

T 17 S

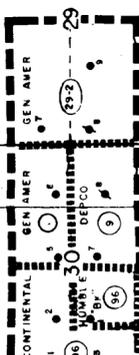
T 18 S

R 29 E

28

33

4



LEGEND

- UNIT BOUNDARY
- TRACT BOUNDARY
- TRACT NUMBER
- PARTIAL TRACTS
- RESIDUE GAS LINES
- PROPOSED GAS INJECTION WELLS

**EMPIRE ABO UNIT**  
 EDDY COUNTY, NEW MEXICO  
 PROPOSED GAS  
 INJECTION WELLS AND LINES  
 UNITIZED RESIDUE GAS INJECTION

DATE: 3-27-73  
 0' 180' 360'

R 28 E

28

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25

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UNIT OUTLINE

PHILLIPS GASOLINE PLANT

EMPIRE GASOLINE PLANT

T 17 S

T 18 S

R 27 E

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EMPIRE ABO POOL, EDDY COUNTY, NEW MEXICO  
 FUTURE RECOVERY PROJECTIONS AS THEY AFFECT STATE OF NEW MEXICO LEASES

	Competitive Natural Depletion (Non- Unitized)	Operational Method	
		Residue Gas Injection (Unitized)	Advantage of Unitized Case Over Non-Unitized Case
Pool Ultimate Oil Recovery (Percent of original oil-in-place)	45.0	52.9	+7.9
Pool Total Reserves After 7-1-73 (Bbls. Oil)	79,023,854	108,956,651	+29,932,797 (Reserve Increase: 37.9%)
State Leases Gross Reserves After 7-1-73 (Bbls. Oil)	60,734,252	77,702,773*	+16,968,521
12.5% Net Royalty Reserves for State Leases after 7-1-73 (Bbls. Oil)	7,591,781	9,712,847*	+ 2,121,066
Value of State Net Royalty Reserves After 7-1-73 (@ \$3.81/Bbl.)	\$28,924,686	\$37,005,947*	+\$8,081,261
Future Life After 7-1-73 (Years)	26	24	

\*Unitized Reserves are based on the proposed unit formula, which gives State leases the following share of a Field-wide Unit:

Phase I: 69.64897% (during first 11,000,000 BO after unitization)  
 Phase II: 71.50243% (Thereafter)

NOTE: Calculated oil lost for each year delay, due to starting unit operations and gas injection at a lower reservoir pressure: 2,050,000 Bbls. Oil lost per year delay.  
 State of New Mexico share of this loss:  
 (2,050,000)(.71315)(.125) = 182,834 Bbls. oil reserves lost per year delay.  
 Value of this lost oil = (\$3.81)(182,834) = \$694,883 lost to State per year delay.

511

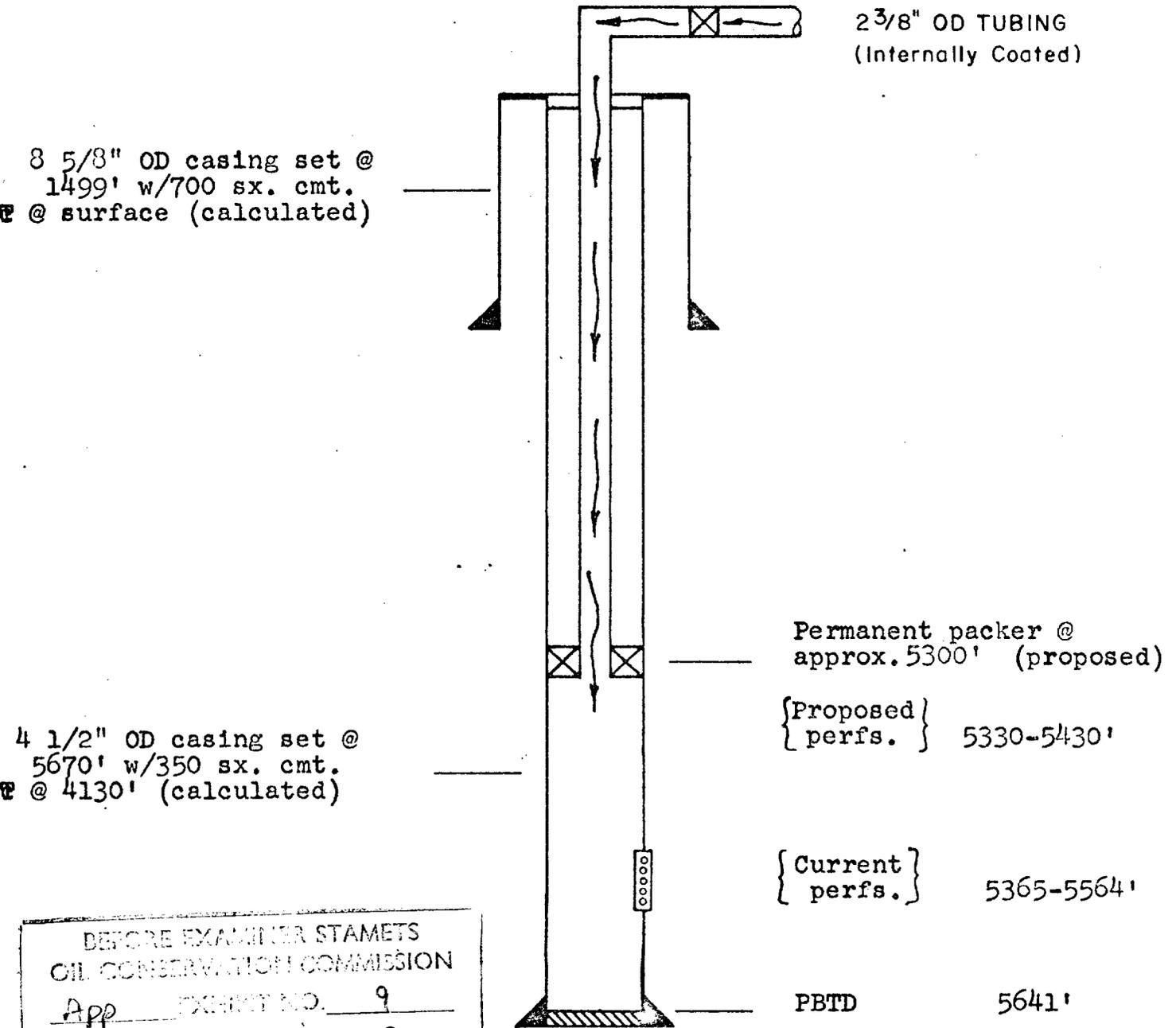
HUMBLE OIL AND REFINING COMPANY

Chalk Bluff Draw Unit A Well No. 4

990' FNL & 2310' FWL SEC. 9, T-18-S, R-27-E

EDDY COUNTY, NEW MEXICO

INJECTION WELL DIAGRAM



BEFORE EXAMINER STAMETS  
OIL CONSERVATION COMMISSION  
App EXHIBIT NO. 9  
CASE NO. 4952 & 4953  
Submitted by ARCO  
Hearing Date 25 April 1973

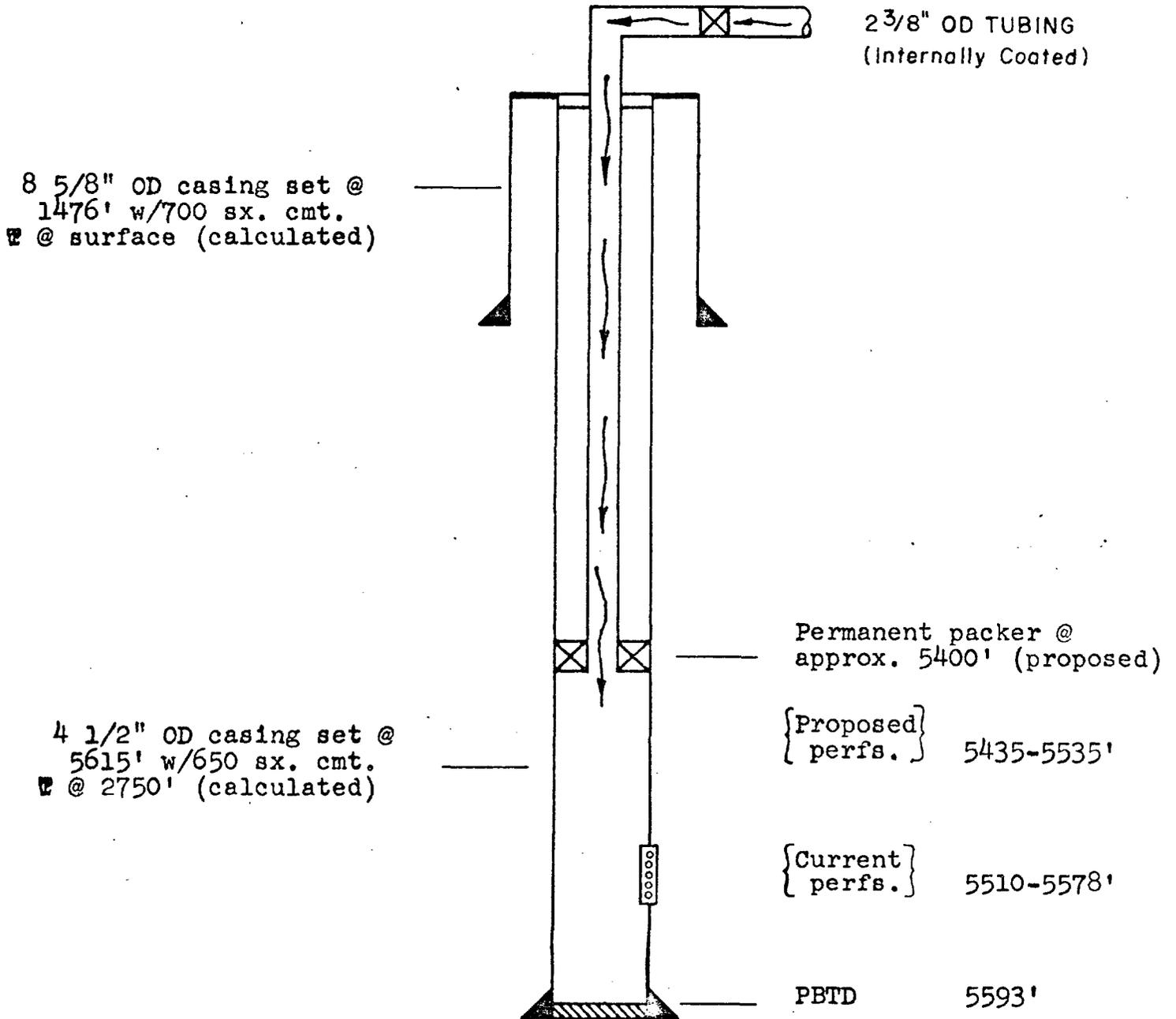
AMOCO PRODUCTION COMPANY

R.H. Windfohr Well No. 4

1582' FSL & 1645' FEL SEC. 4, T-18-S, R-27-E

EDDY COUNTY, NEW MEXICO

INJECTION WELL DIAGRAM



AMOCO PRODUCTION COMPANY

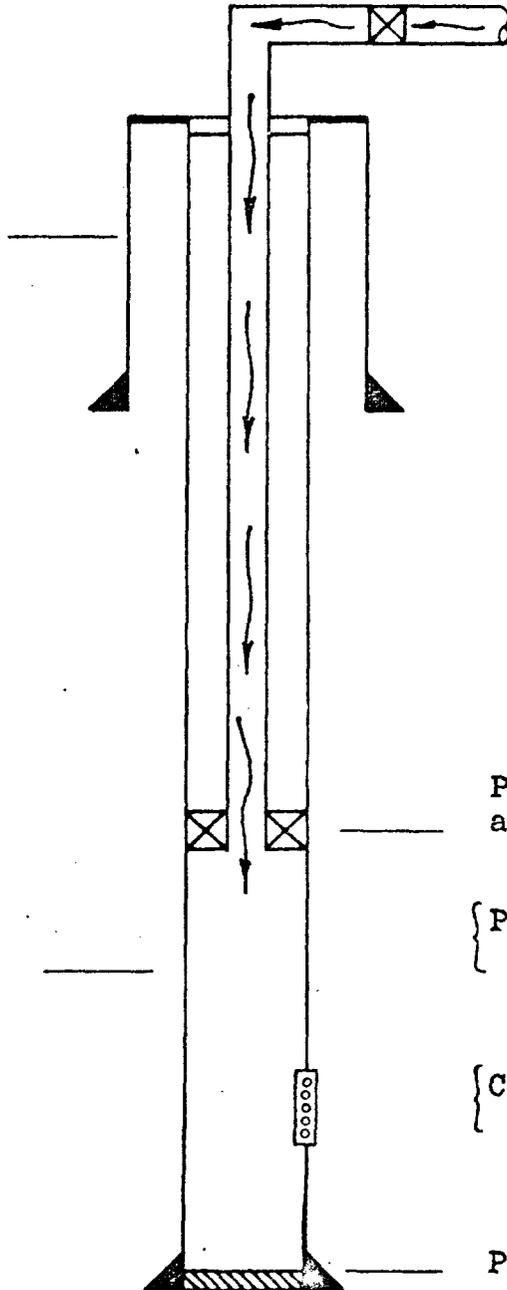
Malco "H" Federal Well No. 2

1980' FNL & 660' FEL SEC. 3, T-18-S, R-27-E

EDDY COUNTY, NEW MEXICO

INJECTION WELL DIAGRAM

8 5/8" OD casing cmt.  
@ 997' w/700 sx.  
(cmt. circulated)



2 3/8" OD TUBING  
(Internally Coated)

5 1/2" OD casing set @  
6123' w/350 sx. cmt.  
@ 4400' (Temp. Survey)

Permanent packer @  
approx. 5350' (proposed)

{ Proposed }  
perfs. } 5400-5500'

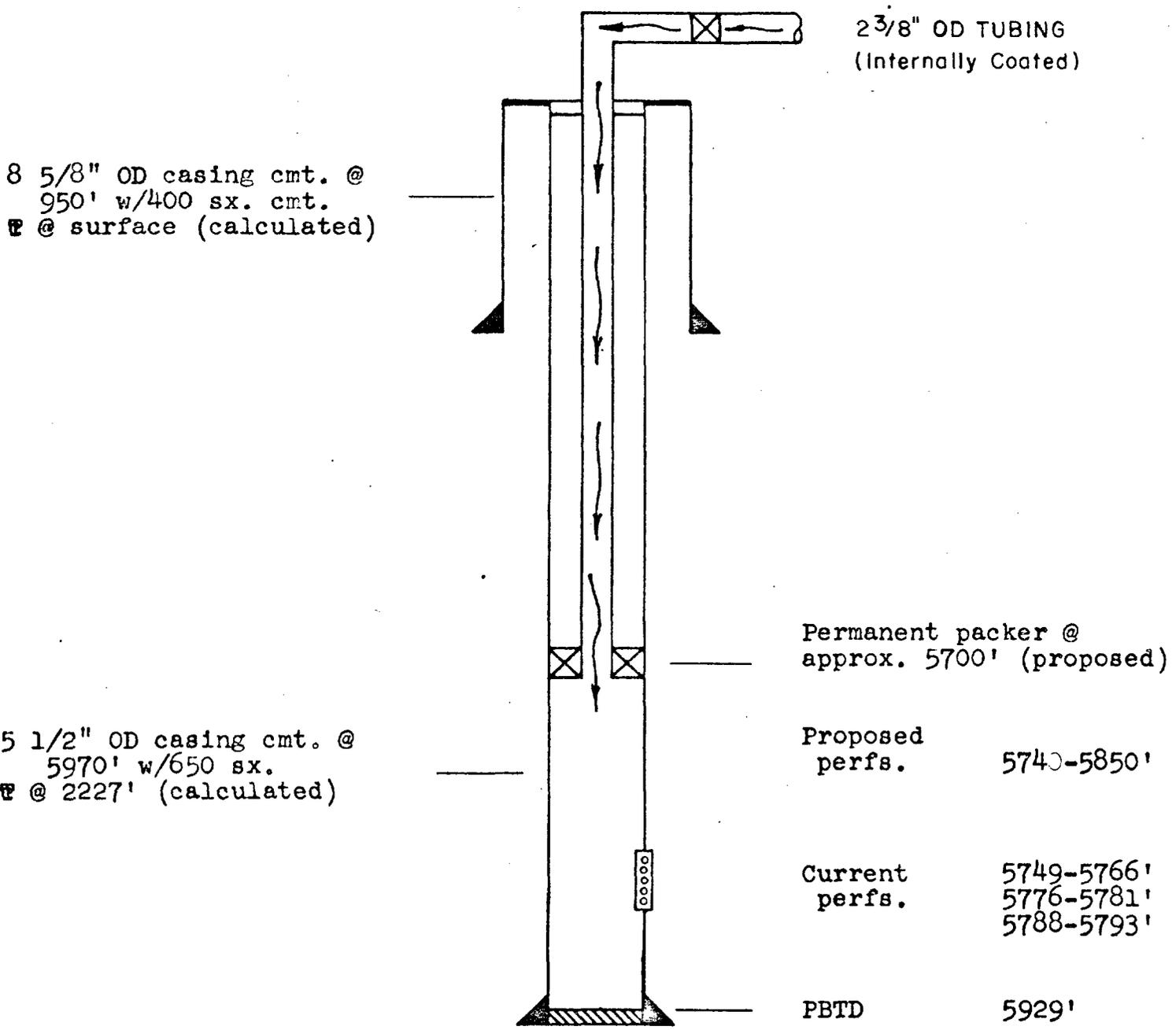
{ Current }  
perfs. } 5650-5670'

PBTD 6090'

MARTIN YATES, III  
 Dooley State ABO No. 2

1650' FSL & 1650' FEL SEC. 36, T-17-S, R-27-E

EDDY COUNTY, NEW MEXICO  
 INJECTION WELL DIAGRAM



8 5/8" OD casing cmt. @  
 950' w/400 sx. cmt.  
 @ surface (calculated)

2 3/8" OD TUBING  
 (Internally Coated)

Permanent packer @  
 approx. 5700' (proposed)

5 1/2" OD casing cmt. @  
 5970' w/650 sx.  
 @ 2227' (calculated)

Proposed  
 perfs. 5740-5850'

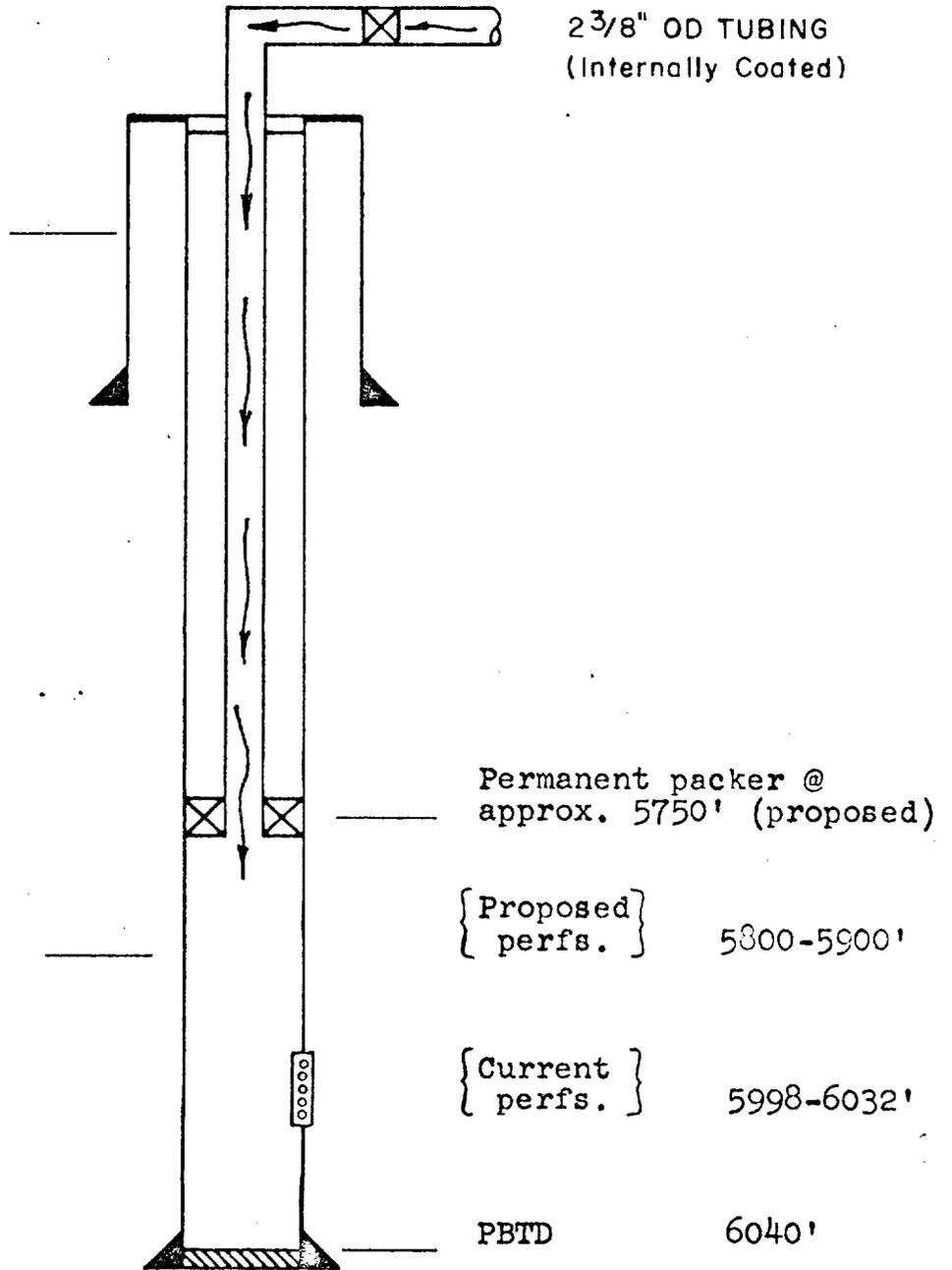
Current  
 perfs. 5749-5766'  
 5776-5781'  
 5788-5793'

PBTD 5929'

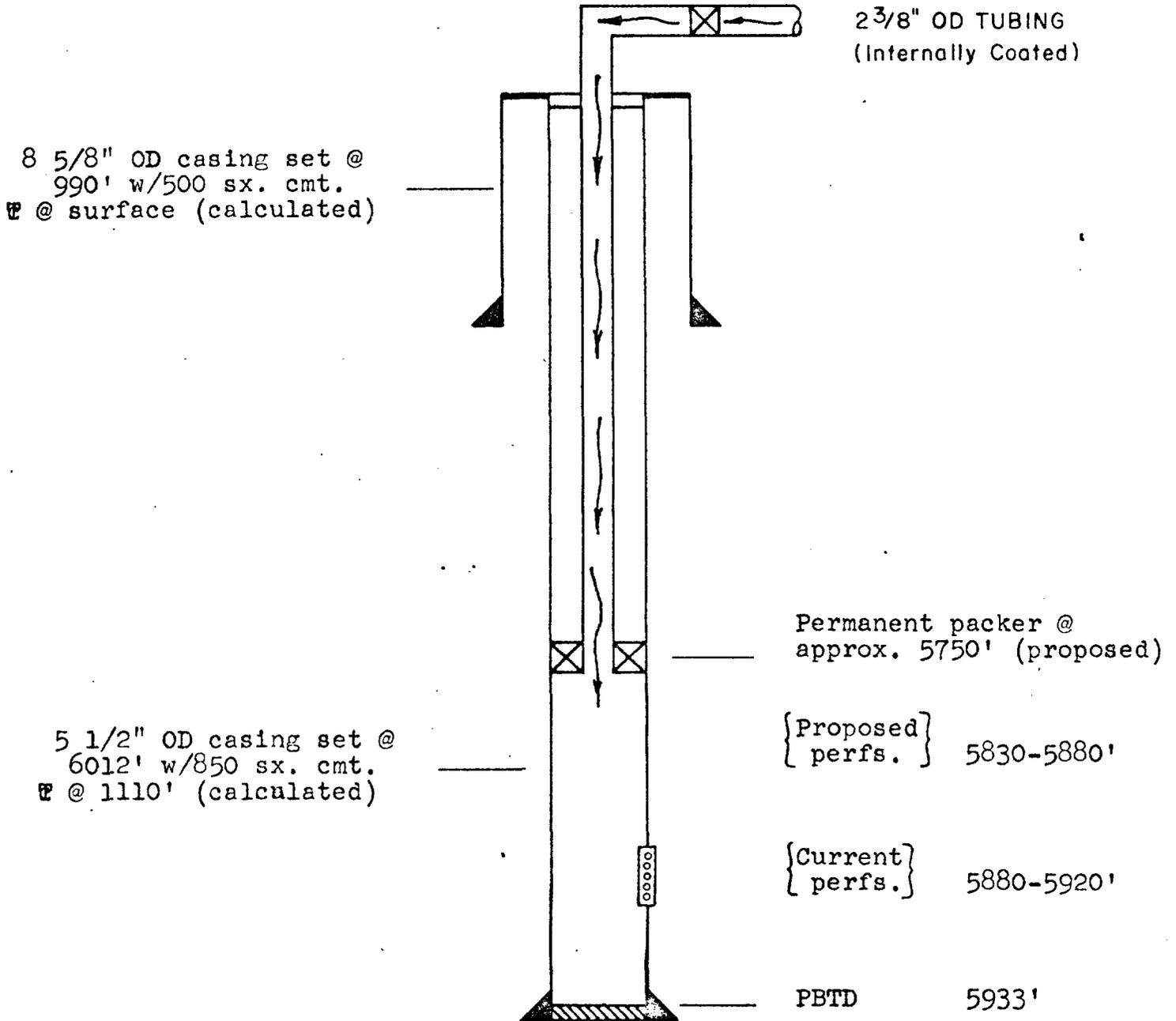
AMOCO PRODUCTION COMPANY  
 State "BM" Well No. 1  
 1650' FSL & 2387' FWL SEC. 31, T-17-S, R-28-E  
 EDDY COUNTY, NEW MEXICO  
 INJECTION WELL DIAGRAM

8 5/8" OD casing set @  
 1275' w/650 sx. cmt.  
 @ surface (calculated)

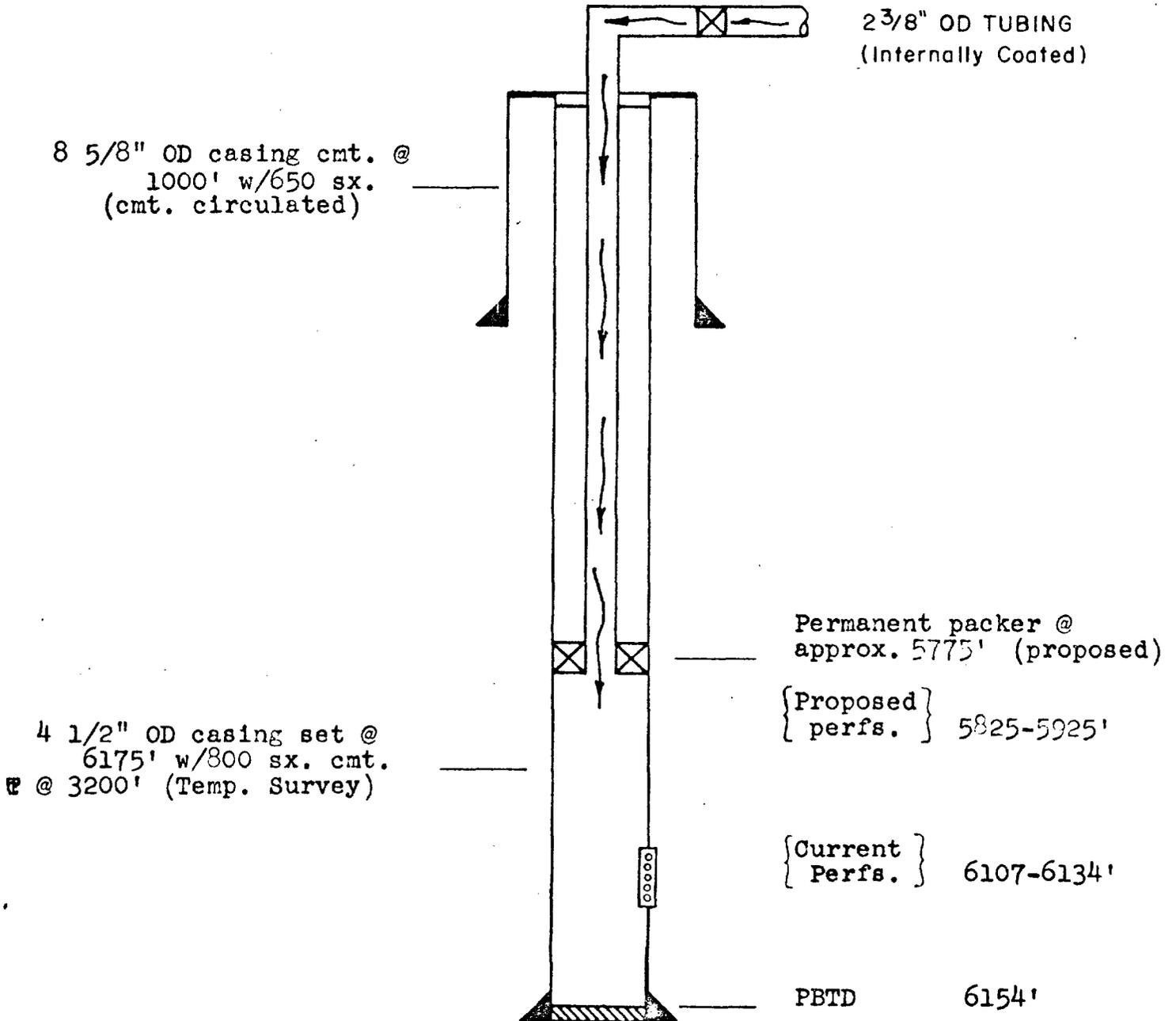
4 1/2" OD casing set @  
 6046' w/750 sx. cmt.  
 @ 2750' (calculated)



AMOCO PRODUCTION COMPANY  
 State "BV" Well No. 1  
 2280' FNL & 978' FEL SEC. 32, T-17-S, R-28-E  
 EDDY COUNTY, NEW MEXICO  
 INJECTION WELL DIAGRAM



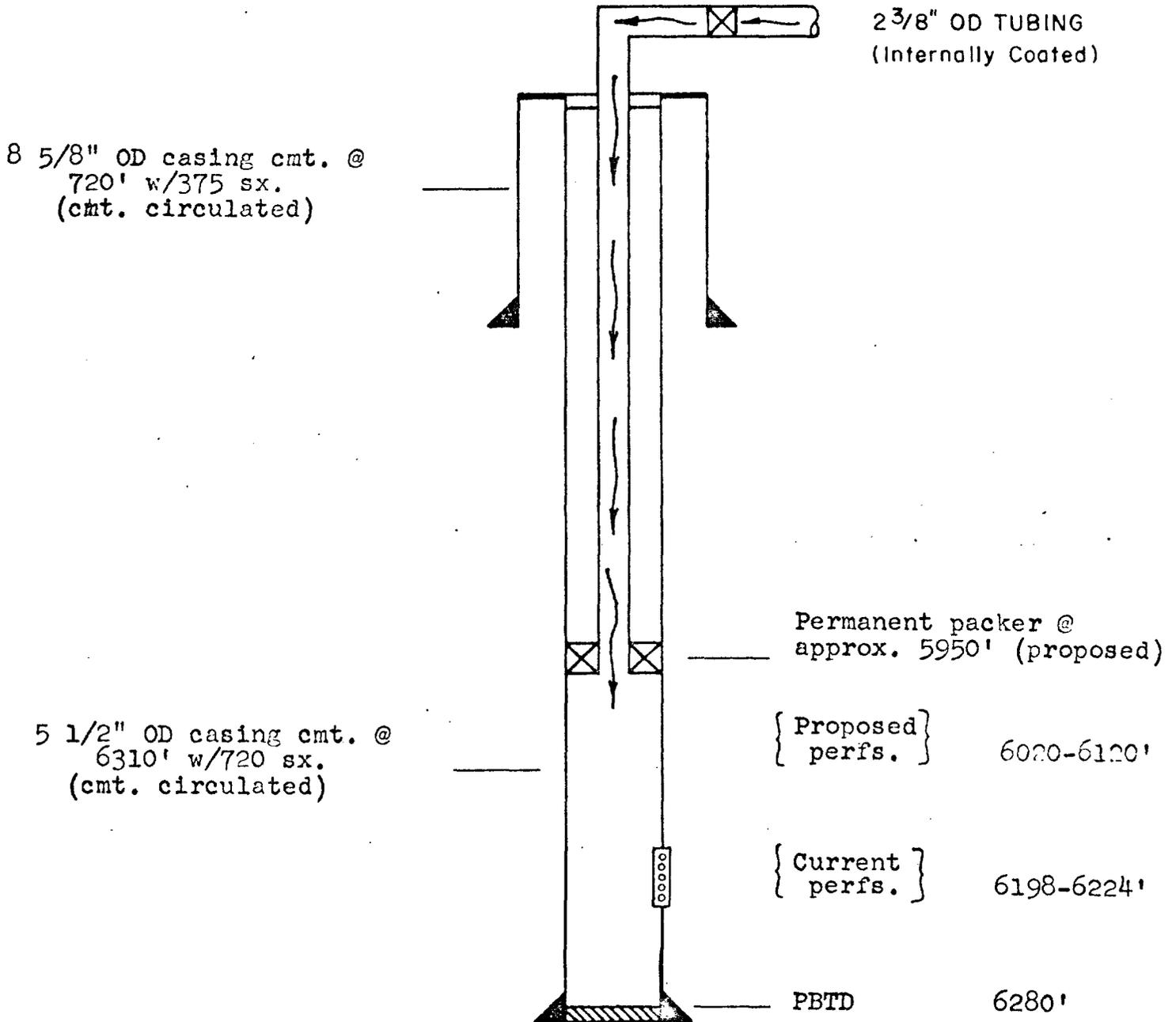
ATLANTIC RICHFIELD COMPANY  
*M. Yates "B" (ARC) Well No. 8*  
 1980' FNL & 2130' FEL SEC. 33, T-17-S, R-28-E  
 EDDY COUNTY, NEW MEXICO  
 INJECTION WELL DIAGRAM



HONDO OIL AND GAS COMPANY  
(ATLANTIC RICHFIELD COMPANY)

State "A" Well No. 21

1650' FSL & 1980' FWL SEC. 26, T-17-S, R-28-E  
EDDY COUNTY, NEW MEXICO  
INJECTION WELL DIAGRAM



EMPIRE ABO POOL

Potential Rate Benefits to New Mexico State Lands Leases  
by Unitization.

(Pool Total Requested Top Allowable: 42,000 BOPD\*)

Unitized State Rate Phase I: (42,000) (.6965)	=	29,253 BOPD
Non-Unitized State Rate: (25,600) (.6881)	=	<u>17,615 BOPD</u>
State Lease Rate Gain by Unitization	=	+11,638 BOPD
State Leases Net Royalty Gain by Unitization: (.125) (11,638)	=	1,455 BOPD
Value of State Leases Net Royalty Gain by Unitization (\$3.81) (1,455)	=	\$ 5,544/Day

(\*To be requested from N. M. O. C. C., supported by  
reservoir numeric model predictions.)

EMPIRE ABO UNIT AREA

Table of Fluid Properties (P Base = 15.025 P<sub>bp</sub> = 2231)

Tres. = 109°F (569° R)

<u>P<sub>r</sub></u> (PSIA)	<u>B<sub>O</sub></u> (RVBO/STBO)	<u>B<sub>g</sub></u> RVB/MCF	<u>R<sub>s</sub></u> (MCF/BBL)	<u>Z</u>
15.025	1.000	194.696	0	1.0
100	1.125	28.229	.180	.965
200	1.163	13.749	.235	.940
300	1.193	8.970	.290	.920
400	1.218	6.692	.345	.915
500	1.244	5.236	.395	.895
600	1.263	4.276	.445	.877
700	1.285	3.644	.495	.872
800	1.304	3.108	.540	.850
900	1.325	2.746	.585	.845
1000	1.344	2.437	.625	.833
1100	1.364	2.178	.675	.819
1200	1.384	1.962	.725	.805
1300	1.404	1.790	.775	.795
1400	1.425	1.649	.825	.789
1500	1.445	1.516	.875	.777
1600	1.465	1.404	.925	.768
1700	1.485	1.304	.975	.758
1800	1.505	1.220	1.025	.751
1900	1.525	1.147	1.075	.745
2000	1.548	1.053	1.125	.720
2100	1.573	1.000	1.175	.718
2200	1.597	.953	1.225	.717
2231	1.606	.939	1.250	.716

P<sub>r</sub> = Reservoir average pressure at datum -2264' subsea, lbs/in<sup>2</sup> absolute.

B<sub>O</sub> = Oil formation volume factor, reservoir volumetric bbls/stock tank bbl.

B<sub>g</sub> = Gas formation volume factor, reservoir volumetric bbls/thousand std. cu. ft.

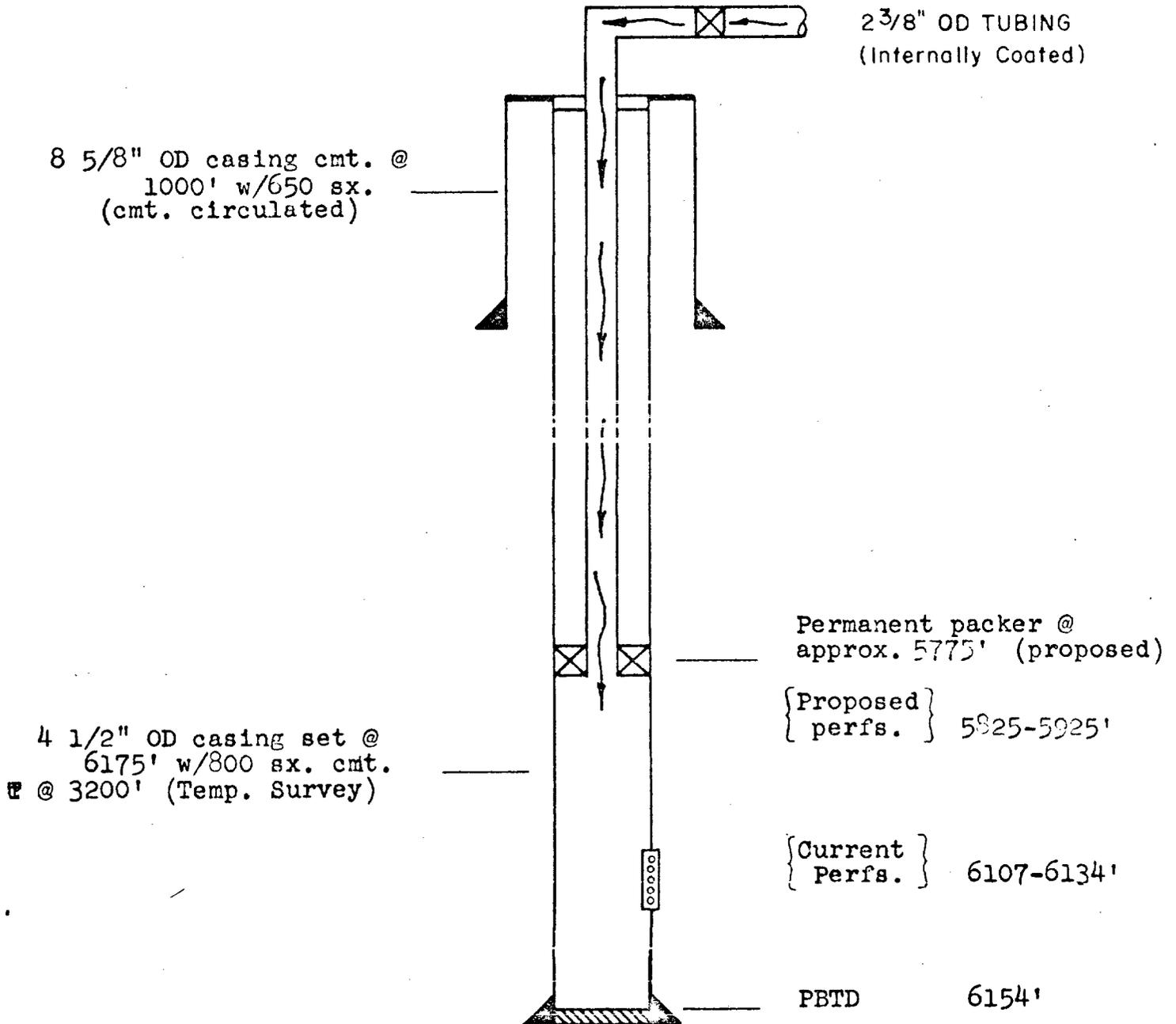
R<sub>s</sub> = Solution Gas/Oil Ratio, Thousand std. cu. ft./stock tank bbls. oil.

Z = Gas Compressibility Factor.

EXHIBIT \_\_\_\_\_

ATLANTIC RICHFIELD COMPANY  
M. Yates "B" (ARC) Well No. 8  
1980' FNL & 2130' FEL SEC. 33, T-17-S, R-28-E  
EDDY COUNTY, NEW MEXICO  
INJECTION WELL DIAGRAM

EMPIRE ABC UNIT  
PLAN OF OPERATION  
EXHIBIT 4



112... 4953



# United States Department of the Interior

GEOLOGICAL SURVEY  
WASHINGTON, D.C. 20242

AUG 10 1972

*Atlantic Richfield Company  
P.O. Box 1610  
Midland, Texas 79701*

*Attention: Mr. R. E. Howard*

*Gentlemen:*

*Your application of November 18, 1971, revised by letters of January 14, 1972, and July 7, 1972, filed with the Area Oil and Gas Supervisor, Roswell, New Mexico, requests the designation of the Empire Abo unit area embracing 11,339.15 acres, more or less, Eddy County, New Mexico, as logically subject to operation under the unitization provisions of the Mineral Leasing Act, as amended.*

*Unitization is for the purpose of conducting more efficient operation with partial pressure maintenance by the injection of residue gas and will be limited to the Abo formation as defined by Section 2(h) of the unit agreement. You estimate that such operations will result in the recovery of approximately 30,000,000 barrels of additional oil.*

*The land requested, as outlined on your plat marked "Exhibit A, Empire Abo unit, Eddy County, New Mexico," is hereby designated as a logical unit area. In order that the land now included in the Chalf Bluff unit area may be incorporated into the Empire Abo unit agreement, the Chalf Bluff unit agreement should be terminated.*

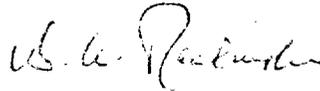
*Your proposed form of unit agreement will be acceptable if modified as indicated. One marked copy of the form is returned herewith, one copy is being retained, and one copy is being sent to the Oil and Gas Supervisor, Roswell, New Mexico. We hereby concur in the Supervisor's recommendation that the proposed basis for allocating unitized production be accepted.*

*The format of the sample exhibits attached to the 1968 reprint of the Form of Unit Agreement for Unproved Areas should be followed closely, including the latest status of all acreage, in the preparation of Exhibits A and B.*

In the absence of any objection not now apparent, a duly executed agreement conformed to the returned copy and approved by the appropriate officials of the State of New Mexico will be approved if submitted in approvable status within a reasonable period of time. However, the right is reserved to deny approval of any executed agreement that, in our opinion, does not have full commitment of sufficient lands to afford effective control of operations in the unit area. ✓

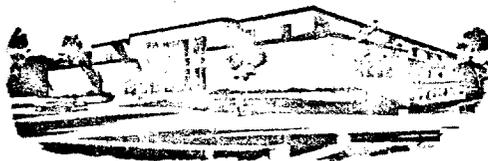
As the unit area contains State of New Mexico lands, we are sending a copy of this letter to the Commissioner of Public Lands of the State of New Mexico in Santa Fe. Please contact the State of New Mexico before soliciting joinders, regardless of prior contacts with or clearance from the State.

Sincerely yours,



Acting Director

# State of New Mexico



## Commissioner of Public Lands

August 30, 1972

ALEX J. ARMIJO  
COMMISSIONER

P. O. BOX 1148  
SANTA FE, NEW MEXICO

Atlantic Richfield Company  
P. O. Box 1610  
Midland, Texas 79701

Re: Proposed Empire Abo Unit  
Eddy County, New Mexico

ATTENTION: Mr. W. L. Embry

Gentlemen:

We have reviewed the proposed unexecuted copy, as well as the modified copy by the USGS and exhibits for the captioned unit and find that it meets with the requirements of the Commissioner of Public Lands, therefore, the Commissioner approves the proposed agreement for the Empire Abo Unit as to form and content.

Your Exhibit "B" requires the following changes.

<u>TRACT NO.</u>	<u>CHANGE TO BE MADE</u>
48	Sec. 31-17S- <u>27E</u> (should be <u>28E</u> )
56	Sec. 28- <u>27S</u> -28E(should be <u>17S</u> )
57	Sec. 31-17S- <u>27E</u> (should be <u>28E</u> )
64	Sec. 31-17S- <u>27E</u> (should be <u>28E</u> )

Upon submitting this unit for final approval the following are required by this office:

1. Two executed copies of Unit Agreement-one must be an original
2. One copy of Operating Agreement
3. Two sets of all Ratifications from Lessees of Record and Working Interest Owners-one copy must be an original
4. Order of the Oil Conservation Commission
5. Initial Plan of Operation

Atlantic Richfield Company  
August 30, 1972  
Page 2

6. Filing Fee in the amount of Three-Hundred (\$300.00) Dollars.
7. Re-designation of wells

In your final application we would also like for you to state all tracts qualified and verification that the Working Interest in the qualified tracts have been contacted and requested to join. Also, state all tracts committed and not committed to the unit.

If we may be of further service please do not hesitate to call on us.

Very truly yours,



RAY D. GRAHAM, Director  
Oil and Gas Department

AJA/RDG/s

North American Producing Division  
 Permian District  
 Post Office Box 1610  
 Midland, Texas 79701  
 Telephone 915 682 8631

Ex. 6



April 25, 1973

United States Department  
 of the Interior  
 Geological Survey  
 P. O. Drawer 1857  
 Roswell, New Mexico 88201

BEFORE EXAMINER STAMENS	
OIL CONSERVATION COMMISSION	
App	6
CASE NO.	4952 & 4953
Submitted by	ARCO
Hearing Date	25 April 1973

Attention: Mr. N. O. Frederick (6)  
 Oil and Gas Supervisor

State of New Mexico  
 Mr. Alex J. Armijo  
 Commissioner of Public Lands  
 P. O. Box 1148  
 Santa Fe, New Mexico

Attention: Mr. Ray D. Graham, Director (3)  
 Oil and Gas Department

State of New Mexico  
 Oil Conservation Commission  
 P. O. Box 2088  
 Santa Fe, New Mexico

Attention: Mr. A. L. Porter, Jr. (3)  
 Secretary Director

Working Interest Owners  
 Empire Abo Unit  
 (see attached address list)

Re: Initial Plan of Operation  
 Empire Abo Unit  
 Eddy County, New Mexico

Gentlemen:

In compliance with Section 11 of the Unit  
 Agreement, Empire Abo Unit, Eddy County,  
 New Mexico, Atlantic Richfield Company, as

United States Department  
of the Interior  
Page 2  
April 25, 1973

Unit Operator on behalf of itself and the other participating working interest owners, hereby submits for your approval a Plan of Operation to cover the period beginning with the effective date of the Unit Agreement and extending through the remainder of calendar year 1973.

Yours very truly,

ATLANTIC RICHFIELD COMPANY .  
OPERATOR



P. E. Fletcher  
Operations Manager

PEF/SHC/jrb

INITIAL PLAN OF OPERATION  
EMPIRE ABO UNIT

1. Project Area

History and Background

The Empire Abo Unit area consists of some 11,339.15 acres in Eddy County, New Mexico (see attached plat, Exhibit 1). The area is located in portions of sections 34, 35, 36 Township 17 South, Range 27 East; sections 1, 2, 3, 4, 8, 9, 10, 11, 12, 15, 16, 17 Township 18 South, Range 27 East; sections 25, 26, 27, 28, 31, 32, 33, 34, 35, 36 Township 17 South, Range 28 East; sections 4, 5, 6 Township 18 South, Range 28 East; sections 29, 30 Township 17 South, Range 29 East. Within the Unit Area, owners of the following tracts have chosen not to participate in the unit: 2,6,42,46,49,55,56,69,73C,77,79,84,91. These non-participating tracts total ~~684.84~~ 640 acres. The remaining ~~10,654.31~~ 10,699.15 acres is to be developed as a project area for pressure maintenance by injection of plant residue gas from Abo production back into the Abo formation.

The Abo producing zone is found at an average depth of about 5800 feet (see attached type log, Exhibit 2). The Abo is a lower Leonard (Permian) carbonate reef which has undergone complete dolomitization. Vugs, fractures and fissures have been observed in cores throughout the main reef, with local anhydrite infilling sometimes restricting flow. Reef development is long (12 1/2 miles) and narrow (1 1/2 miles). The reef crest dips about 1° from southwest to northeast. Average gross reef thickness is about 300 feet, ranging to the maximum of 732 feet on the Amoco State AT No. 1 (L2-18S-27E).

On the up-dip west and southwest end of the reservoir productive limits are the result of anhydrite deposition, while on the back-reef north side there is a facies change to an impermeable carbonate "mud" interspersed with green shale. Limits to the south, east and northeast result as the top of the reef dips below the oil-water contact.

2. Current Production, Future Recovery

The original discovery well was the Amoco Malco Federal A No. 1, located in the NE NW Section 11, T-18-S - R-27-E, completed in November 1957.

At the present time the Pool has 235 producing wells. Of these, 153 are capable of producing more than the current top allowable of 142 BOPD/well. There are 183 flowing wells. Field performance and detailed study of cores indicate excellent vertical permeability. The principal producing mechanism is gravity drainage with an expanding secondary gas cap. There are 22 operators in the field and 112 separate working interest owners.

In January 1973, Abo Pool total oil production averaged 25,625 BOPD with 9% water production and gas oil ratio 1,366 cu. ft./BO. Cumulative oil production from the pool is 90 MMBO to February 1, 1973. Remaining primary after February 1, 1973, based on ARCO numeric model studies, is estimated to be 83 MMBO. Unitized residue gas injection for pressure maintenance is calculated to increase future recovery by about 30 MMBO compared to continued primary operations.

3. Basic Concepts Governing Future Unit Operations

- a) Field production history and reservoir numeric model studies have demonstrated that reservoir recovery is governed by a gravity drainage mechanism. With unitization, the operator will be able to maximize beneficial effects of this most efficient recovery mechanism by careful observation of well performance and shutting in or curtailing production from inefficient wells.
- b) Injection of plant residue gas will act toward pressure maintenance and orderly control of expansion of the secondary gas cap.

4. Special Rules

a) Unit Allowable

1st Step - Starting on the effective date of the unit, the unit will receive a unit allowable, calculated so that Unit Area reservoir voidage will not exceed average daily reservoir voidage rate for 1972. This will result in an increase from current 23,600 BOPD to about 30,000 BOPD for the Unit Area.

2nd Step - to be effective with the start of gas injection. Unit Area allowable to be 40,192 BOPD. Reservoir numeric model studies demonstrate added recovery and no reservoir waste at this rate.

- b) Provision to produce the unit allowable from the most efficient wells without restriction. The only exception will be where a Unit producing well offsets a non-unit well.
- c) Provision that if any unit well is located within 660' of a non-participating tract on which is located an Empire Abo producing well, such unit well will be allowed to produce no more than two times normal unit allowable for the Empire Abo Pool.
- d) Provision for administrative approval of additional injection wells, or changes in injection well locations.

5. Operating Plans for 1973

Initially gas injection will be into the Abo gas cap in the following eight wells (see plat Exhibit 1):

<u>Current Operator</u>	<u>Lease &amp; Well</u>	<u>Location</u>
Exxon	Chalk Bluff Draw Unit "A" No. 4	NE/4 NW/4 Sec.9-T18S-R27E
Amoco	Windfohr Federal No. 4	NW/4 SE/4 Sec.4-T18S-R27E
Amoco	Malco "H" Federal No. 2	SE/4 NE/4 Sec.3-T18S-R27E
M.YatesIII	Dooley Abo State No. 2	NW/4 SE/4 Sec.36-T17S-R27E
Amoco	State "BM" No. 1	NE/4 SW/4 Sec.31-T17S-R28E
Amoco	State "BV" No. 1	SW/4 NW/4 Sec.32-T17S-R28E
Arco	M. Yates B (ARC) No. 8	SW/4 NE/4 Sec.33-T17S-R28E
Hondo	State "A" No. 21	NE/4 SW/4 Sec.26-T17S-R28E

Attached Exhibit 3 is an example of an injection well log, while Exhibit 4 is a schematic diagram of a typical mechanical setup for an injection well.

Maximum gas injection volume into all wells is estimated at 37,000 MCF/Day. In terms of reservoir space fill-up, this is equivalent to over 60,000 barrels of water injection per day. Plans are to pick up residue gas at about 700 psi and compress it to 2000 psi for injection. The gas will contain hydrogen sulfide. Superdehydration facilities are planned in order to minimize possible corrosion.

A rigorous corrosion checking procedure will be maintained.

A regular and comprehensive well-testing program will be followed to maintain reservoir control and aid in determining optimum operating conditions.

Workovers: Wherever well production data and reservoir conditions so indicate, workovers will be performed to lower gas-oil or water-oil ratios and maximize producing well efficiencies.

Facilities for produced water gathering and reinjection will be constructed.

Atlantic Richfield Company, as unit operator, will act prudently to preserve all rights of the mineral owners and to effectively and efficiently recover the unit area reserves. This Company will meet all economical offset obligations and act to prevent undue waste.

Modifications - It is understood that to meet changing conditions, this Plan of Operation may be modified from time to time, with the approval of the Supervisor, the Commissioner of Public Lands of the State of New Mexico and the New Mexico Oil Conservation Commission.

Effective Date:

This Plan of Operation shall be effective July 1, 1973.

If this Plan of Operation meets with your approval, please indicate in the space below and return one copy for our files.

Yours very truly,

ATLANTIC RICHFIELD COMPANY  
OPERATOR



P. E. Fletcher  
Operations Manager

PEF/SHC/jrb

APPROVED BY: \_\_\_\_\_ Date: \_\_\_\_\_  
Supervisor of United  
States Geological Survey

APPROVED BY: \_\_\_\_\_ Date: \_\_\_\_\_  
Commissioner of Public  
Lands, State of New Mexico

APPROVED BY: \_\_\_\_\_ Date: \_\_\_\_\_  
Secretary-Director  
New Mexico Oil Conservation  
Commission

To: N.M.O.C.C. Dist. II (3)  
 P. O. Drawer DD  
 Artesia, New Mexico 88210  
 Attn: Mr. W. A. Gressett

EMPIRE ABO PRESSURE MAINTENANCE PROJECT  
 (N.M.O.C.C. ORDERS , .)  
 ATLANTIC RICHFIELD COMPANY - OPERATOR

MONTHLY REPORT FOR March , 19 74

PROJECT AREA: EMPIRE ABO UNIT Total Requested Allowable for June 19 74 is 3700 BOPD.

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11)  
 Sheet A

Well No.	Location	Well Sta.	Date		Oil Bbls.	Wtr Bbls.	Gas MCF	GOR CF/B	Production-Average		Injection-Average			Voidage Avail. for Resvb/D	Requested Voidage Transfer Resvb/D	Net Void. @ Normal Unit Allow. Resvb/Day	Requested Net Void. ((8)+(9)) See I (9) Resvb/Day	Requested Oil Allowab. for 6, 19 74 BOPD	
			M	Y					March	1974	March	1974	WHInj						Press. PSI
1	J 36 17 27	Inj.	3	74	---	---	---	---	---	---	2773	1800	250	484.6	---	---	---	---	---
2		F	3	74	350	0	245	700	300	0	210	700		56.5	58.9	115.4	300	300	
3		F	3	74	400	0	320	800	300	0	240	800		64.7	66.2	130.9	300	300	
4		F	3	74	365	0	329	900	300	0	270	900		72.7	73.4	146.1	300	300	
5		F	3	74	382	0	382	1000	300	0	300	1000		80.9	80.8	161.7	300	300	
6		F	3	74	424	0	466	1100	348	0	383	1100		118.7	88.0	206.7	348	348	
7		F	3	74	372	0	446	1200	284x	0	341	1200		86.3	95.3	181.6	284	284	
8		F	3	74	325	0	228	700	284x	0	199	700		49.9	58.9	108.8	284	284	
9		F	3	74	310	0	248	800	284x	0	227	800		57.2	66.2	123.4	284	284	
10		F	3	74	360	0	324	900	250	0	225	900		46.8	73.4	120.2	250	250	
11		F	3	74	250	0	250	1000	250	0	250	1000		52.5	80.8	133.3	250	250	
12		F	3	74	250	0	275	1100	210	0	231	1100		33.1	88.0	121.1	210	210	
13		F	3	74	150	0	180	1200	150	0	180	1200		-3.6	95.3	91.7	150	150	

(1) See Attachment I(b) Col. (9)).  
 (2) See Attachment I(a) Col. (10)).  
 (x) = Production limited to twice N.U.A.)  
 (y) = Limited capacity, see Attachment I(c) Col.'s (9) & (9c).)

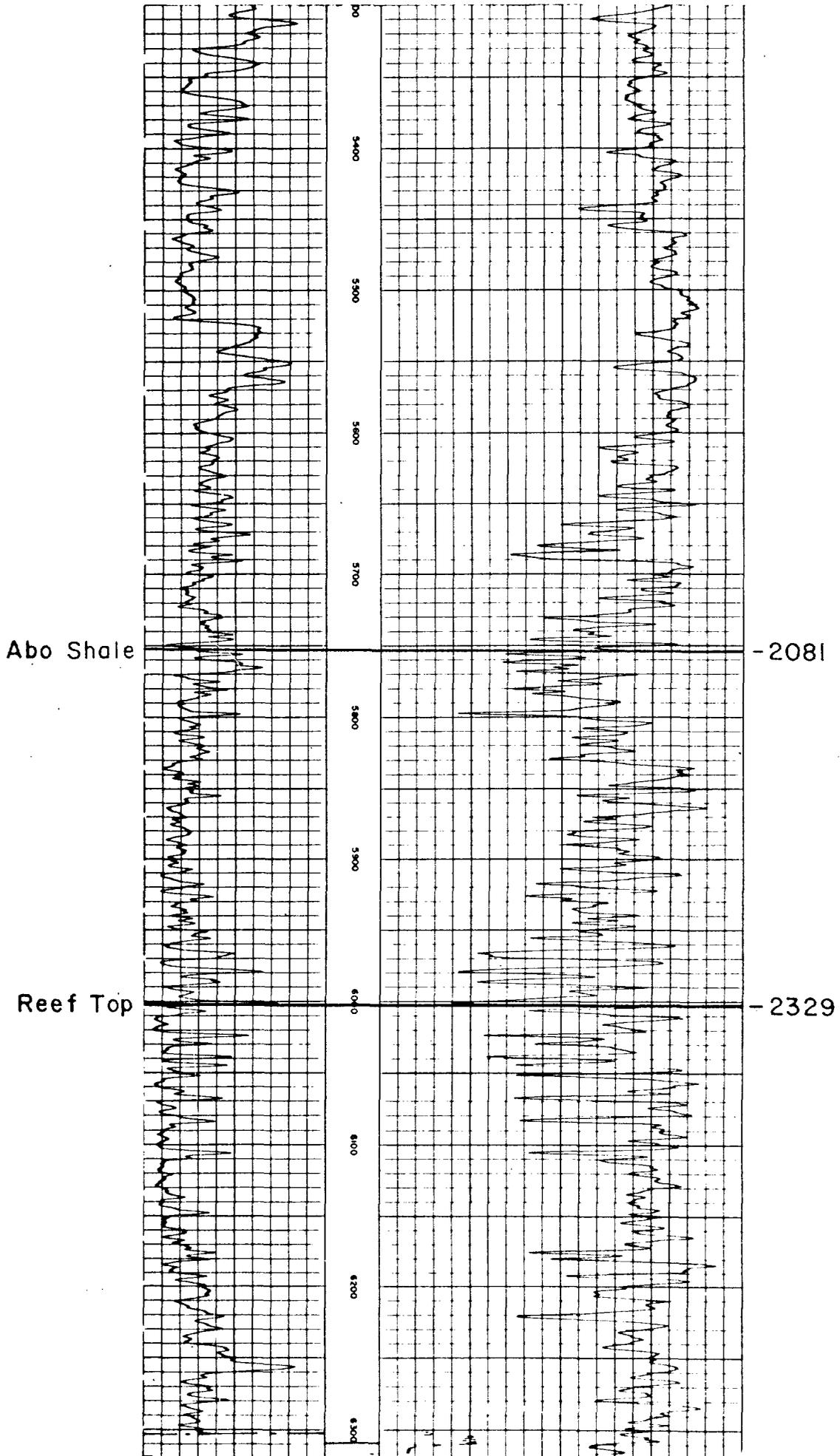
HONDO OIL AND GAS COMPANY  
(ATLANTIC RICHFIELD COMPANY)

State "A" Well No. 21

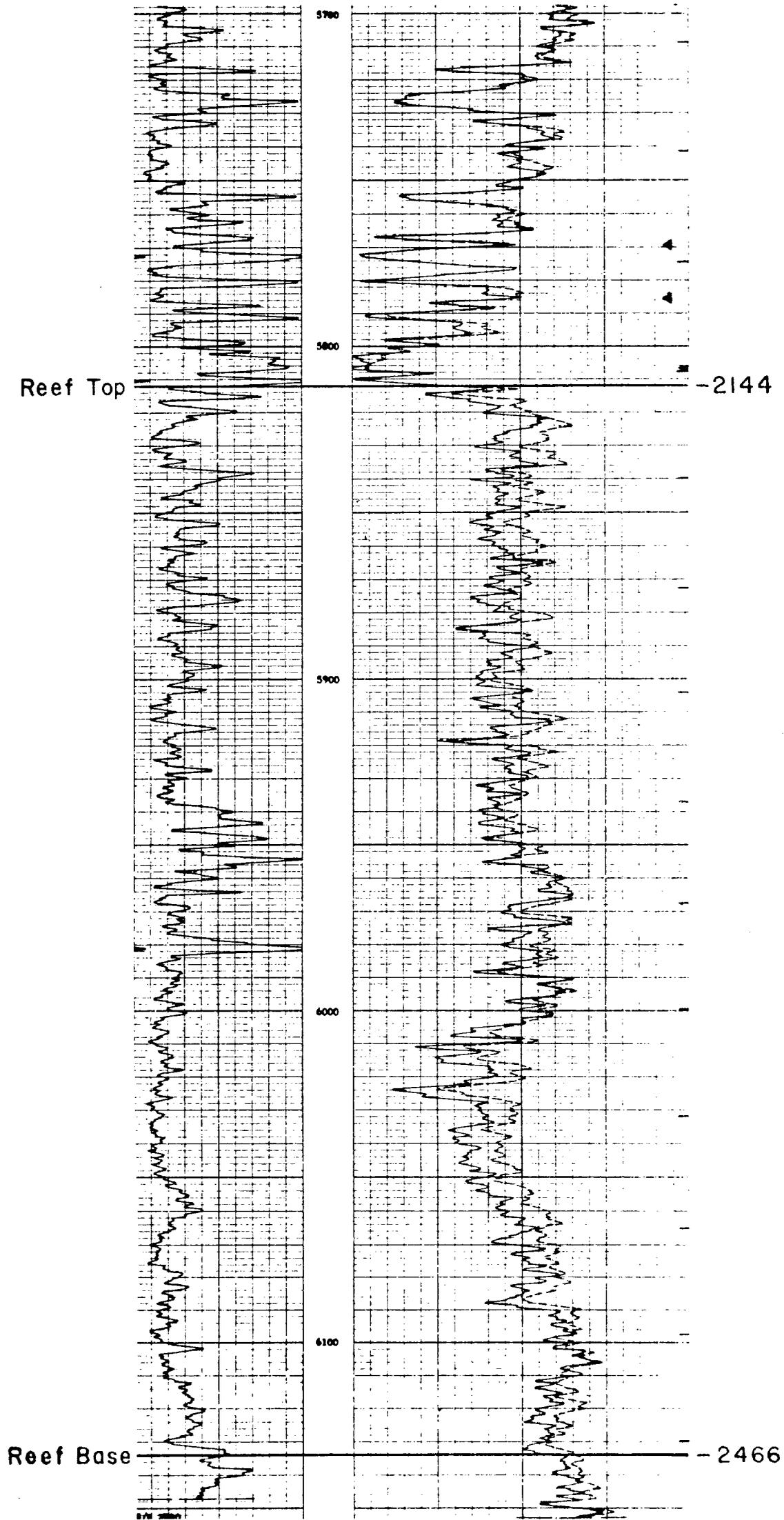
1650' FSL & 1980' FWL SEC. 26, T-17-S, R-28-E

EDDY COUNTY, NEW MEXICO

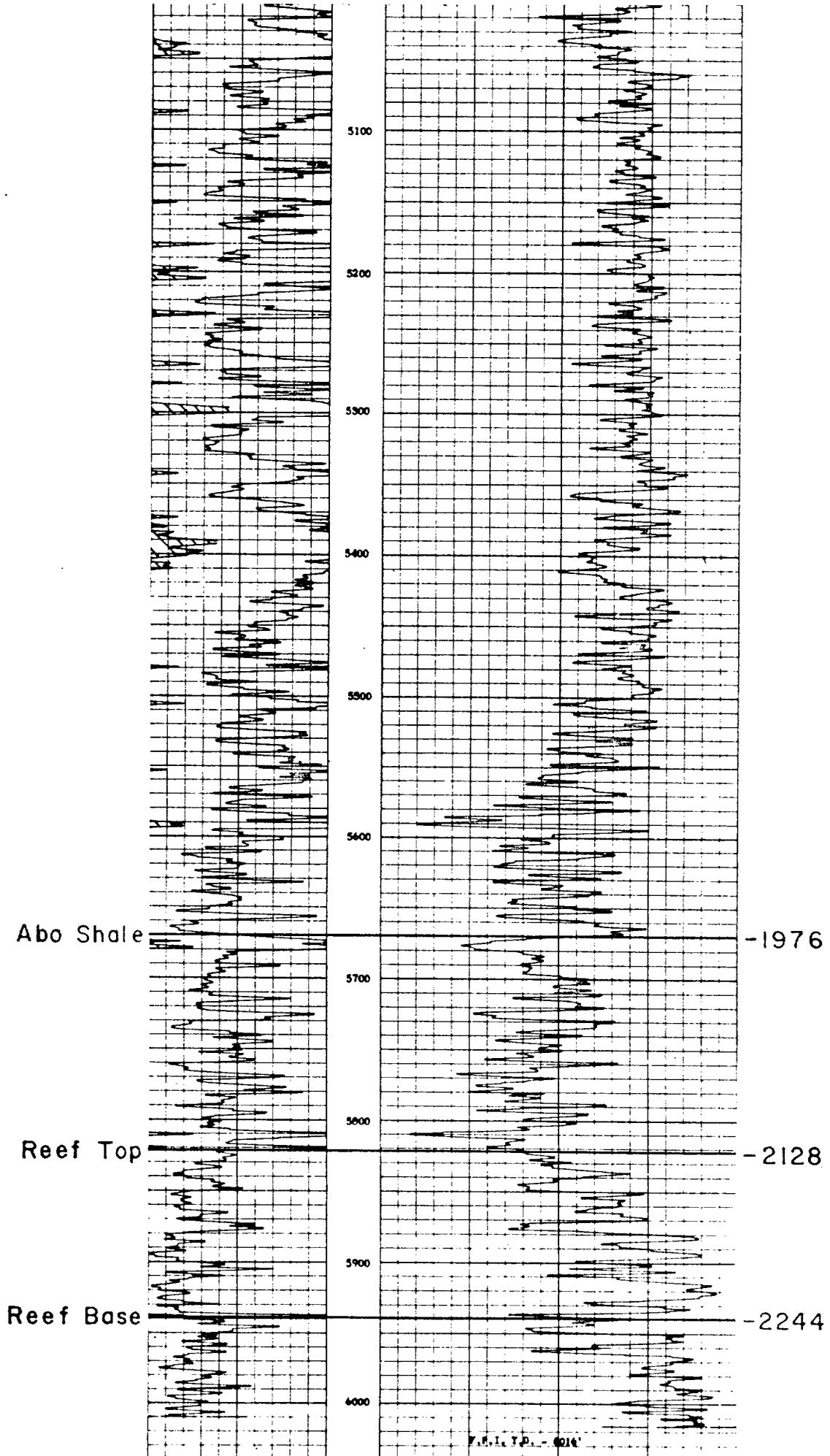
GAMMA RAY - NEUTRON



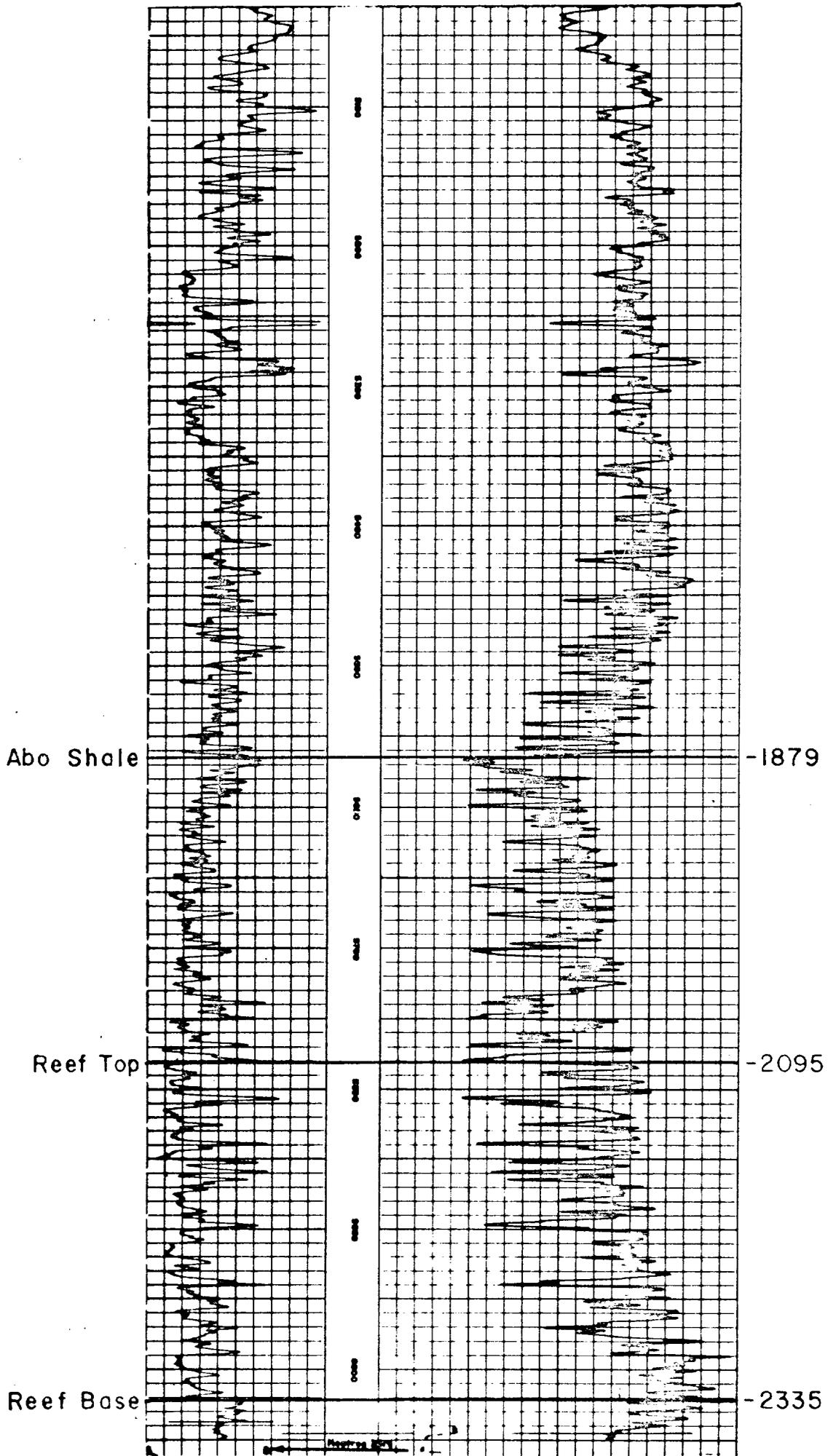
ATLANTIC RICHFIELD COMPANY  
M. Yates "B" (ARC) Well No. 8  
1980' FNL & 2130' FEL SEC. 33, T-17-S, R-28-E  
EDDY COUNTY, NEW MEXICO  
GAMMA RAY - ISOTRON



AMOCO PRODUCTION COMPANY  
State "BV" Well No. 1  
2280' FNL & 978' FEL SEC. 32, T-17-S, R-28-E  
EDDY COUNTY, NEW MEXICO  
GAMMA RAY - ISOTRON



AMOCO PRODUCTION COMPANY  
State "BM" Well No. 1  
1650' FSL & 2387' FWL SEC. 31, T-17-S, R-28-E  
EDDY COUNTY, NEW MEXICO  
GAMMA RAY - NEUTRON

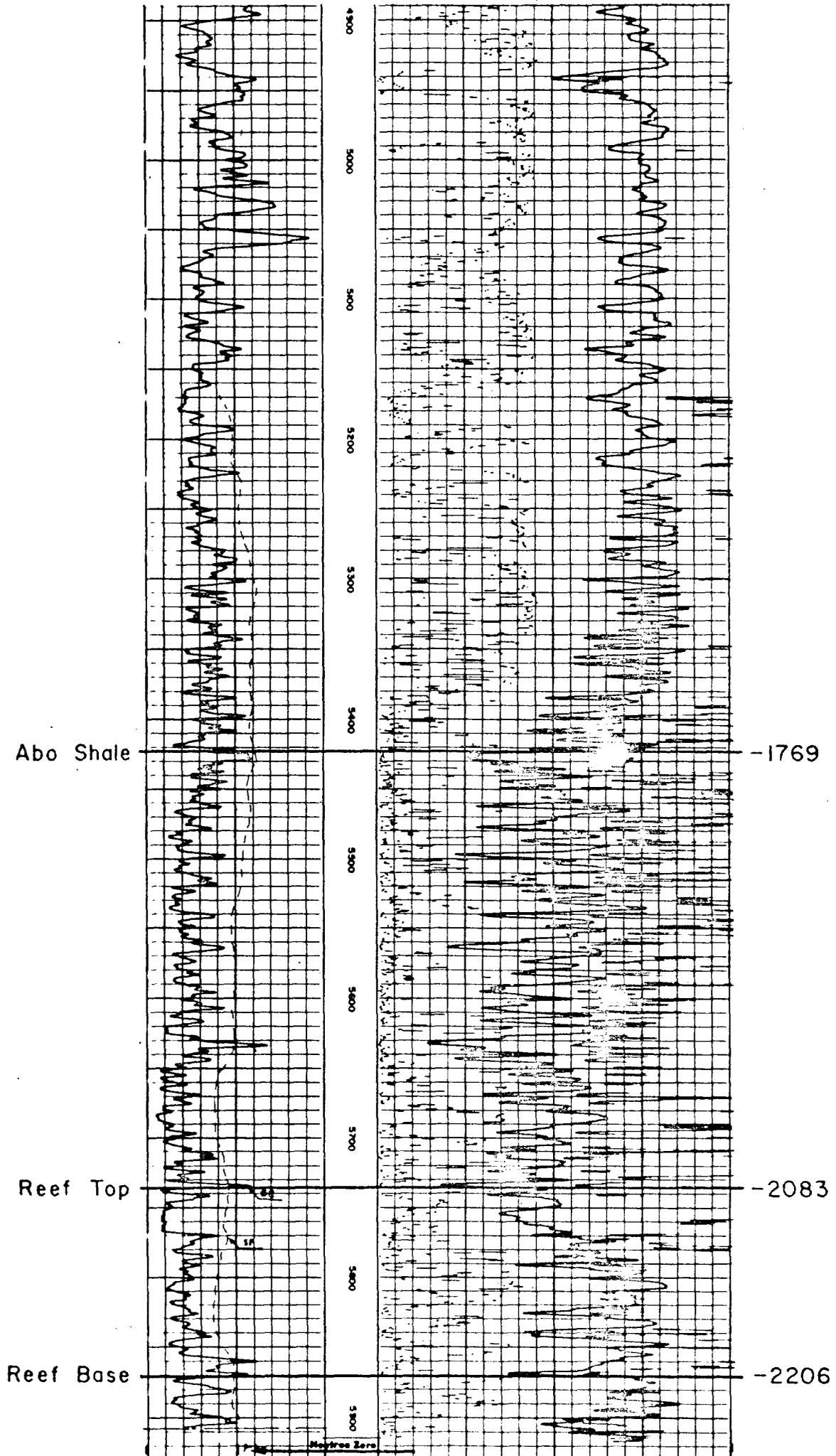


MARTIN YATES, III  
Dooley State ABO No. 2

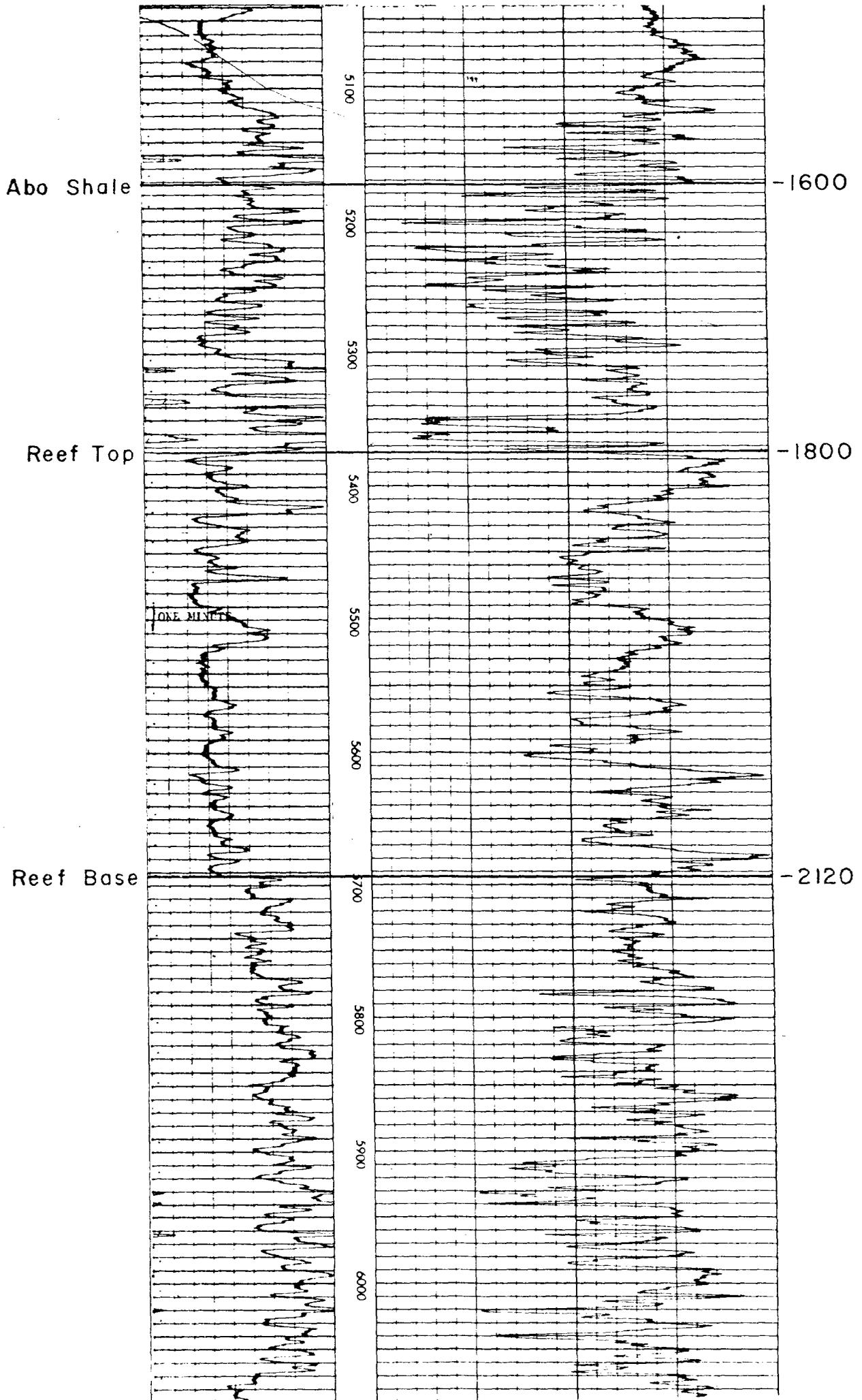
1650' FSL & 1650' FEL SEC. 36, T-17-S, R-27-E

EDDY COUNTY, NEW MEXICO

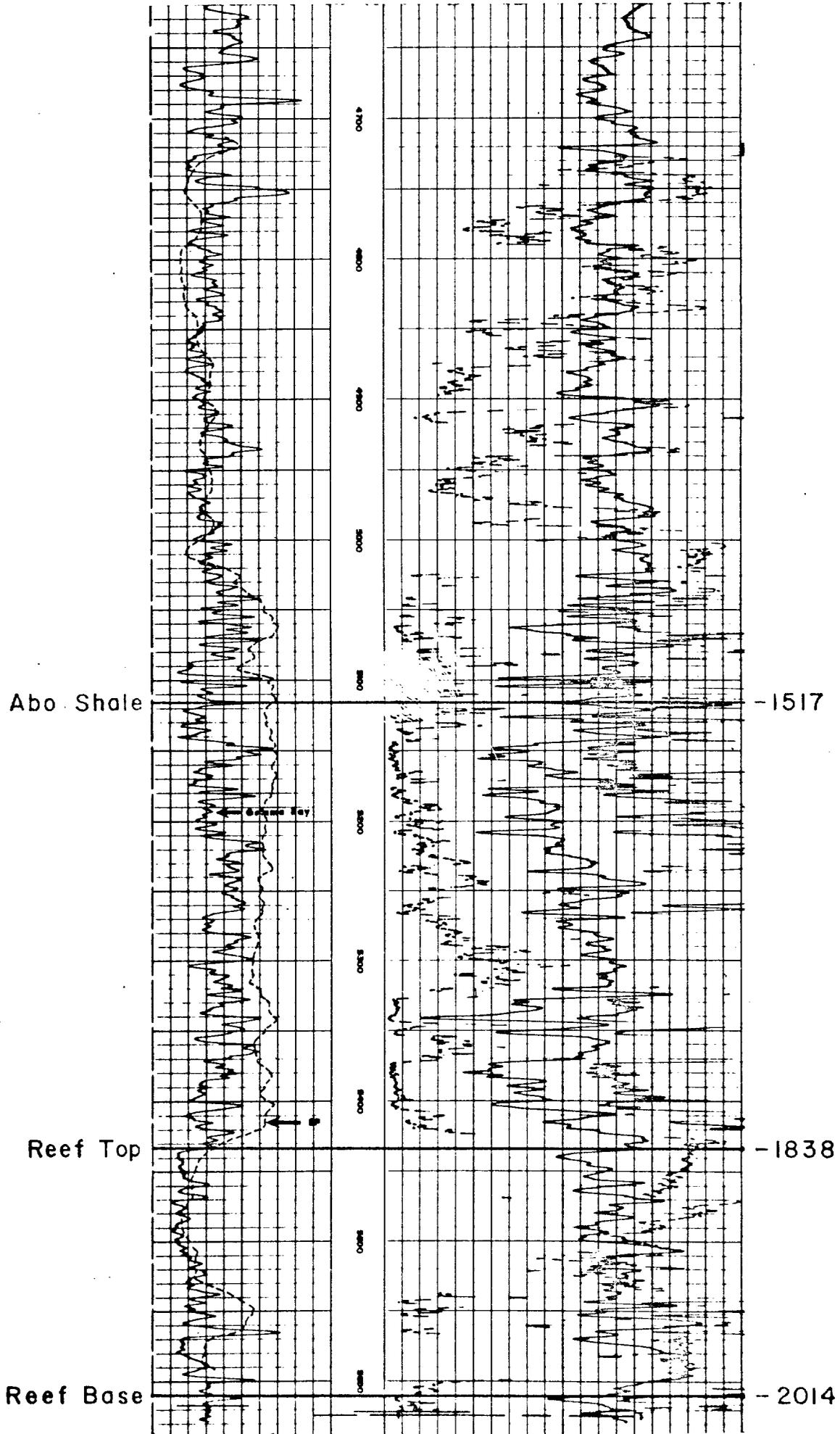
LATEROLOG-GAMMA RAY-NEUTRON



AMOCO PRODUCTION COMPANY  
Malco "H" Federal Well No. 2  
1980' FNL & 660' FEL SEC. 3, T-18-S, R-27-E  
EDDY COUNTY, NEW MEXICO  
GAMMA RAY - NEUTRON



AMOCO PRODUCTION COMPANY  
R.H. Windfohr Well No. 4  
1582' FSL & 1645' FEL SEC. 4, T-18-S, R-27-E  
EDDY COUNTY, NEW MEXICO  
GAMMA RAY - NEUTRON - LATEROLOG



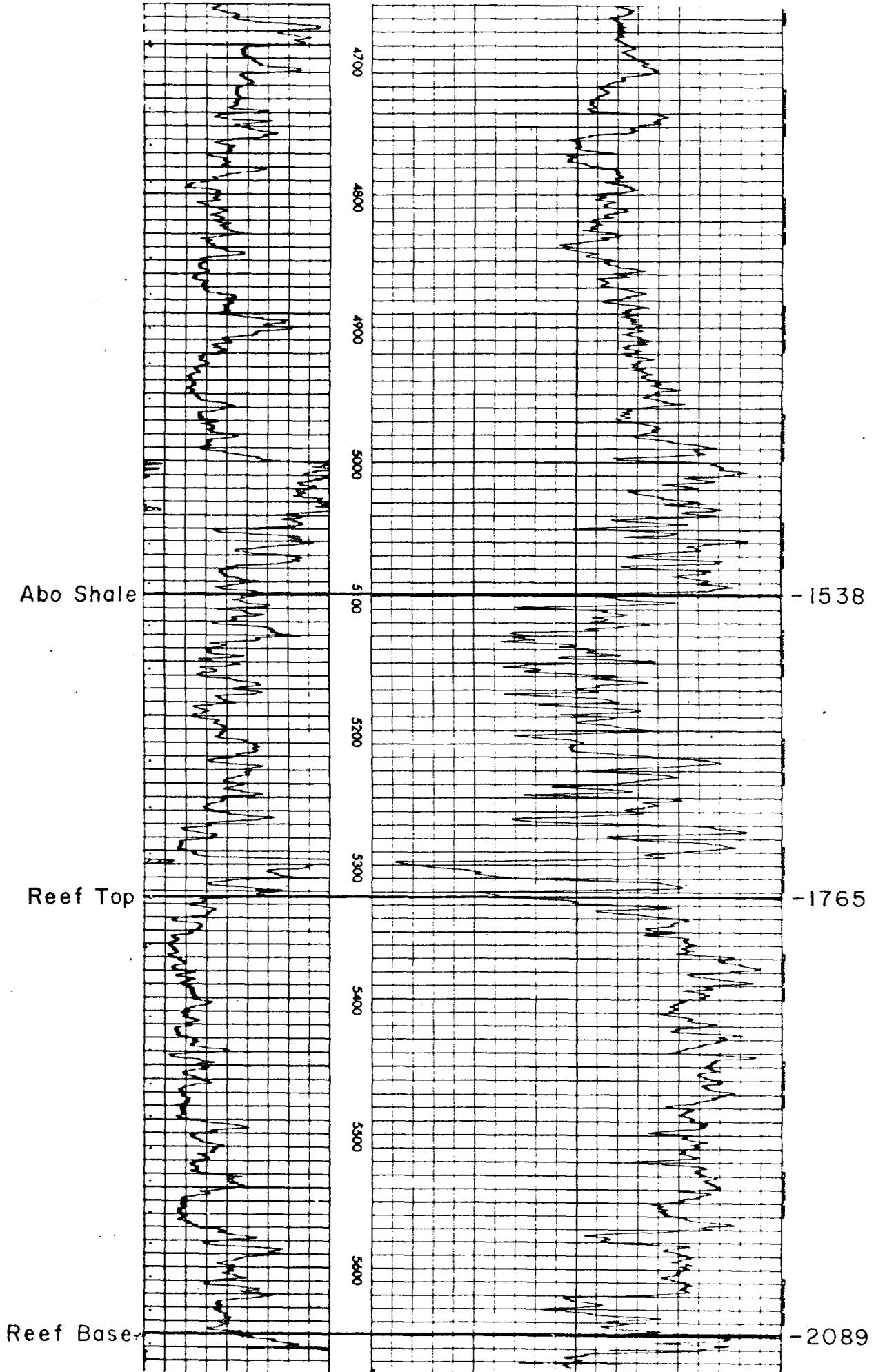
HUMBLE OIL AND REFINING COMPANY

Chalk Bluff Draw Unit A Well No. 4

990' FNL & 2310' FWL SEC. 9, T-18-S, R-27-E

EDDY COUNTY, NEW MEXICO

GAMMA RAY - NEUTRON



Empire Abo Unit

Reservoir Voidage Formula:

Equation 1:  $V_{rvb} = Q_o (B_o + (R_{pn} - R_s) B_g) + (Q_{wp} - Q_{we}) B_w$

Where:

- $V_{rvb}$  = Reservoir voidage, bbls. per day  
 $Q_o$  = Oil production rate, Stock tank bbls. per day  
 $B_o$  = Oil formation volume factor<sup>(1)</sup>, reservoir volumetric bbls/stock tank bbl.  
 $R_{pn}$  = Net producing gas-oil ratio, MCF/S.T.B.O.

$$R_{pn} = R_p \left(1.0 - \frac{G_i}{G_p}\right)$$

- Where:  $R_p$  = producing gas-oil ratio, MCF/BO  
 $G_i$  = daily volume of gas injected, MCF/Day  
 $G_p$  = daily volume of gas produced, MCF/Day

- $R_s$  = Solution gas-oil ratio<sup>(2)</sup>, MCF/STBO  
 $B_g$  = Gas formation volume factor<sup>(3)</sup>, RVB/MCF  
 $Q_{wp}$  = Water production rate, S.T.B.W./Day  
 $Q_{we}$  = Aquifer water influx rate, S.T.B.W./Day, determined from reservoir numeric model runs to be 1950 BWPD  
 $B_w$  = Water formation volume factor, RVBW/STBW, use 1.0

Solving Equation 1 for daily oil rate,  $Q_o$ ,

Equation 2: 
$$Q_o = \frac{V_{rvb} - (Q_{wp} - Q_{we}) B_w}{(B_o + (R_{pn} - R_s) B_g)}$$

(1), (2), (3): These values calculated from fluid analysis data.

EMPIRE ABO PRESSURE MAINTENANCE PROJECT  
Monthly Report for March, 1974

Attachment I: Allowable Calculations Based on Net Reservoir Voidage.

Tract No.	Well No.	Qo = per well Allowabl. Productn. STBOPD (2)	Gt=A-6 Gp A-5 (Fraction) (3)	(1,000-Gt) = Gp (1,000-G) (Fraction) (4)	Rp, from Col. A-5 (GOR) 19 MCF/BO (5)	Rpn = Equa- tion 1a (5)x(4) MCF/BO (6)	Vr(hc) (Equation 1) (ResBbls/Day) (7)	Vr(w) ((A-4)-180/20) x 1.0 (ResBbls/Day) (8)	Vrt=(7)+(8) (Equation 3) Total Res. Voidage (ResBbls/Day) (9)	Vr(hc) for ea. well @ N.U.A. of 142 BOPD (Equation 1) (ResBbls/Day) (10)
a) Totals:										
Wells transferred allowables:										
1	2	300	0.700	0.300	0.700	0.210	124.4	-9	115.4	58.9
3	3	300			0.800	0.240	139.9	-9	130.9	66.2
4	4	300			0.900	0.270	155.1	-9	146.1	73.4
5	5	300			1.000	0.300	170.7	-9	161.7	80.8
6	6	348			1.100	0.330	215.7	-9	206.7	88.0
7	7	284			1.200	0.360	190.6	-9	181.6	95.3
8	8	284			0.700	0.210	117.8	-9	108.8	58.9
9	9	284			0.800	0.240	132.4	-9	123.4	66.2
10	10	250			0.900	0.270	129.2	-9	120.2	73.4
11	11	250			1.000	0.300	142.3	-9	133.3	80.8
12	12	210			1.100	0.330	130.1	-9	121.1	88.0
13	13	150			1.200	0.360	100.7	-9	91.7	95.3
14	14	150			1.200	0.360	100.7	91	191.7	95.3
15	15	150			0.700	0.210	62.2	66	128.2	58.9
b) Totals										
		3560	0.700	0.300	2.000*	2.000	1911.8	49	1960.8	1079.4
c) Capacity wells, allowable calculations:										
1) 142 1.000 1.000 20.286* 2.000 2.000 493.6 -9 484.6										
18 14 0 1.000 1.000 20.286 486.4 -7 479.4										
19 5 0 1.000 1.000 56.800* 56.800 -8 477.9										
20 81 0 1.000 1.000 3.500* 3.500 -9 480.3										
		242					1955.2	-33	1922.2	
1	16	100	0.700	0.300	5.000	1.500	262.1	26	288.1	484.6
17	17	40	0.700	0.300	3.000	0.900	63.8	-9	54.8	484.6

(z Note: Capacity well allowed to produce at any rate as long as  $Vrt(9a)/Vrt(9) \geq 1.0$ . When  $Vrt(9a)/Vrt(9) < 1.0$ , Daily Oil allowable of capacity well must be no greater than (2) x  $Vrt(9a)/Vrt(9)$  or (2) x (9b)).

Fluid Factors: (based on Previous Reservoir Pressure Survey, 1343 psi, July, 1973):  
 Bo, Oil Formation Volume Factor, Reservoir bbls./stock tank bbl=1.415  
 Bg, Gas Formation Volume Factor, Resv. bbls./thousand std cu ft =1.71  
 Rs, Solution gas-oil ratio, MCF/Stock tank bbl oil =0.795  
 Bw, Water formation volume Factor, Resv bbls./stock tank bbl =1.0  
 Qo, Top per-well N.U.A., STBOPD = 142

Basic Voidage Equations: 1)  $Vr(hc) = Qo (Bo(Rpn-Rs)Bg)$ , Net hydrocarbon resv voidage, RvB/D; 1a.)  $Rpn = Rp (1.0-Gt/Gp)$ ; 2)  $Vrw = (Qwp-qwe)Bw$ ,  
 Net resv space voided by wtr, RvB/D; 3)  $Vrt = Vrhc + Vrw$ , Total net reservoir space voided on daily basis.

Established Constants: Qwe, Natural water encroachment; stock tank bbls/day, based on Numeric model studies;

\*  $Rp = 284MCFPD/QOI(2)$ , where 284 MCFPD is the daily gas limit, and QOI(2) is from Attach. I, Column (2).

To: N.M.O.C.C. Dist. II (3)  
P. O. Drawer DD  
Artesia, New Mexico 88210  
Attn: Mr. W. A. Gressett

EMPIRE ABO PRESSURE MAINTENANCE PROJECT  
(N.M.O.C.C. ORDERS , )  
ATLANTIC RICHFIELD COMPANY - OPERATOR

MONTHLY REPORT FOR March , 19 74

Total Requested Allowable for June 1974 is 3700 BOPD.

(1)	(2)	(3)	(4)	(5)						(6)			(7)	(8)	(9)	(10)	(11)		
				Well Test Data - Latest 24-hr.			Production-Average			Injection-Average									
Well No.	Location	Well R Sta.	Date M Y	Oil Bbls.	Wtr Bbls.	Gas MCF	GOR CF/B	Oil BOPD	Wtr. BOPD	Gas MCF/D	GOR CF/B	Gas MCF/D	WHInj Press. PSI	Cum. Inj. MMCF	Voidage Avail. for Transfr. 1 ResvB/D	Requested Voidage Transfer ResvB/D	Net Void. @ Normal Unit Allow. 2 ResvB/Day	Requested Net Void. ((8)+(9)) for See I (9) ResvB/Day	Requested Oil Allowable for 6, 1974 EOPD
14		P	3 74	150	100	180	1200	150	100	180	1200					96.4	95.3	191.7	150
15		P	3 74	150	75	105	700	150	75	105	700					69.3	58.9	128.2	150
16		F	3 74	100	35	500	5000	100	35	500	5000					0	288.1y	288.1	100
17		F	3 74	40	0	120	3000	40	0	120	3000					0	54.8y	54.8	40
18		SI	3 74	14	2	42	3000	---	---	---	---								
19		SI	3 74	5	1	70	14000	---	---	---	---								
20 ✓		SI	3 74	158	0	553	3500	---	---	---	---								
TOTALS:								3700	210	3961	1071	2773		250	1922.2	881.4	1422.3	2303.7	3700

<sup>1</sup> See Attachment I(b) Col. (9)).  
<sup>2</sup> See Attachment I(a) Col. (10)).  
(x = Production limited to twice N.U.A.)  
(y = Limited capacity, see Attachment I(c) Col.'s (9) & (9c).)

EXHIBIT NO. 2 INITIAL PLAN OF OPERATION  
TYPE LOG - UNITIZED FORMATION EMPIRE ABO UNIT

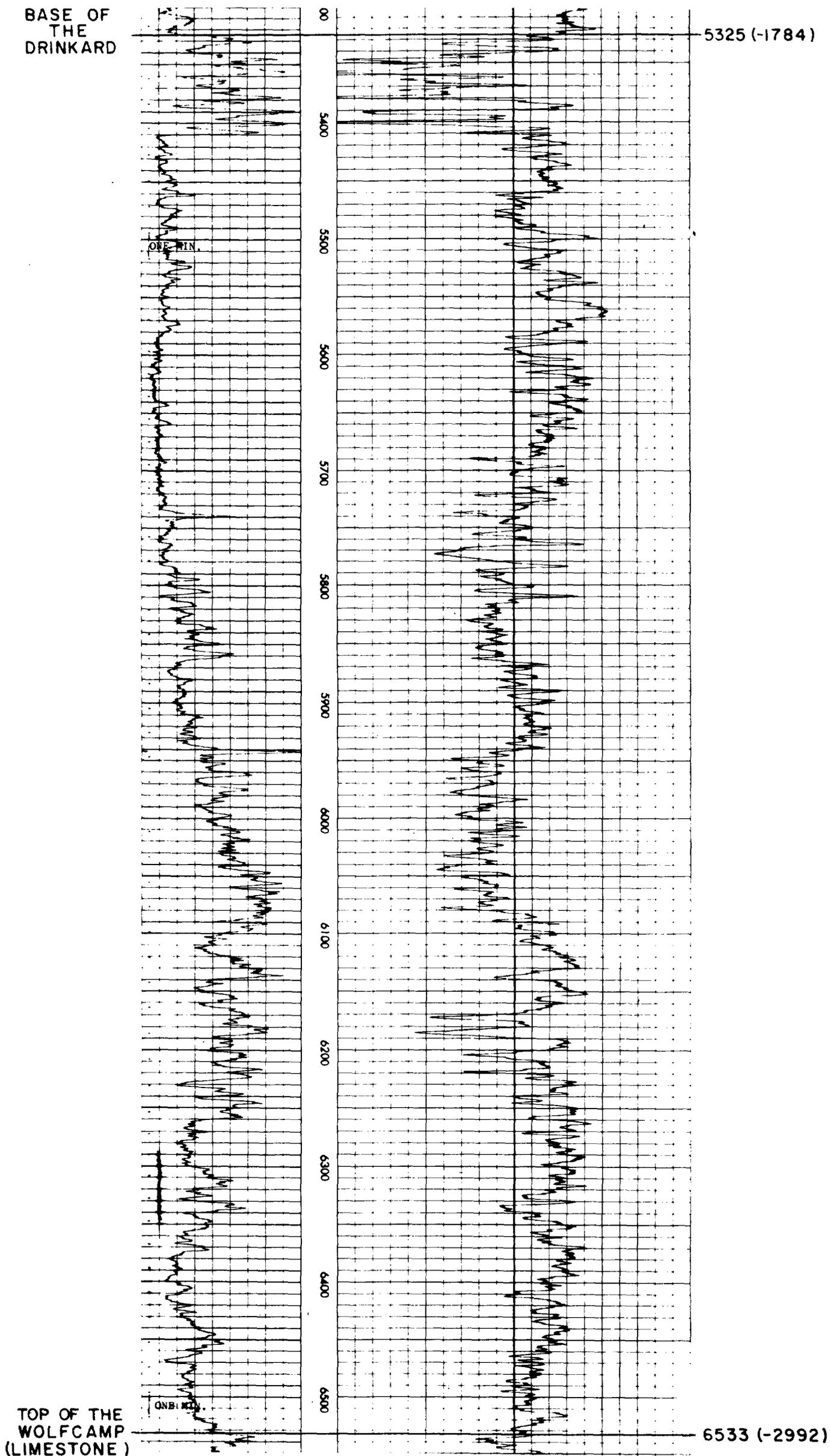
AMOCO PRODUCTION COMPANY  
State AU No. 1

Case 4953

1980' FSL & 1830' FWL SEC. 2, T-18-S, R-27-E

EDDY COUNTY, NEW MEXICO

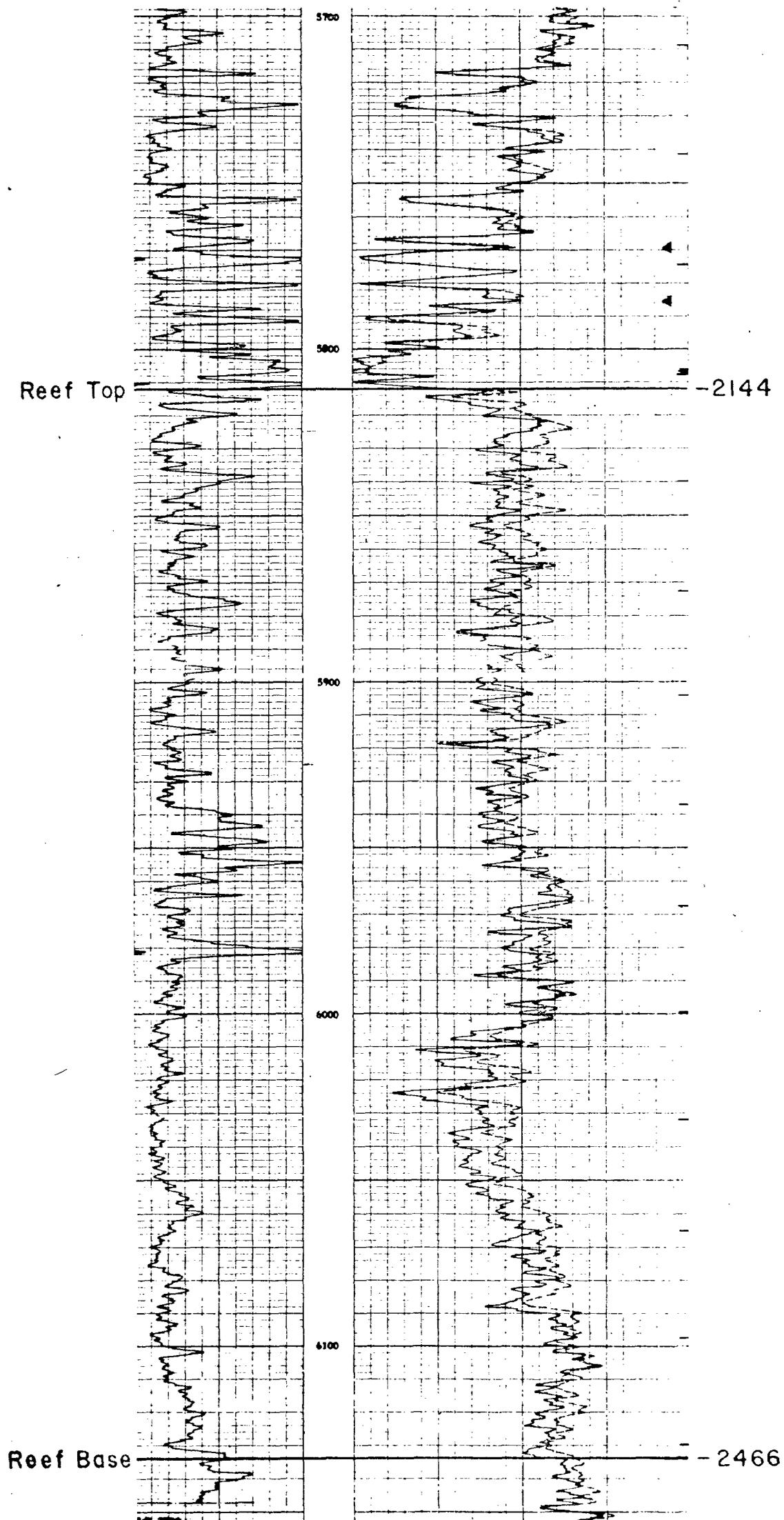
RADIOACTIVITY LOG



ATLANTIC RICHFIELD COMPANY  
M. Yates "B" (ARC) Well No. 8  
1980' FNL & 2130' FEL SEC. 33, T-17-S, R-28-E  
EDDY COUNTY, NEW MEXICO  
GAMMA RAY - ISOTRON

EMPIRE ABC UNIT  
PLAN OF OPERATION  
EXHIBIT 3

Case 4953



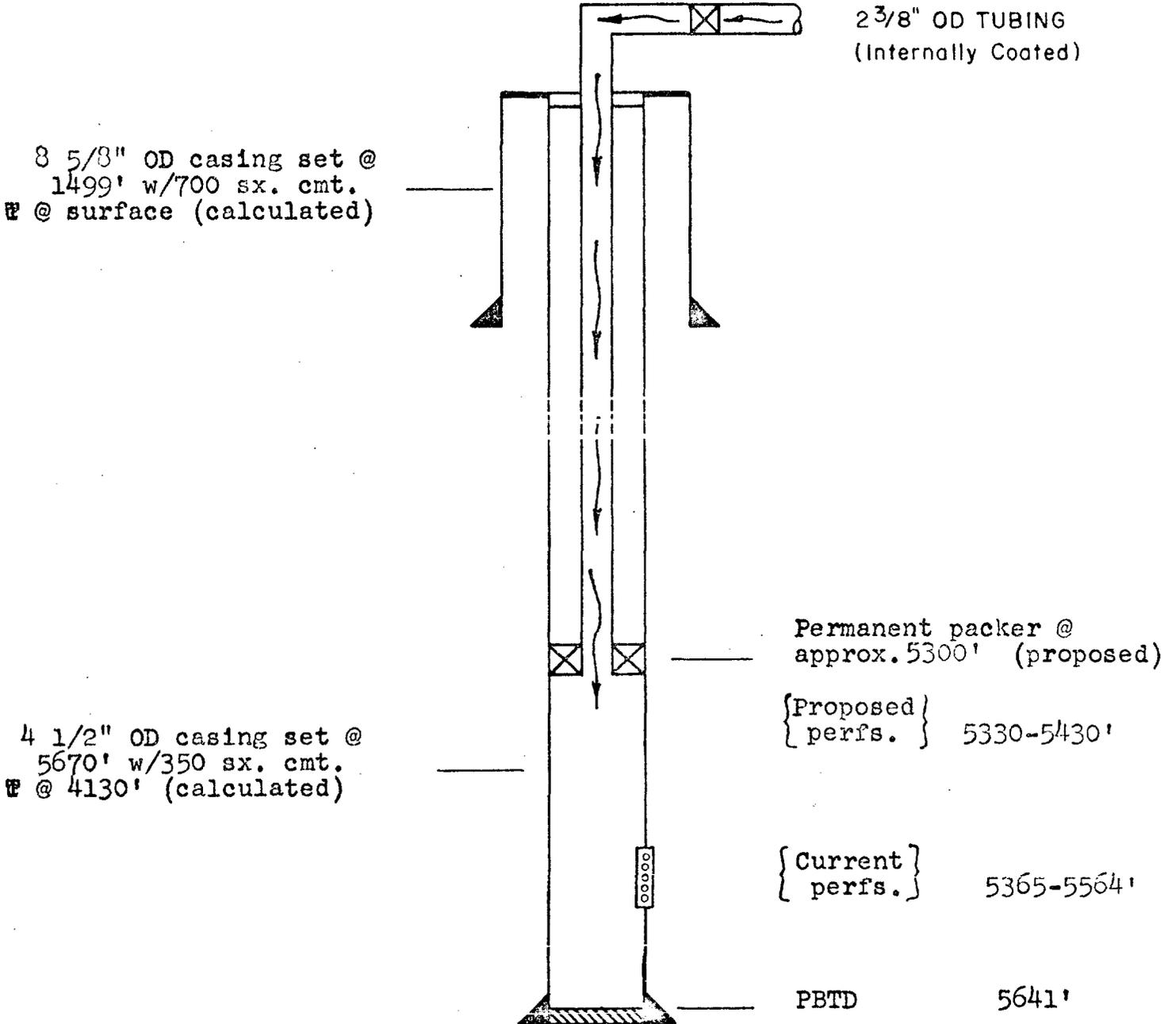
HUMBLE OIL AND REFINING COMPANY

Chalk Bluff Draw Unit A Well No. 4

990' FNL & 2310' FWL SEC. 9, T-18-S, R-27-E

EDDY COUNTY, NEW MEXICO

INJECTION WELL DIAGRAM



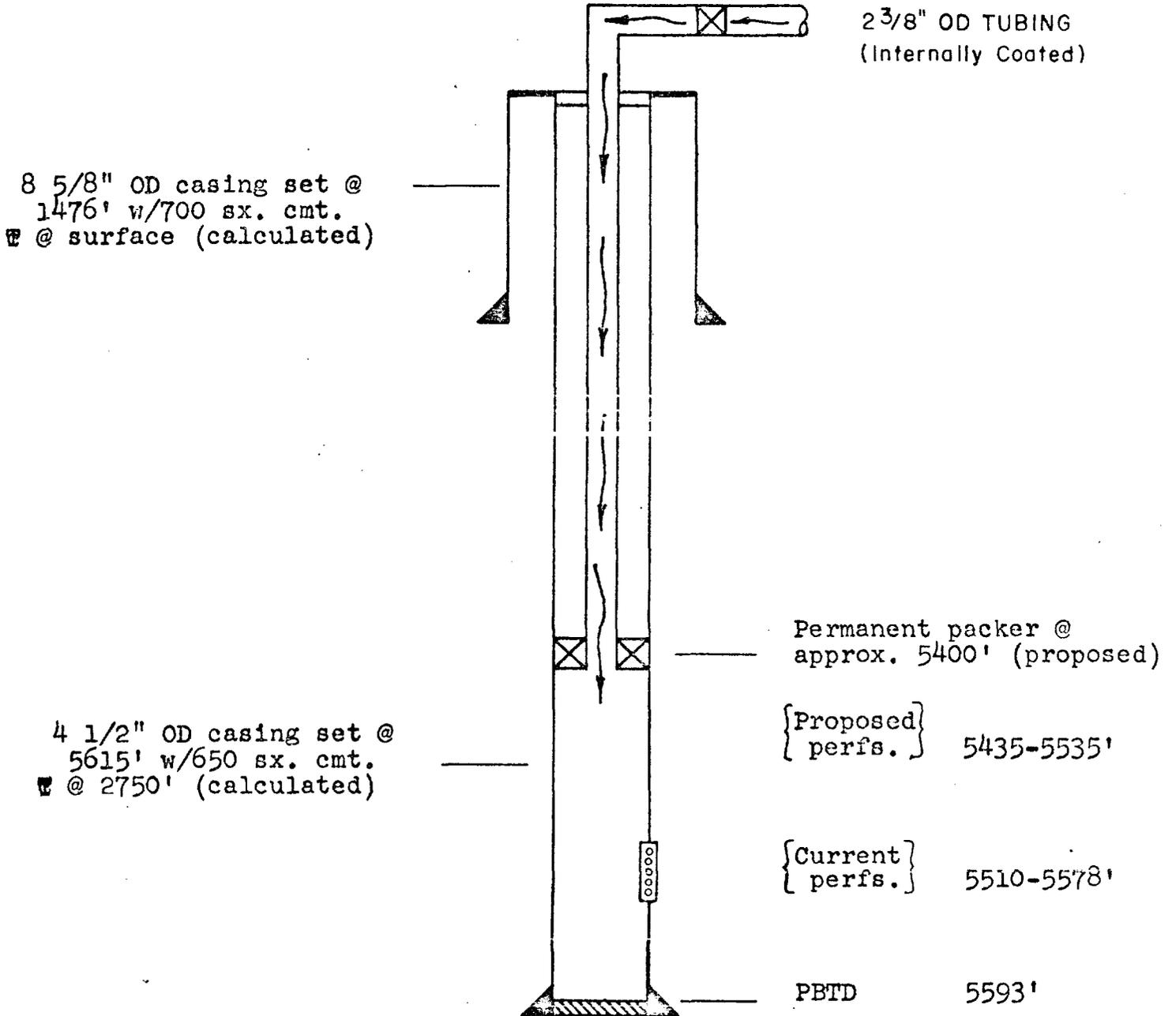
AMOCO PRODUCTION COMPANY

R.H. Windfohr Well No. 4

1582' FSL & 1645' FEL SEC. 4, T-18-S, R-27-E

EDDY COUNTY, NEW MEXICO

INJECTION WELL DIAGRAM

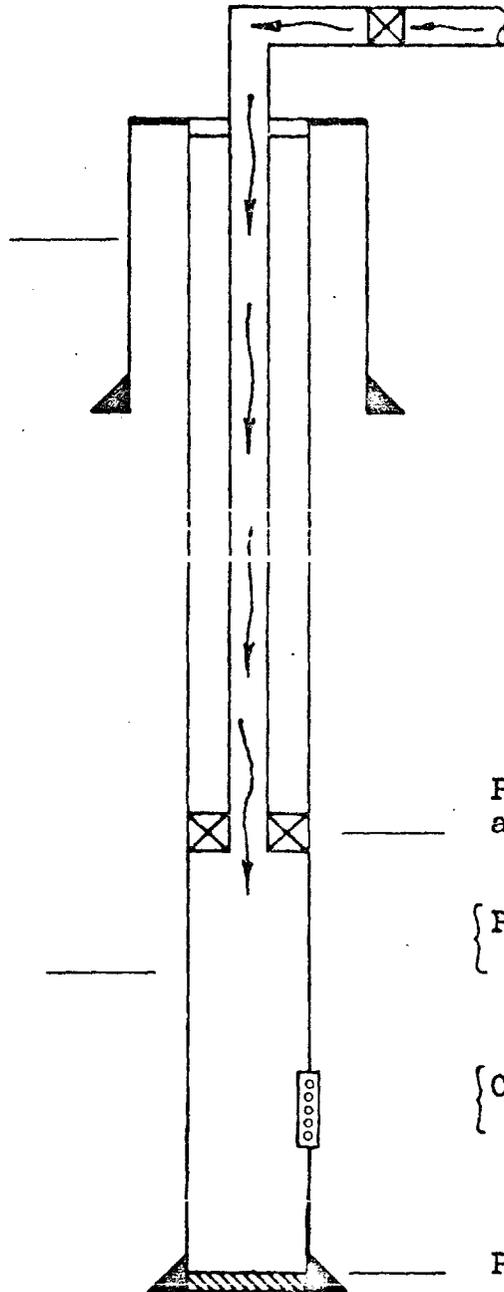


Plan 4953

EXHIBIT NO. \_\_\_\_\_

AMOCO PRODUCTION COMPANY  
 Malco "H" Federal Well No. 2  
 1980' FNL & 660' FEL SEC. 3, T-18-S, R-27-E  
 EDDY COUNTY, NEW MEXICO  
 INJECTION WELL DIAGRAM

8 5/8" OD casing cmt.  
 @ 997' w/700 sx.  
 (cmt. circulated)



2 3/8" OD TUBING  
 (Internally Coated)

5 1/2" OD casing set @  
 6123' w/350 sx. cmt.  
 @ 4400' (Temp. Survey)

Permanent packer @  
 approx. 5350' (proposed)

{ Proposed }  
 perfs. 5400-5500'

{ Current }  
 perfs. 5650-5670'

PBTD 6090'

*P-1196-3*

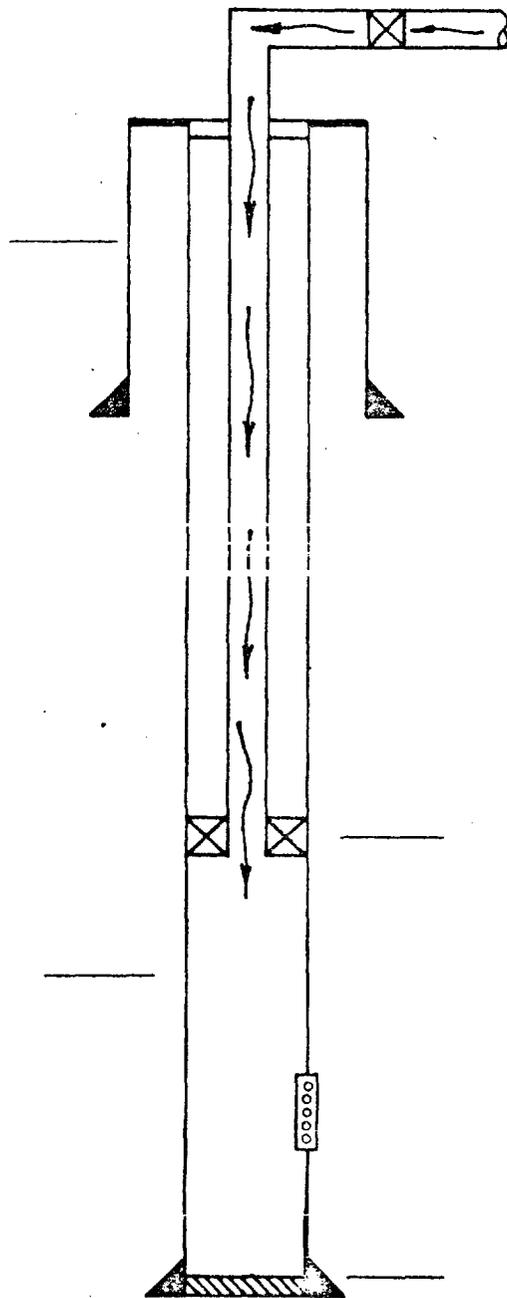
MARTIN YATES, III  
 Dooley State ABO No. 2

1650' FSL & 1650' FEL SEC. 36, T-17-S, R-27-E

EDDY COUNTY, NEW MEXICO  
 INJECTION WELL DIAGRAM

8 5/8" OD casing cmt. @  
 950' w/400 sx. cmt.  
 @ surface (calculated)

5 1/2" OD casing cmt. @  
 5970' w/650 sx.  
 @ 2227' (calculated)



2 3/8" OD TUBING  
 (Internally Coated)

Permanent packer @  
 approx. 5700' (proposed)

Proposed  
 perfs. 5740-5850'

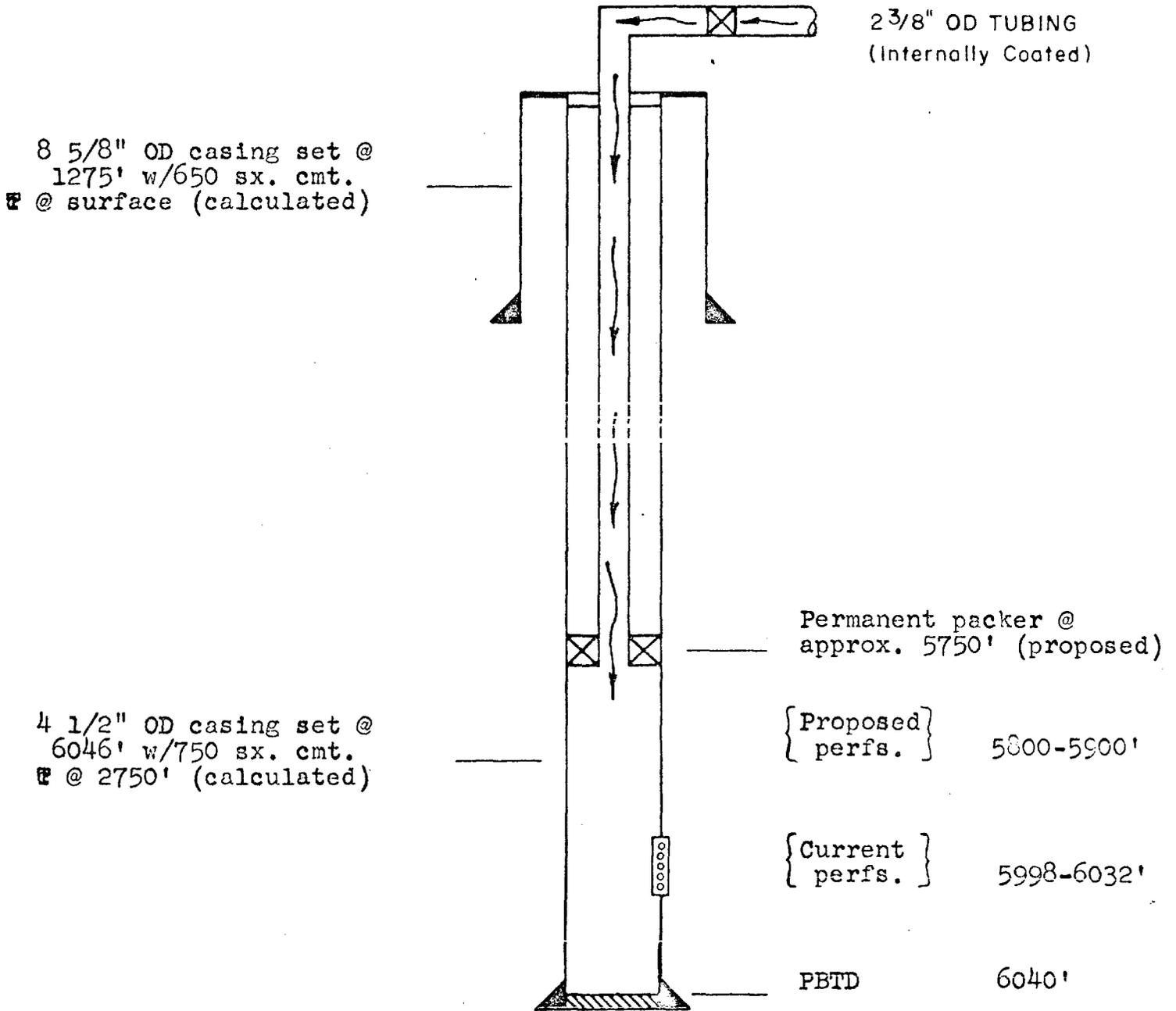
Current  
 perfs. 5749-5766'  
 5776-5781'  
 5788-5793'

PBTD 5929'

*Handwritten:* Case H94-2

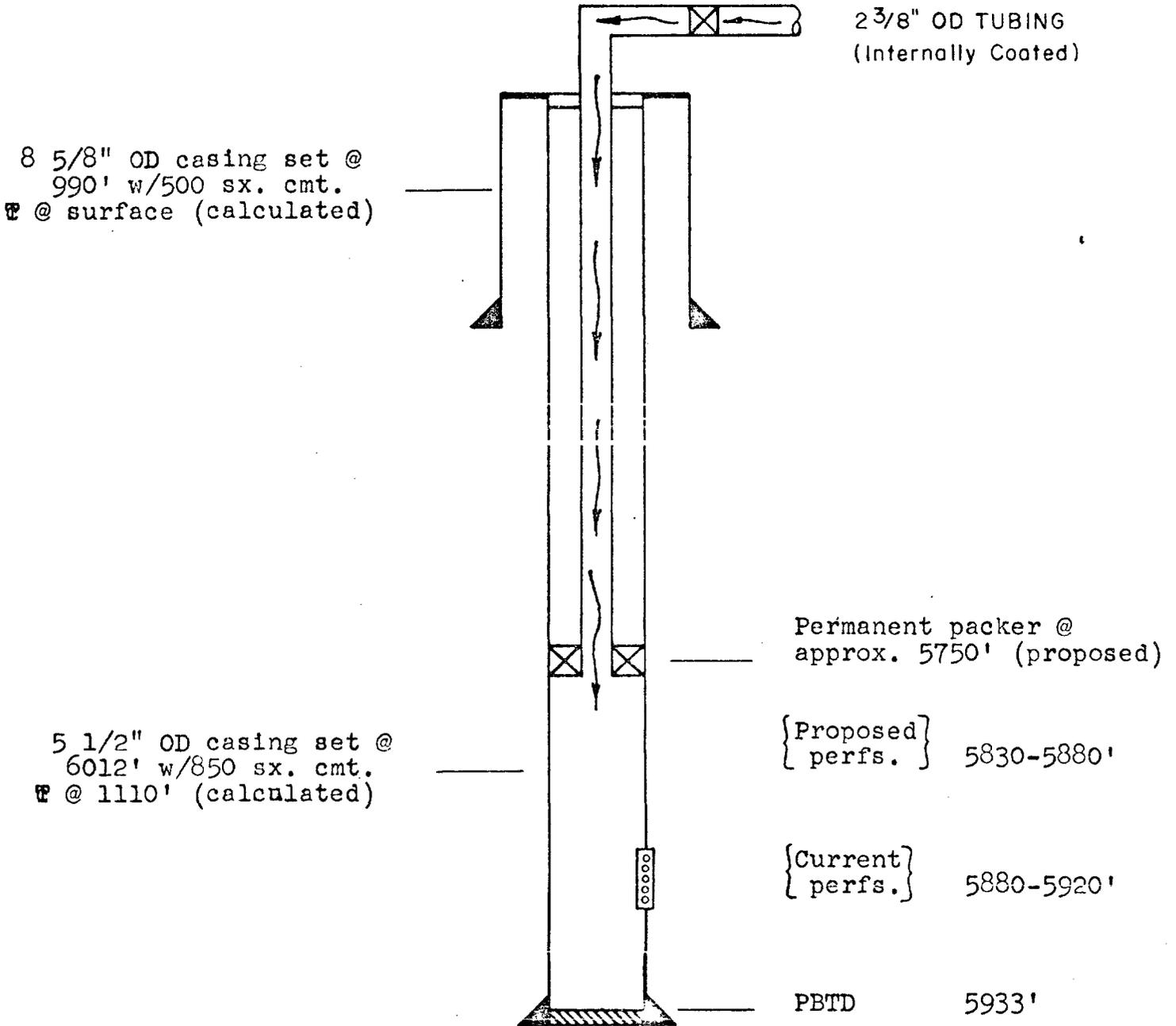
EXHIBIT NO. \_\_\_\_\_

AMOCO PRODUCTION COMPANY  
 State "BM" Well No. 1  
 1650' FSL & 2387' FWL SEC. 31, T-17-S, R-28-E  
 EDDY COUNTY, NEW MEXICO  
 INJECTION WELL DIAGRAM



Plan 495-3

AMOCO PRODUCTION COMPANY  
 State "BV" Well No. 1  
 2280' FNL & 978' FEL SEC. 32, T-17-S, R-28-E  
 EDDY COUNTY, NEW MEXICO  
 INJECTION WELL DIAGRAM



10. 4653

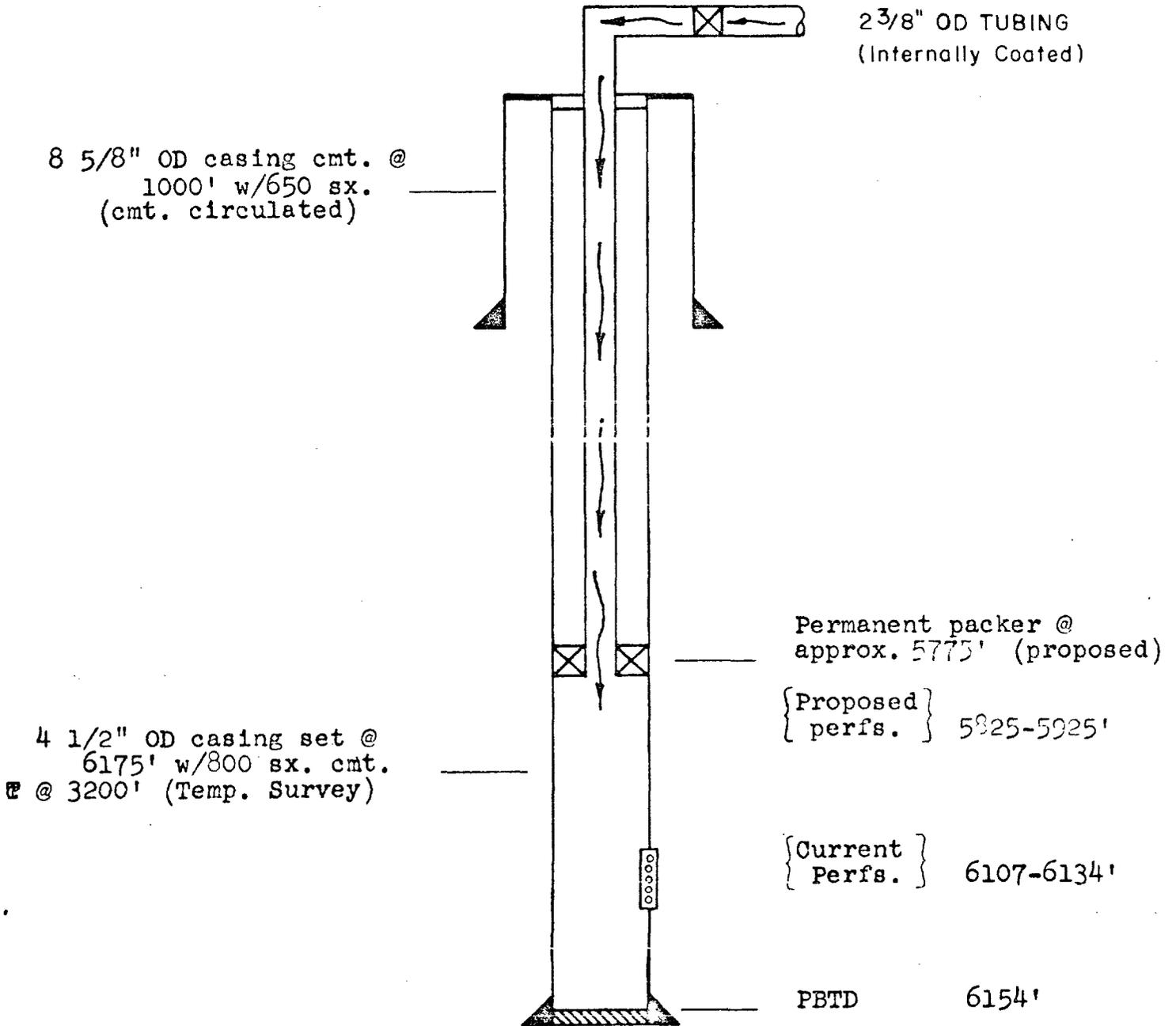
ATLANTIC RICHFIELD COMPANY

M. Yates "B" (ARC) Well No. 8

1980' FNL & 2130' FEL SEC. 33, T-17-S, R-28-E

EDDY COUNTY, NEW MEXICO

INJECTION WELL DIAGRAM



Case 4952

EXHIBIT NO. \_\_\_\_\_

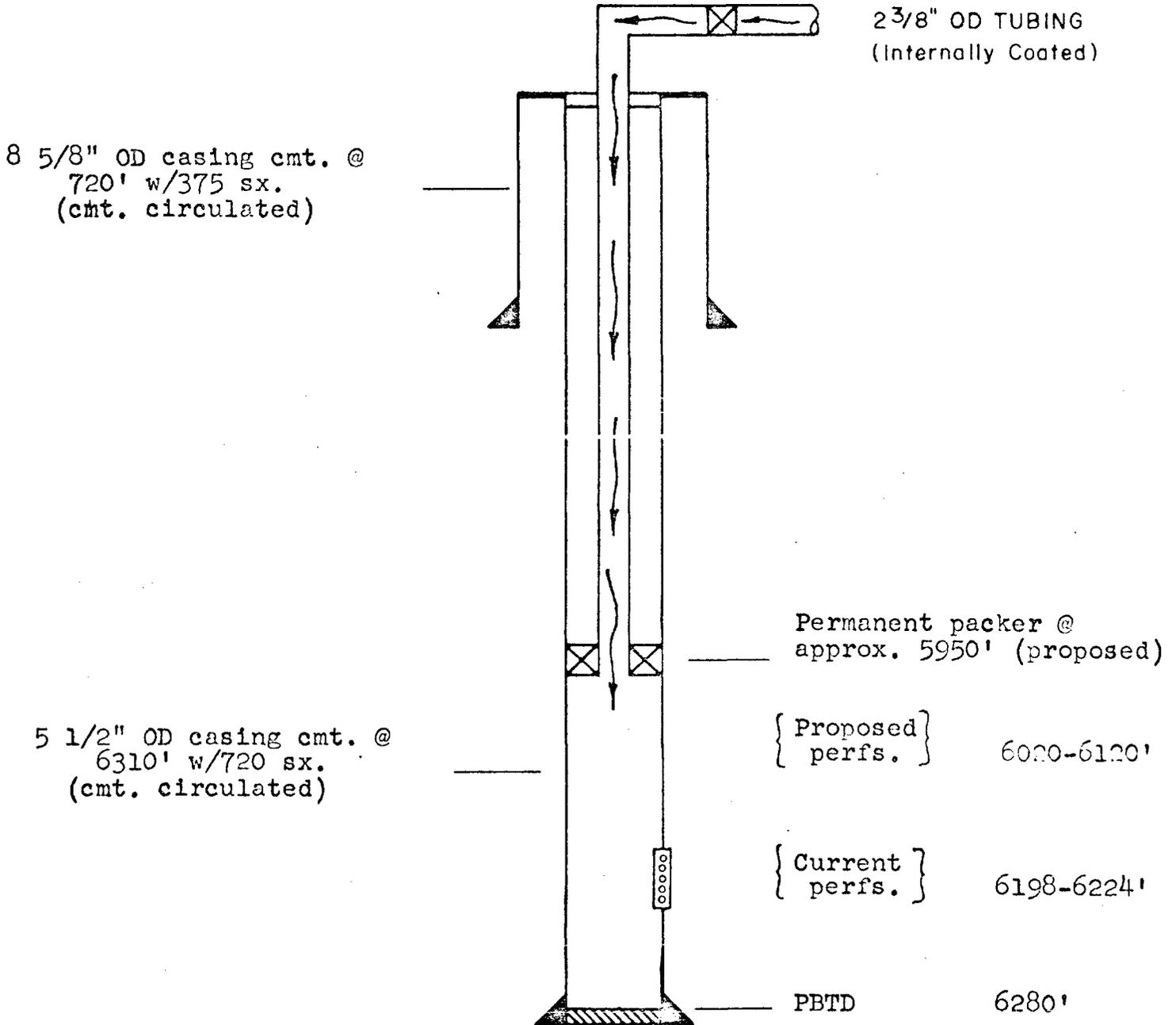
HONDO OIL AND GAS COMPANY  
 (ATLANTIC RICHFIELD COMPANY)

State "A" Well No. 21

1650' FSL & 1980' FWL SEC. 26, T-17-S, R-28-E

EDDY COUNTY, NEW MEXICO

INJECTION WELL DIAGRAM



✓ 4953

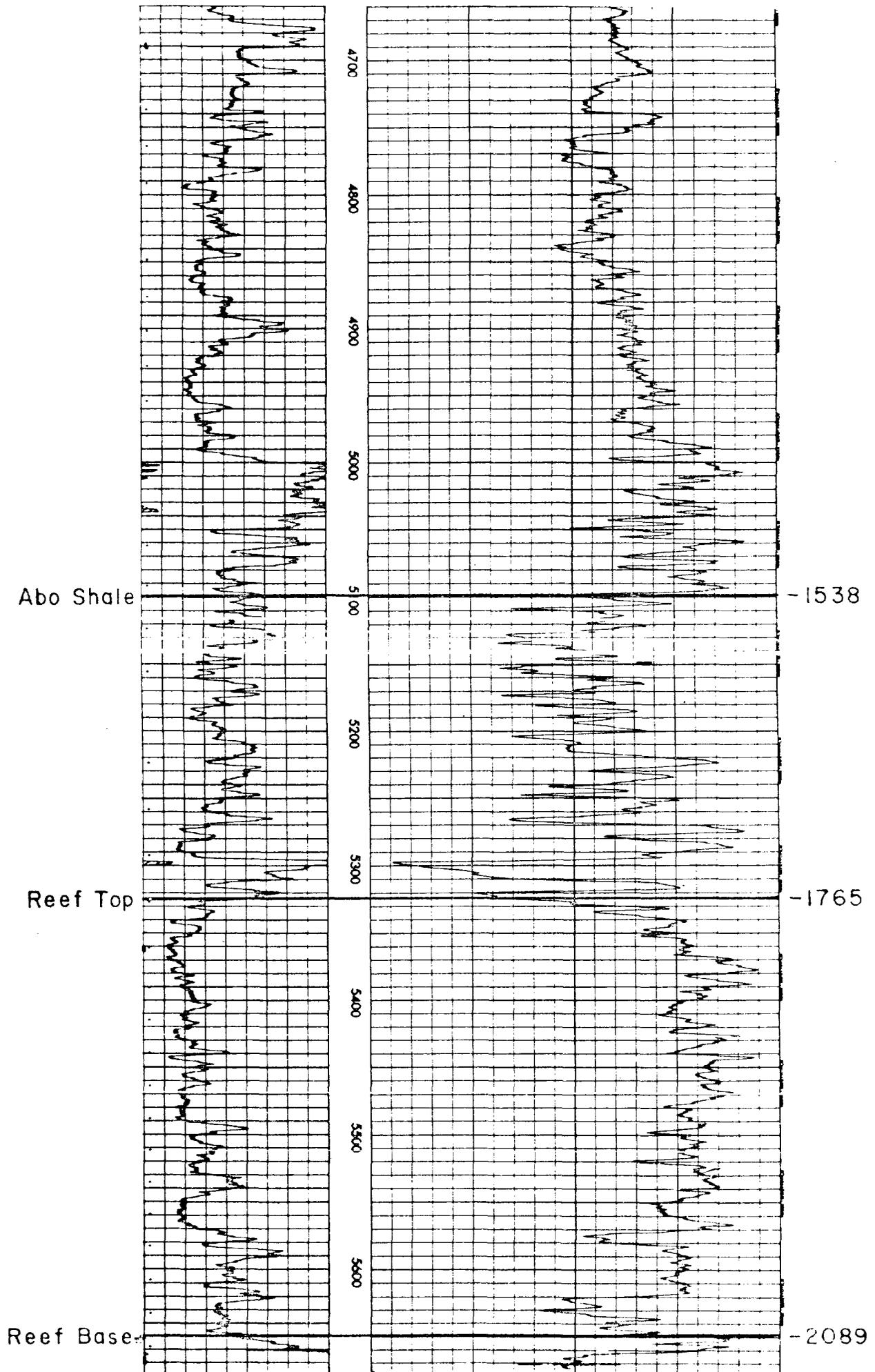
HUMBLE OIL AND REFINING COMPANY

Chalk Bluff Draw Unit A Well No. 4

990' FNL & 2310' FWL SEC. 9, T-18-S, R-27-E

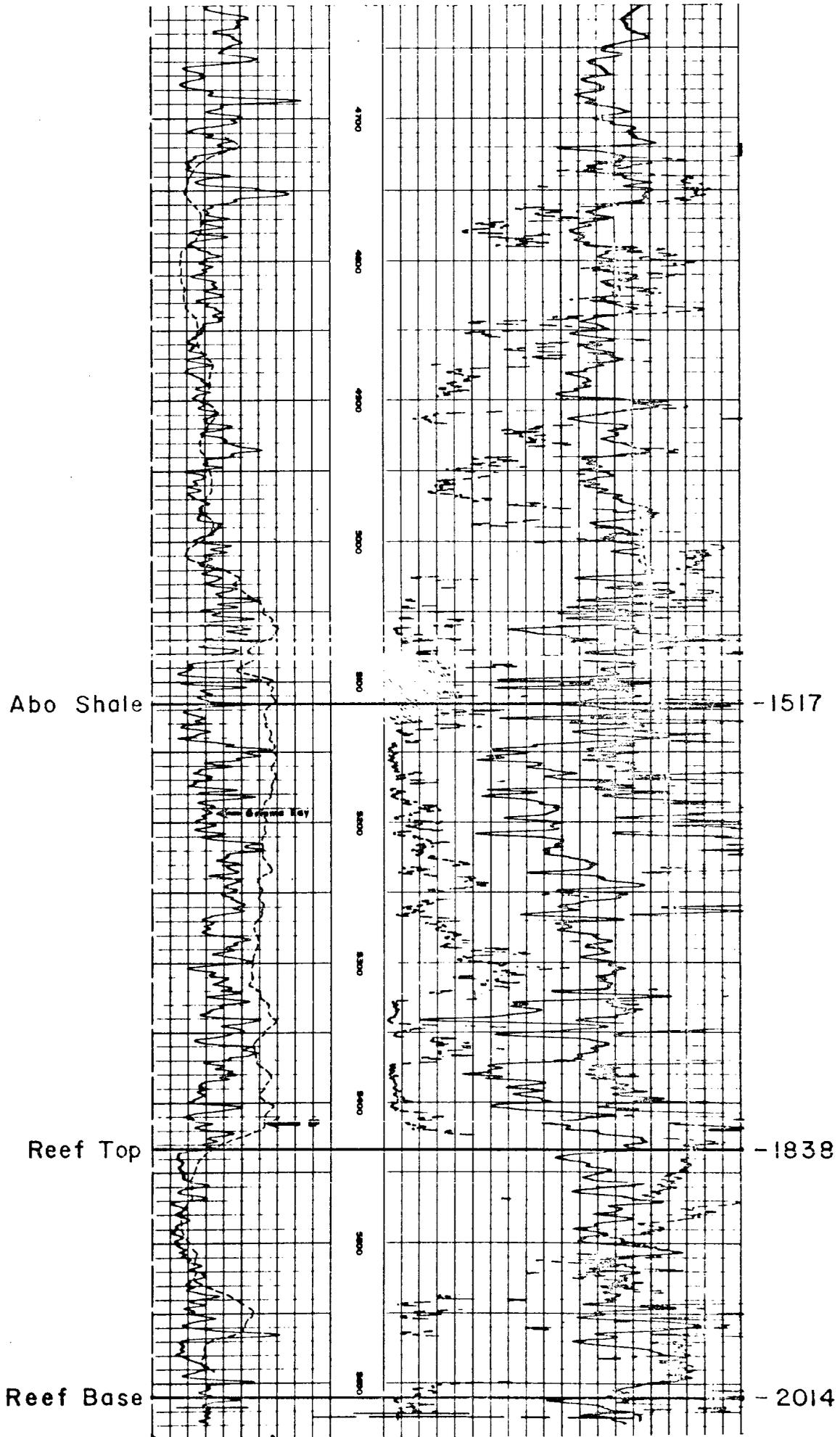
EDDY COUNTY, NEW MEXICO

GAMMA RAY - NEUTRON



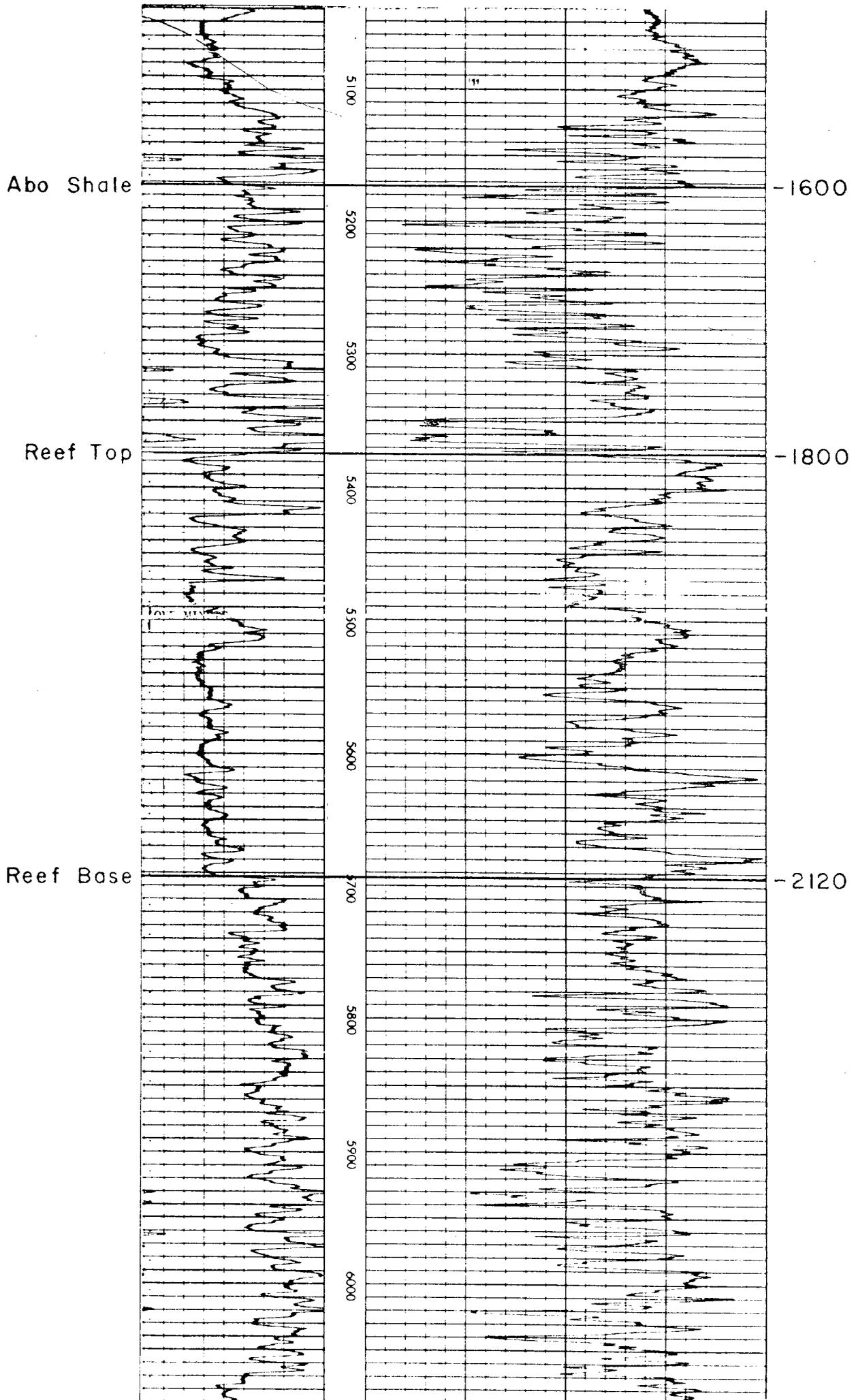
Case 4953

AMOCO PRODUCTION COMPANY  
R.H. Windfohr Well No. 4  
1582' FSL & 1645' FEL SEC. 4, T-1B-S, R-27-E  
EDDY COUNTY, NEW MEXICO  
GAMMA RAY - NEUTRON - LATEROLOG



Case 4953

AMOCO PRODUCTION COMPANY  
Malco "H" Federal Well No. 2  
1980' FNL & 660' FEL SEC. 3, T-18-S, R-27-E  
EDDY COUNTY, NEW MEXICO  
GAMMA RAY - NEUTRON



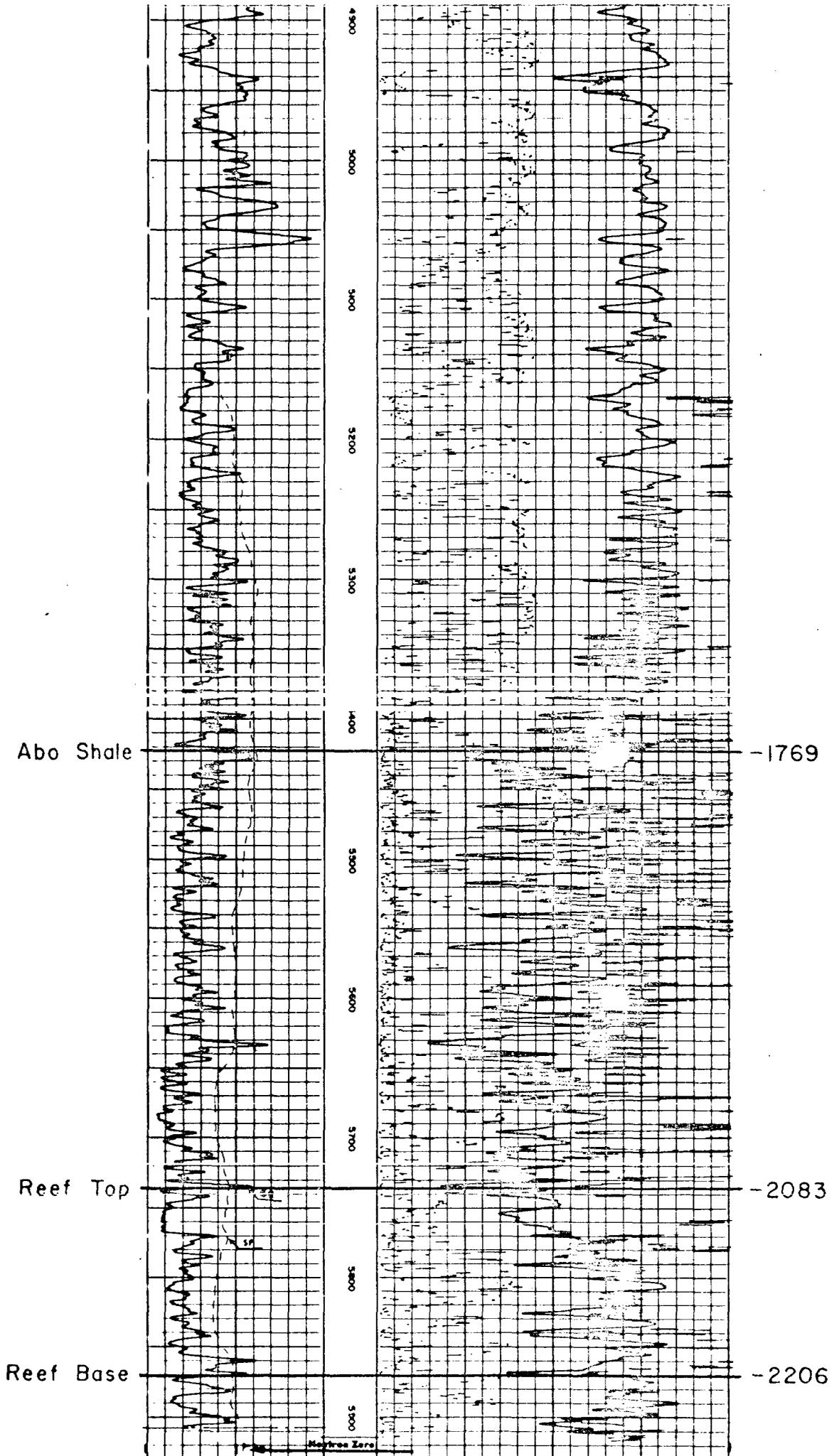
Case 4953

MARTIN YATES, III  
Dooley State ABO No. 2

1650' FSL & 1650' FEL SEC. 36, T-17-S, R-27-E

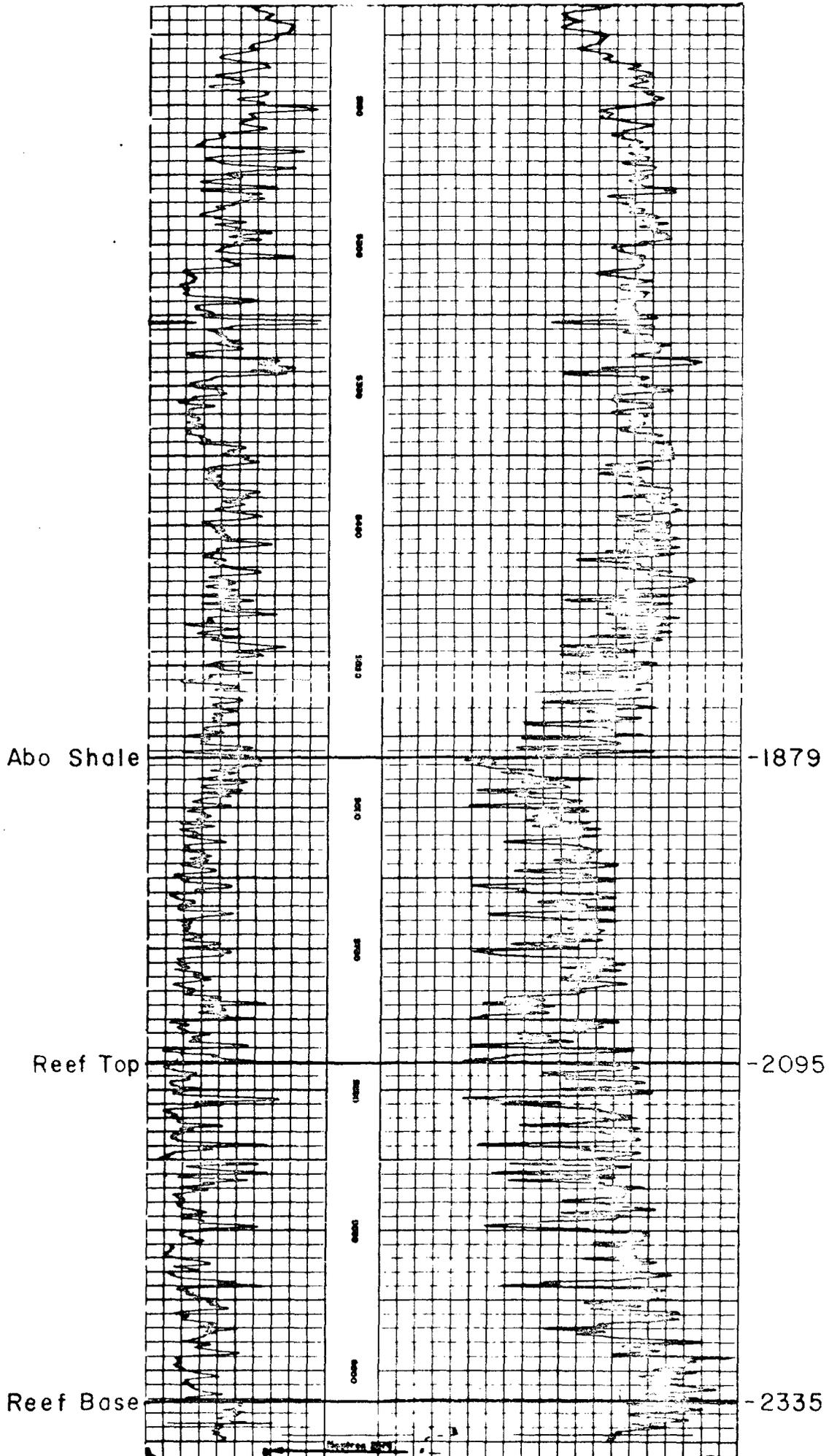
EDDY COUNTY, NEW MEXICO

LATEROLOG-GAMMA RAY-NEUTRON

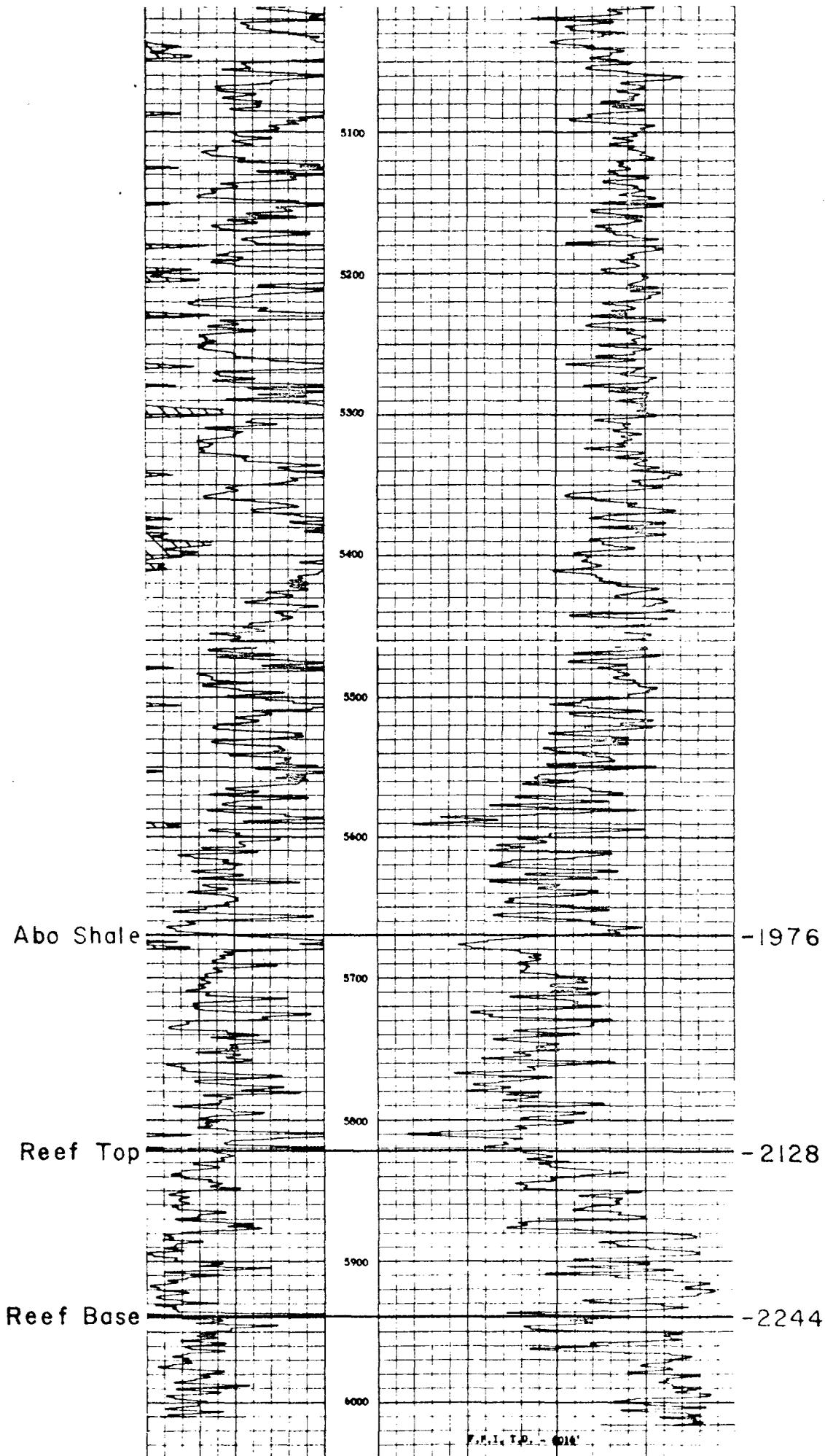


Case 4953

AMOCO PRODUCTION COMPANY  
State "BM" Well No. 1  
1650' FSL & 2387' FWL SEC. 31, T-17-S, R-28-E  
EDDY COUNTY, NEW MEXICO  
GAMMA RAY - NEUTRON

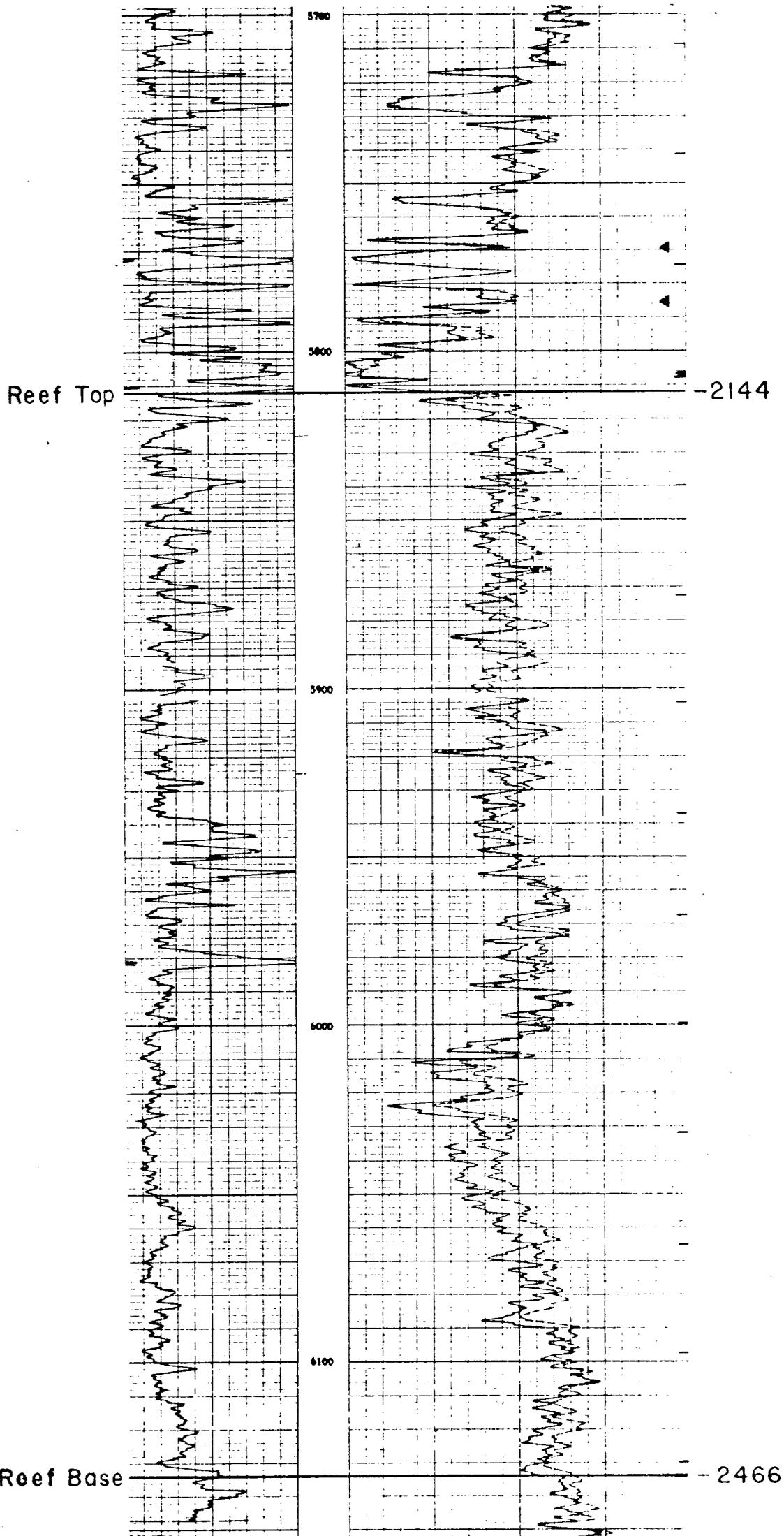


AMOCO PRODUCTION COMPANY  
State "BV" Well No. 1  
2280' FNL & 978' FEL SEC. 32, T-17-S, R-28-E  
EDDY COUNTY, NEW MEXICO  
GAMMA RAY - ISOTRON



Code 4953

ATLANTIC RICHFIELD COMPANY  
M. Yates "B" (ARC) Well No. 8  
1980' FNL & 2130' FEL SEC. 33, T-17-S, R-28-E  
EDDY COUNTY, NEW MEXICO  
GAMMA RAY - ISOTRON



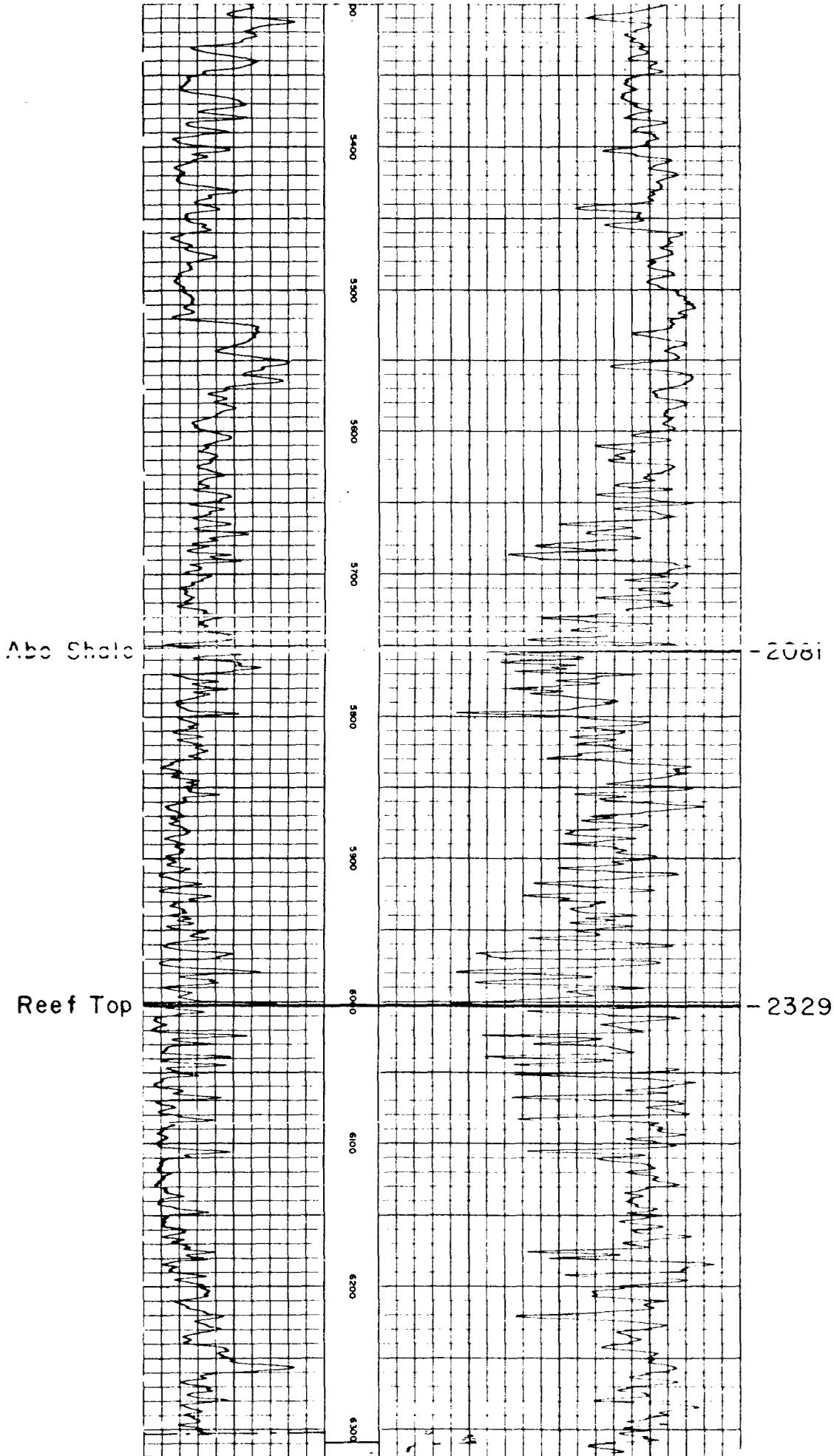
HONDO OIL AND GAS COMPANY  
(ATLANTIC RICHFIELD COMPANY)

State "A" Well No. 21

1650' FSL & 1980' FWL SEC. 26, T-17-S, R-28-E

EDDY COUNTY, NEW MEXICO

GAMMA RAY - NEUTRON



Case 4953