTION TO 1-1-77
Horizon Mapped ---------- Grayburg – San Andres
Contours ----- Points Of Equal Cumulative Production
Contour Interval ---------- 1,000 Barrels/40 Ac.

Figure 22

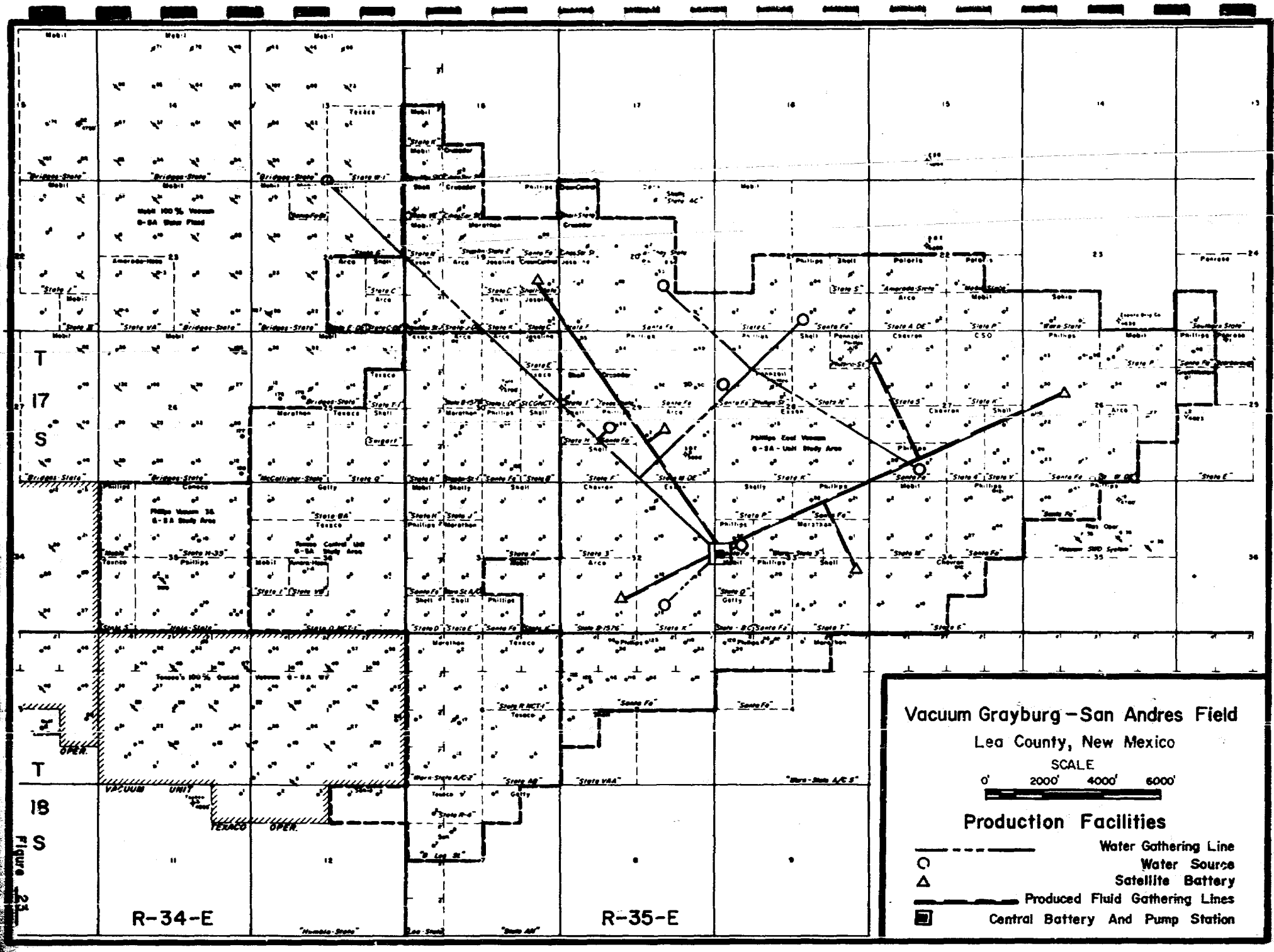

T
17
S
T
18
S
R-34-E
R-35-E
Mobil 100% Vacuum
G-SA Unit Flood
Phillips Vacuum 36
G-SA Study Area
Texaco Central Unit
G-SA Study Area
Phillips East Vacuum
G-SA - Unit Study Area
VACUUM UNIT
TEXACO
OPEN
OPEN
Vacuum Grayburg – San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
Production Facilities
Water Gathering Line
Water Source
Satellite Battery
Produced Fluid Gathering Lines
Central Battery And Pump Station

Figure 21

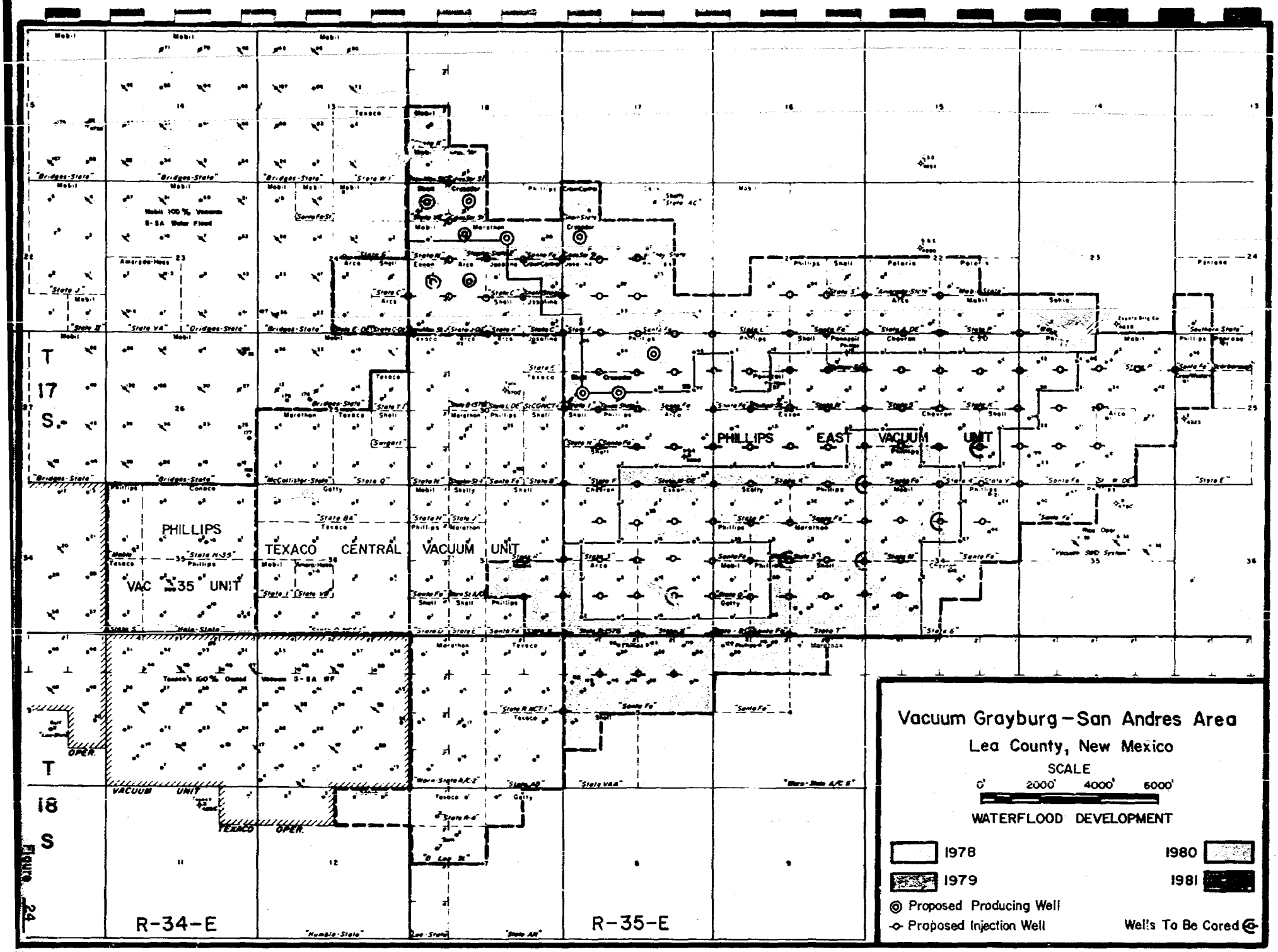

PHILLIPS
EAST
VACUUM
UNIT
PHILLIPS
VAC 35 UNIT
TEXACO
CENTRAL
VACUUM
UNIT
T
17
S.
T
18
S
R-34-E
R-35-E
Vacuum Grayburg – San Andres Area
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
WATERFLOOD DEVELOPMENT
1978
1979
1980
1981
Proposed Producing Well
Proposed Injection Well
Well's To Be Cored

Figure 24

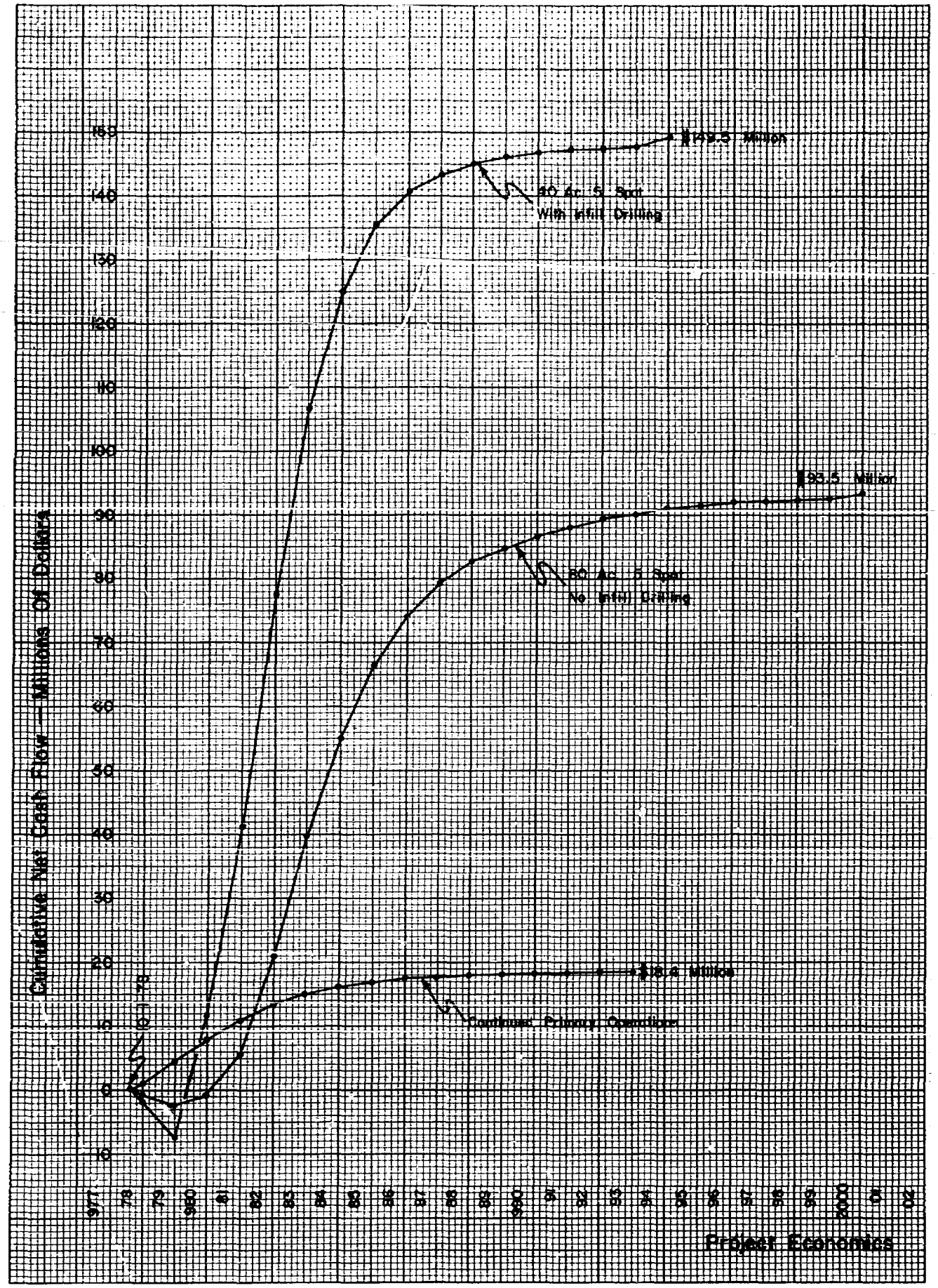
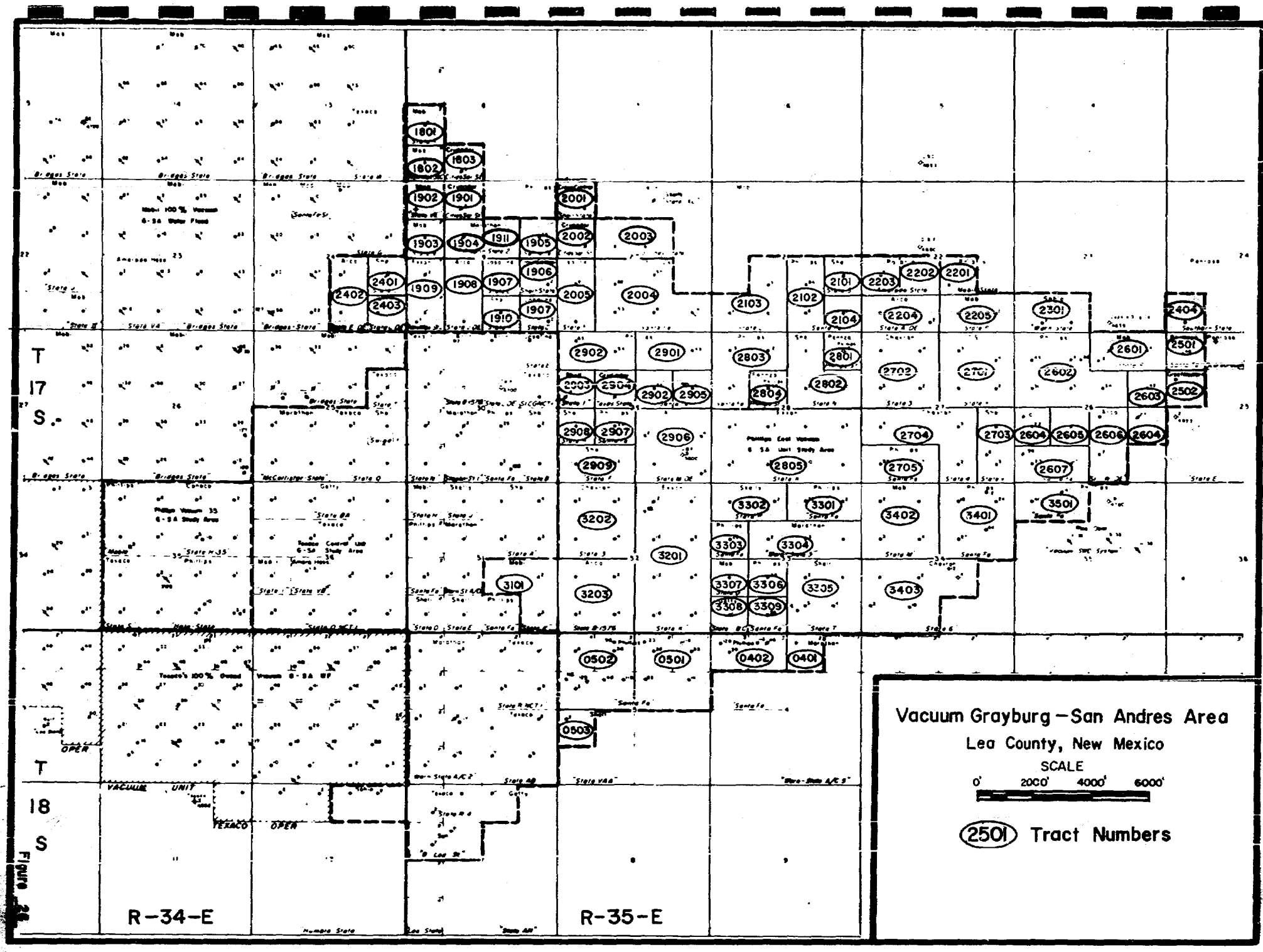

Cumulative Net Cash Flow — Millions Of Dollars
160
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
10
$142.5 Million
80 Ac. 5 Spot
With Infill Drilling
$93.5 Million
80 Ac. 5 Spot
No Infill Drilling
$18.6 Million
Continue Primary Operations
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Project Economics

Figure 25



Vacuum Grayburg – San Andres Area

Lea County, New Mexico

SCALE

0' 2000' 4000' 6000'

(2501) Tract Numbers

Figure 2

METHOD OF ALLOCATION

The following is a sample calculation of allocation of future primary reserves assigned to tracts producing at top allowable and with annual production decline rates less than 13 percent.

Conditions

Ultimate Primary Recoverable Reserves	5,992,000
Less Future Primary Determined from Decline Curves	461,000
Less Cumulative Production, January 1, 1977	4,993,224
Remaining Primary Reserves to be Allocated	537,776
Decline Rate when Wells begin Decline	28% per year
Economic Limit	2 bopd

The three tracts producing under these conditions are shown in the table below:

Line		Tract A	Tract B	Tract C	Total
1	Category	Top Allowable	13% Decline	Top Allowable	
2	Reserves Produced During Decline	86,666	64,444	86,666	237,776
3	Initial Rate, barrels/day	80	60	80	220
4	Percent Remaining Floodable, acre-feet (from map, Fig. 19)	100	75	56.25	
5	Line 3 x Line 4	80	45	45	170
6	Percent of Flat Rate Reserves: $\frac{\text{Line 5} \times 100}{\text{Total Line 5}}$ =	47	26.5	26.5	100
7	Flat Rate Reserves, Based on percent acre-feet	141,000	79,500	79,500	300,000
8	Percent of Total Initial Production Rate: $\frac{\text{Line 3} \times 100}{\text{Total Line 3}}$ =	36.4	27.3	36.4	100
9	Flat Rate Reserves, Based on initial production rates	109,091	81,818	109,091	300,000
10	Reserves Allocated: $\text{Line 2} + \frac{\text{Line 7} + \text{Line 9}}{2}$ =	211,711	145,104	180,961	537,776

APPENDIX B

CALCULATION OF WATER SATURATIONS FROM WELL TESTS BY USE OF FRACTIONAL FLOW FORMULA

The fractional flow formula has long been used as a practical tool in determining the water saturation necessary to obtain a given percent water cut in reservoirs with 100 percent liquid saturation. The following premises are necessary to make the formula applicable in reservoirs with three-phase saturation:

1. Three-phase flow does not exist. Water only contacts the oil. The oil bank ahead of the water absorbs the free gas before the water arrives.

2. The only two systems of two-phase flow that exist are oil-water and oil-gas.

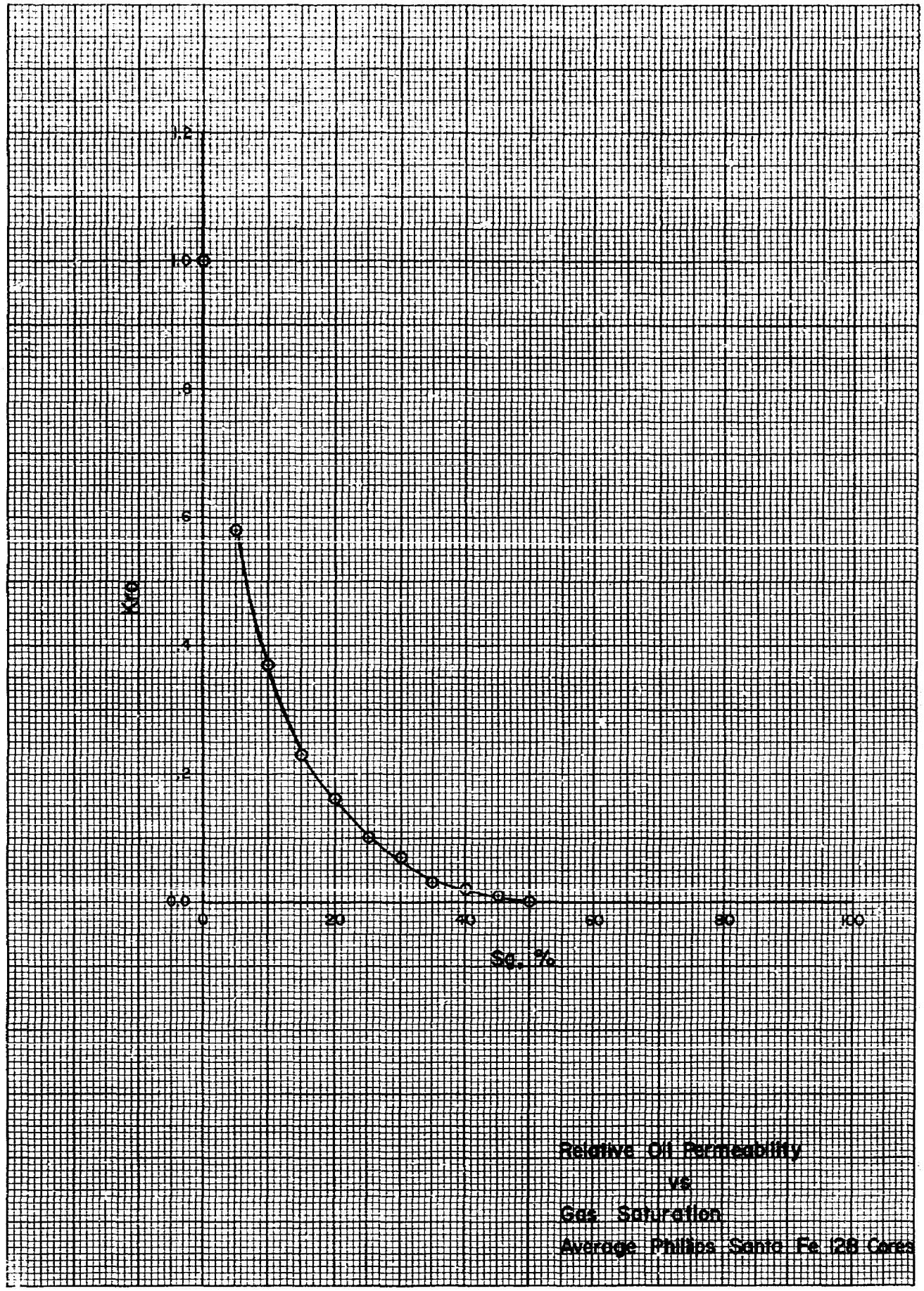
The water relative permeability is only affected by oil, but the oil relative permeability is affected by gas in the oil-gas system and water in the oil-water system. If a gas saturation can be calculated in the oil-gas system, then the permeability to oil in this system can be calculated from the oil-gas relative permeability curve.

In order to calculate the gas saturation in 1972 and K_{ro} at that saturation, production data for 14 wells with pressure histories within the water encroachment area were compiled. Average daily per well production rates for these wells in 1972 were 64 barrels of oil, 65 barrels of water, and 93 Mcf of gas. They produced 51 percent water and at a gas-oil ratio of 1,465 compared to a gas-oil ratio of only 1,252 for the total unit. An average reservoir pressure of 637 psi was calculated from individual well cumulative production versus bottom-hole pressure data.

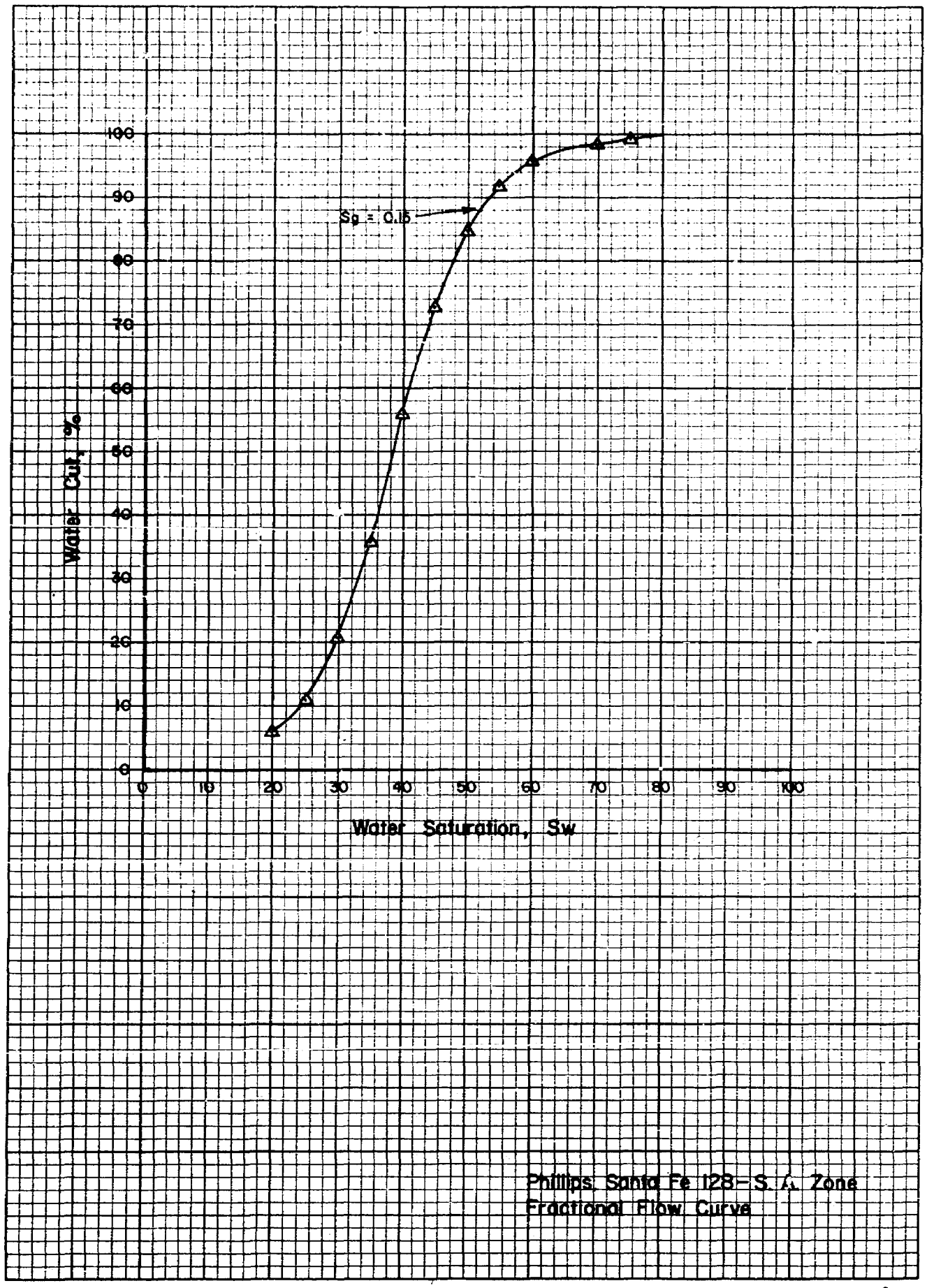
Tarner material balance calculations for depletion type reservoirs were made with the K_g/K_o values changed until the reservoir pressure of 637 psi occurred at approximately the same time as the gas-oil ratio of 1,465. The gas saturation at this point (15 percent) was read from the material balance calculations and entered into the oil-gas permeability curve (Appendix B, Figure 1) to obtain the relative oil permeability. This was used to reduce the permeability to oil in the fractional flow equations. Appendix B, Figure 2, shows the fractional flow curve obtained by this method.

Based on the oil-water relative permeability curves shown in Figure 12, 30 percent residual oil saturation and a connate water saturation of 20 percent were used in calculating the remaining floodable acre-feet from the calculated water saturation. The formula used was:

$$\text{Percent floodable acre-feet remaining} = (.70 - S_w) + .50.$$



Appendix B Figure 1



Phillips Santa Fe 128-S. A. Zone
Fractional Flow Curve

Appendix B Figure 2

PRODUCTION AND OPERATING COST FORECAST

Year	Continued Primary			80-Acre, 5-Spot			40-Acre, 5-Spot		
	Oil M Barrels Per Year	Gas MMcf Per Year	Lifting Cost, $M Per Year	Oil M Barrels Per Year	Gas MMcf Per Year	Lifting Cost, $M Per Year	Oil M Barrels Per Year	Gas MMcf Per Year	Lifting Cost, $M Per Year
1978 (3 Mos.)	444	799	375	365	657	426	510	953	414
1979	1,776	3,198	1,500	1,460	2,628	1,533	2,117	3,811	1,659
1980	1,645	3,620	1,389	1,314	2,102	1,674	5,872	8,221	2,245
1981	1,407	4,361	1,188	2,738	3,833	1,985	8,043	7,238	3,191
1982	1,041	4,162	879	4,380	5,037	1,993	8,760	4,906	3,377
1983	749	2,623	749	5,037	4,533	1,997	7,446	2,606	3,391
1984	539	1,403	539	4,495	2,517	2,009	5,212	1,824	3,386
1985	388	777	388	3,649	1,277	2,009	3,649	1,277	3,374
1986	280	419	336	2,943	1,030	2,009	2,554	894	3,357
1987	201	292	280	2,374	831	2,009	1,788	626	2,873
1988	145	203	232	1,915	670	2,009	1,252	438	2,070
1989	104	141	187	1,545	541	2,009	876	307	1,484
1990	75	98	150	1,246	436	1,678	613	215	1,088
1991	54	68	119	1,005	352	1,369	429	150	789
1992	39	47	94	811	284	1,118	300	105	578
1993	28	32	73	654	229	917	210	74	300
1994				527	185	755	147	51	150
1995				425	149	634			
1996				343	120	525			
1997				277	97	438			
1998				223	78	371			
1999				180	63	316			
2000				145	51	276			
Total upper-tier oil, M barrels				11,335			27,333		

Increased value of infill drilling due to price difference alone = (1,000) (27,333 - 11,335) (12.00 - 5.25) = $108 x 10^6.

Base production control level = 2,040 M barrels per year.

APPENDIX C
Table A

APPENDIX C
Table B

LIFTING COST CATEGORIES

Category	Units	Annual Cost Per Unit
Injection Surveys	Injection Wells	$ 1,000.00
Treating Costs	Thousands of Barrels of Fluid Produced	$ 4.00
Maintenance Costs	Total Wells	$ 5,800.00
Electricity Cost	Producing Wells	$ 6,879.00
Operator Cost	Operators (3 needed)	$16,667.00
Fuel Gas Costs	Thousands of Barrels of Water Injected	$ 4.73

APPENDIX C
Table C

DRILLING WELL AND WORKOVER COSTS

Area	Type	Casing	Total Wells	Cost Per Well		
				Tangible	Intangible	Total
North	Injection	4-1/2"	70	$39,700	$ 96,000	$135,700
All	Producing	4-1/2"	10	40,300	115,000	155,300
South	Injection	5-1/2"	51	50,000	103,000	153,000
South	Injection with Coring	5-1/2"	6	50,000	136,900	186,900
All	Deepen Old Well	All	100 (40-acre) 50 (80-acre)	2,600	19,200	21,800
All	Convert Old Well to Injection	All	65	4,000	30,200	34,200

INVESTMENT SCHEDULE

1978

	80-Acre, 5-Spot			40-Acre, 5-Spot		
	Tangibles	Intangibles	Total	Tangibles	Intangibles	Total
Tank Battery Consolidation	$ 494,500	$ 30,200	$ 524,700	$ 652,600	$ 30,200	$ 682,800
Water Treatment and Injection Plant	492,200	25,900	518,100	693,500	25,900	719,400
Fresh Water Make-up Supply	184,700	9,600	194,300	213,500	9,600	223,100
Drill 10 Injection Wells 1 Well -- S/2 with core 9 Wells -- S/2 no core	0	0	0	500,300	1,063,200	1,563,500
Convert 10 Producers to Injection	40,300	301,800	342,100	0	0	0
Lift Equipment Revision	299,000	86,300	385,300	598,000	172,500	770,500
Total (1978)	$1,510,700	$ 453,800	$ 1,964,500	$ 2,657,900	$ 1,301,400	$ 3,959,300

1979

Tank Battery Consolidation	$1,483,500	$ 90,600	$ 1,574,100	$ 1,957,900	$ 90,600	$ 2,048,500
Water Treatment and Injection Plant	1,476,600	77,600	1,554,200	2,080,400	77,600	2,158,000
Fresh Water Make-up Supply	554,200	28,900	583,100	640,400	28,900	669,300
Drill 43 Injection Wells 4 Wells -- S/2 with core 34 Wells -- S/2 no core 5 Wells -- N/2	0	0	0	2,099,400	4,527,000	6,626,400
Convert 20 Producers to Injection	80,500	603,500	684,000	0	0	0
Deepen Producing Wells	52,900	384,100	437,000	92,600	672,200	764,800
Lift Equipment Revision	897,000	258,800	1,155,800	1,794,000	517,500	2,311,500
Total (1979)	$4,544,700	$1,443,500	$ 5,988,200	$ 8,664,700	$ 5,913,800	$14,578,500

APPENDIX C
Table D

INVESTMENT SCHEDULE--Continued

1980

	80-Acre, 5-Spot			40-Acre, 5-Spot		
	Tangibles	Intangibles	Total	Tangibles	Intangibles	Total
Drill 43 Injection Wells 1 Well -- S/2 with core 8 Wells -- S/2 no core 34 Wells -- N/2	$ 0	$ 0	$ 0	$ 1,799,200	$ 4,225,200	$ 6,024,400
Drill 3 Producers	120,800	345,000	465,800	120,800	345,000	465,800
Convert 20 Producers to Injection	80,500	603,500	684,000	0	0	0
Deepen Producing Wells	52,900	384,100	437,000	92,600	672,200	764,800
Total (1980)	$ 254,200	$1,332,600	$ 1,586,800	$ 2,012,600	$ 5,242,400	$ 7,255,000

1981

Drill 31 N/2 Injection Wells	$ 0	$ 0	$ 0	$ 1,229,900	$ 2,976,800	$ 4,206,700
Drill 7 Producers	281,800	805,000	1,086,800	281,800	805,000	1,086,800
Convert 15 Producers to Injection	60,400	452,600	513,000	0	0	0
Deepen Producing Wells	26,500	192,100	218,600	79,400	576,200	655,600
Total (1981)	$ 368,700	$1,449,700	$ 1,818,400	$ 1,591,100	$ 4,358,000	$ 5,949,100
GRAND TOTAL	$6,678,300	$4,679,600	$11,357,900	$14,926,300	$16,815,600	$31,741,900

APPENDIX C
Table D

EXXON COMPANY, U.S.A.
POST OFFICE BOX 1600 · MIDLAND, TEXAS 79701

PRODUCTION DEPARTMENT
MIDCONTINENT DIVISION
U.S. SECTOR
JOINT INTEREST ACCOUNTING

E/S

State of New Mexico
Energy and Minerals Department

Attention: Oil Conservation Division

Re: Case No. 6470, February 28, 1979,
Hearing Docket, Application of
Phillips Petroleum Company
East Vacuum Unit
Lea County, New Mexico

Gentlemen:

Exxon, as a working interest owner in the East Vacuum (GR.-S.A.) Unit, supports the above referenced request of Phillips Petroleum Company, as Unit Operator, to permit an infill drilling program in the subject Unit. This support is based on a conclusion that under the contemplated unit operations each new infill well to be drilled in an existing proration unit is necessary to effectively and efficiently drain a portion of the reservoir covered by the proration unit which cannot be effectively and efficiently drained by any existing well within the proration unit.

Yours very truly,

J. M. Shepherd

JKL/jg

Chevron U.S.A. Inc.
P. O. Box 1660, Midland, TX 79702

February 22, 1979

Natural Gas Policy Act of 1978
Section 103 - New Onshore Production Wells
E. Vacuum Unit
Lea County, New Mexico

Phillips Petroleum Company
4001 Penbrook
Odessa, Texas 79762

Gentlemen:

Chevron U.S.A. Inc. is in agreement that infill wells to be drilled in the E. Vacuum Grayburg-San Andres Unit would qualify for certification under Section 103 of the Natural Gas Policy Act of 1978.

This statement is offered in support of your application before the New Mexico Oil Conservation Division on February 28, 1979.

Yours very truly,

E. E. Hagan
Division Manager

DGS:cn

Ex 7

EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

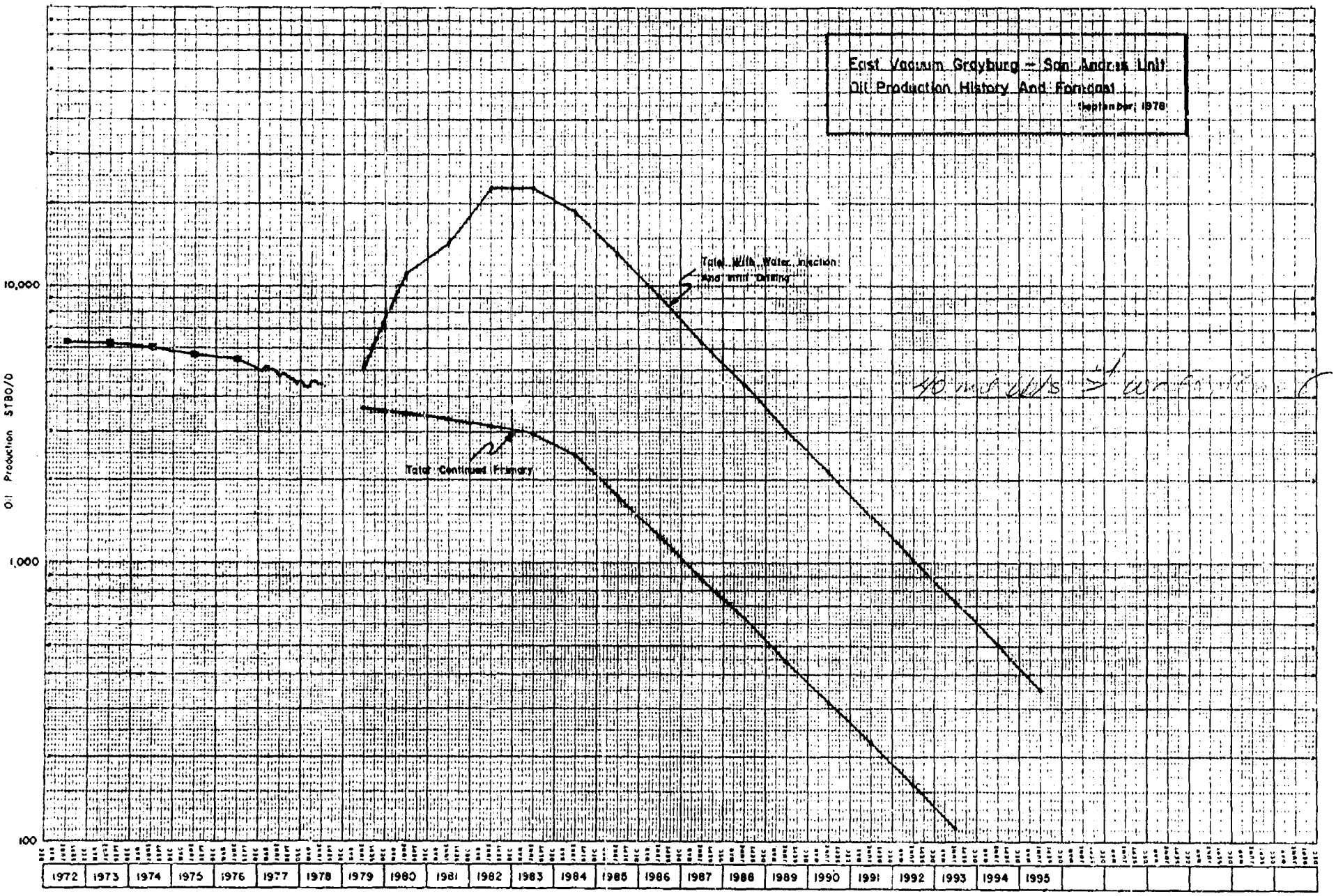
NECESSITY AND RESULTS OF INFILL DRILLING

Each infill well is necessary to effectively and efficiently drain oil and gas reserves from a portion of the reservoir covered by the proration unit which cannot be effectively and efficiently drained by any existing well within the proration unit.

For the total unit area, infill drilling on 20-acre spacing will result in the recovery of 11,582,000 barrels of oil not recoverable with 40-acre spacing. The solution gas associated with this oil will be 4.054 billion cubic feet.

The increased recovery will be 3.9 percent of the original oil-in-place. This percent increase is comparable to published results applicable to geologically similar carbonate reservoirs under waterflood in the general area of Vacuum Field. The infill drilling and the overall development plan conform to the current industry concepts for effective and efficient carbonate waterflooding. The infill drilling will increase oil and associated gas recovery due primarily to (1) encountering discontinuous intervals of porosity and (2) improving waterflood areal and vertical sweep efficiency.

E 4 F



40 wells = 1 unit

401

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease STATE [X] FEE [ ]

5. State Oil & Gas Lease No. B-1576

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]
OIL WELL [X] GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres, Tract 3229

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 005

3. Address of Operator: Room 401, 4001 Penbrook St., Odessa, Texas 79762

10. Field and Pool, or Wildcat: San Vacuum Grayburg/Andres

4. Location of Well: UNIT LETTER M LOCATED 1110 FEET FROM THE South LINE AND 1290 FEET FROM THE West LINE OF SEC. 32 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: San Grayburg/Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3964.7' Ground (unprepared)

21A. Kind & Status Plug. Bond: blanket

21B. Drilling Contractor: Advise later

22. Approx. Date Work will start: Upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13-3/8"	48# -H-40	350' (675 sx Class H w/2% CaCl2 (&1/4# Flocele/sx in 1st 150 sx)		Circ at surface
12¼" X 8-5/8"	7"	23#, K-55	4900' (Sufficient TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx Followed by 260 sx Class H Cement w/8# salt/sx to circulate at surface.)		

(This well is in the same proration unit as Well No. 002)

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 2990'; cemented to surface w/cement of quality adequate to control waterflow and protect casing string.

Re: N.M.O.C.D. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original loc. approved within Order (3) was 1310' from So. & West lines of the above section.

Use mud additives as required for control. (Conf. telecon MCL - Ramey 1-22-79)
BOP: Series 900, 3000# WP, double w/one set pipe rams & one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W.J. Mueller Engineering Advisor Date 1-22-79

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E.V.G.S.A.U. NM Tract 2229	005

Unit Letter	Section	Township	Range	County
M	32	17 South	35 East	Lea

Actual Footage Location of Well:
1110 feet from the South line and 1290 feet from the West line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage
3964.7	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

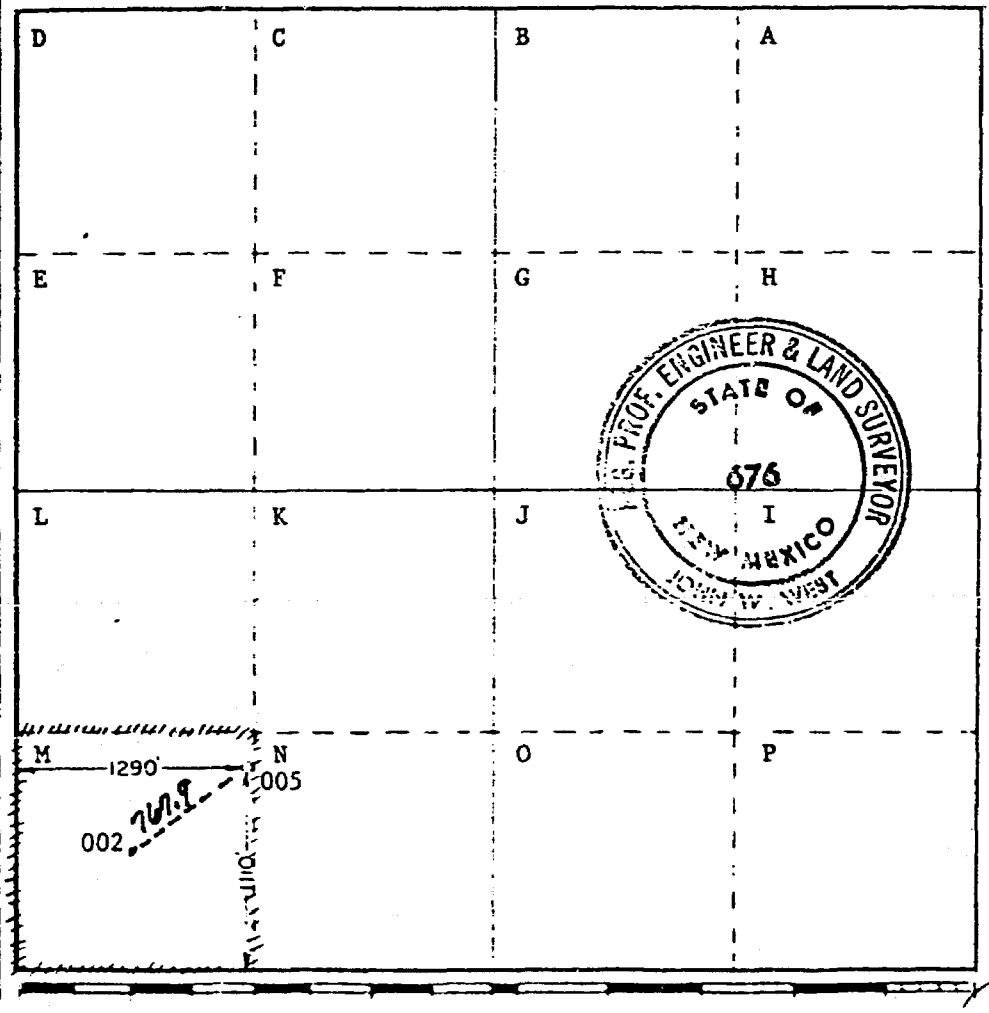
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no" list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Name
W. J. Mueller

Position
Engineering Advisor

Company
Phillips Petroleum Co.

Date
January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Date Surveyed
January 3, 1979

Registered Professional Engineer and/or Land Surveyor

John W West

Certificate No. John W West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: A-1320

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work
b. Type of Well
DRILL [X] DEEPEN [ ] PLUG BACK [ ]
OIL WELL [X] GAS WELL [ ] OTHER SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract No. 3202

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 001

3. Address of Operator: Room 401, Phillips Building, 4001 Penbrook, Odessa, TX 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER I LOCATED 1330 FEET FROM THE South LINE AND 1310 FEET FROM THE East LINE OF SEC. 32 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth	19A. Formation	20. Rotary or C.T.
4900	Grayburg/San Andres	Rotary

21. Elevations (Show whether DF, RT, etc.)	21A. Kind & Status Plug. Bond	21B. Drilling Contractor	22. Approx. Date Work will start
3955.3' Ground (unprepared)	Blanket	Advise later	Upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13 3/8"	48#, H-40	350'	(675 sx class H w/2% $CaCl_2$ & ¼# Flocele/sx in 1st 350 sx)	Circ at Surface
12¼" x 8 5/8"	7"	23#, K-55	4900'	(Suffidient TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonit /sx, following by 260 sx class H cement w/8# salt/sx to circulate at surface.)	

(This well is the same proration Unit as Well No. 004)

NOTE: If excessive waterflow is encountered in salt section, 9 5/8" 40#, N80 intermediate casing will be set at approximately 3015'; cemented to surface with cement of quality adequate to control waterflow and protect casing string.

RE: N.M.O.C.D. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original location approved within, Order (3) was 1310' FS and 1330' FE lines of the above section. (Conf. Telecon Mcl--Ramey 1-22-79)

BOP: Series 900, 3000# WP, double w/one set pipe and one set blind rams.

Use mud additives as required for control.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W. J. Mueller Title Engineering Advisor Date January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E,V,G,S,A,U, Tract 3202	001

Unit Letter	Section	Township	Range	County
I	32	17 South	35 East	Lea

Actual Footage Location of Well:
1330 feet from the South line and 1310 feet from the East line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
3955.3	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

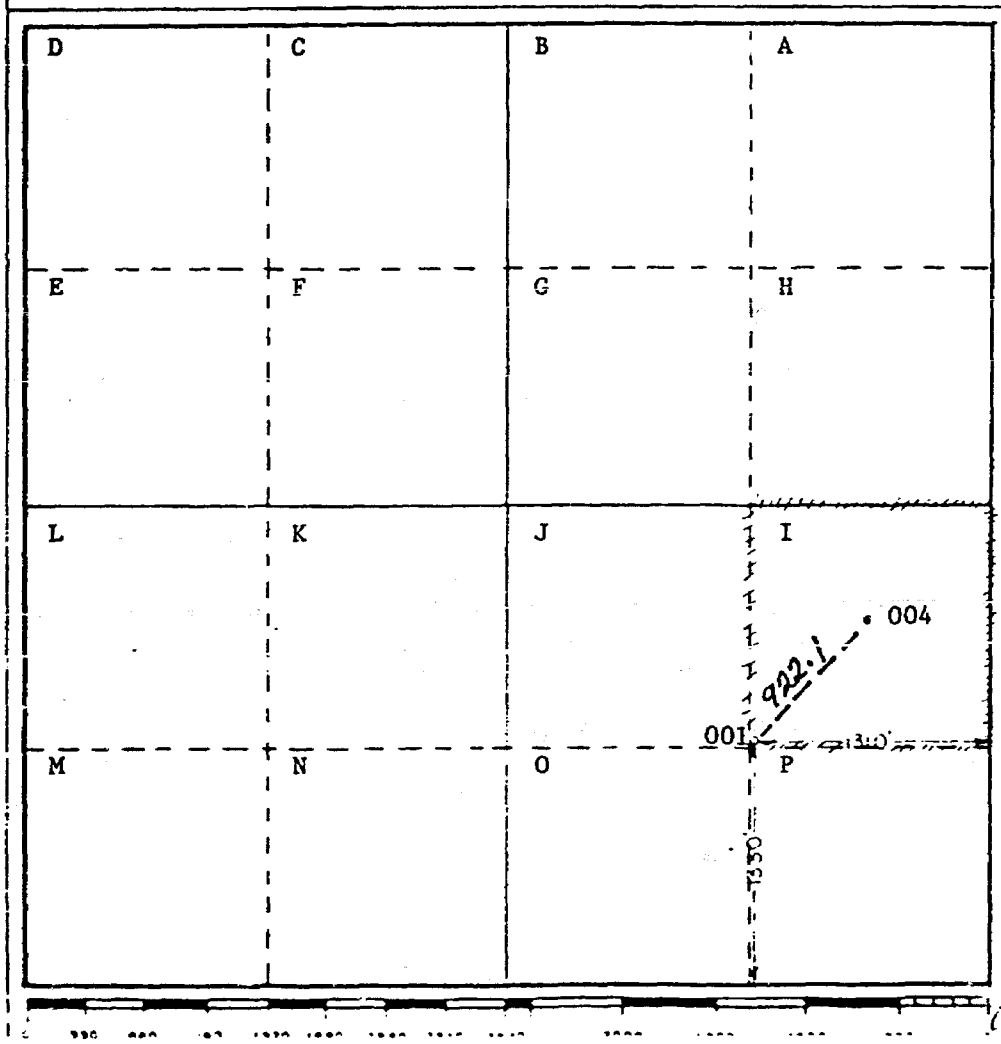
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling. etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

ENGINEER & LAND SURVEYOR — STATE OF NEW MEXICO — JOHN W. WEST

Date Surveyed: December 29, 1978

Registered Professional Engineer and/or Land Surveyor

John W. West

Certificate No. John W. West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: A-1320

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]
GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3202

2. Name of Operator: PHILLIPS PETROLEUM COMPANY

9. Well No.: 003

3. Address of Operator: ROOM 401, 4001 PENBROOK STREET, ODESSA, TEXAS 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER B LOCATED 1180 FEET FROM THE North LINE AND 1480 FEET FROM THE East LINE OF SEC. 32 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3965.4' Ground (Unprepared)

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Advise Later

22. Approx. Date Work will start: Upon Approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17-1/2"	13-3/8"	48#-H-40	350' (675 sx Cl H w/2% CaCl, & (1/4# Flocele/sx in 1st 150 sx)		circ to surfac
12-1/4" x 8-5/8"	7"	23#, K-55	4900' (suff TRLW w/12# salt/sx w/10% DD and ¼# sx Flocele plus 3# Gilsonite/sx followed by 260 sx Cl H cement w/8# salt/sx to circ at surface).		

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3010'; cemented to surface w/cement of quality adequate to control waterflow & protect casing string.

RE: N.M.O.C.D. Order No. 5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original loc approved within Order (3) was 1330' FN&E lines of the above sec. (Confirming telecon McL/Ramey 1-22-79)

(This well is in same proration unit as Well No. 033)

Use Mud Additives as Required for Control.

BOP: Series 900,3000# WP, double w/one set pipe rams and one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information given above is true and complete to the best of my knowledge and belief.

Signed: D. J. Mueller Title: Engineering Advisor Date: January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator: Phillips Petroleum Company		Lease: E.V.G.S.A.U.B. Tract 3202		Well No.: 003
Unit Letter: B	Section: 32	Township: 17 South	Range: 35 East	County: Lea
Actual Footage Location of Well: 1180 feet from the North line and 1480 feet from the East line				
Ground Level Elev.: 3965.4	Producing Formation: Grayburg/San Andres	Pool: Vacuum Grayburg/San Andres		Dedicated Acreage: 40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

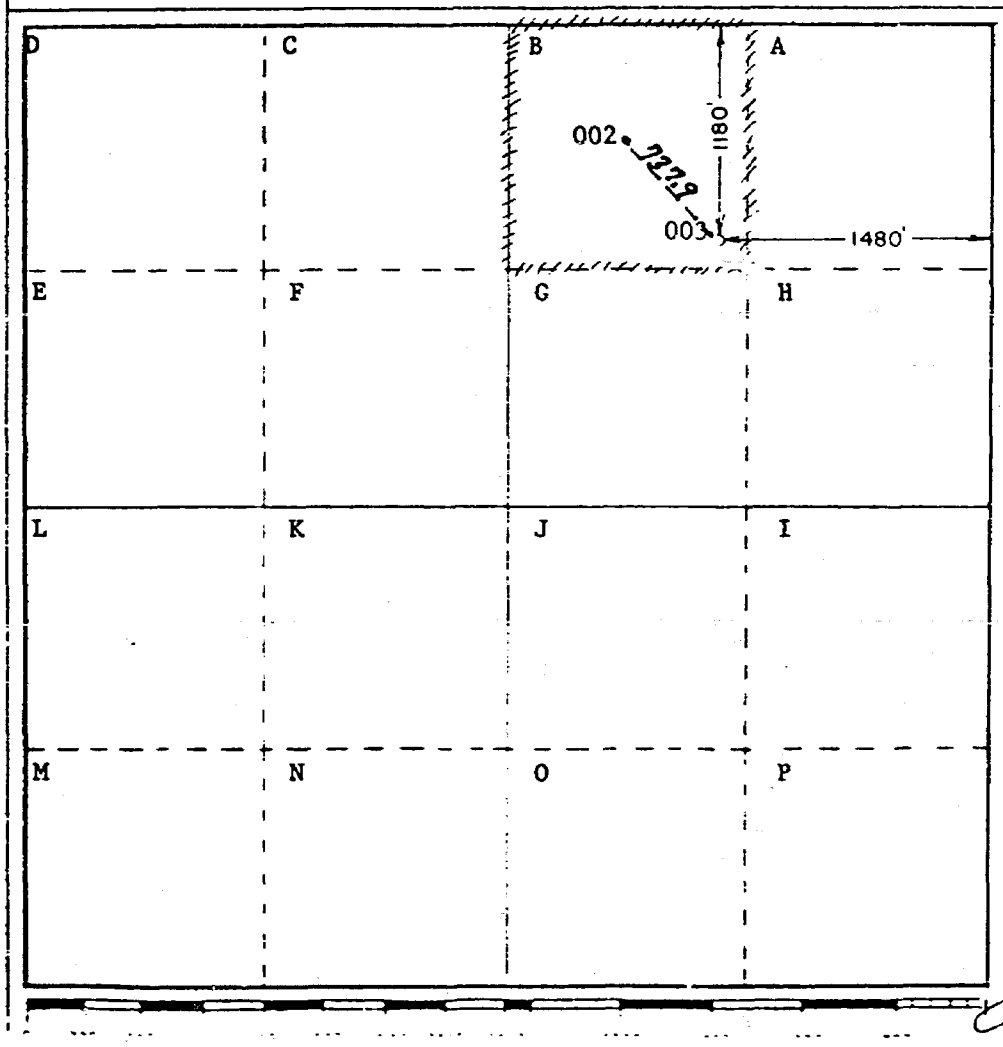
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no" list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

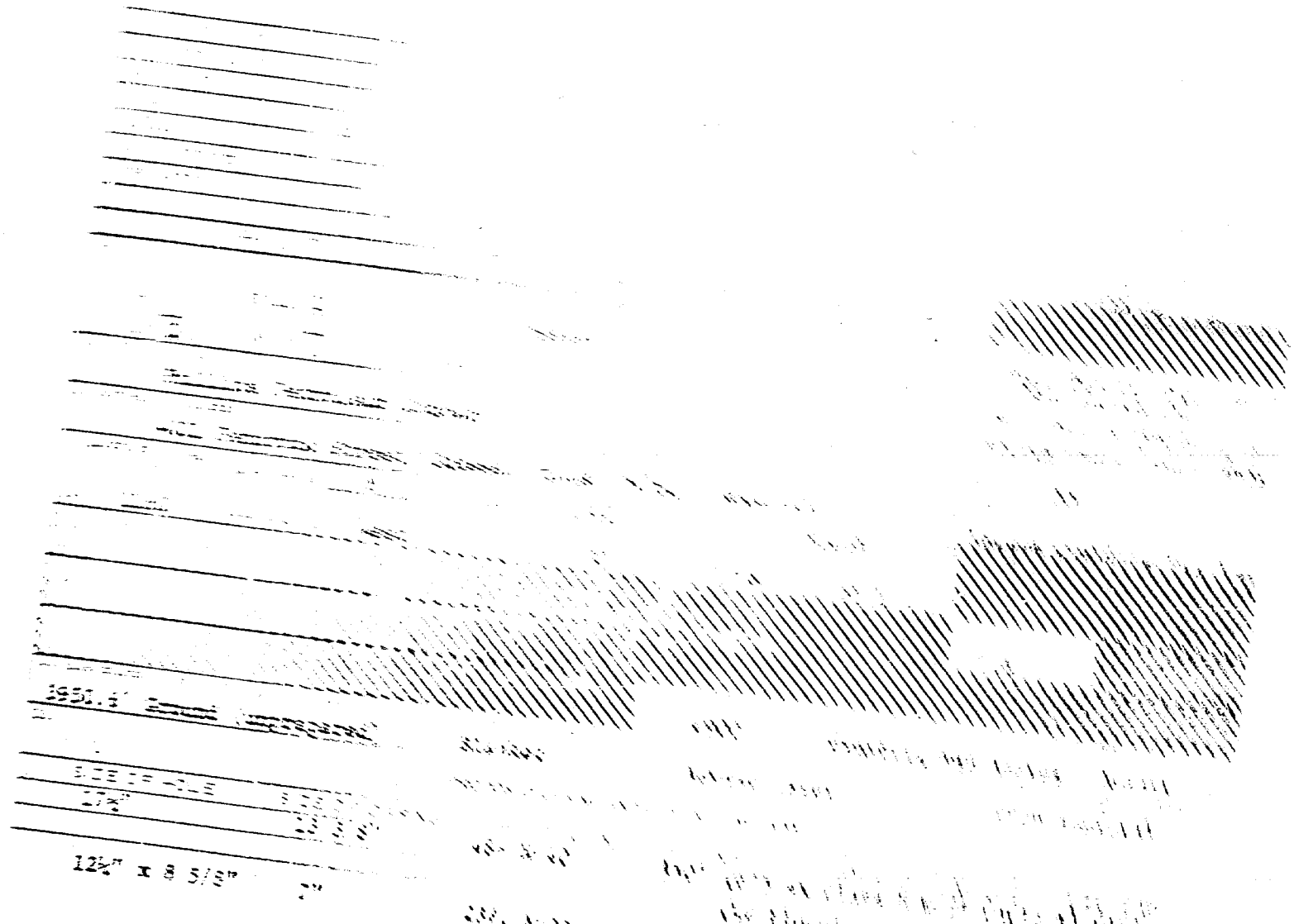
I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

NEW MEXICO — JOHN W. WEST

Date Surveyed: December 29, 1978

Registered Professional Engineer and/or Land Surveyor

Certificate No. John W. West 676



(This well is in the same proration unit as Well No. 11)

NOTE: If excessive waterflow is encountered in salt section, 8 5/8" csg. will be set at approximately 4000'. Cemented to surface w/ amount of cement casing will be set at approximately 4000'. Cemented to surface w/ amount of cement adequate to control waterflow and protect casing across salt section.

RE: N.M.O.C.D. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original location provided within Order (1) was 1110 from south and east lines of the above section. (Conf. Telecon Mel Ramey 1-22-79)

Use mud additives as required for control

BOP: Series 900, 3000# WP, double w/pipe and blind rams.

J. Mueller

Engineering Manager

January 11, 1979

NEW MEXICO OIL CONSERVATION COMMISSION
WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator: Phillips Petroleum Company		Lease: E.V.G.S.A.U. M-3328	Well No.: 002
Unit Letter: M	Section: 33	Township: 17 South	Range: 35 East
County: Lea			
Actual Footage Location: 1310 feet from the South line and 1160 feet from the West line			
Ground Level Elev.: 3950.6	Producing Formation: Grayburg/San Andres	Pool: Vacuum Grayburg/San Andres	Dedicated Acreage: 40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

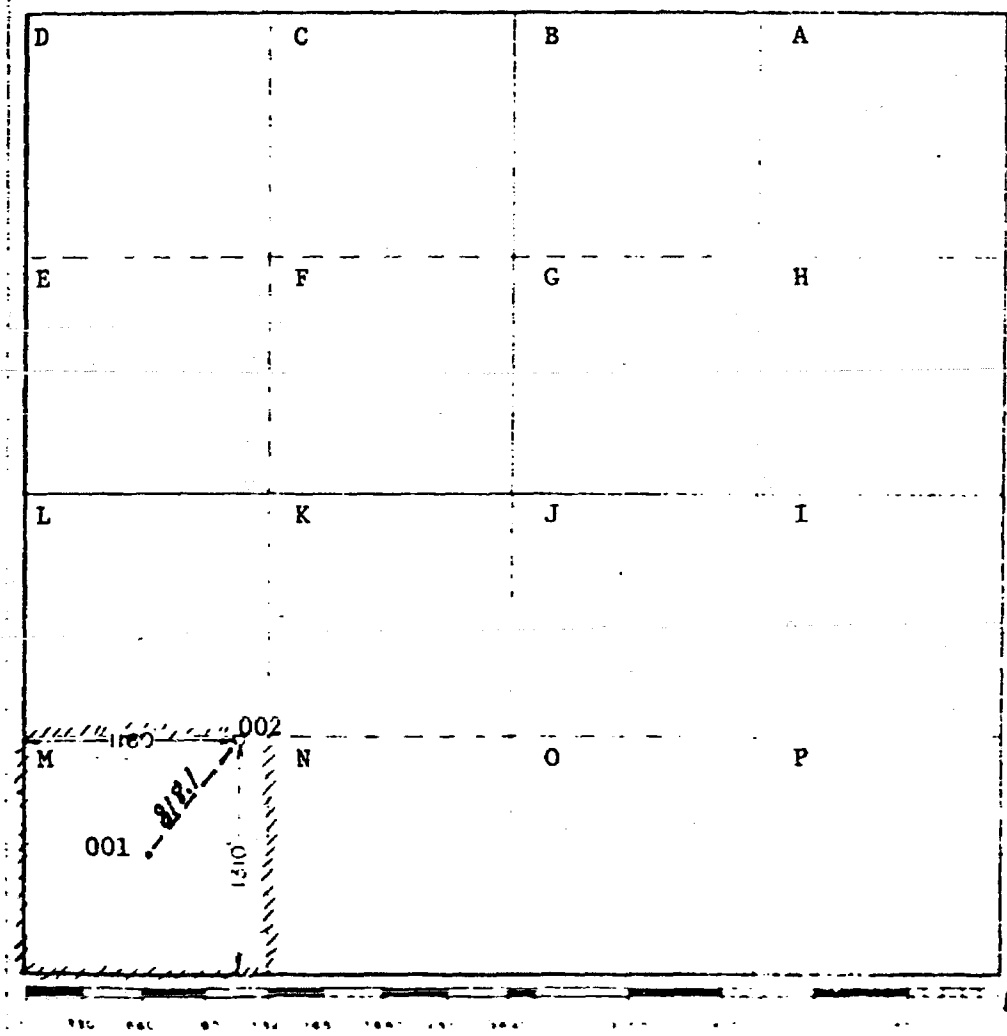
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling etc.

Yes No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

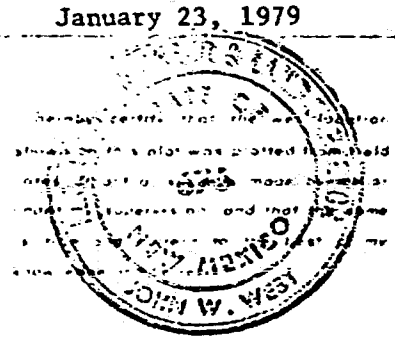
I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Engineering Advisor

Phillips Petroleum Co.

January 23, 1979



December 29 1978

John W. West

John W West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: B-1334

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]
GAS WELL [X] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3308

2. Name of Operator: PHILLIPS PETROLEUM COMPANY

9. Well No.: 003

3. Address of Operator: ROOM 401, 4001 Penbrook St., Odessa, Texas 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER C LOCATED 1150 FEET FROM THE North LINE AND 1510 FEET FROM THE West LINE OF SEC. 33 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'
19A. Formation: Grayburg/San Andres
20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3939.4' Ground (unprepared)
21A. Kind & Status Plug. Bond: Blanket
21B. Drilling Contractor: Advise Later
22. Approx. Date Work will start: Upon Approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17 ½"	13-3/8"	48#-H-40	350'	(675 sx. Cl H w/2% $CaCl_2$) (1/4# Flocele/sx. in 1st 150 sx)	circ to surfac
12 ¼" x 8-5/8"	7"	23#, K-55	4900'	(sufficient TRLW w/12# salt/sx w/10% DD and ¼#/sx flocele plus 3# Gilsonite/sx followed by 260 sx Class H cement w/8# salt/sx to circulate at surface.)	

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3010'; cemented to surface w/cement of quality adequate to control water flow and protect casing string.

Re-NMOCD Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4)- location herein is required due to topogrophical conditions which also required new tract and well number. Original location and well as specified in Order (3) was: Tract 3366, well no. 001, located 1330'FN and 1310' F W lines, above section. Confirming telecon McLemore/Ramey of 1-22-79.

(This well is in the same proration unit as well 002)

Use mud additives as required for control.

BOP: Series 900, 3000# WP, double w/one set pipe rams & one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed: D. J. Mueller (This space for State Use) Name: D. J. Mueller Title: Engineering Advisor Date: January 22, 1979

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION
WELL LOCATION AND ACREAGE DEDICATION PLAT

Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the section

Phillips Petroleum Company	E,V,G,S,A,U, C Tract 3308		003
C	33	17 South	35 East	Lea
1150	North	1510	West
3935.4	Grayburg/San Andres	Vacuum Grayburg/San Andres	40

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

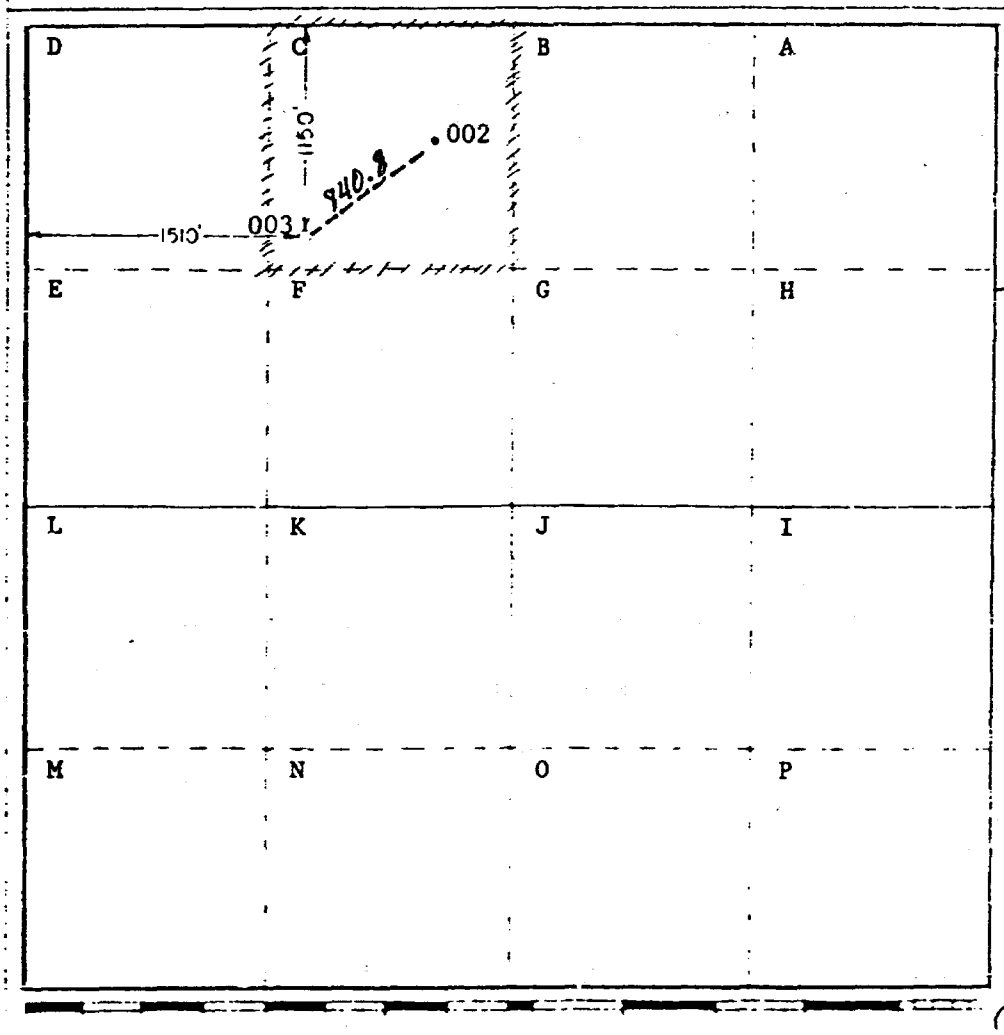
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Engineering Advisor

Phillips Petroleum Co.

January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

REG. PROF. ENGINEER & LAND SURVEYOR
STATE OF NEW MEXICO
675

December 29, 1978

John W West

John W West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: B-1713

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]

OIL WELL [X] GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3333

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 004

3. Address of Operator: Room 401, 4001 Penbrook Street, Odessa, Texas 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andr

4. Location of Well: UNIT LETTER H LOCATED 1380 FEET FROM THE North LINE AND 1280 FEET FROM THE East LINE OF SEC. 33 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3939.0' Ground (unprepared)

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Advise later

22. Approx. Date Work will start: upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13 3/8"	48#, H-40	350'	(675 sx class H w/2% $CaCl_2$ & ¼# Flocele/sx in 1st 150 sx)	Circ to Surface
12¼" x 8 5/8"	7"	23#, K-55	4900'	(Sufficient TRLW w/12# Salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx class H cement w/8# salt/sx to circulate at surface)	

(This well is in the same proration unit as well No. 201)

NOTE: If excessive waterflow is encountered in salt section, 9 5/8" 40# N80 intermediate casing will be set at approximately 3030'; cemented to surface w/cement of quality adequate to control waterflow and protect casing string.

RE: N.M.O.C.D. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original location approved within order (3) was 1330' FN and East lines of the above section.

Use mud additives as required for control.

BOP: Series 900, 3000# WP, double w/one set pipe rams and one set blind rams. (Conf. Telecon Mcl--Ramey 1-22-79)

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W. J. Mueller Engineering Advisor Date January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E.V.G.S.A.U. G Tract 3333	004

Unit Letter	Section	Township	Range	County
H	33	17 South	35 East	Lea

Actual Footage Location of Well:
1380 feet from the North line and 1280 feet from the East line

Ground Level Elev.	Producing Formation	Pool	Indicated Acreage:
3939.0	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

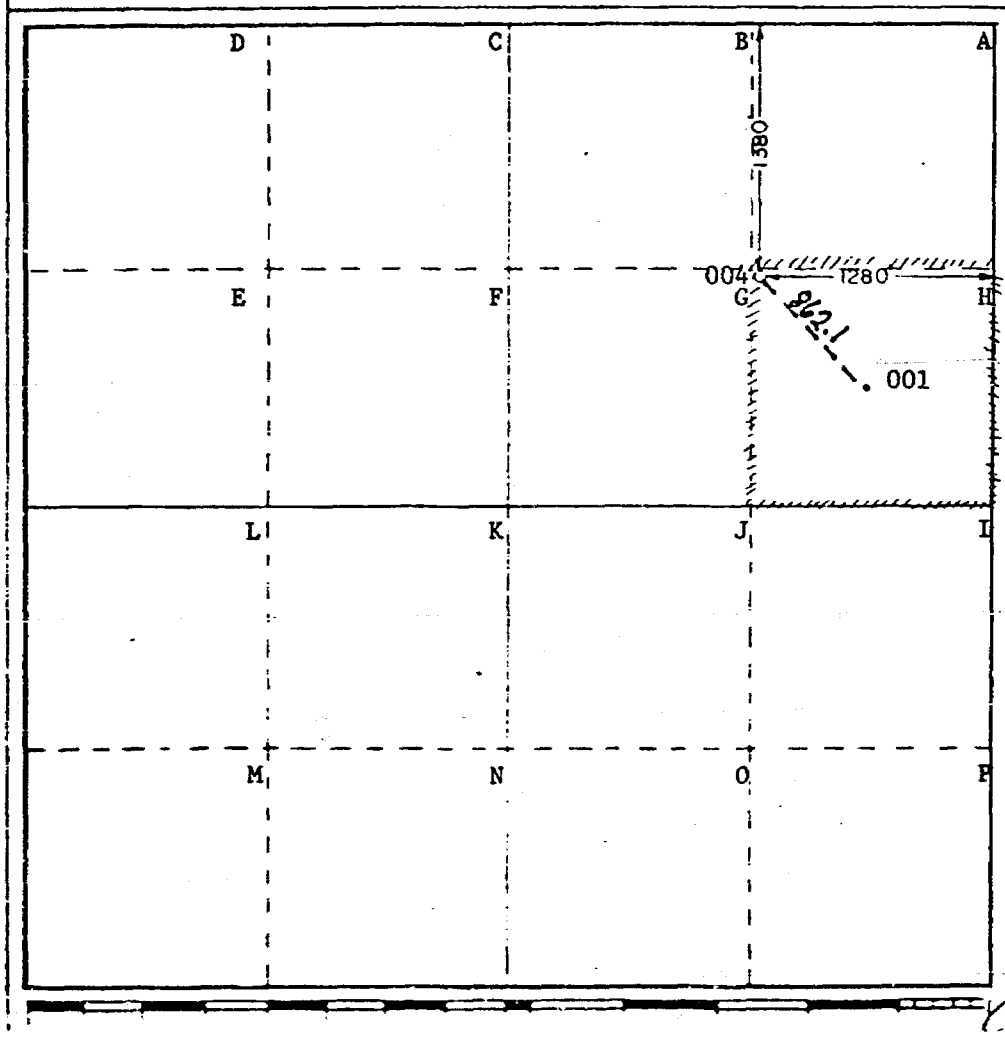
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

NEW MEXICO ENGINEER & LAND SURVEYOR
STATE OF
575
NEW MEXICO

Date Surveyed: January 3, 1979

Registered Professional Engineer and/or Land Surveyor

Certificate No. John W. West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5b. State Oil & Gas Lease No.: B-2273

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work — DRILL [X] DEEPEN [ ] PLUG BACK [ ]

b. Type of Well — SINGLE [X] MULTIPLE [ ]

7. East Vacuum Grayburg/San Andres Unit

8. East Vacuum Grayburg/San Andres Unit, Tract 3456

2. Name of Operator: PHILLIPS PETROLEUM COMPANY

9. Well No.: 005

3. Address of Operator: ROOM 401, 4001 PENBROOK STREET, ODESSA, TEXAS 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well — UNIT LETTER C LOCATED 1030 FEET FROM THE North LINE AND 1410 FEET FROM THE West LINE OF SEC. 34 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3933.6' Ground (unprepared)

21A. Kind & Status Plug. Bond: Blanket

22. Drilling Contractor: Advise Later

22a. Approx. Date Work will start: Upon Approval

23. PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17-1/2"	13-3/8"	48#-H-40	350' (675 sx Cl H w/2% CaCl, (1/4# Flocele/sx in 1st 150 sx)	&) circ to surf.	
12-1/4" x 8-5/8"	7"	23#, K-55	4900' (sufficient TRLW w/12# Salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx Cl H cement w/8# salt/sx to circulate at surface).		

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3070' cemented to surface w/cement of quality adequate to control waterflow & protect casing string.

Re: N.M.O.C.D. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original location approved within, Order (3) was 1330' FN and 1310' FW lines of the above section. (Conf. Telecon McL-Ramey of 1-22-79).

(This well is in the same proration unit as Well No. 001)

Use Mud Additives as required for control.

BOP: Series 900,3000# WP, double w/one set pipe rams and one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed: W. J. Mueller — Engineering Advisor — Date: January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E,V,G,S,A,U, C Tract 3456	005

Unit Letter	Section	Township	Range	County
C	34	17 South	35 East	Lea

Actual Footage Location of Well:
1030 feet from the North line and 1410 feet from the West line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage
3933.6	Grayburg/San Andres	Vacuum Grayburg/San Angres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

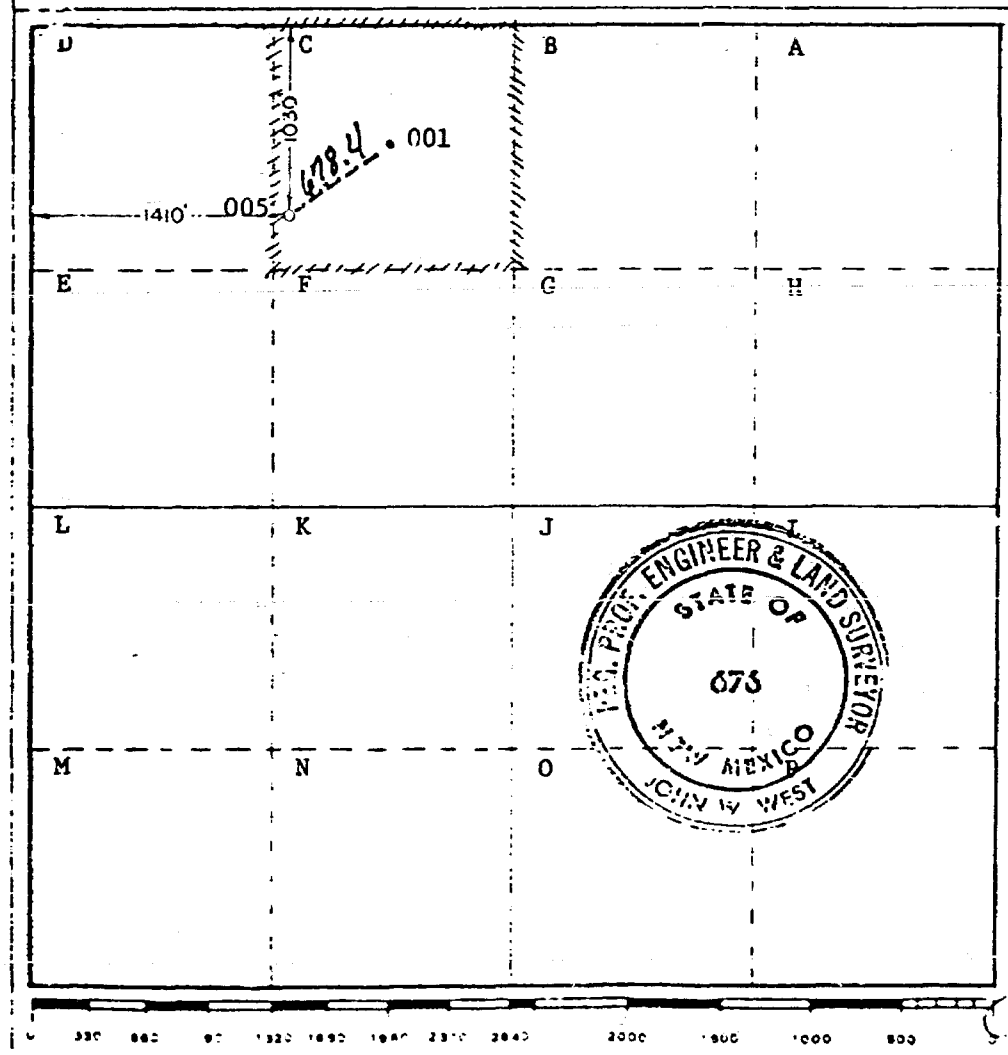
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W.J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Date Surveyed: January 3, 1979

Registered Professional Engineer and/or Land Surveyor

Certificate No. John W West 676
Ronald J Eidson 3239

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: A-1320

APPLICATION FOR PERMIT TO DRILL, DEEPEN OR PLUG BACK

1a. Type of Work:

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]

OIL WELL [X] GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 2801

2. Name of Operator: PHILLIPS PETROLEUM COMPANY

9. Well No.: 002

3. Address of Operator: ROOM 401, 4001 Penbrook Street, ODESSA, TEXAS 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER M LOCATED 1140 FEET FROM THE South LINE AND 1310 FEET FROM THE West LINE OF SEC. 28 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3950.3' Ground (unprepared) blanket

21A. Kind & Status Plug. Bond

21B. Drilling Contractor: advise later

22. Approx. Date Work will start: upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17-1/2"	13-3/8"	48#-H-40	350'	(675 sx Cl H w/2% $CaCl_2$ & (1/4# Flocele/sx in 1st 150/sx)	circ to surface
12-1/4" x 8-5/8"	7"	23#, K-55	4900'	(suff. TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx follwd by 260 sx Cl H cement w/8# salt/sx to circ at surface).	

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3030' cemented to surface w/cement of quality adequate to control waterflow & protect casing string.

(This well is in the same proration unit as well no. 008)

Use Mud Additives as Required for Control

Re:NMOCD Order No R-5897: Administrative approval requested as provided by Rule 8 of Order (4) the location herein is required due to topographical circumstances. The orig. loc. approved within Order (3) was 1310' FS & W lines of the above section. (Conf. Telecon McL-Ramey 1-22-79)

BOP: Series 900,3000# WP, double w/one set pipe rams and one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Name: N. J. Mueller Title: Engineering Advisor Date: January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the section

Operator	Lease	Well No.
Phillips Petroleum Company	E.V.G.S.A.U. M Tract 2801	002

Unit Letter	Section	Township	Range	County
M	28	17 South	35 East	Lea

Actual Footage Location of Well:
1140 feet from the South line and 1310 feet from the West line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
3950.3	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

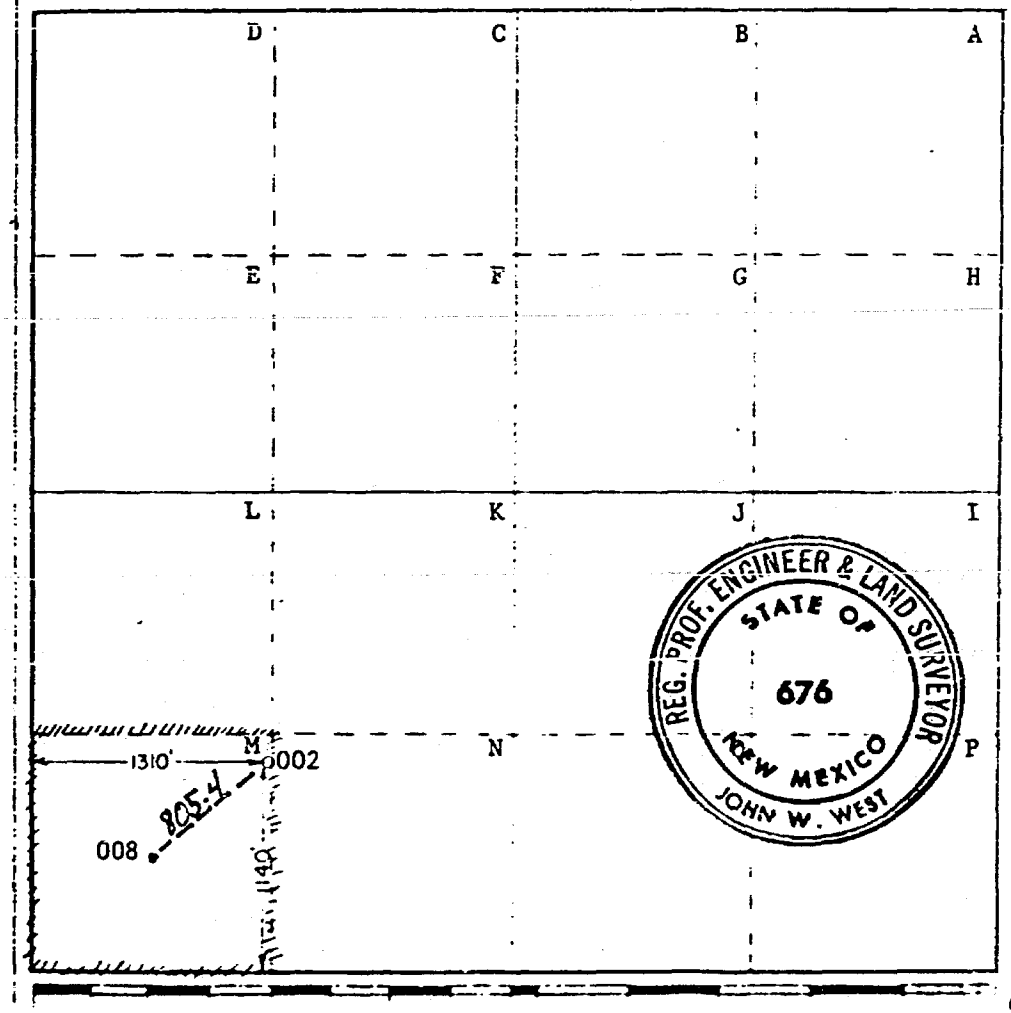
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling etc.?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Engineering Advisor

Phillips Petroleum Co.

January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

January 5, 1979

John W West

John W West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: A-1320

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work
b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]
OIL WELL [X] GAS WELL [ ] OTHER SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 2801

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 004

3. Address of Operator: Room 401, 4001 Penbrook St., Odessa, Tx 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER O LOCATED 1310 FEET FROM THE South LINE AND 1330 FEET FROM THE East LINE OF SEC. 28 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3942.7'Ground(unprepared)

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Advise later

22. Approx. Date Work will start: Upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13-3/8"	48#--H-40	350'(675 sx Class H w/2% CaCl & ¼# Flocele/sx in 1st 150 sx		circ.at surfac
12¼" X 8-5/8"	7"	23#, K-55	4900' (Sufficient TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx Class H cement w/8# salt/sx to circulate at surface.)		

(This well is in the same proration unit as Well No. 010.)

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3025'; cemented to surface w/cement of quality adequate to control waterflow and protect casing string.

RE: N.M.O.C.D. Order No. R-5897 confirming Administrative approval requested as provided by Order (3).

Use mud additives as required for control.

BOP: Series 900, 3000# WP, double w/one set pipe rams & one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W.J. Mueller Engineering Advisor Date 1-22-79

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E,V,G,S,A,U, D Tract 2801	004

Unit Letter	Section	Township	Range	County
O	28	17 South	35 East	Lea

Actual Footage Location of Well:
1310 feet from the South line and 1330 feet from the East line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
3942.7	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

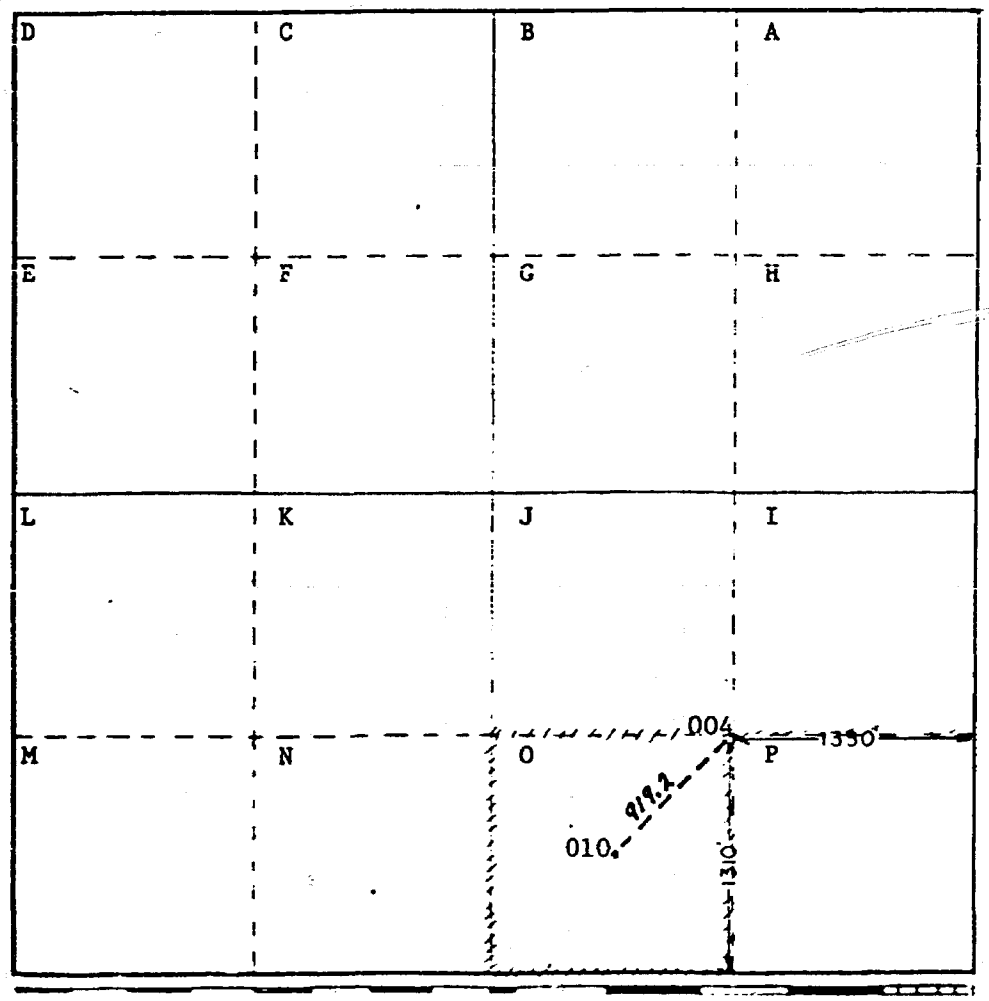
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

STATE OF NEW MEXICO — REGISTERED PROFESSIONAL ENGINEER & LAND SURVEYOR

Date Surveyed: January 3, 1979

Registered Professional Engineer and/or Land Surveyor: John W. West

Certificate No. John W. West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease: STATE X FEE

5. State Oil & Gas Lease No.: B-1840

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well: DRILL X DEEPEN PLUG BACK

OIL WELL X GAS WELL SINGLE ZONE X MULTIPLE ZONE

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 2739

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 005

3. Address of Operator: Room 401, 4001 Penbrook St., Odessa, Tx 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER K LOCATED 1330 FEET FROM THE South LINE AND 1380 FEET FROM THE West LINE OF SEC. 27 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3938.7' Ground (unprepared)

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Advise later

22. Approx. Date Work will start: Upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13-3/8"	48# - H-40	350' (675 sx Class H w/2% CaCl, (1/4# Flocele/sx in 1st 150 sx.)	circ. to surface	
12¼" X 8-5/8"	7"	23#, K-55	4900' (sufficient TRLW w/12# salt/sx w/10% DD and 1/4#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx Class H cement w/8# salt/sx to circulate at surface.)		

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3030'; cemented to surface w/cement of quality adequate to control waterflow & protect casing string.

RE: NMOCD Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). Location herein is required due to topographical conditions which also required new tract & well number. Original location and well as specified in Order (3) was: Tract 2721, Well No. 001, located 1310'FS and w/lines of above section. Confirms telecon McLemore/Ramey 1-22-79.

(This well is in the same proration unit as well No. 001)

Use mud additives as required for control.

BOP: Series 900,3000# WP, double w/one set pipe rams & one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W.J. Mueller Name W.J. Mueller Title Engineering Advisor Date 1-22-79

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

7

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-128
Revised 10-1-78

Operator: Phillips Petroleum Company | Lease: E.V.G.S.A.U. M Tract 2739 | Well No.: 005

Unit Letter: K | Section: 27 | Township: 17 South | Range: 35 East | County: Lea

Actual Footage Location of Well: 1330 feet from the South line and 1380 feet from the West line

Ground Level Elev.: 3938.7 | Producing Formation: Grayburg/San Andres | Pool: Vacuum Grayburg/San Andres | Dedicated Acreage: 40

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

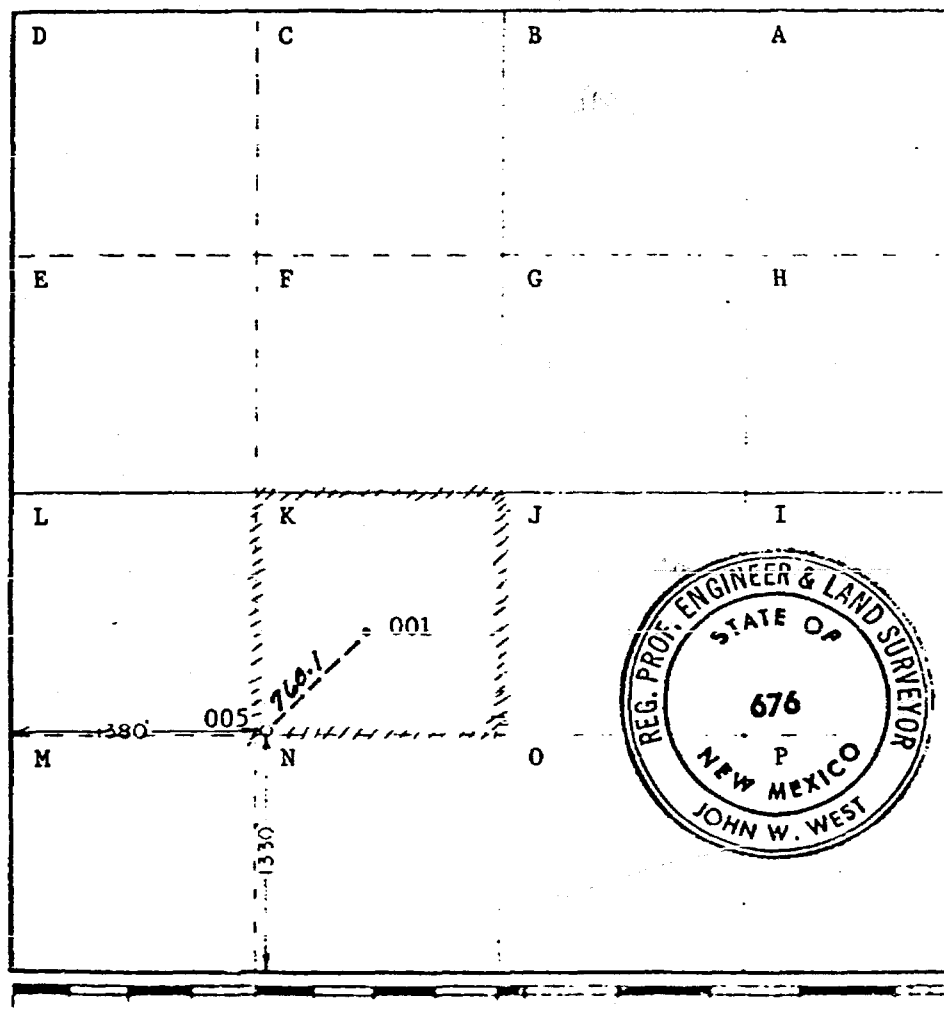
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, forced-pooling, etc?

☐ Yes ☐ No If answer is "yes" type of consolidation _____

If answer is "no" list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Engineering Advisor

Phillips Petroleum Co.

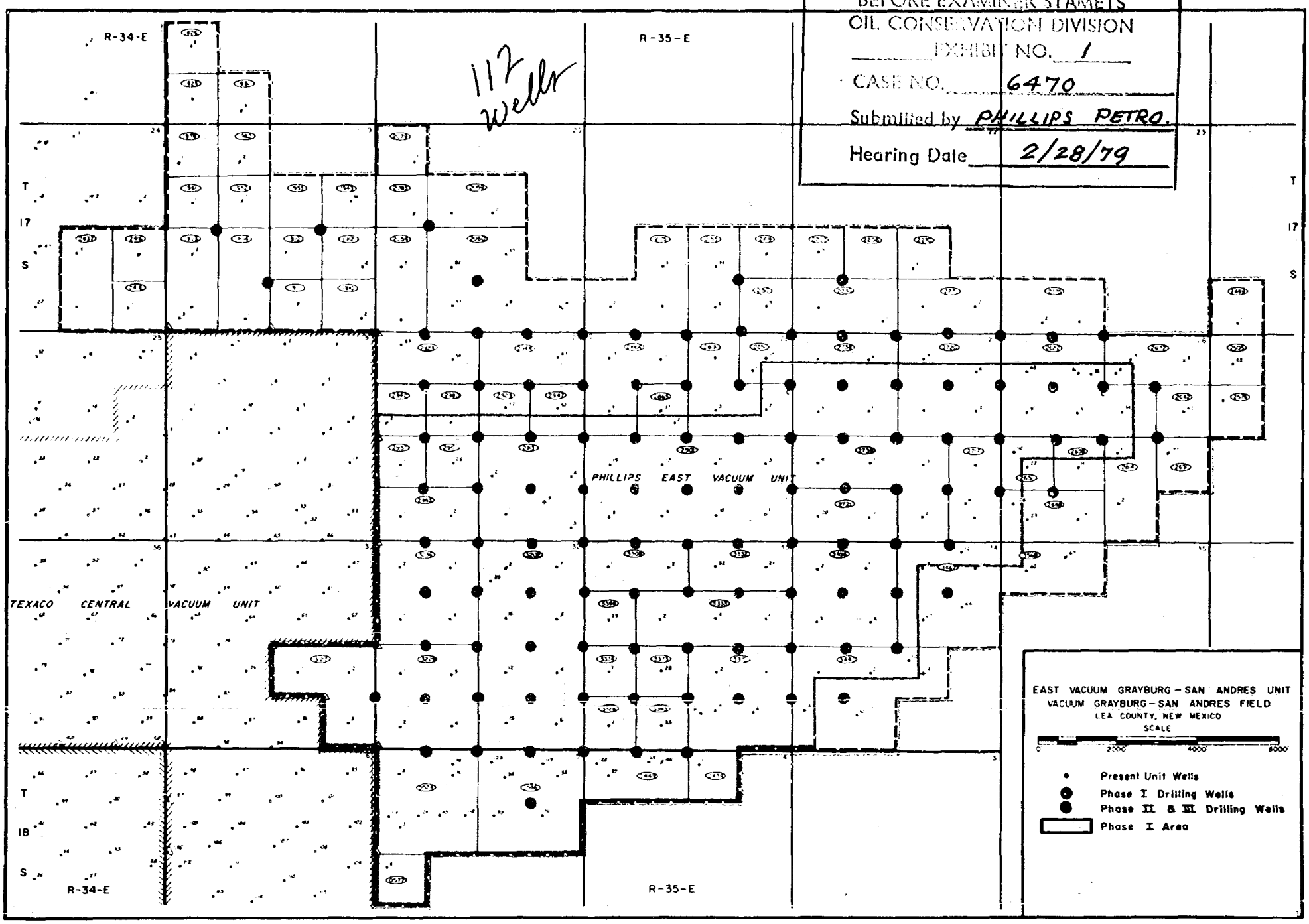
January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

January 3, 1979

John W West 676

BEFORE EXAMINER STAMETS
OIL CONSERVATION DIVISION
EXHIBIT NO. 1
CASE NO. 6470
Submitted by PHILLIPS PETRO.
Hearing Date 2/28/79



STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

EXHIBITS
OIL CONSERVATION DIVISION
2
6470
Submitted by PHILLIPS PETRO.
Hearing Date 2/28/79

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:

CASE NO. 6366
Order No. R-5871

APPLICATION OF PHILLIPS PETROLEUM COMPANY FOR STATUTORY UNITIZATION, LEA COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 9 a.m. on October 25, 1978, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 27th day of November, 1978, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Division has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Phillips Petroleum Company, seeks the statutory unitization, pursuant to the "Statutory Unitization Act," Sections 65-14-1 through 65-14-21, NMSA, 1953 Compilation, of 7,025.3 acres, more or less, of State lands, being a portion of the Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, and approval of the plan of unitization and the proposed operating plan.

(3) That the proposed unit area would be designated the East Vacuum Grayburg-San Andres Unit Area; that the vertical limits of said unit area would be the subsurface formation commonly known as the Grayburg-San Andres formation identified between the depths of 4,050 feet (103 feet sub-sea) and 5,050 feet (1103 feet sub-sea) on the Lane Wells Acoustilog, Run No. 1, dated April 14, 1964, in Exxon's New Mexico State "K" Well No. 19, located in the SE/4 SE/4 of Section 28, Township 17 South, Range 35 East, NMPM, Lea County, New Mexico, and is to include all subsurface points throughout the Unit area correlative to those identified depths, and that the unit area would comprise the following described lands:

TOWNSHIP 17 SOUTH, RANGE 34 EAST, NMPM
Section 24: SE/4

TOWNSHIP 17 SOUTH, RANGE 35 EAST, NMPM
Section 18: W/2 SW/4 and SE/4 SW/4
Section 19: W/2, S/2 NE/4, and SE/4
Section 20: W/2 NW/4, SE/4 NW/4, SW/4, SW/4 NE/4, W/2 SE/4 and SE/4 SE/4
Section 21: SW/4 SW/4, E/2 SW/4, and SE/4
Section 22: SW/4, W/2 SE/4, and SE/4 SE/4
Section 23: S/2 SW/4
Section 24: SW/4 SW/4
Section 25: W/2 NW/4
Section 26: N/2, SW/4, W/2 SE/4, and NE/4 SE/4
Sections 27, 28, and 29: All
Section 31: N/2 SE/4 and SE/4 SE/4
Sections 32 and 33: All
Section 34: N/2, SW/4, and NW/4 SE/4
Section 35: N/2 NW/4

TOWNSHIP 18 SOUTH, RANGE 35 EAST, NMPM
Section 4: N/2 NW/4 and NW/4 NE/4
Section 5: N/2 and NW/4 SW/4

(4) That the portion of the Vacuum Grayburg-San Andres Pool proposed to be included in the aforesaid East Vacuum Grayburg-San Andres Unit Area has been reasonably defined by development.

(5) That the applicant proposes to institute a pressure maintenance project for the secondary recovery of oil and gas in the proposed unit area.

(6) That the unitized management, operation and further development of the subject portion of the Vacuum Grayburg-San Andres Pool, as proposed, is reasonably necessary in order to effectively carry on secondary recovery operations and to substantially increase the ultimate recovery of oil from the pool.

(7) That the proposed unitized method of operation as applied to the East Vacuum Grayburg-San Andres Unit Area is feasible, will prevent waste, and will result with reasonable probability in the increased recovery of substantially more oil from the pool than would otherwise be recovered.

(8) That the estimated additional costs of such operations will not exceed the estimated value of the additional oil so recovered plus a reasonable profit.

(9) That such unitization and adoption of the proposed unitized method of operation will benefit the working interest owners and royalty owners of the oil and gas rights within the East Vacuum Grayburg-San Andres Unit Area.

(10) That the applicant has made a good faith effort to secure voluntary unitization within the Vacuum Grayburg-San Andres Pool.

(11) That the participation formula contained in the unitization agreement allocates the produced and saved unitized hydrocarbons to the separately owned tracts in the unit area on a fair, reasonable and equitable basis, and protects the correlative rights of all owners of interest within the unit area.

(12) That applicant's Exhibits Nos. 1 and 2 in this case, being the Unit Agreement and the Unit Operating Agreement should be incorporated by reference into this order.

(13) That applicant's Exhibit No. 2 in this case, being the Unit Operating Agreement, should be amended by the addition thereto of Exhibit "G", being applicant's Exhibit No. 13 in this case and entitled "Business Ethics Policy Compliance."

(14) That the Statutory Unitization of the East Vacuum Grayburg-San Andres Unit Area, in conformance to the above findings, will prevent waste and protect correlative rights and should be approved.

IT IS THEREFORE ORDERED:

(1) That the East Vacuum Grayburg-San Andres Unit Agreement, covering 7025.3 acres, more or less, of State lands in the Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, is hereby approved for statutory unitization pursuant to the Statutory Unitization Act, Sections 65-14-1 through 65-14-21, NMSA, 1953 Compilation.

(2) That the lands covered by said East Vacuum Grayburg-San Andres Unit Agreement shall be designated the East Vacuum Grayburg-San Andres Unit Area and shall comprise:

TOWNSHIP 17 SOUTH, RANGE 34 EAST, NMPM
Section 24: SE/4

TOWNSHIP 17 SOUTH, RANGE 35 EAST, NMPM

Section 18: W/2 SW/4 and SE/4 SW/4
Section 19: W/2, S/2 NE/4, and SE/4
Section 20: W/2 NW/4, SE/4 NW/4, SW/4, SW/4 NE/4, W/2 SE/4, and SE/4 SE/4
Section 21: SW/4 SW/4, E/2 SW/4 and SE/4
Section 22: SW/4, W/2 SE/4, and SE/4 SE/4
Section 23: S/2 SW/4
Section 24: SW/4 SW/4
Section 25: W/2 NW/4
Section 26: N/2, SW/4, W/2 SE/4, and NE/4 SE/4
Sections 27, 28, and 29: All
Section 31: N/2 SE/4 and SE/4 SE/4
Sections 32 and 33: All
Section 34: N/2, SW/4, and NW/4 SE/4
Section 35: N/2 NW/4

TOWNSHIP 18 SOUTH, RANGE 35 EAST, NMPM

Section 4: N/2 NW/4 and NW/4 NE/4
Section 5: N/2 and NW/4 SW/4

(3) That the vertical limits of the East Vacuum Grayburg-San Andres Unit Area shall be the Grayburg-San Andres formation identified between the depths of 4,050 feet (103 feet sub-sea) and 5,050 feet (1103 feet sub-sea) on the Lane Wells Acoustilog, Run No. 1, dated April 14, 1964, in Exxon's New Mexico State "K" Well No. 19, located in the SE/4 SE/4 of Section 28, Township 17 South, Range 35 East, NMPM, Lea County, New Mexico, and is to include all subsurface points throughout the Unit area correlative to those identified depths.

(4) That applicant's Exhibit No. 1 in this case, being the East Vacuum Grayburg-San Andres Unit Agreement, is hereby incorporated by reference into this order.

(5) That applicant's Exhibit No. 2 in this case, being the East Vacuum Grayburg-San Andres Unit Operating Agreement, as amended by the addition thereto of "Exhibit G, Business Ethics Policy Compliance," being applicant's Exhibit No. 13 in this case, is hereby incorporated by reference into this order.

(6) That the East Vacuum Grayburg-San Andres Unit Agreement and the East Vacuum Grayburg-San Andres Unit Operating Agreement provide for unitization and unit operation of the subject portion of the Vacuum Grayburg-San Andres Pool upon terms and conditions that are fair, reasonable and equitable and include:

an allocation to the separately owned tracts in the unit area of all the oil and gas that is produced from the unit area and is saved, being the production that is not used in the conduct of operations on the unit area or not unavoidably lost;

a provision for the credits and charges to be made in the adjustment among the owners in the unit area for their respective investments in wells, tanks, pumps, machinery, materials and equipment contributed to the unit operations;

a provision governing how the costs of unit operations including capital investments shall be determined and charged to the separately owned tracts and how said costs shall be paid including a provision providing when, how, and by whom the unit production allocated to an owner who does not pay the share of the costs of unit operations charged to such owner, or the interest of such owner, may be sold and the proceeds applied to the payment of such costs;

a provision for carrying any working interest owner on a limited, carried or net-profits basis, payable out of production, upon such terms and conditions determined by the Division Director to be just and reasonable, and allowing an appropriate charge for interest for such service payable out of such owner's share of production, provided that any nonconsenting working interest owner being so carried shall be deemed to have relinquished to the unit operator all of its operating rights and working interest in and to the unit until his share of the costs, service charge and interest are repaid to the unit operator;

a provision designating the unit operator and providing for the supervision and conduct of the unit operations, including the selection, removal or substitution of an operator from among the working interest owners to conduct the unit operations;

a provision for a voting procedure for the decision of matters to be decided by the working interest owners in respect to which each working interest owner shall have a voting interest equal to its unit participation; and

the time when the unit operation shall commence and the manner in which, and the circumstances under which, the operations shall terminate and for the settlement of accounts upon such termination;

and are therefore hereby adopted.

(7) That this order shall not become effective unless and until the appropriate ratification provisions of Section 65-14-8, NMSA, 1953 Compilation, are complied with.

(8) That if the persons owning the required percentage of interest in the unit area as set out in Section 65-14-8, NMSA, 1953 Compilation, do not approve the plan for unit operations within a period of six months from the date of entry of this order, this order shall cease to be of further force and effect and shall be revoked by the Division, unless the Division shall extend the time for ratification for good cause shown.

(9) That the persons owning the required percentage of interest in the unit area have approved the plan for unit operations and the interests of all persons in the unit are unitized whether or not such persons have approved the plan of unitization in writing.

(10) That jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

JOE D. RAMEY
Director

S E A L

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STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

BEFORE EXAMINER STAMETS
OIL CONSERVATION DIVISION
EXHIBIT NO. 3
CASE NO. 6470
Submitted by PHILLIPS PETRO.
Hearing Date 2/28/79

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:

CASE NO. 6367
Order No. R-5897

APPLICATION OF PHILLIPS PETROLEUM COMPANY FOR A PRESSURE MAINTENANCE PROJECT, LEA COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 9 a.m. on October 25, 1978, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 16th day of January, 1979, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Division has jurisdiction of this cause and the subject matter thereof.

(2) That by Division Order No. R-5871 dated November 27, 1978, statutory unitization was approved for the East Vacuum Grayburg-San Andres Unit Area, Lea County, New Mexico.

(3) That the applicant herein, Phillips Petroleum Company, seeks authority to institute a pressure maintenance project on the aforesaid East Vacuum Grayburg-San Andres Unit Area, Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, by the injection of water into the San Andres formation through 59 wells, 31 of which would be drilled in 1979 during Phase II of the Project Development Program and 28 of which would be drilled in 1980 during Phase III of the Development Program.

(4) Applicant further seeks the designation of a project area for said pressure maintenance project and the promulgation of special rules and regulations governing said project including special allowable provisions.

(5) That for Phase I of the Project Development Program, applicant proposes to drill during 1979 ten producing wells at unorthodox locations as specified below:

TRACT NO.	WELL NO.	LOCATION	UNIT	SECTION
3229	005	1310' FSL and 1310' FWL	M	32
3202	001	1310' FSL and 1330' FEL	O	32
3202	003	1330' FNL and 1330' FEL	G	32
3328	002	1310' FSL and 1310' FWL	M	33
3366	001	1330' FNL and 1310' FWL	E	33
3333	004	1330' FNL and 1330' FEL	G	33
3456	005	1330' FNL and 1310' FWL	E	34
2801	002	1310' FSL and 1310' FWL	M	28
2801	004	1310' FSL and 1330' FEL	O	28
2721	001	1310' FSL and 1310' FWL	M	27

all in Township 17 South, Range 35 East, NMPM, Lea County, New Mexico.

(6) That during Phase II of the Development Program applicant proposes to drill 18 additional producing wells, all at unorthodox locations, and during Phase III of the Program applicant proposes to drill 26 additional producing wells, also at unorthodox locations.

(7) That all of the wells referred to in Findings Nos. (3), (5) and (6) above, being 59 injection wells at unorthodox locations and 54 producing wells at unorthodox locations, together with the currently completed producing wells in the Unit Area, will provide a thorough and efficient sweep of hydrocarbons throughout the unitized area, and will result in the recovery of otherwise unrecoverable oil, thereby preventing waste.

(8) That the above-described injection and producing wells, some of which would be at unorthodox locations along the unit boundaries in accordance with lease-line agreements with operators of offsetting lands, will not impair but will protect correlative rights.

(9) That the applicant's request for the designation of a Pressure Maintenance Project for the East Vacuum Grayburg-San Andres Unit Area, and for the promulgation of special rules and regulations governing said project, is in the interest of conservation and should be approved, subject to certain provisions.

(10) That the project area should consist of those proration units within the boundary of the East Vacuum Grayburg-San Andres Unit upon which is located an injection well and any directly or diagonally offsetting proration unit which contains a producing well.

(11) That the total project area allowable should be equal to the sum of the basic project area allowable plus the water injection credit allowable.

(12) That the basic project area allowable should be equal to 80 barrels of oil per day times the number of developed 40-acre proration units in the project area.

(13) That the water injection credit allowable should be based on the following formula:

$$\text{Water Injection Credit Allowable} = \left[\frac{\text{net water injected}}{\text{basic project area allowable voidage}}\right] \times \text{basic project area allowable}$$

and should be calculated in accordance with Exhibits "A" and "B" attached hereto and by reference made a part hereof.

(14) That the project area allowable should be produced from the wells within the project area in any proportion provided that any proration unit situated on the boundary of said East Vacuum Unit which proration unit is not directly or diagonally offset by a San Andres injection well outside the Unit or on the Unit boundary should not be permitted to produce in excess of 80 barrels of oil per day.

(15) That each of the newly drilled production or injection wells in the project should be equipped with surface casing set at approximately 350 feet and cemented to the surface and with "production" casing set at total depth, approximately 4900 feet.

(16) That the "production" casing on each of said newly drilled wells should be cemented to the surface, except that in any well in which an intermediate casing string has been run to below the top of the Yates formation and cemented to the surface, the "production" casing may be cemented back into the base of the intermediate casing string.

(17) That injection should be accomplished through tubing installed in a packer set within 100 feet of the uppermost perforation. The injection tubing should be corrosion protected by a non-reactive internal lining or coating. The casing-tubing

annulus in each injection well should be filled with an inert fluid and a surface pressure gauge or approved leak detection device should be attached to the annulus.

(18) The injection wells or system should be equipped with a pressure control device or acceptable substitute which will limit the surface injection pressure to no more than 0.2 psi per foot of depth to the uppermost perforation. Provision should be made for the Division Director to administratively authorize a pressure limitation in excess of the above upon showing by the Unit Operator that such higher pressure will not result in fracturing of the confining strata.

(19) All wells within the project area should be equipped with risers or in some other acceptable manner as to facilitate the periodic testing of the bradenhead for pressure or fluid production.

(20) That provision should be made for the Division Director to authorize placing wells on injection and the drilling of injection wells and additional producing wells at orthodox and unorthodox locations anywhere within the Unit Area without notice and hearing, provided that no unorthodox location is closer than ten feet to a quarter-quarter section line nor closer than 330 feet to the unit boundary, unless such well located closer than 330 feet to the unit boundary is covered by a lease-line agreement with the operator of the lands offsetting such well or the owner of the offsetting lands has waived objection to such location in writing.

(21) That there are a number of wells within the East Vacuum Grayburg-San Andres Unit Area and on lands offsetting the unit area which have previously been plugged and abandoned in a manner which may permit waters injected into the San Andres formation to escape into other formations, including the Salado formation and the shallow fresh water-bearing formations unless remedial action is taken on said wells prior to injection in their near vicinity.

(22) That there are a number of wells within the East Vacuum Grayburg-San Andres Unit Area and on lands offsetting the unit area which penetrate the Vacuum Grayburg-San Andres Pool and are completed in deeper pay zones, but which are cased and cemented in such a manner as may permit the escape of waters injected into the San Andres formation into other formations as described above.

(23) That those wells referred to in Findings Nos. (21) and (22) above which are inadequately plugged and abandoned or are inadequately cased and cemented, or are suspected of being so, include, but are not necessarily limited to, the wells listed in Exhibit "C" attached hereto and by reference made a part hereof.

(24) That no injection at greater than hydrostatic pressure should be made into the Grayburg or San Andres formation in any well in the East Vacuum Grayburg-San Andres Unit Area within one-half mile of any well listed on Exhibit "C" attached hereto until remedial action has been taken on such well to ensure that it will not serve as an avenue of escape for injected waters or until tests have been conducted on such well or other evidence concerning such well has been presented, all establishing to the satisfaction of the Supervisor of the Hobbs District Office of the Division that remedial work on such well is unnecessary.

IT IS THEREFORE ORDERED:

(1) That the applicant, Phillips Petroleum Company, is hereby authorized to institute and operate a pressure maintenance project in the East Vacuum Grayburg-San Andres Unit Area, Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, by the injection of water into the San Andres formation through certain wells which will be administratively approved for water injection at some later date by the Division Director.

(2) That said project shall be designated the East Vacuum Unit Pressure Maintenance Project.

(3) That the following unorthodox locations are hereby approved for new producing wells which are to be drilled by the unit operator during Phase I of the Project Development Program:

TRACT NO.	WELL NO.	LOCATION	UNIT	SECTION
3229	005	1310' FSL and 1310' FWL	M	32
3202	001	1310' FSL and 1330' FEL	O	32
3202	003	1330' FNL and 1330' FEL	G	32
3328	002	1310' FSL and 1310' FWL	M	33
3366	001	1330' FNL and 1310' FWL	E	33
3333	004	1330' FNL and 1330' FEL	G	33
3456	005	1330' FNL and 1310' FWL	E	34
2801	002	1310' FSL and 1310' FWL	M	28
2801	004	1310' FSL and 1330' FEL	O	28
2721	001	1310' FSL and 1310' FWL	M	27

all in Township 17 South, Range 35 East, NMPM, Lea County, New Mexico.

(4) That Special Rules and Regulations governing the East Vacuum Unit Pressure Maintenance Project are hereby promulgated as follows:

SPECIAL RULES AND REGULATIONS
FOR THE
EAST VACUUM UNIT PRESSURE MAINTENANCE PROJECT

RULE 1. The project area of the East Vacuum Unit Pressure Maintenance Project shall consist of those proration units within the boundaries of the East Vacuum Grayburg-San Andres Unit upon which is located an injection well and any directly or diagonally offsetting proration unit which contains a producing well.

RULE 2. The project area shall receive a project area allowable, and said project area allowable shall be the sum of the basic project area allowable plus the water injection credit allowable.

RULE 3. The basic project area allowable shall be equal to 80 barrels of oil per day times the number of developed 40-acre proration units in the project area.

RULE 4. The water injection credit allowable shall be contingent upon full reservoir voidage replacement of all produced fluids and shall be based upon the following formula:

$$\text{Water Injection Credit Allowable} = \left[\frac{\text{Net Water Injected}}{\text{Basic Project Area Allowable}}\right]_{\text{Reservoir Voidage}} - 1 \times \text{Basic Project Area Allowable}$$

The water injection credit allowable shall be calculated in accordance with the procedures and parameters depicted on Exhibits "A" and "B" to Order No. R-5897.

In no event shall the water injection credit allowable be less than zero, i.e., negative numbers derived from application of the above formula shall be ignored.

RULE 5. The weighted average project area reservoir pressure shall be determined prior to commencement of injection of water into the reservoir and at least annually thereafter. The weighted average project area pressure shall be determined from the pressures in at least ten representative wells selected by the unit operator and the Supervisor of the Hobbs District Office of the Division.

RULE 6. The project area allowable may be produced from the wells within the project area in any proportion provided, however, that any proration unit situated on the boundary of the East Vacuum Unit which proration unit is not directly or diagonally offset by a San Andres injection well outside said East Vacuum Unit or on the East Vacuum Unit boundary shall not be permitted to produce in excess of 80 barrels of oil per day.

RULE 7. Those wells within the East Vacuum Unit Area that are not included within the project area as defined above shall be prorated in accordance with the Rules and Regulations of the Division.

RULE 8. The Division Director shall have authority to approve, without notice and hearing, the drilling of wells at unorthodox locations anywhere within the unit boundary, provided however, no unorthodox location shall be closer than ten feet to any quarter-quarter section line, and provided further, that no such unorthodox location shall be closer than 330 feet to the outer boundary of the unit area, unless such well is covered by a lease-line agreement with the operator of the lands offsetting such well, and a copy of the lease-line agreement accompanies the application for such unorthodox location, or unless such offset operator has waived objection to the proposed unorthodox location in writing, and his waiver accompanies the application.

RULE 9. No well shall be placed on water injection in the East Vacuum Unit Area unless the Division Director has approved such well for injection. Applications for injection approval shall be filed in accordance with Rule 701 of the Division Rules and Regulations.

RULE 10. Each newly drilled injection or producing well shall be equipped with a minimum of 350 feet of surface casing and "production" casing run to total depth (approximately 4900 feet). All casing strings shall be cemented to the surface except that in any well in which an intermediate casing string has been run to below the top of the Yates formation and cemented to the surface, the "production" string may be cemented back into the base of the intermediate casing.

RULE 11. Injection shall be accomplished through tubing installed in a packer set within 100 feet of the uppermost perforation. The injection tubing shall be corrosion protected by a non-reactive internal lining or coating. The casing-tubing annulus in each injection well shall be filled with an inert fluid and a surface pressure gauge or approved leak detection device shall be attached to the annulus.

RULE 12. The injection wells or system shall be equipped with a pressure control device or acceptable substitute which will limit the surface injection pressure to no more than 0.2 psi per foot of depth to the uppermost perforation. The Division Director may administratively authorize a pressure limitation in excess of the above upon showing by the unit operator that such higher pressure will not result in fracturing of the confining strata.

RULE 13. All wells within the project area shall be equipped with risers or in some other acceptable manner as to facilitate the periodic testing of the bradenhead for pressure or fluid production.

RULE 14. The unit operator shall immediately notify the Supervisor of the Hobbs District Office of the Division of the failure of the tubing or packer in any of said injection wells, the leakage of water or oil from or around any producing well, the leakage of water or oil from or around any plugged and abandoned well within the project area, or any other evidence of fluid migration from the injection zone, and shall take such timely steps as may be necessary or required to correct such failure or leakage.

RULE 15. Each month the project operator shall submit to the Division a Pressure Maintenance Project Operator's Report, on a form prescribed by the Division, outlining thereon the data required and requesting allowables for each of the several wells in the Project as well as the total project area allowable.

RULE 16. The Division shall, upon review of the report and after any adjustments deemed necessary, calculate the allowable for the wells in the Project for the next succeeding month in accordance with these rules. The sum of the allowables so calculated shall be assigned to the Project and, except as provided under Rule 6 above, may be produced from the wells in the Project in any proportion.

IT IS FURTHER ORDERED:

(1) That no injection at greater than hydrostatic pressure shall be made into the Grayburg or San Andres formation in any well in the East Vacuum Grayburg-San Andres Unit Area within one-half mile of any well listed on Exhibit "C" attached hereto until remedial action has been taken on such well to ensure that it will not serve as an avenue of escape for injected waters, or until tests have been conducted on such well or other evidence concerning such well has been presented

establishing to the satisfaction of the Supervisor of the Hobbs District Office of the Division that remedial work on such well is unnecessary.

(2) That Order No. R-3150 which authorized a pilot waterflood project in this area is hereby rescinded.

(3) That jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

JOE D. RAMEY
Director

S E A L

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EAST VACUUM GRAYBURG-SAN ANDRES UNIT
PRESSURE MAINTENANCE PROJECT

VACUUM GRAYBURG-SAN ANDRES POOL, LEA COUNTY, NEW MEXICO

WATER INJECTION CREDIT ALLOWABLE CALCULATION DATA

ATTACHMENT TO _____, 19__, REPORT

$$\text{Water Injection Credit Allowable} = \left[\frac{W_i - W_p}{BPAA \left[B_o + \frac{(R_p - R_s)}{(1,000)} B_g \right]} - 1 \right] BPAA$$

W_i = _____ = Average daily water injection, barrels per day, project area only.

W_p = _____ = Average daily water produced, barrels per day, project area only.

BPAA = _____ = Basic project area allowable, 80 bopd x _____ (number of developed 40-acre tracts in project area).

_____ = Weighted average project area reservoir pressure, psig, from _____, 19__, survey data.

B_o = _____ = Oil formation volume factor, reservoir barrels per stock tank barrel (Exhibit B).

R_p = _____ = Producing gas-oil ratio, cubic feet per barrel, project area only.

R_s = _____ = Solution gas-oil ratio, cubic feet per barrel (Exhibit B).

B_g = _____ = Gas formation volume factor, reservoir barrels per Mcf (Exhibit B).

Water injection credit allowable for _____, 19__, = _____ barrels of oil per day.

EXHIBIT "A"
ORDER NO. R-5897

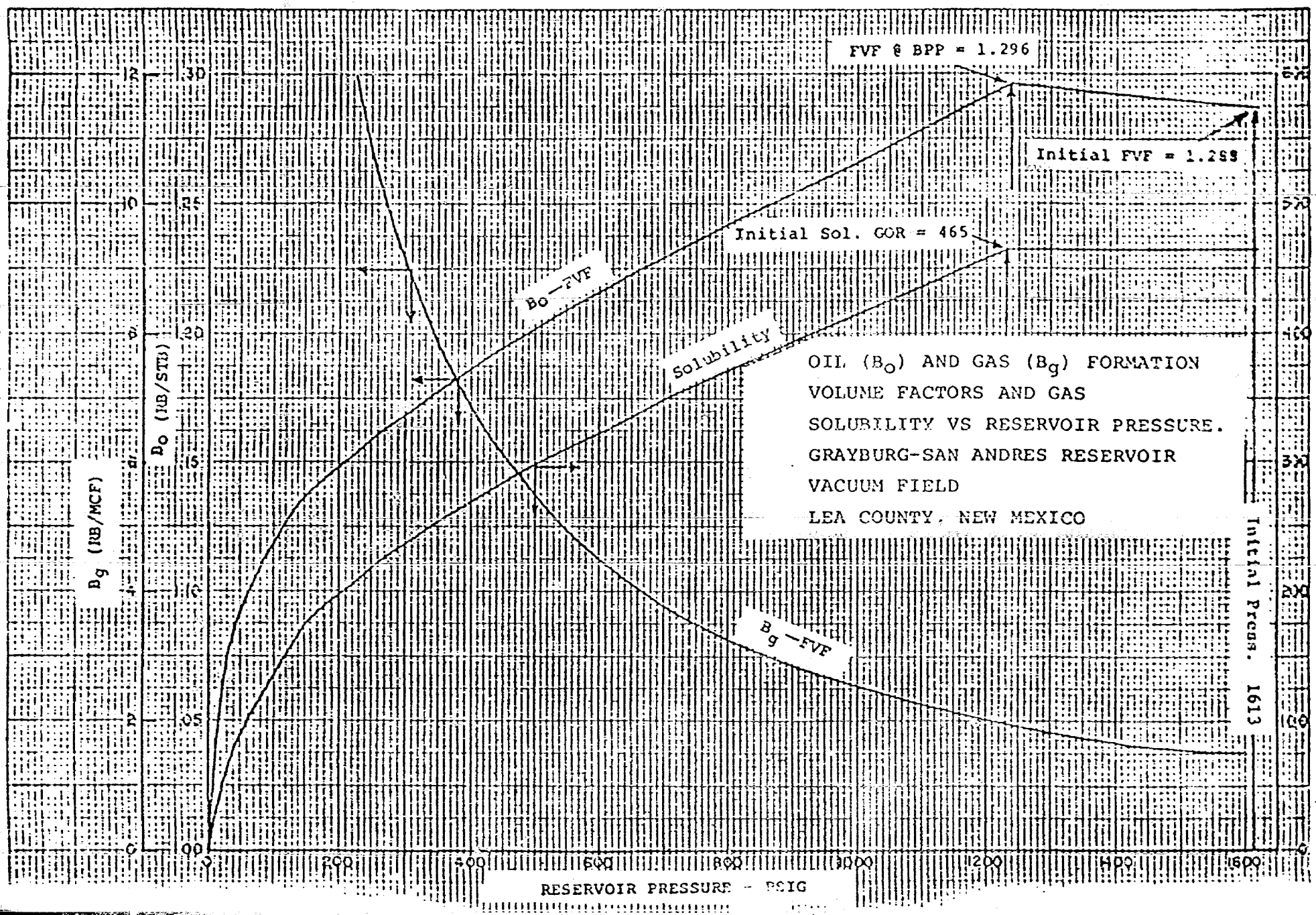


Exhibit "B" Docket No. R-5807

EXHIBIT "C"

WELLS SUSPECTED OF BEING INADEQUATELY PLUGGED AND ABANDONED OR INADEQUATELY CASED AND CEMENTED

OPERATOR	LEASE	WELL NO.	UNIT	SEC-TWP-RGE
Mobil	State P	7	P	22-17S-35E
Penrose	State	2	N	24-17S-35E
Phillips	Santa Fe	15	A	28-17S-35E
Phillips	Santa Fe	16	L	5-18S-35E
Phillips	Santa Fe	37	F	28-17S-35E
Phillips	Santa Fe	47	C	35-17S-35E
Shell	State U	1	C	3-18S-35E
Shell	State VAA	6	K	5-18S-35E
Shell	State C	1	I	24-17S-34E
Shell	State I	1	E	29-17S-35E
Shell	State S	1	I	21-17S-35E
Stoltz etal.	Abo	1	O	24-17S-35E
Zapata	Shell State	1	O	23-17S-35E
Barnett	State B	1	D	19-17S-35E
Jones	State	2	A	35-17S-35E
Penrose	Scarborough	1	C	25-17S-35E
Amoco	State CV	1	F	25-17S-35E
Amoco	State CV	4	L	25-17S-35E
Amoco	State CV	5	F	25-17S-35E
Chevron	State 6-34	4	J	34-17S-35E
Cities Service	State BJ	2	K	35-17S-35E
Crusader	State	1	E	20-17S-35E
Crusader	State	2	C	19-17S-35E
Crusader	State	3	N	18-17S-35E
Exxon	State J	1	M	19-17S-35E
Exxon	State J	2	L	19-17S-35E
Exxon	State AC	1	H	22-17S-35E
Great Western	State E	2	L	25-17S-35E
Marathon	Warn State	1	M	23-17S-35E
Amoco	State CV	2	E	25-17S-35E
Amoco	State CV	2-Y	E	25-17S-35E
Millard Deck	Carthay State	2	G	20-17S-35E
Exxon	State K	17	P	32-17S-35E
Marathon	Staplin State	1	L	20-17S-35E
Marathon	Warn State	1	B	4-18S-35E
Mobil	N.Vac.AboUnit	207	H	24-17S-34E
Pennzoil	Phillips State	1	A	28-17S-35E
Pennzoil	Phillips State	2	F	28-17S-35E
Phillips	Vac.AboUnit	6-68	H	34-17S-35E
Phillips	Vac.Abo Unit	1-9	J	27-17S-35E
Phillips	Vac.Abo Unit	7-3	P	27-17S-35E
Phillips	Vac.Abo Unit	7-4	I	27-17S-35E
Phillips	Vac.Abo Unit	9-5	H	33-17S-35E
Phillips	Vac.Abo Unit	13-2	E	4-18S-35E

OPERATOR	LEASE	WELL NO.	UNIT	SEC-TWP-RGE
Phillips	Vac.Abo Unit	14-3	N	5-18S-35E
Phillips	Vac.Abo Unit	14-4	L	5-18S-35E
Shell	State V	6	P	27-17S-35E
Shell	State K	1	O	19-17S-35E

EXHIBIT "C"
ORDER NO. R-5897

BEFORE EXAMINER STAMETS
OIL CONSERVATION DIVISION
EXHIBIT NO. 4
CASE NO. 6470
Submitted by PHILLIPS PETRO.
Hearing Date 2/28/79

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED

LEA COUNTY, NEW MEXICO

ENGINEERING-GEOLOGICAL COMMITTEE REPORT

NOVEMBER, 1977

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* * * * *

INTRODUCTION

The purpose of this report is to present the findings of the Engineering-Geological Committee concerning the charges to it by the Working Interest Owners of the East Vacuum Grayburg-San Andres Unit, proposed, Lea County, New Mexico. For location, see Figure 1. The charges are listed below:

1. Construct an acceptable base map. (All unit maps in this report use the accepted base map.)
2. Define the vertical interval to be unitized in one or more representative well logs. (The recommended interval to be unitized is that interval of the Grayburg-San Andres correlative to the formations that exist in Exxon's New Mexico State "K" No. 19 from a depth of 4,050 feet to 5,050 feet RKB.)
3. Define the East Vacuum Grayburg-San Andres Unit area in cooperation with the Central Grayburg-San Andres Unit area being expedited by Texaco. (This area is shown on all unit maps in this report.)
4. Tabulate the following parameters by Tract and by Working Interest Owners:

   A. Number of well bore completions and well bores available for recompletion.

   B. Cumulative oil production.

   C. Remaining primary reserves, taking into consideration the effect, if any, of natural water encroachment.

   D. Ultimate primary reserves.

   E. Current production for the most representative period.

   F. Floodable acre-feet by tract and by zone, if possible.

   G. Net hydrocarbon pore volume by tract and by zone, if possible.

   H. Secondary reserves by tract and by zone, if possible.

I. Original oil-in-place by tract and by zone, if possible.

J. Any other parameters considered to be appropriate by the Engineering-Geological Committee. The committee added surface acres and net acre-feet to the parameters. (The committee agreed that it is not possible to determine parameters F through I by zone. With this exception, Table I fulfills this charge. Discussions of the method used to determine each of these parameters are presented in the appropriate section of this report.)

5. Investigate the sources and availability of water to be used for flooding. (There is an adequate source of water available for flooding. Details are in the Water Supply Section of this report.)

6. Develop a detailed plan for secondary recovery operations which will include associated economics containing a differential case between continued primary and waterflooding operations. (The proposed development plan calls for installing the necessary facilities, including drilling 127 water injection wells on a 40-acre, five-spot pattern between unitization date estimated to be October 1, 1978, and the end of 1981. More details are given in the Development Plan Section.)

CONCLUSIONS

From the study of the Grayburg-San Andres zone in the East Vacuum Unit, proposed, area, the Engineering-Geological Committee concludes that:

1. Secondary recovery by waterflooding is feasible in the San Andres reservoir and recovery is estimated to be 29.0 million barrels if conducted on the present 40-acre per well density using a five-spot pattern. The estimated recovery for 20-acre per well density under the same conditions is 40.8 million barrels. Incremental economics above primary and after income tax are:

	40-Acre Less Primary	20-Acre Less Primary
Investment, $M	11,358	31,742
Net Cash Flow, $M	75,158	131,156
Average Annual Rate of Return, percent	63	146
Number of Times Investment Returned	7.62	5.13
Payout, years	3.68	2.32
Present Value at 10 Percent, $M	37,725	83,584

2. Remaining recovery and economics favor the 20-acre per well density and a five-spot pattern. These profit indicators are:

	40-Acre 5-Spot	20-Acre 5-Spot	20-Acre Less 40-Acre
Recovery, MM barrels	38.1	49.8	11.7
Investment, $M	11,358	31,742	20,384
Net Cash Flow, $M	93,545	149,543	55,998
Average Annual Rate of Return, percent	151	234	298
Number of Times Investment Returned	9.24	5.71	3.75
Payout, years	2.60	2.04	1.88
Present Value at 10 Percent, $M	51,583	97,443	45,952

These economics were based on non-escalating costs and a constant lower and upper tier oil price of $5.25 per barrel and $12.00 per barrel, respectively.

3. That water injection into the Grayburg formation is not economically feasible.

RECOMMENDATIONS

The following recommendations are based on the foregoing conclusions:

1. Unitize the Grayburg-San Andres zone in the area shown as East Vacuum Grayburg-San Andres Unit, proposed, on the structure map, Figure 2.

2. Develop the waterflood on a 40-acre, five-spot pattern with 20-acre well spacing by drilling 127 water injection wells and installing the necessary surface facilities to operate the flood.

3. Limit water injection to the San Andres formation.

HISTORY

The Vacuum Field was discovered May 5, 1929, by Socony Vacuum Oil Company's Bridges State Well No. 1 located in Section 13, T-17-S, R-34-E, Lea County, New Mexico, as shown in Figure 2. Development began in 1939 and was virtually complete by the end of 1941 with 330 producing wells. There are currently 453 wells producing from the field.

The first waterflood project in the field was Mobil Oil Company's Bridges State lease that began in 1958. The Texaco West Vacuum Unit was formed in 1966. The first flood developed in the better quality reservoir rock was Texaco's Vacuum Grayburg-San Andres Unit in 1973. The latest flood in the field is Atlantic Richfield Company's State Vacuum Unit which was approved in 1977. Texaco's Central Vacuum Unit became effective October 1, 1977.

The proposed East Vacuum Grayburg-San Andres and Vacuum 35 Units are scheduled to begin development in 1978. When these units are developed, over 98 percent of the Vacuum Grayburg-San Andres Field will be under waterflood. Figure 3 is a map showing these units.

In both the Mobil Bridges State waterflood and the Texaco Vacuum and West Vacuum Units, injection into the Grayburg formation has caused premature water breakthrough with subsequent high water-oil ratio production. It is concluded that the reserve contribution of the Grayburg is of less value than the cost of handling the increased water required to flood it.

Behind casing surface water flows that are apparently related to water injection in the existing projects have recently developed over a wide area of the field. This has resulted in the New Mexico Oil Conservation Commission imposing more stringent regulations for waterflood units. These new regulations have been properly considered in the project analysis.

GEOLOGY

The Vacuum Grayburg-San Andres Field is located on the Artesia-Lovington uplift along the northern limit of the Delaware Basin. The San Andres zone is a dolomitized reef with excellent permeability in the fore-reef to the south, pinching out in the poor quality back-reef and lagoonal depositions to the north. This feature is shown in the north-south Cross-Section H-H', Figure 4. Figure 5 is a west-east cross-section for the unit. The only zones shown on these cross-sections are zones that can be correlated over large areas of the unit. They show clearly the zone discontinuity that cause wider well spacing to result in the recovery of less secondary reserves.

The San Andres structure, Figure 2, is an east-west trending anticline showing a closure of more than 400 feet above the original water-oil contact of -700 feet. Lithologically, the Grayburg formation consists of dense gray dolomite with some anhydrite. It contains interbedded dolomitic sand stringers. Log and core data indicate that this formation has a very small reserve. The San Andres formation consists of dense medium crystalline and oolitic dolomite, white to gray in color, with some anhydrite. The pay is a fine to medium crystalline oolitic dolomite with slight fracturing and some solution cavities. The cross-sections in Figures 4 and 5 show the productive intervals to consist of a series of permeable beds separated by impermeable strata. These strata extend over large areas of the field and serve as effective barriers to prevent cross-flow between the permeable beds.

The recommended unitized interval is the vertical interval that appears between a depth of 4,050 feet and 5,050 feet on the Lane Wells acoustic log, Run No. 1, dated April 14, 1964, on Exxon's New Mexico State "K" No. 19. This well is located 330 feet from south line and 330 feet from east line of Section 28, T-17-S, R-35-E, Lea County, New Mexico. The unitized interval is to include all subsurface points throughout the unit area between these identified correlative depths. This interval is shown in Figure 6.

RESERVOIR PERFORMANCE

The East Vacuum Grayburg-San Andres Unit can be divided into three areas of similar performance as shown in Figure 7--the north area of poor quality rock with low production rates, the east area where the production has been greatly influenced by water encroachment, and the south area where most of the proration units are still producing at top allowable rates.

Production and pressure histories are presented graphically for these three areas and the total unit in Figures 8, 9, and 10. Table II presents reservoir reserves and production data for these areas. Of particular interest is the fact that the average reservoir pressure history of the east area, shown in Figure 10, is very nearly the same as that of the south area even though water has displaced 36 percent of the initial hydrocarbon pore volume in the east area.

CORE DATA

Three sets of core data were analyzed to determine the reservoir rock properties. The first set, consisting of 1,283 core samples from 15 wells within the unit area and having a Dykstra-Parsons permeability variation constant of 0.87, was used to determine the porosity cutoff of six percent. This was done statistically by determining the porosity at which the median permeability was 0.1 millidarcy. The pore volume of samples with porosities equal to or greater than six percent having less than 0.1 millidarcy was approximately the same as that of samples with porosities less than six percent having greater than 0.1 millidarcy.

The second set was 196 core samples having porosities equal to or greater than six percent and taken from six continuous permeable zones within the unit area. The permeability variation constant ranged between 0.63 and 0.84 for the individual zones and was 0.78 for all zones. Weighted average permeability and porosity for these samples were 13.7 millidarcies and

10.9 percent respectively. A plot of porosity versus permeability from these samples is shown in Figure 11.

The third set of data was from Phillips' Santa Fe No. 128 in the northwest of northwest of Section 4, T-18-S, R-35-E, Lea County, New Mexico, which was cored to -766 feet in the San Andres. Relative permeability, flood pot, capillary pressure, and wetability analysis were made on these cores and used as a basis for many of the calculations in this report. Figure 12 shows the average oil and water relative permeability curves. The oil curve shows a residual oil saturation of 27 percent. The flood pot test showed a residual oil saturation of 28.7 percent when oil was displaced by formation water and 36.3 percent when oil was displaced by nitrogen gas. Average water saturation at a capillary pressure of 60 psig was 19 percent. Wetability tests showed the reservoir to be neutral.

COMPARISON OF CORE DATA TO SONIC LOG TRAVEL TIMES

Sonic logs were used to determine porosities. They were normalized by preparing histograms for each sonic log over the Grayburg interval and correcting them to correlate with Phillips' Santa Fe No. 128. The normalization correction varied from -5 to +5 microseconds per foot.

Matrix and fluid travel times were calculated by use of the Holgate* method for six wells in the study area on which adequate core data and reliable sonic logs were available. Figures 13 and 14 show the results of the study of the 816 feet of core porosities and sonic travel times from the six wells. This study resulted in the use of a Delta t_m of 46.4 and a Delta t_f of 131.4 to calculate the porosities from all sonic logs. The logs were digitized and a computer used to determine the porosity of each foot of formation.

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* Holgate, M. M.: "The Microlog as a Porosity Datum from the Neutron Log in Hills Field, Alberta." The Canadian Mining and Metallurgical Bulletin, July, 1960.

RESERVOIR FLUID DATA

Figure 15 shows the formation volume factor and solution gas-oil ratio as a function of reservoir pressure. These curves were constructed from combined reservoir samples from Phillips' Hale No. 1 and Santa Fe No. 1. The initial reservoir pressure of 1,613 psig was recorded by bottom-hole pressure gauges in 1938. The bubble-point pressure is the average of those determined from 37 wells in the unit by plotting cumulative oil production versus reservoir pressure. The minimum of these 37 bubble-point pressures was 1,150 psig and the maximum 1,290 with an average of 1,233 psig.

ORIGINAL WATER LEVEL DETERMINATION

Completion and production data from the unit indicate the original water level to have been approximately -700 feet. Phillips' Santa Fe No. 17 was completed open hole to -699 feet. Its initial production was water free, but in five months it was producing six barrels of water per day. This was the reason for using -700 feet as the water level. Recent electric log analysis on wells drilled in the 1960's in and around Section 35, T-17-S, R-34-E, confirm the -700 feet water level.

CONNATE WATER SATURATION

The curve shown in Figure 16 was used to determine the connate water saturation. Shell Oil Company prepared it from cores taken from their Denver Unit, Wasson Field, Gaines and Yoakum Counties, Texas. The average porosity by 40-acre proration unit, rather than average porosity in the well bore, was used to calculate the water saturation.

VOLUMETRIC CALCULATIONS

The isopachous map shown in Figure 17 and an isovol map were prepared from which a computer calculated the acre-feet and acre-porosity feet by 40-acre proration unit. Porosity, connate water saturation, and hydrocarbon pore volume were calculated from these data for each 40-acre unit. Original oil-in-place was calculated by multiplying the hydrocarbon pore volume by (7,758 + 1.288).

PRIMARY RESERVES

Tarner material balance calculations for a depletion-type reservoir with producing characteristics similar to those of the East Vacuum Grayburg-San Andres Unit indicated a primary recovery factor of approximately 25 percent. Considering the water encroachment from the east, the primary recovery factor was estimated to be 26.3 percent. This resulted in an ultimate primary reserve for the total unit of 78 million barrels. Decline curves were used to determine the primary reserve by tract where possible. Appendix A shows the method used to allocate the rest.

WATER ENCROACHMENT

The pressures from Figure 10 show that water encroachment has not been fast enough to affect reservoir pressure. Water from the east edge of the field has, nonetheless, filled approximately one-eighth of the original hydrocarbon pore volume.

FLOODABLE ACRE-FEET BY TRACT

The floodable acre-feet and secondary reserves, by tract, were based on fractional flow calculations using mid-1972 well tests to determine the

water saturation. This method would not have been viable using well tests after 1972 because most of the operators began plugging back wells to reduce water production at that time. Percent floodable acre-feet were calculated from this saturation and are shown in Figure 18. Floodable acre-feet were calculated by multiplying the average percent remaining floodable acre-feet in each 40-acre proration unit by its acre-feet calculated from the isopachous map shown in Figure 17. Appendix B gives further information concerning the calculations.

SECONDARY RESERVES

A mathematical model study using a residual oil saturation of 35 percent showed that 44 percent of the original oil-in-place could be recovered by primary plus waterflood operations. An estimated recovery of 40 percent was used after a study of other San Andres floods in the Permian Basin showed that none had estimated recoveries as high as 44 percent. The predicted flood performance was obtained by a computer program using the Higgins-Leighton streamline channel flow method.

The San Andres flood with declining production and having reservoir characteristics most similar to the East Vacuum Unit is Shell's Denver Unit in Wasson Field, Gaines and Yoakum Counties, Texas. Table III shows the reservoir data for the two units. Shell's estimated recovery of primary plus secondary is only 35.3 percent for the Denver Unit, but the residual oil saturation for the unit is 40 to 45 percent compared to 35 percent for the East Vacuum Unit.

Shell estimates that reducing well spacing from 40 acres to 20 acres in their Denver Unit will increase the primary and secondary reserves by 3.9 percent of the original oil-in-place. The same increase is estimated for the East Vacuum Unit.

Texaco's Vacuum Grayburg-San Andres Unit began operation in 1973. Even though there is no accurate means of determining the recoverable reserves

at this time, the performance, shown in Figure 19, to date has been impressive. The isopachous map in Figure 20 and the cumulative production map as of January 1, 1973, Figure 21, shows the reservoir to be of similar quality to that of the south portion of the East Vacuum Grayburg-San Andres Unit. Figure 22, cumulative production as of January 1, 1977, shows the effect of increased production from the unit due to unitization.

The secondary reserves were determined for the total unit by subtracting the 78 million barrels of primary oil from 40 percent of the original oil-in-place. This total oil was allocated to each proration unit in proportion to the product of 15 percent of its initial oil-in-place and percent floodable acre-feet (Figure 18).

WATER SUPPLY

A Higgins-Leighton reservoir study showed that the maximum water injection rate will be 95,000 barrels per day. With the four-year development program, the maximum make-up water needed will be 69,000 barrels per day in 1981. Tabulated below are the sources available to supply this need.

Source	Barrels per Day
Phillips Petroleum Company water rights	28,362
Phillips (applied for water rights)	17,977
Rice Engineering (produced water)	10,000
Mobil Oil Corporation (probable)	8,000
Available in Section 36, T-16-S, R-34-E, if needed, from City of Carlsbad:	
4¢/barrel delivered at 50 psi	35,000
Total	99,339
Needed	69,000
Excess	30,339

Phillips will apply for other water rights in the area of the flood as soon as they become available.

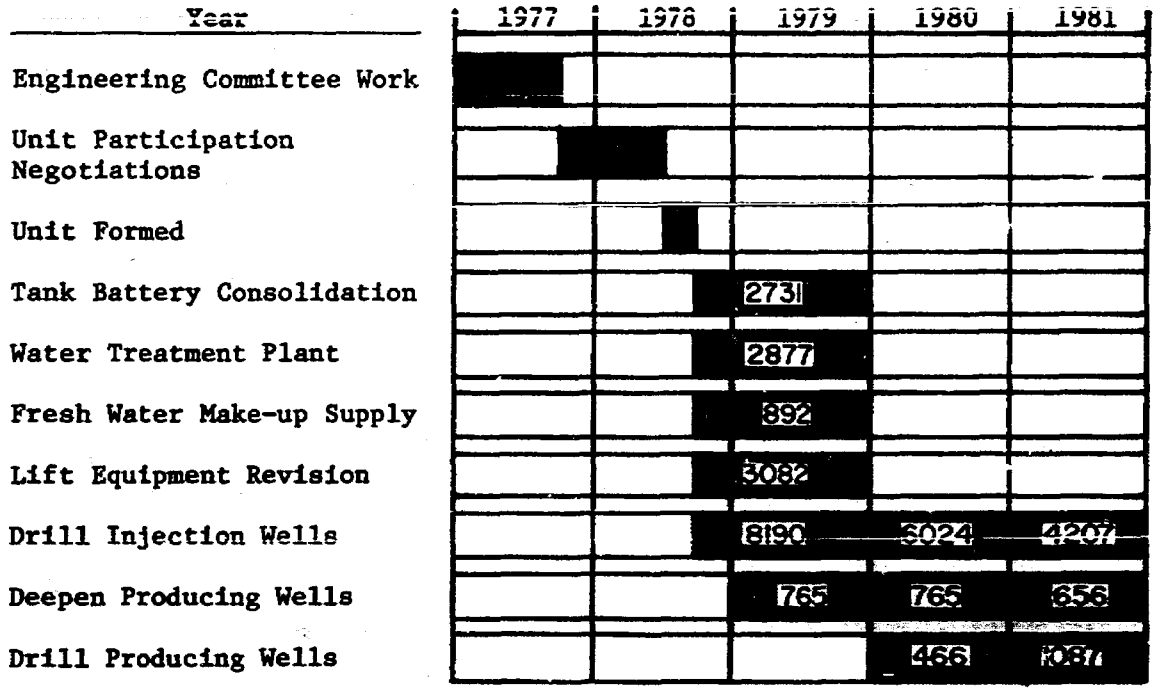
DEVELOPMENT PLAN

Facilities

Facilities necessary for waterflood operations in this unit are a consolidated tank battery, water supply wells and lines, water injection and treatment station with injection lines, 76 pumping units, 127 water injection wells, and 10 additional producing wells. Costs for the wells in the south portion include one resistivity and three porosity logs for each well, and coring six wells. Figure 23 shows the location of the major facilities.

Schedule

Figure 24 is a map showing the annual development by area. The wells to be cored are indicated by a semicircle. Time targets for the preunitization work and the installation of facilities are shown in the bar graph below along with the unescalated estimated cost of each project by year in thousands of dollars.



ECONOMICS

One set of differential economics was run which compared the 40-acre well spacing five-spot at a total primary and secondary recovery of 36.1 percent of the original oil-in-place with continued primary operations. The economics showed a payout of 3.68 years, number of times investment returned 7.62, average annual rate of return 63.3 percent, and a cash flow of 75.2 million dollars for an investment of 11.4 million dollars.

A differential economic analysis was run comparing continued primary operations and 20-acre well spacing five-spot waterflood with primary and secondary recovery of 40 percent of original oil-in-place. For an investment of 31.7 million dollars, the payout was 2.32 years, number of times investment returned 5.13, average annual rate of return 145.5 percent, and cumulative cash flow was 131.2 million dollars. Figure 25 shows cumulative cash flow for future primary plus secondary with infill drilling, future primary plus secondary without infill drilling, and future primary only.

The differential economics after Federal income tax between waterflooding with 20-acre well spacing less waterflooding with 40-acre well spacing are: investment, 20.4 million dollars; payout, 1.88 years; number of times investment returned, 3.75; average annual rate of return, 298 percent; and cash flow, 56 million dollars.

The forecasts from which these analyses were calculated were based on the following premises:

1. The maximum allowable from the unit will be 80 barrels of oil per day times the number of active producing and injection wells in the zone with a maximum number of wells of one per 20 acres (352).
2. The price of lower-tier and upper-tier oil will remain at $5.25 per barrel and $12.00 per barrel, respectively. The gas price will remain at 46¢ per Mcf.
3. The unit will be capable of producing the full allowable based on the proposed wells to be drilled.

4. Infill drilling will increase the recovery by 3.9 percent of the original oil-in-place.

Details of cost and production forecasts used for these analyses are shown in four tables presented in Appendix C.

PARTICIPATION PARAMETERS

The sources of participation parameters included in this report are as follows:

Parameter	Source
1. Current Production	New Mexico Oil and Gas Committee Reports.
2. Future Primary Reserves	See Pages 10 and 11 of this report.
3. Cumulative Production	New Mexico Oil and Gas Committee Reports.
4. Ultimate Primary Reserves	Sum of cumulative production and remaining primary reserves.
5. Acre-Feet of Net Pay	See Pages 8 and 10 of this report.
6. Hydrocarbon Pore Volume	See Page 10 of this report.
7. Original Oil-in-Place	See Page 10 of this report.
8. Secondary Oil Reserves	See Pages 10 and 11 of this report.
9. Floodable Acre-Feet	See Page 11 of this report.
10. Usable Well Bores	Working Interest Owners.
11. Surface Area Acres	Working Interest Owners.

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED
LEA COUNTY, NEW MEXICO

PARAMETERS, TRACT VALUES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume Ac.-Ft.	Original Oil-In-Place STBO	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Atlantic Richfield Company												
State B 1576	3203	38,728	760,200	2,568,914	3,329,100	33,919	3,121.7	18,802,910	2,971,068	33,919	4	160.00
State A DE	2204	3,474	40,900	583,946	624,800	1,540	133.0	801,098	124,254	1,540	2	80.00
State C DE	2403	2,018	7,100	144,383	151,500	1,490	136.0	819,168	127,056	1,490	1	40.00
State E DE	2402	6,726	131,800	328,259	460,100	1,904	106.9	643,890	58,326	1,120	2	80.00
State J DE	1908	526	9,200	100,945	110,100	3,099	263.2	1,585,231	245,892	3,099	1	80.00
State M DE	2906	12,950	269,200	1,746,219	2,015,400	9,431	897.6	5,406,507	838,573	9,430	4	160.00
State W DE	2606	7,167	36,900	659,138	696,100	6,488	533.1	3,211,017	79,239	1,060	2	80.00
Total		71,589	1,255,300	6,131,804	7,387,100	57,871	5,191.5	31,269,921	4,444,408	51,658	16	680.00
Chevron U.S.A., Inc.												
State 3-32	3202	47,719	588,600	2,558,660	3,147,300	19,434	1,692.5	10,194,421	1,469,654	18,027	4	160.00
State 4-27	2704	37,267	413,000	2,637,031	3,050,100	15,463	1,405.5	8,465,737	1,234,820	14,595	4	160.00
State 5-27	2702	10,908	74,600	1,908,711	1,983,400	7,064	665.7	4,009,706	621,923	7,064	4	160.00
State 6-34	3403	43,973	476,400	2,152,498	2,628,800	18,001	1,797.0	10,823,856	1,167,788	12,636	5	200.00
Total		139,867	1,552,600	9,256,900	10,809,600	59,962	5,560.7	33,493,720	4,494,185	52,322	17	680.00
Cities Service Company												
State K	2701	37,153	508,500	2,087,807	2,596,300	6,157	448.0	2,698,436	418,539	6,157	4	160.00
Crown Central Petroleum Corp.												
Shell State E 7259	2001	212	0	16,613	16,600	482	31.7	190,938	29,616	482	1	40.00
Shell State B 1398	1906	214	0	21,921	21,900	889	60.1	362,000	56,148	889	1	40.00
Total		426	0	38,534	38,500	1,371	91.8	552,938	85,764	1,371	2	80.00
Deck, Millard												
Carthay State	2003	1,451	16,600	123,357	140,000	88	6.7	40,357	6,132	86	2	80.00
Elk Oil Company (Old Crusader)												
Cities Service State 1	2002	0	0	65,834	65,834	469	22.9	137,933	21,394	469	0	40.00
Cities Service State 2	1803	0	0	6,841	6,841	743	42.7	257,195	39,095	728	0	40.00
Cities Service State 2	1901	0	0	21,774	21,774	970	59.0	355,374	55,120	970	0	40.00
Total		0	0	94,449	94,449	2,182	124.6	750,502	115,609	2,167	0	120.00

PARAMETERS, TRACT VALUES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume Ac.-Ft.	Original Oil-In-Place STBO	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Exxon Company, U.S.A.												
New Mexico State J	1909	0	0	182,968	183,000	3,215	282.2	1,699,773	263,643	3,214	0	75.38
New Mexico State K	2805	33,840	405,400	3,805,400	4,210,800	23,549	2,443.8	14,719,723	2,235,583	23,041	8	320.00
New Mexico State K	3201	94,207	1,167,700	5,111,800	6,279,400	49,517	4,964.2	29,900,825	4,336,220	46,427	8	320.00
Total		128,047	1,573,100	9,100,210	10,673,200	76,281	7,690.2	46,320,321	6,835,446	72,682	16	715.38
Getty Oil Company												
State BC	3308	14,677	190,100	654,313	844,400	6,854	801.6	4,828,271	748,886	6,854	1	40.00
State P	3302	21,221	240,600	1,292,834	1,533,400	5,846	576.4	3,471,826	538,495	5,845	2	80.00
Total		35,898	430,700	1,947,147	2,377,800	12,700	1,378.0	8,300,097	1,287,381	12,699	3	120.00
Great Western Drilling Company												
State E	2502	1,239	1,900	234,119	236,000	1,502	103.8	625,218	19,395	300	1	40.00
Bettis, Boyle and Stovall (Josaline Production Company)												
State C	1907	1,437	14,400	98,945	113,300	2,223	163.3	983,604	152,562	2,223	2	80.00
State F	2005	287	0	164,301	164,300	925	51.9	312,609	48,486	925	2	80.00
Total		1,724	14,400	263,246	277,600	3,148	215.2	1,296,213	201,048	3,148	4	160.00
Marathon Oil Company												
Staplin State A/C 2	1904	0	0	77,305	77,300	2,366	148.1	892,050	138,361	2,366	0	80.00
Warn State A/C 3	3304	26,914	376,800	1,863,901	2,240,700	17,291	1,882.6	11,339,449	1,745,292	17,157	3	120.00
Warn State A/C 5	0401	634	7,800	9,393	17,200	369	41.3	248,762	21,221	203	1	39.86
Total		27,548	384,600	1,950,599	2,335,200	20,026	2,072.0	12,480,261	1,904,874	19,726	4	239.86
Mobil Oil Corporation												
New Mexico "O"	1802	1,312	13,900	23,994	37,900	622	44.4	267,434	29,037	435	1	37.61
State K	3101	41,650	570,200	2,061,367	2,631,600	21,498	2,060.6	12,411,595	1,925,093	21,498	3	120.00
State K-6	1801	2,604	28,200	26,024	54,200	697	52.2	314,416	34,137	488	1	37.67
State L	2103	1,994	38,600	534,773	573,400	1,494	117.7	708,941	93,934	1,287	3	120.00
State M	3402	58,602	727,000	2,702,492	3,429,500	24,962	2,799.5	16,862,207	2,206,037	21,091	4	160.00
State N	1903	817	10,200	112,499	122,700	1,130	37.7	227,078	35,221	1,130	1	37.68
State O	3307	14,827	189,500	676,596	866,100	6,817	700.5	4,219,316	647,890	6,749	1	40.00
State P	2205	895	21,200	260,193	281,400	978	80.0	481,863	74,739	978	2	80.00
State P	2601	2,381	21,500	215,406	236,900	3,874	294.9	1,776,269	263,515	3,705	2	80.00
Total		125,082	1,620,300	6,613,344	8,233,700	62,072	6,187.5	37,269,119	5,309,603	57,361	18	712.96

PARAMETERS, TRACT VALUES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume Ac.-Ft.	Original Oil-In-Place STBO	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Pennzoil Company												
Phillips State 28	2801	638	6,300	46,248	52,500	1,219	141.1	849,886	131,821	1,219	1	40.00
Phillips State 28	2804	849	8,300	106,808	115,100	517	45.1	271,650	42,135	517	1	40.00
Total		1,487	14,600	153,056	167,600	1,736	186.2	1,121,536	173,956	1,736	2	80.00
Penrose Production Company												
Southern State	2404	33		19,411	19,400	783	49.8	299,960	40,942	689	1	40.00
Phillips Petroleum Company												
Santa Fe	0402	19,536	205,200	741,941	947,141	7,403	760.2	4,578,906	671,307	7,056	2	79.70
Santa Fe	0501	51,699	561,500	1,746,682	2,308,182	19,585	2,306.6	13,893,305	2,009,939	18,272	4	159.85
Santa Fe	0502	56,300	743,212	2,414,830	3,158,042	18,655	1,909.3	11,500,271	1,729,901	18,152	4	159.95
Santa Fe	1905	303	5,968	26,897	32,865	958	68.5	412,595	63,995	958	1	40.00
Santa Fe	2004	3,346	65,900	631,831	697,731	2,439	172.5	1,039,018	156,017	2,370	5	200.00
Santa Fe	2102	757	14,911	307,732	322,643	783	74.2	446,928	69,320	783	2	80.00
Santa Fe	2104	206	4,058	283,587	287,645	596	61.6	371,035	57,549	596	1	40.00
Santa Fe	2501	2,237	44,063	471,789	515,852	1,784	126.2	760,139	82,531	1,249	1	40.00
Santa Fe	2602	43,052	436,561	2,872,130	3,308,691	10,240	794.2	4,783,717	569,878	7,861	5	200.00
Santa Fe	2603	2,097	11,800	406,844	418,644	1,513	97.6	587,873	22,795	378	1	40.00
Santa Fe	2604	7,691	48,000	637,737	685,737	4,849	417.5	2,514,724	192,790	2,230	1	80.00
Santa Fe	2605	980	47,500	564,991	612,491	3,437	297.3	1,790,725	97,212	1,203	1	40.00
Santa Fe	2607	2,097	83,600	852,014	935,614	6,702	628.9	3,788,048	117,907	1,313	1	80.00
Santa Fe	2705	29,124	337,300	1,337,225	1,674,525	11,560	1,328.6	8,002,545	965,648	8,997	2	80.00
Santa Fe	2803	619	12,192	467,691	479,883	1,941	168.6	1,015,526	156,545	1,929	3	120.00
Santa Fe	2901	69	1,359	151,537	152,896	1,493	128.4	773,391	119,957	1,493	1	80.00
Santa Fe	2902	657	12,941	132,022	144,963	2,150	184.8	1,113,104	172,646	2,150	3	120.00
Santa Fe	2905	0	0	60,224	60,224	1,380	169.0	1,017,936	157,886	1,380	1	40.00
Santa Fe	2907	347	6,835	304,534	311,369	1,770	165.5	996,855	154,616	1,770	1	40.00
Santa Fe	3301	28,823	355,800	1,328,059	1,683,859	12,535	1,575.8	9,491,504	1,457,401	12,407	2	80.00
Santa Fe	3303	14,146	188,700	670,659	859,359	5,808	666.3	4,013,319	603,809	5,634	1	40.00
Santa Fe	3306	14,142	188,700	675,211	863,911	6,299	746.4	4,495,785	676,397	6,110	1	40.00
Santa Fe	3309	14,143	183,400	662,053	845,453	5,535	657.1	3,957,905	534,083	4,815	1	40.00
Santa Fe	3401	17,205	192,400	2,272,651	2,465,051	15,715	1,725.5	10,393,191	815,403	7,741	4	160.00
Santa Fe	3501	0	0	312,523	312,523	1,992	194.2	1,170,928	14,042	170	1	80.00
Total		309,576	3,751,900	20,333,394	24,085,500	147,122	15,425.0	92,909,273	11,669,574	117,017	50	2,159.50
Polaris Production Corporation												
Amerada State	2202	0	0	0	0	587	38.8	233,704	36,249	587	0	40.00
Amerada State	2203	997	9,100	259,374	268,474	300	15.6	93,963	14,574	300	1	40.00
Mobil State	2201	508	2,800	10,062	12,900	530	32.4	195,155	30,269	530	1	40.00
Total		1,505	11,900	269,436	281,374	1,417	86.8	522,822	81,092	1,417	2	120.00

PARAMETERS, TRACT VALUES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume Ac.-Ft.	Original Oil-In-Place STBO	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Shell Oil Company												
State C	2401	0	0	22,137	22,100	1,465	85.2	513,184	78,801	1,450	0	40.00
State F	2909	4,750	164,900	986,160	1,151,100	4,029	335.8	2,022,622	263,221	3,394	2	80.00
State H	2908	1,300	34,200	380,373	414,600	2,069	209.2	1,260,073	195,443	2,069	1	40.00
State I	2903	0	0	4,715	4,700	1,298	123.2	742,070	115,099	1,298	0	40.00
State K	1910	0	0	78,825	78,800	1,399	116.3	700,509	108,652	1,399	0	40.00
State N	2802	6,776	139,900	1,356,416	1,496,300	4,444	410.9	2,474,970	383,878	4,444	3	120.00
State S	2101	0	0	20,145	20,100	312	24.5	147,571	22,889	312	0	40.00
State T	3305	48,007	561,600	2,510,107	3,071,600	18,870	2,102.1	12,661,561	1,670,558	15,865	4	157.66
State V	2703	17,275	175,900	1,251,496	1,427,400	7,931	746.0	4,493,376	561,392	6,458	2	80.00
State VAA	0503	4,110	96,800	154,879	251,700	1,379	101.7	612,569	94,061	1,365	1	40.00
State VE	1902	0	0	0	0	735	48.1	289,720	43,140	706	0	40.00
Total		82,218	1,173,300	6,765,253	7,938,400	43,931	4,303.0	25,918,225	3,537,134	38,760	13	717.66
Sohio Petroleum Company												
Warn State	2301	1,279	33,600	258,170	291,800	1,710	114.9	692,076	103,607	1,648	2	80.00
Texaco Inc. (Crusader Texas State)												
State CG NCT-2	2904	0	0	16,538	16,500	806	70.7	425,847	66,051	806	0	40.00
GRAND TOTAL		966,122	12,343,300	65,656,774	78,000,000	500,865	49,306.4	296,986,842	40,794,740	441,750	157	7,025.36

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED
LEA COUNTY, NEW MEXICO

PARAMETERS, TRACT PERCENTAGES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume (Ac.-Ft.) & Original Oil-In-Place (STBO)	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Atlantic Richfield Company											
State B 1576	3203	4.009	6.159	3.913	4.268	6.772	6.331	7.283	7.678	2.548	2.277
State A DE	2204	.360	.331	.889	.801	.307	.270	.305	.349	1.274	1.139
State C DE	2403	.209	.058	.220	.194	.297	.276	.311	.337	.637	.569
State E DE	2402	.696	1.068	.500	.590	.380	.217	.143	.254	1.274	1.139
State J DE	1908	.054	.075	.154	.141	.619	.534	.603	.702	.637	1.139
State M DE	2906	1.340	2.181	2.660	2.584	1.883	1.820	2.056	2.135	2.548	2.277
State W DE	2606	.742	.299	1.004	.892	1.295	1.081	.194	.240	1.274	1.139
Total		7.410	10.171	9.340	9.470	11.553	10.529	10.895	11.695	10.192	9.679
Chevron U.S.A., Inc.											
State 3-32	3202	4.939	4.769	3.897	4.035	3.880	3.433	3.603	4.081	2.548	2.277
State 4-27	2704	3.857	3.346	4.016	3.910	3.087	2.851	3.027	3.304	2.548	2.277
State 5-27	2702	1.129	.604	2.907	2.543	1.410	1.350	1.525	1.599	2.548	2.277
State 6-34	3403	4.551	3.860	3.278	3.370	3.594	3.645	2.863	2.860	3.185	2.847
Total		14.476	12.579	14.098	13.858	11.971	11.279	11.018	11.844	10.829	9.678
Cities Service Company											
State K	2701	3.846	4.120	3.180	3.329	1.229	.909	1.026	1.394	2.548	2.277
Crown Central Petroleum Corp.											
Shell State E 7259	2001	.022		.025	.021	.096	.064	.073	.109	.637	.569
Shell State B 1398	1906	.022		.033	.028	.177	.122	.138	.201	.637	.569
Total		.044		.058	.049	.273	.186	.211	.310	1.274	1.138
Deck, Millard											
Carthay State	2003	.150	.134	.188	.179	.018	.014	.015	.019	1.274	1.139
Elk Oil Company (Old Crusader)											
Cities Service State 1	2002			.100	.084	.094	.046	.052	.106		.569
Cities Service State 2	1803			.010	.009	.148	.087	.096	.165		.569
Cities Service State 2	1901			.033	.028	.194	.120	.135	.220		.570
Total				.143	.121	.436	.253	.283	.491		1.708

PARAMETERS, TRACT PERCENTAGES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume (Ac.-Ft.) & Original Oil-In-Place (STBO)	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Exxon Company, U.S.A.											
New Mexico State J	1909			.279	.235	.642	.572	.646	.728		1.073
New Mexico State K	2805	3.503	3.284	5.795	5.398	4.702	4.958	5.480	5.216	5.095	4.556
New Mexico State K	3201	9.752	9.460	7.786	8.051	9.886	10.068	10.629	10.510	5.095	4.556
Total		13.255	12.744	13.860	13.684	15.230	15.598	16.755	16.454	10.190	10.185
Getty Oil Company											
State BC	3308	1.519	1.540	.997	1.083	1.368	1.626	1.836	1.552	.637	.569
State P	3302	2.197	1.949	1.969	1.966	1.167	1.169	1.320	1.323	1.274	1.139
Total		3.716	3.489	2.966	3.049	2.535	2.795	3.156	2.875	1.911	1.708
Great Western Drilling Company											
State E	2502	.128	.015	.357	.303	.300	.211	.048	.068	.637	.569
Bettis, Boyle and Stovall (Josaline Production Company)											
State C	1907	.149	.117	.151	.145	.444	.331	.374	.503	1.274	1.139
State F	2005	.030		.250	.211	.185	.105	.119	.209	1.274	1.139
Total		.179	.117	.401	.356	.629	.436	.493	.712	2.548	2.278
Marathon Oil Company											
Staplin State A/C 2	1904			.118	.099	.472	.300	.339	.536		1.139
Warn State A/C 3	3304	2.786	3.053	2.839	2.873	3.452	3.818	4.278	3.884	1.911	1.708
Warn State A/C 5	0401	.066	.063	.014	.022	.074	.084	.052	.046	.637	.567
Total		2.852	3.116	2.971	2.994	3.998	4.202	4.669	4.466	2.548	3.414
Mobil Oil Corporation											
New Mexico "O"	1802	.136	.113	.037	.049	.124	.090	.071	.098	.637	.536
State K	3101	4.311	4.620	3.140	3.374	4.292	4.179	4.719	4.865	1.911	1.708
State K-6	1801	.270	.228	.040	.069	.139	.106	.084	.110	.637	.536
State L	2103	.206	.310	.814	.735	.298	.239	.230	.291	1.911	1.708
State M	3402	6.066	5.890	4.116	4.397	4.984	5.678	5.408	4.774	2.548	2.277
State N	1903	.085	.083	.171	.157	.226	.076	.086	.256	.637	.537
State O	3307	1.535	1.535	1.031	1.110	1.361	1.421	1.588	1.528	.637	.569
State P	2205	.093	.172	.396	.361	.195	.162	.183	.221	1.274	1.139
State P	2601	.246	.174	.328	.304	.773	.598	.646	.839	1.274	1.139
Total		12.948	13.125	10.073	10.556	12.392	12.549	13.015	12.982	11.466	10.149

PARAMETERS, TRACT PERCENTAGES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume (Ac.-Ft.) & Original Oil-In-Place (STBO)	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Pennzoil Company											
Phillips State 28	2801	.066	.051	.070	.067	.243	.286	.323	.276	.637	.569
Phillips State 28	2804	.088	.067	.163	.148	.103	.091	.103	.117	.637	.569
Total		.154	.118	.233	.215	.346	.377	.426	.393	1.274	1.138
Penrose Production Company											
Southern State	2404	.003		.030	.025	.156	.101	.100	.156	.637	.569
Phillips Petroleum Company											
Santa Fe	0402	2.022	1.662	1.130	1.214	1.478	1.542	1.646	1.597	1.274	1.134
Santa Fe	0501	5.351	4.549	2.660	2.959	3.914	4.676	4.927	4.136	2.548	2.278
Santa Fe	0502	5.827	6.021	3.678	4.049	3.725	3.872	4.240	4.109	2.545	2.277
Santa Fe	1905	.031	.048	.041	.042	.191	.139	.157	.217	.637	.569
Santa Fe	2004	.346	.534	.962	.895	.487	.350	.382	.536	3.185	2.847
Santa Fe	2102	.078	.121	.469	.414	.156	.150	.170	.177	1.274	1.139
Santa Fe	2104	.021	.033	.432	.369	.119	.125	.141	.135	.637	.569
Santa Fe	2501	.232	.357	.719	.661	.356	.256	.202	.283	.637	.569
Santa Fe	2602	4.456	3.537	4.374	4.242	2.044	1.611	1.397	1.780	3.185	2.849
Santa Fe	2603	.217	.096	.620	.537	.302	.198	.056	.086	.637	.569
Santa Fe	2604	.796	.389	.971	.879	.968	.847	.473	.505	.637	1.139
Santa Fe	2605	.101	.385	.861	.785	.686	.603	.238	.272	.637	.569
Santa Fe	2607	.217	.677	1.298	1.200	1.338	1.275	.289	.297	.637	1.139
Santa Fe	2705	3.015	2.733	2.037	2.147	2.308	2.695	2.367	2.037	1.274	1.139
Santa Fe	2802	.064	.099	.712	.615	.388	.342	.384	.437	1.911	1.708
Santa Fe	2901	.007	.011	.231	.196	.298	.260	.294	.338	.637	1.139
Santa Fe	2902	.068	.105	.201	.186	.429	.375	.423	.487	1.911	1.708
Santa Fe	2905			.092	.077	.276	.343	.387	.312	.637	.569
Santa Fe	2907	.036	.055	.464	.399	.353	.336	.379	.401	.637	.569
Santa Fe	3301	2.983	2.883	2.023	2.159	2.503	3.196	3.573	2.809	1.274	1.139
Santa Fe	3303	1.464	1.529	1.021	1.102	1.160	1.351	1.480	1.275	.637	.569
Santa Fe	3306	1.464	1.529	1.028	1.108	1.258	1.514	1.658	1.383	.637	.569
Santa Fe	3309	1.464	1.486	1.008	1.084	1.105	1.333	1.309	1.090	.637	.569
Santa Fe	3401	1.781	1.559	3.461	3.160	3.138	3.500	1.999	1.752	2.548	2.277
Santa Fe	3501			.476	.401	.398	.394	.034	.038	.637	1.139
Total		32.041	30.398	30.969	30.880	29.378	31.283	28.605	26.489	31.847	30.741
Polaris Production Corporation											
Amerada State	2202					.117	.079	.089	.133		.569
Amerada State	2203	.103	.074	.395	.344	.060	.032	.036	.068	.637	.569
Mobil State	2201	.053	.023	.015	.017	.106	.066	.074	.120	.637	.569
Total		.156	.097	.410	.361	.283	.177	.199	.321	1.274	1.707

PARAMETERS, TRACT PERCENTAGES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume (Ac.-Ft.) & Original Oil-In-Place (STBO)	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Shell Oil Company											
State C	2401			.034	.028	.292	.173	.193	.328		.569
State F	2909	.492	1.336	1.502	1.476	.804	.681	.645	.768	1.274	1.139
State H	2908	.135	.277	.579	.532	.413	.424	.479	.468	.637	.569
State I	2903			.007	.006	.259	.250	.282	.294		.569
State K	1910			.120	.101	.279	.236	.266	.317		.569
State N	2802	.761	1.133	2.066	1.918	.887	.833	.941	1.006	1.911	1.708
State S	2101			.031	.026	.062	.050	.056	.071		.569
State T	3305	4.969	4.550	3.823	3.936	3.767	4.263	4.095	3.591	2.548	2.246
State V	2703	1.788	1.425	1.906	1.830	1.583	1.513	1.376	1.462	1.274	1.139
State VAA	0503	.425	.784	.236	.323	.275	.206	.231	.309	.637	.569
State VE	1902					.148	.098	.106	.160		.569
Total		8.510	9.505	10.304	10.176	8.769	8.727	8.670	8.774	8.281	10.215
Sohio Petroleum Company											
Warn State	2301	.132	.272	.393	.374	.341	.233	.254	.373	1.274	1.139
Texaco Inc. (Crusader Texas State)											
State CG NCT-2	2904			.025	.021	.161	.143	.162	.182		.569
GRAND TOTAL		100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED
LEA COUNTY, NEW MEXICO

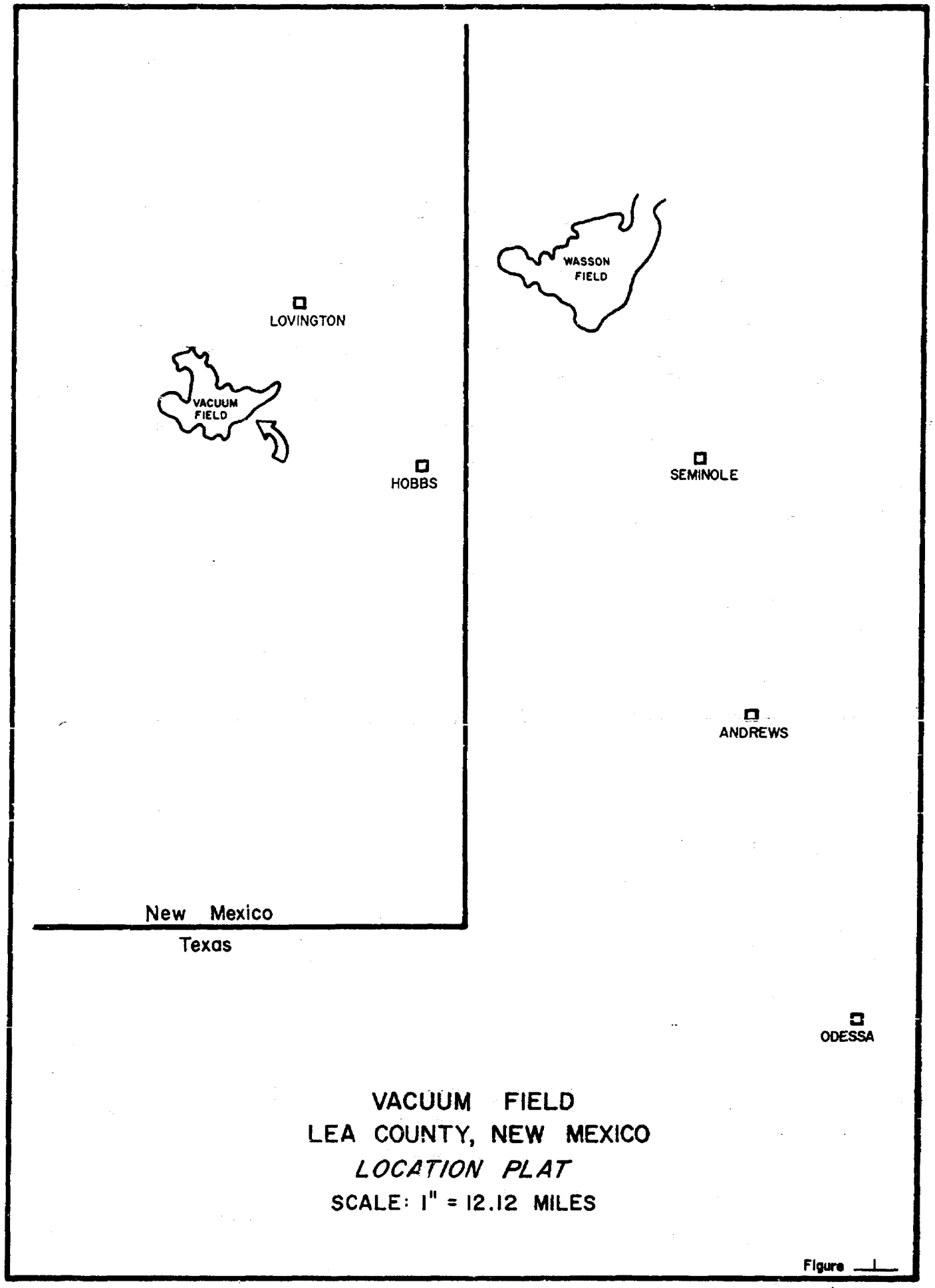
COMPARISON OF PARAMETERS BY AREA

Parameter	North Area	South Area	East Area	Total Area
Average Porosity, percent	10.0	12.4	11.8	11.7
Average Net Thickness, feet	33	127	78	71.3
Average Original Water Saturation, percent	18.6	15.0	15.8	15.9
Original Oil-in-Place, M barrels	59,138	167,341	70,508	296,987
Barrels/Acre	17,393	78,934	46,387	42,273
Cumulative Production 1-1-77, M barrels	18,037	30,717	16,903	65,657
Barrels/Acre	5,305	14,489	11,120	9,346
Remaining Primary 1-1-77, M barrels	2,409	7,971	1,963	12,343
Barrels/Acre	709	3,760	1,291	1,756
Ultimate Primary Recovery, M barrels	20,446	38,688	18,866	78,000
M Barrels/40-Acre Unit	241	730	496	444
Primary Recovery, Percent Original Oil-in-Place	34.6	23.1	26.8	26.3
Total 40-Acre Proration Units	85	53	38	176
Proration Units Producing Top Allowable December, 1976	0	36	7	43
Water Encroachment, Percent Original Hydrocarbon Pore Volume	2.8	4.1	36.0	11.4
Last Half 1976 Production, Barrels/Day/40-Acre Unit	10.6	60.9	29.3	29.8

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED
LEA COUNTY, NEW MEXICO

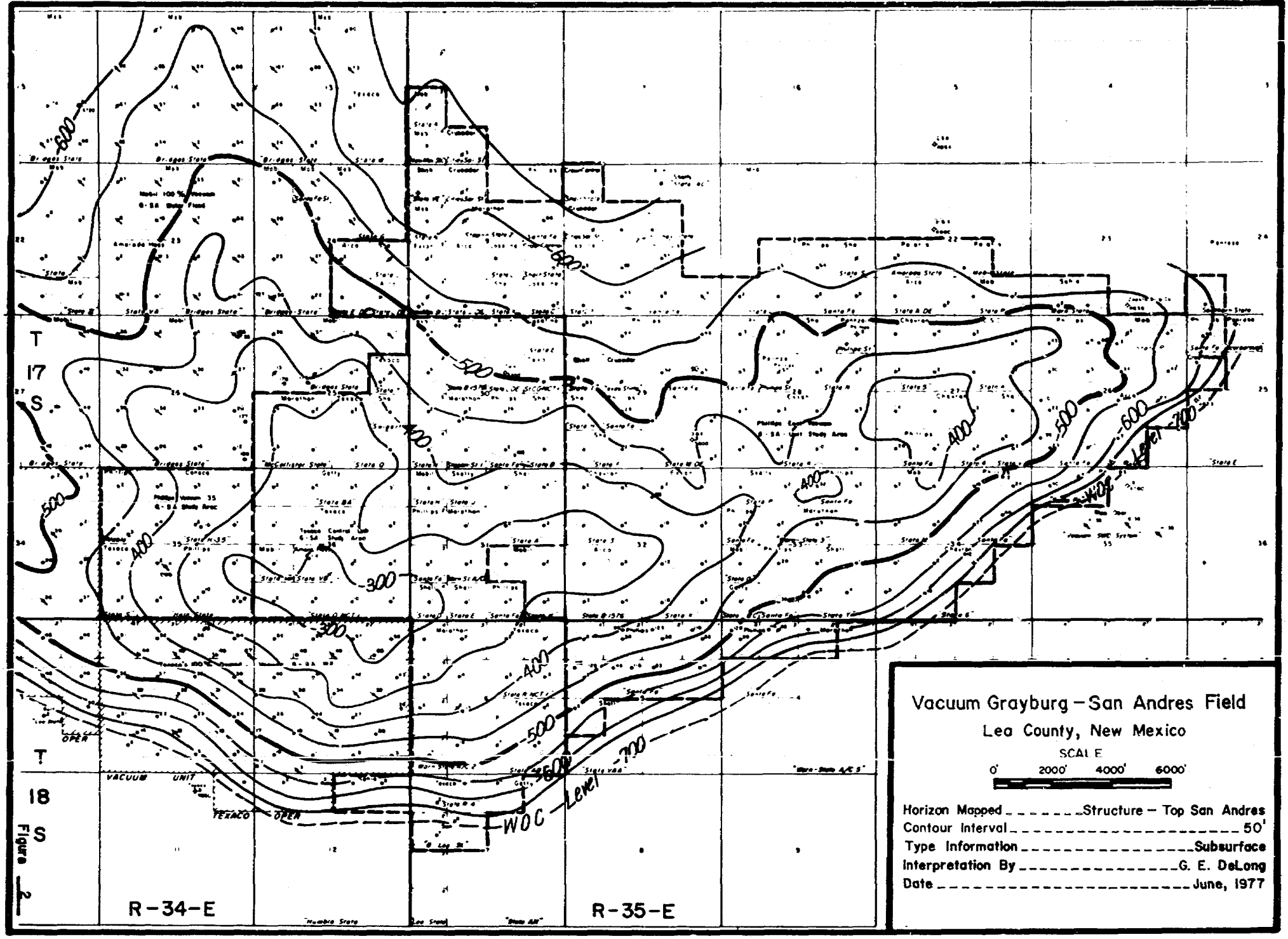
PROJECT COMPARISON OF EAST VACUUM UNIT TO DENVER UNIT

Project	East Vacuum Grayburg-San Andres Unit, Proposed	Shell Oil Company Denver Grayburg-San Andres Unit
Depth, feet	4,400	5,100
Type Formation	Dolomite	Dolomite
Bottom-Hole Temperature, °F.	101	105
Original Bottom-Hole Pressure, psig	1,613	1,805
Net Pay, feet	71	129
Porosity, percent	11.7	12.0
Permeability, Md.	11.0	3.5
Area, acres	7,025	27,850
Connate Water, percent	15.9	15.0
Original Oil Formation Volume Factor	1.288	1.312
Initial Solution Gas-Oil Ratio, cubic feet/stock tank barrel	465	588
Initial Viscosity of Oil, centipoise	0.80	0.97
Gravity, °API	35	33
Original Oil-in-Place, MM barrels	297	2,166
Ultimate Primary, MM barrels	78	354
Estimated Secondary, MM barrels	41	410
Total, MM barrels	119	764
Recovery to Date, MM barrels	66	595
Flood Pot Residual Oil Saturation, percent	30	40 to 45
Percent of Original Oil Recovered after Waterflood (estimate)	40.0	35.3
Original Gas Cap	No	Yes



VACUUM FIELD
LEA COUNTY, NEW MEXICO
LOCATION PLAT
SCALE: 1" = 12.12 MILES

Figure 1



Vacuum Grayburg – San Andres Field

Lea County, New Mexico

SCALE

0' 2000' 4000' 6000'

Horizon Mapped ..... Structure – Top San Andres

Contour Interval ..... 50'

Type Information ..... Subsurface

Interpretation By ..... G. E. DeLong

Date ..... June, 1977

Figure 2

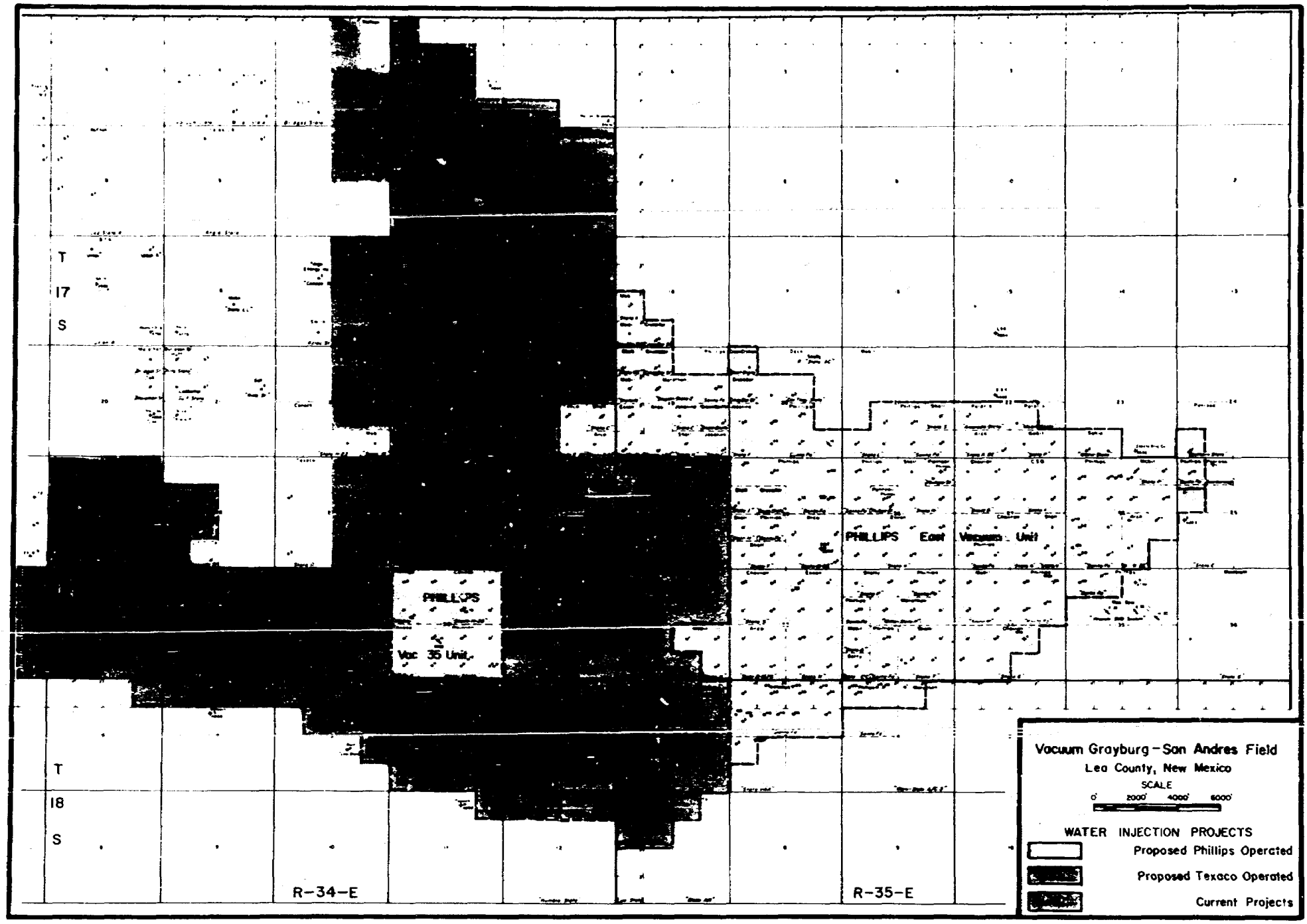
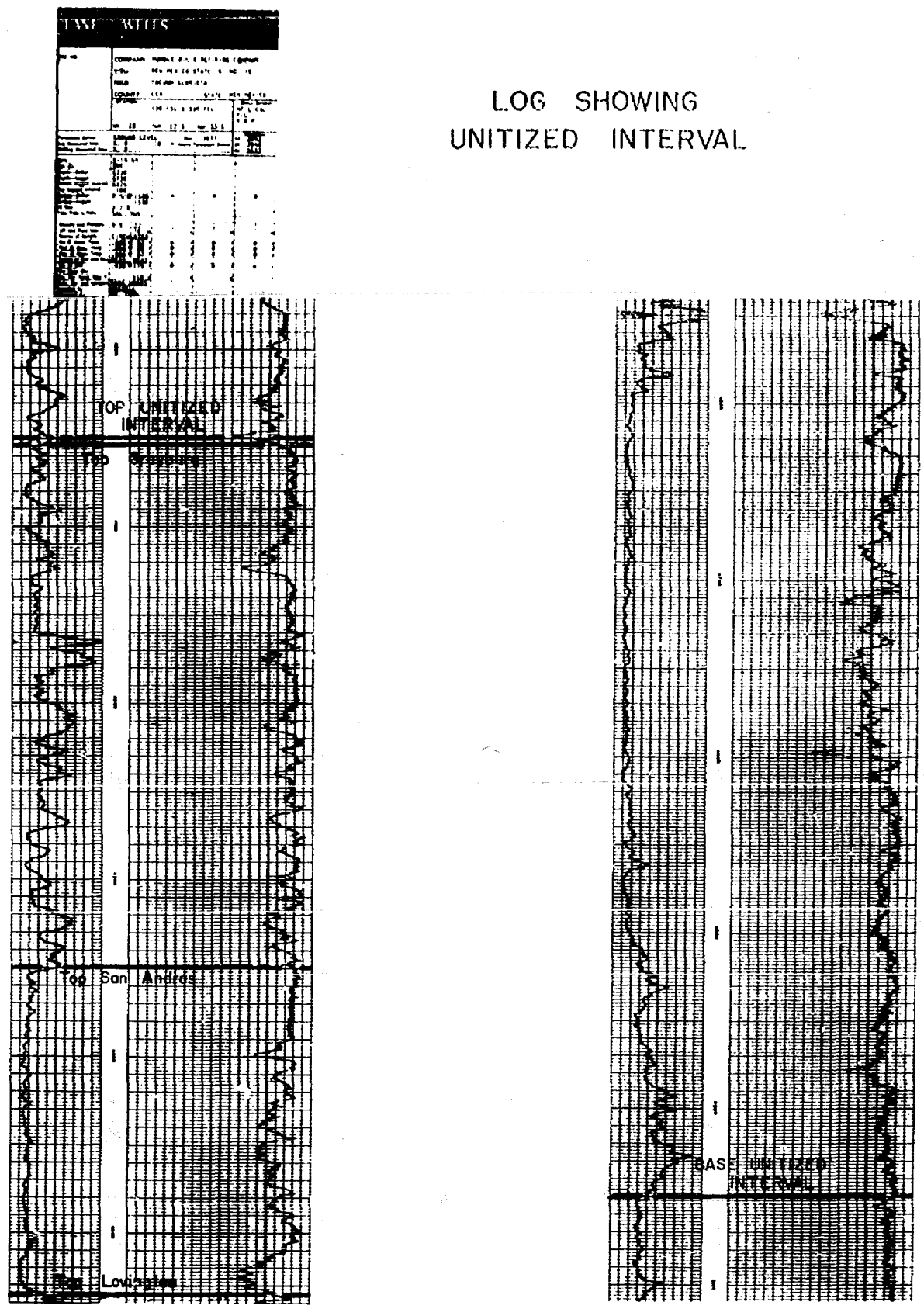

T
17
S
PHILLIPS
Voc 35 Unit
PHILLIPS East Vacuum Unit
T
18
S
R-34-E
R-35-E
Vacuum Grayburg-San Andres Field
Lea County, New Mexico
SCALE
0 2000' 4000' 6000'
WATER INJECTION PROJECTS
Proposed Phillips Operated
Proposed Texaco Operated
Current Projects

Figure 3

LOG SHOWING UNITIZED INTERVAL



The unitized interval will be the vertical interval that appears between a depth of 4050' and 5050' on the Lane wells acoustic log Run #1, dated 4-14-64 on the Humble Oil and Refining Company New Mexico State "K" #19. This well is located 330' FSL, 330' FEL, Sec. 28, Township 17 South, Range 35 East, Lea County, New Mexico. The unitized interval is to include all subsurface points throughout the unit area between these identified correlative depths.

Figure 6

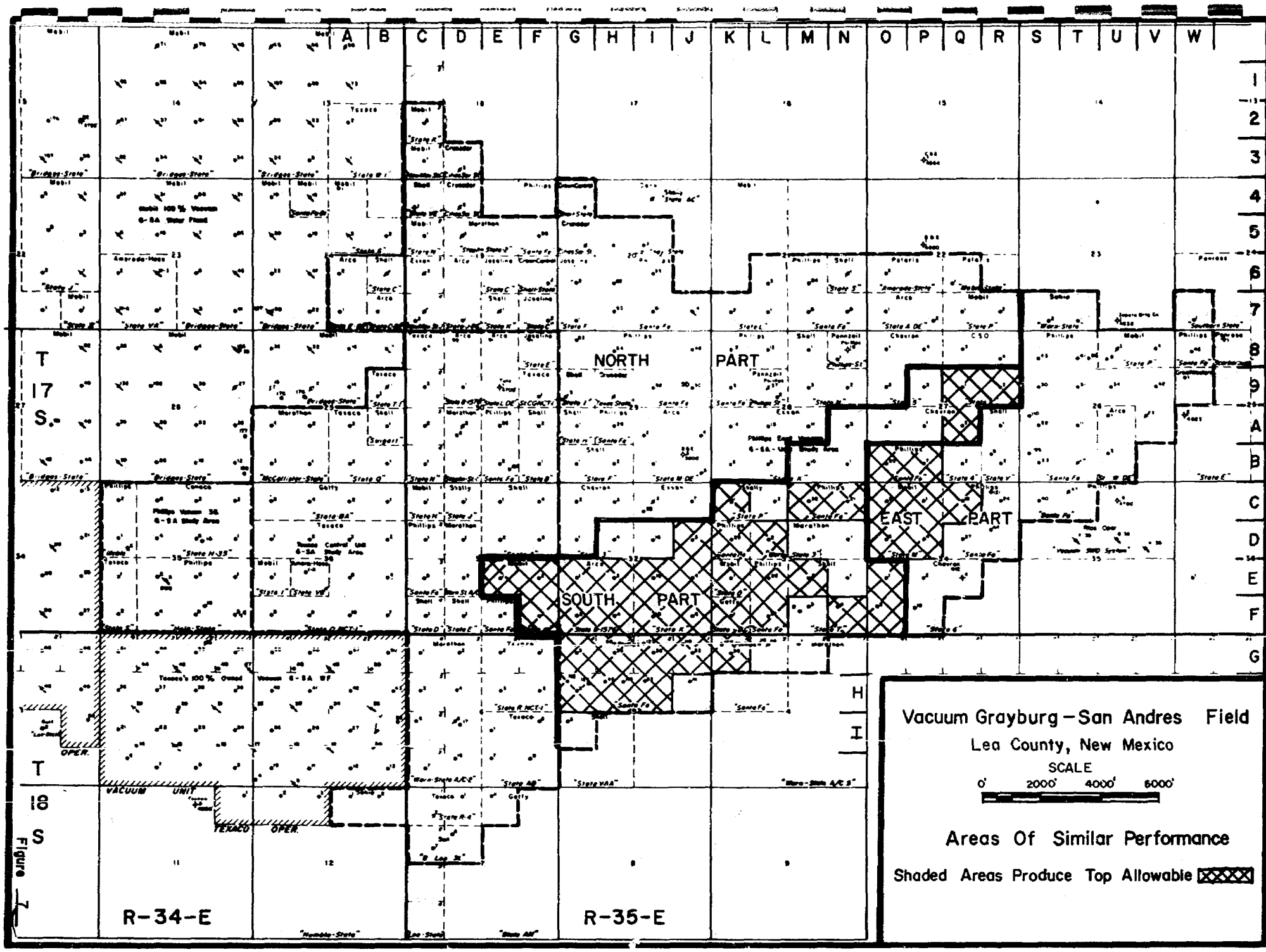

NORTH PART
EAST PART
SOUTH PART
T 17 S.
T 18 S
R-34-E
R-35-E
VACUUM UNIT
TEXACO OPER.
OPER.
Vacuum Grayburg – San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
Areas Of Similar Performance
Shaded Areas Produce Top Allowable

Figure 7

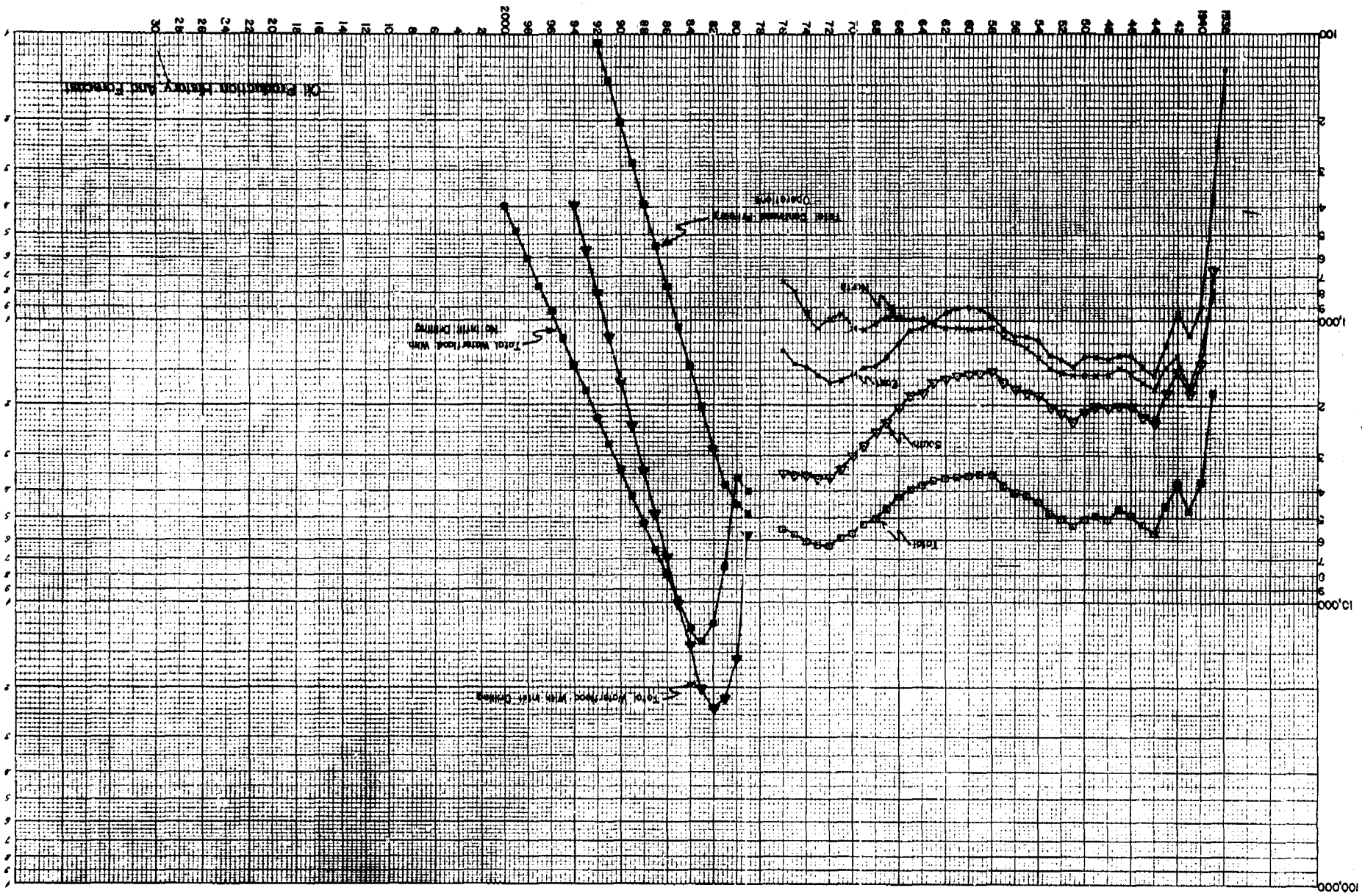
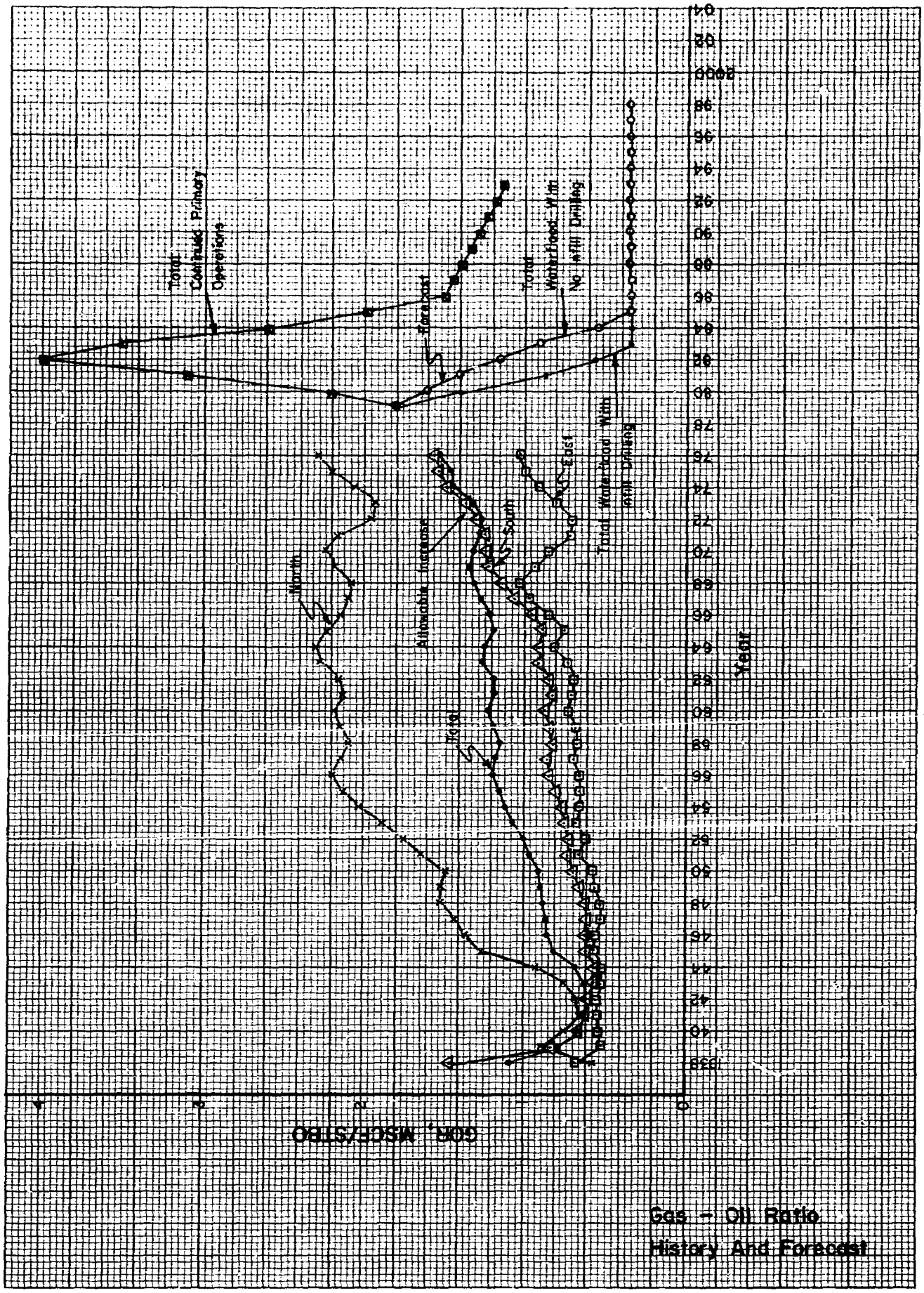
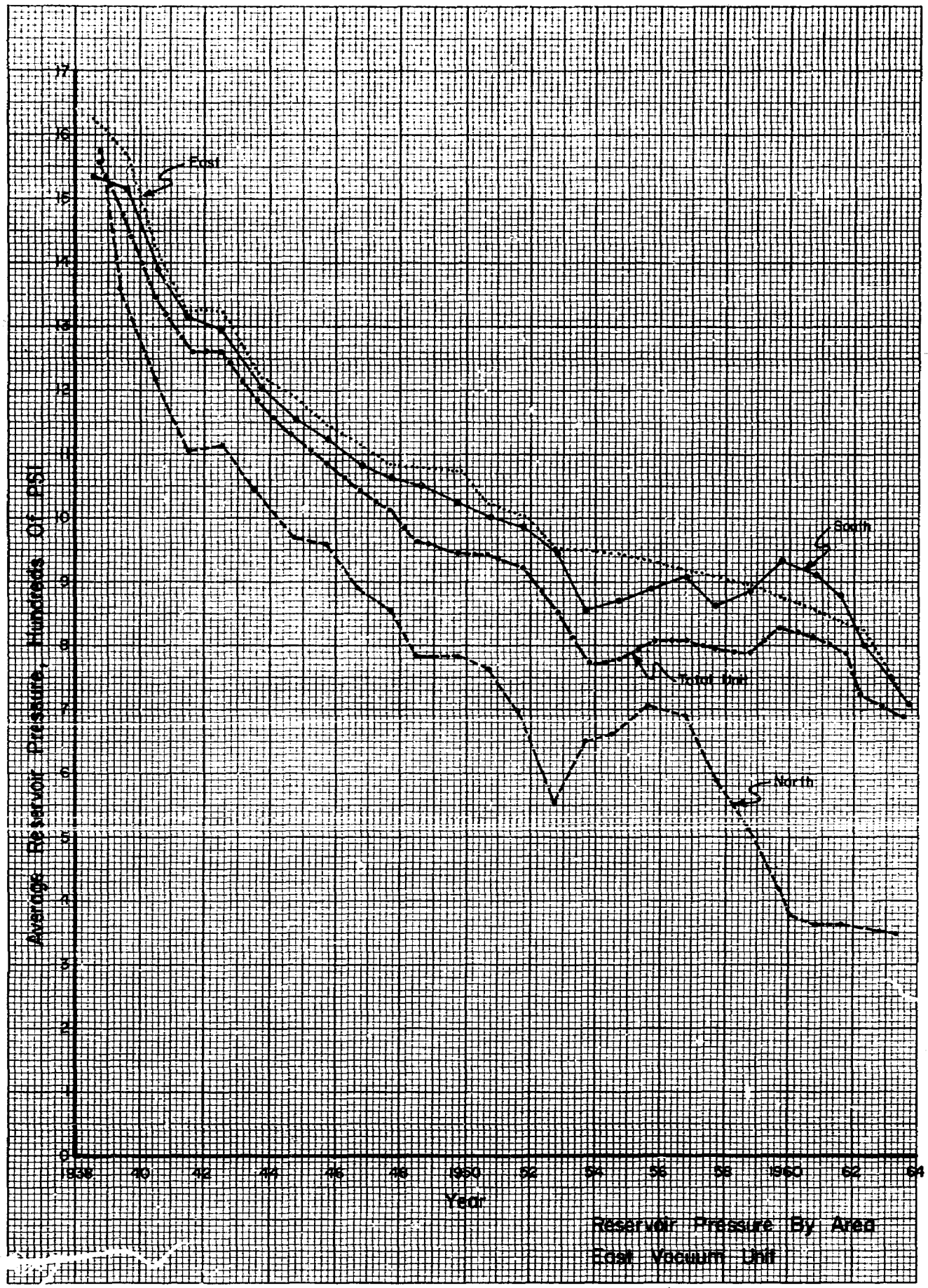

Oil Production, STBO/D
Total
Fresh
Salt
Total Water/Load Wtr. No Limit Drawing
Total Water/Load Wtr. Drawing
Oil Production History and Forecast

Figure 8



Gas - Oil Ratio
History And Forecast

Figure 9



Reservoir Pressure By Area
East Vacuum Unit

Figure 10

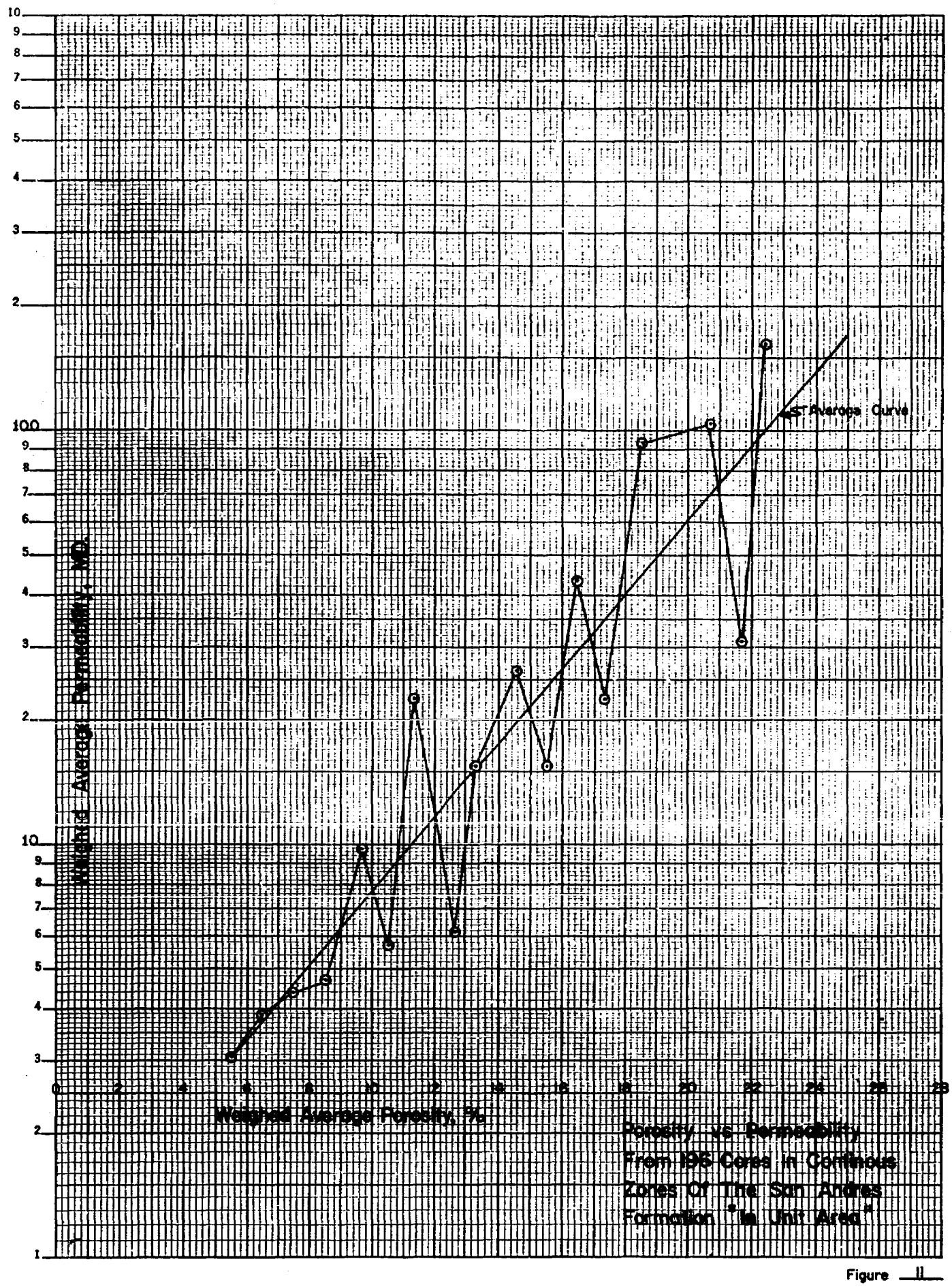
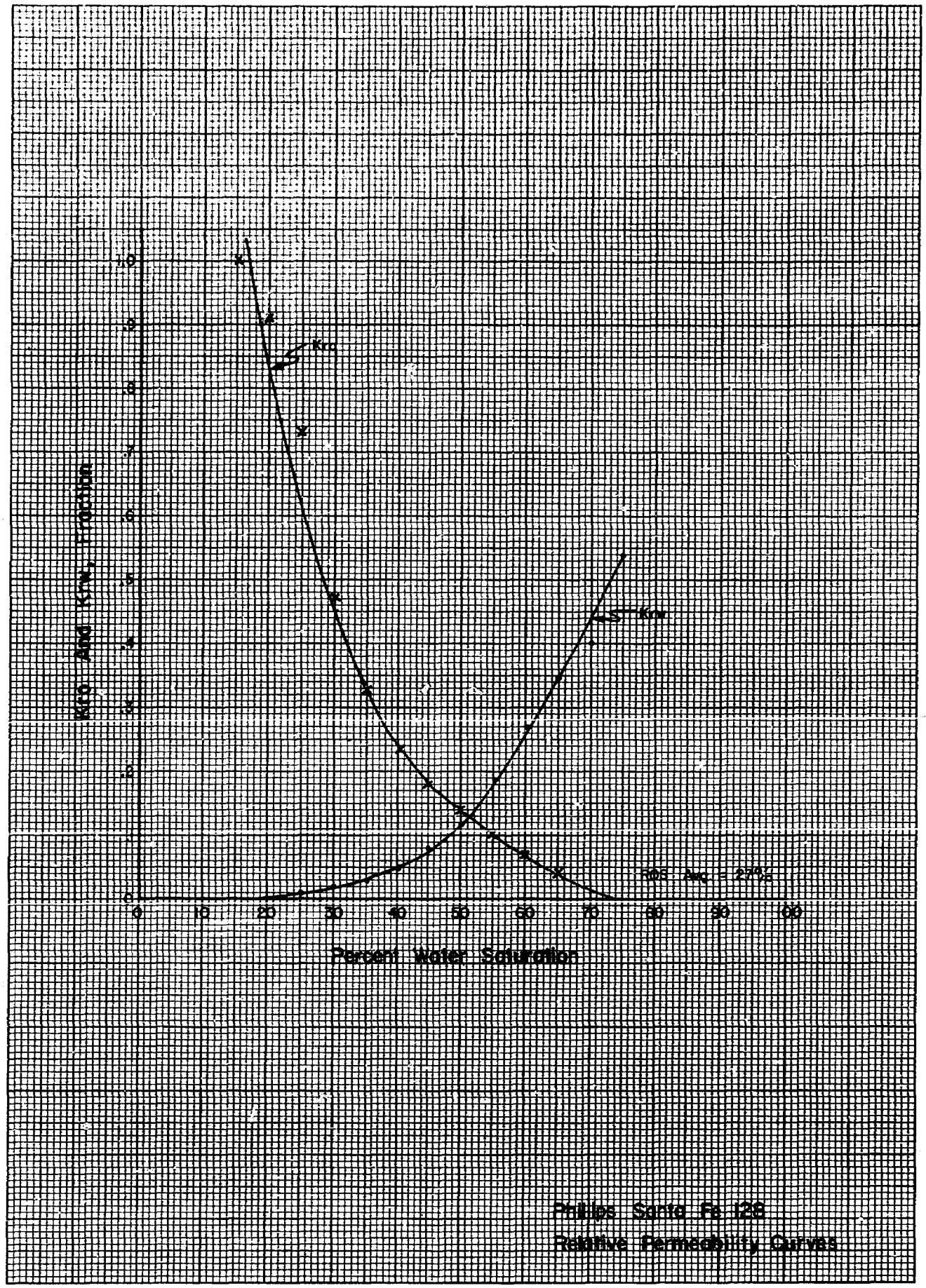

Arithmetic Average Permeability, MD.
Weighted Average Porosity, %
ST Average Curve
Porosity vs. Permeability
From 196 Cores In Continuous
Zones Of The San Andres
Formation "A" Unit Area

Figure II



Phillips Santa Fe 128
Relative Permeability Curves

Figure 12

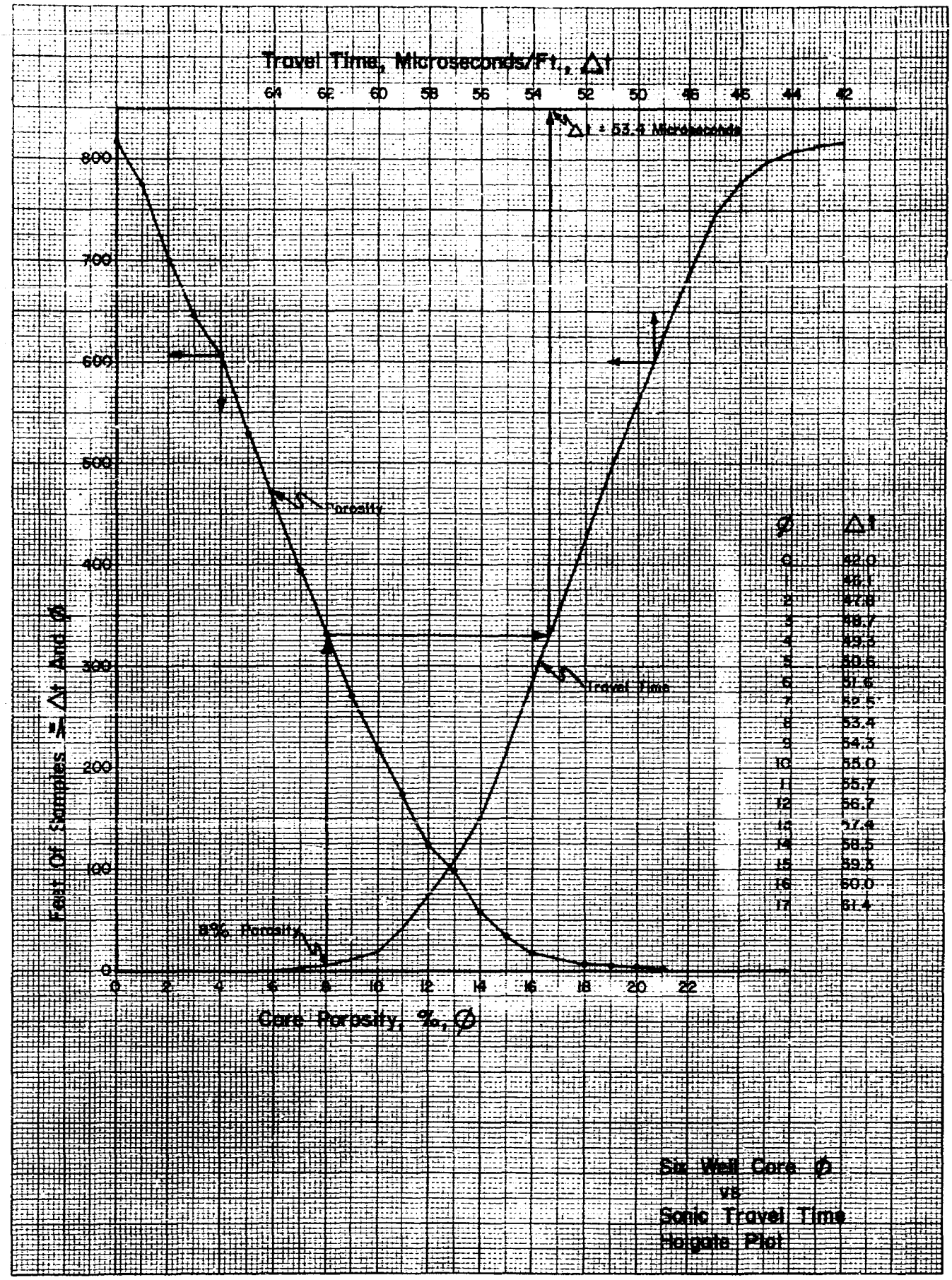

Travel Time, Microseconds/Ft., Δt
64 62 60 58 56 54 52 50 48 46 44 42
Δt = 53.4 Microseconds
800
700
600
500
400
300
200
100
0
Porosity
Travel Time
Feet Of Samples = h And Ø
8% Porosity
0 2 4 6 8 10 12 14 16 18 20 22
Core Porosity, %, Ø
Ø Δt
0 52.0
1 48.1
2 47.8
3 48.7
4 49.5
5 50.6
6 51.6
7 52.5
8 53.4
9 54.3
10 55.0
11 55.7
12 56.7
13 57.4
14 58.5
15 59.5
16 60.0
17 61.4
Six Well Core Ø
vs
Sonic Travel Time
Hingate Plot

Figure 13

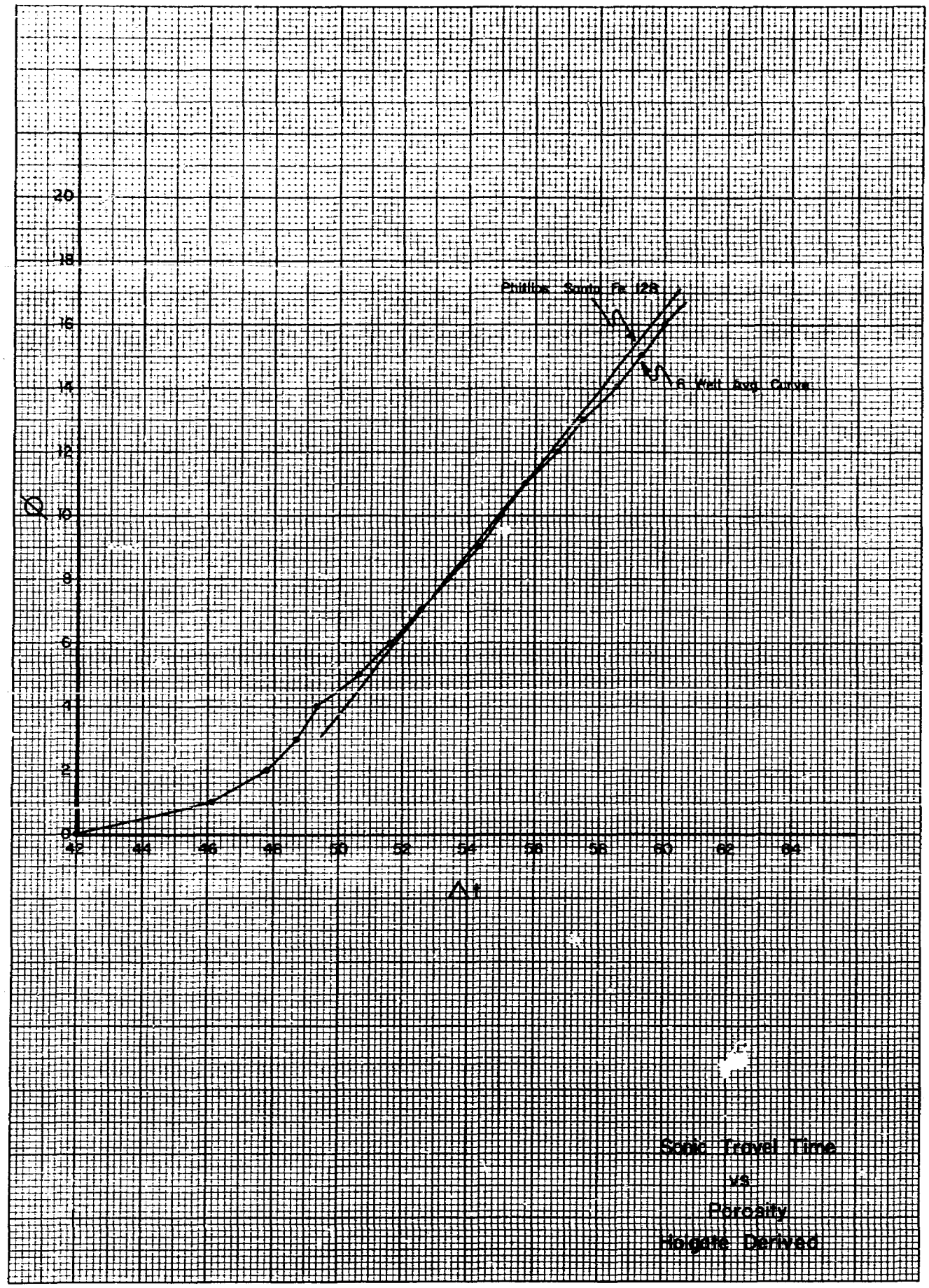

Phillips Sonic Fx. 12A
R. Watt Avg. Curve
Q
20
18
16
14
12
10
8
6
4
2
0
42
44
46
48
50
52
54
56
58
60
62
64
Δt
Sonic Travel Time
vs.
Porosity
Hoigate Derived

Figure 14

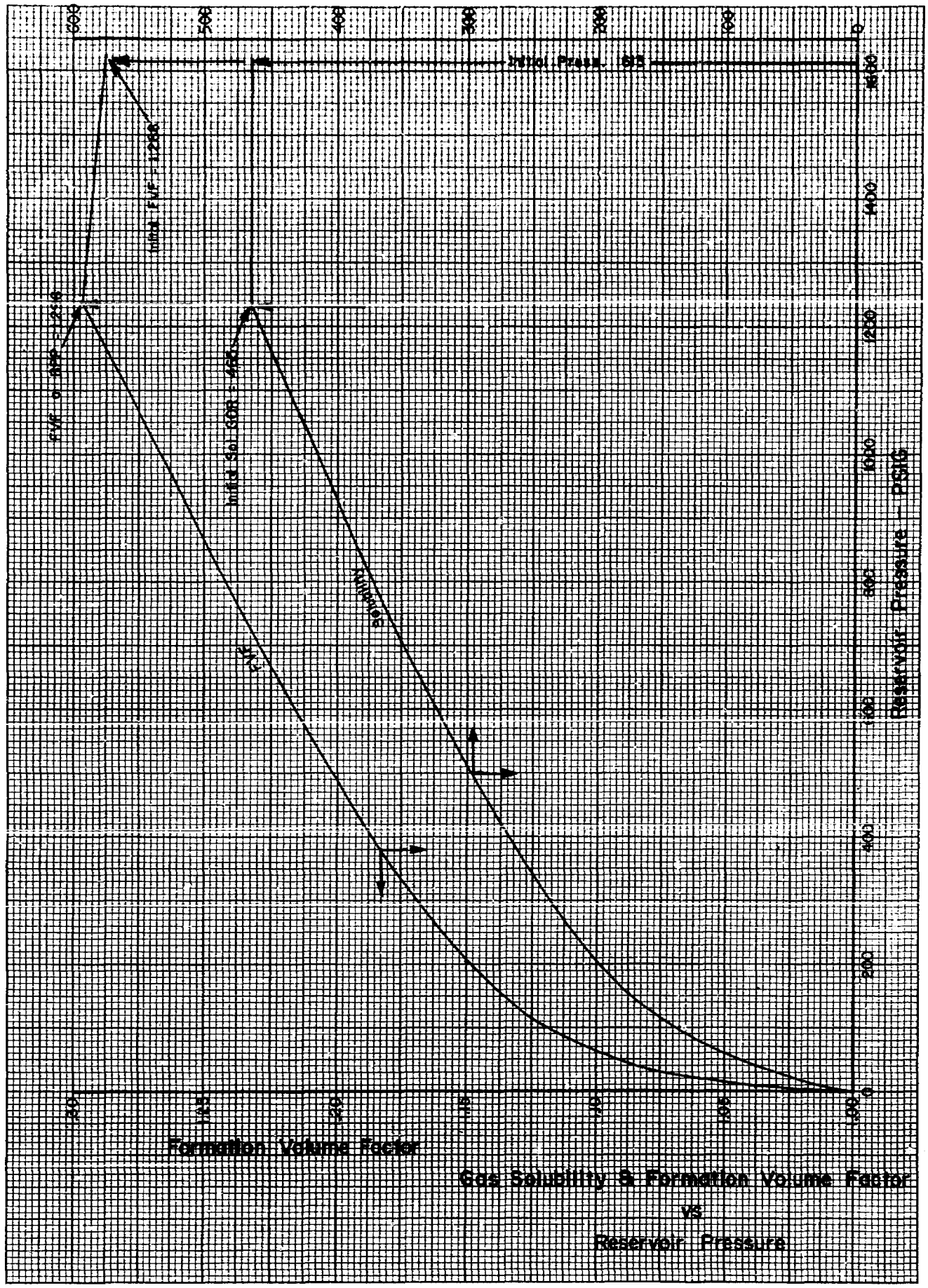

Gas – Oil Ratio – Cu. Ft./Bbl.
Initial Press. 875
Initial F.V.F. = 1.286
Cycle 2 Sol. 608 = 448
Cycle 3 Sol. 448 = 336
Initial Sol. 608 = 448
Saturation
Line
Reservoir Pressure – PSIG
Formation Volume Factor
Gas Solubility & Formation Volume Factor
vs
Reservoir Pressure

Figure 15

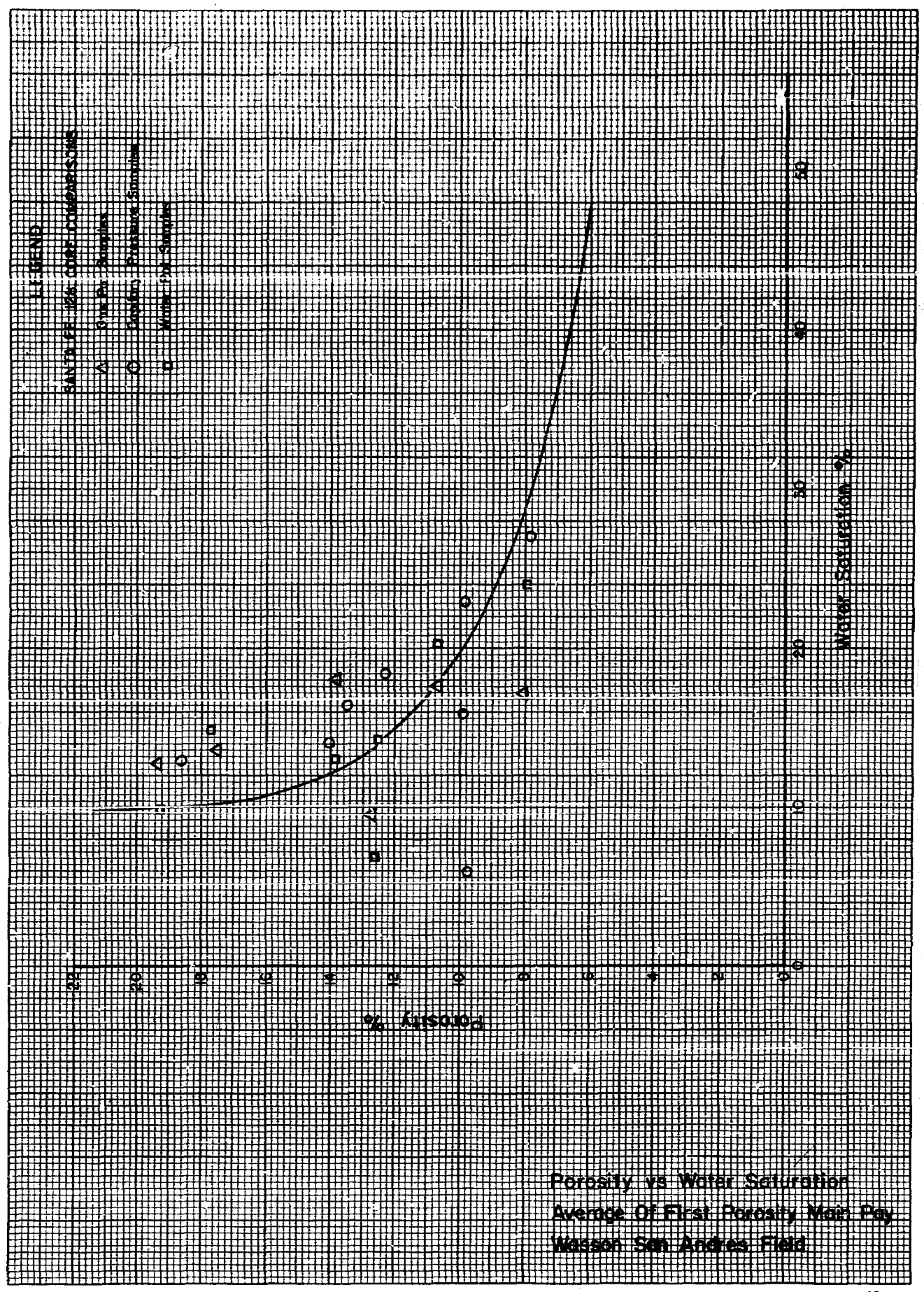

LEGEND
SANDS OF 12% OR LESS COMPRESSIBILITY
Core Bar Samples
Sealed Pressure Samples
Water Free Samples
Water Saturation %
% K_a (1S0.10$_a$)
Porosity vs Water Saturation
Average Of First Porosity Main Pay
Wasson San Andres Field

Figure 16

R 35 E

EAST VACUUM GRAYBUR
SAN ANDRES UNIT PROPO
LEA COUNTY, NEW MEXIC
SCALE IN FEET
0 2000 4000
Horizon Mapped ..... Isopach — Net Pay Top Andres To -700'
Contour Interval .....
Type Information ..... Acoustical
Interpretation By ..... Com
Date ..... September,

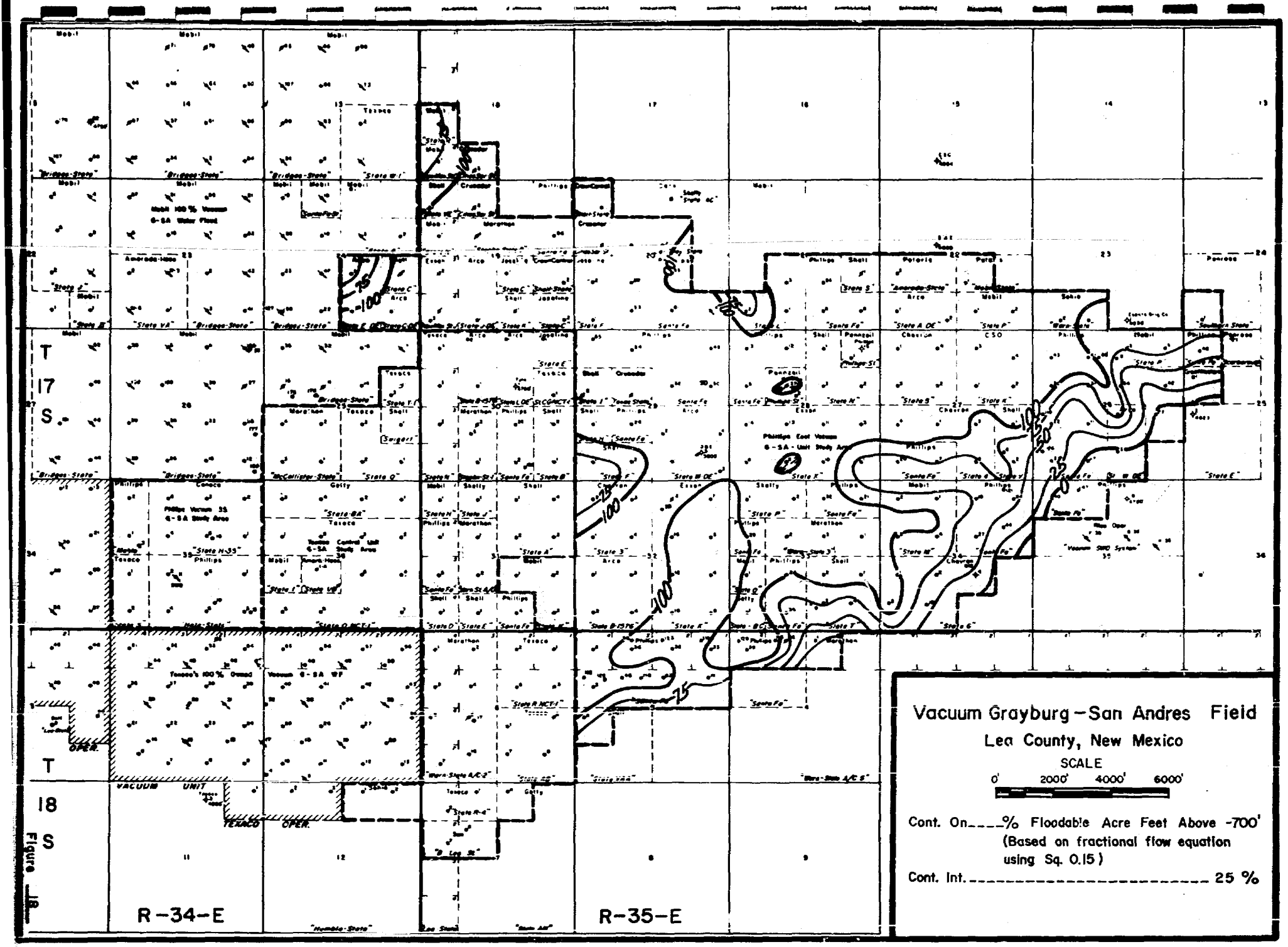

T
17
S
T
18
S
R-34-E
R-35-E
Vacuum Grayburg-San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
Cont. On____% Floodable Acre Feet Above -700'
(Based on fractional flow equation
using Sq. 0.15)
Cont. Int._____ 25 %

Figure 18

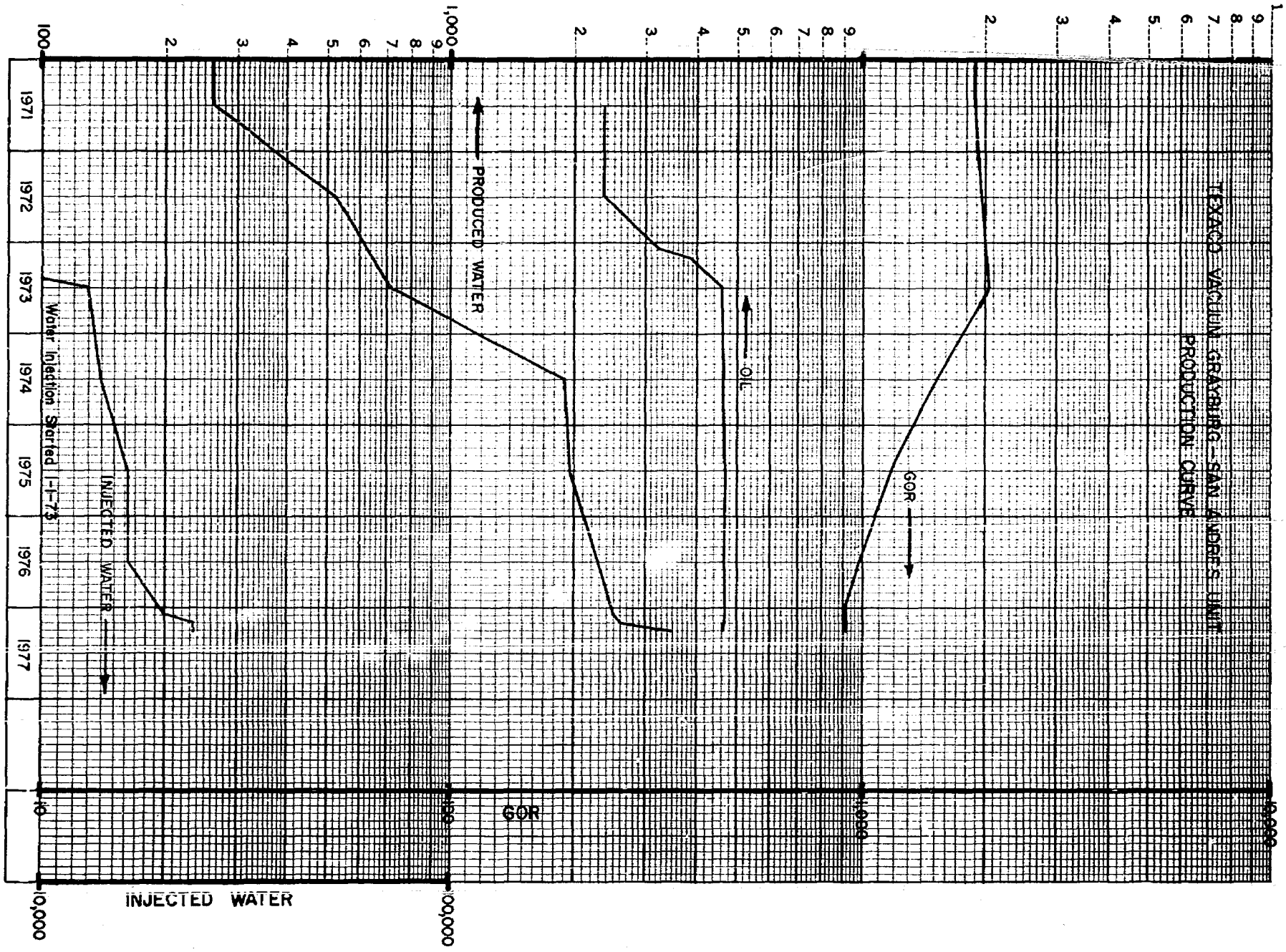
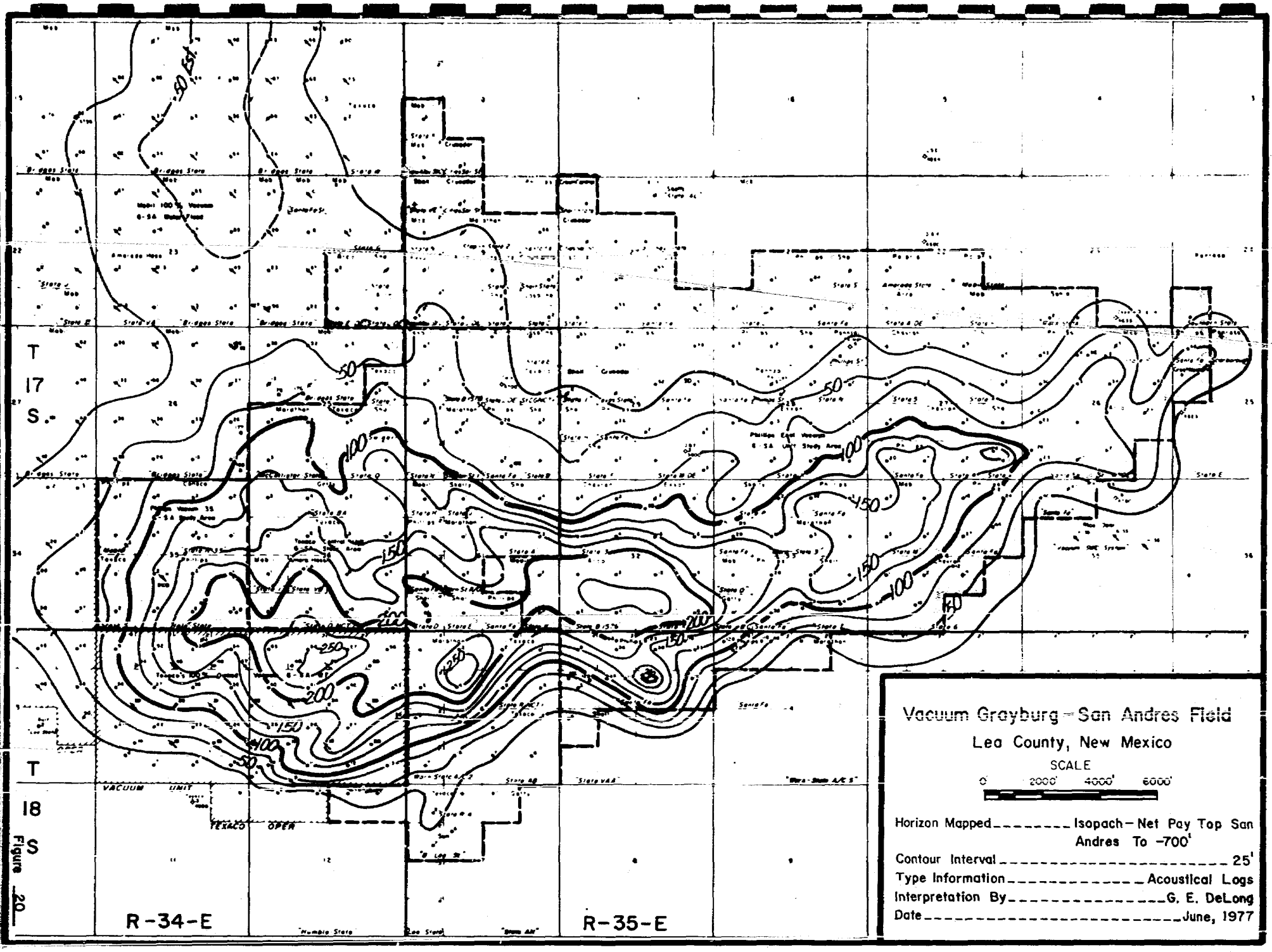

PRODUCED WATER AND OIL (BPD)
TEXACO VACUUM GRAYBURG - SAN ANDRES UNIT
PRODUCTION CURVE
PRODUCED WATER
OIL
GOR
1971
1972
1973
1974
1975
1976
1977
Water Injection Started 1-1-73
INJECTED WATER
INJECTED WATER
GOR
100
1,000
10,000
100,000

Figure 19



Vacuum Grayburg – San Andres Field

Lea County, New Mexico

SCALE

0 2000' 4000' 6000'

Horizon Mapped ..... Isopach – Net Pay Top San Andres To -700'

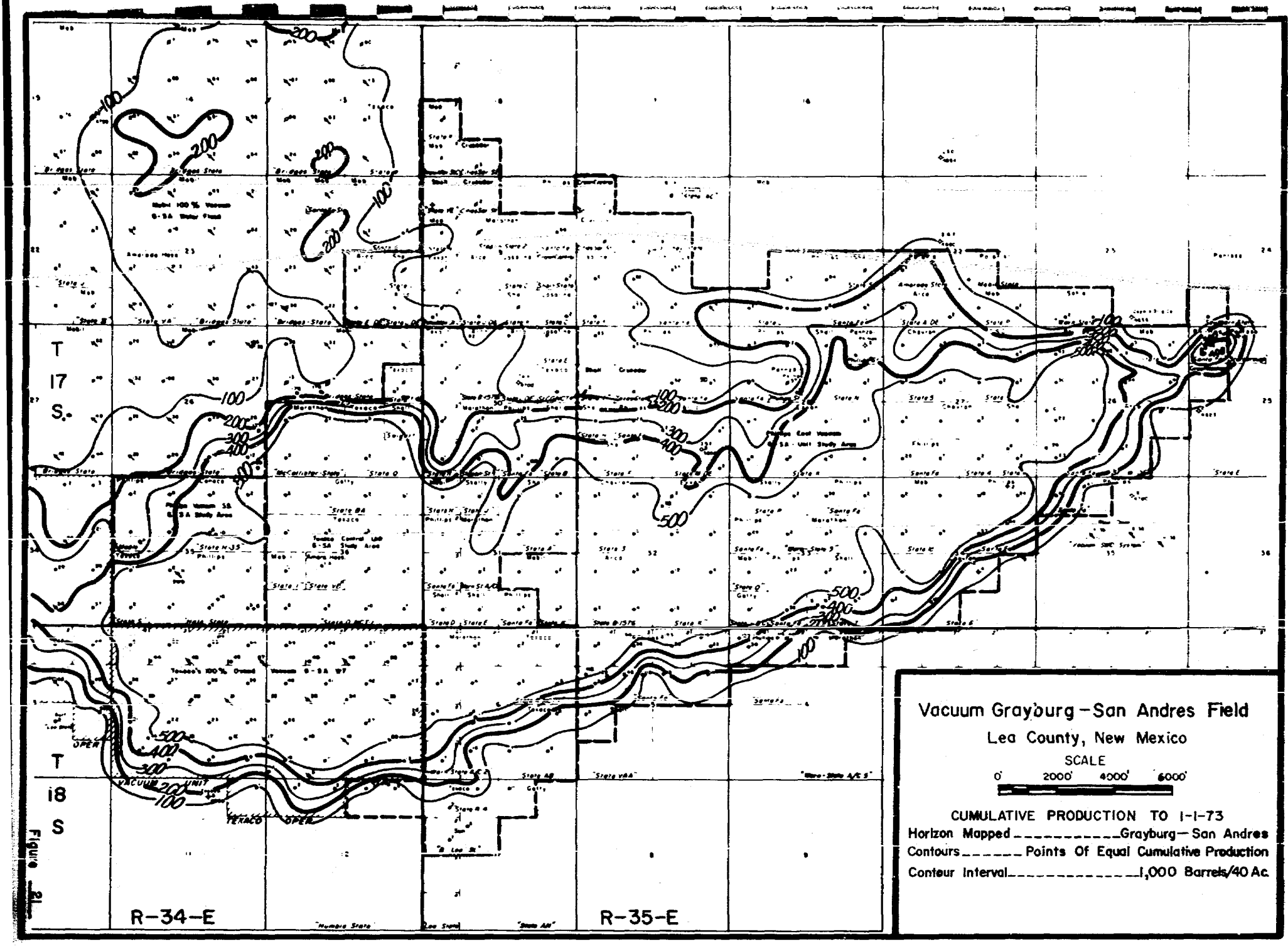
Contour Interval ..... 25'

Type Information ..... Acoustical Logs

Interpretation By ..... G. E. DeLong

Date ..... June, 1977

Figure 20



Vacuum Grayburg – San Andres Field

Lea County, New Mexico

SCALE

0' 2000' 4000' 6000'

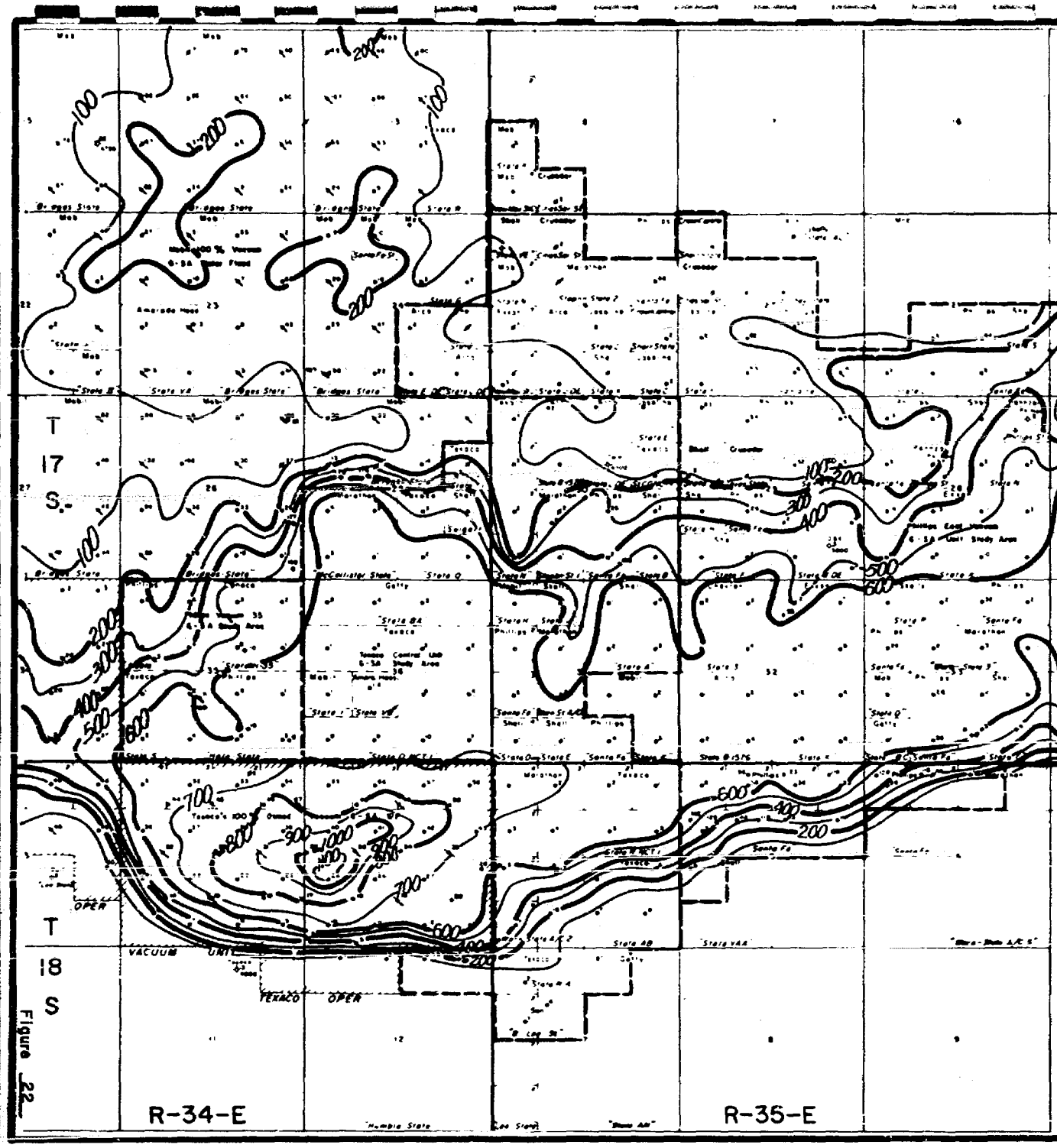
CUMULATIVE PRODUCTION TO 1-1-73

Horizon Mapped ---------- Grayburg – San Andres

Contours ------- Points Of Equal Cumulative Production

Contour Interval ---------- 1,000 Barrels/40 Ac.

Figure 12



Vacuum Grayburg – San Andres Field

Lea County, New Mexico

SCALE

0' 2000' 4000' 6000'

CUMULATIVE PRODUCTION TO 1-1-77

Horizon Mapped ---------- Grayburg – San Andres

Contours ----- Points Of Equal Cumulative Production

Contour Interval ---------- 1,000 Barrels/40 Ac.

Figure 22

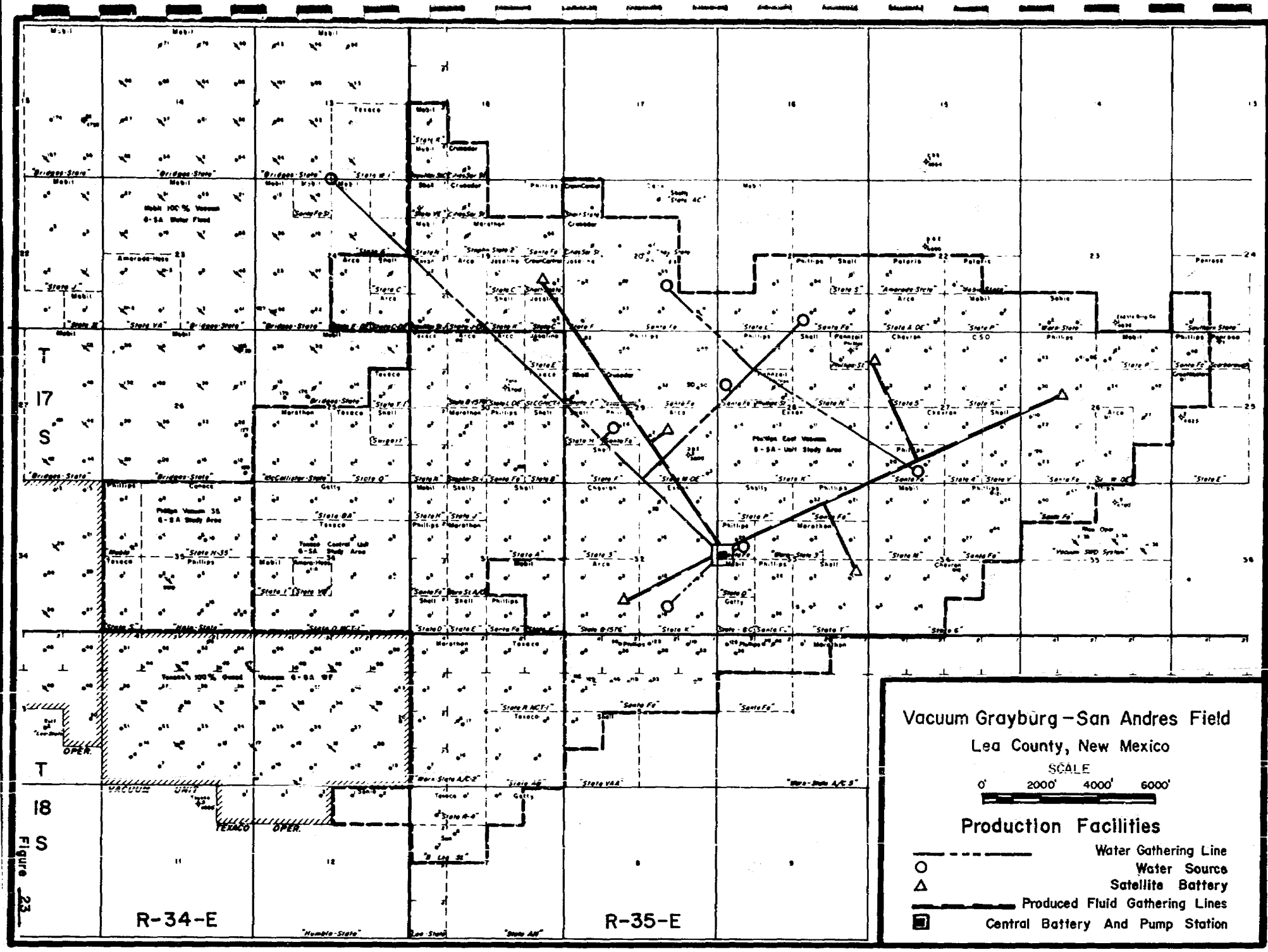

T 17 S
T 18 S
R-34-E
R-35-E
VACUUM UNIT
TEXACO OPER.
Vacuum Grayburg – San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
Production Facilities
Water Gathering Line
Water Source
Satellite Battery
Produced Fluid Gathering Lines
Central Battery And Pump Station

Figure 23

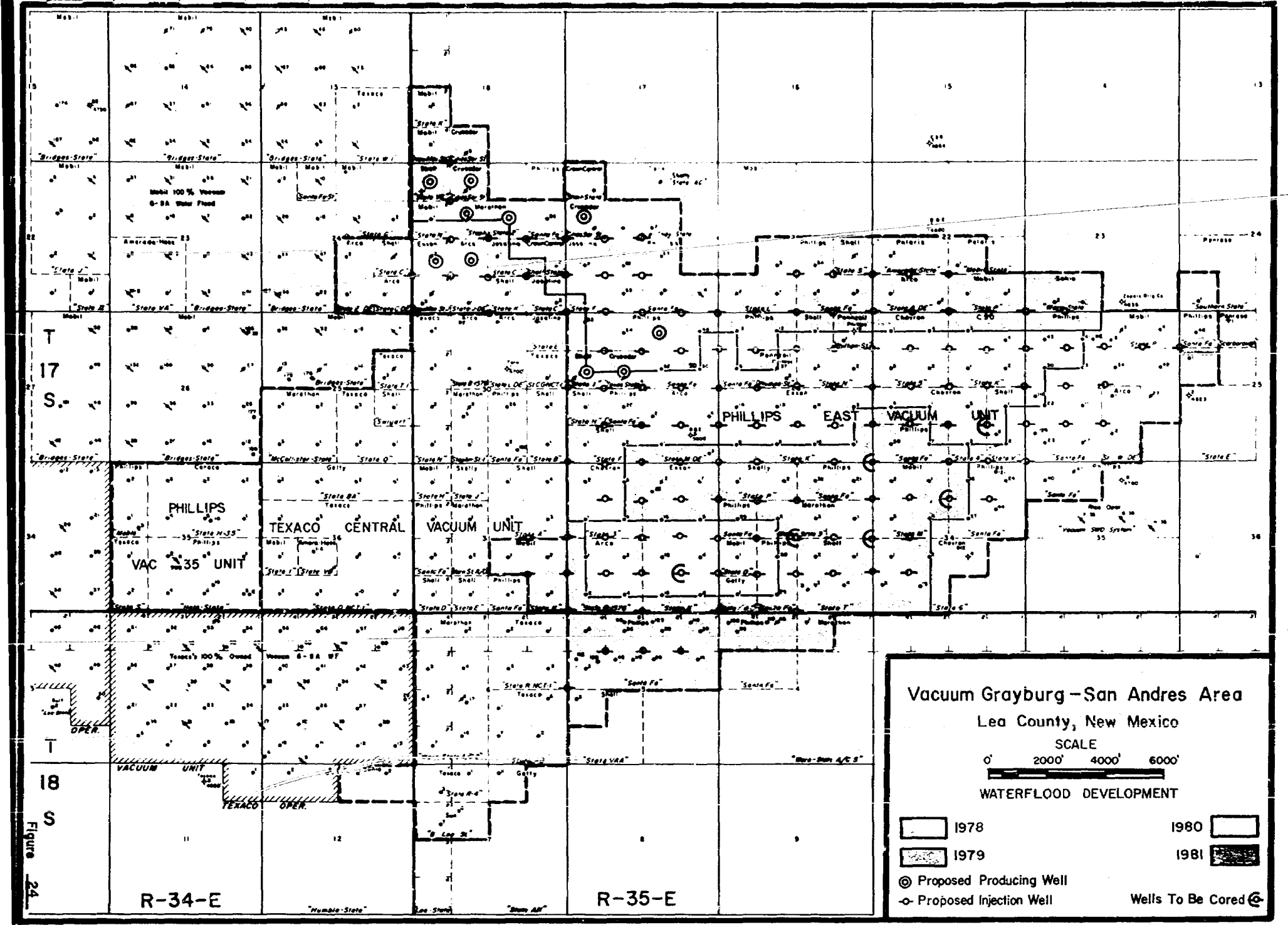

T
17
S.
T
18
S
R-34-E
R-35-E
PHILLIPS
VAC 35 UNIT
TEXACO CENTRAL VACUUM UNIT
PHILLIPS EAST VACUUM UNIT
VACUUM UNIT
TEXACO OPER.
OPER.
Vacuum Grayburg – San Andres Area
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
WATERFLOOD DEVELOPMENT
1978
1979
1980
1981
Proposed Producing Well
Proposed Injection Well
Wells To Be Cored

Figure 24

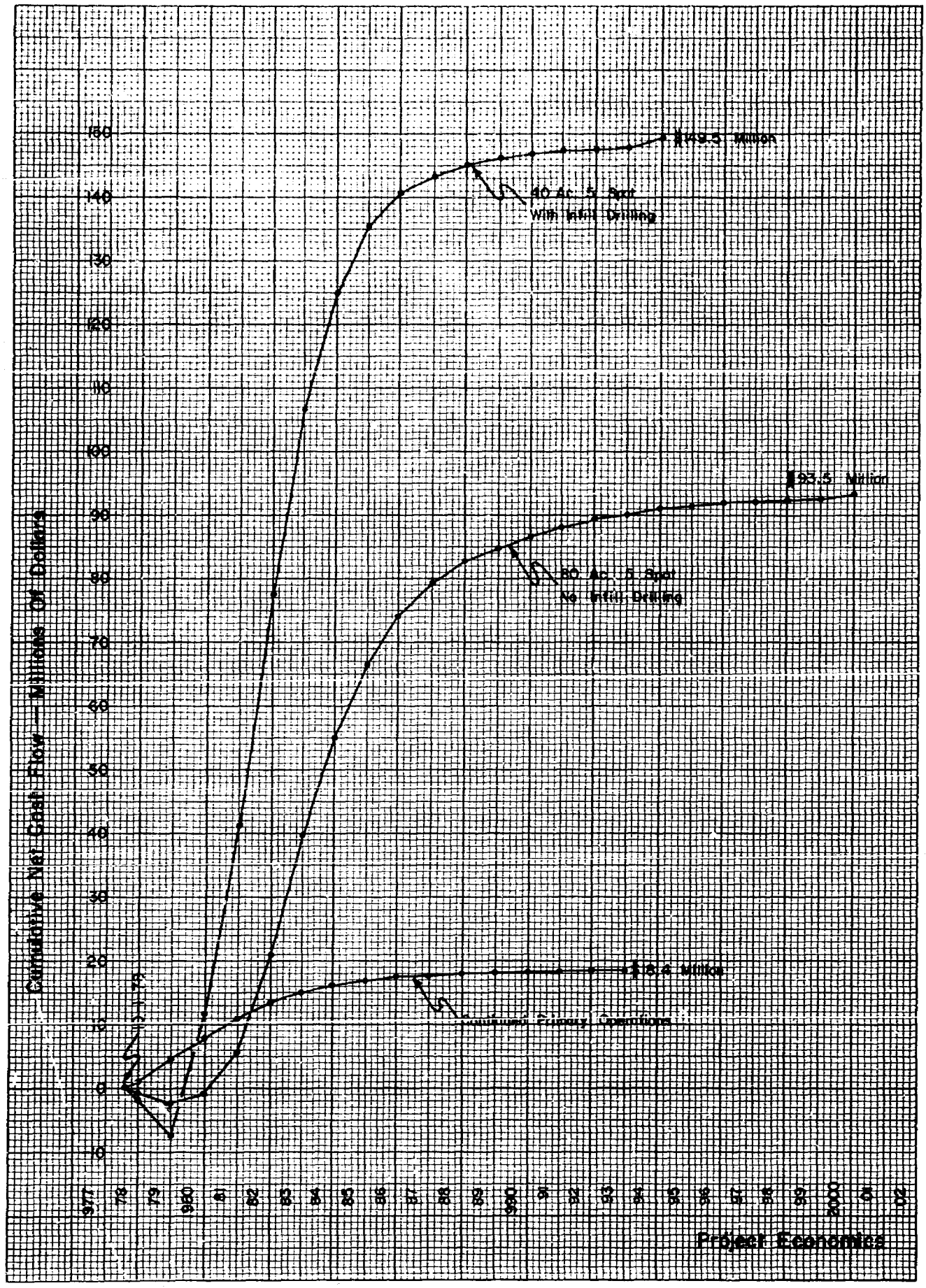
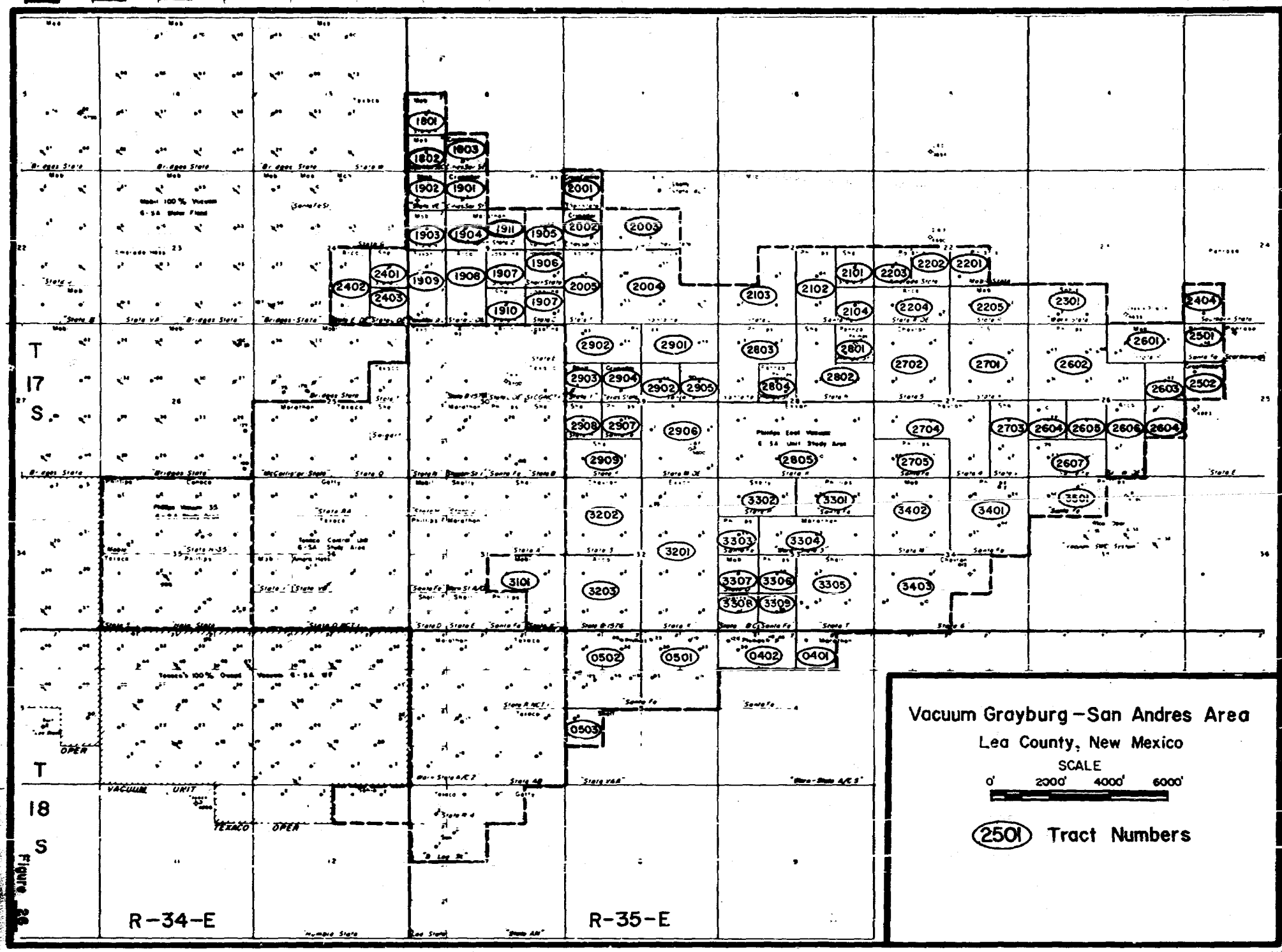

Cumulative Net Cash Flow — Millions Of Dollars
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
$149.5 Million
40 Ac. 5 Spot
With Infill Drilling
$93.5 Million
80 Ac. 5 Spot
No Infill Drilling
$18.4 Million
Continued Primary Operations
77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02
Project Economics

Figure 25



Vacuum Grayburg–San Andres Area

Lea County, New Mexico

SCALE

0' 2000' 4000' 6000'

(2501) Tract Numbers

Figure 26

METHOD OF ALLOCATION

The following is a sample calculation of allocation of future primary reserves assigned to tracts producing at top allowable and with annual production decline rates less than 13 percent.

Conditions

Ultimate Primary Recoverable Reserves	5,992,000
Less Future Primary Determined from Decline Curves	461,000
Less Cumulative Production, January 1, 1977	4,993,224
Remaining Primary Reserves to be Allocated	537,776
Decline Rate when Wells begin Decline	28% per year
Economic Limit	2 bopd

The three tracts producing under these conditions are shown in the table below:

Line		Tract A	Tract B	Tract C	Total
1	Category	Top Allowable	13% Decline	Top Allowable	
2	Reserves Produced During Decline	86,666	64,444	86,666	237,776
3	Initial Rate, barrels/day	80	60	80	220
4	Percent Remaining Floodable, acre-feet (from map, Fig. 19)	100	75	56.25	
5	Line 3 x Line 4	80	45	45	170
6	Percent of Flat Rate Reserves: $\frac{\text{Line 5} \times 100}{\text{Total Line 5}}$ =	47	26.5	26.5	100
7	Flat Rate Reserves, Based on percent acre-feet	141,000	79,500	79,500	300,000
8	Percent of Total Initial Production Rate: $\frac{\text{Line 3} \times 100}{\text{Total Line 3}}$ =	36.4	27.3	36.4	100
9	Flat Rate Reserves, Based on initial production rates	109,091	81,818	109,091	300,000
10	Reserves Allocated: Line 2 + $\frac{\text{Line 7} + \text{Line 9}}{2}$ =	211,711	145,104	180,961	537,776

CALCULATION OF WATER SATURATIONS FROM WELL TESTS BY USE OF FRACTIONAL FLOW FORMULA

The fractional flow formula has long been used as a practical tool in determining the water saturation necessary to obtain a given percent water cut in reservoirs with 100 percent liquid saturation. The following premises are necessary to make the formula applicable in reservoirs with three-phase saturation:

1. Three-phase flow does not exist. Water only contacts the oil. The oil bank ahead of the water absorbs the free gas before the water arrives.

2. The only two systems of two-phase flow that exist are oil-water and oil-gas.

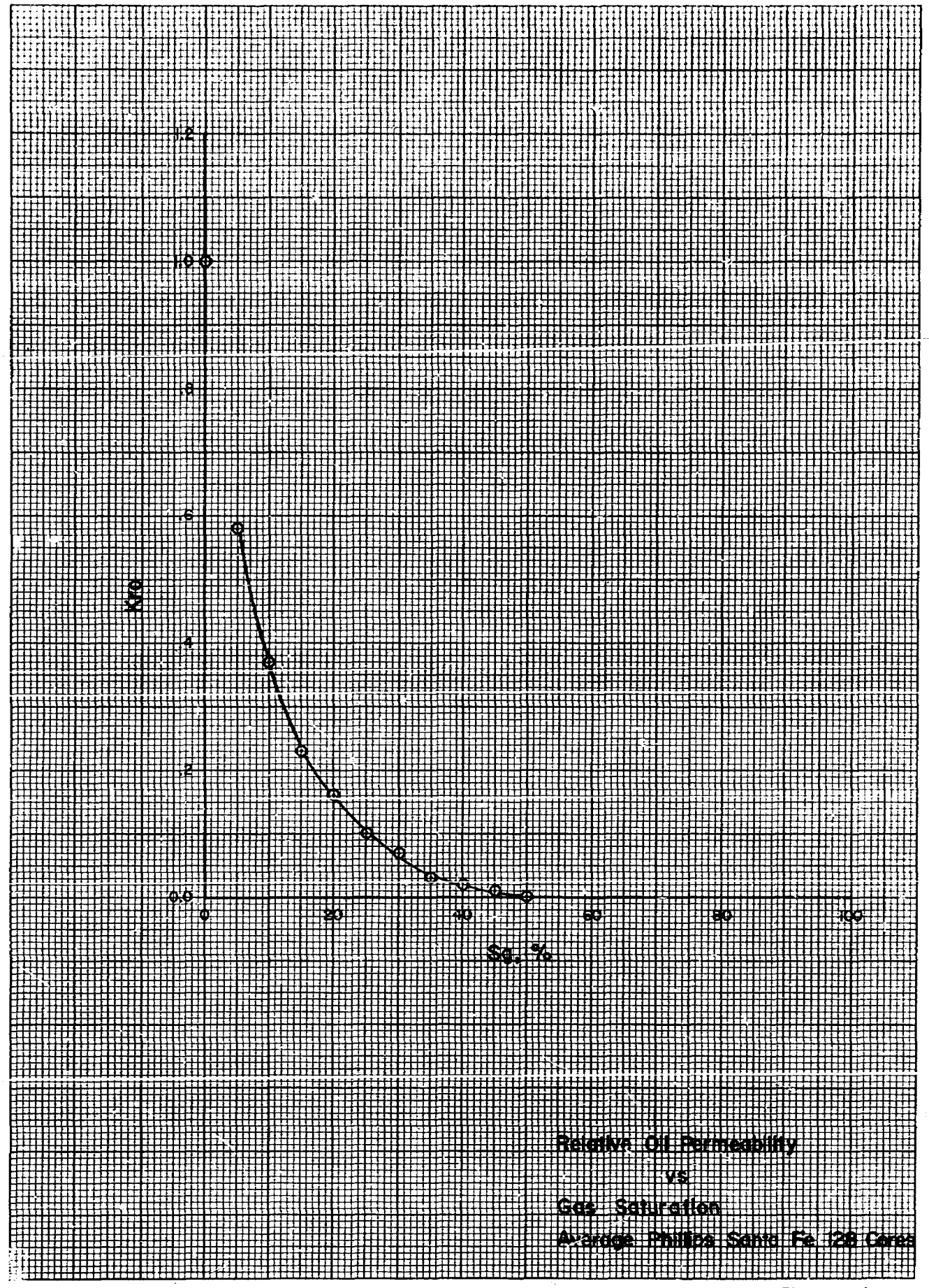
The water relative permeability is only affected by oil, but the oil relative permeability is affected by gas in the oil-gas system and water in the oil-water system. If a gas saturation can be calculated in the oil-gas system, then the permeability to oil in this system can be calculated from the oil-gas relative permeability curve.

In order to calculate the gas saturation in 1972 and K_{ro} at that saturation, production data for 14 wells with pressure histories within the water encroachment area were compiled. Average daily per well production rates for these wells in 1972 were 64 barrels of oil, 65 barrels of water, and 93 Mcf of gas. They produced 51 percent water and at a gas-oil ratio of 1,465 compared to a gas-oil ratio of only 1,252 for the total unit. An average reservoir pressure of 637 psi was calculated from individual well cumulative production versus bottom-hole pressure data.

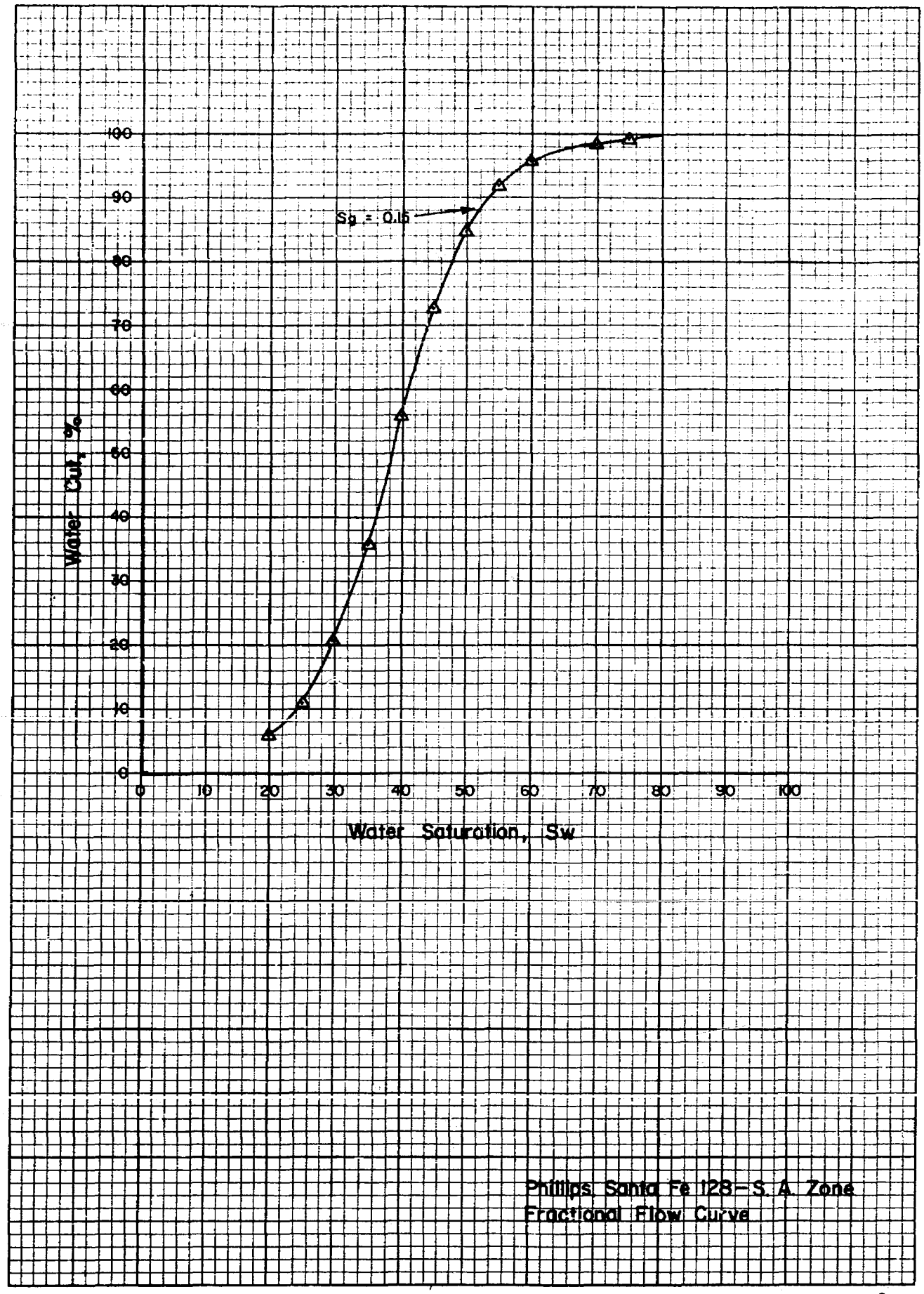
Tarner material balance calculations for depletion type reservoirs were made with the K_g/K_o values changed until the reservoir pressure of 637 psi occurred at approximately the same time as the gas-oil ratio of 1,465. The gas saturation at this point (15 percent) was read from the material balance calculations and entered into the oil-gas permeability curve (Appendix B, Figure 1) to obtain the relative oil permeability. This was used to reduce the permeability to oil in the fractional flow equations. Appendix B, Figure 2, shows the fractional flow curve obtained by this method.

Based on the oil-water relative permeability curves shown in Figure 12, 30 percent residual oil saturation and a connate water saturation of 20 percent were used in calculating the remaining floodable acre-feet from the calculated water saturation. The formula used was:

$$\text{Percent floodable acre-feet remaining} = (.70 - S_w) + .50.$$



Appendix B Figure 1



Appendix B Figure 2

PRODUCTION AND OPERATING COST FORECAST

Year	Continued Primary			80-Acre, 5-Spot			40-Acre, 5-Spot		
	Oil M Barrels Per Year	Gas MMcf Per Year	Lifting Cost, $M Per Year	Oil M Barrels Per Year	Gas MMcf Per Year	Lifting Cost, $M Per Year	Oil M Barrels Per Year	Gas MMcf Per Year	Lifting Cost, $M Per Year
1978 (3 Mos.)	444	799	375	365	657	426	510	953	414
1979	1,776	3,198	1,500	1,460	2,628	1,533	2,117	3,811	1,659
1980	1,645	3,620	1,389	1,314	2,102	1,674	5,872	8,221	2,245
1981	1,407	4,361	1,188	2,738	3,833	1,985	8,043	7,238	3,191
1982	1,041	4,162	879	4,380	5,037	1,993	8,760	4,906	3,377
1983	749	2,623	749	5,037	4,533	1,997	7,446	2,606	3,391
1984	539	1,403	539	4,495	2,517	2,009	5,212	1,824	3,386
1985	388	777	388	3,649	1,277	2,009	3,649	1,277	3,374
1986	280	419	336	2,943	1,030	2,009	2,554	894	3,357
1987	201	292	280	2,374	831	2,009	1,788	626	2,873
1988	145	203	232	1,915	670	2,009	1,252	438	2,070
1989	104	141	187	1,545	541	2,009	876	307	1,484
1990	75	98	150	1,246	436	1,678	613	215	1,088
1991	54	68	119	1,005	352	1,369	429	150	789
1992	39	47	94	811	284	1,118	300	105	578
1993	28	32	73	654	229	917	210	74	300
1994				527	185	755	147	51	150
1995				425	149	634			
1996				343	120	525			
1997				277	97	438			
1998				223	78	371			
1999				180	63	316			
2000				145	51	276			
Total upper-tier oil, M barrels				11,335			27,333		

Increased value of infill drilling due to price difference alone =
(1,000) (27,333 - 11,335) (12.00 - 5.25) = $108 x 10^6.

Base production control level = 2,040 M barrels per year.

APPENDIX C
Table A

APPENDIX C
Table B

LIFTING COST CATEGORIES

Category	Units	Annual Cost Per Unit
Injection Surveys	Injection Wells	$ 1,000.00
Treating Costs	Thousands of Barrels of Fluid Produced	$ 4.00
Maintenance Costs	Total Wells	$ 5,800.00
Electricity Cost	Producing Wells	$ 6,879.00
Operator Cost	Operators (3 needed)	$16,667.00
Fuel Gas Costs	Thousands of Barrels of Water Injected	$ 4.73

APPENDIX C
Table C

DRILLING WELL AND WORKOVER COSTS

Area	Type	Casing	Total Wells	Cost Per Well		
				Tangible	Intangible	Total
North	Injection	4-1/2"	70	$39,700	$ 96,000	$135,700
All	Producing	4-1/2"	10	40,300	115,000	155,300
South	Injection	5-1/2"	51	50,000	103,000	153,000
South	Injection with Coring	5-1/2"	6	50,000	136,900	186,900
All	Deepen Old Well	All	100 (40-acre) 50 (80-acre)	2,600	19,200	21,800
All	Convert Old Well to Injection	All	65	4,000	30,200	34,200

APPENDIX C
Table D

INVESTMENT SCHEDULE

1978

	80-Acre, 5-Spot			40-Acre, 5-Spot		
	Tangibles	Intangibles	Total	Tangibles	Intangibles	Total
Tank Battery Consolidation	$ 494,500	$ 30,200	$ 524,700	$ 652,600	$ 30,200	$ 682,800
Water Treatment and Injection Plant	492,200	25,900	518,100	693,500	25,900	719,400
Fresh Water Make-up Supply	184,700	9,600	194,300	213,500	9,600	223,100
Drill 10 Injection Wells 1 Well -- S/2 with core 9 Wells -- S/2 no core	0	0	0	500,300	1,063,200	1,563,500
Convert 10 Producers to Injection	40,300	301,800	342,100	0	0	0
Lift Equipment Revision	299,000	86,300	385,300	598,000	172,500	770,500
Total (1978)	$1,510,700	$ 453,800	$ 1,964,500	$ 2,657,900	$ 1,301,400	$ 3,959,300

1979

Tank Battery Consolidation	$1,483,500	$ 90,600	$ 1,574,100	$ 1,957,900	$ 90,600	$ 2,048,500
Water Treatment and Injection Plant	1,476,600	77,600	1,554,200	2,080,400	77,600	2,158,000
Fresh Water Make-up Supply	554,200	28,900	583,100	640,400	28,900	669,300
Drill 43 Injection Wells 4 Wells -- S/2 with core 34 Wells -- S/2 no core 5 Wells -- N/2	0	0	0	2,099,400	4,527,000	6,626,400
Convert 20 Producers to Injection	80,500	603,500	684,000	0	0	0
Deepen Producing Wells	52,900	384,100	437,000	92,600	672,200	764,800
Lift Equipment Revision	897,000	258,800	1,155,800	1,794,000	517,500	2,311,500
Total (1979)	$4,544,700	$1,443,500	$ 5,988,200	$ 8,664,700	$ 5,913,800	$14,578,500

INVESTMENT SCHEDULE--Continued

1980

	80-Acre, 5-Spot			40-Acre, 5-Spot		
	Tangibles	Intangibles	Total	Tangibles	Intangibles	Total
Drill 43 Injection Wells	$ 0	$ 0	$ 0	$ 1,799,200	$ 4,225,200	$ 6,024,400
1 Well -- S/2 with core						
8 Wells -- S/2 no core						
34 Wells -- N/2						
Drill 3 Producers	120,800	345,000	465,800	120,800	345,000	465,800
Convert 20 Producers to Injection	80,500	603,500	684,000	0	0	0
Deepen Producing Wells	52,900	384,100	437,000	92,600	672,200	764,800
Total (1980)	$ 254,200	$1,332,600	$ 1,586,800	$ 2,012,600	$ 5,242,400	$ 7,255,000

1981

Drill 31 N/2 Injection Wells	$ 0	$ 0	$ 0	$ 1,229,900	$ 2,976,800	$ 4,206,700
Drill 7 Producers	281,800	805,000	1,086,800	281,800	805,000	1,086,800
Convert 15 Producers to Injection	60,400	452,600	513,000	0	0	0
Deepen Producing Wells	26,500	192,100	218,600	79,400	576,200	655,600
Total (1981)	$ 368,700	$1,449,700	$ 1,818,400	$ 1,591,100	$ 4,358,000	$ 5,949,100
GRAND TOTAL	$6,678,300	$4,679,600	$11,357,900	$14,926,300	$16,815,600	$31,741,900

APPENDIX C
Table D

EXXON COMPANY, U.S.A.
POST OFFICE BOX 1600 · MIDLAND, TEXAS 79701

PRODUCTION DEPARTMENT
MIDCONTINENT DIVISION

J. M. SHEPHERD
JOINT INTEREST MANAGER

BEFORE EXAMINER STAMETS
OIL CONSERVATION DIVISION
EXHIBIT NO. 5
CASE NO. 6470
Submitted by PHILLIPS PETRO.
Hearing Date 2/28/79

State of New Mexico
Energy and Minerals Department

Attention: Oil Conservation Division

Re: Case No. 6470, February 28, 1979,
Hearing Docket, Application of
Phillips Petroleum Company
East Vacuum Unit
Lea County, New Mexico

Gentlemen:

Exxon, as a working interest owner in the East Vacuum (GR.-S.A.) Unit, supports the above referenced request of Phillips Petroleum Company, as Unit Operator, to permit an infill drilling program in the subject Unit. This support is based on a conclusion that under the contemplated unit operations each new infill well to be drilled in an existing proration unit is necessary to effectively and efficiently drain a portion of the reservoir covered by the proration unit which cannot be effectively and efficiently drained by any existing well within the proration unit.

Yours very truly,

J. M. Shepherd

JKL/jg

Chevron U.S.A. Inc.
P. O. Box 1660, Midland, TX 79702

BEFORE EXAMINER STAMETS
OIL CONSERVATION DIVISION
EXHIBIT NO. 6
CASE NO. 6470
Submitted by PHILLIPS PETRO.
Hearing Date 2/28/79

February 22, 1979

Natural Gas Policy Act of 1978
Section 103 - New Onshore Production Wells
E. Vacuum Unit
Lea County, New Mexico

Phillips Petroleum Company
4001 Penbrook
Odessa, Texas 79762

Gentlemen:

Chevron U.S.A. Inc. is in agreement that infill wells to be drilled in the E. Vacuum Grayburg-San Andres Unit would qualify for certification under Section 103 of the Natural Gas Policy Act of 1978.

This statement is offered in support of your application before the New Mexico Oil Conservation Division on February 28, 1979.

Yours very truly,

E. E. Hagan
Division Manager

DGS:cn

EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

NECESSITY AND RESULTS OF INFILL DRILLING

How many wells 113

Each infill well is necessary to effectively and efficiently drain oil and gas reserves from a portion of the reservoir covered by the proration unit which cannot be effectively and efficiently drained by any existing well within the proration unit.

For the total unit area, infill drilling on 20-acre spacing will result in the recovery of 11,582,000 barrels of oil not recoverable with 40-acre spacing. The solution gas associated with this oil will be 4.054 billion cubic feet.

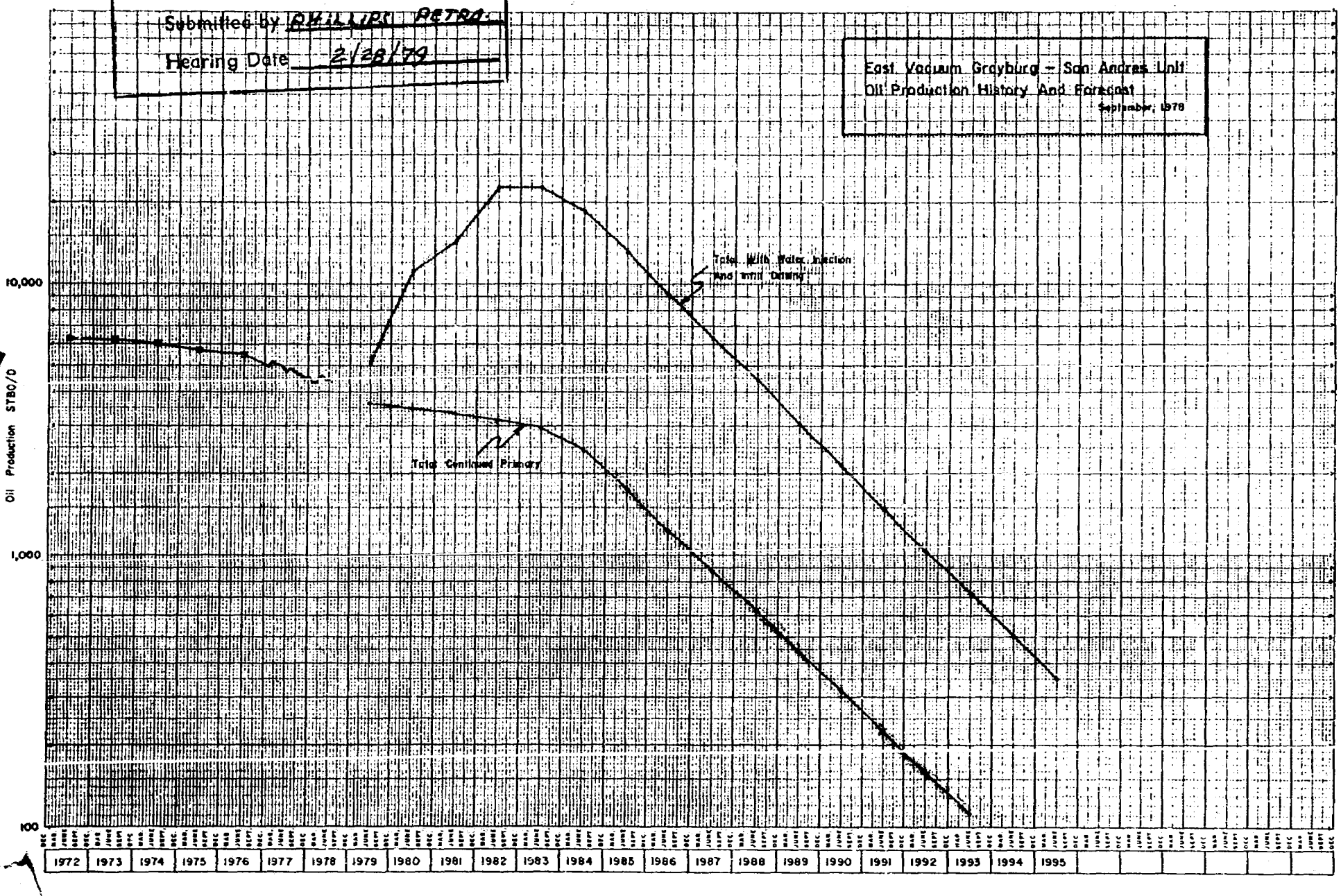
Exhibit H

The increased recovery will be 3.9 percent of the original oil-in-place. This percent increase is comparable to published results applicable to geologically similar carbonate reservoirs under waterflood in the general area of Vacuum Field. The infill drilling and the overall development plan conform to the current industry concepts for effective and efficient carbonate waterflooding. The infill drilling will increase oil and associated gas recovery due primarily to (1) encountering discontinuous intervals of porosity and (2) improving waterflood areal and vertical sweep efficiency.

BEFORE EXAMINER STAMETS
OIL CONSERVATION DIVISION
EXHIBIT NO. 7
CASE NO. 6470
Submitted by PHILLIPS PETRO.
Hearing Date 2/28/79

BEFORE EXAMINER STAMETS
OIL CONSERVATION DIVISION
EXHIBIT NO. 8
CASE NO. 6470
Submitted by PHILLIPS PETRO.
Hearing Date 2/28/79

East Vacuum Grayburg – San Andres Unit
Oil Production History And Forecast
September, 1978



BEFORE EXAMINER STAMETS
OIL CONSERVATION DIVISION
EXHIBIT NO. 9
CASE NO. 6470
Submitted by PHILLIPS PETRO
Hearing Date 2/28/79

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: B-1576

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work
b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]
OIL WELL [X] GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit
8. Farm or Lease Name: East Vacuum Grayburg/San Andres, Tract 3229
2. Name of Operator: Phillips Petroleum Company
9. Well No.: 005
3. Address of Operator: Room 401, 4001 Penbrook St., Odessa, Texas 79762
10. Field and Pool, or Wildcat: East Vacuum Grayburg/San Andres
4. Location of Well: UNIT LETTER M LOCATED 1110 FEET FROM THE South LINE AND 1290 FEET FROM THE West LINE OF SEC. 32 TWP. 17-S RGE. 35-E NMPM
12. County: Lea

19. Proposed Depth: 4900'
19A. Formation: San Grayburg/Andres
20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, GR, etc.): 3964.7' Ground (unprepared)
21A. Kind & status Plug. Bond: blanket
21B. Drilling Contractor: Advise later
22. Approx. Date Work will start: Upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13-3/8"	48# -H-40	350'	(675 sx Class H w/2% CaCl.)(&1/4# Flocele/sx in 1st 150 sx)	Circ at surface
12¼" X 8-5/8"	7"	23#, K-55	4900'	(Sufficient TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx Followed by 260 sx Class H Cement w/8# salt/sx to circulate at surface.)	

(This well is in the same proration unit as Well No. 002)

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 2990'; cemented to surface w/cement of quality adequate to control waterflow and protect casing string.

Re: N.M.O.C.D. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original loc. approved within Order (3) was 1310' from So. & West lines of the above section.

Use mud additives as required for control. (Conf. telecon MCL - Ramey 1-22-79)
BOP: Series 900, 3000# WP, double w/one set pipe rams & one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W.J. Mueller Engineering Advisor Date 1-22-79

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E.V.G.S.A.U. NM Tract 2229	005

Unit Letter	Section	Township	Range	County
M	32	17 South	35 East	Lea

Actual Footage Location of Well:				
1110	feet from the South	line and	1290	feet from the West line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
3964.7	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

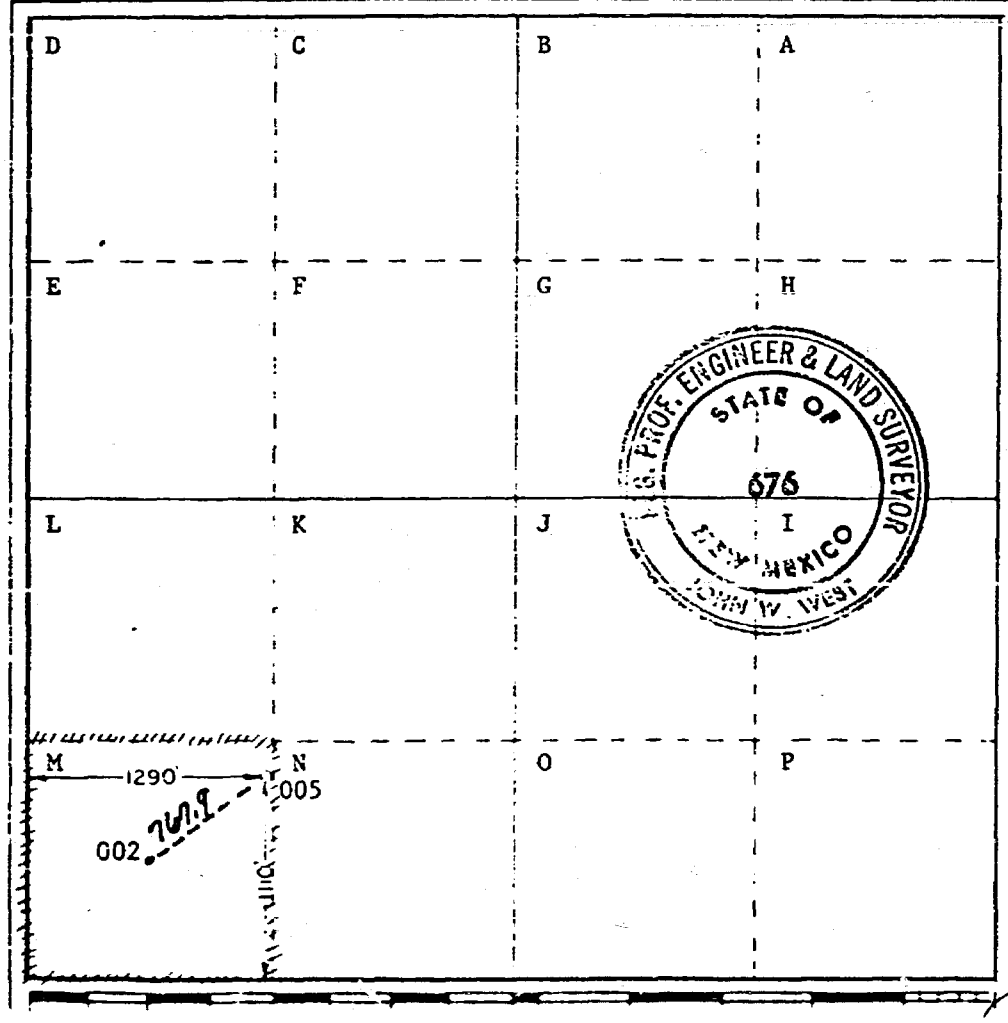
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Name

W. J. Mueller

Position

Engineering Advisor

Company

Phillips Petroleum Co.

Date

January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Date Surveyed

January 3, 1979

Registered Professional Engineer and/or Land Surveyor

John W West

Certificate No. John W West 676

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OPERATOR		

NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease STATE [X] FEE [ ]

5. State Oil & Gas Lease No. A-1320

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]
OIL WELL [X] GAS WELL [ ] OTHER SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract No. 3202

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 001

3. Address of Operator: Room 401, Phillips Building, 4001 Penbrook, Odessa, TX 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER I LOCATED 1330 FEET FROM THE South LINE AND 1310 FEET FROM THE East LINE OF SEC. 32 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth	19A. Formation	20. Rotary or C.T.
4900	Grayburg/San Andres	Rotary

21. Elevations (Show whether DF, RT, etc.)	21A. Kind & Status Plug. Bond	21B. Drilling Contractor	22. Approx. Date Work will start
3955.3' Ground (unprepared)	Blanket	Advise later	Upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13 3/8"	48#, H-40	350'	(675 sx class H w/2% $CaCl_2$ & (¼# Flocele/sx in 1st 150 sx)	Circ at Surface
12¼" x 8 5/8"	7"	23#, K-55	4900'	(Suffidient TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonit /sx, following by 260 sx class H cement w/8# salt/sx to circulate at surface.)	

(This well is the same proration Unit as Well No. 004)

NOTE: If excessive waterflow is encountered in salt section, 9 5/8" 40#, N80 intermediate casing will be set at approximately 3015'; cemented to surface with cement of quality adequate to control waterflow and protect casing string.

RE: N.M.O.C.D. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original location approved within, Order (3) was 1310' FS and 1330' FE lines of the above section. (Conf. Telecon Mcl--Ramey 1-22-79)

BOP: Series 900, 3000# WP, double w/one set pipe and one set blind rams.

Use mud additives as required for control.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W. J. Mueller Title Engineering Advisor Date January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E,V,G,S,A,U, Tract 3202	001

Unit Letter	Section	Township	Range	County
I	32	17 South	35 East	Lea

Actual Footage Location of Well:
1330 feet from the South line and 1310 feet from the East line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
3955.3	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

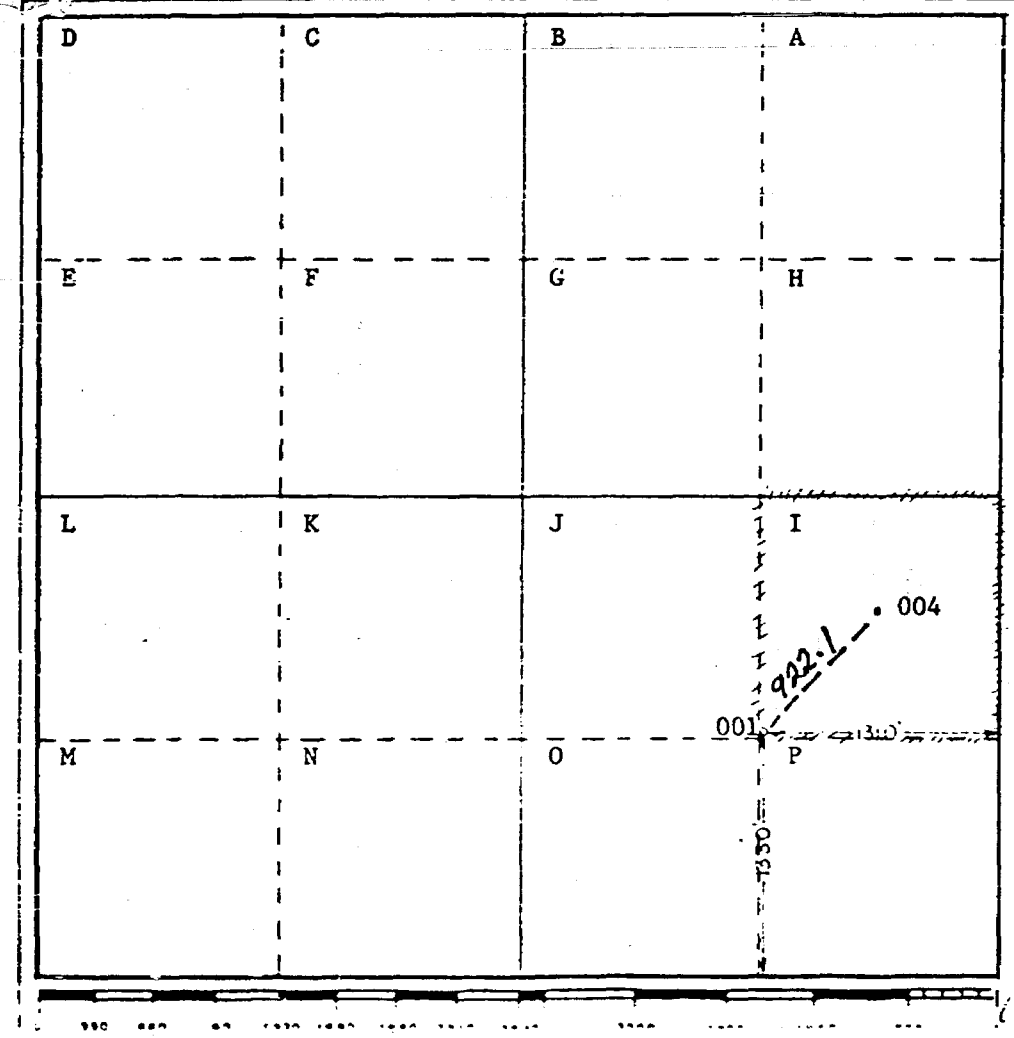
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

ENGINEER & LAND SURVEYOR
NEW MEXICO
JOHN W. WEST

I hereby certify that the location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Date Surveyed: December 29, 1978

Registered Professional Engineer and/or Land Surveyor

John W. West

Certificate No. John W. West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: A-1320

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work:

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]

OIL WELL [X] GAS WELL [ ] OTHER SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3202

2. Name of Operator: PHILLIPS PETROLEUM COMPANY

9. Well No.: 003

3. Address of Operator: ROOM 401, 4001 PENBROOK STREET, ODESSA, TEXAS 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER B LOCATED 1180 FEET FROM THE North LINE AND 1480 FEET FROM THE East LINE OF SEC. 32 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3965.4' Ground (Unprepared)

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Advise Later

22. Approx. Date Work will start: Upon Approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17-1/2"	13-3/8"	48#-H-40	350' (675 sx Cl H w/2% CaCl, & 1/4# Flocele/sx in 1st 150 sx)		circ to surfac
12-1/4" x 8-5/8"	7"	23#, K-55	4900' (suff TRLW w/12# salt/sx w/10% DD and ½# sx Flocele plus 3# Gilsonite/sx followed by 260 sx Cl H cement w/8# salt/sx to circ at surface).		

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3010'; cemented to surface w/cement of quality adequate to control waterflow & protect casing string.

RE: N.M.O.C.D. Order No. 5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original loc approved within Order (3) was 1330' FN&E lines of the above sec. (Confirming telecon McL/Ramey 1-22-79)

(This well is in same proration unit as Well No. 033)

Use Mud Additives as Required for Control.

BOP: Series 900,3000# WP, double w/one set pipe rams and one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Name: R. J. Mueller Title: Engineering Advisor Date: January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator: Phillips Petroleum Company		Lease: E.V.G.S.A.U.B. Tract 3202	Well No.: 003
Unit Letter: B	Section: 32	Township: 17 South	Range: 35 East
County: Lea			
Actual Footage Location of Well: 1180 feet from the North line and 1480 feet from the East line			
Ground Level Elev.: 3965.4	Producing Formation: Grayburg/San Andres	Pool: Vacuum Grayburg/San Andres	Dedicated Acreage: 40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

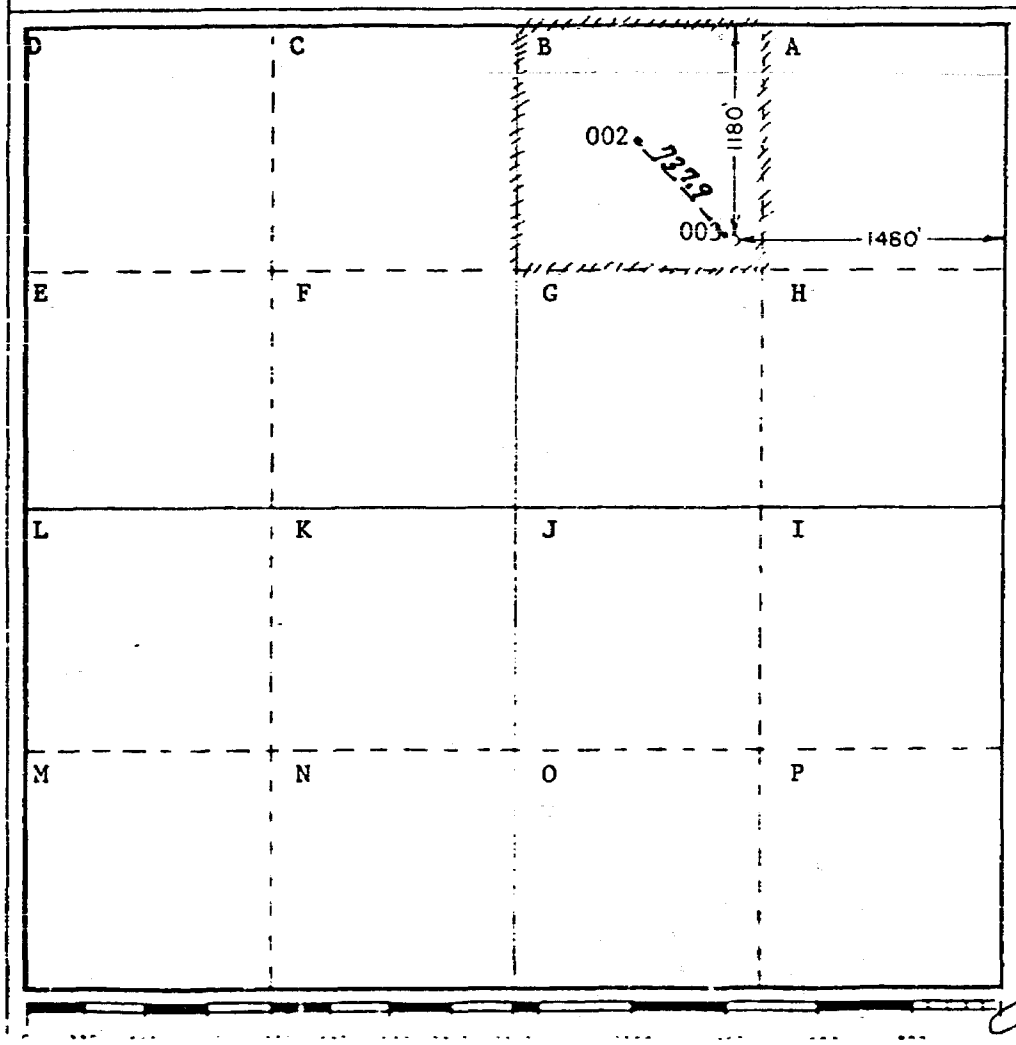
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no" list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

U.S. NEW MEXICO JOHN W. WEST

Date Surveyed: December 29, 1978

Registered Professional Engineer and/or Land Surveyor

Certificate No. John W West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease STATE [X] FEE [ ]

5. State Oil & Gas Lease No. B-1565-2

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well DRILL [X] DEEPEN [ ] PLUG BACK [ ]

OIL WELL [X] GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3328

2. Name of Operator: Phillips Petroleum Company

9. Well No. 002

3. Address of Operator: 4001 Penbrook Street, Odessa, Texas 79762 Room 401

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andr

4. Location of Well: UNIT LETTER M LOCATED 1310 FEET FROM THE South LINE AND 1160 FEET FROM THE West LINE OF SEC. 33 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3950.6' Ground (unprepared)

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Advise later

22. Approx. Date Work will start: upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13 3/8"	48#-H-40	350'	(675 sx class H w/2% $CaCl_2$ & ¼# Flocele/sx in 1st 150 sx)	Circ at surface
12¼" x 8 5/8"	7"	23#, K-55	4900'	(Sufficient TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx class H cement w/8# salt/s to circulate at surface.)	

(This well is in the same proration unit as Well No. #1)

NOTE: If excessive waterflow is encountered in salt section, 9 5/8", 40#, N-80 intermediate casing will be set at approximately 3060'. Cemented to surface w/cement of quality adequate to control waterflow and protect casing string.

RE: N.M.O.C.D. Order No. R-5897: Adminstrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original location provided within Order (3) was 1310 from south and west lines of the above section. (Conf. Telecon Mcl--Ramey 1-22-79)

Use mud additives as required for control

BOP: Series 900, 3000# WP, double w/one set pipe rams and one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. IF PROPOSAL IS TO DRILL OR DEEPEN DIRECTIONALLY, GIVE PERTINENT DATA ON SUBSURFACE LOCATIONS AND MEASURED AND TRUE VERTICAL DEPTHS. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information given above is true and complete to the best of my knowledge and belief.

Signed W. J. Mueller Engineering Advisor Date January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION
WELL LOCATION AND ACREAGE DEDICATION PLAT

Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Phillips Petroleum Company		E.V.G.S.A.U. M-3328		002
M	33	17 South	35 East	Lea
1310	South	1160	West	
3950.6	Grayburg/San Andres	Vacuum Grayburg/San Andres		40

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

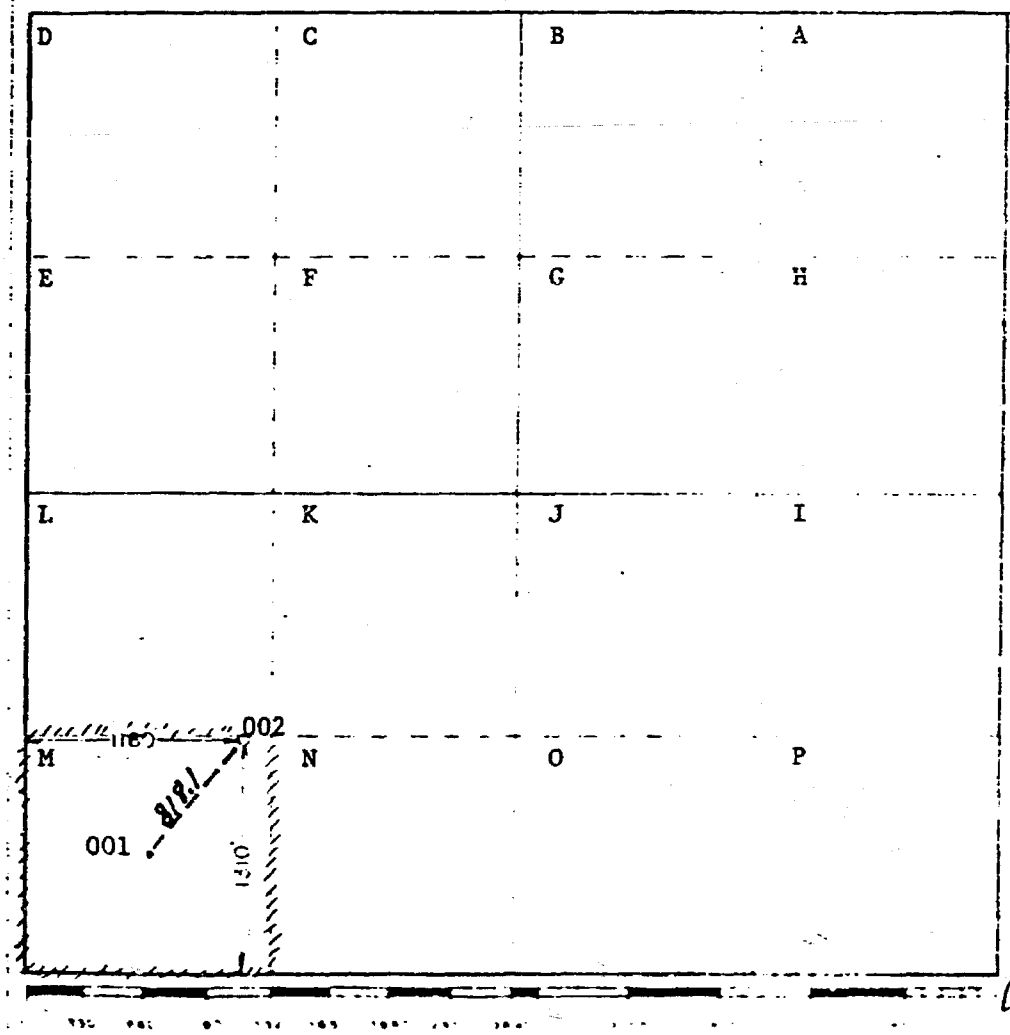
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling etc.

Yes No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

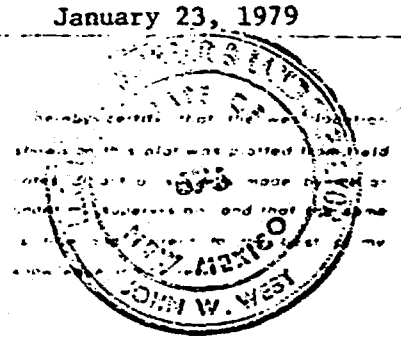
I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Engineering Advisor

Phillips Petroleum Co.

January 23, 1979



December 29 1978

John W West

John W West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: B-1334

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work
b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]
GAS WELL [X] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit
8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3308

2. Name of Operator: PHILLIPS PETROLEUM COMPANY

9. Well No.: 003

3. Address of Operator: ROOM 401, 4001 Penbrook St., Odessa, Texas 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER C LOCATED 1150 FEET FROM THE North LINE AND 1510 FEET FROM THE West LINE OF SEC. 33 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'
19A. Formation: Grayburg/San Andres
20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3939.4' Ground (unprepared)
21A. Kind & Status Plug. Bond: Blanket
21B. Drilling Contractor: Advise Later
22. Approx. Date Work will start: Upon Approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17 ½"	13-3/8"	48#-H-40	350'	(675 sx. Cl H w/2% CaCl2) (1/4# Flocele/sx. in 1st 150 sx)	circ to surface
12 ¼" x 8-5/8"	7"	23#, K-55	4900'	(sufficient TRLW w/12# salt/sx w/10% DD and ¼#/sx flocele plus 3# Gilsonite/sx followed by 260 sx Class H cement w/8# salt/sx to circulate at surface.)	

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3010'; cemented to surface w/cement of quality adequate to control water flow and protect casing string.

Re-NMOCD Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4)- location herein is required due to topographical conditions which also required new tract and well number. Original location and well as specified in Order (3) was: Tract 3366, well no. 001, located 1330'FN and 1310' F W lines, above section. Confirming telecon McLemore/Ramey of 1-22-79.

(This well is in the same proration unit as well #2)

Use mud additives as required for control.

BOP: Series 900, 3000# WP, double w/one set pipe rams & one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed: L. J. Mueller Title: Engineering Advisor Date: January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION
WELL LOCATION AND ACREAGE DEDICATION PLAT

Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the section

Operator: Phillips Petroleum Company	Lease: E.V.G.S.A.U. C Tract 3308		Well No.: 003
Unit Letter: C	Section: 33	Township: 17 South	Range: 35 East
County: Lea			
Actual Footage Location: 1150 feet from the North line and 1510 feet from the West line			
Ground Level Elev.: 3939.4	Producing Formation: Grayburg/San Andres	Pool: Vacuum Grayburg/San Andres	Dedicated Acreage: 40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

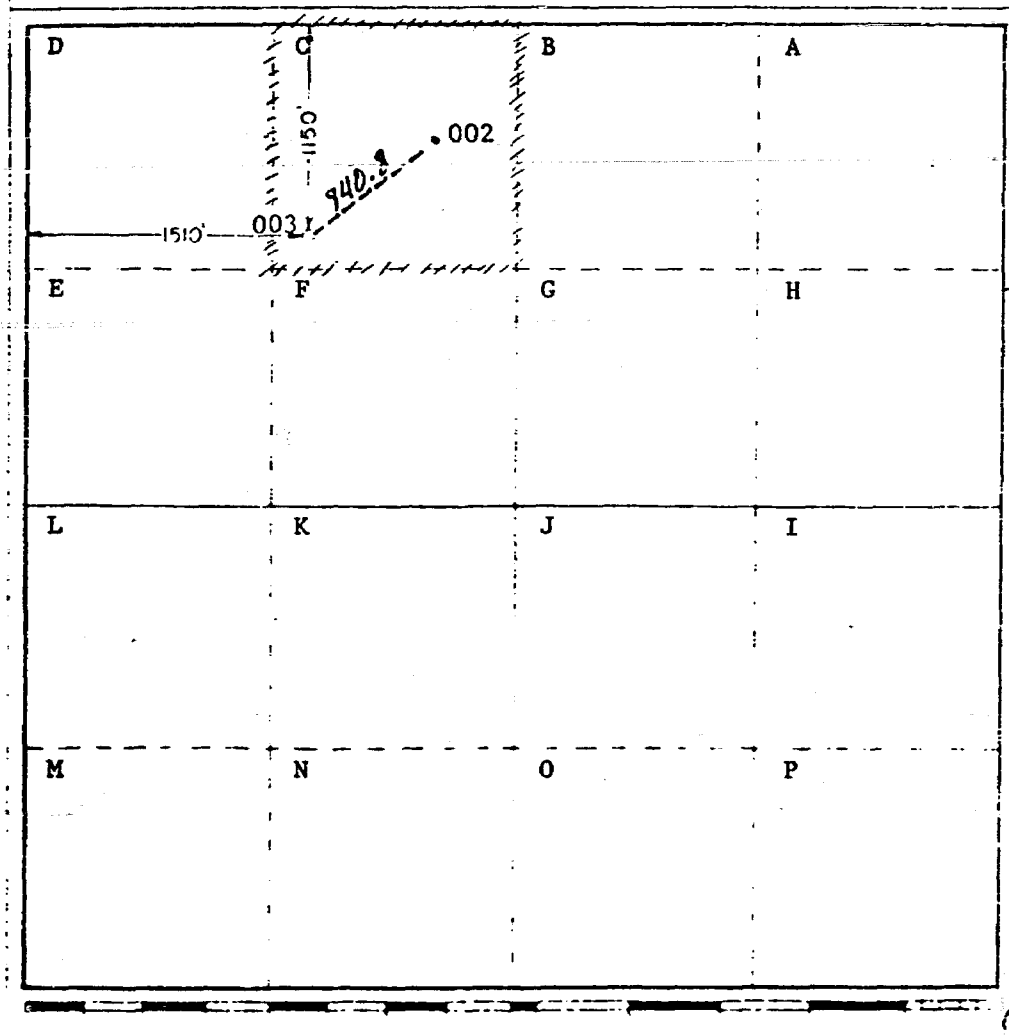
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Engineering Advisor

Phillips Petroleum Co.

January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge, information and belief.

REG. PROF. ENGINEER & LAND SURVEYOR
STATE OF NEW MEXICO
676
JOHN W. WEST

December 29, 1978

John W. West

John W. West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: B-1713

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]

OIL WELL [X] GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3333

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 004

3. Address of Operator: Room 401, 4001 Penbrook Street, Odessa, Texas 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andr

4. Location of Well: UNIT LETTER H LOCATED 1380 FEET FROM THE North LINE AND 1280 FEET FROM THE East LINE OF SEC. 33 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3939.0' Ground (unprepared)

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Advise later

22. Approx. Date Work will start: upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13 3/8"	48#, H-40	350'	(675 sx class H w/2% CaCl, &) Circ to (¼# Flocele/sx in 1st 150 sx)	Surface
12¼" x 8 5/8"	7"	23#, K-55	4900'	(Sufficient TRLW w/12# DD and ¼#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx class H cement w/8# salt/s to circulate at surface)	Salt/sx w/10%

(This well is in the same proration unit as well No. 201)

NOTE: If excessive waterflow is encountered in salt section, 9 5/8" 40# N80 intermediate casing will be set at approximately 3030'; cemented to surface w/cement of quality adequate to control waterflow and protect casing string.

RE: N.M.O.C.D. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original location approved within order (3) was 1330' FN and East lines of the above section.

Use mud additives as required for control.

BOP: Series 900, 3000# WP, double w/one set pipe rams and one set blind rams. (Conf. Telecon Mcl--Ramey 1-22-79)

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W. J. Mueller Engineering Advisor Date January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E.V.G.S.A.U. G Tract 3333	004

Unit Letter	Section	Township	Range	County
H	33	17 South	35 East	Lea

Actual Footage Location of Well:
1380 feet from the North line and 1280 feet from the East line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
3939.0	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

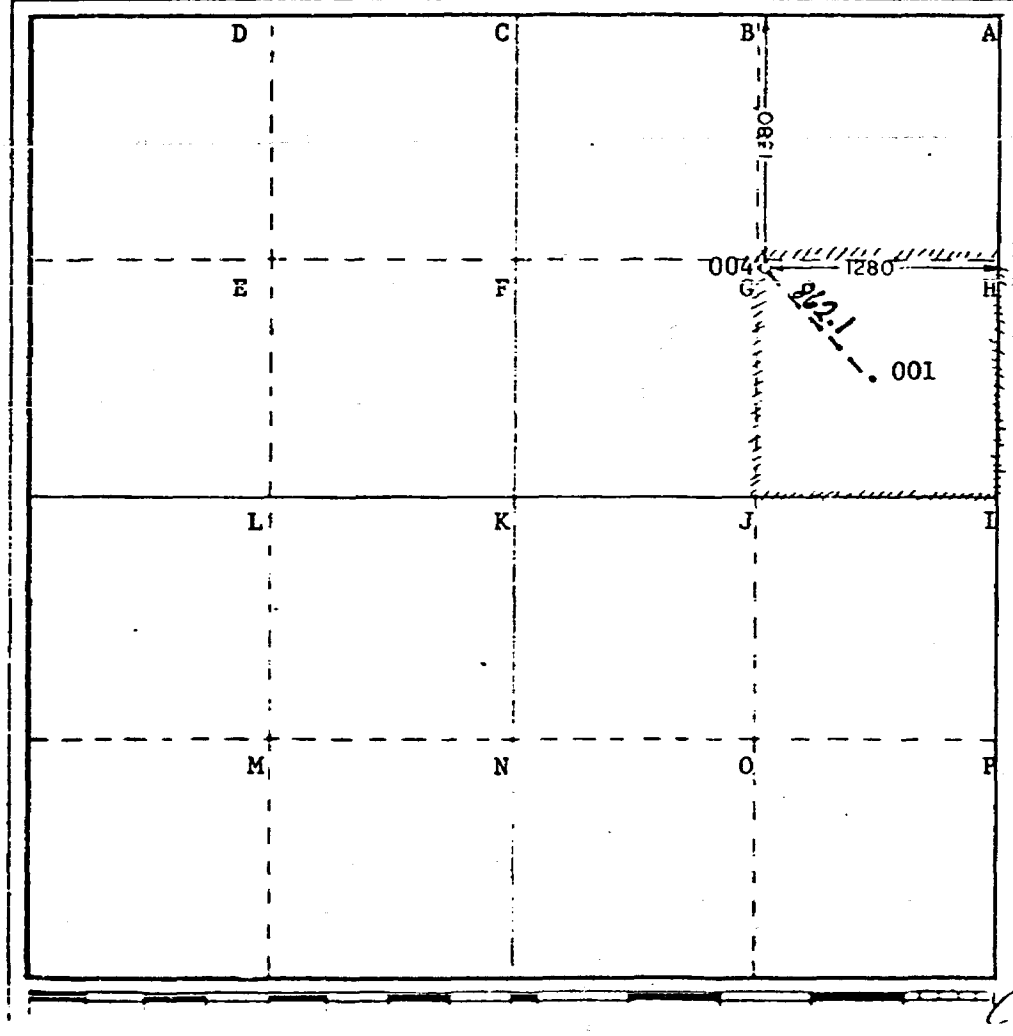
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name
W. J. Mueller

Position
Engineering Advisor

Company
Phillips Petroleum Co.

Date
January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

ENGINEER & LAND SURVEYOR
STATE OF NEW MEXICO
676

Date Surveyed
January 3, 1979

Registered Professional Engineer
and/or Land Surveyor

John W. West

Certificate No. John W. West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease STATE [X] FEE [ ]

5. State Oil & Gas Lease No. B-2273

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well DRILL [X] DEEPEN [ ] PLUG BACK [ ]
OIL WELL [X] GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3456

2. Name of Operator: PHILLIPS PETROLEUM COMPANY

9. Well No. 005

3. Address of Operator: ROOM 401, 4001 PENBROOK STREET, ODESSA, TEXAS 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well UNIT LETTER C LOCATED 1030 FEET FROM THE North LINE AND 1410 FEET FROM THE West LINE OF SEC. 34 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'
19A. Formation: Grayburg/San Andres
20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3933.6' Ground (unprepared)
21A. Kind & Status Plug. Bond: Blanket
21B. Drilling Contractor: Advise Later
22. Approx. Date Work will start: Upon Approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17-1/2"	13-3/8"	48#-H-40	350' (675 sx Cl H w/2% CaCl, circ to surf. (1/4# Flocele/sx in lst 150 sx)		
12-1/4" x 8-5/8"	7"	23#, K-55	4900' (sufficient TRLW w/12# Salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx Cl H cement w/8# salt/sx to circulate at surface).		

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3070' cemented to surface w/cement of quality adequate to control waterflow & protect casing string.

Re: N.M.O.C.D. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original location approved within, Order (3) was 1330' FN and 1310' FW lines of the above section.(Conf. Telecon McL-Ramey of 1-22-79).

(This well is in the same proration unit as Well No. 001)

Use Mud Additives as required for control.

BOP: Series 900,3000# WP, double w/one set pipe rams and one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W. J. Mueller Engineering Advisor Date January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E,V,G,S,A,U, C Tract 3456	005

Unit Letter	Section	Township	Range	County
C	34	17 South	35 East	Lea

Actual Footage Location of Well:
1030 feet from the North line and 1410 feet from the West line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage
3933.6	Grayburg/San Andres	Vacuum Grayburg/San Angres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

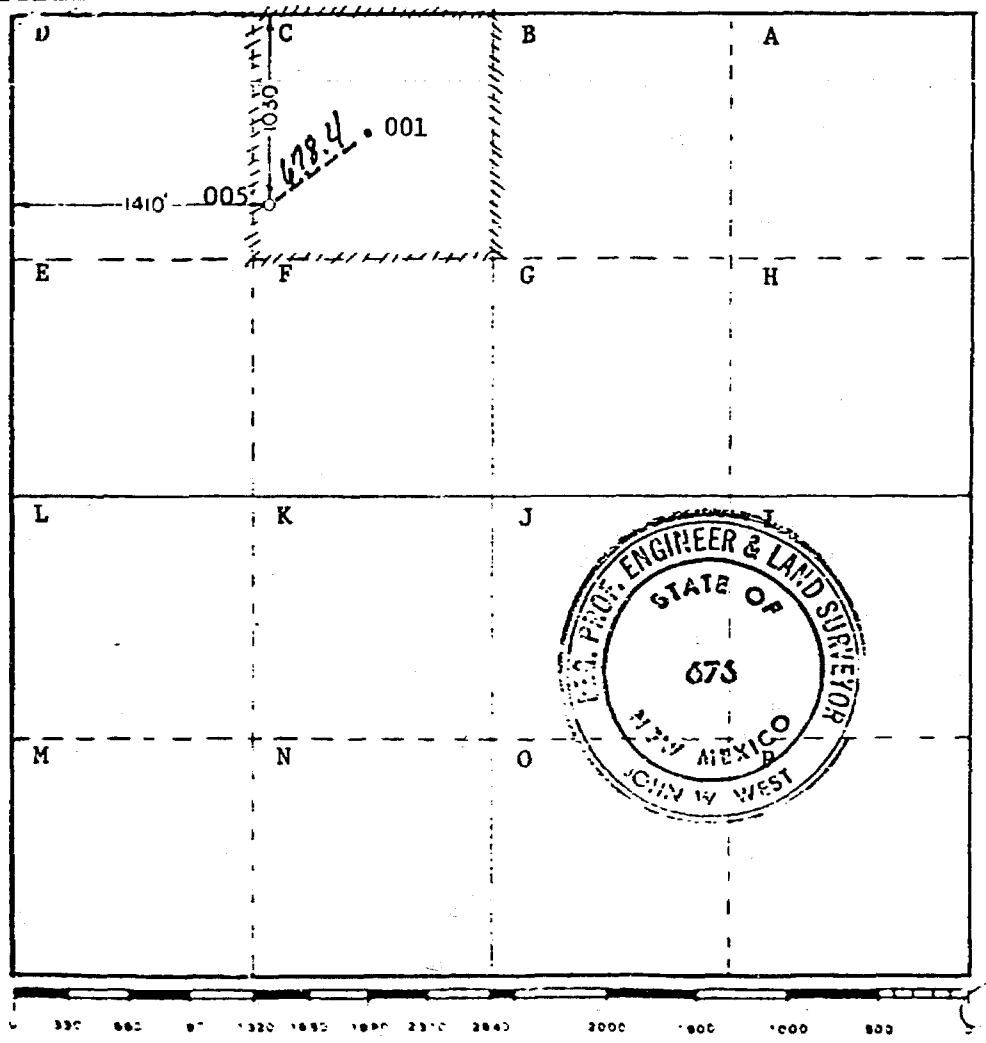
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief

Name: W.J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief

Date Surveyed: January 3, 1979

Registered Professional Engineer and/or Land Surveyor

Certificate No. John W West 676
Ronald J Eidson 3239

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OPERATOR

NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: A-1320

APPLICATION FOR PERMIT TO DRILL, DEEPEN OR PLUG BACK

1a. Type of Work

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]

OIL [X] GAS [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 2801

2. Name of Operator: PHILLIPS PETROLEUM COMPANY

9. Well No.: 002

3. Address of Operator: ROOM 401, 4001 Penbrook Street, ODESSA, TEXAS 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER M LOCATED 1140 FEET FROM THE South LINE AND 1310 FEET FROM THE West LINE OF SEC. 28 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3950.3' Ground (unprepared) blanket

21A. Kind & Status Plug. Bond:

21B. Drilling Contractor: advise later

22. Approx. Date Work will start: upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17-1/2"	13-3/8"	48#-H-40	350'	(675 sx Cl H w/2% $CaCl_2$ & (1/4# Flocele/sx in 1st 150/sx)	circ to surface
12-1/4" x 8-5/8"	7"	23#, K-55	4900'	(suff. TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx follwd by 260 sx Cl H cement w/8# salt/sx to circ at surface).	

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3030' cemented to surface w/cement of quality adequate to control waterflow & protect casing string.

(This well is in the same proration unit as well no. 008)

Use Mud Additives as Required for Control

Re:NMOCD Order No R-5897: Administrative approval requested as provided by Rule 8 of Order (4) the location herein is required due to topographical circumstances. The orig. loc. approved within Order (3) was 1310' FS & W lines of the above section. (Conf. Telecon McL-Ramey 1-22-79)

BOP: Series 900,3000# WP, double w/one set pipe rams and one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Name: N. J. Mueller Title: Engineering Advisor Date: January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the section

Operator	Lease	Well No.
Phillips Petroleum Company	E,V,G,S,A,U, M Tract 2801	002

Unit Letter	Section	Township	Range	County
M	28	17 South	35 East	Lea

Actual Footage Location of Well:				
1140	feet from the South	line and	1310	feet from the West line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
3950.3	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

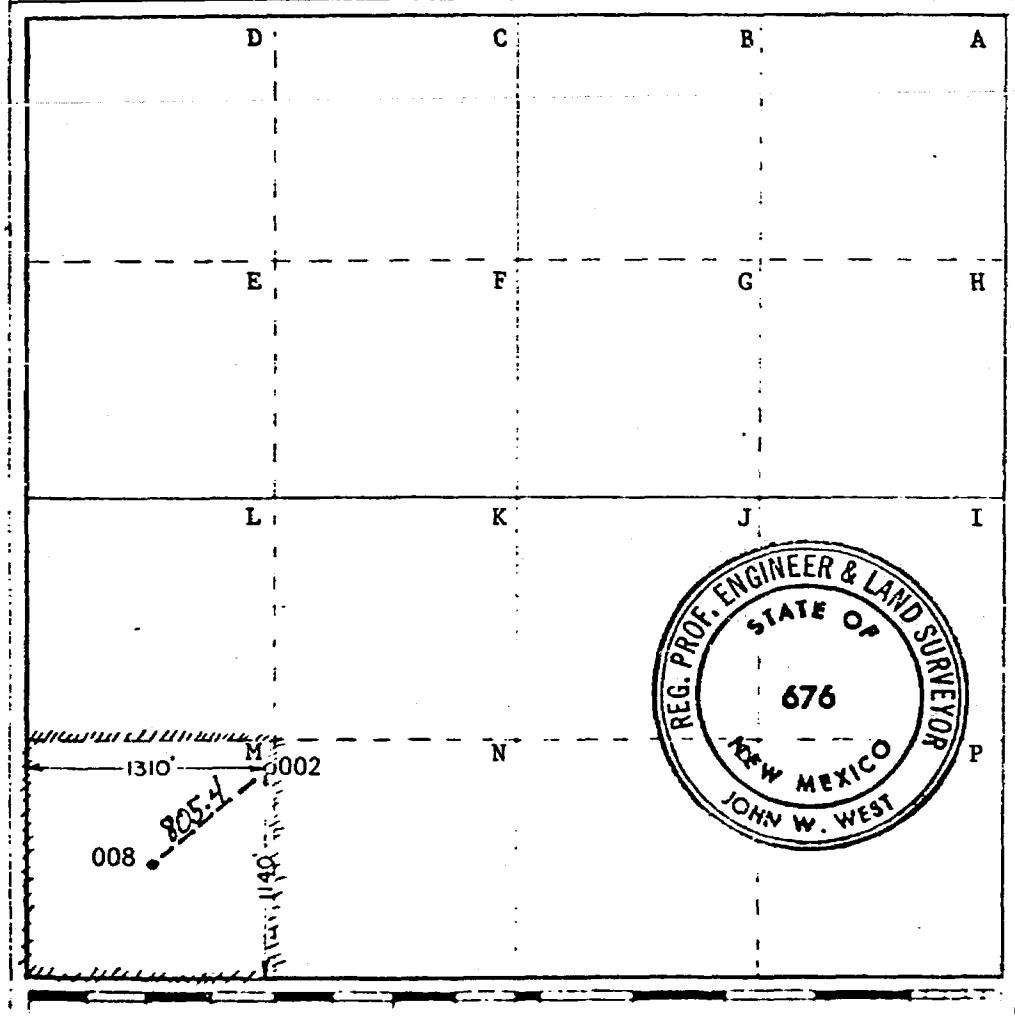
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling etc.?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Date Surveyed: January 5, 1979

Registered Professional Engineer and/or Land Surveyor

Certificate No. John W. West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: A-1320

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work
b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]
OIL WELL [X] GAS WELL [ ] OTHER SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 2801

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 004

3. Address of Operator: Room 401, 4001 Penbrook St., Odessa, Tx 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER 0 LOCATED 1310 FEET FROM THE South LINE AND 1330 FEET FROM THE East LINE OF SEC. 28 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth	19A. Formation	20. Rotary or C.T.
4900'	Grayburg/San Andres	Rotary

21. Elevations (Show whether DF, RT, etc.)	21A. Kind & Status Plug. Bond	21B. Drilling Contractor	22. Approx. Date Work will start
3942.7'Ground(unprepared)	Blanket	Advise later	Upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13-3/8"	48#--H-40	350'(675 sx Class H w/2% CaCl, & ¼# Flocele/sx in 1st 150 sx)		circ.at surfac
12¼" X 8-5/8"	7"	23#, K-55	4900' (Sufficient TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx Class H cement w/8# salt/sx to circulate at surface.)		

(This well is in the same proration unit as Well No. 010.)

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3025'; cemented to surface w/cement of quality adequate to control waterflow and protect casing string.

RE: N.M.O.C.D. Order No. R-5897 confirming Administrative approval requested as provided by Order (3).

Use mud additives as required for control.

BOP: Series 900, 3000# WP, double w/one set pipe rams & one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W.J. Mueller Title Engineering Advisor Date 1-22-79

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator: Phillips Petroleum Company			Lease: E,V.G,S,A,U, D Tract 2801	Well No.: 004
Unit Letter: O	Section: 28	Township: 17 South	Range: 35 East	County: Lea
Actual Footage Location of Well: 1310 feet from the South line and 1330 feet from the East line				
Ground Level Elev.: 3942.7	Producing Formation: Grayburg/San Andres		Pool: Vacuum Grayburg/San Andres	Dedicated Acreage: 40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

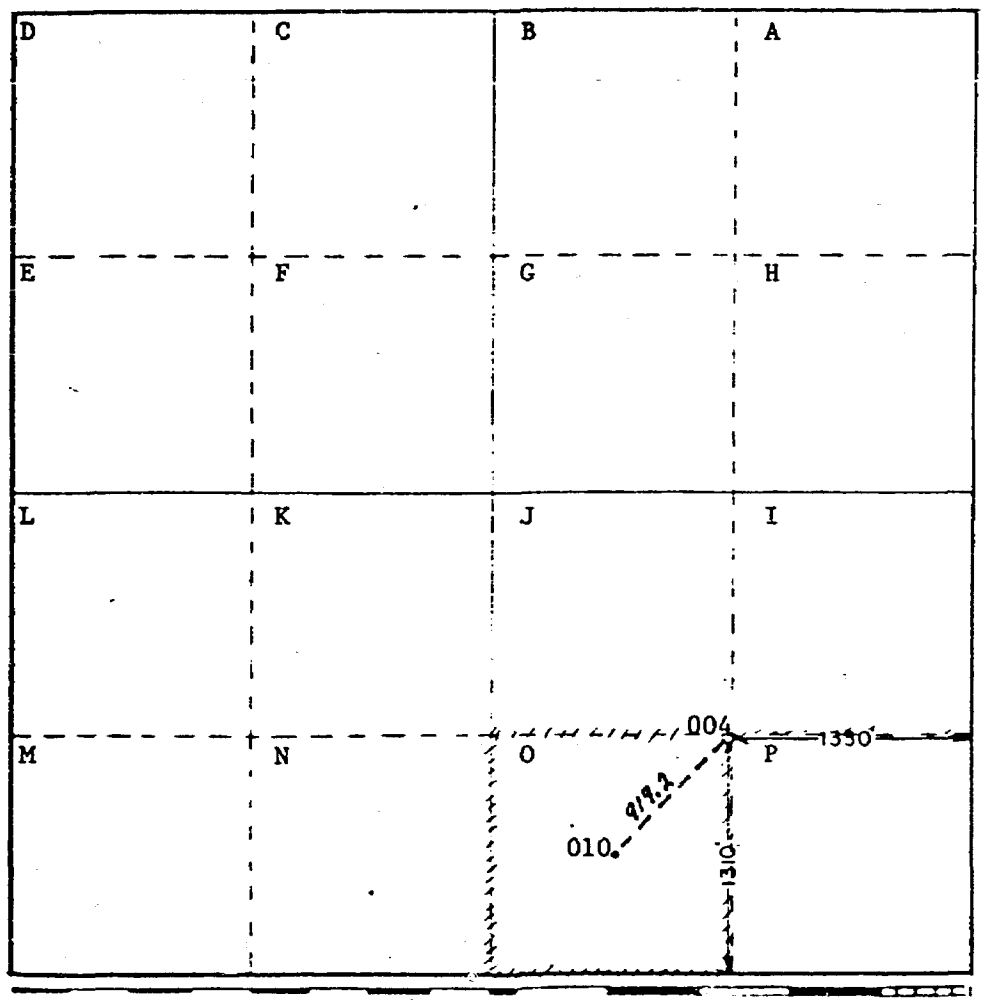
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

STATE OF NEW MEXICO — REGISTERED PROFESSIONAL ENGINEER & LAND SURVEYOR

Date Surveyed: January 3, 1979

Registered Professional Engineer and/or Land Surveyor

John W. West

Certificate No. John W. West 676

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OPERATOR

NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: B-1840

APPLICATION FOR PERMIT TO DRILL, DEEPEN OR PLUG BACK

1a. Type of Work

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]

OIL WELL [X] GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 2739

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 005

3. Address of Operator: Room 401, 4001 Penbrook St., Odessa, Tx 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER K LOCATED 1330 FEET FROM THE South LINE AND 1380 FEET FROM THE West LINE OF SEC. 27 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3938.7' Ground (unprepared)

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Advise later

22. Approx. Date Work will start: Upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13-3/8"	48# - H-40	350' (675 sx Class H w/2% CaCl2) (1/4# Flocele/sx in 1st 150 sx.)	circ. to surface	
12¼" X 8-5/8"	7"	23#, K-55	4900' (sufficient TRLW w/12# salt/sx w/10% DD and 1/4#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx Class H cement w/8# salt/sx to circulate at surface.)		

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3030'; cemented to surface w/cement of quality adequate to control waterflow & protect casing string.

RE: NMOCD Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). Location herein is required due to topographical conditions which also required new tract & well number. Original location and well as specified in Order (3) was: Tract 2721, Well No. 001, located 1310'FS and w/lines of above section. Confirms telecon McLemore/Ramey 1-22-79.

(This well is in the same proration unit as well No. 001)

Use mud additives as required for control.

BOP: Series 900,3000# WP, double w/one set pipe rams & one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W.J. Mueller Name W.J. Mueller Title Engineering Advisor Date 1-22-79

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator: Phillips Petroleum Company		E.V.G.S.A.U. M Tract 2739	Well No.: 005
Unit Letter: K	Section: 27	Township: 17 South	Range: 35 East
County: Lea			
Actual Footage Location: 1330 feet from the South line and 1380 feet from the West line			
Ground Level Elev.: 3938.7	Producing Formation: Grayburg/San Andres	Pool: Vacuum Grayburg/San Andres	Dedicated Acreage: 40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

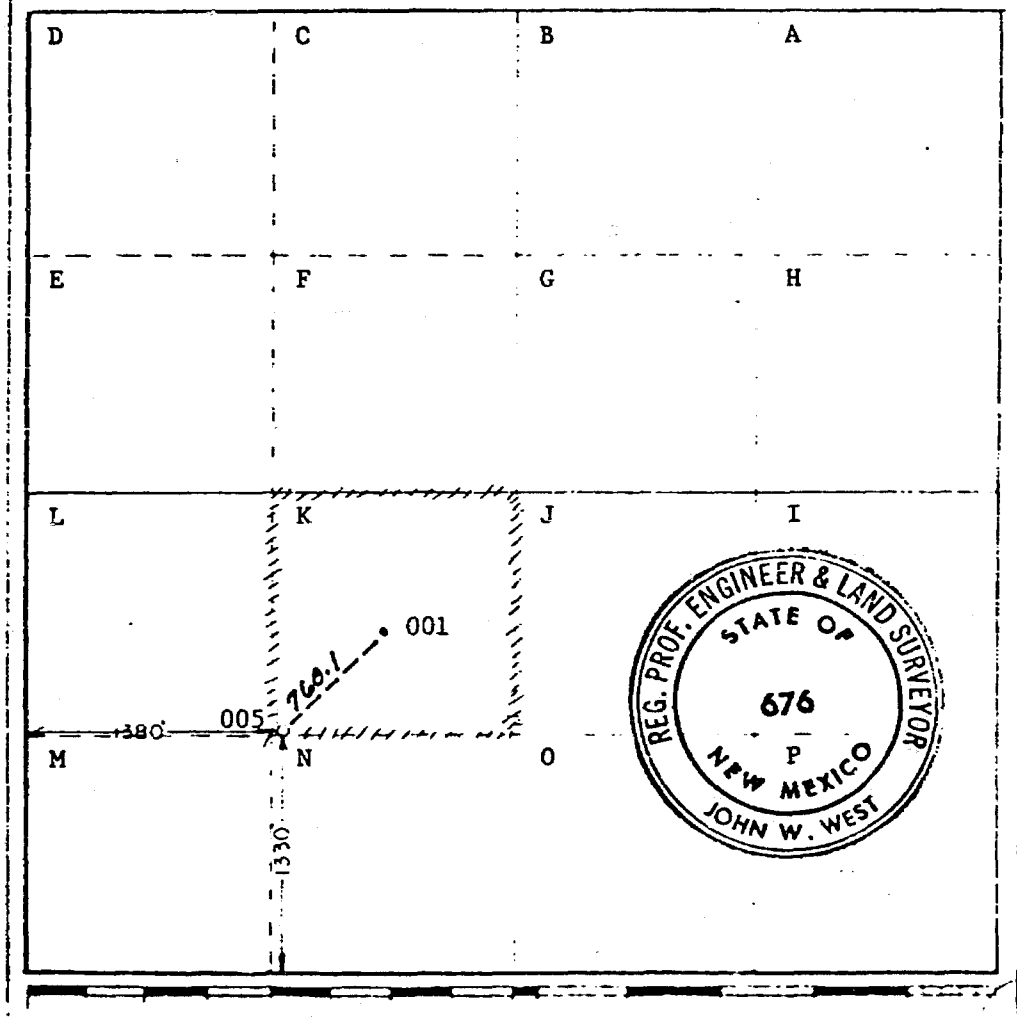
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, forced-pooling.etc?

☐ Yes ☐ No If answer is "yes" type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Engineering Advisor

Phillips Petroleum Co.

January 23, 1979

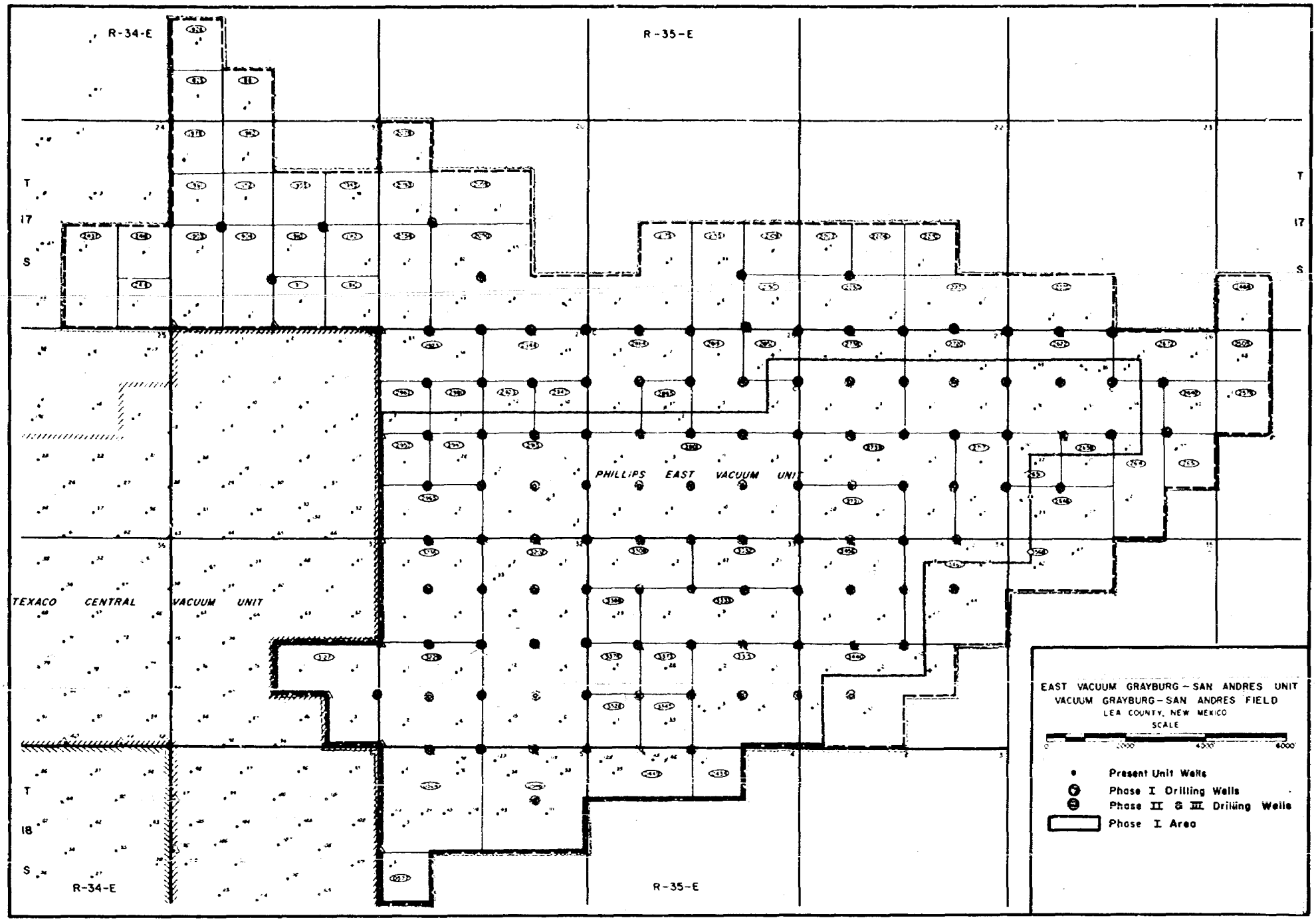
I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

January 3, 1979

Date Surveyed

John W West

Certificate No. John W West 676


R-34-E
R-35-E
T
17
S
PHILLIPS EAST VACUUM UNIT
TEXACO CENTRAL VACUUM UNIT
T
18
S
R-34-E
R-35-E
EAST VACUUM GRAYBURG - SAN ANDRES UNIT
VACUUM GRAYBURG - SAN ANDRES FIELD
LEA COUNTY, NEW MEXICO
SCALE
0
2000
4000
6000
Present Unit Wells
Phase I Drilling Wells
Phase II & III Drilling Wells
Phase I Area

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
DIVISION FOR THE PURPOSE OF
CONSIDERING:

CASE NO. 6366
Order No. R-5871

APPLICATION OF PHILLIPS PETROLEUM
COMPANY FOR STATUTORY UNITIZATION,
LEA COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 9 a.m. on October 25, 1978, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 27th day of November, 1978, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Division has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Phillips Petroleum Company, seeks the statutory unitization, pursuant to the "Statutory Unitization Act," Sections 65-14-1 through 65-14-21, NMSA, 1953 Compilation, of 7,025.3 acres, more or less, of State lands, being a portion of the Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, and approval of the plan of unitization and the proposed operating plan.

(3) That the proposed unit area would be designated the East Vacuum Grayburg-San Andres Unit Area; that the vertical limits of said unit area would be the subsurface formation commonly known as the Grayburg-San Andres formation identified between the depths of 4,050 feet (103 feet sub-sea) and 5,050 feet (1103 feet sub-sea) on the Lane Wells Acoustilog, Run No. 1, dated April 14, 1964, in Exxon's New Mexico State "K" Well No. 19, located in the SE/4 SE/4 of Section 28, Township 17 South, Range 35 East, NMPM, Lea County, New Mexico, and is to include all subsurface points throughout the Unit area correlative to those identified depths, and that the unit area would comprise the following described lands:

TOWNSHIP 17 SOUTH, RANGE 34 EAST, NMPM
Section 24: SE/4

TOWNSHIP 17 SOUTH, RANGE 35 EAST, NMPM
Section 18: W/2 SW/4 and SE/4 SW/4
Section 19: W/2, S/2 NE/4, and SE/4
Section 20: W/2 NW/4, SE/4 NW/4, SW/4, SW/4 NE/4, W/2 SE/4 and SE/4 SE/4
Section 21: SW/4 SW/4, E/2 SW/4, and SE/4
Section 22: SW/4, W/2 SE/4, and SE/4 SE/4
Section 23: S/2 SW/4
Section 24: SW/4 SW/4
Section 25: W/2 NW/4
Section 26: N/2, SW/4, W/2 SE/4, and NE/4 SE/4
Sections 27, 28, and 29: All
Section 31: N/2 SE/4 and SE/4 SE/4
Sections 32 and 33: All
Section 34: N/2, SW/4, and NW/4 SE/4
Section 35: N/2 NW/4

TOWNSHIP 18 SOUTH, RANGE 35 EAST, NMPM
Section 4: N/2 NW/4 and NW/4 NE/4
Section 5: N/2 and NW/4 SW/4

(4) That the portion of the Vacuum Grayburg-San Andres Pool proposed to be included in the aforesaid East Vacuum Grayburg-San Andres Unit Area has been reasonably defined by development.

(5) That the applicant proposes to institute a pressure maintenance project for the secondary recovery of oil and gas in the proposed unit area.

(6) That the unitized management, operation and further development of the subject portion of the Vacuum Grayburg-San Andres Pool, as proposed, is reasonably necessary in order to effectively carry on secondary recovery operations and to substantially increase the ultimate recovery of oil from the pool.

(7) That the proposed unitized method of operation as applied to the East Vacuum Grayburg-San Andres Unit Area is feasible, will prevent waste, and will result with reasonable probability in the increased recovery of substantially more oil from the pool than would otherwise be recovered.

(8) That the estimated additional costs of such operations will not exceed the estimated value of the additional oil so recovered plus a reasonable profit.

(9) That such unitization and adoption of the proposed unitized method of operation will benefit the working interest owners and royalty owners of the oil and gas rights within the East Vacuum Grayburg-San Andres Unit Area.

(10) That the applicant has made a good faith effort to secure voluntary unitization within the Vacuum Grayburg-San Andres Pool.

(11) That the participation formula contained in the unitization agreement allocates the produced and saved unitized hydrocarbons to the separately owned tracts in the unit area on a fair, reasonable and equitable basis, and protects the correlative rights of all owners of interest within the unit area.

(12) That applicant's Exhibits Nos. 1 and 2 in this case, being the Unit Agreement and the Unit Operating Agreement should be incorporated by reference into this order.

(13) That applicant's Exhibit No. 2 in this case, being the Unit Operating Agreement, should be amended by the addition thereto of Exhibit "G", being applicant's Exhibit No. 13 in this case and entitled "Business Ethics Policy Compliance."

(14) That the Statutory Unitization of the East Vacuum Grayburg-San Andres Unit Area, in conformance to the above findings, will prevent waste and protect correlative rights and should be approved.

IT IS THEREFORE ORDERED:

(1) That the East Vacuum Grayburg-San Andres Unit Agreement, covering 7025.3 acres, more or less, of State lands in the Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, is hereby approved for statutory unitization pursuant to the Statutory Unitization Act, Sections 65-14-1 through 65-14-21, NMSA, 1953 Compilation.

(2) That the lands covered by said East Vacuum Grayburg-San Andres Unit Agreement shall be designated the East Vacuum Grayburg-San Andres Unit Area and shall comprise:

TOWNSHIP 17 SOUTH, RANGE 34 EAST, NMPM
Section 24: SE/4

TOWNSHIP 17 SOUTH, RANGE 35 EAST, NMPM
Section 18: W/2 SW/4 and SE/4 SW/4
Section 19: W/2, S/2 NE/4, and SE/4
Section 20: W/2 NW/4, SE/4 NW/4, SW/4, SW/4 NE/4, W/2 SE/4, and SE/4 SE/4
Section 21: SW/4 SW/4, E/2 SW/4 and SE/4
Section 22: SW/4, W/2 SE/4, and SE/4 SE/4
Section 23: S/2 SW/4
Section 24: SW/4 SW/4
Section 25: W/2 NW/4
Section 26: N/2, SW/4, W/2 SE/4, and NE/4 SE/4
Sections 27, 28, and 29: All
Section 31: N/2 SE/4 and SE/4 SE/4
Sections 32 and 33: All
Section 34: N/2, SW/4, and NW/4 SE/4
Section 35: N/2 NW/4

TOWNSHIP 18 SOUTH, RANGE 35 EAST, NMPM
Section 4: N/2 NW/4 and NW/4 NE/4
Section 5: N/2 and NW/4 SW/4

(3) That the vertical limits of the East Vacuum Grayburg-San Andres Unit Area shall be the Grayburg-San Andres formation identified between the depths of 4,050 feet (103 feet sub-sea) and 5,050 feet (1103 feet sub-sea) on the Lane Wells Acoustilog, Run No. 1, dated April 14, 1964, in Exxon's New Mexico State "K" Well No. 19, located in the SE/4 SE/4 of Section 28, Township 17 South, Range 35 East, NMPM, Lea County, New Mexico, and is to include all subsurface points throughout the Unit area correlative to those identified depths.

(4) That applicant's Exhibit No. 1 in this case, being the East Vacuum Grayburg-San Andres Unit Agreement, is hereby incorporated by reference into this order.

(5) That applicant's Exhibit No. 2 in this case, being the East Vacuum Grayburg-San Andres Unit Operating Agreement, as amended by the addition thereto of "Exhibit G, Business Ethics Policy Compliance," being applicant's Exhibit No. 13 in this case, is hereby incorporated by reference into this order.

(6) That the East Vacuum Grayburg-San Andres Unit Agreement and the East Vacuum Grayburg-San Andres Unit Operating Agreement provide for unitization and unit operation of the subject portion of the Vacuum Grayburg-San Andres Pool upon terms and conditions that are fair, reasonable and equitable and include:

an allocation to the separately owned tracts in the unit area of all the oil and gas that is produced from the unit area and is saved, being the production that is not used in the conduct of operations on the unit area or not unavoidably lost;

a provision for the credits and charges to be made in the adjustment among the owners in the unit area for their respective investments in wells, tanks, pumps, machinery, materials and equipment contributed to the unit operations;

a provision governing how the costs of unit operations including capital investments shall be determined and charged to the separately owned tracts and how said costs shall be paid including a provision providing when, how, and by whom the unit production allocated to an owner who does not pay the share of the costs of unit operations charged to such owner, or the interest of such owner, may be sold and the proceeds applied to the payment of such costs;

a provision for carrying any working interest owner on a limited, carried or net-profits basis, payable out of production, upon such terms and conditions determined by the Division Director to be just and reasonable, and allowing an appropriate charge for interest for such service payable out of such owner's share of production, provided that any nonconsenting working interest owner being so carried shall be deemed to have relinquished to the unit operator all of its operating rights and working interest in and to the unit until his share of the costs, service charge and interest are repaid to the unit operator;

a provision designating the unit operator and providing for the supervision and conduct of the unit operations, including the selection, removal or substitution of an operator from among the working interest owners to conduct the unit operations;

a provision for a voting procedure for the decision of matters to be decided by the working interest owners in respect to which each working interest owner shall have a voting interest equal to its unit participation; and

the time when the unit operation shall commence and the manner in which, and the circumstances under which, the operations shall terminate and for the settlement of accounts upon such termination;

and are therefore hereby adopted.

(7) That this order shall not become effective unless and until the appropriate ratification provisions of Section 65-14-8, NMSA, 1953 Compilation, are complied with.

(8) That if the persons owning the required percentage of interest in the unit area as set out in Section 65-14-8, NMSA, 1953 Compilation, do not approve the plan for unit operations within a period of six months from the date of entry of this order, this order shall cease to be of further force and effect and shall be revoked by the Division, unless the Division shall extend the time for ratification for good cause shown.

(9) That the persons owning the required percentage of interest in the unit area have approved the plan for unit operations and the interests of all persons in the unit are unitized whether or not such persons have approved the plan of unitization in writing.

(10) That jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

JOE D. RAMEY
Director

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STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:

CASE NO. 6367
Order No. R-5897

APPLICATION OF PHILLIPS PETROLEUM COMPANY FOR A PRESSURE MAINTENANCE PROJECT, LEA COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 9 a.m. on October 25, 1978, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 16th day of January, 1979, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Division has jurisdiction of this cause and the subject matter thereof.

(2) That by Division Order No. R-5871 dated November 27, 1978, statutory unitization was approved for the East Vacuum Grayburg-San Andres Unit Area, Lea County, New Mexico.

(3) That the applicant herein, Phillips Petroleum Company, seeks authority to institute a pressure maintenance project on the aforesaid East Vacuum Grayburg-San Andres Unit Area, Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, by the injection of water into the San Andres formation through 59 wells, 31 of which would be drilled in 1979 during Phase II of the Project Development Program and 28 of which would be drilled in 1980 during Phase III of the Development Program.

(4) Applicant further seeks the designation of a project area for said pressure maintenance project and the promulgation of special rules and regulations governing said project including special allowable provisions.

(5) That for Phase I of the Project Development Program, applicant proposes to drill during 1979 ten producing wells at unorthodox locations as specified below:

TRACT NO.	WELL NO.	LOCATION	UNIT	SECTION
3229	005	1310' FSL and 1310' FWL	M	32
3202	001	1310' FSL and 1330' FEL	O	32
3202	003	1330' FNL and 1330' FEL	G	32
3328	002	1310' FSL and 1310' FWL	M	33
3366	001	1330' FNL and 1310' FWL	E	33
3333	004	1330' FNL and 1330' FEL	G	33
3456	005	1330' FNL and 1310' FWL	E	34
2801	002	1310' FSL and 1310' FWL	M	28
2801	004	1310' FSL and 1330' FEL	O	28
2721	001	1310' FSL and 1310' FWL	M	27

all in Township 17 South, Range 35 East, NMPM, Lea County, New Mexico.

(6) That during Phase II of the Development Program applicant proposes to drill 18 additional producing wells, all at unorthodox locations, and during Phase III of the Program applicant proposes to drill 26 additional producing wells, also at unorthodox locations.

(7) That all of the wells referred to in Findings Nos. (3), (5) and (6) above, being 59 injection wells at unorthodox locations and 54 producing wells at unorthodox locations, together with the currently completed producing wells in the Unit Area, will provide a thorough and efficient sweep of hydrocarbons throughout the unitized area, and will result in the recovery of otherwise unrecoverable oil, thereby preventing waste.

(8) That the above-described injection and producing wells, some of which would be at unorthodox locations along the unit boundaries in accordance with lease-line agreements with operators of offsetting lands, will not impair but will protect correlative rights.

(9) That the applicant's request for the designation of a Pressure Maintenance Project for the East Vacuum Grayburg-San Andres Unit Area, and for the promulgation of special rules and regulations governing said project, is in the interest of conservation and should be approved, subject to certain provisions.

(10) That the project area should consist of those proration units within the boundary of the East Vacuum Grayburg-San Andres Unit upon which is located an injection well and any directly or diagonally offsetting proration unit which contains a producing well.

(11) That the total project area allowable should be equal to the sum of the basic project area allowable plus the water injection credit allowable.

(12) That the basic project area allowable should be equal to 80 barrels of oil per day times the number of developed 40-acre proration units in the project area.

(13) That the water injection credit allowable should be based on the following formula:

$$\text{Water Injection Credit Allowable} = \left[\frac{\text{net water injected}}{\text{basic project area allowable voidage}}\right] \times \text{basic project area allowable}$$

and should be calculated in accordance with Exhibits "A" and "B" attached hereto and by reference made a part hereof.

(14) That the project area allowable should be produced from the wells within the project area in any proportion provided that any proration unit situated on the boundary of said East Vacuum Unit which proration unit is not directly or diagonally offset by a San Andres injection well outside the Unit or on the Unit boundary should not be permitted to produce in excess of 80 barrels of oil per day.

(15) That each of the newly drilled production or injection wells in the project should be equipped with surface casing set at approximately 350 feet and cemented to the surface and with "production" casing set at total depth, approximately 4900 feet.

(16) That the "production" casing on each of said newly drilled wells should be cemented to the surface, except that in any well in which an intermediate casing string has been run to below the top of the Yates formation and cemented to the surface, the "production" casing may be cemented back into the base of the intermediate casing string.

(17) That injection should be accomplished through tubing installed in a packer set within 100 feet of the uppermost perforation. The injection tubing should be corrosion protected by a non-reactive internal lining or coating. The casing-tubing

annulus in each injection well should be filled with an inert fluid and a surface pressure gauge or approved leak detection device should be attached to the annulus.

(18) The injection wells or system should be equipped with a pressure control device or acceptable substitute which will limit the surface injection pressure to no more than 0.2 psi per foot of depth to the uppermost perforation. Provision should be made for the Division Director to administratively authorize a pressure limitation in excess of the above upon showing by the Unit Operator that such higher pressure will not result in fracturing of the confining strata.

(19) All wells within the project area should be equipped with risers or in some other acceptable manner as to facilitate the periodic testing of the bradenhead for pressure or fluid production.

(20) That provision should be made for the Division Director to authorize placing wells on injection and the drilling of injection wells and additional producing wells at orthodox and unorthodox locations anywhere within the Unit Area without notice and hearing, provided that no unorthodox location is closer than ten feet to a quarter-quarter section line nor closer than 330 feet to the unit boundary, unless such well located closer than 330 feet to the unit boundary is covered by a lease-line agreement with the operator of the lands offsetting such well or the owner of the offsetting lands has waived objection to such location in writing.

(21) That there are a number of wells within the East Vacuum Grayburg-San Andres Unit Area and on lands offsetting the unit area which have previously been plugged and abandoned in a manner which may permit waters injected into the San Andres formation to escape into other formations, including the Salado formation and the shallow fresh water-bearing formations unless remedial action is taken on said wells prior to injection in their near vicinity.

(22) That there are a number of wells within the East Vacuum Grayburg-San Andres Unit Area and on lands offsetting the unit area which penetrate the Vacuum Grayburg-San Andres Pool and are completed in deeper pay zones, but which are cased and cemented in such a manner as may permit the escape of waters injected into the San Andres formation into other formations as described above.

(23) That those wells referred to in Findings Nos. (21) and (22) above which are inadequately plugged and abandoned or are inadequately cased and cemented, or are suspected of being so, include, but are not necessarily limited to, the wells listed in Exhibit "C" attached hereto and by reference made a part hereof.

(24) That no injection at greater than hydrostatic pressure should be made into the Grayburg or San Andres formation in any well in the East Vacuum Grayburg-San Andres Unit Area within one-half mile of any well listed on Exhibit "C" attached hereto until remedial action has been taken on such well to ensure that it will not serve as an avenue of escape for injected waters or until tests have been conducted on such well or other evidence concerning such well has been presented, all establishing to the satisfaction of the Supervisor of the Hobbs District Office of the Division that remedial work on such well is unnecessary.

IT IS THEREFORE ORDERED:

(1) That the applicant, Phillips Petroleum Company, is hereby authorized to institute and operate a pressure maintenance project in the East Vacuum Grayburg-San Andres Unit Area, Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, by the injection of water into the San Andres formation through certain wells which will be administratively approved for water injection at some later date by the Division Director.

(2) That said project shall be designated the East Vacuum Unit Pressure Maintenance Project.

(3) That the following unorthodox locations are hereby approved for new producing wells which are to be drilled by the unit operator during Phase I of the Project Development Program:

TRACT NO.	WELL NO.	LOCATION	UNIT	SECTION
3229	005	1310' FSL and 1310' FWL	M	32
3202	001	1310' FSL and 1330' FEL	O	32
3202	003	1330' FNL and 1330' FEL	G	32
3328	002	1310' FSL and 1310' FWL	M	33
3366	001	1330' FNL and 1310' FWL	E	33
3333	004	1330' FNL and 1330' FEL	G	33
3456	005	1330' FNL and 1310' FWL	E	34
2801	002	1310' FSL and 1310' FWL	M	28
2801	004	1310' FSL and 1330' FEL	O	28
2721	001	1310' FSL and 1310' FWL	M	27

all in Township 17 South, Range 35 East, NMPM, Lea County, New Mexico.

(4) That Special Rules and Regulations governing the East Vacuum Unit Pressure Maintenance Project are hereby promulgated as follows:

SPECIAL RULES AND REGULATIONS
FOR THE
EAST VACUUM UNIT PRESSURE MAINTENANCE PROJECT

RULE 1. The project area of the East Vacuum Unit Pressure Maintenance Project shall consist of those proration units within the boundaries of the East Vacuum Grayburg-San Andres Unit upon which is located an injection well and any directly or diagonally offsetting proration unit which contains a producing well.

RULE 2. The project area shall receive a project area allowable, and said project area allowable shall be the sum of the basic project area allowable plus the water injection credit allowable.

RULE 3. The basic project area allowable shall be equal to 80 barrels of oil per day times the number of developed 40-acre proration units in the project area.

RULE 4. The water injection credit allowable shall be contingent upon full reservoir voidage replacement of all produced fluids and shall be based upon the following formula:

$$\text{Water Injection Credit Allowable} = \left[\frac{\text{Net Water Injected}}{\text{Basic Project Area Allowable}}\right]^{-1} \times \text{Basic Project Area Allowable}$$
$$\text{Reservoir Voidage}$$

The water injection credit allowable shall be calculated in accordance with the procedures and parameters depicted on Exhibits "A" and "B" to Order No. R-5897.

In no event shall the water injection credit allowable be less than zero, i.e., negative numbers derived from application of the above formula shall be ignored.

RULE 5. The weighted average project area reservoir pressure shall be determined prior to commencement of injection of water into the reservoir and at least annually thereafter. The weighted average project area pressure shall be determined from the pressures in at least ten representative wells selected by the unit operator and the Supervisor of the Hobbs District Office of the Division.

RULE 6. The project area allowable may be produced from the wells within the project area in any proportion provided, however, that any proration unit situated on the boundary of the East Vacuum Unit which proration unit is not directly or diagonally offset by a San Andres injection well outside said East Vacuum Unit or on the East Vacuum Unit boundary shall not be permitted to produce in excess of 80 barrels of oil per day.

RULE 7. Those wells within the East Vacuum Unit Area that are not included within the project area as defined above shall be prorated in accordance with the Rules and Regulations of the Division.

RULE 8. The Division Director shall have authority to approve, without notice and hearing, the drilling of wells at unorthodox locations anywhere within the unit boundary, provided however, no unorthodox location shall be closer than ten feet to any quarter-quarter section line, and provided further, that no such unorthodox location shall be closer than 330 feet to the outer boundary of the unit area, unless such well is covered by a lease-line agreement with the operator of the lands offsetting such well, and a copy of the lease-line agreement accompanies the application for such unorthodox location, or unless such offset operator has waived objection to the proposed unorthodox location in writing, and his waiver accompanies the application.

RULE 9. No well shall be placed on water injection in the East Vacuum Unit Area unless the Division Director has approved such well for injection. Applications for injection approval shall be filed in accordance with Rule 701 of the Division Rules and Regulations.

RULE 10. Each newly drilled injection or producing well shall be equipped with a minimum of 350 feet of surface casing and "production" casing run to total depth (approximately 4900 feet). All casing strings shall be cemented to the surface except that in any well in which an intermediate casing string has been run to below the top of the Yates formation and cemented to the surface, the "production" string may be cemented back into the base of the intermediate casing.

RULE 11. Injection shall be accomplished through tubing installed in a packer set within 100 feet of the uppermost perforation. The injection tubing shall be corrosion protected by a non-reactive internal lining or coating. The casing-tubing annulus in each injection well shall be filled with an inert fluid and a surface pressure gauge or approved leak detection device shall be attached to the annulus.

RULE 12. The injection wells or system shall be equipped with a pressure control device or acceptable substitute which will limit the surface injection pressure to no more than 0.2 psi per foot of depth to the uppermost perforation. The Division Director may administratively authorize a pressure limitation in excess of the above upon showing by the unit operator that such higher pressure will not result in fracturing of the confining strata.

RULE 13. All wells within the project area shall be equipped with risers or in some other acceptable manner as to facilitate the periodic testing of the bradenhead for pressure or fluid production.

RULE 14. The unit operator shall immediately notify the Supervisor of the Hobbs District Office of the Division of the failure of the tubing or packer in any of said injection wells, the leakage of water or oil from or around any producing well, the leakage of water or oil from or around any plugged and abandoned well within the project area, or any other evidence of fluid migration from the injection zone, and shall take such timely steps as may be necessary or required to correct such failure or leakage.

RULE 15. Each month the project operator shall submit to the Division a Pressure Maintenance Project Operator's Report, on a form prescribed by the Division, outlining thereon the data required and requesting allowables for each of the several wells in the Project as well as the total project area allowable.

RULE 16. The Division shall, upon review of the report and after any adjustments deemed necessary, calculate the allowable for the wells in the Project for the next succeeding month in accordance with these rules. The sum of the allowables so calculated shall be assigned to the Project and, except as provided under Rule 6 above, may be produced from the wells in the Project in any proportion.

IT IS FURTHER ORDERED:

(1) That no injection at greater than hydrostatic pressure shall be made into the Grayburg or San Andres formation in any well in the East Vacuum Grayburg-San Andres Unit Area within one-half mile of any well listed on Exhibit "C" attached hereto until remedial action has been taken on such well to ensure that it will not serve as an avenue of escape for injected waters, or until tests have been conducted on such well or other evidence concerning such well has been presented

establishing to the satisfaction of the Supervisor of the Hobbs District Office of the Division that remedial work on such well is unnecessary.

(2) That Order No. R-3150 which authorized a pilot waterflood project in this area is hereby rescinded.

(3) That jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

JOE D. RAMEY
Director

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EAST VACUUM GRAYBURG-SAN ANDRES UNIT
PRESSURE MAINTENANCE PROJECT

VACUUM GRAYBURG-SAN ANDRES POOL, LEA COUNTY, NEW MEXICO

WATER INJECTION CREDIT ALLOWABLE CALCULATION DATA

ATTACHMENT TO _____, 19__, REPORT

$$\text{Water Injection Credit Allowable} = \left[\frac{W_i - W_p}{BPAA \left[B_o + \frac{(R_p - R_s)}{(1,000)} B_g \right]} - 1 \right] BPAA$$

W_i = _____ = Average daily water injection, barrels per day, project area only.

W_p = _____ = Average daily water produced, barrels per day, project area only.

BPAA = _____ = Basic project area allowable, 80 bopd x _____ (number of developed 40-acre tracts in project area).

_____ = Weighted average project area reservoir pressure, psig, from _____, 19__, survey data.

B_o = _____ = Oil formation volume factor, reservoir barrels per stock tank barrel (Exhibit B).

R_p = _____ = Producing gas-oil ratio, cubic feet per barrel, project area only.

R_s = _____ = Solution gas-oil ratio, cubic feet per barrel (Exhibit B).

B_g = _____ = Gas formation volume factor, reservoir barrels per Mcf (Exhibit B).

Water injection credit allowable for _____, 19__, = _____ barrels of oil per day.

EXHIBIT "A"
ORDER NO. R-5897

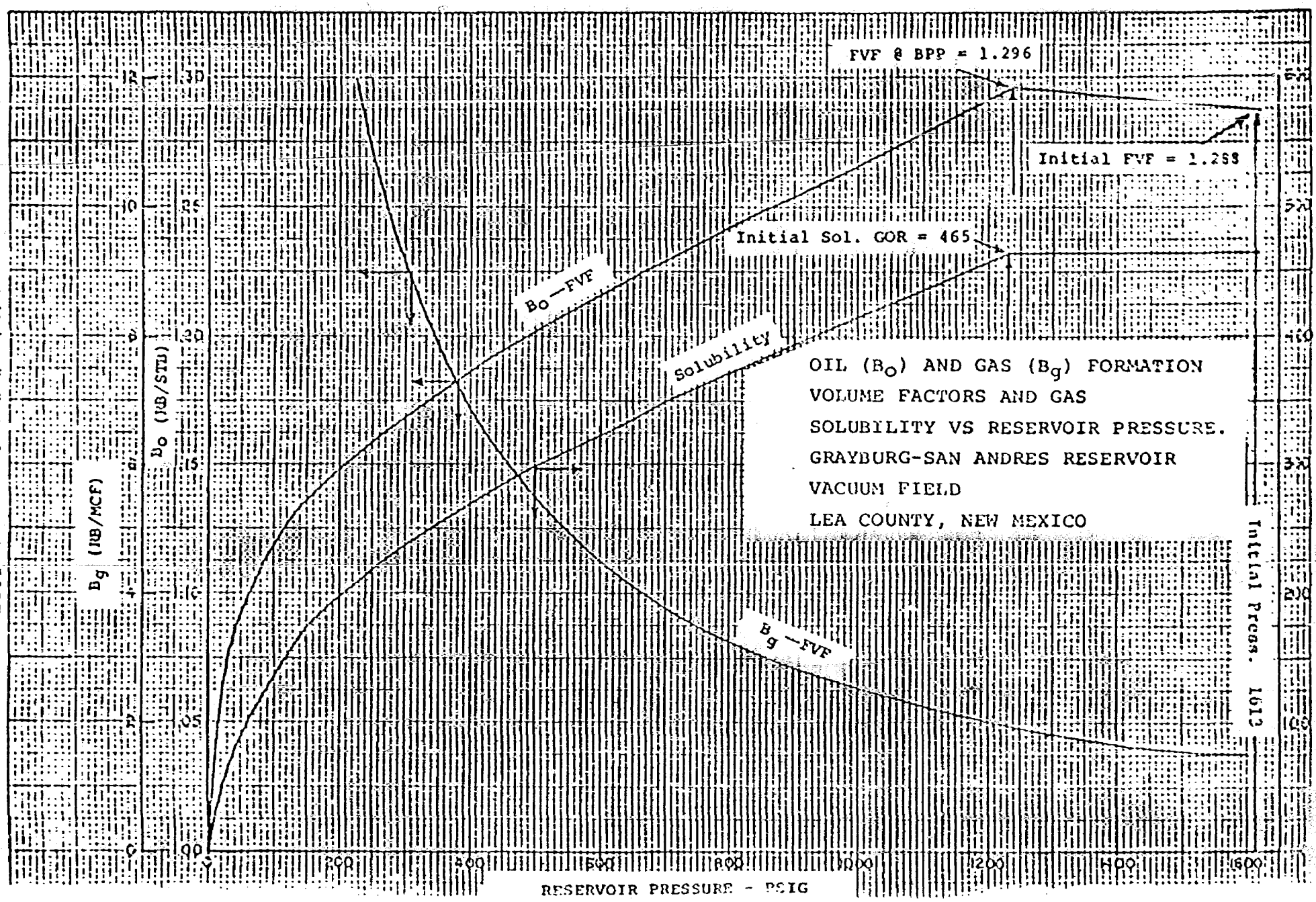


Exhibit "B" Order No. R-5827

EXHIBIT "C"

WELLS SUSPECTED OF BEING INADEQUATELY PLUGGED AND ABANDONED OR INADEQUATELY CASED AND CEMENTED

OPERATOR	LEASE	WELL NO.	UNIT	SEC-TWP-RGE
Mobil	State P	7	F	22-17S-35E
Penrose	State	2	N	24-17S-35E
Phillips	Santa Fe	15	A	28-17S-35E
Phillips	Santa Fe	16	L	5-18S-35E
Phillips	Santa Fe	37	F	28-17S-35E
Phillips	Santa Fe	47	C	35-17S-35E
Shell	State U	1	C	3-18S-35E
Shell	State VAA	6	K	5-18S-35E
Shell	State C	1	I	24-17S-34E
Shell	State I	1	E	29-17S-35E
Shell	State S	1	I	21-17S-35E
Stoltz etal.	Abo	1	O	24-17S-35E
Zapata	Shell State	1	O	23-17S-35E
Barnett	State B	1	D	19-17S-35E
Jones	State	2	A	35-17S-35E
Penrose	Scarborough	1	C	25-17S-35E
Amoco	State CV	1	F	25-17S-35E
Amoco	State CV	4	L	25-17S-35E
Amoco	State CV	5	F	25-17S-35E
Chevron	State 6-34	4	J	34-17S-35E
Cities Service	State BJ	2	K	35-17S-35E
Crusader	State	1	E	20-17S-35E
Crusader	State	2	C	19-17S-35E
Crusader	State	3	N	18-17S-35E
Exxon	State J	1	M	19-17S-35E
Exxon	State J	2	L	19-17S-35E
Exxon	State AC	1	H	22-17S-35E
Great Western	State E	2	L	25-17S-35E
Marathon	Warn State	1	M	23-17S-35E
Amoco	State CV	2	E	25-17S-35E
Amoco	State CV	2-Y	E	25-17S-35E
Millard Deck	Carthay State	2	G	20-17S-35E
Exxon	State K	17	P	32-17S-35E
Marathon	Staplin State	1	L	20-17S-35E
Marathon	Warn State	1	B	4-18S-35E
Mobil	N.Vac.AboUnit	207	H	24-17S-34E
Pennzoil	Phillips State	1	A	28-17S-35E
Pennzoil	Phillips State	2	F	28-17S-35E
Phillips	Vac.AboUnit	6-68	H	34-17S-35E
Phillips	Vac.Abo Unit	1-9	J	27-17S-35E
Phillips	Vac.Abo Unit	7-3	P	27-17S-35E
Phillips	Vac.Abo Unit	7-4	I	27-17S-35E
Phillips	Vac.Abo Unit	9-5	H	33-17S-35E
Phillips	Vac.Abo Unit	13-2	E	4-18S-35E

OPERATOR	LEASE	WELL NO.	UNIT	SEC-TWP-RGE
Phillips	Vac.Abo Unit	14-3	N	5-18S-35E
Phillips	Vac.Abo Unit	14-4	L	5-18S-35E
Shell	State V	6	P	27-17S-35E
Shell	State K	1	O	19-17S-35E

EXHIBIT "C"
ORDER NO. R-5897

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED

LEA COUNTY, NEW MEXICO

ENGINEERING-GEOLOGICAL COMMITTEE REPORT

NOVEMBER, 1977

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* * * * *

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* * * * *

INTRODUCTION

The purpose of this report is to present the findings of the Engineering-Geological Committee concerning the charges to it by the Working Interest Owners of the East Vacuum Grayburg-San Andres Unit, proposed, Lea County, New Mexico. For location, see Figure 1. The charges are listed below:

1. Construct an acceptable base map. (All unit maps in this report use the accepted base map.)
2. Define the vertical interval to be unitized in one or more representative well logs. (The recommended interval to be unitized is that interval of the Grayburg-San Andres correlative to the formations that exist in Exxon's New Mexico State "K" No. 19 from a depth of 4,050 feet to 5,050 feet RKB.)
3. Define the East Vacuum Grayburg-San Andres Unit area in cooperation with the Central Grayburg-San Andres Unit area being expedited by Texaco. (This area is shown on all unit maps in this report.)
4. Tabulate the following parameters by Tract and by Working Interest Owners:
   - A. Number of well bore completions and well bores available for recompletion.
   - B. Cumulative oil production.
   - C. Remaining primary reserves, taking into consideration the effect, if any, of natural water encroachment.
   - D. Ultimate primary reserves.
   - E. Current production for the most representative period.
   - F. Floodable acre-feet by tract and by zone, if possible.
   - G. Net hydrocarbon pore volume by tract and by zone, if possible.
   - H. Secondary reserves by tract and by zone, if possible.

I. Original oil-in-place by tract and by zone, if possible.

J. Any other parameters considered to be appropriate by the Engineering-Geological Committee. The committee added surface acres and net acre-feet to the parameters. (The committee agreed that it is not possible to determine parameters F through I by zone. With this exception, Table I fulfills this charge. Discussions of the method used to determine each of these parameters are presented in the appropriate section of this report.)

5. Investigate the sources and availability of water to be used for flooding. (There is an adequate source of water available for flooding. Details are in the Water Supply Section of this report.)

6. Develop a detailed plan for secondary recovery operations which will include associated economics containing a differential case between continued primary and waterflooding operations. (The proposed development plan calls for installing the necessary facilities, including drilling 127 water injection wells on a 40-acre, five-spot pattern between unitization date estimated to be October 1, 1978, and the end of 1981. More details are given in the Development Plan Section.)

CONCLUSIONS

From the study of the Grayburg-San Andres zone in the East Vacuum Unit, proposed, area, the Engineering-Geological Committee concludes that:

1. Secondary recovery by waterflooding is feasible in the San Andres reservoir and recovery is estimated to be 29.0 million barrels if conducted on the present 40-acre per well density using a five-spot pattern. The estimated recovery for 20-acre per well density under the same conditions is 40.8 million barrels. Incremental economics above primary and after income tax are:

	40-Acre Less Primary	20-Acre Less Primary
Investment, $M	11,358	31,742
Net Cash Flow, $M	75,158	131,156
Average Annual Rate of Return, percent	63	146
Number of Times Investment Returned	7.62	5.13
Payout, years	3.68	2.32
Present Value at 10 Percent, $M	37,725	83,584

2. Remaining recovery and economics favor the 20-acre per well density and a five-spot pattern. These profit indicators are:

	40-Acre 5-Spot	20-Acre 5-Spot	20-Acre Less 40-Acre
Recovery, MM barrels	38.1	49.8	11.7
Investment, $M	11,358	31,742	20,384
Net Cash Flow, $M	93,545	149,543	55,998
Average Annual Rate of Return, percent	151	234	298
Number of Times Investment Returned	9.24	5.71	3.75
Payout, years	2.60	2.04	1.88
Present Value at 10 Percent, $M	51,583	97,443	45,952

These economics were based on non-escalating costs and a constant lower and upper tier oil price of $5.25 per barrel and $12.00 per barrel, respectively.

3. That water injection into the Grayburg formation is not economically feasible.

RECOMMENDATIONS

The following recommendations are based on the foregoing conclusions:

1. Unitize the Grayburg-San Andres zone in the area shown as East Vacuum Grayburg-San Andres Unit, proposed, on the structure map, Figure 2.
2. Develop the waterflood on a 40-acre, five-spot pattern with 20-acre well spacing by drilling 127 water injection wells and installing the necessary surface facilities to operate the flood.
3. Limit water injection to the San Andres formation.

HISTORY

The Vacuum Field was discovered May 5, 1929, by Seeony Vacuum Oil Company's Bridges State Well No. 1 located in Section 13, T-17-S, R-34-E, Lea County, New Mexico, as shown in Figure 2. Development began in 1939 and was virtually complete by the end of 1941 with 330 producing wells. There are currently 453 wells producing from the field.

The first waterflood project in the field was Mobil Oil Company's Bridges State lease that began in 1958. The Texaco West Vacuum Unit was formed in 1966. The first flood developed in the better quality reservoir rock was Texaco's Vacuum Grayburg-San Andres Unit in 1973. The latest flood in the field is Atlantic Richfield Company's State Vacuum Unit which was approved in 1977. Texaco's Central Vacuum Unit became effective October 1, 1977.

The proposed East Vacuum Grayburg-San Andres and Vacuum 35 Units are scheduled to begin development in 1978. When these units are developed, over 98 percent of the Vacuum Grayburg-San Andres Field will be under waterflood. Figure 3 is a map showing these units.

In both the Mobil Bridges State waterflood and the Texaco Vacuum and West Vacuum Units, injection into the Grayburg formation has caused premature water breakthrough with subsequent high water-oil ratio production. It is concluded that the reserve contribution of the Grayburg is of less value than the cost of handling the increased water required to flood it.

Behind casing surface water flows that are apparently related to water injection in the existing projects have recently developed over a wide area of the field. This has resulted in the New Mexico Oil Conservation Commission imposing more stringent regulations for waterflood units. These new regulations have been properly considered in the project analysis.

GEOLOGY

The Vacuum Grayburg-San Andres Field is located on the Artesia-Lovington uplift along the northern limit of the Delaware Basin. The San Andres zone is a dolomitized reef with excellent permeability in the fore-reef to the south, pinching out in the poor quality back-reef and lagoonal depositions to the north. This feature is shown in the north-south Cross-Section H-H', Figure 4. Figure 5 is a west-east cross-section for the unit. The only zones shown on these cross-sections are zones that can be correlated over large areas of the unit. They show clearly the zone discontinuity that cause wider well spacing to result in the recovery of less secondary reserves.

The San Andres structure, Figure 2, is an east-west trending anticline showing a closure of more than 400 feet above the original water-oil contact of -700 feet. Lithologically, the Grayburg formation consists of dense gray dolomite with some anhydrite. It contains interbedded dolomitic sand stringers. Log and core data indicate that this formation has a very small reserve. The San Andres formation consists of dense medium crystalline and oolitic dolomite, white to gray in color, with some anhydrite. The pay is a fine to medium crystalline oolitic dolomite with slight fracturing and some solution cavities. The cross-sections in Figures 4 and 5 show the productive intervals to consist of a series of permeable beds separated by impermeable strata. These strata extend over large areas of the field and serve as effective barriers to prevent cross-flow between the permeable beds.

The recommended unitized interval is the vertical interval that appears between a depth of 4,050 feet and 5,050 feet on the Lane Wells acoustic log, Run No. 1, dated April 14, 1964, on Exxon's New Mexico State "K" No. 19. This well is located 330 feet from south line and 330 feet from east line of Section 28, T-17-S, R-35-E, Lea County, New Mexico. The unitized interval is to include all subsurface points throughout the unit area between these identified correlative depths. This interval is shown in Figure 6.

RESERVOIR PERFORMANCE

The East Vacuum Grayburg-San Andres Unit can be divided into three areas of similar performance as shown in Figure 7--the north area of poor quality rock with low production rates, the east area where the production has been greatly influenced by water encroachment, and the south area where most of the proration units are still producing at top allowable rates.

Production and pressure histories are presented graphically for these three areas and the total unit in Figures 8, 9, and 10. Table II presents reservoir reserves and production data for these areas. Of particular interest is the fact that the average reservoir pressure history of the east area, shown in Figure 10, is very nearly the same as that of the south area even though water has displaced 36 percent of the initial hydrocarbon pore volume in the east area.

CORE DATA

Three sets of core data were analyzed to determine the reservoir rock properties. The first set, consisting of 1,283 core samples from 15 wells within the unit area and having a Dykstra-Parsons permeability variation constant of 0.87, was used to determine the porosity cutoff of six percent. This was done statistically by determining the porosity at which the median permeability was 0.1 millidarcy. The pore volume of samples with porosities equal to or greater than six percent having less than 0.1 millidarcy was approximately the same as that of samples with porosities less than six percent having greater than 0.1 millidarcy.

The second set was 196 core samples having porosities equal to or greater than six percent and taken from six continuous permeable zones within the unit area. The permeability variation constant ranged between 0.63 and 0.84 for the individual zones and was 0.78 for all zones. Weighted average permeability and porosity for these samples were 13.7 millidarcies and

10.9 percent respectively. A plot of porosity versus permeability from these samples is shown in Figure 11.

The third set of data was from Phillips' Santa Fe No. 128 in the northwest of northwest of Section 4, T-18-S, R-35-E, Lea County, New Mexico, which was cored to -766 feet in the San Andres. Relative permeability, flood pot, capillary pressure, and wetability analysis were made on these cores and used as a basis for many of the calculations in this report. Figure 12 shows the average oil and water relative permeability curves. The oil curve shows a residual oil saturation of 27 percent. The flood pot test showed a residual oil saturation of 28.7 percent when oil was displaced by formation water and 36.3 percent when oil was displaced by nitrogen gas. Average water saturation at a capillary pressure of 60 psig was 19 percent. Wetability tests showed the reservoir to be neutral.

COMPARISON OF CORE DATA TO SONIC LOG TRAVEL TIMES

Sonic logs were used to determine porosities. They were normalized by preparing histograms for each sonic log over the Grayburg interval and correcting them to correlate with Phillips' Santa Fe No. 128. The normalization correction varied from -5 to +5 microseconds per foot.

Matrix and fluid travel times were calculated by use of the Holgate* method for six wells in the study area on which adequate core data and reliable sonic logs were available. Figures 13 and 14 show the results of the study of the 816 feet of core porosities and sonic travel times from the six wells. This study resulted in the use of a Delta t_m of 46.4 and a Delta t_f of 131.4 to calculate the porosities from all sonic logs. The logs were digitized and a computer used to determine the porosity of each foot of formation.

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* Holgate, M. M.: "The Microlog as a Porosity Datum from the Neutron Log in Hills Field, Alberta." The Canadian Mining and Metallurgical Bulletin, July, 1960.

RESERVOIR FLUID DATA

Figure 15 shows the formation volume factor and solution gas-oil ratio as a function of reservoir pressure. These curves were constructed from combined reservoir samples from Phillips' Hale No. 1 and Santa Fe No. 1. The initial reservoir pressure of 1,613 psig was recorded by bottom-hole pressure gauges in 1938. The bubble-point pressure is the average of those determined from 37 wells in the unit by plotting cumulative oil production versus reservoir pressure. The minimum of these 37 bubble-point pressures was 1,150 psig and the maximum 1,290 with an average of 1,233 psig.

ORIGINAL WATER LEVEL DETERMINATION

Completion and production data from the unit indicate the original water level to have been approximately -700 feet. Phillips' Santa Fe No. 17 was completed open hole to -699 feet. Its initial production was water free, but in five months it was producing six barrels of water per day. This was the reason for using -700 feet as the water level. Recent electric log analysis on wells drilled in the 1960's in and around Section 35, T-17-S, R-34-E, confirm the -700 feet water level.

CONNATE WATER SATURATION

The curve shown in Figure 16 was used to determine the connate water saturation. Shell Oil Company prepared it from cores taken from their Denver Unit, Wasson Field, Gaines and Yoakum Counties, Texas. The average porosity by 40-acre proration unit, rather than average porosity in the well bore, was used to calculate the water saturation.

VOLUMETRIC CALCULATIONS

The isopachous map shown in Figure 17 and an isovol map were prepared from which a computer calculated the acre-feet and acre-porosity feet by 40-acre proration unit. Porosity, connate water saturation, and hydrocarbon pore volume were calculated from these data for each 40-acre unit. Original oil-in-place was calculated by multiplying the hydrocarbon pore volume by (7,758 + 1.288).

PRIMARY RESERVES

Tarner material balance calculations for a depletion-type reservoir with producing characteristics similar to those of the East Vacuum Grayburg-San Andres Unit indicated a primary recovery factor of approximately 25 percent. Considering the water encroachment from the east, the primary recovery factor was estimated to be 26.3 percent. This resulted in an ultimate primary reserve for the total unit of 78 million barrels. Decline curves were used to determine the primary reserve by tract where possible. Appendix A shows the method used to allocate the rest.

WATER ENCROACHMENT

The pressures from Figure 10 show that water encroachment has not been fast enough to affect reservoir pressure. Water from the east edge of the field has, nonetheless, filled approximately one-eighth of the original hydrocarbon pore volume.

FLOODABLE ACRE-FEET BY TRACT

The floodable acre-feet and secondary reserves, by tract, were based on fractional flow calculations using mid-1972 well tests to determine the

water saturation. This method would not have been viable using well tests after 1972 because most of the operators began plugging back wells to reduce water production at that time. Percent floodable acre-feet were calculated from this saturation and are shown in Figure 18. Floodable acre-feet were calculated by multiplying the average percent remaining floodable acre-feet in each 40-acre proration unit by its acre-feet calculated from the isopachous map shown in Figure 17. Appendix B gives further information concerning the calculations.

SECONDARY RESERVES

A mathematical model study using a residual oil saturation of 35 percent showed that 44 percent of the original oil-in-place could be recovered by primary plus waterflood operations. An estimated recovery of 40 percent was used after a study of other San Andres floods in the Permian Basin showed that none had estimated recoveries as high as 44 percent. The predicted flood performance was obtained by a computer program using the Higgins-Leighton streamline channel flow method.

The San Andres flood with declining production and having reservoir characteristics most similar to the East Vacuum Unit is Shell's Denver Unit in Wasson Field, Gaines and Yoakum Counties, Texas. Table III shows the reservoir data for the two units. Shell's estimated recovery of primary plus secondary is only 35.3 percent for the Denver Unit, but the residual oil saturation for the unit is 40 to 45 percent compared to 35 percent for the East Vacuum Unit.

Shell estimates that reducing well spacing from 40 acres to 20 acres in their Denver Unit will increase the primary and secondary reserves by 3.9 percent of the original oil-in-place. The same increase is estimated for the East Vacuum Unit.

Texaco's Vacuum Grayburg-San Andres Unit began operation in 1973. Even though there is no accurate means of determining the recoverable reserves

at this time, the performance, shown in Figure 19, to date has been impressive. The isopachous map in Figure 20 and the cumulative production map as of January 1, 1973, Figure 21, shows the reservoir to be of similar quality to that of the south portion of the East Vacuum Grayburg-San Andres Unit. Figure 22, cumulative production as of January 1, 1977, shows the effect of increased production from the unit due to unitization.

The secondary reserves were determined for the total unit by subtracting the 78 million barrels of primary oil from 40 percent of the original oil-in-place. This total oil was allocated to each proration unit in proportion to the product of 15 percent of its initial oil-in-place and percent floodable acre-feet (Figure 18).

WATER SUPPLY

A Higgins-Leighton reservoir study showed that the maximum water injection rate will be 95,000 barrels per day. With the four-year development program, the maximum make-up water needed will be 69,000 barrels per day in 1981. Tabulated below are the sources available to supply this need.

Source	Barrels per Day
Phillips Petroleum Company water rights	28,362
Phillips (applied for water rights)	17,977
Rice Engineering (produced water)	10,000
Mobil Oil Corporation (probable)	8,000
Available in Section 36, T-16-S, R-34-E, if needed, from City of Carlsbad:	
4¢/barrel delivered at 50 psi	35,000
Total	99,339
Needed	69,000
Excess	30,339

Phillips will apply for other water rights in the area of the flood as soon as they become available.

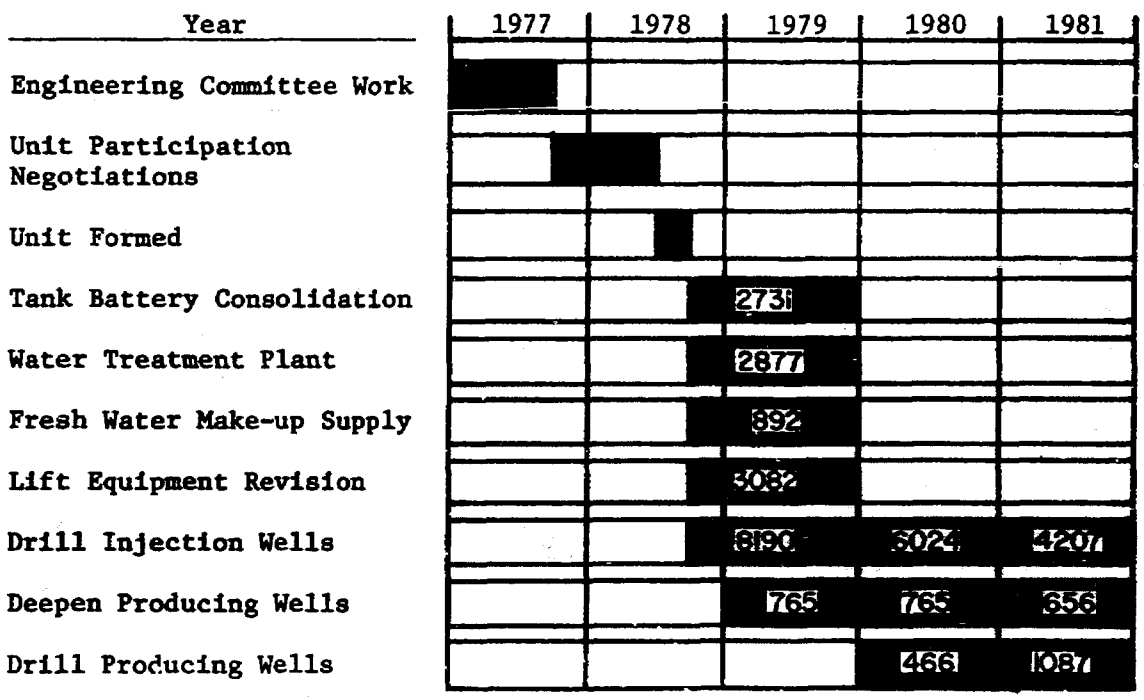
DEVELOPMENT PLAN

Facilities

Facilities necessary for waterflood operations in this unit are a consolidated tank battery, water supply wells and lines, water injection and treatment station with injection lines, 76 pumping units, 127 water injection wells, and 10 additional producing wells. Costs for the wells in the south portion include one resistivity and three porosity logs for each well, and coring six wells. Figure 23 shows the location of the major facilities.

Schedule

Figure 24 is a map showing the annual development by area. The wells to be cored are indicated by a semicircle. Time targets for the preunitization work and the installation of facilities are shown in the bar graph below along with the unescalated estimated cost of each project by year in thousands of dollars.



ECONOMICS

One set of differential economics was run which compared the 40-acre well spacing five-spot at a total primary and secondary recovery of 36.1 percent of the original oil-in-place with continued primary operations. The economics showed a payout of 3.68 years, number of times investment returned 7.62, average annual rate of return 63.3 percent, and a cash flow of 75.2 million dollars for an investment of 11.4 million dollars.

A differential economic analysis was run comparing continued primary operations and 20-acre well spacing five-spot waterflood with primary and secondary recovery of 40 percent of original oil-in-place. For an investment of 31.7 million dollars, the payout was 2.32 years, number of times investment returned 5.13, average annual rate of return 145.5 percent, and cumulative cash flow was 131.2 million dollars. Figure 25 shows cumulative cash flow for future primary plus secondary with infill drilling, future primary plus secondary without infill drilling, and future primary only.

The differential economics after Federal income tax between waterflooding with 20-acre well spacing less waterflooding with 40-acre well spacing are: investment, 20.4 million dollars; payout, 1.88 years; number of times investment returned, 3.75; average annual rate of return, 298 percent; and cash flow, 56 million dollars.

The forecasts from which these analyses were calculated were based on the following premises:

1. The maximum allowable from the unit will be 80 barrels of oil per day times the number of active producing and injection wells in the zone with a maximum number of wells of one per 20 acres (352).
2. The price of lower-tier and upper-tier oil will remain at $5.25 per barrel and $12.00 per barrel, respectively. The gas price will remain at 46¢ per Mcf.
3. The unit will be capable of producing the full allowable based on the proposed wells to be drilled.

4. Infill drilling will increase the recovery by 3.9 percent of the original oil-in-place.

Details of cost and production forecasts used for these analyses are shown in four tables presented in Appendix C.

PARTICIPATION PARAMETERS

The sources of participation parameters included in this report are as follows:

Parameter	Source
1. Current Production	New Mexico Oil and Gas Committee Reports.
2. Future Primary Reserves	See Pages 10 and 11 of this report.
3. Cumulative Production	New Mexico Oil and Gas Committee Reports.
4. Ultimate Primary Reserves	Sum of cumulative production and remaining primary reserves.
5. Acre-Feet of Net Pay	See Pages 8 and 10 of this report.
6. Hydrocarbon Pore Volume	See Page 10 of this report.
7. Original Oil-in-Place	See Page 10 of this report.
8. Secondary Oil Reserves	See Pages 10 and 11 of this report.
9. Floodable Acre-Feet	See Page 11 of this report.
10. Usable Well Bores	Working Interest Owners.
11. Surface Area Acres	Working Interest Owners.

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED
LEA COUNTY, NEW MEXICO

PARAMETERS, TRACT VALUES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume Ac.-Ft.	Original Oil-In-Place STBO	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Atlantic Richfield Company												
State B 1576	3203	38,728	760,200	2,568,914	3,329,100	33,919	3,121.7	18,802,910	2,971,068	33,919	4	160.00
State A DE	2204	3,474	40,900	583,946	624,800	1,540	133.0	801,098	124,254	1,540	2	80.00
State C DE	2403	2,018	7,100	144,383	151,500	1,490	136.0	819,168	127,056	1,490	1	40.00
State E DE	2402	6,726	131,800	328,259	460,100	1,904	106.9	643,890	58,326	1,120	2	80.00
State J DE	1908	526	9,200	100,945	110,100	3,099	263.2	1,585,331	245,892	3,099	1	80.00
State M DE	2906	12,950	269,200	1,746,219	2,015,400	9,431	897.6	5,406,507	838,273	9,430	4	160.00
State W DE	2606	7,167	36,900	659,138	696,100	6,488	533.1	3,211,017	79,239	1,060	2	80.00
Total		71,589	1,255,300	6,131,804	7,387,100	57,871	5,191.5	31,269,921	4,444,408	51,658	16	680.00
Chevron U.S.A., Inc.												
State 3-32	3202	47,719	588,600	2,558,660	3,147,300	19,434	1,692.5	10,194,421	1,469,654	18,027	4	160.00
State 4-27	2704	37,267	413,000	2,637,031	3,050,100	15,463	1,405.5	8,465,737	1,234,820	14,595	4	160.00
State 5-27	2702	10,908	74,600	1,908,711	1,983,400	7,064	665.7	4,009,706	621,923	7,064	4	160.00
State 6-34	3403	43,973	476,400	2,152,498	2,628,800	18,001	1,797.0	10,823,856	1,167,788	12,636	5	200.00
Total		139,867	1,552,600	9,256,900	10,809,600	59,962	5,560.7	33,493,720	4,494,185	52,322	17	680.00
Cities Service Company												
State K	2701	37,153	508,500	2,087,807	2,596,300	6,157	448.0	2,698,436	418,539	6,157	4	160.00
Crown Central Petroleum Corp.												
Shell State E 7259	2001	212	0	16,613	16,600	482	31.7	190,938	29,616	482	1	40.00
Shell State B 1398	1906	214	0	21,921	21,900	889	60.1	362,000	56,148	889	1	40.00
Total		426	0	38,534	38,500	1,371	91.8	552,938	85,764	1,371	2	80.00
Deck, Millard												
Carthay State	2003	1,451	16,600	123,357	140,000	88	6.7	40,357	6,132	86	2	80.00
Elk Oil Company (Old Crusader)												
Cities Service State 1	2002	0	0	65,834	65,834	469	22.9	137,933	21,394	469	0	40.00
Cities Service State 2	1803	0	0	6,841	6,841	743	42.7	257,195	39,095	728	0	40.00
Cities Service State 2	1901	0	0	21,774	21,774	970	59.0	355,374	55,120	970	0	40.00
Total		0	0	94,449	94,449	2,182	124.6	750,502	115,609	2,167	0	120.00

TABLE 1
Page 1

PARAMETERS, TRACT VALUES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume Ac.-Ft.	Original Oil-In-Place STBO	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Exxon Company, U.S.A.												
New Mexico State J	1909	0	0	182,968	183,000	3,215	282.2	1,699,773	263,643	3,214	0	75.38
New Mexico State K	2805	33,840	405,400	3,805,400	4,210,800	23,549	2,443.8	14,719,723	2,235,583	23,041	8	320.00
New Mexico State K	3201	94,207	1,167,700	5,111,800	6,279,400	49,517	4,964.2	29,900,825	4,336,220	46,427	8	320.00
Total		128,047	1,573,100	9,100,210	10,673,200	76,281	7,690.2	46,320,321	6,835,446	72,682	16	715.38
Getty Oil Company												
State BC	3308	14,677	190,100	654,313	844,400	6,854	801.6	4,828,271	748,886	6,854	1	40.00
State P	3302	21,221	240,600	1,292,834	1,533,400	5,846	576.4	3,471,826	538,495	5,845	2	80.00
Total		35,898	430,700	1,947,147	2,377,800	12,700	1,378.0	8,300,097	1,287,381	12,699	3	120.00
Great Western Drilling Company												
State E	2502	1,239	1,900	234,119	236,000	1,502	103.8	625,218	19,395	300	1	40.00
Bettis, Boyle and Stovall (Josaline Production Company)												
State C	1907	1,437	14,400	98,945	113,300	2,223	163.3	983,604	152,562	2,223	2	80.00
State F	2005	287	0	164,301	164,300	925	51.9	312,609	48,486	925	2	80.00
Total		1,724	14,400	263,246	277,600	3,148	215.2	1,296,213	201,048	3,148	4	160.00
Marathon Oil Company												
Staplin State A/C 2	1904	0	0	77,305	77,300	2,366	148.1	892,050	138,361	2,366	0	80.00
Warn State A/C 3	3304	26,914	376,800	1,863,901	2,240,700	17,291	1,882.6	11,339,449	1,745,292	17,157	3	120.00
Warn State A/C 5	0401	634	7,800	9,393	17,200	369	41.3	248,762	21,221	203	1	39.86
Total		27,548	384,600	1,950,599	2,335,200	20,026	2,072.0	12,480,261	1,904,874	19,726	4	239.86
Mobil Oil Corporation												
New Mexico "O"	1802	1,312	13,900	23,994	37,900	622	44.4	267,434	29,037	435	1	37.61
State K	3101	41,650	570,200	2,061,367	2,631,600	21,498	2,060.6	12,411,595	1,925,093	21,498	3	120.00
State K-6	1801	2,604	28,200	26,024	54,200	697	52.2	314,416	34,137	488	1	37.67
State L	2103	1,994	38,600	534,773	573,400	1,494	117.7	708,941	93,934	1,287	3	120.00
State M	3402	58,602	727,000	2,702,492	3,429,500	24,962	2,799.5	16,862,207	2,206,037	21,091	4	160.00
State N	1903	817	10,200	112,499	122,700	1,130	37.7	227,078	35,221	1,130	1	37.68
State O	3307	14,827	189,500	676,596	866,100	6,817	700.5	4,219,316	647,890	6,749	1	40.00
State P	2205	895	21,200	260,193	281,400	978	80.0	481,863	74,739	978	2	80.00
State P	2601	2,381	21,500	215,406	236,900	3,874	294.9	1,776,269	263,515	3,705	2	80.00
Total		125,082	1,620,300	6,613,344	8,233,700	62,072	6,187.5	37,269,119	5,309,603	57,361	18	712.96

PARAMETERS, TRACT VALUES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume Ac.-Ft.	Original Oil-In-Place STBO	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Pennzoil Company												
Phillips State 28	2801	638	6,300	46,248	52,500	1,219	141.1	849,886	131,821	1,219	1	40.00
Phillips State 28	2804	849	8,300	106,808	115,100	517	45.1	271,650	42,135	517	1	40.00
Total		1,487	14,600	153,056	167,600	1,736	186.2	1,121,536	173,956	1,736	2	80.00
Penrose Production Company												
Southern State	2404	33		19,411	19,400	783	49.8	299,960	40,942	689	1	40.00
Phillips Petroleum Company												
Santa Fe	0402	19,536	205,200	741,941	947,141	7,403	760.2	4,578,906	671,307	7,056	2	79.70
Santa Fe	0501	51,699	561,500	1,746,682	2,308,182	19,585	2,306.6	13,893,305	2,009,939	18,272	4	159.85
Santa Fe	0502	56,300	743,212	2,414,830	3,158,042	18,655	1,909.3	11,500,271	1,729,901	18,152	4	159.95
Santa Fe	1905	303	5,968	26,897	32,865	958	68.5	412,595	63,995	958	1	40.00
Santa Fe	2004	3,346	65,900	631,831	697,731	2,439	172.5	1,039,018	156,017	2,370	5	200.00
Santa Fe	2102	757	14,911	307,732	322,643	783	74.2	446,928	69,320	783	2	80.00
Santa Fe	2104	206	4,058	283,587	287,645	596	61.6	371,035	57,549	596	1	40.00
Santa Fe	2501	2,237	44,063	471,789	515,852	1,784	126.2	760,139	82,531	1,249	1	40.00
Santa Fe	2602	43,052	436,561	2,872,130	3,308,691	10,240	794.2	4,783,717	569,878	7,861	5	200.00
Santa Fe	2603	2,097	11,800	406,844	418,644	1,513	97.6	587,873	22,795	378	1	40.00
Santa Fe	2604	7,691	48,000	637,737	685,737	4,849	417.5	2,514,724	192,790	2,230	1	80.00
Santa Fe	2605	980	47,500	564,991	612,491	3,437	297.3	1,790,725	97,212	1,203	1	40.00
Santa Fe	2607	2,097	83,600	852,014	935,614	6,702	628.9	3,788,048	117,907	1,313	1	80.00
Santa Fe	2705	29,124	337,300	1,337,225	1,674,525	11,560	1,328.6	8,002,545	965,648	8,997	2	80.00
Santa Fe	2803	619	12,192	467,691	479,883	1,941	168.6	1,055,526	156,545	1,929	3	120.00
Santa Fe	2901	69	1,359	151,537	152,896	1,493	128.4	773,391	119,957	1,493	1	80.00
Santa Fe	2902	657	12,941	132,022	144,963	2,150	184.8	1,113,104	172,646	2,150	3	120.00
Santa Fe	2905	0	0	60,224	60,224	1,380	169.0	1,017,936	157,886	1,380	1	40.00
Santa Fe	2907	347	6,835	304,534	311,369	1,770	165.5	996,855	154,616	1,770	1	40.00
Santa Fe	3301	28,823	355,800	1,328,059	1,683,859	12,535	1,575.8	9,491,504	1,457,401	12,407	2	80.00
Santa Fe	3303	14,146	188,700	670,659	859,359	5,808	666.3	4,013,319	603,809	5,634	1	40.00
Santa Fe	3306	14,142	188,700	675,211	863,911	6,299	746.4	4,495,785	676,397	6,110	1	40.00
Santa Fe	3309	14,143	183,400	662,053	845,453	5,535	657.1	3,957,905	534,083	4,815	1	40.00
Santa Fe	3401	17,205	192,400	2,272,651	2,465,051	15,715	1,725.5	10,393,191	815,403	7,741	4	160.00
Santa Fe	3501	0	0	312,523	312,523	1,992	194.2	1,170,928	14,042	170	1	80.00
Total		309,576	3,751,900	20,333,394	24,085,500	147,122	15,425.0	92,909,273	11,669,574	117,017	50	2,159.50
Polaris Production Corporation												
Amerada State	2202	0	0	0	0	587	38.8	233,704	36,249	587	0	40.00
Amerada State	2203	997	9,100	259,374	268,474	300	15.6	93,963	14,574	300	1	40.00
Mobil State	2201	508	2,800	10,062	12,900	530	32.4	195,155	30,269	530	1	40.00
Total		1,505	11,900	269,436	281,374	1,417	86.8	522,822	81,092	1,417	2	120.00

PARAMETERS, TRACT VALUES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume Ac.-Ft.	Original Oil-In-Place STBO	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Shell Oil Company												
State C	2401	0	0	22,137	22,100	1,465	85.2	513,184	78,801	1,450	0	40.00
State F	2909	4,750	164,900	986,160	1,151,100	4,029	335.8	2,022,622	263,221	3,394	2	80.00
State H	2908	1,300	34,200	380,373	414,600	2,069	209.2	1,260,073	195,443	2,069	1	40.00
State I	2903	0	0	4,715	4,700	1,298	123.2	742,070	115,099	1,298	0	40.00
State K	1910	0	0	78,825	78,800	1,399	116.3	700,509	108,652	1,399	0	40.00
State N	2802	6,776	139,900	1,356,416	1,496,300	4,444	410.9	2,474,970	383,878	4,444	3	120.00
State S	2101	0	0	20,145	20,100	312	24.5	147,571	22,889	312	0	40.00
State T	3305	48,007	561,600	2,510,107	3,071,600	18,870	2,102.1	12,661,561	1,670,558	15,865	4	157.66
State V	2703	17,275	175,900	1,251,496	1,427,400	7,931	746.0	4,493,376	561,392	6,458	2	80.00
State VAA	0503	4,110	96,800	154,879	251,700	1,379	101.7	612,569	94,061	1,365	1	40.00
State VE	1902	0	0	0	0	735	48.1	289,720	43,140	706	0	40.00
Total		82,218	1,173,300	6,765,253	7,938,400	43,931	4,303.0	25,918,225	3,537,134	38,760	13	717.66
Sohio Petroleum Company												
Warn State	2301	1,279	33,600	258,170	291,800	1,710	114.9	692,076	103,607	1,648	2	80.00
Texaco Inc. (Crusader Texas State)												
State CG NCT-2	2904	0	0	16,538	16,500	806	70.7	425,847	66,051	806	0	40.00
GRAND TOTAL		966,122	12,343,300	65,656,774	78,000,000	500,865	49,306.4	296,986,842	40,794,740	441,750	157	7,025.36

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED
LEA COUNTY, NEW MEXICO

PARAMETERS, TRACT PERCENTAGES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume (Ac.-Ft.) & Original Oil-In-Place (STBO)	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Atlantic Richfield Company											
State B 1576	3203	4.009	6.159	3.913	4.268	6.772	6.331	7.283	7.678	2.548	2.277
State A DE	2204	.360	.331	.889	.801	.307	.270	.305	.349	1.274	1.139
State C DE	2403	.209	.058	.220	.194	.297	.276	.311	.337	.637	.569
State E DE	2402	.696	1.068	.500	.590	.380	.217	.143	.254	1.274	1.139
State J DE	1908	.054	.075	.154	.141	.619	.534	.603	.702	.637	1.139
State M DE	2906	1.340	2.181	2.660	2.584	1.883	1.820	2.056	2.135	2.548	2.277
State W DE	2606	.742	.299	1.004	.892	1.295	1.081	.194	.240	1.274	1.139
Total		7.410	10.171	9.340	9.470	11.553	10.529	10.895	11.695	10.192	9.679
Chevron U.S.A., Inc.											
State 3-32	3202	4.939	4.769	3.897	4.035	3.880	3.433	3.603	4.081	2.548	2.277
State 4-27	2704	3.857	3.346	4.016	3.910	3.087	2.651	3.027	3.304	2.548	2.277
State 5-27	2702	1.129	.604	2.907	2.543	1.410	1.350	1.525	1.599	2.548	2.277
State 6-34	3403	4.551	3.860	3.278	3.370	3.594	3.645	2.863	2.860	3.185	2.847
Total		14.476	12.579	14.098	13.858	11.971	11.279	11.018	11.844	10.829	9.676
Cities Service Company											
State K	2701	3.846	4.120	3.180	3.329	1.229	.909	1.026	1.394	2.548	2.277
Crown Central Petroleum Corp.											
Shell State E 7259	2001	.022		.025	.021	.096	.064	.073	.109	.637	.569
Shell State B 1398	1906	.022		.033	.028	.177	.122	.138	.201	.637	.569
Total		.044		.058	.049	.273	.186	.211	.310	1.274	1.138
Deck, Millard											
Carthay State	2003	.150	.134	.188	.179	.018	.014	.015	.019	1.274	1.139
Elk Oil Company (Old Crusader)											
Cities Service State 1	2002			.100	.084	.094	.046	.052	.106		.569
Cities Service State 2	1803			.010	.009	.148	.087	.096	.165		.569
Cities Service State 2	1901			.033	.028	.194	.120	.135	.220		.570
Total				.143	.121	.436	.253	.283	.491		1.708

PARAMETERS, TRACT PERCENTAGES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume (Ac.-Ft.) & Original Oil-In-Place (STBO)	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Exxon Company, U.S.A.											
New Mexico State J	1909			.279	.235	.642	.572	.646	.728		1.073
New Mexico State K	2805	3.503	3.284	5.795	5.398	4.702	4.958	5.480	5.216	5.095	4.556
New Mexico State L	3201	9.752	9.460	7.786	8.051	9.886	10.068	10.629	10.510	5.095	4.556
Total		13.255	12.744	13.860	13.684	15.230	15.598	16.755	16.454	10.190	10.185
Getty Oil Company											
State BC	3308	1.519	1.540	.997	1.083	1.368	1.626	1.836	1.552	.637	.569
State P	3302	2.197	1.949	1.969	1.966	1.167	1.169	1.320	1.323	1.274	1.139
Total		3.716	3.489	2.966	3.049	2.535	2.795	3.156	2.875	1.911	1.708
Great Western Drilling Company											
State E	2502	.128	.015	.357	.303	.300	.211	.048	.068	.637	.569
Bettis, Boyle and Stovall (Josaline Production Company)											
State C	1907	.149	.117	.151	.145	.444	.331	.374	.503	1.274	1.139
State F	2005	.030		.250	.211	.185	.105	.119	.209	1.274	1.139
Total		.179	.117	.401	.356	.629	.436	.493	.712	2.548	2.278
Marathon Oil Company											
Staplin State A/C 2	1904			.118	.099	.472	.300	.339	.536		1.139
Warn State A/C 3	3304	2.786	3.053	2.839	2.873	3.452	3.818	4.278	3.884	1.911	1.708
Warn State A/C 5	0401	.066	.063	.014	.022	.074	.084	.052	.046	.637	.567
Total		2.852	3.116	2.971	2.994	3.998	4.202	4.669	4.466	2.548	3.414
Mobil Oil Corporation											
New Mexico "O"	1802	.136	.113	.037	.049	.124	.090	.071	.098	.637	.536
State K	3101	4.311	4.620	3.140	3.374	4.292	4.179	4.719	4.865	1.911	1.708
State K-6	1801	.270	.228	.040	.069	.139	.106	.084	.110	.637	.536
State L	2103	.206	.310	.814	.735	.298	.239	.230	.291	1.911	1.708
State M	3402	6.066	5.890	4.116	4.397	4.984	5.678	5.408	4.774	2.548	2.277
State N	1903	.085	.083	.171	.157	.226	.076	.086	.256	.637	.537
State O	3307	1.535	1.535	1.031	1.110	1.361	1.421	1.588	1.528	.637	.569
State P	2205	.093	.172	.396	.361	.195	.162	.183	.221	1.274	1.139
State P	2601	.246	.174	.328	.304	.773	.598	.646	.839	1.274	1.139
Total		12.948	13.125	10.073	10.556	12.392	12.549	13.015	12.982	11.466	10.149

PARAMETERS, TRACT PERCENTAGES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume (Ac.-Ft.) & Original Oil-In-Place (STBO)	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Pennzoil Company											
Phillips State 28	2801	.066	.051	.070	.067	.243	.286	.323	.276	.637	.569
Phillips State 28	2804	.088	.067	.163	.148	.103	.091	.103	.117	.637	.569
Total		.154	.118	.233	.215	.346	.377	.426	.393	1.274	1.138
Penrose Production Company											
Southern State	2404	.003		.030	.025	.156	.101	.100	.156	.637	.569
Phillips Petroleum Company											
Santa Fe	0402	2.022	1.662	1.130	1.214	1.478	1.542	1.646	1.597	1.274	1.134
Santa Fe	0501	5.351	4.549	2.660	2.959	3.914	4.676	4.927	4.136	2.548	2.278
Santa Fe	0502	5.827	6.021	3.678	4.049	3.725	3.872	4.240	4.109	2.545	2.277
Santa Fe	1905	.031	.048	.041	.042	.191	.139	.157	.217	.637	.569
Santa Fe	2004	.346	.534	.962	.895	.487	.350	.382	.536	3.185	2.847
Santa Fe	2102	.078	.121	.469	.414	.156	.150	.170	.177	1.274	1.139
Santa Fe	2104	.021	.033	.432	.369	.119	.125	.141	.135	.637	.569
Santa Fe	2501	.232	.357	.719	.661	.356	.256	.202	.283	.637	.569
Santa Fe	2602	4.456	3.537	4.374	4.242	2.044	1.611	1.397	1.780	3.185	2.849
Santa Fe	2603	.217	.096	.620	.537	.302	.198	.056	.086	.637	.569
Santa Fe	2604	.796	.389	.971	.879	.968	.847	.473	.505	.637	1.139
Santa Fe	2605	.101	.385	.861	.785	.686	.603	.238	.272	.637	.569
Santa Fe	2607	.217	.677	1.298	1.200	1.338	1.275	.289	.297	.637	1.139
Santa Fe	2705	3.015	2.733	2.037	2.147	2.308	2.695	2.367	2.037	1.274	1.139
Santa Fe	2803	.064	.099	.712	.615	.388	.342	.384	.437	1.911	1.708
Santa Fe	2901	.007	.011	.231	.196	.298	.260	.294	.338	.637	1.139
Santa Fe	2902	.068	.105	.201	.186	.429	.375	.423	.487	1.911	1.708
Santa Fe	2905			.092	.077	.276	.343	.387	.312	.637	.569
Santa Fe	2907	.036	.055	.464	.399	.353	.336	.379	.401	.637	.569
Santa Fe	3301	2.983	2.883	2.023	2.159	2.503	3.196	3.573	2.809	1.274	1.139
Santa Fe	3303	1.464	1.529	1.021	1.102	1.160	1.351	1.480	1.275	.637	.569
Santa Fe	3306	1.464	1.529	1.028	1.108	1.258	1.514	1.658	1.383	.637	.569
Santa Fe	3309	1.464	1.486	1.008	1.084	1.105	1.333	1.309	1.090	.637	.569
Santa Fe	3401	1.781	1.559	3.461	3.160	3.138	3.500	1.999	1.752	2.548	2.277
Santa Fe	3501			.476	.401	.398	.394	.034	.038	.637	1.139
Total		32.041	30.398	30.969	30.880	29.378	31.283	28.605	26.489	31.847	30.741
Polaris Production Corporation											
Amerada State	2202					.117	.079	.089	.133		.569
Amerada State	2203	.103	.074	.395	.344	.060	.032	.036	.068	.637	.569
Mobil State	2201	.053	.023	.015	.017	.106	.066	.074	.120	.637	.569
Total		.156	.097	.410	.361	.283	.177	.199	.321	1.274	1.707

PARAMETERS, TRACT PERCENTAGES

Company and Lease	Tract No. (Fig. 26)	Current Production 7-1-76 to 1-1-77	Future Primary Reserves STBO	Cumulative Production 1-1-77 STBO	Ultimate Primary Reserves STBO	Net Pay Ac.-Ft.	Hydrocarbon Pore Volume (Ac.-Ft.) & Original Oil-In-Place (STBO)	Secondary Oil STBO	Floodable Ac.-Ft.	Well Bores	Surface Area, Acres
Shell Oil Company											
State C	2401			.034	.028	.292	.173	.193	.328		.569
State F	2909	.492	1.336	1.502	1.476	.804	.681	.645	.768	1.274	1.139
State H	2908	.135	.277	.579	.532	.413	.424	.479	.468	.637	.569
State I	2903			.007	.006	.259	.250	.282	.294		.569
State K	1910			.120	.101	.279	.236	.266	.317		.569
State N	2802	.701	1.133	2.066	1.918	.887	.833	.941	1.006	1.911	1.708
State S	2101			.031	.026	.062	.050	.056	.071		.569
State T	3305	4.969	4.550	3.823	3.936	3.767	4.263	4.095	3.591	2.548	2.246
State V	2703	1.788	1.425	1.906	1.830	1.583	1.513	1.376	1.462	1.274	1.139
State VAA	0503	.425	.784	.236	.323	.275	.206	.231	.309	.637	.569
State VE	1902					.148	.098	.106	.160		.569
Total		8.510	9.505	10.304	10.176	8.769	8.727	8.670	8.774	8.281	10.215
Sohio Petroleum Company											
Warn State	2301	.132	.272	.393	.374	.341	.233	.254	.373	1.274	1.139
Texaco Inc. (Crusader Texas State)											
State CG NCT-2	2904			.025	.021	.161	.143	.162	.182		.569
GRAND TOTAL		100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED
LEA COUNTY, NEW MEXICO

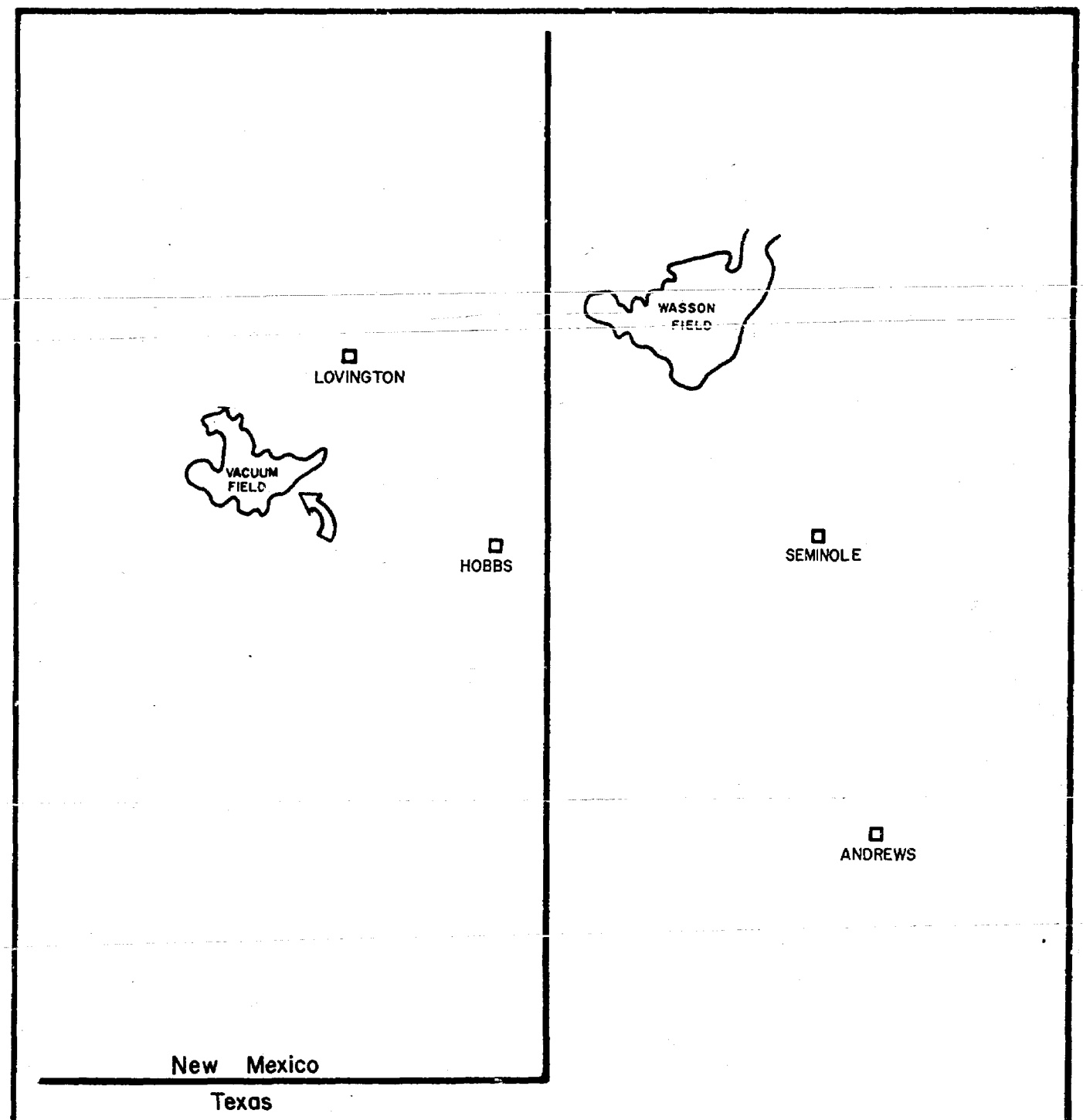
COMPARISON OF PARAMETERS BY AREA

Parameter	North Area	South Area	East Area	Total Area
Average Porosity, percent	10.0	12.4	11.8	11.7
Average Net Thickness, feet	33	127	78	71.3
Average Original Water Saturation, percent	18.6	15.0	15.8	15.9
Original Oil-in-Place, M barrels	59,138	167,341	70,508	296,987
Barrels/Acre	17,393	78,934	46,387	42,273
Cumulative Production 1-1-77, M barrels	18,037	30,717	16,903	65,657
Barrels/Acre	5,305	14,489	11,120	9,346
Remaining Primary 1-1-77, M barrels	2,409	7,971	1,963	12,343
Barrels/Acre	709	3,760	1,291	1,756
Ultimate Primary Recovery, M barrels	20,446	38,688	18,866	78,000
M Barrels/40-Acre Unit	241	730	496	444
Primary Recovery, Percent Original Oil-in-Place	34.6	23.1	26.8	26.3
Total 40-Acre Proration Units	85	53	38	176
Proration Units Producing Top Allowable December, 1976	0	36	7	43
Water Encroachment, Percent Original Hydrocarbon Pore Volume	2.8	4.1	36.0	11.4
Last Half 1976 Production, Barrels/Day/40-Acre Unit	10.6	60.9	29.3	29.8

EAST VACUUM GRAYBURG-SAN ANDRES UNIT, PROPOSED
LEA COUNTY, NEW MEXICO

PROJECT COMPARISON OF EAST VACUUM UNIT TO DENVER UNIT

Project	East Vacuum Grayburg-San Andres Unit, Proposed	Shell Oil Company Denver Grayburg-San Andres Unit
Depth, feet	4,400	5,100
Type Formation	Dolomite	Dolomite
Bottom-Hole Temperature, °F.	101	105
Original Bottom-Hole Pressure, psig	1,613	1,805
Net Pay, feet	71	129
Porosity, percent	11.7	12.0
Permeability, Md.	11.0	3.5
Area, acres	7,025	27,850
Connate Water, percent	15.9	15.0
Original Oil Formation Volume Factor	1.288	1.312
Initial Solution Gas-Oil Ratio, cubic feet/stock tank barrel	465	588
Initial Viscosity of Oil, centipoise	0.80	0.97
Gravity, °API	35	33
Original Oil-in-Place, MM barrels	297	2,166
Ultimate Primary, MM barrels	78	354
Estimated Secondary, MM barrels	41	410
Total, MM barrels	119	764
Recovery to Date, MM barrels	66	595
Flood Pot Residual Oil Saturation, percent	30	40 to 45
Percent of Original Oil Recovered after Waterflood (estimate)	40.0	35.3
Original Gas Cap	No	Yes



VACUUM FIELD
LEA COUNTY, NEW MEXICO
LOCATION PLAT
SCALE: 1" = 12.12 MILES

Figure 1

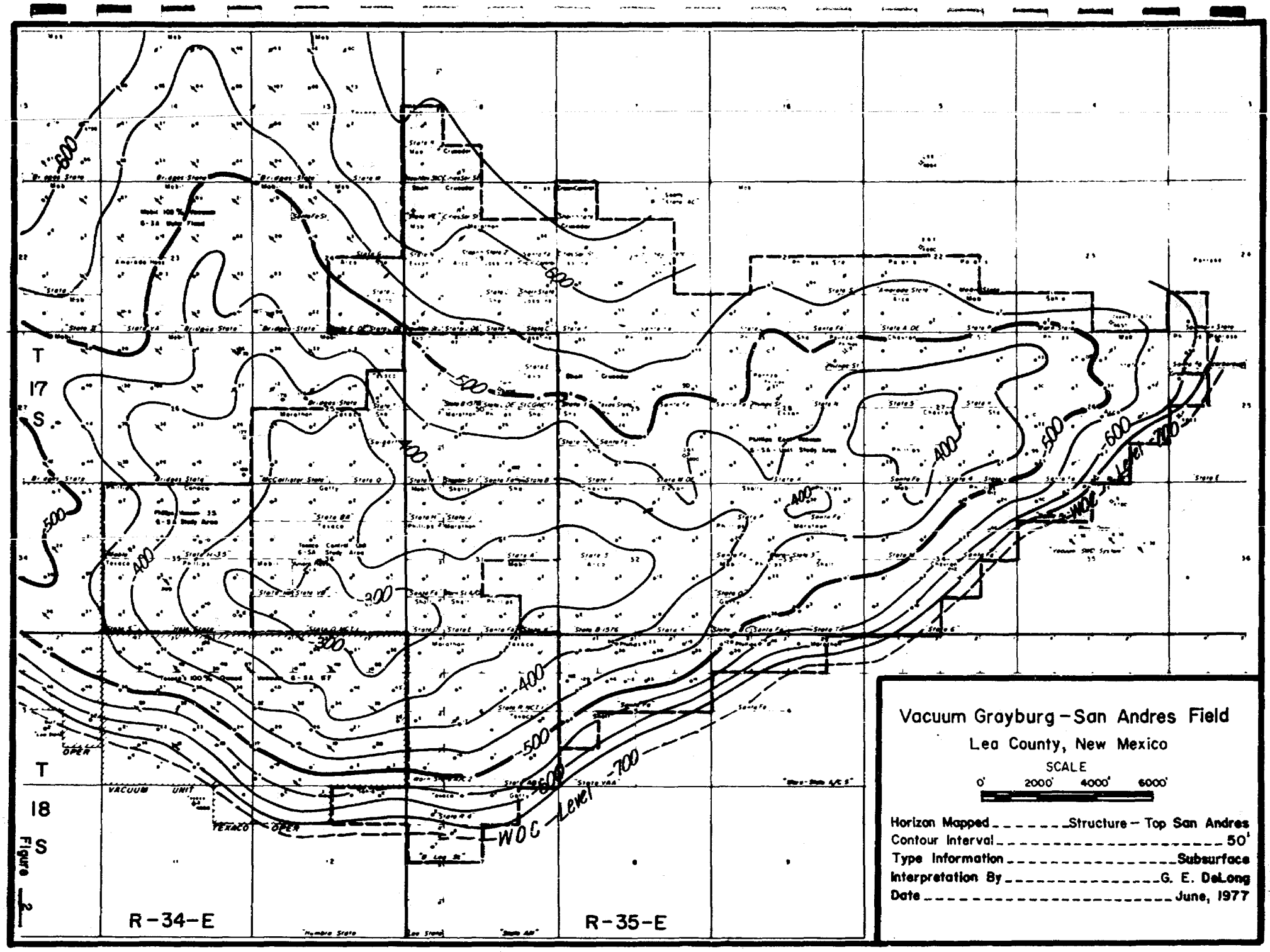
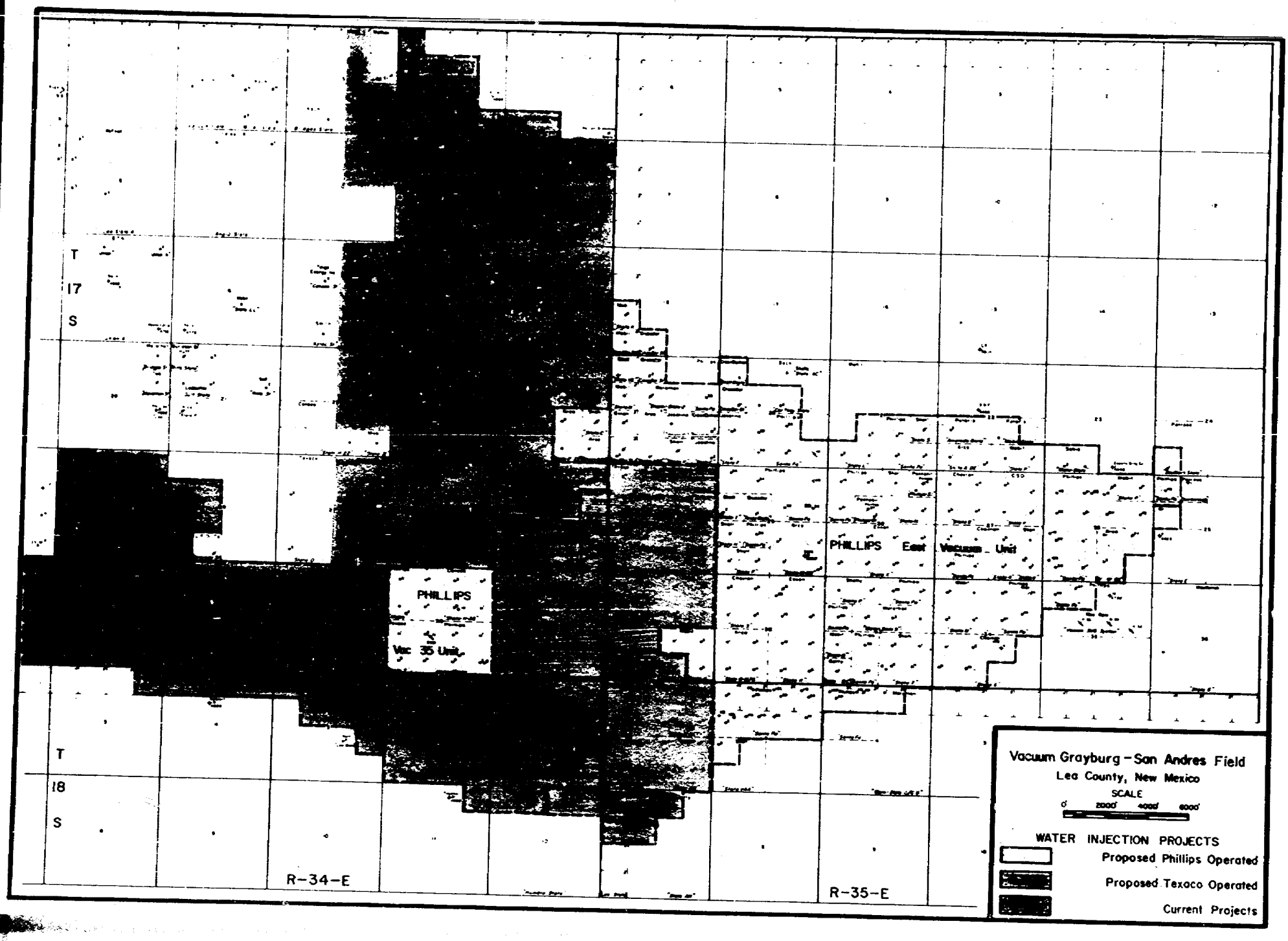
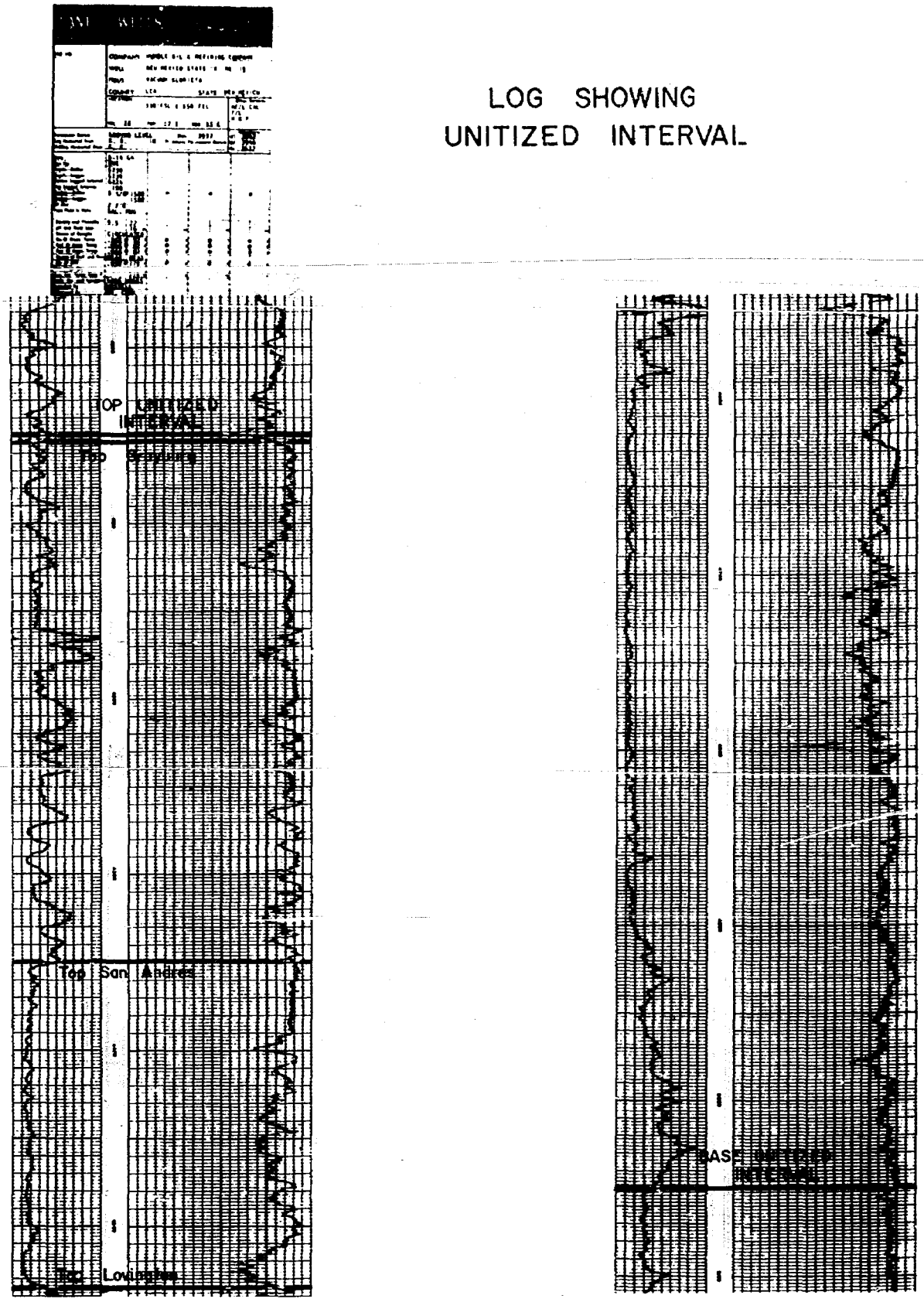

T
17
S
T
18
S
R-34-E
R-35-E
VACUUM UNIT
OPEN
OPEN
WOC Level
600
500
400
300
700
Vacuum Grayburg-San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
Horizon Mapped ..... Structure - Top San Andres
Contour Interval ..... 50'
Type Information ..... Subsurface
Interpretation By ..... G. E. DeLong
Date ..... June, 1977

Figure 2


T
17
S
PHILLIPS
Vac 35 Unit
PHILLIPS East Vacuum Unit
T
18
S
R-34-E
R-35-E
Vacuum Grayburg - San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
WATER INJECTION PROJECTS
Proposed Phillips Operated
Proposed Texaco Operated
Current Projects

Figure

LOG SHOWING
UNITIZED INTERVAL



The unitized interval will be the vertical interval that appears between a depth of 4050' and 5050' on the Lane wells acoustic log Run #1, dated 4-14-64 on the Humble Oil and Refining Company New Mexico State "K" #19. This well is located 330' FSL, 330' FEL, Sec. 28, Township 17 South, Range 35 East, Lea County, New Mexico. The unitized interval is to include all subsurface points throughout the unit area between these identified correlative depths.

Figure 6

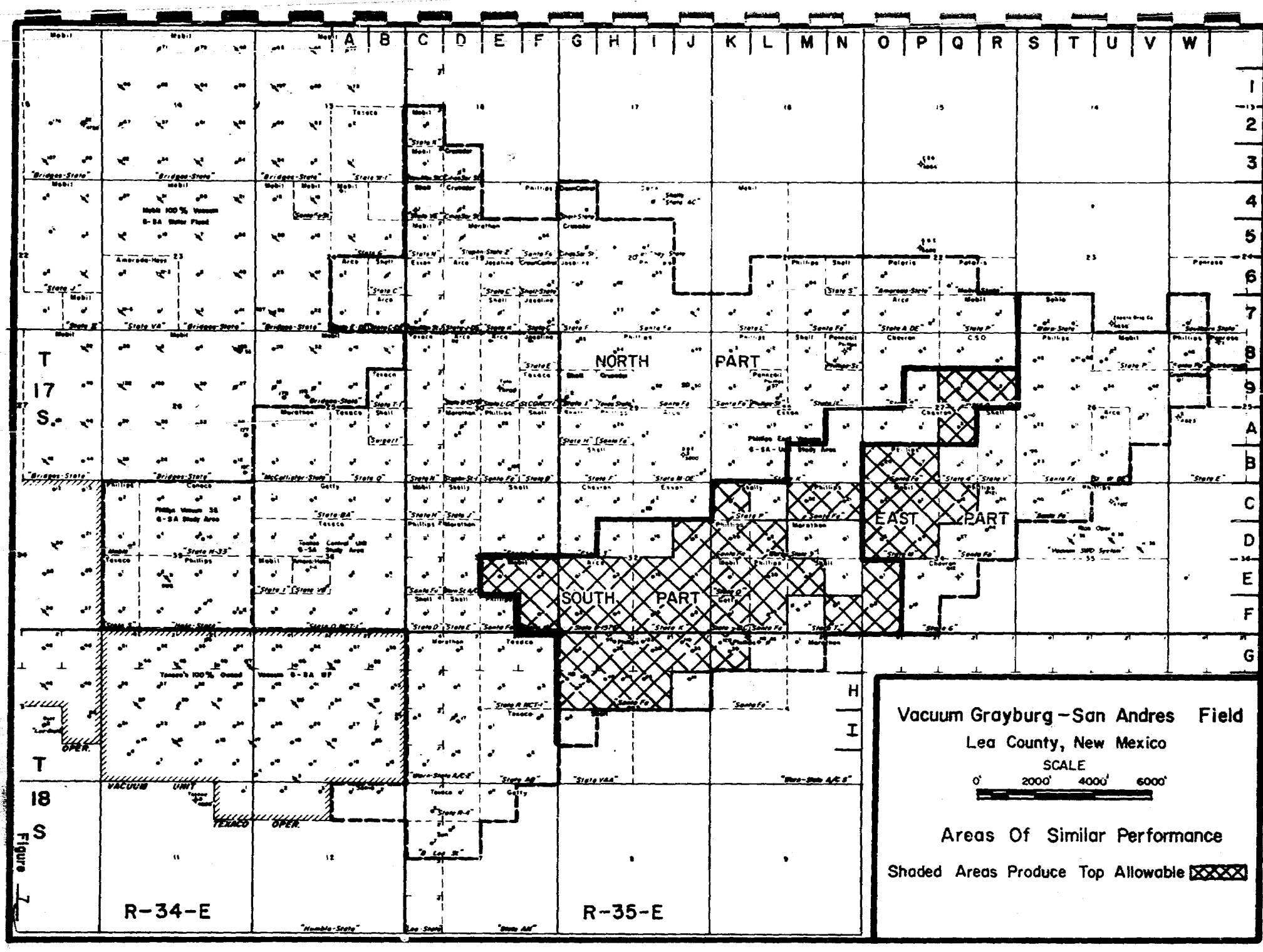

NORTH PART
EAST PART
SOUTH PART
T 17 S
T 18 S
R-34-E
R-35-E
VACUUM UNIT
TEXACO OPER.
OPER.
Vacuum Grayburg – San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
Areas Of Similar Performance
Shaded Areas Produce Top Allowable

Figure 7

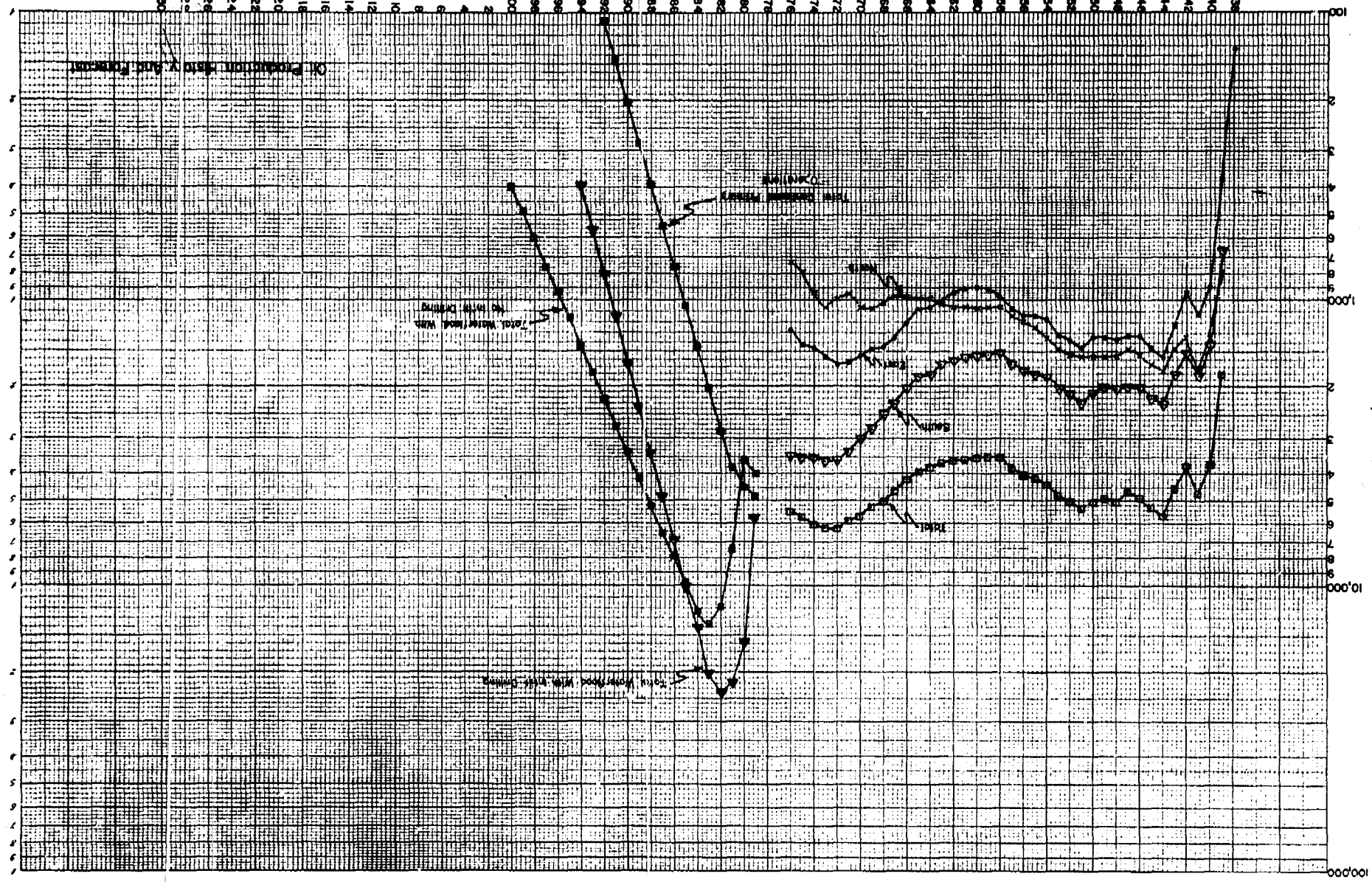

Oil Production, STBO/D
1,000
10,000
100,000
Oil Production History And Forecast

Figure 8

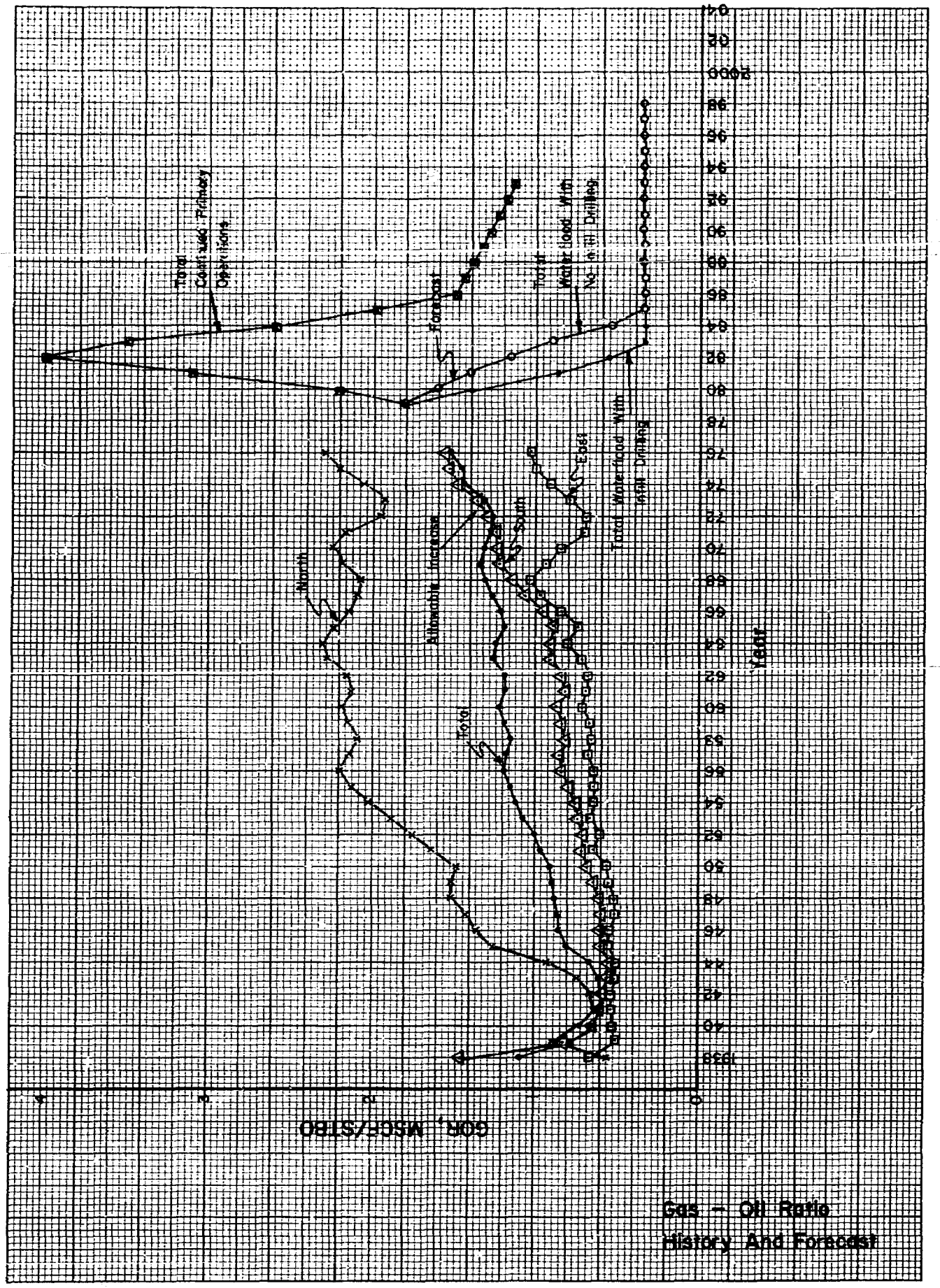

Total Commingled Primary Operations
Forecast
Total Water load With No. of Ill Drilling
Allowable Increase
North
South
East
Total Waterflood With Infill Drilling
GOR, MSCF/STBO
Year
Gas – Oil Ratio
History And Forecast

Figure 9

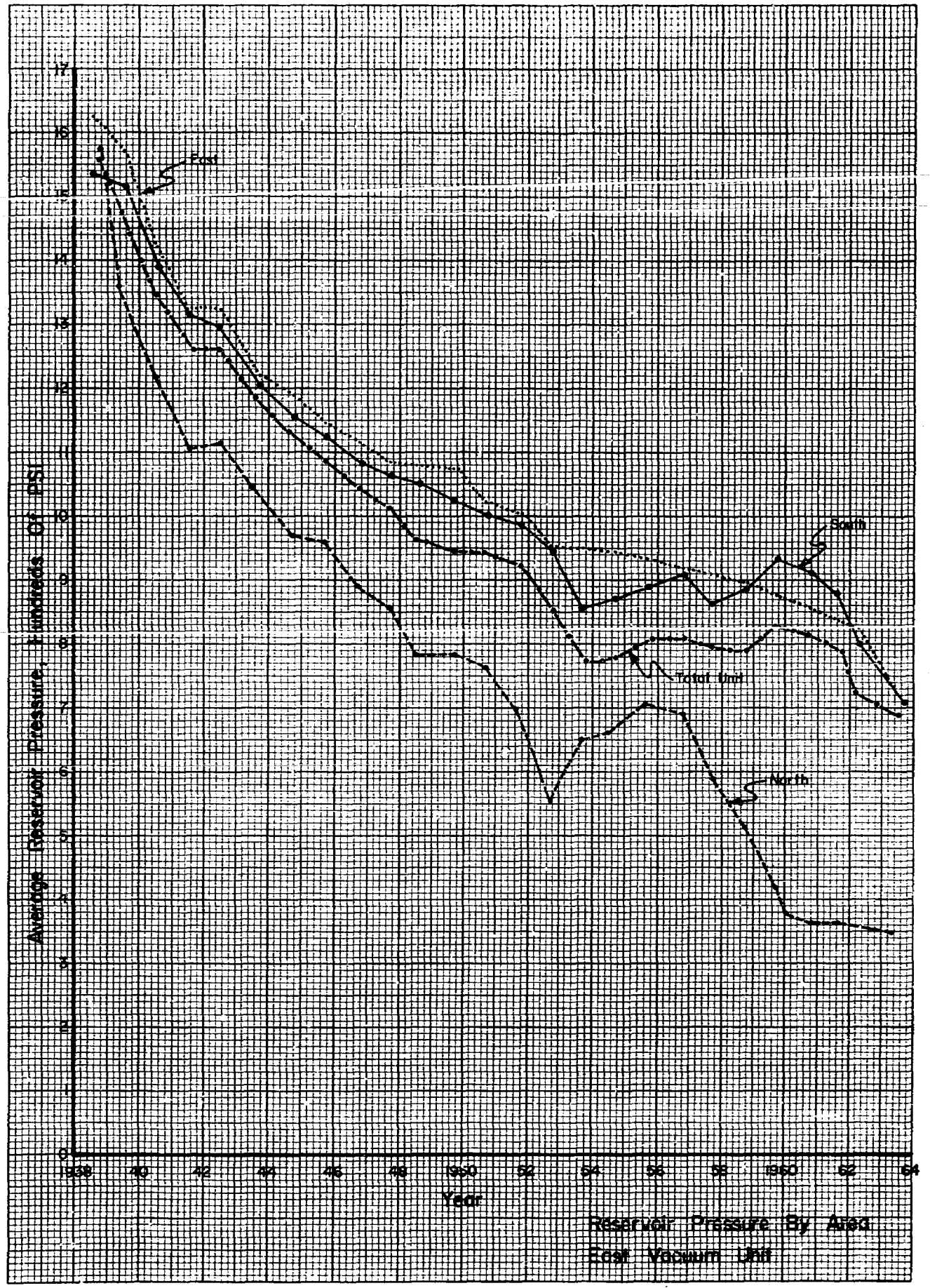
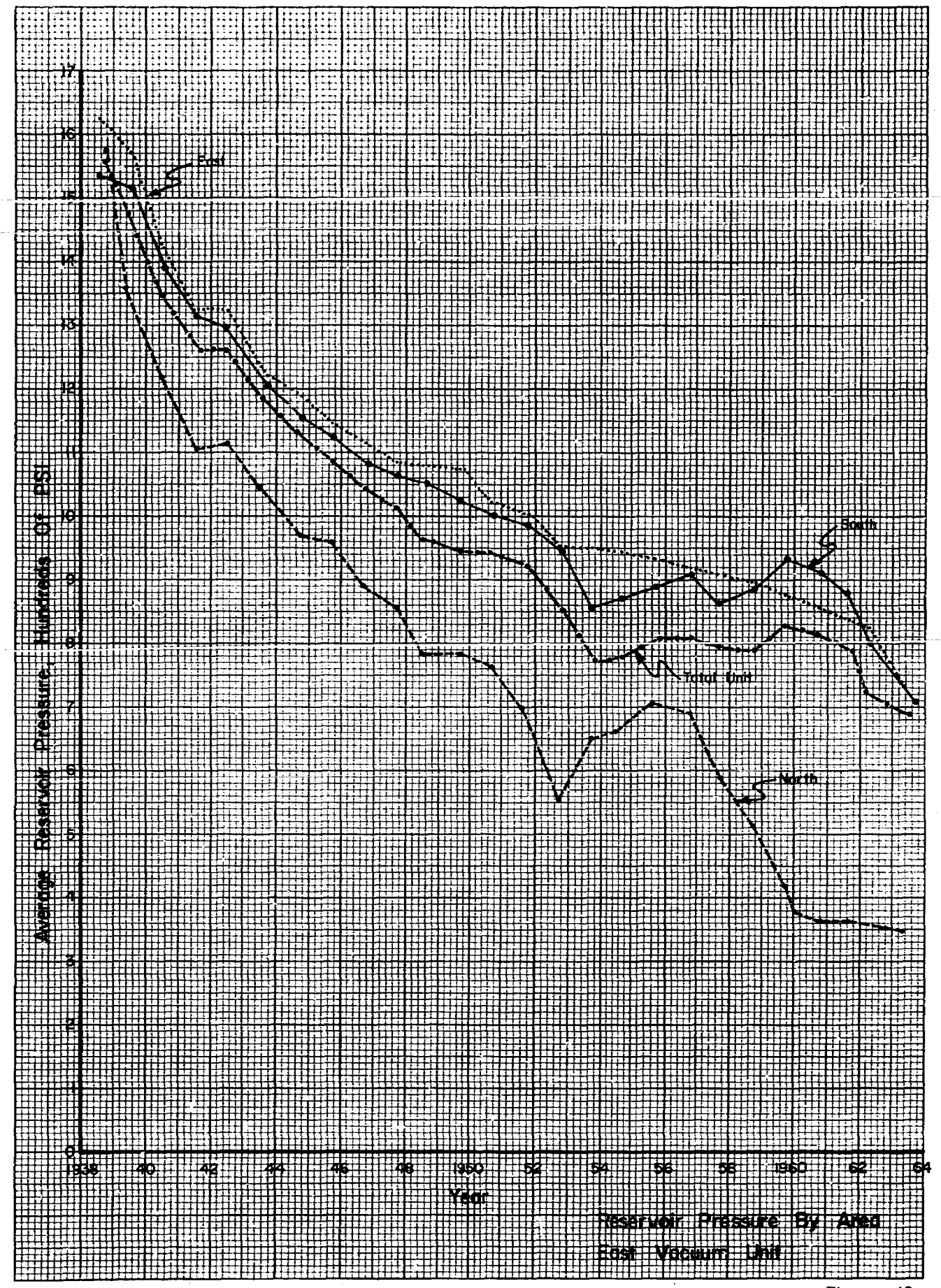

Average Reservoir Pressure - Hundreds Of PSI
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1938
40
42
44
46
48
1950
52
54
56
58
1960
62
64
Year
East
South
Total Unit
North
Reservoir Pressure By Area
East Vacuum Unit

Figure 10



Reservoir Pressure By Area
East Vacuum Unit

Figure 10

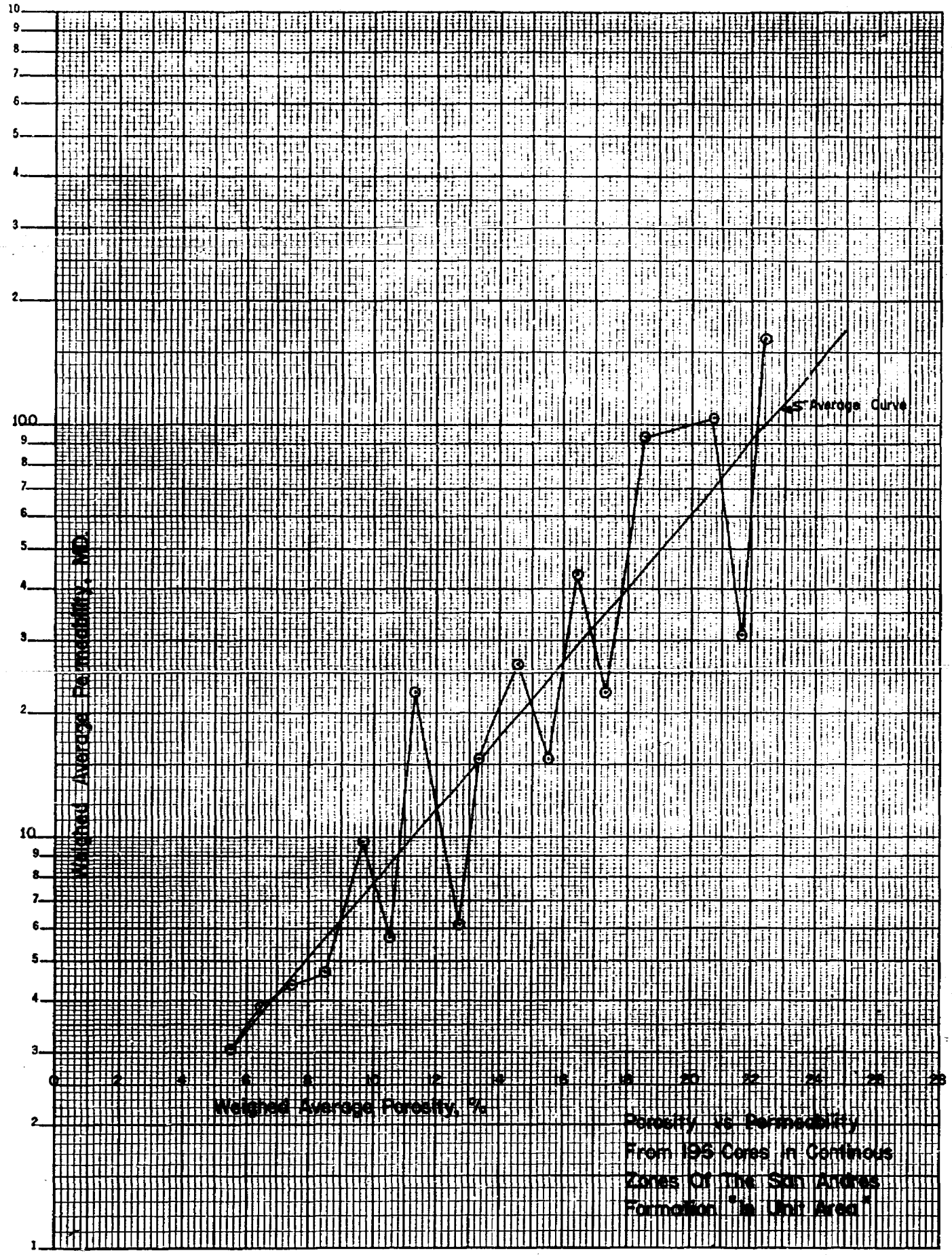
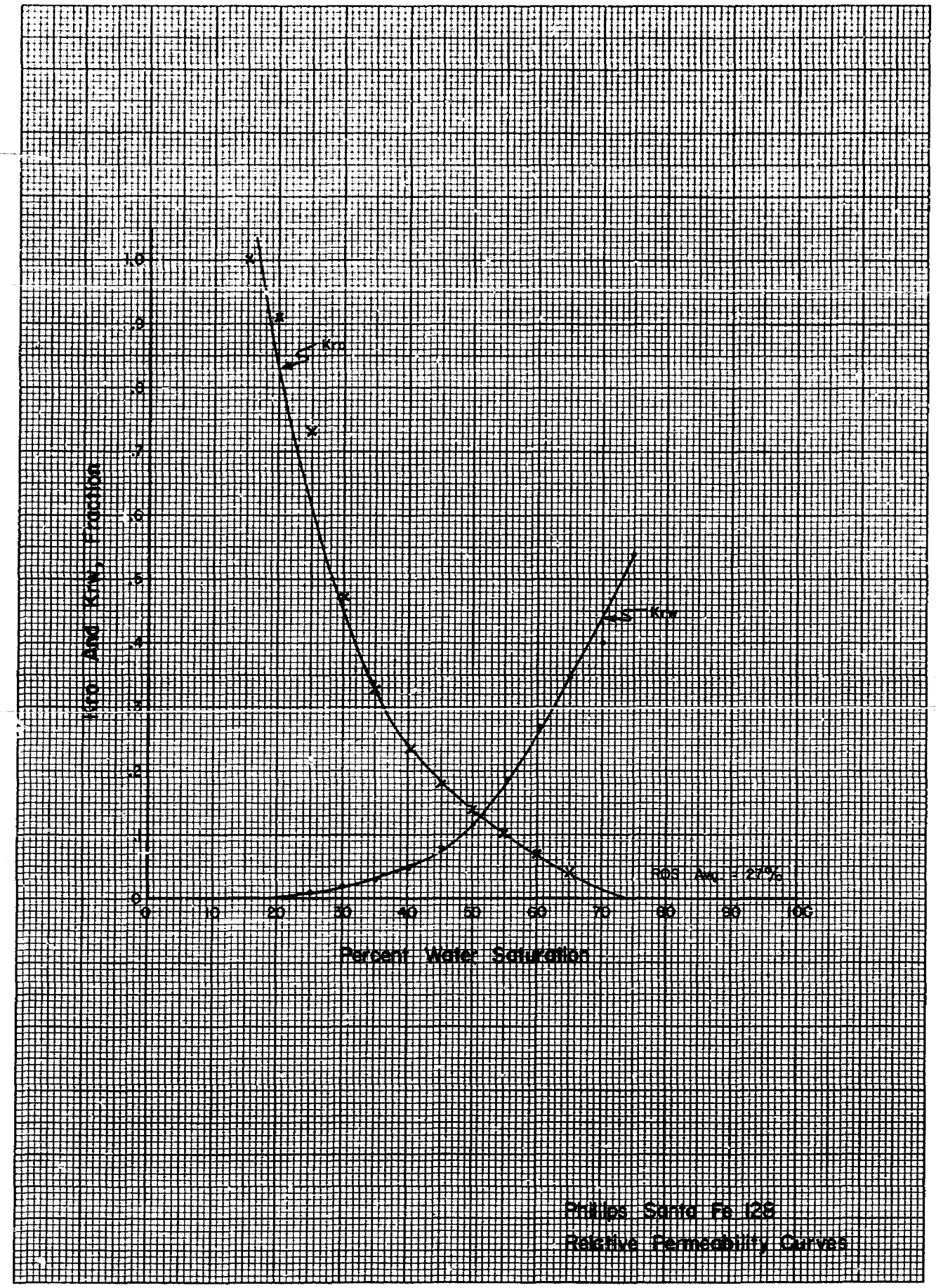

Weighted Average Permeability, MD
Weighted Average Porosity, %
Average Curve
Porosity vs Permeability
From 195 Cores in Continous
Zones Of The San Andres
Formation "A" Unit Area

Figure II



Phillips Santa Fe 128
Relative Permeability Curves

Figure 12

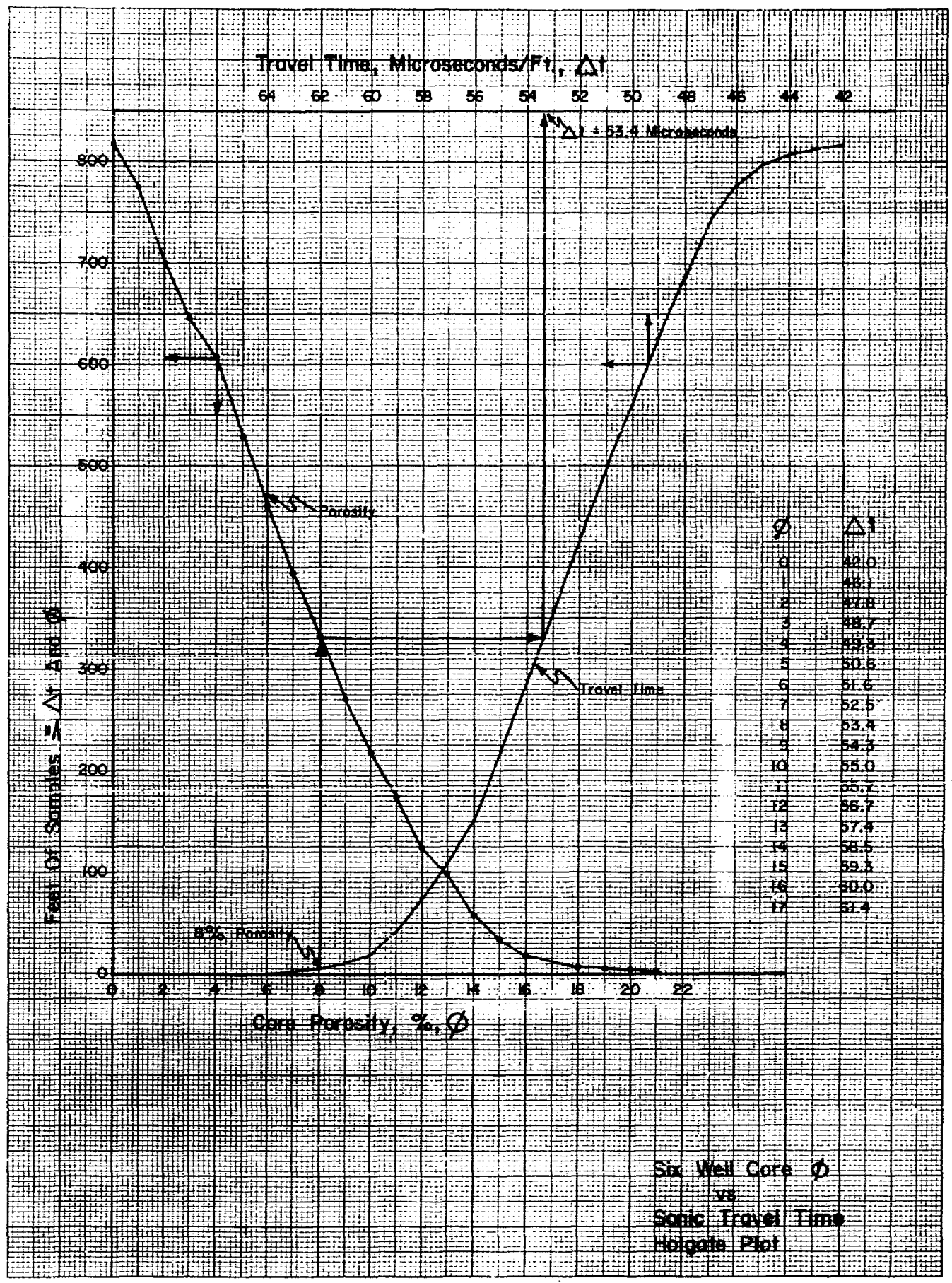

Travel Time, Microseconds/Ft., Δt
64
62
60
58
56
54
52
50
48
46
44
42
Δt = 53.4 Microseconds
800
700
600
500
400
300
200
100
0
Porosity
Travel Time
8% Porosity
Feet Of Samples Δt And ϕ
0
2
4
6
8
10
12
14
16
18
20
22
Core Porosity, %, ϕ
ϕ
Δt
9
42.0
1
46.1
2
47.8
3
48.7
4
49.3
5
50.6
6
51.6
7
52.5
8
53.4
9
54.3
10
55.0
11
55.7
12
56.7
13
57.4
14
58.5
15
59.3
16
60.0
17
61.4
Six Well Core ϕ
vs
Sonic Travel Time
Holgate Plot

Figure 13

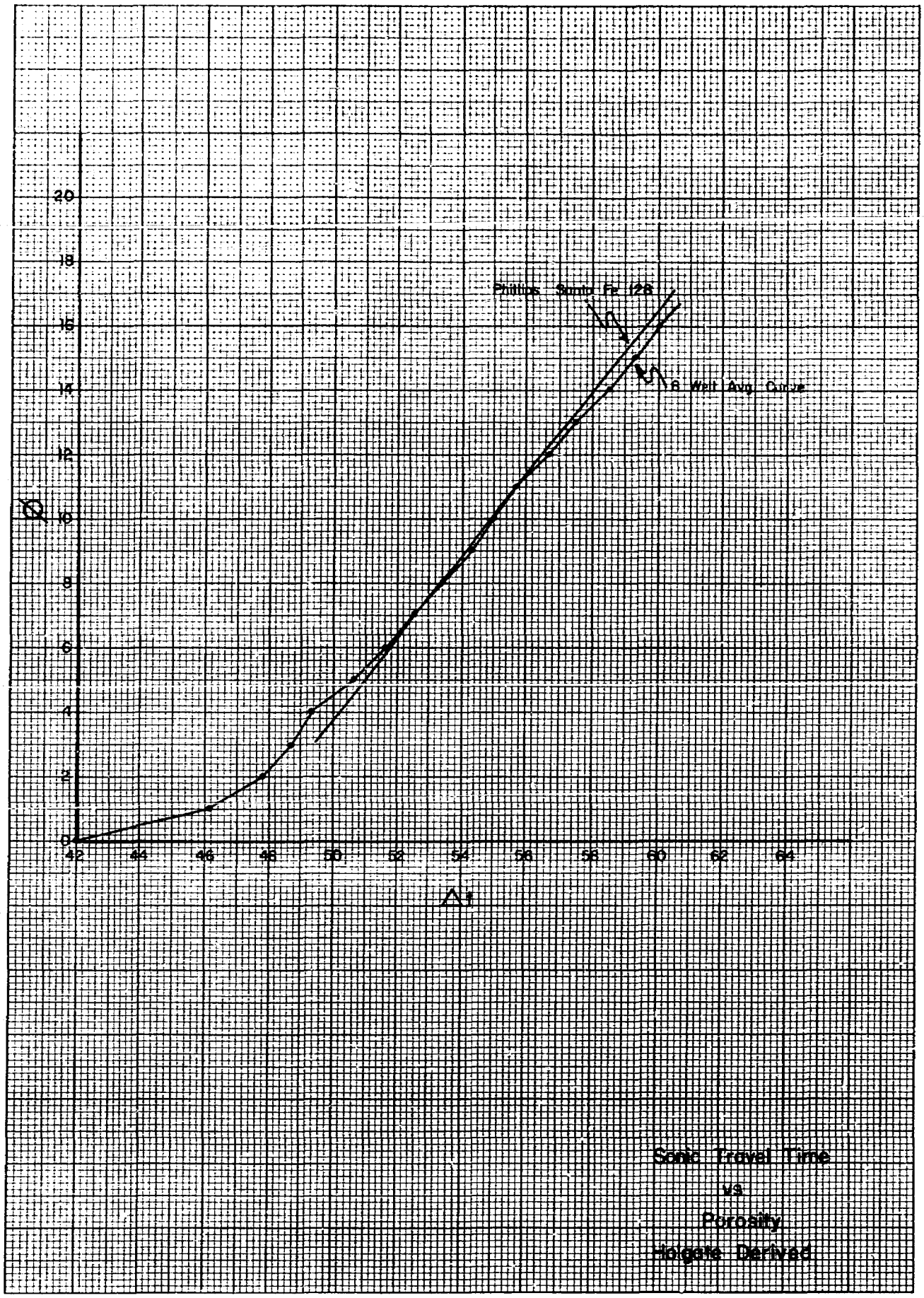

Phillips Sonic Fe 128
6 Well Avg Curve
20
18
16
14
12
10
8
6
4
2
0
42
44
46
48
50
52
54
56
58
60
62
64
Δt
Sonic Travel Time
vs.
Porosity
Hoigate Derived

Figure 14

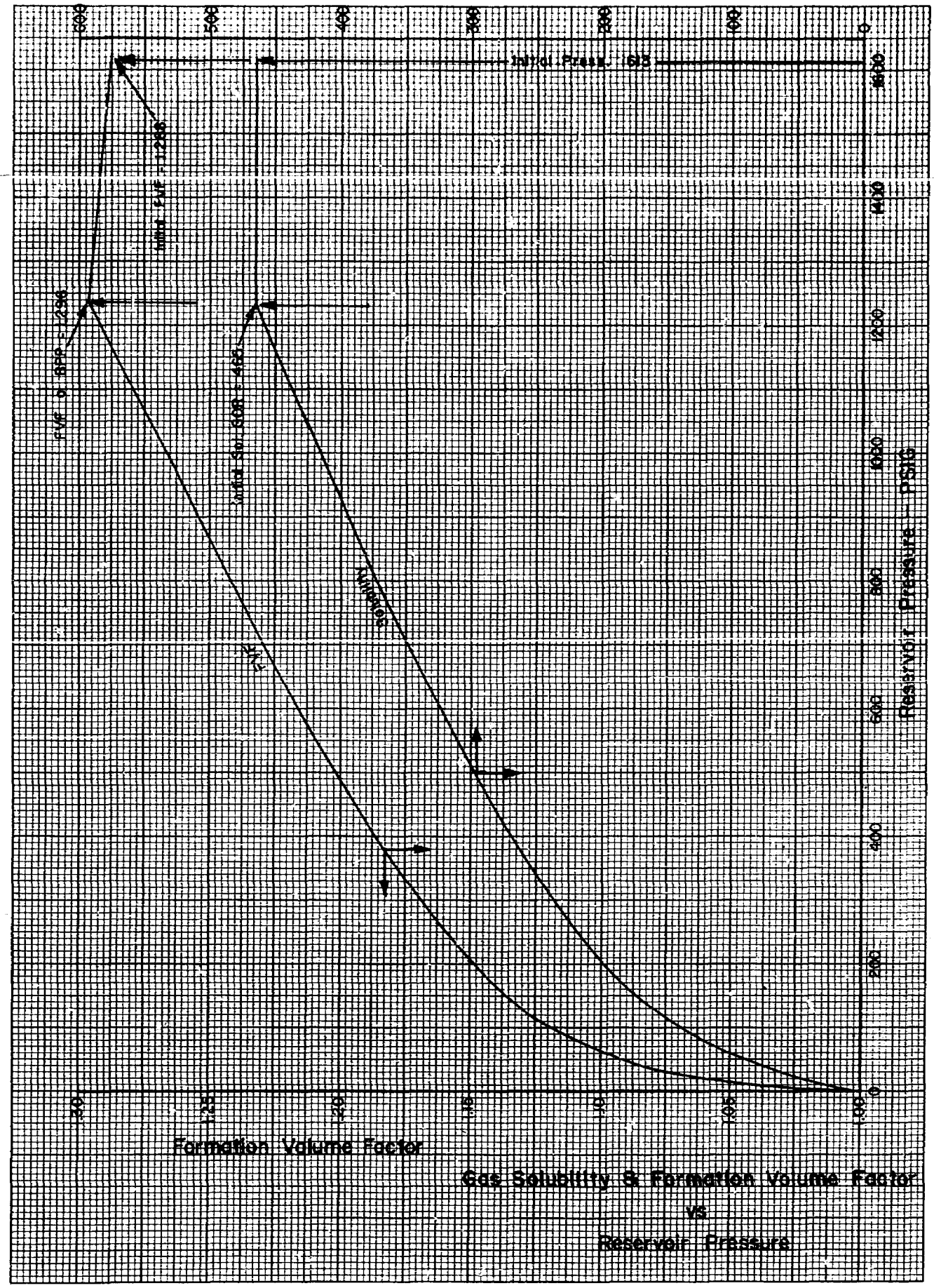
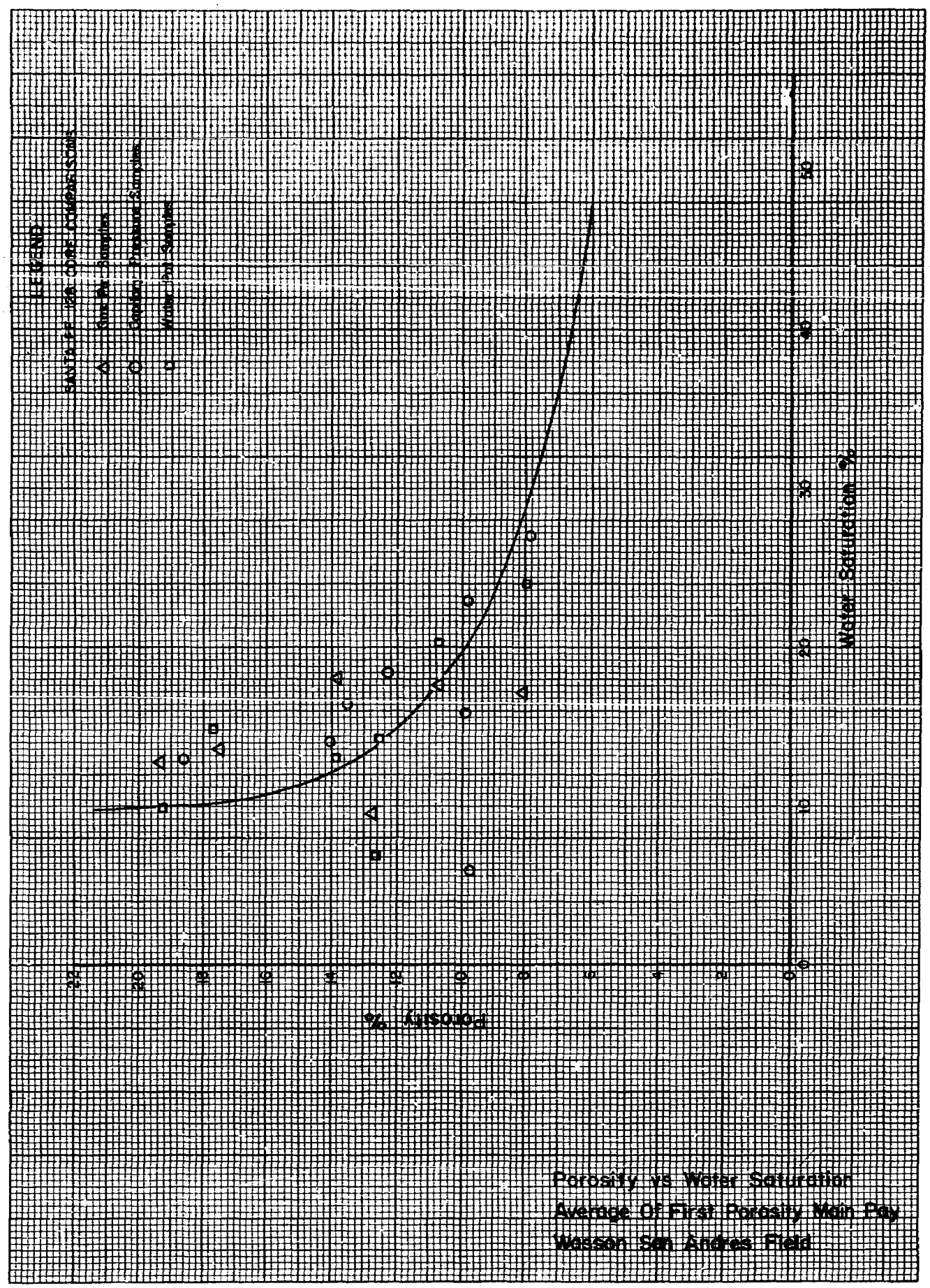

Gas – Oil Ratio – Cu. Ft./Bbl.
Initial Press. 615
Initial F.V.F. = 1.286
F.V.F. @ BPP = 1.236
Initial Sol. GOR = 465
Average
F.V.F.
Reservoir Pressure – PSIG
Formation Volume Factor
Gas Solubility & Formation Volume Factor
vs
Reservoir Pressure

Figure 15



Porosity vs Water Saturation
Average Of First Porosity Main Pay
Wasson San Andres Field

Figure 16

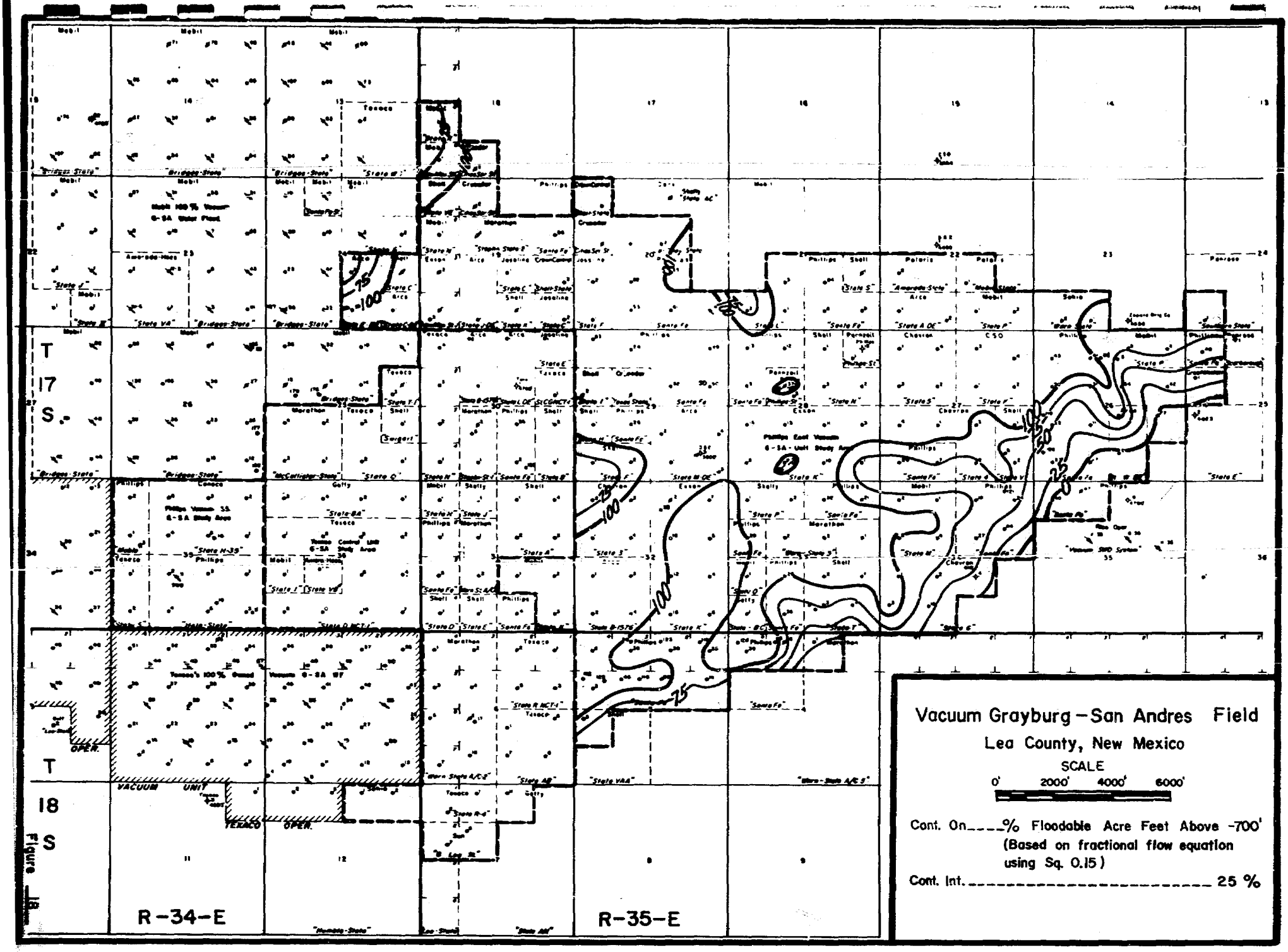

T
17
S
T
18
S
R-34-E
R-35-E
VACUUM UNIT
TEXACO
OPEN.
Vacuum Grayburg – San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
Cont. On____% Floodable Acre Feet Above -700'
(Based on fractional flow equation using Sq. 0.15)
Cont. Int. 25 %

Figure 18

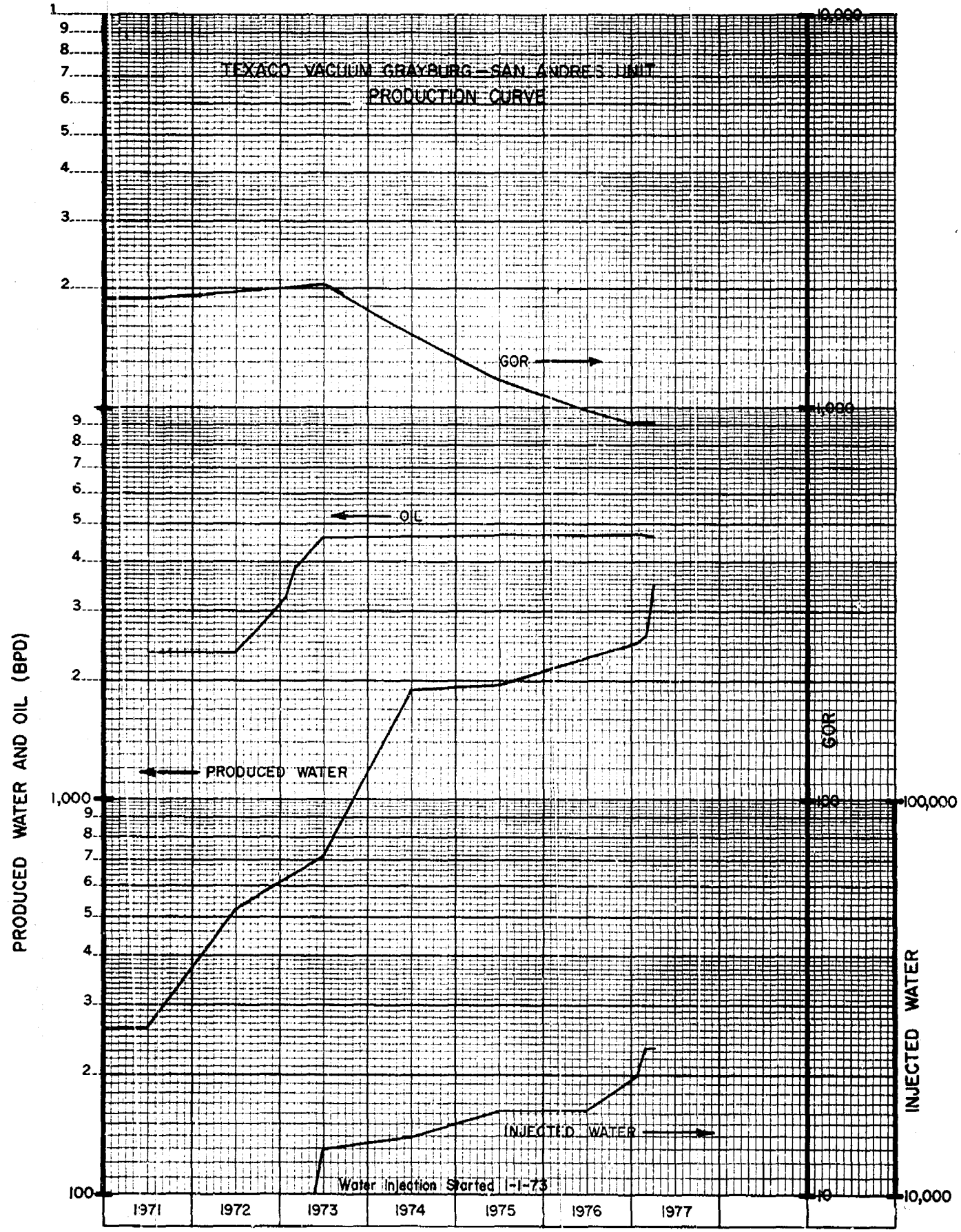
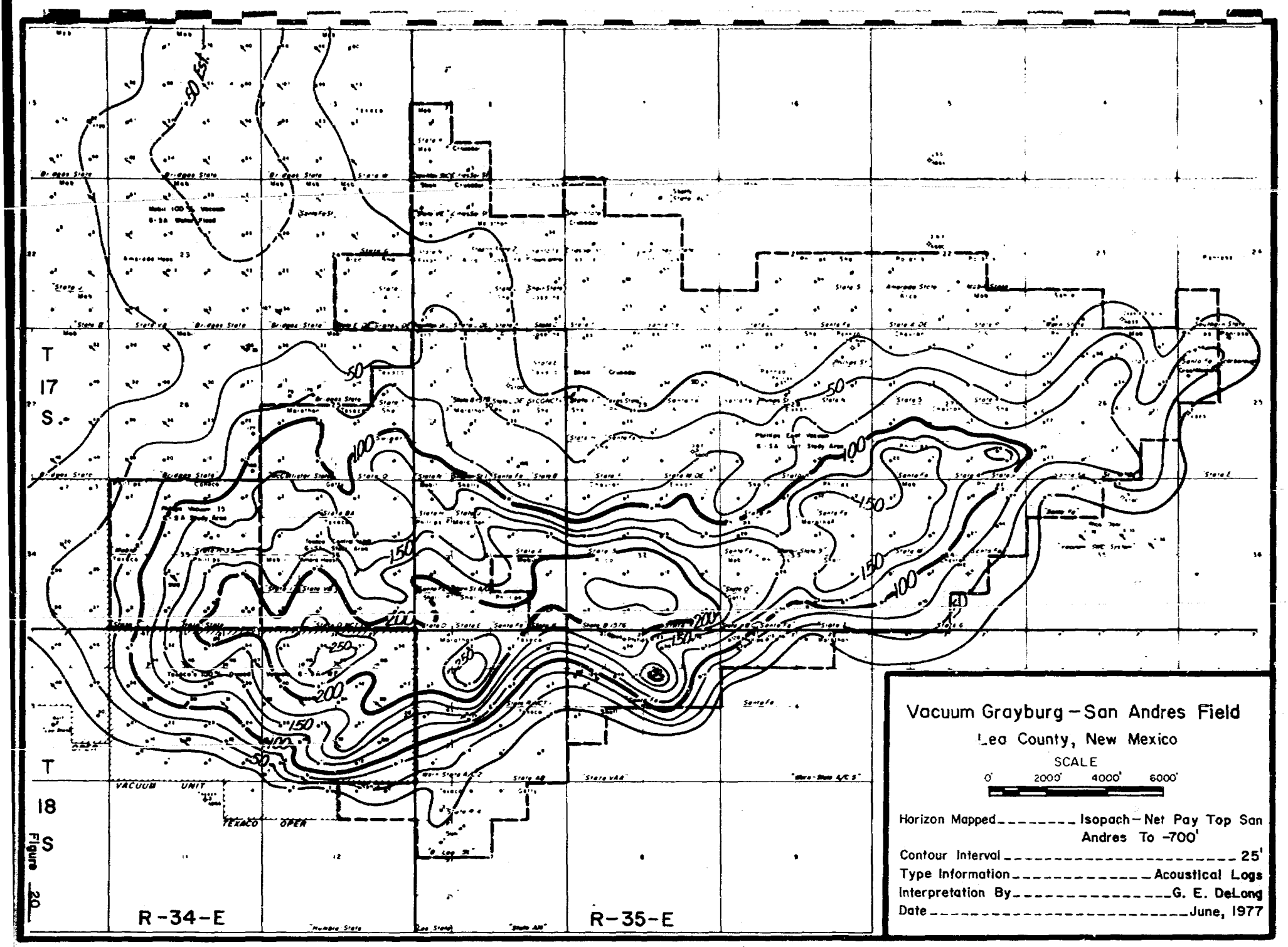

TEXACO VACUUM GRAYBURG—SAN ANDRES UNIT
PRODUCTION CURVE
PRODUCED WATER AND OIL (BPD)
GOR
OIL
PRODUCED WATER
INJECTED WATER
Water Injection Started 1-1-73
1971
1972
1973
1974
1975
1976
1977
10,000
1,000
100
100,000
10

Figure 19



Vacuum Grayburg – San Andres Field

Lea County, New Mexico

SCALE

0' 2000' 4000' 6000'

Horizon Mapped ..... Isopach – Net Pay Top San Andres To -700'

Contour Interval ..... 25'

Type Information ..... Acoustical Logs

Interpretation By ..... G. E. DeLong

Date ..... June, 1977

Figure 20

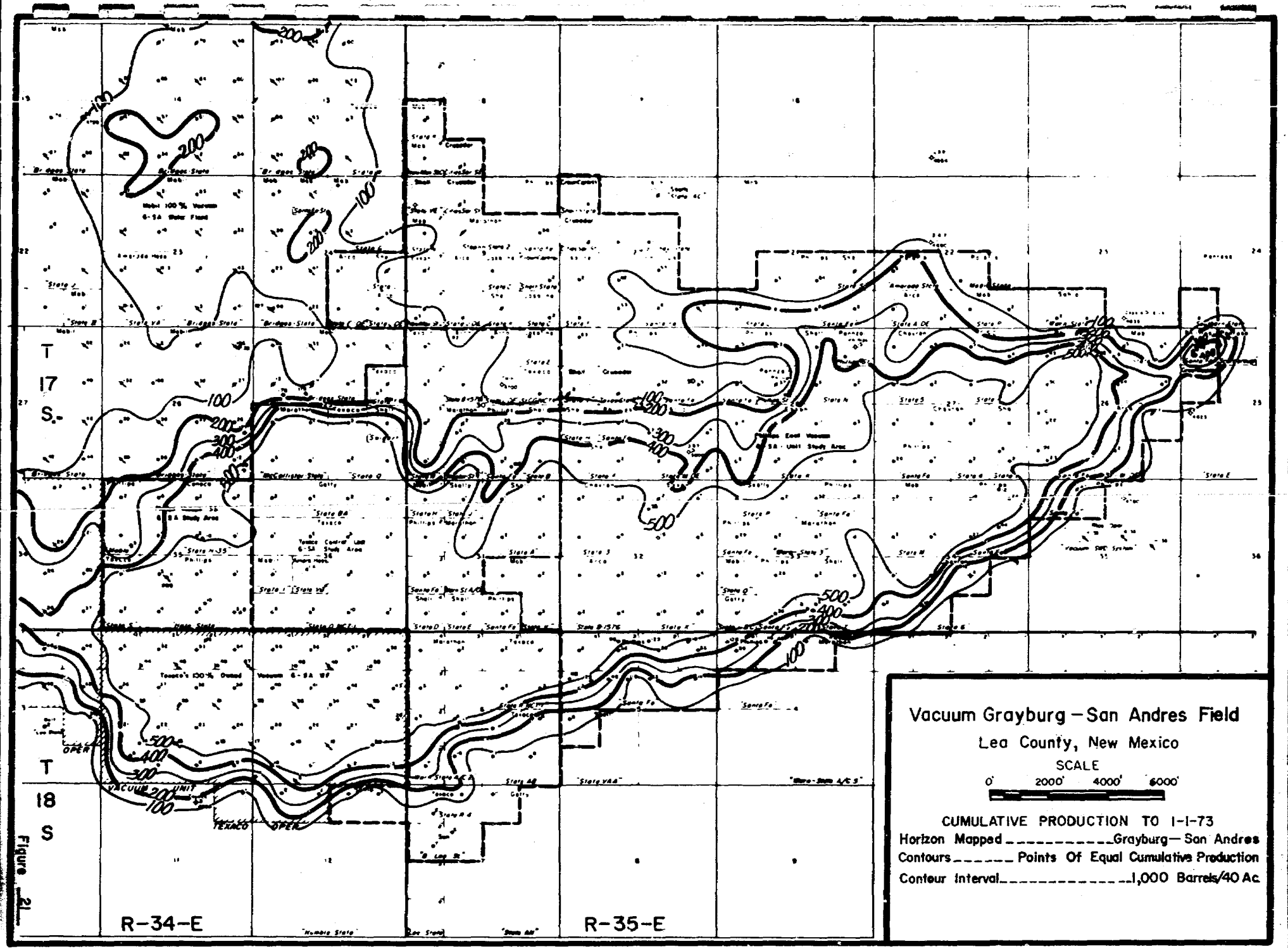
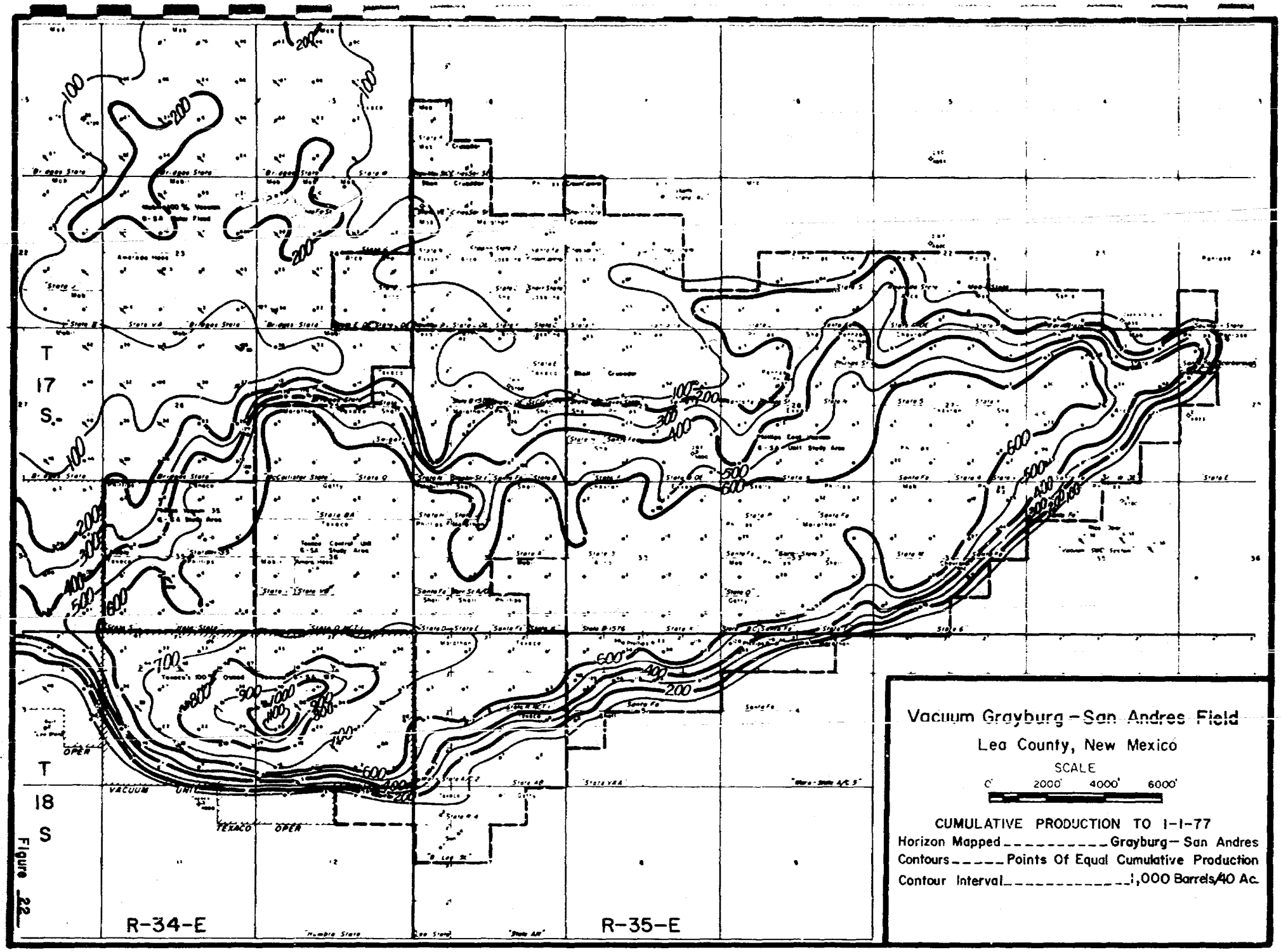

T
17
S
T
18
S
R-34-E
R-35-E
100
200
300
400
500
VACUUM UNIT
TEXACO OPER
OPER
Vacuum Grayburg – San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
CUMULATIVE PRODUCTION TO 1-1-73
Horizon Mapped ---------- Grayburg – San Andres
Contours ------- Points Of Equal Cumulative Production
Contour Interval ---------- 1,000 Barrels/40 Ac.

Figure 21



Vacuum Grayburg – San Andres Field

Lea County, New Mexico

SCALE

0' 2000' 4000' 6000'

CUMULATIVE PRODUCTION TO 1-1-77

Horizon Mapped _____ Grayburg – San Andres

Contours _____ Points Of Equal Cumulative Production

Contour Interval _____ 1,000 Barrels/40 Ac.

Figure 22

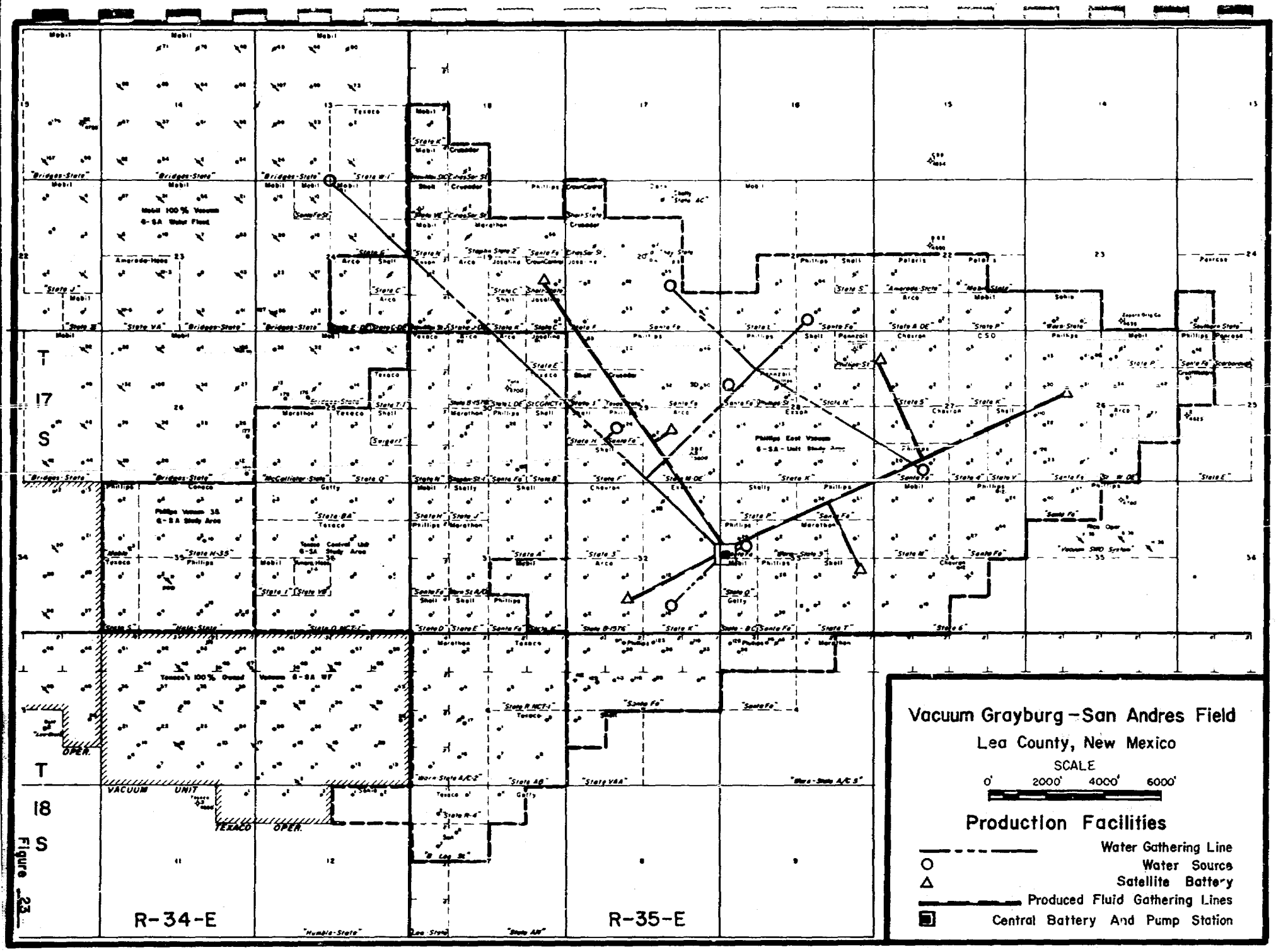

T 17 S
T 18 S
R-34-E
R-35-E
VACUUM UNIT
TEXACO
OPER.
Vacuum Grayburg – San Andres Field
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
Production Facilities
Water Gathering Line
Water Source
Satellite Battery
Produced Fluid Gathering Lines
Central Battery And Pump Station

Figure 23

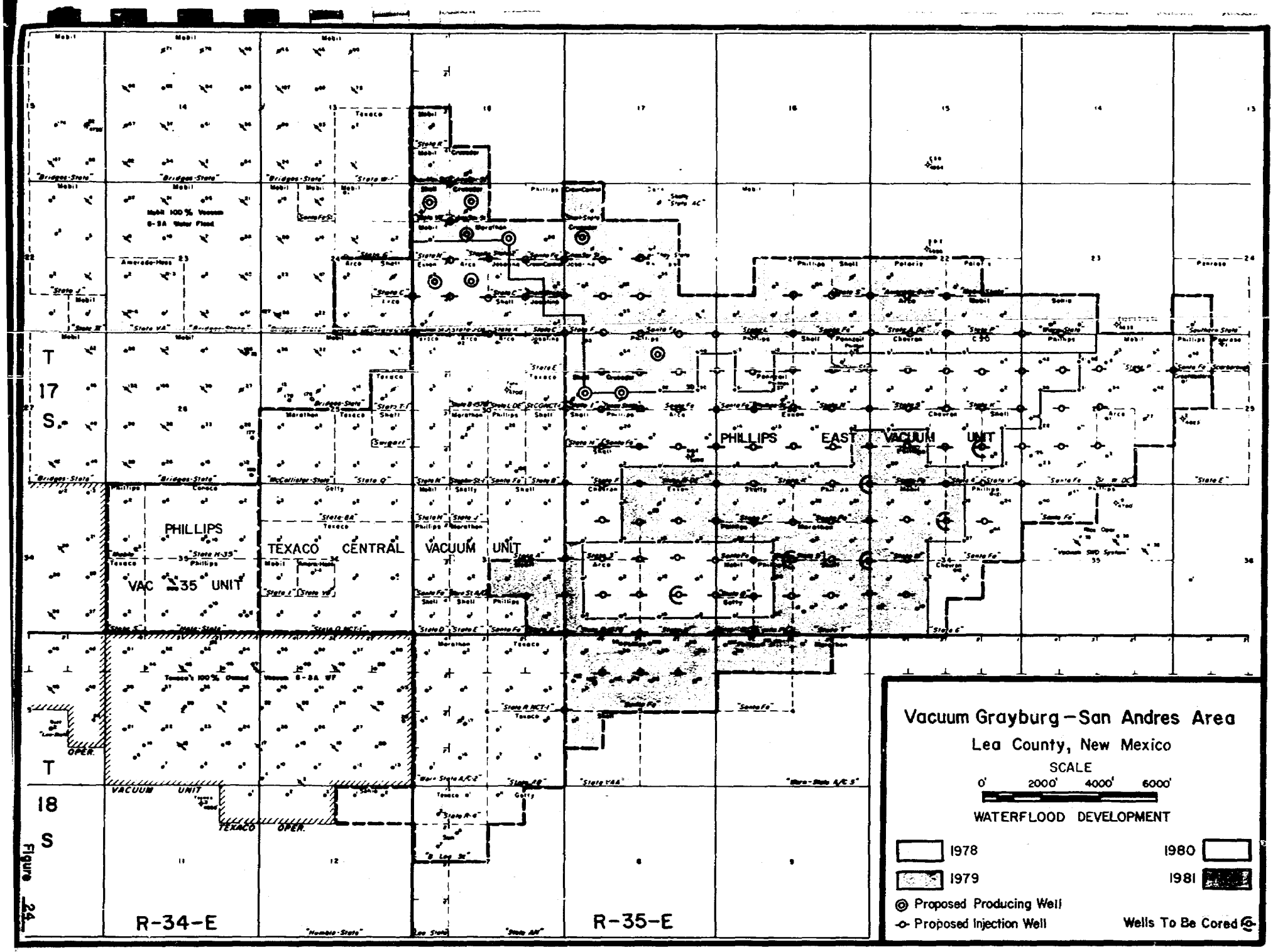

T
17
S
T
18
S
R-34-E
R-35-E
PHILLIPS
VAC 35 UNIT
TEXACO CENTRAL
VACUUM UNIT
PHILLIPS EAST VACUUM UNIT
VACUUM UNIT
TEXACO
OPER.
Vacuum Grayburg – San Andres Area
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
WATERFLOOD DEVELOPMENT
1978
1979
1980
1981
Proposed Producing Well
Proposed Injection Well
Wells To Be Cored

Figure 24

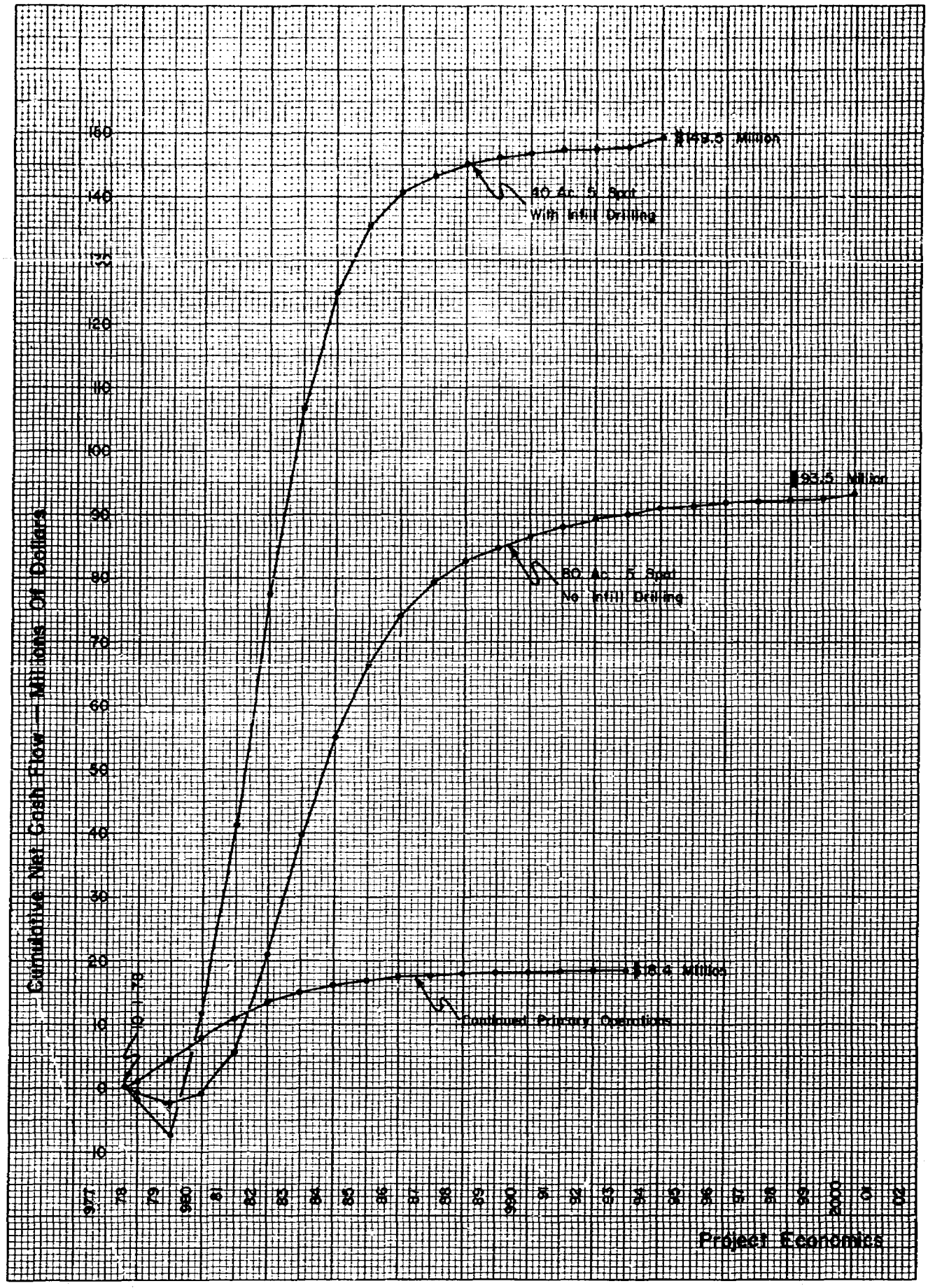

Cumulative Net Cash Flow — Millions Of Dollars
160
140
120
110
100
90
80
70
60
50
40
30
20
10
0
10
$143.5 Million
40 Ac. 5 Spot
With Infill Drilling
$93.5 Million
60 Ac. 5 Spot
No Infill Drilling
$16.4 Million
Continued Primary Operations
Project Economics

Figure 25

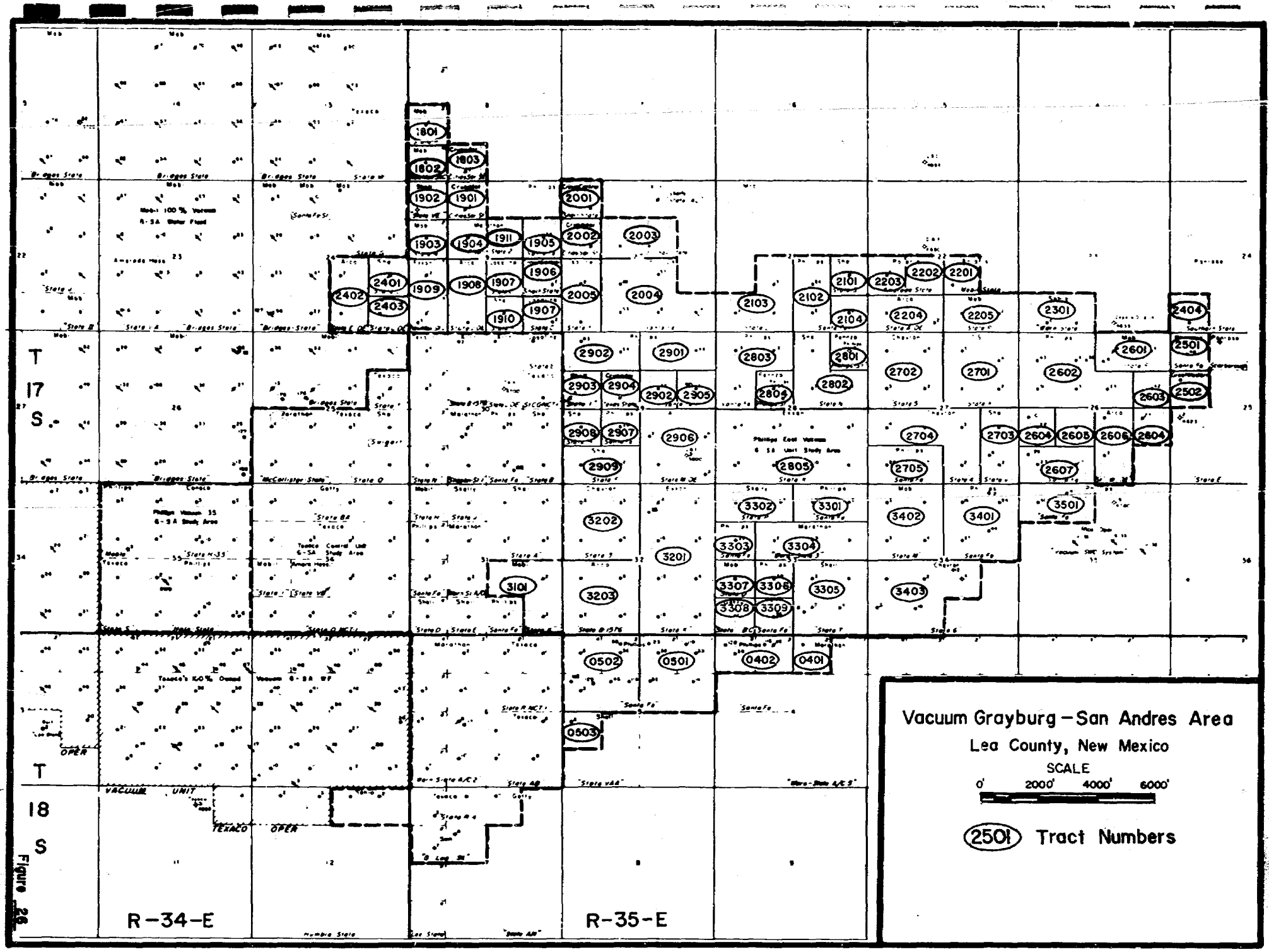

T 17 S
T 18 S
R-34-E
R-35-E
Vacuum Grayburg – San Andres Area
Lea County, New Mexico
SCALE
0' 2000' 4000' 6000'
(2501) Tract Numbers

Figure 28

APPENDIX A

METHOD OF ALLOCATION

The following is a sample calculation of allocation of future primary reserves assigned to tracts producing at top allowable and with annual production decline rates less than 13 percent.

Conditions

Ultimate Primary Recoverable Reserves	5,992,000
Less Future Primary Determined from Decline Curves	461,000
Less Cumulative Production, January 1, 1977	4,993,224
Remaining Primary Reserves to be Allocated	537,776
Decline Rate when Wells begin Decline	28% per year
Economic Limit	2 bopd

The three tracts producing under these conditions are shown in the table below:

Line		Tract A	Tract B	Tract C	Total
1	Category	Top Allowable	13% Decline	Top Allowable	
2	Reserves Produced During Decline	86,666	64,444	86,666	237,776
3	Initial Rate, barrels/day	80	60	80	220
4	Percent Remaining Floodable, acre-feet (from map, Fig. 19)	100	75	56.25	
5	Line 3 x Line 4	80	45	45	170
6	Percent of Flat Rate Reserves: $\frac{\text{Line 5} \times 100}{\text{Total Line 5}}$ =	47	26.5	26.5	100
7	Flat Rate Reserves, Based on percent acre-feet	141,000	79,500	79,500	300,000
8	Percent of Total Initial Production Rate: $\frac{\text{Line 3} \times 100}{\text{Total Line 3}}$ =	36.4	27.3	36.4	100
9	Flat Rate Reserves, Based on initial production rates	109,091	81,818	109,091	300,000
10	Reserves Allocated: $\text{Line 2} + \frac{\text{Line 7} + \text{Line 9}}{2}$ =	211,711	145,104	180,961	537,776

CALCULATION OF WATER SATURATIONS FROM WELL TESTS BY USE OF FRACTIONAL FLOW FORMULA

The fractional flow formula has long been used as a practical tool in determining the water saturation necessary to obtain a given percent water cut in reservoirs with 100 percent liquid saturation. The following premises are necessary to make the formula applicable in reservoirs with three-phase saturation:

1. Three-phase flow does not exist. Water only contacts the oil. The oil bank ahead of the water absorbs the free gas before the water arrives.

2. The only two systems of two-phase flow that exist are oil-water and oil-gas.

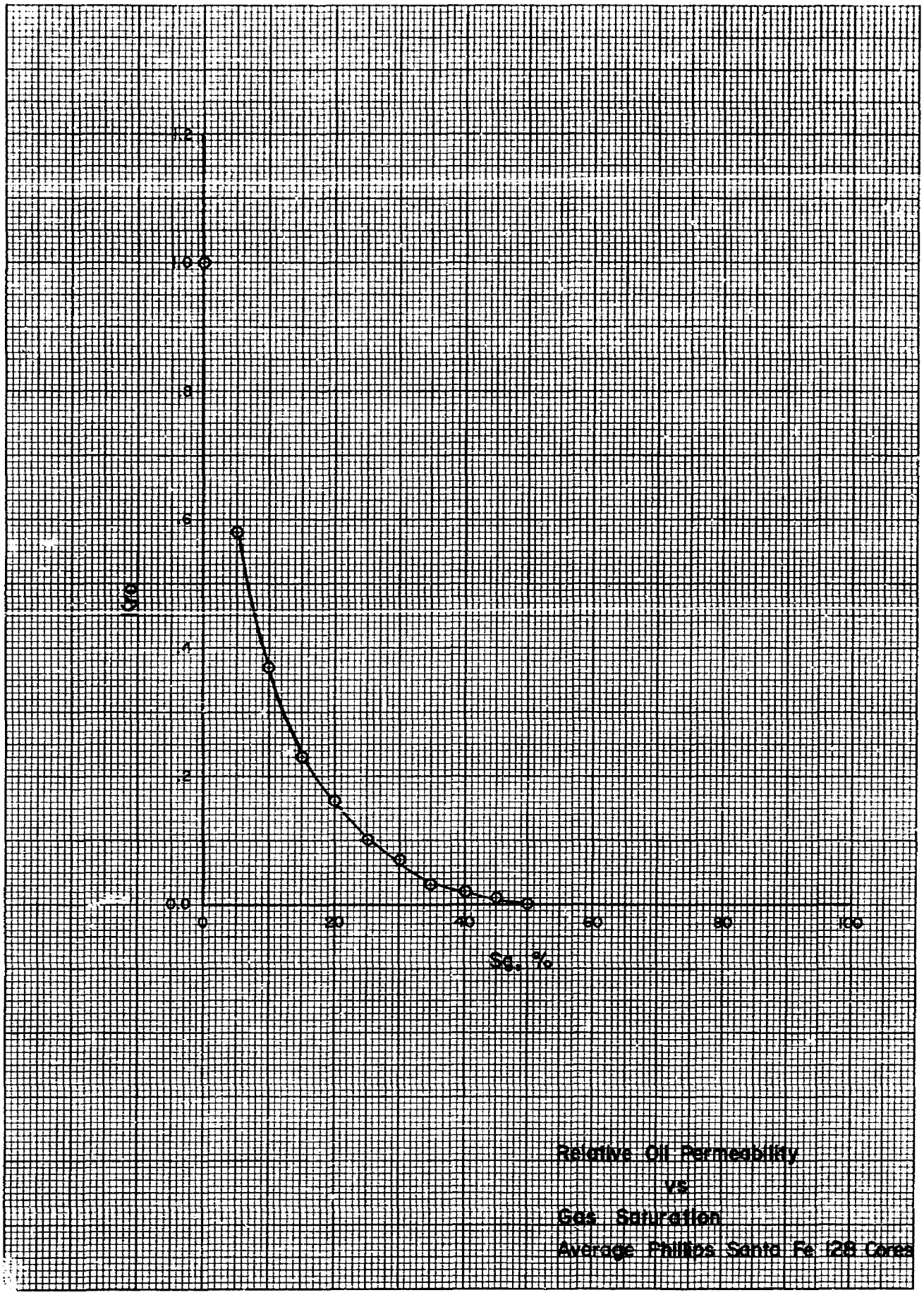
The water relative permeability is only affected by oil, but the oil relative permeability is affected by gas in the oil-gas system and water in the oil-water system. If a gas saturation can be calculated in the oil-gas system, then the permeability to oil in this system can be calculated from the oil-gas relative permeability curve.

In order to calculate the gas saturation in 1972 and K_{ro} at that saturation, production data for 14 wells with pressure histories within the water encroachment area were compiled. Average daily per well production rates for these wells in 1972 were 64 barrels of oil, 65 barrels of water, and 93 Mcf of gas. They produced 51 percent water and at a gas-oil ratio of 1,465 compared to a gas-oil ratio of only 1,252 for the total unit. An average reservoir pressure of 637 psi was calculated from individual well cumulative production versus bottom-hole pressure data.

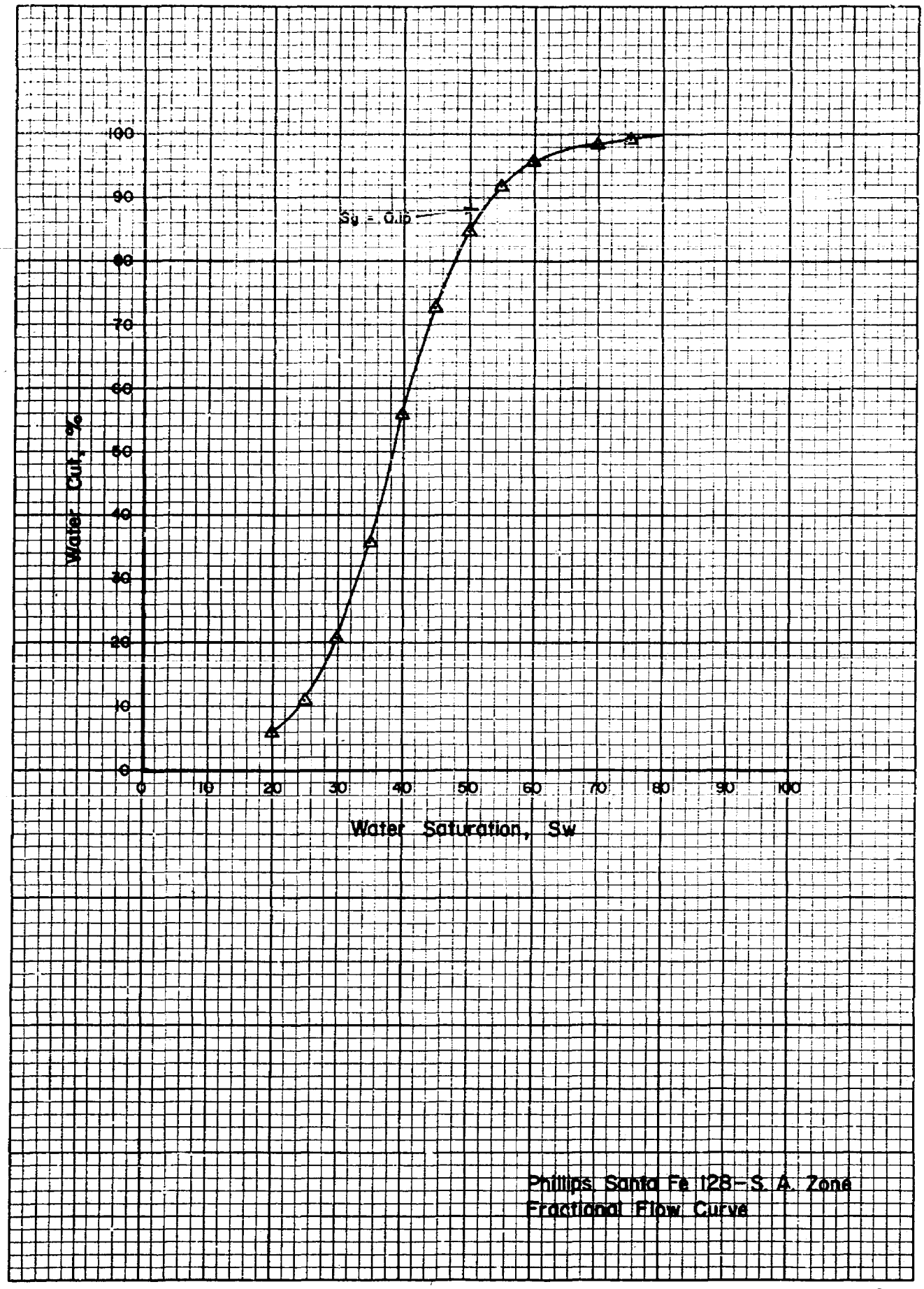
Tarner material balance calculations for depletion type reservoirs were made with the K_g/K_o values changed until the reservoir pressure of 637 psi occurred at approximately the same time as the gas-oil ratio of 1,465. The gas saturation at this point (15 percent) was read from the material balance calculations and entered into the oil-gas permeability curve (Appendix B, Figure 1) to obtain the relative oil permeability. This was used to reduce the permeability to oil in the fractional flow equations. Appendix B, Figure 2, shows the fractional flow curve obtained by this method.

Based on the oil-water relative permeability curves shown in Figure 12, 30 percent residual oil saturation and a connate water saturation of 20 percent were used in calculating the remaining floodable acre-feet from the calculated water saturation. The formula used was:

$$\text{Percent floodable acre-feet remaining} = (.70 - S_w) + .50.$$



Appendix B Figure 1



Phillips Santa Fe 128-S. A. Zone
Fractional Flow Curve

Appendix B Figure 2

PRODUCTION AND OPERATING COST FORECAST

Year	Continued Primary			80-Acre, 5-Spot			40-Acre, 5-Spot		
	Oil M Barrels Per Year	Gas MMcf Per Year	Lifting Cost, $M Per Year	Oil M Barrels Per Year	Gas MMcf Per Year	Lifting Cost, $M Per Year	Oil M Barrels Per Year	Gas MMcf Per Year	Lifting Cost, $M Per Year
1978 (3 Mos.)	444	799	375	365	657	426	510	953	414
1979	1,776	3,198	1,500	1,460	2,628	1,533	2,117	3,811	1,659
1980	1,645	3,620	1,389	1,314	2,102	1,674	5,872	8,221	2,245
1981	1,407	4,361	1,188	2,738	3,833	1,985	8,043	7,238	3,191
1982	1,041	4,162	879	4,380	5,037	1,993	8,760	4,906	3,377
1983	749	2,623	749	5,037	4,533	1,997	7,446	2,606	3,391
1984	539	1,403	539	4,495	2,517	2,009	5,212	1,824	3,386
1985	388	777	388	3,649	1,277	2,009	3,649	1,277	3,374
1986	280	419	336	2,943	1,030	2,009	2,554	894	3,357
1987	201	292	280	2,374	831	2,009	1,788	626	2,873
1988	145	203	232	1,915	670	2,009	1,252	438	2,070
1989	104	141	187	1,545	541	2,009	876	307	1,484
1990	75	98	150	1,246	436	1,678	613	215	1,088
1991	54	68	119	1,005	352	1,369	429	150	789
1992	39	47	94	811	284	1,118	300	105	578
1993	28	32	73	654	229	917	210	74	300
1994				527	185	755	147	51	150
1995				425	149	634			
1996				343	120	525			
1997				277	97	438			
1998				223	78	371			
1999				180	63	316			
2000				145	51	276			
Total upper-tier oil, M barrels				11,335			27,333		

Increased value of infill drilling due to price difference alone =
(1,000) (27,333 - 11,335) (12.00 - 5.25) = $108 x 10^6.

Base production control level = 2,040 M barrels per year.

APPENDIX C
Table A

APPENDIX C
Table B

LIFTING COST CATEGORIES

Category	Units	Annual Cost Per Unit
Injection Surveys	Injection Wells	$ 1,000.00
Treating Costs	Thousands of Barrels of Fluid Produced	$ 4.00
Maintenance Costs	Total Wells	$ 5,800.00
Electricity Cost	Producing Wells	$ 6,879.00
Operator Cost	Operators (3 needed)	$16,667.00
Fuel Gas Costs	Thousands of Barrels of Water Injected	$ 4.73

APPENDIX C
Table C

DRILLING WELL AND WORKOVER COSTS

Area	Type	Casing	Total Wells	Cost Per Well		
				Tangible	Intangible	Total
North	Injection	4-1/2"	70	$39,700	$ 96,000	$135,700
All	Producing	4-1/2"	10	40,300	115,000	155,300
South	Injection	5-1/2"	51	50,000	103,000	153,000
South	Injection with Coring	5-1/2"	6	50,000	136,900	186,900
All	Deepen Old Well	All	100 (40-acre) 50 (80-acre)	2,600	19,200	21,800
All	Convert Old Well to Injection	All	65	4,000	30,200	34,200

INVESTMENT SCHEDULE

1978

	80-Acre, 5-Spot			40-Acre, 5-Spot		
	Tangibles	Intangibles	Total	Tangibles	Intangibles	Total
Tank Battery Consolidation	$ 494,500	$ 30,200	$ 524,700	$ 652,600	$ 30,200	$ 682,800
Water Treatment and Injection Plant	492,200	25,900	518,100	693,500	25,900	719,400
Fresh Water Make-up Supply	184,700	9,600	194,300	213,500	9,600	223,100
Drill 10 Injection Wells 1 Well -- S/2 with core 9 Wells -- S/2 no core	0	0	0	500,300	1,063,200	1,563,500
Convert 10 Producers to Injection	40,300	301,800	342,100	0	0	0
Lift Equipment Revision	299,000	86,300	385,300	598,000	172,500	770,500
Total (1978)	$1,510,700	$ 453,800	$ 1,964,500	$ 2,657,900	$ 1,301,400	$ 3,959,300

1979

Tank Battery Consolidation	$1,483,500	$ 90,600	$ 1,574,100	$ 1,957,900	$ 90,600	$ 2,048,500
Water Treatment and Injection Plant	1,476,600	77,600	1,554,200	2,080,400	77,600	2,158,000
Fresh Water Make-up Supply	554,200	28,900	583,100	640,400	28,900	669,300
Drill 43 Injection Wells 4 Wells -- S/2 with core 34 Wells -- S/2 no core 5 Wells -- N/2	0	0	0	2,099,400	4,527,000	6,626,400
Convert 20 Producers to Injection	80,500	603,500	684,000	0	0	0
Deepen Producing Wells	52,900	384,100	437,000	92,600	672,200	764,800
Lift Equipment Revision	897,000	258,800	1,155,800	1,794,000	517,500	2,311,500
Total (1979)	$4,544,700	$1,443,500	$ 5,988,200	$ 8,664,700	$ 5,913,800	$14,578,500

APPENDIX C
Table D

INVESTMENT SCHEDULE--Continued

1980

	80-Acre, 5-Spot			40-Acre, 5-Spot		
	Tangibles	Intangibles	Total	Tangibles	Intangibles	Total
Drill 43 Injection Wells 1 Well -- S/2 with core 8 Wells -- S/2 no core 34 Wells -- N/2	$ 0	$ 0	$ 0	$ 1,799,200	$ 4,225,200	$ 6,024,400
Drill 3 Producers	120,800	345,000	465,800	120,800	345,000	465,800
Convert 20 Producers to Injection	80,500	603,500	684,000	0	0	0
Deepen Producing Wells	52,900	384,100	437,000	92,600	672,200	764,800
Total (1980)	$ 254,200	$1,332,600	$ 1,586,800	$ 2,012,600	$ 5,242,400	$ 7,255,000

1981

Drill 31 N/2 Injection Wells	$ 0	$ 0	$ 0	$ 1,229,900	$ 2,976,800	$ 4,206,700
Drill 7 Producers	281,800	805,000	1,086,800	281,800	805,000	1,086,800
Convert 15 Producers to Injection	60,400	452,600	513,000	0	0	0
Deepen Producing Wells	26,500	192,100	218,600	79,400	576,200	655,600
Total (1981)	$ 368,700	$1,449,700	$ 1,818,400	$ 1,591,100	$ 4,358,000	$ 5,949,100
GRAND TOTAL	$6,678,300	$4,679,600	$11,357,900	$14,926,300	$16,815,600	$31,741,900

APPENDIX C
Table D

COMPANY, U.S.A.
POST OFFICE BOX 1600 · MIDLAND, TEXAS 79701

PRODUCTION DEPARTMENT
MIDCONTINENT DIVISION

JOINT INTEREST MANAGER

State of New Mexico
Energy and Minerals Department

Attention: Oil Conservation Division

Re: Case No. 6470, February 28, 1979,
Hearing Docket, Application of
Phillips Petroleum Company
East Vacuum Unit
Lea County, New Mexico

Gentlemen:

Exxon, as a working interest owner in the East Vacuum (GR.-S.A.) Unit, supports the above referenced request of Phillips Petroleum Company, as Unit Operator, to permit an infill drilling program in the subject Unit. This support is based on a conclusion that under the contemplated unit operations each new infill well to be drilled in an existing proration unit is necessary to effectively and efficiently drain a portion of the reservoir covered by the proration unit which cannot be effectively and efficiently drained by any existing well within the proration unit.

Yours very truly,

J. M. Shepherd

JKL/jg

Chevron U.S.A. Inc.
P. O. Box 1660, Midland, TX 79702

February 22, 1979

Natural Gas Policy Act of 1978
Section 103 - New Onshore Production Wells
E. Vacuum Unit
Lea County, New Mexico

Phillips Petroleum Company
4001 Penbrook
Odessa, Texas 79762

Gentlemen:

Chevron U.S.A. Inc. is in agreement that infill wells to be drilled in the E. Vacuum Grayburg-San Andres Unit would qualify for certification under Section 103 of the Natural Gas Policy Act of 1978.

This statement is offered in support of your application before the New Mexico Oil Conservation Division on February 28, 1979.

Yours very truly,

E. E. Hagan
Division Manager

DGS:cn

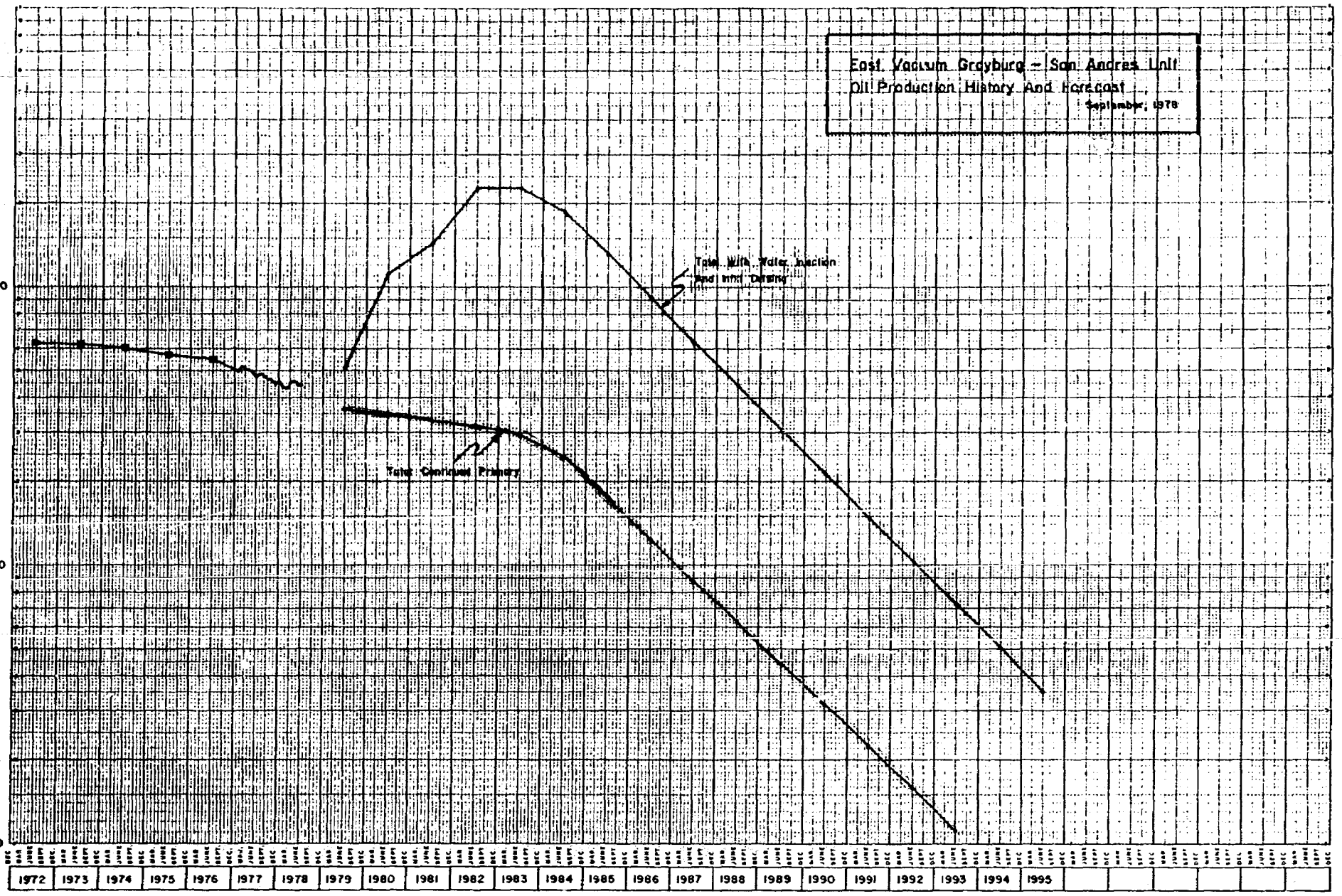
EAST VACUUM GRAYBURG-SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

NECESSITY AND RESULTS OF INFILL DRILLING

Each infill well is necessary to effectively and efficiently drain oil and gas reserves from a portion of the reservoir covered by the proration unit which cannot be effectively and efficiently drained by any existing well within the proration unit.

For the total unit area, infill drilling on 20-acre spacing will result in the recovery of 11,582,000 barrels of oil not recoverable with 40-acre spacing. The solution gas associated with this oil will be 4.054 billion cubic feet.

The increased recovery will be 3.9 percent of the original oil-in-place. This percent increase is comparable to published results applicable to geologically similar carbonate reservoirs under waterflood in the general area of Vacuum Field. The infill drilling and the overall development plan conform to the current industry concepts for effective and efficient carbonate waterflooding. The infill drilling will increase oil and associated gas recovery due primarily to (1) encountering discontinuous intervals of porosity and (2) improving waterflood areal and vertical sweep efficiency.


East Vacuum Grayburg – San Andres Unit
Oil Production History And Forecast
September, 1978
Total With Water Injection and Infill Drilling
Total Continued Primary
Oil Production STBO/D
10,000
1,000
100
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: B-1576

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work — DRILL [X] DEEPEN [ ] PLUG BACK [ ]

b. Type of Well — OIL WELL [X] GAS WELL [ ] OTHER — SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres, Tract 3229

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 005

3. Address of Operator: Room 401, 4001 Penbrook St., Odessa, Texas 79762

10. Field and Pool, or Wildcat: East Vacuum Grayburg/San Andres

4. Location of Well — UNIT LETTER M LOCATED 1110 FEET FROM THE South LINE AND 1290 FEET FROM THE West LINE OF SEC. 32 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: San Grayburg/Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3964.7' Ground (unprepared)

21A. Kind & Status Plug. Bond: blanket

21B. Drilling Contractor: Advise later

22. Approx. Date Work will start: Upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13-3/8"	48# -H-40	350' (675 sx Class H w/2% CaCl$_2$) (&1/4# Flocele/sx in 1st 150 sx)	Circ	at surface
12¼" X 8-5/8"	7"	23#, K-55	4900' (Sufficient TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx Followed by 260 sx Class H Cement w/8# salt/sx to circulate at surface.)		

(This well is in the same proration unit as Well No. 002)

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 2990'; cemented to surface w/cement of quality adequate to control waterflow and protect casing string.

Re: N.M.O.C.D. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original loc. approved within Order (3) was 1310' from So. & West lines of the above section.

Use mud additives as required for control. (Conf. telecon MCL - Ramey 1-22-79)

BOP: Series 900, 3000# WP, double w/one set pipe rams & one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W.J. Mueller (Signature of State Agent) Engineering Advisor Date 1-22-79

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E.V.G.S.A.U. M Tract 3229	005

Unit Letter	Section	Township	Range	County
M	32	17 South	35 East	Lea

Actual Footage Location of Well				
1110	feet from the South	line and 1290	feet from the West	line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage
3964.7	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

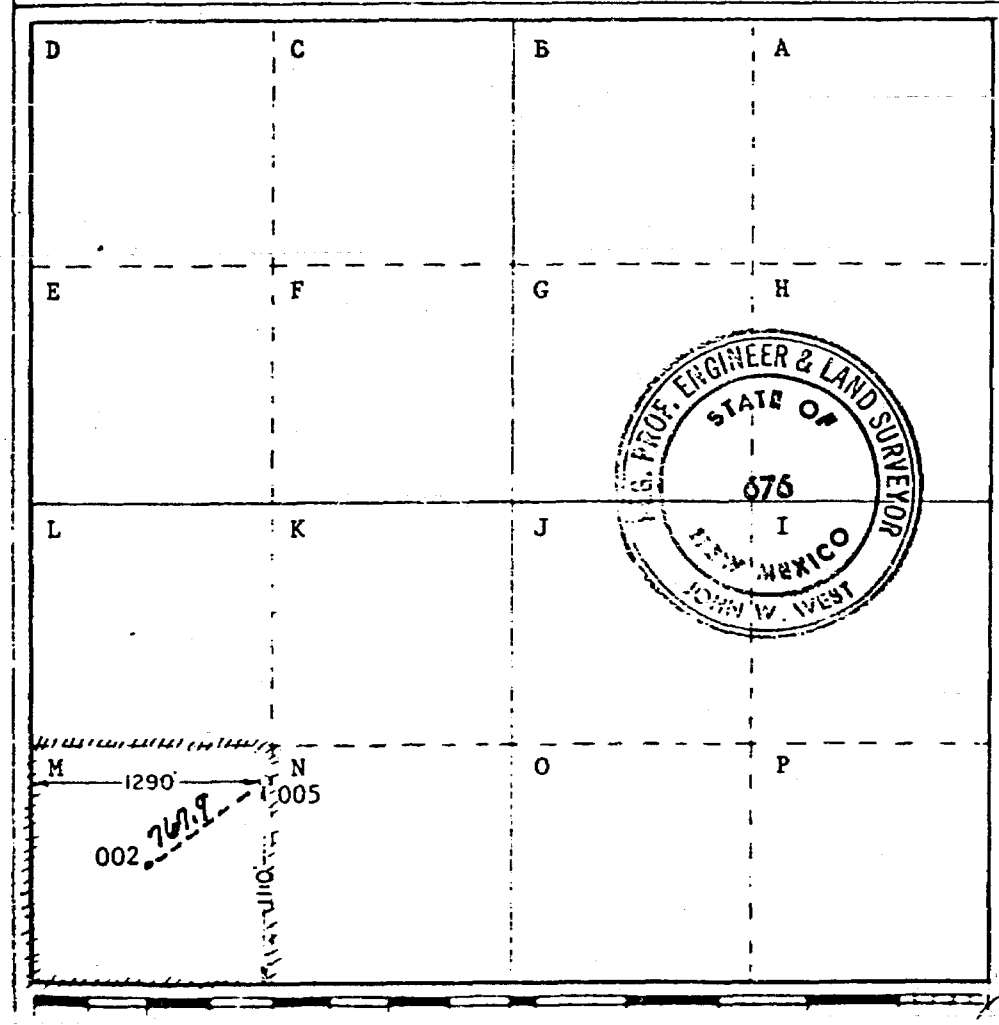
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Name

Engineering Advisor

Position

Phillips Petroleum Co.

Company

January 23, 1979

Date

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Date Surveyed

January 3, 1979

Registered Professional Engineer and/or Land Surveyor

John W. West

Certificate No. John W. West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

5A. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: A-1320

1a. Type of Work: DRILL [X] DEEPEN [ ] PLUG BACK [ ]

b. Type of Well: OIL WELL [X] GAS WELL [ ] OTHER SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract No. 1202

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 001

3. Address of Operator: Room 401, Phillips Building, 4001 Penbrook, Odessa, TX 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER I LOCATED 1330 FEET FROM THE South LINE AND 1310 FEET FROM THE East LINE OF SEC. 32 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth	19A. Formation	20. Rotary or C.T.
4900	Grayburg/San Andres	Rotary

21. Elevations (Show whether DF, RT, etc.)	21A. Kind & Status Plug. Bond	21B. Drilling Contractor	22. Approx. Date Work will start
3955.3' Ground (unprepared)	Blanket	Advise later	Upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13 3/8"	48#, H-40	350'	(675 sx class H w/2% $CaCl_2$ & ¼# Flocele/sx in 1st 350 sx)	Circ at Surface
12¼" x 8 5/8"	7"	23#, K-55	4900'	(Sufficient TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonit /sx, following by 260 sx class H cement w/8# salt/sx to circulate at surface.)	

(This well is the same proration Unit as Well No. 004)

NOTE: If excessive waterflow is encountered in salt section, 9 5/8" 40#, N80 intermediate casing will be set at approximately 3015'; cemented to surface with cement of quality adequate to control waterflow and protect casing string.

RE: N.M.O.C.D. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original location approved within, Order (3) was 1310' FS and 1330' FE lines of the above section. (Conf. Telecon Mcl—Ramey 1-22-79)

BOP: Series 900, 3000# WP, double w/one set pipe and one set blind rams.

Use mud additives as required for control.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W. J. Mueller Title Engineering Advisor Date January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E.V.G.S.A.U. Tract 3202	001

Unit Letter	Section	Township	Range	County
I	32	17 South	35 East	Lea

Actual Footage Location of Well:
1330 feet from the South line and 1310 feet from the East line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
3955.3	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

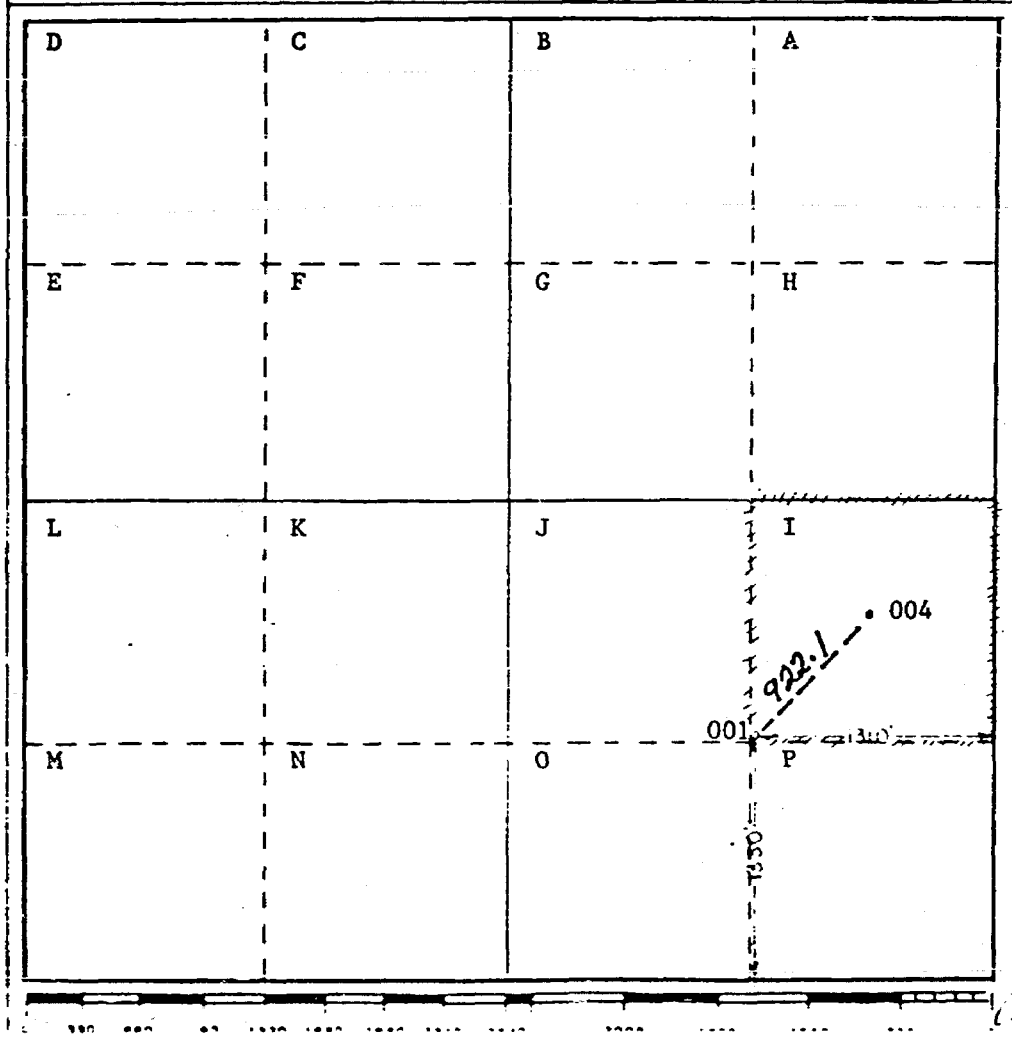
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling. etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

NEW MEXICO — ENGINEER & LAND SURVEYOR — JOHN W. West

Date Surveyed: December 29, 1978

Registered Professional Engineer and/or Land Surveyor

John W. West

Certificate No. John W. West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: A-1320

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work: DRILL [X] DEEPEN [ ] PLUG BACK [ ]

b. Type of Well: OIL WELL [X] GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3202

2. Name of Operator: PHILLIPS PETROLEUM COMPANY

9. Well No.: 003

3. Address of Operator: ROOM 401, 4001 PENBROOK STREET, ODESSA, TEXAS 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER B LOCATED 1180 FEET FROM THE North LINE AND 1480 FEET FROM THE East LINE OF SEC. 32 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth	19A. Formation	20. Rotary or C.T.
4900'	Grayburg/San Andres	Rotary

21. Elevations (Show whether DF, RT, etc.)	21A. Kind & Status Plug. Bond	22. Drilling Contractor	22. Approx. Date Work will start
3965.4' Ground (Unprepared)	Blanket	Advise Later	Upon Approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17-1/2"	13-3/8"	48#-H-40	350' (675 sx Cl H w/2% CaCl, & (1/4# Flocele/sx in 1st 150 sx)		circ to surfac
12-1/4" x 8-5/8"	7"	23#, K-55	4900' (suff TRLW w/12# salt/sx w/10% DD and ¼# sx Flocele plus 3# Gilsonite/sx followed by 260 sx Cl H cement w/8# salt/sx to circ at surface).		

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3010'; cemented to surface w/cement of quality adequate to control waterflow & protect casing string.

RE: N.M.O.C.D. Order No. 5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original loc approved within Order (3) was 1330' FN&E lines of the above sec. (Confirming telecon McL/Ramey 1-22-79)

(This well is in same proration unit as Well No. 033)

Use Mud Additives as Required for Control.

BOP: Series 900,3000# WP, double w/one set pipe rams and one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information given above is true and complete to the best of my knowledge and belief.

Signed: D. J. Mueller Title: Engineering Advisor Date: January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator: Phillips Petroleum Company		Lease: E.V.G.S.A.U.B. Tract 3202	Well No.: 003
Unit Letter: B	Section: 32	Township: 17 South	Range: 35 East
County: Lea			
Actual Footage Location of Well: 1180 feet from the North line and 1480 feet from the East line			
Ground Level Elev.: 3965.4	Producing Formation: Grayburg/San Andres	Pool: Vacuum Grayburg/San Andres	Dedicated Acreage: 40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

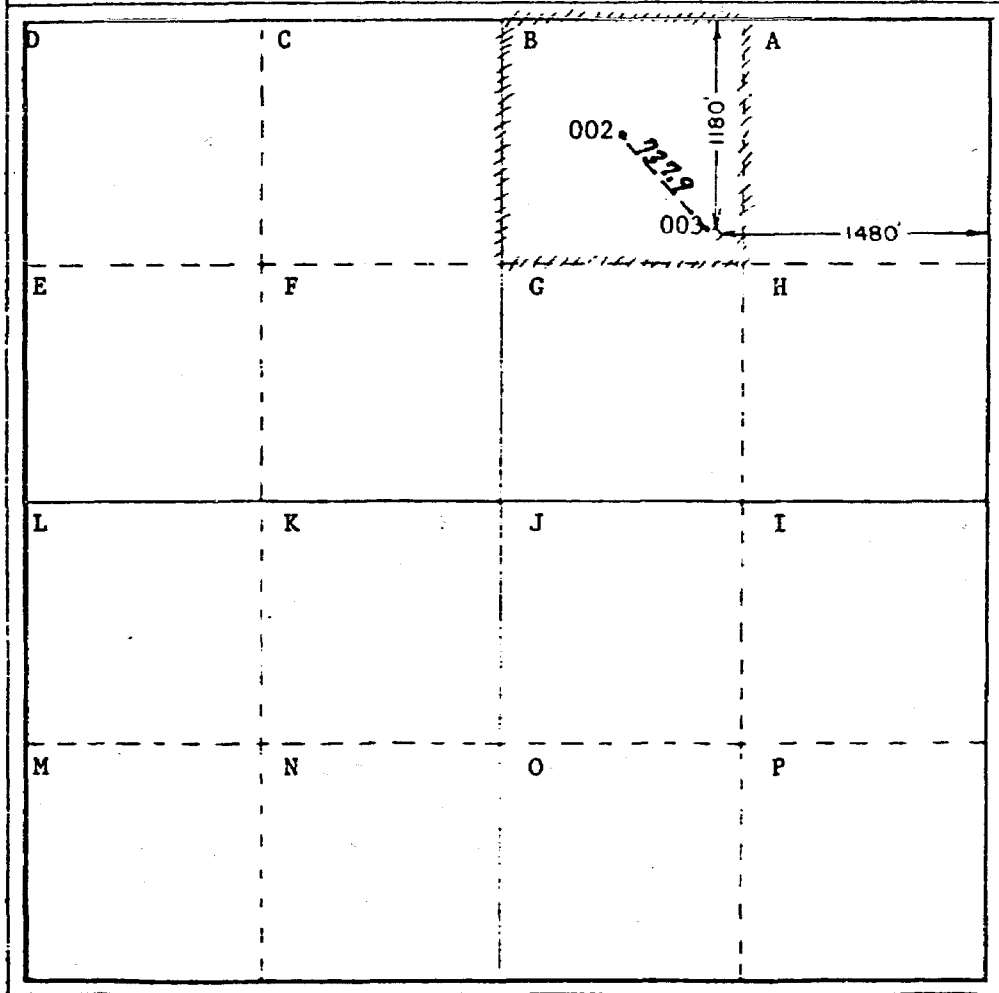
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no" list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

NEW MEXICO — JOHN W. WEST — 676 — REGISTERED PROFESSIONAL ENGINEER & LAND SURVEYOR

Date Surveyed: December 29, 1978

Registered Professional Engineer and/or Land Surveyor

Certificate No. John W. West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: B-1565-2

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well: OIL WELL [X] GAS WELL [ ] DRILL [X] DEEPEN [ ] PLUG BACK [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3328

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 002

3. Address of Operator: 4001 Penbrook Street, Odessa, Texas 79762 Room 401

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andr

4. Location of Well: UNIT LETTER M LOCATED 1310 FEET FROM THE South LINE AND 1160 FEET FROM THE West LINE OF SEC. 33 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3950.6' Ground (unprepared)

21A. Kind & Status Plug. Bond: Blanket

22. Approx. Date Work will start: upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13 3/8"	48#-H-40	350'	(675 sx class H w/2% $CaCl_2$ & ¼# Flocele/sx in 1st 150 sx)	Circ at surface
12¼" x 8 5/8"	7"	23#, K-55	4900'	(Sufficient TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx class H cement w/8# salt/s to circulate at surface.)	

(This well is in the same proration unit as Well No. 001)

NOTE: If excessive waterflow is encountered in salt section, 9 5/8", 40#, N-80 intermediate casing will be set at approximately 3060'. Cemented to surface w/cement of quality adequate to control waterflow and protect casing string.

RE: N.M.O.C.D. Order No. R-5897: Adminstrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original location provided within Order (3) was 1310 from south and west lines of the above section. (Conf. Telecon Mcl--Ramey 1-22-79)

Use mud additives as required for control

BOP: Series 900, 3000# WP, double w/one set pipe rams and one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W. J. Mueller Engineering Advisor Date January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION
WELL LOCATION AND ACREAGE DEDICATION PLAT

Supersedes C-128 Effective 1-1-65

All distances must be from the outer boundaries of the Section

Phillips Petroleum Company	E.V.G.S.A.U. M-3328		002
M	33	17 South	35 East	Lea
1310	South	1160	West	
3950.6	Grayburg/San Andres	Vacuum Grayburg/San Andres	40

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

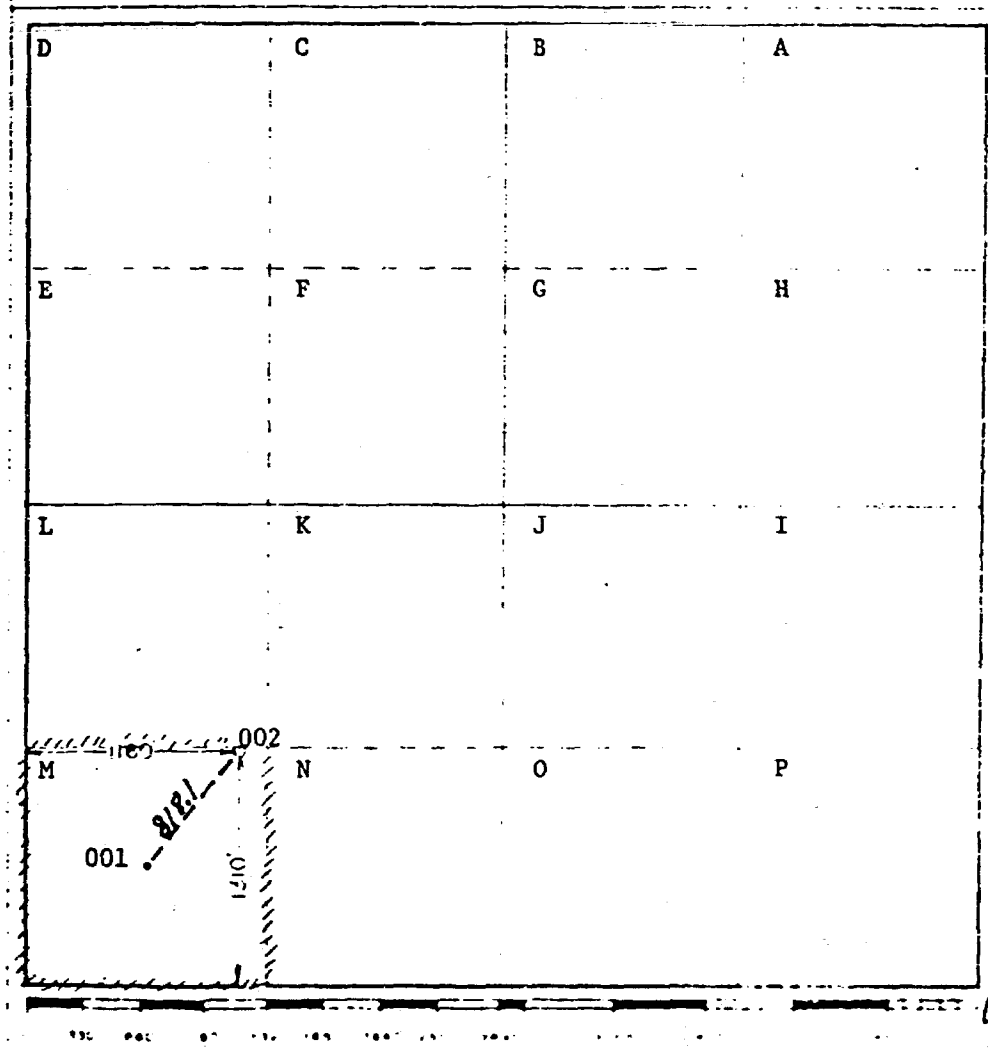
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc.

Yes No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Engineering Advisor

Phillips Petroleum Co.

January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

NEW MEXICO
JOHN W. WEST

December 29 1978

John W West

John W West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: B-1334

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]

OIL WELL [X] GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3308

2. Name of Operator: PHILLIPS PETROLEUM COMPANY

9. Well No.: 003

3. Address of Operator: ROOM 401, 4001 Penbrook St., Odessa, Texas 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER C LOCATED 1150 FEET FROM THE North LINE AND 1510 FEET FROM THE West LINE OF SEC. 33 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3939.4' Ground (unprepared)

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Advise Later

22. Approx. Date Work will start: Upon Approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17 ½"	13-3/8"	48#-H-40	350'	(675 sx. Cl H w/2% $CaCl_2$) (1/4# Flocele/sx. in 1st 150 sx)	circ to surfac
12 ¼" x 8-5/8"	7"	23#, K-55	4900'	(sufficient TRLW w/12# salt/sx w/10% DD and ¼#/sx flocele plus 3# Gilsonite/sx followed by 260 sx Class H cement w/8# salt/sx to circulate at surface.)	

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3010'; cemented to surface w/cement of quality adequate to control water flow and protect casing string.

Re-NMOCD Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4)- location herein is required due to topographical conditions which also required new tract and well number. Original location and well as specified in Order (3) was: Tract 3366, well no. 001, located 1330'FN and 1310' F W lines, above section. Confirming telecon McLemore/Ramey of 1-22-79.

(This well is in the same proration unit as well #2)

Use mud additives as required for control.

BOP: Series 900, 3000# WP, double w/one set pipe rams & one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed: L. J. Mueller Name: L. J. Mueller Title: Engineering Advisor Date: January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION
WELL LOCATION AND ACREAGE DEDICATION PLAT

Supersedes C-128 Effective 1-1-65

All distances must be from the outer boundaries of the section

Phillips Petroleum Company	E.V.G.S.A.U. C Tract 3308		003
C	33	17 South	35 East	Lea
1150 North		1510	West
3939.4 Grayburg/San Andres		Vacuum Grayburg/San Andres	40

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

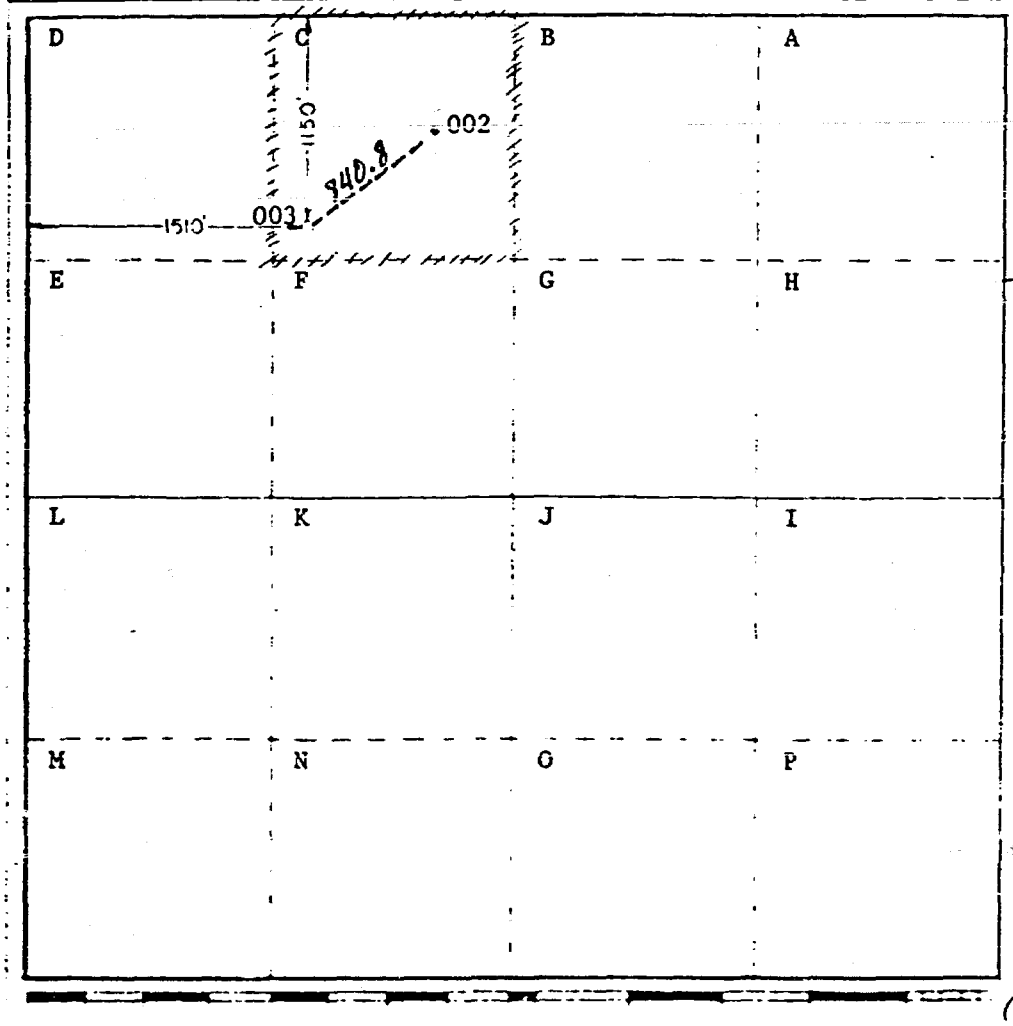
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Engineering Advisor

Phillips Petroleum Co.

January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge, information and belief.

REG. PROFESSIONAL ENGINEER & LAND SURVEYOR
STATE OF NEW MEXICO
676

December 29, 1978

John W. West

John W. West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: B-1713

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work
DRILL [X] DEEPEN [ ] PLUG BACK [ ]

b. Type of Well
OIL WELL [X] GAS WELL [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3333

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 004

3. Address of Operator: Room 401, 4001 Penbrook Street, Odessa, Texas 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andr

4. Location of Well UNIT LETTER H LOCATED 1380 FEET FROM THE North LINE AND 1280 FEET FROM THE East LINE OF SEC. 33 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3939.0' Ground (unprepared)

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Advise later

22. Approx. Date Work will start: upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13 3/8"	48#, H-40	350'	(675 sx class H w/2% CaCl, &) Circ to (¼# Flocele/sx in 1st 150 sx)	Surface
12¼" x 8 5/8"	7"	23#, K-55	4900'	(Sufficient TRLW w/12# DD and ¼#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx class H cement w/8# salt/s to circulate at surface)	Salt/sx w/10%

(This well is in the same proration unit as well No. 201)

NOTE: If excessive waterflow is encountered in salt section, 9 5/8" 40# N80 intermediate casing will be set at approximately 3030'; cemented to surface w/cement of quality adequate to control waterflow and protect casing string.

RE: N.M.O.C.D. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original location approved within order (3) was 1330' FN and East lines of the above section.

Use mud additives as required for control.

BOP: Series 900, 3000# WP, double w/one set pipe rams and one set blind rams. (Conf. Telecon Mcl--Ramey 1-22-79)

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W. J. Mueller Engineering Advisor Date January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E.V.G.S.A.U. G Tract 3333	004

Unit Letter	Section	Township	Range	County
H	33	17 South	35 East	Lea

Actual Footage Location of Well:
1380 feet from the North line and 1280 feet from the East line

Ground Level Elev.	Producing Formation	Pool	Estimated Acreage:
3932.0	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

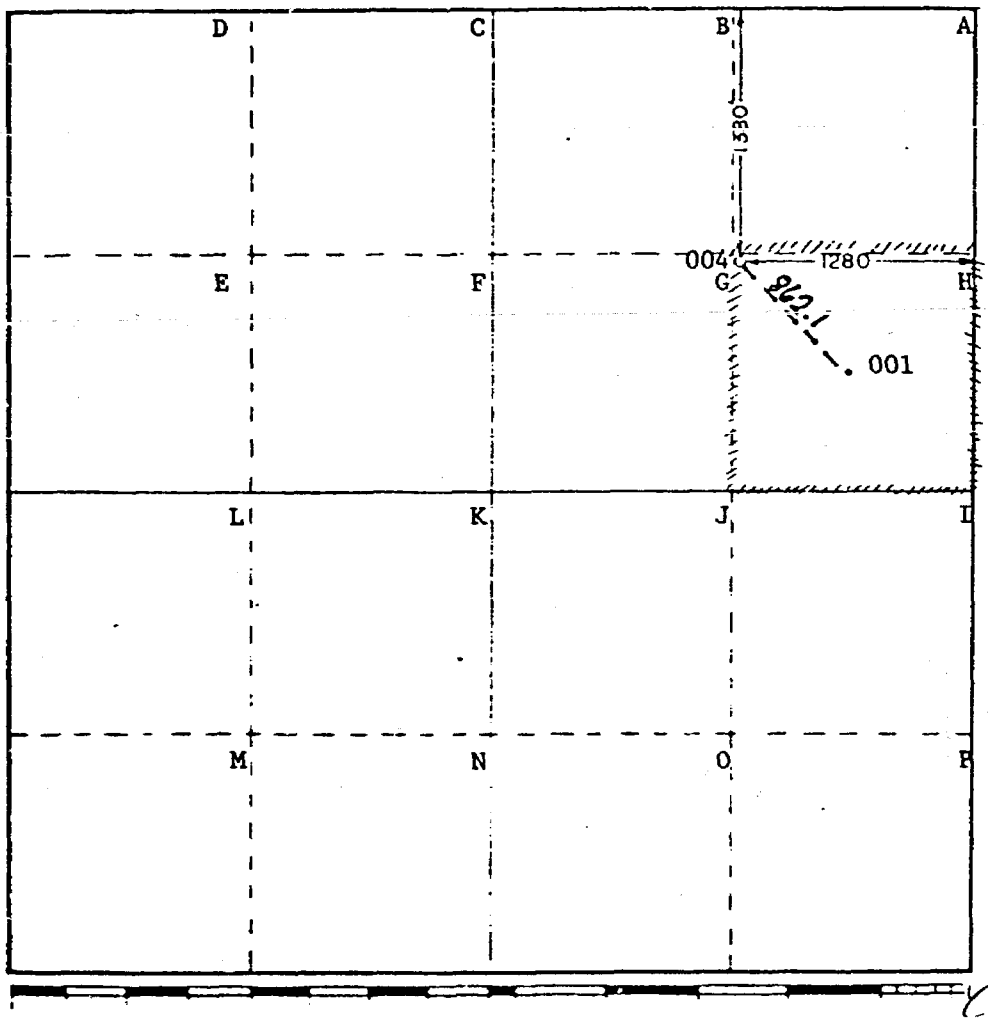
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

NEW MEXICO — STATE OF — REGISTERED PROFESSIONAL ENGINEER & LAND SURVEYOR — 676

Date Surveyed: January 3, 1979

Registered Professional Engineer and/or Land Surveyor

Certificate No. John W. West 676

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: B-2273

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]

OIL WELL [X] GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 3456

2. Name of Operator: PHILLIPS PETROLEUM COMPANY

9. Well No.: 005

3. Address of Operator: ROOM 401, 4001 PENBROOK STREET, ODESSA, TEXAS 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER C LOCATED 1030 FEET FROM THE North LINE AND 1410 FEET FROM THE West LINE OF SEC. 34 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3933.6' Ground (unprepared)

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Advise Later

22. Approx. Date Work will start: Upon Approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17-1/2"	13-3/8"	48#-H-40	350' (675 sx Cl H w/2% CaCl, (1/4# Flocele/sx in 1st 150 sx)		&) circ to surf.
12-1/4" x 8-5/8"	7"	23#, K-55	4900' (sufficient TRLW w/12# Salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx Cl H cement w/8# salt/sx to circulate at surface).		

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3070' cemented to surface w/cement of quality adequate to control waterflow & protect casing string.

Re: N.M.O.C.C. Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). The location herein is required due to topographical circumstances. The original location approved within, Order (3) was 1330' FN and 1310' FW lines of the above section. (Conf. Telecon McL-Ramey of 1-22-79).

(This well is in the same proration unit as Well No. 001)

Use Mud Additives as required for control.

BOP: Series 900, 3000# WP, double w/one set pipe rams and one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W. J. Mueller Engineering Advisor Date January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E,V,G,S,A,U. C Tract 3456	005

Unit Letter	Section	Township	Range	County
C	34	17 South	35 East	Lea

Actual Footage Location of Well:
1030 feet from the North line and 1410 feet from the West line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage
3933.6	Grayburg/San Andres	Vacuum Grayburg/San Angres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

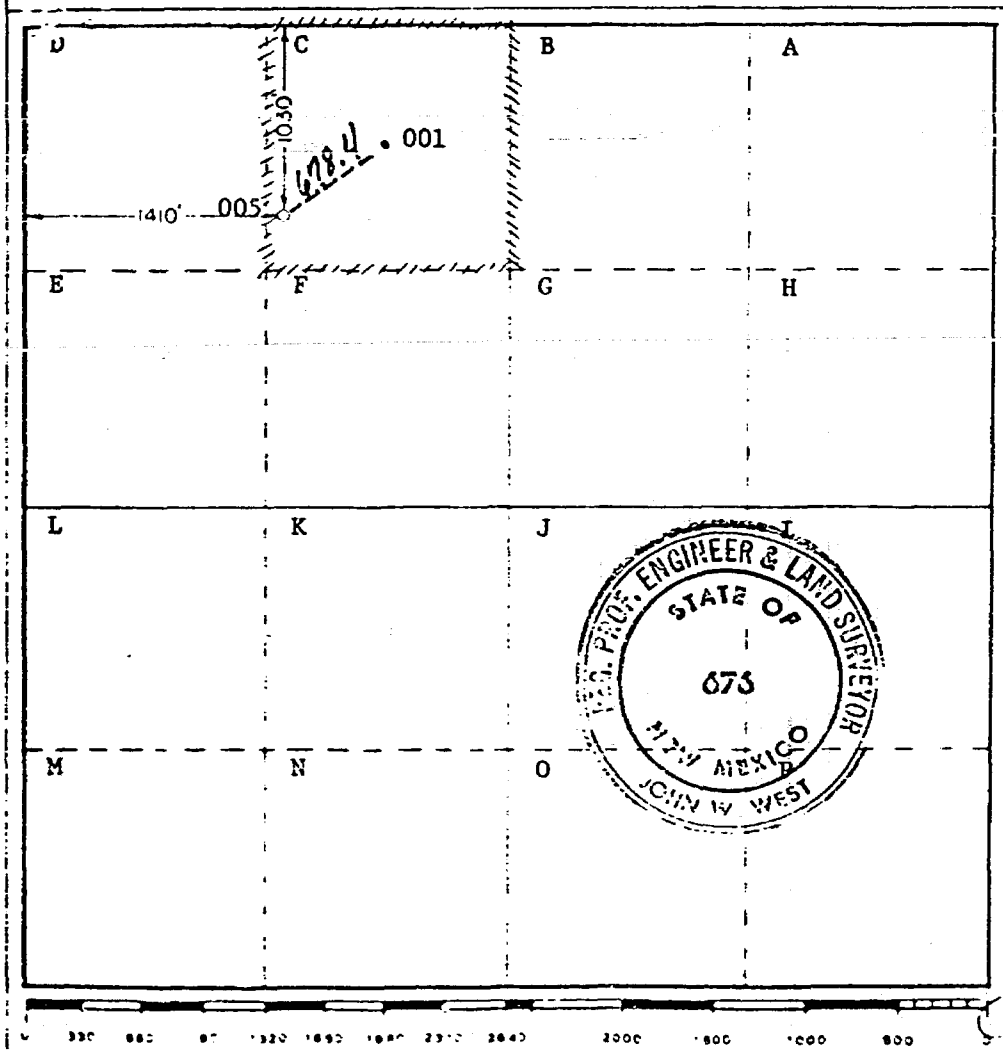
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief

Name: W.J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief

Date Surveyed: January 3, 1979

Registered Professional Engineer and/or Land Surveyor

Certificate No. John W West 676
Ronald J Eidson 3239

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NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: A-1320

APPLICATION FOR PERMIT TO DRILL, DEEPEN OR PLUG BACK

1a. Type of Work:

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]
OIL WELL [X] GAS WELL [ ] OTHER SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 2801

2. Name of Operator: PHILLIPS PETROLEUM COMPANY

9. Well No.: 002

3. Address of Operator: ROOM 401, 4001 Penbrook Street, ODESSA, TEXAS 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER M LOCATED 1140 FEET FROM THE South LINE AND 1310 FEET FROM THE West LINE OF SEC. 28 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3950.3' Ground (unprepared)

21A. Kind & Status Plug. Bond: blanket

21B. Drilling Contractor: advise later

22. Approx. Date Work will start: upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17-1/2"	13-3/8"	48#-H-40	350'	(675 sx C1 H w/2% $CaCl_2$ & (1/4# Flocele/sx in 1st 150/sx)	circ to surfac
12-1/4" x 8-5/8"	7"	23#, K-55	4900'	(suff. TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx follwd by 260 sx C1 H cement w/8# salt/sx to circ at surface).	

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3030' cemented to surface w/cement of quality adequate to control waterflow & protect casing string.

(This well is in the same proration unit as well no. 008)

Use Mud Additives as Required for Control

Re:NMOCD Order No R-5897: Administrative approval requested as provided by Rule 8 of Order (4) the location herein is required due to topographical circumstances. The orig. loc. approved within Order (3) was 1310' FS & W lines of the above section. (Conf. Telecon McL-Ramey 1-22-79)

BOP: Series 900,3000# WP, double w/one set pipe rams and one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller Title: Engineering Advisor Date: January 22, 1979

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 10-65

All distances must be from the outer boundaries of the section

Operator	Lease	Well No.
Phillips Petroleum Company	E.V.G.S.A.U. M Tract 2801	002

Unit Letter	Section	Township	Range	County
M	28	17 South	35 East	Lea

Actual Footage Location of Well:				
1140	feet from the South	line and	1310	feet from the West line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
3950.3	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

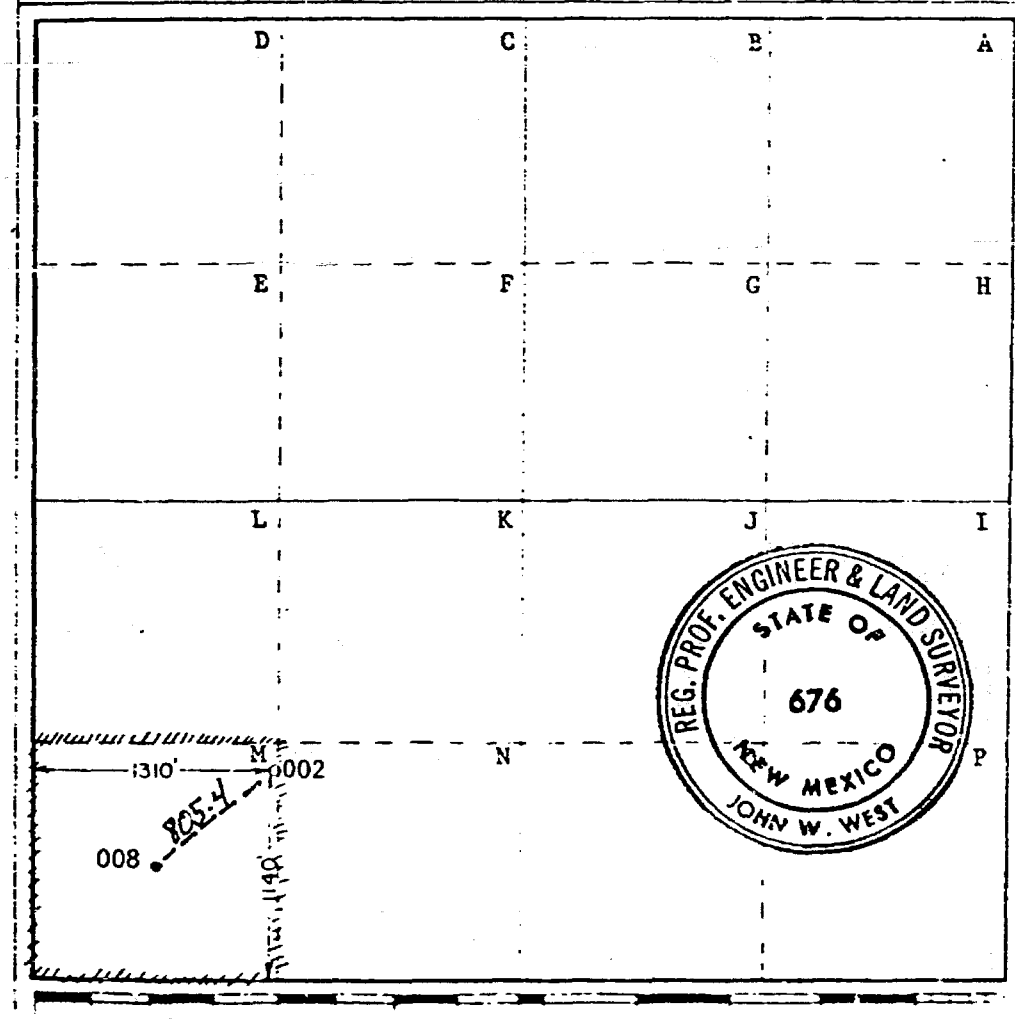
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, forced-pooling etc.?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Date Surveyed: January 5, 1979

Registered Professional Engineer and/or Land Surveyor

Certificate No. John W West 676

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OPERATOR	

NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: A-1320

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]

OIL WELL [X] GAS WELL [ ] OTHER SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 2801

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 004

3. Address of Operator: Room 401, 4001 Penbrook St., Odessa, Tx 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER 0 LOCATED 1310 FEET FROM THE South LINE AND 1330 FEET FROM THE East LINE OF SEC. 28 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth	19A. Formation	20. Rotary or C.T.
4900'	Grayburg/San Andres	Rotary

21. Elevations (Show whether DF, RT, etc.)	21A. Kind & Status Plug. Bond	21B. Drilling Contractor	22. Approx. Date Work will start
3942.7'Ground(unprepared)	Blanket	Advise later	Upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13-3/8"	48#--H-40	350'	(675 sx Class H w/2% CaCl, & ¼# Flocele/sx in lst 150 sx)	circ.at surfac
12¼" X 8-5/8"	7"	23#, K-55	4900'	(Sufficient TRLW w/12# salt/sx w/10% DD and ¼#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx Class H cement w/8# salt/sx to circulate at surface.)	

(This well is in the same proration unit as Well No. 010.)

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3025'; cemented to surface w/cement of quality adequate to control waterflow and protect casing string.

RE: N.M.O.C.D. Order No. R-5897 confirming Administrative approval requested as provided by Order (3).

Use mud additives as required for control.

BOP: Series 900, 3000# WP, double w/one set pipe rams & one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W.J. Mueller Title Engineering Advisor Date 1-22-79

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Phillips Petroleum Company	E,V,G,S,A,U, D Tract 2801	004

Unit Letter	Section	Township	Range	County
O	28	17 South	35 East	Lea

Actual Footage Location of Well:
1310 feet from the South line and 1330 feet from the East line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
3942.7	Grayburg/San Andres	Vacuum Grayburg/San Andres	40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

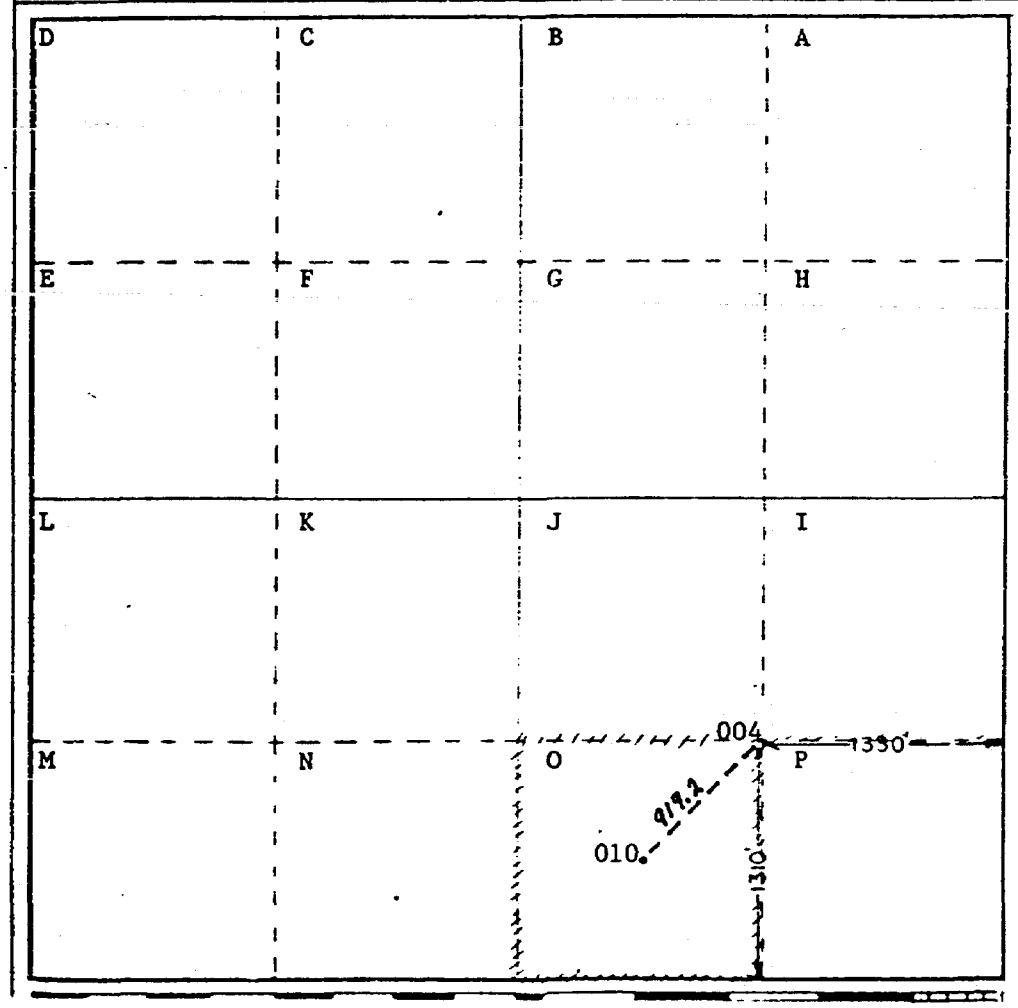
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling, etc?

☐ Yes ☐ No If answer is "yes," type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: W. J. Mueller

Position: Engineering Advisor

Company: Phillips Petroleum Co.

Date: January 23, 1979

I hereby certify that the location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Date Surveyed: January 3, 1979

Registered Professional Engineer and/or Land Surveyor

John W. West

Certificate No. John W. West 676

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U.S.G.S.
LAND OFFICE
OPERATOR

NEW MEXICO OIL CONSERVATION COMMISSION

Form C-101
Revised 1-1-65

5a. Indicate Type of Lease: STATE [X] FEE [ ]

5. State Oil & Gas Lease No.: B-1840

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work:

b. Type of Well: DRILL [X] DEEPEN [ ] PLUG BACK [ ]
OIL WELL [X] GAS WELL [ ] OTHER [ ] SINGLE ZONE [X] MULTIPLE ZONE [ ]

7. Unit Agreement Name: East Vacuum Grayburg/San Andres Unit

8. Farm or Lease Name: East Vacuum Grayburg/San Andres Unit, Tract 2739

2. Name of Operator: Phillips Petroleum Company

9. Well No.: 005

3. Address of Operator: Room 401, 4001 Penbrook St., Odessa, Tx 79762

10. Field and Pool, or Wildcat: Vacuum Grayburg/San Andres

4. Location of Well: UNIT LETTER K LOCATED 1330 FEET FROM THE South LINE AND 1380 FEET FROM THE West LINE OF SEC. 27 TWP. 17-S RGE. 35-E NMPM

12. County: Lea

19. Proposed Depth: 4900'

19A. Formation: Grayburg/San Andres

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 3938.7' Ground (unprepared)

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Advise later

22. Approx. Date Work will start: Upon approval

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
17½"	13-3/8"	48# - H-40	350' (675 sx Class H w/2% CaCl$_2$ (1/4# Flocele/sx ~~in 1st 150 sx.~~)	circ. to surface	
12¼" X 8-5/8"	7"	23#, K-55	4900' (sufficient TRLW w/12# salt/sx w/10% DD and 1/4#/sx Flocele plus 3# Gilsonite/sx followed by 260 sx Class H cement w/8# salt/sx to circulate at surface.)		

NOTE: If excessive waterflow is encountered in salt section, 9-5/8", 40#, N80 intermediate casing will be set at approx. 3030'; cemented to surface w/cement of quality adequate to control waterflow & protect casing string.

RE: NMOCD Order No. R-5897: Administrative approval requested as provided by Rule 8 of Order (4). Location herein is required due to topographical conditions which also required new tract & well number. Original location and well as specified in Order (3) was: Tract 2721, Well No. 001, located 1310'FS and w/lines of above section. Confirms telecon McLemore/Ramey 1-22-79.

(This well is in the same proration unit as well No. 001)

Use mud additives as required for control.

BOP: Series 900,3000# WP, double w/one set pipe rams & one set blind rams.

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed W.J. Mueller Title Engineering Advisor Date 1-22-79

(This space for State Use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 10-65

Operator: Phillips Petroleum Company		E.V.G.S.A.U. M Tract 2739	Well No.: 005
Unit Letter: K	Section: 27	Township: 17 South	Range: 35 East
County: Lea			
Actual Footage Location: 1330 feet from the South line and 1380 feet from the West line			
Ground Level Elev.: 3938.7	Producing Formation: Grayburg/San Andres	Pool: Vacuum Grayburg/San Andres	Dedicated Acreage: 40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

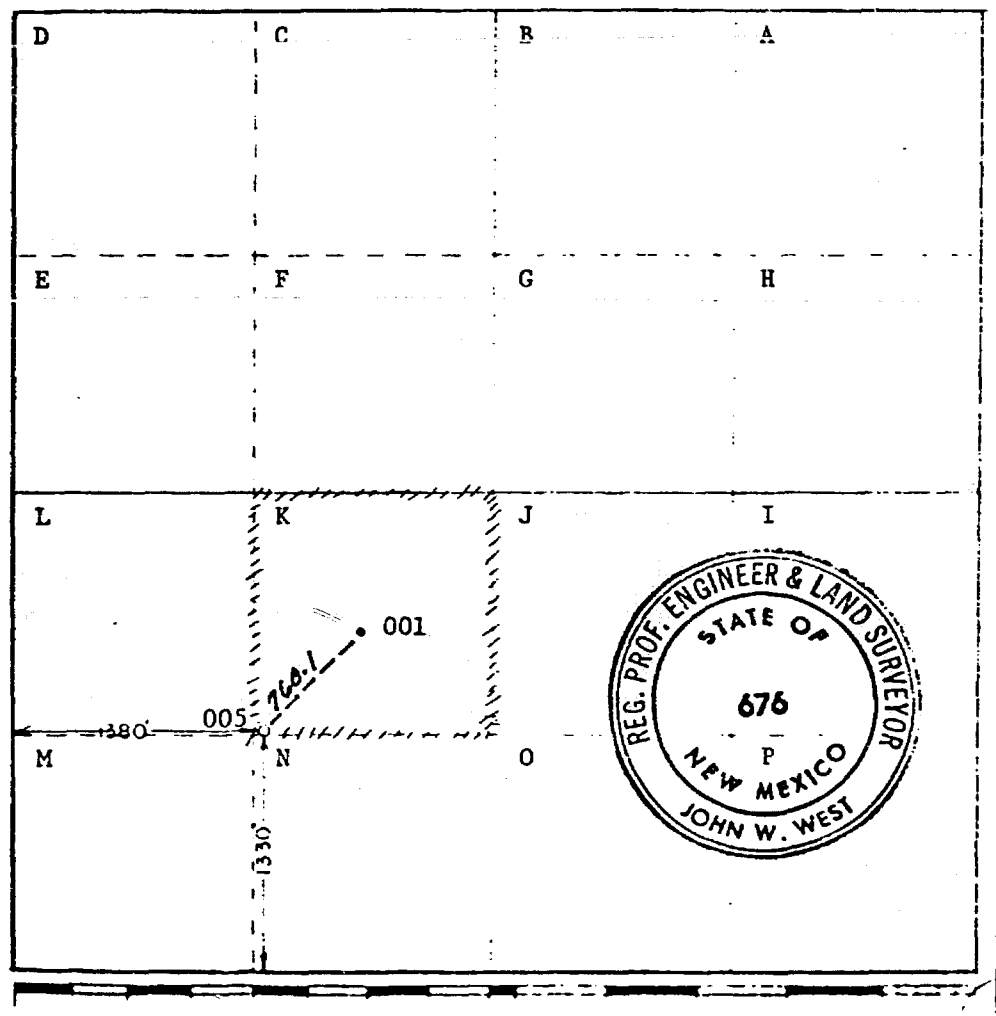
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, forced-pooling, etc?

☐ Yes ☐ No If answer is "yes" type of consolidation _____

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) _____

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

W. J. Mueller

Engineering Advisor

Phillips Petroleum Co.

January 23, 1979

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

January 3, 1979

Date Surveyed

Registered Professional Engineer and/or Land Surveyor

John W West 676

Certificate No.

CASE 6475: Application of Consolidated Oil & Gas, Inc. for approval of infill drilling, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks a waiver of existing well-spacing requirements and a finding that the drilling of its Montova Well No. 1-A to be located in Unit I of Section 35, Township 32 North, Range 13 West, Basin-Dakota Pool, San Juan County, New Mexico, is necessary to effectively and efficiently drain that portion of the proration unit which cannot be so drained by the existing well.

CASE 6476: Application of Pennzoil Company for an unorthodox gas well location, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks approval for the unorthodox location of a well to be located 660 feet from the South line and 990 feet from the West line of Section 24, Township 17 South, Range 28 East, Aid-Morrow Gas Pool, Eddy County, New Mexico, the S/2 of said Section 24 to be dedicated to the well.

CASE 6477: Application of Sun Oil Company for a waterflood project, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a waterflood project on its East Millman Pool Unit Area by the injection of water into the Queen and Grayburg formations through eleven wells located in Sections 12 and 13 of Township 19 South, Range 28 East, East Millman Pool, Eddy County, New Mexico.

CASE 6437: (Continued and Readvertised)

Application of Curtis Little for compulsory pooling, approval of infill drilling, and a non-standard proration unit, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks the rescission of Order No. R-4556 and approval of an order pooling all mineral interests in the Dakota formation underlying all of Section 11 and Lot 4 and the SW/4 SW/4 of Section 12, Township 28 North, Range 13 West, Basin-Dakota Pool, San Juan County, New Mexico, to form a 344.36-acre non-standard gas proration unit to be dedicated to a well to be located 1085 feet from the South line and 285 feet from the West line of said Section 12. Also to be considered will be the cost of drilling and completing said well and the allocation of the cost thereof as well as actual operating costs and charges for supervision. Also to be considered will be the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

Applicant further seeks a finding that the drilling of said well is necessary to effectively and efficiently drain that portion of the proration unit which cannot be so drained by the existing well.

CASE 6478: Application of Coronado Exploration Corp. for compulsory pooling, Chaves County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the San Andres formation underlying the NW/4 SE/4 of Section 26, Township 10 South, Range 28 East, Chaves County, New Mexico, to be dedicated to a well to be located at a standard location thereon. Also to be considered will be the cost of drilling and completing said well and the allocation of the cost thereof as well as actual operating costs and charges for supervision. Also to be considered will be the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

CASE 6479: Application of Coronado Exploration Corp. for compulsory pooling, Chaves County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the San Andres formation underlying the SE/4 SE/4 of Section 5, Township 10 South, Range 28 East, Chaves County, New Mexico, to be dedicated to a well to be located at a standard location thereon. Also to be considered will be the cost of drilling and completing said well and the allocation of the cost thereof as well as actual operating costs and charges for supervision. Also to be considered will be the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

CASE 6480: Application of Harvey E. Yates Company for an NGPA determination, Lea County, New Mexico. Applicant, in the above-styled cause, seeks a new onshore reservoir or in the alternative a new onshore production well determination for its State 22 Well No. 1 located in Unit P of Section 22, Township 18 South, Range 35 East, Queen formation, Lea County, New Mexico.

CASE 6481: Application of Harvey E. Yates Company for an NGPA determination, Lea County, New Mexico. Applicant, in the above-styled cause, seeks a new onshore reservoir or in the alternative a new onshore production well determination for its Hanlad State Well No. 1 located in Unit K of Section 2, Township 18 South, Range 35 East, Queen formation, Lea County, New Mexico.

CASE 6482: Application of Harvey E. Yates Company for an NGPA determination, Lea County, New Mexico. Applicant, in the above-styled cause, seeks a new onshore reservoir or in the alternative a new onshore production well determination for its Mobil 27 State Well No. 1 located in Unit A of Section 27, Township 18 South, Range 35 East, Queen formation, Lea County, New Mexico.

CASE 6483: Application of Harvey E. Yates Company for compulsory pooling, Lea County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the Wolfcamp, Pennsylvanian, and Mississippian formations underlying the S/2 of Section 8, Township 14 South, Range 36 East, Lea County, New Mexico, to be dedicated to a well to be drilled at a standard location thereon. Also to be considered will be the cost of drilling and completing said well and the allocation of the cost thereof as well as actual operating costs and charges for supervision. Also to be considered will be the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

CASE 6484: Application of Harvey E. Yates Company for compulsory pooling, Lea County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the Wolfcamp, Pennsylvanian, and Mississippian formations underlying the E/2 of Section 28, Township 16 South, Range 37 East, Lea County, New Mexico, to be dedicated to a well to be drilled at a standard location thereon. Also to be considered will be the cost of drilling and completing said well and the allocation of the cost thereof as well as actual operating costs and charges for supervision. Also to be considered will be the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

CASE 6485: Application of Harvey E. Yates Company for compulsory pooling, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the Wolfcamp, Pennsylvanian, and Mississippian formations underlying the S/2 of Section 13, Township 16 South, Range 28 East, Eddy County, New Mexico, to be dedicated to a well to be drilled at a standard location thereon. Also to be considered will be the cost of drilling and completing said well and the allocation of the cost thereof as well as actual operating costs and charges for supervision. Also to be considered will be the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

CASE 6486: Application of Depco Inc. for an unorthodox well location, Chaves County, New Mexico. Applicant, in the above-styled cause, seeks approval for the unorthodox location of a well to be located 660 feet from the North and East lines of Section 21, Township 13 South, Range 30 East, undesignated Morrow pool, Chaves County, New Mexico, the E/2 of said Section 21 to be dedicated to the well.

CASE 6487: Application of El Paso Natural Gas Company for approval of infill drilling, Lea County, New Mexico. Applicant, in the above-styled cause, seeks a waiver of existing well-spacing requirements and a finding that the drilling of its Shell E State Com Well No. 2 located in Unit N of Section 6, Township 21 South, Range 36 East, Eumont Gas Pool, Lea County, New Mexico, is necessary to effectively and efficiently drain that portion of the proration unit which cannot be so drained by the existing well.

Dockets Nos. 9-79 and 10-79 are tentatively set for hearing on March 14 and 28, 1979. Applications for hearing must be filed at least 22 days in advance of hearing date.

Docket No. 7-79

DOCKET: COMMISSION HEARING - FRIDAY - FEBRUARY 23, 1979

OIL CONSERVATION COMMISSION - 9 A.M. - ROOM 205
STATE LAND OFFICE BUILDING, SANTA FE, NEW MEXICO

CASE 6461: In the matter of the hearing called by the Oil Conservation Commission on its own motion to permit Mayor Eddie Armenta, the Village of Jemez Springs, and all other interested parties to appear and show cause why the Jemez Well No. 1 located in Unit A of Section 26, Township 18 North, Range 2 East, Sandoval County, New Mexico, should not be plugged and abandoned in accordance with a Division-approved plugging program.

****

Docket No. 8-79

DOCKET: EXAMINER HEARING - WEDNESDAY - FEBRUARY 28, 1979

9 A.M. - OIL CONSERVATION DIVISION CONFERENCE ROOM,
STATE LAND OFFICE BUILDING, SANTA FE, NEW MEXICO

The following cases will be heard before Richard L. Stamets, Examiner, or Daniel S. Nutter, Alternate Examiner:

CASE 6422: (Continued from January 31, 1979, Examiner Hearing)

In the matter of the hearing called by the Oil Conservation Division on its own motion to permit Helton Engineering & Geological Services, Inc., Travelers Indemnity Company, and all other interested parties to appear and show cause why the Brent Well No. 1 located in Unit M of Section 29 and the Brent Well No. 3 located in Unit G of Section 19, both in Township 13 North, Range 6 East, Sandoval County, New Mexico, should not be plugged and abandoned in accordance with a Division-approved plugging program.

CASE 6434: (Continued from January 31, 1979, Examiner Hearing)

Application of Amerada Hess Corporation for approval of infill drilling, Lea County, New Mexico. Applicant, in the above-styled cause, seeks a finding that the drilling of its State "O" Well No. 5 to be located in Unit H of Section 30, Township 19 South, Range 37 East, Eumont Gas Pool, Lea County, New Mexico, is necessary to effectively and efficiently drain that portion of the proration unit which cannot be so drained by the existing well, and further seeks approval of a waiver of existing well-spacing requirements.

CASE 6435: (Continued from February 14, 1979, Examiner Hearing)

Application of Amerada Hess Corporation for approval of infill drilling, Lea County, New Mexico. Applicant, in the above-styled cause, seeks a finding that the drilling of its W. A. Weir "B" Well No. 3 located in Unit B of Section 26, Township 19 South, Range 36 East, Eumont Gas Pool, Lea County, New Mexico, is necessary to effectively and efficiently drain that portion of the proration unit which cannot be so drained by the existing well, and further seeks approval of a waiver of existing well-spacing requirements.

CASE 6436: (Continued from January 31, 1979, Examiner Hearing)

Application of Amerada Hess Corporation for approval of infill drilling, Lea County, New Mexico. Applicant, in the above-styled cause, seeks a finding that the drilling of its State "U" Gas Com Well No. 2 to be located in Unit C of Section 32, Township 19 South, Range 37 East, Eumont Gas Pool, Lea County, New Mexico, is necessary to effectively and efficiently drain that portion of the proration unit which cannot be so drained by the existing well, and further seeks approval of a waiver of existing well-spacing requirements.

CASE 6462: Application of McClellan Oil Corporation for an unorthodox well location, Chaves County, New Mexico. Applicant, in the above-styled cause, seeks approval for the unorthodox location of its Marlisue State Well No. 3 to be located 1155 feet from the North line and 1485 feet from the West line of Section 24, Township 14 South, Range 29 East, Double "L" Queen Associated Pool, Chaves County, New Mexico, the NE/4 NW/4 of said Section 24 to be dedicated to the well.

CASE 6463: Application of Orville Slaughter for pool and lease commingling, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks authority to commingle Oswell-Farmington Pool production from his Sangre de Cristo Well No. 1 with undesignated Fruitland production from his Sangre de Cristo Well No. 2, both located in Unit D of Section 34, Township 30 North, Range 11 West, San Juan County, New Mexico.

CASE 6464: Application of Dallas McCasland for clarification of Orders Nos. R-2789 and R-2794, Lea County, New Mexico. Applicant, in the above-styled cause, seeks clarification of Orders Nos. R-2789 and R-2794 to determine what formations have been unitized and what formations are subject to a waterflood project under the South Penrose-Skelly Unit, Sections 6 and 7, Township 22 South, Range 37 East, Lea County, New Mexico, and of the vertical limits of the Eumont and Penrose-Skelly Pools in said sections.

CASE 6465: Application of Getty Oil Company for an unorthodox well location and a non-standard proration unit, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval of a 160-acre non-standard gas proration unit comprising the SE/4 of Section 31, Township 24 South, Range 37 East, Jalmat Gas Pool, Lea County, New Mexico, to be dedicated to its J. W. Sherrell Well No. 9 located 2250 feet from the South line and 1650 feet from the East line of said Section 31.

CASE 6466: Application of Getty Oil Company for a dual completion, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval for the dual completion of its State 35 Well No. 1 located in Unit K of Section 35, Township 21 South, Range 34 East, Lea County, New Mexico, to produce oil from an undesignated Wolfcamp pool and gas from the Grama Ridge-Morrow Gas Pool through parallel strings of tubing.

CASE 6467: Application of Getty Oil Company for pool creation and special pool rules, Lea County, New Mexico. Applicant, in the above-styled cause, seeks an order creating a new oil pool in the Wolfcamp formation for its State 35 Well No. 1 located in Unit K of Section 35, Township 21 South, Range 34 East, Lea County, New Mexico, and for promulgation of special pool rules, including provision for 160-acre spacing.

CASE 6468: Application of Dome Petroleum Corporation for an exception to Order No. R-1069, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks an exception to Rule 2 of Order No. R-1069, as amended, for the Bisti-Lower Gallup Oil Pool to approve the following 13 non-standard proration units: the W/2 NW/4, W/2 NE/4, E/2 SW/4, and the E/2 SE/4 of Sections 3, 4, and 9, and the W/2 NW/4 of Section 10, all in Township 26 North, Range 14 West, San Juan County, New Mexico.

CASE 6469: Application of Continental Oil Company for a dual completion, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks approval for the dual completion of its Fed. 34 Well No. 1 located in Unit N of Section 34, Township 20 South, Range 26 East, Eddy County, New Mexico, to produce gas from the Springs-Upper Pennsylvanian Pool and an undesignated Morrow pool through parallel strings of tubing.

CASE 6470: Application of Phillips Petroleum Company for approval of infill drilling, Lea County, New Mexico. Applicant, in the above-styled cause, seeks a waiver of existing well spacing requirements to permit an infill drilling program in its East Vacuum Unit Area, Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, and a finding that such infill wells are necessary to effectively and efficiently drain that portion of their proration units which is not presently being drained by any existing well. Applicant specifically seeks such waivers and findings now for ten wells, all in Township 17 South, Range 35 East, and located as follows: Unit K of Section 27; Units M and O, Section 28; Units B, I, and M of Section 32; Units C, H, and M of Section 33; and Unit C of Section 34.

CASE 6471: Application of Consolidated Oil & Gas, Inc. for approval of infill drilling, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks a waiver of existing well-spacing requirements and a finding that the drilling of its Freeman Well No. 1-A to be located in Unit C of Section 11, Township 31 North, Range 13 West, Basin-Dakota Pool, San Juan County, New Mexico, is necessary to effectively and efficiently drain that portion of the proration unit which cannot be so drained by the existing well.

CASE 6472: Application of Consolidated Oil & Gas, Inc. for approval of infill drilling, Rio Arriba County, New Mexico. Applicant, in the above-styled cause, seeks a waiver of existing well-spacing requirements and a finding that the drilling of its Jenny Well No. 1-A to be located in Unit P of Section 13, Township 26 North, Range 4 West, Basin-Dakota Pool, Rio Arriba County, New Mexico, is necessary to effectively and efficiently drain that portion of the proration unit which cannot be so drained by the existing well.

CASE 6473: Application of Consolidated Oil & Gas, Inc. for approval of infill drilling, Rio Arriba County, New Mexico. Applicant, in the above-styled cause, seeks a waiver of existing well-spacing requirements and a finding that the drilling of its McIntyre Well No. 1-A to be located in Unit K of Section 11, Township 26 North, Range 4 West, Basin-Dakota Pool, Rio Arriba County, New Mexico, is necessary to effectively and efficiently drain that portion of the proration unit which cannot be so drained by the existing well.

CASE 6474: Application of Consolidated Oil & Gas, Inc. for approval of infill drilling, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks a waiver of existing well-spacing requirements and a finding that the drilling of its Williams Well No. 1-A to be located in Unit C of Section 24, Township 31 North, Range 13 West, Basin-Dakota Pool, San Juan County, New Mexico, is necessary to effectively and efficiently drain that portion of the proration unit which cannot be so drained by the existing well.

JASON W. KELLAHIN
W. THOMAS KELLAHIN
KAREN AUBREY

KELLAHIN and KELLAHIN
ATTORNEYS AT LAW
500 DON GASPAR AVENUE
P. O. BOX 1769
SANTA FE, NEW MEXICO 87501

TELEPHONE 982-4285
AREA CODE 505

February 5, 1979

RECEIVED
FEB 6 1979
Oil Conservation

Mr. Joe Ramey
Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87501

Dear Joe:

Please set the enclosed application for hearing on February 28, 1979.

Very truly yours,

W. Thomas Kellahin

CC: Mr. Joe Peacock

WTK:kfm

Enclosure

RECEIVED
FEB 6 1979
Oil Conservation

STATE OF NEW MEXICO
ENERGY AND MINERAL DEPARTMENT
OIL CONSERVATION DIVISION

IN THE MATTER OF THE APPLICATION OF PHILLIPS PETROLEUM COMPANY FOR WELL-HEAD PRICE CEILING CATEGORY DETERMINATION, LEA COUNTY, N.M.

CASE 6470

A P P L I C A T I O N

Comes now PHILLIPS PETROLEUM COMPANY and applies to the New Mexico Energy and Minerals Department, Oil Conservation Division, for an order for well-head price ceiling category determination pursuant to the Special Rules of the Division, and Part 271.305(b) Federal Energy Regulatory Commission's Regulations Implementing the Natural Gas Policy Act of 1978, and in support thereof would show the Division:

1. Applicant is of the East Vacuum Grayburg-San Andres Unit Area, Lea County, New Mexico being operated pursuant to Division Orders R-5897 and R-5871.

2. Applicant proposes to drill the following wells spudding said wells after a well classification determination has been made:

Tract No.	Well No.	Location		Unit	Section
3229	005	1110'S	1290'W	M	32
2801	004	1310'S	1330'E	O	28
2801	002	1140'S	1310'W	M	28
3328	002	1310'S	1160'W	M	33
3202	003	1180'N	1480'E	B	32
2739	005	1330'S	1380'W	K	27
3456	005	1030'N	1410'W	C	34

3333	004	1380'N	1280'E	II	33
3308	003	1150'N	1510'W	C	33
3202	001	1330'S	1310'E	I	32

all in Township 17 South, Range 35 East, NMPM, Lea County, New Mexico.

3. Applicant seeks a determination pursuant to the F.E.R.C. rules, Part 271.305 that the subject well is necessary to effectively and efficiently drain a portion of the ~~Lemont~~ Vacuum Grayburg-San Andres ~~Pool~~ reservoir covered by the proposed proration unit which cannot be effectively and efficiently drained by any existing well within the proration unit and will offer evidence in support of that determination.

Should be Vacuum 28-17 Pool

4. In the alternative applicant seeks determination of wellhead price ceiling category determination pursuant to the provisions of Part 271.305 (c) of the F.E.R.C. Regulations Implementing the Natural Gas Policy Act of 1978, based upon a review of the records of the Division affecting the area and producing formation involved, as provided by the above section of the Regulations.

WHEREFORE Applicant respectfully requests that this matter be set for hearing at the February 28, 1979 Examiner hearing, and that after notice and hearing as required by law, the Division enter its order making the wellhead price ceiling category determination as requested.

Respectfully submitted,

PHILLIPS PETROLEUM COMPANY

By _____

KELLAHIN & KELLAHIN
P. O. Box 1769
Santa Fe, New Mexico 87501

ATTORNEYS FOR APPLICANT

RECEIVED
FEB 6 1979
Oil Conservation

STATE OF NEW MEXICO

ENERGY AND MINERAL DEPARTMENT

OIL CONSERVATION DIVISION

IN THE MATTER OF THE APPLICATION OF PHILLIPS PETROLEUM COMPANY FOR WELL-HEAD PRICE CEILING CATEGORY DETERMINATION, LEA COUNTY, N.M.

CASE 6470

A P P L I C A T I O N

Comes now PHILLIPS PETROLEUM COMPANY and applies to the New Mexico Energy and Minerals Department, Oil Conservation Division, for an order for well-head price ceiling category determination pursuant to the Special Rules of the Division, and Part 271.305(b) Federal Energy Regulatory Commission's Regulations Implementing the Natural Gas Policy Act of 1978, and in support thereof would show the Division:

1. Applicant is of the East Vacuum Grayburg-San Andres Unit Area, Lea County, New Mexico being operated pursuant to Division Orders R-5897 and R-5871.

2. Applicant proposes to drill the following wells spudding said wells after a well classification determination has been made:

Tract No.	Well No.	Location		Unit	Section
3229	005	1110'E	1290'W	M	32
2801	004	1310'S	1330'E	O	28
2801	002	1140'S	1310'W	M	28
3328	002	1310'S	1160'W	M	33
3202	003	1180'N	1480'E	B	32
2739	005	1330'S	1380'W	K	27
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3333	004	1380'N	1280'E	H	33
3308	003	1150'N	1510'W	C	33
3202	001	1330'S	1310'E	I	32

all in Township 17 South, Range 35 East, NMPM, Lea County, New Mexico.

3. Applicant seeks a determination pursuant to the F.E.R.C. rules, Part 271.305 that the subject well is necessary to effectively and efficiently drain a portion of the ~~Eumont~~ Vacuum Grayburg San Andres ~~Queen~~ reservoir covered by the proposed proration unit which cannot be effectively and efficiently drained by any existing well within the proration unit and will offer evidence in support of that determination.

4. In the alternative applicant seeks determination of wellhead price ceiling category determination pursuant to the provisions of Part 271.305 (c) of the F.E.R.C. Regulations Implementing the Natural Gas Policy Act of 1978, based upon a review of the records of the Division affecting the area and producing formation involved, as provided by the above section of the Regulations.

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Respectfully submitted,

PHILLIPS PETROLEUM COMPANY

By _____

KELLAHIN & KELLAHIN
P. O. Box 1769
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ENERGY AND MINERAL DEPARTMENT

OIL CONSERVATION DIVISION

IN THE MATTER OF THE APPLICATION OF PHILLIPS PETROLEUM COMPANY FOR WELL-HEAD PRICE CEILING CATEGORY DETERMINATION, LEA COUNTY, N.M.

CASE 6470

A P P L I C A T I O N

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3202	001	1330'S	1310'E	I	32

all in Township 17 South, Range 35 East, NMPM, Lea County, New Mexico.

3. Applicant seeks a determination pursuant to the F.E.R.C. rules, Part 271.305 that the subject well is necessary to effectively and efficiently drain a portion of the ~~Eumont~~ Jalmat Grayburg San Andres reservoir covered by the proposed proration unit which cannot be effectively and efficiently drained by any existing well within the proration unit and will offer evidence in support of that determination.

4. In the alternative applicant seeks determination of wellhead price ceiling category determination pursuant to the provisions of Part 271.305 (c) of the F.E.R.C. Regulations Implementing the Natural Gas Policy Act of 1978, based upon a review of the records of the Division affecting the area and producing formation involved, as provided by the above section of the Regulations.

WHEREFORE Applicant respectfully requests that this matter be set for hearing at the February 28, 1979 Examiner hearing, and that after notice and hearing as required by law, the Division enter its order making the wellhead price ceiling category determination as requested.

Respectfully submitted,

PHILLIPS PETROLEUM COMPANY

By _____

KELLAHIN & KELLAHIN
P. O. Box 1769
Santa Fe, New Mexico 87501

ATTORNEYS FOR APPLICANT

Application of Phillips Petroleum Co for approval of infill drilling, Lea County, New Mexico.

Applicant, in the above-styled cause, seeks a waiver of existing well spacing requirements to permit an infill drilling program in its East Vacuum Unit Area, Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, and a finding that such infill wells are necessary to effectively and efficiently drain that portion of their proration units which is not presently being drained by ~~the~~ any existing well. ~~and~~ Applicant specifically seeks approval for ten wells ~~located~~ all in Township 17 South, Range 35 East and located as follows: Unit K of Section 27; Units M and O, Section 28; Units B, I, and M of Section 32; Units C, H, and M of Section 33; and Unit C of Section 34.

M 32 ✓

B 32 ✓

I 32 ✓

M 33 ✓

H 33 ✓

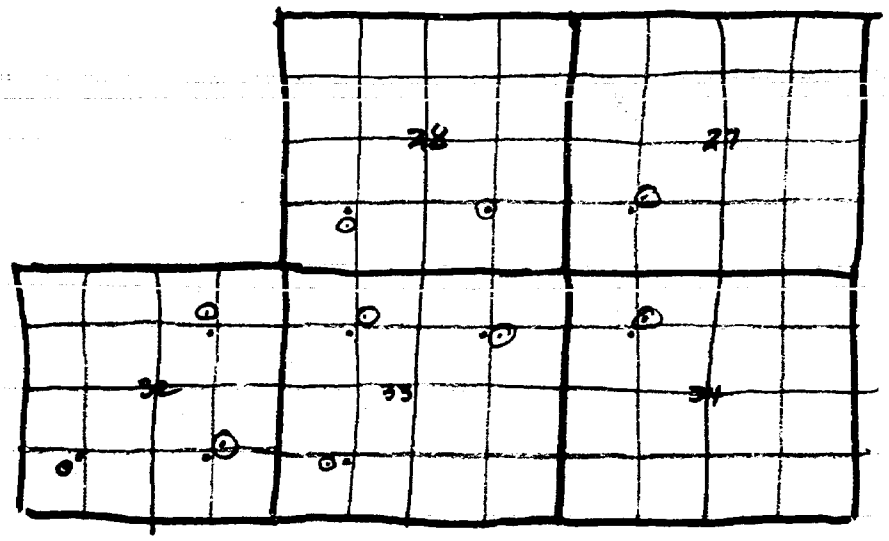
C 33 ✓

K 27 ✓

M 28 ✓

O 28 ✓

C 34 ✓



black = locations approved by Order No. R-5897

green = location presently requested (moved from orig loc because of topography etc.)

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:

CASE NO. 6470
ORDER NO. R-5971

THE APPLICATION OF PHILLIPS PETROLEUM COMPANY FOR WELL-HEAD PRICE CEILING CATEGORY DETERMINATION, LEA COUNTY, NEW MEXICO

ORDER OF THE DIVISION

BY THE DIVISION:

This matter came on for hearing at 9:00 a.m., on February 28, 1979, at Santa Fe, New Mexico, before Examiner Richard Stamets.

NOW, on this _____ day of _____, 1979, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Division has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Phillips Petroleum Company, seeks a determination pursuant to the Federal Energy Regulatory Commission ~~Rules~~ Regulations, ~~Part~~ Section 271.305(b), that ten specific wells proposed to be drilled in applicant's East Vacuum Grayburg-San Andres Unit Area in the Vacuum Grayburg-San Andres Pool, Lea County, New Mexico, on existing proration units are necessary to effectively and efficiently drain a portion of the reservoir covered by each of the proration units which cannot be effectively and efficiently drained by any existing well within that proration unit.

(3) That the applicant, Phillips Petroleum Company, further seeks a unit-wide determination pursuant to the

(4) That the standard spacing unit in the Vacuum Grayburg-San Andres Pool is 40 acres and the applicant proposes to infill drill a substantial part or all of said Unit Area on 20-acre ~~units~~ spacing.

Federal Energy Regulatory Commission ~~Rules~~ Regulations Section ~~Part~~ 271.305(b) that each subsequent infill well, in addition to the original ten wells, is necessary to effectively and efficiently drain oil and gas reserves from a portion of the reservoir covered by the proration unit involved which cannot be effectively and efficiently drained by any existing well within the proration unit.

(5) That the Division, after notice and hearing ~~which~~ of the evidence ~~was~~ presented in Case No. 6366, previously entered its Order No. R-5871 on November 27, 1978 approving applicant's East Vacuum Grayburg-San Andres Unit Agreement for the development and operation of a portion of the Vacuum-Grayburg-San Andres Pool, finding that the unitized management, operation and further development of that portion of said pool, as proposed, is necessary in order to carry out secondary recovery operations and to substantially increase ultimate recovery of oil and associated gas from the pool, and that the proposed method of operation will prevent waste and result in increased recovery of substantially more oil and associated gas from the pool than would otherwise be recovered as a result of the unit operations.

(6) That the Division, after notice and hearing of the ~~which~~ evidence ~~was~~ presented in Case No. 6367, ~~by~~ entered its Order No. R-5897, ~~entered~~ our January 16, 1979, approving institution of a pressure maintenance project in the East Vacuum Grayburg-San Andres Unit, based on a finding that such pressure maintenance project will result in the production of hydrocarbons from tracts within the unit that would not otherwise be recovered, ~~which~~ and said order also approved unorthodox well locations for the wells listed ~~herein~~ in Finding No. (7) below as exceptions to existing well spacing regulations.

(7) At the hearing of the instant case on February 28, 1979, evidence was presented that established that the infill drilling of the wells listed below in the East Vacuum Grayburg-San Andres Unit Area is necessary to effectively and efficiently drain that portion of the reservoir covered by the proration unit upon which each respective well is located which cannot be effectively and efficiently drained by any existing well within the proration unit, and that such wells will recover natural gas and other hydrocarbons that will not otherwise be recovered by any other well within the East Vacuum Grayburg-San Andres Unit or within the proration unit involved. The subject wells are as follows:

Tract No.	Well No.	Location		Unit	Section
3229	005	1110'S	1290'W	M	32
2801	004	1310'S	1330'E	O	28
2801	002	1140'S	1310'W	M	28
3328	002	1310'S	1160'W	M	33
3202	003	1180'N	1480'E	B	32
2739	005	1330'S	1380'W	K	27
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3333	004	1380'N	1280'E	H	33
3308	003	1150'N	1510'W	C	33
3202	001	1330'S	1310'E	I	32

all in Township 17 South, Range 35 East, NMPM, Lea County, New Mexico.

(8) That the evidence presented demonstrated that the drilling and completion of the above ten infill wells and approximately 102 subsequent infill wells should result in the production of an additional 4.054 billion cubic feet of gas from the proration units involved, which gas would not otherwise be recovered from the proration units.

(9) That each of the above ten infill wells and each of the subsequent infill wells to be drilled in the East Vacuum Grayburg-San Andres Unit Area ~~on this unit is~~ is necessary to effectively and efficiently drain a portion of the reservoir covered by the proration unit on which such well is located which cannot be effectively and efficiently drained by any existing well within the proration unit.

(10) ~~(9)~~ That ~~based upon the evidence introduced in this hearing and in Cases No. 6366 and 6367, the Division finds that the infill wells to be drilled for the total unit area are necessary for the production of gas from the units involved which would not otherwise be recovered from the proration units, and such additional recovery should reasonably be expected to amount to 4.054 billion cubic feet of additional gas that could not be recovered by any other wells on the proration units.~~ in order to permit the drainage of a portion of the reservoir underlying the proration units on which the 10 infill wells described in Finding No. (7) above, and the subsequent infill wells described in Finding No. (8) above, are located and which cannot be efficiently and effectively drained by any existing well thereon, the previously approved infill drilling authority should be ratified as an exception to the well spacing requirements for said Vacuum Grayburg-San Andres Pool.

IT IS THEREFORE ORDERED:

(1) That the authorization of Phillips Petroleum Company to drill its infill wells as listed in Finding No. (7) of this order, the unorthodox locations of which have heretofore been approved by Division Order No. R-5897, be and the same hereby is ratified and confirmed.

(2) ~~each~~ The ratification and affirmation of the infill drilling by this Order is an exception to applicable well spacing requirements and is necessary to permit the drainage of a portion of the reservoir covered by the existing proration units underlying each of the subject wells which cannot effectively and efficiently be drained by any existing wells on such proration units.

(2) That each of the above infill wells and ~~all~~ each additional infill well approved by the Division or by the Division Director as provided for by Division Order No. R-5897

~~is~~and shall be an exception to applicable well spacing requirements and is necessary to permit the drainage of a portion of the reservoir covered by the existing proration unit underlying each of such wells which cannot effectively and efficiently be drained by any existing wells on such proration units.

(3) That jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

JOE D. RAMEY
Director