#1666

COMMERCIAL RESOURCES
(505)-827-5724

SURFACE RESOURCES
(505)-827-5793

MINERAL RESOURCES
(505)-827-5744

ROYALTY
(505)-827-5772

State of New Mexico
Commissioner of Public Lands
Ray Powell, M.S., D.V.M.
310 Old Santa Fe Trail, P. O. Box 1148
Santa Fe, New Mexico 87504-1148
Phone (505)-827-5760, Fax (505)-827-5766

PUBLIC AFFAIRS
(505)-827-5765

ADMINISTRATIVE MGMT.
(505)-827-5700

LEGAL
(505)-827-5713

PLANNING
(505)-827-5752

September 10, 1998

Central Resources, Inc.
P.O. Box 2810
Farmington, New Mexico 87499-2810

Attn: Ms. Victoria K. Parise

Re: 1998 Plan of Development
Central Bisti Lower Gallup Sand Unit
San Juan County, New Mexico

Dear Ms. Parise:

The Commissioner of Public Lands has, of this date, approved the above-captioned Plan of Development. Our approval is subject to like approval by all other appropriate agencies.

The possibility of drainage by wells outside of the unit area and the need for further development of the unit may exist. You may be contacted at a later date regarding these possibilities.

If you have any questions or if we may be of further help, please contact Pete Martinez at (505) 827-5791.

Very truly yours,

RAY POWELL, M.S., D.V.M.
COMMISSIONER OF PUBLIC LANDS

BY:
JAMI BAILEY, Director
Oil, Gas and Minerals Division
(505) 827-5744

RP/JB/cpm
pc: Reader File **OCD** BLM

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Santa Fe, New Mexico 87504-1148
Phone (505)-827-5760, Fax (505)-827-5766

PUBLIC AFFAIRS
(505)-827-5765

ADMINISTRATIVE MGMT.
(505)-827-5700

LEGAL
(505)-827-5713

PLANNING
(505)-827-5752

November 4, 1997

Central Resources, Inc.
P.O. Box 2810
Farmington, New Mexico 87499

Attn: Ms. Victoria K. Parise

Re: 1997 Plan of Development
Central Bisti Lower Gallup Sand Unit
San Juan County, New Mexico

Dear Ms. Parise:

The Commissioner of Public Lands has, of this date, approved the above-captioned Plan of Development. Our approval is subject to like approval by all other appropriate agencies.

The possibility of drainage by wells outside of the unit area and the need for further development of the unit may exist. You may be contacted at a later date regarding these possibilities.

If you have any questions or if we may be of further help, please contact Pete Martinez at (505) 827-5791.

Very truly yours,

RAY POWELL, M.S., D.V.M.
COMMISSIONER OF PUBLIC LANDS

BY:
JAMI BAILEY, Director
Oil, Gas and Minerals Division
(505) 827-5744

RP/JB/cpm
xc: Reader File OCD BLM

1652

State of New Mexico
Commissioner of Public Lands

RAY POWELL, M.S., D.V.M.
COMMISSIONER

310 OLD SANTA FE TRAIL P.O. BOX 1148
SANTA FE, NEW MEXICO 87504-1148

(505) 827-5760
FAX (505) 827-5766

January 15, 1998

Central Resources, Inc.
2600 Mellon Center
1775 Sherman Street
Denver, Colorado 80203

Attn: Ms. Irene Martinez

Re: Resignation/Designation of Successor Unit Operator
Central Bisti Unit
San Juan County, New Mexico

Dear Ms. Martinez:

We are in receipt of your resignation/designation of successor unit operator, wherein Giant Exploration & Production Company has resigned as unit operator of the Central Bisti Unit and designated Central Resources, Inc. as the successor unit operator.

The Commissioner of Public Lands has this date approved the resignation of Giant Exploration & Production Company and the designation of Central Resources, Inc. as the successor unit operator of this unit.

This change in operators is effective August 30, 1996. In accordance with this approval, Central Resources, Inc. is now responsible for all operations and the reporting of all production from the unit. This approval is subject to like approval by the Bureau of Land Management.

If you have any questions or if we may be of further help, please contact Pete Martinez at (505) 827-5791.

Very truly yours,

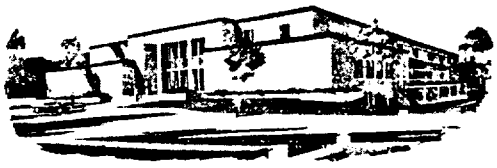
RAY POWELL, M.S., D.V.M.
COMMISSIONER OF PUBLIC LANDS

BY:
JAMI BAILEY, Director
Oil, Gas and Minerals Division
(505) 827-5744

RP/JB/cpm
xc: Reader File OCD-Roy Johnson TRD BLM Giant Exploration & Production Company

1666

State of New Mexico



Commissioner of Public Lands

W.R. HUMPHRIES
COMMISSIONER

SLO REF NO. OG-672

P.O. BOX 1148
SANTA FE, NEW MEXICO 87504-1148

February 4, 1988

Hixon Development Company
ATTENTION: Mr. Aldrich L. Kuchera
P. O. Box 2810
Farmington, New Mexico 87499

Re: 1988 Plan of Development
Central Bisti Unit
San Juan County, New Mexico

Gentlemen:

The Commissioner of Public Lands has this date approved your 1988 Plan of Development for the Central Bisti Unit Area, San Juan County, New Mexico. Such plan calls for the drilling of no wells.

Our approval is subject to like approval by the New Mexico Oil Conservation Division and the Bureau of Land Management.

Enclosed is an approved copy for your files.

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

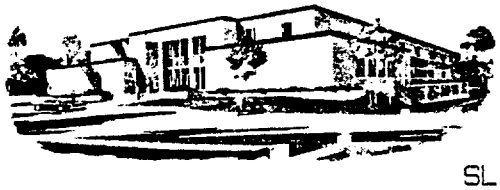
Very truly yours,

W. R. HUMPHRIES
COMMISSIONER OF PUBLIC LANDS

BY: Floyd O. Prando
FLOYD O. PRANDO, Director
Oil and Gas Division
(505) 827-5744

WRH/FOP/pm
encls.
cc: OCD-Santa Fe, New Mexico
BLM-Albuquerque, New Mexico Attn: Fluids Branch

State of New Mexico



SLO REF. NO. OG-397

W.R. HUMPHRIES
COMMISSIONER

Commissioner of Public Lands

P.O. BOX 1148
SANTA FE, NEW MEXICO 87504-1148

September 3, 1987

Hixon Development Company
Attention: Earlene J. Bickford
P. O. Box 2810
Farmington, New Mexico 87499

Re: Central Bisti Lower Gallup Unit
1987 Plan of Development
San Juan County, New Mexico

Gentlemen:

The Commissioner of Public Lands has this date approved the above captioned Plan of Development. Our approval is subject to like approval by all appropriate agencies.

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

Very truly yours,

W. R. HUMPHRIES
COMMISSIONER OF PUBLIC LANDS

BY: Floyd Prando
FLOYD O. PRANDO, Director
Oil & Gas Division
(505) 827-5744

WRH/FOP/ams
enclosure
cc:Bureau of Land Management
Oil Conservation Division

Central Bisti
Lower Gallup
Unit POD
3100 (015)

JAN 2 1986

#1666

Hixon Development Company
ATTN: Earlene J. Bickford
P.O. Box 2810
Farmington, NM 87499

Gentlemen:

One approved copy of your 1986 Plan of Development for the Central Bisti Lower Gallup Unit area, San Juan County, New Mexico is enclosed. Such plan, proposing the drilling of no new wells, the conversion of two wells to active injection status and the return of four wells to production, is approved this date subject to like approval by the appropriate officials of the State of New Mexico.

Our records show that the Central Bisti Lower Gallup Unit wells No. 87, 89 and 90, from the 1985 Plan of Development, have not been drilled. Please inform us of the status of the three wells.

If you have any questions, please contact Gail Keller at the above address or telephone (505) 766-2841.

Sincerely,

(Orig. Signed) - Sid Vogelpohl

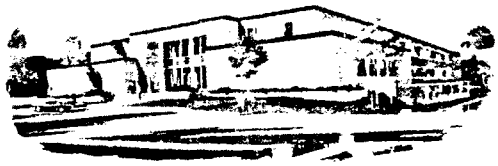
For District Manager

Enclosure(s)

cc:
NMOCD, Santa Fe
Comm. of Pub. Lands, Santa Fe
Micrographics 943B-1
Fluids Section FRAH
O&G Chron

015:GKeller:klm:12-23-85:1340M

State of New Mexico



Commissioner of Public Lands

December 4, 1985

JIM BACA
COMMISSIONER

P.O. BOX 1148
SANTA FE, NEW MEXICO 87504-1148
Express Mail Delivery Use:
310 Old Santa Fe Trail
Santa Fe, New Mexico 87501

Hixon Development Company
P. O. Box 2810
Farmington, New Mexico 87499

Re: 1986 Plan of Development
Central Bisti Unit
San Juan County, New Mexico

ATTENTION: Ms. Earlene J. Bickford

Gentlemen:

The Commissioner of Public lands has this date approved your 1986 Plan of Development for the Central Bisti Unit Area, San Juan County, New Mexico. Such plan proposes to increase your waterflood injection capacity by converting two wells to an active injection status and to return four unit wells to production. Our approval is subject to like approval by the New Mexico Oil Conservation Division and the Bureau of Land Management.

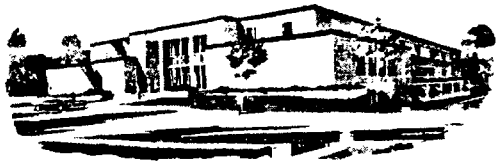
Enclosed is an approved copy for your files.

Very truly yours,

JIM BACA
COMMISSIONER OF PUBLIC LANDS
BY: Ray D Graham by JP.
RAY D. GRAHAM, Director
Oil and Gas Division
AC 505/827-5744

JB/RDG/pm
encls.
cc: OCD-Santa Fe, New Mexico
BLM-Albuquerque, New Mexico Attn: Fluids Branch
BLM-Roswell, New Mexico Attn: Mr. Armando Lopez

State of New Mexico



Commissioner of Public Lands

JIM BACA
COMMISSIONER

P.O. BOX 1148
SANTA FE, NEW MEXICO 87504-1148
Express Mail Delivery Use:
310 Old Santa Fe Trail
Santa Fe, New Mexico 87501

February 3, 1986

Hixon Development Company
P. O. Box 2810
Farmington, New Mexico 87499

Re: Amendment to 1985 Plan of Development
Central Bisti Lower Gallup Unit
San Juan County, New Mexico

ATTENTION: Ms. Earlene J. Bickford

Gentlemen:

This office is in receipt of your letter dated January 16, 1986, wherein you have notified us that your 1985 Plan of Development has been amended and at this point in time you have abandoned the drilling of the Central Bisti Unit Wells No. 87, 89 and 90.

The Commissioner of Public Lands has this date accepted your notice and has this date approved the amendment to your 1985 Plan of Development.

Very truly yours,

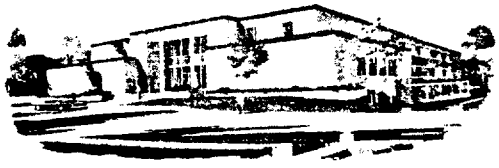
JIM BACA
COMMISSIONER OF PUBLIC LANDS

BY: Floyd O Prando
FLOYD O. PRANDO, Director
Oil and Gas Division
AC 505/827-5744

JB/FOP/pm
encls.
cc: OCD-Santa Fe, New Mexico
BLM-Albuquerque, New Mexico Attn: Fluids Branch
BLM-Roswell, New Mexico Attn: Mr. Armando Lopez

State of New Mexico

1666



Commissioner of Public Lands

JIM BACA
COMMISSIONER

P.O. BOX 1148
SANTA FE, NEW MEXICO 87504-1148

Express Mail Delivery Only:
310 Old Santa Fe Trail
Santa Fe, New Mexico 87501

March 12, 1985

Hixon Development Company
P. O. Box 2810
Farmington, New Mexico 87499

Re: 1985 Plan of Development and Operation
Central Bisti Lower Gallup Unit
San Juan County, New Mexico

ATTENTION: Ms. Cindy A. Barnes

Gentlemen:

The Commissioner of Public Lands has this date approved your 1985 Plan of Development for the Central Bisti Lower Gallup Sand Unit Area, San Juan County, New Mexico. Such plan proposes to drill the Central Bisti Unit Infill Well Nos. 87, 89 and 90, water source well No. 4, convert six wells to active injectors and return 5 CBU wells to production. Our approval is subject to like approval by the New Mexico Oil Conservation Division and the Bureau of Land Management.

Enclosed is an approved copy for your files.

Very truly yours,

JIM BACA
COMMISSIONER OF PUBLIC LANDS

BY: Ray D. Graham
RAY D. GRAHAM, Director
Oil and Gas Division
AC 505/827-5744

JB/RDG/pm
encls.
cc: OCD-Santa Fe, New Mexico
BLM-Albuquerque, New Mexico Attn: Fluids Branch
BLM-Roswell, New Mexico

#16666

GIANT

GIANT EXPLORATION AND PRODUCTION COMPANY

RECEIVED
BLM

91 APR -8 PM 2:55

019 FARMINGTON, N.M.

NMOCD

April 4, 1991

Bureau of Land Management
1235 La Plata Highway
Farmington, New Mexico 87401

Subject: 1991 Plan of Development
and Operations
Central Bisti Unit
San Juan County, New Mexico

Gentlemen:

Enclosed for your review and approval are two (2) copies of our 1991 Plan of Development for the above referenced unit.

Very truly yours,

Aldrich L. Kuchera
President

EJB/das

Enclosures

APPROVED
APR 29 1991
AREA MANAGER

1991 PLAN OF DEVELOPMENT
CENTRAL BISTI LOWER GALLUP UNIT
SAN JUAN COUNTY, NEW MEXICO

GENERAL

The Central Bisti Lower Gallup Unit was formed July 1, 1959 with the purpose of enacting secondary recovery operations. Sunray DX Oil Company was elected Unit operator.

On January 15, 1971 Sunray DX (Sun Oil) and its partners transferred their Unit working interest to Weldon S. Guest and I. J. Wolfson. Guest and Wolfson succeeded Sun Oil as Unit Operator. Guest and Wolfson in turn transferred their interest in the Unit to Hixon Development Company April 1, 1971.

Hixon Development Company has operated the Central Bisti Lower Gallup Unit from April 1, 1971 through the present.

On January 1, 1990, Hixon Development Company merged with Giant Industries. Effective July 1, 1990 Hixon Development Company became Giant Exploration & Production Company.

SUMMARY OF 1990 OPERATIONS

No further development of the Central Bisti Lower Gallup Unit occurred during 1990. There was no change in geologic interpretations or well and participating area boundaries during 1990. Routine waterflood operations were carried out during this period.

CURRENT OPERATIONS

Current well status, production data and waterflood status are as follows:

Well Status

Gallup Oil Producers - 54

1 - POW	29 - POW	58 - POW	79 - POW
4 - POW	30 - POW	59 - POW	80 - POW
6 - POW	31 - POW	60 - POW	81 - POW
8 - POW	32 - POW	64 - POW	82 - POW
9 - POW	33 - POW	66 - POW	83 - POW
10 - POW	37 - POW	67 - POW	84 - POW
13 - POW	38 - POW	68 - POW	85 - POW
16 - POW	43 - POW	69 - POW	86 - POW
18 - POW	44 - POW	71 - POW	94 - POW
19 - POW	45 - POW	72 - POW	95 - POW
22 - POW	48 - POW	73 - POW	96 - POW
23 - POW	52 - POW	74 - POW	97 - POW
24 - POW	53 - POW	76 - POW	
26 - POW	55 - POW	77 - POW	

Inactive Oil Wells - 13

11 - OSI	35 - TA	46 - OSI	70 - OSI
12 - OSI	36 - OSI	51 - OSI	
25 - OSI	40 - OSI	61 - TA	
27 - OSI	42 - TA	65 - OSI	

Water Injectors (Active) - 10

WI-3 - WIW	WI-54 - WIW	WI-78 - WIW
WI-4 - WIW	WI-56 - WIW	WI-88 - WIW
WI-13 - WIW	WI-57 - WIW	
WI-14 - WIW	WI-75 - WIW	

Water Injectors (Inactive) - 5

WI-2 - WIW	WI-62 - WIW
WI-5 - WIW	WI-63 - WIW
WI-21 - WIW	

Oil, Gas Production and Water Injection

Oil and water production during 1990 averaged 6,857 BOPM and 30,128 BWPM, with a 4.39 WOR.

Gas production and water injection during this period averaged 2,598 MCFM and 30,016 BWPM.

Cumulative Oil, Water, Gas Produced and Water Injected

(Since Unitization through December 1990)

Cumulative Oil Produced - 6,350,778 bbls.

Cumulative Water Produced - 13,191,049 bbls.

Cumulative Gas Produced - 15,780,926 MCF.

Cumulative Water Injected - 30,301,131 bbls.

Waterflood Status

The Central Bisti Lower Gallup Unit Waterflood is a commercial secondary recovery project. During the past 12 years, temporarily abandoned and shut in wells have gradually been returned to pump and water injection as dictated by waterflood requirements.

During 1990 extensive maintenance work was carried out on existing injection wells to improve injectivity. One inactive injection well was reactivated during 1990.

PLAN OF DEVELOPMENT

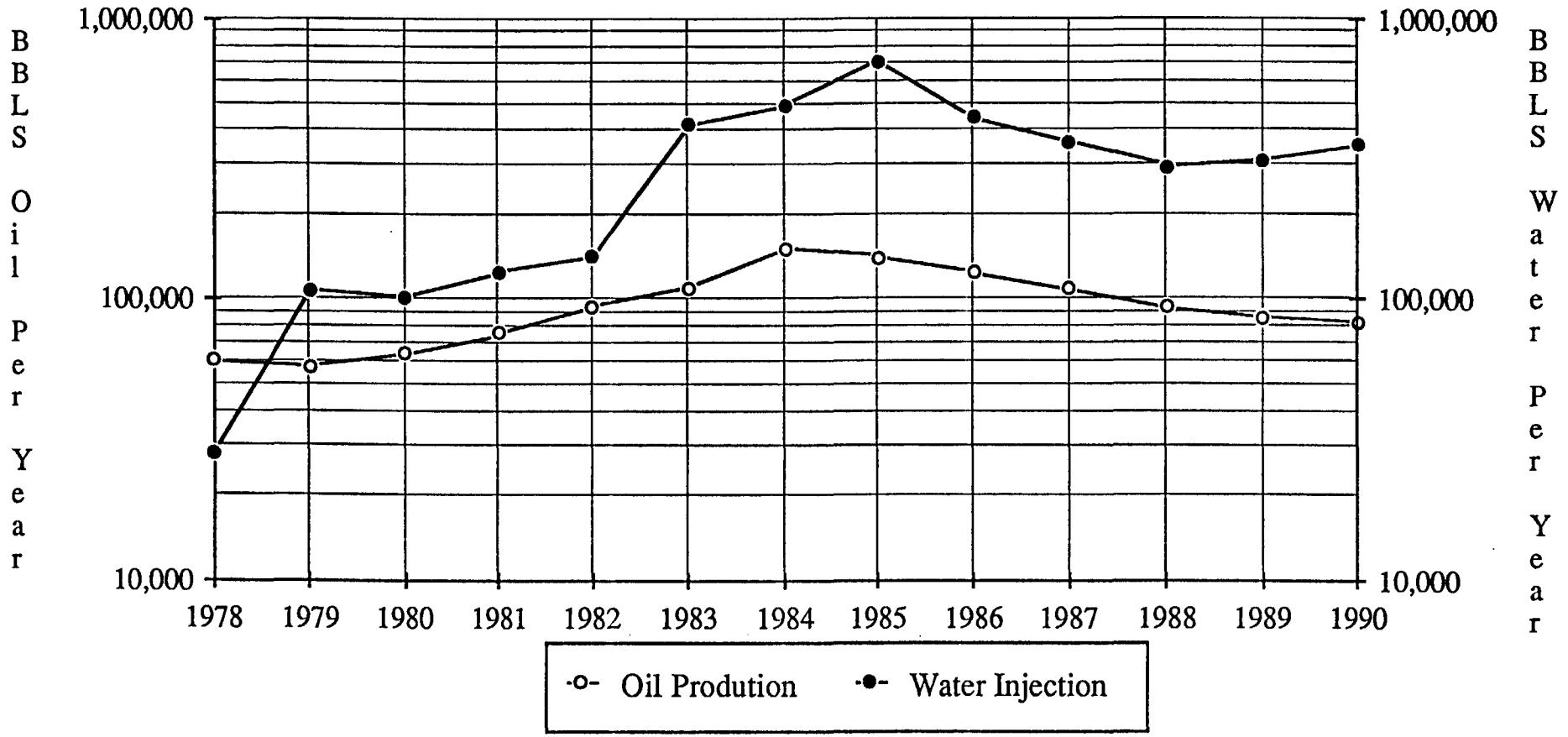
During 1991 it is planned to return five Gallup wells to pump, convert three wells to water injection, and plug and abandon one existing water injection well and one producing well. No new drilling is planned within this Unit.

Plan of Development

Approved by: _____

Title: _____ Date: _____

Central Bisti Unit Yearly Production & Injection



II. SUMMARY AND RECOMMENDATIONS

The Bisti Engineering Committee, as directed by the Operators Committee, studied the area of the Bisti Lower Gallup Oil Pool West of Shell's Carson Unit which now consists of two proposed units referred to as Western and Central. This report covers only the Central Unit which is delineated in Exhibit 2.

Net pay thickness was determined by two methods, (1) Microlog net pay and (2) Area under the SP curve corrected to core footage. The oil in place at bubble point conditions was calculated to be 38.04 million barrels from Microlog net pay acre feet and 62.23 million barrels from corrected SP net pay acre feet. The 63 producing wells had a cumulative oil production of 1,844,431 barrels as of February 1, 1959. Estimated ultimate recoveries and economics of the operating plans studied are as follows:

	Natural Depletion	LPG-Gas Miscible Phase Flood	Water Flood
Ultimate Recovery (8/8)			
Stock tank oil, bbls.	5,929,100	11,888,553	10,029,200
Gas sales, MMcf	7,238	9,058	4,070
Plant products, bbls.	740,000	367,400	278,000
LPG slug, bbls.	0	118,825	0
Value of Net (7/8) Recovery	$17,082,555	$32,166,419	$26,397,600
Investment Totals	$ 4,800,000	$ 5,612,000	$ 5,725,000
Total Expenses	$ 2,793,599	$ 9,750,719	$ 7,640,300
Salvage	$ 400,000	$ 602,450	$ 581,500
Operating Profit After Salvage	$ 9,888,956	$18,006,150	$13,613,800
Total Operating Profit/$ Inv.	$ 2.06	$ 3.21	$ 2.38
Benefit Operating Profit after Salvage	0	$ 8,117,194	$ 3,724,845
Total Benefit Profit /$ Inv.	0	$10.00	$ 4.02

It is recommended that the area delineated in Exhibit 2 be unitized and operated as an LPG-gas miscible displacement pressure maintenance project as described in the Engineering Committee report entitled "Plan of Operation" dated April 6, 1959.

IV. GENERAL FIELD INFORMATION

A. Location of Field and Unit

The Bisti Lower Gallup Oil Pool is located 20 miles south of Farmington, New Mexico in San Juan County. The 25,000 acre pool has a northwest to southeast trend that is approximately 30 miles long with a width variation from one-half to three miles.

The Operators west of Shell's Carson Unit have made joint engineering studies of all of the area shown by Exhibit 1, and are currently pursuing unitization. The area studied has been divided into two separate units also depicted on Exhibit 1. British American has been elected Operator of the proposed Western Unit. Sunray Mid-Continent has been elected Operator of the proposed Central Unit.

This report concerns only the Central Bisti Lower Gallup Sand Unit which is outlined in detail by Exhibit 2. This exhibit shows participating area and unit area for affected tracts with operator and royalty ownership. The participating area is that portion of the reservoir which has been proven productive, whereas the land between the participating area boundary and the unit boundary has not been proven. The unit boundary is extended for protection of the participating area from drainage of secondary recoverable oil and/or injected substances.

B. Geology

The Lower Gallup sandstone of the Mesa Verde group is of Upper Cretaceous age. The Bisti Lower Gallup reservoir is found at a depth of approximately 4,900 feet and has an average gross thickness of 130 feet of alternating

layers of sandstone, sandy shale, and shale, with only 10 to 20 percent having a permeability greater than one millidarcy. The low permeability sands have required heavy fracturing to stimulate production.

Exhibit 3 is a typical log illustrating the six sand stringers which compose the Lower Gallup reservoir. For the purpose of engineering work, the stringers were classified into three separate zones as shown in this exhibit. The upper stringer (Zone 1) is the principal oil horizon; it is a light gray, medium-grained, clean, well sorted sandstone. The lower four stringers (Zone 3) are silty, fine-grained sandstones with irregular dark gray, micaceous shale inclusions and partings. Zone 2 is similar to Zone 3 but generally is a better quality sandstone.

The best developed productive sands follow the axis of the long narrow sand bar which has a northwest to southeast trend. The trap which dips 70 feet per mile northwest, is of stratigraphic nature.

C. Development History

The Bisti Lower Gallup reservoir was discovered in December, 1955 when El Paso Natural Gas Company recompleted their Kelly State No. 1 in the reservoir for 646 barrels of oil per day. Drilling on adjoining leases began in February, 1956 and the majority of the Central Bisti wells were completed that year. Initial potentials of the oil wells have usually ranged from 100 to 700 barrels per day. Since all apparent good sand development in the Central Bisti Unit has been drilled, future drilling will probably be confined to a few infield locations for development of a secondary recovery drainage pattern. The number of wells completed in the participating area, cumulative oil produced, and current oil produced, are shown in Exhibit 4.

D. Well Completion Practices

The common method of well completion in the unit area has been to set 8-5/8 inch surface casing to a depth of 230 feet and circulate cement to the surface. When the Lower Gallup reservoir is drilled, an electric log and Microlog survey are conducted. The oil string of 5-1/2 inch casing is run to total depth and cemented from the casing shoe to 500 feet above the top of the pay zone. The pay zone is then perforated, sand oil fraced, and put on production.

E. Production History

Exhibit 5 shows the pertinent oil production history for the Central Bisti Lower Gallup Sand Unit. Limited local market and lack of pipe line outlet restricted production until May, 1958 when pipe line connections were completed. Several wells are now establishing a normal production decline. Delivery facilities for gas should become available in 1959.

F. Reservoir Fluid Characteristics

Samples of reservoir fluids have been analyzed from British American Marye Well No. 1 and Sunray Mid-Continent Federal C Well No. 21. The similarity of fluid properties from both samples is shown in Exhibit 6. The saturation pressure of the samples had a difference of 105 psi, i.e., Federal C No. 21 - 1,260 psia, and Marye No. 1 - 1,155 psia.

The average bubble point properties used in reservoir studies are:

Bubble point pressure at 145° F, psia	1,207
Solution gas content, cu. ft./bbl.	406
Formation volume factor, res. bbls/STB	1.26
Viscosity - centipoises	0.83

G. Reservoir Rock Characteristics

1. Core Analysis

The Engineering Committee studied all of the cored wells west of Shell's Carson Unit, completed in the Lower Gallup reservoir. Data from these wells were employed in the determination of pertinent reservoir rock characteristics. Core data in a few wells were excluded from the study because the analyses did not represent pay zones, the well cored was dry, or the well was far removed from other development. None of the wells were cored with oil base mud, consequently, capillary pressure analyses were conducted for studies of water saturation.

Since the wells cored were dispersed throughout the field and not concentrated in any one particular area, it was assumed that the data represented average properties for the entire unitized area.

2. Connate Water Saturation

The water saturations used in calculating oil in place were determined by plotting values of irreducible water saturations from capillary pressure analyses versus fluid permeability on semi-log paper. The data were fitted to a straight line using the method of least squares. The mathematical model used for this fit was:

$$Y = be^{mx}$$

Where Y = permeability, K in md
x = irreducible water saturations, S_w
b = constant
m = slope
e = 2.718

Rewritten in terms of the variables used, the equation becomes:

$$K = be^{(mS_w)}$$

A plot of these variables (K and S_w) and the results of the least squares fit are shown in Exhibit 7.

3. Porosity and Permeability

The Engineering Committee did not determine porosity and permeability. However, early in 1957 Sunray Mid-Continent engineers made statistical studies of the Bisti Lower Gallup rock characteristics. Core analyses from 20 wells west of the Carson Unit showed that 97.35 percent of the total permeability capacity was in reservoir rocks with permeabilities greater than 1.1 md. From histograms using all samples with permeabilities between 1.1 and 432 md. the average Lower Gallup rock properties were found to be 9.05 md. permeability and 14.43 percent porosity, with a water saturation of 24.5% from capillary pressure data or 28.6% from electric log studies. Exhibit 8 is frequency distribution diagrams of permeability. In this study, Zone 1 and 2 were not separated, but Zone 3 is the same as considered by the Committee.

4. Hydrocarbon Pore Volume

Having established the relationship between permeability and connate water saturations by the least squares method, core samples were selected by correlation to agree with the Microlog and SP intervals in each of the wells. The average value for $\phi (1-S_w)$ in each zone was calculated by substituting values of K in the least squares equation, solving for S_w and evaluating $\phi (1-S_w)$ for each foot of sample. The summations of $\phi (1-S_w)$ divided by the number of feet represented in that zone for the Microlog and SP intervals, gave the average values in each well. The summation of $\phi (1-S_w)$ in each zone for all wells divided by the total number of feet represented in that zone, gave average values for the field. The results of these calculations are shown in Exhibit 9.

V. STOCK TANK OIL IN PLACE AT BUBBLE POINT

A. Sand Thickness and Acre Feet Determinations

Two criteria were used to calculate the acre feet of pay. One included only the thickness of the net pay zones shown by Microlog separation, while the other, using the electric log, included the feet of pay calculated by determining the area under the SP curves in millivolt feet divided by the static SP in millivolts. The SP acre feet were corrected by a factor derived from core analyses. A tabulation showing net thickness is presented as Exhibit 10.

The procedure used is as follows:

1. Microlog Net Pay

All positive Microlog separation was counted to the nearest half-foot, provided the separation was located opposite zones indicated by the SP curve to be porous. No isolated interval was counted unless it was more than one foot thick. Thin shale laminations were deducted from the net footage if they were indicated by the Microlog to be one-half foot, or more, in thickness.

The count was obtained from the 5-inch to 100-foot recording of the Microlog instead of the 25-inch to 100-foot recording, since only a small percentage of the logs included the expanded scale.

2. SP Area

An SP shale base line through Zones 1, 2, and 3 was marked on the logs to be planimetered. Since an SP drift was noted on most of the logs analyzed, the base line was obtained by connecting the SP minimum opposite two

characteristic shales, located within the first 100 feet above the top of Zone 1. On many logs, this produced a slanting base line which compensated for the drift of the SP curve.

A consistent shale base line could not be selected below the productive zones, since most of these sections contain varying amounts of sand. As a result, the SP curve does not return to the base line.

The SP curve through the cored intervals was planimetered separately for the purpose of establishing a means of adjusting the net SP footage in the cored interval to the equivalent core footage.

3. Static SP - (SSP)

The SSP was obtained from the nearest water-bearing sandstone approximately 1,000 feet above the Lower Gallup. This sand occurs at 3,600 feet in Sunray Mid-Continent's Federal C-14 well. This was considered more reliable than a theoretical SSP calculated from the mud data. A new shale base line was picked in the vicinity of the zone selected for the SSP value.

B. Acre Feet Determinations

Two isopachous maps were prepared by the Engineering Committee for each of the three zones, one representing the Microlog pay and the other representing the SP pay. These six isopachous maps are shown in Exhibits 11 and 12, inclusive. Acre feet for each lease was determined from the isopachous maps by reading the average sand thickness within each ten acre grid, and then summing the product of thickness times grid acres within a lease.

In the evaluation of SP acre feet, it was necessary to apply a correction factor so as to adjust values of SP feet to the corresponding values from the core data. This was done by dividing net pay from core data in

each zone by feet of pay from electric logs (SP feet). For net pay from cored data, all samples above one md. were counted as one foot, and those with less than one md. were given a fraction of a foot equal to its permeability. This calculation is shown on the last page of Exhibit 10, entitled "Electric Log Analysis and Net Pay Determination." The results of these calculations are as follows:

	Correction Factor Core Footage/SP Log Footage
Zone 1	1.0203
Zone 2	0.6204
Zone 3	0.4634

C. Oil in Place at Bubble Point

The oil in place was calculated by the volumetric method.

$$\text{Oil in place in STB} = \frac{7758\ \phi\ (1-S_w)}{B_o}\ \text{x acre feet}$$

Where ϕ = porosity
S_w = connate water saturation
B_o = formation volume factor at bubble point (1.26)

From the values of $\phi\ (1-S_w)$ determined for each zone in both Microlog and SP intervals, the following values of stock tank oil in place per acre foot were calculated:

	ML	SP
Zone 1	748.6	652.0
Zone 2	482.3	397.1
Zone 3	432.7	407.0

The results of the isopachous picks of corrected acre feet and the oil in place calculations are found in Exhibit 13.

The differences in values for oil in place using Microlog and SP is attributed to the fact that the SP curve will show sands of lower permeability than does the Microlog.

VI. PREDICTED PRIMARY RECOVERY FROM CENTRAL BISTI UNIT (PLAN I)

The primary recovery mechanisms causing fluid flow in the Unit Area are fluid expansion and solution gas drive.

A. Fluid Expansion

Oil recovery by fluid expansion occurred from the time the Kelly State 1 was completed until the reservoir pressure reached bubble point pressure of 1207 psi. Oil recoveries as estimated from fluid expansion data are compared with field performance data in Exhibit 14. Difference in the comparative values may be attributed to (1) fluid migration to this area of early development from undeveloped areas, (2) inaccurate determination of average weighted original reservoir pressure, (3) an error in the average field pressures which were used to arrive at field production at the time bubble point is reached, or (4) a conservative estimate of oil in place. The original reservoir pressure would need to be 3200 psi for theoretical data to check field data, and this is improbable since none of the wells exhibit an original pressure approaching this value. The field pressures are obtained from areally weighted isobaric maps. It is improbable that average pressure would measure less, for most surveys were shut in for 48 hours which is inadequate for true build-up in many wells. Also, a volumetric weighted averaged pressure would be higher because the highest pressures are in the best developed part of the reservoir. Therefore, it seems that some additional recovery was contributed by fluid migration as in (1) above.

B. Solution Gas Drive

Primary recovery by solution gas drive has been estimated by material balance calculations. Relative permeability was determined by laboratory

measurements upon 14 samples within a permeability range from 299 md. to 0.43 md. as shown in Exhibit 15. It should be noted that laboratory curves in the range of 200-299 md. are of the same order of magnitude as the average curve published by Mr. John Arps, which indicates the dirty nature of sands in Bisti. All relative permeability data were used to construct a k_g/k_o curve which represents average reservoir rock conditions for the Central Unit. The tabulation of material balance natural depletion calculations for this average k_g/k_o curve is shown on Exhibit 16. The estimated recoveries by solution gas drive are 13.66% as indicated by the material balance calculation.

Low primary recoveries are also indicated by production data in the Central Unit. As of January 1, 1959, 32 wells in Central Bisti depict a definite production decline. The remaining 32 wells lie along the longitudinal axis in best developed sands on the structure.

For the purpose of estimating oil recoveries from decline curves, it was assumed that wells which have not established early natural decline will have an average recovery of 150,000 barrels per well or 4,800,000 barrels. The estimated recovery from the wells which have decline curves that can be extrapolated was added to the 4,800,000 barrels. This estimate gave an ultimate recovery factor of 15.5% and checks the overall estimated primary recovery by fluid expansion plus solution gas drive which was estimated to be approximately 16%.

VII. DISCUSSION OF LPG PILOT PERFORMANCE

A. Production History

Since August, 1957, an LPG-miscible displacement pilot flood has been operated by Sunray Mid-Continent in Zone 1 of the Bisti Lower Gallup Field. This project area is shown in Exhibit 1. Through January, 1959, the production from the pilot producing wells during the LPG flood displacement was 262,407 barrels of stock tank oil.

In August and September, 1957, 15,800 barrels of butane and 15,215 barrels of propane, or a total of 31,015 barrels were injected into Zone 1 of the Lower Gallup Sand to form the LPG zone of miscibility. Gas injection was started immediately after the completion of the LPG injection.

Calculations were made to determine if the total volume of gas injected was greater than the total volume of withdrawals from the pilot project area. The results of these calculations are presented in graphical form in Exhibit 17. These calculations consider reservoir pressure wherein volumetric balance of the net withdrawals and injections give total net volume changes. Volume determinations are presented in tabular form in Exhibit 17C.

The following relationship was used in establishing the net reservoir injection volume:

$$V_I - V_{FPG} - N_{pB} \pm E_g \mp C_o \mp Sh_{oil} = \text{Net reservoir injection vol.}$$

Where:

V_I = is the reservoir volume of gas injected

V_{FPG} = is the reservoir volume of free gas produced

N_{pB} = is the reservoir volume of oil produced

E_g = is the volume of gas expansion

C_o = is the volume of oil compression

Sh_{oil} = is the volume of oil shrinkage

$V_I = B_g \times V_i$

Where: B_g - is the injected gas formation volume factor (res. bbls./SCF)

V_i - is the volume of injected gas (SCF)

$V_{FPG} = N_p (R-R_s) B_g$

Where: N_p - volume of stock tank oil produced

R - is the producing gas-oil ratio (SCF/STB)

R_s - is the solution gas-oil ratio (SCF/STB)

$E_g = V_{g(1)} (B_{g2}/B_{g1}) - V_{g(1)}$

Where: $V_{g(1)}$ - is the cumulative free gas volume in the reservoir, (total reservoir volume of gas inj. - free gas prod.), previous month (res. bbl.)

Expansion Ratio - is equal to $\frac{B_{g(2)}}{B_{g(1)}}$

Where: Subscript (1) - is previous month

Subscript (2) - is present month

$C_o = V_{o(1)} \times C (P_{R(2)} - P_{R(1)})$

Where: $V_{o(1)}$ - is the oil volume in the reservoir during previous month

C - is the compressibility factor for oil (vol/vol/psi)

$P_{R(2)}$ - is the reservoir pressure

Since the compression (or expansion) is continuous, oil volume at the end of each month was calculated as follows:

$V_{o(2)} = V_{o(1)} - C_{o(2)}$

$SH_{oil} = (NB_o)_2 - (NB_o)_2$ (SH ratio)

Where: $(NB_o)_2$ - is the oil volume in the reservoir - present month (res. bbls.)

Sh ratio - is equal to $\frac{B_{o(2)}}{B_{o(1)}}$

B_o - is the oil formation volume factor (res. bbls./STB)

B. Pilot Performance Prediction

1. Oil in Place in Pilot

The oil in place was calculated separately for an enclosed 40-acre five-spot and a 90-acre area which extends 1/4 of the distance between the producing wells in the 40-acre five-spot as shown on Exhibit 18. The 40 acres enclosed by the four pilot producers are calculated to contain 560,869 barrels of stock tank oil. The large area contains 1,180,017 barrels of stock tank oil.

The oil in place for the four 10-acre grids lettered A, B, C, and D, on Exhibit 18 was calculated using average porosity and saturations determined from the injection well and the producing well draining the area. For example, the GI #1 and the Sunray Mid-Continent Federal C #1 rock properties were average for the D grid, etc.

2. Production Performance Predictions

The total predicted production from the pilot project was calculated from the actual performance of the four wells in the pilot project. These predictions are presented in graphical form on Exhibit 19. The graphs for each well were constructed by calculating the ratio of the stock tank production in barrels, divided by the reservoir voidage in barrels. This ratio was then plotted vs. the cumulative production in stock tank barrels. These calculations which are shown on Exhibit 20 were obtained by the following method:

$$Q_R = Q_s \left[B_o + (R-R_s)\, B_g \right]$$

or,

$$\frac{Q_s}{Q_r} = \frac{1}{\left[B_o + (R-R_s)\, B_g \right]}$$

$$B_g = \frac{P_s}{P_R} \times \frac{T_R}{T_s} \times \frac{Z_R}{5.61}$$

Where: B_g = the reservoir barrels of space occupied by one SCF of gas.

P_s = the base pressure, psia

P_R = the reservoir pressure, psia

T_R = the reservoir temperature, ^oR

T_s = the standard temperature, ^oR

Z_R = the gas compressibility factor

B_o = the oil formation volume factor

R = the producing gas-oil ratio, SCF/STB

R_s = the solution gas-oil ratio, SCF/STB

Q_s = the stock tank oil production in barrels

Q_R = the reservoir voidage in barrels.

In Exhibit 21 the recovery efficiencies for the pilot project wells are listed. These recovery efficiencies were calculated with the assumption that there are three different possible flooding patterns occurring in the LPG project area. These three possible flooding patterns are: (1) that the production is from the 40-acre area enclosed by the four producing wells; (2) that 15% of the production is from the area outside of the area enclosed by the four producing wells; (3) that the LPG-miscible flood is sweeping an area greater than the area enclosed by the producing wells, i.e., that the total area sweep includes the 90 acres.

Theoretical calculations[1,2] were performed to predict the recovery from (1) the enclosed 40-acre five-spot and (2) the 90-acre area. The results of these calculations (shown graphically on Exhibit 22) indicate that the sweep efficiency from an enclosed 40-acre area should be 1.915 times greater than the 90-acre open area. These theoretical calculations provide a method of converting recoveries predicted from the $(\frac{Q_S}{Q_R})$ decline curves to a common basis as is done on Exhibit 21. Oil recoveries for each well were estimated from the Q_S/Q_R curves at first signs of gas breakthrough and at a producing gas-oil ratio of 20,000 cubic feet per barrel. These recoveries were divided by the oil in place calculated for each quadrant. The calculations were reduced to the enclosed five-spot basis under the assumption that an LPG flood would be operated on a true closed five-spot injection pattern.

C. Production of the LPG Slug from Pilot Area

A method was devised by which the amount of the LPG slug that has been produced each month from each of the four pilot area wells could be estimated.

The method consists essentially of comparing the measured concentrations of propane and butanes in the produced separator gases from the four pilot area wells with the concentrations of propane and butane that would have been found in the separator gases if no LPG slug had been used. The differences in concentrations, assumed to be due to the slug breaking through, when associated with the volume of produced separator gas, gave a measure of the

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1. Caudle, B. H., Erickson, R. A., and Slobod, R. L., "The Enchroachment of Injected Fluids Beyond the Normal Well Pattern," A.I.M.E., Petroleum Transactions, Vol. 204, 1955, p. 79.

2. Dyes, A. B., Caudle, B. H., and Erickson, R.A., "Oil Production After Breakthrough as Influenced by Mobility Ratio," A.I.M.E., Petroleum Transactions, Vol. 201, 1954, p. 81.

volume of propane and butane that had been a part of the slug. In order to give a complete accounting of volumes, the volumes of propane and butane that remained in the stock tank oil were estimated and added to the volumes in the separator to get the total. Details of the method will be shown with an example calculation.

The samples of separator gas that have been collected and analyzed periodically have been collected at various separator pressures and temperatures. Before the observed propane and butane concentrations could be compared with calculated values, it was necessary to select a "base" separator pressure and temperature and then correct the observed concentrations of propane and butane for the difference between the sampling temperature and pressure and the "base" values. The "base" values were 60° F and 30 psig. A set of correction charts were prepared from the results of a series of equilibrium flash vaporization calculations made for a range of temperatures, pressures and feeds that included the values encountered at the time the samples were taken. These charts allowed the observed concentrations of propane and butane in the monthly gas samples to be corrected to base temperature and pressure. The corrected concentrations were then plotted versus cumulative separator gas volume in Exhibits 23A, 23B, 23C, and 23D. These curves are labeled "actual." The dates shown on the exhibits are those on which the gas samples were taken.

A second set of equilibrium flash vaporization calculations was prepared that, in effect, predicted what the propane and butane concentrations would have been in the separator gas if the well effluent were composed of only injected gas and reservoir oil. In other words, this assumption approximates the case of no LPG injection. The computations were made for the base

conditions of 60° F and 30 psig. Values for the vaporization equilibrium constants for the components were taken from the NGAA Equilibrium Ratio Data Book, 10,000 psi convergence pressure. The results gave propane and butane concentrations for various gas-oil ratios. The monthly reports furnished values for the gas-oil ratio of each pilot well for each month. Using the monthly reports and the calculations, the propane and butane concentrations were plotted as in Exhibits 23A, 23B, 23C and 23D. These curves are labeled "no-slug".

Actually two sets of flash calculations were required to establish the "no-slug" curves of the exhibits because the composition of the injected gas was changed from the lean gas of the El Paso tap line to rich separator gas during April, 1958. One set utilized the composition of the lean gas and reservoir oil to simulate well effluents and the second set used average separator gas composition and reservoir oil. It was estimated that all the lean gas in the pilot area had been displaced by the rich gas by August 1, 1958. Accordingly, the propane and butane concentrations calculated for the "lean" well effluents were plotted in Exhibits 23A, 23B, 23C, and 23D for the period ending August 1, 1958 and thereafter the concentrations for the rich well effluents were plotted.

The difference between the "actual" curve and the "no-slug" curve at any given date is considered to be the evidence that a part of the LPG was being produced in the separator gas. The volume of the LPG slug produced with the separator gas during one month was obtained by integrating the area between the curves and between the limits of the initial and final dates. For some months early in 1958, the actual C_4 compositions in the separator gas from the Hospah #1 and Marye #1 did not exceed those calculated for the "no-slug" situation. No explanation is given for this.

The aforementioned flash vaporization calculations also provided data to show the relationship between the volumes of propane and butane contained in the gas and their volumes retained in the stock tank oil. In order to save time and effort, it was believed that the computations made for the "base" conditions would be a suitable substitute for the more accurate method of making the computation for the conditions of temperature, pressure and gas-oil ratio that prevailed at the time each gas sample was taken. Thus, Exhibit 24 was constructed from the "base" condition calculations and used to estimate the volume of propane and butane retained in the stock tank oil. The volume of propane and butane contained in the stock tank vapors was neglected because the flash vaporization calculations indicated that the amounts were less than two percent of the sum of the amounts in the separator gas and stock tank oil.

The results of the calculations are summarized in Exhibit 25.

The details of the procedure for constructing Exhibit 25 are demonstrated by the example that follows.

Reference is made to Exhibit 23D for the period 7-29-58 to 8-29-58.

Average gas-oil ratio during period (monthly report)	= 1645 cu. ft./bbl.
Cumulative separator gas produced	= 60.0-46.2 = 13.8 MMscf
Average propane concentration (actual)	= 10.65%
Average propane concentration (no-slug)	= 8.10%
Average butane concentration (actual)	= 5.08%
Average butane concentration (no-slug)	= 4.40%
Volume vaporous propane per barrel liquid propane	= 1530 SCF/bbl.
Volume vaporous butane per barrel liquid butane	= 1311 SCF/bbl.

Volume butane from slug in separator gas	=	$\frac{13.8 \times 10^6 (.0508-.0440)}{1311}$	=	71.5 bbls.
Volume butane from slug in stock tank oil (Exhibit 24)	=	71.5 x 0.31	=	22.3 bbls.
		Total		93.8 bbls.
Volume of propane from slug in separator gas	=	$\frac{13.8 \times 10^6 (0.1065-0.0810)}{1530}$	=	230 bbls.
Volume propane from slug in stock tank oil (Exhibit 24)	=	230 x 0.092	=	21 bbls.
		Total		251 bbls.

These results are found in Exhibit 25 for the month of August, 1958.

VIII. LPG ON FIELD BASIS (PLAN II)

A. Discussion

Sixteen five-spots or modified five-spots were studied for possibility of LPG-miscible flooding, as outlined on Exhibit 26. Of these areas studied, only eleven of the five-spots were considered economically feasible for LPG-miscible flooding.

The recoverable oil for each individual five-spot and an example calculation are included in Exhibit 27. These calculations show that the best areas for miscible flooding are the wells located on the fairway of the sand bar which comprises the field. Only the upper sand was considered in the calculations.

The oil in place was calculated by the standard volumetric method for each five-spot. The porosity and water saturation $[(1-S_w)\ \phi]$ used was the Zone 1 average.

The recovery factors were determined by comparison of each of the individual five-spot kh values to the kh values of the wells in the pilot project. The reduction of recovery with permeability was also indicated by laboratory experiments where various pore volumes of LPG were injected at 2000 psi into oil saturated cores and displaced with gas at 2000 psi. The volume of LPG injected was as follows:

Pore Volumes of LPG Injected in Laboratory Displacement Tests Shown in Exhibit 10

Run No.	Core L 284	Core L 285
1	1.765	1.846
2	.823	.974
3	.484	.414
4	.314	.193
5	Dry Gas	Dry Gas

B. Example Calculation LPG Flood

Phillips I-Tah-Nip #2, 9-25-12, Injection Well

Oil in place (res. bbls.) = $7758 \times \phi (1-S_w)$ AF
= 7758 (.145)(.755)(1730) = 1,470,179 RB

Stock tank oil in place = 1470,179/1.26 = 1,166,809 STB

Recovery by LPG flooding = 1,166,809 (recovery factor)
= (1,166,809)(.30) = 350,048 STB

Blow down recovery

Note: Assume that 10,000 cubic feet of gas is produced from the swept area for each barrel of oil produced.

$$350{,}048 \times 1.26 \times \frac{1400}{14.7} \times \frac{520}{605} \times \frac{5.61}{.835} / 10{,}000 = 24{,}398 \text{ STB}$$

Total recovery = 350,048 + 24,398 = 374,446 STB

LPG flood - gas volume calculations

(1) Voidage replacement of 350,048 bbls. = V_{s_c}

$$V_{s_c} = (350{,}048)(B_o)\frac{1}{B_g}$$

$$V_{s_c} = 350{,}048 \times 1.26 \left[\frac{1400}{14.7} \times \frac{520}{605} \times \frac{5.61}{.835}\right]$$

$$= 244 \times 10^6 \text{ SCF}$$

(2) Oil compression and gas resaturation

$$\text{Free gas space at } 800\# = \frac{(HCPV)(1-S_L)}{(1-S_w)}$$

$$\text{Reservoir bbls. of oil at } 800\# = HCPV - HCPV\left(\frac{1-S_L}{1-S_w}\right)$$

$$= 1470{,}179 \left[1 - \frac{(1-.908)}{(1-.245)}\right] = 1{,}291{,}180$$

$$\text{Reservoir bbls. of oil at } 1300\# = (1291{,}180)\left(\frac{1.26}{1.2257}\right)$$

$$= 1{,}330{,}800$$

Reservoir bbls. of gas needed to swell oil from 800# to 1300# =

1,330,800 - 1,291,180 = 36,300

Reservoir bbls. space occupied by injected gas = 1,470,180 -

1,330,800 = 139,374

Reservoir bbls, space vacated due to compression and

resaturation = 139,374 - 36,300 = 103,074

MMcf of gas to fill space = 103,074 x B_g = 103,074 RB x

553 SCF/RB = 57

(3) Total gas production handled throughout LPG flood displacement period.

From pilot project = 2.5 bbls. res. void/bbl. STO

Bbls. of res. void. space = 2.5 $\frac{\text{bbls. res. void.}}{\text{STB}}$ -

1.26 $\frac{\text{res. bbls.}}{\text{STB}}$ = 1.24 RB/STB (free gas prod.)

V_{sc} = 1.24 x 5.61 x 1/B_g = 1.24 x 5.61 x 98.6

V_{sc} = 686 CF of free gas/STB

V_{sc} = 407 CF of sol. gas/STB

V_{sc} = 1093 CF of gas/STB

Ultimate gas handled = (1093)(350,048) = 383 x 10^6 SCF

(4) Fuel requirement at 5% of total gas handled

V_{sc} = 383 x 10^6 (.05) = 19.2 x 10^6 SCF

(5) LPG requirement and gas equivalent

Required LPG = $\frac{31,015 \text{ Bbls.}}{706,695 \text{ HCPV}}$ x 1,470,179 HCPV = 64,700 Bbls.

Gas equivalent = $\frac{64,600 \text{ bbls.}}{B_g}$ x B_o = 64,700 x 1.16 x

553 SCF/RB = 41.5 x 10^6 SCF

(6) LPG recovery = 80% recovery x 35% lease share =

(64,700)(.80)(.35) = 18,100 bbls.

(7) Total gas in reservoir and sales volume

	MMcf
Oil and sol. gas voidage	244.0
Oil compression and gas resaturation	57.0
Free gas at start of blow down	301.0
Sol. gas remaining in unswept area (816,761)(407)	332.0
Total gas in reservoir at start BD	633.0
Less residual gas after BD	156.5
Total gas recovered	476.5
Shrinkage, fuel, and losses at 40%	190.6
Total gas sales	285.9

(8) Total plant products = 143 bbls./MMcf x .35 lease share

= 143 x 135 x 476.5 = 18,100 bbls.

(9) Gas purchase

	MMcf
Oil and solution gas voidage	244.0
Oil compression and gas resaturation	57.0
Fuel requirements	19.2
	320.2
Less sol. gas prod. (rec. x 407)	142.5
Gas purchases (cycling thru plant)	177.7

IX. WATER FLOOD ON FIELD BASIS (PLAN III)

A. Discussion

Sixteen individual five-spots or modified five-spots were studied for the possibility of water flooding. These five-spot areas are shown on Exhibit 26. Of these areas studied, only nine of the five-spot areas were considered economically feasible for water flooding.

The recovery obtained from water flood susceptibility data is shown in Exhibit 28. A field average was used for porosity and water saturation, and oil in place was calculated by the volumetric method.

Recoverable oil calculations of each of the individual five-spots are shown in Exhibit 27. The method of calculation is shown for one five-spot by the following example:

B. Water Flood Calculations (Examples)

Phillips, I-Tah-Nip #2, 9-25-12, Injection well

Recovery factor - $\frac{S_i - S_r}{S_i}$ (CF)

Where S_i = initial oil saturation

S_r = residual oil saturation

CF = conformance factor (estimated 60%)

$$RF = \frac{0.67-0.344}{.67} (.60) = 29.2\%$$

Oil in place = $7758 \phi (1-S_w) (\frac{1}{B_o})$ (acre-feet)

Where ϕ = porosity = 14.5%

S_w = water saturation 24.5%

B_o = formation volume factor

= $7758 (.145)(.755)(\frac{1}{1.26})(1730)$

= 1,166,809 STB

Recoverable oil = 1,166,809 (.292) = 340,708 STB

Saleable Gas

Oil recovery will be carried out at a constant pressure.

Gas sales = gas recovered less fuel, losses and shrinkage.

$$V_s = n \times R_s - F$$

Where n = recoverable oil, bbls.

R_s = solution gas-oil ratio at 800#

F = shrinkage, fuel and other losses at 40% total gas produced

V_s = 340,708 x 308 - 42,000,000 = 62.9 MMcf

Plant products - 143 bbls./MMcf at 35% to lease hold

(104.9) (143) (.35) = 5,250 bbls.

Life of five-spot based on Unit Area average properties

(Note: The I-Tah-Nip is below average and five-spot life is not representative)

Average injection rate for area:

Set water injection rates equal to oil withdrawal rates

$$Q = \frac{3.07\ K_w\ h\ \Delta P}{\mu_w \log_{10} r_e/r_w} = \frac{3.07\ K_o h\ \Delta P}{\mu_o \log_{10} r_e/r_w}$$

μ_w = 0.5 P_{I_w} = 2400 psi r_e = 742 P_w = prod. well press.

μ_o = 0.8 $K_a h$ = 770 r_w = 0.23 P_e = reservoir press.

P_e	P_w	K_{rw}	K_{ro}	Q BOPD
1100	400	0.33	1.0	580
1625	800	0.33	1/2	346
1352	800	0.167	1/2	224

$$\frac{1,470,179 \text{ bbls. x } 1.25 \text{ PVWI}}{(1-.245)(346 \text{ bbls./day})(365 \text{ days/yr.})} = 19.3 \text{ years}$$

X. 70% PRODUCED GAS RE-INJECTED (PLAN IV)

Material balance calculations were made for a dispersed gas drive assuming that 70% of the produced gas would be re-injected. The tabulation of these calculations for 100% conformance are shown in Exhibit 29. It may be observed that the increased recovery estimate of five percent is minor, which would be further reduced after conformance corrections are made. Economic analyses of this process were not made since the method is obviously unattractive.

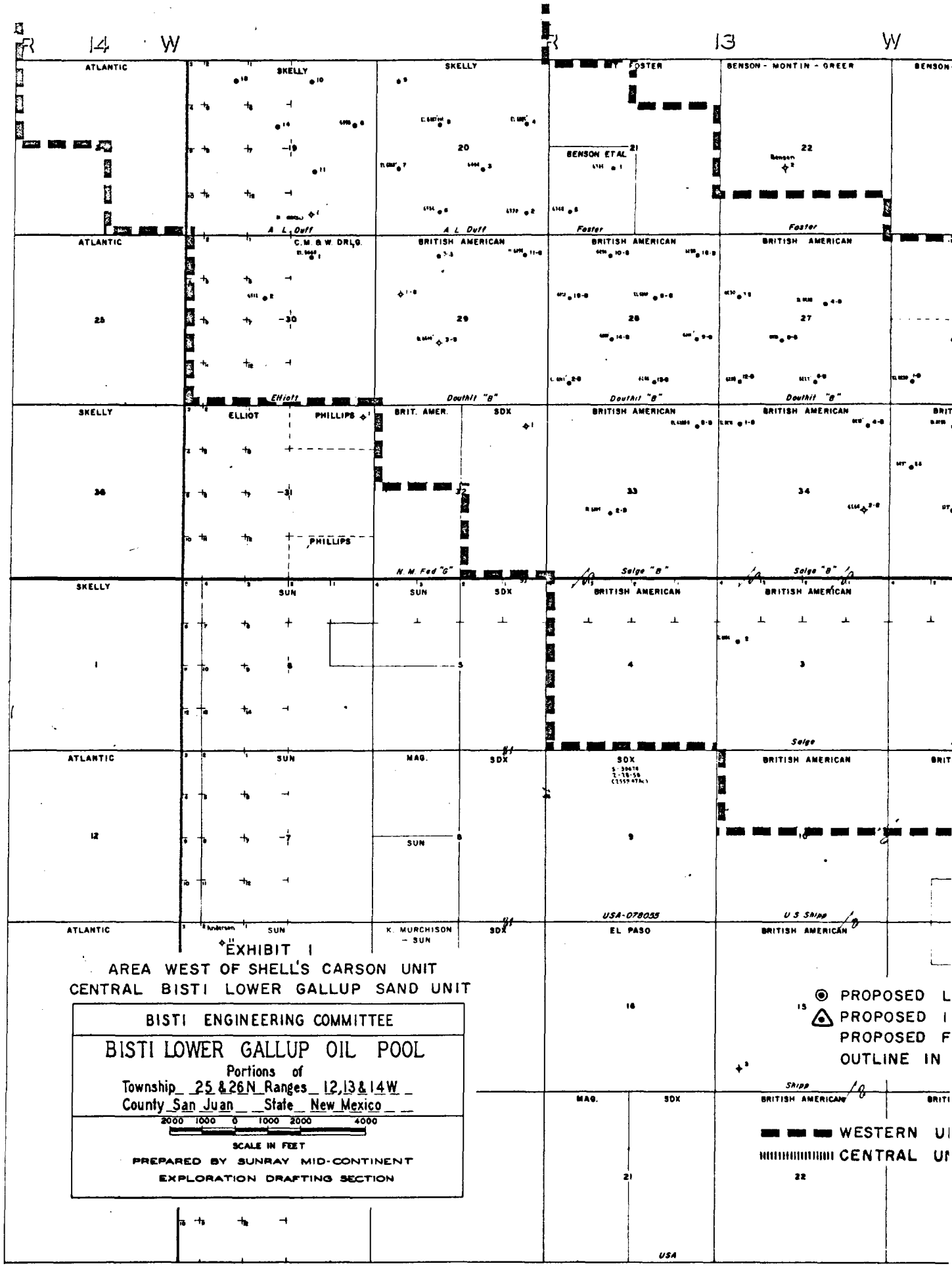
XI. PRESSURE MAINTENANCE BY GAS INJECTION (PLAN V)

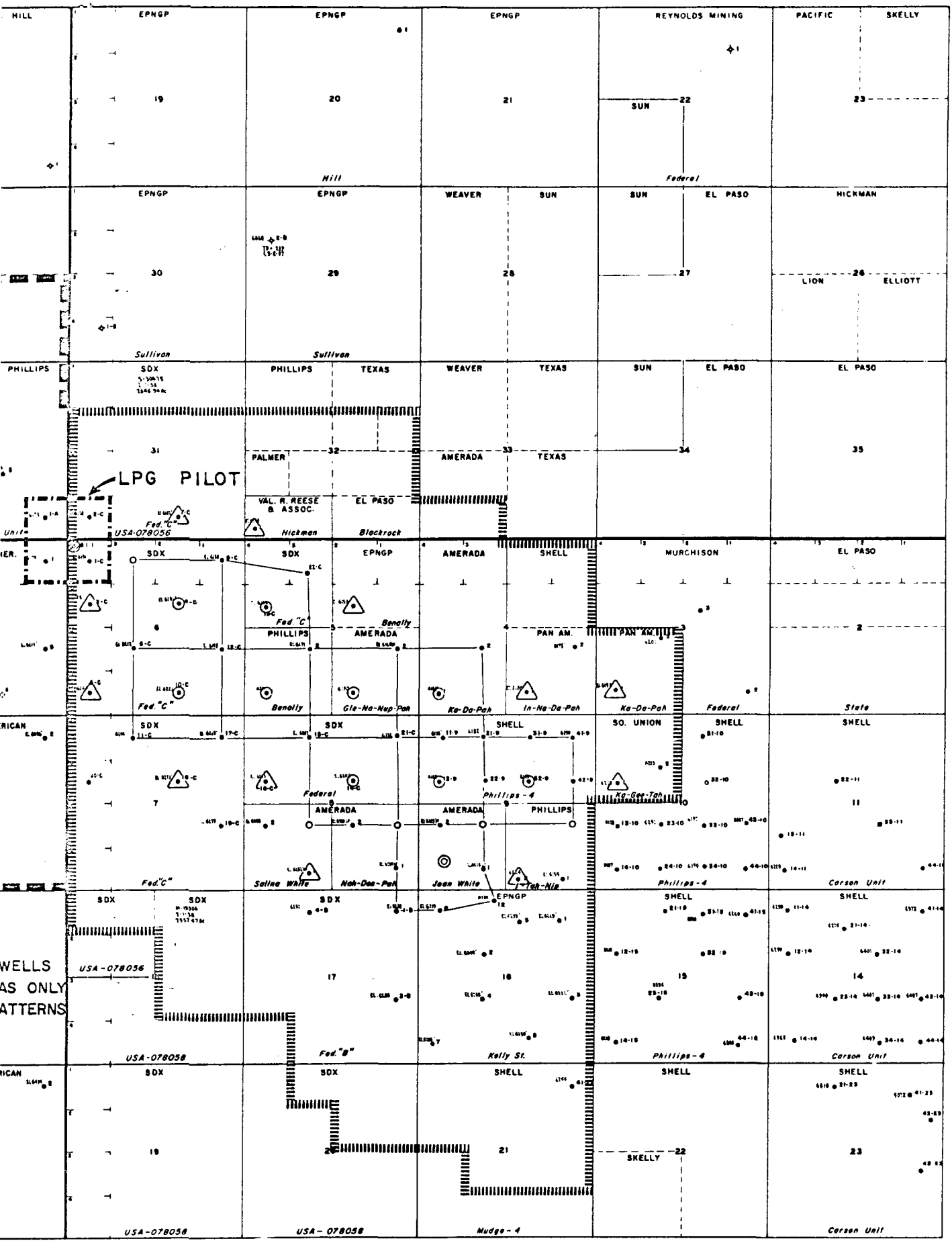
Internal sweep efficiency at a pressure maintenance by gas injection was determined by laboratory measurements of two reservoir samples, one of 4.26 md. and one of 133 md. Results of these analyses are shown by Exhibit 30. The curve applying to straight gas injecting is that which is dashed from zero pore volumes injected throughout the displacement process. Using conformance factor of 0.50, it was estimated that the recovery by gas injection into the tight edge of the Unit Area will be 22.4% of the oil in place.

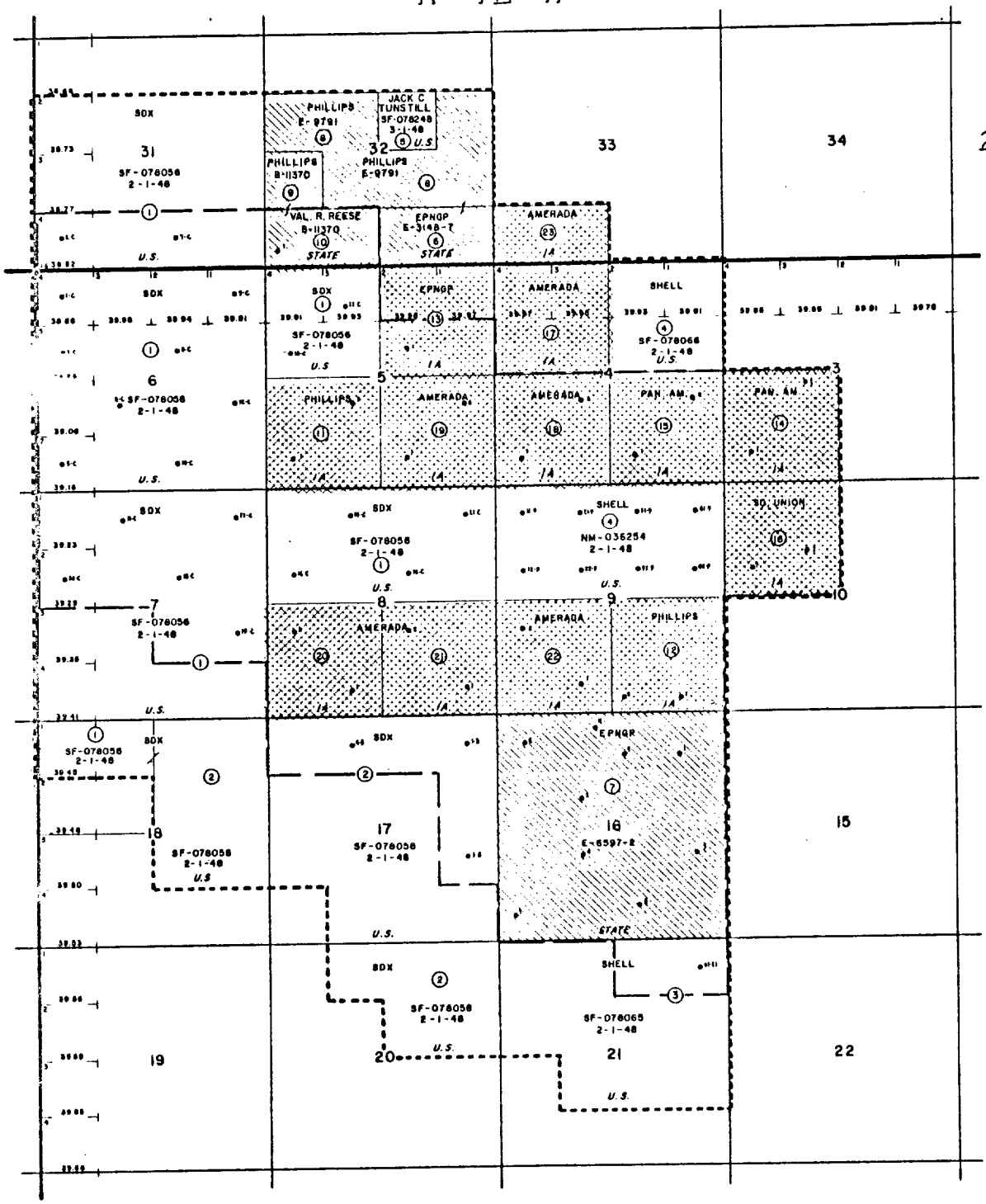
XII. ECONOMICS

Economic evaluation of the Central Bisti Unit will depend upon the plan of operation. For that reason, a separate report entitled "Plan of Operation" contains the details of economics which may require revision if changes in unit boundary or plan of operation are necessary.

Therefore, only a summary of economics is included in Exhibit 31. Recovery calculations are based on material balance, analysis of the pilot, and laboratory analyses.


R 14 W
R 13 W
T 26 N
T 25 N
ATLANTIC
SKELLY
FOSTER
BENSON - MONTIN - GREER
BENSON ETAL
A L Duff
Foster
C.M. & W. DRLG.
BRITISH AMERICAN
Elliot
Douthit "B"
ELLIOT
PHILLIPS
BRIT. AMER.
SDX
N M Fed "G"
Salge "B"
SUN
MAG.
Salge
USA-078055
U S Ship
K. MURCHISON - SUN
EL PASO
USA
EXHIBIT 1
AREA WEST OF SHELL'S CARSON UNIT
CENTRAL BISTI LOWER GALLUP SAND UNIT
BISTI ENGINEERING COMMITTEE
BISTI LOWER GALLUP OIL POOL
Portions of
Township 25 &26N Ranges 12,13&14W
County San Juan State New Mexico
2000 1000 0 1000 2000 4000
SCALE IN FEET
PREPARED BY SUNRAY MID-CONTINENT
EXPLORATION DRAFTING SECTION
PROPOSED L
PROPOSED I
PROPOSED F
OUTLINE IN
WESTERN U
CENTRAL U


R 12 W
EPNGP
REYNOLDS MINING
PACIFIC
SKELLY
SUN
Federal
Hill
WEAVER
EL PASO
HICKMAN
LION
ELLIOTT
Sullivan
PHILLIPS
SDX
TEXAS
PALMER
AMERADA
LPG PILOT
VAL. R. REESE & ASSOC.
Hickman
Blackrock
USA-078056
SHELL
MURCHISON
PAN AM.
Fed. "C"
Benally
Gle-Na-Nap-Pah
Ke-Da-Pah
In-Na-Da-Pah
State
SO. UNION
Federal
Phillips - 4
Ka-Gee-Tah
Carson Unit
Saline White
Nah-Dee-Pah
Joan White
Teh-Nie
WELLS
AS ONLY
ATTERNS
Fed. "B"
Kelly St.
Mudge - 4



LEGEND

- UNIT AREA
- PARTICIPATING AREA
- FEDERAL LAND
- STATE OF NEW MEXICO LAND
- ALLOTTED INDIAN LAND

N

EXHIBIT-2

CENTRAL BISTI LOWER GALLUP SAND UNIT

San Juan County, New Mexico

SCALE

1000 0 1000 2000 3000

FEET

COMPLETED JAN. 14, 1958

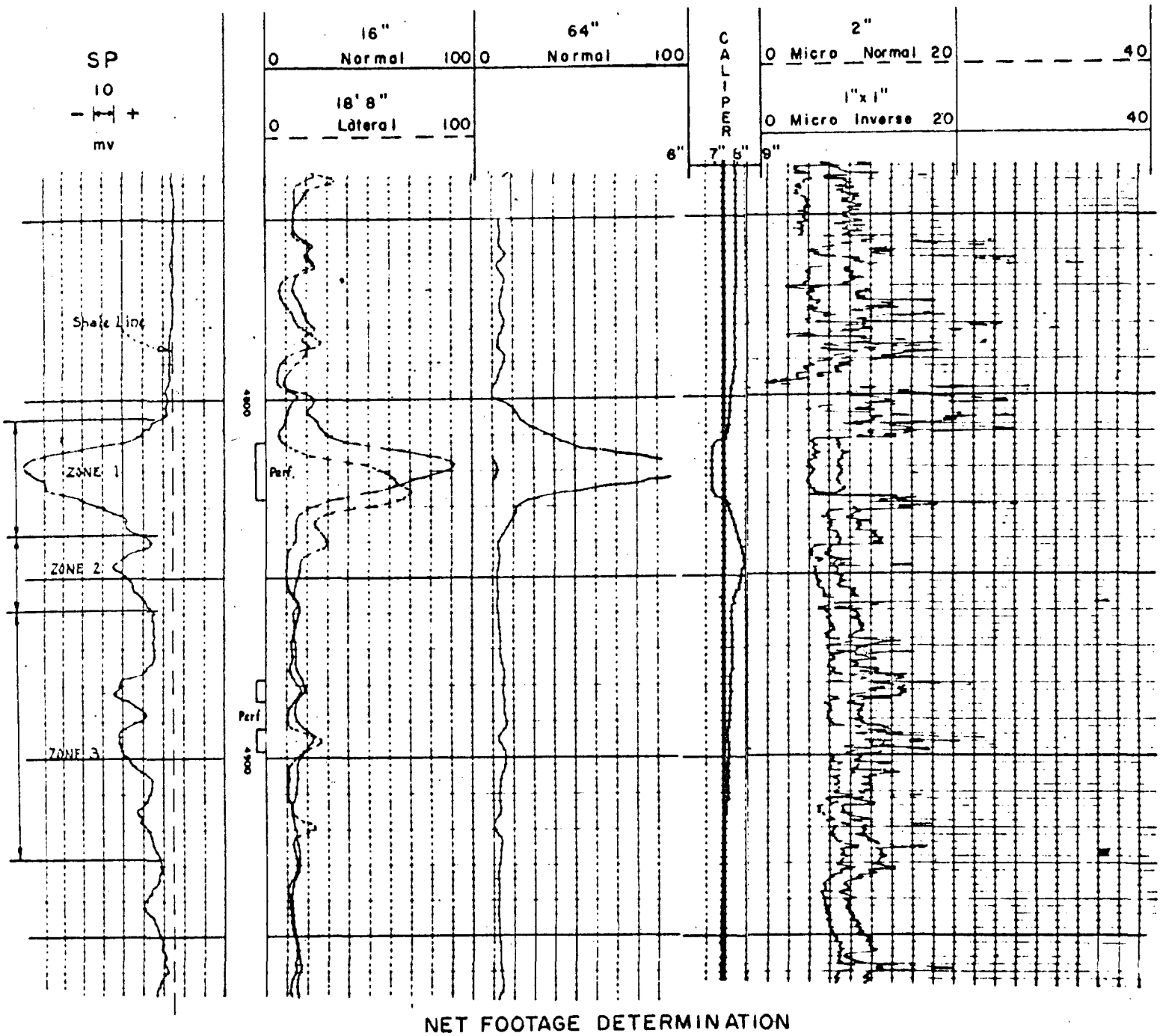
B2-330

SUNRAY MID-CONTINENT OIL COMPANY

N. M. Fed. #C-12

Sec. 6 - 25 N - 12 W

San Juan, New Mexico



NET FOOTAGE DETERMINATION

	SP					Microlog
	Area Sq.In.	Area Mv. Ft.	Ft.	Correction Factor	Net Ft.	
ZONE 1	1.92	1392	25.3'	1.04306	26.5'	15.5'
ZONE 2	.57	411	7.5'	0.6280	4.5'	0.0'
ZONE 3	1.59	1154	21.0'	0.4325	9.0'	0.0'

Rm = 2.5 @ 90° F
Rmf = 1.8 @ 87° F (M)
Rmc = 2.0 @ 85° F (M)
Max. Temp. 120° F

EXHIBIT-3

EXHIBIT 6A

RESERVOIR FLUID AND GAS ANALYSIS

(1) Component	(2) Reservoir Oil Mol %	(3) K at 1155 psia 145°F Equilibrium Const.	(4) Res. Gas Mol % (2) x (3)	(5) Mol wt. #/Mol	(6) lb/Mol (4) x (5)
N_2	1.11	4.44	4.93	28.0	1.38
C_1	19.80	4.10	81.18	16.0	13.00
C_2	5.10	1.20	6.12	30.1	1.84
C_3	9.24	0.51	4.71	44.1	2.08
C_4	7.41	0.26	1.93	58.1	1.12
C_5	4.74	0.11	0.52	72.1	0.37
C_6	4.80	0.06	0.29	86.2	0.25
C_{7+}	47.80	0.0066	0.32	228.0	0.73
	100.00		100.00		20.77

Sp. Gr. of gas = $\frac{20.77}{29}$ = 0.715 (Air = 1.00)

Density at 60 °F = 0.8553 gm/cc

°API at 60° F = 36.7°

CALCULATIONS OF GAS VOLUME FACTOR

Factor at 145° F

P_c = 670 psia T_c = 390° R

Pressure Psia P	P_r $\frac{P}{670}$	Tr $\frac{605}{T_c}$	Z at 145° F	Z/P 10^{-4}	3.049 Z/P 10-4	B_g Bbl Res Gas/SCF 10-3	$1/B_g$ SCF/Bbl
1155	1.72	1.55	0.86	7.446	22.703	2.270	440
1100	1.64	1.55	0.87	7.905	24.102	2.398	417
1000	1.495	1.55	0.88	8.800	26.831	2.683	373
900	1.34	1.55	0.89	9.910	30.215	3.012	332
800	1.195	1.55	0.90	11.250	34.301	3.430	292
700	1.045	1.55	0.91	13.000	39.637	3.968	252
600	0.896	1.55	0.92	15.333	46.750	4.675	214
500	0.747	1.55	0.94	18.810	57.352	5.682	176
400	0.598	1.55	0.95	23.750	72.414	7.241	138
350	0.523	1.55	0.955	27.320	83.298	8.404	119
300	0.448	1.55	0.96	32.162	98.062	10.000	100
250	0.373	1.55	0.97	38.700	117.996	12.048	83
200	0.299	1.55	0.98	49.000	149.401	14.940	67
150	0.224	1.55	0.985	66.625	203.139	20.000	50
100	0.149	1.55	0.99	99.000	301.851	30.185	34
14.7	0.022	1.55	1.00	680.272	2074.149	207.415	4.83

Calculation of gas volume factor:

$$B_g = (1)\left(\frac{14.7}{P}\right)\left(\frac{T}{520}\right)\left(\frac{Z}{5.61}\right) = \text{Res bbl gas/SCF gas} = 3.049\ Z/P$$

EXHIBIT 9A

CORE ANALYSIS CALCULATION SUMMARY
BISTI HYDROCARBON PORE VOLUME FOR THE SP INTERVAL (8-22-58)

	Code	ZONE 1 Number Ft.	ZONE 1 $\Sigma\phi(1-S_w)$	ZONE 1 Avg. $\phi(1-S_w)$	ZONE 2 Number Ft.	ZONE 2 $\Sigma\phi(1-S_w)$	ZONE 2 Avg. $\phi(1-S_w)$	ZONE 3 Number Ft.	ZONE 3 $\Sigma\phi(1-S_w)$	ZONE 3 Avg. $\phi(1-S_w)$
Sunray Federal C #1	1001	24	2.9305	0.1221						
Amerada - Gle-Na-Nup-Pah #2	1002	16	1.6122	0.1008	4	0.1500	0.0375	8	0.4205	0.0526
Sunray - Federal C #14	1004	16	1.7008	0.1063	10	0.6111	0.0611	9	0.5645	0.0627
Sunray - Federal C #10	1005	16	1.8767	0.1173				11	0.5853	0.0532
Sunray - Federal C #18	1006	9	0.7755	0.0862	4	0.2476	0.0619	12	0.7141	0.0595
El Paso - Kelly State #2	1007	4	0.3551	0.0888	1	0.0793	0.0793	7	0.7002	0.1000
El Paso - Kelly State #3	1010	5	0.4375	0.0875	5	0.3543	0.0709	6	0.5431	0.0905
El Paso - Kelly State #6	1011	8	0.7666	0.0958	6	0.6394	0.1066	11	0.7142	0.0649
El Paso - Kelly State #7	1012	1	0.0351	0.0351	3	0.1340	0.0447	9	0.6518	0.0724
B/A - Salge B #5	1013	13	1.3756	0.1058	7	0.5771	0.0824			
B/A - Marye B #5	1014	18	1.7282	0.0960				6	0.4686	0.0781
Amerada - Joan White #2	1015	14	1.2930	0.0924	8	0.5106	0.0638	10	0.6577	0.0658
B /A - Douthit B #2	1016	12	1.6757	0.1396	4	0.3107	0.0777	6	0.2884	0.0481
B/A Douthit B #11	1019	14	1.3930	0.0995						
B/A Salge B #1	1021	17	2.0455	0.1203	6	0.3513	0.05855	8	0.4803	0.0600
Sunray Federal C #7	1023							3	0.0712	0.0237
B/A Marye #3	1026	5	0.5914	0.1183						
B/A Marye B #4	1027	18	2.3691	0.1316	5	0.2507	0.0501	6	0.2628	0.0438
C.M.W. - Elliott #2	1032	5	0.2477	0.0492	2	0.1255	0.0628	1	0.0436	0.0436
C.M.W. - Elliott #1	1033							2	0.0643	0.0321
Phillips Benally #2	1034	19	2.1657	0.1140	3	0.1440	0.0480	8	0.7438	0.0930
Ben.-Mon.-Gr. - Foster #1	1035	8	0.7945	0.0993						
Ben.-Mon.-Gr. - Foster #5	1037	25	2.6643	0.1065						
Phillips - Hospah B #1	1038							5	0.3633	0.0727
B/A - Douthit B #4	1040	11	1.0771	0.0979				6	0.3948	0.0658
B/A - Marye B #1	1042	18	1.8932	0.1052	2	0.0438	0.0219			
Phillips - I-Tah-Nip #1	1043	12	1.3801	0.1150	5	0.4249	0.0850	9	0.7469	0.0830
Phillips - Hospah C #1	1044	17	1.6548	0.0973						
Sunray - Bisti G.I. #1	1045	23	2.6434	0.1149						
El Paso - Sullivan D #2	1046	11	1.1851	0.1077				6	0.3605	0.0601
So. Union - Ka-Gee-Tah #1	1047	20	2.0272	0.1014	6	0.2903	0.0484	12	0.7184	0.0599
B/A - Marye #2		9	0.7146	0.0794	2	0.1161	0.0580	9	0.6010	0.0668
El Paso - Kelly State #4		1	0.0437	0.0437	5	0.3229	0.0646	10	0.7647	0.0765
El Paso - Sullivan #1-D		13	1.3259	0.1020						
El Paso - Benally #1		12	1.0616	0.0885				6	0.3747	0.0625
		414	43.8404		88	5.6776		186	12.2987	

EXHIBIT 10

BISTI FIELD, SAN JUAN COUNTY, NEW MEXICO
ELECTRIC LOG ANALYSIS AND NET PAY DETERMINATIONS

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Micrologg Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(8) Ft.(S.P. Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft./ S.P.Feet (9)/(12) Ft./Ft.
Amerada														
Gle-Na-Nup-Pah #1	1	6,190	4,776	4,808		18.0	1,334	-	60	-	-	22.233	-	-
	2			4,832		0	382	-		-	-	6.366	-	-
	3			4,901	125	2.0	1,081	-		-	-	18.016	-	-
Gle-Na-Nup-Pah #2	1	6,167	4,774	4,803		4.0	721	721	48	13.24	-	15.021	15.021	0.8814
	2			4,829		0	288	288		1.97	-	6.000	6.000	0.3283
	3			4,894	120	0	836	836		7.74	-	17.417	17.417	0.4444
Ka-Da-Pa #1	1	6,170	4,758	4,788		12.0	959	-	60	-	-	15.983	-	-
	2			4,814		0	346	-		-	-	5.766	-	-
	3			4,882	124	0	908	-		-	-	15.133	-	-
Ka-Da-Pa #2	1	6,145	4,748	4,777		5.0	663	92	49	-	-	13.537	-	-
	2			4,802		0	296	41		-	-	6.033	-	-
	3			4,870	122	6.0	836	116		-	-	17.068	-	-
Nah-Des-Pah #1	1	6,239	4,752	4,779		1.5	411	-	58	-	-	7.086	-	-
	2			4,801		3.5	526	-		-	-	9.068	-	-
	3			4,882	130	1.0	1,406	-		-	-	24.241	-	-
Nah-Des-Pah #2	1	6,229	4,761	4,790		9.0	721	-	56	-	-	12.875	-	-
	2			4,814		4.0	584	-		-	-	10.428	-	-
	3			4,892	131	6.5	1,471	-		-	-	26.267	-	-
Joan White #1	1	6,226	4,739	4,768		10.0	764	-	62	-	-	12.322	-	-
	2			4,787		4.5	642	-		-	-	10.354	-	-
	3			4,872	133	2.5	1,615	-		-	-	26.048	-	-
Joan White #2	1	6,209	4,743	4,770		8.0	642	642	47	17.09	361.58	13.66	13.66	1.251
	2			4,796		2.0	570	570		7.35	40.73	12.13	12.13	0.606
	3			4,870	127	4.0	952	952		8.69	8.69	20.26	20.26	0.429
Salena White #1	1	6,254	4,770	4,798		0	418	-	50	-	-	8.360	-	-
	2			4,816		0	454	-		-	-	9.080	-	-
	3			4,896	126	4.0	1,774	-		-	-	35.480	-	-
Salena White #2	1	6,287	4,824	4,852		0	555	-	63	-	-	8.890	-	-
	2			4,870		0	361	-		-	-	5.730	-	-
	3			4,952	128	2.0	1,572	-		-	-	24.952	-	-

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(8) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft. S.P.Feet (9)/(12) Ft./Ft.
Benson, Montin and Greer														
Foster #1 *	1	6,306	5,106	5,130	(Incomp.	6.5	540	540	72	10.58	154.38	7.500	7.500	1.410
	2			?	Pent.)	0	-	-		-	-	-	-	-
	3			?		0	-	-		-	-	-	-	-
Foster #5 *	1	6,346	5,127	5,158	(Incomp.	17.0	952	952	40	20.09	1,012.09	23.800	23.800	0.844
	2			?	Pent.)	0	-	-		-	-	-	-	-
	3			?		0	-	-		-	-	-	-	-
British American														
Douthit #B-2 *	1	6,311	5,010	5,040		9.5	800	728	67	9.85	346.25	11.940	10.866	0.906
	2			5,059		0	418	418		2.14	2.14	6.239	6.239	0.343
	3			5,108	98	0	901	901		1.96	2.46	13.448	13.448	0.146
Douthit #B-4 *	1	6,208	4,950	4,979		7.5	649	649	60	13.34	50.34	10.817	10.817	1.2332
	2			-		0	0	-		-	6.18	0	0	-
	3			5,044	94	11.0	779	440		4.28		12.983	7.333	0.584
Douthit #B-11 *	1	6,398	5,157	5,189		11.0	872	872	63	18.63	-	13.841	13.841	1.346
	2			5,214		0	238	-		-	-	3.778	-	-
	3			5,250	93	0	461	-		-	-	7.314	-	-
Marye #2 *	1	6,268	4,8[illegible]3	4,880		5.5	534	461	50	5.3	11.10	10.680	9.220	0.5748
	2			4,897		0	187	187		0.5	0.5	3.740	3.740	0.1337
	3			4,966	113	10.0	1,370	1,370		3.1	3.2	27.400	27.400	0.1131
Marye #3 *	1	6,223	4,854	4,884		9.0	793	793	50	5.04	101.74	15.86	15.86	0.318
	2			4,908		3.0	728	-		-	-	14.56	-	-
	3			4,951(TD)		2.0	750	490		.08	.08	15.00	9.80	0.008
Marye #B-1 *	1	6,229	4,905	4,938		10.0	959	959	55	11.25	221.35	17.44	17.44	0.645
	2			4,952		0	202	202		0.54	0.54	3.67	3.67	0.147
	3			5,006	101	0	699	-		0	-	12.71	-	-
Marye #B-4 *	1	6,247	4,904	4,936		14.5	966	966	52	18.38	1,051.58	18.577	18.577	0.9894
	2			4,958		0	418	418		2.39	3.19	8.038	8.038	0.2973
	3			5,014	110	0	699	447		2.13	2.13	13.442	8.596	0.2478
Marye #B-5 *	1	6,240	4,921	4,952		13.0	1,067	634	60	16.91	1,078.21	17.783	10.566	1.6004
	2			4,970		0	238	-		-	-	3.967	-	-
	3			5,026	105	0	707	404		11.99	12.69	11.783	6.733	1.7807

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(8) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft/ S.P. Feet (9)/(12) Ft./Ft.
British American (Cont'd.)														
Salge #B-1	1	6,282	4,973	5,002		12.0	865	865	53	11.22	1,179.62	16.321	16.321	0.687
	2			5,020		0	505	505		4.15	6.15	9.528	9.528	0.435
	3			5,074	101	0	937	937		3.78	8.88	17.679	17.679	0.214
Salge #B-5 *	1	6,298	4,990	5,022		6.0	671	671	49	19.13	53.13	13.694	13.694	1.3969
	2			5,044		2.5	512	512		8.39	16.39	10.449	10.449	0.8029
	3			5,092	102	0	714	-		-	-	14.571	-	-
El Paso														
Benally #1	1	6,166	4,786	4,814		6.0	656	656	55	12.84	38.24	11.927	11.927	1.077
	2			4,839		0	245	245		2.43	2.43	4.455	4.455	0.5454
	3			4,900	114	1.0	743	663		9.31	9.31	13.509	12.055	0.7722
Kelly State #1	1	6,240	4,729	4,750		2.5	332	-	52	-	-	6.384	-	-
	2			4,788		13.5	815	-		-	-	15.673	-	-
	3			4,860	131	9.0	1,384	-		-	-	26.615	-	-
Kelly State #2	1	6,256	4,746	4,770		1.5	281	281	60	2.27	5.22	4.683	4.683	0.4847
	2			4,802		0	310	310		0.59	0.59	5.166	5.166	0.1142
	3			4,874	128	1.0	822	822		10.95	17.31	13.700	13.700	0.7993
Kelly State #3	1	6,233	4,697	4,721		4.5	324	324	63	9.59	22.58	5.143	5.143	1.8647
	2			4,756		1.0	454	454		4.77	4.80	7.206	7.206	0.6619
	3			4,812 (TD)	115(Incomp)	1.0	808	808		15.05	20.47	12.825	12.825	1.1735
Kelly State #4	1	6,270	4,743	4,768		0	245	245	55	0.13	0.13	4.454	4.454	0.0292
	2			4,800		0	433	433		0.98	0.98	7.872	7.872	0.1245
	3			4,878	135	0	1,139	1,139		5.12	5.12	20.709	20.709	0.2472
Kelly State #5	1	6,239	4,734	4,760		1.5	418	-	60	-	-	6.966	-	-
	2			4,787		9.5	728	-		-	-	12.133	-	-
	3			4,870	136	9.0	1,319	-		-	-	21.983	-	-
Kelly State #6	1	6,252	4,755	4,780		1.0	469	469	60	12.1	22.20	7.816	7.816	1.548
	2			4,808		0	519	519		8.8	12.90	8.650	8.650	1.017
	3			4,888	133	2.0	1,420	1,420		3.70	3.70	23.666	23.666	0.156
Kelly State #7	1	6,270	4,728	4,754		0	238	238	60	0.4	0.4	3.967	3.967	0.101
	2			4,779		0	310	310		1.3	2.1	5.167	5.167	0.252
	3			4,856	128	1.0	1,182	1,182		5.1	6.8	19.700	19.700	0.259

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(8) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft./ S.P. Feet (9)/(12) Ft./Ft.
El Paso (Cont'd.)														
Kelly State #8	1	6,260	4,712	4,736		0	202	-	57	-	-	3.5438	-	-
	2			4,768		0	433	-		-	-	7.5964	-	-
	3			4,842	130	2.0	1,269	-		-	-	22.2630	-	-
Kelly State #10	1	6,258	4,881	4,910		5.5	699	-	58	-	-	12.0517	-	-
	2			4,926		0	195	-		-	-	3.4310	-	-
	3			4,955(TD)	-	0	671	-		-	-	11.5689	-	-
Kelly State #12	1	6,314	4,716	4,742		0	505	-	60	-	-	8.4166	-	-
	2			4,772		4.5	923	-		-	-	15.3833	-	-
	3			4,846	130	4.5	1,694	-		-	-	28.2333	-	-
Sullivan #1-D *	1	6,239	4,963	4,995		10.0	815	815	63	17.18	134.38	12.937	12.937	1.3279
	2			-		0	0	0		-	-	0	0	-
	3			5,064	101	0	663	-		-	-	10.524	-	-
Sullivan #2-D *	1	6,206	4,931	4,960		9.5	591	591	58	18.45	52.65	10.190	10.190	1.8105
	2			-		0	0	0		-	-	0	0	-
	3			5,030	99	0	692	483		5.63	8.03	11.931	8.328	0.6760
Pan American														
In-Ni-Da-Pah #1	1	6,183	4,774	4,802		7.0	728	-	72	-	-	10.111	-	-
	2			4,832		0	433	-		-	-	6.014	-	-
	3			4,896	122	0	808	-		-	-	11.222	-	-
In-Ni-Da-Pah #2	1	6,175	4,788	4,816		0	649	-	70	-	-	9.271	-	-
	2			4,839		0	310	-		-	-	4.429	-	-
	3			4,902	114	4.0	945	-		-	-	13.500	-	-
Ka-Da-Pah #1	1	6,199	4,798	4,828		0	598	-	75	-	-	7.973	-	-
	2			4,850		0	209	-		-	-	2.787	-	-
	3			4,916	118	4.5	771	-		-	-	10.280	-	-
Ka-Da-Pah #2	1	6,204	4,824	4,850		0	288	-	70	-	-	4.114	-	-
	2			4,867		0	166	-		-	-	2.371	-	-
	3			4,934	110	0	894	-		-	-	12.771	-	-

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(7) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft/ S.P. Feet (9)/(12) Ft./Ft.
Shell (Cont'd.)														
Gov't. #12-15	1	?	4,694	4,722		1.5	411	-	67	-	-	6.134	-	-
	2			4,752		4.0	1,009	-		-	-	15.059	-	-
	3			4,832	138	0	1,435	-		-	-	21.417	-	-
Gov't. #13-10	1	6,188	4,727	4,760		19.5	1,298	-	45	-	-	28.844	-	-
	2			4,786		0	332	-		-	-	7.377	-	-
	3			4,852(TD)	125+	5.0	945	-		-	-	21.000	-	-
Gov't. #14-10	1	6,246	4,770	4,803		8.0	880	-	60	-	-	14.666	-	-
	2			4,826		0	267	-		-	-	4.450	-	-
	3			4,906	136	0	1,045	-		-	-	17.416	-	-
Gov't. #21-9	1	6,184	4,750	4,782		15.0	1,161	-	53	-	-	21.905	-	-
	2			4,807		0	310	-		-	-	5.849	-	-
	3			4,876	126	0	836	-		-	-	15.773	-	-
Gov't. #22-9	1	6,206	4,757	4,790		15.5	1,103	-	55	-	-	20.054	-	-
	2			4,813		0	281	-		-	-	5.109	-	-
	3			4,884 (TD)	127	7.0	981	-		-	-	17.836	-	-
Gov't. #31-9	1	6,199	4,767	4,796		16.0	1,240	-	55	-	-	22.545	-	-
	2			4,825		0	562	-		-	-	10.218	-	-
	3			4,892	125	8.0	771	-		-	-	14.018	-	-
Gov't. #31-10 *	1	6,243	4,821	4,854		3.0	678	678	65	-	-	10.430	-	-
	2			4,874		0	209	209		-	-	3.215	-	-
	3			4,944	123	0	916	620		-	-	14.092	-	-
Gov't. #32-9	1		4,745	4,776		17.0	1,319	-	57	-	-	23.140	-	-
	2			4,803		0	339	-		-	-	5.947	-	-
	3			4,874	129	10.0	1,161	-		-	-	20.368	-	-
Gov't. #41-9	1	6,201	4,771	4,800		7.5	793	-	50	-	-	15.860	-	-
	2			4,829		0	375	-		-	-	7.500	-	-
	3			4,898	127	8.0	901	-		-	-	18.020	-	-
Gov't. #41-21	1	6,268	4,707	4,736		0	245	-	57	-	-	4.298	-	-
	2			4,765		2.0	440	-		-	-	7.719	-	-
	3			4,842	135	11.0	1,485	-		-	-	26.053	-	-
Gov't. #42-9	1	6,222	4,776	4,808		17.5	1,341	-	58	-	-	23.121	-	-
	2			4,836		0	411	-		-	-	7.086	-	-
	3			4,895(TD)	119+	6.0	836	-		-	-	14.413	-	-

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(7) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft/ S.P. Feet (9)/(12) Ft./Ft.
Skelly														
Duff #2 *	1	6,385	5,166	5,196		17.0	793	-	48	-	-	16.521	-	-
	2			-		0	-	-		-	-	-	-	-
	3	Poss. water		5,258	92	0	671	671		12.9	-	13.979	13.979	0.9228
Southern Union														
Ka-Gee-Tah #1	1	6,218	4,776	4,806		11.5	1,024	1,024	52	16.25	657.25	19.692	19.692	0.825
	2			4,835		0	469	469		5.70	5.70	9.019	9.019	0.631
	3			4,904	128	1.0	1,370	901		6.79	8.09	26.346	17.326	0.391
Ka-Gee-Tah #2	1	6,233	4,794	4,822		7.0	800	-	62	-	-	12.903	-	-
	2			4,853		0	425	-		-	-	6.854	-	-
	3			4,924	130	1.0	851	-		-	-	13.725	-	-
Sunray Mid-Continent														
Bisti G.I. #1	1	6,190	4,822	4,854		17.5	1,247	1,247	55	16.26	1,248.56	22.671	22.672	0.717
	2			4,874		0	252	-		-	-	4.581	-	-
	3			4,934	112	0	887	-		-	-	16.127	-	-
Federal #B-1	1	6,240	4,754	4,778		5.0	433	-	63	-	-	6.873	-	-
	2			4,812		0	490	-		-	-	7.778	-	-
	3			4,884	130	8.0	1,255	-		-	-	19.920	-	-
Federal #B-3	1	6,271	4,755	4,784		0	274	-	63	-	-	4.349	-	-
	2			4,808		0	353	-		-	-	5.603	-	-
	3			4,882	137	13.0	1,211	-		-	-	19.222	-	-
Federal #B-4	1	6,302	4,806	4,830		0	332	-	62	-	-	5.354	-	-
	2			4,855		0	382	-		-	-	6.161	-	-
	3			4,930	124	4.0	1,500	-		-	-	24.193	-	-
Federal #C-1	1	6,196	4,830	4,862		20.0	1,233	1,233	70	18.5	774.5	22.833	22.833	0.810
	2			4,878		0	353	-		-	-	6.537	-	-
	3			4,944	114	5.0	1,161	-		-	-	21.500	-	-
Federal #C-2	1	6,171	4,832	4,863		11.0	865	-	57	-	-	15.175	-	-
	2			4,883		0	260	-		-	-	4.561	-	-
	3			4,942	110	5.0	966	-		-	-	16.947	-	-

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv-Ft/Mv (6)/(8) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft/ S.P. Feet (9)/(12) Ft./Ft.
Sunray Mid-Continent (Cont'd.)														
Federal #C-3	1	6,199	4,816	4,848		13.0	1,031	-	65	-	-	15.861	-	-
	2			4,864		0	281	-		-	-	4.323	-	-
	3			4,932	116	1.0	1,045	-		-	-	16.076	-	-
Federal #C-4	1	6,190	4,813	4,848		21.0	1,355	-	62	-	-	21.854	-	-
	2			4,867		0	245	-		-	-	3.951	-	-
	3			4,932	119	10.0	757	-		-	-	12.209	-	-
Federal #C-5	1	6,241	4,832	4,860		7.5	642	-	50	-	-	12.840	-	-
	2			4,882		1.0	555	-		-	-	11.100	-	-
	3			4,950	118	9.0	1,218	-		-	-	24.360	-	-
Federal #C-6	1	6,211	4,818	4,847		12.0	829	-	65	-	-	12.753	-	-
	2			4,876		0	526	-		-	-	8.092	-	-
	3			4,938	120	7.5	1,024	-		-	-	15.753	-	-
Federal #C-7	1	6,163	4,827	4,842		4.0	469	-	60	-	-	7.82	-	-
	2			4,860		0	360	-		-	-	6.00	-	-
	3			4,922	95	0	851	519		0.81	0.81	14.18	8.65	0.094
Federal #C-9	1	6,170	4,810	4,841		11.0	887	-	70	-	-	12.671	-	-
	2			4,864		0	281	-		-	-	4.014	-	-
	3			4,924	114	7.0	923	-		-	-	13.185	-	-
Federal #C-10	1	6,220	4,811	4,836		11.0	894	894	58	13.41	681.57	15.41	15.41	0.870
	2			4,863		6.0	800	-		-	-	13.79	-	-
	3			4,934	123	6.0	1,377	771		3.95	5.15	23.74	13.29	0.297
Federal #C-11	1	6,258	4,838	4,867		6.5	540	-	45	-	-	12.000	-	-
	2			4,886		5.0	512	-		-	-	11.377	-	-
	3			4,960	122	19.0	1,255	-		-	-	27.888	-	-
Federal #C-12	1	6,194	4,805	4,838		15.5	1,392	-	55	-	-	25.309	-	-
	2			4,859		0	411	-		-	-	7.472	-	-
	3			4,928	123	0	1,154	-		-	-	20.981	-	-
Federal #C-13	1	6,168	4,797	4,828		8.5	1,045	-	65	-	-	16.076	-	-
	2			4,851		0	310	-		-	-	4.769	-	-
	3			4,914	117	4.0	937	-		-	-	14.415	-	-
Federal #C-14	1	6,201	4,766	4,793		11.0	865	865	55	4.44	1,032.83	15.727	15.727	0.2823
	2			4,820		6.0	844	800		10.18	31.34	15.345	14.545	0.6999
	3			4,896	130	7.0	1,089	952		4.34	18.34	19.800	17.309	0.2507

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Micrologs Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(8) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft/ S.P.Feet (9)/(12) Ft./Ft.
Sunray Mid-Continent (Cont'd.)														
Federal #C-15	1	6,207	4,789	4,817		11.0	663	-	60	-	-	11.050	-	-
	2			4,848		0	375	-		-	-	6.250	-	-
	3			4,914	125	6.0	714	-		-	-	11.900	-	-
Federal #C-16	1	6,241	4,797	4,824		7.5	577	-	60	-	-	9.616	-	-
	2			4,848		3.0	490	-		-	-	8.166	-	-
	3			4,916	119	3.0	988	-		-	-	16.466	-	-
Federal #C-17	1	6,268	4,796	4,824		11.0	793	-	65	-	-	12.200	-	-
	2			4,850		5.5	808	-		-	-	12.430	-	-
	3			4,919	123	4.0	1,168	-		-	-	17.969	-	-
Federal #C-18	1	6,281	4,836	4,862		2.0	548	548	65	2.11	2.11	8.43	8.43	0.25
	2			4,880		0	353	353		0.88	0.88	5.43	5.43	0.162
	3			4,958	122	7.5	1,615	1,298		3.82	3.82	24.85	19.97	0.191
Federal #C-19	1	6,289	4,833	4,860		4.5	577	-	65	-	-	8.876	-	-
	2			4,880		0	245	-		-	-	3.769	-	-
	3			4,954	121	7.0	1,312	-		-	-	20.184	-	-
Federal #C-20	1	6,303	4,867	4,894		4.5	512	71	45	-	-	11.376	-	-
	2			4,914		0	202	28		-	-	4.486	-	-
	3			4,987	120	6.5	1,233	171		-	-	27.398	-	-
Federal #C-21	1	6,188	4,754	4,784		15.5	1,269	-	58	-	-	21.879	-	-
	2			4,808		0	288	-		-	-	4.965	-	-
	3			4,880	126	3.0	959	-		-	-	16.534	-	-
									Σ Zone 1	- 417.81		Σ Zone 1	- 409.49	
									Σ Zone 2	- 89.03		Σ Zone 2	- 143.506	
									Σ Zone 3	- 183.26		Σ Zone 3	- 395.455	

* Well not in Central Bisti Unit, but included because of core analysis.

1 square inch of SP area (10 Mv. scale) = 724.6 Mv. - Ft.

SP area in Mv.-Ft. (Column #6) = $\frac{\text{Planimeter Units}}{\text{Planimeter Constant (100.5)}} \times 724.6$

SP footage (Column #11) = $\frac{\text{SP area in Mv.-Ft. (Column \#6)}}{\text{SSP from 4000' Zone (Column \#8)}}$

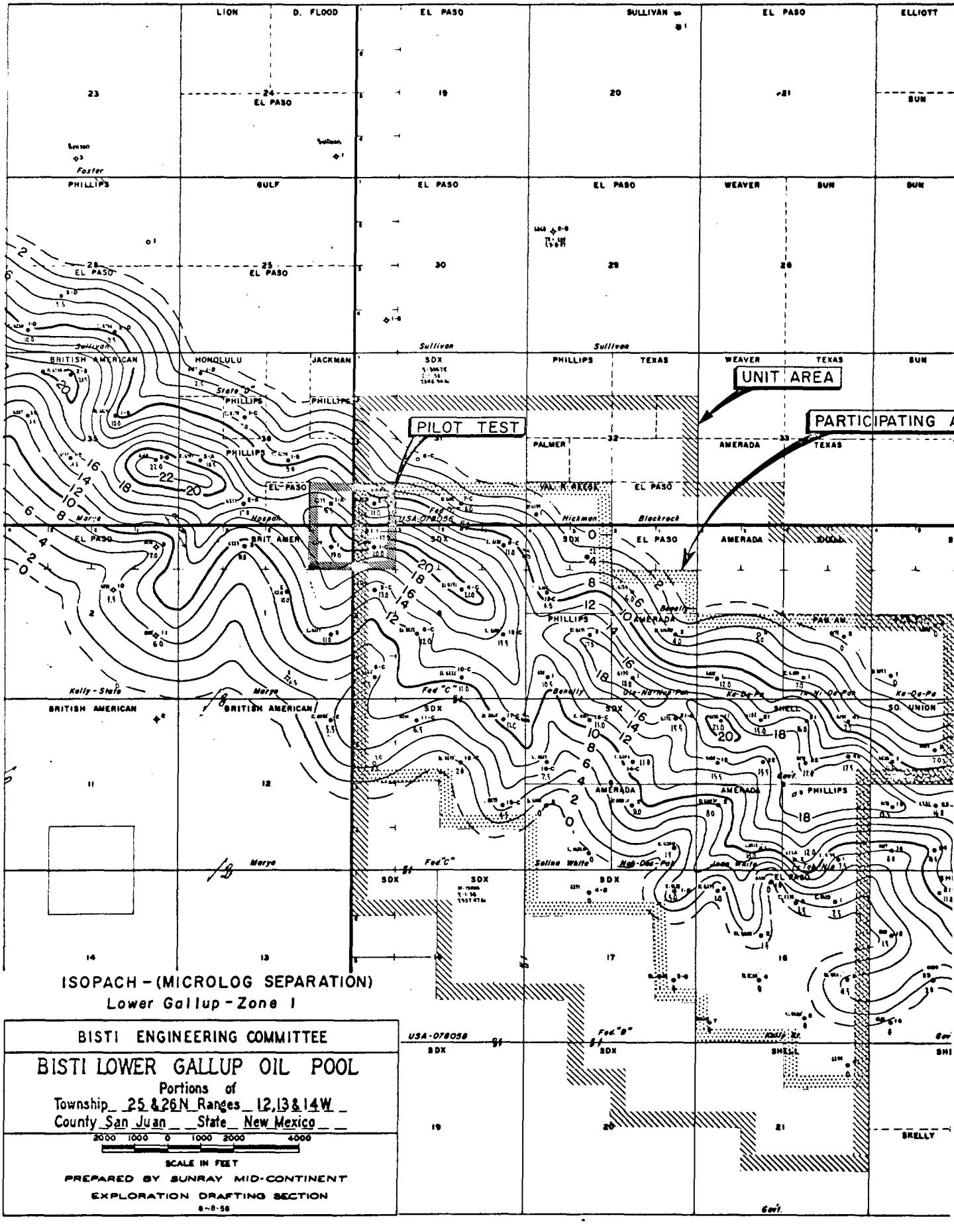
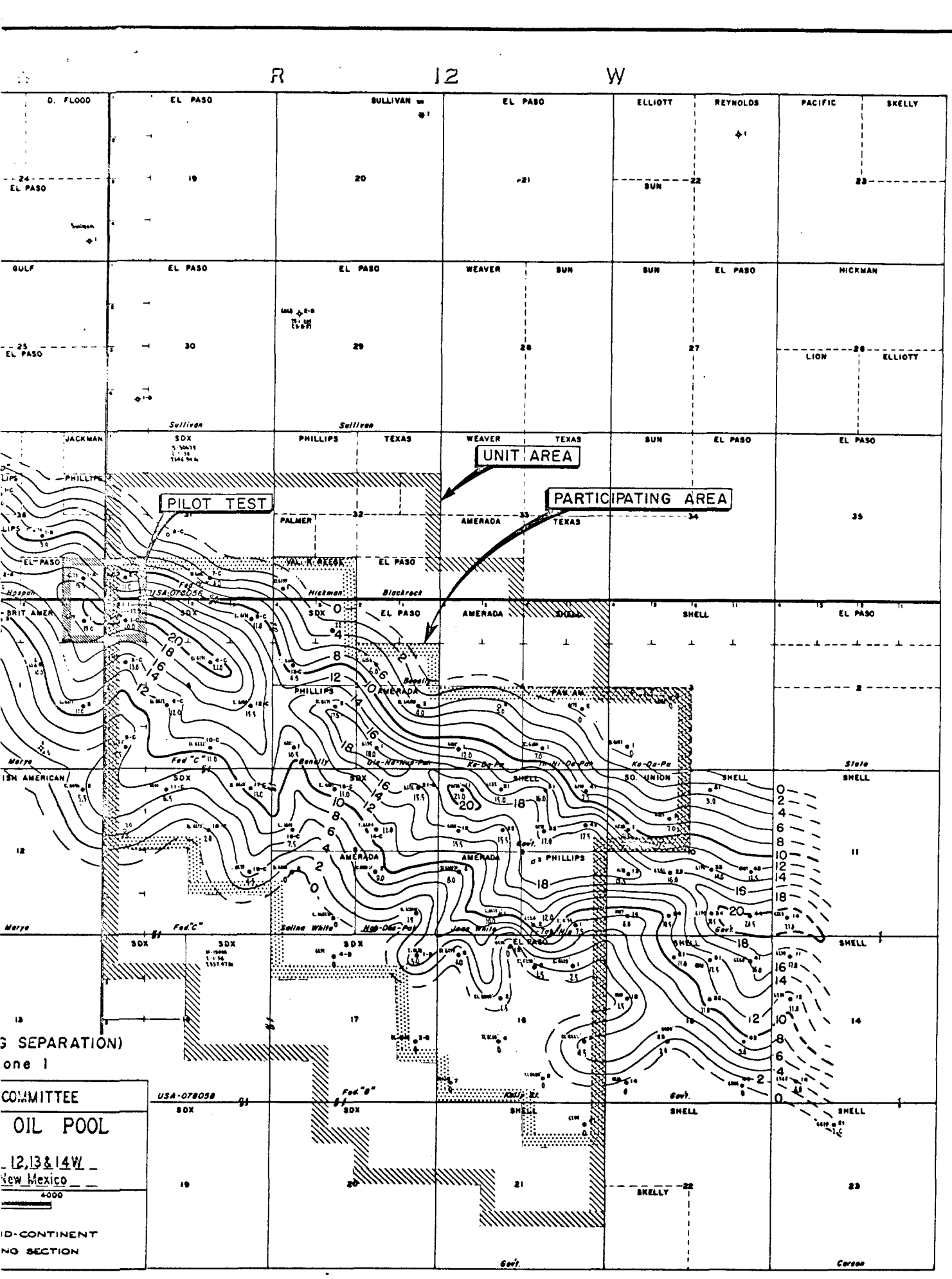

R 13 W
R 12 W
T 26 N
T 25 N
UNIT AREA
PILOT TEST
PARTICIPATING A
ISOPACH - (MICROLOG SEPARATION)
Lower Gallup - Zone I
BISTI ENGINEERING COMMITTEE
BISTI LOWER GALLUP OIL POOL
Portions of
Township 25 & 26 N Ranges 12, 13 & 14 W
County San Juan State New Mexico
2000 1000 0 1000 2000 4000
SCALE IN FEET
PREPARED BY SUNRAY MID-CONTINENT
EXPLORATION DRAFTING SECTION
8-8-58

EXHIBIT II-A


R 12 W
UNIT AREA
PARTICIPATING AREA
PILOT TEST
SEPARATION)
one 1
COMMITTEE
OIL POOL
12,13 & 14W
New Mexico
4000
ID-CONTINENT
NG SECTION
A

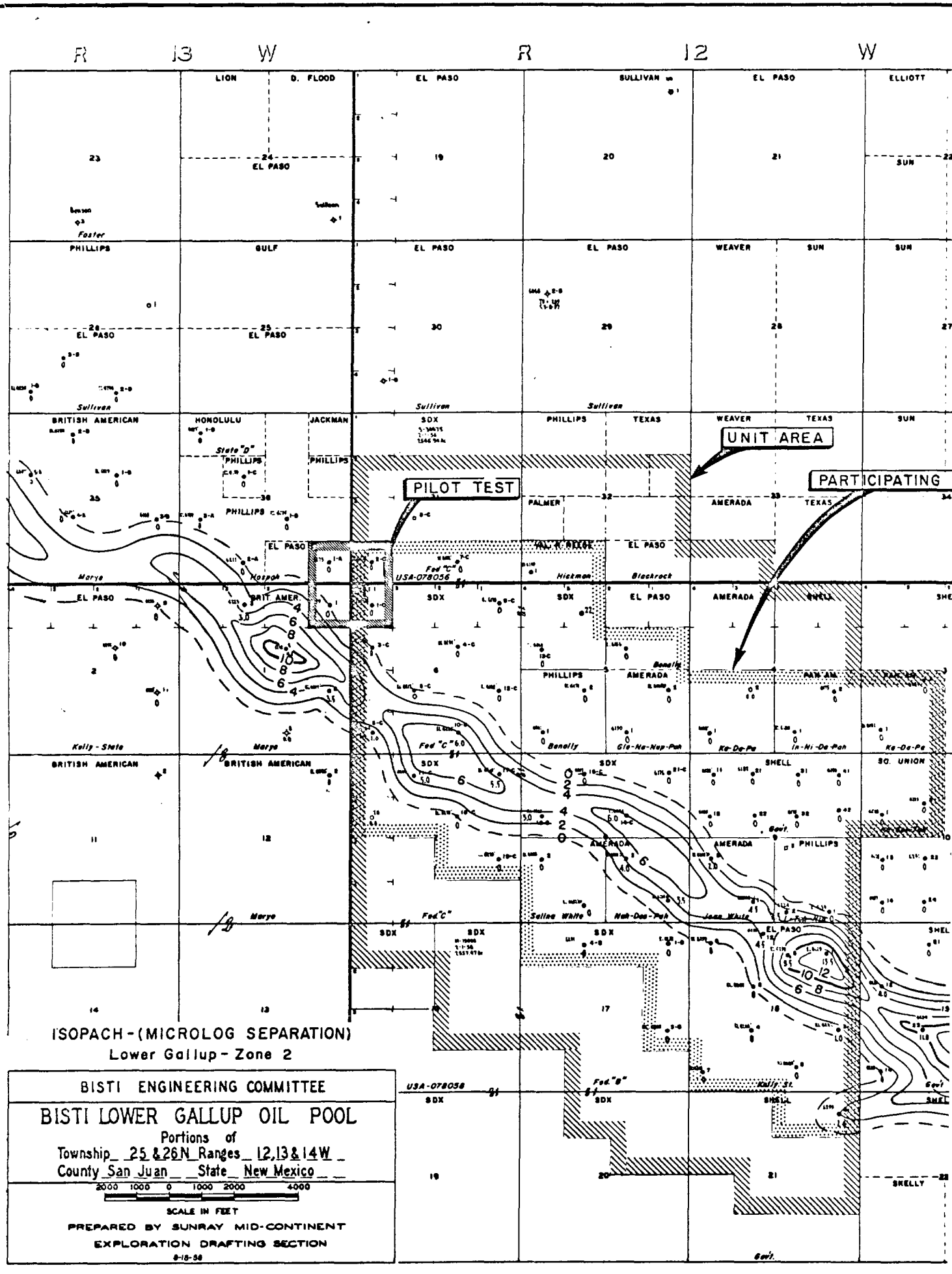
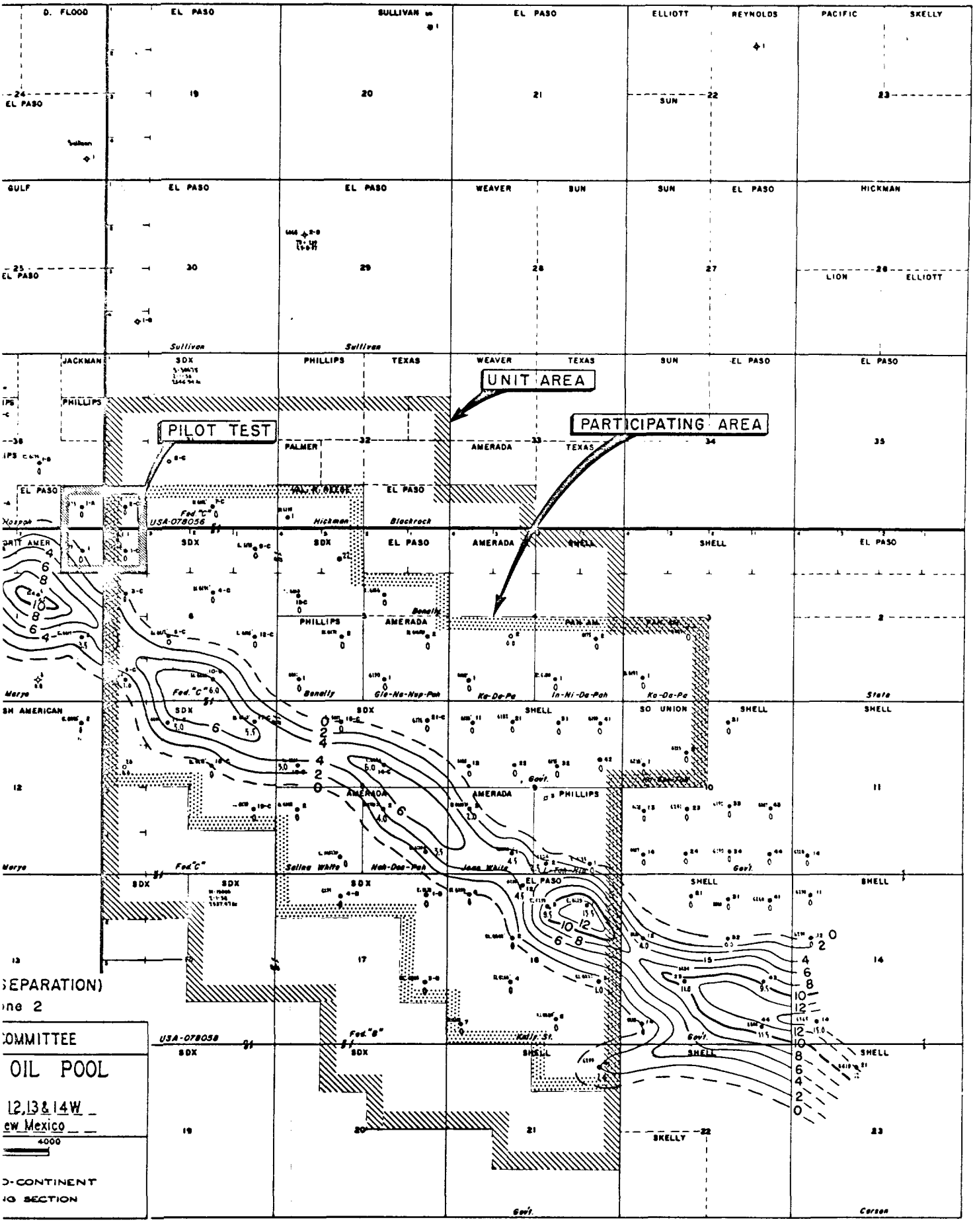

R 13 W
R 12 W
T 26 N
T 25 N
UNIT AREA
PARTICIPATING
PILOT TEST
ISOPACH - (MICROLOG SEPARATION)
Lower Gallup - Zone 2
BISTI ENGINEERING COMMITTEE
BISTI LOWER GALLUP OIL POOL
Portions of
Township 25 & 26 N Ranges 12, 13 & 14 W
County San Juan State New Mexico
2000 1000 0 1000 2000 4000
SCALE IN FEET
PREPARED BY SUNRAY MID-CONTINENT
EXPLORATION DRAFTING SECTION
8-18-58

EXHIBIT II-B


W
R
12
W
UNIT AREA
PARTICIPATING AREA
PILOT TEST
EL PASO
SULLIVAN
ELLIOTT
REYNOLDS
PACIFIC
SKELLY
GULF
WEAVER
SUN
HICKMAN
LION
JACKMAN
PHILLIPS
TEXAS
PALMER
AMERADA
SHELL
SO UNION
Fed. "C"
Fed. "B"
USA-078058
Hickman
Blackrock
Bonelly
Gle-Na-Nup-Pah
Ka-Da-Pa
In-Ni-Da-Pah
Selma White
Nah-Doo-Pah
Jane White
Kaiser St.
Govt.
State
Carson
SEPARATION)
one 2
COMMITTEE
OIL POOL
12,13&14W
ew Mexico
4000
D-CONTINENT
IG SECTION

C2-206A

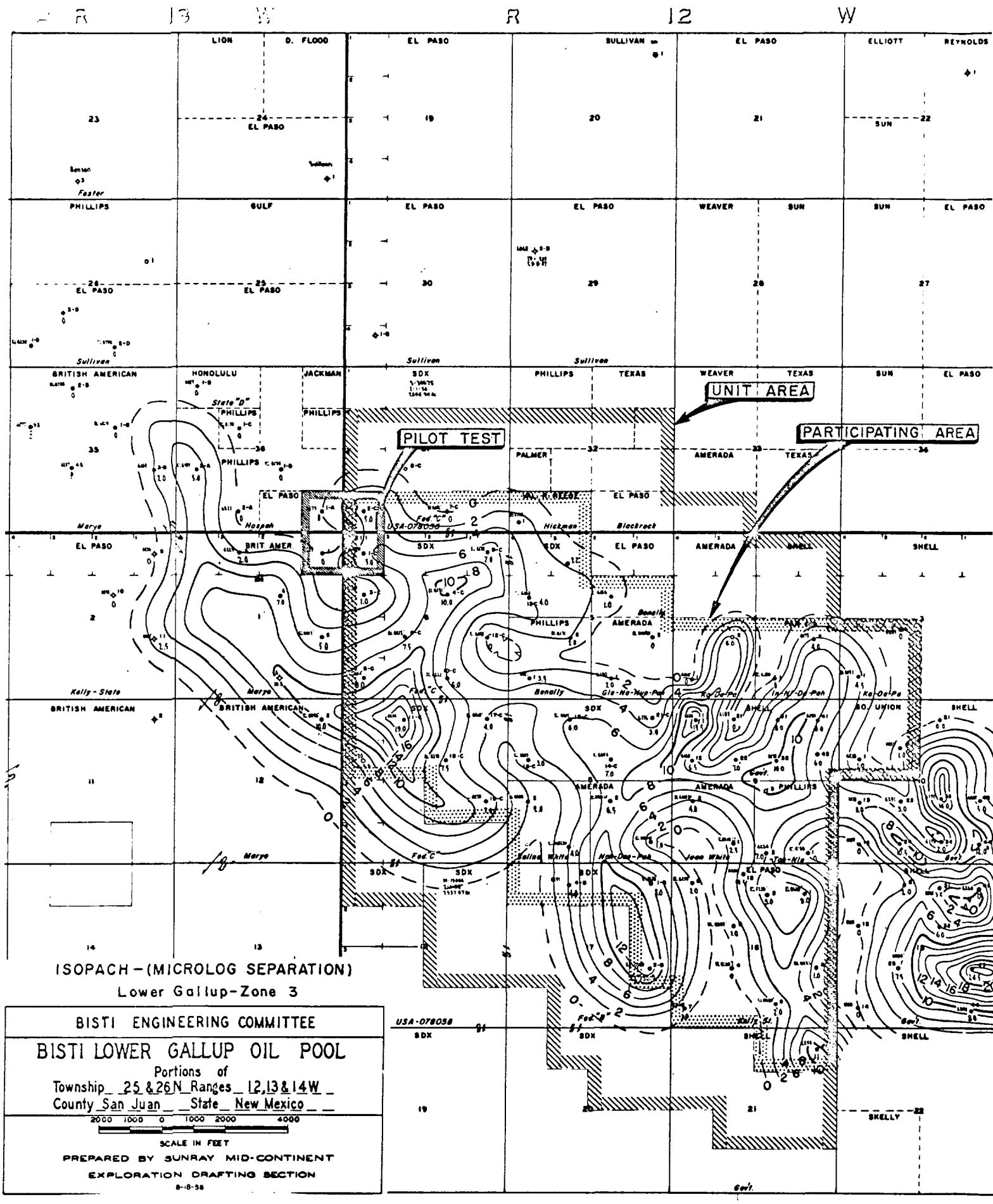
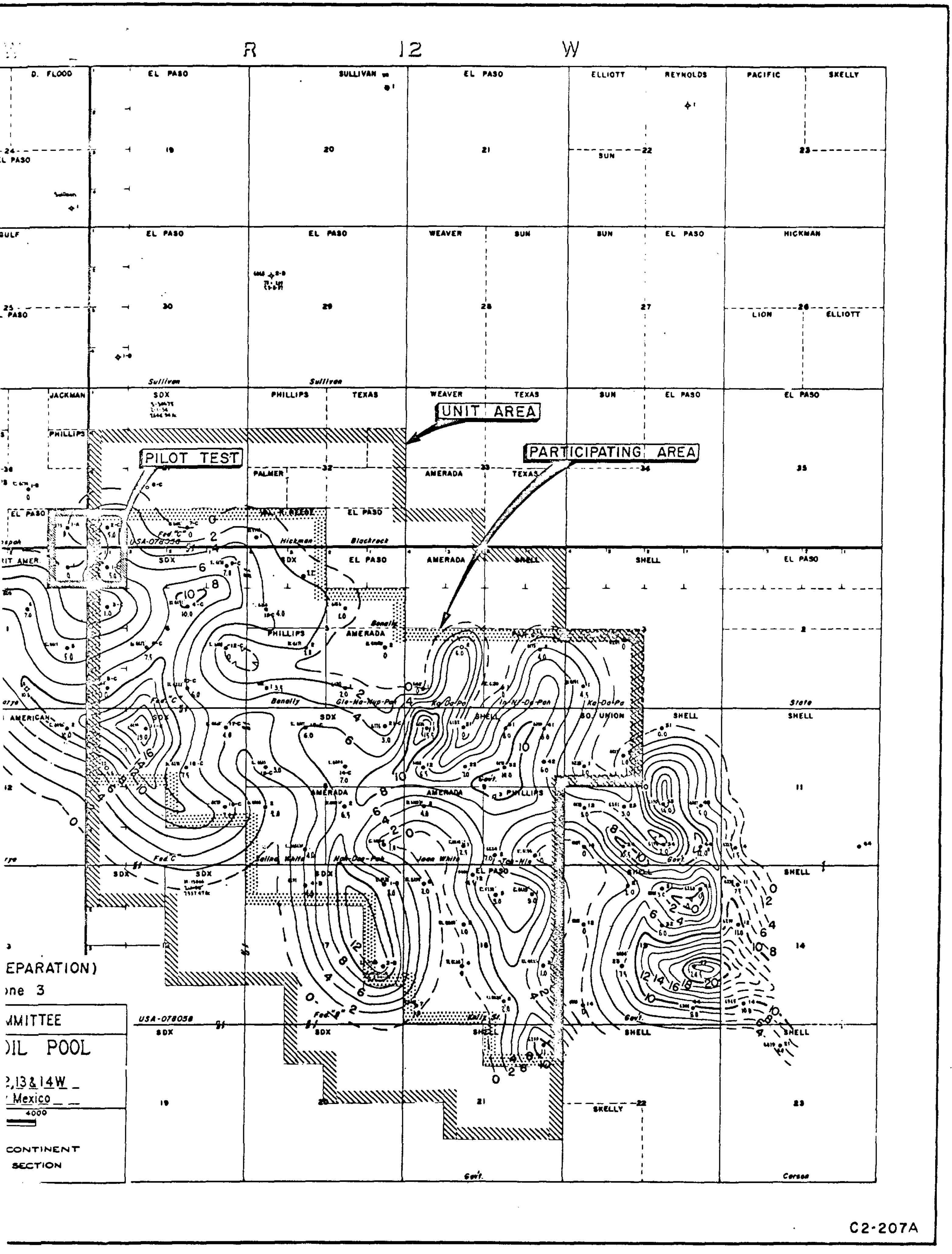

R 13 W
R 12 W
T 26 N
T 25 N
UNIT AREA
PARTICIPATING AREA
PILOT TEST
USA-078038
ISOPACH - (MICROLOG SEPARATION)
Lower Gallup-Zone 3
BISTI ENGINEERING COMMITTEE
BISTI LOWER GALLUP OIL POOL
Portions of
Township 25 & 26 N Ranges 12, 13 & 14 W
County San Juan State New Mexico
2000 1000 0 1000 2000 4000
SCALE IN FEET
PREPARED BY SUNRAY MID-CONTINENT
EXPLORATION DRAFTING SECTION
8-18-58

EXHIBIT II-C



R 12 W
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UNIT AREA
PILOT TEST
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MMITTEE
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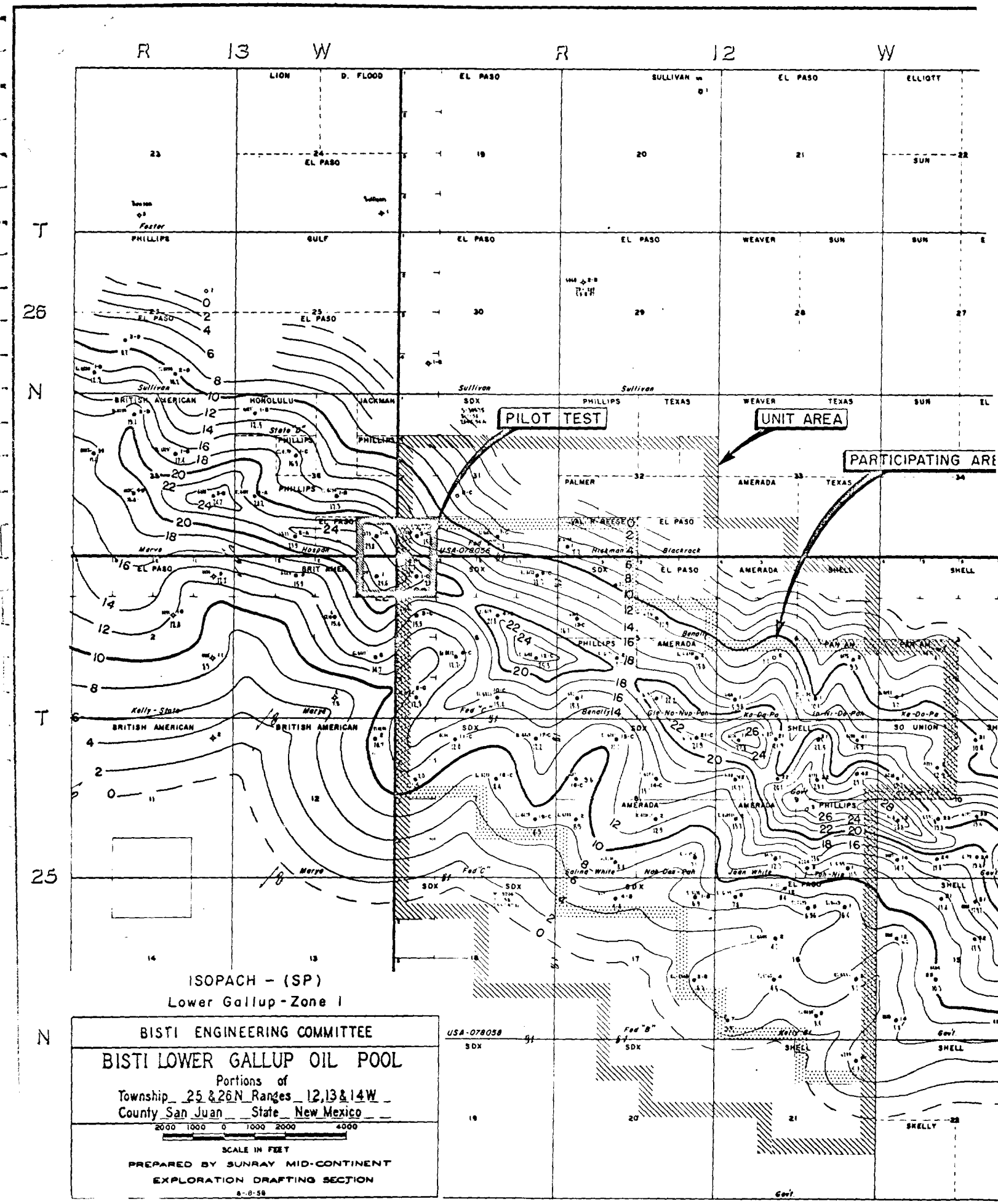
CONTINENT
SECTION
C2-207A


R 13 W
R 12 W
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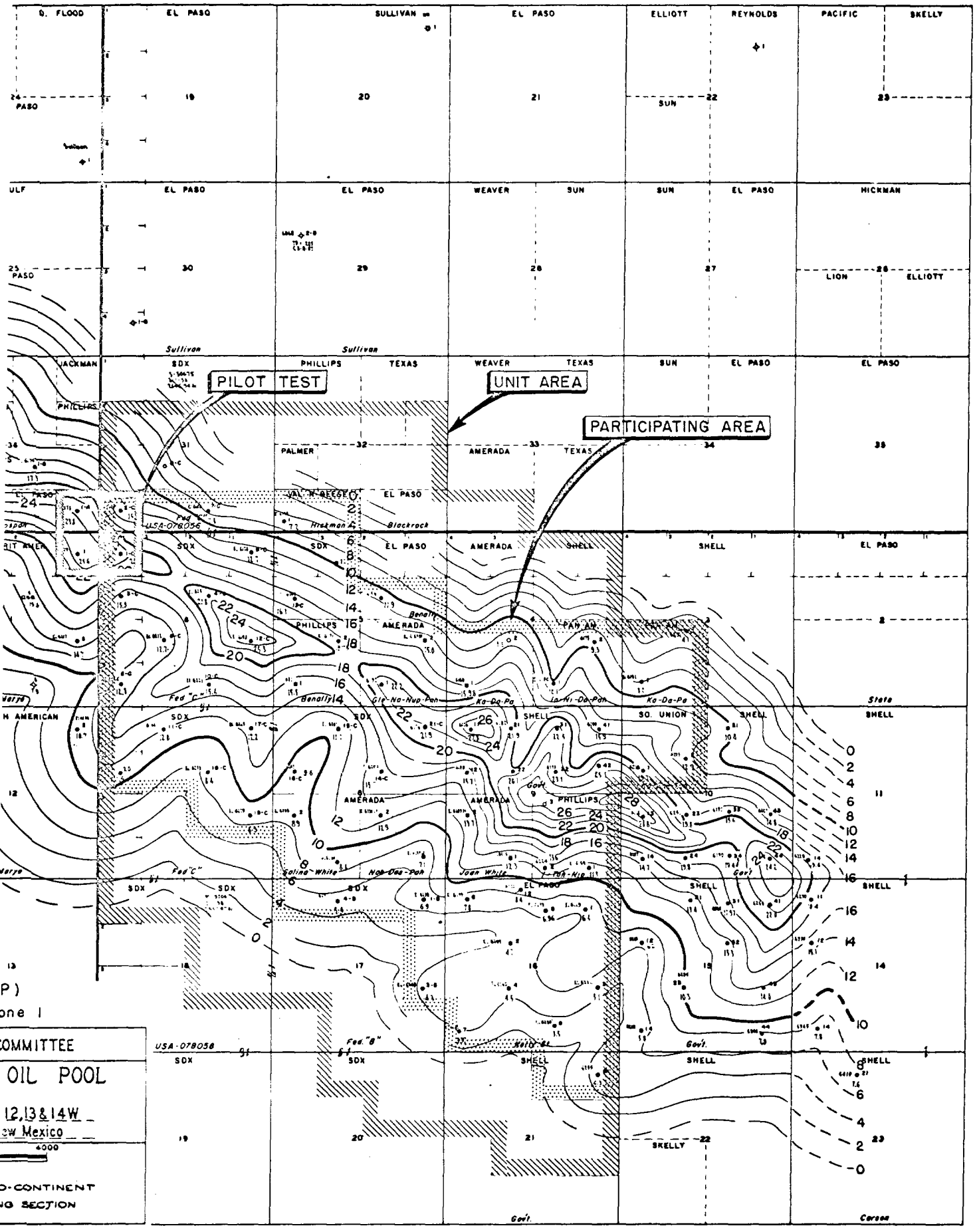
UNIT AREA
PARTICIPATING ARE
ISOPACH - (SP)
Lower Gallup - Zone I
BISTI ENGINEERING COMMITTEE
BISTI LOWER GALLUP OIL POOL
Portions of
Township 25 & 26 N Ranges 12, 13 & 14 W
County San Juan State New Mexico
2000 1000 0 1000 2000 4000
SCALE IN FEET
PREPARED BY SUNRAY MID-CONTINENT
EXPLORATION DRAFTING SECTION
8-8-58

EXHIBIT 12-A



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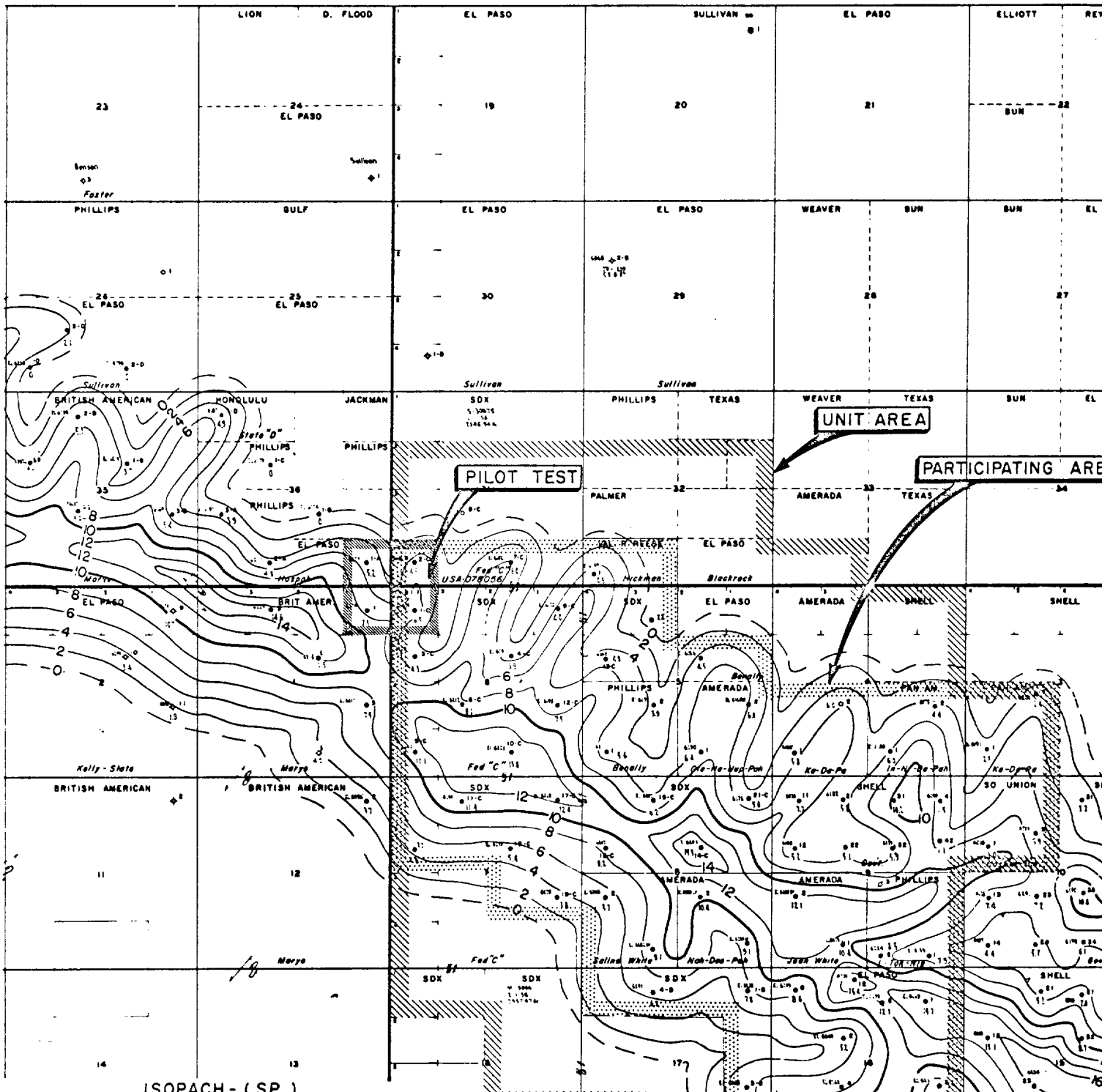
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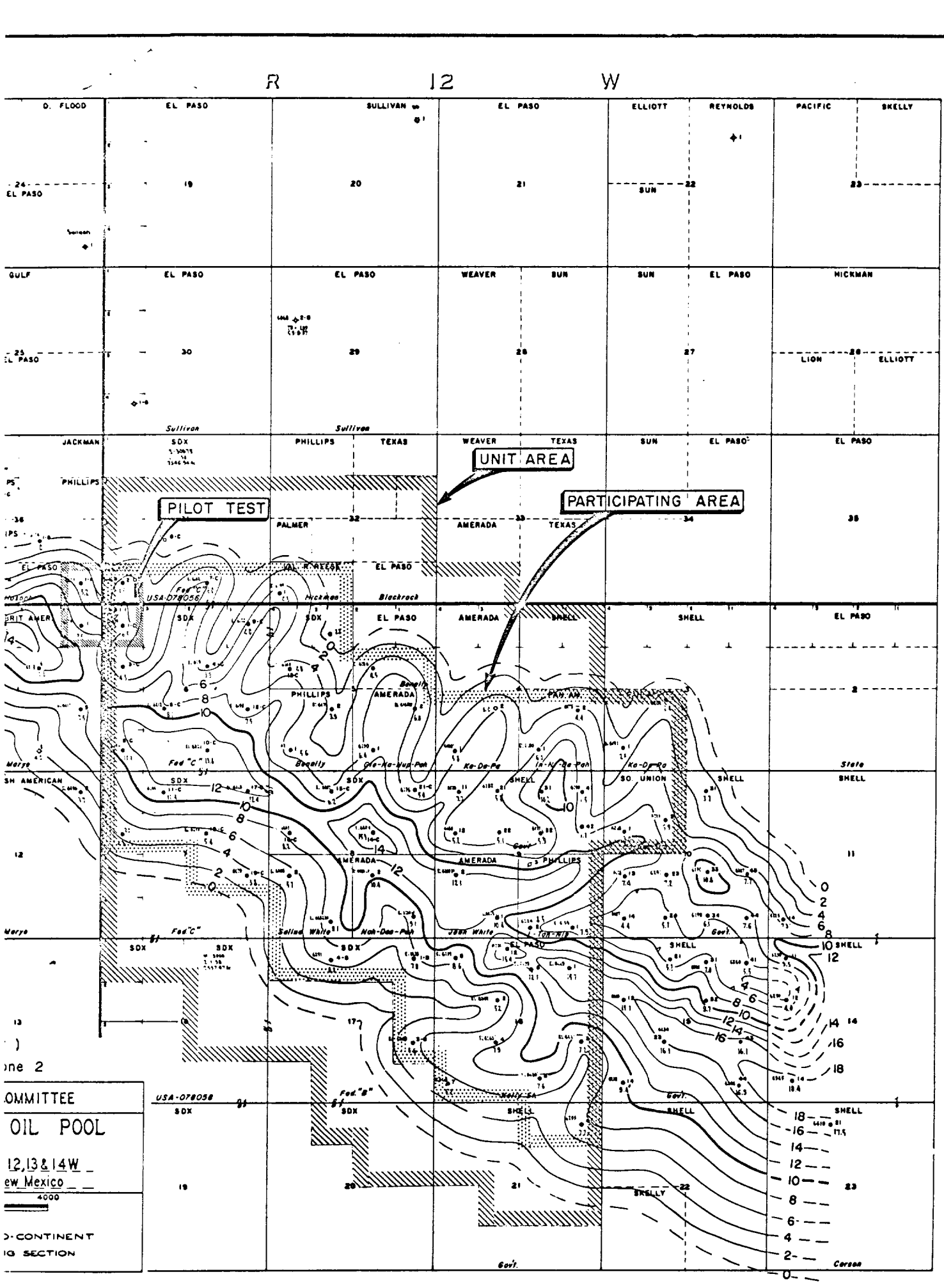
PARTICIPATING ARE
ISOPACH - (SP)
Lower Gallup - Zone 2
BISTI ENGINEERING COMMITTEE
BISTI LOWER GALLUP OIL POOL
Portions of
Township 25 & 26 N Ranges 12, 13 & 14 W
County San Juan State New Mexico
2000 1000 0 1000 2000 4000
SCALE IN FEET
PREPARED BY SUNRAY MID-CONTINENT
EXPLORATION DRAFTING SECTION
8-8-58

EXHIBIT 12-B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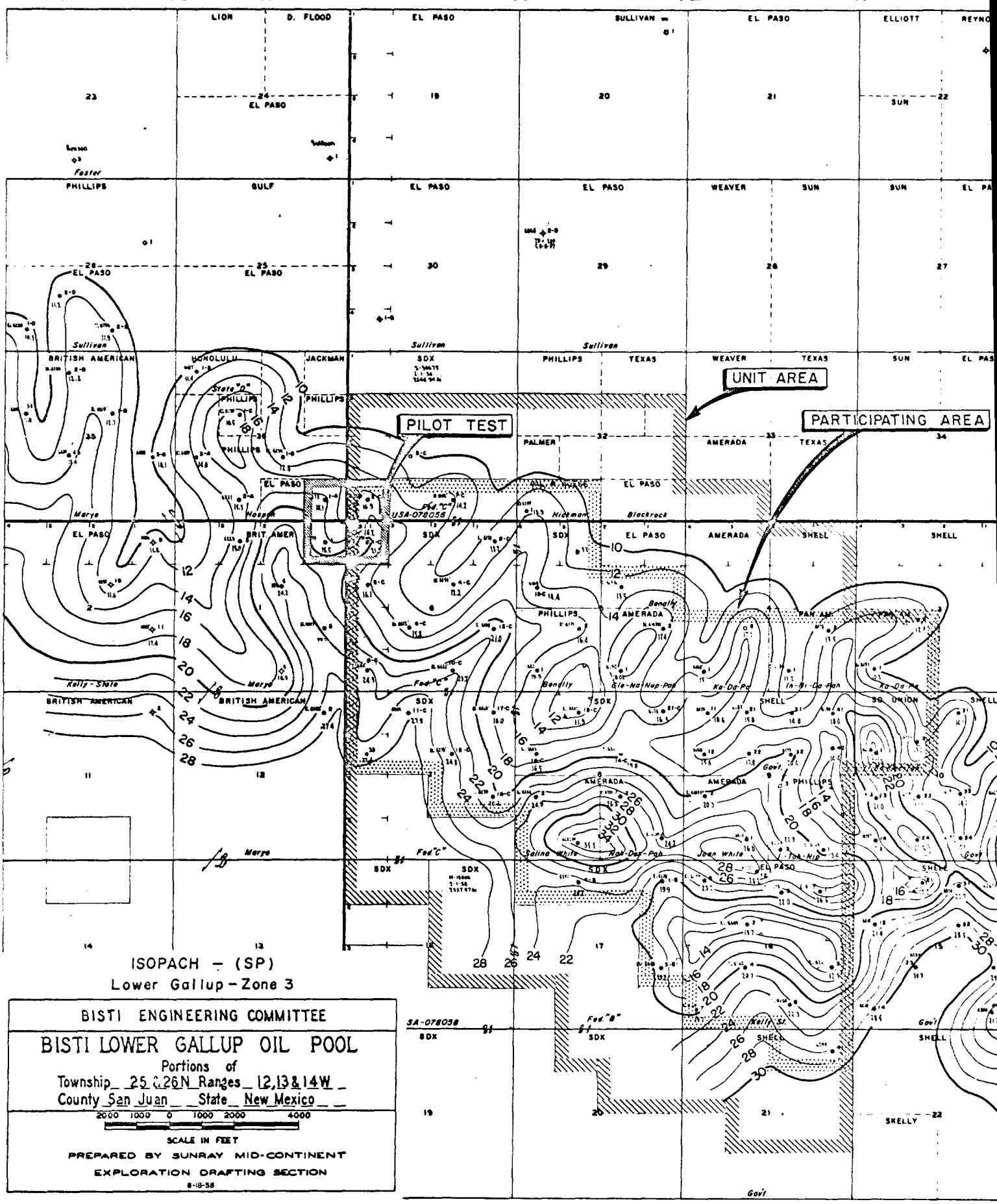
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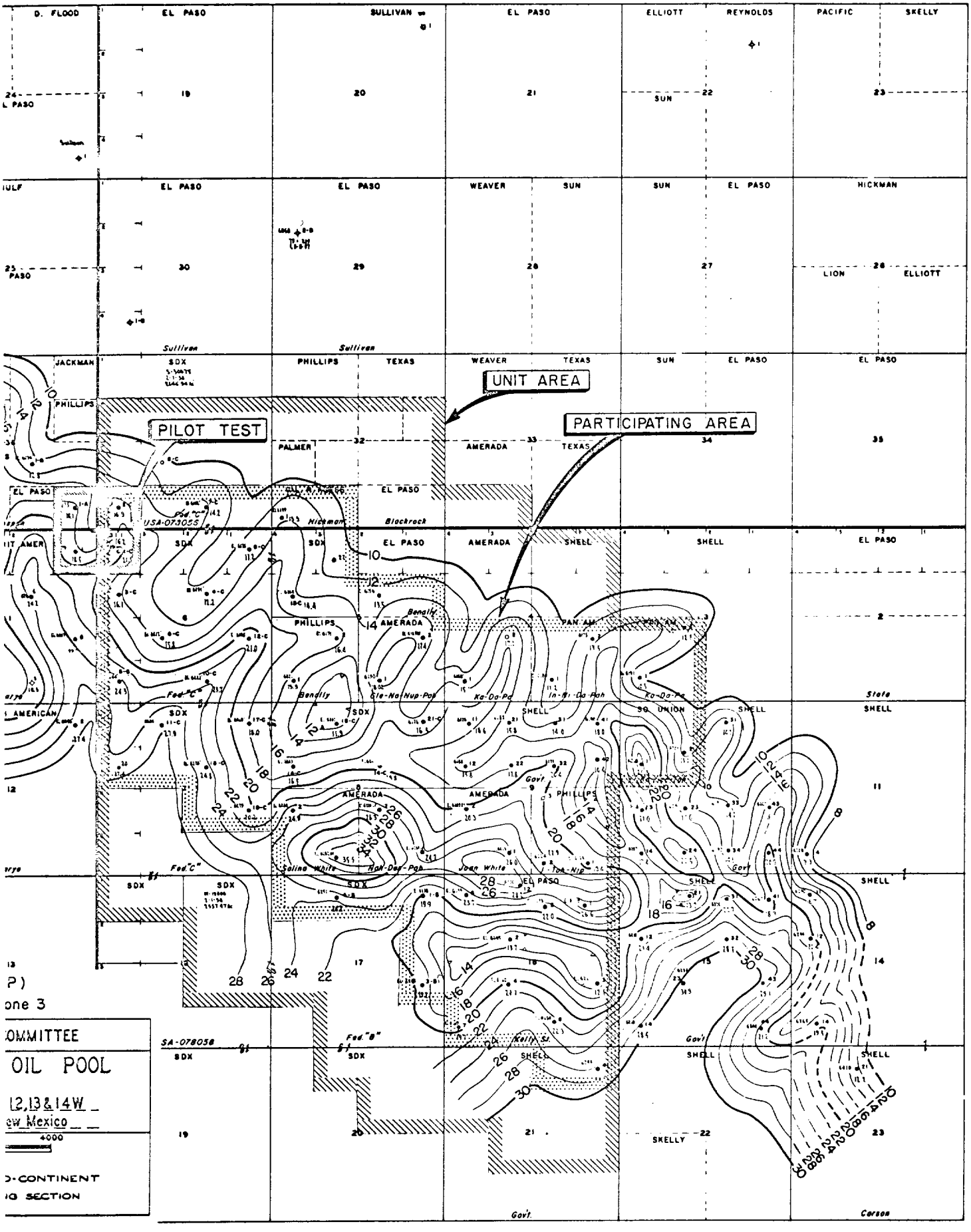
UNIT AREA
PILOT TEST
PARTICIPATING AREA
ISOPACH - (SP)
Lower Gallup - Zone 3
BISTI ENGINEERING COMMITTEE
BISTI LOWER GALLUP OIL POOL
Portions of
Township 25 & 26N Ranges 12,13 & 14W
County San Juan State New Mexico
2000 1000 0 1000 2000 4000
SCALE IN FEET
PREPARED BY SUNRAY MID-CONTINENT
EXPLORATION DRAFTING SECTION
8-18-58

EXHIBIT 12-C



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OMMITTEE
OIL POOL
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IG SECTION

C2-210A

OIL CONSERVATION COMMISSION
P. O. BOX 2088
SANTA FE, NEW MEXICO

1666

June 2, 1965

COPY

Sunray DX Oil Company
Tulsa 2, Oklahoma

Attention: Mr. Norbert E. Proctor

Re: Contraction of Unit
Area, Central Bisti
Lower Gallup Sand Unit,
San Juan County, New Mexico

Gentlemen:

This is to advise that the New Mexico Oil Conservation Commission has this date approved the contraction of the unit area by elimination of unitized lands not entitled to be in the participating area as of August 1, 1964, of the Central Bisti Lower Gallup Sand Unit, San Juan County, New Mexico, subject to like approval by the United States Geological Survey and the Commissioner of Public Lands of the State of New Mexico.

Very truly yours,

A. L. PORTER, Jr.,
Secretary-Director

ALP/JEK/og
cc: Commissioner of Public Lands
Santa Fe, New Mexico

United States Geological Survey
Roswell, New Mexico

Sunray DX Oil Company

Tulsa 2, Oklahoma

Legal Department

'65 JAN 11 AM 8 15

January 6, 1965

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

Re: Central Bisti Lower Gallup Sand Unit Area
San Juan County, New Mexico
AUTOMATIC CONTRACTION OF UNIT AREA

Gentlemen:

By letter dated September 21, 1964, copy of which is enclosed, this company submitted, pursuant to Section 2(e) of the Unit Agreement for the captioned Unit, a description of lands automatically eliminated from the said Unit. The same has been approved by the Commissioner of Public Lands, State of New Mexico, and by the Director, USGS, as evidenced by letters dated October 1 and November 16, 1964, respectively, copies of which are attached for your information.

Section 2(e) of the subject Unit Agreement appears to require concurrence by the New Mexico Oil Conservation Commission as well as the Commissioner of Public Lands and the USGS. Accordingly, if satisfactory, we would appreciate evidence of your approval of the contraction of the Unit Area as outlined in our letter of September 21, 1964.

Yours very truly,

Norbert E. Proctor
Attorney

NEP:jd
Encls.

Sunray DX Oil Company

'65 JAN 11 AM 8

September 21, 1964

The Oil and Gas Supervisor
U. S. Geological Survey
Department of the Interior
Drawer 1857
Roswell, New Mexico 88201
Attention: Mr. Carl C. Traywick

The Commissioner of Public Lands
State Land Office
Santa Fe, New Mexico

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

Re: Central Bisti Lower Gallup Sand Unit Area
San Juan County, New Mexico
AUTOMATIC CONTRACTION OF UNIT AREA

Gentlemen:

By virtue of Section 2(e) of the Unit Agreement for the Development and Operation of the Central Bisti Lower Gallup Sand Unit Area, all legal subdivisions of unitized lands not entitled to be in the participating area on August 1, 1964 were as of the following day automatically eliminated from the Unit Agreement and are no longer a part of the unit area. Accordingly, Sunray DX Oil Company, as Unit Operator, submits that the following described lands situated in San Juan County, New Mexico, comprise the area automatically eliminated from the captioned unit pursuant to said Section 2(e):

Description		Acreage
TOWNSHIP 26 NORTH, RANGE 12 WEST		
Section 31: Lots 2, 3 & SE/4 NW/4 & S/2 NE/4 and NE/4 SW/4 & N/2 SE/4	-	317.50 acres

Description			Acreage
TOWNSHIP 26 NORTH, RANGE 12 WEST (Contd.)			
Section 32:	S/2 N/2 and N/2 S/2 & S/2 SE/4	-	400.00 acres
Section 33:	S/2 SW/4	-	80.00 acres
TONWSHIP 25 NORTH, RANGE 12 WEST			
Section 4:	Lots 1, 2, 3, 4, & S/2 NW/4 & S/2 NE/4	-	319.76 acres
Section 5:	Lots 1 and 2	-	79.92 acres
Section 7:	Lots 3, 4 and E/2 SW/4 & S/2 SE/4	-	238.76 acres
Section 17:	S/2 NW/4 & SW/4 NE/4 & NW/4 SW/4 & E/2 SW/4 & W/2 SE/4 & SE/4 SE/4	-	360.00 acres
Section 18:	Lot 1 & NE/4 NW/4 & NE/4 & N/2 SE/4	-	319.45 acres
Section 20:	NE/4 & NE/4 NW/4	-	200.00 acres
Section 21:	NW/4 & S/2 NE/4 & NE/4 SW/4 & N/2 SE/4	-	360.00 acres
			2,675.39 acres

There is also transmitted herewith a plat showing (a) the boundaries of the unit area prior to contraction, (b) the acreage eliminated from the unit area, and (c) the boundaries of the

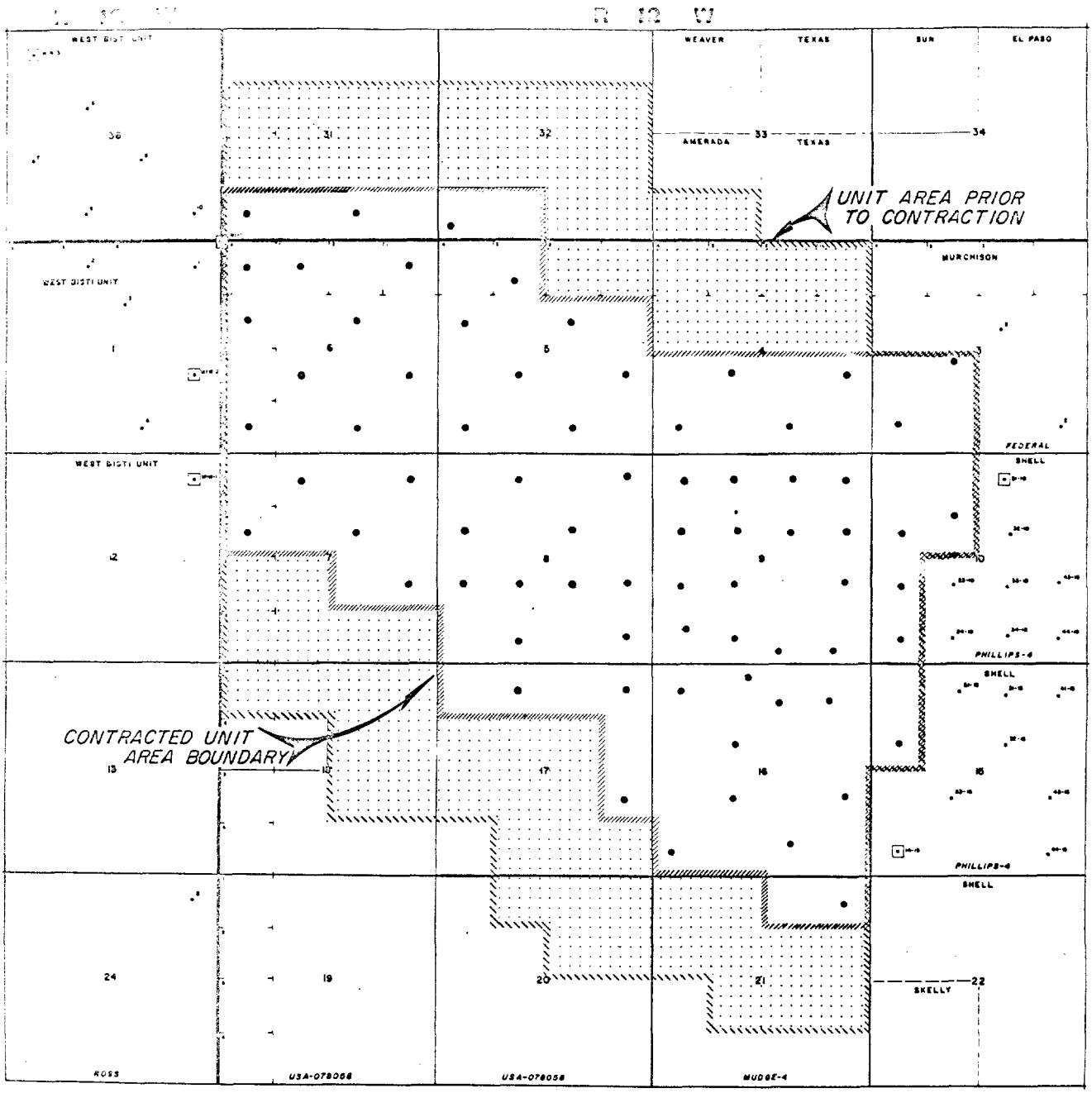
unit area as contracted.

Respectfully submitted,

SUNRAY DX OIL COMPANY

By Norbert E. Proctor
Norbert E. Proctor
Attorney

NEP:jd
Enclosure



LEGEND

- UNIT AREA PRIOR TO CONTRACTION
- CONTRACTED UNIT AREA BOUNDARY
- ACREAGE ELIMINATED FROM UNIT AREA

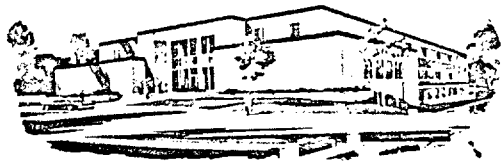
CENTRAL BISTI LOWER GALLUP SAND UNIT

San Juan County, New Mexico

0 1000 2000 3000 4000

SCALE IN FEET

State of New Mexico



Commissioner of Public Lands

E. S. JOHNNY WALKER
COMMISSIONER

P. O. BOX 791
SANTA FE, NEW MEXICO

October 1, 1964

Sunray DX Oil Company
Tulsa 2, Oklahoma

Re: Central Bisti Lower Gallup
Sand Unit
San Juan County, New Mexico

Attention: Mr. Norbert E. Proctor

Gentlemen:

The Commissioner of Public Lands approves the automatic elimination of certain acreage within the Central Bisti Lower Gallup Sand Unit, San Juan County, New Mexico, subject to like approval by the United States Geological Survey.

This acreage is described in your application dated September 21, 1964, entitled Automatic Contraction of Unit Area.

The elimination of this acreage is provided for by Section 2 (e) of the Central Bisti Unit Agreement and shall be effective as of August 1, 1964.

We are returning two approved Xerox copies of this Application.

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

Sunray DX Oil Company
P. O. Box 2039
Tulsa 2, Oklahoma

NOV 16 1964

Attention: Mr. Norbert B. Proctor

Gentlemen:

Your letter-notice of September 21, 1964, to the Oil and Gas Supervisor, Roswell, New Mexico, describes the automatic elimination of certain lands pursuant to Section 2(e) of the Central Bisti Lower Gallup Sand unit agreement, San Juan County, New Mexico. The lands eliminated are described as containing 2,675.39 acres which constitute all the lands not included in the 4,873.07 acre Lower Gallup participating area.

The following leases are affected by automatic elimination:

Leases Entirely Eliminated	Leases Partially Eliminated
New Mexico 036254-A	Santa Fe 078056
Santa Fe 078248-A	Santa Fe 078058
Navajo Allotted 14-20-603-322	Santa Fe 078065
Navajo Allotted 14-20-603-327	Navajo Allotted 14-20-603-1448

The Central Bisti Lower Gallup Sand unit was approved on June 26, 1959, effective July 1, 1959, and later expanded to include an additional 160 acres effective October 1, 1959. Pursuant to Section 2(e) of the unit agreement, all lands not within the Lower Gallup participating area are automatically eliminated effective August 1, 1964.

You have satisfactorily described the lands automatically eliminated from the unit agreement. You should notify all parties in interest after concurrence by the Commissioner of Public Lands of the State of New Mexico and the New Mexico Oil Conservation Commission.

Revised Exhibits "A" and "B" should be filed with the Supervisor to reflect the changed unit area, retaining the existing tract numbers but showing current ownership.

Sincerely yours,

Acting Director

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

Sunray DX Oil Company
P. O. Box 2039
Tulsa 2, Oklahoma

NOV 16 1964

Attention: Mr. Norbert B. Proctor

Gentlemen:

Your letter-notice of September 21, 1964, to the Oil and Gas Supervisor, Roswell, New Mexico, describes the automatic elimination of certain lands pursuant to Section 2(e) of the Central Bisti Lower Gallup Sand unit agreement, San Juan County, New Mexico. The lands eliminated are described as containing 2,675.39 acres which constitute all the lands not included in the 4,673.07 acre Lower Gallup participating area.

The following leases are affected by automatic elimination:

Leases Entirely Eliminated	Leases Partially Eliminated
New Mexico 036254-A	Santa Fe 078056
Santa Fe 078340-A	Santa Fe 078058
Navajo Allotted 14-20-603-322	Santa Fe 078065
Navajo Allotted 14-20-603-327	Navajo Allotted 14-20-603-1448

The Central Bisti Lower Gallup Sand unit was approved on June 26, 1959, effective July 1, 1959, and later expanded to include an additional 160 acres effective October 1, 1959. Pursuant to Section 2(e) of the unit agreement, all lands not within the Lower Gallup participating area are automatically eliminated effective August 1, 1964.

You have satisfactorily described the lands automatically eliminated from the unit agreement. You should notify all parties in interest after concurrence by the Commissioner of Public Lands of the State of New Mexico and the New Mexico Oil Conservation Commission.

Revised Exhibits "A" and "B" should be filed with the Supervisor to reflect the changed unit area, retaining the existing tract numbers but showing current ownership.

Sincerely yours,

Acting Director

cc:
Roswell (2) (w/2cys of Notice)
BLM, Santa Fe (w/cy of Notice)
Com. of Pub. Lands (ltr. only)
Nav. Ind. Ag., Window Rock (w/cy of Notice)
Area Director, Gallup (w/cy of Notice)
NMOCC, Santa Fe (ltr. only)

JWSutherland:cn:10-9-64

CCC

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

Sunray MX Oil Company
P. O. Box 2039
Tulsa 2, Oklahoma

Attention: Mr. Herbert B. Proctor

Gentlemen:

Our letter of November 16, 1956, erroneously listed Federal lease New Mexico 036254-A as being eliminated from the Central Blesi Lower Gallup Sand unit area. Federal lease New Mexico 036254 should have been listed as entirely eliminated from the unit area and lease New Mexico 036254-A remains committed to the unit, inasmuch as such lease was within the Lower Gallup participating area as of the effective date of automatic elimination.

Sincerely yours,

Acting Director

cc:

Roswell (2)
Com. of Pub. Lands
BLM, Santa Fe
Navy. Ind. Ag., Window Rock
Area Director, Gallup
NMOCC, Santa Fe ✓

Sunray DX Oil Company

8th Floor 1st National Building Oklahoma City 2, Oklahoma

Central Division

V. L. Smith
Production Manager

January 27, 1965

The Oil and Gas Supervisor
United States Geological Survey
Department of the Interior
Drawer 1857
Roswell, New Mexico 88201

Attention: Carl C. Traywick

Re: PA-1
Central Bisti Lower Gallup Sand Unit Area
San Juan County, New Mexico
Automatic Contraction of Unit Area

Gentlemen:

Attached are 4 copies each of the Revised Exhibits "A" and "B" for the contracted Central Bisti Lower Gallup Sand Unit, San Juan County, New Mexico. These Exhibits are furnished in accordance with the request in the last paragraph of Mr. Baker's letter of November 16, 1964. Prior to the mailing of these Exhibits to you, each working interest owner in the unit has been provided copies for approval.

Yours truly,

SUNRAY DX OIL COMPANY

A. W. Wadman
A. W. Wadman
Joint Operations Coordinator

AWW/kb
Attachments
cc: N. E. Proctor
F. S. Goddard
Lease Records w/att
All Working Interest Owners

Commissioner of Public Lands w/att
State Land Office
Santa Fe, New Mexico

New Mexico Oil Conservation Commission w/att
State Land Office
Santa Fe, New Mexico

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Drawer 1857
Roswell, New Mexico 88201

March 10, 1965

Sunray DX Oil Company
9th Floor, First National Bank Bldg.
Oklahoma City 2, Oklahoma

Attention: Mr. A. G. Wadman

Gentlemen:

Your letter of March 4, 1965, transmitting four copies of revised Exhibits "A" and "B" to the Central Dist. Lower Gallup Sand Unit, San Juan County, New Mexico.

Copies of the revised exhibits are being distributed to the appropriate Federal offices to be filed with the unit records.

Sincerely yours,

(ORIG. SGD.) JOHN A. ANDERSON

JOHN A. ANDERSON
Regional Oil & Gas Supervisor

cc:
Washington (w/cy Ex. A & B)
NMOCC - Santa Fe (w/cy Ex. A & B)
Farmington (w/cy Ex. A & B)
Nav. Ind. Ag., Window Rock (w/cy Ex. A & B)
Area Director, Gallup (w/cy Ex. A & B)
Com. of Pub. Lands, Santa Fe (w/ltr. only)
NMOCC - Santa Fe (w/ltr. only)

ILLEGIBLE