



United States Department of the Interior

GEOLOGICAL SURVEY

P. O. Drawer U
Artesia, New Mexico 88210

December 12, 1972

Shell Oil Company
Post Office Box 1509
Midland, Texas 79701

Gentlemen:

Your letter of December 1, 1972 requests approval to institute and operate a waterflood project of the San Andres formation in the Cato pool, located in T. 8 and 9 S., R. 30 E., N.M.P.M., Chaves County, New Mexico involving that portion of Federal oil and gas leases described as follows:

New Mexico 0155254-A

T. 8 S., R. 30 E.
sec. 33: $W\frac{1}{2}$, $W\frac{1}{2}E\frac{1}{2}$, $E\frac{1}{2}SE\frac{1}{4}$
T. 9 S., R. 30 E.
sec. 4: $N\frac{1}{2}$

New Mexico 022636

T. 8 S., R. 30 E.
sec. 34: $W\frac{1}{2}$

The plan proposes to convert to water injection the following wells:

<u>Well Number and Lease</u>	<u>Location</u>
4 - Amoco Federal	1980/N&E sec. 33
6 - Amoco Federal	660/S 1980/E sec. 33
7 - Amoco Federal	1980/N 660/W sec. 33
8 - Amoco Federal	660/S&W sec. 33
4 - Hodges Federal "B"	660/S&W sec. 34

The plan for operating this project as proposed in the application is satisfactory to this office and hereby approved subject to approval by the New Mexico Oil Conservation Commission and the following:

1. This project will be operated in compliance with the New Mexico Oil Conservation Commission regulations governing waterflood operations.
2. Duplicate copies of a monthly progress report (N.M.O.C.C. form C-120 acceptable) are to be submitted to this office showing the volume of water injected and average pressure for the injection wells and production for the producing wells in the project area.
3. This approval does not preclude the necessity for further approval when the project is expanded to include other wells and leases or the necessity to submit the usual notices and reports on wells involved. When this project is expanded to involve other operators and interests, the correlative rights of all concerned should be considered.

Sincerely yours,



James A. Knauf
District Engineer

cc:
N.M.O.C.C., Santa Fe
Roswell
Accounts

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO THE EASTLAND OIL COMPANY		POSTMARK OR DATE MIDLAND TX NOV 1971
STREET AND NO. 704 WESTERN UNITED LIFE BLDG.		
P.O., STATE AND ZIP CODE MIDLAND, TX 79701		
OPTIONAL SERVICES FOR ADDITIONAL FEES		
RETURN	1. Shows to whom and date delivered	15¢
RECEIPT	With delivery to addressee only	65¢
SERVICES	2. Shows to whom, date and where delivered ..	35¢
	With delivery to addressee only	85¢
DELIVER TO ADDRESSEE ONLY		50¢
SPECIAL DELIVERY (extra fee required)		

PS Form 3800 NO INSURANCE COVERAGE PROVIDED— (See other side)
Nov. 1971 NOT FOR INTERNATIONAL MAIL * GPO: 1970 O-397-488

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO ATLANTIC RICHFIELD COMPANY		POSTMARK OR DATE MIDLAND TX NOV 1971
STREET AND NO. P. O. BOX 1610		
P.O., STATE AND ZIP CODE MIDLAND, TX 79701		
OPTIONAL SERVICES FOR ADDITIONAL FEES		
RETURN	1. Shows to whom and date delivered	15¢
RECEIPT	With delivery to addressee only	65¢
SERVICES	2. Shows to whom, date and where delivered ..	35¢
	With delivery to addressee only	85¢
DELIVER TO ADDRESSEE ONLY		50¢
SPECIAL DELIVERY (extra fee required)		

PS Form 3800 NO INSURANCE COVERAGE PROVIDED— (See other side)
Nov. 1971 NOT FOR INTERNATIONAL MAIL * GPO: 1970 O-397-488

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO AMOCO PRODUCTION COMPANY		POSTMARK OR DATE MIDLAND TX NOV 1971
STREET AND NO. P. O. BOX 68		
P.O., STATE AND ZIP CODE HOBBS, NM 88240		
OPTIONAL SERVICES FOR ADDITIONAL FEES		
RETURN	1. Shows to whom and date delivered	15¢
RECEIPT	With delivery to addressee only	65¢
SERVICES	2. Shows to whom, date and where delivered ..	35¢
	With delivery to addressee only	85¢
DELIVER TO ADDRESSEE ONLY		50¢
SPECIAL DELIVERY (extra fee required)		

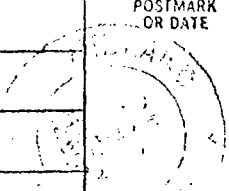
PS Form 3800 NO INSURANCE COVERAGE PROVIDED— (See other side)
Nov. 1971 NOT FOR INTERNATIONAL MAIL * GPO: 1970 O-397-488

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO ADOBE OIL COMPANY		POSTMARK OR DATE MIDLAND TX NOV 1971
STREET AND NO. 601 WILKINSON-FOSTER BLDG.		
P.O., STATE AND ZIP CODE MIDLAND, TX 79701		
OPTIONAL SERVICES FOR ADDITIONAL FEES		
RETURN	1. Shows to whom and date delivered	15¢
RECEIPT	With delivery to addressee only	65¢
SERVICES	2. Shows to whom, date and where delivered ..	35¢
	With delivery to addressee only	85¢
DELIVER TO ADDRESSEE ONLY		50¢
SPECIAL DELIVERY (extra fee required)		

PS Form 3800 NO INSURANCE COVERAGE PROVIDED— (See other side)
Nov. 1971 NOT FOR INTERNATIONAL MAIL * GPO: 1970 O-397-488

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO EUGENE E. NEARBURG		POSTMARK OR DATE 
STREET AND NO. 4219 SIGMA ROAD		
P.O., STATE AND ZIP CODE DALLAS, TX 75240 11		
OPTIONAL SERVICES FOR ADDITIONAL FEES		
RETURN RECEIPT SERVICES	1. Shows to whom and date delivered 15¢ With delivery to addressee only 65¢ 2. Shows to whom, date and where delivered .. 35¢ With delivery to addressee only 85¢	
DELIVER TO ADDRESSEE ONLY 50¢		
SPECIAL DELIVERY (extra fee required)		

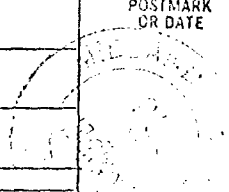
PS Form 3800 NO INSURANCE COVERAGE PROVIDED— (See other side)
 Nov. 1971 NOT FOR INTERNATIONAL MAIL * GPO: 1970 O-397-488

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO MWJ PRODUCING COMPANY		POSTMARK OR DATE
STREET AND NO. 413 FIRST NAT'L. BANK BLDG.		
P.O., STATE AND ZIP CODE MIDLAND, TX 79701		
OPTIONAL SERVICES FOR ADDITIONAL FEES		
RETURN RECEIPT SERVICES	1. Shows to whom and date delivered 15¢ With delivery to addressee only 65¢ 2. Shows to whom, date and where delivered .. 35¢ With delivery to addressee only 85¢	
DELIVER TO ADDRESSEE ONLY 50¢		
SPECIAL DELIVERY (extra fee required)		

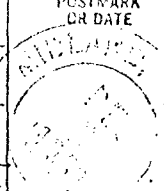
PS Form 3800 NO INSURANCE COVERAGE PROVIDED— (See other side)
 Nov. 1971 NOT FOR INTERNATIONAL MAIL * GPO: 1970 O-397-488

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO McCLELLAN OIL CORP.		POSTMARK OR DATE 
STREET AND NO. P. O. BOX 848		
P.O., STATE AND ZIP CODE ROSWEIL, NM 88201		
OPTIONAL SERVICES FOR ADDITIONAL FEES		
RETURN RECEIPT SERVICES	1. Shows to whom and date delivered 15¢ With delivery to addressee only 65¢ 2. Shows to whom, date and where delivered .. 35¢ With delivery to addressee only 85¢	
DELIVER TO ADDRESSEE ONLY 50¢		
SPECIAL DELIVERY (extra fee required)		

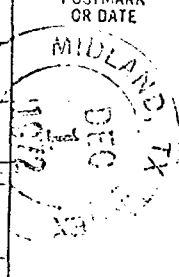
PS Form 3800 NO INSURANCE COVERAGE PROVIDED— (See other side)
 Nov. 1971 NOT FOR INTERNATIONAL MAIL * GPO: 1970 O-397-488

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO GLENN PETROLEUM CORP.		POSTMARK OR DATE 
STREET AND NO. 2902 MAPLE AVENUE		
P.O., STATE AND ZIP CODE DALLAS, TX 75201		
OPTIONAL SERVICES FOR ADDITIONAL FEES		
RETURN RECEIPT SERVICES	1. Shows to whom and date delivered 15¢ With delivery to addressee only 65¢ 2. Shows to whom, date and where delivered .. 35¢ With delivery to addressee only 85¢	
DELIVER TO ADDRESSEE ONLY 50¢		
SPECIAL DELIVERY (extra fee required)		

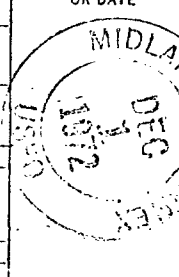
PS Form 3800 NO INSURANCE COVERAGE PROVIDED— (See other side)
 Nov. 1971 NOT FOR INTERNATIONAL MAIL

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO TERRA RESOURCES, INC.		POSTMARK OR DATE 
STREET AND NO. FOURTH NATIONAL BANK BUILDING		
P.O., STATE AND ZIP CODE TULSA, OK 74119		
OPTIONAL SERVICES FOR ADDITIONAL FEES		
RETURN RECEIPT SERVICES	1. Shows to whom and date delivered 15¢ With delivery to addressee only 65¢ 2. Shows to whom, date and where delivered .. 35¢ With delivery to addressee only 85¢	
DELIVER TO ADDRESSEE ONLY 50¢		
SPECIAL DELIVERY (extra fee required)		

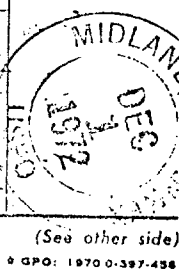
PS Form 3800 NO INSURANCE COVERAGE PROVIDED— (See other side)
 Nov. 1971 NOT FOR INTERNATIONAL MAIL * GPO: 1970 O-397-458

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO TAMARACK PETROLEUM COMPANY, INC.		POSTMARK OR DATE 
STREET AND NO. 910 BUILDING OF THE SOUTHWEST		
P.O., STATE AND ZIP CODE MIDLAND, TX 79701		
OPTIONAL SERVICES FOR ADDITIONAL FEES		
RETURN RECEIPT SERVICES	1. Shows to whom and date delivered 15¢ With delivery to addressee only 65¢ 2. Shows to whom, date and where delivered .. 35¢ With delivery to addressee only 85¢	
DELIVER TO ADDRESSEE ONLY 50¢		
SPECIAL DELIVERY (extra fee required)		

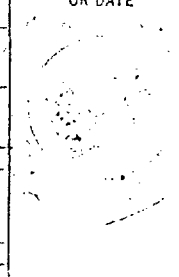
PS Form 3800 NO INSURANCE COVERAGE PROVIDED— (See other side)
 Nov. 1971 NOT FOR INTERNATIONAL MAIL * GPO: 1970 O-397-458

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO SUN OIL COMPANY		POSTMARK OR DATE 
STREET AND NO. P. O. BOX 1861		
P.O., STATE AND ZIP CODE MIDLAND, TX 79701		
OPTIONAL SERVICES FOR ADDITIONAL FEES		
RETURN RECEIPT SERVICES	1. Shows to whom and date delivered 15¢ With delivery to addressee only 65¢ 2. Shows to whom, date and where delivered .. 35¢ With delivery to addressee only 85¢	
DELIVER TO ADDRESSEE ONLY 50¢		
SPECIAL DELIVERY (extra fee required)		

PS Form 3800 NO INSURANCE COVERAGE PROVIDED— (See other side)
 Nov. 1971 NOT FOR INTERNATIONAL MAIL * GPO: 1970 O-397-458

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO J. CECIL RHODES		POSTMARK OR DATE 
STREET AND NO. 822 BUILDING OF THE SOUTHWEST		
P.O., STATE AND ZIP CODE MIDLAND, TX 79701		
OPTIONAL SERVICES FOR ADDITIONAL FEES		
RETURN RECEIPT SERVICES	1. Shows to whom and date delivered 15¢ With delivery to addressee only 65¢ 2. Shows to whom, date and where delivered .. 35¢ With delivery to addressee only 85¢	
DELIVER TO ADDRESSEE ONLY 50¢		
SPECIAL DELIVERY (extra fee required)		

PS Form 3800 NO INSURANCE COVERAGE PROVIDED— (See other side)
 Nov. 1971 NOT FOR INTERNATIONAL MAIL * GPO: 1970 O-397-458

No. 69117

PS Form 3800 NO INSURANCE COVERAGE PROVIDED--- (See other side)
Nov. 1971 NOT FOR INTERNATIONAL MAIL * GPO: 1970 O-387-480



SHELL OIL COMPANY

PETROLEUM BUILDING

P.O. BOX 1509

MIDLAND, TEXAS 79701

December 1, 1972

Subject: Shell-Amco Federal Lease
Shell-Amco Federal "A" Lease
Cato (San Andres) Field
Sections 33, 34, T-8-S, R-30-E
Chaves County, New Mexico

Amco Oil Corporation
390 Franklin Street
Denver, Colorado 80218

Gentlemen:

You are probably well aware of the severe decline in production that the Amco Federal and Amco Federal "A" Leases, in which you own an overriding Royalty Interest, have suffered in the past few years. To arrest this decline and to realize the maximum recovery possible, Shell Oil Company is instigating a program to waterflood the Cato (San Andres) Reservoir underlying these properties. It is estimated that this program will increase the recovery of the properties in which you are interested on the order of 500,000 barrels of oil.

We plan to submit to the New Mexico Conservation Commission early in December our application to waterflood these properties. Our plan of waterflooding will consist of converting initially five San Andres producing wells to water injection at the locations shown on the attached plat. Water for injection will be produced water from these properties and from Shell-operated salt water disposal wells.

The initial conversion of producing wells to injection wells will result in a reduction of production from these properties of approximately 65 barrels of oil per day. However, we believe that the reservoir is amenable to secondary recovery operations and that this reduction will be more than offset by the arresting of decline and a possible increase in the rate of production as the reservoir responds to waterflood efforts.

We sincerely hope that this information will be of help to you in your future reviews of these properties. If we can be of any further help in this regard, please advise.

Yours very truly,

Jack L. Mahaffey
Production Manager
Mid-Continent Division

WEB:SH

Attachment

OPERATORS
CATO (SAN ANDRES) FIELD
CHAVES COUNTY, NEW MEXICO

ADOBE OIL COMPANY
601 WILKINSON-FOSTER BLDG.
MIDLAND, TX 79701

AMOCO PRODUCTION COMPANY
P. O. BOX 68
HOBBS, NM 88240

ATLANTIC RICHFIELD COMPANY
P. O. BOX 1610
MIDLAND, TX 79701

THE EASTLAND OIL COMPANY
704 WESTERN UNITED LIFE BLDG.
MIDLAND, TX 79701

GLENN PETROLEUM CORP.
2902 MAPLE AVENUE
DALLAS, TX 75201

McCLELLAN OIL CORP.
P. O. BOX 848
ROSWELL, NM 88201

MWJ PRODUCING COMPANY
413 FIRST NAT'L. BANK BLDG.
MIDLAND, TX 79701

EUGENE E. NEARBURG
4219 SIGMA ROAD
DALLAS, TX 75240

J. CECIL RHODES
822 BUILDING OF THE SOUTHWEST
MIDLAND, TX 79701

SUN OIL COMPANY
P. O. BOX 1861
MIDLAND, TX 79701

TAMARACK PETROLEUM COMPANY, INC.
910 BUILDING OF THE SOUTHWEST
MIDLAND, TX 79701

TERRA RESOURCES, INC.
FOURTH NATIONAL BANK BUILDING
TULSA, OK 74119

UNION TEXAS PETROLEUM CORP.
1300 WILCO BUILDING
MIDLAND, TX 79701

THE WIL-MC OIL CORPORATION
607 FIDELITY UNION LIFE BLDG.
DALLAS, TX 75201

PROPOSED WATER INJECTION WELLS
CATO (SAN ANDRES) FIELD
CHAVES

Hodges Federal "B" No. 4 - Lease No. NM 022636

Location: Unit Letter M, 660' FSL, 660' FWL
Section 34, T-8-S, R-30-E, Chaves County, New Mexico.

Amco Federal No. 4 - Lease No. NM 0155254A

Location: Unit Letter G, 1980' FNL, 1980' FEL
Section 33, T-8-S, R-30-E, Chaves County, New Mexico.

Amco Federal No. 6

Location: Unit Letter O, 660' FSL, 1980' FEL
Section 33, T-8-S, R-30-E, Chaves County, New Mexico.

Amco Federal No. 7

Location: Unit Letter E, 660' FWL, 1980' FNL
Section 35, T-8-S, R-30-E, Chaves County, New Mexico.

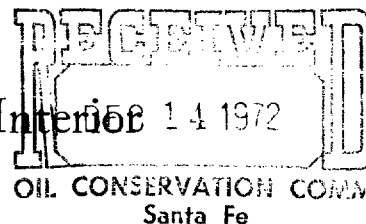
Amco Federal No. 8

Location: Unit Letter M, 660' FSL, 660' FWL
Section 33, T-8-S, R-30-E, Chaves County, New Mexico.



United States Department of the Interior

GEOLOGICAL SURVEY



P. O. Drawer U
Artesia, New Mexico 88210

Case 4882

December 12, 1972

Shell Oil Company
Post Office Box 1509
Midland, Texas 79701

Gentlemen:

Your letter of December 1, 1972 requests approval to institute and operate a waterflood project of the San Andres formation in the Cato pool, located in T. 8 and 9 S., R. 30 E., N.M.P.M., Chaves County, New Mexico involving that portion of Federal oil and gas leases described as follows:

New Mexico 0155254-A

T. 8 S., R. 30 E.
sec. 33: $W\frac{1}{2}$, $W\frac{1}{2}E\frac{1}{2}$, $E\frac{1}{2}SE\frac{1}{2}$
T. 9 S., R. 30 E.
sec. 4: $W\frac{1}{2}$

New Mexico 022636

T. 8 S., R. 30 E.
sec. 34: $W\frac{1}{2}$

The plan proposes to convert to water injection the following wells:

<u>Well Number and Lease</u>	<u>Location</u>
4 - Amoco Federal	1980/N&E sec. 33
6 - Amoco Federal	660/S 1980/E sec. 33
7 - Amoco Federal	1980/N 660/W sec. 33
8 - Amoco Federal	660/S&W sec. 33
4 - Hodges Federal "B"	660/S&W sec. 34

The plan for operating this project as proposed in the application is satisfactory to this office and hereby approved subject to approval by the New Mexico Oil Conservation Commission and the following:

1. This project will be operated in compliance with the New Mexico Oil Conservation Commission regulations governing waterflood operations.
2. Duplicate copies of a monthly progress report (N.M.O.C.C. form C-120 acceptable) are to be submitted to this office showing the volume of water injected and average pressure for the injection wells and production for the producing wells in the project area.
3. This approval does not preclude the necessity for further approval when the project is expanded to include other wells and leases or the necessity to submit the usual notices and reports on wells involved. When this project is expanded to involve other operators and interests, the correlative rights of all concerned should be considered.

Sincerely yours,

(Orig. Sgd.) J.A.K.

James A. Knauf
District Engineer

cc:
N.M.O.C.C., Santa Fe ✓
Roswell
Accounts



OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

GOVERNOR
BRUCE KING
CHAIRMAN

LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER

STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

January 9, 1973

Mr. Owen Lopez
Montgomery, Federici, Andrews,
Hannahs, & Morris
Attorneys at Law
Post Office Box 2307
Santa Fe, New Mexico

Re: Case No. 4882
Order No. R-4462
Applicant:
Shell Oil Company

Dear Sir:

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

Very truly yours,

A. L. PORTER, Jr.
Secretary-Director

ALP/ir

Copy of order also sent to:

Hobbs OCC x
Artesia OCC x
Aztec OCC

Other Mr. D. E. Gray - State Engineer Office, Santa Fe

SHELL OIL COMPANY
WATER ANALYSIS REPORT
MID-CONTINENT DIVISION

SAMPLE DESCRIPTION

COMPANY Shell Oil Company
 FIELD Caddo San Andres
 LEASE Shell Federal
 WELL NUMBER #1 SWD
 COUNTY & STATE Chaves, N. m.
 PRODUCING FORMATION _____
 WHERE SAMPLED Triplex discharge.
 REMARKS _____

LABORATORY Martin Water Laboratories
 LABORATORY NUMBER 127241
 DATE SAMPLE TAKEN 12-4-72
 DATE SAMPLE RECEIVED 12-12-72
 DATE SAMPLE REPORTED 12-12-72

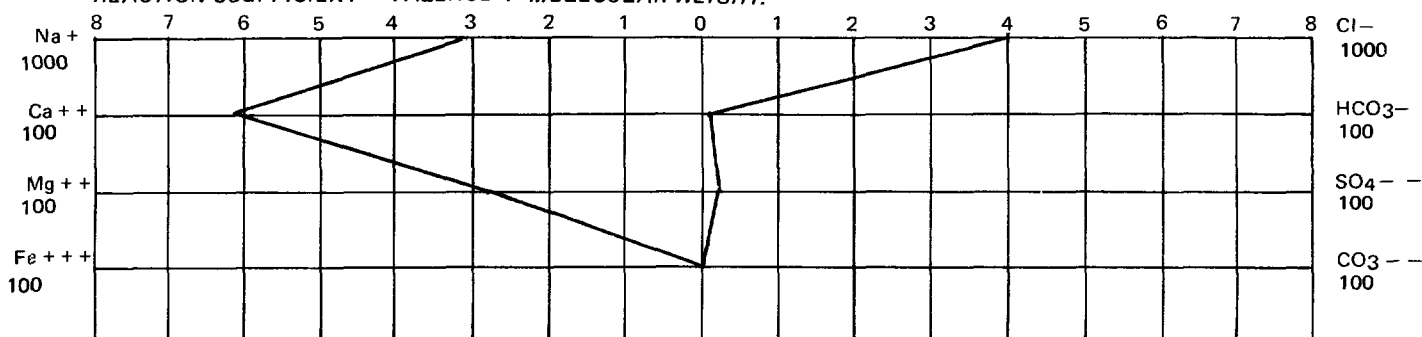
CHEMICAL AND PHYSICAL PROPERTIESTOTAL HARDNESS Mg/L AS Ca CO₃ 44,500TOTAL ALKALINITY Mg/L AS Ca CO₃ 670

CONSTITUENT	Mg/LITER	REACT. COEF.	Meq/LITER
SODIUM (INCL. POTASSIUM) AS Na ⁺	71,664	0.04350	3,116.0
CALCIUM - Ca ⁺⁺	12,200	0.04990	610.0
MAGNESIUM - Mg ⁺⁺	3,402	0.08224	279.8
IRON TOTAL - Fe ⁺⁺ & Fe ⁺⁺⁺	15	0.03581	0.5
BARIUM - Ba ⁺⁺		0.01460	
POSITIVE SUB-TOTAL	87,281		4,006.3
CHLORIDE - Cl ⁻	140,618	0.02820	3,965.4
CARBONATE & BICARBONATE - CO ₃ ⁼ & HCO ₃ ⁻	817	0.01639 *	13.4
SULFATE - SO ₄ ⁼	1,083	0.02082	22.5
HYDROXYL - OH ⁻	0	0.05880	0.0
SULFIDE - S ⁼	80	0.06238	5.0
NEGATIVE SUB-TOTAL	142,598		4,006.3
TOTAL DISSOLVED SOLIDS	229,879		8,012.6

* BICARBONATE

SPECIFIC GRAVITY 1.1507 @ 60 °F pH 6.8 RES. 0.056 @ 80 °FANALYST W. Reagan White
REQUESTED BY B. W. Best

REACTION VALUE = (MILLIGRAMS/LITER) X (REACTION COEFFICIENT)
 REACTION COEFFICIENT = VALENCE ÷ MOLECULAR WEIGHT.



WATER ANALYSIS
CATO-SAN ANDRES FIELD
CHAVES COUNTY, NEW MEXICO

	PROPOSED WATER SOURCE WELL		PROPOSED INJECTION WELL	
	SALT WATER DISPOSAL WATER		PRODUCED WATER	
	SHELL FED. #1 Mg/L	THELMA CROSBY "F" 1 Mg/L	AMCO FED. #6 Mg/L	AMCO FED. #7 Mg/L
Specific Gravity	1.1507	1.1431	1.1427	1.1543
Ph	6.8	7.1	6.5	6.8
Rw	0.056	0.059	0.058	0.055
Total Dissolved Solids	229,879	225,096	221,459	253,048
Calcium and Barium Ca & Ba ⁺⁺	12,200	7,500	9,100	14,800
Magnesium Mg ⁺⁺	3,402	2,612	3,159	4,799
Sodium & Potassium Na & K ⁺	71,664	76,092	72,153	75,847
Bicarbonate HCO ₃ ⁻⁻	817	946	799	586
Sulfate So ₄ ⁻⁻	1,083	1,482	1,140	728
Chloride Cl ⁻	140,618	136,356	134,936	156,242
Iron Fe ⁺⁺	15	0	7.1	9.5
Sulphur	80	108	165	36.2

SHELL OIL COMPANY
WATER ANALYSIS REPORT
MID-CONTINENT DIVISION

SAMPLE DESCRIPTION

COMPANY Shell Oil Company
FIELD Caddo San Andres
LEASE Amoco Federal
WELL NUMBER #7
COUNTY & STATE Chaves, N. M.
PRODUCING FORMATION _____
WHERE SAMPLED wellhead
REMARKS _____

LABORATORY Martin Water Laboratories
LABORATORY NUMBER 127243
DATE SAMPLE TAKEN 12-4-72
DATE SAMPLE RECEIVED 12-12-72
DATE SAMPLE REPORTED 12-12-72

CHEMICAL AND PHYSICAL PROPERTIES

TOTAL HARDNESS Mg/L AS Ca CO₃ 56,750

TOTAL ALKALINITY Mg/L AS Ca CO₃ 480

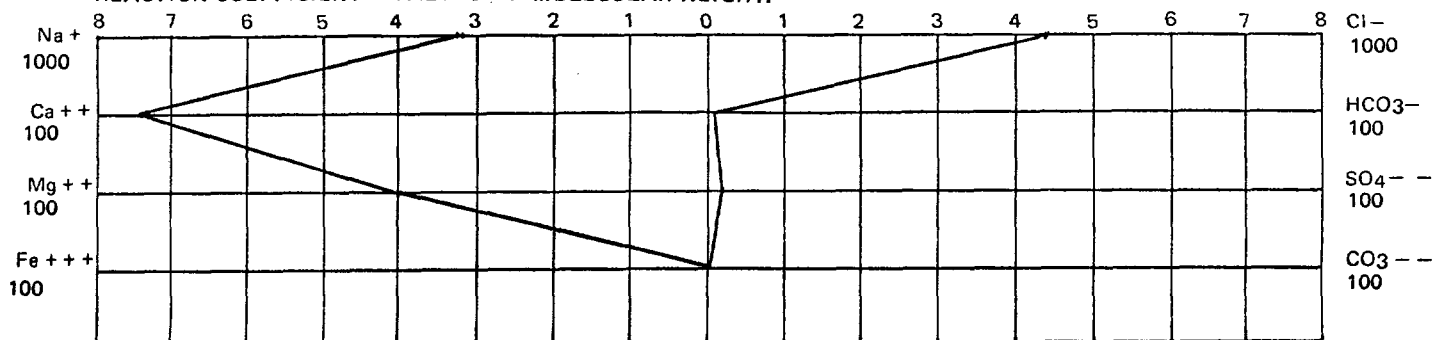
CONSTITUENT	Mg/LITER	REACT. COEF.	Meq/LITER
SODIUM (INCL. POTASSIUM) AS Na ⁺	75,847	0.04350	3,297.7
CALCIUM - Ca ⁺⁺	14,800	0.04990	740.0
MAGNESIUM - Mg ⁺⁺	4,799	0.08224	395.0
IRON TOTAL - Fe ⁺⁺ & Fe ⁺⁺⁺	9.5	0.03581	0.3
BARIUM - Ba ⁺⁺		0.01460	
POSITIVE SUB-TOTAL	95,456		4,433.0
CHLORIDE - Cl ⁻	156,242	0.02820	4,406.1
CARBONATE & BICARBONATE - CO ₃ = & HCO ₃ -	586	0.01639 *	9.6
SULFATE - SO ₄ =	728	0.02082	15.1
HYDROXYL - OH -	0	0.05880	0.0
SULFIDE - S =	36.2	0.06238	2.2
NEGATIVE SUB-TOTAL	157,592		4,433.0
TOTAL DISSOLVED SOLIDS	253,048		8,866.0

* BICARBONATE

SPECIFIC GRAVITY 1.1543 @ 60 °F pH 6.8 RES. 0.055 @ 80 °F

ANALYST W. Reagan White
REQUESTED BY B. W. Best

REACTION VALUE = (MILLIGRAMS/LITER) X (REACTION COEFFICIENT)
REACTION COEFFICIENT = VALENCE ÷ MOLECULAR WEIGHT.



SHELL OIL COMPANY
WATER ANALYSIS REPORT
MID-CONTINENT DIVISION

SAMPLE DESCRIPTION

COMPANY Shell Oil Company
FIELD Caddo San Andres
LEASE Amoco Federal
WELL NUMBER #6
COUNTY & STATE Chaves, N. M.
PRODUCING FORMATION _____
WHERE SAMPLED wellhead
REMARKS _____

LABORATORY Martin Water Laboratories
LABORATORY NUMBER 127244
DATE SAMPLE TAKEN 12-4-72
DATE SAMPLE RECEIVED 12-12-72
DATE SAMPLE REPORTED 12-12-72

CHEMICAL AND PHYSICAL PROPERTIES

TOTAL HARDNESS Mg/L AS Ca CO₃ 35,750

TOTAL ALKALINITY Mg/L AS Ca CO₃ 655

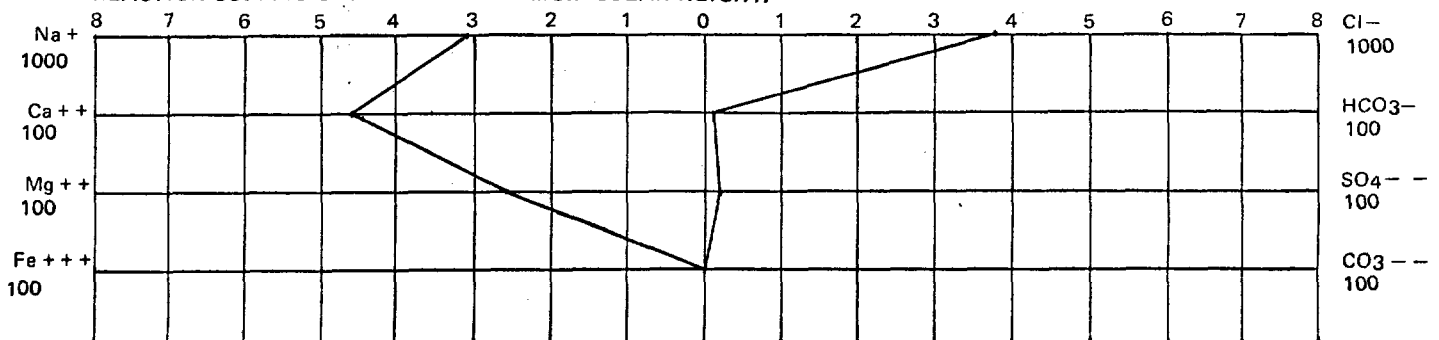
CONSTITUENT	Mg/LITER	REACT. COEF.	Meq/LITER
SODIUM (INCL. POTASSIUM) AS Na ⁺	72,153	0.04350	3,137.0
CALCIUM - Ca ⁺⁺	9,100	0.04990	455.0
MAGNESIUM - Mg ⁺⁺	3,159	0.08224	260.0
IRON TOTAL - Fe ⁺⁺ & Fe ⁺⁺⁺	7.1	0.03581	0.3
BARIUM - Ba ⁺⁺		0.01460	
POSITIVE SUB-TOTAL	84,419		3,852.3
CHLORIDE - Cl ⁻	134,936	0.02820	3,805.2
CARBONATE & BICARBONATE - CO ₃ ⁼ & HCO ₃ ⁻	799	0.01639 *	13.1
SULFATE - SO ₄ ⁼	1,140	0.02082	23.7
HYDROXYL - OH ⁻	0	0.05880	0.0
SULFIDE - S ⁼	165	0.06238	10.3
NEGATIVE SUB-TOTAL	137,040		3,852.3
TOTAL DISSOLVED SOLIDS	221,459		7,704.6

* BICARBONATE

SPECIFIC GRAVITY 1.1427 @ 60 °F pH 6.5 RES. 0.058 @ 80 °F

ANALYST W. Reagan White
REQUESTED BY B. W. Best

REACTION VALUE = (MILLIGRAMS/LITER) X (REACTION COEFFICIENT)
REACTION COEFFICIENT = VALENCE ÷ MOLECULAR WEIGHT.



SHELL OIL COMPANY
WATER ANALYSIS REPORT
MID-CONTINENT DIVISION

SAMPLE DESCRIPTION

COMPANY Shell Oil Company
FIELD Caddo San Andres
LEASE Thelma Crosby "F"
WELL NUMBER #1 SWD
COUNTY & STATE Chaves, N. M.
PRODUCING FORMATION _____
WHERE SAMPLED Triplex discharge
REMARKS _____

LABORATORY Martin Water Laboratories
LABORATORY NUMBER 127242
DATE SAMPLE TAKEN 12-4-72
DATE SAMPLE RECEIVED 12-12-72
DATE SAMPLE REPORTED 12-12-72

CHEMICAL AND PHYSICAL PROPERTIES

TOTAL HARDNESS Mg/L AS Ca CO₃ 29,500

TOTAL ALKALINITY Mg/L AS Ca CO₃ 775

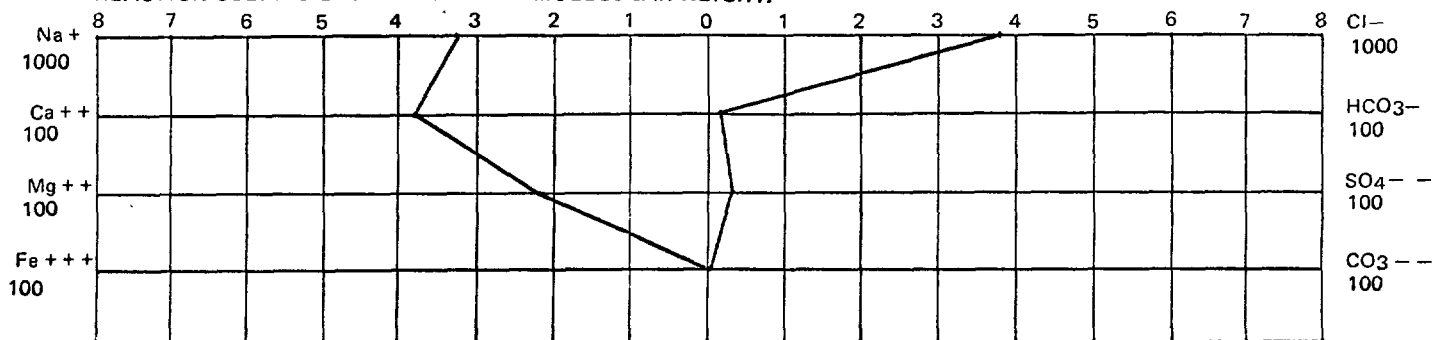
CONSTITUENT	Mg/LITER	REACT. COEF.	Meq/LITER
SODIUM (INCL. POTASSIUM) AS Na ⁺	76,092	0.04350	3,308.2
CALCIUM - Ca ⁺⁺	7,500	0.04990	375.0
MAGNESIUM - Mg ⁺⁺	2,612	0.08224	215.0
IRON TOTAL - Fe ⁺⁺ & Fe ⁺⁺⁺	0.79	0.03581	0.0
BARIUM - Ba ⁺⁺		0.01460	
POSITIVE SUB-TOTAL	86,204		3,898.2
CHLORIDE - Cl ⁻	136,356	0.02820	3,845.2
CARBONATE & BICARBONATE - CO ₃ ⁼ & HCO ₃ ⁻	946	0.01639 *	15.5
SULFATE - SO ₄ ⁼	1,482	0.02082	30.8
HYDROXYL - OH ⁻	0	0.05880	0.0
SULFIDE - S ⁼	108	0.06238	6.7
NEGATIVE SUB-TOTAL	138,892		3,898.2
TOTAL DISSOLVED SOLIDS	225,096		7,796.4

* BICARBONATE

SPECIFIC GRAVITY 1.1431 @ 60 °F pH 7.1 RES. 0.059 @ 80 °F

ANALYST W. Reagan White
REQUESTED BY B. W. Best

REACTION VALUE = (MILLIGRAMS/LITER) X (REACTION COEFFICIENT)
REACTION COEFFICIENT = VALENCE ÷ MOLECULAR WEIGHT.



DATE	AMCO FEDERAL			AMCO FEDERAL "A"			HODGES FEDERAL "B"		
	BOPM	BWPD	MCF GPM	BOPM	BWPM	MCF GPM	BOPM	BWPM	MCF GPM
1-71	23,393	27,699	28,128	6,584	2,348	2,925	1,426	9,589	3,377
2-71	18,035	22,058	21,143	4,577	12,858	2,126	2,099	14,231	3,426
3-71	17,118	26,804	22,667	5,812	21,676	2,198	2,470	16,848	4,176
4-71	18,678	31,369	24,836	5,295	19,183	2,613	2,399	19,924	3,881
5-71	18,198	33,946	28,908	5,115	18,705	1,874	1,086	8,474	3,224
6-71	17,702	32,052	35,898	4,950	19,126	2,396	1,952	17,261	3,839
7-71	19,062	34,105	36,520	5,125	20,448	2,598	2,478	28,758	4,562
8-71	16,686	31,658	36,885	5,126	20,357	2,559	1,684	17,990	2,950
9-71	16,328	33,746	33,079	4,950	19,862	2,273	857	9,784	2,562
10-71	15,511	34,229	36,132	4,961	23,523	3,092	893	12,329	4,200
11-71	11,958	29,772	29,741	4,350	21,110	3,072	847	12,264	4,381
12-71	10,880	38,667	23,067	3,876	24,349	3,002	1,240	8,296	5,638
1-72	11,937	34,409	29,643	2,135	16,436	2,615	925	6,527	5,284
2-72	10,509	42,841	18,784	3,584	17,517	2,398	1,063	8,017	4,994
3-72	9,376	37,966	20,386	3,118	15,314	2,407	826	6,118	5,470
4-72	9,729	64,806	18,377	3,086	9,763	2,179	774	6,460	4,804
5-72	5,486	228,587	22,832	4,386	24,459	2,268	764	5,372	4,076
6-72	7,036	79,028	19,081	4,601	18,447	2,325	747	3,358	3,908
7-72	5,531	68,208	18,046	4,035	15,712	1,998	517	4,063	3,847
8-72	4,218	27,144	17,883	5,093	16,588	1,985	431	1,664	1,697
9-72	4,831	38,716	17,014	4,677	18,707	2,412	400	62,025	1,737
TOTAL	1,125,473	881,032	871,565	381,239	434,155	144,325	208,168	523,529	175,719

SHELL AMCO-HODGES-FEDERAL
WATERFLOOD PROJECT

DATE	AMCO FEDERAL			AMCO FEDERAL "A"			HODGES FEDERAL "B"		
	BOPM	BWPD	MCF GPM	BOPM	BWPM	MCF GPM	BOPM	BWPM	MCF GPM
9-67	---	---	---	---	---	---	1,893	---	492
10-67	864	---	---	---	---	---	1,826	165	475
11-67	8,276	---	---	---	---	---	2,116	1,552	537
12-67	12,942	130	2,432	1,456	---	---	1,912	1,153	820
1-68	17,648	121	2,572	3,942	380	1,197	2,269	1,457	990
2-68	22,601	1,067	7,542	6,541	886	2,330	3,683	1,062	651
3-68	25,669	110	8,541	9,157	1,093	3,062	4,796	2,653	1,074
4-68	24,071	155	8,113	8,599	293	2,909	4,712	8,831	1,009
5-68	25,216	197	8,484	9,004	90	3,041	4,774	4,040	1,042
6-68	24,255	442	8,198	8,660	531	2,937	4,972	3,947	1,009
7-68	25,134	1,116	8,484	8,977	635	3,043	5,407	6,840	1,009
8-68	25,002	1,108	1,495	8,933	632	796	5,331	6,543	237
9-68	24,409	1,684	8,893	8,717	661	1,183	5,303	3,889	740
10-68	25,052	1,728	8,688	8,950	678	1,221	5,495	3,904	670
11-68	24,829	2,910	7,089	8,866	1,152	1,183	5,307	4,105	559
12-68	24,729	3,544	7,454	8,833	1,391	1,199	5,513	3,751	546
1-69	26,190	3,752	7,693	9,355	1,474	1,264	5,742	4,495	549
2-69	22,761	4,495	7,254	8,128	1,891	1,093	5,623	4,435	707
3-69	26,175	5,248	10,492	9,349	1,953	2,134	6,348	5,069	2,712
4-69	26,463	5,194	10,383	9,450	1,717	3,408	6,859	4,998	3,746
5-69	26,541	5,632	11,315	9,481	1,731	2,173	6,506	4,337	3,336
6-69	26,755	6,237	6,973	9,550	2,073	2,597	6,414	4,006	4,231
7-69	27,822	5,558	10,968	9,939	2,064	3,915	6,634	1,734	3,962
8-69	28,043	6,596	16,184	10,015	2,429	2,532	7,984	3,117	5,395
9-69	27,164	8,789	20,430	9,703	3,879	2,369	8,127	4,372	5,255
10-69	28,976	8,876	18,283	10,349	3,391	2,278	6,857	3,695	5,652
11-69	27,940	8,589	13,927	9,970	3,321	3,581	7,011	3,867	3,639
12-69	25,330	8,240	13,280	9,050	3,387	3,563	6,765	3,813	4,194
1-70	22,511	10,636	15,409	8,550	3,484	3,409	5,781	4,440	2,919
2-70	20,873	17,285	13,079	8,338	4,438	4,170	4,630	8,054	4,317
3-70	22,461	26,034	18,514	9,449	6,445	3,480	4,585	7,447	7,129
4-70	28,425	44,402	29,017	11,596	10,859	2,806	4,460	7,717	6,521
5-70	27,180	37,713	27,573	11,333	12,381	5,678	4,550	14,801	6,759
6-70	24,563	39,850	26,242	8,532	10,272	5,168	4,481	23,800	10,300
7-70	23,647	39,301	14,601	7,454	98,998	5,307	3,101	24,678	2,124
8-70	24,061	45,755	21,867	7,290	16,395	4,073	3,100	23,562	2,153
9-70	24,021	32,352	28,941	10,226	29,366	5,446	2,356	40,014	4,917
10-70	27,735	42,718	22,874	4,001	12,090	5,350	1,428	6,825	4,156
11-70	23,160	35,182	22,705	7,351	21,964	7,301	2,250	59,761	5,361
12-70	22,007	36,920	26,634	9,125	31,797	5,228	2,316	17,836	4,518

SHELL AMCO-HODGES-FEDERAL
WATERFLOOD PROJECT

<u>DATE</u>	<u>OIL, BPM</u>	<u>WATER, BPM</u>	<u>GAS, MCFPM</u>	<u>DATE</u>	<u>OIL, BPM</u>	<u>WATER, BPM</u>	<u>GAS, MCFPM</u>
9-67	1,893	---	492	1-71	31,403	39,636	34,430
10-67	2,690	165	475	2-71	24,711	49,147	26,695
11-67	10,392	1,552	537	3-71	25,400	65,328	29,041
12-67	16,310	1,283	3,252	4-71	26,372	70,476	31,330
				5-71	24,399	61,125	34,006
1-68	23,859	1,958	4,759	6-71	24,604	68,439	40,133
2-68	32,825	3,015	10,523	7-71	26,665	83,311	43,680
3-68	39,622	3,856	12,677	8-71	23,496	70,005	42,394
4-68	37,382	9,279	12,031	9-71	22,135	63,392	37,914
5-68	38,994	4,327	12,567	10-71	21,365	70,081	43,424
6-68	37,887	4,920	12,144	11-71	17,155	63,146	37,194
7-68	39,518	8,591	12,536	12-71	15,996	71,312	31,707
8-68	39,266	8,283	2,528				
9-68	38,429	6,234	10,816	1-72	14,997	57,372	37,542
10-68	39,497	6,310	10,579	2-72	15,156	68,375	26,176
11-68	39,002	8,167	8,831	3-72	13,320	59,398	28,263
12-68	39,075	8,686	9,199	4-72	13,589	81,033	25,360
				5-72	10,636	258,418	29,176
1-69	41,287	9,721	9,506	6-72	12,384	100,833	25,314
2-69	36,512	10,821	9,054	7-72	10,083	87,983	23,891
3-69	41,872	12,270	15,338	8-72	9,742	45,396	21,565
4-69	42,772	11,909	17,537	9-72	9,908	119,448	21,163
5-69	42,528	11,700	16,824				
6-69	42,719	12,316	13,801	TOTAL	1,714,880	1,838,716	1,191,609
7-69	44,392	9,356	18,845				
8-69	46,042	12,142	24,111				
9-69	44,994	17,040	28,054				
10-69	46,182	15,962	26,213				
11-69	44,921	15,777	21,147				
12-69	41,145	15,440	21,037				
1-70	36,842	18,560	21,737				
2-70	33,841	29,777	21,566				
3-70	36,495	39,926	29,123				
4-70	44,481	62,978	38,344				
5-70	43,063	64,895	40,010				
6-70	37,576	73,922	41,710				
7-70	34,202	162,977	19,826				
8-70	34,451	85,712	28,093				
9-70	36,603	101,732	39,304				
10-70	32,664	61,653	32,380				
11-70	32,761	116,907	35,367				
12-70	33,448	86,553	36,380				

CATO SAN ANDRES FIELD PRODUCTION, 9-1-72:

<u>Oil, Bbls.</u>	<u>Water, Bbls.</u>	<u>Gas, MCF</u>
12,174,000	6,914,000	20,327,000

**CATO FIELD
SHELL-AMCO-FEDERAL LEASE
PRODUCTION HISTORY**

OIL & WATER PRODUCTION (BBLs./MO.)

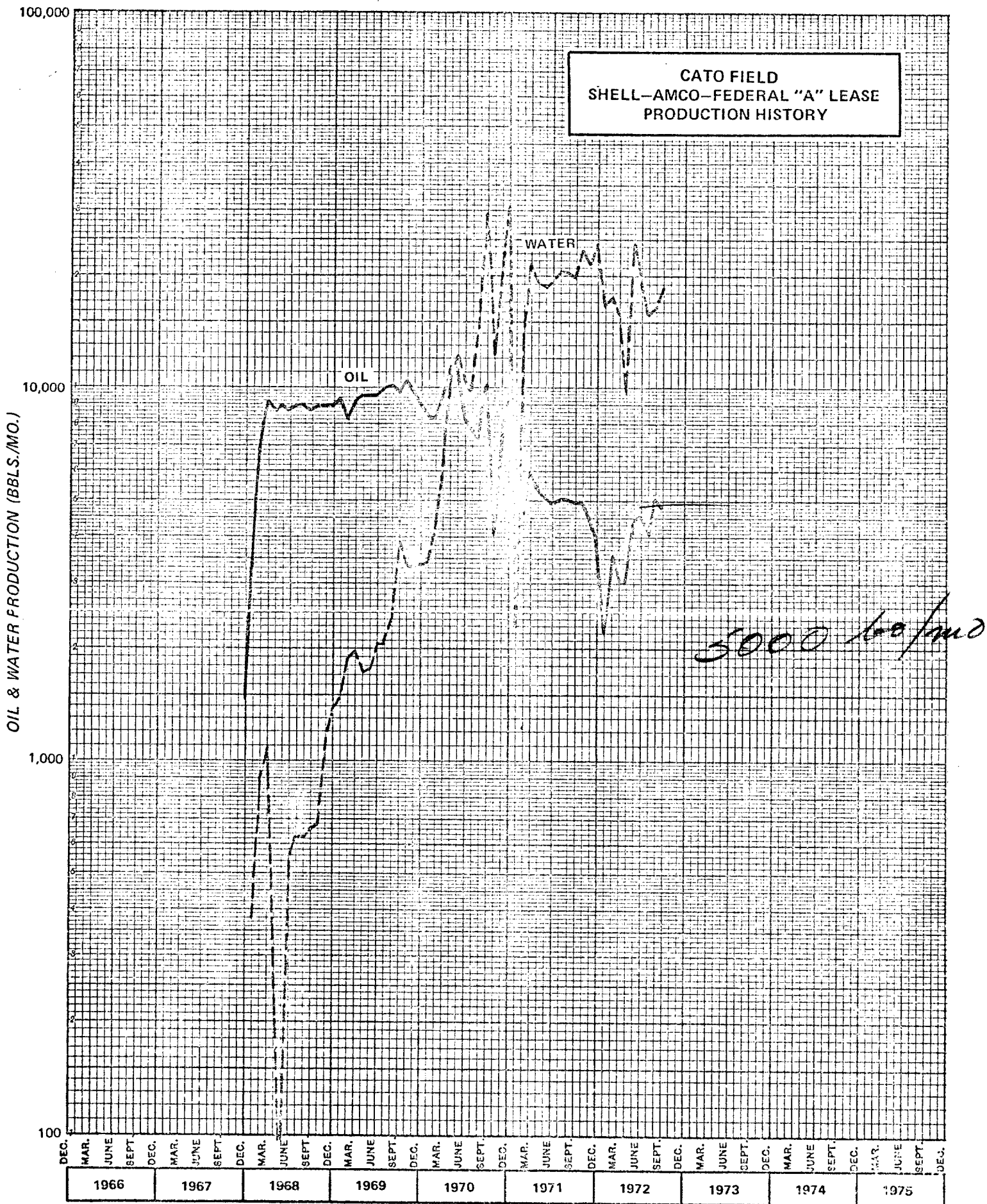
WATER

OIL

19 wells
4500 bbls
237 B/mo
8 bopd/a

Year	Month	Oil Production (BBLs./MO.)	Water Production (BBLs./MO.)
1966	DEC.	-	-
1967	MAR.	-	-
1967	JUNE	-	-
1967	SEPT.	-	-
1967	DEC.	~10,000	-
1968	MAR.	~25,000	~1,000
1968	JUNE	~25,000	~1,000
1968	SEPT.	~25,000	~1,000
1968	DEC.	~25,000	~1,000
1969	MAR.	~25,000	~1,000
1969	JUNE	~25,000	~1,000
1969	SEPT.	~25,000	~1,000
1969	DEC.	~25,000	~1,000
1970	MAR.	~25,000	~1,000
1970	JUNE	~25,000	~1,000
1970	SEPT.	~25,000	~1,000
1970	DEC.	~25,000	~1,000
1971	MAR.	~25,000	~1,000
1971	JUNE	~25,000	~1,000
1971	SEPT.	~25,000	~1,000
1971	DEC.	~25,000	~1,000
1972	MAR.	~25,000	~1,000
1972	JUNE	~25,000	~1,000
1972	SEPT.	~25,000	~1,000
1972	DEC.	~25,000	~1,000
1973	MAR.	~25,000	~1,000
1973	JUNE	~25,000	~1,000
1973	SEPT.	~25,000	~1,000
1973	DEC.	~25,000	~1,000
1974	MAR.	~25,000	~1,000
1974	JUNE	~25,000	~1,000
1974	SEPT.	~25,000	~1,000
1974	DEC.	~25,000	~1,000
1975	MAR.	~25,000	~1,000
1975	JUNE	~25,000	~1,000
1975	SEPT.	~25,000	~1,000
1975	DEC.	~25,000	~1,000

1945200
4500.00/mo
237 B/mo/wed
86000/wed



100

FOIL

400 k/mo
3.3 k/mo/well

**CATO FIELD
SHELL-HODGES-FEDERAL "B" LEASE
PRODUCTION HISTORY**

