

CASE 5778: GAS CO. OF NEW MEXICO
FOR UNDERGROUND GAS STORAGE
FINDINGS, EDDY COUNTY, NEW MEXICO

CASE 110.

5778

Application,

Transcripts,

Small Exhibits

ETC.

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 5778
Order No. R-5412

APPLICATION OF GAS COMPANY OF
NEW MEXICO FOR UNDERGROUND GAS
STORAGE FINDINGS, EDDY COUNTY,
NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on September 29, 1976, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 12th day of April, 1977, the Commission, a quorum being present, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

- (1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.
- (2) That the applicant in the subject case, Gas Company of New Mexico, proposes the establishment of an underground gas storage project in Eddy County, New Mexico, to be known as the Duffield Gas Storage Project.
- (3) That the applicant has conducted geological and engineering studies to confirm the existence of a geological structure underlying portions of the SW/4 Section 15, S/2 Section 16, SE/4 Section 17, E/2 Section 20, All Section 21, W/2 Section 22, NW/4 Section 27, N/2 Section 28 and NE/4 Section 29, all in Township 16 South, Range 27 East, NMPM, Eddy County, New Mexico, and to determine the suitability of said structure for the underground storage of natural gas.
- (4) That gas storage within said structure would be in the Pennsylvanian formation from the top of the Morrow clastics to the top of the Barnett shale.

Case No. 5778
Order No. R-5412

(5) That the aforesaid interval from the top of the Morrow clastics to the top of the Barnett shale within the geological structure underlying the lands described in Finding No. (3) above is a gas reservoir, having been designated by the Commission as the Duffield-Pennsylvanian Gas Pool comprising the SW/4 of Section 21, Township 16 South, Range 27 East, NMPM, by Commission Order No. R-928, dated December 13, 1956.

(6) That said Duffield-Pennsylvanian Gas Pool was discovered by the Continental Oil Company Gertrude M. Duffield Well No. 1 located in the NE/4 SW/4 of the aforesaid Section 21. Said well was completed in the Morrow formation within the interval described in Finding No. (4) above through perforations from 8616 feet to 8647 feet and from 8690 feet to 8715 feet on April 17, 1952.

(7) That although several other wells were drilled to the Pennsylvanian formation in the near vicinity to the aforesaid well, none was successful, and said Duffield-Pennsylvanian Gas Pool remained a one-well pool until its abandonment in December, 1967.

(8) That the original volume of gas in place in the aforesaid Duffield-Pennsylvanian is estimated to have been 5.245 billion cubic feet, with an original reservoir pressure of 3630 psia.

(9) That prior to its abandonment, the aforesaid Gertrude M. Duffield well produced 4.480 billion cubic feet of gas, or 85.4 percent of the original gas in place, and the reservoir pressure had declined to approximately 543 psia.

(10) That the remaining gas in the reservoir, some 0.765 billion cubic feet at approximately 543 psia, does not constitute economically recoverable gas reserves at the subject reservoir's depth.

(11) That during its final 11 months of production prior to its abandonment in December, 1967, the Gertrude M. Duffield Well No. 1 averaged approximately 18 MCF per day of production.

(12) That the Duffield-Pennsylvanian Gas Pool is substantially depleted of recoverable native gas in place.

(13) That although the areal extent of the permeability and porosity of the Duffield-Pennsylvanian Gas Pool as presently known is somewhat less than the entire area described in Finding No. (3) above, all of said lands should be included in the Duffield Gas Storage Project in order to protect the

structure from drainage by non-project wells, in the event the areal extent of the structure is larger than presently known.

(14) That the applicant has attempted to acquire gas storage rights in the interval from the top of the Morrow clastics to the top of the Barnett shale underlying the SW/4 Section 15, S/2 Section 16, SE/4 Section 17, E/2 Section 20, All Section 21, W/2 Section 22, NW/4 Section 27, N/2 Section 28, and NE/4 Section 29, all in Township 16 South, Range 27 East, NMPM, Eddy County, New Mexico, and has indeed acquired such rights underlying 87.5 percent of said lands, and is in the process of acquiring such rights under the remaining lands.

(15) That pursuant to Section 65-9-5 NMSA 1953 Comp., this case was called to consider the propriety of utilization of the aforesaid interval underlying the above-described lands, and consequently thereto, the Commission finds:

- A. That the above-described sub-surface interval underlying the above described lands is suitable for the underground storage of natural gas and should be designated as the Duffield Gas Storage Project.
- B. That the Duffield Gas Storage Project is incapable of producing oil in paying quantities through any known recovery method.
- C. That the Duffield Gas Storage Project does not underlie any known commercial deposits of potash.
- D. That storage of natural gas in the Duffield Gas Storage Project will not cause injury to surface or underground water resources.
- E. That the underground strata constituting the Duffield Gas Storage Project formerly contained native gas capable of production in paying quantities, but are now substantially depleted of recoverable native gas, and such strata have a greater value as a gas storage reservoir than for the production of the remaining volumes of native gas therein.

-4-

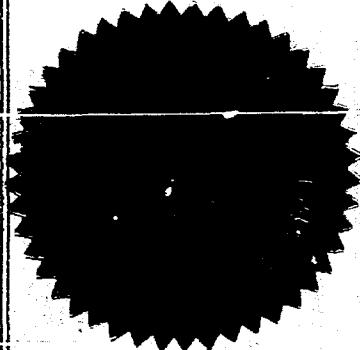
Case No. 5778
Order No. R-5412

- F. That the horizontal extent of the displaced or injected gas in the above-described sub-surface interval will be within the outer boundaries of the above-described lands.
- G. That no portion of the above-described sub-surface interval underlying the above-described lands has been appropriated or is being utilized for the injection, storage and withdrawal of natural gas by any other party.

(16) That jurisdiction of this cause is retained for the entry of such further findings as may be necessary.

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

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION



Phil R. Lucero

PHIL R. LUCERO, Chairman

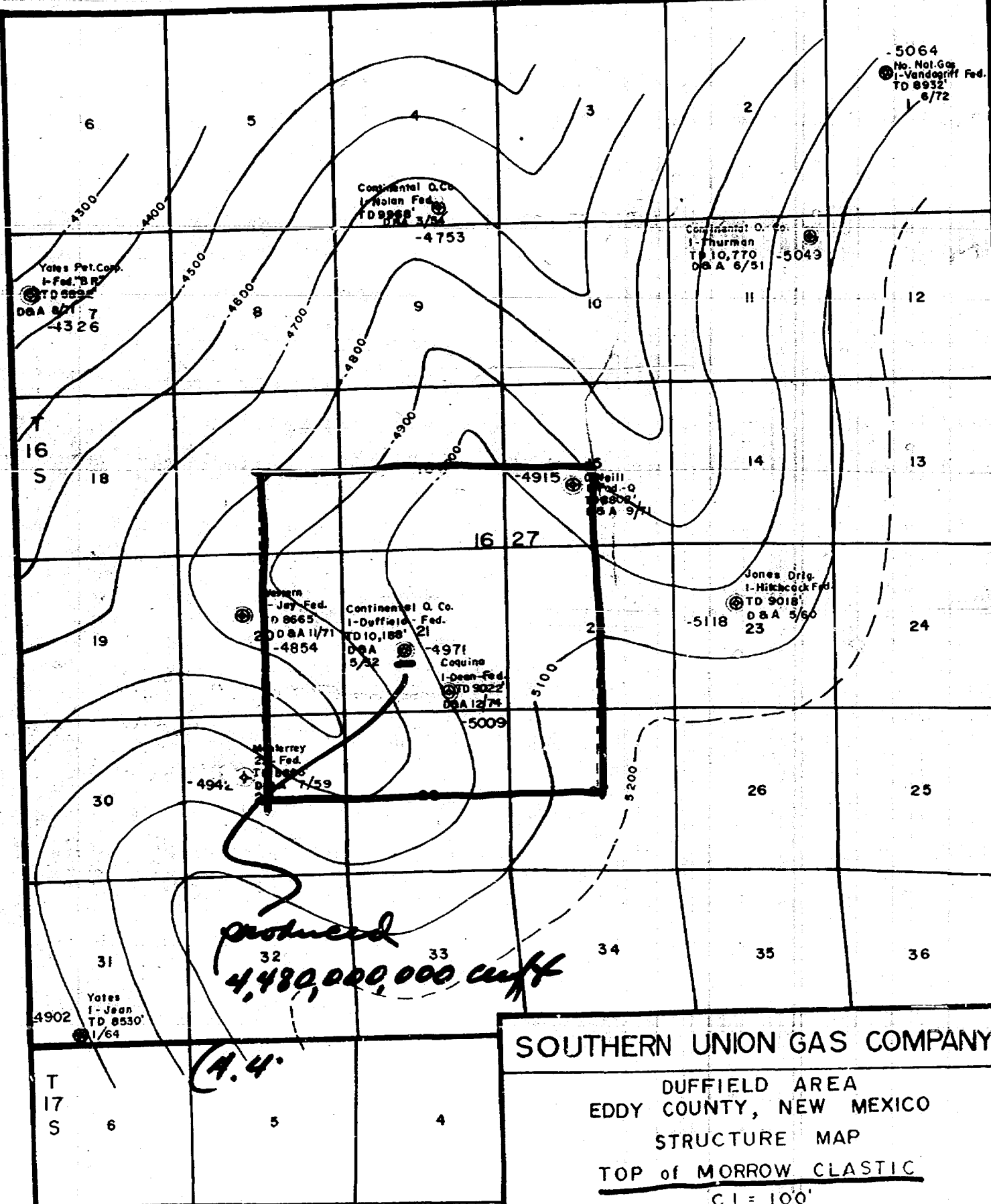
EMERY C. ARNOLD, Member

Joe D. Ramet
JOE D. RAMEY, Member & Secretary

S E A L

dr/

R-27-E



SOUTHERN UNION GAS COMPANY

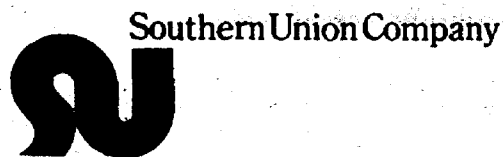
DUFFIELD AREA
EDDY COUNTY, NEW MEXICO
STRUCTURE MAP
TOP of MORROW CLASTIC

C.I. = 100'

EXHIBIT NO. 3

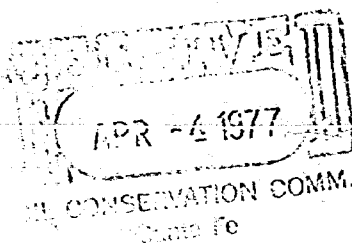
Geology: R.G. Sherrock
Date: January 5, 1976

Scale: 0 4000' 6000' 8000'
0 1 2
one mile



Southern Union Company

March 31, 1977



Oil Conservation Commission
State of New Mexico
P. O. Box 2088
Santa Fe, New Mexico 87501

Attention: Mr. Dan Nutter

Re: Docket No. 26-76; Case No. 5778

Dear Mr. Nutter:

As per your request, I am forwarding material as back up to the Pressure-Production Decline Curve constructed on the Continental Duffield #1, a depleted Morrow gas well. The curve is represented as Exhibit No. 9, a copy of which is attached. With respect to the initial SITP, I have marked it for your reference on page 4 of the attachments. Also for your reference, on page 5, I have indicated Continental's request for abandonment, which states that the well had decreased to a rate of 18 MCFD.

Please don't hesitate to contact me if you require further information regarding this subject.

Best regards,

James G. Ellis
Chief Petroleum Engineer

JGE:mt

Attachments

cc: Mr. O. L. Haseltine
Mr. W. M. Parks

ELLIS
3/31/77

NATIONAL
35107 EYE EASE
45407 10.20 HUFF
VIA TO S.A.

Plotting Data Pressure vs Production Continental Oil Field #1

1 DATE	2 Measured SITP P _{sia}	3 Calculated BHP P _{sia}	4 Calculated BHP/z P _{sia}	5 Cum Production M MCF	6	7
1 INITIAL	2943 2956	3632 3630	4236	-0-		
2 5-27-64	510	613	662	4425		
3 11-13-65	480	576	619	4465		
4 4-7-66	479	575	619	4471		
5 10-19-67	453	543	582	4480		
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INTEROFFICE CORRESPONDENCE

SUG-8920

SOUTHERN UNION  GAS COMPANY

TO	NAME	CITY	FROM	NAME	CITY
	Mr. James G. Ellis	Gas Supply		Roy Sharrock	Gas Supply
JECT	Continental #1 Gertrude Duffield-Federal			DATE	ACTION
				January 19, 1976	FOR INFORMATION <input type="checkbox"/>

WELL DRILLING AND COMPLETION HISTORY

The Continental Oil Company #1 Gertrude Duffield-Federal, located 1980 feet from the South and West lines of Section 21, T-16-S, R-27-E, Eddy County, New Mexico, was commenced as an Ellenburger wildcat on December 22, 1951. 13 3/8 inch O.D. surface casing was set in a 17 1/2 inch hole to 274 feet and cemented with 275 sacks cement. 9 5/8 inch O.D. intermediate casing was set in a 12 1/4 inch hole to 1381 feet and cemented with 875 sacks cement. The well reached total depth of 10188 feet on April 17, 1952. 7 inch O.D. production casing was set into 8 3/4 inch hole at 8799' and cemented with 1019 sacks cement. The well was perforated with 100 holes from 8690-8715 and 124 holes from 8616-8647. The perforations were acidized with 1000 gallons acid. 2 1/2 inch production tubing was set at 8605 feet. The well tested as follows:

- F. 5,250 MCFGPD, 1 1/4" ch., TP 380#; SITP 2412#;
- F. 3,185 MCFGPD + 30 bbls. dist., 1 1/2" ch.;
- F. 1,800 MCFGPD + 33 bbls. dist., 1 1/2" ch.;
- F. 1,551 MCFGPD, 1 1/2" ch.;
- F. 1,204 MCFGPD + 17 bbls. dist., 1 1/2" ch.;
- F. 845 MCFGPD + 28 bbls., dist., 1 1/2" ch.; SIP
- F. 2943#; OF 3,800,000 CFGPD.

P. 2

PRODUCTION

The well was connected June 16, 1952, and disconnected December 1967. Cumulative gas production was 4.48 bcf and 15,761 bbl. condensate.

The annual gas production is as follows:

<u>Year</u>	<u>Production MCF</u>
1952	257,089
1953	493,100
1954	684,324
1955	650,293
1956	445,974
1957	393,485
1958	408,589
1959	279,153
1960	349,115
1961	117,534
1962	6,248
1963	258,232
1964	88,709
1965	35,688
1966	6,424
1967	6,203

The shut in pressures are as follows:

<u>Date</u>	<u>Pressure</u>
5/27/64	510.3 PSIA
11/13/65	480.0 PSIA
4/7/66	479.0 PSIA
10/19/67	453.0 PSIA

FORMATION RECORD

<u>From</u>	<u>To</u>	<u>Total Feet</u>	<u>Formation</u>
0	1375	1375	Red Shale and Sand
1375	4875	3500	Dolomite (Streaks of Sand)
4875	5600	725	Shale
5600	6080	480	Dolomite
6080	8000	1920	Lime and Shale
8000	8880	880	Shale, Lime and Sand
8880	9300	420	Lime and Chert
9300	9350	50	Shale
9350	10,020	670	Dolomite
10,020	10,060	40	Shale and Sand
10,060	10,188	128	Dolomite

P. 3

FORMATION TOPS

<u>Formation</u>	<u>Tops</u>
T/Glorieta	2853
T/Abo	4875
T/Hueco	6080
T/Strawn	8010
T/Atoka	8407
T/Morrow Clastics	8543
T/Chester	8750
T/Mississippian Line	8947
T/Woodford Shale	9308
T/Simpson	10,022
T/Ellenburger	10,080

Total Depth 10,188 in Ellenburger
Formation

PLUGGING PROCEDURE

The well was plugged and abandoned by the procedure shown below:

Found packer at 8508 and hold-down at 8498. Cut tubing at 8485
and pulled same (2 1/2" OD). Set 50 sacks Neat cement 8485-8170. Cut
7" casing at 3020 and pulled same. Set 50 sacks cement 3030-2900,
25 sacks 1380-1320 and 10 sacks at surface. Erected dry hole marker
12-18-67.

RGS:bfc

Fgl

COMPANY Continental Oil Co. - #1 Gertrude Elev. 3573 DF
 Loc. 1980' FSL & FWL Duffield-Federal
 Sec. 21, T.16-S, R. 27-E

P.4

ACID OR SHOT	CASINO RECORD	S.A.	TUPS
1000 acid	13 3/8- 274- 300	Glor.	1375
	9 5/8-1381- 875	Tubb	2780
	7 -8799- 977	Abo	4160
	2 1/2-8606	Waco	4875
		Penn.	6095
		Wolfe.	6700
		Dev.	9290
		Simp.	9347
		Ellen.	10025
		TP	10060
		TP	8616
		TP	10,188 dolo.
		PUD	8766

SPO. 12-22-51 COMP. 5-14-52
 I. P. F. 3,800,000 CFGPD + 30 bbls.
 dist.; 1/2" ch.
 GR. 66 GOR - TP 7943 CP 8543
 REMARKS DST 6090-6134 op. 30 mins. rec.
 120' mud. DST 7192-7276 op. 2 hrs. rec.
 1260' sul. wtr. FT. CONT'D. PAGE 2.
 600; SIP 2400/15 mins.

EDDY, N.M. 21-16-27
 Continental Oil Co. - #1 - Gertrude Duffield-Federal.

PAGE 2.

DST 7515-7665 op. 1 hr. gas 40 mins. rec. 420' SGCM;
 FP 350; SIP 1000/
 DST 8540-8660 op. 1 hr. 5 mins. gas 4 mins. mud 18
 mins. F. 4,600,000 CFGPD; FP 1535; SIP 2875/15"
 DST 8690-8750 op. 2 hrs. gas 20 mins. @ 15,360 CFGPD;
 rec. 1000' WB + 90' SO&GCM; FP 625; SIP 1075/
 DST 8690-8750 op. 2 hrs. gas 20 mins. rec. 90' SO&GCM;
 FP 625; SIP 1075/
 DST 9347-9440 op. 2 1/2 hrs. rec. 1500' WB + 2600' salty
 sul. wtr.; FP 2000; SIP 4000/
 DST 9440-9502 op. 2 hrs., rec. 1500' WB, 7110' sul. wtr.;
 FP 3480; SIP 4720/
 DST 9927-9974 op. 2 hrs. rec. 1500' WB + 6500' SW; FP
 3980; SIP 4280/
 DST 10080-10192, 1700' WB, rec. WB, 3070' SW; FP 2420;
 SIP 4226/ (tool open undes. time); ran Surveys
 Perf.: 100/8690-3715; 2 1/2" pkr.
 Perf. 124/8616-8647; 500 acid; ran 2 1/2" @ 8605';
 CONT'D. @ 8605';

EDDY, N.M.
 Continental Oil Co. - #1 - Gertrude Duffield-Federal

PAGE 3.

F. 5,250 MCFGPD, 1 1/4" ch., TP 380#; SIP 2412#;
 F. 3,185 MCFGPD + 30 bbls. dist., 1 1/2" ch.;
 F. 1,800 MCFGPD + 33 bbls. dist., 1 1/2" ch.;
 F. 1,551 MCFGPD, 1 1/2" ch.;
 F. 1,204 MCFGPD + 17 bbls. dist., 1 1/3" ch.;
 F. 845 MCFGPD + 28 bbls. dist., 1 1/2" ch. SIP
 2943# OF 3,800,000 CFGPD.

2943#

R. M. O. C. C. COPY

Form 9-331
(May 1963)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBMIT IN TRIPlicate
(Other instructions on re-verse side)

Form approved.
Budget Bureau No. 42-R1424.

SUNDY NOTICES AND REPORTS ON WELLS

(Do not use this form for proposals to drill or to deepen or plug back to a different reservoir. Use "APPLICATION FOR PERMIT" for such proposals.)

1. OIL WELL <input type="checkbox"/> GAS WELL <input checked="" type="checkbox"/> OTHER <input type="checkbox"/>		2. NAME OF OPERATOR Continental Oil Company		3. ADDRESS OF OPERATOR P. O. Box 460, Hobbs, New Mexico 88240		4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements. See also space 17 below.) At surface 1980' FSL and 1988' FWL, Sec. 21, T-16, R-27, Unit Letter "K", Eddy County, New Mexico		5. LEASE DESIGNATION AND SERIAL NO. IC 062618		6. IF INDIAN, ALLOTTEE OR TRIBE NAME		7. UNIT AGREEMENT NAME		8. FARM OR LEASE NAME G. W. Duffield		9. WELL NO. 1		10. FIELD AND POOL, OR WILDCAT Penn. Gas Pool		11. SEC., T., R., M., OR BLM. AND SURVEY OR AREA Sec. 21, T-16, R-27		12. COUNTY OR PARISH Eddy		13. STATE N.M.	
14. PERMIT NO.				15. ELEVATIONS (Show whether DP, MT, CA, etc.) 3573' DF																					

16. Check Appropriate Box To Indicate Nature of Notice, Report, or Other Data

NOTICE OF INTENTION TO:				SUBSEQUENT REPORT OF:			
TEST WATER SHUT-OFF	<input type="checkbox"/>	FULL OR ALTER CASING	<input type="checkbox"/>	WATER SHUT-OFF	<input type="checkbox"/>	REPAIRING WELL	<input type="checkbox"/>
FRACTURE TREAT	<input type="checkbox"/>	MULTIPLE COMPLETION	<input type="checkbox"/>	FRACTURE TREATMENT	<input type="checkbox"/>	ALTERING CASING	<input type="checkbox"/>
SHOOT OR ACIDIZE	<input type="checkbox"/>	ABANDON*	<input checked="" type="checkbox"/>	SHOOTING OR ACIDIZING	<input type="checkbox"/>	ABANDONMENT*	<input type="checkbox"/>
REPAIR WELL	<input type="checkbox"/>	CHANGE PLANS	<input type="checkbox"/>	(Other)	<input type="checkbox"/>		
(Other)				(NOTE: Report results of multiple completion on Well Completion or Recompletion Report and Log form.)			

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)

This well has declined to a point where production for the month of August was 18 MCF a day, which is below the economic limit. It is proposed to plug and abandon the well using the following procedure:

1. Spot 25 sacks class "C" $\frac{1}{2}$ gel cement, plug across perforations from 8590'-8740'.
2. Fill hole with 10# mud.
3. Cut and pull 4800' of 7" casing (TOC-4800' by temp. survey).
4. Place 25 sacks cement plug in top of 7" casing.
5. Place 25 sacks from 2800'-2900'.
6. Place 25 sacks cement plug in base of intermediate casing (1381').
7. Place 10 sacks cement plug at surface.
8. Erect marker and return location to original condition.

RECEIVED
OCT 12 1967
U. S. GEOLOGICAL SURVEY
ARTS & MINES DIVISION

18. I hereby certify that the foregoing is true and correct

SIGNED James D. Hobbs TITLE Sup. Prod. Engineer DATE 10-9-67
(This space for Federal or State office use)

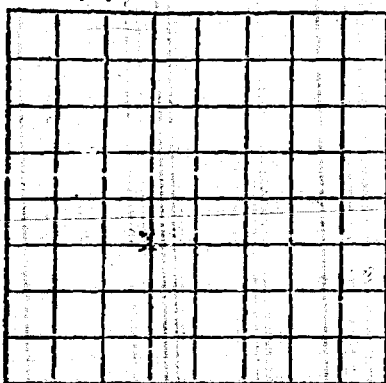
APPROVED BY _____ TITLE _____
CONDITIONS OF APPROVAL, IF ANY:

USGS-5 FILE-2

OCT 1 1967

*See Instructions on Reverse Side

Form 9-330



LOCATE WELL CORRECTLY

Revised Form No. 12-1333.2
Expires 12-31-52

U. S. LAND OFFICE Las Cruces
SERIAL NUMBER 062618
LEASE OR PERMIT TO PROSPECT _____

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Oil Control
Artesia Office

LOG OF OIL OR GAS WELL

Company Continental Oil Company Address Box 427, Hobbs, New Mexico
Lessor or Tract Gertrude M. Buffield Field Wildcat State New Mexico
Well No. 1 Sec 21 T. 13S R. 27E Meridian N.M.P.M. County Eddy
Location 1930 ft. (N.) of S Line and 1960 ft. (E.) of W Line of Section 21 Elevation 3573
(Denote gas by G)

The information given herewith is a complete and correct record of the well and all work done thereon so far as can be determined from all available records.

Signed [Signature]

Date May 26, 1952 Title Dist. Supt.

The summary on this page is for the condition of the well at above date.

Commenced drilling December 22, 1951 Finished drilling April 17, 1952

OIL OR GAS SANDS OR ZONES

(Denote gas by G)

No. 1, from 8616 to 8715 No. 4, from _____ to _____
No. 2, from _____ to _____ No. 5, from _____ to _____
No. 3, from _____ to _____ No. 6, from _____ to _____

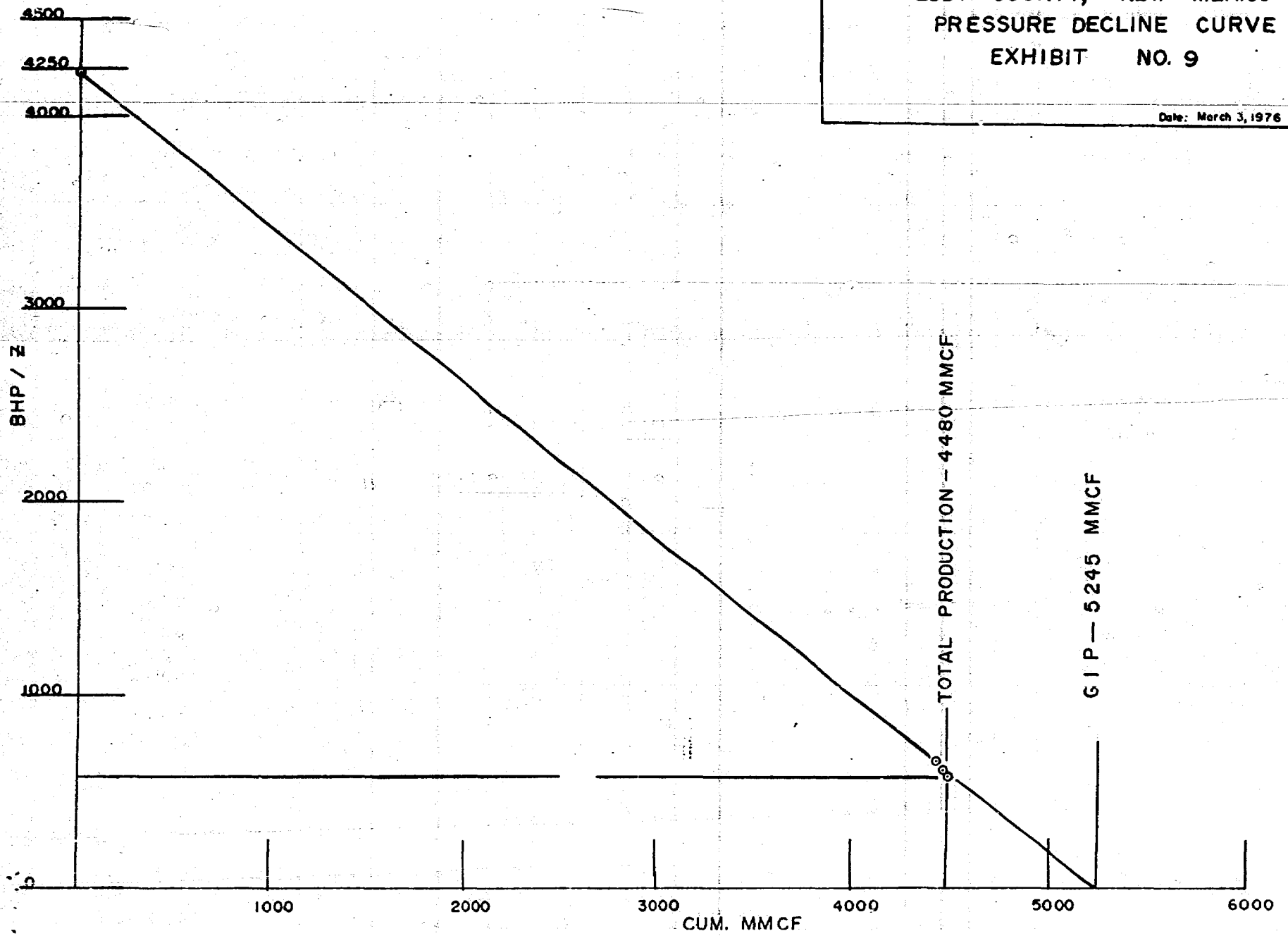
IMPORTANT WATER SANDS


JUN 2 1952

SOUTHERN UNION GAS COMPANY

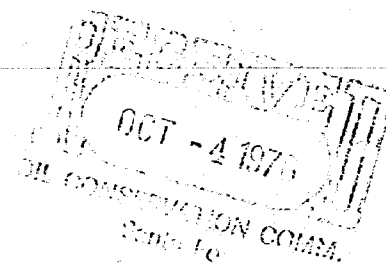
DUFFIELD AREA
EDDY COUNTY, NEW MEXICO
PRESSURE DECLINE CURVE
EXHIBIT NO. 9

Date: March 3, 1976




SOUTHERN UNION GAS COMPANY
FIRST INTERNATIONAL BUILDING • DALLAS, TEXAS • 75270

September 30, 1976



Oil Conservation Commission
State of New Mexico
P. O. Box 2088
Santa Fe, New Mexico 87501

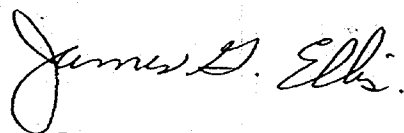
Attention: Mr. Dan Nutter

Re: Docket No. 26-76; Case No. 5778

Dear Mr. Nutter:

At your request, I am forwarding the attached, related to the captioned subject. If you wish additional information, please advise.

Very truly yours,



James G. Ellis
Chief Petroleum Engineer

JGE:mt

cc: Montgomery, Federici, Andrews & Hannahs
325 Paseo DePeralta
Santa Fe, New Mexico 87501
Attention: Mr. Owen Lopez

PRODUCTION

The well was connected June 16, 1952, and disconnected December 1967. Cumulative gas production was 4.48 bcf and 15,761 bbl. condensate.

The annual gas production is as follows:

	<u>Year</u>	<u>Production MCF</u>
257,089. +	1952	257,089
493,100. +	1953	493,100
684,324. +	1954	684,324
650,293. +	1955	650,293
445,974. +	1956	445,974
393,485. +	1957	393,485
408,589. +	1958	408,589
279,153. +	1959	279,153
349,115. +	1960	349,115
117,534. +	1961	117,534
6,248. +	1962	6,248
258,232. +	1963	258,232
434,136. ◊	1964	434,136
88,709. +	1965	88,709
443,1845. ◊	1966	35,688
	1967	6,424
35,688. +		6,203
446,533. ◊		4,480,160

res are as follows:

	<u>Date</u>	<u>Pressure</u>
6,424. +	7/27/64	510.3 PSIA
447,3957. ◊	7/13/65	480.0 PSIA
6,203. +	4/7/66	479.0 PSIA
4480,160. *	10/19/67	453.0 PSIA

FORMATION RECORD

<u>From</u>	<u>To</u>	<u>Total Feet</u>	<u>Formation</u>
0	1375	1375	Red Shale and Sand
1375	4875	3500	Dolomite (Streaks of Sand)
4875	5600	725	Shale
5600	6080	480	Dolomite
6080	8000	1920	Lime and Shale
8000	8880	880	Shale, Lime and Sand
8880	9300	420	Lime and Chert
9300	9350	50	Shale
9350	10,020	670	Dolomite
10,020	10,060	40	Shale and Sand
10,060	10,188	128	Dolomite

PRODUCTION

connected June 16, 1952, and disconnected December
as production was 4.48 bcf and 15,761 bbl. condensate.
Production is as follows:

<u>Year</u>	<u>Production MCF</u>
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1957	393,485
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1959	279,153
1960	349,115
1961	117,534
1962	6,248
1963	258,232
1964	88,709
1965	35,688
1966	6,424
1967	6,203
	<u>4,343,136</u>
	<u>4,480,160</u>

The shut in pressures are as follows:

<u>Date</u>	<u>Pressure</u>
5/27/64	510.3 PSIA
11/13/65	480.0 PSIA
4/7/66	479.0 PSIA
10/19/67	453.0 PSIA

FORMATION RECORD

<u>From</u>	<u>To</u>	<u>Total Feet</u>	<u>Formation</u>
0	1375	1375	Red Shale and Sand
1375	4875	3500	Dolomite (Streaks of Sand)
4875	5600	725	Shale
5600	6080	480	Dolomite
6080	8000	1920	Lime and Shale
8000	8880	880	Shale, Lime and Sand
8880	9300	420	Lime and Chert
9300	9350	50	Shale
9350	10,020	670	Dolomite
10,020	10,060	40	Shale and Sand
10,060	10,188	128	Dolomite

DRILLING PROGNOSIS

Operator: Southern Union Gas Company

Well Name: Continental #1 Gertrude Duffield-Federal

Location: 1980' FSL & 1988' FWL, Sec. 21, T16S, R27E, Unit Letter "K", Eddy County, New Mexico

Elevation: 3573' DF

Proposed Depth: 8750'

Drilling Casing & Cementing:

1. Remove abandonment marker and install 12" casing flange.
2. Drill out plugs at surface, 1320-1380 and 2900 to 3030.
3. Dress off top of old 7" casing. Fishing tools, mills and casing patch will be furnished by M&B Fishing Tool and Supply, Hobbs (505-393-4185).
4. Run casing patch on new 7" OD, 23# K-55 casing and patch on to old casing.
5. Nipple up BOP stack and pressure test casing and patch to 2000 psig for 30 min. If patch does not hold, perforate 25' below patch and cement casing with 500 sacks of cement leaving 50' in casing. WOC 18 hrs. and drill out. Repeat pressure test.
6. Mill out tubing and packer at 8495'.
7. Clean out hole to 8750'.

Mud Program:

0 - 3030' - Use fresh water and gel for a viscosity of 45-50 Sec. and lower filter loss to 10-20 cc. Use Hyseal for seepage loss of fluid.

3030 - TD - Displace all fluid in the hole at 8495 with kcl water. Mix light gel, 32-35 viscosity, 10-20 cc water loss 9.0-9.5 ppg for milling out packer and cleaning out remaining hole.

Completion Program:

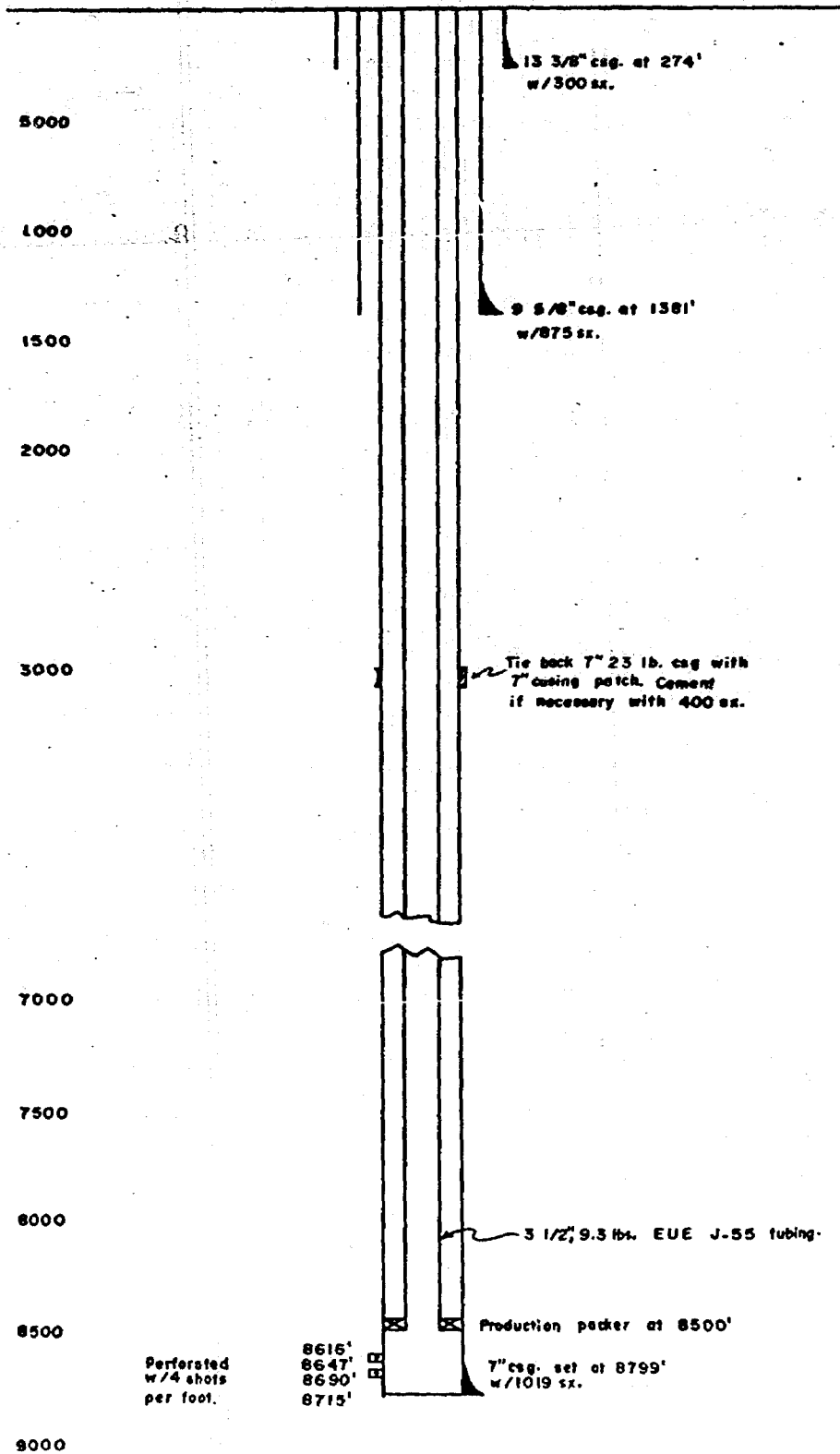
1. Go in hole with tubing and displace all fluid in hole with 2% kcl water.
2. Set packer on 3 1/2" OD, 9.3# EUE, J-55 tubing at 8500'.
3. Acidize old perforations with 2000 gal. 7 1/2% acid.
4. Fracture old perforations with 40000 gallons of gelled fluid and 44000# 20-40 sand.
5. Swab back loadwater.
6. Connect well for injection and production.

Miscellaneous:

A daily operations report is to be called to the Dallas office (214-748-8511) each day by 9:00 a.m. On weekends or for emergencies when the Dallas office is closed, one of the following should be called:

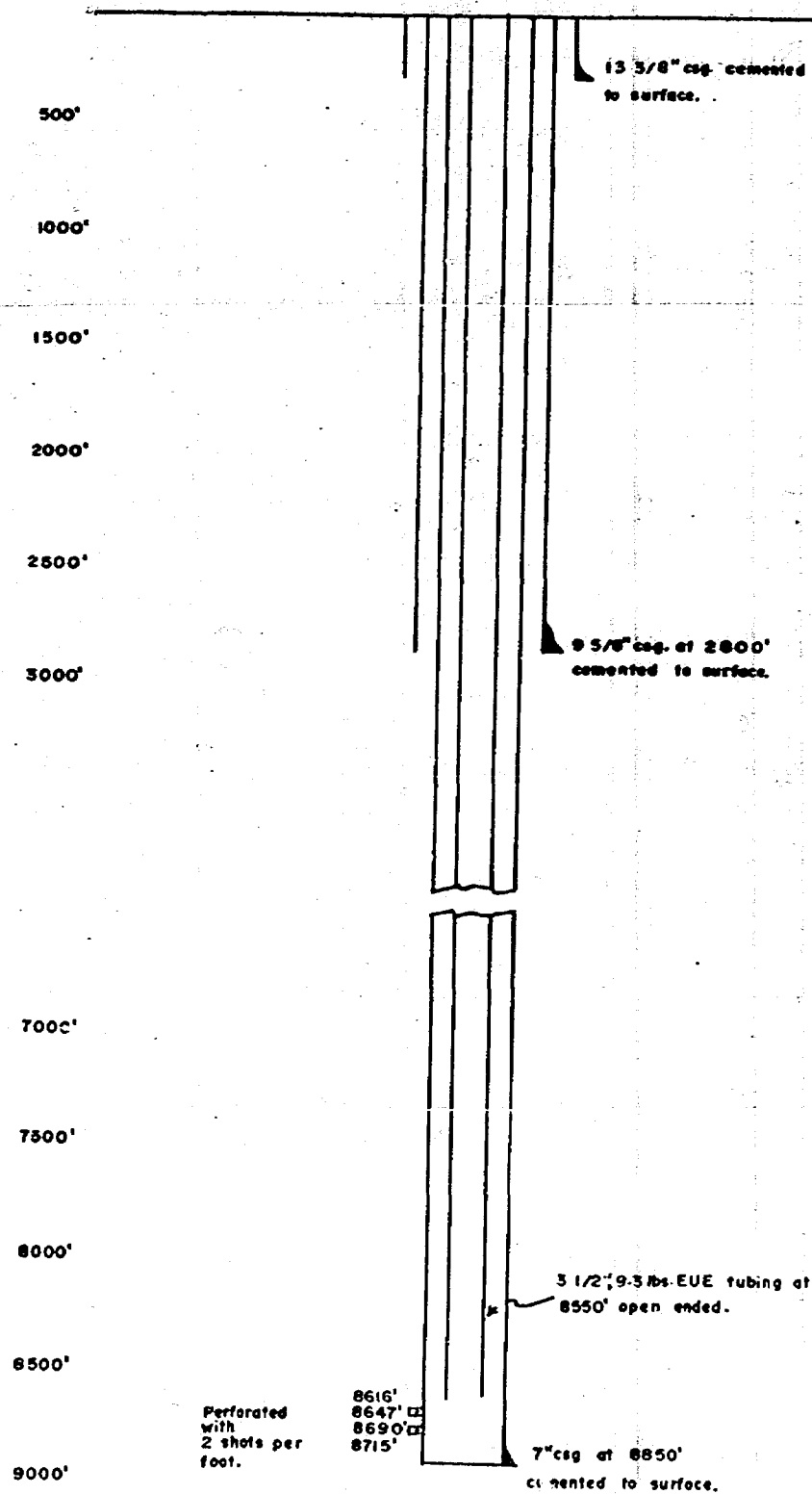
D. J. Ahalt, Drilling Engineer	214-242-9264
R. G. Sharrock, Geologist	214-271-4392
J. G. Ellis, Chief Petr. Engr.	214-223-6558
Martin Boges, Field Oper. Agent (Carlsbad, New Mexico)	505-885-5447

SOUTHERN UNION GAS COMPANY
Subsurface Schematic
Proposed Re-entry ✓
Continental #1
Gertude Duffield - Federal



8646-47
8690-15

SOUTHERN UNION GAS COMPANY
 Subsurface Schematic
 Proposed New Well
 Southern Union Gas Company
 Duffield #1-A



8616-47
 8690-8715

EXHIBIT NO. 3

WELL DRILLING AND COMPLETION HISTORY

The Continental Oil Company #1 Gertrude Duffield-Federal, located 1980 feet from the South and West lines of Section 21, T-16-S, R-27-E, Eddy County, New Mexico, was commenced as an Ellenburger wildcat on December 22, 1951. 13 3/8 inch O.D. surface casing was set in a 17 1/2 inch hole to 274 feet and cemented with 275 sacks cement. 9 5/8 inch O.D. intermediate casing was set in a 12 1/4 inch hole to 1381 feet and cemented with 875 sacks cement. The well reached total depth of 10188 feet on April 17, 1952. 7 inch O.D. production casing was set into 8 3/4 inch hole at 8799' and cemented with 1019 sacks cement. The well was perforated with 100 holes from 8690-8715 and 124 holes from 8616-8647. The perforations were acidized with 1000 gallons acid. 2 1/2 inch production tubing was set at 8605 feet. The well tested as follows:

- F. 5,250 MCFGPD, 1 1/4" ch., TP 380#; SITP 2412#;
- F. 3,185 MCFGPD + 30 bbls. dist., 1 1/2" ch.;
- F. 1,800 MCFGPD + 33 bbls. dist., 1 1/2" ch.;
- F. 1,551 MCFGPD, 1 1/2" ch.;
- F. 1,204 MCFGPD + 17 bbls. dist., 1 1/2" ch.;
- F. 845 MCFGPD + 28 bbls., dist., 1 1/2" ch.; SIP
- F. 2943#; OF 3,800,000 CFGPD.

Form 2-200

Revised Form No. 19-22822
April 1942

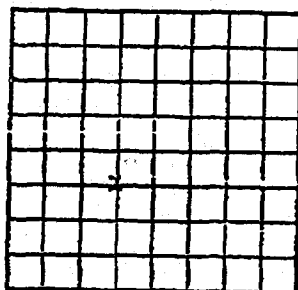
U. S. LAND OFFICE Las Cruces

SERIAL NUMBER 662618

LEASE OR PERMIT TO PROSPECT

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

LOG OF OIL OR GAS WELL



LOCATE WELL CORRECTLY

Company Continental Oil Company Address Box 427, Hobbs, New Mexico
 Lessor or Tract Gertrude W. Duffield Field Wildcat State New Mexico
 Well No. 1 Sec. 21 T. 15S R. 27E Meridian H.M.P.M. County Eddy
 Location 1980 ft. (N.) of S. Line and 1980 ft. (E.) of N. Line of Section 21 Elevation 3571

The information given herewith is a complete and correct record of the well and all work done thereon
 so far as can be determined from all available records.

Signed [Signature]Date May 25, 1952Title Dist. Supt.

The summary on this page is for the condition of the well at above date.

Commenced drilling December 22, 1951 Finished drilling April 17, 1952

OIL OR GAS SANDS OR ZONES

(Denote gas by G)

No. 1, from 8616 to 8715 No. 4, from _____ to _____
 No. 2, from _____ to _____ No. 5, from _____ to _____
 No. 3, from _____ to _____ No. 6, from JUN 2 - 52 to _____

IMPORTANT WATER SANDS

No. 1, from _____ to _____ No. 3, from _____ to _____
 No. 2, from _____ to _____ No. 4, from _____ to _____

CASING RECORD

Size casing	Weight per foot	Threads per foot	Make	Amount	Kind of shoe	Cut and pulled from	Perforated		Purpose
							From	To	
13"					Guide				
9 5/8"					Guide Shoe & Flange Collar				
7"					Guide Shoe & Flange Collar				

MUDDING AND CEMENTING RECORD

Size casing	Where put	Number sacks of cement	Method used	Mud gravity	Amount of mud used
13"	276	275	Pump & Plug		
9 5/8"	1387	675	Pump & Plug		
7"	6799	1019	Pump & Plug		

PLUGS AND ADAPTERS

Heaving plug—Material _____ Length _____ Depth set _____
 Adapters—Material _____ Size _____

SHOOTING RECORD

Size	Shells used	Explosive used	Quantity	Date	Depth shot	Depth cleaned out
None						

TOOLS USED

Rotary tools were used from _____ feet to 10,162 feet, and from _____ feet to _____ feet
 Cable tools were used from _____ feet to _____ feet, and from _____ feet to _____ feet

DATES

Put to producing May 13, 1952

The production for the first 24 hours was 30.0 barrels of fluid of which 30.0 % was distillate %
 emulsion; _____ % water; and _____ % sediment. Gravity, °Bé. 66.2

If gas well, cu. ft. per 24 hours 2,800,000 Gallons gasoline per 1,000 cu. ft. of gas _____

FOLD MARK

COMPANY Continental Oil Co. - #1

LOC. 1980' FSL & FWL
Sec. 21, T.16-S, R. 27-E

Gertrude Elev. 3573 DF
Duffield-Federal

ACID OR SHOT	CASINO RECORD	S.A.	TUPS
1000 acid	13 3/8-274-300	Glor.	1375
	9 5/8-1381-875	Tubb	2780
	7 -8799-977	Abo	4160
	2 1/2-8606	Waco	4875
		Penn.	6095
		Wolfo.	6700
		Dev.	9290
		Simp.	9347
		Ellen.	10025
			10060

Sec. 12-22-51 CORR. 5-14-52

I. P. F. 3,800,000 CFGPD + 30 bbls.
dist.; 1/2" ch.

Gr. 66 GOR - TP 7943 CP 8543

REMARKS DST 6090-6134 op. 30 mins. rec.
120' mud. DST 7192-7276 op. 2 hrs. rec.
1260' sul. wtr. 2400/15 mins. CONT'D. PAGE 2.
600; SIP 2400/15 mins.

EDDY, N.M. 21-16-27

Continental Oil Co. - #1 - Gertrude Duffield-Federal. PAGE 2.

DST 7515-7665 op. 1 hr. gas 40 mins. rec. 420' SGCM;
FP 350; SIP 1000/
DST 8540-8660 op. 1 hr. 5 mins. gas 4 mins. mud 18
mins. F. 4,600,000 CFGPD; FP 1535; SIP 2875/15"
DST 8690-8750 op. 2 hrs. gas 20 mins. @ 15.360 CFGPD;
rec. 1000' WB + 90' SO&GCM; FP 625; SIP 1075/
DST 8690-8750 op. 2 hrs. gas 20 mins. rec. 90' SO&GCM;
FP 625; SIP 1075/
DST 9347-9440 op. 2 1/2 hrs. rec. 1500' WB + 2600' salty
sul. wtr.; FP 2000; SIP 4000/
DST 9440-9502 op. 2 hrs., rec. 1500' WB, 7110' sul. wtr.;
FP 3480; SIP 4720/
DST 9927-9974 op. 2 hrs. rec. 1500' WB + 6500' SW; FP
3980; SIP 4280/
DST 10080-10192, 1700' WB, rec. WB, 3070' SW; FP 2420;
SIP 4226/ (tool open undes. time); ran Surveys
Perf.: 100/8690-8715; 2 1/2" pkr.
Perf. 124/8616-8647; 500 acid; ran 2 1/2" @ 8605;
CONT'D. PAGE 3.

EDDY, N.M.

Continental Oil Co. - #1 - Gertrude Duffield-Federal. PAGE 3.

F. 5,250 MCFGPD, 1 1/4" ch., TP 380#; SIP 2412#;
F. 3,185 MCFGPD + 30 bbls. dist., 1 1/2" ch.;
F. 1,800 MCFGPD + 33 bbls. dist., 1 1/2" ch.;
F. 1,551 MCFGPD, 1 1/2" ch.;
F. 1,204 MCFGPD + 17 bbls. dist., 1 1/3" ch.;
F. 845 MCFGPD + 28 bbls. dist., 1 1/2" ch.; SIP
2943# OF 3,800,000 CFGPD.

FORMATION TOPS

<u>FORMATION</u>	<u>TOPS</u>
T/Glorieta	2853
T/Abo	4875
T/Huaco	6080
T/Strawn	8010
T/Atoka	8407
T/Morrow Clastics	8543
T/Chester	8750
T/Mississippian Lime	8947
T/Woodford Shale	9308
T/Simpson	10,022
T/Ellenburger	10,080

Total Depth 10,188 in Ellenburger
Formation

Form 9-33i
(May 1963)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBMIT IN TRIPPLICATE
(Other instructions on re-
verse side)

Form Approved
Budget Bureau No. 42-21424

5. LEASE DESIGNATION AND SERIAL NO.

LC 062618

6. IF INDIAN, ALLOTTEE OR TRIBE NAME

SUNDRY NOTICES AND REPORTS ON WELLS

(Do not use this form for proposals to drill or to deepen or plug back to a different reservoir.
Use "APPLICATION FOR PERMIT" for such proposals.)

1. ☐ OIL WELL ☐ GAS WELL ☒ OTHER

2. NAME OF OPERATOR

Continental Oil Company

3. ADDRESS OF OPERATOR

P. O. Box 460, Hobbs, New Mexico 88240

4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements.
See also space 17 below.)
At surface

1980' FSL and 1983' FWL, Sec. 21, T-16, R-27,
Unit Letter "K", Eddy County, New Mexico

14. PERMIT NO.

15. ELEVATIONS (Show whether ST, RT, CR, etc.)

3573' DF

7. UNIT AGREEMENT NAME

8. FARM OR LEASE NAME

G. W. Duffield

9. WELL NO.

1

10. FIELD AND POOL, OR WILDCAT

Penn. Gas Pool

11. SEC., T., R., M., OR S.E. AND
SURVEY OR AREA

Sec. 21, T-16, R-27

12. COUNTY OR PARISH

Eddy

13. STATE

N.M.

16.

Check Appropriate Box To Indicate Nature of Notice, Report, or Other Data

NOTICE OF INTENTION TO:

TEST WATER SHUT-OFF

FRACURE TREAT

SHOOT OR ACIDIZE

REPAIR WELL

(Other)

PULL OR ALTER CASING

MULTIPLE COMPLETE

ABANDON

CHANGE PLANS

X

SUBSEQUENT REPORT OF:

WATER SHUT-OFF

FRACURE TREATMENT

SHOOTING OR ACIDIZING

(Other)

REPAIRING WELL

ALTERING CASING

ABANDONMENT

(Note: Report results of multiple completion on Well
Completion or Recompletion Report and Log form.)

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting and proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)

This well has declined to a point where production for the month of August was 18 MCF a day, which is below the economic limit. It is proposed to plug and abandon the well using the following procedure:

1. Spot 25 sacks class "C" $\frac{1}{2}$ gel cement, plug across perforations from 8590'-8740'.
2. Fill hole with 10# mud.
3. Cut and pull 4800' of 7" casing (TOC-4800' by temp. survey).
4. Place 25 sacks cement plug in top of 7" casing.
5. Place 25 sacks from 2800'-2900'.
6. Place 25 sacks cement plug in base of intermediate casing (1381').
7. Place 10 sacks cement plug at surface.
8. Erect marker and return location to original condition.

RECEIVED
OCT 12 1967
U. S. GEOLOGICAL SURVEY
HOBBS, NEW MEXICO

18. I hereby certify that the foregoing is true and correct

SIGNED

TITLE Sup. Prod. Engineer

DATE 10-9-67

(This space for Federal or State office use)

APPROVED BY

CONDITIONS OF APPROVAL, IF ANY:

USGS-5 FILE-2

TITLE

DATE

*See Instructions on Reverse Side

IP (Morrow) Perfs 8698-8743' CAOF 1570 MCF/GPD. GOR dry; Grav
NR: SIWRP 2331#

5-22-72 TD 8932'; WOO
DST (Atoka-Morrow) 8672-8932', open 2 hrs 10 mins,
GTS in 18 mins @ 450 MCFGPD - 490 MCFGPD, rec 90'
HCCM, 2 hr ISIP 2171#, FP 246-259#, 3 hr FSIP
3397#, HP 4332-4294#

5-30-72 TD 8932'; "Tight"

6-2-72 TD 8932'; "Tight"

6-6-72 TD 8932'; SI
Perf 8698-8717', 8720-28', 8731-43'
Flwd @ 476 MCFGPD thru 1/2" chk, TP 76#
(8698-8743')
Acid (8698-8743') 2250 gals
Flwd @ 850 MCFGPD thru 24/64" chk, TP 250#

6-12-72 TD 8932'; Tstg

10-10-72 Continued
LOG TOPS: Yates 110', San Andres 1609', Glorieta
2910', Tubb 4265', Abo 5030', Wolfcamp 6144',
Cisco 7439', Canyon 7746', Strawn 8113', Atoka
8518', Morrow 8638', Chester 8894'.
Morrow Discovery
10-14-72 COMPLETION REPORTED

EXHIBIT NO. 10-A

Co. EDDY

POOL WILDCAT

STATE N.M.-KROENLEIN 17-54

COMPANY Continental Oil Co. - #1 - Tom Nolan-
Federal ELEV. 3580Loc. 660' FSL & 1980' FEL
Sec. 4, T.16-S, R. 27-E

4-106-2

ACID OR SHOT

CASING RECORD

13 3/8- 254- 300
9 5/8- 1395- 257

Artesia TOPS	590
S.A.	1348
Tubb	4105
Abo	4862
Hueco	6041
W.C.	6070
Miss.	8745
Miss. Chty. L.	8780
Woodf.	9126

SPD. 11-20-53 COMP. 3-12-54

I. P. P & A

SR. SON TP CP
REMARKS TOPS CONT'D.: Dev. 9162; Simp.
9779; Ellen 9823.
Morrow L. 8555

TP
TO 9968 dolo.
POD

SEE "REMARKS"

Continental Oil Co. - #1 - Tom Nolan-Federal

DST 1733-65 op. 30 mins., rec. 40' mud, NS; FP 0;
SIP 0.
DST 8135-75 op. 1 hr., weak blow thruout, rec. 25'
sll. GCM, no shows; FP 0; SIP 275/15 mins.
DST 9192-9255 op. 1 hr., weak blow 16 mins. & died;
rec. 35' mud w/sll. sul. odor, no shows; FP 0;
SIP 1000/15 mins.
DST 9255-9381 op. 2 hrs., rec. 540' mud, 6450' SW;
FP 425-3000; SIP 3750/15"
DST 9875-9968 op. 1 hr. 25 mins., 1000' WB, good
blow 1 hr. 12 mins. & died; rec. WB + 8000'
sul. wtr.; FP 1100; SIP 4175/15 mins.

EXHIBIT NO. 10-B

30-015-20364
Co. EDDY

POOL WILDCAT

STATE N.M.

Y-7-16-27
KROENLEIN

COMPANY Yates Pet. Corp. - #1 - Federal "BR"

LOC. 1980'FNL & 660'FWL
Sec. 7, T.16-S, R.27-E
8800'RT-Penn-Dev.

Elev. 3470 GR
3482 DF

PAY STIMULATION

PERF:

CASING

13 3/8- 160- 150
8 5/8- 1535- 400
4 1/2- 6692- 150

TOPS

Queen 537
S. And 1200
Glor 2433
Tubb 3820
Abo 4571
Wolfe 5716
Clisco 6554
Canyon 7275
Strn 7538
Atoka 7807

Srs. 12-26-71 Comp. 8-12-71

I. P. P & A

GR. SDR TP CP

TOPS CONT'D.: Morrow 7895;

TP cont'd.

TD 8692

FED

Yates Pet. Corp. - #1 - Federal "BR"

TOPS CONT'D.: Chester 8048; Miss 8174;
Woodf 8602; Fuss 8626.

No cores or tests.

EXHIBIT NO. 10-C

Co. EDDY POOL WILDCAT STATE N.M. KROENLEIN 17-51
 COMPANY Continental Oil Co. - #1 - W.P. Thurman ELEV. 3668
 LOG. 660' FNL & FEL .P
 Sec. 11, T.16-S, R. 27-E 4-106-2

ASID OR SHOT	CASING RECORD	TOPS
	13 3/8- 134- 140	S. And. 1610
	9 5/8-1627- 475	Glor. 2990
		Tubb. 4382
		Abo. 5090
		Waco. 5310
		Penn. 6742
		Miss. 9005
		Wood. 9512
		Dev. 9547
SPD. 12-19-50	COMP. 6-27-51	SEE "REMARKS"
DR. P & A		TO 10770 Gr. Wash.
DR. GOR TP CP		PG. 3-another record
REMARKS More TOPS: Mont. 10110; Simp. 10255; Ell. 10295; Gr. Wash. 10735.		

DST 10370-1447, op. 45 mins., rec. 1750' WB, 105' sul. & salt CM; FP 0; SI 4000.
 DST 1649-1710, op. 1 hr., rec. 8' drlg. mud; NS.
 DST 2160-2190, op. 1 hr., rec. 50' drlg. mud; NS.
 DST 6315-45, op. 1 hr., rec. 30' SGCM.
 DST 7178-7221, op. 90 mins., rec. 15' HGC drlg. mud.
 DST FP 0; 15 min. SI 0.
 DST 7296-7330, op. 1 hr., 40 mins., rec. 60' GCM.
 DST 7338-7451, op. 3 hrs., rec. 60' SO&GC drlg. mud;
 DST 120' salt wtr.
 DST 8215-66, op. 5 hrs., gas 23 mins., est. 6200 CFPT
 DST rec. 60' SGCM; FP 150; 15 min. SI 2750.
 DST 8486-8525, op. 1 1/2 hrs., rec. 40' ali. GCM;
 DST 8548-8628, op. 1 1/2 hrs., rec. 30' HGCM.
 DST 8755-8802, op. 1 1/2 hrs., gas 1 hr. 10 mins.,
 DST rec. 40' HGCM; FP 0; SI 0.

DST 9546-93, op. 1 hr., rec. 10' mud.
 DST 9593-9631, op. 30 mins., rec. 2' mud.
 DST 9819-9915, op. 1 hr., 30 mins., rec. 7500' sul.
 DST wtr.; FP 1050-3725; 15 min. SI 4100.
 DST 10315-371, op. 1 hr., rec. 40' drlg. mud;
 DST FP 0; 15 min. SI 3600.
 DST 10447-581, op. 1 1/2 hr., rec. 440' salty sul.
 DST wtr.; FP 900-1075; SI 5900; 1800' WB.
 DST 10580-770, op. 30 mins., rec. 1900' WB, 30' mud; FP 0; 10 min. SI 2575.

Micro Log to TD.
 Another Tops Record: S. And 1623, Glor. 2993, Drink. 4318, Abo. 5088, Hueco 6298, Bur. 6853, Penn. 7393, Ato. 8558, Miss. Li. 9000, Wood 9503, Dev. 9548, Simp. 10258, Ellen. 10293, Sd. 10713, Gr. Wash 10748.

EXHIBIT NO. 10.D

EDDY COUNTY NEW MEXICO WILDCAT
 Well: JOSEPH L. O'NEILL, JR. & HILLARD O&G CO. I-Q Federal Result: D&A WP
 Loc: N/part county, 10 mi NE/Artesia; 1980' FS&WL's sec 15-16S-27E; 2 mi SW/10,777' failure; 2 mi N/Duffield (Penn-gas) Fld.
 Spud: 8-11-71; Comp: 9-13-71; Elev: 3569' grd; TD: 8802'
 Casing: 12 3/4" 373' / 300 sx, 8 5/8" 1500' / 200 sx
 Comp info: DST 8345-8600', op 30 min, fair to wk blo, rec 80' DF, no oil, wtr or gas, ISIP 387#/1 hr, FP 43-43#, FSIP 474#/1 hr; C/WEK Drig. Co.
 Tops: (EL) Abo 4920', Cisco 7213', Canyon 7700', Atoka 8354'
 API No: 30-015-20480

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Petroleum Information

Corporation
A Subsidiary of A.C. Nielsen Company

Date: 10-13-71

Card No: 4 rm

EDDY COUNTY NEW MEXICO UNDESIGNATED FIELD
 Well: FRANKLIN, ASTON & FAIR INC, 1 Federal "Q"-OWWO Result: D&A D
 Loc: Sec 15-16S-27E; 1980' FSL, 1980' FWL
 (Orig dld by O'Neill-Hilliard, D & A 9-13-71 @ TD 8802')

Spud: 8-9-73; Comp: 8-16-73; Elev: 3659' Grd; TD: 8802'; PB: 2369'
 Casing: 12-3/4" 373' / 300 sx; 8-5/8" 1450' / 400 sx; 5-1/2" 2369'
 Comp info: Perf 2160-2279', A/1000 gal; swbd
 Tops: NR
 API No: 30-015-20480

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Petroleum Information

Corporation
A Subsidiary of A.C. Nielsen Company

Date: 9-12-73

Card No: 6 db

EXHIBIT NO. 10-E

EDDY COUNTY

NEW MEXICO

WILDCAT

Well: WESTERN OIL PROD. INC. 1 Jay

Result: DGA WF

Loc: 8 mi NE/Artesia in N/part county; 1980' FNGWL's sec 20-16S-27E; 2 mi SW/8802' failure;
2 1/4 mi NW/Dog Canyon Fld.

Spud: 10-23-71; Comp: 11-25-71; Elev: 3462' grd; TD: 8665'

Casing: 12 3/4" 348'/250 ft, 8 5/8" 1348'/300 ft

Comp Inf: DST 8060-8130', op 1 hr, wk blo, incr to fair, GTS 40 min, rec 100' GCDM.
ISIP 5364/45 min, FP 93-934, FSIP 1210/90 min; DST 8200-8257', 15 min pre-
flow, rec 210' DM, ISIP 28468/1 hr, FP 93-934, FSIP 28724/2 hrs.

Tops: (EL) Queen 650', San And 1300', Glor 2650', Tubb 3950', Abo 4710', Wolfe 5920',
Cisco 6890', Canyon 7460', Atoka 8200'

API No.: 30-015-20522

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Petroleum Information

COMPANIES
A Division of P. O. Box 1000

Date: 12-15-71 Card No.: 4

EXHIBIT NO. 10-F

Eddy County NEW MEXICO DUFFIELD FIELD
 Well: COQUINA OIL CORP, 1 Dean Federal
 Loc'n: 7 mi NW/Loco Hills; Sec 21-16S-27E; 660' FSL, 1880' FEL Sec

Spud: 11-3-74; Comp: 12-11-74; Elev: 3540' Grd; TD: 9022' Min
 Casing: 8-5/8" 1403' / 450 ft
 Comp Inf: DST 8555-8612', op 1 hr 15 mins, rec 10' SGCM, ISIP 1054' / 1 hr, FP 42-424
 FSIP 2471' / 2 hrs, HP 4132-4132'; DST 8612-92', mis run; DST 8612-92', op 1 hr 15
 mins, rec 90' GCM, no press reported; PB to 2815'; DST 2786-2815', op 1 hr 15 mins
 rec 180' DM, ISIP 11584' / 1 hr, FP 211-3604, FSIP 11584' / 2 hrs, HP 13678; C/Hondo Drlg
 Tops El: Queen 675', San And 1390', Gler 2815', Tubb 4000', Abc 4293', Wolfe 6086'
 Cisco 6980', Canyon 7508', Strawa 8051', Atoka 8302', Morrow 8494', Barnett 8745'
 Chester 8798', Mies H 8927
 API No: 30-015-21352

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PI Petroleum Information.
 A Division of A.C. Petco Company

Date: 1-22-75

Cord No.: 1 dh

EXHIBIT NO. 10-G

CO. EDDY POOL WILDCAT STATE W.M. C-21-16-27
 COMPANY Continental Oil Co. - #1 - Gertrude ELEV. 3573 DB
 Duffield-Federal
 LOC. 1980' FSL & FWL
 Sec. 21, T.16-S, R. 27-E

ACID OR SHOT	CADING RECORD	S.A.	TOPS
1000 acid	13 3/8- 274- 300	Glor.	1375
	9 5/8-1381- 875	Tubb	2780
	7 -8799- 977	Abo	4160
	2 1/2-8606	Waco	4875
		Penn.	6095
		Wolfe.	6200
		Dev.	9290
		Simp.	9347
		Ellen.	10025
			10060
			8616
			10,188 dolo.
			8766

Sp. 12-22-51 - Comp. 5-14-52

L. P. F. 3,800,000 CFGPD + 30 bbls.
 dist.; 1/2" ch.

Gr. 66 SON - TP 7943 CP 8543

REMARKS DST 6090-6134 op. 30 mins. rec.

120' mud. DST 7192-7276 op. 2 hrs. rec.

1260' sul. wtr. FP
 600; SIP 2400/15 mins.

DST 7515-7665 op. 1 hr. gas 40 mins. rec. 420' SGCM;
 FP 350; SIP 1000/

DST 8540-8660 op. 1 hr. 5 mins. gas 4 mins. mud 18
 mins. F. 4,600,000 CFGPD; FP 1535; SIP 2875/15"

DST 8690-8750 op. 2 hrs. gas 20 mins. @ 15,360 CFGPD;
 rec. 1000' WB + 90' SO&GCM; FP 625; SIP 1075/

DST 8690-8750 op. 2 hrs. gas 20 mins. rec. 90' SO&GCM;
 FP 625; SIP 1075/

DST 9347-9440 op. 2 1/2 hrs. rec. 1500' WB + 2600' salty
 sul. wtr.; FP 2000; SIP 4000/

DST 9440-9502 op. 2 hrs., rec. 1500' WB, 7110' sul. wtr.;
 FP 3480; SIP 4720/

DST 9927-9974 op. 2 hrs. rec. 1500' WB + 6500' SW; FP
 3980; SIP 4280/

DST 10080-10192, 1700' WB, rec. WB, 3070' SW; FP 2420;
 SIP 4226/ (tool open undes. time); ran Surveys

Part. 100/8690-8715; 2 1/2" dtr.

Perf. 124/8616-8647; 500 acid; ran 2 1/2" @ 86051

8690 } 25 ft 100 shots
 8715 }
 8616 } 31 ft 124 shots
 8647 }
 F. 5,250 MCFGPD, 1 1/4" ch., TP 380#; SITP 2412#;
 F. 3,185 MCFGPD + 30 bbls. dist., 1 1/2" ch.;
 F. 1,800 MCFGPD + 33 bbls. dist., 1 1/2" ch.;
 F. 1,551 MCFGPD, 1 1/2" ch.;
 F. 1,204 MCFGPD + 17 bbls. dist., 1 1/3" ch.,
 F. 845 MCFGPD + 28 bbls. dist., 1 1/2" ch.; SIP
 2943# OF 3,800,000 CFGPD.

EDDY COUNTY NEW MEXICO WILDCAT
Well: J. E. JONES DRUG CO. #1-23 Hitchcock Federal Result: DCA
Loc'n: 8 mi NE/Artesia in N/central part county; Sec 23-16S-27E; 1980' FNEWLs Eac;
 1/2 mi W of a 2293' dry hole & 3 mi N of Daugherty Fld;

Spud: 3-28-60; Comp: 5-20-60; Elev: 3574' DF; TD: 9018'; FBTD: 2976'
Casing: 8 5/8" 1569'/750 sx, 4 1/2" 2906'/175 sx
Prod Zone: None
Comp Info: DST 2180-2837', op 1 hr, rec 470' mud w/trace oil, FP 275-315#, SIP
 1080#/20 min; DST 8198-8476', op 1 hr, rec 120' slt GCM, FP 190-225#, SIP
 300#/30 min; Perf 2246-16, 2555-65, 2580-90, 2638-48 & 2747-57'; A/3,500 gals;
 Frac w/10,000 gals
Tors: (EL) Glor 2953', Abo 5032', Wolfc 6242', Perm 6880', Miss 8980'.

See Remarks
OIL REPORTS

Date:

6-8-60

Cord No.:

9

NM

1/b

EXHIBIT NO.10-1

EDDY COUNTY

NEW MEXICO

DUFFIELD MISS FIELD

Well: MONTEREY OIL CO. #22-29 Federal

Result: DCA

Loc'n:

29-16S-27E; 1980' FNEW1:Sec. 1-1/4 mi SW outpost to fld.

Spud: 5-20-59; Comp: 7-16-59; Elev: (Not available); TD: 8865'

Casing: 2-5/8" 1323'/850 in

Cor'n info: DST 1670-1877', op 1 hr, rec 140' mud, FP 1354, SIP 1458/
30 min; DST 8460-8540', (Straw), op 2 hrs, gas 62 min, rec 80' GCM,
FP 60-607, SIP 515#/30 min: A/1000 gals.

Top: Not available.

See Appendix
on reverse

Date: 7-29-59

Card No.: 8 NM 1s

EXHIBIT NO.10-J

Co. EDDY
OWDD
COMPANY John A. Yates - #1 - Jean "M"
(fmly. Woolley & Metcalf - #1 - Pecon, Elev. 3313
LOC. 330' FSL & 1650' FWL
Sec. 31, T.16-S, R.27-E
OTD 3313' dolo.: 7600' RT
STATE N.M. KROENLEIN 20-

PAY STIMULATION	CASING	TYPE	
OH/8310-	old 10 3/4-1308-425	S. And.	1100
8530,	4 1/2-8310-367	Glor.	2417
Natural		Blind.	3111
		Drink.	3790
		Abo sh.	4499
		W.C.	5700
		Cisco	6825
		Strn.	7770
		Atoka	8155
		Morrow	8275
		TP	8310 (Morrow)
		Nto	8530
		PSD	

SPD re- COMP. 1-7-64 1-3-64

I.P. F. 2,100,000 CFGPD, 21/64" ch.
Natural

Sr. SOR TP 500 CF

REMARKS: DST 7161-7352 op. 1 hr., rec.
90' drlg. mud; FP 214; ISIP 179/
30".

DST : 8294-8388 op. 7 hrs., gas in 3 mins.,
at rate of 4,144,000 CFGPD & decr. to
2,600,000 CFGPD; rec. 65' cond.; FP
798-504; ISIP 3297/30"; FSIP 2797/1 hr.
DST 6946-7072 (strad.pkr.) op. 4 hrs., rec.
90' SOCM & 270' very hvy. O&GCM + 1170'
sl. oil, gas & mud out wtr.; FP 73-388;
ISIP 2600/___; FSIP 2600/___
DST 6830-6904 (strad.pkr.) op. 45 mins., rec.
200' EGCM & 200' gas & mud out SW; FP 21-
85; ISIP 2721/1 hr.; no FSIP.
F. 2,100,000 CFGPD/OH; natural: 8310-8530',
21/64" ch.

EXHIBIT NO. 10-K

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 5778
R-25

APPLICATION OF **GAS COMPANY OF
NEW MEXICO** FOR UNDERGROUND GAS
STORAGE FINDINGS, **EDDY** COUNTY,
NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on ~~September~~²⁹ 1976,
at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, On this ~~29th~~ day of ~~September~~^{April}, 1977, the Commission, a
quorum being present, having considered the testimony, the
record, and the recommendations of the Examiner, and being
fully advised in the premises,

FINDS:

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

(2) That the applicant in the subject case, Gas Company
of New Mexico, proposes the establishment of an
underground gas storage project in Eddy County,
New Mexico, to be known as the Duffield
Gas Storage Project.

(3) That the applicant has conducted geological
and engineering studies to confirm the existence
of a geological structure underlying ^{portions of} the SW 1/4
Section 15, S 1/2 Section 16, SE 1/4 Section 17, E 1/2
Section 20, All Section 21, W 1/2 Section 22, NW 1/4
Section 27, N 1/2 Section 28, and NE 1/4 Section 29,
all in Township 16 South, Range 27 East, NMPM,
Eddy County, New Mexico, and to determine
the suitability of said structure for the under-
ground storage of natural gas.

(4) That gas storage within said structure would be in the Pennsylvanian formation from the top of the Morrow clastics to the top of the Barnett shale.

(5) That the aforesaid interval from the top of the Morrow clastics to the top of the Barnett shale within the geological structure underlying the lands described in Finding No. (3) above is a gas reservoir, having been designated by the Commission as the Duffield-Pennsylvanian Gas Pool comprising the SW $\frac{1}{4}$ of Section 21, Township 16 South, Range 27 East, NMPM, by Commission Order No. R-928, dated December 13, 1956.

(6) That said Duffield-Pennsylvanian Gas Pool was discovered by the Continental Oil Company Gertrude M. Duffield Well No. 1 located in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of the aforesaid Section 21. Said well was completed in the Morrow formation within the interval described in Finding No. (4) above through perforations from 8615 feet to 8647 feet and from 8690 feet to 8715 feet on April 17, 1952.

(7) That although several other wells were drilled to the Pennsylvanian formation in the near vicinity to the aforesaid well, none was successful, and said Duffield-Pennsylvanian Gas Pool remained a one-well pool until its abandonment in December, 1967.

- (8) That the original volume of gas in place in the aforesaid Duffield-Pennsylvanian is estimated to have been 5.245 billion cubic feet, with an original reservoir pressure of 3630 psia.
- (9) That prior to its abandonment, the aforesaid Gertrude M. Duffield well produced 4.480 billion cubic feet ^{or 85.4 percent of the original gas in place,} of gas, and the reservoir pressure had declined to approximately 543 psia.
- (10) That the remaining gas in the reservoir, some 0.765 billion cubic feet at approximately 543 pounds pressure, does not constitute economically recoverable gas reserves at the subject's reservoir's depth.
- (11) That during its final 11 months of production prior to its abandonment in December, 1967, the Gertrude M. Duffield Well No. 1 averaged approximately 18 MCF per day of production.
- (12) That the Duffield Pennsylvanian Gas Pool is substantially depleted of recoverable native gas in place.
- (13) That although the areal extent of the permeability and porosity of the Duffield-Pennsylvanian Gas Pool as presently known is somewhat less than the entire area described in Finding No. (3) above, all of said lands should be included in the Duffield Gas Storage Project in order to protect the structure from drainage by non-project wells in the event the areal extent of the structure is larger than presently known.

(14) That the applicant has attempted to acquire gas storage rights in the interval from the top of the Marrow clastics to the top of the Barnett shale underlying the SW¹/₄ Section 15, S¹/₂ Section 16, SE¹/₄ Section 17, E¹/₂ Section 20, All Section 21, W¹/₂ Section 22, NW¹/₄ Section 27 N¹/₂ Section 28, and NE¹/₄ Section 29, all in Township 16 South, Range 27 East, NMPM, Eddy County, New Mexico, and has indeed acquired such rights underlying 87.5 percent of said lands, and is in the process of acquiring such rights under the remaining lands.

(15) That pursuant to Section 65-9-5 NMSA, 1953 Comp., this case was called to consider the propriety of utilization of the aforesaid interval underlying the above-described lands, and consequently thereto, the Commission finds:

A. That the above-described sub-surface interval underlying the above described lands is suitable for the underground storage of natural gas and should be designated as the **Duffield** Gas Storage Project.

B. That the **Duffield** Gas Storage Project is incapable of producing oil in paying quantities through any known recovery method.

C. That the **Duffield** Gas Storage Project does not underlie any known commercial deposits of potash.

D. That storage of natural gas in the **Duffield** Gas Storage Project will not cause injury to surface or underground water resources.

E. That the underground strata constituting the **Duffield** Gas Storage Project formerly contained native gas capable of production in paying quantities, but now substantially

depleted of reservoir native gas, and such strata have a greater value as a gas storage reservoir than for the production of the remaining volumes of native gas therein.

- F. That the horizontal extent of the displaced or injected gas in the above-described sub-surface interval will be within the outer boundaries of the above-described lands.
- G. That no portion of the above-described sub-surface interval underlying the above-described lands has been appropriated or is being utilized for the injection, storage and withdrawal of natural gas by any other than the applicant, Southern Union Gas Company.

(16) That jurisdiction of this cause is retained for the entry of such further findings as may be necessary.

DONE at Santa Fe, New Mexico, on the day and year herein-above designated.

depleted of reservoir native gas, and such strata have a greater value as a gas storage reservoir than for the production of the remaining volumes of native gas therein.

- F. That the horizontal extent of the displaced or injected gas in the above-described sub-surface interval will be within the outer boundaries of the above-described lands.
- G. That no portion of the above-described sub-surface interval underlying the above-described lands has been appropriated or is being utilized for the injection, storage and withdrawal of natural gas by any other than the applicant, Southern Union Gas Company.

(16) That jurisdiction of this cause is retained for the entry of such further findings as may be necessary.

DONE at Santa Fe, New Mexico, on the day and year herein-above designated.

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
September 29, 1976

EXAMINER HEARING

IN THE MATTER OF:

Application of Gas Company of) CASE
New Mexico for underground storage) 5778
findings, Eddy County, New Mexico.)

BEFORE: Daniel S. Nutter, Examiner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the New Mexico Oil Conservation Commission: William F. Carr, Esq.
Legal Counsel for the Commission
State Land Office Building
Santa Fe, New Mexico

For the Applicant: Owen M. Lopez, Esq.
MONTGOMERY, FEDERICI, ANDREWS
AND HANNAHS
Attorneys at Law
P. O. Box 2307
Santa Fe, New Mexico

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General Court Reporting Service
825 Calle Mejia, No. 122, Santa Fe, New Mexico 87501
Phone (505) 982-9212

I N D E X

Page

JIM ELLIS

Direct Examination by Mr. Lopez

3

Cross Examination by Mr. Nutter

17

EXHIBIT INDEX

Offered

Admitted

Applicant's Exhibit One, Map

4

17

Applicant's Exhibit Two, Map

4

17

Applicant's Exhibit Three, Contour Map

6

17

Applicant's Exhibit Four, Isopach Map

7

17

Applicant's Exhibit Five, Log

9

17

Applicant's Exhibit Six, Cross Section

10

17

Applicant's Exhibit Seven, Cross Section

11

17

Applicant's Exhibit Eight, Cross Section

11

17

Applicant's Exhibit Nine, Tabulation

14

17

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1 MR. NUTTER: We will call Case Number 5778.

2 MR. CARR: Case 5778, application of Gas Company of
3 New Mexico for underground gas storage findings, Eddy County,
4 New Mexico.

5 MR. LOPEZ: If the Examiner please, my name is Owen
6 Lopez with the firm of Montgomery, Federici, Andrews and
7 Hannahs appearing on behalf of the applicant and I have one
8 witness to be sworn.

9 (THEREUPON, the witness was duly sworn.)

10
11 JIM ELLIS
12 called as a witness, having been first duly sworn, was
13 examined and testified as follows:

14
15 DIRECT EXAMINATION

16 BY MR. LOPEZ:

17 Q Would you please state your name, residence and
18 occupation?

19 A My name is Jim Ellis, I'm Chief Petroleum Engineer
20 for Southern Union Company from Dallas, Texas.

21 Q Have you previously testified before the Commission
22 and had your qualifications made a matter of record?

23 A Yes, I have.

24 Q Are you familiar with the application of Gas
25 Company of New Mexico in this case?

1 A. Yes, I am.

2 MR. LOPEZ: Are the witness' qualifications
3 acceptable?

4 MR. NUTTER: Yes, they are.

5 Q (Mr. Lopez continuing.) What does Gas Company of
6 New Mexico propose by the application in this case?

7 A Gas Company of New Mexico is seeking a decision from
8 the Oil Conservation Commission as to the propriety of the
9 utilization for underground gas storage of the sub-surface
10 strata from the top of the Morrow clastic to the top of the
11 Barnett strata underlying sections -- I beg your pardon, that
12 will be the southwest quarter of Section 15, the south half
13 of Section 16, the southeast quarter of Section 17, the east
14 half of Section 20 and the northwest quarter of Section 29 and
15 the north half of Section 28, the northwest quarter of Section
16 27, the west half of Section 22 and that's all --

17 Q And all of Section 21, is that correct?

18 A Yes, all of Section 21 and that's all in Township 16,
19 Range 27 in Eddy County, New Mexico.

20 Q Turning to Exhibit One would you please describe it?

21 A Yes, Exhibit One is simply a regional map indicating
22 the general area of this proposed storage unit and it is
23 something like five miles northeast of the town of Artesia
24 and Exhibit Two gives it in more clarity.

25 Q Now, what does Exhibit Three describe?

1 A Well, could I talk about Exhibit Two.

2 Q Yes, sure.

3 A Exhibit Two gives you a more detailed view of the
4 overall unit that we are proposing and it is comprised of
5 twenty-five hundred and sixty acres.

6 MR. NUTTER: Before you go any further, the applica-
7 tion originally was for all of Sections 15, 16, 17, 20, 21, 22,
8 27, 28 and 29?

9 A Yes.

10 MR. NUTTER: Now, as I understand it, the application
11 was amended after the advertisement of the case and only one
12 hundred and sixty acres in Section 15, being the southwest
13 quarter and the south half of 16, the southeast of 17 and the
14 east half of 20 and the west half of 22, the northwest of
15 27, north half of 28 and the northeast of 29 and all of 21
16 are being sought at this time?

17 A That is correct.

18 MR. NUTTER: So you have shrunk the area down from
19 that which was advertised?

20 A That is correct.

21 MR. NUTTER: But all of the lands that you are
22 seeking, the findings for it, were included in the notice of
23 the case?

24 A That is correct.

25 MR. NUTTER: Okay, we will consider the application

1 then amended to the lesser described acreage.

2 MR. LOPEZ: Thank you, Mr. Examiner.

3 Q (Mr. Lopez continuing.) All right, now, turning to
4 Exhibit Three would you please describe that?

5 A Exhibit Three depicts a contour map that is drawn
6 on the top of the Morrow clastic and the wells that are
7 plotted are all of the wells in the general area that have
8 been drilled through the formation in question which is the
9 Morrow zone. The main well that we are looking at here in
10 developing storage in is in Section 21. It's nineteen, eighty
11 off of the south and west line, it is a depleted Morrow well
12 and we consider it as a one-well reservoir. It was completed
13 in 1952 by Continental Oil Company and plugged in 1967. All
14 of the gas produced from the well which amounted to four point
15 ~~four~~ ^{4.48 billion} four eight billion produced into Southern Union's
16 southeastern gas pipe line system. There are cross sections
17 further in the exhibit that will more nearly detail the
18 subsurface.

19 MR. NUTTER: Now, let me see, let me get this
20 straight, what you are talking about is the old Continental
21 Duffield Federal No. 1, right?

22 A Yes, that is correct and we are calling this the
23 Duffield Project.

24 MR. NUTTER: And this Duffield well was drilled in
25 1952?

1 A Drilled and completed.

2 MR. NUTTER: In the Morrow formation?

3 A Yes, sir.

4 MR. NUTTER: And it was produced into Southern Union's
5 pipeline until it was plugged and abandoned in 1967?

6 A That is correct.

7 MR. NUTTER: And the total cum production on it was
8 four point four eight billion?

9 A Yes, sir.

10 MR. NUTTER: And will you use this same well for your
11 project, re-enter it?

12 A That is the project, yes, sir. It's such an old
13 well that we are not sure if we will be able to use the well
14 as such because the casing may not be that good but if we are
15 not able to effect an injection withdrawal well in the same
16 wellbore then we will offset the minimal number of feet and
17 drill a new well and that's what I feel we're going to do is
18 drill a new well.

19 MR. NUTTER: I see.

20 Q (Mr. Lopez continuing.) Now, turning to Exhibit
21 Four would you describe that?

22 A Exhibit Four is the geological section of Southern
23 Union Company's interpretation of an isopach map of the
24 Morrow B sand which we consider to be the productive interval
25 within the Morrow. You will note a channel generally trends

1 from the northwest to the southeast and there is a build up
2 right in the vicinity of the Duffield Well. The zero contour
3 of that particular embankment is within the limits of our
4 prescribed unit.

5 Now, if you will notice in the south half of 16
6 especially, there is a dotted line depicting ten foot of sand.
7 We feel that certainly there is ten foot of Morrow sand that
8 could possibly be -- could course through there but we don't
9 feel like the permeability is sufficient to be productive
10 since we have found this very same thing in wells drilled
11 surrounding the Duffield and those stringers were unproductive.

12 MR. NUTTER: I wonder if you would read the numbers
13 that are on this Exhibit Four? Some of them are so faint on
14 this exhibit that I can't make them out. I presume these are
15 net feet of Morrow pay in some of these wells or I don't know
16 what the figures are but the little figures that have a foot
17 symbol by them by these various wells.

18 A. Yes, sir. In Section 20, I presume that to be
19 eight feet rather than the way it looks to be three feet.
20 Directly south of that in Section 29, I presume that to be ten
21 feet.

22 MR. NUTTER: Is your copy dim too?

23 A. No, sir, it's not that dim, here, do you want mine?

24 MR. NUTTER: Yes, I think this is a little easier
25 to read. You go ahead and read them.

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1 A. In Section 15 that is supposed to be eight feet.

2 MR. NUTTER: That's an eight in Section 15?

3 A. Yes. In the southeast quarter of Section 21, where
4 the dry hole is depicted, that is eight feet. Then by the
5 Duffield Well itself in the southwest quarter of 21, that
6 should be twenty-one feet. Okay, looking up in Section 7,
7 that is eight feet. Going directly south in Section 31,
8 that is twenty feet.

9 MR. NUTTER: Okay.

10 A. We're skipping. All right, in Section 23, that's
11 four feet. In Section 1, that's six feet, I believe that
12 should just about get them.

13 MR. NUTTER: There is no way of reading the one
14 in 4 or the one in 11, I don't think.

15 A. Well, let's see, the wells in Section 4 and 11 are
16 really so far away from this unit that they are of no
17 significance anyway.

18 MR. NUTTER: Well, we got the wells immediately
19 surrounding the project, I guess.

20 Q (Mr. Lopez continuing.) Would you please describe
21 Exhibit Five?

22 A. Exhibit Five is a type log of the Pennsylvanian
23 series starting with the Atoka and also includes the Barnett
24 and the Chester and the top of the Mississippian lime. This
25 type log which depicts the log from the Continental Duffield

1 is mainly to outline the productive section of the Morrow,
2 which is the B zone, and the top of which is depicted at a
3 subsea depth of minus five thousand and forty-one feet.

4 Q Do you have anything else of that exhibit that you
5 want to describe?

6 A No, because the following exhibit will depict more
7 detailed information.

8 Q Turning to Exhibit Six will you please describe it?

9 A Exhibit Six indicates the cross section AA prime
10 which extends from the Continental Duffield Well to the
11 Coquina Dean Federal Well, both of which were drilled in
12 Section 21. Now, the Dean Federal Well was the most
13 recently drilled well in the area. It was drilled and abandoned
14 in December of '74. As you will notice it was drilled on a
15 northwest-southeast trend with the Duffield in order to get
16 into a channel if, in fact, there was one.

17 The drill stem tests across the productive Morrow
18 interval in the Duffield Well and the non-productive intervals
19 in the Dean Federal Well are depicted on this Exhibit Six.
20 And, of course, it indicates four point six million was
21 recovered when the Duffield was drill stem tested in '52 prior
22 to completion and the drill stem test on the Dean Federal --
23 well, more or less it was indicative of the zone being non-
24 productive.

25 Q Turning to Exhibit Seven would you describe it?

1 A Exhibit Seven is a cross section BB prime that
2 originates in Section 20 which is adjacent to the section in
3 which the Duffield Well is located. At the Western No. 1 J
4 Federal it extends through the Duffield Well, southeast
5 through the Coquina Dean Federal, thence through Section 22
6 to the old Jones Drilling Federal 123 in Section 23.

7 There again we are highlighting, attempting to
8 highlight the relative buildup of sand in the Morrow B zone
9 versus the lack of buildup of sand in the B zone as compared
10 to respective wells.

11 What we are attempting to depict, Mr. Examiner, is
12 the fact that the B sand is shaled out in these surrounding
13 wells and we feel that we just have a pocket, if you will, of
14 Morrow sand buildup surrounding the Duffield Well. There are
15 five dry holes drilled in the immediate area of the Duffield
16 location.

17 Q Turning to Exhibit Eight would you describe it?

18 A Exhibit Eight is cross section CC prime. It
19 originates from the Yates No. 1 Gene in Section 31. It extends
20 to, I believe that's Section 29, through the Monterrey Federal
21 Well, north to the Western J Federal, then east to the
22 Continental Duffield, southeast to the Coquina Dean Federal,
23 then northeast through the O'Neill No. 1 Federal Q, extending
24 further northeast to the Continental No. 1 Thurman and
25 terminating at the Northern Natural No. 1 Vandegriff in

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1 Section 1 of 16, 27.

2 And as I mentioned previously, this cross section
3 depicts the relative qualities of the Morrow B sand and other
4 zones, of course, but we are highlighting the B zone in the
5 Morrow since it is the productive zone in the Continental Well.
6 The only well in this cross section that produces from the
7 Morrow, other than, of course, that that was recovered from
8 the Duffield, is the Yates Gene Well in Section 31 and it was
9 drill stem tested for four point one four million and it
10 decreased to two point six million. It was subsequently
11 completed in the interval eighty-two, ninety-four to eighty-
12 three, eighty-eight. However, I don't have the test on it,
13 but we don't feel that the point in which it is completed
14 is connected laterally to the Continental Duffield zone.

15 The Northern Natural Vandegriff was completed but
16 the drill stem test was from eighty-six, seventy-two to
17 eighty-nine, thirty-two and our cross section shows --
18 well, the various zones within the Morrow aren't broken
19 down so that completion in the Vandegriff is considered
20 an Atoka-Morrow completion. But there again, it's so
21 far removed from the Duffield that we are just attempting
22 to show on a regional basis the lack of Morrow wells in
23 the area.

24 MR. NUTTER: Do you know what the productive
25 interval on the Vandegriff Well is, where it's perforated?

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1 A I just have the general drill stem test interval.

2 I don't believe I brought that information with me. It was
3 completed for -- I think the potential was a little over
4 a million, a million a day, and I don't believe that well has
5 ever produced. I should have it in this information. Yeah,
6 here it is. The perforated interval was eighty-six, ninety-
7 eight to eighty-seven, forty-three. The CAOF was one point
8 five seven million.

9 MR. NUTTER: One point five seven?

10 A Yes.

11 MR. NUTTER: Okay, while we're at it, what did you
12 say that perforated interval in that Yates Gene was?

13 A Well, it was completed natural and they show an
14 overall interval of eighty-three, ten to eighty-five, thirty.

15 MR. NUTTER: It's an open hole then?

16 A An open hole, right.

17 MR. NUTTER: And do you have a CAOF on it?

18 A Yes, sir, it was two point one million. And I have
19 no knowledge of that well having produced. It may be on
20 production but I'm not familiar with it.

21 MR. NUTTER: But the principal purpose of this
22 Exhibit Number Eight, this long southwest-northeast cross
23 section is to show that the productive wells are far
24 removed from your well and separated between your Duffield
25 Well by dry holes?

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Phone (505) 982-9212

1 A. Yes, sir.

2 MR. NUTTER: To show that you've got an isolated
3 reservoir?

4 A. We perceive it to be isolated, yes, sir.

5 Q. (Mr. Lopez continuing.) Now, turning to Exhibit
6 Number Nine, would you please explain it?

7 A. Exhibit Number Nine indicates -- well, it has two
8 purposes. One shows that the well has been produced to the
9 volume of four point four eight billion and further projections
10 indicate that the gas in place was calculated to be five point
11 two four five billion. The difference of which is the gas
12 lift in the reservoir by Continental and we assume this to
13 be un-recoverable. I calculated that recovery factor to be
14 eighty-six point five percent.

15 MR. NUTTER: That has already been recovered?

16 A. Yes, sir. We feel that there are insignificant
17 amounts of gas left in the hole to be recovered.

18 Upon approval we plan to simply re-inject gas to
19 the initial conditions for peaking purposes. That is after
20 we have prepared sufficient facilities to do this.

21 Q. (Mr. Lopez continuing.) Have you attempted by lease
22 or other means to obtain the formation or strata which you
23 propose to use as a gas storage project?

24 A. Just from the State.

25 Q. No, from anyone with respect to the area included in

1 the gas storage area, from the State or Federal?

2 A From other leases we have obtained an agreement
3 from the Department of the Interior which in the Federal leases
4 amount to eighty-seven and a half percent of this unit.

5 Q Have you tried to negotiate a lease with the State
6 Land Office?

7 A Well, we were in communication with them but the
8 State Land Office preferred that this be brought to hearing such
9 that the Oil Conservation Commission could study these leases
10 to evaluate our interpretations of the conditions.

11 Q What area is now subject to lease within the
12 designated area?

13 A The south half of Section 16.

14 Q Is there any oil capable of producing in paying
15 quantities through any known recovery method in the formation
16 or strata which you propose to use?

17 A Not to my knowledge.

18 Q Is there any native gas that is producible in any
19 quantities from this same strata?

20 A No, not to my knowledge.

21 Q Are there any commercial deposits of potash located
22 in the proposed project area?

23 A No.

24 Q Will the use of the strata for gas storage purposes
25 cause injury to surface or underground water resources?

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1 A. No.

2 Q. In your opinion is the underground strata which you
3 seek to have declared as suitable for underground storage
4 suitable for underground storage of natural gas?

5 A. Yes, we feel it is.

6 Q. Is any portion of the strata being sought to be
7 acquired or found to be suitable for the storage of underground
8 natural gas being utilized for injection or storage or with-
9 drawal of natural gas by others at this time?

10 A. No.

11 Q. Were the Exhibits One through Nine prepared by you
12 or under your supervision?

13 A. Yes, they were.

14 Q. In your opinion will the granting of this application
15 prevent waste and protect correlative rights?

16 A. Yes, it would.

17 MR. LOPEZ: At this time I would like to introduce
18 Exhibits One through Nine.

19 MR. NUTTER: Southern Union Exhibits One through
20 Nine will be admitted into evidence.

21 MR. LOPEZ: Gas Company of New Mexico Exhibits One
22 through Nine.

23 MR. NUTTER: Gas Company of New Mexico Exhibits
24 One through Nine.

25

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(THEREUPON, Gas Company of New Mexico Exhibits One through Nine were admitted into evidence.)

MR. LOPEZ: That ends our direct examination.

CROSS EXAMINATION

BY MR. NUTTER:

Q In making a finding the Commission is required to find certain things in one of these cases. I think Mr. Lopez covered the questions but I would like to have a little further elaboration on the answers possibly. You stated that the approval of this would not cause injury to surface or underground water resources, would you delve into the matter of existing water in this area and what you would do to protect that water, please?

A Yes, sir, I have a -- now, this is assuming that we are able to re-enter the old well, we would drill out the plugs at the surface, thirteen, twenty to thirteen, eighty and twenty-nine hundred to three thousand and thirty. We would dress off the top of the old seven inch.

Q Where was that seven inch cut?

A Let's see, I have a record of it in here. Okay, they cut and pulled forty-eight hundred feet of seven-inch casing, based on Continental Oil Company's plugging report filed with the USGS.

Q Okay, your program got down to the point where you

1 dress off the top of that seven inch?

2 A. Yes, sir, and we will run a casing patch onto the
3 new seven inch and patch onto the old casing and nipple up
4 the blowout preventer stack and pressure test casing and
5 patch to two thousand pounds for thirty minutes. If patch
6 does not hold, perforate twenty-five feet below the patch and
7 cement casing with five hundred sacks of cement, leaving
8 fifty feet in the casing. Wait on cement and drill out and
9 repeat pressure test, mill out tubing and packer at eighty-four
10 hundred and ninety-five feet and clean out hole to eighty-
11 seven hundred and fifty feet.

12 Now, this program, Mr. Examiner, is a routine one,
13 I would say, when reentering an old well and I have my doubts
14 as to whether we are really going to follow this program because
15 I feel like we will probably drill a new well.

16 Q. Now, would injection and withdrawals into this
17 well be through tubing or through the casing in this well or
18 a new well, either one?

19 A. We plan to complete with three-and-a-half inch
20 production tubing in order to get a maximum of twenty million
21 a day if we can. Under normal conditions, and I'm thinking
22 about my experience in the past, under normal conditions we
23 would produce through the annulus but we would have production
24 tubing in the hole but we would produce up through the
25 annulus to conserve the energy, you know. But we plan to

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1 inject and/or produce through the same medium.

2 Q Why would you run tubing if you are going to
3 produce through the annulus?

4 A Well, in case we had fluid problems.

5 Q I see, so if it loaded up so you could produce it
6 through the tubing or swab it?

7 A Yes.

8 Q Normally you would use the annulus for your medium
9 in and out?

10 A Right.

11 Q And then if you use the Continental Duffield Well,
12 that's the program that you just outlined for recompletion
13 of the well as a combination injector-withdrawal well, right?

14 A Well, I didn't get to the completion. We will clean
15 it out to eighty-seven hundred and fifty feet and then we
16 will complete with three-and-a-half-inch tubing and acidize
17 the old perforations and we will acid frac the old perforations
18 to increase deliverability and swab back the load water and
19 connect the well for injection and production.

20 Q Well, now, the question was: What provision will be
21 made to protect the underground water resources, I presume --

22 A We will set intermediate --

23 Q The casing and the repair job on the casing, the
24 testing of the casing up to two thousand pounds after tying
25 the two casing strings together and I presume the well does have

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1 surface pipe in it also?

2 A. Yes.

3 Q. And this would afford adequate protection for the
4 water resources in the area?

5 A. Yes.

6 Q. In the event you drill a new well because you can't
7 use this old Continental Well, what would be your program for
8 a new well?

9 A. We'll set thirteen-and-three-eighths at two hundred
10 and seventy-four feet and we will set nine-and-five-eighths at
11 thirteen hundred and eighty-one feet and we'll set seven inch
12 at previously mentioned -- I think that was forty -- we'll run
13 seven inch all of the way to the bottom, which will be eighty-
14 five hundred feet.

15 Q. And what about cement on those three casing strings?

16 A. Well, with thirteen-and-three-eighths we will
17 cement with three hundred sacks. The nine-and-five-eighths we
18 will cement it with eight hundred and seventy-five sacks and
19 the seven inch we will cement it with a thousand and nineteen
20 sacks.

21 Q. And you feel that this casing cementing would provide
22 adequate protection to underground water resources then?

23 A. Yes, sir.

24 Q. Now, 65-9-5 (e) states that the underground stratum
25 sought to be acquired if it contained native gas capable of

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1 production in paying quantities is substantially depleted
2 of recoverable native gas. I think on your Exhibit Number
3 Nine you show that the original gas in place is calculated
4 to be five point two four five billion cubic feet. You also
5 stated that the well, the Duffield No. 1 Well, had produced
6 four point four eight oh billion cubic feet. What would be
7 the amount of remaining gas in the reservoir?

8 A It would be a matter of subtracting those two. It
9 amounts to seven hundred and sixty-five million.

10 Q Now, is this, in your opinion, a substantially
11 depleted gas reservoir?

12 A Mr. Examiner, I examined Continental's complete
13 production records from initial delivery to abandonment and
14 it was my opinion that the only reason they abandoned the
15 well was that they experienced low pressure problems such
16 that it became uneconomical to produce the well. Now, at
17 this day and time, I would say that that same well, more
18 evaluation would have been given the well such that perhaps
19 they would have installed a compressor due to the economic
20 environment we have now. However, back then with the gas price
21 as it was in '66 and '67, at which time they recovered a
22 little over six million per year in each year, I doubt very
23 seriously if it would have been economical to attempt to
24 recover anymore.

25 Q Do you have a tabulation of the annual production

1 or monthly production on the well that you can give us up from
2 the time of its connection to its abandonment?

3 A Well, I don't right at this moment. I have it
4 included in this book. I have a complete pressure history
5 and production history on this particular page and I can make
6 it available to you.

7 Q Would you send that to us after you get home?

8 A Certainly.

9 MR. NUTTER: And also, Mr. Lopez, we will take
10 administrative notice of the Commission's records regarding
11 this Duffield Well, production history as well as casing
12 and abandonment and so forth.

13 Q (Mr. Nutter continuing.) Now, Mr. Ellis, you stated
14 that you have acquired the use of all of the lands sought here
15 with the exception of the south half of Section 16, is that
16 it?

17 A We have acquired the leases on all of the land
18 and we have approached the Department of the Interior and
19 received agreement from them to utilize their portion as an
20 underground storage unit.

21 Q Are all of the lands in the proposed area Federal
22 lands with the exception of the south half of Section 16?

23 A Yes, sir, they are.

24 Q So this agreement covers all of the land except the
25 south half of Section 16?

1 A Yes, sir, it does.

2 Q And the south half of 16 is a State lease, is
3 that right?

4 A It's comprised of two State leases, as I recall, and
5 I'm sorry I didn't bring those -- don't have those lease
6 numbers available but there are two leases involved.

7 Q Is there an outstanding oil and gas lease on those
8 lands?

9 A Well, yes, they are both in force now, they are
10 under Gas Company -- well, they are under Southern Union's
11 name because we acquired the lease.

12 Q You do have an oil and gas lease on it, you just
13 don't have the storage project on the lands?

14 A That is correct.

15 Q But you do have the oil and gas leases?

16 A Yes, sir, that is correct.

17 Q Now, I think we need to define the vertical limits
18 that you are seeking for this storage project. These cross
19 sections, the logs are rather small in scale, now, you are
20 seeking the interval from the top of the Morrow clastic to
21 the top of the Barnett, I believe, could you give us the
22 depth in the Duffield No. 1 of the top of the Morrow clastic
23 and the depth of the top of the Barnett stratum?

24 A Well, I have it defined. I need to check the
25 application to see what the application specifies. The top

1 of the Morrow clastic to the top. Okay, that would be eight
2 thousand five hundred and forty-three feet or on a subsea
3 basis minus forty-nine, seventy-one. The top of the Barnett
4 is eighty-seven hundred and fifteen feet or minus fifty-one,
5 forty-three.

6 Q The top of the Morrow clastic in the Duffield No. 1
7 then is eighty-one, forty-three?

8 A Yes.

9 Q Or minus forty-nine, seventy-one and the top of
10 the Barnett is eighty-seven, fifteen or minus five one four
11 three, correct?

12 A Yes, sir.

13 MR. NUTTER: Are there any further questions of the
14 witness? He may be excused.

15 (THEREUPON, the witness was excused.)

16 MR. NUTTER: Is there anything further, Mr. Lopez?

17 MR. LOPEZ: No, Mr. Examiner.

18 MR. NUTTER: Does anyone have anything they wish to
19 offer in Case Number 5778? We will take the case under
20 advisement and recess the hearing until one-thirty.

21 (THEREUPON, the hearing was in recess.)

22

23

24

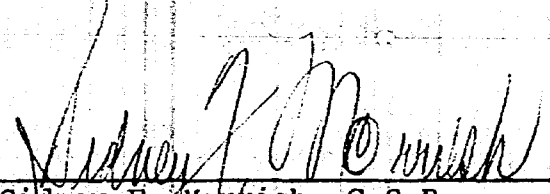
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REPORTER'S CERTIFICATE

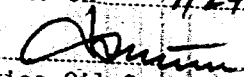
I, SIDNEY F. MORRISH, a Certified Shorthand Reporter,
do hereby certify that the foregoing and attached Transcript
of Hearing before the New Mexico Oil Conservation Commission
was reported by me, and the same is a true and correct record
of the said proceedings to the best of my knowledge, skill and
ability.


Sidney F. Morrish, C.S.R.

sid morrish reporting service

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Phone (505) 982-9212

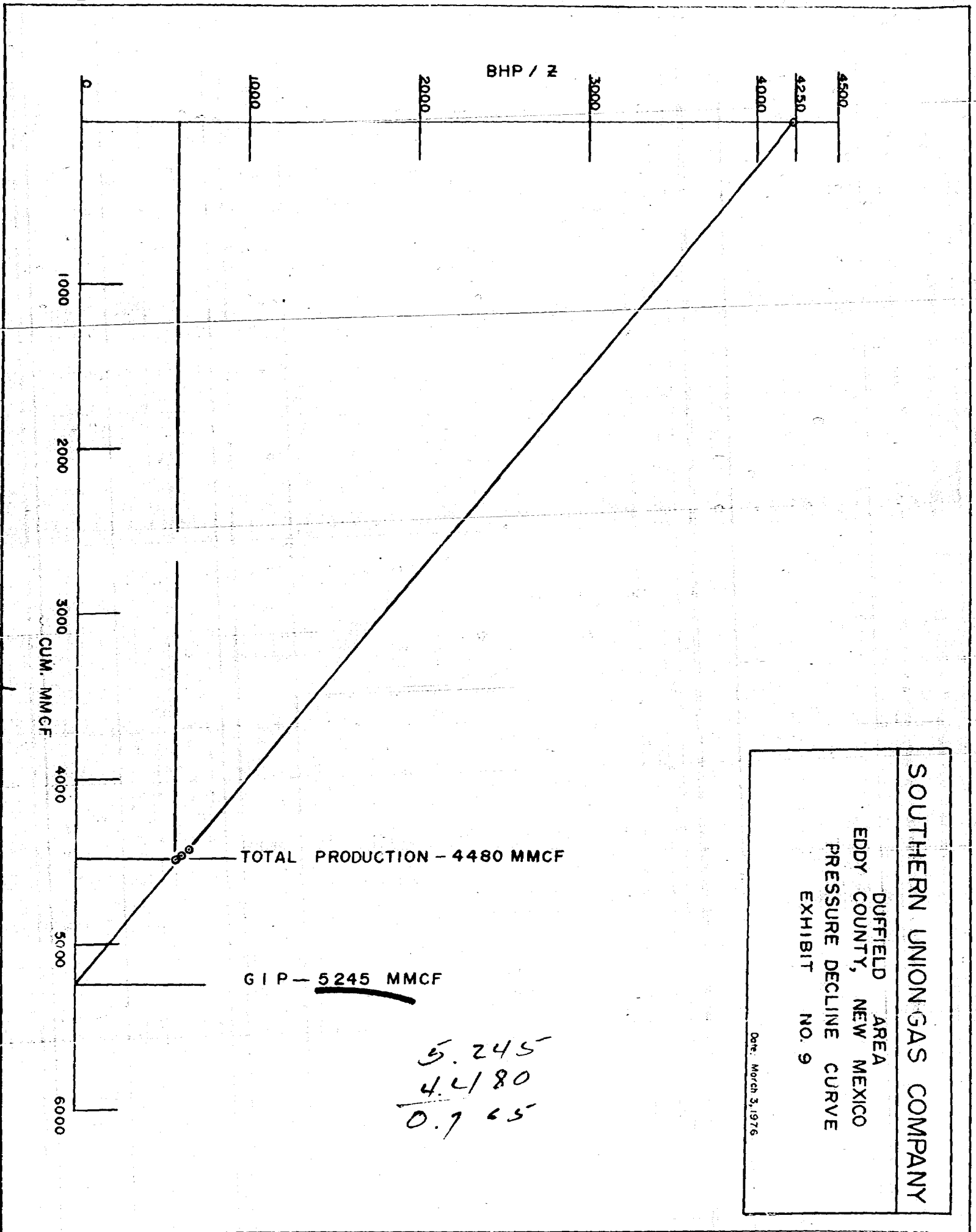
I do hereby certify that the foregoing is
a complete record of the proceedings in
the Examiner hearing of Case No. 5778
heard by me on 9/29, 1976.


Examiner
New Mexico Oil Conservation Commission

SOUTHERN UNION GAS COMPANY

DUFFIELD AREA
EDDY COUNTY, NEW MEXICO
PRESSURE DECLINE CURVE
EXHIBIT NO. 9

Date: March 3, 1976



J. O. SETH (1883-1863)

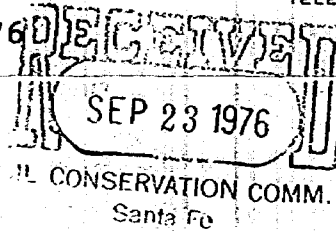
A. K. MONTGOMERY
WM. R. FEDERICI
FRANK ANDREWS
FRED C. HANNAHS
SETH D. MONTGOMERY
FRANK ANDREWS III
OWEN M. LOPEZ
JEFFREY R. BRANNEN
JOHN BENNETT POUND

GARY R. KILPATRICK
THOMAS W. OLSON
WALTER J. MELENDRÉS
BRUCE L. HERR

MONTGOMERY, FEDERICI, ANDREWS & HANNAHS
ATTORNEYS AND COUNSELORS AT LAW
325 PASEO DE PERALTA
SANTA FE, NEW MEXICO 87501

POST OFFICE BOX 2307
AREA CODE 505
TELEPHONE 982-3873

September 21, 1976



Oil Conservation Commission
State Land Office
Santa Fe, New Mexico 87503

Re: Application of Gas Company of New Mexico to acquire
certain interests in lands in Sections 15, 16, 17,
20, 21, 22, 27, 28 and 29, Township 16 South, Range
27 East, N.M.P.M., Eddy County, New Mexico, for the
purpose of underground storage of natural gas;
Case No. 5778

Gentlemen:

Enclosed for filing are an original and two copies of an
Amendment to Application.

Sincerely yours,
Clara M. Lopez

OML:RB
3058-76-8

Enclosures (3)

BEFORE THE NEW MEXICO OIL CONSERVATION COMMISSION

IN RE APPLICATION OF GAS COMPANY)
OF NEW MEXICO TO ACQUIRE CERTAIN)
INTERESTS IN LANDS IN SECTIONS)
15, 16, 17, 20, 21, 22, 27, 28 AND)
29, TOWNSHIP 16 SOUTH, RANGE 27)
EAST, N.M.P.M., EDDY COUNTY,)
NEW MEXICO, FOR THE PURPOSE OF)
UNDERGROUND STORAGE OF NATURAL GAS.)

Case No. 5778

AMENDMENT TO APPLICATION

Comes now Gas Company of New Mexico, by and through its attorneys, Montgomery, Federici, Andrews & Hannahs, and hereby amends paragraph 1 of its Application to read as follows:

1. Applicant proposes to store natural gas in the sub-surface strata or formations from the top of the Morrow clastic stratum to the top of the Barnett stratum in, through, along, across and under the following described lands:

SW 1/4 of Section 15, S 1/2 of Section 16,
SE 1/4 of Section 17, E 1/2 of Section 20,
all of Section 21, W 1/2 of Section 22,
NW 1/4 of Section 27, N 1/2 of Section 28,
and the NE 1/4 of Section 29, Township 16
South, Range 27 East, N.M.P.M., Eddy County,
New Mexico.

In all other respects the Application as filed is re-affirmed.

Respectfully submitted,

MONTGOMERY, FEDERICI, ANDREWS
& HANNAHS

By C. W. H. Lopez
P.O. Box 2307
Santa Fe, New Mexico 87501

BEFORE THE NEW MEXICO OIL CONSERVATION COMMISSION

IN RE APPLICATION OF GAS COMPANY)
OF NEW MEXICO TO ACQUIRE CERTAIN)
INTERESTS IN LANDS IN SECTIONS)
15, 16, 17, 20, 21, 22, 27, 28 AND)
29, TOWNSHIP 16 SOUTH, RANGE 27)
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and the NE 1/4 of Section 29, Township 16
South, Range 27 East, N.M.P.M., Eddy County,
New Mexico.

In all other respects the Application as filed is re-affirmed.

Respectfully submitted,

MONTGOMERY, FEDERICI, ANDREWS
& HANNAHS

By *Chas. H. Hoff*
P.O. Box 2307
Santa Fe, New Mexico 87501

BEFORE THE NEW MEXICO OIL CONSERVATION COMMISSION

IN RE APPLICATION OF GAS COMPANY)
OF NEW MEXICO TO ACQUIRE CERTAIN)
INTERESTS IN LANDS IN SECTIONS)
15, 16, 17, 20, 21, 22, 27, 28 AND)
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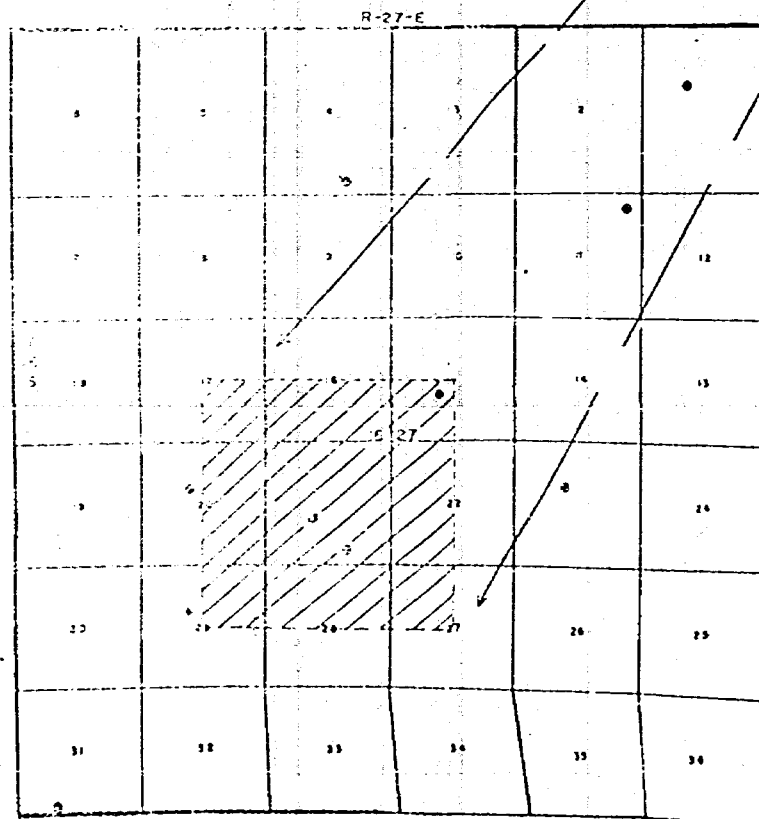
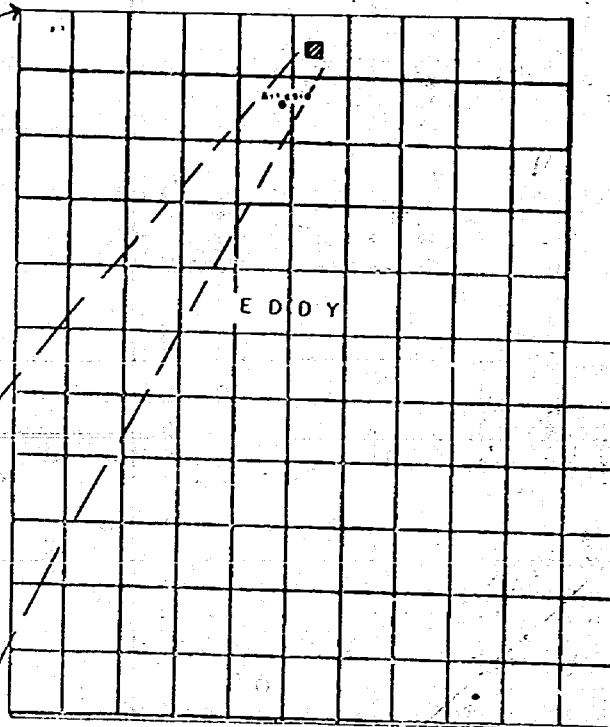
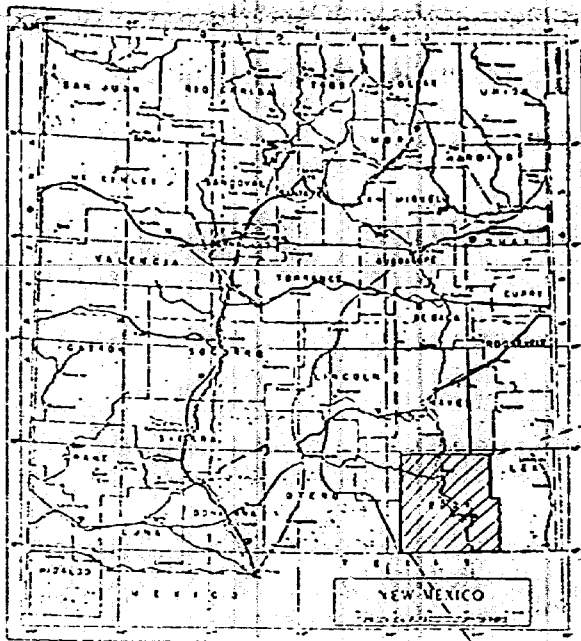
SW 1/4 of Section 15, S 1/2 of Section 16,
SE 1/4 of Section 17, E 1/2 of Section 20,
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and the NE 1/4 of Section 29, Township 16
South, Range 27 East, N.M.P.M., Eddy County,
New Mexico.

In all other respects the Application as filed is re-affirmed.

Respectfully submitted,

MONTGOMERY, FEDERICI, ANDREWS
& HANNAHS

By C. W. M. Lopez
P.O. Box 2307
Santa Fe, New Mexico 87501

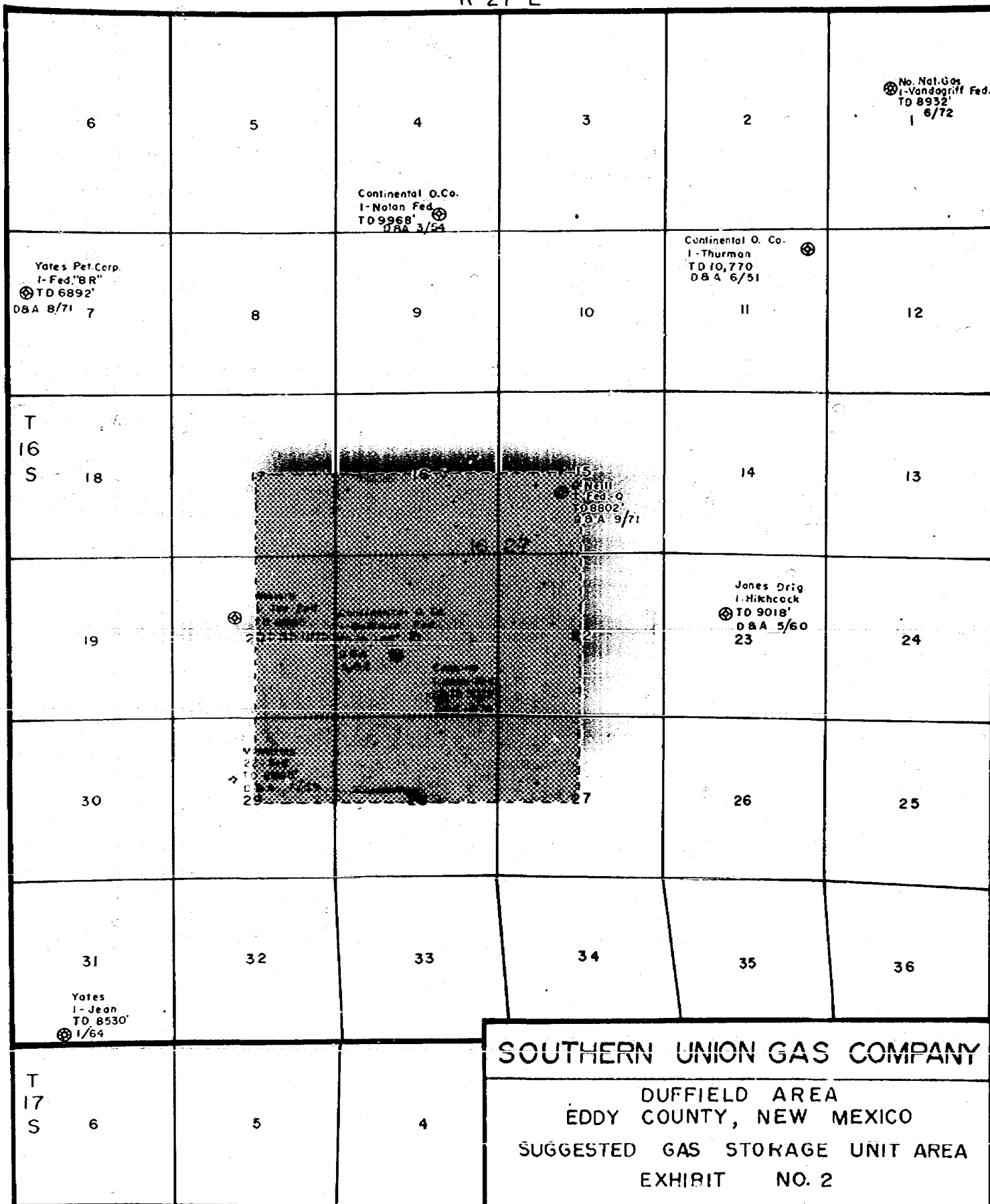


SOUTHERN UNION GAS COMPANY

DUFFIELD AREA
 EDDY COUNTY, NEW MEXICO
 LOCATION MAP
 SUGGESTED GAS STORAGE AREA
 EXHIBIT NO. 1

January 5, 1975

R-27-E



No. Nat. Gas
 I-Vandegriff Fed.
 TD 8932'
 6/72

Continental O. Co.
 I-Nolan Fed.
 TD 9968'
 O&A 3/54

Yates Pet. Corp.
 I-Fed. "BR"
 TD 6892'
 O&A 8/71 7

Continental O. Co.
 I-Thurman
 TD 10,770
 O&A 6/51

T
 I6
 S 18

I5
 Fed. O
 TD 8802'
 O&A 9/71

Jones Drig
 I-Hickcock
 TD 9018'
 O&A 5/60
 23

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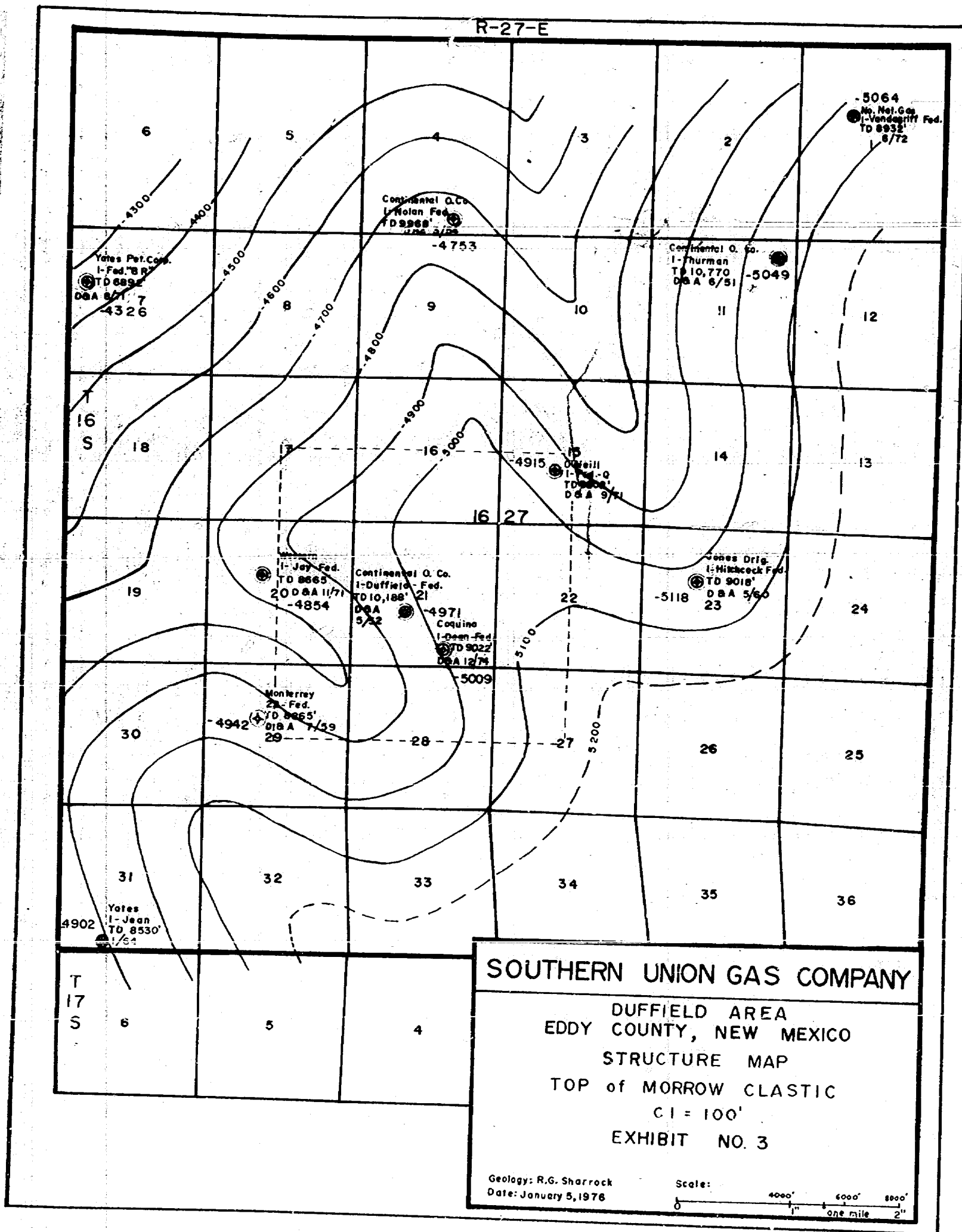
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Yates
 I-Jean
 TD 8530'
 1/64

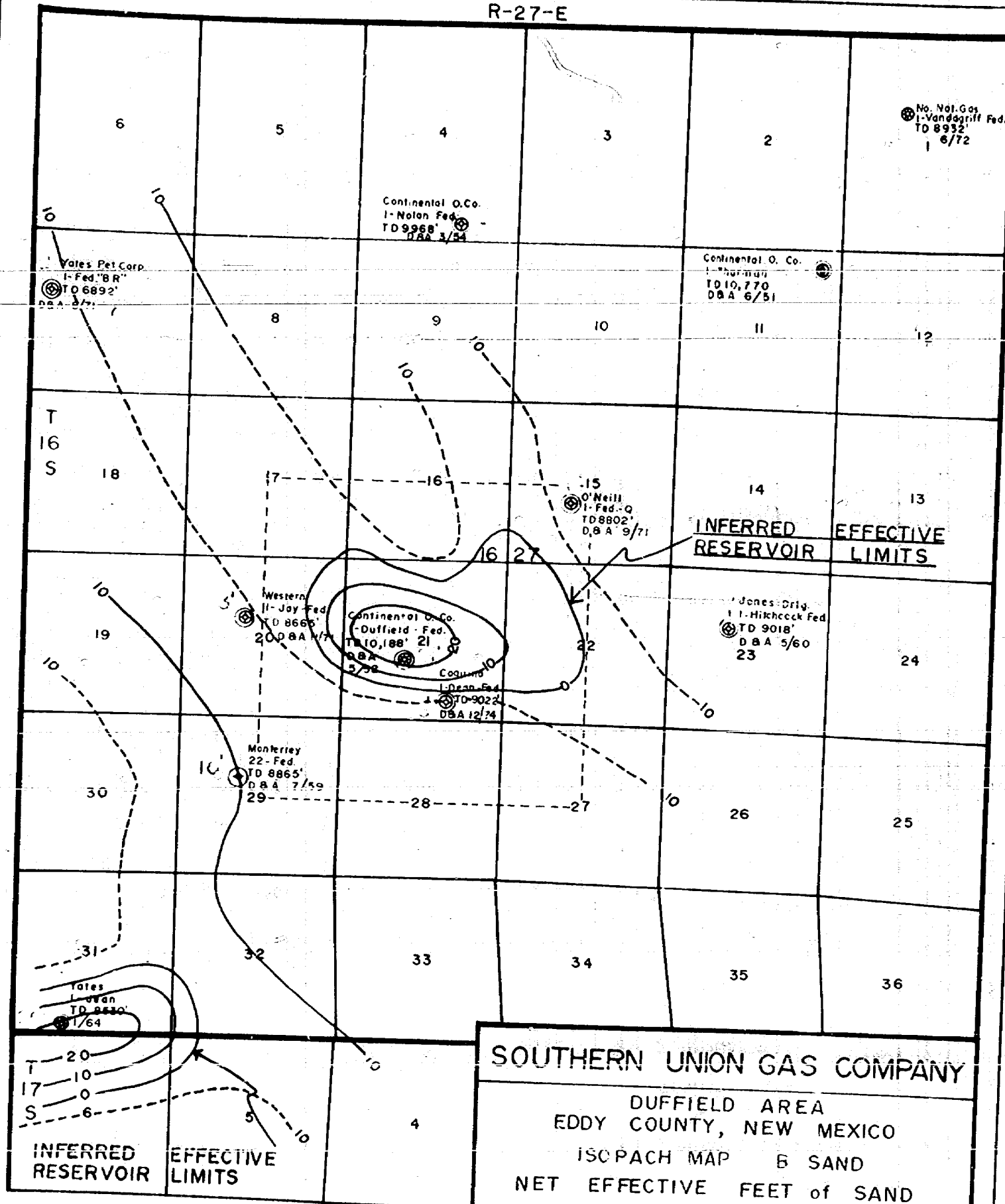
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R-27-E

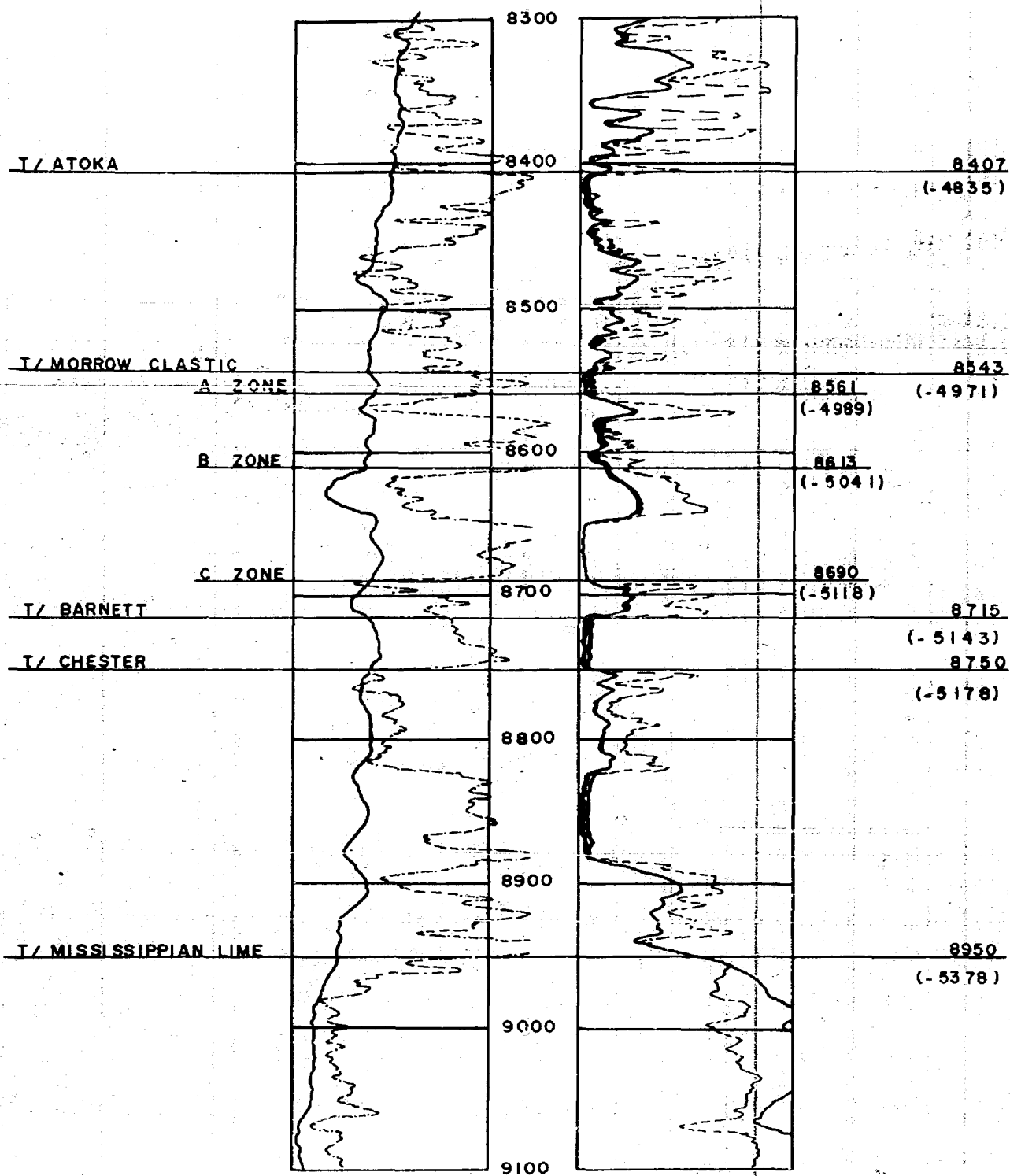


SOUTHERN UNION GAS COMPANY

DUFFIELD AREA
 EDDY COUNTY, NEW MEXICO
 ISCPACH MAP B SAND
 NET EFFECTIVE FEET of SAND
 C I = 10'
 EXHIBIT NO. 4

Geology: R.G. Sharrack
 Date: January 5, 1976

Scale: 0 4000' 6000' 8000'
 1" one mile 2"

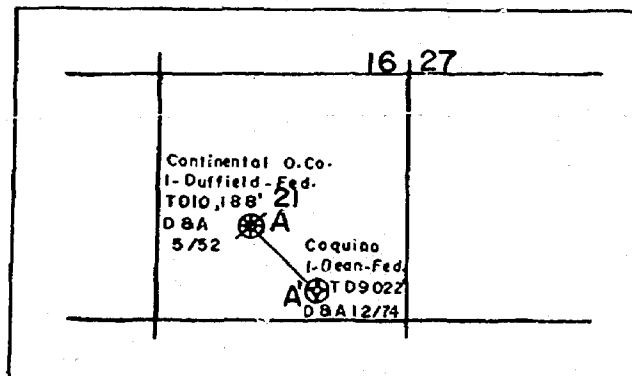
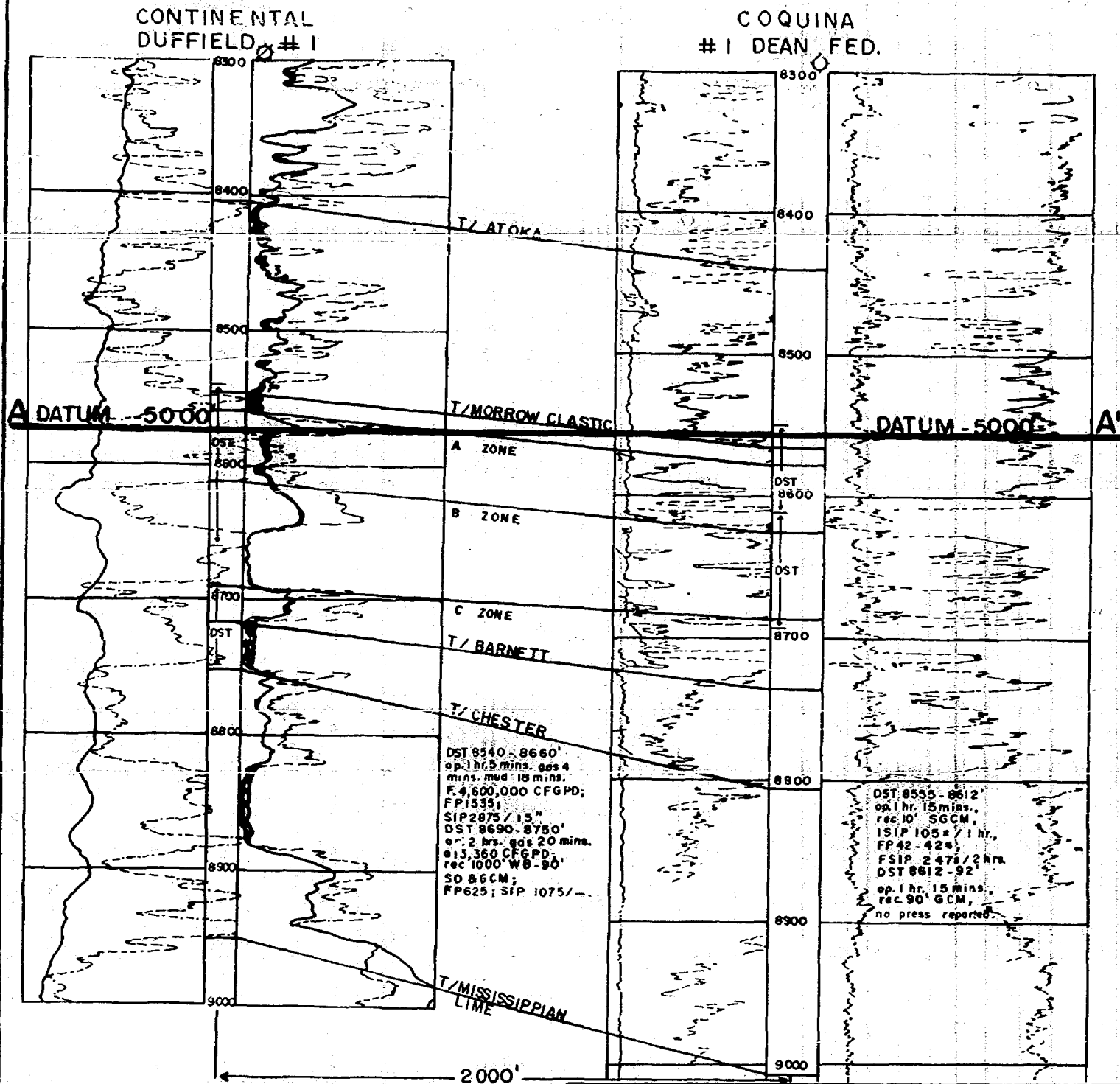


TD 10,192'
EL. 3572 D.F.

SOUTHERN UNION GAS COMPANY

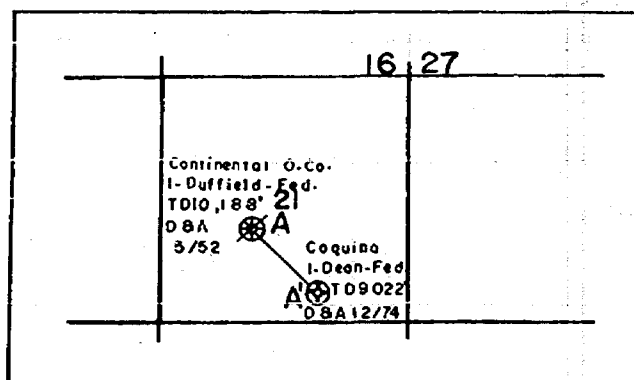
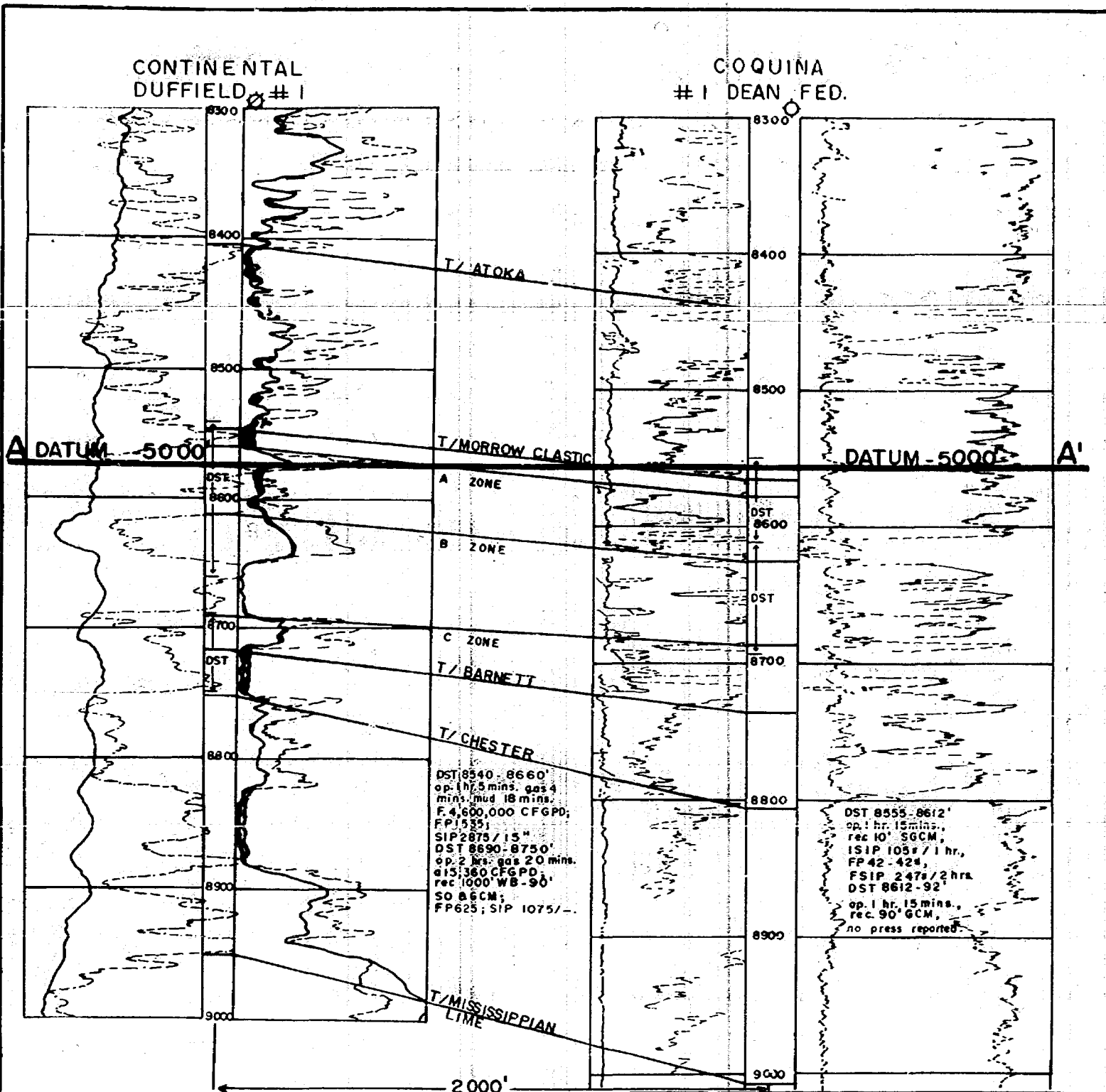
DUFFIELD AREA
EDDY COUNTY, NEW MEXICO
TYPE LOG of ATOKA
and MORROW FORMATIONS
CONTINENTAL OIL COMPANY
DUFFIELD #1
EXHIBIT NO. 5

January 5, 1976



SOUTHERN UNION GAS COMPANY

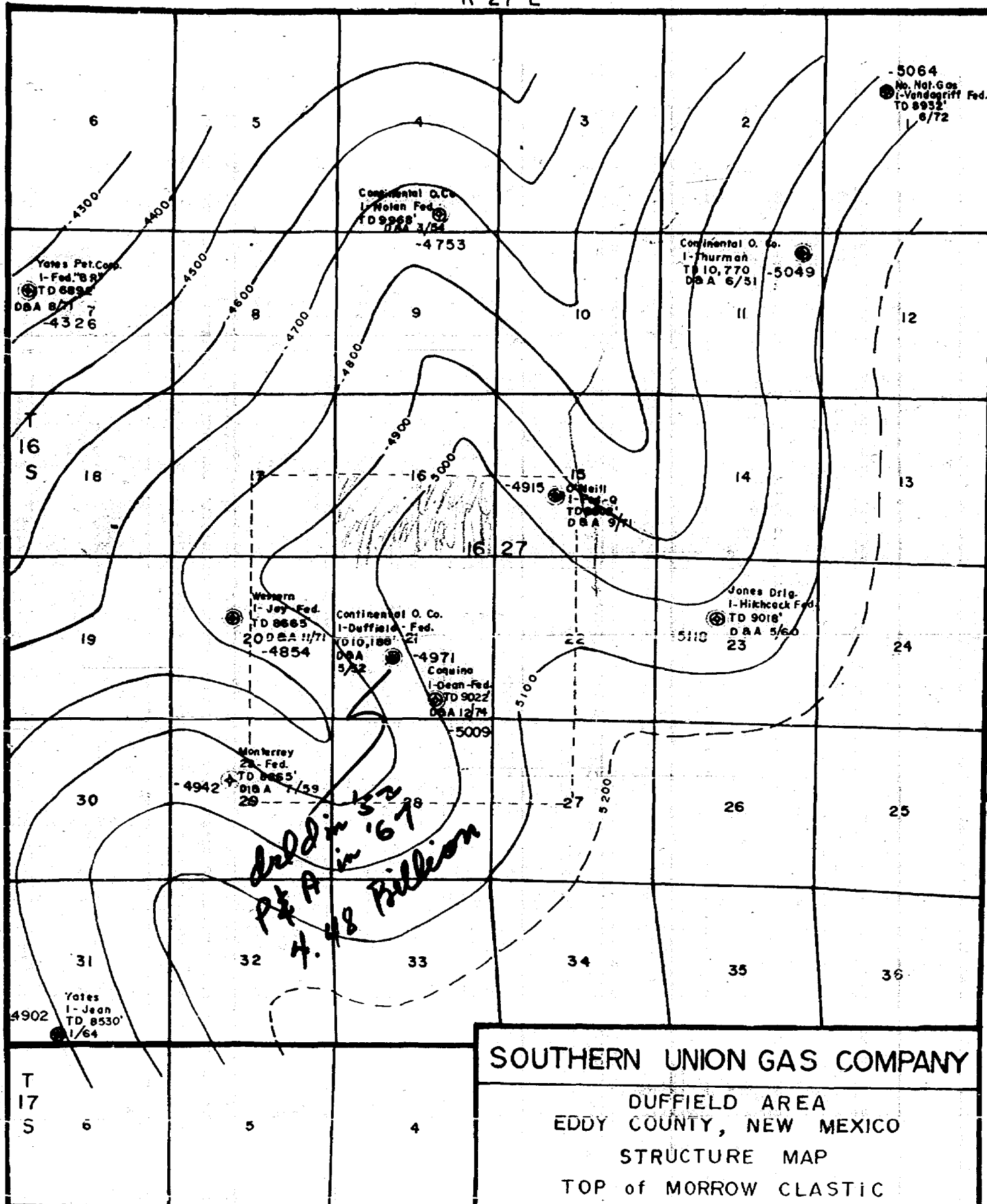
DUFFIELD AREA
 EDDY COUNTY, NEW MEXICO
 CROSS SECTION A-A'
 EXHIBIT NO. 6



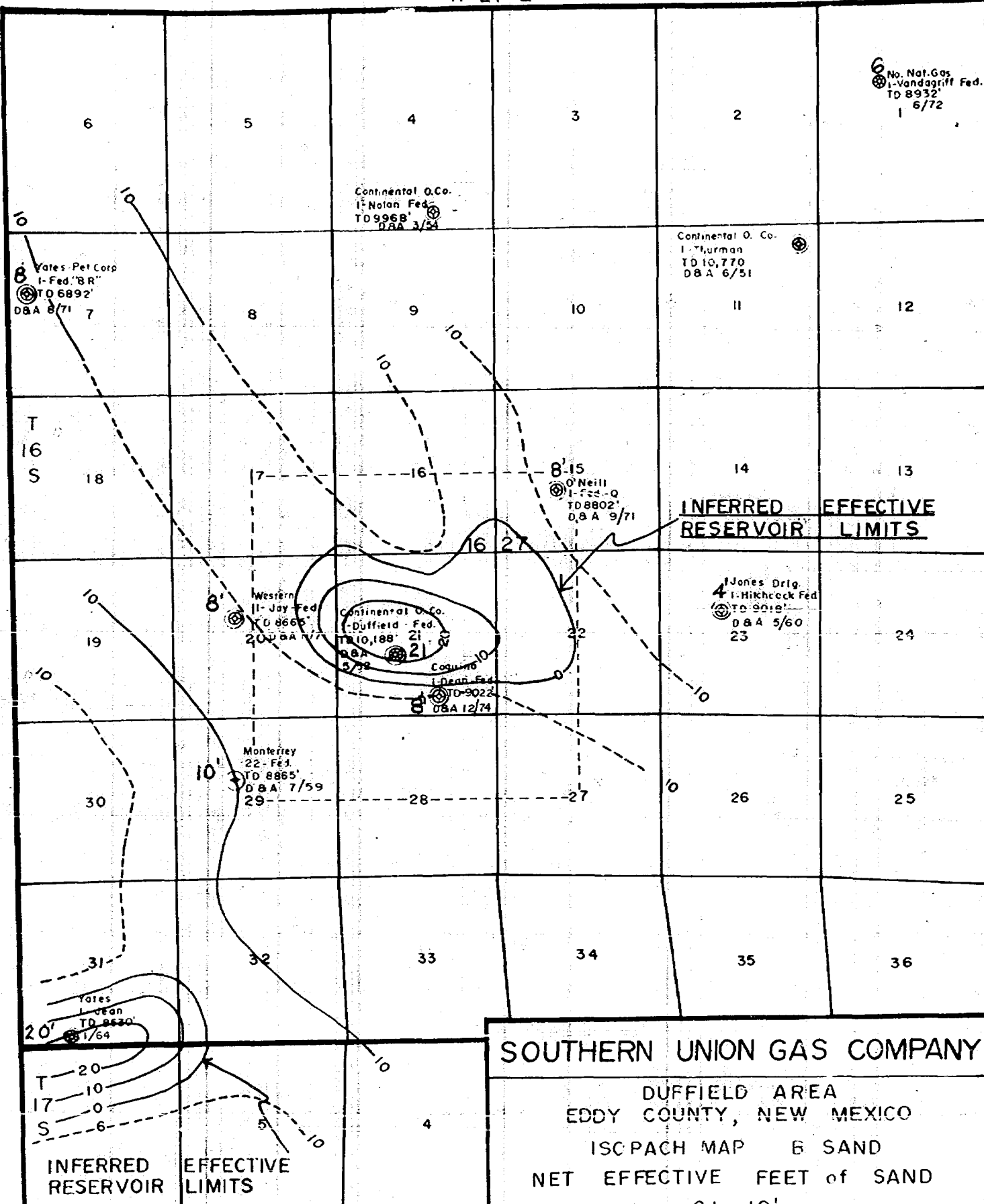
SOUTHERN UNION GAS COMPANY

DUFFIELD AREA
EDDY COUNTY, NEW MEXICO
CROSS SECTION A-A'
EXHIBIT NO. 6

R-27-E



R-27-E

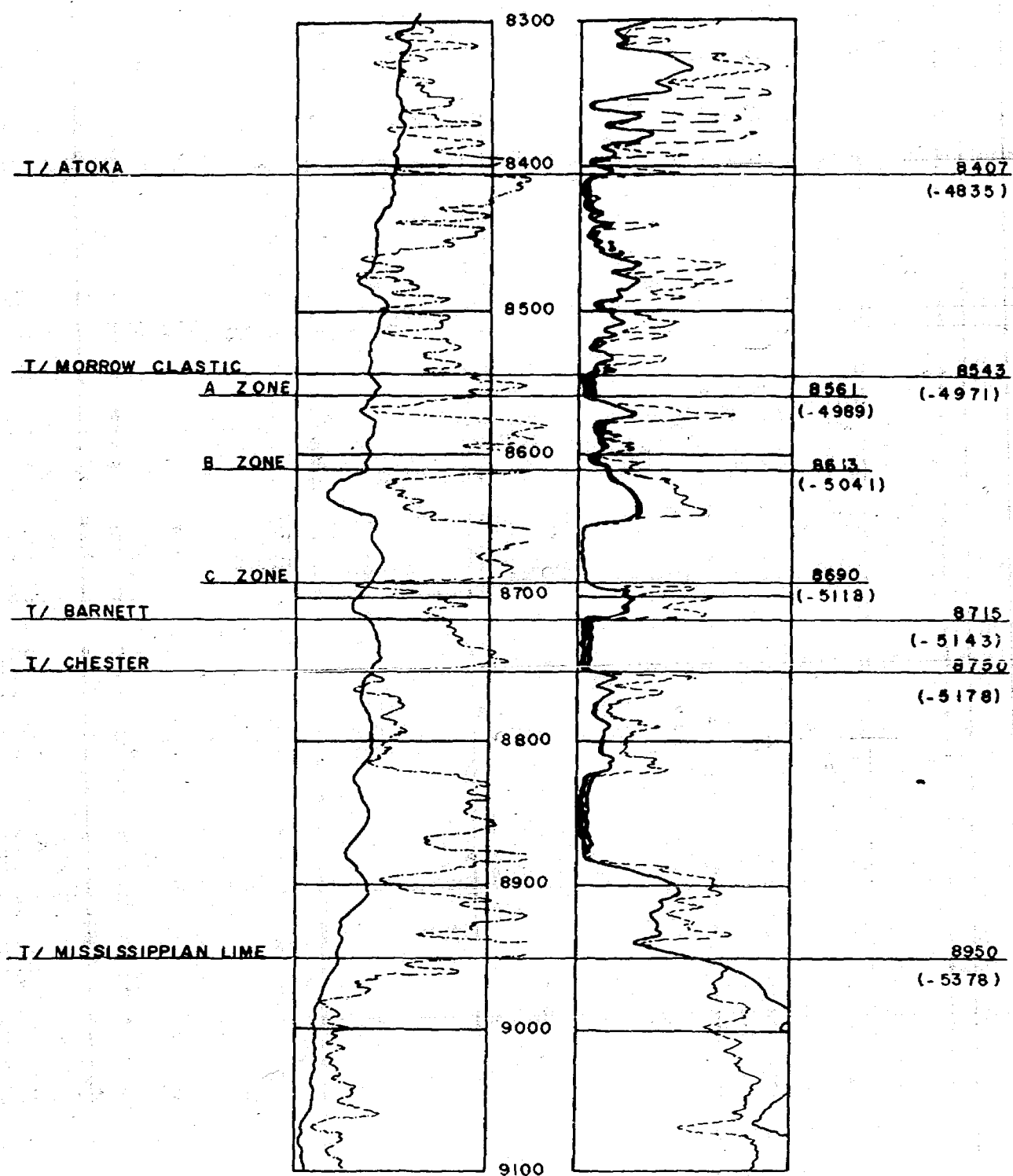


SOUTHERN UNION GAS COMPANY

DUFFIELD AREA
 EDDY COUNTY, NEW MEXICO
 ISCPACH MAP B SAND
 NET EFFECTIVE FEET of SAND
 CI = 10'
 EXHIBIT NC. 4

Geology: R.G. Sharrack
 Date: January 5, 1975

Scale: 0 4000' 6000' 8000'
 0 1" one mile 2"



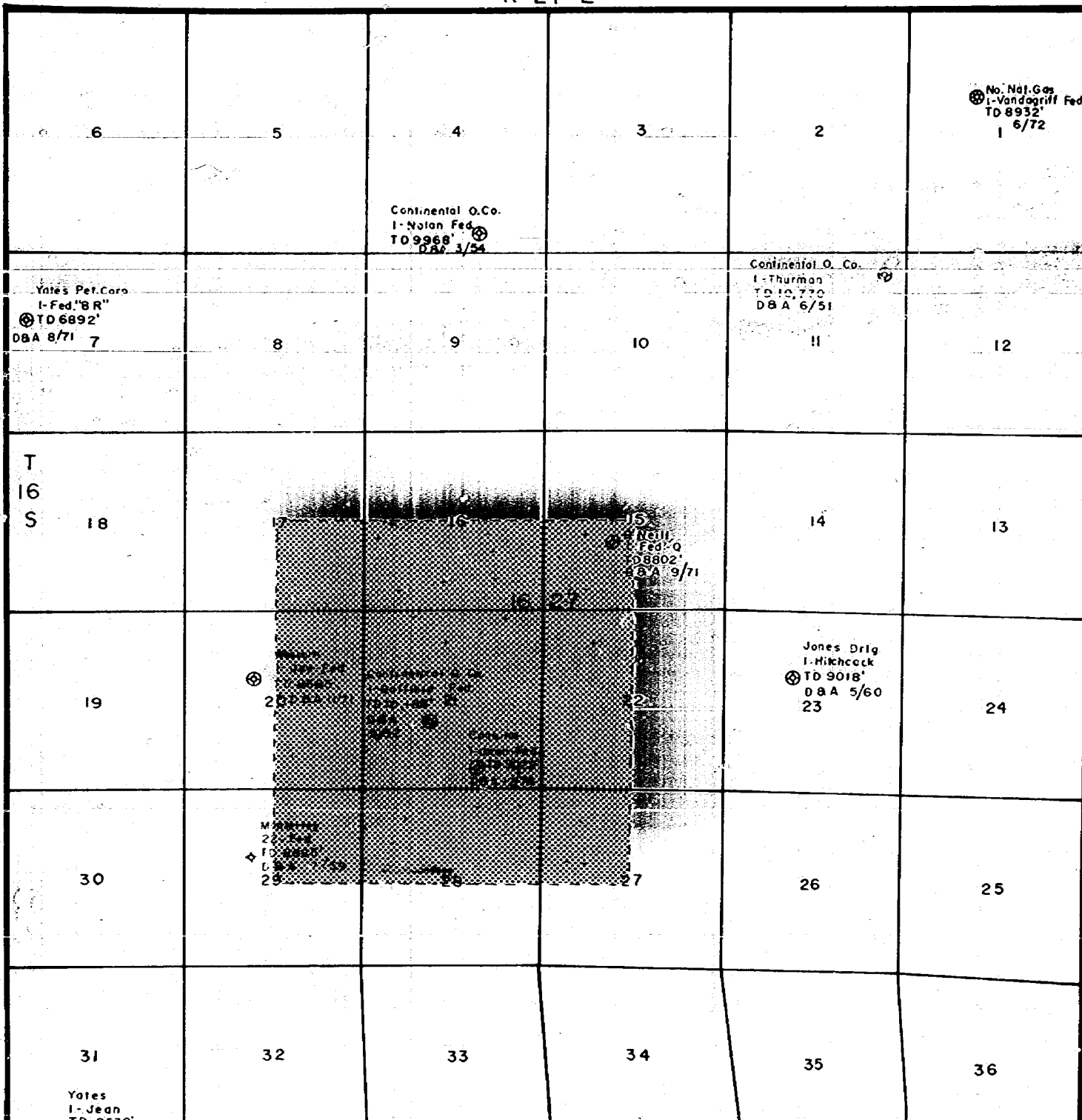
TD 10,192'
EL. 3572 D.F.

SOUTHERN UNION GAS COMPANY

DUFFIELD AREA
EDDY COUNTY, NEW MEXICO
TYPE LOG of ATOKA
and MORROW FORMATIONS
CONTINENTAL OIL COMPANY
DUFFIELD # 1
EXHIBIT NO. 5

January 5, 1976

R-27-E

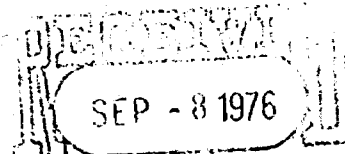


SOUTHERN UNION GAS COMPANY

DUFFIELD AREA
 EDDY COUNTY, NEW MEXICO
 SUGGESTED GAS STORAGE UNIT AREA
 EXHIBIT NO. 2

Geology: R.G. Sharrack
 Date: January 5, 1976

Scale: 0 4000' 8000' 12000'
 0 1" 2" one mile



OIL CONSERVATION COMM.

Santa Fe

BEFORE THE NEW MEXICO OIL CONSERVATION COMMISSION

IN RE APPLICATION OF GAS COMPANY
OF NEW MEXICO TO ACQUIRE CERTAIN
INTERESTS IN LANDS IN SECTIONS
15, 16, 17, 20, 21, 22, 27, 28 AND
29, TOWNSHIP 16 SOUTH, RANGE 27
EAST, N.M.P.M., EDDY COUNTY,
NEW MEXICO, FOR THE PURPOSE OF
UNDERGROUND STORAGE OF NATURAL GAS.)

Case No. 5778

A P P L I C A T I O N

Comes now Gas Company of New Mexico, by and through its attorneys, Montgomery, Federici, Andrews & Hannahs, and applies to the Commission, or one of its examiners, for a finding that certain lands located in Eddy County, New Mexico are suitable for the underground storage of natural gas, and in support of this application, states:

1. Applicant proposes to store natural gas in the subsurface strata or formations from the top of the Morrow clastic stratum to the top of the Barnett stratum in, through, along, across and under the following described lands:

Sections 15, 16, 17, 20, 21, 22, 27, 28 and
29, Township 16 South, Range 27 East, N.M.P.M.,
Eddy County, New Mexico.

2. That the subsurface strata or formations from the top of the Morrow clastic stratum to the top of the Barnett stratum are suitable for the underground storage of natural gas; that said strata or formations are incapable of producing oil in paying quantities through any known recovery method; that said strata or formations do not underlie lands which contain known commercial deposits of potash; that injury will not be caused to surface or underground water and resources; that the said strata

or formations do not contain native gas capable of production in paying quantities; that the extent of the horizontal limits of the reservoir expected to be penetrated or displaced by injected gas underlie those lands described in paragraph 1 above; that no portion of the strata or formations has been appropriated or is being utilized for the injection, storage and withdrawal of natural gas by others.

3. That the applicant has been able to obtain the necessary and requisite interests in the subsurface strata or formations in all the Federal lands which are a part of the lands described in paragraph 1 above, and that the applicant is in the process of negotiating a lease of the necessary and requisite interests in the subsurface strata or formations in all State lands which are a part of the lands described in paragraph 1 above.

4. The granting of this application is in the public interest and welfare of the State of New Mexico and the citizens thereof.

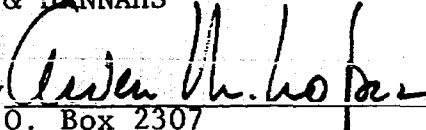
5. The granting of this application will prevent waste and protect correlative rights.

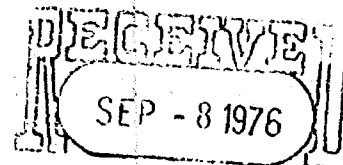
6. This application may be set for the next scheduled hearing before either the Commission or one of its examiners.

Respectfully submitted,

MONTGOMERY, FEDERICI, ANDREWS
& HANNAHS

By


P.O. Box 2307
Santa Fe, New Mexico 87501



OIL CONSERVATION COMM.

Santa Fe

BEFORE THE NEW MEXICO OIL CONSERVATION COMMISSION

IN RE APPLICATION OF GAS COMPANY)
OF NEW MEXICO TO ACQUIRE CERTAIN)
INTERESTS IN LANDS IN SECTIONS)
15, 16, 17, 20, 21, 22, 27, 28 AND)
29, TOWNSHIP 16 SOUTH, RANGE 27)
EAST, N.M.P.M., EDDY COUNTY,)
NEW MEXICO, FOR THE PURPOSE OF)
UNDERGROUND STORAGE OF NATURAL GAS.)

Case No. 5778

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Sections 15, 16, 17, 20, 21, 22, 27, 28 and
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or formations do not contain native gas capable of production in paying quantities; that the extent of the horizontal limits of the reservoir expected to be penetrated or displaced by injected gas underlie those lands described in paragraph 1 above; that no portion of the strata or formations has been appropriated or is being utilized for the injection, storage and withdrawal of natural gas by others.

3. That the applicant has been able to obtain the necessary and requisite interests in the subsurface strata or formations in all the Federal lands which are a part of the lands described in paragraph 1 above, and that the applicant is in the process of negotiating a lease of the necessary and requisite interests in the subsurface strata or formations in all State lands which are a part of the lands described in paragraph 1 above.

4. The granting of this application is in the public interest and welfare of the State of New Mexico and the citizens thereof.

5. The granting of this application will prevent waste and protect correlative rights.

6. This application may be set for the next scheduled hearing before either the Commission or one of its examiners.

Respectfully submitted,

MONTGOMERY, FEDERICI, ANDREWS
& HANNAHS

By C. W. M. Lopez
P.O. Box 2307
Santa Fe, New Mexico 87501

DRAFT

dr/

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 5778

Order No. R- 5412

APPLICATION OF GAS COMPANY OF
NEW MEXICO FOR UNDERGROUND GAS
STORAGE FINDINGS, EDDY COUNTY,
NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on September 29,
19 76, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this day of April, 19 77, the Commission,
a quorum being present, having considered the testimony, the record,
and the recommendations of the Examiner, and being fully advised
in the premises,

FINDS:

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

(2) That the applicant in the subject case, Gas Company of
New Mexico, proposes the establishment of an underground gas
storage project in Eddy County, New Mexico, to be known as the
Duffield Gas Storage Project.

(3) That the applicant has conducted geological and
engineering studies to confirm the existence of a geological
structure underlying portions of the SW/4 Section 15, S/2 Section 16,
SE/4 Section 17, E/2 Section 20, All Section 21, W/2 Section 22,
NW/4 Section 27, N/2 Section 28 and NE/4 Section 29, all in Town-
ship 16 South, Range 27 East, NMPM, Eddy County, New Mexico, and
to determine the suitability of said structure for the underground
storage of natural gas.

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Case No. 5778

Order No. R-

(4) That gas storage within said structure would be in the Pennsylvanian formation from the top of the Morrow clastics to the top of the Barnett shale.

(5) That the aforesaid interval from the top of the Morrow clastics to the top of the Barnett shale within the geological structure underlying the lands described in Finding No. (3) above is a gas reservoir, having been designated by the Commission as the Duffield-Pennsylvanian Gas Pool comprising the SW/4 of Section 21, Township 16 South, Range 27 East, NMPM, by Commission Order No. R-928, dated December 13, 1956.

(6) That said Duffield-Pennsylvanian Gas Pool was discovered by the Continental Oil Company Gertrude M. Duffield Well No. 1 located in the NE/4 SW/4 of the aforesaid Section 21. Said well was completed in the Morrow formation within the interval described in Finding No. (4) above through perforations from 8616 feet to 8647 feet and from 8690 feet to 8715 feet on April 17, 1952.

(7) That although several other wells were drilled to the Pennsylvanian formation in the near vicinity to the aforesaid well, none was successful, and said Duffield-Pennsylvanian Gas Pool remained a one-well pool until its abandonment in December, 1967.

(8) That the original volume of gas in place in the aforesaid Duffield-Pennsylvanian is estimated to have been 5.245 billion cubic feet, with an original reservoir pressure of 3630 psia.

(9) That prior to its abandonment, the aforesaid Gertrude M. Duffield well produced 4.480 billion cubic feet of gas, or 85.4 percent of the original gas in place, and the reservoir pressure had declined to approximately 543 psia.

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Case No. 5778
Order No. R-

(10) That the remaining gas in the reservoir, some 0.765 billion cubic feet at approximately 543 ^{PSia} ~~pounds pressure~~, does not constitute economically recoverable gas reserves at the subject reservoir's depth.

(11) That during its final 11 months of production prior to its abandonment in December, 1967, the Gertrude M. Duffield Well No. 1 averaged approximately 18 MCF per day of production.

(12) That the Duffield-Pennsylvanian Gas Pool is substantially depleted of recoverable native gas in place.

(13) That although the areal extent of the permeability and porosity of the Duffield-Pennsylvanian Gas Pool as presently known is somewhat less than the entire area described in Finding No. (3) above, all of said lands should be included in the Duffield Gas Storage Project in order to protect the structure from drainage by non-project wells, in the event the areal extent of the structure is larger than presently known.

(14) That the applicant has attempted to acquire gas storage rights in the interval from the top of the Morrow clastics to the top of the Barnett shale underlying the SW/4 Section 15, S/2 Section 16, SE/4 Section 17, E/2 Section 20, All Section 21, W/2 Section 22, NW/4 Section 27, N/2 Section 28, and NE/4 Section 29, all in Township 16 South, Range 27 East, NMPM, Eddy County, New Mexico, and has indeed acquired such rights underlying 37.5 percent of said lands, and is in the process of acquiring such rights under the remaining lands.

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(15) That pursuant to Section 65-9-5 NMSA 1953 Comp., this case was called to consider the propriety of utilization of the aforesaid interval underlying the above-described lands, and consequently thereto, the Commission finds:

- A. That the above-described sub-surface interval underlying the above described lands is suitable for the underground storage of natural gas and should be designated as the Duffield Gas Storage Project.
- B. That the Duffield Gas Storage Project is incapable of producing oil in paying quantities through any known recovery method.
- C. That the Duffield Gas Storage Project does not underlie any known commercial deposits of potash.
- D. That storage of natural gas in the Duffield Gas Storage Project will not cause injury to surface or underground water resources.
- E. That the underground strata constituting the Duffield Gas Storage Project formerly contained native gas capable of production in paying quantities, but ^{now} ~~are~~ substantially depleted of recoverable native gas, and such strata have a greater value as a gas storage reservoir than for the production of the remaining volumes of native gas therein.

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F. That the horizontal extent of the displaced or injected gas in the above-described sub-surface interval will be within the outer boundaries of the above-described lands.

G. That no portion of the above-described sub-surface interval underlying the above-described lands has been appropriated or is being utilized for the injection, storage and withdrawal of natural gas by any other ^{party} ~~than the applicant;~~
~~Gas Company of New Mexico.~~

(16) That jurisdiction of this cause is retained for the entry of such further ~~lands~~ findings as may be necessary.

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

Bill Parks Dallas
So Union Supply

Sept 76 26-76

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