STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION
P. O. Box 2088
SANTA FE, NEW MEXICO
87501

ADMINISTRATIVE ORDER
NFL 118

INFILL DRILLING FINDINGS AND WELL-SPACING WAIVER
MADE PURSUANT TO SECTION 271.305(b) OF THE
FEDERAL ENERGY REGULATORY COMMISSION REGULATIONS,
NATURAL GAS POLICY ACT OF 1978 AND OIL CONSERVATION DIVISION
ORDER NO. R-6013

I.

Operator ARCO OIL & GAS COMPANY Well Name and No. State Vacuum Unit Well No. 22

Location: Unit F Sec. 32 Twp. 17S Rng. 34E Cty. Lea

II.

THE DIVISION FINDS:

(1) That Section 271.305(b) of the Federal Energy Regulatory Commission Interim Regulations promulgated pursuant to the Natural Gas Policy Act of 1978 provides that, in order for an infill well to qualify as a new onshore production well under Section 103 of said Act, the Division must find, prior to the commencement of drilling, that the well is necessary to effectively and efficiently drain a portion of the reservoir covered by the proration unit which cannot be so drained by any existing well within that unit, and must grant a waiver of existing well-spacing requirements.

(2) That by Order No. R-6013, dated June 7, 1979, the Division established an administrative procedure whereby the Division Director and the Division Examiners are empowered to act for the Division and find that an infill well is necessary.

(3) That the well for which a finding is sought is to be completed in the Vacuum Grayburg San Andres Pool, and the standard spacing unit in said pool is 40 acres.

(4) That a 40 -acre proration unit comprising the SE/4 NW/4 of Sec. 32, Twp. 17S, Rng. 34E, is currently dedicated to the applicant's State Vacuum Well No. 8 located in Unit F of said section.

(5) That this proration unit is (X) standard ( ) nonstandard; if nonstandard, said unit was previously approved by Order No. NA.

(6) That said proration unit is not being effectively and efficiently drained by the existing well(s) on the unit.

(7) That the drilling and completion of the well for which a finding is sought should result in the production of an additional 12,950 MCF of gas from the proration unit which would not otherwise be recovered.

(8) That all the requirements of Order No. R-6013 have been complied with, and that the well for which a finding is sought is necessary to effectively and efficiently drain a portion of the reservoir covered by said proration unit which cannot be so drained by any existing well within the unit.

(9) That in order to permit effective and efficient drainage of said proration unit, the subject application should be approved as an exception to the standard well spacing requirements for the pool.

IT IS THEREFORE ORDERED:

(1) That the applicant is hereby authorized to drill the well described in Section I above as an infill well on the existing proration unit described in Section II(4) above. The authorization for infill drilling granted 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 said proration unit which cannot be effectively and efficiently drained by any existing well thereon.

(2) 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 this 30th day of January, 19 86.

DIVISION DIRECTOR / EXAMINER ✓

Received 12/9/83
Release Immediately
M. Stogner

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION
P. O. Box 2088
SANTA FE, NEW MEXICO
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ADMINISTRATIVE ORDER
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I.

Operator ARCO Oil & Gas Company Well Name and No. State Vacuum Unit Well No. 22

Location: Unit F Sec. 32 Twp. 17 South Rng. 34 East Cty. Lea

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(3) That the well for which a finding is sought is to be completed in the Vacuum Grayburg San Andres Pool, and the standard spacing unit in said pool is 40 acres.

(4) That a 40 -acre proration unit comprising the SE/4 NW/4 of Sec. 32, Twp. 17 South, Rng. 34 East, is currently dedicated to the applicant's State Vacuum Well No. 8 located in Unit F of said section.

(5) That this proration unit is (✓) standard ( ) nonstandard; if nonstandard, said unit was previously approved by Order No. NA.

(6) That said proration unit is not being effectively and efficiently drained by the existing well(s) on the unit.

(7) That the drilling and completion of the well for which a finding is sought should result in the production of an additional 12,950 MCF of gas from the proration unit which would not otherwise be recovered.

(8) That all the requirements of Order No. R-6013 have been complied with, and that the well for which a finding is sought is necessary to effectively and efficiently drain a portion of the reservoir covered by said proration unit which cannot be so drained by any existing well within the unit.

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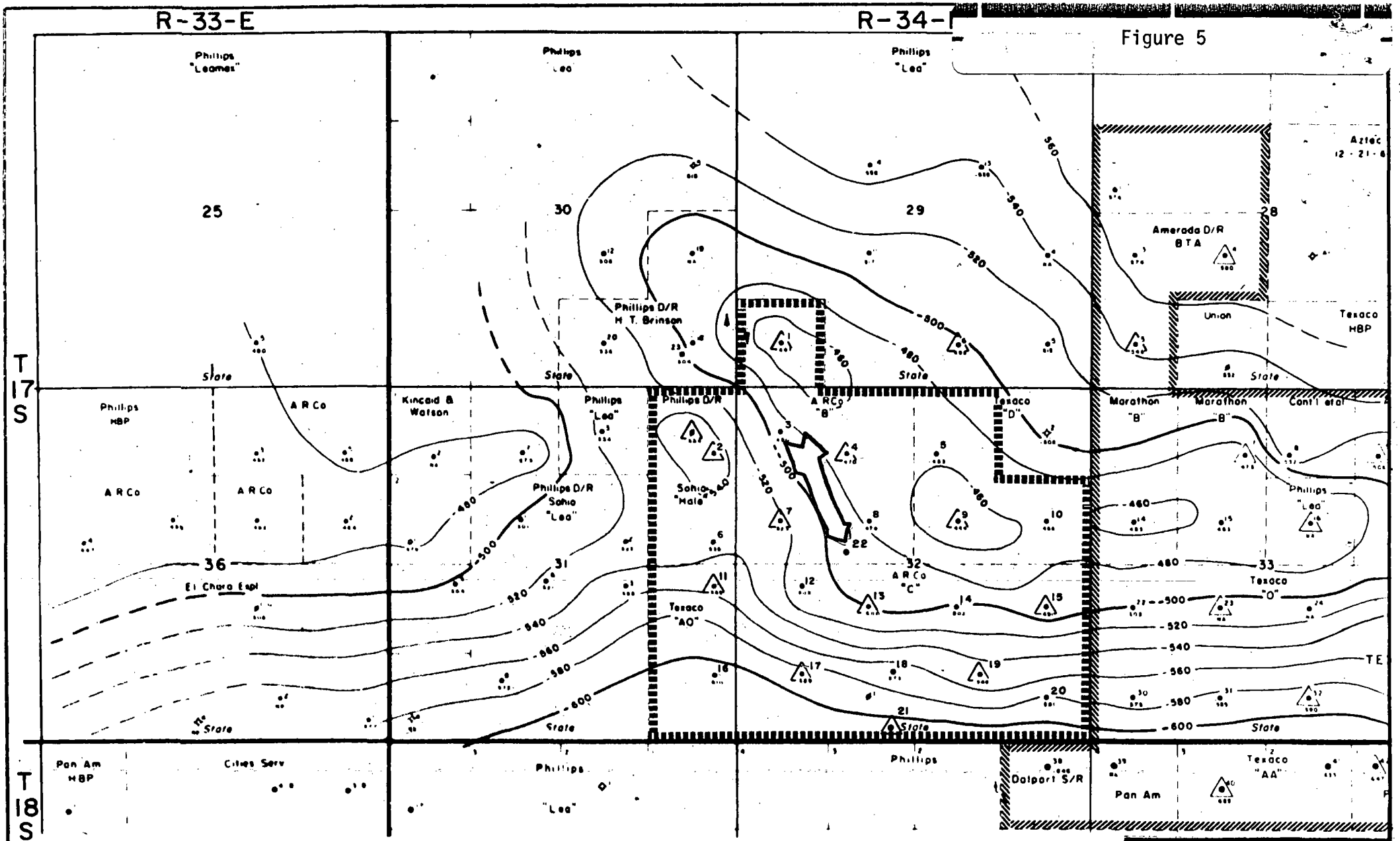
DONE at Santa Fe, New Mexico, on this _____ day of _____, 19_____.

DIVISION DIRECTOR ___ EXAMINER ___

Figure 5



L E G E N D

STATE VACUUM UNIT BOUNDARY

PROPOSED WELL LOCATION

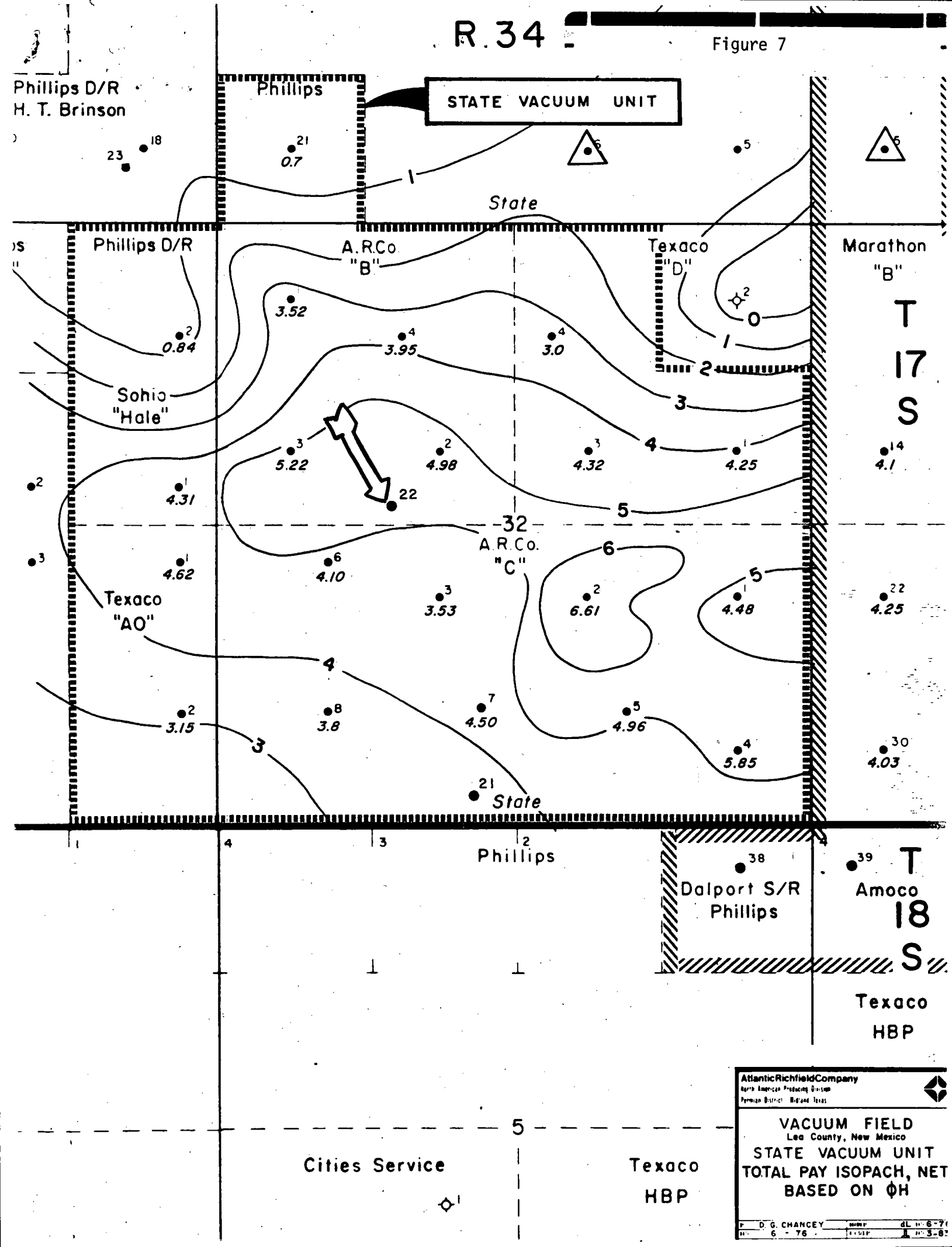
Atlantic Richfield Company
North American Producing Division
Permian District Midland Texas

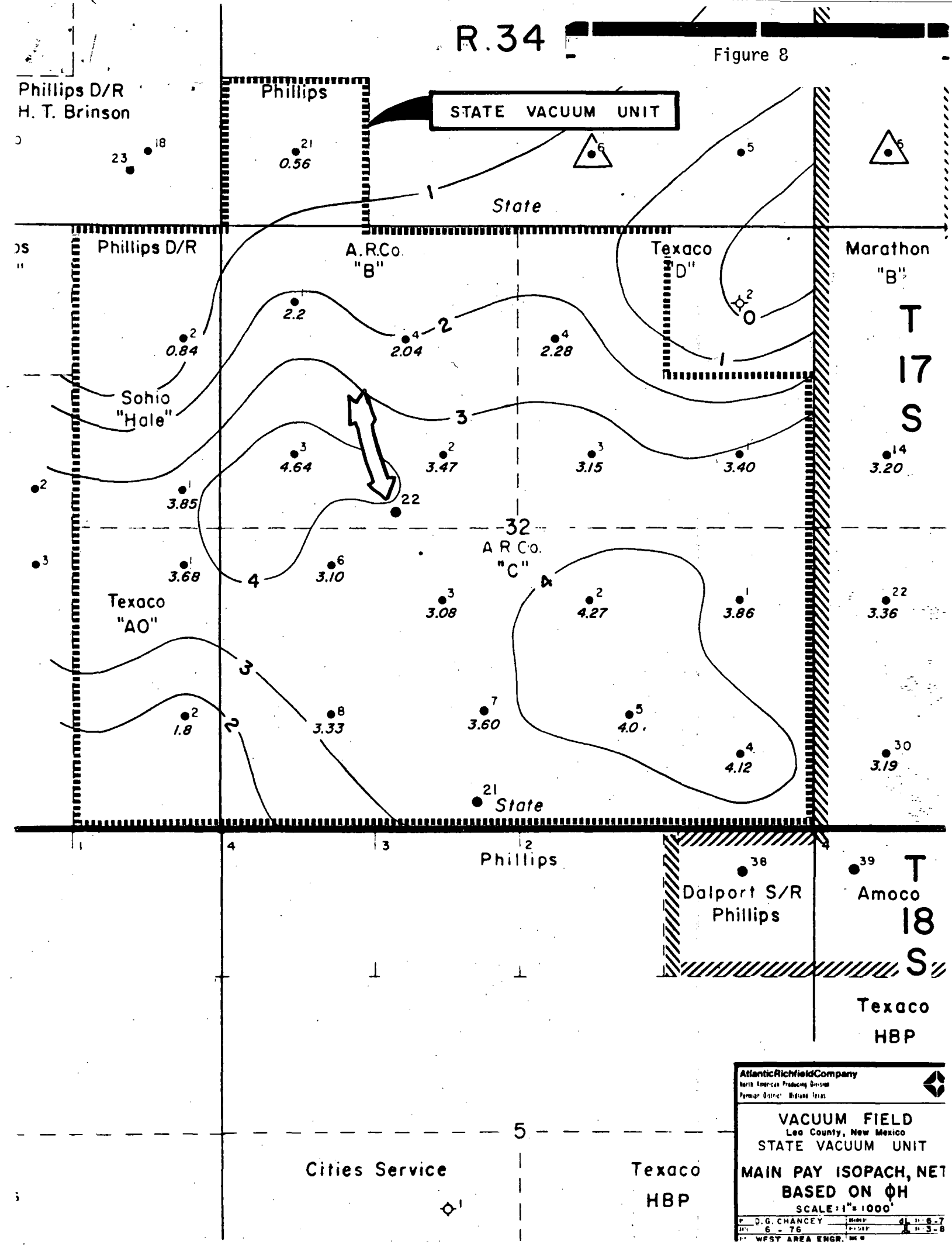
VACUUM FIELD
Lea County, New Mexico

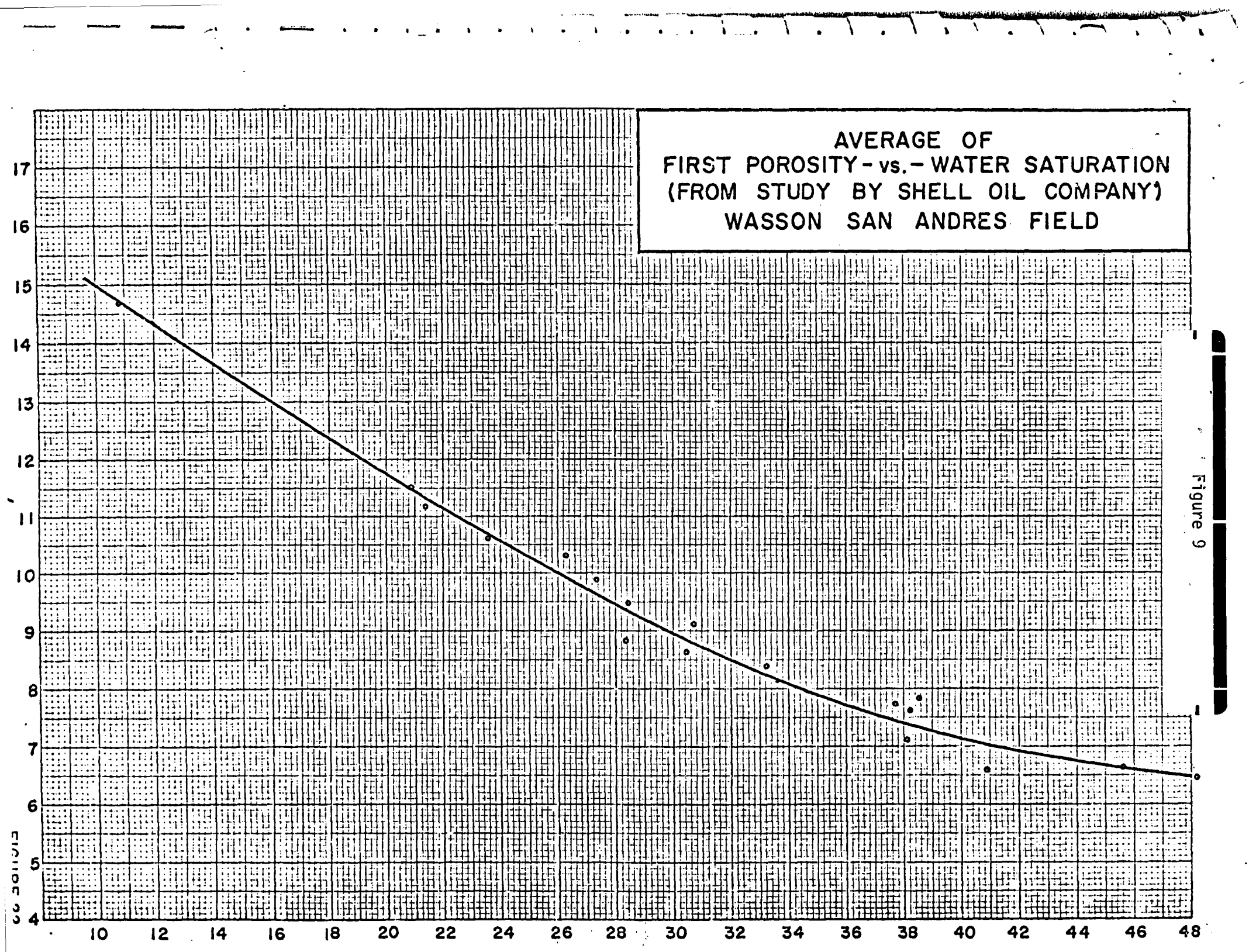
STATE VACUUM UNIT

STRUCTURE MAP
TOP OF SAN ANDRES

BY	J. A. FRAGA	APPROVED	
DATE	3-83	DRAWING NO.	3-83
DEPT	WEST ENGR.	JOB NO.	


R.34
Figure 7
Phillips D/R
H. T. Brinson
Phillips
STATE VACUUM UNIT
State
Phillips D/R
A.R.Co "B"
Texaco "D"
Marathon "B"
Sohio "Hale"
A.R.Co. "C"
Texaco "AO"
Dalport S/R Phillips
Amoco
Phillips
Cities Service
Texaco HBP
Texaco HBP
T 17 S
T 18 S
32
5
0.7
0.84
3.52
3.95
3.0
5.22
4.98
4.32
4.25
4.1
4.31
4.62
4.10
3.53
6.61
4.48
4.25
3.15
3.8
4.50
4.96
5.85
4.03
1
2
3
4
5
6
AtlanticRichfieldCompany
North American Producing Division
Permian District Midland Texas
VACUUM FIELD
Lea County, New Mexico
STATE VACUUM UNIT
TOTAL PAY ISOPACH, NET
BASED ON ϕH
D. G. CHANCEY
6 - 76


R.34
Figure 8
Phillips D/R
H. T. Brinson
Phillips
STATE VACUUM UNIT
State
Phillips D/R
A.R.Co.
"B"
Texaco
"D"
Marathon
"B"
T
17
S
Sohio
"Hale"
A R Co.
"C"
Texaco
"AO"
Phillips
Dalport S/R
Phillips
Amoco
T
18
S
Texaco
HBP
Cities Service
Texaco
HBP
0.56
0.84
2.2
2.04
2.28
0
4.64
3.47
3.15
3.40
3.20
3.85
3.68
3.10
3.08
4.27
3.86
3.36
1.8
3.33
3.60
4.0
4.12
3.19
1
2
3
4
5
6
32
5
AtlanticRichfieldCompany
North American Producing Division
Permian District Midland Texas
VACUUM FIELD
Lea County, New Mexico
STATE VACUUM UNIT
MAIN PAY ISOPACH, NET
BASED ON ϕH
SCALE: 1" = 1000'
D.G. CHANCEY
6 - 76
WEST AREA ENGR.


AVERAGE OF
FIRST POROSITY - vs. - WATER SATURATION
(FROM STUDY BY SHELL OIL COMPANY)
WASSON SAN ANDRES FIELD
17
16
15
14
13
12
11
10
9
8
7
6
5
4
10
12
14
16
18
20
22
24
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42
44
46
48

Figure 9

Figure 10

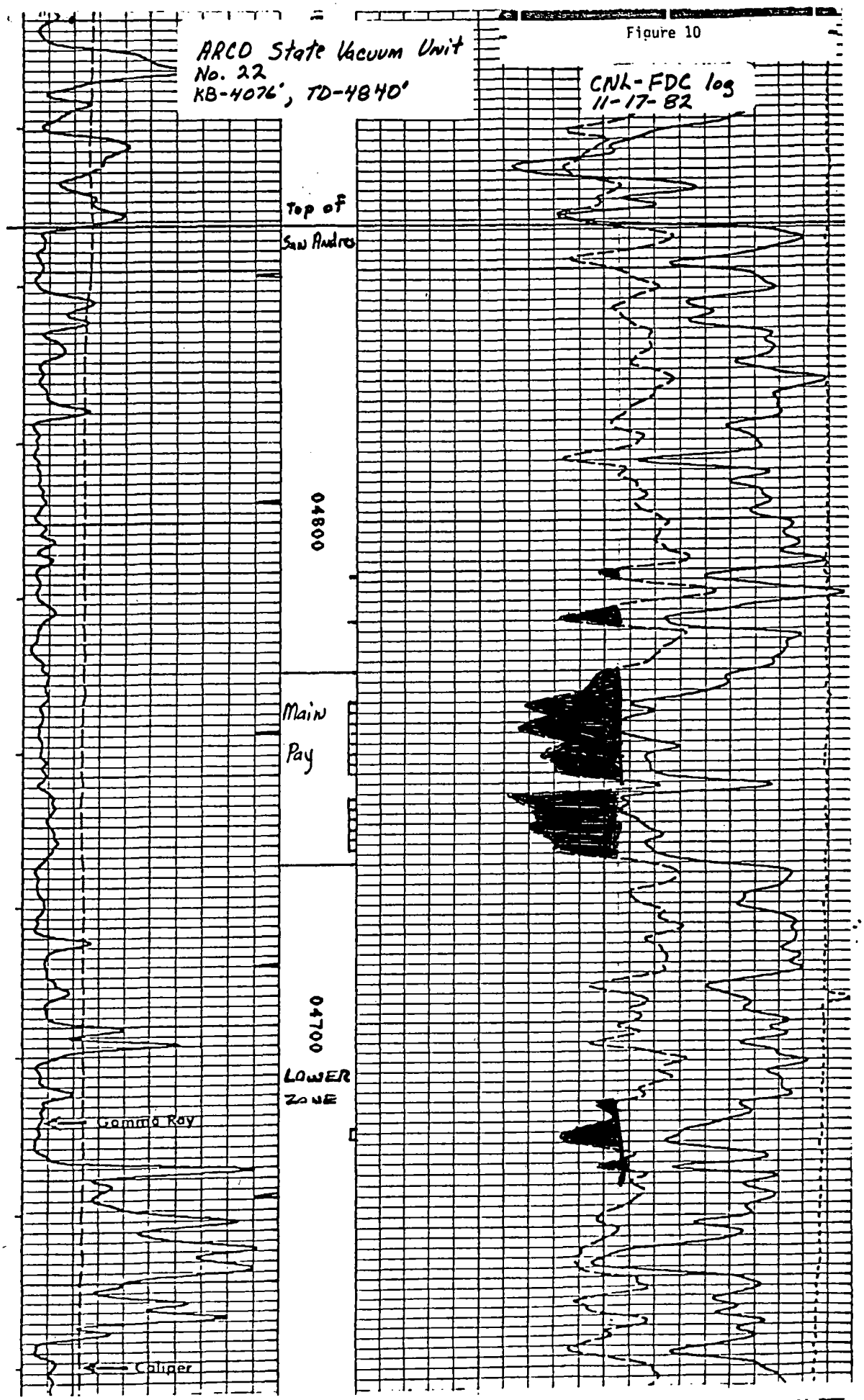

ARCO State Vacuum Unit
No. 22
KB-4076', TD-4840'
CNL-FDC log
11-17-82
Top of
San Andres
04800
Main
Pay
04700
LOWER
ZONE
Gamma Ray
Caliper

Figure 11
Continued Operations vs Infill Drilling

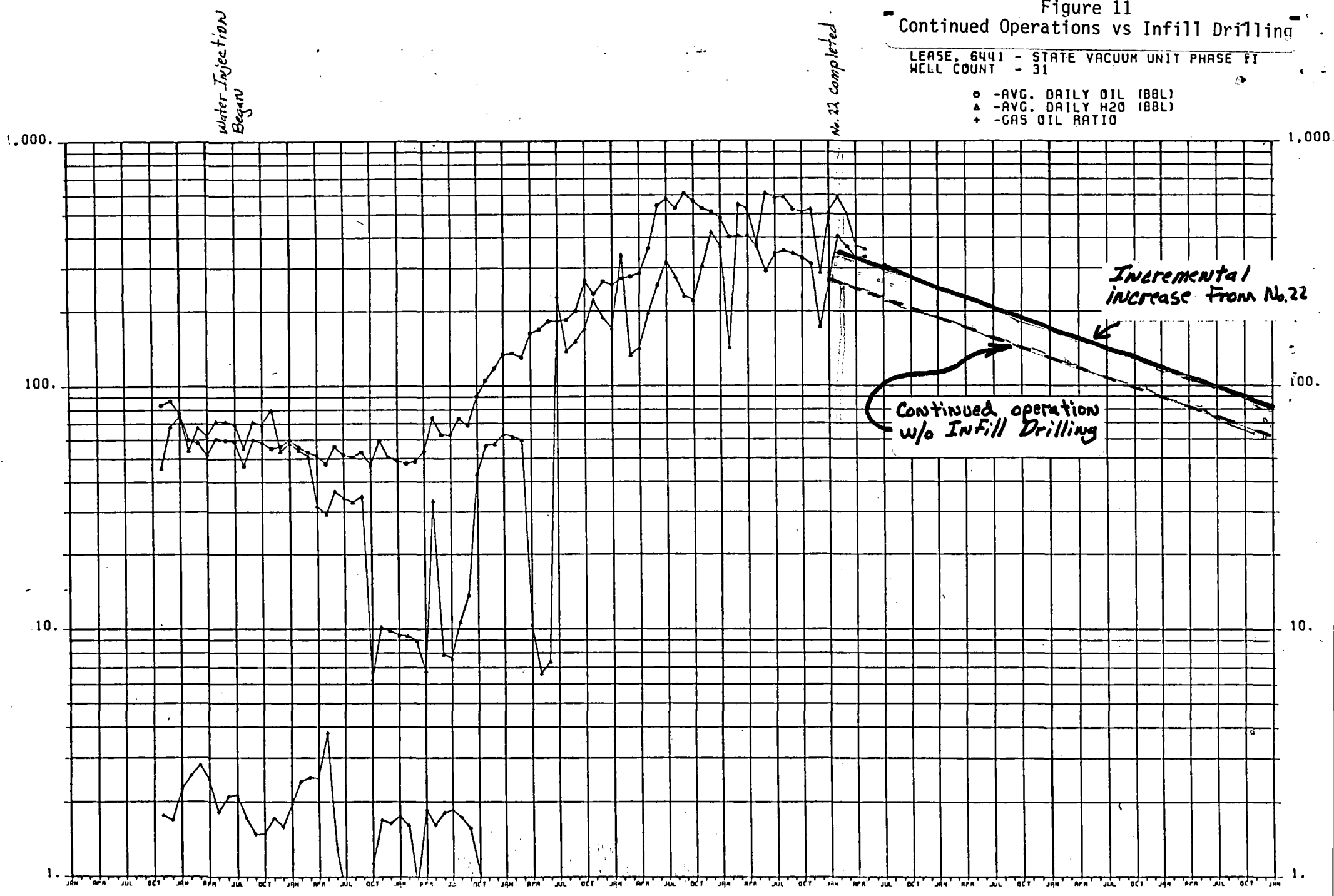


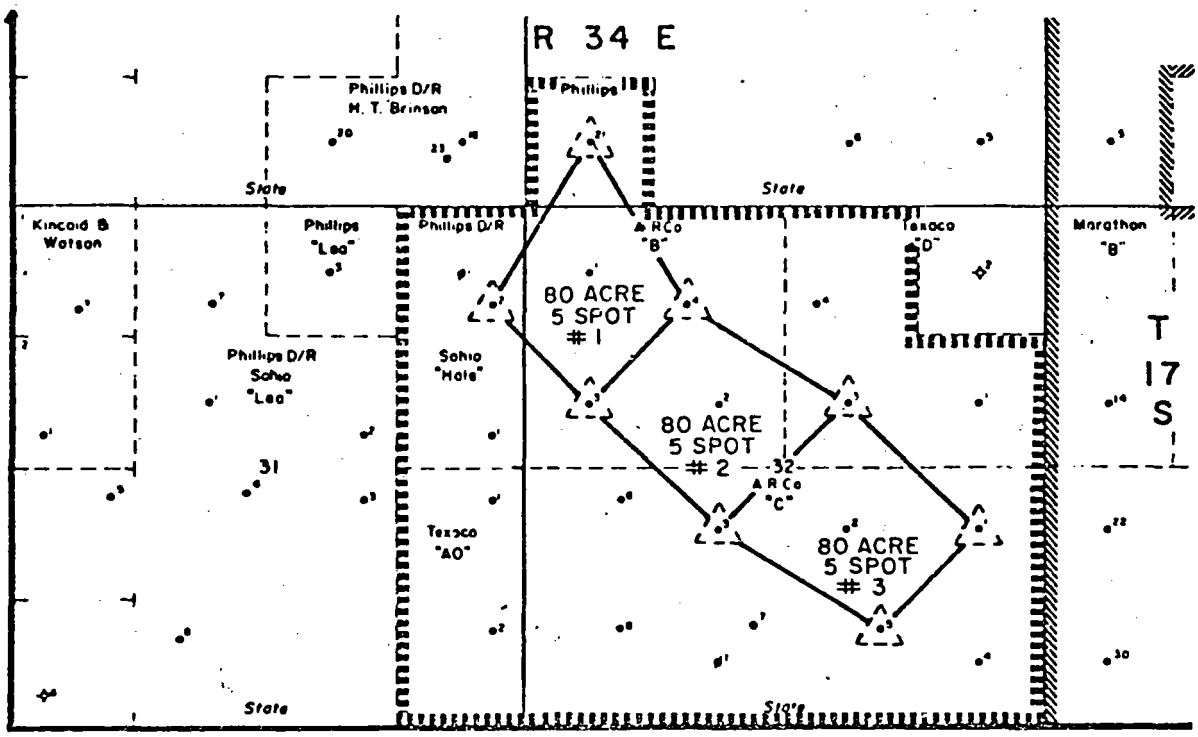
Table I

Basic Reservoir Data

Unit:	State Vacuum Unit
Operator:	ARCO Oil and Gas Company
Field:	Vacuum Grayburg-San Andres
Lithology:	Dolomite and Limestone
Area:	800 Acres
Average Porosity:	9.88%
Average Permeability:	17.8 md
Initial Formation Volume Factor:	1.26 RB/STB
Connate Water Saturation:	26.5%
Residual Oil Saturation:	30.0%
Oil Gravity:	37° API
Average GOR:	175 SCF/bbl
Original Oil In Place:	13,306 MSTBO
Primary Recovery (40-acres):	3,266 MSTBO
Secondary Recovery (40-acres):	1,700 MSTBO

TABLE 2

STRATIFICATION ANALYSIS



	% Thickness of Total	Kl, md	Scw,%	Sgx,%	Sor,%
80-ACRE 5-SPOT NO. 1					
Layer #1	42.1	4.6	26.5	24.0	30.0
Layer #2	37.0	1.7	26.5	24.0	30.0
Layer #3	20.9	0.5	26.5	24.0	30.0
	100.0				
80-ACRE 5-SPOT NO. 2					
Layer #1	25.4	26.0	26.5	24.0	30.0
Layer #2	30.8	8.6	26.5	24.0	30.0
Layer #3	17.6	2.8	26.5	24.0	30.0
Layer #4	14.9	1.0	26.5	24.0	30.0
Layer #5	11.3	0.4	26.5	24.0	30.0
	100.0				
80-ACRE 5-SPOT NO. 3					
Layer #1	18.2	19.8	26.5	24.0	30.0
Layer #2	23.5	7.0	26.5	24.0	30.0
Layer #3	29.4	2.6	26.5	24.0	30.4
Layer #4	12.6	0.9	26.5	24.0	30.4
Layer #5	16.3	0.3	26.5	24.0	30.4
	100.0				

Appendix A

I. Incremental Secondary Reserves with 20-acre Infills:

OOIP = 13,306 MBO (Eng. Study 1976)
Recovery Factor = .039 (EVU Eng. Study, Phillips)
Additional Reserves from 20-acre Spacing = 519 MBO
Unit Area = 800 acres
therefore, Equivalent 20-acre infills required = 20

519 MBO ÷ 20 Wells = 26 MBO/Well Incremental Oil

(26 MBO/Well)(175 SCF/STB) = 4.55 MMCF/Well Incremental Gas

II. Undrained Primary Reserves for Typical 20-acre Infill Location :

Øh = 4.56 (log data)
Sw = .265 (Eng. Study 1976)
Recovery Factor = .248 (Eng. Study 1976)
Boi = 1.26 RB/STB (Eng. Study 1976)
A = 5 acres (Undrained area planimetered from drainage maps)

$$\frac{7758\ A\emptyset h(1-Sw)}{Boi} \times R_f = \frac{7758(5)(4.56)(1-.265)}{1.26} \times .248 = 25.6 \text{ MBO Primary Reserves from 20-acre Spacing}$$

25.6 MBO x 175 SCF/STB = 4.48 MMCF Primary Gas

III. New Primary Reserves from A Lower Zone:

Øh = 1
A = 20 acres

$$\frac{7758\ A\emptyset h(1-Sw)}{Boi} \times R_f = \frac{7758(20)(1)(1-.265)}{1.26} \times .248 = 22.4 \text{ MBO Primary Reserves for Lower Zone}$$

22.4 MBO x (175 SCF/STB) = 3.92 MMCF Primary Gas

ARCO Oil and Gas Company
Natural Gas Marketing
Post Office Box 2819
Dallas, Texas 75221
Telephone 214 880 4675

Paul T. Davis
Manager, Gas Regulations

December 5, 1983

Department of Energy and Minerals
Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87501

RE: NGPA - Well Pricing Category Determination
State Vacuum Unit #22
Lea County, New Mexico
AR #46429

Gentlemen:

Pursuant to Order No.R-5878-B of the Oil Conservation Division, ARCO Oil and Gas Company, a Division of Atlantic Richfield Company (ARCO), hereby submits an original and one copy of an application for determination of Section 103, New Onshore Well, pricing category for the above captioned well.

Also, please find our application for "Natural Gas Policy Act Infill Findings Administration Procedure".

Co-owners with different Purchasers than those listed on Form 121 should furnish a copy of these documents to said purchaser(s).

Please return the extra copy of this letter with evidence of your receipt thereof, in the enclosed, self-addressed envelope.

Very truly yours,

Donna G. Harrison

Donna G. Harrison
Sr. Gas Regulations Administrator
(214) 880-5168

DGH/ld

Enclosures

State Vacuum Unit #22
Lea County, New Mexico
AR #46429

"Infill Finding"

Rules and Regulations
Natural Gas Policy Act Infill Findings
Administrative Procedure

Rule 3: No waivers from offset operators are necessary. See Exhibit 1

Rule 5: See attached approved Form C-101 for the infil well and Form C-102 showing proration unit dedicated.

Rule 6: See Well Completion Report and Log for name of the pool in which the infill well has been drilled and the standard spacing unit size therefor.

Rule 7: Exhibit 2: Number of the Division Order approving the non-standard proration unit dedicated to the well.

Rule 8: Exhibit I: Description of all wells drilled on proration unit.

Rule 9: See Engineering Discussion plus all "figures" associated within.

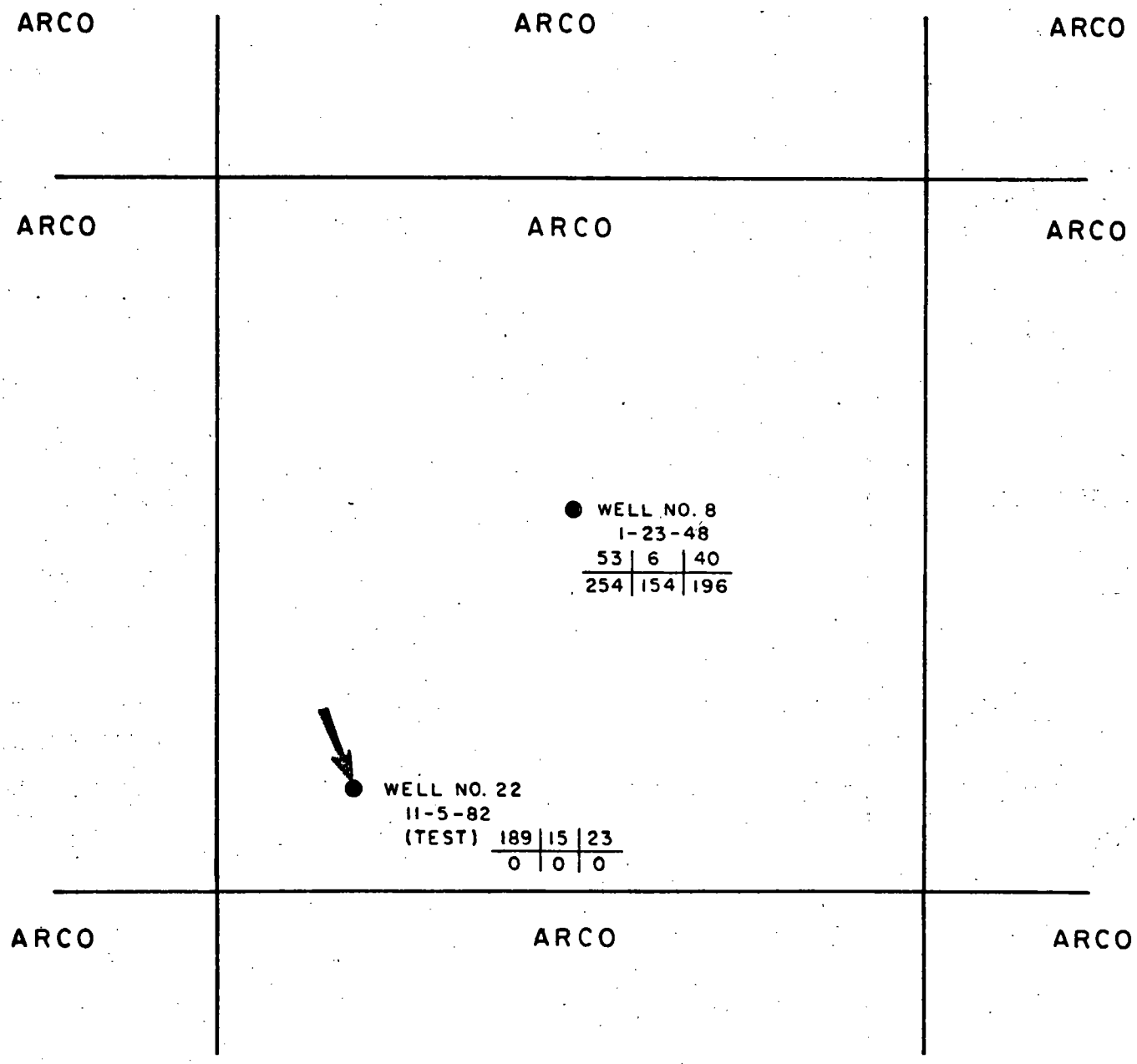
Exhibit I

STATE VACUUM UNIT

WELL NO. 22

Lea Co., New Mexico

UNIT LETTER F SECTION 32 TOWNSHIP 17S RANGE 34E



● VACUUM (GRAYBURG-SAN ANDRES)

5-10-78 SPUD DATE

BOPD	MCFPD	BWPD
CUM MBO	CUM MMCF	CUM MBW

▲● WATER INJECTION

5-10-78 SPUD DATE

6-14-81 CONVERSION DATE

CUM MBO	CUM MMCF	CUM MBW

CUMULATIVES AS OF 7-1-83

SCALE: 1" = 300'

30-025-27991

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U.S.G.S.		
LAND OFFICE		
OPERATOR		

NEW MEXICO OIL CONSERVATION COMMISSION

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OIL CONSERVATION DIVISION
SANTA FE

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease STATE [X] FEE [ ]

5. State Oil & Gas Lease No. E-1447

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

a. Type of Work
DRILL [X] DEEPEN [ ] PLUG BACK [ ]

7. Unit Agreement Name: State Vacuum Unit

b. Type of Well
OIL WELL [X] GAS WELL [ ] OTHER SINGLE ZONE [X] MULTIPLE ZONE [ ]

8. Farm or Lease Name: State Vacuum Unit

2. Name of Operator: ARCO Oil and Gas Company
Division of Atlantic Richfield Company

9. Well No.: 22

3. Address of Operator: P. O. Box 1710, Hobbs, New Mexico 88240

10. Field and Pool, or Wildcat: Vacuum Grayburg SA

4. Location of Well UNIT LETTER F LOCATED 2500 FEET FROM THE North LINE
AND 1575 FEET FROM THE West LINE OF SEC. 32 TWP. 17S RGE. 34E NMPM

12. County: Lea

19. Proposed Depth	19A. Formation	20. Rotary or C.T.
4840'	San Andres	Rotary

21. Elevations (Show whether DF, RT, etc.)	21A. Kind & Status Plug. Bond	21B. Drilling Contractor	22. Approx. Date Work will start
4064.30' GL	GCA #8	Not selected	10/25/82

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" OD	Cond Pipe	30'	2½ yds Redi-mix	Surf
11"	8-5/8" OD	24# K-55	1580'	475 sx	Circ to surface
7-7/8"	5½" OD	15.5# & 17# K-55	4840'	995 sx	Circ to surface

Propose to drill a 20 acres infill development well to recover additional primary and secondary reserves in the San Andres formation.

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CENTRAL FILES

APPROVAL VALID FOR 180 DAYS
PERMIT EXPIRES 5/4/82
UNLESS DRILLING UNDERWAY

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 Robert P. Lawrence Title Drlg. Engr. Date 10/15/82

Midland
Dallas
11-MO

(This space for State Use)

APPROVED BY Edwin W Guy TITLE OIL & GAS INSPECTOR DATE NOV 4 1982

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: Div. of Atlantic Richfield Company ARCO OIL & GAS COMPANY	Lease: STATE VACUUM UNIT		Well No.: 22
Unit Letter: F	Section: 32	Township: 17 SOUTH	Range: 34 EAST
County: LEA			
Actual Footage Location of Well: 2500 feet from the NORTH line and 1575 feet from the WEST line			
Ground Level Elev.: 4064.30	Producing Formation: San Andres	Pool: Vacuum Grayburg SA	Dedicated Acreage: 40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

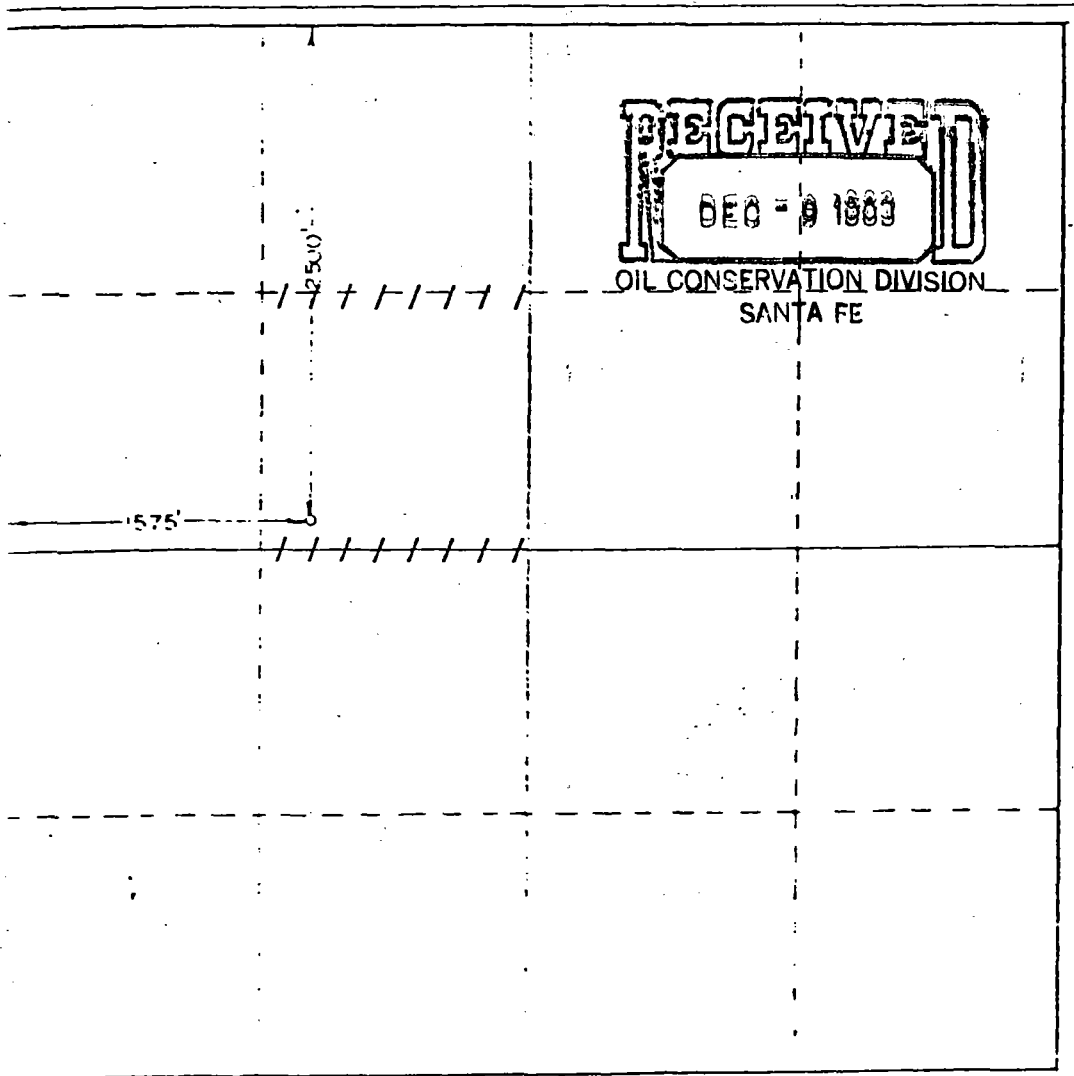
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

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.



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OIL CONSERVATION DIVISION
SANTA FE

CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: Roland P. Laurence

Position: Drlg. Engr.

Company: ARCO Oil and Gas Co.
Div of Atlantic Richfield Co.

Date: 10/15/82

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: 10/13/82

Registered Professional Engineer and/or Land Surveyor:

Certificate No. JOHN W. WEST 676
PATRICK A. ROMERO 6668
Ronald J. Eidson 3239

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT

Form C-105
Revised 10-1-78

OIL CONSERVATION DIVISION

P. O. BOX 2088
SANTA FE, NEW MEXICO 87501

WELL COMPLETION OR RECOMPLETION REPORT AND LOG

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FILE		
U.S.G.S.		
LAND OFFICE		
OPERATOR		

5a. Indicate Type of Lease: State [X] Fee [ ]

5. State Oil & Gas Lease No.: E-1447

7. Unit Agreement Name:

8. Farm or Lease Name: State Vacuum Unit

9. Well No.: 22

10. Field and Pool, or Wildcat: Vacuum Grayburg SA

12. County: Lea

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OIL CONSERVATION DIVISION
SANTA FE

1a. TYPE OF WELL: OIL WELL [X] GAS WELL [ ] DRY [ ]

b. TYPE OF COMPLETION: NEW WELL [X] WORK OVER [ ] DEEPEN [ ] PLUG BACK [ ] DIFF. RESVR. [ ] OTHER

2. Name of Operator: ARCO Oil and Gas Company
Division of Atlantic Richfield Company

3. Address of Operator: P. O. Box 1710, Hobbs, New Mexico 88240

4. Location of Well: UNIT LETTER F LOCATED 2500 FEET FROM THE North LINE AND 1575 FEET FROM

West LINE OF SEC. 32 TWP. 17S RGE. 34E NMPM

15. Date Spudded	16. Date T.D. Reached	17. Date Compl. (Ready to Prod.)	18. Elevations (DF, RKB, RT, GR, etc.)	19. Elev. Cashinghead
11/5/82	11/16/82	2/2/83	4064.30' GR	

20. Total Depth	21. Plug Back T.D.	22. If Multiple Compl., How Many	23. Intervals Drilled By	Rotary Tools	Cable Tools
4845'	4770'		→	0 - 4845'	

24. Producing Interval(s), of this completion — Top, Bottom, Name: 4721-23' & 4611-4665' Grayburg San Andres

25. Was Directional Survey Made: No

26. Type Electric and Other Logs Run: GR-DLL, Micro Laterolog w/RXO, GR-CNL/CDL w/Caliper, CBL & Noise Log

27. Was Well Cored: Yes

28. CASING RECORD (Report all strings set in well)

CASING SIZE	WEIGHT LB./FT.	DEPTH SET	HOLE SIZE	CEMENTING RECORD	AMOUNT PULLED
14"	Cond Pipe	31'	17½"	4 yds Redi-mix	Circ to surf
8-5/8" OD	24# K-55	1555'	11"	550 sx	None
5½" OD	15.5# K-55	4845'	7-7/8"	1540 sx	None

29. LINER RECORD

SIZE	TOP	BOTTOM	SACKS CEMENT	SCREEN

30. TUBING RECORD

SIZE	DEPTH SET	PACKER SET
2-3/8" OD	4736'	-

31. Perforation Record (Interval, size and number)

4721-4723' = 4 .50" holes
4611-4665' = 32 .50" holes

32. ACID, SHOT, FRACTURE, CEMENT SQUEEZE, ETC.

DEPTH INTERVAL	AMOUNT AND KIND MATERIAL USED
3750'	Sqzd w/150 sx Cl C w/15#/sk sal
	& .3% Halad 9, 50 sx Cl H w/3/4
	of 1% CFR-2 & ½ of 1% Halad-9,
	(cont'd on attached sheet)

33. PRODUCTION

Date First Production	Production Method (Flowing, gas lift, pumping — Size and type pump)	Well Status (Prod. or Shut-in)
1/7/83	Pumping - 2" x 1½" x 12' rod	Prod.

Date of Test	Hours Tested	Choke Size	Prod'n. For Test Period →	Oil — Bbl.	Gas — MCF	Water — Bbl.	Gas — Oil Ratio
2/8/83	24	-		189	15	23	79:1

Flow Tubing Press.	Casing Pressure	Calculated 24-Hour Rate →	Oil — Bbl.	Gas — MCF	Water — Bbl.	Oil Gravity — API (Corr.)
-	-		189	15	23	37.0°

34. Disposition of Gas (Sold, used for fuel, vented, etc.): Sold

Test Witnessed By: E. E. Erwin

35. List of Attachments: Logs as listed in Items 26 above, Core Records & Inclination Report.

36. I hereby certify that the information shown on both sides of this form is true and complete to the best of my knowledge and belief.

SIGNED Elizabeth L. Burch TITLE Drlg. Engr. DATE 2/9/83

INSTRUCTIONS

This form is to be filed with the appropriate District Office of the Division not later than 20 days after the completion of any newly-drilled or deepened well. It shall be accompanied by one copy of all electrical and radio-activity logs run on the well and a summary of all special tests conducted, including drill stem tests. All depths reported shall be measured depths. In the case of directionally drilled wells, true vertical depths shall also be reported. For multiple completions, Items 36 through 34 shall be reported for each zone. The form is to be filed in quintuplicate except on state land, where six copies are required. See Rule 1105.

INDICATE FORMATION TOPS IN CONFORMANCE WITH GEOGRAPHICAL SECTION OF STATE

Southeastern New Mexico				Northwestern New Mexico			
T. Anhy	1505'	T. Canyon		T. Ojo Alamo		T. Penn. "B"	
T. Salt	1646'	T. Strawn		T. Kirtland-Fruitland		T. Penn. "C"	
B. Salt	2652'	T. Atoka		T. Pictured Cliffs		T. Penn. "D"	
T. Yates	2804'	T. Miss		T. Cliff House		T. Leadville	
T. 7 Rivers		T. Devonian		T. Menefee		T. Madison	
T. Queen	3518'	T. Silurian		T. Point Lookout		T. Elbert	
T. Grayburg	4168'	T. Montoya		T. Mancos		T. McCracken	
T. San Andres	4530'	T. Simpson		T. Gallup		T. Ignacio Qtzte	
T. Glorieta		T. McKee		Base Greenhorn		T. Granite	
T. Paddock		T. Ellenburger		T. Dakota		T.	
T. Blinebry		T. Gr. Wash		T. Morrison		T.	
T. Tubb		T. Granite		T. Todilto		T.	
T. Drinkard		T. Delaware Sand		T. Entrada		T.	
T. Abo		T. Bone Springs		T. Wingate		T.	
T. Wolfcamp		T.		T. Chinle		T.	
T. Penn.		T.		T. Permian		T.	
T Cisco (Bough C)		T.		T. Penn. "A"		T.	

OIL OR GAS SANDS OR ZONES

No. 1, from 4721' to 4723' No. 4, from ____ to ____

No. 2, from 4611' to 4665' No. 5, from ____ to ____

No. 3, from ____ to ____ No. 6, from ____ to ____

IMPORTANT WATER SANDS

Include data on rate of water inflow and elevation to which water rose in hole.

No. 1, from 3750' to Surf feet. Water to surf @ 250 BPD

No. 2, from ____ to ____ feet. ____

No. 3, from ____ to ____ feet. ____

No. 4, from ____ to ____ feet. ____

FORMATION RECORD (Attach additional sheets if necessary)

From	To	Thickness in Feet	Formation	From	To	Thickness in Feet	Formation
0	30	30	Surface	3621	3779	158	Salt & Anhy.
30	40	10	Anhydrite	3779	3936	157	Sd & lime.
40	771	731	Surf Rock	3936	4100	164	Lime & Dolo
771	1370	599	Red Bed & Anhy	4100	4245	145	Potash, Dolo & Salt
1370	1490	120	Anhy	4245	4300	55	Dolo
1490	1554	64	Red Bed & Anhy	4300	4357	57	Lime
1554	1591	37	Anhy	4357	4486	129	Dolo & Potash
1591	2349	758	Anhy & Salt	4486	4845	359	Dolo, Lime & Sd
2349	2645	296	Anhy, Salt, Red Bed & Lime				
2645	2845	200	Salt & Anhy				
2845	3027	182	Lime & Sand				
3027	3250	223	Salt, Sd, Lime, Anhy				
3250	3458	208	Lime				
3458	3621	163	Lime, Sd				

Form C-105 cont'd
State Vacuum Unit #22
2500' FNL & 1575' FWL
Sec 32-17S-34E, Lea County

Item 32 - Acid, Shot, Fracture, Cement Squeeze, etc.

Depth Interval	Amount & Kind Material Used
1580'	Squeezed w/500 sx Cl H cmt cont'g 2% $CaCl_2$
1520'	Squeezed w/200 sx Cl H cmt cont'g 2% $CaCl_2$
4721-4723'	Acidized w/800 gals 15% LST-NE
4611-4665'	Acidized w/4000 gals 15% Acid

Spot 5 bbls acid & pump 4000 gals 15% acid. Max press 3000#. Ran GR-Temp survey. In 10 hrs swbd 17 BNO & 17 BLW. On 1/12/83 swbd Grbg SA perfs 4611-4665', rec 36 BNO & 40 BLW. 1/13/83 SITP 50#. Rel pkr & RBP, POH. RIH w/CA. Set btm of tbg @ 4736', SN @ 4702'. In 2 hrs swbd 17 BNO. SITP 0#. On 24 hr potential test 2/8/83 pmpd 189 BO, 23 BW, 15 MCFG on 12-94" spm. GOR 79:1. Final Report.

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

Exhibit 2

BRUCE KING
GOVERNOR

October 27, 1982

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

ARCO Oil and Gas Company
P. O. Box 1610
Midland, Texas 79702

Attention: J. A. Fraga

Administrative Order NSL-1600

Gentlemen:

Reference is made to your application for a non-standard location for your State Vacuum Unit Well No. 22 to be located 2500 feet from the North line and 1575 feet from the West line of Section 32, Township 17 South, Range 34 East, NMPM, Lea County, New Mexico.

By authority granted me under the provisions of Rule 104 F of the Division Rules and Regulations, the above-described unorthodox location is hereby approved.

Sincerely,

JOE D. RAMEY,
Director

JDR/RLS/dr

cc: Oil Conservation Division - Hobbs
Oil & Gas Engineering Committee - Hobbs
Oil & Gas Division - State Land Office, Santa Fe

CENTRAL FILES
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Engineering Discussion of Infill Drilling on the State Vacuum Unit

INTRODUCTION

ARCO Oil and Gas Company's State Vacuum Unit produces from the Vacuum Grayburg-San Andres field in Lea County, New Mexico. It has been concluded that to effectively and efficiently produce this reservoir 20-acre well spacing is necessary. The following is a brief history of the State Vacuum Unit and the engineering and geological data supporting this finding.

HISTORY

The State Vacuum Unit was formed by ARCO on November 11, 1976 and water injection began on July 1, 1977. The unit was developed on 40-acre spacing using a 5-spot injection pattern. Primary reserves for this unit were calculated to be 3,266 MBO, or 24.8% of the OOIP. The unit has shown favorable response to the flood producing 347 MBO of secondary reserves as of April, 1983. However, several wells have experienced premature water breakthrough which has reduced the efficiency of the waterflood (see Figures 1, 2, and 3).

In February of 1983 we completed the State Vacuum Unit No. 22, our first 20-acre infill in the unit (see attached well plat, Fig. 4). It is too early to make final conclusions for this well, but so far the results have been very promising and further infill drilling is planned.

GEOLOGY

The Vacuum Grayburg-San Andres field is located on an east-west trending anticline at the east end of the Artesia-Vacuum trend along the southern edge of the northwestern platform. The State Vacuum Unit is located in the western portion of the field (see attached structure map, Fig. 5). Oil production is principally from dolomite in the San Andres formation with minor contributions from limestone in the Grayburg. The main pay zone (first porosity zone in the San Andres) is an oolite dolomite continuous throughout the State Vacuum Unit (see cross-section Fig. 6). Attached is Table No. 1 showing basic reservoir data for this unit.

VOLUMETRIC CALCULATIONS

Volumetric calculations for the San Andres formation in the State Vacuum Unit yield an original-oil-in-place of 10,381,109 STB for the main pay and 13,305,882 STB for the total pay zone. The Grayburg formation was not included in any volumetric calculations. These calculations involved determination of porosity-feet (Øh) for each well. Two isopachs were prepared, one for total Øh (Figure 7) and one for main pay Øh (Figure 8). These maps were constructed using logs and core data were available. Acre-Øh numbers were determined by planimetering the isopach maps.

The original-oil-in-place numbers were calculated by transforming acre-Øh numbers into net hydrocarbon pore volume and converting to stock tank barrels using a formation volume factor of 1.26. The water saturation used in the conversion was taken from Figure 9, "Average of First Porosity vs Water Saturation" from a field study of the Wasson San Andres reservoir by Shell Oil Company.

SECONDARY RESERVES FOR 40-ACRE SPACING

ARCO's Engineering Study of 1976 concluded that only the "main pay" section of the San Andres was continuous enough to be economically flooded. Secondary reserves were calculated to be 1,300 MBO which represents a ratio of 0.5:1 of secondary to primary reserves. This low ratio is due to the main pay being the only zone floodable on 40-acre spacing.

Secondary performance was determined with the aid of one of Atlantic Richfield Company's computer programs, which calculated sweep-out for a five-spot pattern. Three five-spot patterns were used to model performance within the 800-acre proposed project area. Each pattern was broken down into quarters five-spot elements. In each element, core and log analysis helped determine porosity, permeability, and net pay. Twelve elements were analyzed in a total of three five spots. Total performance of the eight five-spots were determined by summing representative five-spots. Permeability distribution was determined for each well having core data with Atlantic Richfield's core data sorting program. Stratification analysis was handled by dividing each five-spot into layers. Table 2 gives the data used in each of the three typical five-spots.

SECONDARY AND PRIMARY RESERVES FOR 20-ACRE SPACING

By infill drilling, additional pay in the San Andres will be floodable on closer spacing. Based on the Engineering-Geological Committee Report, November 1977, (Exhibit No. 4, Case No. 6570) for the East Vacuum Grayburg-San Andres Unit, it was determined that an estimated 3.9% increase in recovery of OOIP for the EVGSAU could be expected on 20-acre spacing. Since the State Vacuum Unit has similar reservoir characteristics and quality, an increase recovery value of 3.9% of the OOIP was used in predicting additional secondary oil reserves with 20-acre infills. This value includes encountering discontinuous intervals of porosity and improvement in recovery efficiency.

Using the 3.9% infill recovery value and the total pay zone OOIP reserves, additional secondary reserves of 518,929 STB were calculated for the unit. The 800 acre unit would require 20 equivalent 20-acre infill wells for a recovery of about 26 MBO/well location. These calculations are outlined in Appendix A.

Primary drainage analysis of the State Vacuum Unit were done using volumetrics, decline curves and production data. This analysis indicated that each 20-acre infill well will drain 5 acres previously missed at 40-acre spacing. Incrementally each infill well will recover 26 MBO (see Appendix A).

The State Vacuum Unit No. 22 will also produce primary reserves from a lower zone near the top of the Lovington Sand (see Fig. 10). The porosity logs indicate this zone to contain 8-10 feet of net pay with about 10% porosity. Estimate recoverable primary reserves for the lower zone, using 20-acre spacing and a 24.8% recovery factor, is 22 MBO. Secondary reserves were not calculated since this zone at present is not being flooded.

Premature water breakthrough has been experienced in several wells, as is seen in the attached plots (see Fig. 1-3). The 20-acre spacing will drain reserves being bypassed due to the breakthrough.

CONCLUSION

By drilling the infill Well No. 22 we will recover new reserves of approximately 74 MSTBO. The initial stabilized rate on this well was predicted to be 75 BOPD declining to abandonment at 30% per year (see Fig. 11). Gas production in association with this oil will be 12.95 MMCF.

ARCO is presently in the process of updating its Engineering Study of 1976 for the State Vacuum Unit. This study will fully evaluate the infill drilling of this unit.

The production history of the State Vacuum Unit and other units in this field indicate that to effectively and efficiently produce the Vacuum Grayburg-San Andres reservoir, 20-acre spacing is necessary. By going to this closer spacing, additional pay will be encountered and flooded. Additional primary reserves that were undrained on 40-acre spacing will be recovered along with secondary reserves bypassed due to premature water breakthrough.

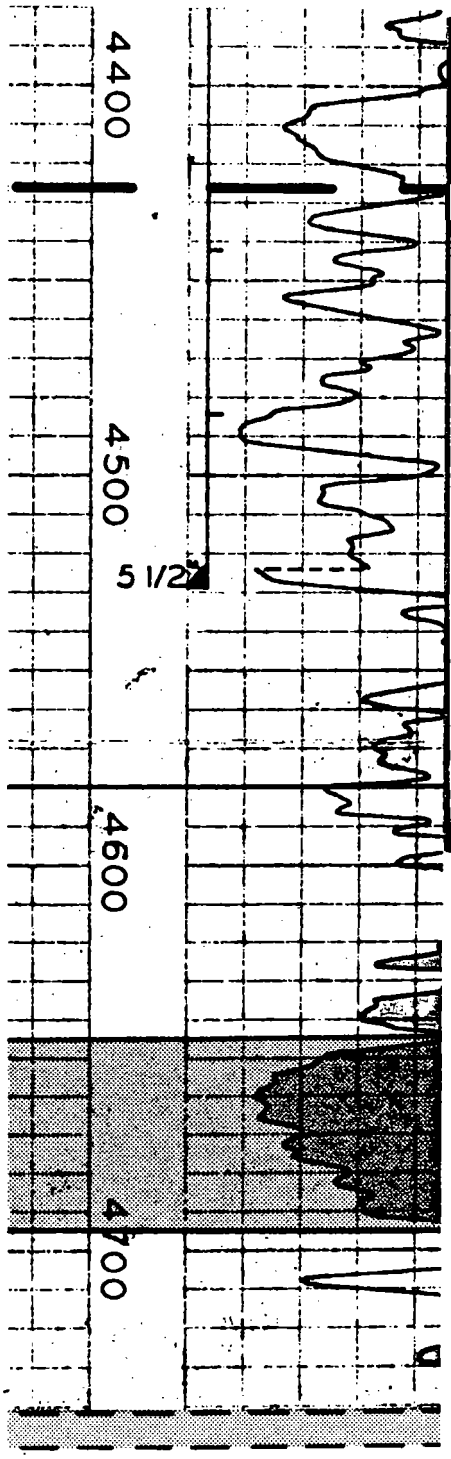
Lawrence G. Griffin

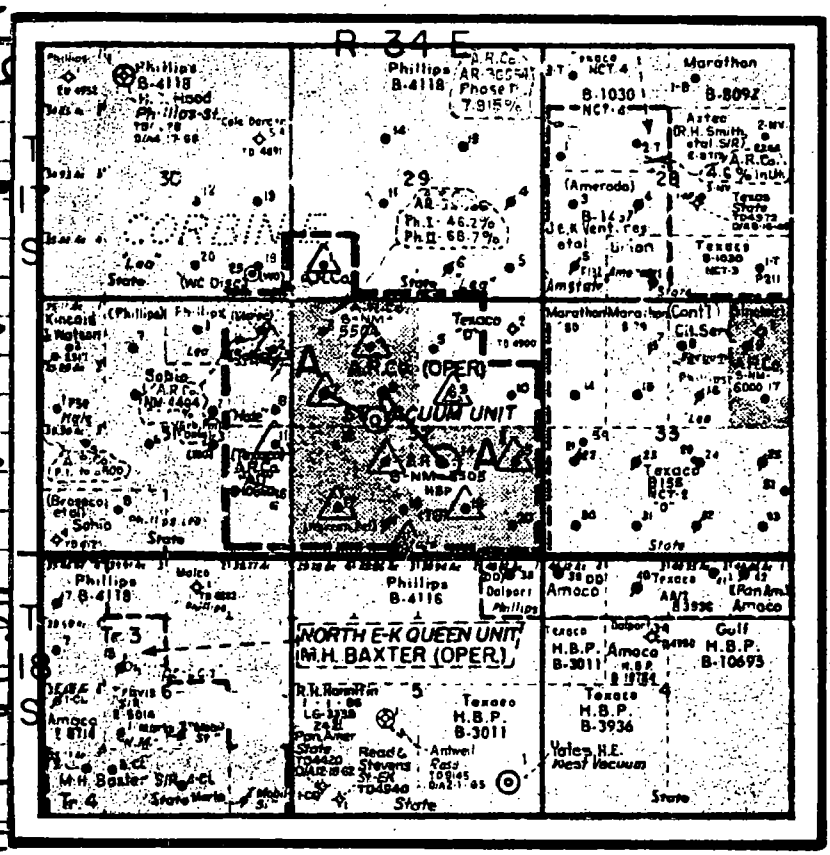
LGG:dmm

8-29-83

VACUUM UNIT NO. 14
– GULF PROD. CO.)
"C" NO. 2)
77' T.D. 4742.5

Figure 6





INDEX MAP
Scale : 1" = 4000'

ARCO Oil and Gas Company
Permian District Midland, Texas

STATE VACUUM UNIT
LEA COUNTY, NEW MEXICO

CROSS SECTION A-A'

VERT. SCALE: 2" = 100'

By T. FRAGA	Drawn By	Date 3 - 82
Date 3 - 82	Revised By	Date
Dept WEST AREA ENGR.	Dwg No.	

WPP RELEASE 4.4 - PLOT SEQ NO. 2
CONFIDENTIAL, (A O G C)

Figure 1
State Vacuum Unit No. 6

FIELD, 830 - VACUUM
LEASE, 6441 - STATE VACUUM UNIT PHASE II
RESV., 02 - GRAYBURG SAN ANDRES

o -AVG. DAILY OIL (BBL)
▲ -AVG. DAILY H2O (BBL)

Breakthrough

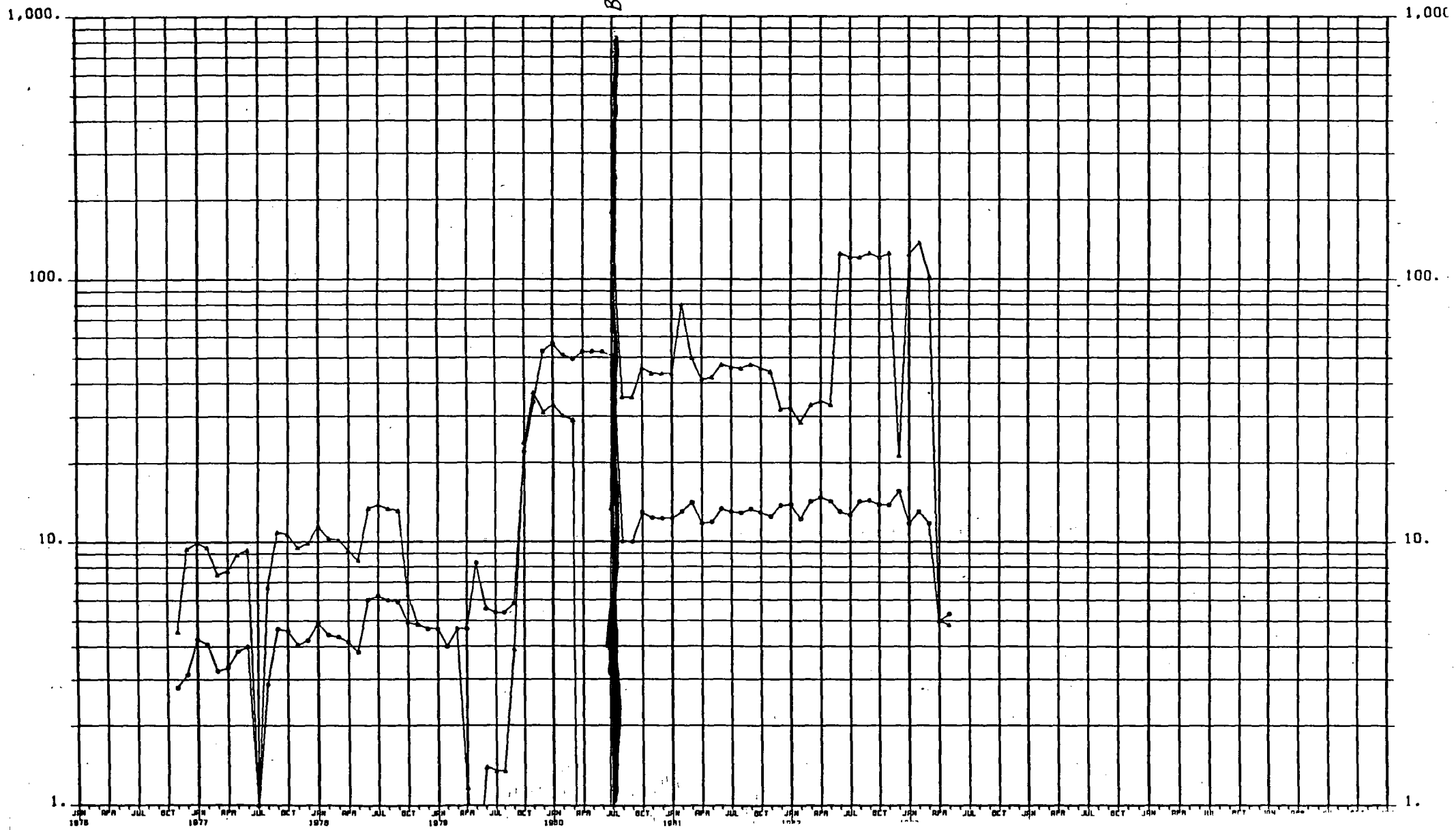


Figure 2
State Vacuum Unit No. 10

LEASE, 6441 - STATE VACUUM UNIT PHASE II
RESV., 02 - GRAYBURG SAN ANDRES
⊕ -AVG. DAILY OIL (BBL)
▲ -AVG. DAILY H2O (BBL)

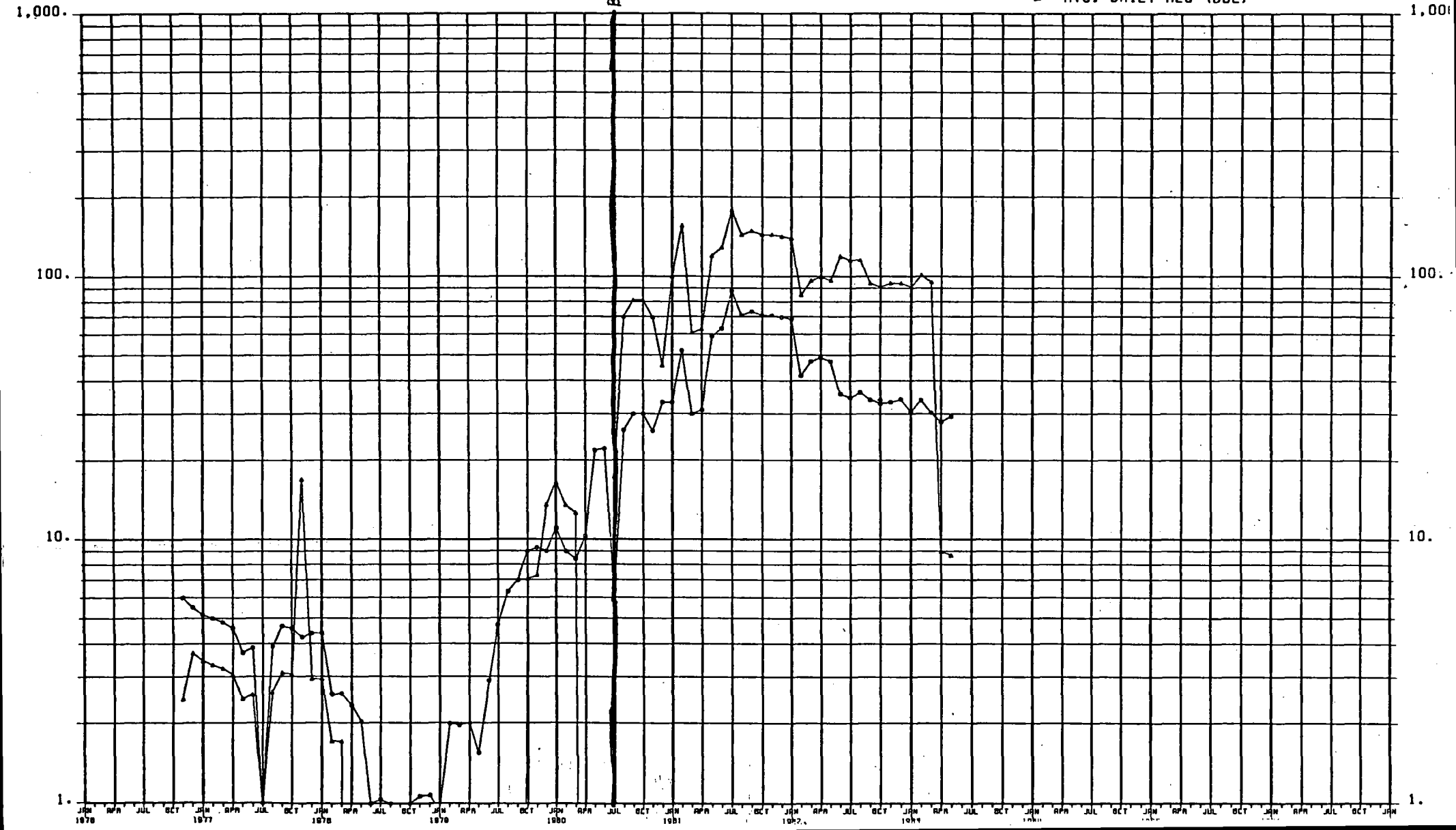


Figure 3
State Vacuum Unit No. 14

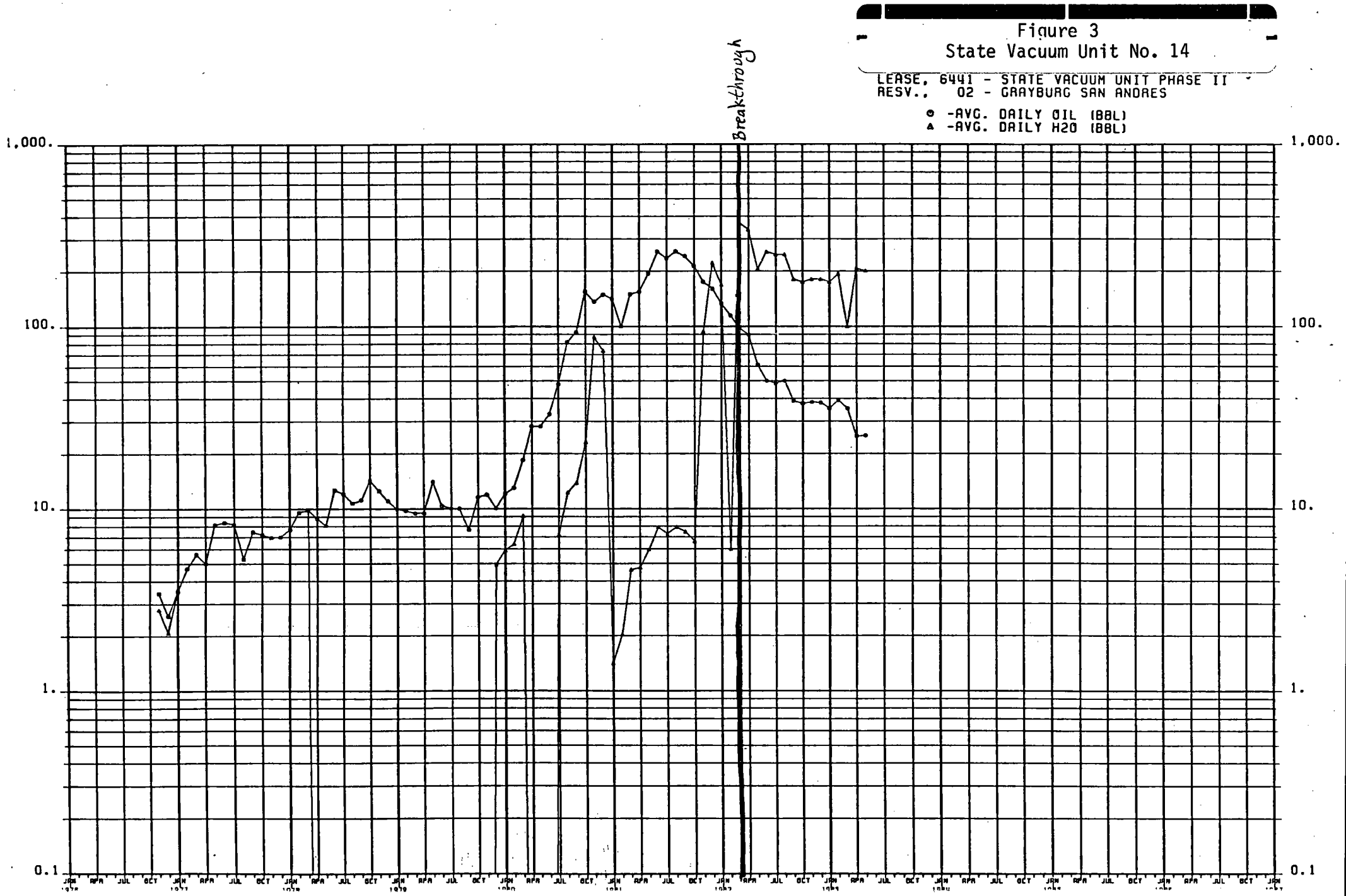
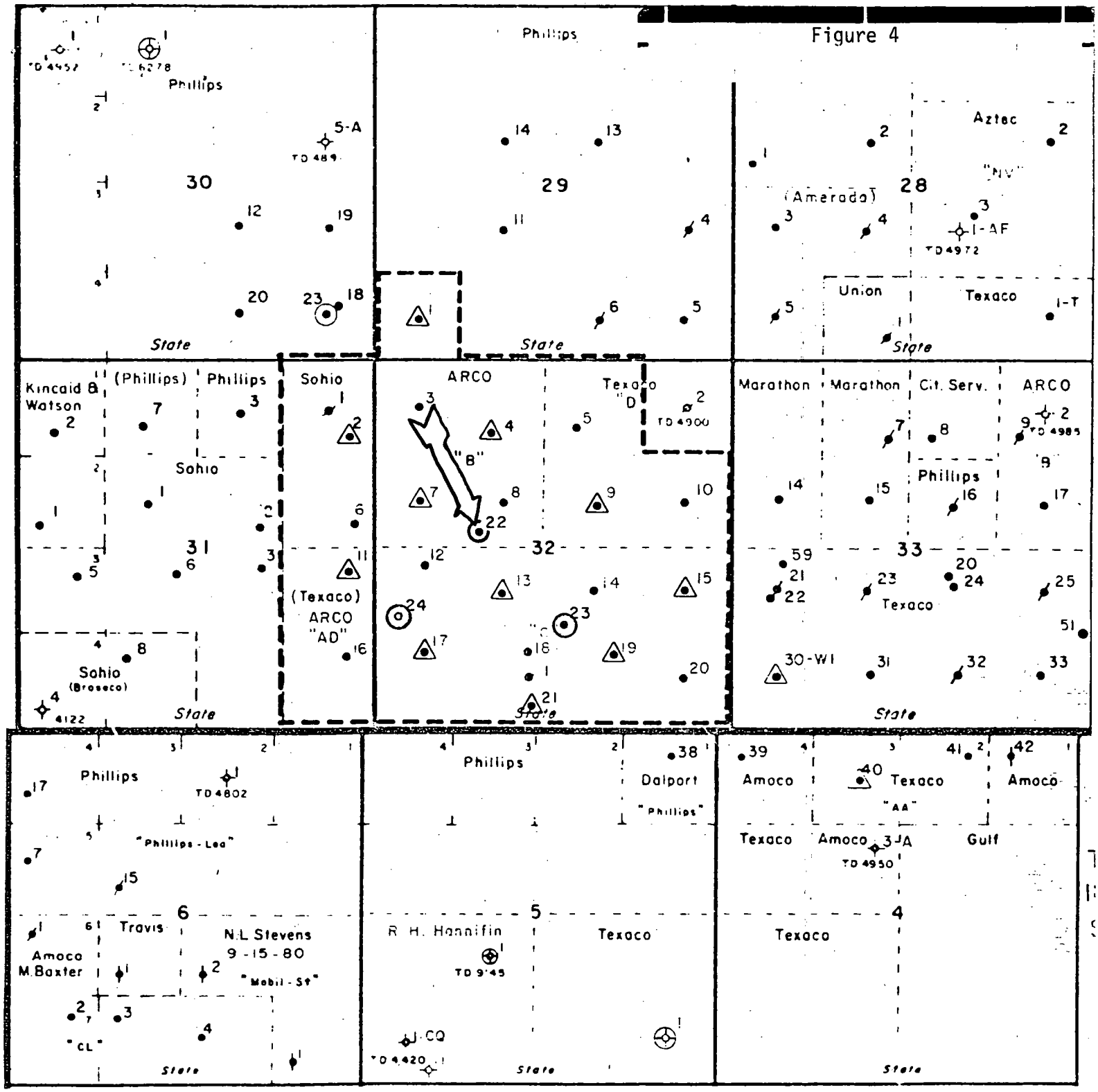


Figure 4



R 34 E

ARCO Oil and Gas Company

Permian District Midland, Texas

VACUUM (GRBG-S.A.) AREA
STATE VACUUM UNIT
Lea County, New Mexico

Scale 1" = 2000'

By J. A. Fruga	Checked By TCB	Date 10-82
Date 10-20-82	Revised By	Date 5-83
Job West Engineering	Dwg. No.	

LEGEND

- UNIT BOUNDARY
- PRODUCER - SAN ANDRES
- INJECTOR - SAN ANDRES
- PROPOSED LOCATION

State Vacuum Unit #22
Lea County, New Mexico
AR #46429

"Infill Finding"

Rules and Regulations
Natural Gas Policy Act Infill Findings
Administrative Procedure

Rule 3: No waivers from offset operators are necessary. See Exhibit 1

Rule 5: See attached approved Form C-101 for the infil well and Form C-102 showing proration unit dedicated.

Rule 6: See Well Completion Report and Log for name of the pool in which the infill well has been drilled and the standard spacing unit size therefor.

Rule 7: Exhibit 2: Number of the Division Order approving the non-standard proration unit dedicated to the well.

Rule 8: Exhibit I: Description of all wells drilled on proration unit.

Rule 9: See Engineering Discussion plus all "figures" associated within.

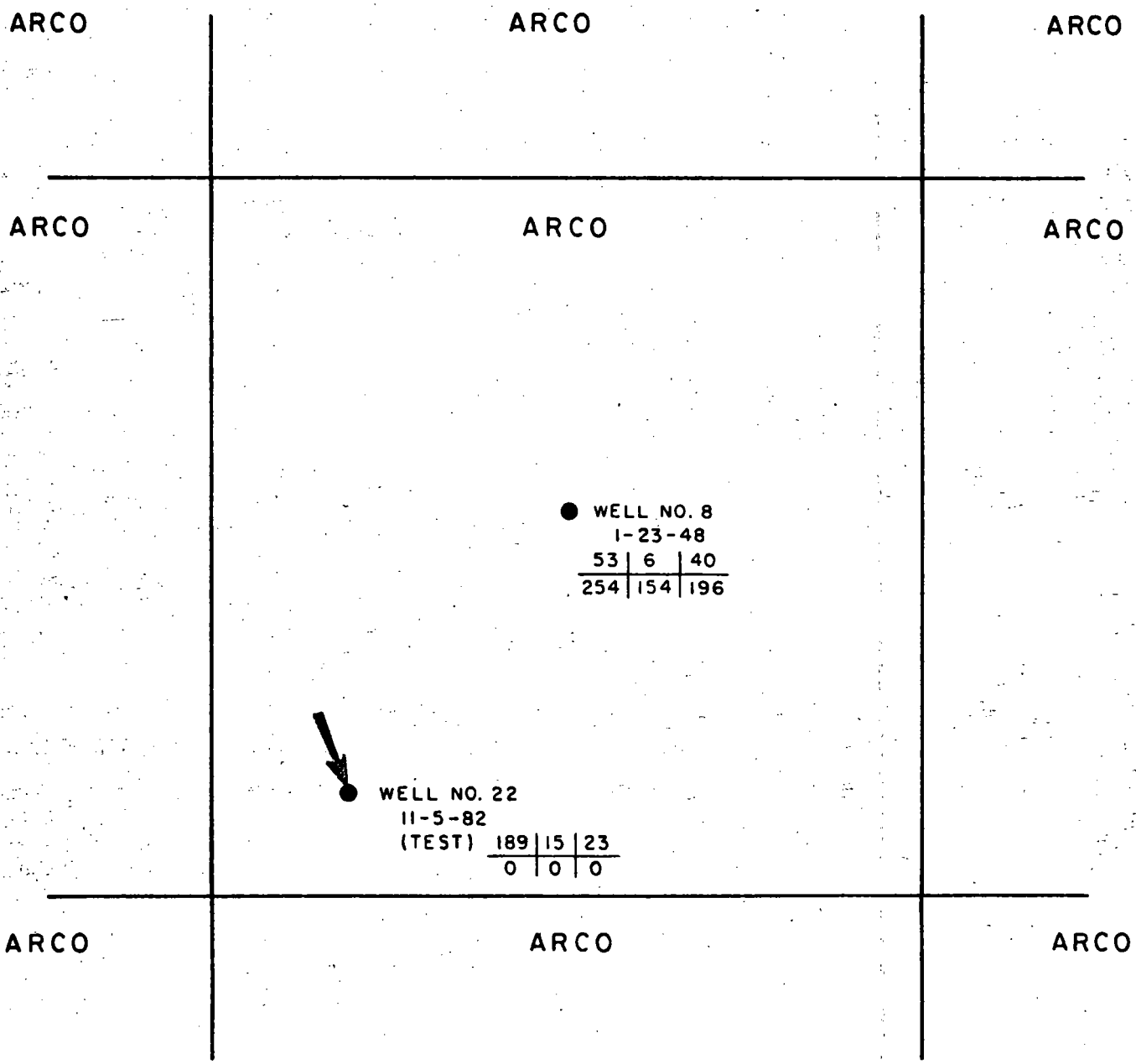
Exhibit I

STATE VACUUM UNIT

WELL NO. 22

Lea Co., New Mexico

UNIT LETTER F SECTION 32 TOWNSHIP 17S RANGE 34E



● VACUUM (GRAYBURG-SAN ANDRES)

5-10-78 SPUD DATE

BOPD	MCFPD	BWPD
CUM MBO	CUM MMCF	CUM MBW

▲ WATER INJECTION

5-10-78 SPUD DATE

6-14-81 CONVERSION DATE

CUM MBO	CUM MMCF	CUM MBW

CUMULATIVES AS OF 7-1-83

SCALE : 1" = 300'

30-025-27991

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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. E-1447

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: State Vacuum Unit

8. Farm or Lease Name: State Vacuum Unit

2. Name of Operator: ARCO Oil and Gas Company Division of Atlantic Richfield Company

9. Well No. 22

3. Address of Operator: P. O. Box 1710, Hobbs, New Mexico 88240

10. Field and Pool, or Wildcat: Vacuum Grayburg SA

4. Location of Well: UNIT LETTER F LOCATED 2500 FEET FROM THE North LINE AND 1575 FEET FROM THE West LINE OF SEC. 32 TWP. 17S RGE. 34E NMPM

12. County: Lea

19. Proposed Depth	19A. Formation	20. Rotary or C.T.
4840'	San Andres	Rotary

21. Elevations (Show whether DF, RT, etc.)	21A. Kind & Status Plug. Bond	21B. Drilling Contractor	22. Approx. Date Work will start
4064.30' GL	GCA #8	Not selected	10/25/82

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" OD	Cond Pipe	30'	2½ yds Redi-mix	Surf
11"	8-5/8" OD	24# K-55	1580'	475 sx	Circ to surface
7-7/8"	5½" OD	15.5# & 17# K-55	4840'	995 sx	Circ to surface

Propose to drill a 20 acres infill development well to recover additional primary and secondary reserves in the San Andres formation.

RECEIVED DEC - 9 1983 OIL CONSERVATION DIVISION SANTA FE

RECEIVED NOV 18 1982 CENTRAL FILES

APPROVAL VALID FOR 180 DAYS
PERMIT EXPIRES 5/4/82
UNLESS DRILLING UNDERWAY

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.

Midland Dallas 17-7-10

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed [signature] Title Drlg. Engr. Date 10/15/82

(This space for State Use)

APPROVED BY [signature] TITLE OIL & GAS INSPECTOR DATE NOV 4 1982

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: Div. of Atlantic Richfield Company ARCO OIL & GAS COMPANY		Lease: STATE VACUUM UNIT		Well No.: 22
Unit Letter: F	Section: 32	Township: 17 SOUTH	Range: 34 EAST	County: LEA
Actual Footage Location: 2500 feet from the NORTH line and 1575 feet from the WEST line				
Ground Level Elev.: 4064.30	Producing Formation: San Andres	Pool: Vacuum Grayburg SA		Dedicated Acreage: 40 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

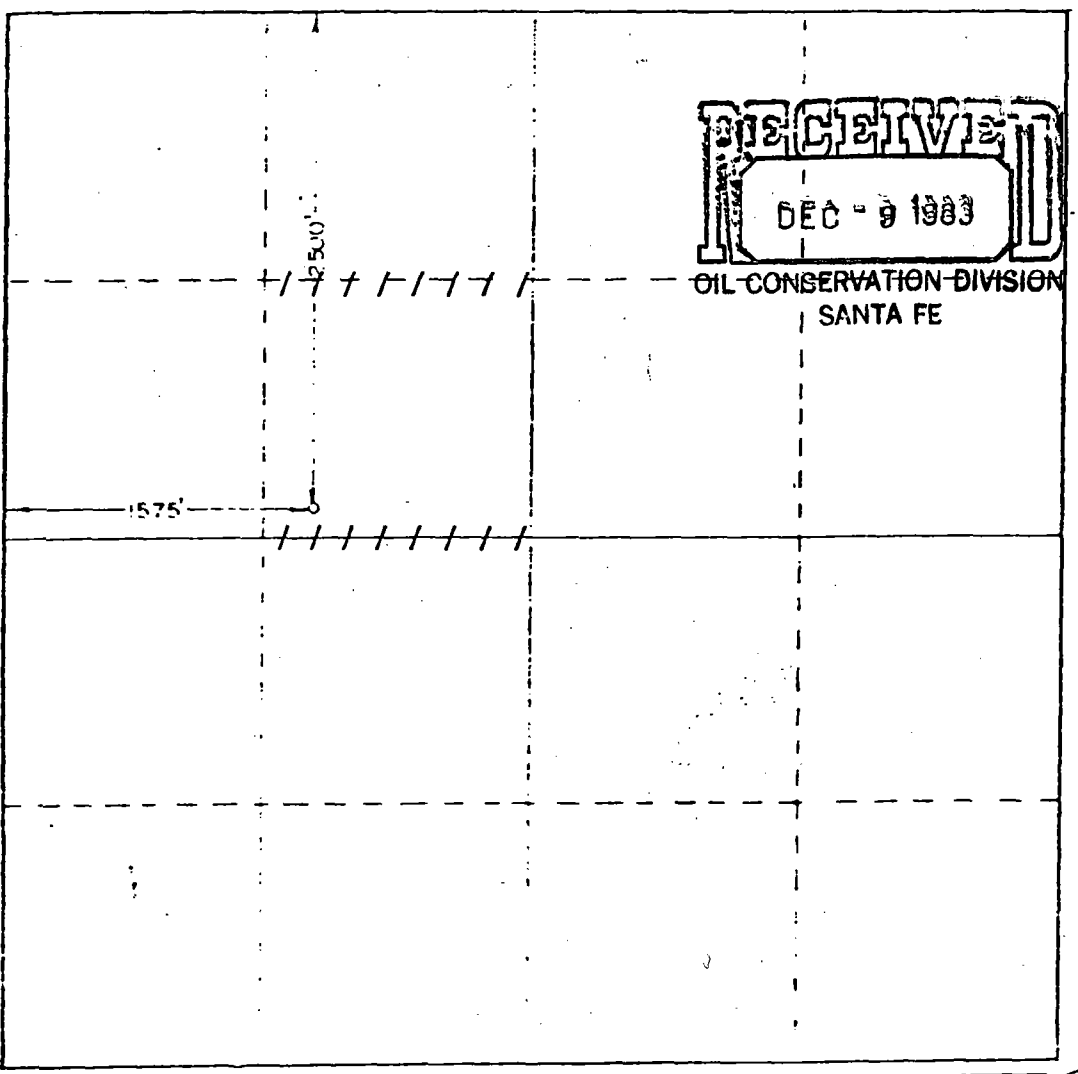
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

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.



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OIL CONSERVATION DIVISION
SANTA FE

CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Name: Roland P. Laurence

Position: Drlg. Engr.

Company: ARCO Oil and Gas Co. Div of Atlantic Richfield Co.

Date: 10/15/82

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: 10/13/82

Registered Professional Engineer and/or Land Surveyor:

Certificate No. JOHN W. WEST 676
PATRICK A. ROMERO 6668
Ronald J. Eidson 3239

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT

Form C-105
Revised 10-1-78

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OPERATOR		

OIL CONSERVATION DIVISION

P. O. BOX 2088
SANTA FE, NEW MEXICO 87501

WELL COMPLETION OR RECOMPLETION REPORT AND LOG

5a. Indicate Type of Lease: State [X] Fee [ ]
5. State Oil & Gas Lease No.: E-1447
7. Unit Agreement Name:
8. Farm or Lease Name: State Vacuum Unit
9. Well No.: 22
10. Field and Pool, or Wildcat: Vacuum Grayburg SA
12. County: Lea

a. TYPE OF WELL: OIL WELL [X] GAS WELL [ ] DRY [ ] OTHER
b. TYPE OF COMPLETION: NEW WELL [X] WORK OVER [ ] DEEPEN [ ] PLUG BACK [ ] DIFF. RESVR. [ ] OTHER

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OIL CONSERVATION DIVISION
SANTA FE

2. Name of Operator: ARCO Oil and Gas Company
Division of Atlantic Richfield Company
3. Address of Operator: P. O. Box 1710, Hobbs, New Mexico 88240
4. Location of Well: UNIT LETTER F LOCATED 2500 FEET FROM THE North LINE AND 1575 FEET FROM
THE West LINE OF SEC. 32 TWP. 17S RGE. 34E NMPM

15. Date Spudded	16. Date T.D. Reached	17. Date Compl. (Ready to Prod.)	18. Elevations (DF, RKB, RT, GR, etc.)	19. Elev. Cashinghead
11/5/82	11/16/82	2/2/83	4064.30' GR	

20. Total Depth	21. Plug Back T.D.	22. If Multiple Compl., How Many	23. Intervals Drilled By	Rotary Tools	Cable Tools
4845'	4770'		→	0 - 4845'	

24. Producing Interval(s), of this completion — Top, Bottom, Name
4721-23' & 4611-4665' Grayburg San Andres

25. Was Directional Survey Made: No

26. Type Electric and Other Logs Run
GR-DLL, Micro Laterolog w/RXO, GR-CNL/CDL w/Caliper, CBL & Noise Log

27. Was Well Cored: Yes

28. CASING RECORD (Report all strings set in well)

CASING SIZE	WEIGHT LB./FT.	DEPTH SET	HOLE SIZE	CEMENTING RECORD	AMOUNT PULLED
14"	Cond Pipe	31'	17½"	4 yds Redi-mix	Circ to surf
8-5/8" OD	24# K-55	1555'	11"	550 sx	None
5½" OD	15.5# K-55	4845'	7-7/8"	1540 sx	None

29. LINER RECORD

SIZE	TOP	BOTTOM	SACKS CEMENT	SCREEN

30. TUBING RECORD

SIZE	DEPTH SET	PACKER SET
2-3/8" OD	4736'	-

31. Perforation Record (Interval, size and number)
4721-4723' = 4 .50" holes
4611-4665' = 32 .50" holes

32. ACID, SHOT, FRACTURE, CEMENT SQUEEZE, ETC.

DEPTH INTERVAL	AMOUNT AND KIND MATERIAL USED
3750'	Sqzd w/150 sx Cl C w/15#/sk salt & .3% Halad 9, 50 sx Cl H w/3/4 of 1% CFR-2 & ½ of 1% Halad-9, (cont'd on attached sheet)

33. PRODUCTION

Date First Production	Production Method (Flowing, gas lift, pumping — Size and type pump)	Well Status (Prod. or Shut-in)
1/7/83	Pumping - 2" x 1¼" x 12' rod	Prod.

Date of Test	Hours Tested	Choke Size	Prod'n. For Test Period →	Oil — Bbl.	Gas — MCF	Water — Bbl.	Gas — Oil Ratio
2/8/83	24	-		189	15	23	79:1

Flow Tubing Press.	Casing Pressure	Calculated 24-Hour Rate →	Oil — Bbl.	Gas — MCF	Water — Bbl.	Oil Gravity — API (Corr.)
-	-		189	15	23	37.0°

34. Disposition of Gas (Sold, used for fuel, vented, etc.)
Sold

Test Witnessed By: E. E. Erwin

35. List of Attachments
Logs as listed in Items 26 above, Core Records & Inclination Report.

36. I hereby certify that the information shown on both sides of this form is true and complete to the best of my knowledge and belief.

SIGNED Elizabeth L. Buck TITLE Drlg. Engr. DATE 2/9/83

INSTRUCTIONS

This form is to be filed with the appropriate District Office of the Division not later than 20 days after the completion of any newly-drilled or deepened well. It shall be accompanied by one copy of all electrical and radio-activity logs run on the well and a summary of all special tests conducted, including drill stem tests. All depths reported shall be measured depths. In the case of directionally drilled wells, true vertical depths shall also be reported. For multiple completions, Items 30 through 34 shall be reported for each zone. The form is to be filed in quintuplicate except on state land, where six copies are required. See Rule 1105.

INDICATE FORMATION TOPS IN CONFORMANCE WITH GEOGRAPHICAL SECTION OF STATE

Southeastern New Mexico				Northwestern New Mexico			
T. Anhy	1505'	T. Canyon		T. Ojo Alamo		T. Penn. "B"	
T. Salt	1646'	T. Strawn		T. Kirtland-Fruitland		T. Penn. "C"	
B. Salt	2652'	T. Atoka		T. Pictured Cliffs		T. Penn. "D"	
T. Yates	2804'	T. Miss		T. Cliff House		T. Leadville	
T. 7 Rivers		T. Devonian		T. Menefee		T. Madison	
T. Queen	3518'	T. Silurian		T. Point Lookout		T. Elbert	
T. Grayburg	4168'	T. Montoya		T. Mancos		T. McCracken	
T. San Andres	4530'	T. Simpson		T. Gallup		T. Ignacio Qtzte	
T. Glorieta		T. McKee		Base Greenhorn		T. Granite	
T. Paddock		T. Ellenburger		T. Dakota		T.	
T. Blinebry		T. Gr. Wash		T. Morrison		T.	
T. Tubb		T. Granite		T. Todilto		T.	
T. Drinkard		T. Delaware Sand		T. Entrada		T.	
T. Abo		T. Bone Springs		T. Wingate		T.	
T. Wolfcamp		T.		T. Chinle		T.	
T. Penn.		T.		T. Permian		T.	
T. Cisco (Bough C)		T.		T. Penn. "A"		T.	

OIL OR GAS SANDS OR ZONES

No. 1, from 4721' to 4723' No. 4, from ____ to ____

No. 2, from 4611' to 4665' No. 5, from ____ to ____

No. 3, from ____ to ____ No. 6, from ____ to ____

IMPORTANT WATER SANDS

Include data on rate of water inflow and elevation to which water rose in hole.

No. 1, from 3750' to Surf feet. Water to surf @ 250 BPD

No. 2, from ____ to ____ feet. ____

No. 3, from ____ to ____ feet. ____

No. 4, from ____ to ____ feet. ____

FORMATION RECORD (Attach additional sheets if necessary)

From	To	Thickness in Feet	Formation	From	To	Thickness in Feet	Formation
0	30	30	Surface	3621	3779	158	Salt & Anhy,
30	40	10	Anhydrite	3779	3936	157	Sd & lime.
40	771	731	Surf Rock	3936	4100	164	Lime & Dolo
771	1370	599	Red Bed & Anhy	4100	4245	145	Potash, Dolo & Salt
1370	1490	120	Anhy	4245	4300	55	Dolo
1490	1554	64	Red Bed & Anhy	4300	4357	57	Lime
1554	1591	37	Anhy	4357	4486	129	Dolo & Potash
1591	2349	758	Anhy & Salt	4486	4845	359	Dolo, Lime & Sd
2349	2645	296	Anhy, Salt, Red Bed & Lime				
2645	2845	200	Salt & Anhy				
2845	3027	182	Lime & Sand				
3027	3250	223	Salt, Sd, Lime, Anhy				
3250	3458	208	Lime				
3458	3621	163	Lime, Sd				

Form C-105 cont'd
State Vacuum Unit #22
2500' FNL & 1575' FWL
Sec 32-17S-34E, Lea County

Item 32 - Acid, Shot, Fracture, Cement Squeeze, etc.

Depth Interval	Amount & Kind Material Used
1580'	Squeezed w/500 sx Cl H cmt cont'g 2% $CaCl_2$
1520'	Squeezed w/200 sx Cl H cmt cont'g 2% $CaCl_2$
4721-4723'	Acidized w/800 gals 15% LST-NE
4611-4665'	Acidized w/4000 gals 15% Acid

Spot 5 bbls acid & pump 4000 gals 15% acid. Max press 3000#. Ran GR-Temp survey. In 10 hrs swbd 17 BNO & 17 BLW. On 1/12/83 swbd Grbg SA perfs 4611-4665', rec 36 BNO & 40 BLW. 1/13/83 SITP 50#. Rel pkr & RBP, POH. RIH w/CA. Set btm of tbg @ 4736', SN @ 4702'. In 2 hrs swbd 17 BNO. SITP 0#. On 24 hr potential test 2/8/83 pmpd 189 BO, 23 BW, 15 MCFG on 12-94" spm. GOR 79:1. Final Report.

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

Exhibit 2

BRUCE KING
GOVERNOR

October 27, 1982

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

RECEIVED
DEC - 9 1982
OIL CONSERVATION DIVISION
SANTA FE

ARCO Oil and Gas Company
P. O. Box 1610
Midland, Texas 79702

Attention: J. A. Fraga

Administrative Order NSL-1600

Gentlemen:

Reference is made to your application for a non-standard location for your State Vacuum Unit Well No. 22 to be located 2500 feet from the North line and 1575 feet from the West line of Section 32, Township 17 South, Range 34 East, NMPM, Lea County, New Mexico.

By authority granted me under the provisions of Rule 104 F of the Division Rules and Regulations, the above-described unorthodox location is hereby approved.

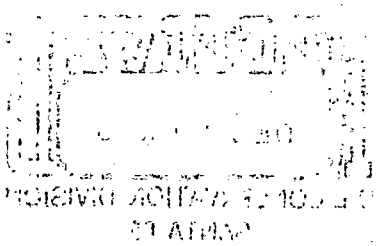
Sincerely,

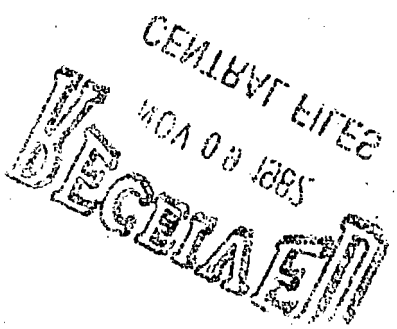
JOE D. RAMEY,
Director

JDR/RLS/dr

cc: Oil Conservation Division - Hobbs
Oil & Gas Engineering Committee - Hobbs
Oil & Gas Division - State Land Office - Santa Fe

CENTRAL FILES
NOV 09 1982
RECEIVED




RECEIVED

Engineering Discussion of Infill Drilling on the State Vacuum Unit

INTRODUCTION

ARCO Oil and Gas Company's State Vacuum Unit produces from the Vacuum Grayburg-San Andres field in Lea County, New Mexico. It has been concluded that to effectively and efficiently produce this reservoir 20-acre well spacing is necessary. The following is a brief history of the State Vacuum Unit and the engineering and geological data supporting this finding.

HISTORY

The State Vacuum Unit was formed by ARCO on November 11, 1976 and water injection began on July 1, 1977. The unit was developed on 40-acre spacing using a 5-spot injection pattern. Primary reserves for this unit were calculated to be 3,266 MBO, or 24.8% of the OOIP. The unit has shown favorable response to the flood producing 347 MBO of secondary reserves as of April, 1983. However, several wells have experienced premature water breakthrough which has reduced the efficiency of the waterflood (see Figures 1, 2, and 3).

In February of 1983 we completed the State Vacuum Unit No. 22, our first 20-acre infill in the unit (see attached well plat, Fig. 4). It is too early to make final conclusions for this well, but so far the results have been very promising and further infill drilling is planned.

GEOLOGY

The Vacuum Grayburg-San Andres field is located on an east-west trending anticline at the east end of the Artesia-Vacuum trend along the southern edge of the northwestern platform. The State Vacuum Unit is located in the western portion of the field (see attached structure map, Fig. 5). Oil production is principally from dolomite in the San Andres formation with minor contributions from limestone in the Grayburg. The main pay zone (first porosity zone in the San Andres) is an oolite dolomite continuous throughout the State Vacuum Unit (see cross-section Fig. 6). Attached is Table No. 1 showing basic reservoir data for this unit.

VOLUMETRIC CALCULATIONS

Volumetric calculations for the San Andres formation in the State Vacuum Unit yield an original-oil-in-place of 10,381,109 STB for the main pay and 13,305,882 STB for the total pay zone. The Grayburg formation was not included in any volumetric calculations. These calculations involved determination of porosity-feet (Øh) for each well. Two isopachs were prepared, one for total Øh (Figure 7) and one for main pay Øh (Figure 8). These maps were constructed using logs and core data were available. Acre-Øh numbers were determined by planimetering the isopach maps.

The original-oil-in-place numbers were calculated by transforming acre-Øh numbers into net hydrocarbon pore volume and converting to stock tank barrels using a formation volume factor of 1.26. The water saturation used in the conversion was taken from Figure 9, "Average of First Porosity vs Water Saturation" from a field study of the Wasson San Andres reservoir by Shell Oil Company.

SECONDARY RESERVES FOR 40-ACRE SPACING

ARCO's Engineering Study of 1976 concluded that only the "main pay" section of the San Andres was continuous enough to be economically flooded. Secondary reserves were calculated to be 1,300 MBO which represents a ratio of 0.5:1 of secondary to primary reserves. This low ratio is due to the main pay being the only zone floodable on 40-acre spacing.

Secondary performance was determined with the aid of one of Atlantic Richfield Company's computer programs, which calculated sweep-out for a five-spot pattern. Three five-spot patterns were used to model performance within the 800-acre proposed project area. Each pattern was broken down into quarters five-spot elements. In each element, core and log analysis helped determine porosity, permeability, and net pay. Twelve elements were analyzed in a total of three five spots. Total performance of the eight five-spots were determined by summing representative five-spots. Permeability distribution was determined for each well having core data with Atlantic Richfield's core data sorting program. Stratification analysis was handled by dividing each five-spot into layers. Table 2 gives the data used in each of the three typical five-spots.

SECONDARY AND PRIMARY RESERVES FOR 20-ACRE SPACING

By infill drilling, additional pay in the San Andres will be floodable on closer spacing. Based on the Engineering-Geological Committee Report, November 1977, (Exhibit No. 4, Case No. 6570) for the East Vacuum Grayburg-San Andres Unit, it was determined that an estimated 3.9% increase in recovery of OOIP for the EVGSAU could be expected on 20-acre spacing. Since the State Vacuum Unit has similar reservoir characteristics and quality, an increase recovery value of 3.9% of the OOIP was used in predicting additional secondary oil reserves with 20-acre infills. This value includes encountering discontinuous intervals of porosity and improvement in recovery efficiency.

Using the 3.9% infill recovery value and the total pay zone OOIP reserves, additional secondary reserves of 518,929 STB were calculated for the unit. The 800 acre unit would require 20 equivalent 20-acre infill wells for a recovery of about 26 MBO/well location. These calculations are outlined in Appendix A.

Primary drainage analysis of the State Vacuum Unit were done using volumetrics, decline curves and production data. This analysis indicated that each 20-acre infill well will drain 5 acres previously missed at 40-acre spacing. Incrementally each infill well will recover 26 MBO (see Appendix A).

The State Vacuum Unit No. 22 will also produce primary reserves from a lower zone near the top of the Lovington Sand (see Fig. 10). The porosity logs indicate this zone to contain 8-10 feet of net pay with about 10% porosity. Estimate recoverable primary reserves for the lower zone, using 20-acre spacing and a 24.8% recovery factor, is 22 MBO. Secondary reserves were not calculated since this zone at present is not being flooded.

Premature water breakthrough has been experienced in several wells, as is seen in the attached plots (see Fig. 1-3). The 20-acre spacing will drain reserves being bypassed due to the breakthrough.

CONCLUSION

By drilling the infill Well No. 22 we will recover new reserves of approximately 74 MSTBO. The initial stabilized rate on this well was predicted to be 75 BOPD declining to abandonment at 30% per year (see Fig. 11). Gas production in association with this oil will be 12.95 MMCF.

ARCO is presently in the process of updating its Engineering Study of 1976 for the State Vacuum Unit. This study will fully evaluate the infill drilling of this unit.

The production history of the State Vacuum Unit and other units in this field indicate that to effectively and efficiently produce the Vacuum Grayburg-San Andres reservoir, 20-acre spacing is necessary. By going to this closer spacing, additional pay will be encountered and flooded. Additional primary reserves that were undrained on 40-acre spacing will be recovered along with secondary reserves bypassed due to premature water breakthrough.

Lawrence G. Griffin

LGG:dmm

8-29-83

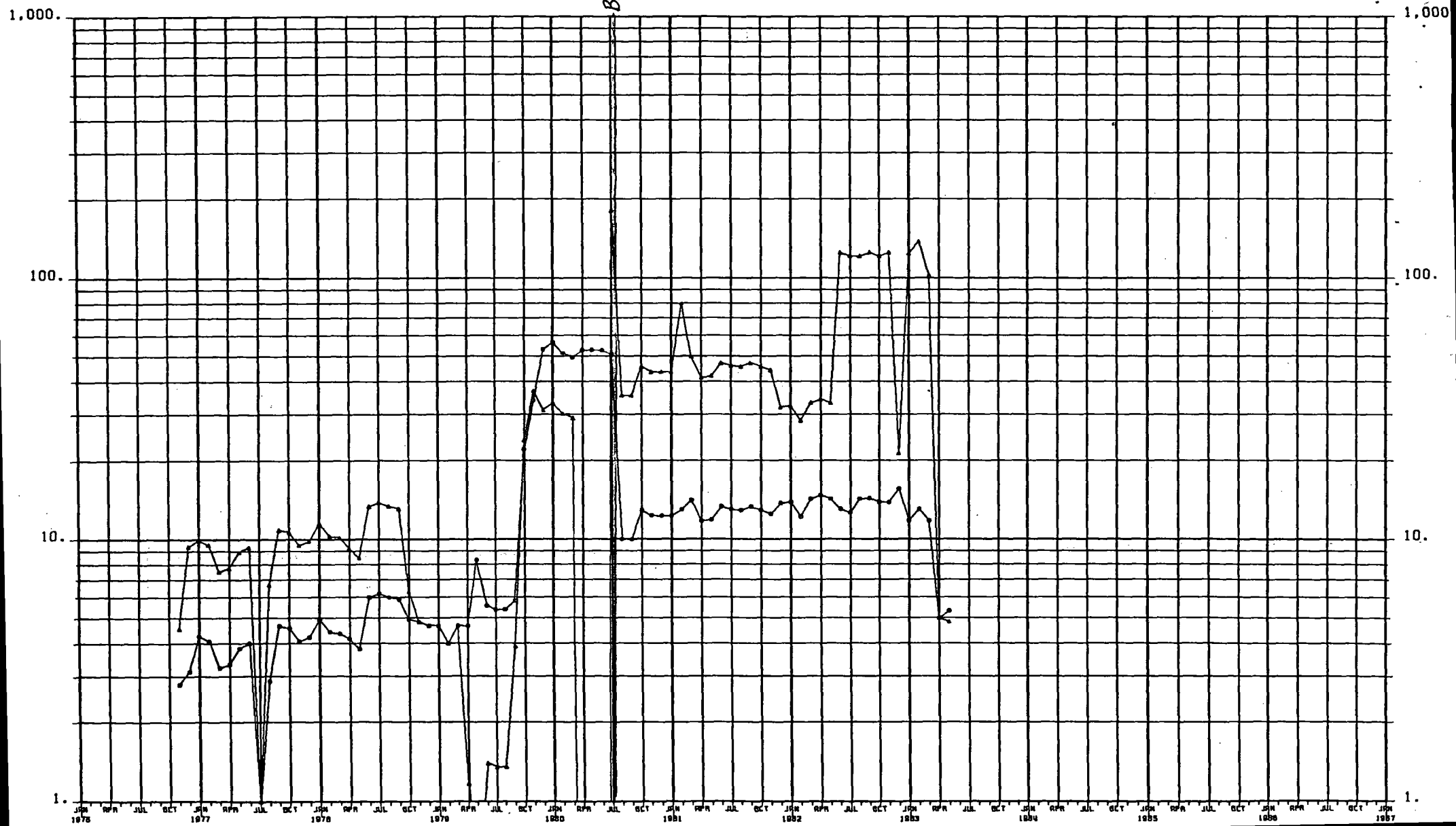
WPP RELEASE 4.4 - PLOT SEQ NO. 2
CONFIDENTIAL. (A D G C)

Figure 1
State Vacuum Unit No. 6

o -AVG. DAILY OIL (BBL)
▲ -AVG. DAILY H2O (BBL)

FIELD, 830 - VACUUM
LEASE, 6441 - STATE VACUUM UNIT PHASE II
RESV., 02 - GRAYBURG SAN ANDRES

Breakthrough



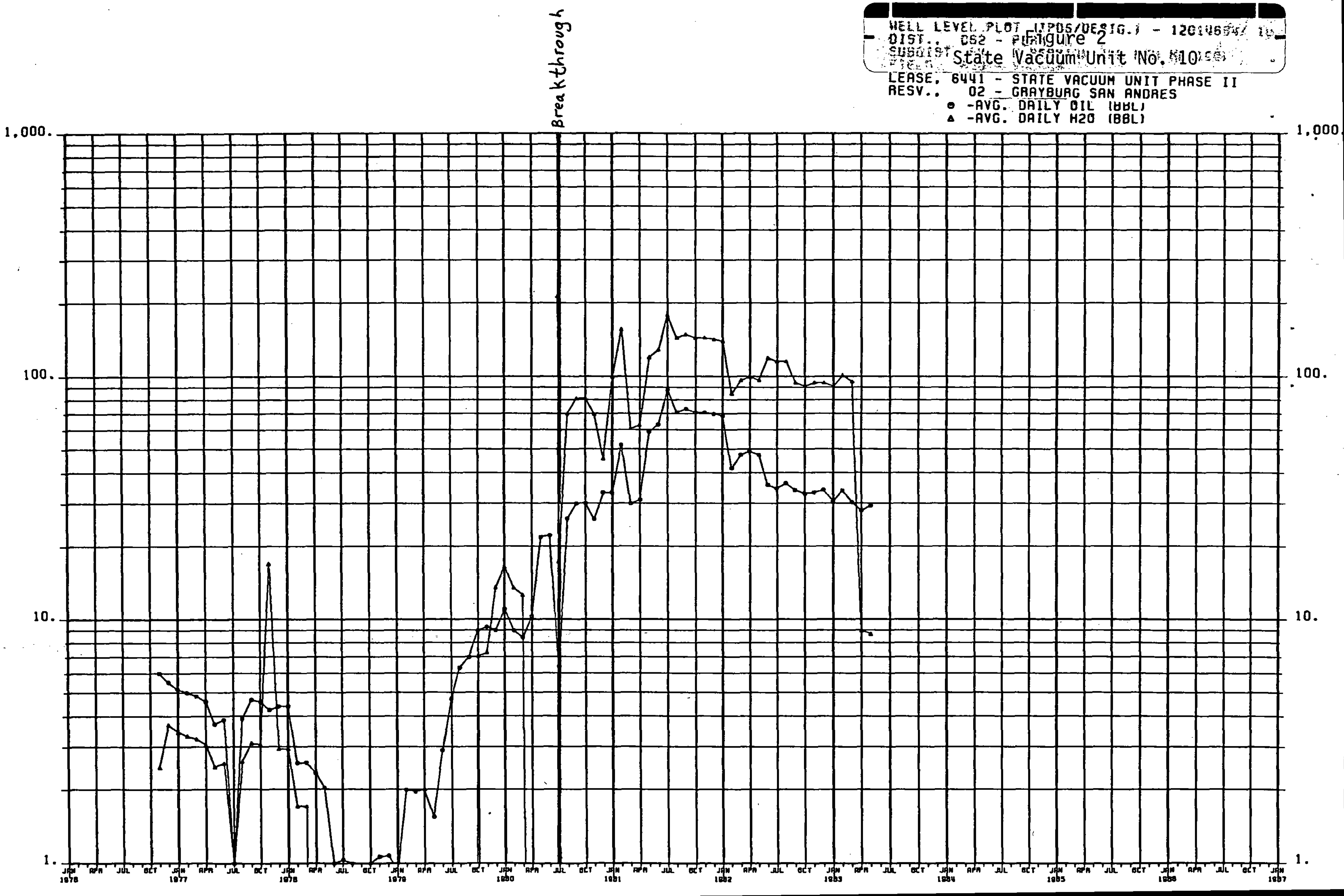


Figure 2
State Vacuum Unit No. 10

Figure 3
State Vacuum Unit No. 14

WELL LEVEL PLOT - [illegible]
DIST.. 062 - PERMIAN
SUBDIST. 030 - VACUUM
FIELD. 030 - VACUUM
LEASE, 6441 - STATE VACUUM UNIT PHASE II
RESV.. 02 - GRAYBURG SAN ANDRES

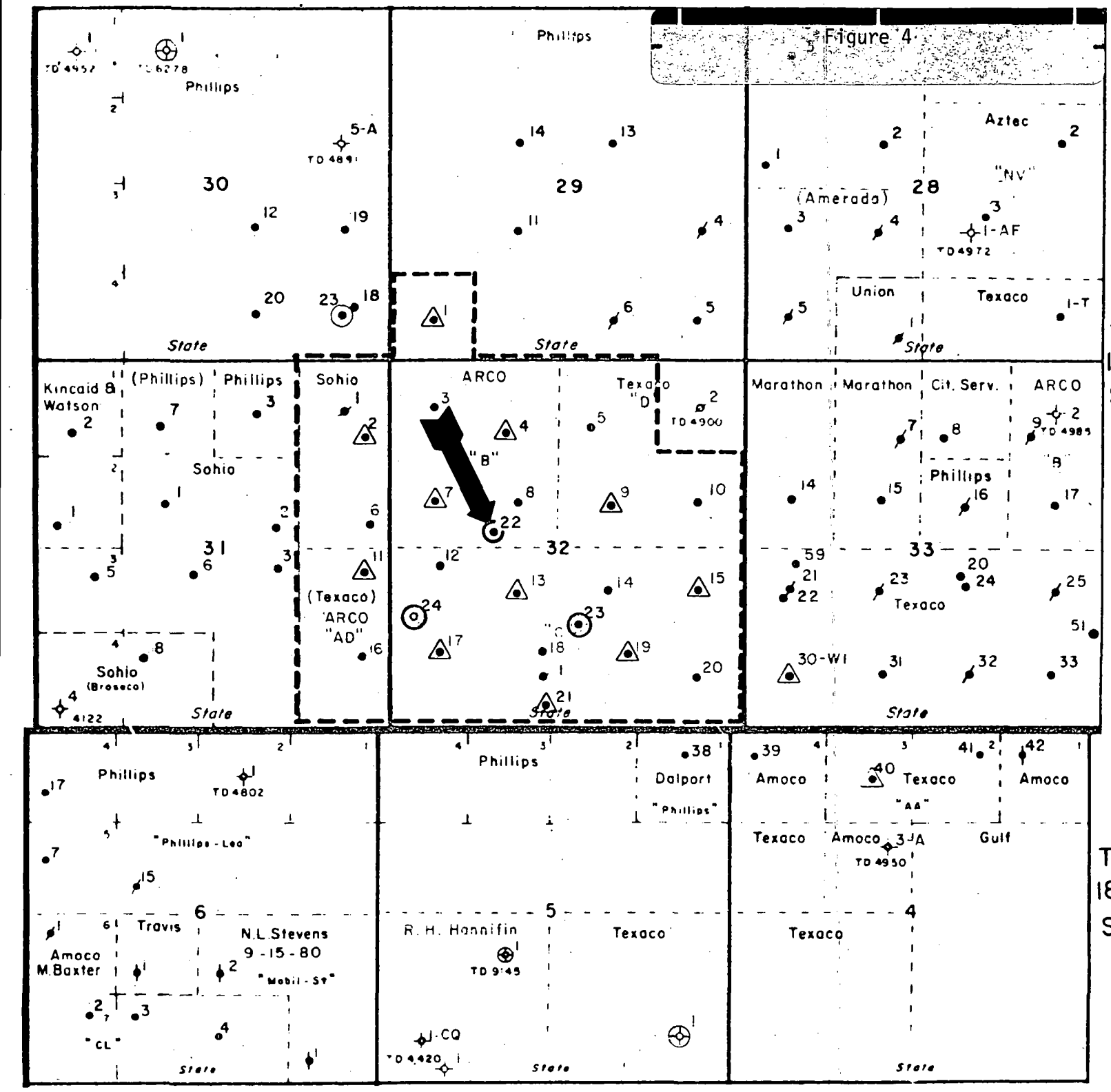
⊙ -AVG. DAILY OIL (BBL)
▲ -AVG. DAILY H2O (BBL)

Breakthrough

1,000.
100.
10.
1.
0.1

JAN 1976 APR JUL OCT JAN 1977 APR JUL OCT JAN 1978 APR JUL OCT JAN 1979 APR JUL OCT JAN 1980 APR JUL OCT JAN 1981 APR JUL OCT JAN 1982 APR JUL OCT JAN 1983 APR JUL OCT JAN 1984 APR JUL OCT JAN 1985 APR JUL OCT JAN 1986 APR JUL OCT JAN 1987

Figure 4



LEGEND

- UNIT BOUNDARY
- PRODUCER - SAN ANDRES
- INJECTOR - SAN ANDRES
- PROPOSED LOCATION

ARCO Oil and Gas Company

Permian District Midland, Texas

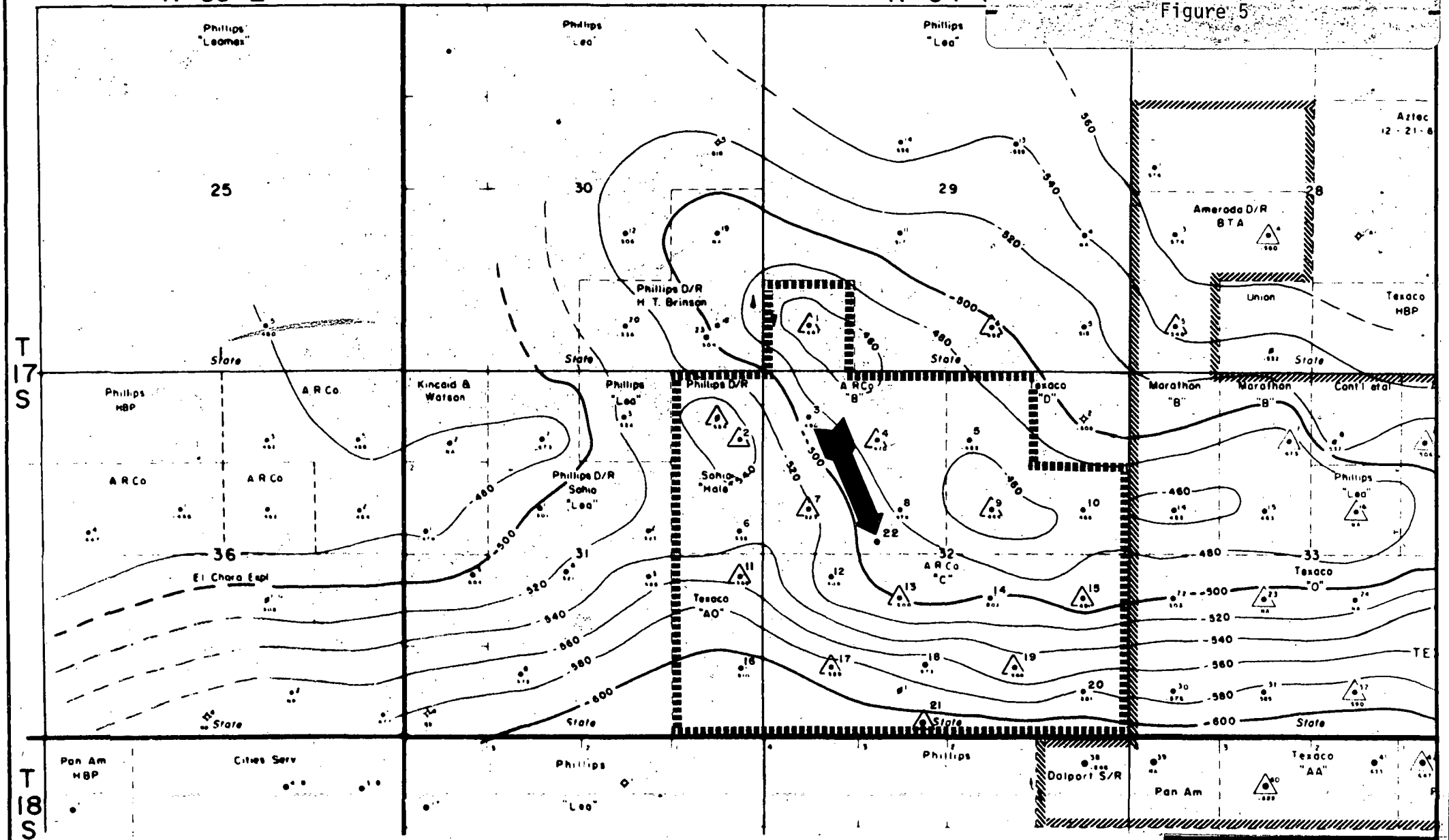
VACUUM (GRBG - S.A.) AREA
STATE VACUUM UNIT

Lea County, New Mexico

Scale 1" = 2000'

By J. A. Frago	Drawn By TCB Date 10-82
Date 10-20-82	Revised By Date 5-83
West Engineering	Dwg. No.

Figure 5



LEGEND

STATE VACUUM UNIT BOUNDARY

PROPOSED WELL LOCATION

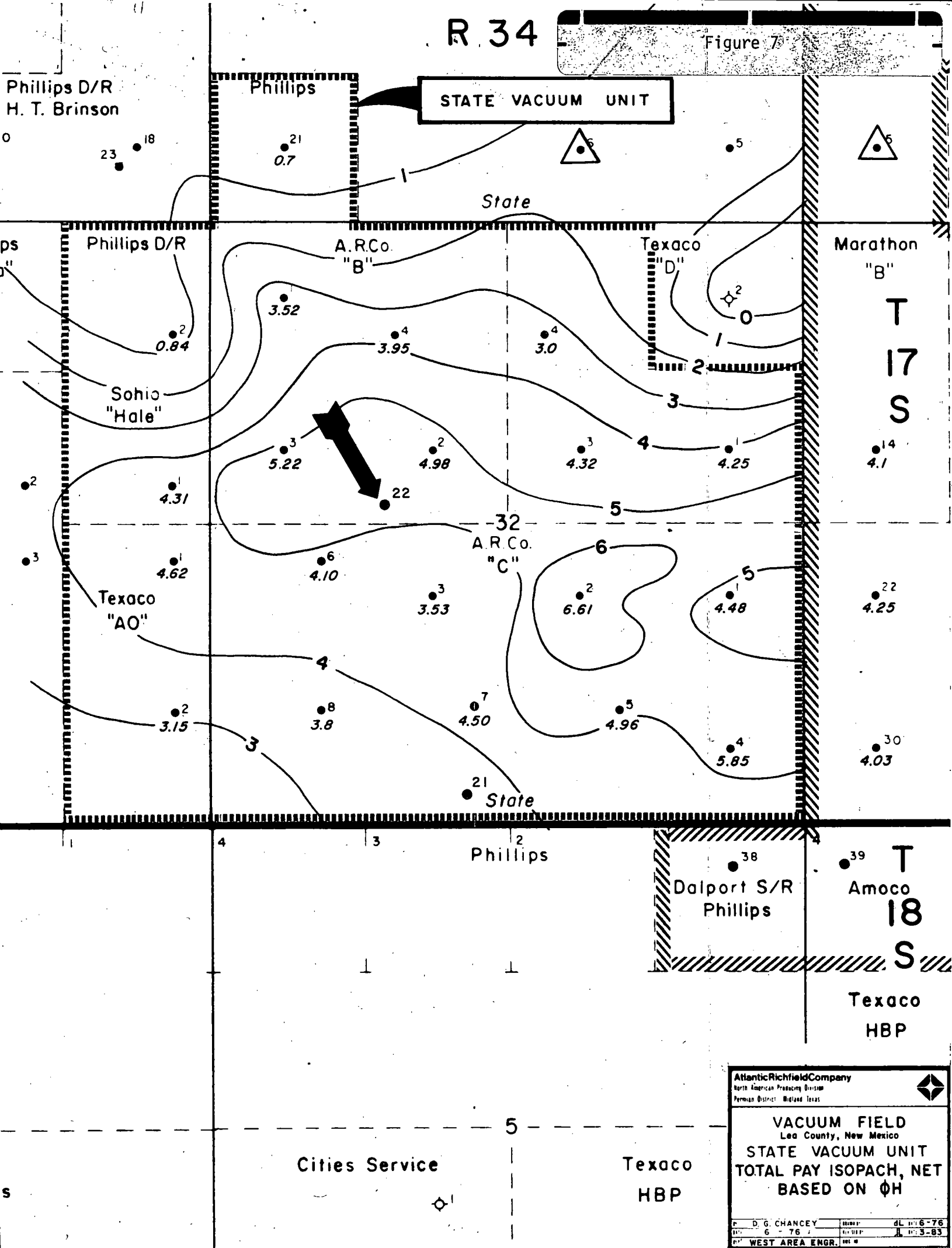
AtlanticRichfieldCompany
North American Producing Division
Permian District Midland, Texas

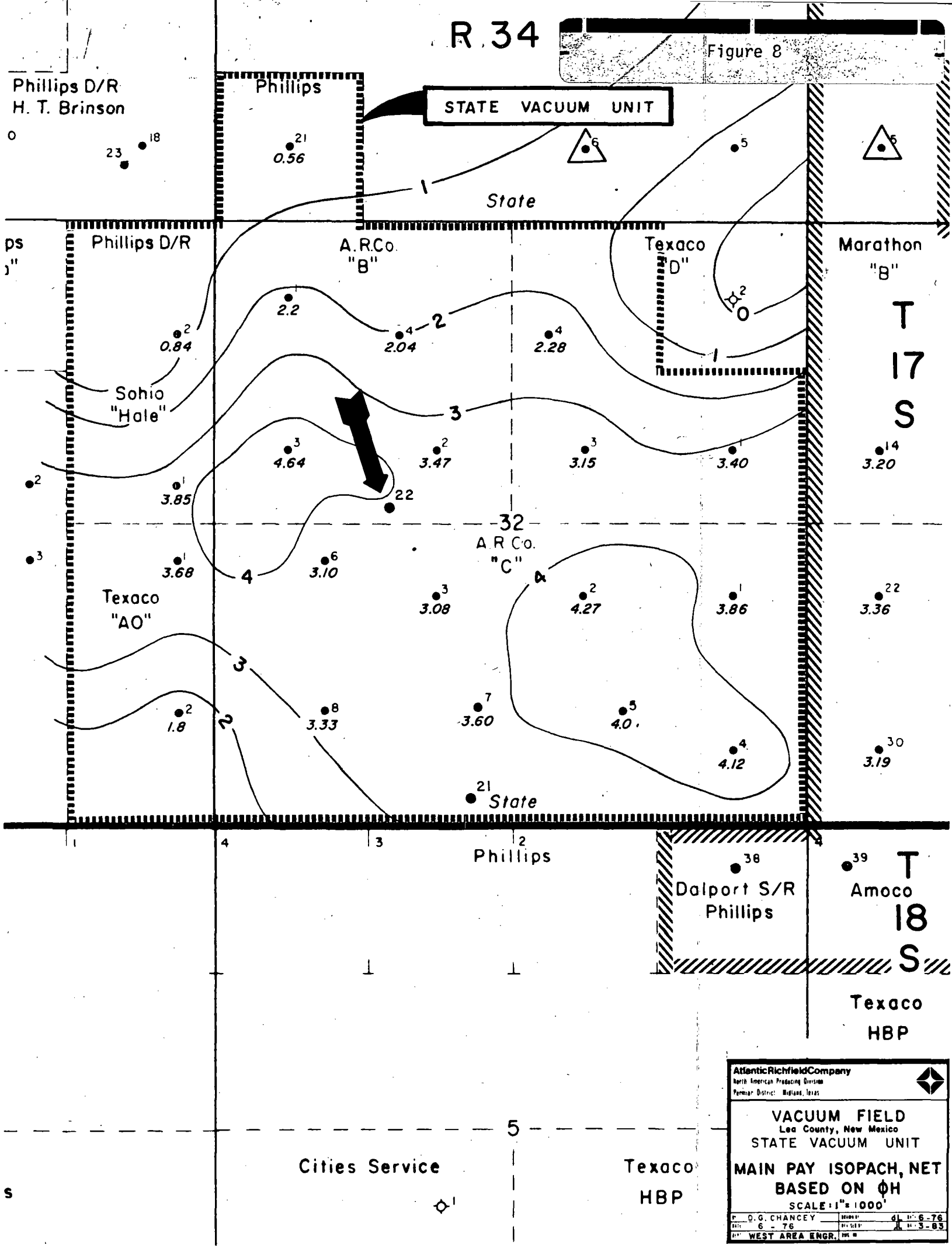
VACUUM FIELD
Lea County, New Mexico

STATE VACUUM UNIT

STRUCTURE MAP
TOP OF SAN ANDRES

BY J. A. FRAGA	DATE 5-83
DATE 5-83	
BY WEST ENGR.	


R 34
Figure 7
STATE VACUUM UNIT
Phillips D/R
H. T. Brinson
Phillips
State
Phillips D/R
A.R.Co. "B"
Texaco "D"
Marathon "B"
Sohio "Hale"
A.R.Co. "C"
Texaco "AO"
Phillips
Dalport S/R Phillips
Amoco
Texaco HBP
Cities Service
Texaco HBP
T 17 S
T 18 S
32
5
1
4
3
2
0.7
0.84
3.52
3.95
3.0
5.22
4.98
4.32
4.25
4.1
4.31
4.62
4.10
3.53
6.61
4.48
4.25
3.15
3.8
4.50
4.96
5.85
4.03
Atlantic Richfield Company
North American Producing Division
Permian District Midland Texas
VACUUM FIELD
Lea County, New Mexico
STATE VACUUM UNIT
TOTAL PAY ISOPACH, NET
BASED ON ϕH
D. G. CHANCEY
6 - 76
WEST AREA ENGR.
dL 6-76
3-83


R 34
Figure 8
STATE VACUUM UNIT
Phillips D/R
H. T. Brinson
Phillips
0.56
State
Phillips D/R
A.R.Co.
"B"
Texaco
"D"
Marathon
"B"
T
17
S
0.84
2.2
2.04
2.28
Sohio
"Hale"
4.64
3.47
3.15
3.40
3.20
3.85
32
A.R.Co.
"C"
3.68
3.10
Texaco
"AO"
3.08
4.27
3.86
3.36
1.8
3.33
3.60
4.0
4.12
3.19
State
Phillips
Dalport S/R
Phillips
Amoco
T
18
S
Texaco
HBP
5
Cities Service
Texaco
HBP
Atlantic Richfield Company
North American Producing Division
Permian District: Midland, Texas
VACUUM FIELD
Lea County, New Mexico
STATE VACUUM UNIT
MAIN PAY ISOPACH, NET
BASED ON ϕH
SCALE: 1" = 1000'
D. G. CHANCEY
6 - 76
WEST AREA ENGR.
6-76
3-83

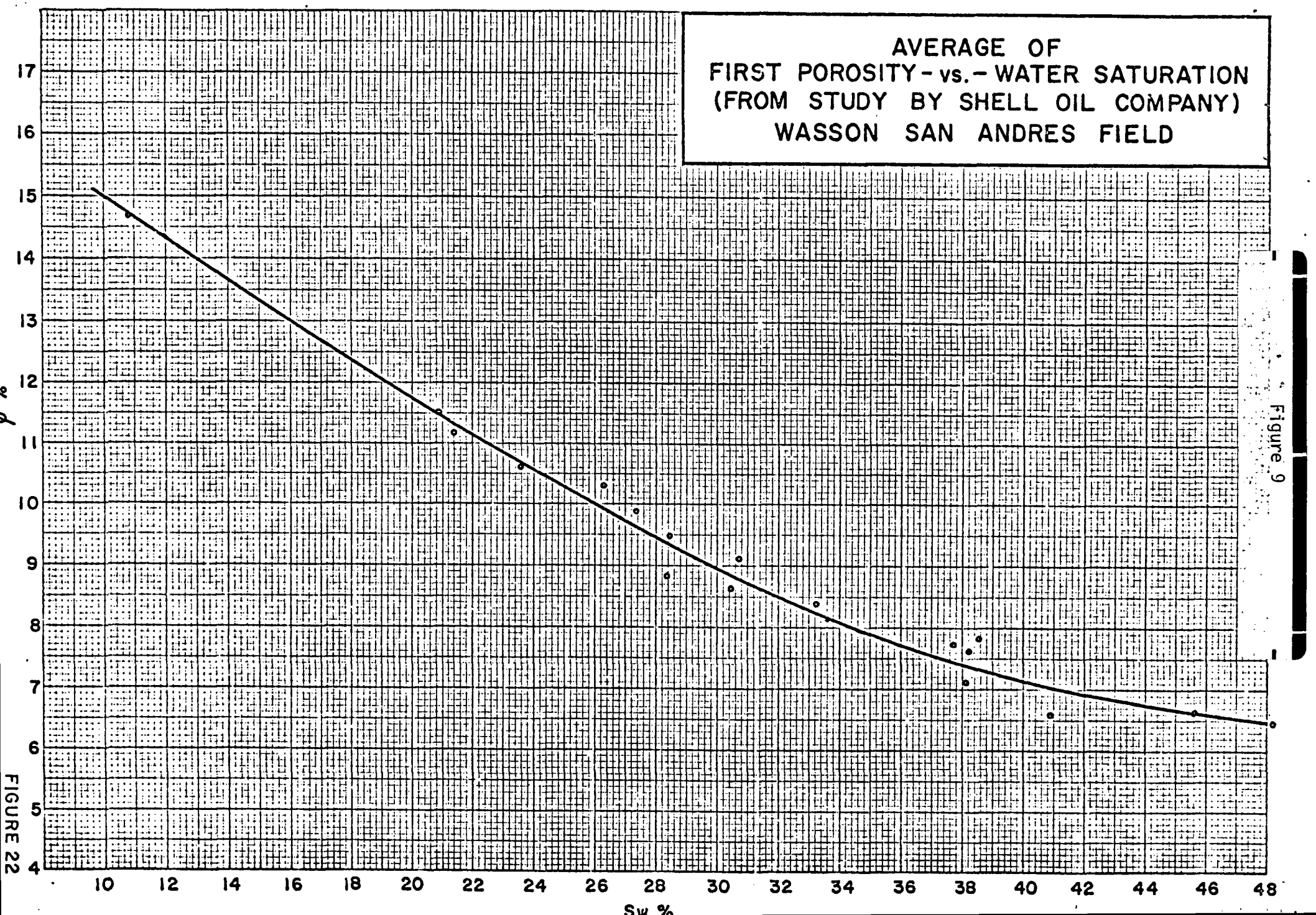
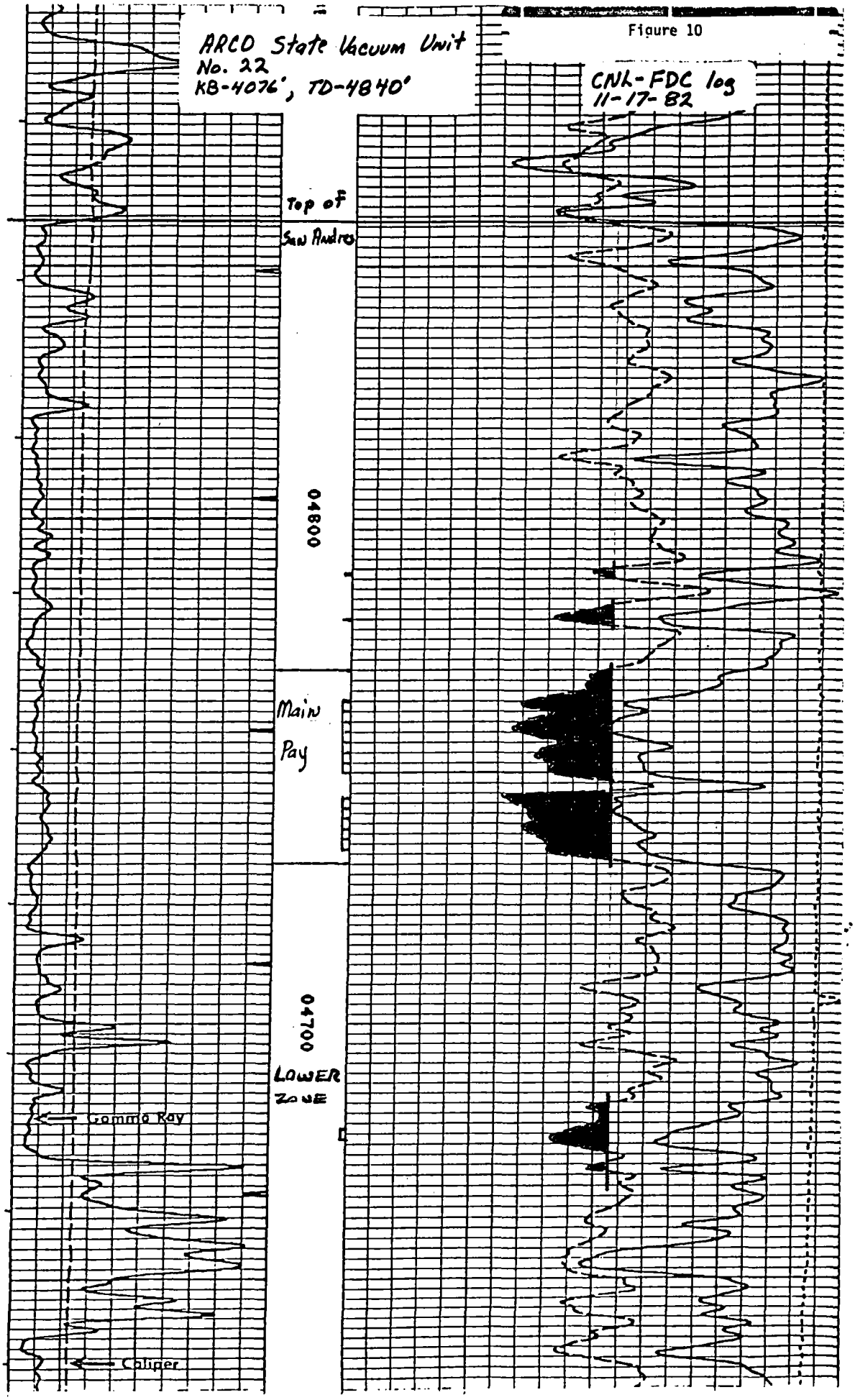


FIGURE 22

Figure 9

Figure 10


ARCO State Vacuum Unit
No. 22
KB-4076', TD-4840'
CNL-FDC log
11-17-82
Top of
San Andres
04800
Main
Pay
04700
LOWER
ZONE
Gamma Ray
Caliper

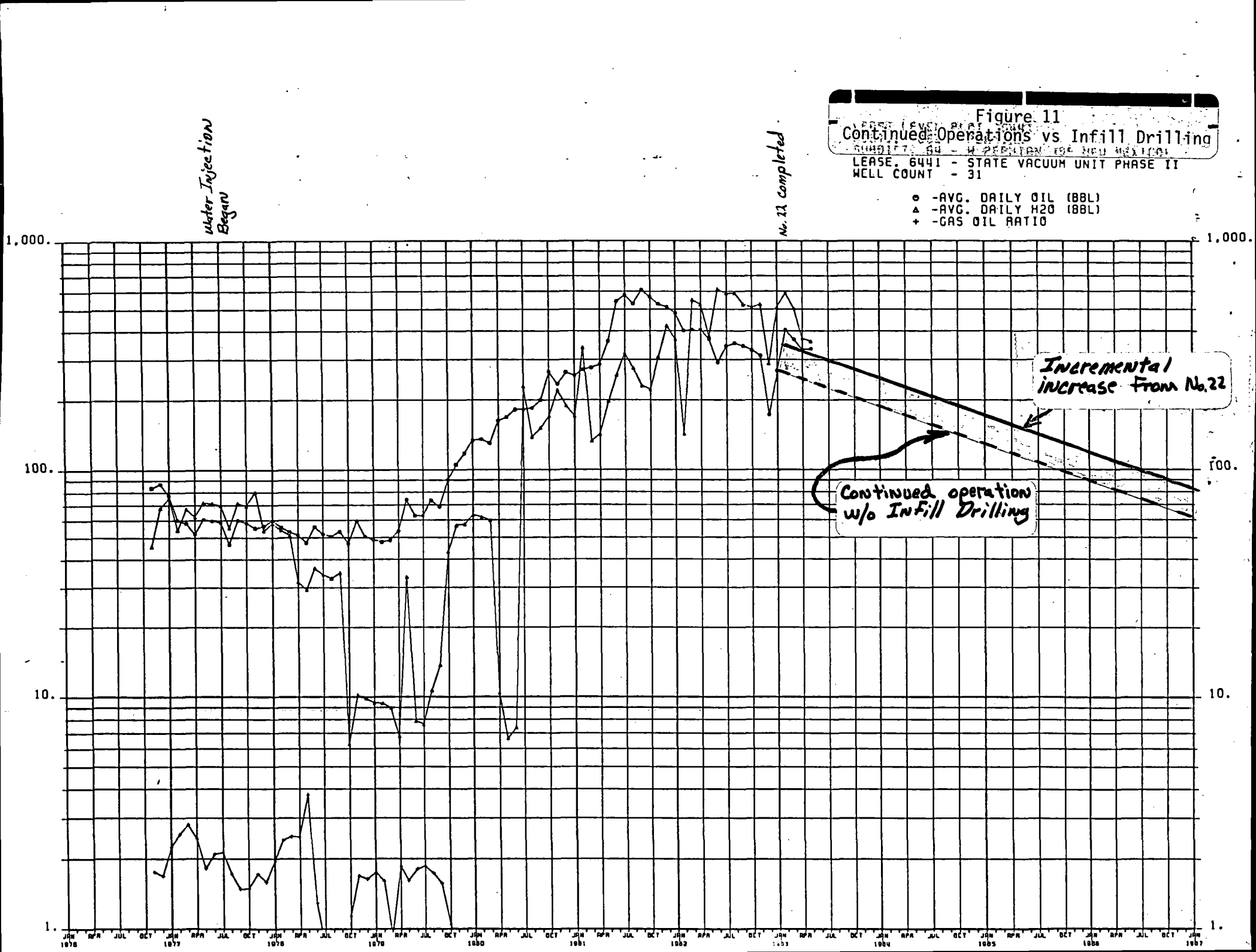


Figure 11
Continued Operations vs Infill Drilling
LEASE, 6441 - STATE VACUUM UNIT PHASE II
WELL COUNT - 31
o -AVG. DAILY OIL (BBL)
Δ -AVG. DAILY H2O (BBL)
+ -GAS OIL RATIO
Water Injection Began
No. 22 completed
1,000.
100.
10.
1.
Incremental increase From No.22
Continued operation w/o Infill Drilling
JAN 1976
APR
JUL
OCT
JAN 1977
APR
JUL
OCT
JAN 1978
APR
JUL
OCT
JAN 1979
APR
JUL
OCT
JAN 1980
APR
JUL
OCT
JAN 1981
APR
JUL
OCT
JAN 1982
APR
JUL
OCT
JAN 1983
APR
JUL
OCT
JAN 1984
APR
JUL
OCT
JAN 1985
APR
JUL
OCT
JAN 1986
APR
JUL
OCT
JAN 1987

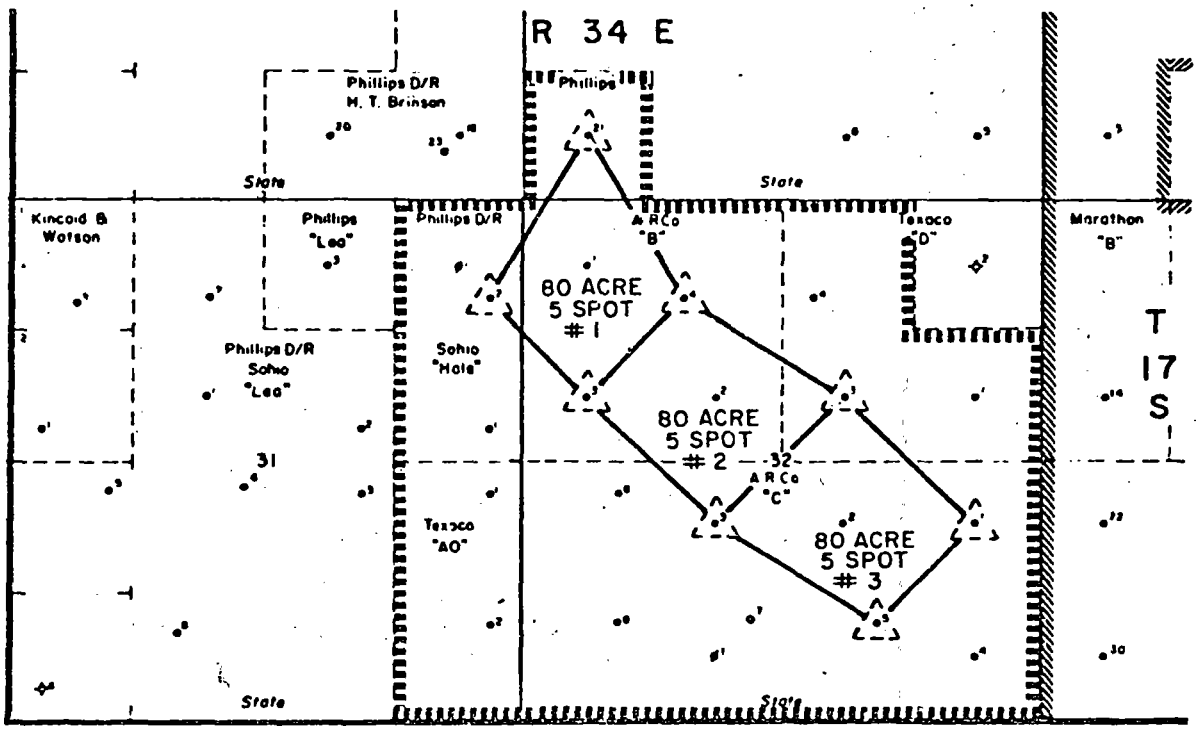
Table I

Basic Reservoir Data

Unit:	State Vacuum Unit
Operator:	ARCO Oil and Gas Company
Field:	Vacuum Grayburg-San Andres
Lithology:	Dolomite and Limestone
Area:	800 Acres
Average Porosity:	9.88%
Average Permeability:	17.8 md
Initial Formation Volume Factor:	1.26 RB/STB
Connate Water Saturation:	26.5%
Residual Oil Saturation:	30.0%
Oil Gravity:	37° API
Average GOR:	175 SCF/bbl
Original Oil In Place:	13,306 MSTBO
Primary Recovery (40-acres):	3,266 MSTBO
Secondary Recovery (40-acres):	1,700 MSTBO

TABLE 2

STRATIFICATION ANALYSIS



	% Thickness of Total	Kl, md	Scw,%	Sgx,%	Sor,%
80-ACRE 5-SPOT NO. 1					
Layer #1	42.1	4.6	26.5	24.0	30.0
Layer #2	37.0	1.7	26.5	24.0	30.0
Layer #3	20.9	0.5	26.5	24.0	30.0
	100.0				
80-ACRE 5-SPOT NO. 2					
Layer #1	25.4	26.0	26.5	24.0	30.0
Layer #2	30.8	8.6	26.5	24.0	30.0
Layer #3	17.6	2.8	26.5	24.0	30.0
Layer #4	14.9	1.0	26.5	24.0	30.0
Layer #5	11.3	0.4	26.5	24.0	30.0
	100.0				
80-ACRE 5-SPOT NO. 3					
Layer #1	18.2	19.8	26.5	24.0	30.0
Layer #2	23.5	7.0	26.5	24.0	30.0
Layer #3	29.4	2.6	26.5	24.0	30.4
Layer #4	12.6	0.9	26.5	24.0	30.4
Layer #5	16.3	0.3	26.5	24.0	30.4
	100.0				

Appendix A

I. Incremental Secondary Reserves with 20-acre Infills:

OOIP = 13,306 MBO (Eng. Study 1976)
Recovery Factor = .039 (EVU Eng. Study, Phillips)
Additional Reserves from 20-acre Spacing = 519 MBO
Unit Area = 800 acres
therefore, Equivalent 20-acre infills required = 20

519 MBO ÷ 20 Wells = 26 MBO/Well Incremental Oil

(26 MBO/Well)(175 SCF/STB) = 4.55 MMCF/Well Incremental Gas

II. Undrained Primary Reserves for Typical 20-acre Infill Location:

$\emptyset h$ = 4.56 (log data)
Sw = .265 (Eng. Study 1976)
Recovery Factor = .248 (Eng. Study 1976)
Boi = 1.26 RB/STB (Eng. Study 1976)
A = 5 acres (Undrained area planimetered from drainage maps)

$$\frac{7758\ A\emptyset h(1-Sw)}{Boi} \times R_f = \frac{7758(5)(4.56)(1-.265)}{1.26} \times .248 = 25.6 \text{ MBO Primary Reserves from 20-acre Spacing}$$

25.6 MBO x 175 SCF/STB = 4.48 MMCF Primary Gas

III. New Primary Reserves from A Lower Zone:

$\emptyset h$ = 1
A = 20 acres

$$\frac{7758\ A\emptyset h(1-Sw)}{Boi} \times R_f = \frac{7758(20)(1)(1-.265)}{1.26} \times .248 = 22.4 \text{ MBO Primary Reserves for Lower Zone}$$

22.4 MBO x (175 SCF/STB) = 3.92 MMCF Primary Gas