CASE 2447: Application of HUMBLE for approval of pressure maintenance project in CHA CHA-GALLUP.

-ase 110.

2447

-lication, Transcript,
-ll Exhibits, Etc.

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

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

CASE No. 2447
Order No. R-2154

APPLICATION OF HUMBLE OIL & REFINING
COMPANY FOR APPROVAL OF THE CHA CHA-
GALLUP PRESSURE MAINTENANCE PROJECT,
SAN JUAN COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 o'clock a.m. on December 11, 1961, at Santa Fe, New Mexico, before Elvis A. Utz, Examiner duly appointed by the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission," in accordance with Rule 1214 of the Commission Rules and Regulations.

NOW, on this 3rd day of January, 1962, the Commission, a quorum being present, having considered the application, the evidence adduced, and the recommendations of the Examiner, Elvis A. Utz, and being fully advised in the premises,

FINDS:

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

(2) That the applicant, Humble Oil & Refining Company, proposes to institute a pressure maintenance project in the Cha Cha-Gallup Oil Pool, said project area to comprise Navajo Indian Reservation Lands constituting portions of Sections 15, 16, 17, 18, 19, 23, 24, 28, and 34, and all of Sections 20, 21, 22, 25, 26, 27, 35, and 36, all in Township 29 North, Range 14 West, NMPM, San Juan County, New Mexico. Initial injection into the Gallup formation would be through certain wells located in Sections 21, 26, 27, and 36 of the same Township.

(3) That the applicant proposes that an administrative procedure be established whereby said pressure maintenance project may be expanded for good cause shown, and whereby additional wells in the project area may be converted to water injection.

(4) That Special Rules and Regulations for the operation of the Humble Oil & Refining Company Cha Cha-Gallup Pressure Maintenance Project should be promulgated and, for operational

convenience, such rules should provide certain flexibility in authorizing the production of the project allowable from any well or wells in the project in any proportion, provided that no well in the project area which directly or diagonally offsets a well outside the project area producing from the same common source of supply should be allowed to produce in excess of top unit allowable for the Cha Cha-Gallup Oil Pool until such time as the well has experienced a substantial response from water injection. When such a response has occurred, the well should be permitted to produce up to two times top unit allowable for the Cha Cha-Gallup Oil Pool. Production of such well at a higher rate should be authorized only after notice and hearing.

IT IS THEREFORE ORDERED:

(1) That the applicant is hereby authorized to institute a Pressure Maintenance Project in the Cha Cha-Gallup Oil Pool, San Juan County, New Mexico, by the injection of water into the Gallup formation through the following-described wells in Township 29 North, Range 14 West:

Pan American-Navajo "E" No. 3, Unit K, Section 21;

Pan American-Navajo "E" No. 2, Unit I, Section 21;

El Paso Natural Gas Products-Ojo Amarillo No. 2, Unit C, Section 27;

Humble-Navajo "L" No. 1, Unit E, Section 26;

Humble-Navajo "L" No. 4, Unit O, Section 26;

Humble-Navajo "L" No. 5, Unit E, Section 36.

(2) That Special Rules and Regulations governing the operation of The Humble Oil & Refining Company Cha Cha-Gallup Pressure Maintenance Project, San Juan County, New Mexico, are hereby promulgated as follows, effective January 1, 1962:

SPECIAL RULES AND REGULATIONS
FOR THE HUMBLE OIL & REFINING COMPANY
CHA CHA-GALLUP PRESSURE MAINTENANCE PROJECT

RULE 1. The project area of The Humble Oil & Refining Company Cha Cha-Gallup Pressure Maintenance Project, San Juan County, New Mexico, hereinafter referred to as the Project, shall comprise that area described as follows:

TOWNSHIP 29 NORTH, RANGE 14 WEST, NMPM
Section 15: That portion of the S/2 lying South of the mid-channel of the San Juan River

Section 16: All that portion lying South of the mid-channel of the San Juan River
Section 17: All that portion lying South of the mid-channel of the San Juan River
Section 18: All that portion lying South of the mid-channel of the San Juan River
Section 19: NE/4
Section 20: All
Section 21: All
Section 22: All
Section 23: S/2 and NW/4
Section 24: SW/4 SE/4 and S/2 SW/4
Section 25: All
Section 26: All
Section 27: All
Section 28: E/2 and NW/4
Section 34: N/2
Section 35: All
Section 36: All

RULE 2. The allowable for the Project shall be the sum of the allowables of the several wells within the project area, including those wells which are shut-in, curtailed, or used as injection wells. Allowables for all wells shall be determined in a manner hereinafter prescribed.

RULE 3. Allowables for injection wells may be transferred to producing wells within the project area, as may the allowables for producing wells which, in the interest of more efficient operation of the Project, are shut-in or curtailed because of high gas-oil ratio or are shut-in for any of the following reasons: pressure regulation, control of pattern or sweep efficiencies, or to observe changes in pressures or changes in characteristics of reservoir liquids or progress of sweep.

RULE 4. The allowable assigned to any well which is shut-in or which is curtailed in accordance with the provisions of Rule 3, which allowable is to be transferred to any well or wells in the project area for production, shall in no event be greater than its ability to produce during the test prescribed by Rule 6, below, or greater than the current top unit allowable for the pool during the month of transfer, whichever is less.

RULE 5. The allowable assigned to any injection well on an 80-acre proration unit shall be top unit allowable for the Cha Cha-Gallup Oil Pool.

RULE 6. The allowable assigned to any well which is shut-in or curtailed in accordance with Rule 3, shall be determined by a

24-hour test at a stabilized rate of production, which shall be the final 24-hour period of a 72-hour test throughout which the well should be produced in the same manner and at a constant rate. The daily tolerance limitation set forth in Commission Rule 502 I (a) and the limiting gas-oil ratio (2,000 to 1) for the Cha Cha-Gallup Oil Pool shall be waived during such tests. The project operator shall notify all operators offsetting the well, as well as the Commission, of the exact time such tests are to be conducted. Tests may be witnessed by representatives of the offsetting operators and the Commission, if they so desire.

RULE 7. The allowable assigned to each producing well in the Project shall be equal to the well's ability to produce or to top unit allowable for the Cha Cha-Gallup Oil Pool, whichever is less, provided that any producing well in the project area which directly or diagonally offsets a well outside the project area producing from the same common source of supply shall not produce in excess of top unit allowable for the pool until such time as the well receives a substantial response to water injection. When such a response has occurred, the well shall be permitted to produce up to two times top unit allowable for the pool. Production of such well at a higher rate shall be authorized only after notice and hearing. Each producing well shall be subject to the limiting gas-oil ratio (2,000 to 1) for the Cha Cha-Gallup Oil Pool, except that any well or wells within the project area producing with a gas-oil ratio in excess of 2,000 cubic feet of gas per barrel of oil may be produced on a "net" gas-oil ratio basis, which net gas-oil ratio shall be determined by applying credit for daily average gas injected, if any, into the Cha Cha-Gallup Oil Pool within the project area to such high gas-oil ratio well. The daily adjusted oil allowable for any well receiving gas injection credit shall be determined in accordance with the following formula:

$$A_{adj} = \frac{TUA \times F_a \times 2{,}000}{\frac{P_g - I_g}{P_o}}$$

where:

A_{adj} = the well's daily adjusted allowable

TUA = top unit allowable for the pool

F_a = the well's acreage factor

P_g = average daily volume of gas produced by the well during the preceding month, cubic feet

I_g = the well's allocated share of the daily average gas injected during the preceding month, cubic feet

P_o = average daily volume of oil produced by the well during the preceding month, barrels

In no event shall the amount of injected gas being credited to a well be such as to cause the net gas-oil ratio, $\frac{P_g - I_g}{P_o}$, to be less than 2,000 cubic feet of gas per barrel of oil produced.

RULE 8. Credit for daily average net water injected into the Cha Cha-Gallup Oil Pool through any injection well located within the project area may be converted to its gas equivalent and applied to any well producing with a gas-oil ratio in excess of two thousand cubic feet of gas per barrel of oil. Total credit for net water injected in the project area shall be the gas equivalent volume of the daily average net water injected during a one-month period. The daily average gas equivalent of net water injected shall be computed in accordance with the following formula:

$$E_g = (V_{w\ inj} - V_{w\ prod}) \times 5.61 \times \frac{P_a}{15.025} \times \frac{520^\circ}{T_r} \times \frac{1}{Z}$$

where:

E_g = Average daily gas equivalent of net water injected, cubic feet

$V_{w\ inj}$ = Average daily volume of water injected, barrels

$V_{w\ prod}$ = Average daily volume of water produced, barrels

5.61 = Cubic foot equivalent of one barrel of water

P_a = Average reservoir pressure at a datum of + 418 feet above sea level, psig + 12.00, as determined from most recent survey

15.025 = Pressure base, psi

520° = Temperature base of 60°F expressed as absolute temperature

T_r = Reservoir temperature of 158°F expressed as absolute temperature (618°R)

Z = Compressibility factor from analysis of Cha Cha-Gallup gas at average reservoir pressure, P_a, interpolated from compressibility tabulation below:

Pressure Psig	Z	Pressure Psig	Z	Pressure Psig	Z
0	.986	500	.912	1000	.869
50	.976	550	.906	1050	.865
100	.963	600	.902	1100	.860
150	.952	650	.899	1150	.857
200	.943	700	.895	1200	.853
250	.935	750	.891	1250	.849
300	.930	800	.886	1300	.845
350	.927	850	.882	1350	.842
400	.923	900	.877	1400	.838
450	.918	950	.873		

RULE 9. Each month the project operator shall, within three days after the normal unit allowable for Northwest New Mexico has been established, submit to the Commission a Pressure Maintenance Project Operator's Report, on a form prescribed by the Commission, outlining thereon the data required, and requesting allowables for each of the several wells in the Project as well as the total Project allowable. The aforesaid Pressure Maintenance Project Operator's Report shall be filed in lieu of Form C-120 for the Project.

RULE 10. The Commission shall, upon review of the report and after any adjustments deemed necessary, calculate the allowable for each well in the Project for the next succeeding month in accordance with these rules. The sum of the allowables so calculated shall be assigned to the Project and may be produced from the wells in the Project in any proportion except that no well in the Project which directly or diagonally offsets a well outside the Project producing from the same common source of supply shall produce in excess of two times top unit allowable for the pool.

RULE 11. The conversion of producing wells to injection, the drilling of additional wells for injection, and expansion of the project area shall be accomplished only after approval of the same by the Secretary-Director of the Commission. To obtain such approval, the Project operator shall file proper application with the Commission, which application, if it seeks authorization to convert additional wells to injection or to drill additional injection wells shall include the following:

(1) A plat showing the location of proposed injection well, all wells within the project area, and offset operators, locating wells which offset the project area.

(2) A schematic drawing of the proposed injection well which fully describes the casing, tubing, perforated interval, and depth showing that the injection of gas or water will be confined to the Gallup formation.

(3) A letter stating that all offset operators to the proposed injection well have been furnished a complete copy of the application and the date of notification.

The Secretary-Director may approve the proposed injection well if, within 20 days after receiving the application, no objection to the proposal is received. The Secretary-Director may grant immediate approval, provided waivers of objection are received from all offset operators.

Expansion of the project area may be approved by the Secretary-Director of the Commission administratively when good cause is shown therefor.

(3) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

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

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

EDWIN L. MECHEM, Chairman

E. S. WALKER, Member

A. L. PORTER, Jr., Member & Secretary

esr/

Case 2447
Heard. 12-11-61
Rec. 12-18-61

1. Recommend that case be approved as follows:

2. Issue Rules as attached.

3. The administrative approval for the Navajo "C" & "J" & "L" should be covered in Rule 11. However if an additional requirement for a "lease line" agreements seems necessary please add.

4. Unit should be approved as requested because of the difficulty in unitizing Indian acreage with other acreage.

Elvis A. Utz

GOVERNOR
EDWIN L. MECHEM
CHAIRMAN

State of New Mexico
Oil Conservation Commission

LAND COMMISSIONER
E. S. JOHNNY WALKER
MEMBER

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

P. O. BOX 871
SANTA FE

January 3, 1962

Re: CASE NO. 2447
ORDER NO. R-2154
APPLICANT:
HUMBLE OIL & REFINING COMPANY

Mr. Howard Bratton
Hervey, Dow & Hinkle
P. O. Box 10
Roswell, New Mexico

Dear Sir:

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

Very truly yours,

A. L. Porter, Jr.

A. L. PORTER, Jr.
Secretary-Director

ir/

Carbon copy of order also sent to:

Hobbs OCC x
Artesia OCC
Aztec OCC x

OTHER Mr. George Verity
Mr. John Mason

Mr. Guy Buell

CLASS OF SERVICE

This is a fast message unless its deferred character is indicated by the proper symbol.

WESTERN UNION TELEGRAM

W. P. MARSHALL, PRESIDENT

1961 DEC 18 PM 2:45

SYMBOLS

DL=Day Letter

NL=Night Letter

LT=International Letter Telegram

The filing time shown in the date line on domestic telegrams is LOCAL TIME at point of origin. Time of receipt is LOCAL TIME at point of destination

LA116

L DVA259 PD=FAX DENVER COLO 18 226P MST=

=ELVIS A UTZ,OIL CONSERVATION COMM OF THE STATE
OF NEW MEXICO= SANTAFE NMEX=

AS PER YOUR VERBAL REQUEST ON THIS DATE, THIS IS TO
ADVISE THAT THE DATUM USED FOR THE NORTHWEST CHA CHA
UNIT AREA IS 418 FEET ABOVE SEA LVEL=
HUMBLE OIL & REF CO BY JAMES A KELLEY

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

ENCO

HUMBLE OIL & REFINING COMPANY

CENTRAL REGION

POST OFFICE BOX 120 • DENVER 1, COLORADO

DENVER AREA

RAYMOND D. SLOAN
AREA MANAGER

RICHARD S. HICKLIN
AREA EXPLORATION MANAGER

J. ROY DORROUGH
AREA PRODUCTION MANAGER

G. T. PHIPPS
AREA MARKETING MANAGER

December 14, 1961

Mr. Elvis A. Utz
The Oil Conservation Commission
of the State of New Mexico
Santa Fe, New Mexico

Dear Sir:

As per your verbal request, the following data is transmitted to you:

1) The average reservoir pressure at the mid-point of the pay zones of the Northwest Cha Cha Gallup Unit in the project area was 1,230 psig based on the September, 1961 survey. Atmospheric pressure in this area is 12.00 psi.

2) The compressibility factors (z) based on analysis of the sample taken from the Humble Oil and Refining Company's Navajo "L" No. 3 for the liberated gas are as follows:

Pressure Psig	z	Pressure Psig	z	Pressure Psig	z
0	.986	500	.912	1000	.869
50	.976	550	.906	1050	.865
100	.963	600	.902	1100	.860
150	.952	650	.899	1150	.857
200	.943	700	.895	1200	.853
250	.935	750	.891	1250	.849
300	.930	800	.886	1300	.845
350	.927	850	.882	1350	.842
400	.923	900	.877	1400	.838
450	.918	950	.873		

If additional information is needed, please advise.

Yours very truly,

HUMBLE OIL & REFINING COMPANY

J. Roy Dorrough

By James A. Kelley /RLS
James A. Kelley

RLS/blr

GRANTHAM, SPANN AND SANCHEZ
ATTORNEYS AT LAW
914 BANK OF NEW MEXICO BUILDING
POST OFFICE BOX 1031
ALBUQUERQUE, NEW MEXICO

EVERETT M. GRANTHAM
CHARLES C. SPANN
MAURICE SANCHEZ

TELEPHONE
243-3525

December 8, 1961

Mr. A. L. Porter, Jr.
Director of N. M. Oil Conservation Commission
Santa Fe, New Mexico

Re: Case No. 2447
Application of Humble Oil & Refining Co.
for Approval of Pressure Maintenance
Project, Cha Cha Gallup Oil Pool, San Juan
County, N. M.

Dear Mr. Porter:

Please enter my appearance as local Attorney of record for El Paso Natural Gas Products Company in the above entitled and numbered cause, which is set for examiner hearing on Monday, December 11, 1961.

Mr. John Mason, Attorney, or some other representative of El Paso will be personally present at the hearing.

Very truly yours,

GRANTHAM, SPANN & SANCHEZ

BY: Charles C. Spann

CCS/s
cc. John Mason

HUMBLE OIL AND REFINING COMPANY

P. O. Box 3082
Durango, Colorado
November 22, 1961

New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Attention: Mr. D. S. Nutter

Dear Sir:

For your information, attached are 1 copies of a report titled "A Reservoir Study of the Proposed NW Cha Cha Unit, Cha Cha Gallup Field, San Juan County, New Mexico." This report summarizes the status of unit engineering studies as of May, 1961.

Three development wells (Humble's Nos. L-14 and L-15, and Pan American's No. H-15) have been drilled since the May study. Since these development wells do not alter the conclusions and recommendations of the May, 1961 study, the report has not been updated. However, it has been necessary to revise the "A" sand net pay isopach map and water flood injection wells to accomodate the new developments. A revised "A" sand isopach map is attached.

During the reservoir study it was estimated that water injection would begin October 1, 1961, however, it was not possible to complete unitization and initiate injection by that date. Design of the water injection system is now near completion and it is estimated that water injection will start during the first quarter of 1962.

Very truly yours,

H. J. Flatt
Chairman
NW Cha Cha Engineering
Committee

MRW/jal
Attach.

DISTRIBUTION

New Mexico Oil Conservation Commission (1)
Box 871
Santa Fe, New Mexico
Attention: Mr. D. S. Nutter

New Mexico Oil Conservation Commission (1)
1000 Rio Brazos Road
Aztec, New Mexico

United States Geological Survey (2)
P. O. Box 959
Farmington, New Mexico

United States Geological Survey (2)
P. O. Box 1809
Durango, Colorado

United States Geological Survey (2)
Drawer 1857
Roswell, New Mexico

El Paso Natural Gas Products Company (2)
P. O. Box 1161
El Paso, Texas
Attention: Mr. M. L. Ayers

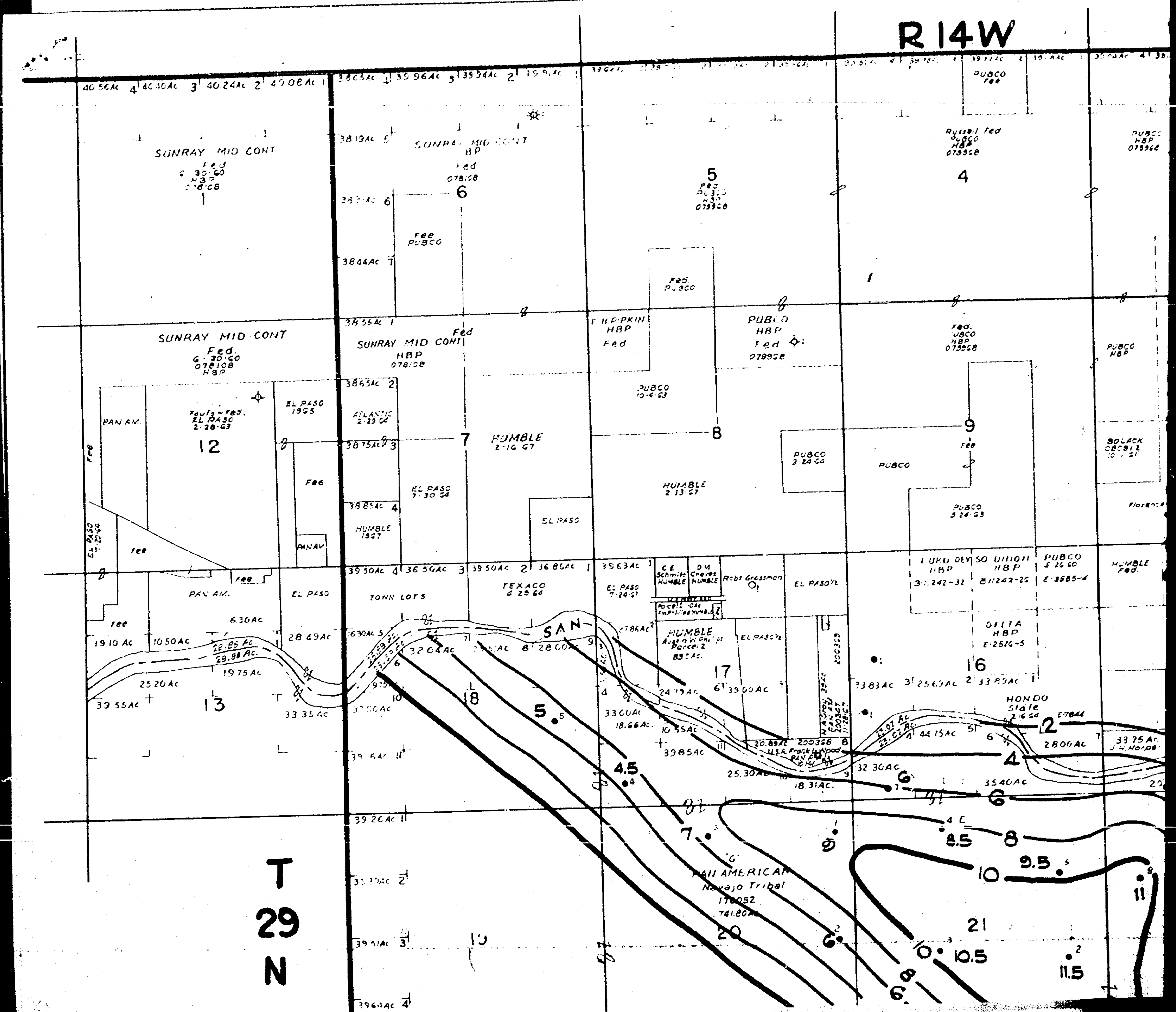
El Paso Natural Gas Products Company (1)
P. O. Box 1560
Farmington, New Mexico
Attention: Mr. E. N. Walsh

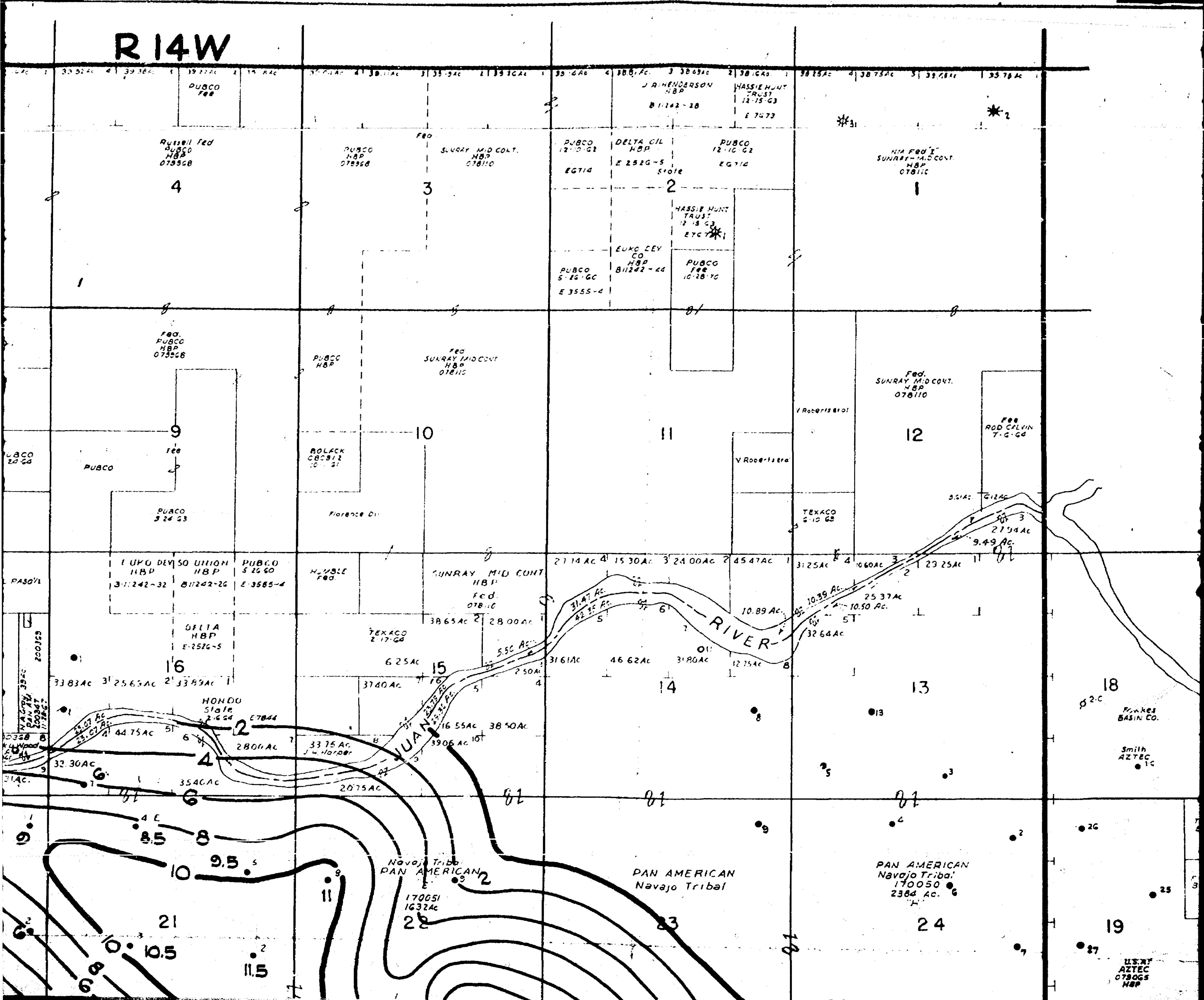
Pan American Petroleum Corporation (2)
P. O. Box 1410
Fort Worth 1, Texas
Attention: Mr. Bruce A. Landis, Jr.

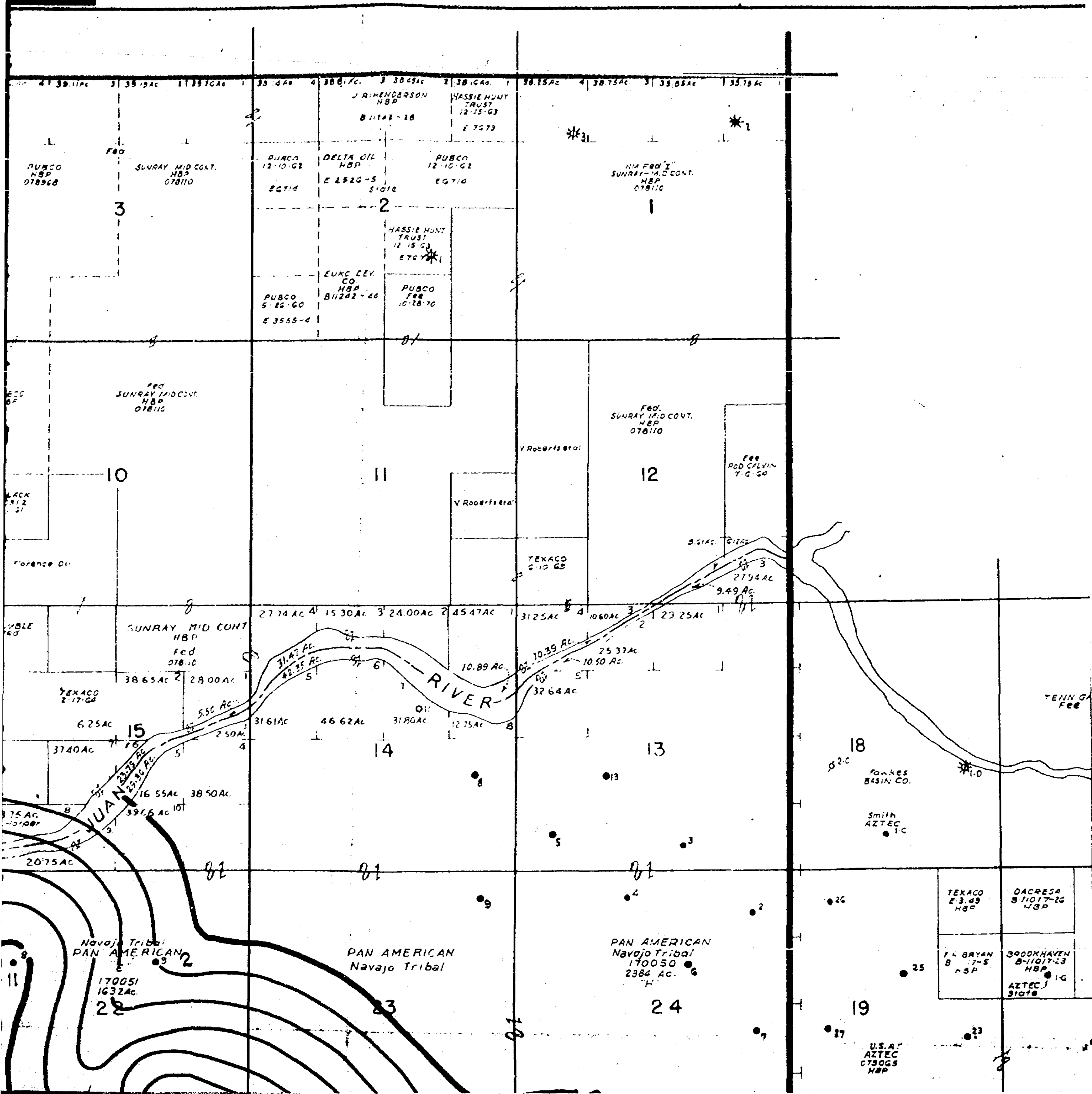
Pan American Petroleum Corporation (2)
P. O. Box 480
Farmington, New Mexico
Attention: Mr. Fred L. Nabors

Humble Oil and Refining Company (2)
P. O. Box 120
Denver 1, Colorado
Attention: Mr. J. Roy Dorrough

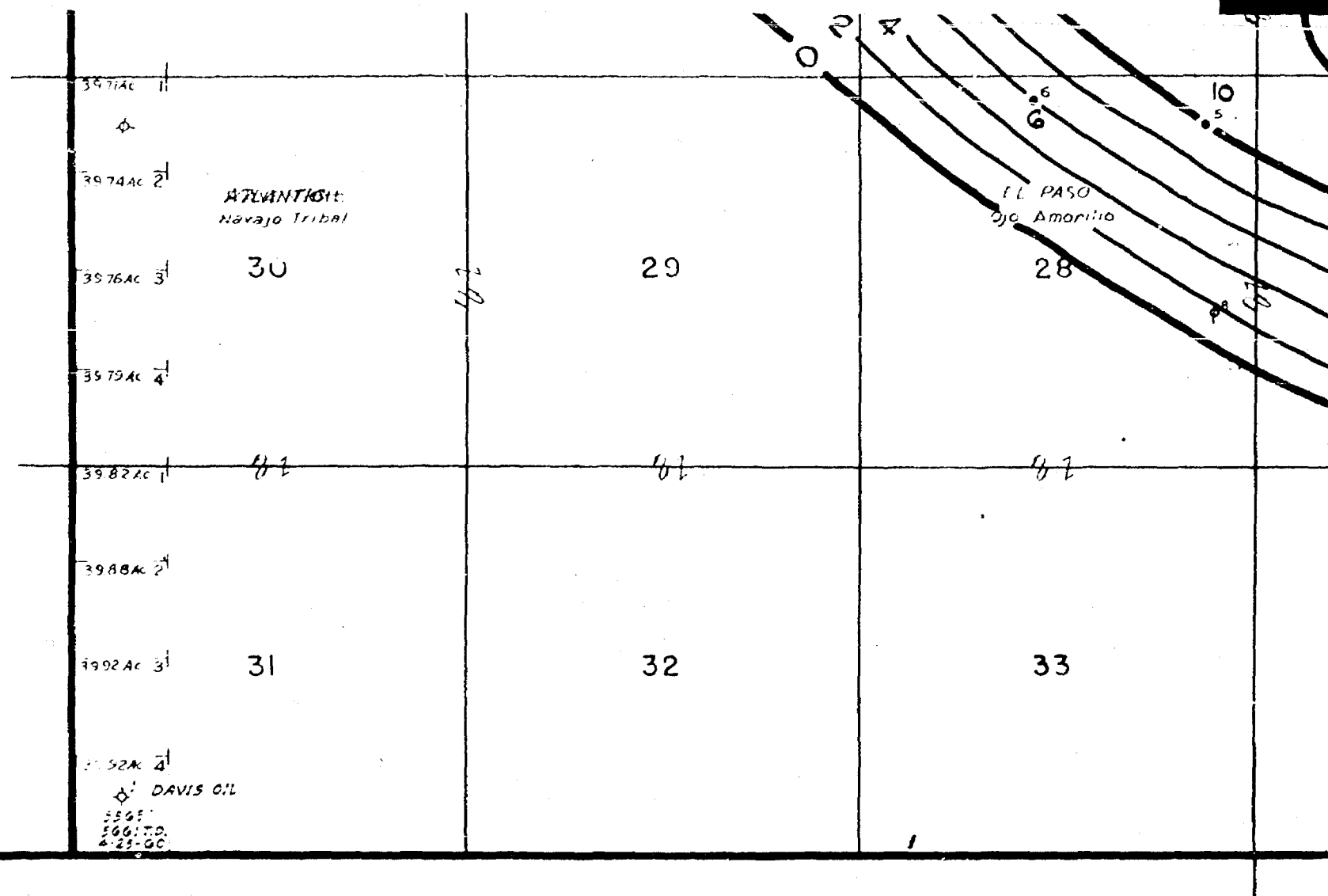
Humble Oil and Refining Company (2)
P. O. Box 3082
Durango, Colorado
Attention: Mr. B. M. Bradley

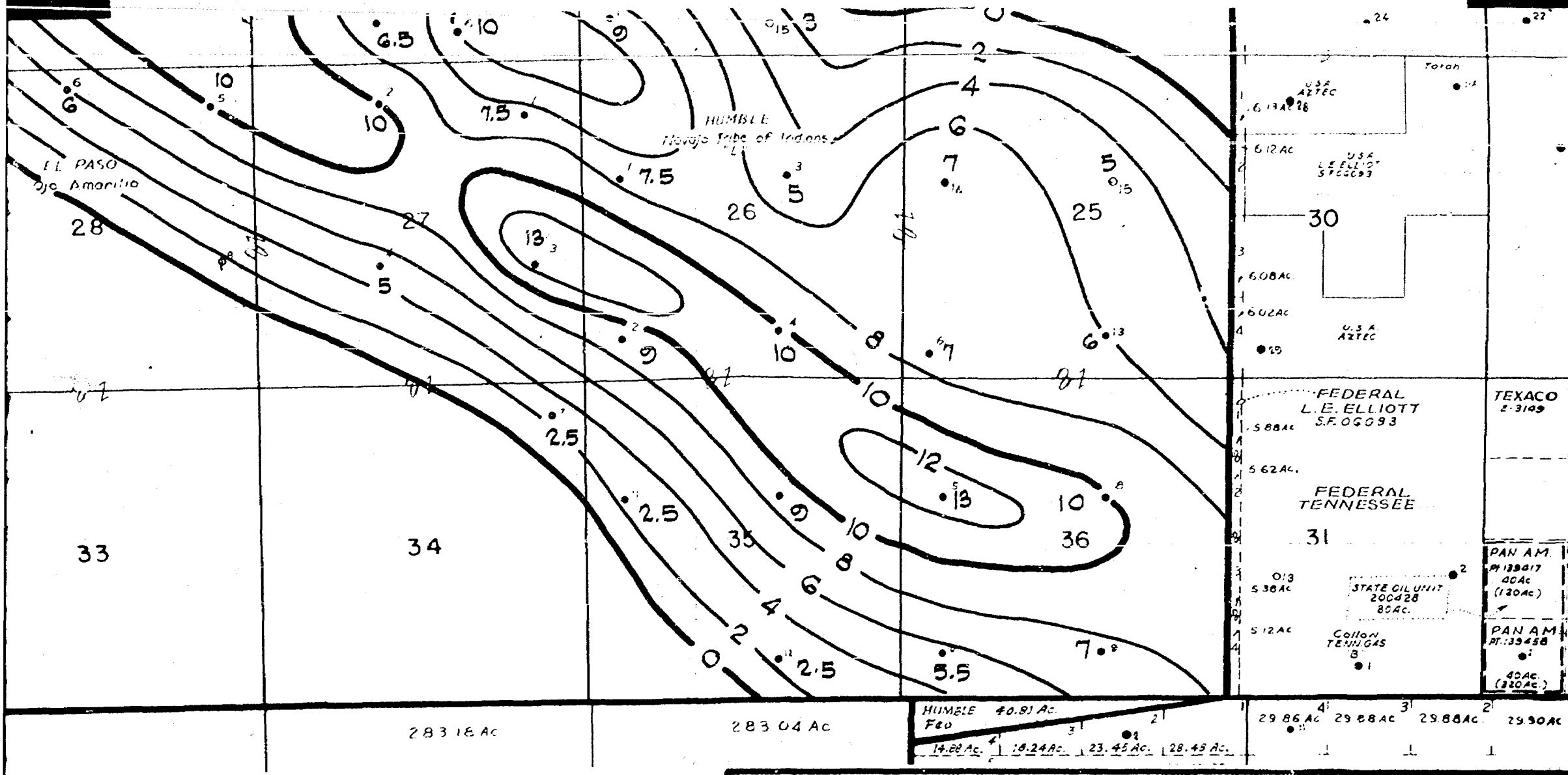

R14W
T
29
N
SUNRAY MID CONT
SUNRAY MID CONT BP
SUNRAY MID CONT HBP
Fed
Fee PUBCO
PUBCO HBP Fed 079968
Russell Fed PUBCO HBP 079968
PUBCO Fee
Fed. PUBCO
PAN AM.
EL PASO
HUMBLE
TEXACO
ATLANTIC
TOWN LOTS
Robt Grossman
PUBCO
BOLACK
HONDO State
DELTA HBP
SO UNION HBP
PAN AMERICAN Navajo Tribal
SAN
1
4
5
6
7
8
9
12
13
16
17
18
20
21
4.5
8.5
9.5
10
10.5
11
11.5


R 14W
PUBCO Fee
Russell Fed PUBCO HBP 079568
4
PUBCO HBP 079568
SUNRAY MID CONT. HBP 078110
3
J. R. HENDERSON HBP
HASSIE HUNT TRUST
PUBCO
DELTA OIL HBP
State
2
HASSIE HUNT TRUST
EUKO DEV CO HBP
PUBCO Fee
NM Fed "I" SUNRAY-MID CONT. HBP 078110
1
Fed. PUBCO HBP 079568
PUBCO HBP
Fed SUNRAY MID CONT HBP 078110
9
10
11
Fed. SUNRAY MID CONT. HBP 078110
12
Fee ROD CALVIN
PUBCO
BOLACK
V Roberts et al
TEXACO
Florence Oil
SO UNION HBP
PUBCO
HUMBLE Fed.
SUNRAY MID CONT HBP Fed. 078110
DELTA HBP
TEXACO
16
15
14
13
18
RIVER
JUAN
HONDO State
Fowkes BASIN CO.
Smith AZTEC
Navajo Tribe PAN AMERICAN
170051 1632Ac
PAN AMERICAN Navajo Tribal
PAN AMERICAN Navajo Tribal 170050 2384 Ac.
21
22
23
24
19
U.S.A. AZTEC 078065 HBP
2
4
6
8
8.5
9.5
10
10.5
11
11.5



J. A. HENDERSON HBP
HASSIE HUNT TRUST 12-15-63
PUBCO HBP 078968
SUNRAY MID CONT. HBP 078110
PUBCO 12-10-62
DELTA OIL HBP
PUBCO 12-10-62
3
2
1
HASSIE HUNT TRUST 12-15-63
EUKC DEV. CO. HBP
PUBCO 5-26-60
PUBCO Fee 10-28-70
Fed SUNRAY MID CONT HBP 078110
V Roberts et al
Fed. SUNRAY MID CONT. HBP 078110
Fee ROD CALVIN 7-6-64
10
11
12
V Roberts et al
TEXACO
SUNRAY MID CONT HBP Fed 078110
TEXACO 2-17-64
RIVER
JUAN
15
14
13
18
Fowkes BASIN CO.
Smith AZTEC
TENN GAS Fee
TEXACO E-3-69 HBP
DACRESA
F. BRYAN
BROOKHAVEN HBP
AZTEC State
Navajo Tribal PAN AMERICAN
170051 1632Ac.
22
PAN AMERICAN Navajo Tribal
23
PAN AMERICAN Navajo Tribal 170050 2384 Ac.
24
19
U.S.A. AZTEC 079065 HBP


3971Ac 1
3974Ac 2
3976Ac 3
3979Ac 4
3982Ac 1
3988Ac 2
3992Ac 3
3952Ac 4
ATLANTIC
Navajo Tribal
30
29
28
31
32
33
DAVIS OIL
5505'
5661' T.D.
4-29-60
EL PASO
Ojo Amarillo
0
2
4
6
6
10
5



PAN AMERICAN PETROLEUM CORPORATION

Farmington, New Mexico

NORTHWEST CHA CHA UNIT AREA

NET PAY ISOPACH
GALLUP "A" SAND

9-13-61

PAN AMERICAN PETROLEUM CORPORATION

Farmington, New Mexico

NORTHWEST CHA CHA UNIT AREA

NET PAY ISOPACH
GALLUP "A" SAND

9-13-61

BEFORE THE NEW MEXICO OIL CONSERVATION COMMISSION

RE: IN THE MATTER OF THE APPLICATION OF HUMBLE OIL & REFINING COMPANY FOR APPROVAL OF A PRESSURE MAINTENANCE PROJECT IN THE CHA CHA-GALLUP OIL POOL, SAN JUAN COUNTY, NEW MEXICO.

Case No. 244

ENTRY OF APPEARANCE

Comes now L. C. WHITE of GILBERT, WHITE AND GILBERT, Santa Fe, New Mexico, and hereby enters his formal appearance in the above entitled matter as resident counsel for Aztec Oil & Gas Company.

L. C. WHITE

GILBERT, WHITE AND GILBERT
ATTORNEYS AT LAW
SANTA FE, NEW MEXICO

Case 2497

J. M. HERVEY 1874-1953
HIRAM M. DOW
CLARENCE E. HINKLE
W. E. BONDURANT, JR.
GEORGE H. HUNKER, JR.
HOWARD C. BRATTON
S. B. CHRISTY IV
LEWIS C. COX, JR.
PAUL W. EATON, JR.
CONRAD E. COFFIELD
HAROLD L. HENSLEY, JR.

LAW OFFICES
HERVEY, DOW & HINKLE
HINKLE BUILDING
ROSWELL, NEW MEXICO

TELEPHONE MAIN 2-6510
POST OFFICE BOX 10

November 16, 1961

Mr. A. L. Porter, Jr.
Secretary-Director
New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Dear Mr. Porter:

On behalf of Humble Oil & Refining Company, we hand you herewith in triplicate, an Application for a pressure maintenance project in the Cha Cha Gallup Oil Pool, San Juan County, New Mexico. Attached to the application are three copies of Exhibit "A", which is the plat, three copies of Exhibit "C", which is the data on the injection wells, and one copy of Exhibit "B", which are the logs on the injection wells. If additional copies of the logs are needed we will make them available.

It is my understanding that Mr. Knodell has conferred with your office and made arrangements to have this case advertised for the November 29th Examiner Hearing. If you need anything further prior to that date, please let us hear from you.

Yours very truly,

HERVEY, DOW & HINKLE

Howard C. Bratton

HCB:lm

Enclosures

cc: John Knodell

Dockets Mailed 11-16-61

BEFORE THE OIL CONSERVATION COMMISSION

OF THE STATE OF NEW MEXICO

APPLICATION OF HUMBLE OIL & REFINING COMPANY FOR AN ORDER AUTHORIZING THE INJECTION OF WATER FOR PRESSURE MAINTENANCE AND SECONDARY RECOVERY PURPOSES INTO THE GALLUP-SANDSTONE FORMATION UNDERLYING APPLICANT'S NAVAJO "L" LEASE, PAN AMERICAN PETROLEUM CORPORATION'S NAVAJO "E", "G" AND "H" LEASES AND EL PASO NATURAL GAS PRODUCTS CORPORATION'S OJO AMARILLO LEASE IN THE CHA CHA-GALLUP OIL POOL, SAN JUAN COUNTY, NEW MEXICO PURSUANT TO RULE 701 OF THE RULES AND REGULATIONS OF THE NEW MEXICO OIL CONSERVATION COMMISSION AND FOR THE PROMULGATION OF SPECIAL RULES GOVERNING THE OPERATION OF SAID PROJECT

CASE NUMBER 2447

TO THE HONORABLE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO:

Now comes HUMBLE OIL & REFINING COMPANY, a Delaware Corporation authorized to do business in the State of New Mexico, as Unit Operator of the Northwest Cha Cha-Gallup Unit authorized and designated in that certain Unit Operating Agreement executed or to be executed by and between the operators of the Navajo leases identified herein, and hereby makes application to the New Mexico Oil Conservation Commission for an order authorizing the injection of water for pressure maintenance and secondary recovery purposes into the Gallup-Sandstone formation underlying the Navajo "L" lease of applicant, the Navajo "E", "G" and "H" leases of Pan American Petroleum Corporation and the Ojo Amarillo lease of El Paso Natural Gas Products Corporation which said leases embrace lands within the Cha Cha-Gallup Oil Pool, San Juan County, New Mexico, pursuant to Rule 701 of the Commission, and for the promulgation of special rules governing the operation of said project, and in support thereof respectfully shows:

1. That there is attached hereto, made a part hereof, and

for purposes of identification marked Exhibit "A", a plat showing the Navajo "L" lease of applicant, the Navajo "E", "G" and "H" leases of Pan American Petroleum Corporation and the Ojo Amarillo lease of El Paso Natural Gas Products Corporation embracing lands within the Cha Cha-Gallup Oil Pool, together with the location of all wells drilled thereon and all wells drilled within a radius of two miles from the proposed injection wells hereinafter referred to, all of which said wells located upon said leases are producing from the Gallup-Sandstone formation which is a member of the Mancos formation of Cretaceous age. Said Exhibit "A" also shows the location of the proposed injection wells and the ownership of the respective leasehold interests within a radius of two miles from the said injection wells identified herein.

2. That there is outlined in red on Exhibit "A" attached hereto, the proposed project area which is a part of the lands embraced in the Navajo leases identified above, and which include the following described lands, to-wit:

Township 29 North, Range 14 West, N.M.P.M.

Section 15: $S\frac{1}{2}$ lying south of the San Juan River
Section 16: All lying south of the San Juan River
Section 17: All lying south of the San Juan River
Section 18: All lying south of the San Juan River
Section 19: $NE\frac{1}{4}$
Section 20: All
Section 21: All
Section 22: All
Section 23: $S\frac{1}{2}$ and $NW\frac{1}{4}$
Section 24: $SW\frac{1}{4}SE\frac{1}{4}$ and $S\frac{1}{2}SW\frac{1}{4}$
Section 25: All
Section 26: All
Section 27: All
Section 28: $E\frac{1}{2}$ and $NW\frac{1}{4}$
Section 34: $N\frac{1}{2}$
Section 35: All
Section 36: All

3. That there is filed herewith and for purposes of identification marked Exhibit "B", electrical logs of the following producing wells which are proposed to be converted to water injection wells in the project area:

Pan American Petroleum Corporation, Navajo "G" Well No. 4, Section 17
Pan American Petroleum Corporation, Navajo "G" Well No. 1, Section 20
Pan American Petroleum Corporation, Navajo "E" Well No. 3, Section 21

Pan American Petroleum Corporation, Navajo "E" Well No. 2, Section 21
El Paso Natural Gas Products Corporation, Ojo Amarillo Well No. 2, Section 27
Humble Oil & Refining Company, Navajo "L" Well No. 1, Section 26
Humble Oil & Refining Company, Navajo "L" Well No. 4, Section 26
Humble Oil & Refining Company, Navajo "L" Well No. 5, Section 36
Humble Oil & Refining Company, Navajo "L" Well No.15, Section 25.

4. That there is also attached hereto, made a part hereof, and for purposes of identification marked Exhibit "C", a schedule listing all proposed injection wells located upon the Navajo leases identified above within the proposed project area, and which shows the total depth of each well, the size of production casing in each well, the depth to which the casing in each well has been set, the estimated top of the cement used in setting the casing in each well, the perforated interval in each well and the completion date of each well.

5. Applicant proposes to inject water through the proposed injection wells above set forth into the Gallup-Sandstone producing formation which is encountered beneath the project area at depths from 4,600 feet to 5,600 feet beneath the surface, such water to be injected at rates ranging between 500 barrels and 1,300 barrels per day per well.

6. Applicant proposes to obtain the water for injection purposes from either the San Juan River alluvium sand by means of wells drilled and to be drilled adjacent to the bed of said river in Sections 15 and 16, Township 29 North, Range 14 West, N.M.P.M. or the Morrison formation beneath the project area, or from both sources. One water source well has heretofore been drilled to the San Juan River alluvium sand in the Southwest Quarter of the Southwest Quarter ($SW\frac{1}{4}SW\frac{1}{4}$) of said Section 16. The producing capacity of that well will be tested and based upon such capacity such further wells will be drilled as are necessary to produce water in quantities sufficient for the proposed pressure maintenance and secondary recovery project. The State Engineer has issued a permit authorizing applicant to obtain water for injection from such source. In the event water from the Morrison formation is also needed, applicant will drill a well to that formation at a location in in the project area now undetermined. Applicant has submitted to the Office of the State Engineer a copy of this application and will submit

at its earliest opportunity an analysis of water from each source utilized.

7. Applicant is Unit Operator of the Northwest Cha Cha-Gallup Unit under and pursuant to the terms of that certain operating agreement for said Unit executed or to be executed by all working interest owners in the Navajo leases identified above, and applicant submits this application as such Unit Operator. All premises included in the proposed project area are owned by the Navajo Tribal Council of Navajo Indians and are subject to leases providing royalty payments of one-eighth (1/8) of oil and gas produced. Since all such premises are owned in common by said Council and subject to leases providing identical royalty, the working interest owners in said leases do not plan to unitize said leases prior to commencement of the proposed project and no unit agreement of any kind has been prepared or submitted to said Council or the Department of the Interior. Soon after commencement of pressure maintenance operations as described herein, Unit Operator plans to prepare and submit for execution and approval a simple Unit Agreement which will permit Unit Operator to operate the various leases described herein as a single unit for the recovery of oil and gas.

8. Applicant believes and asserts that it will be in the interest of conservation and the prevention of waste to inaugurate a water injection program for pressure maintenance and secondary recovery purposes as soon as possible by the injection of water into the injection wells above referred to, and that said project is in the interest of obtaining the greatest ultimate recovery of oil and gas from said formation. Applicant therefore respectfully requests the proposed pressure maintenance program be approved, that the area hereinabove described be designated as the project area, and that an allowable formula be fixed therefor; and in connection therewith, applicant recommends the adoption of special field rules governing said project as follows:

(a) The conversion of the producing wells listed in Paragraph 3 hereof to water injection wells be approved and applicant be authorized to institute the pressure maintenance project proposed herein.

(b) That the allowable for the project area be the sum of the allowables of the several wells within the project area including those wells which may be shut in, curtailed, or used as injection wells.

(c) That allowables for injection wells be transferred to producing wells within the project area as well as allowables for producing wells which, in the interest of more efficient operation of the project, are shut in or curtailed because of high gas-oil ratio or are shut in for any of the following reasons: pressure regulation, control of pattern or sweep efficiencies, or to observe changes in pressures or changes in characteristics of reservoir liquids or progress of sweep.

(d) That the allowable assigned to any well which is shut in or which may be curtailed in accordance with the applicable special rules, and which allowable is to be transferred to any well or wells in the project area for production, shall in no event be greater than its ability to produce during the test period prescribed by the special rules, or greater than the top unit allowable for the pool during the month of transfer, whichever is less.

(e) That the allowable assigned to any injection well on an 80-acre proration unit shall be the top unit allowable for the Cha Cha-Gallup Oil Pool.

(f) That the ability to produce of any well which is shut in or curtailed in accordance with the special rules shall be determined by a 24-hour test at a stabilized rate of production, which shall be the final 24-hour period of a 72-hour test throughout which the well should be produced in the same manner and at the constant rate. The daily tolerance limitation set forth in Commission Rule 502 I (a) and the limiting gas-oil ratio (2,000 to 1) for the Cha Cha-Gallup Oil Pool shall be waived during such tests. The project operator shall notify all operators offsetting the well, as well as the Commission, of the exact time such tests are to be conducted. Tests may be witnessed by representatives of the offsetting operators and the Commission if so desired.

(g) That the top allowable assigned to each producing well in the project shall be equal to the well's ability to produce or to the top unit allowable of the Cha Cha-Gallup Oil Pool, whichever is less, provided that any producing well in the project area which directly or diagonally offsets a well outside the project area producing from the same common source of supply shall not produce in excess of two times top unit allowable for the pool. Each producing well shall be subject to the limiting gas-oil ratio (2,000 to 1) for the Cha Cha-Gallup Oil Pool, except that any well or wells within the project area producing with a gas-oil ratio in excess of 2,000 cubic feet of gas per barrel of oil may be produced on a "net gas-oil ratio basis", which net gas-oil ratio shall be determined in accordance with such equitable formula as may be determined by the Commission including credit for daily average net water injected through any injection well located within the project area.

(h) That the project operator submit each month, within a reasonable time after the normal unit allowable for Northwest New Mexico has been established, to the Commission, a pressure maintenance project operator's report on a form prescribed by the Commission, requesting allowables for each of the several wells in the project area as well as the total project allowable.

(i) That the Commission calculate the allowable for each well in the project area, and that the sum of the allowables so calculated be assigned to the project so that the same may be produced from any well or wells in the project in any proportion except that no well in the project which directly or diagonally offsets a well outside the project producing from the same common source of supply shall produce in excess of two times top unit allowable for the Cha Cha-Gallup Oil Pool.

(j) That provision be made for the administrative approval by the Commission of the conversion of additional producing wells to injection wells, and the drilling of additional producing and injection wells, and the expansion of the project area under such reasonable conditions as may be prescribed by the Commission.

WHEREFORE, Applicant requests that this application be set down for hearing before an examiner after due notice as required by law and the rules and regulations of the Commission.

Respectfully submitted,

HUMBLE OIL & REFINING COMPANY

By John D. Kodell, Jr.
per bk

HERVEY, DOW & HINKLE

By _____
Roswell, New Mexico
Attorneys for Applicant

CLASS OF SERVICE
This is a fast message unless its deferred character is indicated by the proper symbol.

WESTERN UNION
TELEGRAM

W. P. MARSHALL, PRESIDENT

3220
R-4-60

SYMBOLS
DL = Day Letter
NL = Night Letter
LT = International Letter Telegram

The filing time shown in the date line on domestic telegrams is LOCAL TIME at point of origin. Time of receipt is LOCAL TIME at point of destination

LA172 DB316 1961 NOV 23 PM 4 29

D EPA477 PD=FAX EL PASO TEX 28 335P MST=
NEW MEXICO OIL CONSERVATION COMMISSION=
SANTA FE NMEX=

ATTENTION MR A L PORTER JR, RE CASE NO 2447 MAY THE RECORD IN CASE NO 2447 SCHEDULED FOR HEARING ON NOVEMBER 29 1961, SHOW THAT EL PASO NATURAL GAS PRODUCTS COMPANY, A PARTICIPANT IN THE PROJECT CONCURS WITH THE REQUESTS. TO BE MADE BY HUMBLE OIL AND REFINING CO, APPLICANT IN SAID CAUSE, IN SEEKING PERMISSION TO INSTITUTE A PRESSURE MAINTENANCE PROJECT ON CERTAIN ACREAGE IN CHA=CHA GALLUP OIL POOL AND FURTHER SEEKING THE PROMULGATION OFSPECIAL RULES AND REGULATIONS GOVERNING SAID PROJECT=

W T HOLLIS MANAGER EXPLORATION AND PRODUCTION=

==2447 2447 29 1961 CHA CHA ...

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

No. 33-61

DOCKET: EXAMINER HEARING - MONDAY - DECEMBER 11, 1961

9 A.M. - OIL CONSERVATION COMMISSION CONFERENCE ROOM, STATE LAND OFFICE BUILDING - SANTA FE, NEW MEXICO

The following cases will be heard before Elvis A. Utz, Examiner, or Daniel S. Nutter, as alternate examiner:

CASE 2447: (Continued)
Application of Humble Oil & Refining Company for approval of a pressure maintenance project in the Cha Cha-Gallup Oil Pool, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks permission to institute a pressure maintenance project in the Cha Cha-Gallup Oil Pool by the injection of water into certain wells located on the Navajo Indian Reservation in Sections 13 through 29 and 33 through 36, Township 29 North, Range 14 West, San Juan, New Mexico. Applicant further seeks the promulgation of special rules and regulations governing said project.

CASE 2429: (Continued)
Application of Standard Oil Company of Texas for approval of the Jurnegan Point Unit Agreement, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks approval of the Jurnegan Point Unit Agreement embracing 10,240.84 acres, more or less, of State and fee lands in Township 24 South, Ranges 24 and 25 East, Eddy County, New Mexico.

CASE 2450: Application of Texaco Inc. for an exception to Rule 309-A, Lea County, New Mexico. Applicant, in the above-styled cause, seeks an exception to Rule 309-A to permit the Abo production from its State "AB" Lease, located in Section 6, Township 18 South, Range 35 East, Lea County, New Mexico, to be transported prior to measurement on said lease to applicant's State "R" (NCT-1) Lease, located in said Section 6.

CASE 2462: Application of Texaco Inc. for three triple completions, Lea County, New Mexico. Applicant, in the above-styled cause, seeks an order authorizing the triple completion of its V. M. Henderson Well Nos. 7, 8 and 9, located in Units F, E, and G, respectively, Section 30, Township 21 South, Range 37 East, NMPM, Lea County, New Mexico, in such a manner as to permit the production of oil from each well from the Penrose-Skelly, Paddock, and Drinkard Pools through parallel strings of 2 3/8-inch tubing cemented in common well bores.

CASE 2451: Application of The Ohio Oil Company for a dual completion, Lea County, New Mexico. Applicant, in the above-styled cause, seeks permission to complete its Lea Unit Well No. 6, located in Unit J of Section 11, Township 20 South, Range 34 East, Lea County, New Mexico, as a dual completion (conventional) adjacent to the Lea-Pennsylvanian Gas and Lea-Devonian Pools, with the production of gas from the Pennsylvanian formation and the production of oil from the Devonian formation through parallel strings of 2 3/8-inch tubing.

CASE 2452: Application of Southwest Production Company for an order pooling all mineral interests in the Basin-Dakota Gas Pool in the W/2 of Section 7, Township 30 North, Range 11 West, San Juan County, New Mexico. Interested parties include Maleta Y. Brimhall, Phoenix, Arizona, and Barbara Brimhall Burnham, Aztec, New Mexico.

CASE 2453: Application of Southwest Production Company for an order pooling all mineral interests in the Basin-Dakota Gas Pool in the E/2 of Section 7, Township 30 North, Range 11 West, San Juan County, New Mexico. Interested parties include Harold Marion Brimhall and his wife, Maleta Y. Brimhall, both of Phoenix, Arizona.

CASE 2454: Application of Socony Mobil Oil Company, Inc., for an exception to Rule 303 (a), Lea County, New Mexico. Applicant, in the above-styled cause, seeks an exception to Rule 303 (a) to permit the commingling of the production from the Denton-Devonian and the Denton-Wolfcamp Pools on its T. D. Pope lease, comprising the S/2 of Section 26 and the W/2 of Section 36, Township 14 South, Range 37 East, Lea County, New Mexico. Applicant proposes to meter the production from one pool only and to allocate production to the other pool according to the subtraction method; the API gravity of the crude from one of the pools is greater than 45°.

CASE 2455: Application of Hondo Oil & Gas Company for an unorthodox oil well location, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks approval of an unorthodox oil well location in the Empire Abo Pool 660 feet from the East line and 2590 feet from the North line of Section 25, Township 17 South, Range 28 East, Eddy County, New Mexico.

Docket No. 33-61

CASE 2131: (Reopened)

In the matter of the application of Robinson Brothers Oil Producers for the establishment of 320-acre gas proration units in the TV-Pennsylvanian Gas Pool, Chaves County, New Mexico. Case 2131 will be reopened pursuant to Order No. R-1839 to permit the applicant and other interested parties to appear and show cause why the TV-Pennsylvanian Gas Pool should not be developed on 160-acre proration units.

CASE 2456: Application of Great Western Drilling Company for a unit agreement and for a waterflood project, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval of the Malmar Unit Agreement, covering 1,360 acres, more or less, in Township 17 South, Ranges 32 and 33 East, Lea County, New Mexico. Applicant further seeks authority to institute a waterflood project in the Maljamar (Grayburg-San Andres) Pool by the injection of water into the Grayburg-San Andres formation initially through six wells located in Sections 7 and 18, Township 17 South, Range 33 East, and in Sections 12 and 13, Township 17 South, Range 32 East, Lea County, New Mexico, said project to be governed by the provisions of Rule 701.

CASE 2457: Application of Murphy H. Baxter for a waterflood project in the Maljamar (Grayburg-San Andres) Pool, Lea County, New Mexico. Applicant, in the above-styled cause, seeks permission to institute a waterflood project in the Maljamar (Grayburg-San Andres) Pool in Section 13, Township 17 South, Range 32 East and Sections 17 and 18, Township 17 South, Range 33 East, Lea County, New Mexico, with the injection of water initially to be through four wells located in Section 18, Township 17 South, Range 33 East; said project is to be governed by Rule 701.

CASE 2458: Application of Zapata Petroleum Corporation for a waterflood project in the Maljamar (Grayburg-San Andres) Pool, Lea County, New Mexico. Applicant, in the above-styled cause, seeks permission to institute a waterflood project in the Maljamar (Grayburg-San Andres) Pool in Sections 17 and 20, Township 17 South, Range 33 East, Lea County, New Mexico, with the injection of water initially to be through three wells located in said Sections 17 and 20; said project is to be governed by Rule 701.

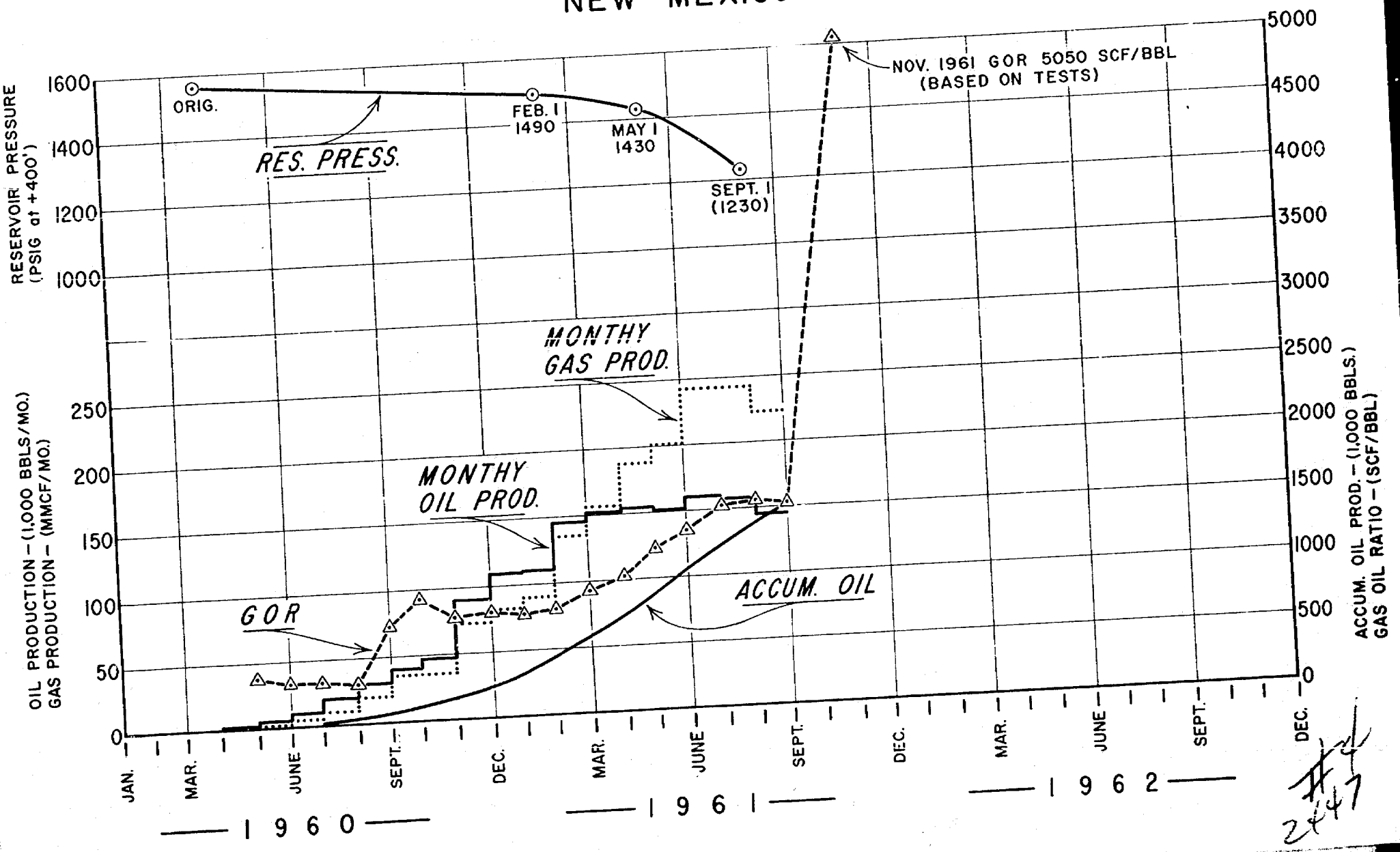
iqg/

PRODUCTION DATA

PROPOSED N.W. CHA CHA UNIT

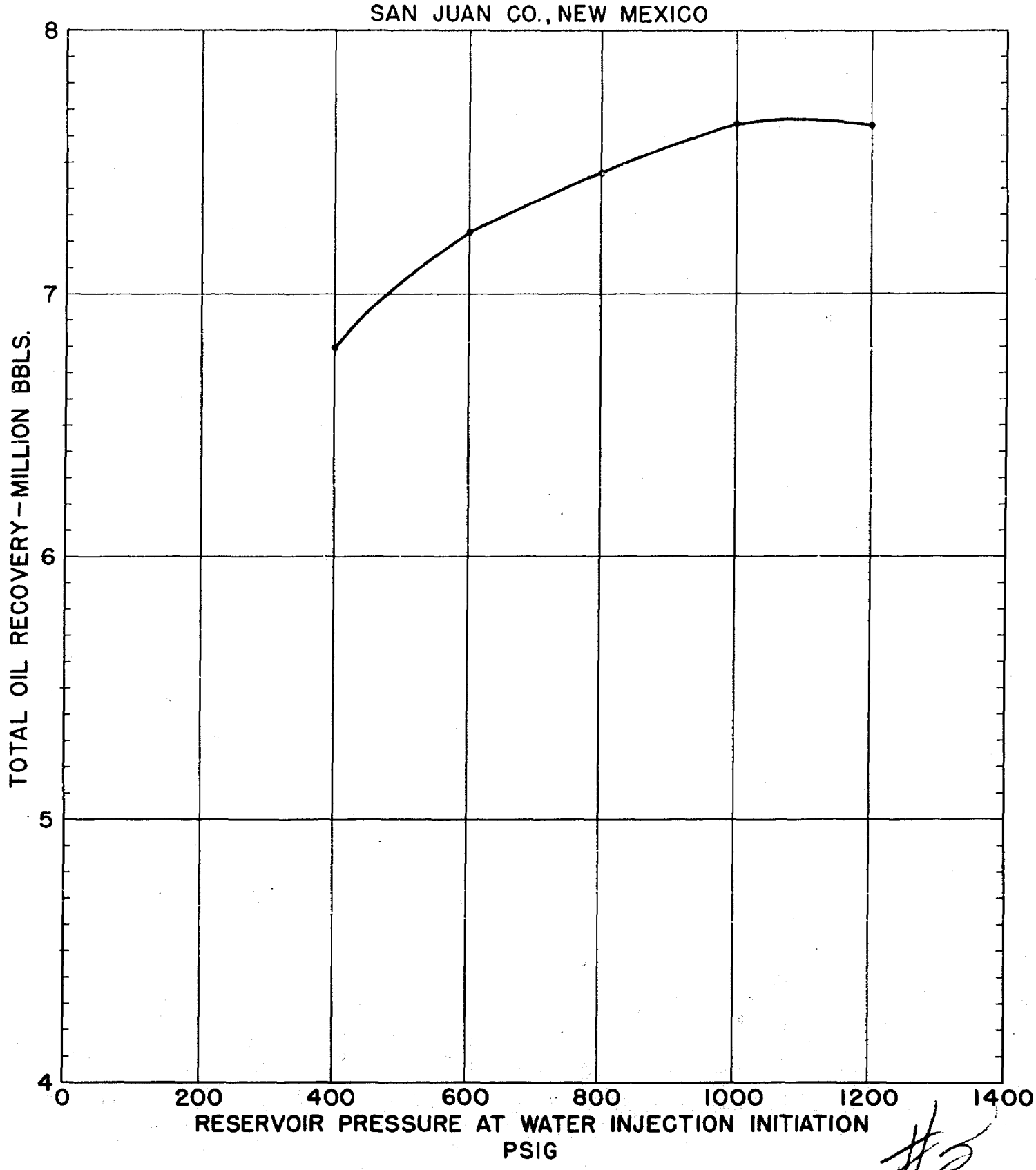
CHA CHA GALLUP FIELD

NEW MEXICO



247

TOTAL RECOVERY
VS
RESERVOIR PRESSURE AT WATER INJECTION INITIATION
N. W. CHA CHA GALLUP UNIT
SAN JUAN CO., NEW MEXICO



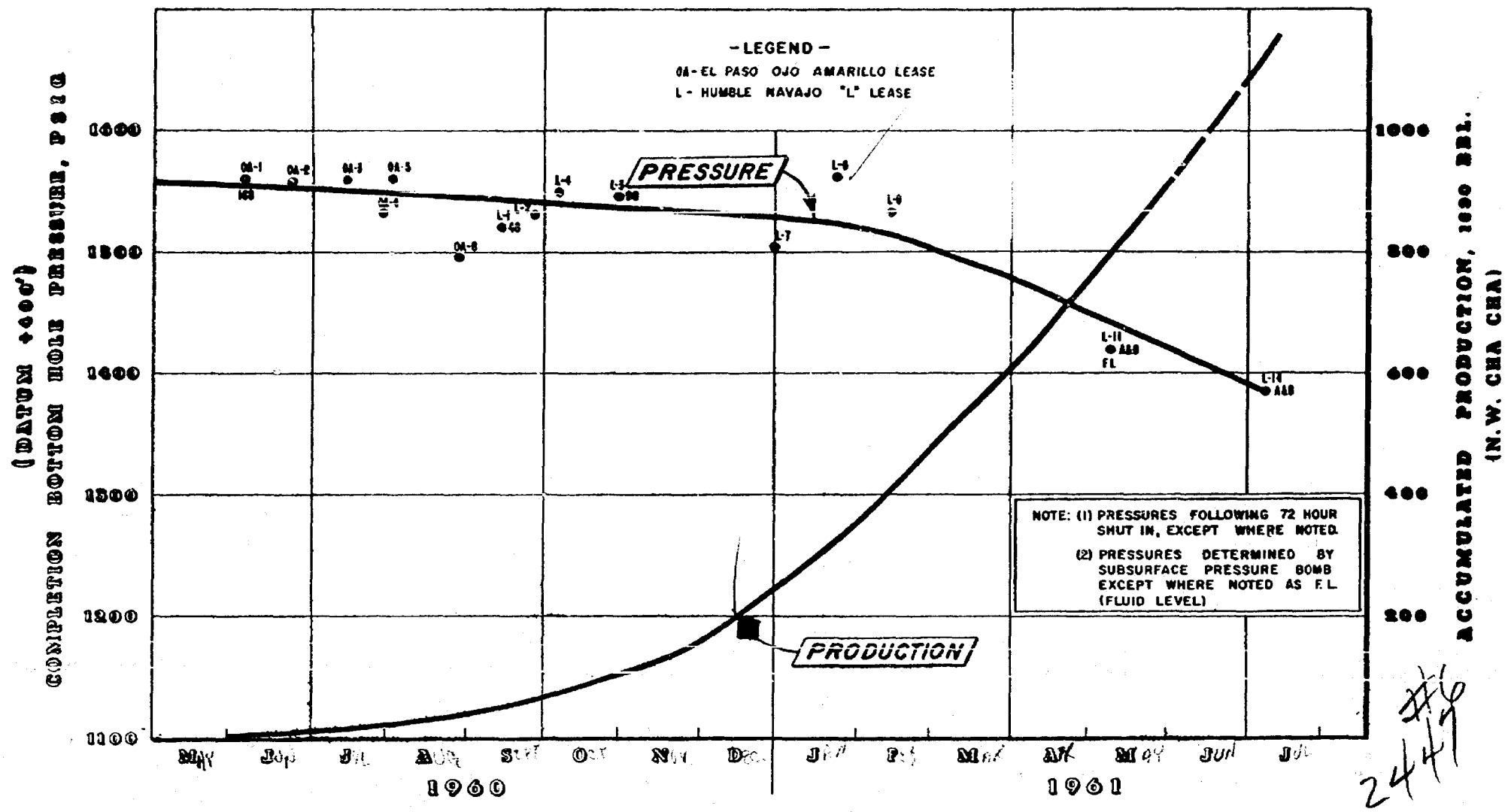
2447

COMPLETION BOTTOM HOLE PRESSURES vs. TIME

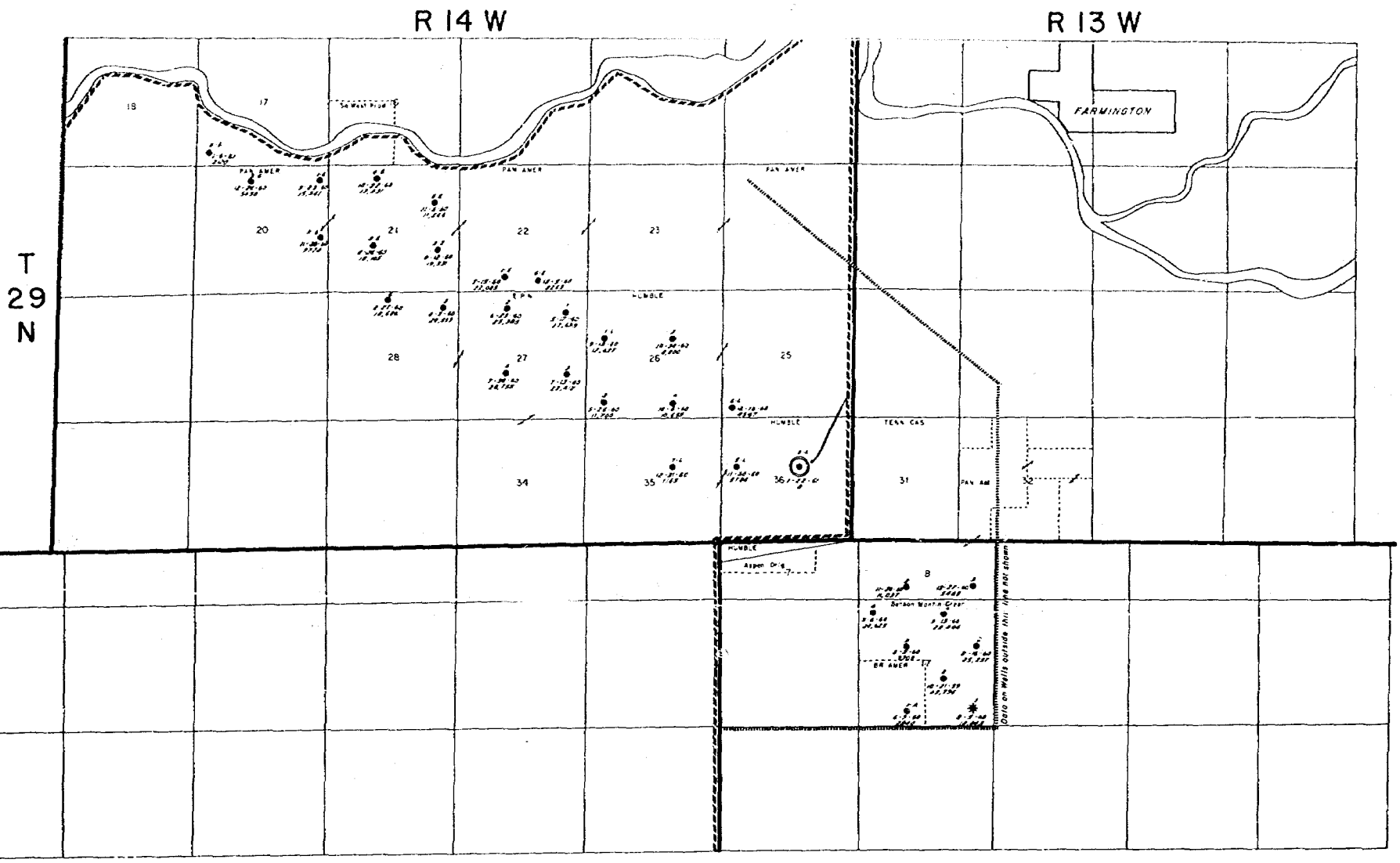
ACCUMULATED OIL PRODUCTION vs. TIME

CHA CHA GALLUP FIELD

SAN JUAN COUNTY, NEW MEXICO



#6
249



HUMBLE OIL & REFINING COMPANY
DENVER AREA

CHA CHA GALLUP FIELD

San Juan County, New Mexico

Notes:

Total Accum. Oil Prod. (1-22-61)
OF Wells Shown = *475,330 BBLS.*

Total Accum. Oil Prod. (1-22-61)
OF CHA CHA Gallup Field = *507,798 BBLS.*

Status on *Jan. 22, 1961*

Completion Date *L-8: 1-22-61*

Legend:

/ Well No.

•
5-17-60 Completion Date
27,699 Accum. Oil Prod. BBLS (1-22-61)

#1
247

WATER INJECTION WELL DATA

PROPOSED N.W. CHA CHA UNIT

SAN JUAN COUNTY, NEW MEXICO

Name	*Completion Date*	*Location*	*Total Depth*	*Plugback Total Depth*	*Casing Size*	*Casing Depth*	*Top Cement (Est.)*	*Perf. Interval*
El Paso Natural Gas Products								
Ojo Amarillo No. 2	6-23-60	NE NW Sec. 27-29N-14W	6105	5330	5 1/2	5376	4120	5322-44
Humble Oil & Refining Co.								
Navajo "L" No. 1	9-13-60	SW NW Sec. 26-29N-14W	5488	5447	4 1/2	5484	4800	5390-5400
Navajo "L" No. 4	10-6-60	SW SW Sec. 26-29N-14W	5591	5587	4 1/2	5587	3100	5499-5510
Navajo "L" No. 5	11-30-60	SW NW Sec. 36-29N-14W	5627	5588	4 1/2	5624	3100	5528-41
*Navajo "L" No. 15	9-8-61	SW NE Sec. 25-29N-14W	5416	5385	4 1/2	5414	4418	5305-15 5360-65
Pan American Petroleum								
Navajo "E" No. 2	8-12-60	NE SE Sec. 21-29N-14W	5289	5238	5 1/2	5283	4600	5145-53
Navajo "E" No. 3	8-26-60	NE SW Sec. 21-29N-14W	5270	5226	5 1/2	5270	4600	5116-26
*Navajo "G" No. 1	9-23-60	NE NE Sec. 20-29N-14W	4828	4796	4 1/2	4832	4200	4681-89
*Navajo "G" No. 4	1-6-61	SW SW Sec. 17-29N-14W	4669	4626	4 1/2	4661	3900	4578-84

** Conversions to be delayed until satisfactory Lease Line agreements are effected.*

#6
2447

EXHIBIT "C"
WATER INJECTION WELLS
PROPOSED NORTHWEST CHA CHA GALLUP UNIT
SAN JUAN COUNTY, NEW MEXICO

Name	Completion Date	Location	Total Depth	Plugback Total Depth	Casing Size	Casing Depth	Top Cement (Est.)	Perf Interval
El Paso Natural Gas Products								
Ojo Amarillo No. 2	6-23-60	NE NW Sec. 27-29N-14W	6105	5330	5½	5376	4120	5322-44
Humble Oil & Refining Company								
Navajo "L" No. 1	9-13-60	SW NW Sec. 26-29N-14W	5488	5447	4½	5484	4800	5390-5400
Navajo "L" No. 4	10-6-60	SW SW Sec. 26-29N-14W	5591	5587	4½	5587	3100	5499-5510
Navajo "L" No. 5	11-30-60	SW NW Sec. 36-29N-14W	5627	5588	4½	5624	3100	5528-41
Navajo "L" No. 15	9-8-61	SW NE Sec. 25-29N-14W	5416	5385	4½	5414	4418	(5305-15 (5360-65
Pan American Petroleum								
Navajo "E" No. 2	8-12-60	NE SE Sec. 21-29N-14W	5289	5238	5½	5283	4600	5145-53
Navajo "E" No. 3	8-26-60	NE SW Sec. 21-29N-14W	5270	5226	5½	5270	4600	5116-26
Navajo "G" No. 1	9-23-60	NE NE Sec. 20-29N-14W	4828	4796	4½	4832	4200	4681-89
Navajo "G" No. 4	1-6-61	SW SW Sec. 17-29N-14W	4669	4626	4½	4661	3900	4578-84

RM-908

JOINT OPERATING AGREEMENT

NORTHWEST CHA CHA UNIT AREA

SAN JUAN COUNTY, NEW MEXICO

JOINT OPERATING AGREEMENT
NORTHWEST CHA CHA UNIT AREA
SAN JUAN COUNTY, NEW MEXICO

TABLE OF CONTENTS

JOINT OPERATING AGREEMENT
NORTHWEST CHA CHA UNIT AREA
SAN JUAN COUNTY, NEW MEXICO

THIS AGREEMENT, made and entered into as of the 1st day of October, 1961, by and between EL PASO NATURAL GAS PRODUCTS COMPANY, a corporation, hereinafter referred to as "El Paso Products", EL PASO NATURAL GAS COMPANY, a corporation, hereinafter referred to as "El Paso", HUMBLE OIL & REFINING COMPANY, a corporation, hereinafter roferred to as "Humble", and PAN AMERICAN PETROLEUM CORPORATION, a corporation, hereinafter referred to as "Pan American", all of said parties being sometimes collectively referred to as "Working Interest Owners";

WITNESSETH:

WHEREAS, El Paso and El Paso Products are the owners of that Certain Oil and Gas Lease dated December 31, 1956, in which the Navajo Tribe of Indians is Lessor and which is designated Navajo Tribal Lands Contract No. 14-20-603-2168 insofar as said lease embraces all of Section 27, the North One-Half (N/2) and the Southeast Quarter (SE/4) of Section 28, and the North One-Half (N/2) of Section 34, Township 29-North, Range 14-West, San Juan County, New Mexico; and

WHEREAS, Humble is the owner of that Certain Oil and Gas Lease dated December 21, 1956, in which the Navajo Tribe of Indians is the Lessor and which is designated Navajo Tribal Lands Contract No. 14-20-603-2712 insofar as said lease embraces all of Sections 25, 26, 35, and 36, Township 29-North, Range 14-West, San Juan County, New Mexico; and

WHEREAS, Pan American is the owner of that Certain Oil and Gas Lease dated December 20, 1956, in which the Navajo Tribe of Indians is the Lessor and which is designated Navajo Tribal Lands Contract No. 14-20-603-2198 insofar as said lease embraces the Northwest Quarter (NW/4) and the South One-Half (S/2) of Section 23, and the South One-Half of the Southwest Quarter (S/2 SW/4) and the Southwest Quarter of the Southeast Quarter (SW/4 SE/4) of Section 24, that Certain Oil and Gas Lease dated December 20, 1956, in which the Navajo Tribe of Indians is the Lessor and which is designated Navajo Tribal Lands Contract No. 14-20-603-2199 insofar as said lease embraces all of that portion of the South One-Half (S/2) of Section 15 lying south of the mid-channel of the San Juan River, all of that portion of Section 16 lying south of the mid-channel of the San Juan River and all of Sections 21 and 22, and that Certain Oil and Gas Lease dated December 20, 1956, in which the Navajo Tribe

of Indians is the Lessor and which is designated Navajo Tribal Lands Contract No. 14-20-603-2200 insofar as said lease embraces all of those portions of Section 17 and 18 lying south of the mid-channel of the San Juan River, the Northeast Quarter (NE/4) of Section 19, and all of Section 20, all of said land being in Township 29-North, Range 14-West, San Juan County, New Mexico.

WHEREAS, all of the above-described lands shall in this agreement be referred to as the Unit Area.

WHEREAS, the Working Interest Owners desire to provide for the operation and further development of said leases for increasing the recovery of oil and gas and other hydrocarbons from the Gallup Formation, including the obtaining of source water and, in accordance with good engineering and production practices, to engage in pressure maintenance operations, which may include (without limiting the right of the parties to employ other methods) the injection of gas, water, or other substances, or combinations of such, into the Gallup Formation.

NOW, THEREFORE, for and in consideration of the mutual agreements herein set forth, it is agreed as follows:

ARTICLE 1
DEFINITIONS

As used in this agreement, the terms hereinafter set out shall have the following meaning:

1.1 Unit Area shall mean the lands situated within the Cha Cha Gallup Field, San Juan County, New Mexico, described by Tracts in Exhibit A, and shown on Exhibit B.

1.2 Unitized Formation shall mean that subsurface portion of the Unit Area commonly known as the Gallup Formation, which is that continuous stratigraphic interval occurring between the top of the Gallup Formation and the top of the Sanastee Formation, and which is the same formation that was penetrated between the elevations of plus 781 feet and plus 314 feet in El Paso's Ojo Amarillo #1 Well, located 890' from the North and East Lines of Section 27, Township 29 North, Range 14 West, as such formation is shown on the Schlumberger induction-electrical log of said well dated April 22, 1960.

1.3 Unitized Substances shall mean all oil, gas, gaseous substances, sulphur contained in gas, condensate, distillate, and all associated and constituent liquid or liquefiable hydrocarbons within or produced from the Unitized Formation.

1.4 Working Interest Owner shall mean any party hereto, including a carried working interest owner, holding an interest in Unitized Substances by virtue of a lease, operating agreement, fee title or otherwise, which interest is chargeable with and obligated to pay or bear, either in cash or out of production or otherwise, all or a portion of the cost of drilling, developing, producing and operating the Unitized Formation.

1.5 Tract shall mean each parcel of land described as such and given a Tract Number in Exhibit A.

1.6 Unit Operator shall mean the Working Interest Owner designated by the Working Interest Owners to develop and operate the Unitized Formation.

ARTICLE 2
EXHIBITS

2.1 Exhibits. Attached hereto and made a part hereof are the following exhibits:

2.1.1 Exhibit A is a schedule which contains the description, serial number, date of lease or application, and ownership of each of the tracts in the Unit Area insofar as is known to the Unit Operator.

2.1.2 Exhibit B is a map of a portion of the Cha Cha Gallup Field, showing the boundary line of the Unit Area and Tracts thereon.

2.1.3 Exhibit C is the Accounting Procedure applicable to the development and operation of the Unit Area. In the event of conflict between this agreement and Exhibit C, this agreement shall prevail.

2.1.4 Exhibit D contains insurance provisions applicable to the development and operation of the Unit Area.

ARTICLE 3
SUPERVISION OF OPERATIONS BY WORKING INTEREST OWNERS

3.1 Overall Supervision. Working Interest Owners shall exercise overall supervision and control of all matters pertaining to the development and operation of the Unit Area pursuant to this agreement. In the exercise of such power each Working Interest Owner shall act solely in its own behalf in the capacity of an individual owner and not on behalf of the owners as an entirety.

3.2 Particular Powers and Duties. The matters to be passed upon and decided by Working Interest Owners shall include, but not be limited to, the following:

3.2.1 Method of Operation. The kind, character, and method of operation, including any type of pressure maintenance or secondary recovery program to be employed.

3.2.2 Drilling of Wells. The drilling of any well within the Unit Area for use as an injection well, or for use as a source water well. Any other well will require ninety per cent (90%) approval.

3.2.3 Well Recompletions and Change of Status. The recompletion, abandonment, or change of status of any well in the Unit Area or use of any such well for source water, injection or other purposes.

3.2.4 Expenditures. The making of any single expenditure in excess of Ten Thousand Dollars ($10,000) except as provided in Section 7.9 herein; provided, that approval by Working Interest Owners of the drilling, recompletion, drilling deeper, or plugging back of any well shall include approval of all necessary expenditures required therefor and for completing, testing and equipping the same, including necessary flow lines, separators and lease tankage.

3.2.5 Disposition of Surplus Facilities. The selling or otherwise disposing of any major item of material or equipment, previously declared surplus by the Working Interest Owners, the current list price of new equipment similar thereto being Two Thousand Five Hundred Dollars ($2,500) or more.

3.2.6 Appearances. The designating of a representative to appear before any court or regulatory body in matters pertaining to unit operations; provided, however, that the authorization by Working Interest Owners of the designation of any such representative shall not prevent any Working Interest Owner, at its own expense, from appearing in person or from designating another representative in its own behalf.

3.2.7 Audits. The making of proper audits of the accounts of Unit Operator pertaining to operations hereunder; provided, that such audits shall

(a) not be conducted more than once each year except upon the resignation or removal of Unit Operator; and shall

(b) be made at the expense of all Working Interest Owners other than the Working Interest Owner designated as Unit Operator; and

(c) be upon not less than thirty (30) days' written notice to Unit Operator.

3.2.8 Inventories. The taking of periodic inventories under the terms of Exhibit C.

3.2.9 Technical Services. Any direct charges to the joint account for services by consultants of Unit Operator's technical personnel not covered by the overhead charges provided by Exhibit C or in Section 11.4 herein.

3.2.10 Assignments to Committees. The appointment or designation of the purposes of committees or subcommittees necessary for the study of any problem in connection with unit operations.

3.2.11 Plans of Development. The adoption or submission of any operating and development plan to any regulatory body.

3.2.12 Other Matters. Other matters pertaining to the operation of the Unit Area, such as

(a) the removal of Unit Operator and the selection of a successor.

(b) the adjustment of investments.

(c) the termination of this agreement.

ARTICLE 4
MANNER OF EXERCISING SUPERVISION

4.1 Designation of Representatives. Each Working Interest Owner shall advise the Unit Operator and all other Working Interest Owners in writing the names and addresses of its representative and alternate authorized to represent and bind it in respect to any matter pertaining to the development and operation of the Unit Area. Such representative or alternate may be changed from time to time by written notice to Unit Operator and all other Working Interest Owners.

4.2 Meetings. All meetings of Working Interest Owners for the purpose of considering and acting upon any matter pertaining to the development and operation of the Unit Area shall be called by the Unit Operator upon its own motion or at the request of any Working Interest Owner. No meeting shall be called on less than twenty (20) days' advance written notice, with agenda for the meeting attached. The Working Interest Owners attending such meeting shall not be prevented from amending items included on the agenda or from deciding such amended items or from deciding such other items presented at such meeting. The representative of the Unit Operator shall be chairman of each meeting.

4.3 Voting Procedure. Working Interest Owners shall act upon and determine all matters coming before them as follows:

4.3.1 Voting Interest. In voting on any matter each Working Interest Owner shall have the voting interest set out opposite its name below, to-wit:

El Paso Products and El Paso	15.83 *
Humble	43.64
Pan American	40.53

* This interest in which El Paso Products owns the oil rights and El Paso owns the gas rights shall be voted by El Paso Products.

4.3.2 Vote Required. Except as otherwise provided herein, Working Interest Owners shall act upon and determine all matters coming before them by the affirmative vote of two or more of the parties owning in the aggregate fifty-one per cent (51%) or more of the voting interests, and such affirmative vote shall be binding on all parties hereto.

4.3.3 Voting at Meeting by Non-attending Working Interest Owners. Any Working Interest Owner not represented at a meeting may vote on any matter included on the agenda of the meeting by letter or telegram addressed to the chairman of the meeting, provided such vote is received prior to the submission of such item to vote. Such vote shall not be counted with respect to any item considered which is amended at the meeting, provided, however, non-attending Working Interest Owners may vote by mail on such amended items following receipt of the minutes of the meeting.

4.3.4 Poll Votes. Working Interest Owners may decide any matter by vote taken by letter or telegram, provided the matter is first submitted in writing to each Working Interest Owner and no meeting on the matter is called as provided in Section 4.2, within seven calendar days after such proposal is dispatched to Working Interest Owner. Unit Operator will give prompt notice of the results of such voting to all Working Interest Owners.

ARTICLE 5
INDIVIDUAL RIGHTS AND PRIVILEGES OF WORKING INTEREST OWNERS

5.1 Reservation of Rights. Working Interest Owners severally reserve to themselves all their rights, power, authority and privileges, except as expressly provided in this agreement.

5.2 Specific Rights. Each Working Interest Owner shall have, among others, the following specific rights and privileges:

5.2.1 Access to Unit Area. Access to the Unit Area at all reasonable times to inspect the operation hereunder and all wells and records and data pertaining thereto.

5.2.2 Reports by Request. The right to receive from Unit Operator, upon written request, copies of all reports to any governmental agency, reports of crude oil runs and stocks, inventory reports and all other data pertaining to unit operations. The cost of gathering and furnishing data not ordinarily furnished by Unit Operator to all Working Interest Owners shall be charged to the Working Interest Owners requesting the same.

ARTICLE 6
UNIT OPERATOR

6.1 Initial Unit Operator. Humble Oil & Refining Company is hereby designated as initial Unit Operator.

6.2 Resignation or Removal. Unit Operator may resign at any time. Working Interest Owners may remove Unit Operator for cause by the affirmative vote of one hundred per cent (100%) of the voting interest remaining after excluding the voting interest of Unit Operator. A Unit Operator who resigns or is removed shall not be released from its obligations hereunder for a period of three (3) months after its resignation or discharge unless a successor Unit Operator shall have taken over the operations hereunder prior to the expiration of said period.

6.3 Selection of Successor. In the event of the resignation or removal of a Unit Operator, a successor Unit Operator shall be selected by the Working Interest Owners by the vote provided in Section 4.3.2 hereof, provided, however, that no Unit Operator who has been removed may vote to succeed himself.

ARTICLE 7
POWERS AND DUTIES OF UNIT OPERATOR

7.1 Exclusive Right to Conduct Operations. Subject to the provisions of this agreement and to the orders, directions and limitations rightfully given or imposed by Working Interest Owners, Unit Operator shall have the exclusive right and be obligated to develop and operate the Unit Area for the production of Unitized Substances.

7.2 Workmanlike Conduct. Unit Operator shall conduct all operations hereunder in a good and workmanlike manner and, in the absence of specific instructions from Working Interest Owners, shall have the right and duty to conduct such operations in the same manner as would a prudent operator under the same or similar circumstances.

Unit Operator shall freely consult with Working Interest Owners and keep them advised of all matters arising in connection with such operations which Unit Operator, in the exercise of its best judgment, considers important. Unit Operator shall not be liable to Working Interest Owners for damages unless such damages result from the gross negligence or willful misconduct of Unit Operator.

7.3 Liens and Encumbrances. Unit Operator shall endeavor to keep the lands and leases in the Unit Area free from all liens and encumbrances occasioned by its operations hereunder, except the lien of Unit Operator granted hereunder.

7.4 Employees. The number of employees used by Unit Operator in conducting operations hereunder, the selection of such employees, the hours of labor, and the compensation for services to be paid any and all such employees shall be determined by Unit Operator. Such employees shall be the employees of Unit Operator.

7.5 Records. Unit Operator shall furnish to each Working Interest Owner periodic reports of the development and operation of the Unit Area.

7.6 Reports to Working Interest Owners. Unit Operator shall furnish to Working Interest Owners periodic reports of the operations.

7.7 Reports to Governmental Authorities. Unit Operator shall make all reports to governmental authorities that it has the duty to make as Unit Operator.

7.8 Engineering and Geological Information. Unit Operator shall furnish to each Working Interest Owner, upon written request, copies of the log of, and copies of engineering and geological data pertaining to wells drilled by Unit Operator for the joint account.

7.9 Expenditures. Subject to the provisions of Section 3.2.4, Unit Operator is authorized to make single expenditures not in excess of Ten Thousand Dollars ($10,000) without prior approval of Working Interest Owners except in case of blowout, explosion, fire, flood or other sudden emergency, Unit Operator may take such steps and incur such expenses as, in its opinion, are required to deal with the emergency to safeguard life and property; provided, that Unit Operator shall, as promptly as possible, report the emergency and the action taken to the Working Interest Owners. The Unit Operator shall be permitted to perform well workovers, repairs, and stimulations without additional approval of the Working Interest Owners, provided each such expenditure does not exceed the Ten Thousand Dollar ($10,000) limit.

7.10 Settlement. Unit Operator may settle any single damage claim not involving an expenditure in excess of Two Thousand Dollars ($2,000) provided such payment is a complete settlement of such claim and Unit Operator shall have secured complete release for Working Interest Owners of and from all liabilities relating to the cause or alleged cause of such claim.

ARTICLE 8
TAXES

8.1 Ad Valorem Taxes. Unit Operator shall, beginning in the first calendar year after the effective date hereof, make and file for ad valorem tax purposes all necessary renditions and returns with the proper taxing authorities or governmental sub-division covering all real and personal property, excluding the surface rights to lands lying within the Unit Area and improvements located on said lands not utilized for unit operations, of each Working Interest Owner within the Unit Area and used in connection with the development and operation of the Unit Area. Any Non-Operator dissatisfied with any proposed rendition or assessment of its interest in real or personal property shall have the right, at its own expense, to protest and resist the same. All such ad valorem taxes due and payable on account of real and personal property of each Working Interest Owner located within the Unit Area and used in connection with unit operations shall be paid by Unit Operator for the joint account in the same manner as other costs and expenses of unit operations; provided, however, that the account of any Working Interest Owner owning less than a seven-eighths (7/8) working interest covered by this agreement shall be charged only for its proportion of the ad valorem taxes levied on the full working interest, adjusted so as to reflect a credit for such taxes levied on values assigned to outstanding excess royalties, overriding royalties, and production payments burdening such working interest.

8.2 Direct Taxes and Assessments. Each Working Interest Owner shall pay or cause to be paid all production, severance, gathering and other direct taxes and assessments imposed upon or on account of the production or handling of its share of Unitized Substances.

ARTICLE 9
INSURANCE

9.1 Insurance. Operator shall carry, with respect to unit operations subject to this agreement, such insurance as set forth in Exhibit D, Insurance Provisions.

ARTICLE 10
ADJUSTMENT OF INVESTMENTS

10.1 Personal Property Taken Over. Upon the effective date hereof, Working Interest Owners shall deliver to Unit Operator possession of:

10.1.1 Wells. All wells shown on Exhibit B which are completed in the Unitized Formation or which Working Interest Owners determine are necessary or desirable for conducting operations hereunder, together with the casing, tubing and inhole equipment up to and including the Christmas tree.

10.1.2 Equipment. All lease and operating equipment being used in the operation of the wells in the Unitized Formation shown on Exhibit B which Working Interest Owners determine is necessary or desirable for conducting operations hereunder.

10.1.3 Records. A copy of all production and well records pertaining to such wells.

10.2 Inventory and Evaluation of Personal Property. The Working Interest Owners shall appoint an inventory committee which shall, as of the effective date hereof, or as soon thereafter as feasible, cause to be taken, under the supervision of the Unit Operator and at unit expense, joint physical inventories of lease and well equipment within the area shown on Exhibit "B", which inventories shall be used as a basis for determining the controllable items of equipment to be taken over by the Unit Operator hereunder. The Unit Operator shall notify each Working Interest Owner within each separate Tract at least five (5) days prior to the taking of the inventory with respect to said Tract, so that each of said Working Interest Owners may make arrangements to be represented at the taking of the inventory. Failure of a Working Interest Owner to be represented at the taking of the inventory shall, nevertheless, bind such Working Interest Owner to accept the inventory taken by representatives of the other Working Interest Owners. Such inventories shall include and be limited to those items of equipment normally considered controllable by operators of oil and gas properties, as indicated in the "Materials Classification Manual (Revised 1960)", prepared by the Petroleum Accountants Society of Oklahoma, except that certain items normally considered noncontrollable, such as sucker rods, Kobe tubing of sizes less than two inches (2"), and other items as agreed upon by the Working Interest Owners, may be included on the inventories in order to insure a more equitable adjustment of investments. All other noncontrollable items of lease and well equipment installed

within the Unit Area, although excluded from the inventories, shall nevertheless be taken over by the Unit Operator. Immediately following completion, such inventories shall be priced in accordance with the provisions of Exhibit C, Accounting Procedure, attached hereto and made a part hereof, such pricing shall be performed under the supervision of, by the personnel of, and in the offices of the Unit Operator, with other Working Interest Owners furnishing such additional pricing help as may be available and necessary. Casing shall be included in the inventory for record purposes but shall be excluded from pricing and investment adjustment.

10.3 Investment Adjustment on Equipment. Upon approval by Working Interest Owners of such inventory and evaluation, each Working Interest Owner shall be credited with the value of its interest in all personal property, exclusive of the casing in wells, so taken over by the Unit Operator under Sections 10.1.1 and 10.1.2, and charged with an amount equal to that obtained by multiplying the total value of all such personal property, except casing, so taken over by Unit Operator under Sections 10.1.1 and 10.1.2 by such Working Interest Owners' participation as shown in Section 11.1. If the charge against any Working Interest Owner is greater than the amount credit to such Working Interest Owner, the resulting net charge shall be paid and in all other respects be treated as any other item of unit expense chargeable against such Working Interest Owner. If the credit to any Working Interest Owner is greater than the amount charged against such Working Interest Owner, the resulting net credit shall be paid to such Working Interest Owner by Unit Operator out of funds received by it in settlement of the charges described above.

10.4 Intangible Adjustments. There shall be an adjustment with respect to the intangible costs incurred in the following wells: El Paso Product's Ojo Amarillo No. 5, Humble's "L" 10, 12, 13, 14, and 15, and Pan American's "E" 2 and 9 and H-15. With respect to each such well the Working Interest Owner thereof shall be credited with the sum of $6,000.00, and the total of all such credits shall be charged to all of the Working Interest Owners in the proportions set forth in Section 11.1 Such credits and charges shall be handled in the manner set forth in the last two sentences of Section 10.3

10.5 General Facilities. The acquisition of warehouses, warehouse stocks, lease houses, camps, facility systems, and office buildings necessary for operations hereunder shall be by negotiation by and between the owners thereof and Unit Operator, subject to the approval of Working Interest Owners. There shall be no adjustment for lease roads or appurtenances.

10.6 Ownership of Personal Property and Facilities. Each Working Interest Owner, individually, shall by virtue hereof own an undivided interest in all personal property and facilities taken over or otherwise acquired by Unit Operator pursuant to this agreement equal to its Participation shown in Section 11.1. All lease and well equipment and other personal property within the Unit Area not taken over by the Unit Operator, as hereinabove provided, shall remain the property of the original owners.

ARTICLE 11
DEVELOPMENT AND OPERATING COSTS

11.1 Basis of Charges to Working Interest Owners. Unit Operator initially shall pay and discharge all costs and expenses incurred in the development and operation of the Unit Area. All charges, credits and accounting for costs and expenses shall be in accordance with Exhibit C or Section 11.4 herein. Each Working Interest Owner shall reimburse Unit Operator for all such costs and expenses in the following repsective proportions, to-wit:

El Paso Products and El Paso	15.83*
Humble	43.64
Pan American	40.53
	100.00

*The proportionate share of such costs and expenses which are attributable to this interest in which El Paso Products owns the oil rights and El Paso owns the gas rights shall be billed to and borne by El Paso Products.

11.2 Budgets. Before or as soon as practical after the effective date hereof, Unit Operator shall prepare a budget of estimated costs and expenses for the remainder of the calendar year and on or before the first day of each October thereafter shall prepare a budget of estimated costs and expenses for the ensuing calendar year. Such budgets shall set forth the estimated costs and expenses by quarterly periods. Unless otherwise specified in the budget, it shall be presumed for the purpose of advance billings that the estimated costs and expenses for each month of a quarterly period shall be one-third (1/3) of the estimate for the quarterly period. Budgets so prepared shall be estimates only and shall be subject to adjustment and correction by Working Interest Owners and Unit Operator from time to time whenever it shall appear that an adjustment or correction is proper. Approval of a budget shall not constitute approval of expenditures for any item contained therein. A copy of each such budget and adjusted budget shall be promptly furnished each Working Interest Owner.

11.3 Advance Billing. Unit Operator shall have the right at its option to require Working Interest Owners to advance their respective proportions of such costs and expenses by submitting to Working Interest Owners, on or before the 15th day of any month, an itemized estimate of such costs and expenses for the succeeding

month with a request for payment in advance. Within fifteen (15) days thereafter, each Working Interest Owner shall pay to Unit Operator its proportionate part of such estimate. Adjustment between estimates and the actual costs shall be made by Unit Operator at the close of each calendar month, and the accounts of the Working Interest Owners shall be adjusted accordingly.

11.4 Facility Charges. The charges provided for in Paragraph 12 of Section II of Exhibit C do not apply to any facility, such as water injection plants, or other similar installations, which are constructed or acquired by the unit and operated by the Unit Operator. In connection with any such facilities, the Unit Operator is hereby authorized to charge and collect the following charge:

11.4.1 Construction, Addition or Alteration to Facility. Eight per cent (8%) of the first $25,000 of the total cost of original construction and/or addition or alteration, and two per cent (2%) of all such costs in excess of $25,000.

11.4.2 Amendment of Facility Charges. The specifically authorized facility rates may be amended from time to time by agreement between the Unit Operator and the Working Interest Owners if in practice they are found to be insufficient or excessive.

11.5 Commingling of Funds. No funds received by Unit Operator under this agreement need be segregated by Unit Operator or maintained by it as a joint fund, but may be commingled with its own fund.

11.6 Lien of Unit Operator. Each Working Interest Owner grants to Unit Operator a lien upon such Working Interest Owner's leasehold and other mineral interests except royalty interests in each tract, its interest in all jointly-owned materials, equipment and other property and its interest in all Unitized Substances, as security for payment of the costs and expenses chargeable to it, together with interest thereon at the rate of six per cent (6%) per annum as provided in Exhibit C, Accounting Procedure. Unit Operator shall have the right to bring any action at law or in equity to enforce collection of such indebtedness with or without foreclosure of such lien. In addition, upon default by any Working Interest Owner in the payment of costs and expenses chargeable to it, Unit Operator shall have the right to collect and receive from the purchaser or purchasers the proceeds of such Working Interest Owner's share of Unitized Substances up to an amount owing by such Working Interest Owner plus interest, as aforesaid, until paid. By execution hereof, each subscribing party hereto agrees that

each such purchaser shall be entitled to rely upon Unit Operator's statement concerning the existence and amount of any such default.

11.7 Wells Drilled by Unit Operator. All wells drilled by Unit Operator shall be drilled on a competitive contract basis at the usual rates prevailing in the area. Unit Operator may employ its own tools and equipment in the drilling of wells, but in such event the charge therefor shall not exceed the prevailing rate in the area, and such work shall be performed by Unit Operator under the same terms and conditions as are customary and usual in the area in contracts of independent contractors doing work of a similar nature.

11.8 Investments Prior to Effective Date. Working Interest Owners may, prior to the effective date hereof, expend sums for the obtainment of source water, the installation of injection equipment and the conversion of wells for injection purposes. All such expenditures shall be charged to the joint account on the effective date hereof.

ARTICLE 12
OIL IN LEASE TANKAGE ON EFFECTIVE DATE

12.1 Gauge of Merchantable Oil. Unit Operator shall make a proper and timely gauge of all lease and other tanks within the Unit Area in order to ascertain the amount of merchantable oil produced from the Unitized Formation in such tanks as of 7:00 A.M. on the effective date hereof. All such oil as is a part of the prior allowable of the well or wells from which the same was produced shall be and remain the property of the Working Interest Owners entitled thereto the same as if the Unit had not been formed; and such Working Interest Owners shall promptly remove said oil from the Unit Area. Any such oil not so removed may be sold by the Unit Operator for the account of such Working Interest Owners, subject to the payment of all royalty by such Working Interest Owners to Royalty Owners under the terms and provisions of the applicable lease or leases and other contracts. All such oil as is in excess of the prior allowable of the well or wells from which the same was produced shall be regarded and treated the same as Unitized Substances produced after the effective date hereof. If, as of the effective date hereof, any Tract is overproduced with respect to the allowable of the well or wells on that Tract and the amount of such overproduction has been sold or otherwise disposed of, such overproduction shall be regarded and included as a part of the Unitized Substances produced after the effective date hereof and the amount thereof charged as having been delivered to the party contributing such Tract to this agreement.

ARTICLE 13
OPERATION OF NON-UNITIZED FORMATIONS

13.1 Right to Operate in Non-Unitized Formations. Any Working Interest Owner now having or hereafter acquiring the right to drill for and produce oil, gas or minerals, other than Unitized Substances, within the Unit Area shall have the full right to do so notwithstanding this agreement. In exercising said right, however, such Working Interest Owner shall exercise every reasonable precaution to prevent unreasonable interference with operations hereunder. No Working Interest Owner shall produce Unitized Substances through any well drilled or operated by it. If any Working Interest Owner drills any well into the Unitized Formation, the Unitized Formation shall be cased or otherwise protected in such a manner that the Unitized Formation and the production of Unitized Substances will not be adversely affected.

13.2 Dual Completions. Notwithstanding anything herein expressed or implied to the contrary, no well which is dually completed in the Unitized Formation and a non-unitized formation shall be taken over by the Unit Operator. The Working Interest Owners or owners of any such well which is within the Unit Area, or any revision thereof, at his, or their sole cost, expense and risk, prior to the date on which this agreement becomes effective as to the Tract on which such well is located shall seal off with cement all formations, other than the Unitized Formation from which such well is producing or is capable of producing oil or gas.

ARTICLE 14
TITLES

14.1 Warranty and Indemnity. Each Working Interest Owner represents and warrants that, to the best of its knowledge, it is the owner of the respective working interest set forth opposite its name in Exhibit A and hereby indemnifies and holds the other Working Interest Owners harmless from any loss due to failure, in whole or in part, of its title to any such interest, except failure of title arising out of operations hereunder; provided, however, that to the extent that such damages are based upon the values of Unitized Substances produced from such Working Interest Owner's lands such indemnity shall be limited to an amount equal to the net value that had been received from the sale of Unitized Substances attributed hereunder to the interest as to which title failed. Each failure of title will be effective, insofar as this agreement is concerned, as of the first day of the calendar month in which such failure is finally determined, and there shall be no retroactive

adjustment of development and operating expenses, Unitized Substances, or the proceeds therefrom as a result of title failure.

The acreage content of each tract has been established using the best information available. In the event it subsequently is determined by all of the Working Interest Owners or is finally determined by a court having jurisdiction that a miscalculation has been made as to the acreage content of any tract covered hereby, then there shall be a retroactive adjustment, to the effective date of this agreement, of ownership or production, investments, development, and operating costs. Such retroactive adjustment shall not include any re-evaluation of engineering or geological interpretation used in establishing ownership of production, and the original basis of computation of such ownership shall be employed.

14.2 Failure Because of Unit Operations. The failure of title to any working interest in any Tract by reason of unit operations, including non-production from such Tract, shall be borne by all Working Interest Owners in accordance with their respective unit participations. Any Working Interest Owner whose title has so failed shall remain a party to this agreement and shall continue to participate hereunder to the same relative degree as existed prior to the title failure.

ARTICLE 15
LIABILITY, CLAIMS AND SUITS

15.1 Individual Liability. The duties, obligations and liabilities of Working Interest Owners shall be several and not joint or collective; and nothing herein contained shall ever be construed as creating a partnership of any kind, joint venture, or an association or trust between or among Working Interest Owners. Each Working Interest Owner shall be individually responsible only for its own obligations as set out in this agreement and shall be liable only for its proportionate share of the costs, expenses, and liabilities as herein stipulated. Except with respect to damages arising from loss of title to a Tract each Working Interest Owner, to the extent of such Owner's percentage of participation, indemnifies and agrees to hold each other Working Interest Owner harmless of and from any claim of or liability to any third person, asserted upon the ground that operations under this agreement have resulted in or will result in any loss or damage to such third person, to the extent, but only to the extent, that such claim or liability is asserted against such other Working Interest Owner's share of such claim or liability corresponding to the latter's per cent of participation; it being the intention of Working Interest Owners that

any claim of or liability to any third person asserted upon the ground that operations under this agreement have resulted in, or will result in, any loss or damage to such third person shall be borne by all Working Interest Owners in proportion to their respective unit participations.

15.2 Settlements. In the event claim is made against any Working Interest Owner or any Working Interest Owner is sued on account of any matter or thing arising from the development and operation of the Unit Area and over which such Working Interest Owner individually had no control because of the rights, powers, and duties granted by this agreement, said Working Interest Owner shall immediately notify the Unit Operator of such claim or suit. Unit Operator, on behalf of the Working Interest Owners, shall assume and take over the further handling of such claim or suit and all costs and expenses of handling, settling or otherwise discharging such claim or suit shall be borne by Working Interest Owners as any other cost or expense of operating the Unit Area.

ARTICLE 16
INTERNAL REVENUE PROVISION

16.1 Internal Revenue Provision. Each Working Interest Owner hereby elects that it and the operations covered by this agreement be excluded from the application of Subchapter K of Chapter 1 of Subtitle A of the Internal Revenue Code of 1954, or such portion or portions thereof as the Secretary of the Treasury of the United States or his delegate shall permit by election to be excluded therefrom. Unit Operator is hereby authorized and directed to execute on behalf of each Working Interest Owner such additional or further evidence of said election as may be required by regulations issued under said Subchapter K, or should said regulations require each party to execute such further evidence, each Working Interest Owner agrees to execute or join in the execution thereof.

ARTICLE 17
NOTICES

17.1 Notices. All notices required hereunder shall be in writing and shall be deemed to have been properly served when sent by mail or telegram to the address of the representative of each Working Interest Owner as furnished to Unit Operator in accordance with Article 4 hereof.

ARTICLE 18
WITHDRAWAL OF WORKING INTEREST OWNER

18.1 Withdrawal. If any Working Interest Owner so desires, it may withdraw from this agreement by conveying, assigning and transferring without warranty of

title, either express or implied, to the other Working Interest Owners who do not desire to withdraw herefrom, all of the former's rights, title and interest in and to its lease or leases, or other operating rights in the Unit Area, insofar as said lease, leases or rights pertain to the Unitized Formation, together with the withdrawing Working Interest Owner's interest in all wells, pipe lines, casing, injection equipment, facilities and other personal property used in conjunction with the development and operation of the Unit Area; provided, that such transfer, assignment or conveyance shall not relieve said Working Interest Owner from any obligation or liability incurred prior to the date of the execution and delivery thereof. The interest so transferred, assigned and conveyed shall be taken and owned by the other Working Interest Owners in proportion to their respective unit participations. After the execution and delivery of such transfer, assignment or conveyance, the withdrawing Working Interest Owner shall be relieved from all further obligations and liability hereunder and the right of such Working Interest Owner to any benefits subsequently accruing hereunder shall cease; provided, that upon delivery of said transfer, assignment or conveyance, the assignees, in the ratio of the respective interests so acquired, shall pay to the assignor for its interest in all jointly owned equipment, casing and other personal property the net salvage value thereof, as estimated and fixed by Working Interest Owners. This section shall not prevent a Working Interest Owner from assigning its interest, in whole or in part, subject to the terms of applicable lease agreements, provided such assignment is made subject to the terms of this agreement.

18.2 Creation of New Interest. If any Working Interest Owner shall, after executing this agreement, create any overriding royalty, production payment, or other similar interest, hereafter referred to as "New Interest", out of its interest subject to this agreement, such New Interest shall be subject to all the terms and provisions of this agreement. In the event the Working Interest Owner, owning the interest from which the New Interest was created, withdraws from this agreement under the terms of Section 18.1, or fails to pay any expenses and costs chargeable to it under this agreement and the production to the credit of such Working Interest Owner is insufficient for that purpose, the owner of the New Interest will be liable for the pro rata portion of all costs and expenses which the original Working Interest Owner, creating such New Interest, would have been liable by virtue of his ownership of the new Interest had the same not been transferred. In this event, the lien provided in Section 11.6 may be enforced against such New Interest. If the owner of the New Interest

bears a portion of the costs and expenses or the same is enforced against such New Interest, the owner of the New Interest will be subrogated to the rights of the Unit Operater with respect to the interest primarily chargeable with such costs and expenses.

ARTICLE 19
OWNERSHIP OF PRODUCTION

19.1 Separate Ownership. All oil, gas and other hydrocarbon substances produced and saved from the subject lands during the life of this agreement, except Unitized Substances used or consumed in operations hereunder, or unavoidaly lost, shall, subject to the payment of royalty, be owned by Working Interest Owners as tenants in common in the following proportions, to-wit:

El Paso Products and El Paso	15.83*
Humble	43.64
Pan American	40.53
	100.00%

*All production attributable to this interest shall be owned by El Paso Products.

Each party hereto shall separately own its proportionate share of all such production and shall at all times take, receive and separately dispose of its proportionate share of such production to whomsoever it may desire. To the extent that royalty production is not taken in kind, each Working Interest Owner shall pay or cause to be paid all royalties, overriding royalties and other payments out of production due and payable under its leases included in the Unit Area, provided that the basic one-eighth (1/8) royalty prescribed by the terms of each of the leases covered hereby shall be borne by the parties hereto in the proportions hereinabove set forth in this Section 19.1

19.2 Failure to Take in Kind. If any Working Interest Owner should fail to take or adequately provide for the disposition of any part of its share of the production from subject lands, Unit Operator shall have the right, revocable at will, subject to the provisions of Section 19.1, to dispose of such production on a day-to-day basis at not less than the prevailing market price in the area for like production and such Working Interest Owner, upon such disposition, shall be considered as having received the same; provided, however, that any proceeds received by Unit Operator from such disposal shall, subject to payment of royalty, overriding royalties, and other payments out of production, be credited and paid to such Working Interest Owner the reasonable costs and expenses incurred in making such disposition.

19.3 Payment of Rentals. Each Working Interest Owner shall timely pay all rentals which become due and payable under the terms and provisions of its lease or leases committed to this agreement and, on or before the date on which such rentals shall become due and payable, shall furnish evidence of such payment to the other parties hereto. To the extent that such rentals so paid are attributable to land lying within the Unit Area and are not recovered by the withholding of royalty pursuant to the terms of the leases covered hereby, they shall be treated as items of operating expense hereunder, incurred at the end of the year specified in the lease or leases for which such payments are made.

ARTICLE 20
FORCE MAJEURE

20.1 Force Majeure. All obligations of each party hereto, except for the payment of money, shall be suspended while said party is prevented from complying therewith, in whole or in part, by strikes, fire, war, civil disturbances, acts of God, federal, state or municipal laws, orders or regulations, inability to secure materials, or other causes beyond the reasonable control of said party. This agreement or the leases or other interests subject hereto shall not be terminated by reason of suspension of unit operations due to the aforesaid causes. Any party hereto who relies upon this Section 20.1 as excusing any performance hereunder, extending this agreement, or extending any interest or estate in oil or gas-in-place shall, within a reasonable time after the occurrence of the interference giving rise to the application of this section, give written notice to all other parties hereto stating reasonable particulars of such interference, and shall use diligence to obviate the same. Said requirement that reasonable diligence be used to obviate any such interference shall not be deemed to require any party to settle any labor dispute against its will.

ARTICLE 21
EFFECTIVE DATE AND TERM

21.1 Effective Date. This agreement shall become effective as of October 1, 1961, and Operator shall take possession of and commence to operate Unit Area hereunder on December 1, 1961.

~~day of the calendar month next following the execution of this agreement by all Working Interest Owners.~~

21.2 Term. This agreement shall continue in full force and effect for and during the time that Unitized Substances are produced in paying quantities and thereafter until all wells jointly owned by Working Interest Owners have been abandoned

and plugged or turned over to Working Interest Owners in accordance with Article 22 hereof, and all personal and real property owned by the Working Interest Owners has been disposed of by Unit Operator in accordance with instructions of Working Interest Owners.

ARTICLE 22
ABANDONMENT OF WELLS

22.1 Rights of Former Owners. If Working Interest Owners decide to permanently abandon any well within the Unit Area prior to termination of this agreement, Unit Operator shall give written notice of such fact to the Working Interest Owners of the Tract on which such well is located and said Working Interest Owners shall have the right and option for a period of ninety (90) days after receipt of such notice to notify Unit Operator of their election to take over and own said well and to deepen or plug back said well to a formation other than the Unitized Formation. Within ten (10) days after said Working Interest Owners have so notified Unit Operator of their desire to take over such well, they shall pay to the Unit Operator, for credit to the joint account of the Working Interest Owners, the amount as estimated and fixed by Working Interest Owners to be the net salvage value of the salvable casing and equipment in and on said well. At the same time, the Working Interest Owners taking over the well shall agree by letter addressed to Unit Operator to effectively seal off and protect the Unitized Formation, and at such time as the well is ready for abandonment to plug and abandon the well in a workmanlike manner in accordance with applicable laws. In the event the Working Interest Owners of a Tract do not elect to take over a well located thereon which is proposed for abandonment, Unit Operator shall plug and abandon the well in accordance with applicable laws.

ARTICLE 23
ABANDONMENT OF OPERATIONS

23.1 Termination. Upon termination of this agreement, the following will occur:

23.1.1 Oil and Gas Rights. Possession of all oil and gas leasehold rights in and to subject lands shall revert to the Working Interest Owners thereof.

23.1.2 Right to Operate. Each Working Interest Owner desiring to take over and continue to operate any well or wells located on the portion of the subject lands covered by its lease may do so by paying Unit Operator, for the credit of the joint account, the salvage value of the casing and equipment in and on the well less the costs of recovering and salvaging the same, and by

agreeing to properly plug each such well at such time as it is abandoned.

23.1.3 Salvaging Wells. With respect to all wells not taken over by Working Interest Owners, Unit Operator shall at the joint expense of Working Interest Owners salvage as much of the casing and equipment in or on such wells as can economically and reasonably be salvaged and shall cause the same to be properly plugged and abandoned.

23.1.4 Cost of Salvaging. Working Interest Owners shall share the costs of salvaging, liquidating or other distribution of assets and properties used in the development and operation of the Unit Area in proportion to their respective unit participations.

ARTICLE 24
SUCCESSORS AND ASSIGNS

24.1 Successors and Assigns. The terms and provisions hereof shall be covenants running with the lands and unitized leases covered hereby and shall be binding upon and inure to the benefit of the respective heirs, successors and assigns of the parties hereto.

ARTICLE 25
LAWS AND REGULATIONS

25.1 Laws and Regulations. This agreement shall be subject to the conservation laws of the State of New Mexico, to the valid rules, regulations and orders of the New Mexico Oil Conservation Commission, and to all other applicable federal, state and municipal laws, rules, regulations and orders. It is not the intention of this agreement to limit, restrict or prorate production from the Unit Area, it being recognized that such powers are exclusively exercised by governmental authority.

Article 26 contained on Page 22a is a part of this Agreement prior to its execution.

IN WITNESS WHEREOF, the parties have respectively executed this agreement as of the day and year first above written.

ATTEST:

Assistant Secretary

EL PASO NATURAL GAS PRODUCTS COMPANY

BY Roland L Hamelin

ITS Attorney-In-Fact

ARTICLE 26
SUPERVISION AND RIGHTS OF INDIAN LESSORS

26.1 Supervision and rights of Indian Lessors. It is agreed between the parties hereto that the Secretary of the Interior, or his duly authorized representative, shall have the right of supervision over all operations within the area covered by this Joint Operating Agreement to the same extent and degree as provided in the applicable oil and gas mining leases on Navajo Tribal Lands and in the applicable oil and gas regulations of the Department of the Interior.

It is further agreed that nothing herein contained and no approval hereof by the Navajo Tribe or the Bureau of Indian Affairs shall impair any of the rights of the lessor or relieve any of the duties of the lessee under said Tribal Leases.

ATTEST:

Assistant Secretary

EL PASO NATURAL GAS COMPANY

BY

ITS ATTORNEY-IN-FACT

ATTEST: WITNESS:

Assistant Secretary

HUMBLE OIL & REFINING COMPANY

BY

ITS Attorney in Fact

J. J. Mullane
Attorney in Fact

O. K. as to transaction
O. K. as to form

JRD/RHB

ATTEST:

Assistant Secretary

PAN AMERICAN PETROLEUM CORPORATION

BY

ITS Attorney-in-Fact

APPROVED

CORPORATE ACKNOWLEDGMENT

STATE OF TEXAS

COUNTY OF EL PASO

On this 1st day of December, 1961, before me appeared Roland L. Hamblin, to me personally known, who, being by me duly sworn did say that he is the Attorney-In-Fact of EL PASO NATURAL GAS PRODUCTS COMPANY, and that the seal affixed to said instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors, and said Roland L. Hamblin acknowledged said instrument to be the free act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal on this, the day and year first above written.

Mary T. Saxon
NOTARY PUBLIC in and for
EL PASO County, TEXAS

MARY T. SAXON
Notary Public in and for El Paso County, Texas
My Commission Expires June 1, 1963

STATE OF Texas

COUNTY OF El Paso

On this 1st day of December, 1961, before me appeared Sam Smith, to me personally known, who, being by me duly sworn did say that he is the ATTORNEY-IN-FACT of EL PASO NATURAL GAS COMPANY, and that the seal affixed to said instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors, and said Sam Smith acknowledged said instrument to be the free act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal on this, the day and year first above written.

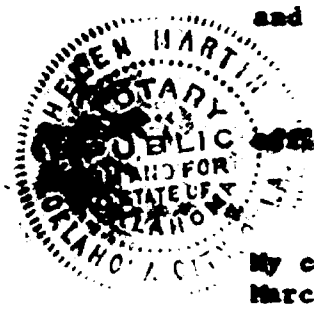
Natalie Taylor
NOTARY PUBLIC in and for
_____ County, _____

NOTARY PUBLIC
NATALIE TAYLOR
Notary Public in and for El Paso County, Texas
My Commission Expires June 1, 1963
COUNTY OF EL PASO

STATE OF OKLAHOMA,)
)ss.
COUNTY OF OKLAHOMA.)

On this 29th day of November, 1961, before me appeared J. J. Mullane, to me personally known, who, being by me duly sworn did say that he is the Attorney-in-Fact of HUMBLE OIL & REFINING COMPANY, and that said instrument was signed in behalf of said corporation by authority of its Board of Directors, and said J. J. Mullane acknowledged said instrument to be the free act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal on this, the day and year first above written.



Helen Martin
Notary Public in and for
Oklahoma County, Oklahoma

My commission expires:
March 27, 1965

26R

STATE OF Colorado

COUNTY OF Denver

On this _____ day of December, 196 1, before me appeared Raymond D. Sloan, to me personally known, who, being by me duly sworn did say that he is the Attorney in Fact of HUMBLE OIL & REFINING COMPANY, ~~and that the seal affixed to said instrument is the corporate seal of said corporation~~ and that said instrument was signed ~~and sealed~~ in behalf of said corporation by authority of its Board of Directors, and said Raymond D. Sloan acknowledged said instrument to be the free act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal on this, the day and year first above written.

NOTARY PUBLIC in and for

Denver County, Colorado

. . . . . .

STATE OF TEXAS

COUNTY OF TARRANT

On this 30th day of November, 1961, before me appeared C. F. BEDFORD, to me personally known, who, being by me duly sworn did say that he is ATTORNEY-IN-FACT of PAN AMERICAN PETROLEUM CORPORATION, and that the seal affixed to said instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors, and said C. F. BEDFORD acknowledged said instrument to be the free act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal on this, the day and year first above written.

NOTARY PUBLIC * STATE OF TEXAS * COUNTY

Ada Belle Zartman Ada Belle Zartman

NOTARY PUBLIC in and for

TARRANT County, TEXAS

EXHIBIT "A"

SCHEDULE SHOWING THE PERCENTAGE AND KIND OF OWNERSHIP
OF ALL LANDS WITHIN THE NORTHWEST CHA CHA UNIT
TOWNSHIP 29 NORTH, RANGE 14 WEST, SAN JUAN COUNTY, NEW MEXICO

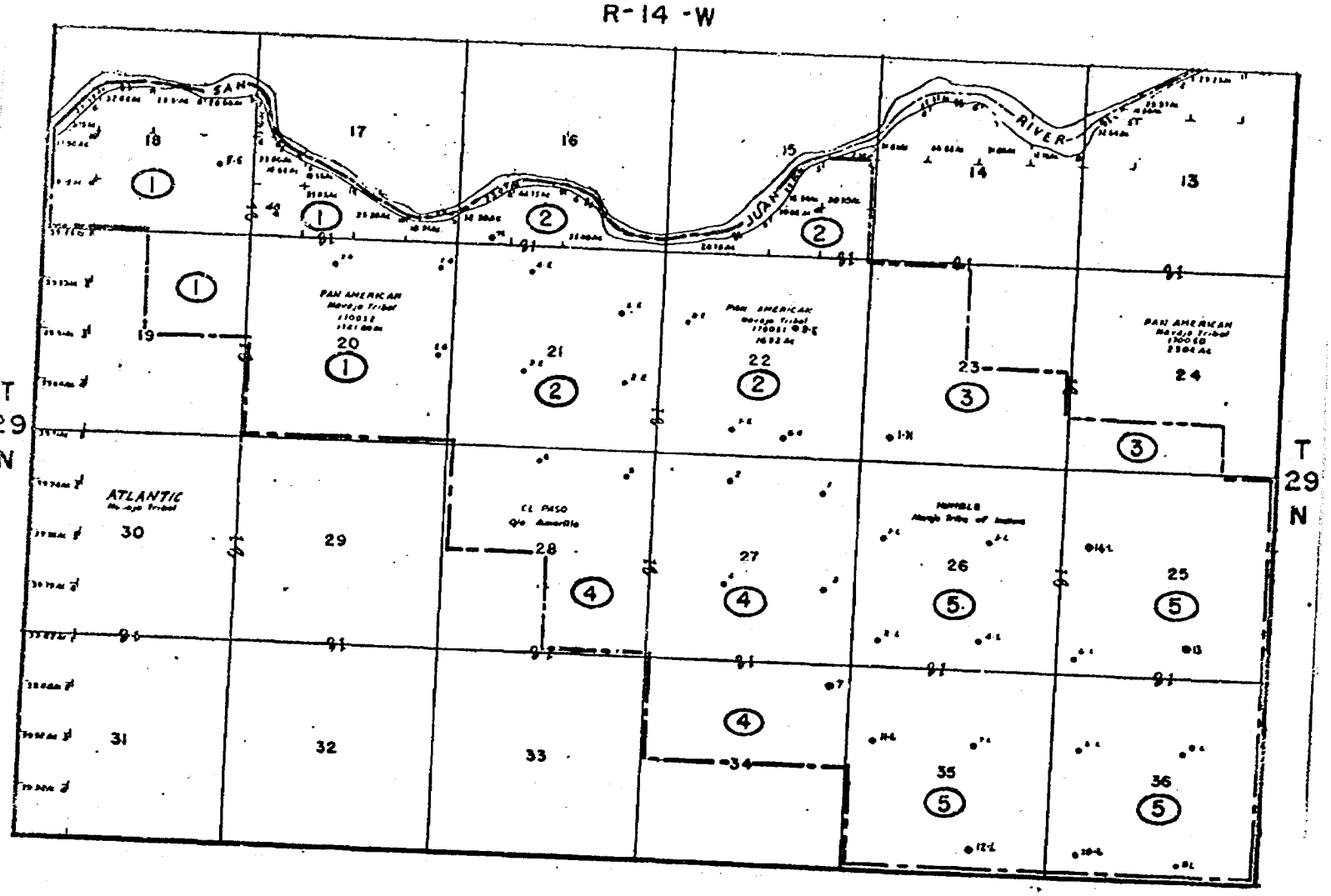
Tract No.	Description	No. Acres	Serial No. & Date of Lease or Application	Basic Royalty & Percentage	Lessee of Record	ORRI and Percentage	Working Interest and Percentage	
	NAVAJO TRIBAL LAND							
1	T-29-N, R-14-W: Sec. 17 - All South of Mid-Channel, San Juan River Sec. 18 - All South of Mid-Channel, San Juan River Sec. 19 - NE/4 Sec. 20 - ALL	989.17	14-20-603-2200 12-20-56	USA in Trust for Navajo Tribe 12.50%	Pan American	None	Pan American	87.50%
2	T-29-N, R-14-W: Sec. 15 - All that portion of the S/2 lying south of Mid-Channel, San Juan River Sec. 16 - All South of Mid-Channel, San Juan River Sec. 21 - ALL Sec. 22 - ALL	1595.68	14-20-603-2199 12-20-56	USA in Trust for Navajo Tribe 12.50%	Pan American	None	Pan American	87.50%
3	T-29-N, R-14-W: Sec. 23 - NW/4 & S/2 Sec. 24 - S/2 SW/4 and SW/4 SE/4	600.00	14-20-603-2198 12-20-56	USA in Trust for Navajo Tribe 12.50%	Pan American	None	Pan American	87.50%

EXHIBIT "A" (Cont'd)
Page 2

Tract No.	Description	No. Acres	Serial No. & Date of Lease or Application	Basic Royalty & Percentage	Lessee of Record	ORRI and Percentage	Working Interest and Percentage
4	T-29-N, R-14-W: Sec. 27 - ALL Sec. 28 - N/2 and SE/4 Sec. 34 - N/2	1440.00	14-20-603-2168 12-31-56	USA in Trust for Navajo Tribe 12.50%	El Paso Natural Gas Products Company	None	El Paso Natural Gas Products Co. and El Paso Natural Gas Company* 87.50%
5	T-29-N, R-14-W: Sec. 25 - ALL Sec. 26 - ALL Sec. 35 - ALL Sec. 36 - ALL	2560.00	14-20-603-2172	Paul Jones, Chairman for the Navajo Tribal Council for the Navajo Tribe of Indians 12.50%	Humble Oil & Refining Company	None	Humble Oil & Refining Company 87.50%

* - The gas rights in Tract No. 4 are owned by El Paso Natural Gas Company and the oil rights in said tract are owned by El Paso Natural Gas Products Company. The oil rights are subject to a 6.25% production payment owned by El Paso Natural Gas Company.

R-14-W



UNIT AREA

(5) = TRACT NO.

EXHIBIT "B"

NORTHWEST CHA CHA UNIT

T 29 N R 14 W

SAN JUAN CO., NEW MEXICO

SCALE: 1" = 4000'

FORM 139 12-59
PRINTED IN U.S.A.

PASO-T-1955-2

EXHIBIT "C"

Attached to and made a part of JOINT OPERATING AGREEMENT
NORTHWEST CHA CHA UNIT AREA
SAN JUAN COUNTY, NEW MEXICO

ACCOUNTING PROCEDURE

(UNIT AND JOINT LEASE OPERATIONS)

I. GENERAL PROVISIONS

1. Definitions

"Joint property" as herein used shall be construed to mean the subject area covered by the agreement to which this "Accounting Procedure" is attached.

"Operator" as herein used shall be construed to mean the party designated to conduct the development and operation of the subject area for the joint account of the parties hereto.

"Non-Operator" as herein used shall be construed to mean any one or more of the non-operating parties.

2. Statements and Billings

Operator shall bill Non-Operator on or before the last day of each month for its proportionate share of costs and expenditures during the preceding month. Such bills will be accompanied by statements, reflecting the total costs and charges as set forth under Subparagraph C ..... below:

A. Statement in detail of all charges and credits to the joint account.

B. Statement of all charges and credits to the joint account, summarized by appropriate classifications indicative of the nature thereof.

C. Statements as follows:

(1) Detailed statement of material ordinarily considered controllable by operators of oil and gas properties;

(2) Statement of ordinary charges and credits to the joint account summarized by appropriate classifications indicative of the nature thereof; and

(3) Detailed statement of any other charges and credits.

3. Payments by Non-Operator

Each party shall pay its proportion of all such bills within fifteen (15) days after receipt thereof. If payment is not made within such time, the unpaid balance shall bear interest at the rate of six per cent (6%) per annum until paid.

4. Adjustments

Payment of any such bills shall not prejudice the right of Non-Operator to protest or question the correctness thereof. Subject to the exception noted in Paragraph 5 of this section I, all statements rendered to Non-Operator by Operator during any calendar year shall conclusively be presumed to be true and correct after twenty-four (24) months following the end of any such calendar year, unless within the said twenty-four (24) month period Non-Operator takes written exception thereto and makes claim on Operator for adjustment. Failure on the part of Non-Operator to make claim on Operator for adjustment within such period shall establish the correctness thereof and preclude the filing of exceptions thereto or making of claims for adjustment thereon. The provisions of this paragraph shall not prevent adjustments resulting from physical inventory of property as provided for in Section VI, Inventories, hereof.

5. Audits

A Non-Operator, upon notice in writing to Operator and all other Non-Operators, shall have the right to audit Operator's accounts and records relating to the accounting hereunder for any calendar year within the twenty-four (24) month period following the end of such calendar year, provided, however, that Non-Operator must take written exception to and make claim upon the Operator for all discrepancies disclosed by said audit within said twenty-four (24) month period. Where there are two or more Non-Operators, the Non-Operators shall make every reasonable effort to conduct joint or simultaneous audits in a manner which will result in a minimum of inconvenience to the Operator.

II. DEVELOPMENT AND OPERATING CHARGES

Subject to limitations hereinafter prescribed, Operator shall charge the joint account with the following items:

1. Rentals and Royalties

Delay or other rentals, when such rentals are paid by Operator for the joint account; royalties, when not paid directly to royalty owners by the purchaser of the oil, gas, casinghead gas, or other products.

2. Labor

A. Salaries and wages of Operator's employees directly engaged on the joint property in the development, maintenance, and operation thereof, including salaries or wages paid to geologists and other employees who are temporarily assigned to and directly employed on a drilling well.

B. Operator's cost of holiday, vacation, sickness and disability benefits, and other customary allowances applicable to the salaries and wages chargeable under Subparagraph 2 A and Paragraph 11 of this Section II. Costs under this Subparagraph 2 B may be charged on a "when and as paid basis" or by "percentage assessment" on the amount of salaries and wages chargeable under Subparagraph 2 A and Paragraph 11 of this Section II. If percentage assessment is used, the rate shall be based on the Operator's cost experience.

C. Costs of expenditures or contributions made pursuant to assessments imposed by governmental authority which are applicable to Operator's labor cost of salaries and wages as provided under Subparagraphs 2 A, 2 B, and Paragraph 11 of this Section II.

3. Employee Benefits

Operator's current cost of established plans for employees' group life insurance, hospitalization, pension, retirement, stock purchase, thrift, bonus, and other benefit plans of a like nature, applicable to Operator's labor cost, provided that the total of such charges shall not exceed ten per cent (10%) of Operator's labor costs as provided in Subparagraphs A and B of Paragraph 2 of this Section II and in Paragraph 11 of this Section II.

4. Material

Material, equipment, and supplies purchased or furnished by Operator for use of the joint property. So far as it is reasonably practical and consistent with efficient and economical operation, only such material shall be purchased for or transferred to the joint property as may be required for immediate use; and the accumulation of surplus stocks shall be avoided.

5. Transportation

Transportation of employees, equipment, material, and supplies necessary for the development, maintenance, and operation of the joint property subject to the following limitations:

A. If material is moved to the joint property from vendor's or from the Operator's warehouse or other properties, no charge shall be made to the joint account for a distance greater than the distance from the nearest reliable supply store or railway receiving point where such material is available, except by special agreement with Non-Operator.

B. If supplies [illegible] moved to Operator's warehouse or other storage point, no charge shall be made to the joint account for a distance greater than the distance from the nearest reliable supply store or railway receiving point, except by special agreement with Non-Operator. No charge shall be made to the joint account for moving material to other properties belonging to Operator, except by special agreement with Non-Operator.

6. Service

A. Outside Services:
The cost of contract services and utilities procured from outside sources.

B. Use of Operator's Equipment and Facilities:
Use of and service by Operator's exclusively owned equipment and facilities as provided in Paragraph 5 of Section III entitled "Operator's Exclusively Owned Facilities."

7. Damages and Losses to Joint Property and Equipment

All costs or expenses necessary to replace or repair damages or losses incurred by fire, flood, storm, theft, accident, or any other cause not controllable by Operator through the exercise of reasonable diligence. Operator shall furnish Non-Operator written notice of damages or losses incurred as soon as practicable after report of the same has been received by Operator.

8. Litigation Expense

All costs and expenses of litigation, or legal services otherwise necessary or expedient for the protection of the joint interests, including attorneys' fees and expenses as hereinafter provided, together with all judgments obtained against the parties or any of them on account of the joint operations under this agreement, and actual expenses incurred by any party or parties hereto in securing evidence for the purpose of defending against any action or claim prosecuted or urged against the joint account or the subject matter of this agreement.

A. If a majority of the interests hereunder shall so agree, actions or claims affecting the joint interests hereunder may be handled by the legal staff of one or more of the parties hereto; and a charge commensurate with cost of providing and furnishing such services rendered may be made against the joint account; but no such charge shall be made until approved by the legal departments of or attorneys for the respective parties hereto.

B. Fees and expenses of outside attorneys shall not be charged to the joint account unless authorized by the majority of the interests hereunder.

9. Taxes

All taxes of every kind and nature assessed or levied upon or in connection with the properties which are the subject of this agreement, the production therefrom or the operation thereof, and which taxes have been paid by the Operator for the benefit of the parties hereto.

10. Insurance and Claims

A. Premiums paid for insurance required to be carried for the benefit of the joint account, together with all expenditures incurred and paid in settlement of any and all losses, claims, damages, judgments, and other expenses, including legal services, not recovered from insurance carrier.

B. If no insurance is required to be carried, all actual expenditures incurred and paid by Operator in settlement of any and all losses, claims, damages, judgments, and any other expenses, including legal services, shall be charged to the joint account.

11. District and Camp Expense (Field Supervision and Camp Expense)

A pro rata portion of the salaries and expenses of Operator's production superintendent and other employees serving the joint property and other properties of the Operator in the same operating area, whose time is not allocated directly to the properties, and a pro rata portion of the cost of maintaining and operating a production office known as Operator's Farmington Area Durango District office located at or near Farmington, New Mexico Durango, Colo (or a comparable office if location changed), and necessary suboffices (if any), maintained for the convenience of the above-described office, and all necessary camps, including housing facilities for employees if required, used in the conduct of the operations on the joint property and other properties operated in the same locality. The expense of, less any revenue from, these facilities should be inclusive of depreciation or a fair monthly rental in lieu of depreciation on the investment. Such charges shall be apportioned to all properties served on some equitable basis consistent with Operator's accounting practice.

12. Administrative Overhead

Operator shall have the right to assess against the joint property covered hereby the following management and administrative overhead charges, which shall be in lieu of all expenses of all offices of the Operator not covered by Section II, Paragraph 11, above, including salaries and expenses of personnel assigned to such offices, except that salaries of geologists and other employees of Operator who are temporarily assigned to and directly serving on the joint property will be charged as provided in Section II, Paragraph 2, above. Salaries and expenses of other technical employees assigned to such offices will be considered as covered by overhead charges in this paragraph unless charges for such salaries and expenses are agreed upon between Operator and Non-Operator as a direct charge to the joint property.

WELL BASIS (Rate Per Well Per Month)

Well Depth	DRILLING WELL RATE — Each Well	PRODUCING WELL RATE (Use Completion Depth) — First Five	Next Five	All Wells Over Ten
ALL DEPTHS	$ 225	$ 50	$ 40	$ 30

A. Overhead charges for drilling wells shall begin on the date each well is spudded and terminate when it is on production or is plugged, as the case may be, except that no charge shall be made during the suspension of drilling operations for fifteen (15) or more consecutive days.

B. In connection with overhead charges, the status of wells shall be as follows:

(1) Injection wells for recovery operations, such as for repressure or water flood, shall be included in the overhead schedule the same as producing oil wells.

(2) Water supply wells utilized for water flooding operations shall be included in the overhead schedule the same as producing oil wells.

(3) Producing gas wells shall be included in the overhead schedule the same as producing oil wells.

(4) Wells permanently shut down but on which plugging operations are deferred shall be dropped from the overhead schedule at the time the shutdown is effected. When such wells are plugged, overhead shall be charged at the producing well rate during the time required for the plugging operation.

(5) Wells being plugged back, drilled deeper, or converted to a source or input well shall be included in the overhead schedule the same as drilling wells.

(6) Temporarily shut-down wells (other than by governmental regulatory body) which are not produced or worked upon for a period of a full calendar month shall not be included in the overhead schedule; however, wells shut in by governmental regulatory body shall be included in the overhead schedule only in the event the allowable production is transferred to other wells on the same property. In the event of a unit allowable, all wells capable of producing will be counted in determining the overhead charge.

(7) Wells completed in dual or multiple horizons shall be considered as two wells in the producing overhead schedule.

(8) Lease salt water disposal wells shall not be included in the overhead schedule unless such wells are used in a secondary recovery program on the joint property.

C. The above overhead schedule for producing wells shall be applied to the total number of wells operated under the Operating Agreement to which this accounting procedure is attached, irrespective of individual leases.

D. It is specifically understood that the above overhead rates apply only to drilling and producing operations and are not intended to cover the construction or operation of additional facilities such as, but not limited to, gasoline plants, compressor plants, repressuring projects, salt water disposal facilities, and similar installations. If at any time any or all of these become necessary to the operation, a separate agreement will be reached relative to an overhead charge and allocation of district expense.

E. The above specific overhead rates may be amended from time to time by agreement between Operator and Non-Operator if, in practice, they are found to be insufficient or excessive.

13. Operator's Fully Owned Warehouse Operating and Maintenance Expense

(Describe fully the agreed procedure to be followed by the Operator.)

No charge, either direct or indirect, will be made to the joint account for operating and maintenance expense of Operator's fully-owned warehouse.

14. Other Expenditures

Any expenditure, other than expenditures which are covered and dealt with by the foregoing provisions of this Section II, incurred by the Operator for the necessary and proper development, maintenance, and operation of the joint property.

III. BASIS OF CHARGES TO JOINT ACCOUNT

1. Purchases

Material and equipment purchased and service procured shall be charged at price paid by Operator after deduction of all discounts actually received.

2. Material Furnished by Operator

Material required for operations shall be purchased for direct charge to joint account whenever practicable, except that Operator may furnish such material from Operator's stocks under the following conditions:

A. New Material (Condition "A")

(1) New material transferred from Operator's warehouse or other properties shall be priced f.o.b. the nearest reputable supply store or railway receiving point, where such material is available, at current replacement cost of the same kind of material. This will include material such as tanks, pumping units, sucker rods, engines, and other major equipment. Tubular goods, two-inch (2") and over, shall be priced on carload basis effective at date of transfer and f.o.b. railway receiving point nearest the joint account operation, regardless of quantity transferred.

(2) Other material shall be priced on basis of a reputable supply company's preferential price list effective at date of transfer and f.o.b. the store or railway receiving point nearest the joint account operation where such material is available.

(3) Cash discount shall not be allowed.

B. Used Material (Condition "B" and "C")

(1) Material which is in sound and serviceable condition and is suitable for reuse without reconditioning shall be classed as Condition "B" and priced at seventy-five per cent (75%) of new price.

(2) Material which cannot be classified as Condition "B" but which,

(a) After reconditioning will be further serviceable for original function as good secondhand material (Condition "B"), or

(b) Is serviceable for original function but substantially not suitable for reconditioning,

shall be classed as Condition "C" and priced at fifty per cent (50%) of new price.

(3) Material which cannot be classified as Condition "B" or Condition "C" shall be priced at a value commensurate with its use.

(4) Tanks, buildings, and other equipment involving erection costs shall be charged at applicable percentage of knocked-down new price.

3. Premium Prices

Whenever materials and equipment are not readily obtainable at the customary supply point and at prices specified in Paragraphs 1 and 2 of this Section III because of national emergencies, strikes or other unusual causes over which the Operator has no control, the Operator may charge the joint account for the required materials on the basis of the Operator's direct cost and expense incurred in procuring such materials, in making it suitable for use, and in moving it to the location, provided, however, that notice in writing is furnished to Non-Operator of the proposed charge prior to billing the Non-Operator for the material and/or equipment acquired pursuant to this provision, whereupon Non-Operator shall have the right, by so electing and notifying Operator within 10 days after receiving notice from the Operator, to furnish in kind, or in tonnage as the parties may agree, at the location, nearest railway receiving point, or Operator's storage point within a comparable distance, all or part of his share of material and/or equipment suitable for use and acceptable to the Operator. Transportation costs on any such material furnished by Non-Operator, at any point other than at the location, shall be borne by such Non-Operator. If, pursuant to the provisions of this paragraph, any Non-Operator furnishes material and/or equipment in kind, the Operator shall make appropriate credits therefor to the account of said Non-Operator.

4. Warranty of Material Furnished by Operator

Operator does not warrant the material furnished beyond or back of the dealer's or manufacturer's guaranty; and in case of defective material, credit shall not be passed until adjustment has been received by Operator from the manufacturers or their agents.

5. Operator's Exclusively Owned Facilities

The following rates shall apply to service rendered to the joint account by facilities owned exclusively by Operator:

A. Water, fuel, power, compressor and other auxiliary services at rates commensurate with cost of providing and furnishing such service to the joint account but not exceeding rates currently prevailing in the field where the joint property is located.

B. Automotive equipment at rates commensurate with cost of ownership and operation. Such rates should generally be in line with the schedule of rates adopted by the Petroleum Motor Transport Association, or some other recognized organization, as recommended uniform charges against joint account operations and revised from time to time. Automotive rates shall include cost of oil, gas, repairs, insurance, and other operating expense and depreciation; and charges shall be based on use in actual service on, or in connection with, the joint account operations. Truck and tractor rates may include wages and expenses of driver.

C. A fair rate shall be charged for the use of drilling and cleaning-out tools and any other items of Operator's fully owned machinery or equipment which shall be ample to cover maintenance, repairs, depreciation, and the service furnished the joint property; provided that such charges shall not exceed those currently prevailing in the field where the joint property is located. Pulling units shall be charged at hourly rates commensurate with the cost of ownership and operation, which shall include repairs and maintenance, operating supplies, insurance, depreciation, and taxes. Pulling unit rates may include wages and expenses of the operator.

D. A fair rate shall be charged for laboratory services performed by Operator for the benefit of the joint account, such as gas, water, core, and any other analyses and tests; provided such charges shall not exceed those currently prevailing if performed by outside service laboratories.

E. Whenever requested, Operator shall inform Non-Operator in advance of the rates it proposes to charge.

F. Rates shall be revised and adjusted from time to time when found to be either excessive or insufficient.

IV. DISPOSAL OF LEASE EQUIPMENT AND MATERIAL

The Operator shall be under no obligation to purchase interest of Non-Operator in surplus new or secondhand material. The disposition of major items of surplus material, such as derricks, tanks, engines, pumping units, and tubular goods, shall be subject to mutual determination by the parties hereto; provided Operator shall have the right to dispose of normal accumulations of junk and scrap material either by transfer or sale from the joint property.

1. Material Purchased by the Operator or Non-Operator

Material purchased by either the Operator or Non-Operator shall be credited by the Operator to the joint account for the month in which the material is removed by the purchaser.

2. Division in Kind

Division of material in kind, if made between Operator and Non-Operator, shall be in proportion to their respective interests in such material. Each party will thereupon be charged individually with the value of the material received or receivable by each party, and corresponding credits will be made by the Operator to the joint account. Such credits shall appear in the monthly statement of operations.

3. Sales to Outsiders

Sales to outsiders of material from the joint property shall be credited by Operator to the joint account at the net amount collected by Operator from vendee. Any claims by vendee for defective material or otherwise shall be charged back to the joint account if and when paid by Operator.

V. BASIS OF PRICING MATERIAL TRANSFERRED FROM JOINT ACCOUNT

Material purchased by either Operator or Non-Operator or divided in kind, unless otherwise agreed, shall be valued on the following basis:

1. New Price Defined

New price as used in the following paragraphs shall have the same meaning and application as that used above in Section III, "Basis of Charges to Joint Account."

2. New Material

New material (Condition "A"), being new material procured for the joint account but never used thereon, at one hundred per cent (100%) of current new price (plus sales tax if any).

3. Good Used Material

Good used material (Condition "B"), being used material in sound and serviceable condition, suitable for reuse without reconditioning:

A. At seventy-five per cent (75%) of current new price if material was charged to joint account as new, or

B. At sixty-five per cent (65%) of current new price if material was originally charged to the joint property as secondhand at seventy-five per cent (75%) of new price.

4. Other Used Material

Used material (Condition "C"), at fifty per cent (50%) of current new price, being used material which:

A. After reconditioning will be further serviceable for original function as good secondhand material (Condition "B"), or

B. Is serviceable for original function but substantially not suitable for reconditioning.

5. Bad-Order Material

Material and equipment (Condition "D"), which is no longer usable for its original purpose without excessive repair cost but is further usable for some other purpose, shall be priced on a basis comparable with that of items normally used for that purpose.

6. Junk

Junk (Condition "E"), being obsolete and scrap material, at prevailing prices.

7. Temporarily Used Material

When the use of material is temporary and its service to the joint account does not justify the reduction in price as provided in Paragraph 3 B, above, such material shall be priced on a basis that will leave a net charge to the joint account consistent with the value of the service rendered.

VI. INVENTORIES

1. Periodic Inventories, Notice and Representation

At reasonable intervals, inventories shall be taken by Operator of the joint account material, which shall include all such material as is ordinarily considered controllable by operators of oil and gas properties.

Written notice of intention to take inventory shall be given by Operator at least thirty (30) days before any inventory is to begin so that Non-Operator may be represented when any inventory is taken.

Failure of Non-Operator to be represented at an inventory shall bind Non-Operator to accept the inventory taken by Operator, who shall in that event furnish Non-Operator with a copy thereof.

2. Reconciliation and Adjustment of Inventories

Reconciliation of inventory with charges to the joint account shall be made by each party at interest, and a list of overages and shortages shall be jointly determined by Operator and Non-Operator.

Inventory adjustments shall be made by Operator with the joint account for overages and shortages, but Operator shall be held accountable to Non-Operator only for shortages due to lack of reasonable diligence.

3. Special Inventories

Special inventories may be taken, at the expense of the purchaser, whenever there is any sale or change of interest in the joint property; and it shall be the duty of the party selling to notify all other parties hereto as quickly as possible after the transfer of interest takes place. In such cases, both the seller and the purchaser shall be represented and shall be governed by the inventory so taken.

EXHIBIT "D"

Attached to and made a part of
Joint Operating Agreement

NORTHWEST CHA CHA UNIT AREA
SAN JUAN COUNTY, NEW MEXICO

INSURANCE PROVISIONS

(1) Unit Operator shall comply with the Workmen's Compensation and Employer's Liability Laws of the State of New Mexico.

(2) Where Unit Operator retains an independent contractor for any of the operations hereunder, it shall require that contractor to have adequate insurance coverages in line with Unit Operator's usual practices.

(3) Each party may, individually and severally at its own expense, obtain such insurance in addition as it may desire; provided, however, that such additional insurance shall contain an endorsement waiving all rights by subordination or otherwise against the other parties, if the other parties are not named as a co-insured in the policy.

Case 2447

ENGINEERING & PRODUCTION SERVICE, INC.
P. O. BOX 190 -:- PH. 325-1924
FARMINGTON, NEW MEXICO 87401

March 30, 1973

New Mexico Oil Conservation Commission
1000 Rio Brazos Road
Aztec, New Mexico 87410

Att: Mr. Emery Arnold

Re: Water Source Wells
NW Cha Cha Unit
Cha Cha Gallup Field
San Juan County, N. Mex.

Dear Mr. Arnold:

Please be advised that 12 shallow water source wells (depth 25-50 ft.) located along the San Juan River in Sec 15 & 16-29N-14W formerly owned by Exxon Corporation have been purchased by Suburban Propane Gas Corporation as part of the NW Cha Cha Unit purchase.

Should you desire further information concerning this matter, please advise.

Yours very truly,

Ben K. Kelley

Ben K. Kelley

BKK:sw

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico

November 29, 1961

EXAMINER HEARING

IN THE MATTER OF:
Application of Humble Oil & Refining Company for approval of a pressure maintenance project in the Cha Cha-Gallup Oil Pool, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks permission to institute a pressure maintenance project in the Cha Cha-Gallup Oil Pool by the injection of water into certain wells located on the Navajo Indian Reservation in Sections 13 through 29 and 33 through 36, Township 29 North, Range 14 West, San Juan County, New Mexico. Applicant further seeks the promulgation of special rules and regulations governing said project.

CASE NO. 2447

BEFORE: Daniel S. Nutter, Examiner

TRANSCRIPT OF HEARING

EXAMINER NUTTER: We will call Case No. 2447.

MR. WHITFIELD: Application of Humble Oil & Refining Company for approval of a pressure maintenance project in the Cha Cha-Gallup Oil Pool, San Juan County, New Mexico.

MR. VERITY: I have a motion to make in this case.

MR. BRATTON: Howard C. Bratton on behalf of Applicant, Humble Oil & Refining Company.

EXAMINER NUTTER: Are there any other appearances in Case No. 6447?

MR. VERITY: George L. Verity, representing Southwest Production Company. I have a motion to make with regard to the matter.

MR. BUELL: Guy Buell, on behalf of Pan American Petroleum Corporation.

MR. SWANSON: Kenneth Swanson, representing Aztec Oil & Gas.

EXAMINER NUTTER: Are there any other appearances?

MR. WOLF: Walter Wolf, Jr., representing the Navajo Tribe. I am not entering an appearance before the Commission but I am here as an observer on behalf of the royalty owner.

EXAMINER NUTTER: You may proceed.

MR. VERITY: On behalf of Southwest Production Company I would like for the record to show that they have never received the usual and customary letter that the Commission refers to interested parties regarding setting of these matters, and they were not advised as to this hearing until a very recent date. They have had no opportunity to make any study of the application and are not in any position at this time to either cross-examine witnesses that might be put on nor are we in any position to make any presentation whatsoever. The truth of the matter is that Southwest is not even in a position to know whether or not they want or need to oppose the application.

In this connection, I would like to direct the Commission's attention to the fact that the application does not contain the requirement with regard to names and addresses of interested parties. I am sure this is the reason that Southwest did not receive the customary letter with regard to the matter. Also, I have a notice that the application makes reference to unitization of lands, that there has been a request that it be pooled. Southwest Production Company has had no opportunity to discuss entering the unit, to discuss the nature of it or to have any opportunity to join in it.

We feel that at this time it's premature from this standpoint to have a hearing regarding the matter. We feel that it is necessary that the matter be continued until such time as study can be made to note whether or not we need to oppose the application, to investigate the possibilities of having the unit cover all of the area that is affected by the application and to know whether or not there is need to oppose, to know whether or not this formation in the South half of 16 will be damaged, and whether or not there is need to oppose it. We feel that it's improper at this time to proceed to hear the application.

MR. BRATTON: Humble Oil & Refining Company resists this motion. We are all here today. We are prepared to proceed with the presentation of this case. Southwest Production Company received the notice that we all receive in cases and month after month I have appeared before this Commission having received notice

of such cases as being in the same position in which Mr. Verity is and until I hear the case, we are deciding our position right up to the last minute. That's just the way the rules of the Commission are set up. That's the way the cases are heard every month. Secondly, I think we can demonstrate to the Commission and to the satisfaction of Mr. Verity's clients that we are not affecting them. This project borders on the San Juan River and embraces solely the Navajo tribal lands to the north of it including those of Humble and Pan American, who are the applicants in this proposal. Those lands north of the River, I believe we will demonstrate to the Commission that every day's delay in the institution of a pressure maintenance program in this field will result in ultimate loss of oil. This application contains a plat as required by the regulations and Mr. Verity had three cases on the docket right in front of this. Southwest Production had, I assume, received the docket the same time that we did or anybody else did.

As far as a continuance, I think it would be a real waste of time. Mr. Verity knows the rules as well as the Commission does, or I do, and there is a procedure for a hearing denovo before the Commission if Mr. Verity thinks a wrong order has been entered. At that time, he has relief before the Commission. To establish a precedent of continuing a case because one party does not know what his position may or may not be in connection with the case, I think would be one that the Commission

would regret. I might add that Mr. Verity sent me word yesterday that he would make this motion for continuance, but the procedure which I have certainly seen followed numerous times -- I would say monthly -- is that when a case appears on the docket in which a company owning adjoining acreage did not know whether it may be an interested party or what his position may be, they invariably call that applicant to see what it is all about. That is normal procedure. We have received no request for information. We would certainly have been happy to furnish it. We are willing to furnish it fully here today and, I might add, to the satisfaction of Mr. Verity. We are not going to damage his client. As a matter of fact, we are most anxious to cooperate with them and we will demonstrate that in the hearing today.

MR. VERITY: In response, with reference to the plat attached to Rule 701B, at one place it shows it to be within a two-mile radius. Southwest Production Company's acreage in the South half of 16, north of the River, is, of course, within the two-mile radius. It is actually within the land that is noted by the notice but their name does not appear on the plat as required by Rule 701B. Also, the rule requires that the application must give the names of the interested parties and the truth of the situation, of course, I did receive the customary notice the Commission sent out, but I do not follow the notice for each of these pools or the clients names who has any acreage in the area. Southwest Production Company had no knowledge whatsoever of the

fact and does not know whether the rule has been complied with. This would not have been the situation had they received notice in the customary manner.

We think it is improper and that the rights of Southwest Production Company may be violated with regard to the matter if they are not given ample opportunity to appear and cross-examine witnesses and present evidence in the case. We certainly do not have that opportunity at this time.

MR. MORRIS: May I make an inquiry, Mr. Verity? You say that improper notice has been given under the statute and rules of the Commission in this case?

MR. VERITY: I wouldn't go so far as to say that its failure to comply with the rules of the Commission may necessarily be jurisdictional. I am just not making that assertion. This I am saying: That the Commission promulgated the rules with which the Commission feels that applicants should comply so that applicants will not be surprised. Possibly they did not read the public notice in the newspaper or their attention was not called to the fact that their areas lay in the immediate vicinity. We think the Commission has promulgated these rules so that people who might want to protest will not be surprised, and in this case, they were and it can be traced directly to the failure to comply.

MR. BRATTON: What rule is that?

MR. VERITY: Rule 701(B-1) and Rule 1203.

MR. BRATTON: What failure in Rule 701 (B-1) are you

referring to?

MR. VERITY: It provides among other things that the names of the lessees within a two-mile radius shall appear on the plat.

MR. BRATTON: Southwest Production's name appears on the plat that is attached to our application.

MR. VERITY: I beg your pardon, so it does.

MR. BRATTON: What other rule?

MR. VERITY: Rule 1203 regarding a copy of an application to interested parties.

EXAMINER NUTTER: Regarding the names and addresses of all interested parties known to the applicant?

MR. VERITY: Right.

MR. BRATTON: If that is to be interpreted as including every active operator in every application, it would come as a surprise to me. I think Rule 701 requiring our plat to show the lessees certainly supplies that information. If they were required, they were shown on the plat.

MR. VERITY: We feel that when you start talking about waterflooding a pool, a common source of supply, that you are not talking about something that someone can sit down and offer a map and come up with all the answers. The Christmas period is upon us and I feel that this matter should be continued until some time in January.

EXAMINER NUTTER: Mr. Bratton, you are proposing in

your application to inject water on leases belonging to other than Humble leases.

MR. HATTON: Humble, Pan American, and El Paso. They are all Navajo tribal leases. We are actually applying on behalf of the three companies for a cooperative agreement to institute a flood in this area. I might add for the benefit of the Commission and Southwest Production that we intend, and in fact, we will withdraw now our application to inject water into the Navajo well in the Southwest of the Southwest of Section 18. That is the Navajo G well No. 4 in the Southwest of the Southwest of Section 17. Also, the Pan American Navajo G Well No. 1 in the Northeast of the Northeast of Section 20. Going down to the Southeast part of the proposal, the Humble Oil Well No. L15 in Section 25. Now, we applied for nine wells and as the Commission can see, they're down the middle of the block owned by these three companies and are on Navajo tribal lands. We are limiting it to six wells right down the center, and I don't believe the closest well to Southwest Production Company is within a mile of them and there are three producing wells intervening. I cannot conceive of how it could affect them. We want to and we intend to -- we must work out a cooperative agreement along the edges of the flood. However, as our evidence will indicate to the Commission, we believe that time is of the essence and the thought of a continuance into January, I would protest. I believe we will be able to demonstrate loss of ultimate recovery every day

between now and then. I don't believe that just because the operator doesn't know what his position is or may be, although he can certainly and fully protect his rights by applying for a denovo hearing before the Commission if he is dissatisfied, should delay the hearing. I think a hearing today is essential to the prevention of waste.

MR. VERITY: We must have some very detailed and technical study to know whether or not it will flood out our well. The fact that it's a mile away is only a matter of a very small period of time until the water reaches our area anyway, and it's difficult to know right at this juncture how fast the water will travel in one area because the water injected can travel across the one-mile distance in a very short period of time. The fact remains that we need to have an opportunity to study the situation and to cross-examine any witnesses when this case is presented and to present testimony with regard to it. The fact that we have an opportunity for a trial denovo hearing is true, but that doesn't mean that we shouldn't have the opportunity to present evidence when it's heard before the trial examiner. The Commission is dedicating itself more and more all the time to the philosophy of hearing these cases before the trial examiner. It's of no consequence if one party is not heard before the trial examiner merely because he can have a trial denovo hearing before the entire Commission, and this should not be allowed.

MR. BURR: On behalf of Pan American, I would like to

support Mr. Bratton's request to the effect that the hearing should go forward. I couldn't help but observe as Mr. Verity in his remarks concerning the ills of Southeast that actually, the best medicine in the world is this hearing today. They should be hollering for the hearing to continue.

EXAMINER NUTTER: Mr. Wolf, do you have any comments to make?

MR. WOLF: No comment.

EXAMINER NUTTER: Mr. Swanson, do you have any comment to make?

MR. SWANSON: I have no comments.

EXAMINER NUTTER: Mr. Verity, I feel that sufficient notice has been given in this case to all parties that are concerned as far as the legal notice is concerned. However, it is a complex situation and one that does require considerable time to properly evaluate and assess as to what one's position would be in the case. For that reason, I think the case should be continued to the first Examiner Hearing in January.

MR. BRATTON: I would like to suggest that we are prepared to put on our evidence. We would propose to put on our evidence today and if there is an Examiner Hearing before January -- there is one December 11th -- that if Mr. Verity wants to decide between now and then that he would like to cross-examine our witnesses or to put on evidence, we would have no objection to that. We will bring our witnesses back and make them available.

We have every intention between now and then of supplying him with all the available information and anything else that he might be interested in. There is no doubt in my mind that we can and will work out something. I assume this is just a boundaryline problem which we can work out. If Mr. Verity should decide between now and then, if he would notify us, say, by a week from tomorrow that he does want to cross examine our witnesses or put on evidence himself, we certainly will be willing to come back on the 11th.

EXAMINER NUTTER: In other words, you would put on your evidence today and more or less have a continuance to the next Examiner Hearing if Mr. Verity desires to come back and reopen the case.

MR. BRATTON: If he wants to. We want to satisfy Southwest Production's people, whatever their concern may be or their lack of knowledge of the proposal if we can satisfy them to where they feel they don't need to put on anything or they're satisfied that the project can go ahead, then there would be no necessity for further hearing on the 11th. On the other hand, if they want to, we will bring our witnesses back and they can bring theirs and go into whatever they might be interested in.

MR. VERITY: We feel the ruling is correct on the matter. In times past, in my experience, I have endeavored to cross-examine witnesses two, three, four weeks later after they testified, and I find it extremely difficult. I just don't think it fair to be

asked to do that. In addition, I should like to call to the Commission's attention that the plan discussed by or expanding the unit to include the lands of Southwest Produc- tion and possibly others that are fringe areas who might be dam- aged by a partial waterflood.

MR. BRATTON: If on the 11th Southwest can come here and say they need further time and can show a reason for it, we have no objection. I have seen these hearings held month after month and I don't think they will. I don't think they can or I don't think they will want to, either one.

EXAMINER NUTTER: Mr. Bratton, the Examiner Hearing scheduled for December 11 had slipped my mind when I made my previous ruling. It will be continued to the December 11th Examiner Hearing.

* * * * *

STATE OF NEW MEXICO)
(ss.
COUNTY OF SAN JUAN)

I, THOMAS F. HORNE, NOTARY PUBLIC in and for the County of San Juan, State of New Mexico, do hereby certify that the foregoing and attached transcript of hearing was reported by me in stenotype and that the same was reduced to typewritten transcript under my personal supervision and contains a true and correct record of said proceedings, to the best of my knowledge, skill and ability.

Thomas F. Horne
NOTARY PUBLIC

My Commission expires:

October 2, 1965

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 2447, heard by me on 11/29, 1961.

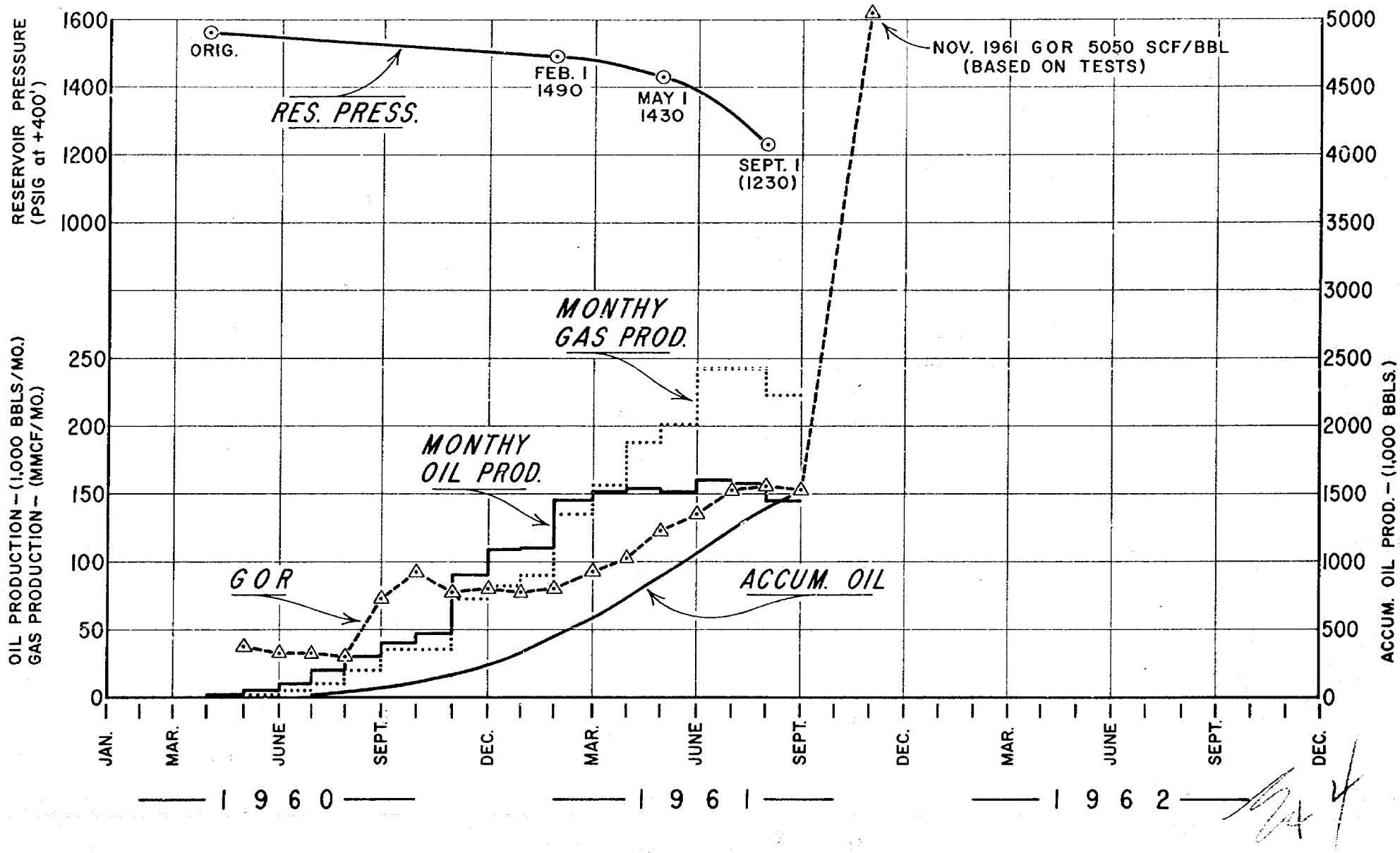
Examiner
New Mexico Oil Conservation Commission

PRODUCTION DATA

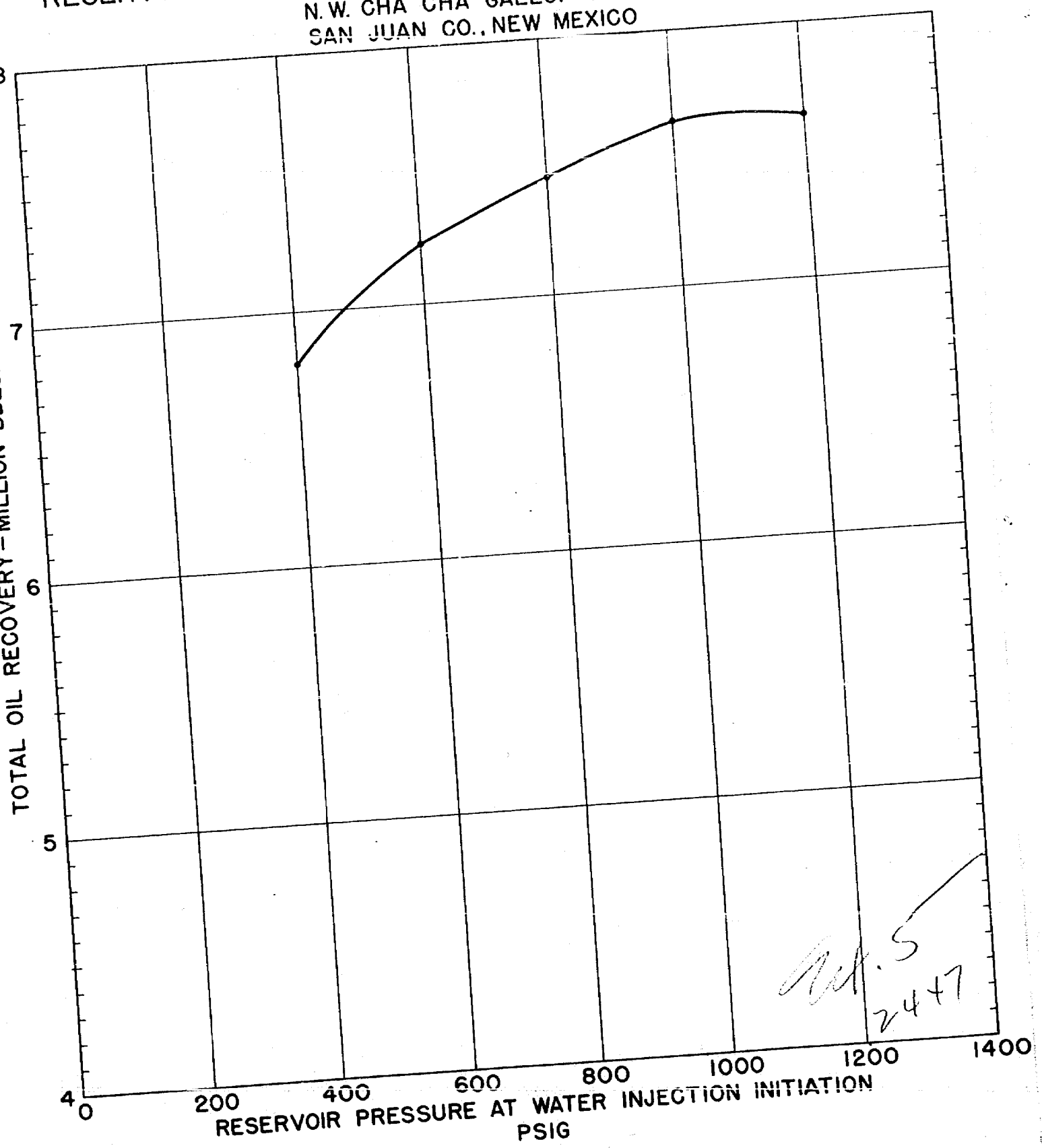
PROPOSED N. W. CHA CHA UNIT

CHA CHA GALLUP FIELD

NEW MEXICO



TOTAL RECOVERY
VS
RESERVOIR PRESSURE AT WATER INJECTION INITIATION
N.W. CHA CHA GALLUP UNIT
SAN JUAN CO., NEW MEXICO



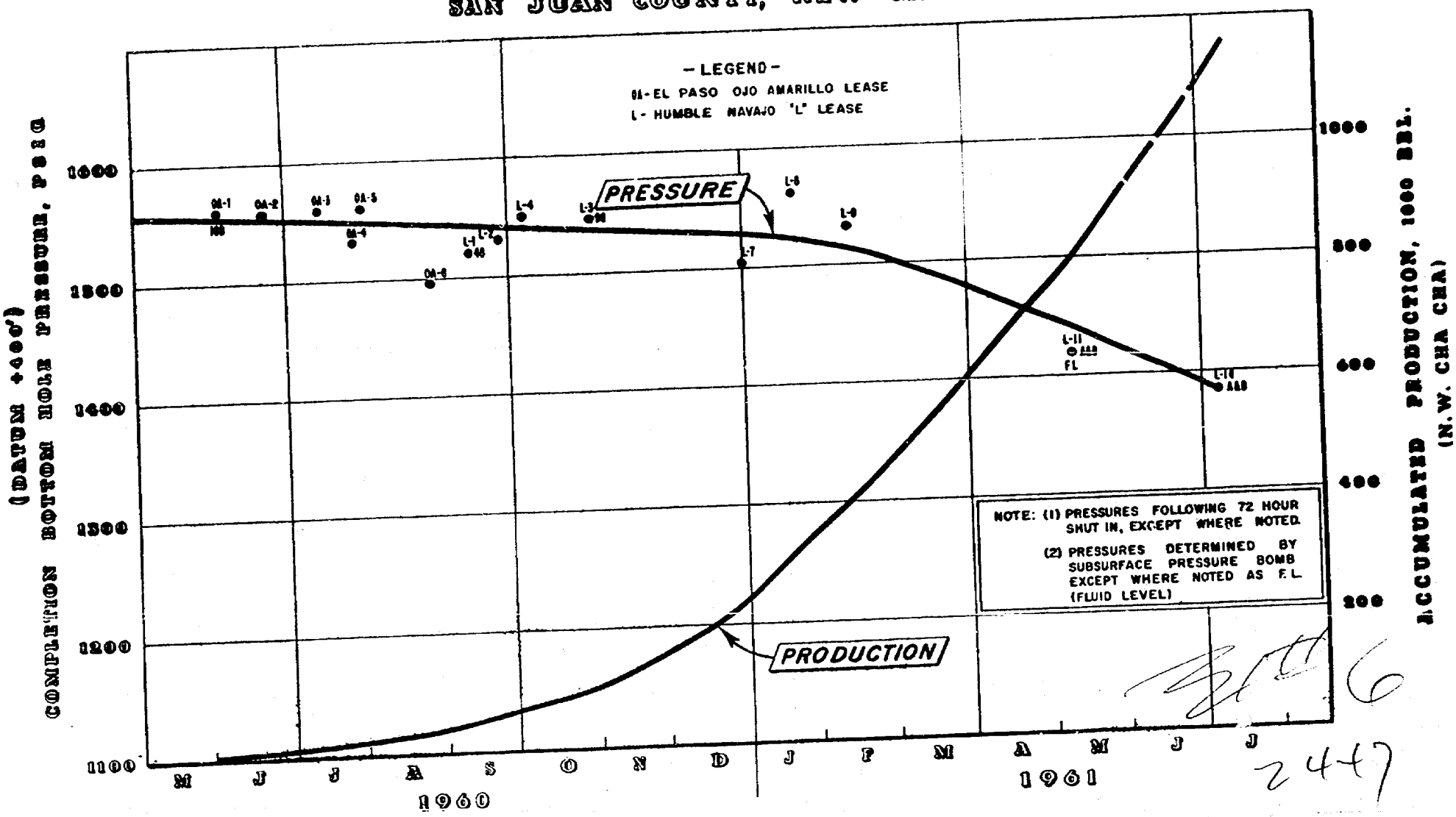
N.M. S
247

COMPLETION BOTTOM HOLE PRESSURES vs. TIME

ACCUMULATED OIL PRODUCTION vs. TIME

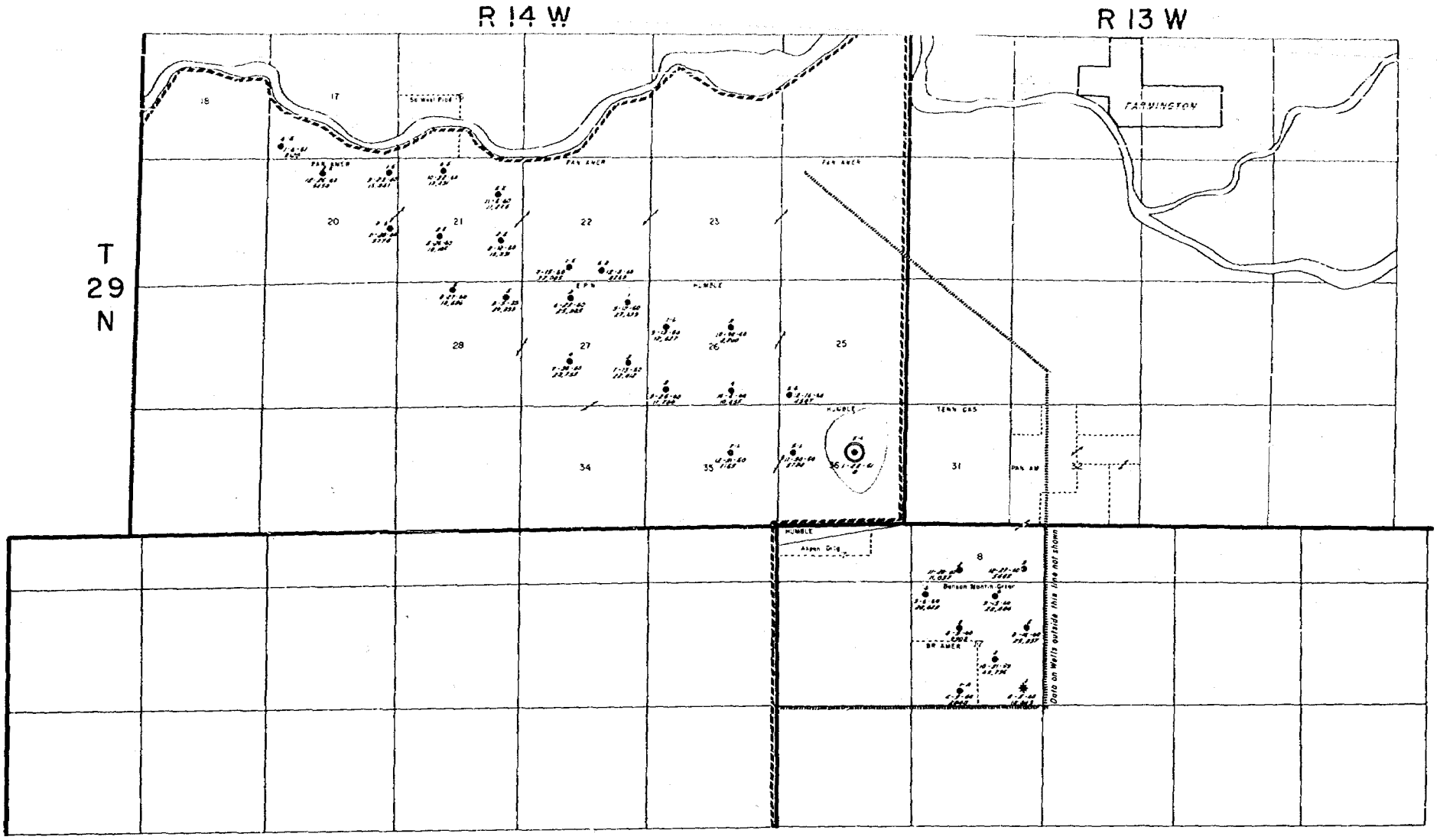
CHA CHA GALLUP FIELD

SAN JUAN COUNTY, NEW MEXICO



6

247



HUMBLE OIL & REFINING COMPANY
DENVER AREA

CHA CHA GALLUP FIELD

San Juan County, New Mexico

Notes:

Total Accum. Oil Prod. (1-22-61)
OF Wells Shown = *475,330 BBLS.*

Total Accum. Oil Prod. (1-22-61)
OF CHA CHA Gallup Field = *507,798 BBLS.*

Status on *Jan. 22, 1961*

Completion Date *L-8: 1-22-61*

Legend:

/ Well No.

5-17-60 Completion Date

27,699 Accum. Oil Prod. BBLS (1-22-61)

2447

WATER INJECTION WELL DATA

PROPOSED N.W. CHA CHA UNIT

SAN JUAN COUNTY, NEW MEXICO

Name	Completion Date	Location	Total Depth	Plugback Total Depth	Casing Size	Casing Depth	Top Cement (Est.)	Perf. Interval
El Paso Natural Gas Products								
Ojo Amarillo No. 2	6-23-60	NE NW Sec. 27-29N-14W	6105	5330	5 1/2	5376	4120	5322-44
Humble Oil & Refining Co.								
Navajo "L" No. 1	9-13-60	SW NW Sec. 26-29N-14W	5488	5447	4 1/2	5484	4800	5390-5400
Navajo "L" No. 4	10-6-60	SW SW Sec. 26-29N-14W	5591	5587	4 1/2	5587	3100	5499-5510
Navajo "L" No. 5	11-30-60	SW NW Sec. 36-29N-14W	5627	5588	4 1/2	5624	3100	5528-41
*Navajo "L" No. 15	9-8-61	SW NE Sec. 25-29N-14W	5416	5385	4 1/2	5414	4418	5305-15 5360-65
Pan American Petroleum								
Navajo "E" No. 2	8-12-60	NE SE Sec. 21-29N-14W	5289	5238	5 1/2	5283	4600	5145-53
Navajo "E" No. 3	8-26-60	NE SW Sec. 21-29N-14W	5270	5226	5 1/2	5270	4600	5116-26
*Navajo "G" No. 1	9-23-60	NE NE Sec. 20-29N-14W	4828	4796	4 1/2	4832	4200	4681-89
*Navajo "G" No. 4	1-6-61	SW SW Sec. 17-29N-14W	4669	4626	4 1/2	4661	3900	4578-84

** Conversions to be delayed until satisfactory Lease Line agreements are effected.*

#1 P
2 47

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
December 12, 1961

EXAMINER HEARING

IN THE MATTER OF:

Application of Humble Oil & Refining Company for approval of a pressure maintenance project in the Cha Cha-Gallup Oil Pool, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks permission to institute a pressure maintenance project in the Cha Cha-Gallup Oil Pool by the injection of water into certain wells located on the Navajo Indian Reservation in Sections 13 through 29 and 33 through 36, Township 29 North, Range 14 West, San Juan, New Mexico. Applicant further seeks the promulgation of special rules and regulations governing said project.

Case 2447
(Continued)

BEFORE: Elvis A. Utz, Examiner

TRANSCRIPT OF HEARING

MR. UTZ: Case 2447.

MR. MORRIS: Application of Humble Oil & Refining Company for approval of a pressure maintenance project in the Cha Cha-Gallup Oil Pool, San Juan County, New Mexico.

MR. BRATTON: Howard Bratton, appearing on behalf of Humble Oil & Refining Company. Associated with me is Mr. John

Knodell. We have one witness.

(Witness sworn.)

MR. UTZ: Do we have other appearances?

MR. VERITY: George L. Verity for Southwest Production.

MR. BUELL: For Pan American Petroleum Corporation, Guy Buell.

MR. MASON: For El Paso Gas Products Company, John Mason.

MR. MORRIS: Mr. Mason, you are associated with the firm of Grantham, Spann and Sanchez?

MR. MASON: Right, represented by the written appearance of Mr. Spann of the firm of Grantham, Spann & Sanchez.

MR. MORRIS: Mr. Buell, you are associated with counsel in this case?

MR. BUELL: No.

MR. UTZ: Any other appearances? You may proceed, Mr. Bratton.

JAMES A. KELLY

called as a witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. BRATTON:

Q Will you state your name, by whom you are employed, and in what capacity?

A My name is James A. Kelly. I am employed by Humble Oil & Refining Company as area engineer.

Q That's in the Denver area?

A That is correct.

Q Does your area include the Northwest Cha Cha Unit?

A Yes, it does.

Q Have you previously appeared before this Commission as an expert witness?

A Yes, I have.

Q Are you familiar with the proposed Northwest Cha Cha Unit and the matters contained in the application?

A Yes, I am.

(Whereupon, Humble's Exhibit No. 1 was marked for identification.)

Q Mr. Kelly, will you refer to what has been marked as Applicant's Exhibit No. 1 and identify that?

A Exhibit No. 1 is a map of the Navajo Tribal Lands, and those lands in the immediate area surrounding the Navajo Tribal Lands located in the Cha Cha-Gallup Pool of San Juan County, in New Mexico. Also shown on this map is a proposed plan of injection to accomplish a pressure maintenance program on these tribal lands.

Q Now, the unit boundaries are identified by the dotted line, is that correct?

A That is correct.

Q There are three Navajo Tribal leases within the proposed unit?

A More than that, there are six Navajo Tribal leases within the unit.

Q All of the lands within the unit are Navajo Tribal Lands?

A That is correct.

Q The royalty ownership, of course, is common throughout?

A That is correct.

Q And there are no overriding royalty interests throughout?

A That is correct.

Q There are no lands within the unit other than Navajo Tribal Lands, is that correct?

A That is correct.

Q And the unit contains all of the Navajo Tribal Lands in the Cha Cha-Gallup Field?

A That is correct.

Q Will you please explain the detail on the proposed injection wells?

A It is planned upon the approval of this Commission to immediately convert six wells to injection service. These wells are shown on this exhibit colored in green. Also shown are three wells colored in red, which will be converted at a later date, that conversion will occur only after satisfactory lease line

agreements have been reached with the people outside the Navajo lands.

Q I believe at the previous hearing we agreed to convert those wells upon administrative approval at a later date?

A That is our request, yes.

Q What type of flood is this, Mr. Kelly?

A It will be a crestal type injection with the input wells or injection wells to be located down the center, or approximate center, of this Northwest, Southeast trending sand bar.

Q Have you submitted application for this project to the United States Geological Survey as required by the regulations?

A Yes, we have.

Q Mr. Kelly, could you state why this particular area was chosen as a proposed pressure maintenance unit?

A This particular area was chosen primarily because it contains only Navajo Tribal Lands. We have had recent experience in efforts to communitize Navajo lands with other lands, and it is extremely difficult to accomplish, and it was our firm belief that to attempt to unitize lands other than Navajo in this case would result in extreme delay of flood initiation.

Q Later in your testimony I believe you'll indicate that in your opinion you can not avoid delay in instituting pressure maintenance without suffering ultimate loss?

A That is correct.

Q In your opinion does this proposed unit constitute a reasonable area for a pressure maintenance project?

A It is. We feel that the area is large enough that we can initiate a flood at this time, excuse me, a pressure maintenance program at this time, exercise complete control over it without adversely affecting lands outside the tribal boundaries.

Q Was this basic idea of a Navajo unit separate from the other lands in the pool discussed and agreed upon at an early stage of development of the pool?

A It was. The first Cha Cha-Gallup Engineering Committee meeting was held in December of last year. That was attended by most of the operators who are presently producing from the Cha Cha-Gallup Pool. At that time, or shortly thereafter, in January, 1961, at a subsequent meeting it was recognized by most parties that efforts to communitize Navajo Tribal Lands with other lands would undoubtedly result in a delay, and as a result of that it was agreed by those present that the people owning Navajo Tribal Lands would separate from the other group and proceed to unitize only the tribal lands.

Q Now, the operators of the Navajo Tribal Lands are Humble, Pan American and El Paso Natural Gas Products Company?

A That is correct.

Q Pursuant to that decision have you reached an operating agreement with those two companies?

A Yes, we have.

(Whereupon, Humble's Exhibit No. 2 was marked for identification.)

Q I'll hand you what has been marked as Applicant's Exhibit 2 and ask you to identify that.

A Applicant's Exhibit No. 2 is a joint operating agreement for the Northwest Cha Cha Unit area of San Juan County, New Mexico. It has been executed by Humble, Pan American and El Paso Natural Gas.

Q That is what is known as a working interest owners' operating agreement, is that correct?

A That is correct.

MR. VERITY: Do you have an extra copy?

MR. BRATTON: That's the only one. We can furnish one later.

MR. UTZ: Do you want to look at it now, George?

MR. VERITY: I'll check it later.

MR. BRATTON: We have an unexecuted copy.

MR. VERITY: Thank you.

Q (By Mr. Bratton) The Navajo royalty extending throughout the whole lease, it was felt there was no need to form a

royalty and working interest owners' unit agreement?

A Not at this time.

Q But pursuant to that agreement, the working interest throughout is held in common by the three companies?

A That is correct.

Q And under that Humble is designated as operator of the project area?

A Yes.

Q With the authority to institute operations throughout the entire area on behalf of all three companies?

A Right.

(Whereupon, Humble's Exhibit No. 3 was marked for identification.)

Q Mr. Kelly, refer to what has been marked as Applicant's Exhibit No. 3, what is that, Mr. Kelly?

A Applicant's No. 3 is a reservoir study of the Northwest Cha Cha Unit, in the Cha Cha-Gallup Field, San Juan County, New Mexico, which was jointly prepared by Humble, Pan American and El Paso Natural Gas.

Q That was completed as of May, 1961, is that correct?

A That is correct. This report was completed effective as of that date. However, included in the report are many, many tables and other factual data, certain engineering computations

and calculations, all of which are still valid. On the fly leaf of the report an updated isopach map has been inserted. The effective date of that isopach map on the fly leaf is 9-13-61.

Q But the computations and the projections made in the report are still valid, needing only to be projected out to date?

A That is correct.

Q Go through that exhibit, if you will, Mr. Kelly, going through the various tables which start on page 8, and explain each of those tables as you go through in brief, if you will, please.

A Table I is entitled "Pertinent Data Sheet, Cha Cha-Gallup Field". On that is contained data such as the date of discovery, the location of the discovery well, the structural features of the reservoir, the reservoir factors of the pool, various characteristics of the rock from which the oil is produced. That continues over to page nine, on which is computed important volume data, ultimate primary recovery calculations, ultimate water flood or secondary recovery calculations.

Q Now, I notice that that calculation is made on the basis of instituting a pressure maintenance project at 1200 pounds per square inch?

A That is correct. However, later in the testimony I will relate that recovery to other pressures. On Table II,

which is on page 11 of the report, we have a table that shows only basic core and log information for various wells located in the Northwest Cha Cha area. Table III on page 12 is a computation of oil in place, primary recovery and the secondary recovery that can be expected with some of the factors that were used to make these computations.

Table IV, which starts on page 14, lists the economic factors and proposed investment schedule in order to ascertain the feasibility and profitability of the flood.

Table V is an amplification of Table IV showing the profitability of the flood. Following these tables we have various maps, the first of which noted is figure 2, and it shows the structure on the top of the Gallup A sand marker.

Figure 3 is the following map, it shows the net pay isopach as of the effective date of this report, which was May, '61. As I previously stated, there is an updated isopach map on the fly leaf of the report.

Figure 4 is a net sand isopach of the B interval of the Gallup sand which is located immediately below the A sand. Figure 5 is a cross section following the crest of the Cha Cha-Gallup development through the Navajo lands. Figure 6 is a cross section at right angles to the previous cross section, which shows the Northeast-Southwest extent of the same.

Figure 7 is another cross section located at a different point in the pool. Figure 8, again, is a third point crossing the pool showing the cross sections. Figure 9 is a map which is a key to the previously mentioned cross sections, showing cross section AA, BB, CC and DD.

Q Now, Mr. Kelly, do all of these cross sections and your structure map and your isopach map, do they show continuity of the sand throughout the proposed unit area?

A Yes, they do.

Q I might ask, there are two stringers, are there not?

A That is correct.

Q Are you proposing to flood or put water into both stringers or one or just what are your proposals?

A Ultimately it will be in both. The initial flood plan does not anticipate it.

MR. UTZ: Which is the initial?

A The A or upper is the initial. The B is an extremely poorly developed tight sand with a permeability that averages some .33 millidarcies in the Navajo Tribal Lands. That compares with the upper or A zone, which has an average permeability of 57 millidarcies.

Q Does the information through which you have gone indicate that pressure maintenance would be effective in the

upper sand?

A It does.

Q And possibly might help in the lower sand?

A That is correct.

Q Is there anything further you care to state with relation to all of your structure and cross section information?

A Not with relation to those items.

Q All right.

A I might point out that there are additional data contained in this report which follows the last mentioned, showing the capillary pressure determinations, the permeability of the oil versus permeability of the gas relationships, the relative permeability of the oil and the gas properties of the gas produced in the area, the change in oil viscosity with the reservoir pressure.

Also, in figure 16, we have a calculated or theoretical primary depletion diagram which is a mathematical approach to predicting the performance of this pool. Figure 17 amplifies that previous diagram and has the primary depletion plotted against time rather than against the cumulative percent recovery. The only other figure that I would refer you to is figure 19, the last in the report, which is the computed performance of the Northwest Cha Cha area or tribal lands under a pressure

maintenance program.

Q Mr. Kelly, based on the data in this report, I believe your conclusions are shown on page 2 of that report, that your primary recovery will be in the order of 13.7% and that the institution of a pressure maintenance program would increase the total recovery to 38.3% of oil in place?

A That is correct.

Q The recommendation of the Engineering Committee was that it be maintained on a center line pattern?

A That is correct.

Q And that injection be initiated at the earliest possible date?

A That is correct.

Q Those are the basic conclusions of the Engineering Committee contained in this study?

A Right.

(Whereupon, Humble's Exhibit No. 4 was marked for identification.)

Q Refer now, Mr. Kelly, to what has been marked as Applicant's Exhibit No. 4, identify that and explain its significance, if you will, please.

A Exhibit 4 is a graph on which is depicted various factors concerning production from the tribal lands in the Northwest Cha Cha-Gallup Field. Shown on it are a plot of

accumulated oil produced, monthly oil production rate, gas-oil ratio, monthly total gas produced and reservoir pressure. The two significant curves are the plot of gas-oil ratio and the reservoir pressure. On it will be noted that the gas-oil ratio has increased tremendously within the past two to three months.

As a corollary to that, the pressure likewise came down and is continuing to drop at a rather accelerated rate.

Q What is the significance of those two facts with relation to the institution of a pressure maintenance program?

A The reservoir pressure dropping at this rate is permitting gas to come out of solution in the reservoir without efficiently moving all the oil with it that could be expected under other types of operation. Likewise, the viscosity of the oil is increasing, there is a point which will be demonstrated later at which ultimate loss of recoverable oil will occur unless this trend is halted.

Q That fact is demonstrated on your Exhibit No. 5, is it not, Mr. Kelly?

A That is correct.

(Whereupon, Humble's Exhibit No. 5 was marked for identification.)

Q Will you identify Exhibit No. 5 and explain its significance?

A Exhibit No. 5 is a plot of the total recovery versus reservoir pressure at water injection initiation for the Northwest Cha Cha-Gallup Unit area which encompasses these tribal lands.

There is a semi-curve plotted on that, on the bottom of the graph is shown a plot of reservoir pressure; on the left side is a plot of the total oil recovery in millions of barrels that is to be expected as a result of this pressure maintenance program.

You will note that in the range of 1,000 to 1,200 pounds per square inch, we have a maximum recovery from the reservoir. Below a thousand pounds per square inch, reservoir pressure, the anticipated recovery begins to drop rather quickly. The last point plotted on this is a pressure of 400 pounds per square inch, at which point it is indicated that some 6.8 in round figures, 6.8 million barrels will be recovered, whereas at the optimum pressure the recovery will be on the order of 7.6 million barrels. So there is a decided loss in production with decrease in reservoir pressure below this optimum pressure.

As was shown on the previous exhibit, the pressure in the Navajo Tribal portion of this reservoir at this time, or as of September 1st, 1961, was 1230 psi. It indicates that we are approaching this optimum pressure at which to flood.

Q And your Exhibit No. 4 shows that pressure to be declining steadily, is that correct?

A That is correct, and rather rapidly.

Q Mr. Kelly, then, I take it that the significance of these two exhibits would be that if a pressure maintenance program is not initiated in the immediate future, there will be loss of ultimate recovery from the reservoir?

A That is correct.

Q And the longer the delay in initiation, the more the loss?

A That is correct.

Q Ranging up to 800,000 barrels of recoverable oil that could be lost?

A That is correct. It is in excess of that if the pressure were allowed to get below 400 pounds per square inch, but as shown on that exhibit, it's in the order of 800,000.

Q Mr. Kelly, it is true that the pressure decline has probably leveled off somewhat from the very rapid decline shown on the previous exhibit, but undoubtedly it is still a steady decline?

A That is correct. As a result of an institution of the no-flare order and the imposition of the 2,000 to 1 gas-oil ratio, the rate of pressure reduction is not as great as it was prior to November the 30th when the order became effective. However, that pressure is continuing to drop at a rather high rate.

Q Along that line, Mr. Kelly, what are or would be the results, as far as correlative rights, if production from the entire pool were drastically cut back, or let's say even shut in, what would be the effect on correlative rights in the pool?

A The pressure information that is now available indicates that the average reservoir pressure in the tribal land area of this pool is on the order of 250 pounds per square inch higher than in the Southeastern portion of this same pool.

As a result of that pressure differential, any drastic curtailment in rate of production would inevitably result in drainage from the Navajo lands.

Q In other words, a drastic curtailment of production would tend to level off the pressure throughout the pool which would drain substantial quantities of oil from the Navajo lands to those to the Southeast?

A That is correct.

Q Which would be a violation of the correlative rights of these operators and of the Navajo Tribe?

A That is correct.

Q Based on those observations, Mr. Kelly, would it be a fair observation that the immediate institution of a pressure maintenance project in the Navajo Tribal lands is the only means to prevent waste and to protect correlative rights?

A That is correct in that it would immediately begin to reduce gas-oil ratios, it would immediately begin to stop this increase in viscosity of oil in the reservoir. As the viscosity of the oil in the reservoir goes up the efficiency of a flood goes down.

Q Is there anything else you care to point out with relation to the previous two exhibits?

A I believe they have been covered unless there are some questions.

(Whereupon, Humble's Exhibit No. 6 was marked for identification.)

Q Turn, then, to your Exhibit No. 6, Mr. Kelly, and if you will, identify that and explain what it reflects.

A Exhibit No. 6 is the same as Humble introduced as testimony on the Cha Cha-Gallup spacing hearing which was held some two to three months ago. On that is plotted completion pressure of individual wells versus completion time. Also shown is accumulated production on the Navajo Tribal Lands also plotted against time.

The one significant point which I wish to bring out here is that the well shown on this exhibit as L-8, which is located in the section shown in the extreme Southeast portion of these Navajo Tribal Lands, I'll point to it on the map on the wall, well

L No. 8 is the one shown here. As shown on this plot, L No. 8 appears to be anomalous in that it's higher than the curve would normally indicate it to be under these particular conditions. However, there is a good reason for that if the conditions at the time the L-8 was completed are taken into consideration.

Those conditions are simply this, that at the time of the completion of L-8, the development of the lands outside the Navajo Tribal Land and immediately Southeast of the Scutheast corner of the Navajo Tribal Lands had not been developed. That is shown by the following exhibit which is a map which depicts the amount of development that had occurred as of that effective date.

This map clearly illustrates that immediately offsetting the Navajo Tribal Lands to the Southeast the pool had not been developed. That naturally resulted in a high pressure higher in that immediate area. This high pressure area prevented, and to this day is still preventing, migration from the Navajo Tribal Lands to the Southeast. This situation can not continue forever, which it's well recognized. However, I might point out that we are among the operators initiating the necessary steps to protect the Navajo Tribal Lands from this pressure differential which does exist between the Northwest and Southeast portions of the pool.

Q Mr. Kelly, let's identify that map as Exhibit No. 7, the one showing the development of the pool at the time the Navajo L-8 well was brought in.

A Right.

(Whereupon, Humble's Exhibit No. 7 was marked for identification.)

Q And that Navajo L-8 well is the one circled in the extreme Southeast corner of the unit?

A That is right, on Exhibit 7 it does have a double circle shown around it. Back on Exhibit 6 the plot of L-8 confirms that migration or pressure maintenance, to use a better word, was occurring there and preventing migration at that time.

Q Anything further you care to point out with relation to Exhibit 6 or 7?

A I believe they have been covered.

(Whereupon, Humble's Exhibit No. 8 was marked for identification.)

Q Refer to your Exhibit No. 8, Mr. Kelly, explain what that reflects.

A Exhibit No. 8 lists only the pertinent and necessary data concerning the wells which it is proposed to convert to injection service in the Tribal land portion of the Cha Cha-Gallup Pool. On this is shown the list or the name of the wells, the datum which it is completed, the location, the total depth, the

plug back total depth, the casing size in the well, the depth at which the casing was set, the estimated top of the cement behind the pipe and the perforated interval.

This list includes all wells which will ultimately be used or it is planned to use in injection service. It is not the intent to convert all of these wells at this time.

Q It includes the three wells which we have withdrawn at the moment and will convert to injection upon the working out of satisfactory line agreements with the offset operators?

A That is correct.

Q Have you supplied to the State Engineer all of the information and materials required by Rule 701?

A Yes, to the best of my knowledge we have.

Q In your opinion is there any danger of contamination of any fresh water sources that might exist in the area?

A No, there is not.

Q Mr. Kelly, what are the rules which you are proposing or requesting in this hearing?

A Referring to the application which was submitted to this Commission, we are requesting the following rules: the conversion of certain producing wells to water injection service. This application has been amended by withdrawal of some certain wells.

Q Leaving the six wells requested, the ones in green, and deleting the outside injection wells, you might call it?

A That is correct. That the allowable for the project area be the sum of the allowable of the several wells within the project area, including those wells which may be shutin, curtailed or used as injection wells. That the allowables for injection wells be transferred to producing wells within the project area as well as allowables for producing wells which, in the interest of more efficient operation of the project, are shut in or curtailed because of high gas-oil ratio or are shut in for any of the following reasons: pressure regulation, control of pattern or sweep efficiencies, or to observe changes in pressure or changes in characteristics of reservoir liquids or progress of sweep.

Item (d), that the allowable assigned to any well which is shut in or which may be curtailed in accordance with the applicable special rules, and which allowable is to be transferred to any well or wells in the project area for production, shall in no event be greater than its ability to produce during the test period prescribed by the special rules, or greater than the top unit allowable for the pool during the month of transfer, whichever is less.

Item (e), that the allowable assigned to any injection well on an 80-acre proration unit shall be the top unit allowable

for the Cha Cha-Gallup Oil Pool. Item F, that the ability to produce of any well which is shut in or curtailed in accordance with the special rules shall be determined by a twenty-four hour test at a stabilized rate of production, which shall be the final twenty-four hour period of a seventy-two hour test, throughout which the well should be produced in the same manner and at the constant rate. The daily tolerance limitation set forth in Commission Rule 502-1(a) and the limiting gas-oil ratio 2,000 to 1 for the Cha Cha-Gallup Oil Pool shall be waived during such tests.

The project operator shall notify all operators offsetting the well, as well as the Commission, of the exact time such tests are to be conducted. Tests may be witnessed by representatives of the offsetting operators and the Commission, if so desired.

Item G, that the top allowable assigned to each producing well in the project shall be equal to the well's ability to produce or to the top unit allowable of the Cha Cha-Gallup Oil Pool, whichever is less, provided that any producing well in the project area which directly or diagonally offsets a well outside the project area producing from the same common source of supply shall not produce in excess of two times unit allowable for the pool. Each producing well shall be subject to the limiting gas-oil ratio 2,000 to 1 for the Cha Cha-Gallup Oil Pool, except that any well or wells within the project area producing with a

gas-oil ratio in excess of 2,000 cubic feet of gas per barrel of oil may be produced on a net gas-oil ratio basis, which net gas-oil ratio shall be determined in accordance with such equitable formula as may be determined by the Commission, including credit for daily average net water injection through any injection well located within the project area.

H, that the project operator submit each month, within a reasonable time after the normal unit allowable for Northwest New Mexico has been established, to the Commission, a pressure maintenance project operators' report on a form prescribed by the Commission, requesting allowables for each of the several wells in the project area as well as the total project allowable.

I, that the Commission calculate the allowable for each well in the project area, and that the sum of the allowables so calculated be assigned to the project so that the same may be produced from any well or wells in the project in any proportion except that no well in the project which directly or diagonally offsets a well outside the project producing from the same common source of supply shall produce in excess of two times top unit allowable for the Cha Cha-Gallup Oil Pool.

J, that provision be made for the administrative approval by the Commission of the conversion of additional producing wells to injection wells, and the drilling of additional producing and

injection wells, and the expansion of the project area under such reasonable conditions as may be prescribed by the Commission.

Q Referring to that later request, I assume you certainly would want any offset operator notified of the proposed conversion of any additional wells to injection?

A That is correct.

Q Mr. Kelly, are these the rules which are in effect in the Atlantic and Pan American pressure maintenance projects in the Horseshoe-Gallup Pool?

A Insofar as I know, they are.

Q And they were drawn to request those same rules that are in effect in those projects?

A That is correct.

Q Is there anything you care to state with regard to the suggested rules?

A No, not that I'm aware of.

Q What are your proposed rates of injection initially in your project?

A The six wells shown in green on one of the previous exhibits, I believe it was either the first or second exhibit, we are anticipating injecting water at the rate of a thousand barrels per well per day, or a total of approximately 6,000 barrels per day.

Q Do you have any estimate, Mr. Kelly, how soon that would

start to reduce your gas-oil ratio and halt your pressure decline?

A On the wells which immediately offset those injection wells, and by immediately I'm referring to wells which are within the one-quarter of a mile of it, the effect of pressure injection should be detectable within three months. That will be, excuse me, if I may, that effect will not be an increase in oil initially, but a decrease in gas-oil ratio. The increase in oil will follow that.

Q Limiting your injection wells initially to the six proposed in your estimate, would that have any effect on operators outside of the unit?

A Not within the reasonably foreseeable future.

Q And prior to that time you are going to work out line agreements to protect the correlative rights of the parties inside as well as outside?

A That is our intent.

Q Mr. Kelly, in your opinion is the granting of this application at this time essential to the prevention of waste?

A Yes, it is.

Q Would the application protect the correlative rights of the parties inside and outside the unit?

A It is our belief that they will.

Q Exhibits 1 through 8 were prepared by you or under your

supervision?

A That is correct.

Q Do you have anything further you care to state with regard to the application at this time?

A Not that I'm aware of.

MR. BRATTON: We would offer in evidence Exhibits 1 through 8 inclusive, and that concludes our direct examination.

MR. UTZ: Exhibits 1 through 8 inclusive will be entered into the record of this case.

CROSS EXAMINATION

BY MR. UTZ:

Q What did you call this type?

A Crestal. We could also easily refer to it as an inverted five spot. By inverted, I mean only that the input well in general is surrounded by producers. The development of this sand in an elongated bar does not lend itself readily to a full pattern type flood as we normally refer to them such as five spot or modified land drive.

Q Well, the effect of this flood will be to push oil out to the edges of the trend, will it not?

A That is correct.

Q What's going to happen to the oil that is pushed by your outside wells?

A I'm sorry, I didn't hear you.

Q I say, what is going to happen to the oil that is pushed by the outside wells, out into the questionable producing area?

A I can refer to several established floods, the Upper Cypress Sand flood in the Hyattsville Pool of Kentucky, the Dixie flood in Kentucky, several floods in Oklahoma, Illinois, and two specific floods in Canada, wherein it has been proven conclusively that this type injection does not water out these edge wells and trap a significant amount of oil beyond those wells into the limits of the reservoir itself.

Test wells that have been drilled in two of these particular floods have indicated very decidedly that the pattern of the flood sweep is such that it does go around behind the producing wells and largely sweeps out the effective portion of the reservoir. It does not result in any appreciable oil being trapped between the outside edge producing wells and the edge of the reservoir.

Q Do you have any explanation as to why the oil would actually go out around these wells?

A Do I have any explanation why?

Q Yes.

A It is just a matter of pressure differentials that are

created from input to producer. It is agreed that the direct line is the shortest path between those points. However, that direct line does not have sufficient transmissibility or capacity to transmit the total flood injected to prevent this pressure differential itself from existing on each side, and to a large degree even, behind the edge producing well.

All we need to move oil to that producing well is a pressure differential, and that pressure differential does exist. Our calculations, all of our studies have shown that this type flood has the approximate same efficiencies as a full pattern flood. That has been confirmed by the people who were associated with us in this study and the data as shown in this Engineering Committee report; Pan American's experience and background, although not on the identical pools, the results apparently are completely similar.

Q Why, then, are you anticipating requesting that your No. 15 well be put on injection at some later date?

A That well is approaching an edge well and we feel that we will need to work out suitable lease line agreements with people outside the Navajo Tribal Lands.

Q You feel, don't you, that you need to inject in that well in order to drive the oil back toward the other wells?

A Well, that is correct. The only reason that possibly I

missed your point there, the No. 15, which breaks the so-called crestal pattern here, if you will refer to the map which is contained in the fly leaf of the Engineering Committee Report, you will notice that the sand width is greater in that particular area, it bulges out to the Northeast, giving a generally greater width than we have in other parts of it, and that conversion there will simply be an expediency of time.

It is not absolutely required to efficiently flood, but the big factor is this, that the sand is so thick in that portion and so far from the crestal injection, that the time of injection would make it uneconomic to flood in that portion unless we stepped out and away from the crestal pattern.

Q Mr. Kelly, is the gas gathering system connected in this area at the present time?

A I'm sorry, I couldn't hear you.

Q Is the gas gathering system connected in this particular area?

A Yes, it is, currently, and by currently I am referring to a check which I made last week, The Northwest Cha Cha Unit area which we are proposing here of these tribal lands was producing into the pipeline 6.3 million cubic feet of gas per day.

Q Is that all the gas that's being produced?

A That is all that's being produced. We are restricting

ourselves to available compressor capacity, there's no gas being flared.

Q How soon do you think that you'll be injecting water into these wells if this application is approved?

A That is somewhat difficult to estimate in that we have two other agencies, Governmental agencies that we must have their permission to start, and it's impossible and also dangerous to predict how soon said agencies will approve any given project. However, we have made application to the United States Geological Survey, we do know they have it under serious consideration.

I was informed by Mr. Anderson last Thursday that if he had any questions that he would call me on Friday. However, he did not call. I can assume only that he had no questions with respect certainly to them that was to go here, and he also indicated that there would be no undue delay from that agency in that the approval for the project rests solely with Mr. Anderson and will not have to go to his Washington office.

The other agency with which we must deal is the Navajo Tribal Council and the Bureau of Indian Affairs. We have submitted all data to them and requested their approval. They have not indicated when they will approve it. However, they have stated that they have got it under serious study, request that we proceed with these preliminary plans, and that as soon as feasible they will

approve it. So, it is our hope that within the next thirty to sixty days at the most we will actually have water going in the ground.

Q Then if you are injecting within the next sixty days and it takes three months from the beginning of injection to have any effect on your offset, it will be approximately five months, or possibly longer, before you'll have any increased production?

A That is correct.

Q By that length of time do you anticipate that you will have a gas gathering system installed with enough compressors so that you'll be able to take the additional gas?

A Well, our tentative thinking in that respect is that we will continue to observe the no-flare order. There is no immediate plan to increase the capacity of the gas gathering system or of the compression equipment. You are, to some extent, defeating the entire purpose of this flood if you produce the maximum amount that could be produced under the 2,000 to 1 gas-oil ratio in that that continues to void the reservoir at a fairly high rate, whereas if we can get water going, get the gas-oil ratios down, it is entirely conceivable that in the year coming that we'll have the gas-oil ratios down to the point where the existing compression facilities and gathering system will handle all gas produced. We are anticipating gas-oil ratios less than

three hundred.

Q You are not actually anticipating any great increase in production, but rather to arrest the decrease in pressure?

A That will be the immediate reaction. There will be ultimately an increase in production, it will follow this decrease of gas-oil ratio and gas production. That is borne out very clearly in the results of the Horseshoe-Gallup Pool in which we operate a pressure maintenance program some fifteen, seventeen miles Northwest of here. This water has been injected in that particular pool now since December of last year, a year to date.

Gas-oil ratios begin to drop very noticeably within seven months after the initiation of the program at a reduced injection rate in comparison to this one. And it is only now that we are first beginning to detect an increase in oil production in those wells immediately offsetting the injection wells.

Q In seven months?

A A year for the increase in oil. Seven months for a very noticeable decrease in the gas-oil ratios.

MR. UTZ: Are there other questions of the witness?

MR. VERITY: I have just a few.

MR. UTZ: Mr. Verity.

CROSS EXAMINATION

BY MR. VERITY:

Q If I understand you, you hope to be injecting water in your six injection wells in a relatively short period of time. Can you tell us whether those wells are producing at capacity or not or whether or not they are making a top allowable at this time?

A Which wells?

Q The injection wells.

A The injection wells. Yes, I can tell you, if you'll let me refer to a list that I have here. Starting over on the West side, the first well shown in green there, which is the Navajo Tribal "E", No. 3, that well currently is capable of producing at a rate of 132 barrels per day. The gas-oil ratio on the well is 5,853 cubic feet per barrel. Its allowable under the present limiting 2,000 to 1 gas-oil ratio is 56 barrels per day. So, in answer to your question, that well will not produce top allowable currently. Moving on to the East, Well No. 2 on the Navajo Tribal "E" lease, that well is capable of producing 70 barrels of oil per day. Gas-oil ratio on it is 79,506 cubic feet per barrel, it's oil allowable under the limiting ratio is 35 barrels per day.

To clarify one point, these are tests that were run in November of this year. In moving on to the Southeast to the El Paso Natural Gas No. 2 Ojo Amarillo lease, that well is currently producing 44 barrels of oil per day with a gas-oil ratio of 12,886, giving it a present allowable of 25 barrels per day.

Further to the East on the Navajo "L" lease, Well No. 1, that well is currently capable of producing 90 barrels per day with a gas-oil ratio of 2,489, giving it a current allowable of 90 barrels per day.

Well No. 4, further to the Southeast on the Navajo "L" lease, currently is capable of producing 171 barrels per day with a gas-oil ratio of 5,363 with an allowable associated therewith of 61 barrels per day.

The Navajo "L" No. 5 in the Southeast edge of the project, or Navajo Tribal Land area is capable of producing 204 barrels per day with a GOR of 3,608, giving it an allowable of 91 barrels per day.

Those are the six wells that we are currently anticipating converting to injection service.

Q If I understand your requested rules, you request the privilege of having a project allowable assigned?

A That is correct.

Q And in calculating that project allowable you have requested top allowable for these six injection wells?

A That is correct.

Q By virtue of this, does this mean that prior to the time that your injection of water takes effect that you would actually increase the amount of oil that you can produce from the project

area over what you are able to produce today?

A Mr. Verity, before I could give you an absolutely definitive answer on that I would have to check every well.

Q Can you approximate that answer?

A Let me just check these various injection wells and see the capacity of the wells they would be transferred to. That's the only way I can.

Q Let me pass it for a moment, then, without burdening you doing that, and ask you if you believe that you should be allowed to increase the amount of oil you are presently producing prior to the time that your water injection makes a reaction in the wells you are going to produce?

A Yes, I think we should simply for this reason, we are going to great expense and are taking some risk to get a project started here which ultimately should result in conservation in a large amount of oil, certainly a large amount of gas, and what minor production increase you would get as a result of this would be a very poor rate of return on the expense that you are now encumbering ourselves with to get this project started.

Q You understand, do you, that I'm speaking about the period of time prior to your substantial or your reaction from the water flood injection?

A Yes, sir, I do.

Q Now, if you do increase the overall amount of oil that you are presently capable of producing under your present allowable as to edge wells that might be offsetting other production, will this also possibly increase what they're able to produce?

A I'm not sure I followed your question right at the last.

Q My question was a little involved. What I'm saying is that this being the case, your answer, it follows, does it not, that edge wells that are offsetting production outside the project area can also be increased over present allowables?

A Can be?

Q Under your requested rules, yes.

A Yes, that is correct.

Q Well, this being the case, wouldn't it also follow, then, that you would create drainage from those offset wells during this interim period prior to the effect of your flood?

A Well, it will depend entirely on the amount of oil that is transferred to those individual wells and their ability to produce is going to be one of the controlling factors that will determine how much you are capable of transferring.

My point is simply this, to illustrate, just take any particular well, say we do have a matter of, oh, for conversation purposes, 600 barrels of oil to transfer, and that is conversation I have not checked it, we must of necessity distribute that to

wells that will be capable of producing it or we will be unable to realize the full benefit of permission to transfer. So to definitively answer your question, I think we should probably ascertain specific wells and discuss those as such.

Q All right, let me make reference now, you said that these rules were the same as those that were in effect someplace else, and I didn't quite get your answer to that question.

A Yes.

Q That is, your requested rules are now in effect, where did you say, in other pressure maintenance projects?

A Well, there's Atlantic's Horseshoe-Gallup and Pan American.

MR. BRATTON: Pan American's Horseshoe-Gallup.

A Pan American's Horseshoe-Gallup.

Q Do you have objection to the rules that were promulgated by the Commission for Humble's Horseshoe-Gallup water pressure maintenance?

A Well, objections, no, I could have hoped for something a little better, but certainly no objections. It's an embarrassing question.

Q I wonder if you would object to an inclusion of the rules that you propose, or the rules for this pressure maintenance, of something similar to Rule No. 7 of Order R-1745, which is that

Humble Horseshoe-Gallup?

A Would you mind reading that, or permitting me to read it?

Q This rule provides, and I quote, "The allowable assigned to each producing well in the project shall be equal to the well's ability to produce or to the top unit allowable for the Horseshoe-Gallup Oil Pool, whichever is less, provided that any producing well in the project area which directly or diagonally offsets a well outside the project area producing from the same common source of supply shall not produce in excess of top unit allowable for the pool until such time as the well receives a substantial response to water injection."

A No, I do not think that we would strongly or seriously or even object to that, depending upon the definition of what is an edge well, of course.

Q Yes. Let's go to that next. Would you consider the Navajo 7-"E" in the Southwest Quarter of 16 to be direct or diagonal offset?

A No. Well, use your own definition there. Certainly it would be one or the other.

Q Well, that's what I meant, one or the other.

A Right.

Q What about the 4-"E", I believe it is in the Northwest quarter of 21?

A 4-"B" is a little different situation, in that it is approximately a half mile back from any other well outside the project area. I will bring to your attention that the development on the Navajo Tribal Lands here has been on a pattern of one well to each 160 acres, whereas to the Northwest of the Navajo Tribal Lands, to the Southeast of the Navajo Tribal Lands you will find that the density of well development is much greater. I bring that out only to illustrate that the well No. 4 is considerably removed from the boundary of the tribal lands.

Q In that regard, I wonder if we could call the witness's attention to the fact that on your Exhibit 1, I believe the Foutz No. 1 State well is slightly mislocated.

A If it is, I apologize.

Q No apology required, it's been very recently drilled, and I think probably you didn't have proper occasion, but it is, we would like to stipulate with you that it is actually in the Southeast quarter of 16 rather than in the Southwest where you show it. It's approximately, what would you say, 800 feet due East of where they show it.

MR. **WEIDEKEHR:** Probably.

Q Approximately eight feet due East of where you show it on this map.

A All right, fine.

Q If I understand one of your statements, you stated to the Commission that in your opinion, and I presume that this is the position of the Applicant, that this water flood can be controlled so that it will not in any wise damage any offsetting formations?

A That is correct. There are several approaches which can be used, Mr. Verity. The most logical method, and the one which we strongly prefer, is to work out cooperative agreements with those people offsetting this project. That's the No. 1 choice. We believe that we can do so. However, recognizing that the possibility exists that we can not do that, then we have other avenues that are open to us, that is, that we would drill the necessary wells along the boundary with the permission of this Commission, of course, to prevent the effect of the flood crossing the Tribal boundary itself.

I have, as a matter of my own information here, which I would be very happy to show you several possible and feasible cooperative plans which we can work out.

Q And if those can't be worked out, you still feel that you will so operate your water flood as not to damage offsetting properties, and particularly the properties to the North of the water flood in Section 16?

A That is correct.

Q One more question. What do you envision in the nature of delaying the three injection wells until satisfactory lease line agreements are effected? If it should develop that you can't work out a satisfactory lease line agreement, then what do you propose for those three wells?

A Then it is my best estimate at this time that their position will have to be relocated in certain cases, and possibly left as producers to achieve this purpose that I formerly referred to.

Q Then, if I understand you, you are saying that you do not now request permission to inject these wells --

A That is correct.

Q -- unless you have written permission from the off-setting leases outside the project area?

A Well --

Q Then administrative approval from the Commission after?

A Right. If you will notice down on the legend at the bottom, those are indicated to be conversions to be delayed until satisfactory lease line agreements are effected, and in our application we asked that be handled by administrative approval. I would assume that the best way to show, to the satisfaction of whoever administers this project, a written agreement that we have reached said agreement.

Q Then, if that couldn't be obtained, I presume you would request, and have a hearing or whatever you would propose?

A Whatever action would be required, it would either be hearing or any other acceptable procedure.

MR. VERITY: I believe that's all.

MR. UTZ: Let's take a ten minute recess.

(Whereupon, a recess was held.)

MR. UTZ: The hearing will come to order. Are there any other questions of the witness?

MR. MORRIS: Yes, sir.

MR. UTZ: Mr. Morris.

CROSS EXAMINATION

BY MR. MORRIS:

Q There has been quite a bit of reference to the line agreements that are going to have to be at least attempted. In the event line agreements are consummated, will they in turn have to be submitted to the approval of the United States Geological Survey and the Bureau of Indian Affairs?

A Yes, it is our belief that they must be submitted to those people.

Q That would, presumably, occasion further delay, would it not?

A It could result in that, yes. However, I do not anti-

cipate any undue delay as a result of that.

Q Has any notice been given to either of the two agencies that line agreements are going to be attempted and are they on notice that this is in the process?

A Yes. It has been discussed with both agencies.

Q What has been their comment?

A Well, I hope that I do not misquote anyone. I'll say this, that certainly we have had no adverse reaction provided we can negotiate acceptable lease line agreements, and that is only concerned with protecting the various equities involved.

Q Mr. Kelly, from a rundown of the production data that you gave on the wells that are going to be converted to injection wells, it's apparent that there is going to be a decrease in the overall gas production by converting those particular wells to injection, is that correct? In other words, you have taken your high ratio wells and anticipate converting them to injection?

A No, sir. They were not selected for that purpose at all. They were selected only because of their location and examination of the gas-oil ratios on other wells. In there we find wells that are just as high or higher than the ones I have referred to.

Q But it will have that effect whether or not they were selected for that reason?

A Yes, yes, that is correct. I might amplify, in glancing over this I find gas-oil ratios up to as high as 16,579 cubic feet per barrel on one particular well.

Q I believe that you gave as one reason for urgency in this matter, that the production of gas should be contained within at least its present limits to prevent the penalty that would otherwise be incurred by those wells and the resultant loss of production by those wells as one reason for urgency in the formation of this project?

A No. If I inferred that I certainly didn't intend to. The urgency comes about for a different reason. That reason is that the loss of this gas from the oil presently contained in the reservoir has very adverse effects upon the oil itself and decreases the efficiency of the flood. It is not the increased revenue, that is not the primary purpose or current revenue at all.

Q But it would tend to maintain the pressure in this portion of the reservoir by containing the gas?

A That's correct.

Q Other than the reason that you just mentioned, could you summarize the reasons for recommending urgency in this matter?

A Yes, I would be happy to. I have forgotten the exact exhibit numbers, but I would refer you back to the exhibit wherein is plotted the production statistics on this particular portion

of the Cha Cha-Gallup Pool which shows the gas-oil ratio increasing rapidly as a result of the loss in the reservoir pressure. That was Exhibit No. 4. Also Exhibit No. 5, that shows, unless we get this flood started in the very near future we will encounter a reduction in the total amount of oil that can be recovered, there will be waste that can not be prevented, simply as a result of pressure having been lost from the reservoir.

Q In other words, the pressure is dropping to the optimum point and that is the point at which your project should be commenced?

A That is correct.

Q You would cite those two factors?

A Those are the principal ones. If you wish, I'll be happy to amplify on why this occurs. It is contained, however, in the Engineering Committee Report.

Q I think that will be sufficient. What is the water source?

A The water source is somewhat in doubt as yet. However, at this time we propose and are under way on the drilling of an alluvium source well to tap the waters, the alluvium waters of the San Juan River. The area in which these wells will be located is in the Southeast quarter of Section 15, Township 29 North, Range 14 West of San Juan County.

If that test, which is currently under way, we're getting ready to start on it, is successful, then that alluvium source will become the source of water for the pool. However, we have an alternate plan in case the alluvium does not develop into a suitable source of water. We plan on drilling a Morrison sand water source well in an area that we have tentatively selected, and it is shown on the same map, well, I don't know the section number here.

MR. VERITY: 16 or 21.

A Section 21. It's shown circled with an "X" or something to distinguish. I might point out that further downstream on this same river, the San Juan, in the San Juan County of Utah where the Aneth, McKelver and Rutherford and White Mesa floods are under way, the alluvium has proven to be an acceptable source of flood water.

Q You are not planning to rely on surface appropriations from the river?

A Yes, there will be, alluvium water is considered.

Q Yes, but by well rather than by just surface appropriation.

A Correct, that is it.

Q Mr. Kelly, in the joint operating agreement I note that page 22a was inserted and it was inserted at such a point that the signature of El Paso Natural Gas Products Company to the

agreement appears before the page that was inserted. Does that have any effect?

A It has no significance, I would say that was just a bust on my part. This final executed copy came into our possession just very recently and we have been rapidly putting them together.

Q So El Paso Natural Gas Company, as well as the El Paso Natural Gas Products Company, are parties to the agreement?

A That is correct. However, you'll find that in the body El Paso Natural Gas Products Company is to vote and to exercise all interest of El Paso Natural Gas Company.

MR. MORRIS: I believe that's all. Thank you.

CROSS EXAMINATION

BY MR. UTZ:

Q The reason you gave, I believe, as to limiting this flood to its proposed boundaries, was so that you wouldn't have to work with the Indian people to unitize?

A No, sir, what I intended to infer was simply this, that from our experience we have found it much more difficult and time-consuming to effect a unit of Navajo Tribal Lands with lands other than Navajo Tribal; in the McElmo-Aneth area we have found that just recently we can ascribe to our attempt to unitize difficult royalties with Navajo Tribal Lands delayed that project well over a year. It is just the sheer size of the project that creates

that delay because justifiably they insist that they be convinced in every case that their equity is protected. That is just a time-consuming process.

Whereas, when we unitize only tribal lands, that is, the only thing we have to convince them on is that their equity is protected on the lease line agreements. That is only a small portion of the entire project.

Q But you have, in some cases, unitized Indian lands with other lands?

A We have, and I must say much to my regret, because it delayed it unduly.

Q Now, the lands in 29 North, 13 West, are those Indian lands?

A 29 North, 13 West?

Q Yes, in Sections 30 and 31.

A No, sir, they are not, if I have my finger on those. They are Federal leases, but they are not Navajo Tribal Lands. The Navajo Tribal leases, insofar as I know, are those that are located West of the East side of Range 14 West, South of the San Juan River.

Q Now, the wells that are shown to the Northeast are Totah wells, all of them?

A Yes, they are Totah wells.

Q That includes the Navajo "H" No. 9 also?

A The Navajo "H" No. 9 is a Totah-Gallup well.

Q And you believe that there's an impermeable zone between the Totah and the Cha Cha in this area?

A Yes, sir, we do. I believe, if you will refer back to the spacing hearing that was held some two to three months ago, that that was demonstrated.

MR. UTZ: Any other questions?

CROSS EXAMINATION

BY MR. McGRATH:

Q Mr. Kelly, I believe you stated that there was approximately 250 pounds bottom hole pressure in the Northwest part of the Cha Cha than there is in the Southeast; if they start this water injection that will increase that water differential, won't it?

A That is correct. If we start this water injection program and a comparable program in the Southeast Unit is not instituted immediately, then that pressure differential will increase.

Q Something will have to be done to protect it?

A That is correct. Our preference is certainly that the people in the Southeast portion of this pool, which includes ourselves on the one tract down there and several other companies

who are, at least Pan American is down in the Southeast, feel that the best solution to get that flood started, work out comparable agreements to take care of the lease line. However, failing to do that, there are other alternatives available such as drilling wells right along the Southeast border of the Navajo Tribal Lands. If this unit can not be put together down there and the necessary line agreements worked out, then we will feel that we must take that approach.

MR. McGRATH: That's all.

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. Kelly, is the proposed flood to the Southeast adjoining this flood here?

A Yes, sir, that is under way at this time.

Q That's the Pan American flood?

A Yes, Pan American, I understand, will be the operator of that flood.

Q And you people are working on the same lease line agreements?

A Are we?

Q Yes.

A Yes, sir, that is one of the prime considerations for both of these.

MR. UTZ: Any other questions?

REDIRECT EXAMINATION

BY MR. BRATTON:

Q I have a question. Mr. Kelly, referring to the rules which you have requested, they are the same as the Pan American and Atlantic Horseshoe-Gallup rules?

A That is correct, insofar as I know.

Q And the Humble Horseshoe-Gallup rules have only the additional requirement that an allowable can not be transferred to a well directly or diagonally offsetting an outside tract until it has received substantial response?

A That is my understanding, right.

Q When this application was presented, you had some injection wells right along the boundary?

A That is correct.

Q And, of course, if those wells were to be injection, you would need to transfer allowable right along the boundary?

A That is correct.

Q Before you get response? A That is correct.

Q If those wells should go on injection by administrative route after agreement from the offsetting operators, you would still need to transfer allowables along the boundary, would you not?

A That is correct.

Q To protect the correlative rights inside?

A Yes.

Q One further thing, Mr. Kelly, just East of your Navajo 7-"E" and directly offsetting to the South the Foutz State well, there is a proration unit established, is that correct?

A That is correct.

Q That little triangle along the boundary is a non-standard proration unit that has been established?

A That is correct.

Q So that the No. 4 well to the South of that is not a direct or diagonal offset to a proration unit outside the boundary?

A I couldn't consider it as such.

Q Certainly the Navajo 7-"E" well is?

A It is, very definitely.

Q Regardless of what rule might be adopted, would you want to transfer any allowable to the Navajo 7-"E" prior to obtaining response?

A No, we would not.

MR. BRATTON: I believe that's all.

MR. UTZ: Are there other questions? The witness may be excused.

(Witness excused.)

MR. UTZ: Do you have any further witnesses?

MR. BRATTON: No, sir.

MR. UTZ: Any statements in this case? Mr. Buell.

MR. BUELL: Guy Buell, may it please the Examiner, Pan American Petroleum Corporation, as an interest owner in the Northwest Cha Cha Unit, has worked extremely closely with the El Paso Natural Gas Products Company and the Humble Oil & Refining Company in the formation of this unit and the designing of the pressure maintenance program. As such an interest owner we wholeheartedly concur in the recommendations of Humble here today.

Also Pan American is an operator North of the San Juan River immediately North of the Northern boundary of the Northwest Cha Cha Unit. As an operator in that area, as is Southwest Production Company, we have critically evaluated the pressure maintenance program and the rules proposed by Humble. It is our firm and sincere conclusion that the only effect on our properties North of the river by this program proposed and these rules proposed will be an additional effect on those properties North of the river.

Actually Pan American is concerned over Southwest, maybe opposition isn't the correct word, but certainly their reluctance at this time to see injection wells in the Northern portion of the Northwest Cha Cha Unit. Actually Pan American feels that it is

absolutely necessary in order to protect our properties North of the river to immediately convert wells to injection service in the Northern portion of the Northwest Cha Cha Unit. We feel that it is mandatory to protect our interests North of the river.

MR. UTZ: Any other statements?

MR. VERITY: Relying upon the Applicant's witness's statement that he and the Applicant were assured that this water flood could not damage any leases offsetting the project area, Southwest Production Company has no objection to the granting of the application.

MR. UTZ: Any other statements?

MR. MASON: John Mason with the El Paso Natural Gas Products Company. We also concur in this application of Humble since we also are an interest owner in the project area. There has been no evidence introduced here today to indicate that there would be any damage to offsetting properties, that to the contrary there will be certain precautions that should be taken to protect the project area itself, and it has been indicated that these measures will be undertaken as the need arises.

If anything, as far as the offset operators is concerned, as Mr. Buell has indicated, they will perhaps benefit from this program. In view of those matters and in view of the urgency which Mr. Kelley has clearly indicated, as far as the conditions

now existing in the river, the high gas-oil ratios and the rapid decline in pressure, we feel that it is urgent that approval be gained as soon as possible so that injection can begin, so that these conditions can be arrested. We heartily concur in the request that has been made in this application and urge that the Commission grant this approval as soon as possible.

MR. UTZ: Mr. Buell.

MR. BUELL: Guy Buell, may it please the examiner, it might be proper for this record to briefly comment on the other conservation efforts that are going on in the Cha Cha-Gallup Pool. As the examiner probably knows, Pan American has an application on the first Examiner Hearing in January for a lease flood in the Southeast portion of Cha Cha. I would like to state for the record that last week an operators' meeting, as well as an Engineering Subcommittee meeting was held with regard to unitization efforts in the Southeast portion of Cha Cha, and the people who are dealing directly with that effort are extremely optimistic and are hopeful within the immediate future that we will see in conjunction with this Northwest Cha Cha Unit a Southeast Cha Cha Unit, which will, in effect, subject about 90 or 95% of the Cha Cha-Gallup Oil Pool to unitize pressure maintenance operation.

MR. UTZ: Thank you, Mr. Buell.

MR. BRATTON: Mr. Examiner, I would just like to make one

statement. Every month all of those present here, and many others, come up here charging up as white knights of conservation, and sometimes the Commission views that favorably and sometimes with a somewhat skeptical attitude. I want to say in all sincerity that I believe this is an urgent conservation project. I believe we have tried to demonstrate to our absolute utmost we aren't going to violate anybody's correlative rights, those across the boundary, and certainly we have to protect those inside the boundary.

This is a sincerely and urgently needed project, and I would hope that the Commission would act favorably on it without any delay, because as the witness pointed out, we have to work just as fast as we can through all agencies to try to get water in the ground just as soon as possible. Thank you.

MR. UTZ: Any other statements? The case will be taken under advisement and the hearing is adjourned.

(Whereupon, the hearing was adjourned.)

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my hand and notarial seal this 14th day of December, 1961.

Ada Dearnley
Notary Public-Court Reporter

My commission expires:

June 19, 1963.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 2442, heard by me on Dec. 12, 1961.

....., Examiner
New Mexico Oil Conservation Commission

P. O. Box 3082
Durango, Colorado
November 22, 1961

Dear Sir:

For your information, attached are _____ copies of a report titled "A Reservoir Study of the Proposed NW Cha Cha Unit, Cha Cha Gallup Field, San Juan County, New Mexico." This report summarizes the status of unit engineering studies as of May, 1961.

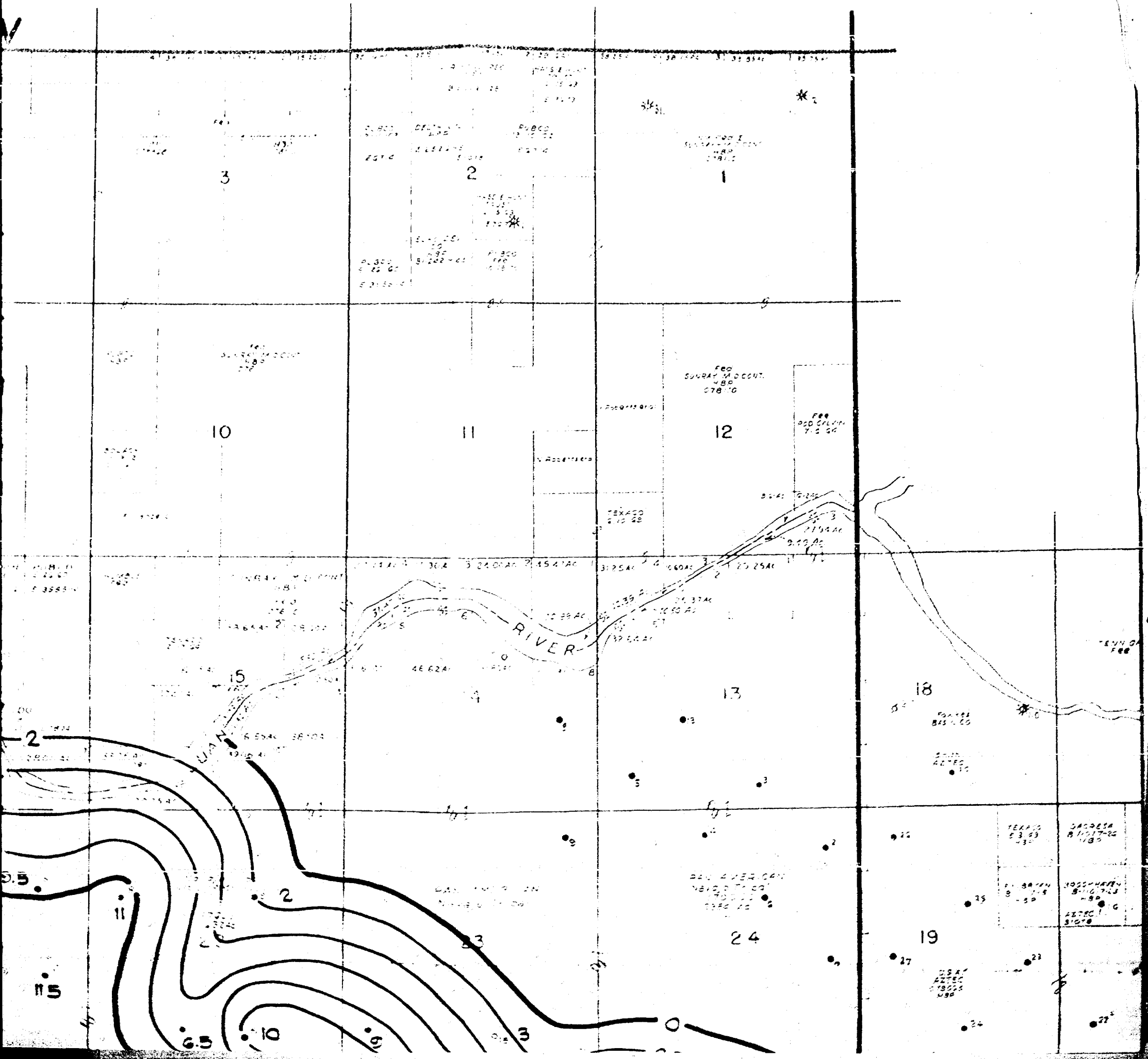
Three development wells (Humble's Nos. L-14 and L-15, and Pan American's No. H-15) have been drilled since the May study. Since these development wells do not alter the conclusions and recommendations of the May, 1961 study, the report has not been updated. However, it has been necessary to revise the "A" sand net pay isopach map and water flood injection wells to accomodate the new developments. A revised "A" sand isopach map is attached.

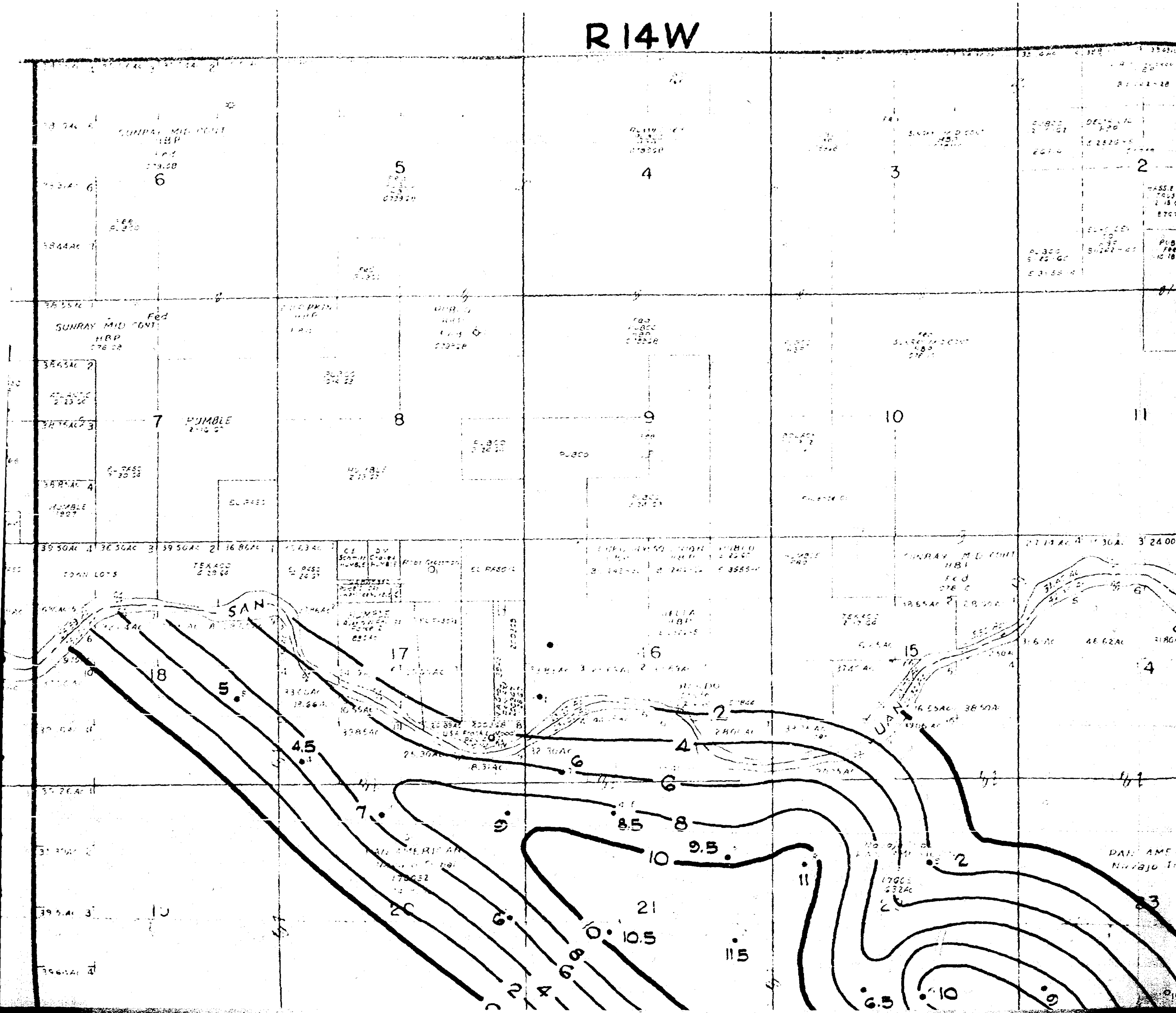
During the reservoir study it was estimated that water injection would begin October 1, 1961, however, it was not possible to complete unitization and initiate injection by that date. Design of the water injection system is now near completion and it is estimated that water injection will start during the first quarter of 1962.

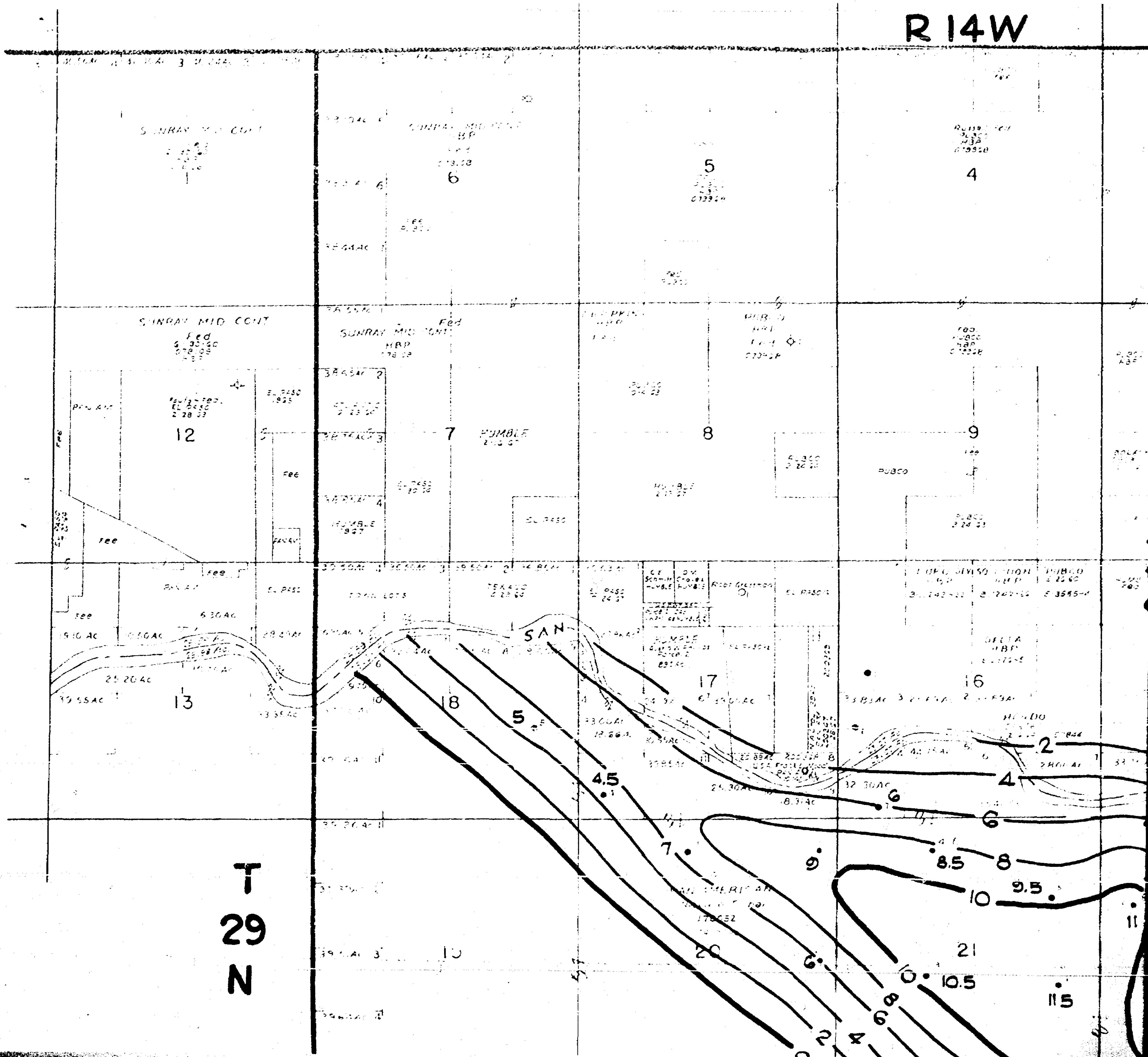
Very truly yours,

H. J. Flatt
Chairman
NW Cha Cha Engineering
Committee

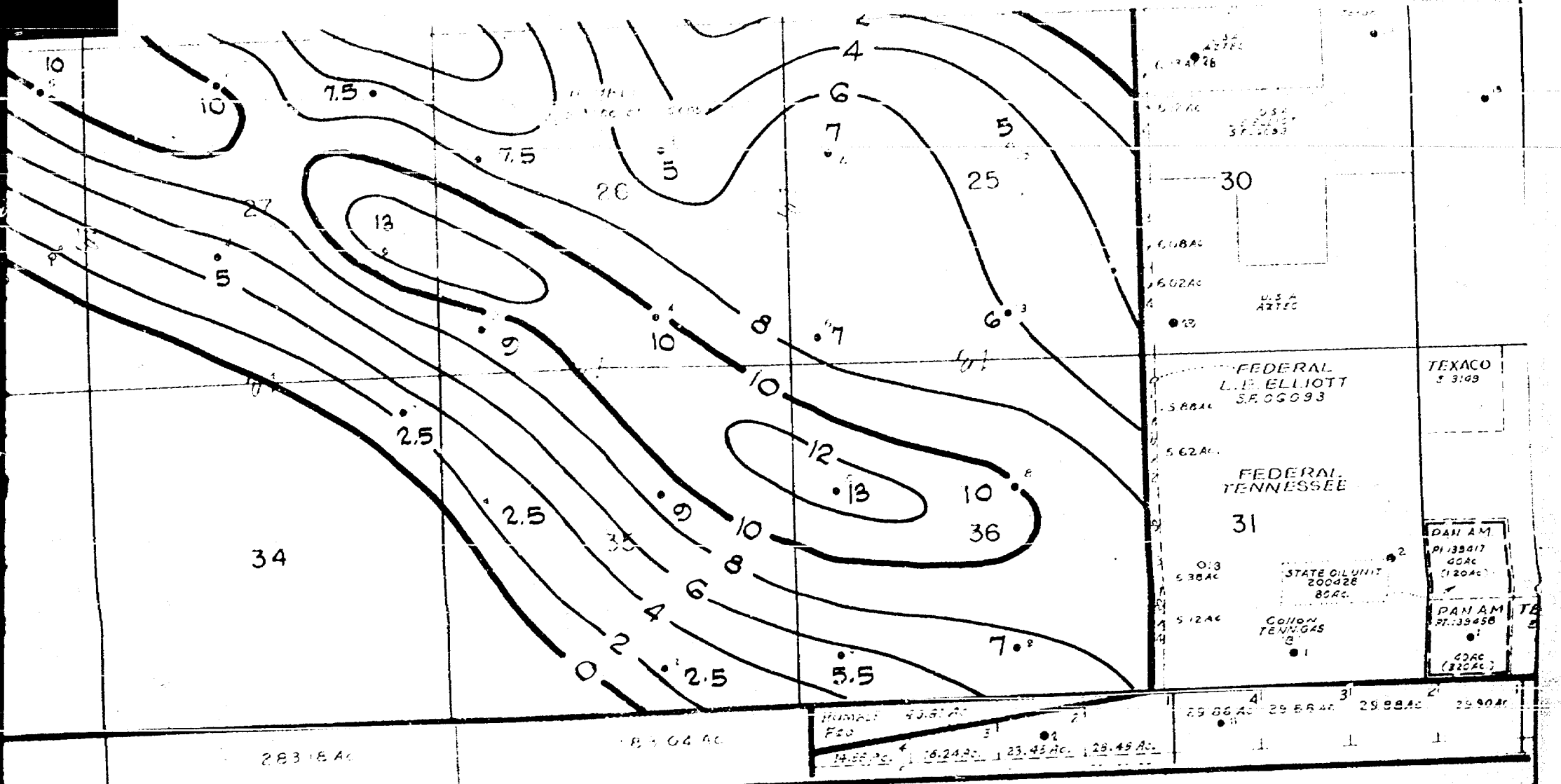
MMW/jal
Attach.


3
2
1
10
11
12
15
13
18
24
19
RIVER
2
0.5
11
2
3
11.5
6.5
10
6
3
0


R14W
SUNRAY MID CONT
HBP
6
5
4
3
2
SUNRAY MID CONT
HBP
7
HUMBLE
8
9
10
11
TEXACO
EL PASO
17
16
15
14
18
SAN
JUAN
21
PAN AMERICAN
Navajo Tribal
PAN AMERICAN
Navajo Tribal
20
22
23
2
4
6
8
10
4.5
5
7
8.5
9.5
10.5
11
11.5
6.5
10



R 14W
T
29
N
SUNRAY MID CONT
SUNRAY MID CONT
HUMBLE
TEXACO
SAN
1
4
5
6
7
8
9
12
13
16
17
18
20
21



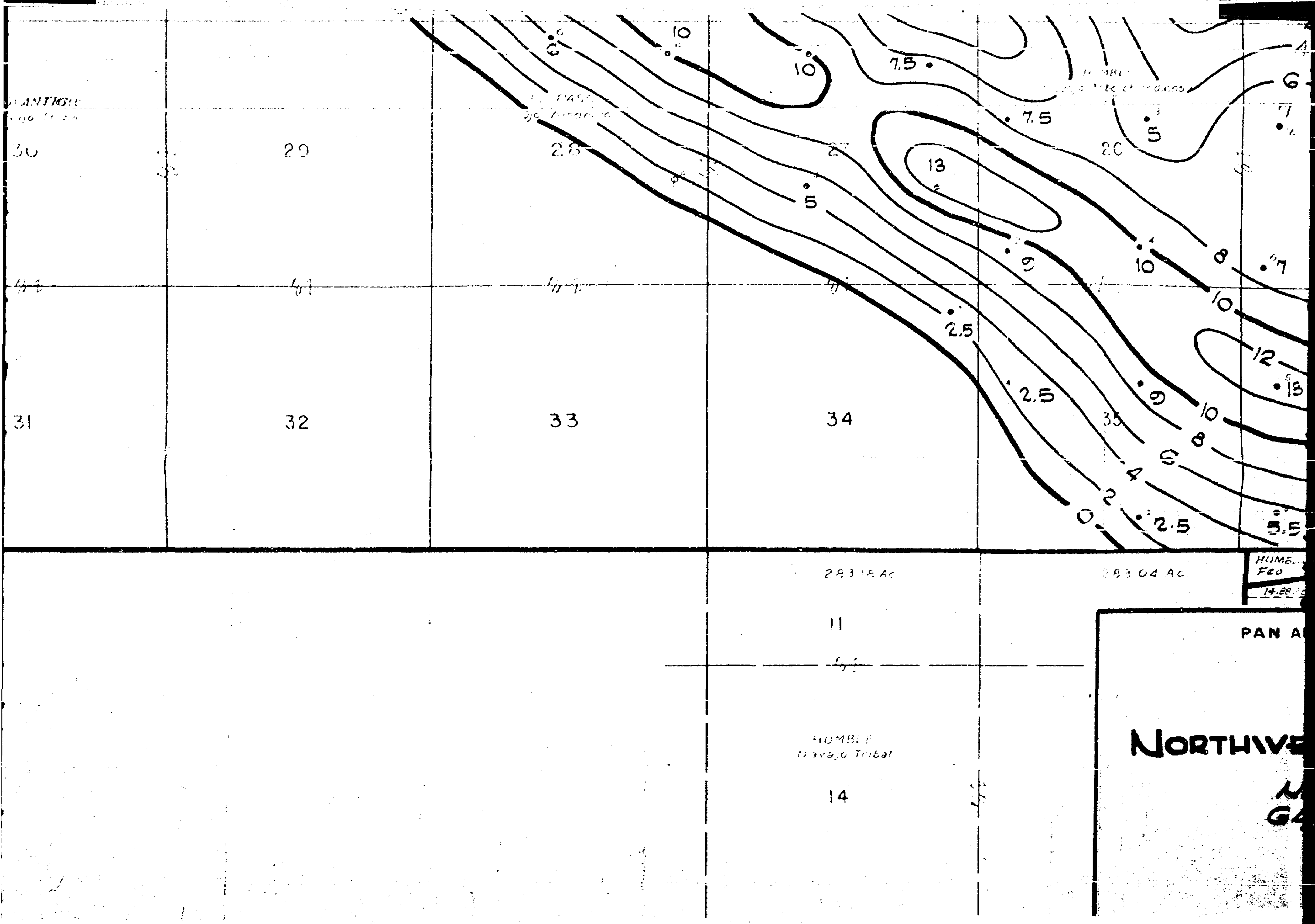
PAN AMERICAN PETROLEUM CORPORATION

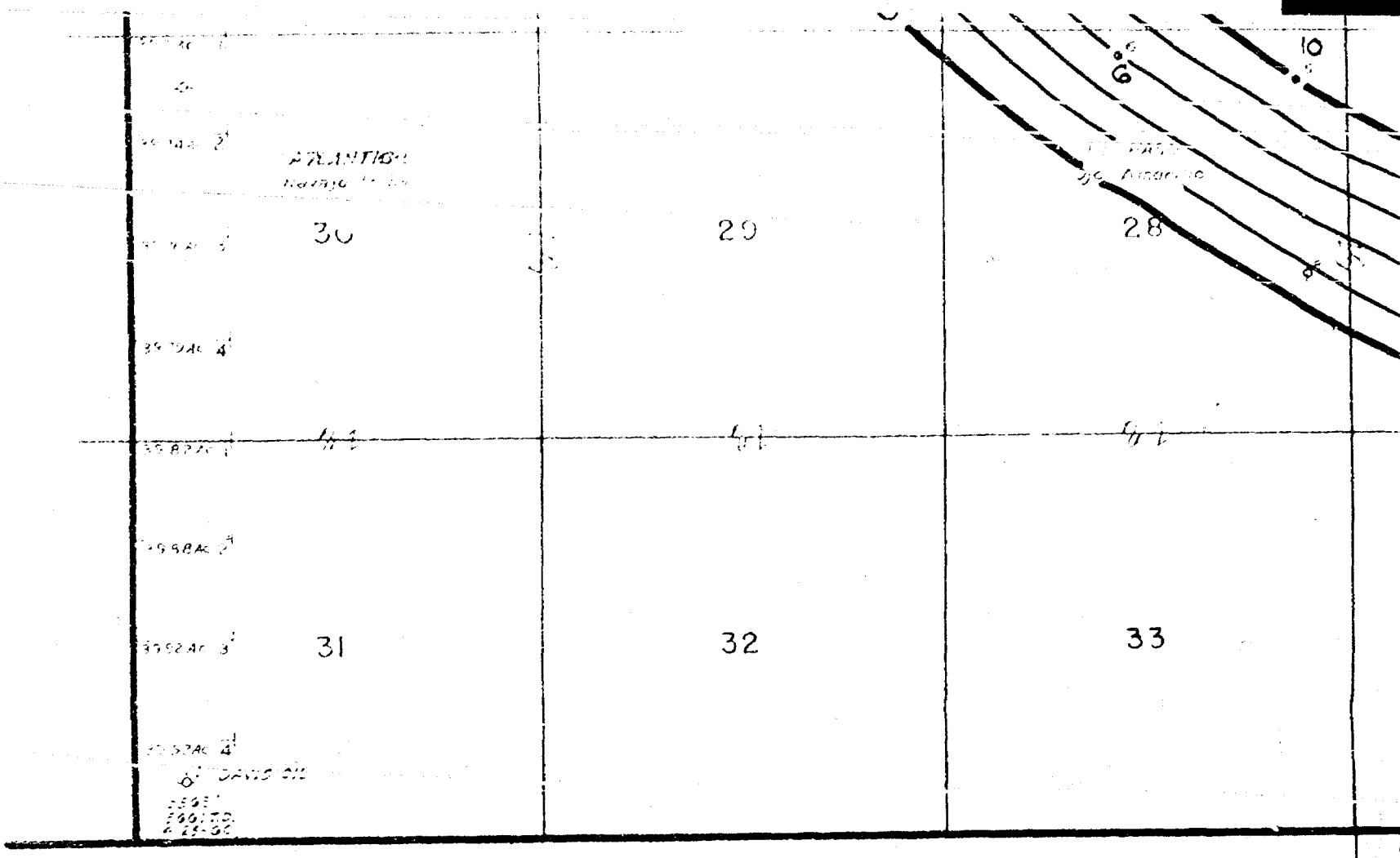
Farmington, New Mexico

NORTHWEST CHA CHA UNIT AREA

NET PAY ISOPACH
GALLUP "A" SAND

9-18-61


30
29
28
27
26
31
32
33
34
35
11
14
HUMBLE
Navajo Tribal
PAN A
NORTHWE
13
10
7.5
2.5
5.5


ATLANTIC
30
29
28
10
31
32
33

DISTRIBUTION

New Mexico Oil Conservation Commission (1)
Box 871
Santa Fe, New Mexico
Attention: Mr. D. S. Nutter

New Mexico Oil Conservation Commission (1)
1000 Rio Brazos Road
Aztec, New Mexico

United States Geological Survey (2)
P. O. Box 959
Farmington, New Mexico

United States Geological Survey (2)
P. O. Box 1809
Durango, Colorado

United States Geological Survey (2)
Drawer 1857
Roswell, New Mexico

El Paso Natural Gas Products Company (2)
P. O. Box 1161
El Paso, Texas
Attention: Mr. M. L. Ayers

El Paso Natural Gas Products Company (1)
P. O. Box 1560
Farmington, New Mexico
Attention: Mr. E. N. Walsh

Pan American Petroleum Corporation (2)
P. O. Box 1410
Fort Worth 1, Texas
Attention: Mr. Bruce A. Landis, Jr.

Pan American Petroleum Corporation (2)
P. O. Box 480
Farmington, New Mexico
Attention: Mr. Fred L. Nabors

Humble Oil and Refining Company (2)
P. O. Box 120
Denver 1, Colorado
Attention: Mr. J. Roy Dorrough

Humble Oil and Refining Company (2)
P. O. Box 3082
Durango, Colorado
Attention: Mr. B. M. Bradley

A RESERVOIR STUDY
OF THE
PROPOSED NW CHA CHA UNIT
CHA CHA GALLUP FIELD
SAN JUAN COUNTY, NEW MEXICO

Status as of May, 1961

This report compiled by Humble Oil and Refining Company
from initial and supplemental Engineering Committee
reports through May 11, 1961.

Engineering Committee
(Companies Represented)

El Paso Natural Gas Products Company
Humble Oil and Refining Company
Pan American Petroleum Corporation

TABLE OF CONTENTS

RESERVOIR STUDY OF THE PROPOSED NW CHA CHA UNIT
CHA CHA GALLUP FIELD
SAN JUAN COUNTY, NEW MEXICO

INTRODUCTION

Early in the development of the Cha Cha Gallup Field, the ultimate need for a water injection project was recognized and an engineering committee was established to consider unitization of the entire field. However, to expedite unitization and secondary recovery, the pool was divided into two areas and operators holding Navajo Tribe of Indians leases formed an engineering committee to study the reservoir and recommend a secondary recovery program for Indian leases. The companies represented were El Paso Natural Gas Products Company, Humble Oil and Refining Company, and Pan American Petroleum Corporation. This report presents the findings of the committee as of May, 1961.

SUMMARY

The Cha Cha Gallup Field, located approximately 5 miles southwest of Farmington, New Mexico, produces from the Gallup sand at a depth of approximately 5,000 feet. The original reservoir pressure was 1,560 psig and the production mechanism is dissolved gas drive. To expedite initiation of water injection for secondary recovery, a unit is proposed consisting of developed Navajo Tribe of Indians leases. Pore volume calculations of the proposed unit indicate 19,885,000 barrels of stock tank oil originally in place in the "A" sand. Because of the limited production data on the tight "B" sand, its reserves are not shown in this study. Primary recovery was calculated to be 2,724,000 barrels, or 13.7 percent, using standard dissolved gas drive calculation procedures. As of May 1, 1961, the unit area had produced 760,000 barrels of oil, or 3.8 percent of the oil originally in place. Cumulative production from the entire field on May 1, 1961, was 1,220,000 barrels.

The proposed unit consists of 5 adjoining Navajo Indian leases which form a large single block in the northwest portion of the field. These leases contain 35 wells on 160-acre development, or 53 percent of the producing wells in the field. Because of relatively high withdrawal rates, production is expected to decline rapidly and an injection project is needed to retard this decline and increase recovery. A combination of primary and water flood will provide an ultimate recovery of 38.3 percent of the oil originally in place or a total ultimate recovery of 7,616,000 barrels.

Several potential water sources for a water flood exist within the vicinity of the NW Cha Cha Gallup Field. These are the San Juan River alluvium sands, the Pictured Cliffs, the Upper Menefee and the Menefee Proper, and the Morrison subsurface formations. Preliminary investigations indicate San Juan River alluvium sand and the Morrison formation are the more desirable because of anticipated higher capacities.

The following is an economic summary of remaining primary and water flood operations for a flood starting October 1, 1961.

SUMMARY OF PRIMARY & WATER FLOOD ECONOMICS
FROM INITIAL DEVELOPMENT (6-1-60)

	Recovery		Total	Profit Before F.I.T.		Life
	%	Barrels	Investment	Actual Value	PDV @ 6%	Years
Primary Operations	13.7	2,724,000	$2,503,100	$ 3,741,500	$3,336,700	4.7
Secondary Operations (Flood Start 10-1-61)	38.3	7,616,000	$3,089,600	$12,121,500	$9,870,900	9.9
Incremental	24.6	4,892,000	$ 586,500	$ 8,380,000	$6,534,200	5.2

Water flood of the Cha Cha Unit is an attractive investment which will more than double the anticipated recovery and increase the current income for all concerned.

CONCLUSIONS

1. Primary recovery of the proposed NW Cha Cha Unit will be in the order of 13.7%.
2. Water flood will increase the total recovery to 38.3% of OOIP.
3. Water flooding this field is an economically attractive venture from a current day income standpoint as well as from additional recovery.

RECOMMENDATIONS

It is recommended that:

1. The proposed NW Cha Cha Unit in the Cha Cha Gallup Field be water flooded on a center line pattern.
2. A water source be developed to supply injection water.
3. Injection be initiated at the earliest possible date.

FIELD HISTORY

Location and Discovery:

The Cha Cha Gallup Field is located in north-central San Juan County, New Mexico, approximately 5 miles southwest of Farmington, New Mexico. The field was discovered on October 19, 1959, by Benson-Montin-Greer Drilling Company's Jones No. 2, located in Section 17-T28N-R13W. The northwest extension of the field was discovered by the completion of El Paso Natural Gas Products Company's Ojo Amarillo No. 1 on May 17, 1960. Subsequent

development has joined the two areas. Figure 1 shows the entire Cha Cha Gallup Field and the proposed NW Cha Cha Unit which is discussed in this report. As can be seen from the map, the NW Cha Cha Unit consists of all Navajo Tribe of Indians land within the Cha Cha Gallup Field. Pertinent field and reservoir data are tabulated in Table I.

Geology:

The Cha Cha Gallup Field is a northwest-southeast trending stratigraphic trap, typical of Gallup off-shore sand bar type developments. The structure is a monocline gently dipping to the northeast with field development occurring approximately on strike as shown in Figure 2. Since there is no evidence of a gas cap or underlying water, structure should have no appreciable effect upon field performance.

The field is approximately 1.5 miles in width and 10.5 miles long. Production is from the Gallup "A" (Upper) and "B" (Lower) sand members of the Mancos formation of Cretaceous age. The "A" sand is the main member and is productive throughout the field. The Gallup "A" is a fine to medium grained, light gray, glauconitic sand which varies in thickness from 2.0 to 13.0 feet in the study area.

The "B" sand is a tight, fine-grained sand containing minute fractures. It varies in thickness from 0 to 12 feet, and has been proven productive in a limited number of wells. Because of the low permeability of the sand, production is apparently from natural fractures that have been observed in some cores. Also, natural fractures have been observed in cores of the shale zone between the two sands.

Because of surface features and structure, the depth of wells in the study area varies from 4,600 feet to 5,600 feet. A maximum depth of 6,209 feet was reached by Humble's well No. L-7, however, this well was completed in the Gallup at 5,506-18 feet.

Development:

In May, 1961, there were 59 producing wells in the field, 31 of which were in the proposed NW Cha Cha Unit. Four additional wells were being drilled or completed in the unit. Development within the NW Cha Cha Unit area has been on 160-acre spacing except for one non-standard drilling unit, an 89-acre block developed by Pan American's well No. E-7.

Production is based on an allowable of 164 barrels per day, or a GOR limit of 2,000 $ft.^3/bbl$. As of May 1, 1961, accumulated oil production for the field was 1,220,000 barrels of which 760,000 barrels were produced from the NW area.

ANALYSIS OF RESERVOIR DATA

Determination of Original Oil-in-Place:

The proposed NW Cha Cha Unit "A" sand has a productive volume of 37,340.6 acre-feet and averages 6.5 feet in thickness. The original oil-

in-place was 532.53 barrels of stock tank oil per acre-foot, or a total of 19,885,000 barrels. These values are based on net pay, average core properties, and reservoir fluid analysis discussed in the following paragraphs.

Net Pay:

"A" sand net pay picks are based on core analysis and microlog separation. For wells with core analysis only, net pay is picked on those samples with permeability equal to or greater than 1 millidarcy and porosity equal to or greater than 6 percent. Wells having microlog and no core use microlog separation as net pay, and for wells with both core and micrologs, net pay is picked as the average of the two. For wells which have neither core analysis nor microlog, net pay is based on 79 percent of the average gross sand as shown on the Spontaneous Potential (SP) log and the Gamma-Ray log. The factor of 79 percent was determined by a comparison of core analysis and microlog with the average of SP-Gamma Ray gross pay as shown in Table II. In arriving at Gamma-Ray gross sand, indicated shale streaks were excluded. Certain edge wells were further adjusted based on known producing characteristics. Figure 3 shows a net pay isopach for the "A" sand.

For the "B" sand, an analysis similar to that on the "A" sand was found to be unsatisfactory since most of the "B" sand shows a uniformly low porosity ranging from 1.0 to 11.9 percent and permeabilities of less than 0.01 to 2.9 millidarcies. Minute natural fractures have been observed in cores and apparently increase flow rates and recovery from the tight sand; however, data are not adequate for analysis of the fractures and development of a net pay isopach. A gross sand isopach map was constructed using gross SP sand thickness with Gamma-Ray gross sand thickness being substituted when the SP was not available. The gross sand isopach of the Gallup "B" sand is shown in Figure 4. Cross sections of the field showing the "A" and "B" sands are shown in Figures 5 through 9.

Average Core Properties:

Based on core analysis of 102 feet of cores from 14 wells in the study area, average core properties of the "A" sand are 14.7 percent porosity and 57 millidarcies permeability. In obtaining average values, data on cores of less than 1 millidarcy permeability or 6 percent porosity, were not included. Core permeabilities ranged from 1.0 to 244 millidarcies and porosities varied from 3.8 percent (at 1.0 millidarcy) to 21.9 percent.

Based on core analysis of 75 feet of cores from 14 wells in the study area, average core properties of the "B" sand are 7.7 percent porosity and 0.33 millidarcies permeability. Average values are based on all permeable sand since the "B" sand contains minute fractures which are apparently providing some production from sands with less than 1.0 millidarcy permeability. Analysis of a pressure buildup curve on Humble's Navajo "L" No. 10 indicates that the effective permeability of the "B" sand, including natural fractures, is approximately 1.0 millidarcy. In the study area, core permea-

bilities varied from less than 0.01 to 2.9 millidarcies and porosity varies from 1.0 percent to 11.9 percent.

A connate water saturation of 35 percent was used for the "A" sand based on Totah and Horseshoe Gallup capillary pressure data weighted in accordance with the permeability distribution discussed above. Figure 10 shows a plot of permeability versus water saturation.

Average core properties are summarized in Table I.

Reservoir Fluid Analyses:

A subsurface sample analysis was not available from the study area at the time the initial engineering committee study was prepared, It was agreed that sample analysis data for the Totah Gallup Field should be representative of the Cha Cha Gallup Field and would be used. Figures 11 through 15 show fluid flow and reservoir fluid properties based on other Gallup sands and adjusted to Cha Cha Gallup reservoir conditions. The fluid sample was taken from Tennessee Gas and Oil Company's Glen "H" Callow No. 9 which is in the Totah Gallup Field. It was assumed that the oil was initially saturated at the original reservoir pressure of 1,560 psig in Cha Cha Gallup Field. Subsequent analysis of a subsurface sample from the Cha Cha Gallup Field indicates that the adjusted Totah sample data were reasonably close to actual Cha Cha conditions and the small difference did not justify recalculation of performance.

PRIMARY ("A" SAND) PERFORMANCE

A primary performance prediction was made for the reservoir using the Tracy method. Results are shown in Figure 16. A recovery of 13.7 percent of the original oil-in-place is estimated at an abandonment pressure of 200 psig. This represents a recovery of 2,724,000 barrels of oil or 72.9 barrels per acre-foot.

Figure 17 shows predicted primary performance as a function of time. This estimate is based on an initial average well productivity index of 0.75 BOPD per psi-drawdown, an initial formation capacity to oil of 200 md. ft., a completion ratio of 2.0 and appropriate fluid and core properties. Rates were limited by the lesser of allowable, gas-oil ratio limit of 2,000, or producing capacity. With the data used, capacity of the average well was limited by allowable to a pressure of 1,200 psig, gas-oil ratio from 1,200 to 800 psig and producing capacity from 800 psig to abandonment pressure. It is estimated that an economic limit of 4 BOPD per well will be reached at a reservoir pressure of 200 psig.

Field performance to date is compared with predicted performance on Figure 16.

WATER FLOOD ("A" SAND) PERFORMANCE

After consideration of several water injection patterns, a center line pattern was selected. Figure 18 shows the proposed water injection

pattern which consists of 9 injection wells plus some possible additional wells for boundary and/or areal sweep efficiency considerations. An interpretation of probable areal sweep is also shown. The center line pattern was selected because it will result in a higher stabilized injection rate, without a sacrifice in efficiency, than can be obtained by other patterns. It is estimated that a stabilized injection rate of 1,000 BWPD per well can be obtained. On a volumetrically weighted basis, this pattern gives an areal sweep efficiency of approximately 85 percent. As may be noted, this pattern appears readily adaptable to cooperative flooding in the event several separate floods are involved.

Vertical sweep efficiency of 86 percent was arrived at, based on a Stiles type calculation modified to allow for varying hydrocarbon pore volumes using an average porosity and connate water saturation for each permeability grouping. A limiting water cut-off of 97.5 percent of produced fluid was used.

Average residual oil saturation after flood of 31 percent is anticipated. This is based on average values measured by Atlantic Refining Company for Horseshoe and Central Bisti Unit floods in similar Gallup sands.

As shown in Table 3, water flood recovery was calculated assuming 50 percent resaturation of the unconformable zone, vertical and sweep efficiency of 86 percent and 85 percent, respectively, a residual oil saturation of 31 percent, a connate water saturation of 35 percent and appropriate formation volume factors and saturations as indicated by primary material balance prediction and fluid property data. Results indicate a recovery of 38.3 percent of the original oil-in-place for a flood at 1,200 psig (approximately October 1, 1961).

A detailed plot of predicted water flood performance with time for a flood commencing October 1, 1961, is given in Figure 19. Some initial gains are indicated in approximately 7 months after injection start with complete fillup being obtained in approximately 21 months with allowance for additional voidage. Significant water breakthroughs should also commence about this time. A total life of 10 years from initial development is indicated, however, most water flood oil will be produced within 2 to 3 years after fillup. Individual well maximum fluid production of approximately 400 barrels per day is anticipated.

WATER SOURCE

Several potential water source formations exist in the vicinity of the NW Cha Cha Gallup Field study area. There are the San Juan River alluvium sands, the Pictured Cliffs, the Upper Menefee and the Menefee Proper, and the Morrison formations. Preliminary investigations indicated that because of deliverability considerations, the San Juan River alluvium sands and the Morrison formation would prove most suitable. Tests are planned to evaluate the potential of the alluvium sands with a water well drilled in the SE Section 15-T29N-R14W. If these tests indicate that

sufficient capacity can be economically developed, it is recommended that the alluvium sands be utilized as a water source for the pressure maintenance program. If it is not feasible to develop this water source, it is then recommended that the Morrison formation be completely tested to determine its true potential as a water source.

ECONOMICS OF OPERATION

Primary economics ("A" sand only) and economics for a pressure maintenance program commencing October 1, 1961, are shown in Table V with economic factors and investment schedules shown on Table IV. This analysis envisions utilizing the San Juan River alluvium sand as a water source and is subject to revision if it becomes necessary to develop an alternate source. As shown on Table V, primary operation to depletion is estimated to yield a return of only $1.49 per dollar invested whereas the return on operations based on initiating pressure maintenance on October 1, 1961, is estimated to be $3.92 per dollar invested. Thus the proposed pressure maintenance program is economically attractive.

Economics of operation in the "B" sand have not been evaluated as the probable fractured nature of the reservoir necessitates obtaining additional performance data through testing, including a pilot injection program prior to making a definitive evaluation.

TABLE I
PERTINENT DATA SHEET
CHA CHA GALLUP FIELD
NORTHWEST CHA CHA UNIT AREA
SAN JUAN COUNTY, NEW MEXICO

Date of Discovery	October 19, 1959
Discovery Well	Benson-Montin-Greer Drlg. Co. - Jones No. 2, NW SE Sec. 17-28N-13W IPP 132 BOPD GOR 1272 Perforations 5623-27' and 5660-76'
2nd Well & Northwest Area Discovery	El Paso Natural Gas Products - Ojo Amarillo No. 1 NE NE Sec. 27-29N-14W IPF 304 BOPD GOR 386 Perforations 5322-5344' Completed May 17, 1960
Structural Features of Reservoir	
Producing Formation	Gallup
Structure	Monocline
Gas-Oil or Water-Oil Contacts	None Indicated
Type Accumulation	Stratigraphic Trap (Sand Bar)
Producing Depth	4600-5600' Average 5400'
Average Gross Thickness "A" Sand	8' +
Average Gross Thickness "B" Sand	6.0'
Reservoir Temperature	158°F
Initial Reservoir Pressure	1560 psig @ + 400' Datum
Estimated Abandonment Pressure	200 psig

Properties of Reservoir Rock	"A" Sand	"B" Sand
Average Porosity	14.7%	7.66%
Average Permeability (air)	57.0 md.	.33 md.
Mean Permeability (air)	41.0 md.	
Average Interstitial Water Saturation (Capillary Press.)	35.0%	

Properties of Reservoir Fluids	
Oil Gravity	38 - 45° API Average 43° API

Properties of Reservoir Fluids (Con't)

Estimated Flash FVF to 0 psig 2/1560 psig bpp and Flash Separation at 40 psig & 75°F	1.350
Estimated Diff. FVF to 0 psig 2/1560 psig bpp and 158°F	1.392
Estimated Diff. GOR to 0 psig @ 158°F	649 cu. ft./Bbl.
Estimated Avg. Initial Separator GOR @ 40 psig & 75°F	490 cu. ft./Bbl.
Estimated Oil Viscosity @ bpp.	.415 cp.
Estimated Water Viscosity @ 158°F	.45 cp.

Number of Wells

As of May 10, 1961	35
Estimated Ultimate (160-Acre Spacing)	35

Northwest Area Pore Volume Data

	Current Net "A" Sand	Gross "B" Sand
Acre-Feet	37,340.6 *	36,971.8 *
Productive Acres	5,729.5 *	6,156.5 *
Average Thickness	6.52	6.01
Original Oil-in-Place Within NW Unit Area		
Bbls/Ac. Ft.	523.53	
Bbls/Ac.	3,470	
Total Bbls.	19,885,000	

Ultimate Primary Recovery

% OOIP	13.7
Bbls/Ac. Ft.	72.9
Total Bbls.	2,724,000

Ultimate Water Flood Recovery

	(1200 psig)
% OOIP	38.3
Bbls/Ac. Ft.	203.8
Total Bbls.	7,616,000

* Excludes Humble's Navajo Tribal lease in Section 12-28N-14W and Atlantic's Navajo lease.

TABLE I (Con't)

Cumulative Production 5-1-61

% OOIP	3.02
% Ultimate Recovery	27.90
Bbls/Ac. Ft.	20.35
Total Bbls.	760,000

Pertinent Proration Rules

Proration Units	80 Acres (Temporary)
Current Allowable	164 Bbls/Cal. Day/Well
GOR Limit	2000 cu. ft./Bbl.
Spacing	Within 150' of center of either 1/4 1/4 Section

TABLE II
NORTHWEST CHA CHA UNIT AREA
DATA FOR "A" SAND
GROSS TO NET RATIO

Operator	Lease	Well No.	ML	Core	Avg Core-ML	Avg SP-GR
El Paso	Ojo Amarillo	1	8	7	7.5	12.5
		2	10	10	10.0	13.0
		3	12	14	13.0	13.0
		4	7	3	5.0	9.0
		5	10	---	10.0	12.0
		6	6	6	6.0	7.0
Humble	Navajo "L"	1	7	8	7.5	10.0
		2	9	---	9.0	14.0
		4	10	---	10.0	12.0
		5	13	---	13.0	11.5
		6	7	7	7.0	9.0
		7	9	---	9.0	10.0
		8	10	---	10.0	11.0
		9	7	7	7.0	10.0
		10	7	4	5.5	7.5
Pan American	Navajo "E"	7	---	6	6.0	8.0
		8	---	11	11.0	12.0
	Navajo "G"	3	---	7	7.0	9.0
		5	---	3	3.0	8.0
	Navajo "H"	1	---	9	9.0	12.0
					165.5	210.5

"A" Sand Gross to Net Ratio = $\frac{165.5}{210.5}$ = .79

TABLE III
NORTHWEST CHA CHA UNIT AREA
PRIMARY AND WATERFLOOD RECOVERIES

Original Oil-in-Place

$$N = \frac{7758\ \phi\ (1\text{-}Swc)\ Ah}{bo}$$

$$N = \frac{7758 \times .147 \times (1-.35) \times 37,340.6}{1.392} = 19,885,000 \text{ Bbls.}$$

Primary Recovery

Bbls. = N x RF = 19,885,000 x .137 = 2,724,000 Bbls.

Total Recovery with Water Flood

Total Rec. = Rec. to Start WF + WF Rec.

$$\text{WF Rec. Bbls./Ac-Ft.} = 7758\ \phi \left[\frac{So_1}{Bo_1} - \frac{E\ Sor}{Bo_2} - \frac{(1-E)(1-Swc-Sg_2)}{Bo_2} \right]$$

$$\text{Total Rec. \%} = \frac{\text{Total Rec. Bbls./Ac. Ft.}}{\text{OOIP Bbls./Ac.Ft.}}$$

Total Rec. Bbls. = % Rec. x N

$$\text{Free Gas in p.s., cu. ft./Bbls} = 5.615\ \frac{Bo_1\ Sg_1}{So} \left(\frac{P_1}{Psc} \frac{Tsc + 460}{T + 560} \right) \frac{1}{Z}$$

$$= .321\ \frac{Bo_1\ Sg_1\ P_1}{So_1\ Z_1}$$

Assumptions

1. 50% resaturation of unconformable zone
2. Sor = .31 (Average Atlantic Horseshoe & CBU)
3. $Sg_1 = \frac{1}{2} Sg_1 = \frac{1}{2} (1\text{-}S_{l_1})$
4. Ev = .86, Ea = .85, E = .731

Other Data

	1200 psig
Free gas in p.s. @ Flood Start	81.3 cu. ft./bbl.
New bpp with $\frac{1}{2}$ back in soln.	1322 psig
Bo_1	1.342
Bo_2	1.376
So_1 (primary MB)	.5747
Sg_1	.0753

TABLE III (Con't)

Other Data (Con't)

Swc	.3500
ø	14.7%
Rec. to Start WF, Bbls./Ac.Ft.	44.14

Results

WF Rec., Bbls./Ac.Ft.	159.66
Total Rec., Bbls./Ac.Ft.	203.80
Total Rec., % OOIP	38.3%
Total Rec., Bbls.	7,616,000 Bbls.

TABLE IV
NORTHWEST CHA CHA UNIT AREA
ECONOMIC FACTORS AND INVESTMENT SCHEDULE
USED IN PROFIT AND LOSS STATEMENT

1.	Net Interest Factor		.075
2.	Value of Oil to W.I. (2.75-0.05 Gathering)		$2.70/Bbl.
3.	Value of Nat. Gas and Liquids (40% of 15.9¢)		$0.0636/MCF
4.	Ad Valorem, Severance and State Sales Tax (7.4% of Oil Value)		$0.20/Bbl.
5.	Combined Taxes of Gas and Liquids (4.7% of Sales Value)		$0.003/MCF
6.	Direct Operating Expenses		
	Flowing Wells		$100/well/mo.
	Pumping Wells		$200/well/mo.
	Water Flood (Producers & Injection Wells)		$300/well/mo.
	Operating & Maintenance (Supply & Injection Water)		$0.025/Bbl.
7.	Investment Schedule (Primary)		
	1960 - 22 Wells @ $60,000/Well & Lease		$1,320,000
	1961 - 13 Wells @ $60,000/Well & Lease	$780,000	
	- Electrical Distribution System 84,500' @ $1.25/ft.	$105,625	
	- 15 PPG Units @ $8,500/Unit	$127,500	$1,013,125
	1962 - 20 PPG Units @ $8,500/Unit		$ 170,000
	1964 - 35 PPG Units Salvaged @ $2,000/Unit		($ 70,000)
			$2,433,125

8.	Investment Schedule (10-1-61 Water Flood)		
	1960 - 22 Wells @ $60,000/Well & Lease		$1,320,000
	1961 - * 16 Wells @ $60,000/Well & Lease	$960,000	
	- 10 PPG Units @ $8,500/Unit	$ 85,000	
	- Electrical Distribution System 84,500' @ $1.25/ft.	$105,625	
	- Water Injection Plant	$ 90,000	
	- Water Dist. System	$100,000	
	- Input Well Conversion	$ 45,000	
	- Water Supply Wells	$ 11,000	$1,396,625
	1962 - 19 PPG Units @ $18,000/Unit		$ 342,000
	1963 - Produced Water Disposal System		$ 31,000
	1970 - Salvage		($ 58,000)
			$3,031,625

* Three additional wells for flooding.

Ad Val-Sev State Income Taxes (Oil) $	Combined Tax Rates (Gas) 4.7% $	Operating & Workover Expenses $	Supply & Ins. Water Oper & Maint. Exp. $	Total Direct Expenses $	Net Operating Income $	Investment $	Net Cash Flow $	6% Disc. Factor (7-1-60)	Disc. Cash Flow $	Cumulative Disc. Cash Flow $
42,700	-	7,400	-	50,100	526,400	1,320,000	(793,600)	.9853	(781,900)	(781,900)
279,800	4,200	42,900	-	326,900	3,539,200	1,013,100	2,526,100	.9424	2,380,600	1,598,700
113,600	9,400	84,000	-	207,000	1,525,500	170,000	1,355,500	.8874	1,202,900	2,801,600
20,400	5,800	58,800	-	94,000	425,700	-	425,700	.8358	355,800	3,157,400
11,200	2,100	25,200	-	38,500	157,800	(70,000)	227,800	.7871	179,300	3,336,700
476,700	21,500	218,300	-	716,500	6,174,600	2,433,100	3,741,500		3,336,700	
42,700	-	7,400	-	50,100	526,400	1,320,000	(793,600)	.9853	(781,900)	(781,900)
278,400	4,200	67,900	22,800	373,300	3,473,990	1,396,600	2,077,300	.9424	1,957,600	1,175,700
183,200	8,500	156,800	89,700	438,200	2,214,600	342,000	1,872,600	.8874	1,661,700	2,837,400
314,300	2,500	156,800	77,500	551,100	3,744,000	31,000	3,713,000	.8358	3,103,300	5,940,700
293,800	1,600	156,800	81,700	479,900	2,789,900	-	2,789,900	.7871	2,195,900	8,136,600
130,600	800	146,000	79,400	356,800	1,423,800	-	1,423,800	.7412	1,055,300	9,191,900
52,700	300	146,000	77,600	276,600	441,800	-	441,800	.6981	308,400	9,500,300
36,200	200	128,000	77,600	242,000	252,000	-	252,000	.6574	165,700	9,666,000
27,300	200	110,000	75,900	213,400	159,000	-	159,000	.6192	98,500	9,764,500
21,700	100	92,000	75,800	189,600	106,400	-	106,400	.5831	62,000	9,826,500
6,000	-	29,000	25,000	60,000	21,300	(58,000)	79,300	.5599	44,400	9,870,900
1,332,900	18,400	1,196,700	683,000	3,231,000	15,153,100	3,031,600	12,121,500		9,870,900	

Net PW @ 6% = $9,870,900 NCF = $12,121,500

+14.5 Mos. Net PW @ 6% = $6,534,200 Incr. NCF = $8,380,000

AREA
ENT

Net Oil Production Bbls	Net Gas Production MCF	W. I. Oil Income $	W. I. Gas Income (.4)(15.9¢) per MCF $	Total W. I. Income $	Ad Val-Sev State Income Taxes (Oil) $	Combined Tax Rates (Gas) 4.7% $	Operating & Workover Expenses $	Supply & Ins. Water Oper & Maint. Exp. $	Total Direct Expenses $	Net Operating Income $	Investment $
213,500	161,900	576,500	-	576,500	42,700	-	7,400	-	50,100	526,400	1,320,000
1,399,100	2,064,100	3,777,600	88,500	3,866,100	279,800	4,200	42,900	-	326,900	3,539,200	1,013,100
567,900	3,132,500	1,533,300	199,200	1,732,500	113,600	9,400	84,000	-	207,000	1,525,500	170,000
147,000	1,930,300	396,900	122,800	519,700	20,400	5,800	58,800	-	94,000	425,700	-
56,000	708,800	151,200	45,100	196,300	11,200	2,100	25,200	-	38,500	157,800	(70,000)
2,383,500	7,997,600	6,435,500	455,600	6,891,100	476,700	21,500	218,300	-	716,500	6,174,600	2,433,100

$2,503,100 ROI = 1.49

WF)

213,500	161,900	576,500	-	576,500	42,700	-	7,400	-	50,100	526,400	1,320,000
1,392,100	2,064,100	3,758,700	88,500	3,847,200	278,400	4,200	67,900	22,800	373,300	3,473,900	1,396,600
916,100	2,819,300	2,473,500	179,300	2,652,800	183,200	8,500	156,800	89,700	438,200	2,214,600	342,000
1,571,500	817,300	4,243,100	52,000	4,295,100	314,300	2,500	156,800	77,500	551,100	3,744,000	31,000
1,198,800	518,900	3,236,800	33,000	3,269,800	293,800	1,600	156,800	81,700	479,900	2,789,900	-
652,800	282,600	1,762,600	18,000	1,780,600	130,600	800	146,000	79,400	356,800	1,423,800	-
263,400	113,800	711,200	7,200	718,400	52,700	300	146,000	77,600	276,600	441,800	-
181,100	78,400	489,000	5,000	494,000	36,200	200	128,000	77,600	242,000	252,000	-
136,500	59,100	368,600	3,800	372,400	27,300	200	110,000	75,900	213,400	159,000	-
108,500	47,000	293,000	3,000	296,000	21,700	100	92,000	75,800	189,600	106,400	-
29,800	12,900	80,500	800	81,300	6,000	-	29,000	25,000	60,000	21,300	(58,000)
6,664,100	6,975,300	17,993,500	390,600	18,384,100	1,332,900	18,400	1,196,700	683,000	3,231,000	15,153,100	3,031,600

$3,089,600 ROI = 3.92 Payout = 14.6 Mos. Net PW @ 6% = $9,870,900 NCF = $12,121,500

$586,500 Incr. ROI = 14.3 Payout (10-1-61) = +14.5 Mos. Net PW @ 6% = $6,534,200 Incr. NCF = $8,380,0

954,000 MCF

TABLE V
NORTHWEST CHA CHA UNIT AREA
PROFIT AND LOSS STATEMENT

Time	Avg. No. of Wells	Gross Oil Production Bbls	Gross Gas Production MCF	Net Oil Production Bbls	Net Gas Production MCF	W. I. Oil Income $	W. I. Gas Income (.4)(15.9¢) per MCF $	Total W. I. Income $	Ad Val-Sev State Income Taxes (Oil) $
PRIMARY OPERATIONS									
7 Mos. 1960	10.5	244,000	185,000	213,500	161,900	576,500	-	576,500	42,700
1961	32.0**	1,599,000	2,359,000*	1,399,100	2,064,100	3,777,600	88,500	3,866,100	279,800
1962	35.0	649,000	3,580,000	567,900	3,132,500	1,533,300	199,200	1,732,500	113,600
1963	24.5	168,000	2,206,000	147,000	1,930,300	396,900	122,800	519,700	20,400
1964	10.5	64,000	810,000	56,000	708,800	151,200	45,100	196,300	11,200
TOTALS		2,724,000	9,140,000	2,383,500	7,997,600	6,435,500	455,600	6,891,100	476,700
		Gross Inv. = $2,503,100			ROI = 1.49				
SECONDARY OPERATIONS (10-1-61 WF)									
1960	10.5	244,000	185,000	213,500	161,900	576,500	-	576,500	42,700
1961	32.0	1,591,000	2,359,000	1,392,100	2,064,100	3,758,700	88,500	3,847,200	278,400
1962	38.0	1,047,000	3,222,000	916,100	2,819,300	2,473,500	179,300	2,652,800	183,200
1963	38.0	1,796,000	934,000	1,571,500	817,300	4,243,100	52,000	4,295,100	314,300
1964	38.0	1,370,000	593,000	1,198,800	518,900	3,236,800	33,000	3,269,800	293,800
1965	35.0	746,000	323,000	652,800	282,600	1,762,600	18,000	1,780,600	130,600
1966	35.0	301,000	130,000	263,400	113,800	711,200	7,200	718,400	52,700
1967	30.0	207,000	89,600	181,100	78,400	489,000	5,000	494,000	36,200
1968	25.0	156,000	67,500	136,500	59,100	368,600	3,800	372,400	27,300
1969	20.5	124,000	53,700	108,500	47,000	293,000	3,000	296,000	21,700
(4 Mos)1970	20.0	34,000	14,700	29,800	12,900	80,500	800	81,300	6,000
TOTALS		7,616,000	7,971,500	6,664,100	6,975,300	17,993,500	390,600	18,384,100	1,332,900
		Total Gross Inv. = $3,089,600			ROI = 3.92		Payout = 14.6 Mos.		
		Incr. Gross Inv. = $586,500			Incr. ROI = 14.3		Payout (10-1-61) = +14.5 Mos.		

* Gas Sales Start 7-1-61.
Cumulative Gas Prod. 7-1-61 = 954,000 MCF

** 15 Wells Pump 3 Months.