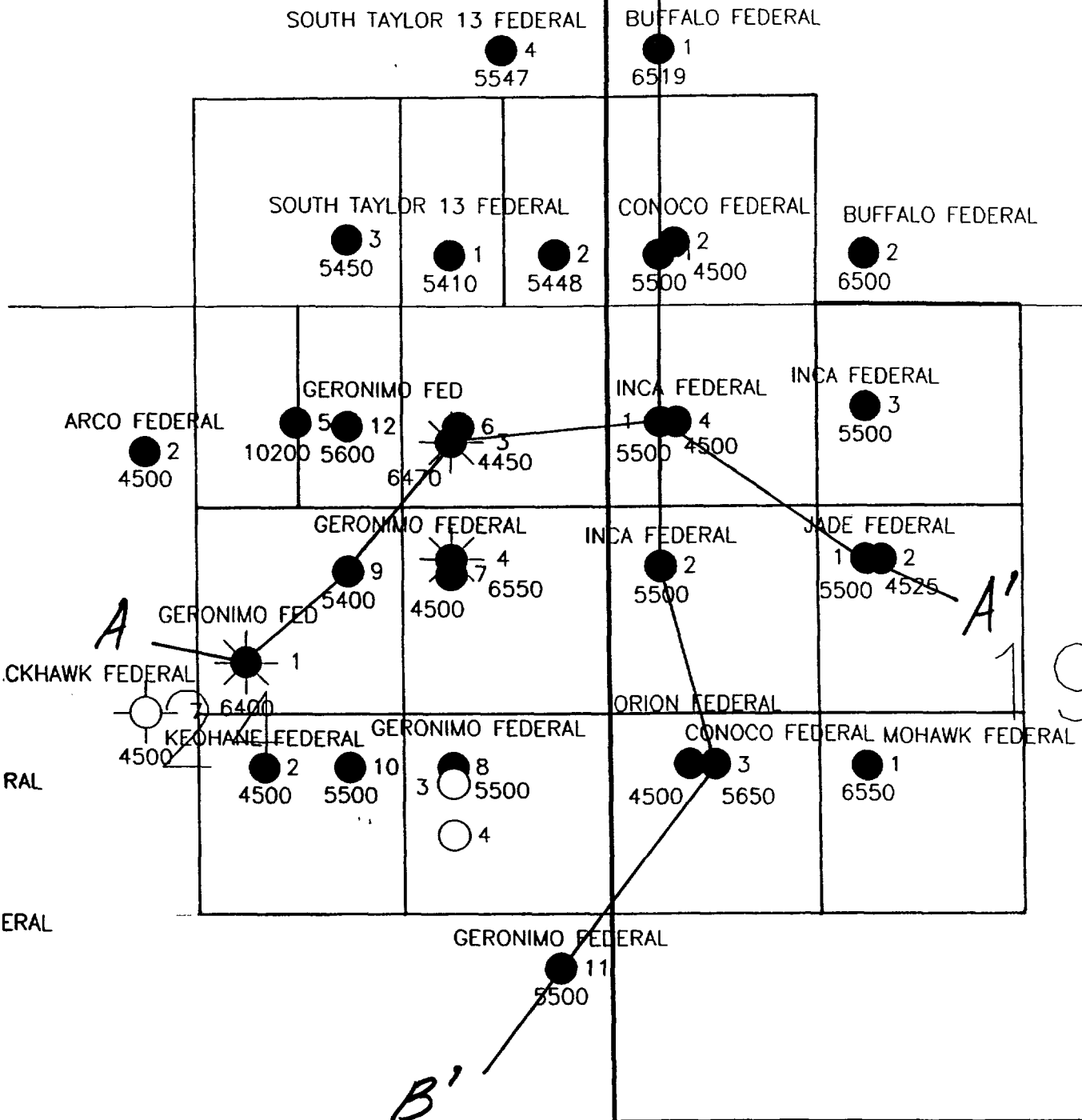


13

B

18



9

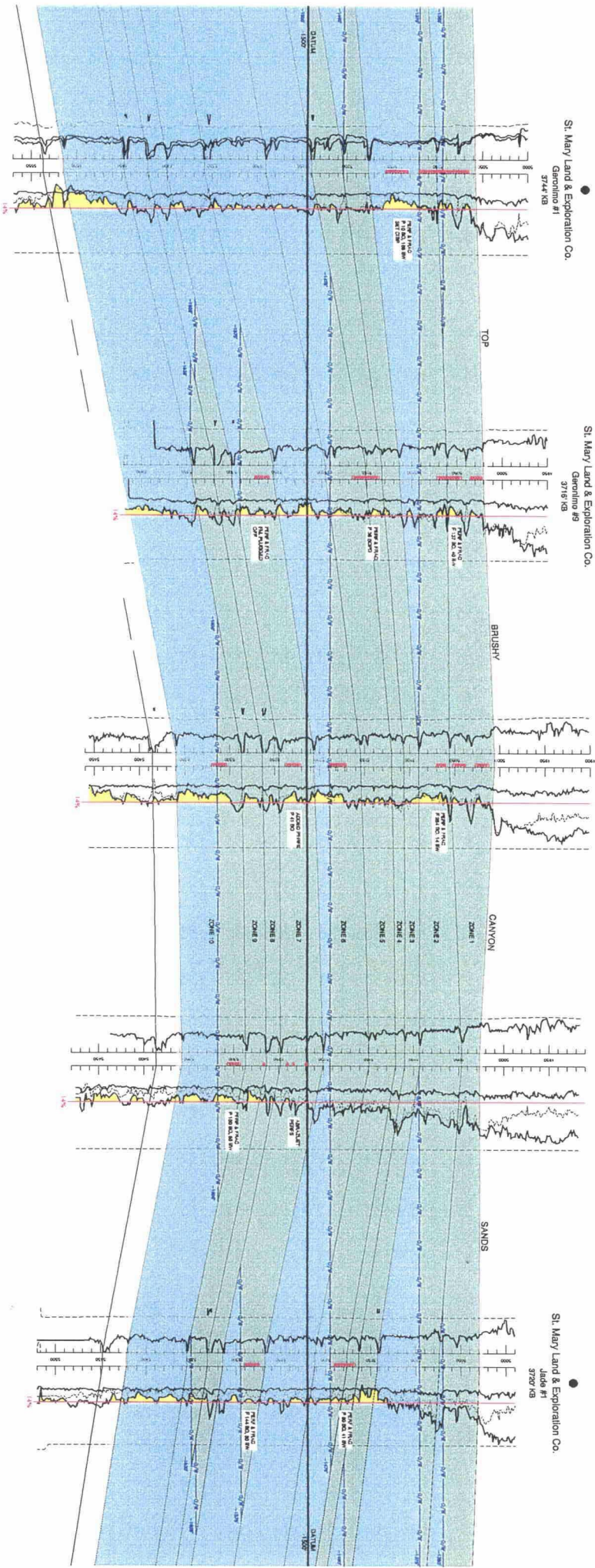
INCA FEDERAL  
○ 1  
5500

RECEIVED  
U.S. GEOLOGICAL SURVEY

EXHIBIT 20

CASE NO. \_\_\_\_\_

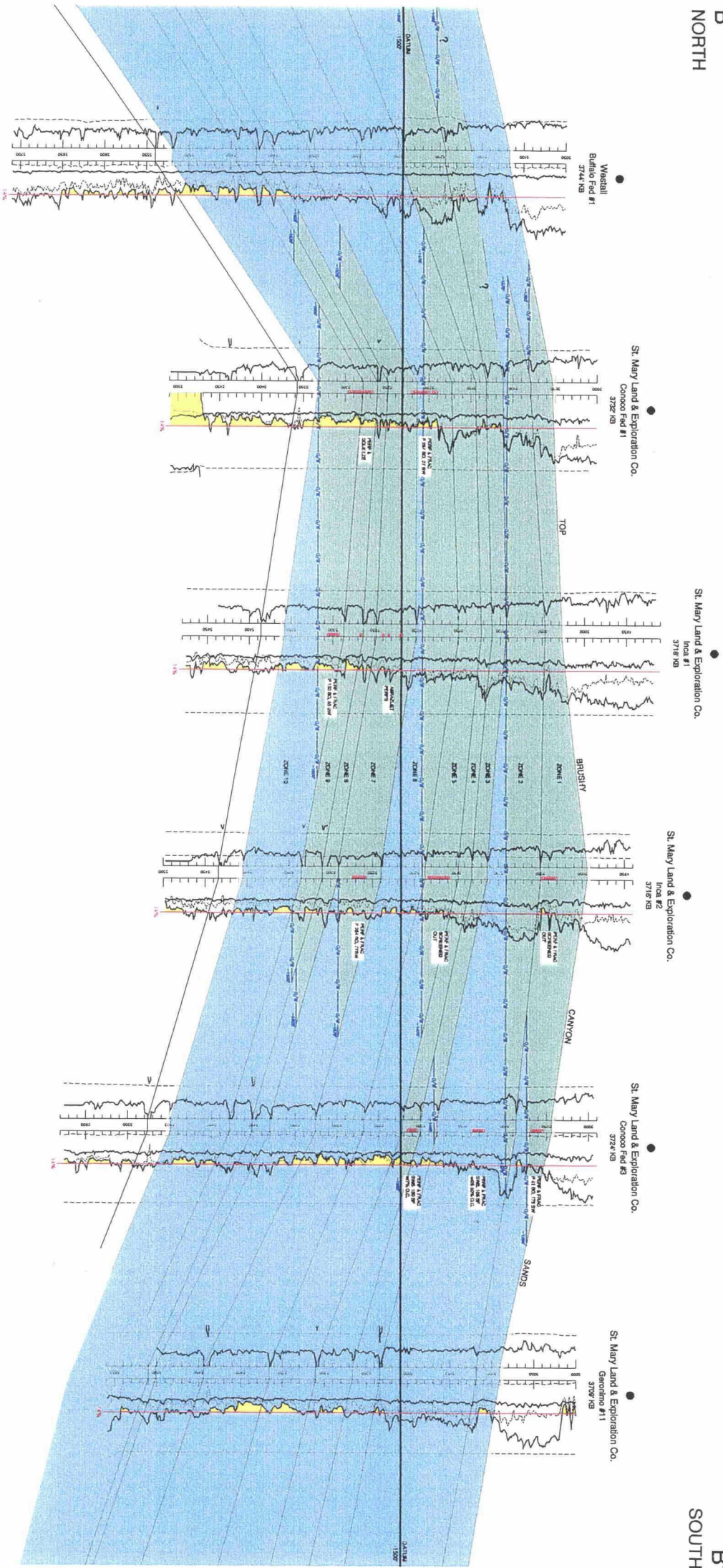
A'  
WEST



A'  
EAST



B  
NORTH



B  
SOUTH

THE STATE OF  
OIL CONSERVATION DIVISION

EXHIBIT

21

CASE NO.

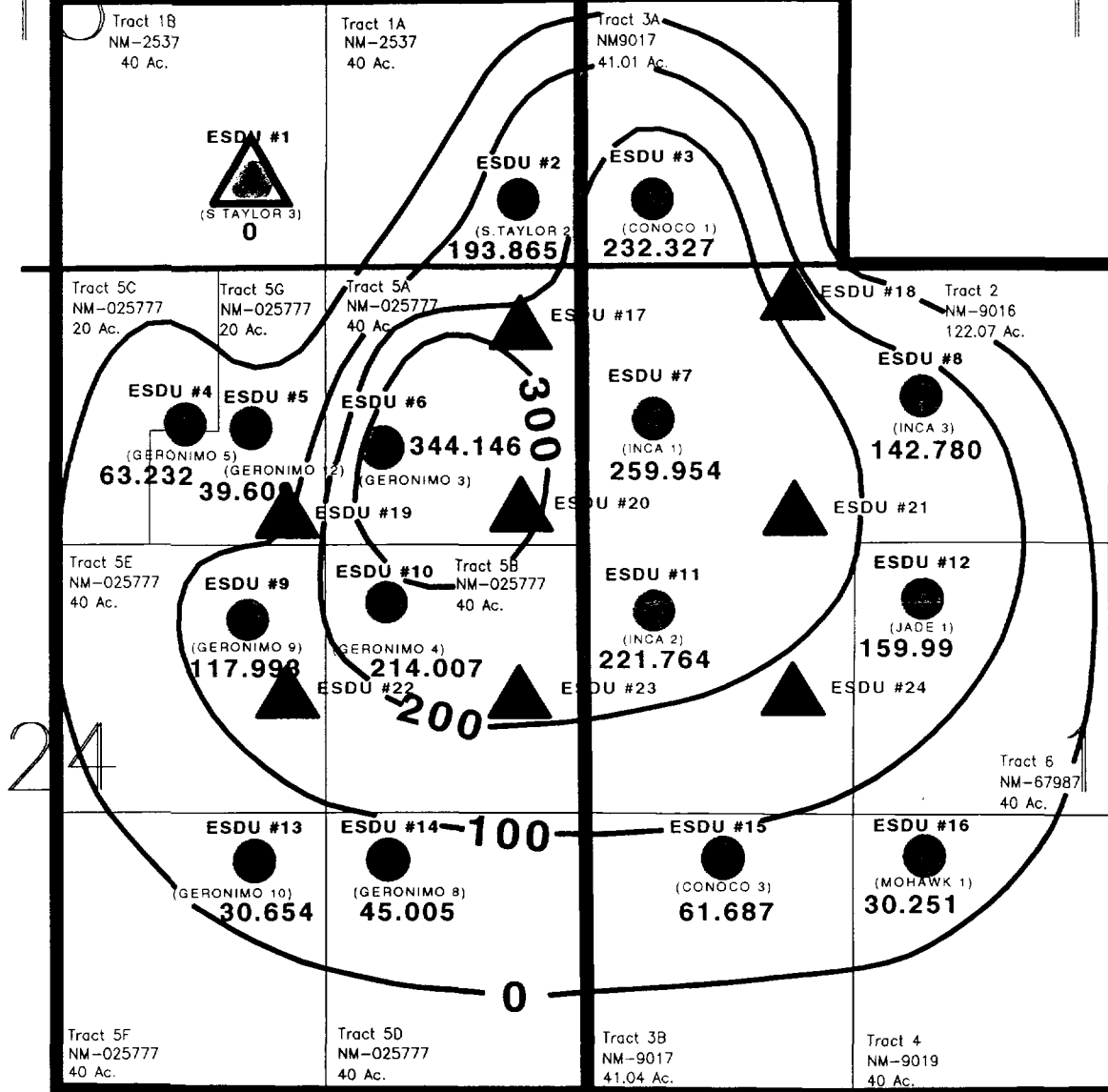
R 31 E

R 32 E

13

18

T  
18  
S



LEGEND

Proposed Well #  
(Former Well Name)



Delaware Producer



Proposed Conversion



Proposed Injection Well

ST. Mary Land & Exploration Co.

EAST SHUGART DELAWARE UNIT

PROPOSED WATERFLOOD  
Cum Prod. (STBO)

C.I. = 100 MBO

Scale 1 : 3000

1000000  
100000  
10000

100000  
10000  
100

WTR-BPD  
GAS-MPD  
OIL-BPD

10000  
1000  
10

1000  
100  
1

EAST SHUGART DELAWARE  
PDP (RL) : PNP, PUD (BP99)

OIL-BPD  
Ref= 02/99  
Cum=2177.227

GAS-MPD  
Ref= 02/99  
Cum=4937.200

WTR-BPD  
Ref= 02/99  
Cum=1859.910

Workover & Waterflood Reserves = 3713 MBO

OIL  
Ref= 09/98  
Cum=2143.346  
Rem= 835.456  
EUR=2978.802  
YCS= 57.329  
Q1= 4908.7  
De= .000  
n= .000  
Qab= 531.5

Cumulative Primary  
Oil @ 2/99 = 2205 MBO

Remaining Primary Oil  
@ 2/99 = 596 MBO

GAS  
Ref= 09/98  
Cum=4840.707  
Rem=3145.641  
EUR=7986.348  
YCS= 57.329  
Q1= .000  
De= .000  
n= .000  
Qab= .0

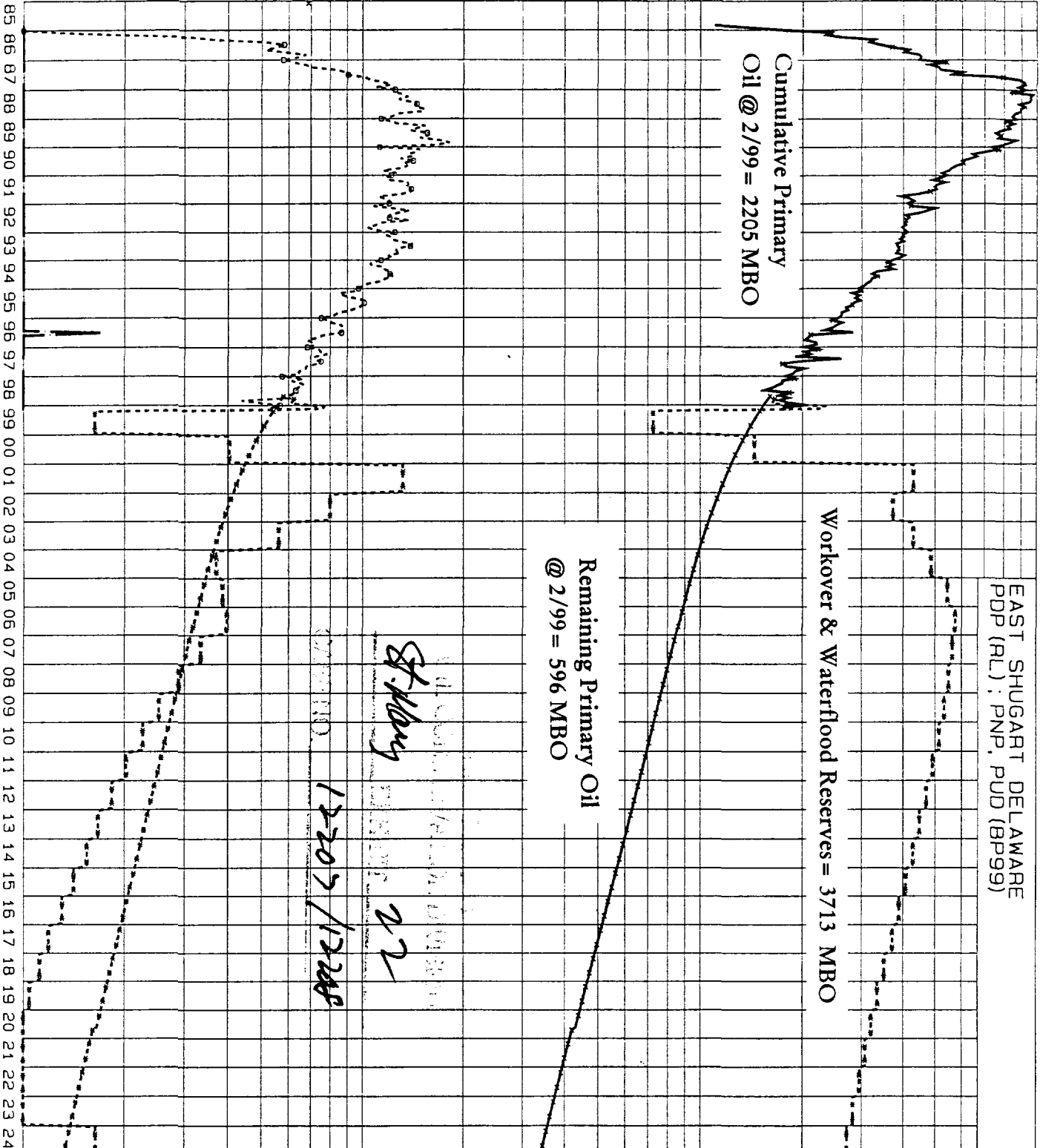
OIL  
Ref= 10/98  
Cum=3878.651  
EUR=3878.651  
YCS= 26.418  
Q1= 7275.7  
De= .000  
n= .000  
Qab= 12603.4

St Mary 22

12207/12248

GAS  
Ref= 10/98  
Cum=2774.992  
EUR=2774.992  
YCS= 26.418  
Q1= 4974.5  
De= .000  
n= .000  
Qab= 2145.0

DATE



SHUGRES2

## EAST SHUGART DELAWARE UNIT RESERVES TABLE

|                                                        | <u>RESERVES</u>                   | <u>% OF OOIP</u> |
|--------------------------------------------------------|-----------------------------------|------------------|
| CUMULATIVE PRODUCTION @ 2/99                           | 2205 MBO<br>4934 MMCF<br>2112 MBW | 7.0              |
| REMAINING PRIMARY RESERVES (PDP)                       | 596 MBO<br>2195 MMCF              | 1.9              |
| INCREMENTAL W/O RESERVES (PDNP)                        | 822 MBO<br>3695 MMCF              | 2.6              |
| TOTAL PRIMARY RESERVES                                 | 3623 MBO<br>10824 MMCF            | 11.5             |
| INCREMENTAL WATERFLOOD RESERVES (PUD)                  | 2891 MBO<br>-2495 MMCF            | 9.1              |
| TOTAL REMAINING RESERVES<br>PRIMARY + W/O + WATERFLOOD | 4309 MBO<br>3395 MMCF             | 13.6             |
| ULTIMATE RECOVERY                                      | 6514 MBO<br>8329 MMCF             | 20.6             |

OOIP = 31645 MBO

S/P RATIO =  $2891/3623 = .80$ 

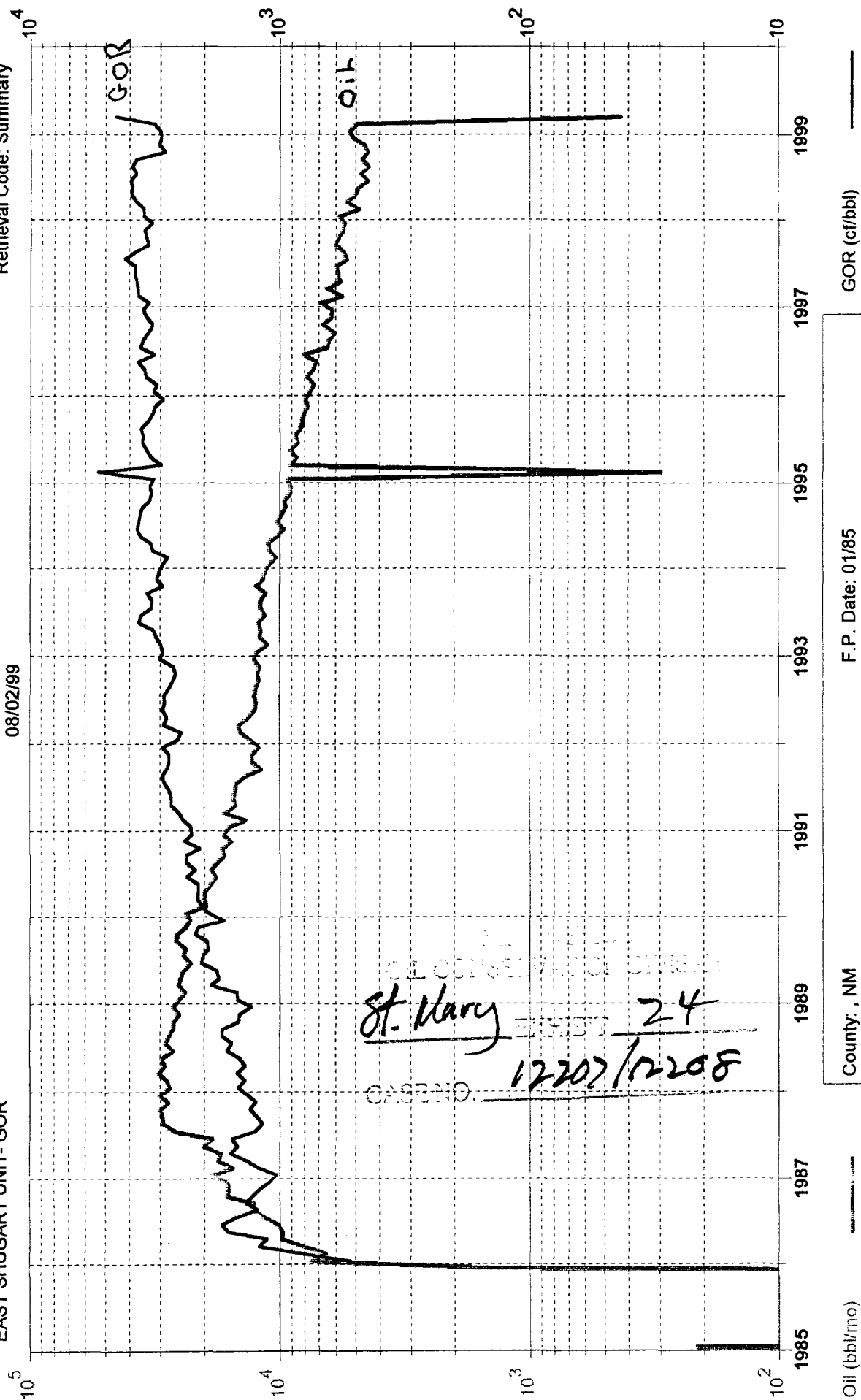
  
*St. Mary* 23  
 \_\_\_\_\_  
 CASE NO. 12207/12208

# Dwights

EAST SHUGART UNIT- GOR

08/02/99

Retrieval Code: Summary



St. Mary 24  
12207/12208

Oil (bbl/mo)

GOR (cf/bbl)

County: NM

F.P. Date: 01/85

Field: SHUGART EAST (DELAWARE) DL

Oil Cum: 2180 mbbl

Reservoir: DELAWARE

Gas Cum: 4937 mmcf

Operator:

Location: 19L 18S 32E

SHUGAROPWELL

**EAST SHUGART DELAWARE UNIT**  
**PROPOSED WELL NAMES**

| OPERATOR | CURRENT<br>WELL NAME | PROPOSED<br>WELL NAME | API #       | S-T-R        | LOCATION               | CURRENT<br>STATUS | PROPOSED<br>STATUS |
|----------|----------------------|-----------------------|-------------|--------------|------------------------|-------------------|--------------------|
| ST. MARY | GERONIMO #3          | ESDU #6               | 30-15-25385 | 24-T18S-R31E | 890' FNL<br>990' FEL   | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | GERONIMO #4          | ESDU #10              | 30-15-25457 | 24-T18S-R31E | 1650' FNL<br>990' FEL  | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | GERONIMO #5          | ESDU #4               | 30-15-25546 | 24-T18S-R31E | 765' FNL<br>1980' FEL  | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | GERONIMO #8          | ESDU #14              | 30-15-25652 | 24-T18S-R31E | 2310' FSL<br>990' FEL  | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | GERONIMO #9          | ESDU #9               | 30-15-25723 | 24-T18S-R31E | 1730' FNL<br>1650' FEL | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | GERONIMO #10         | ESDU #13              | 30-15-25735 | 24-T18S-R31E | 2310' FSL<br>1650' FEL | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | GERONIMO #12         | ESDU #5               | 30-15-26022 | 24-T18S-R31E | 990' FNL<br>1650' FEL  | PROD.<br>OIL      | PROD.<br>OIL       |
| HEYCO    | SO. TAYLOR 13 #2     | ESDU #2               | 30-15-25847 | 13-T18S-R31E | 330' FSL<br>330' FEL   | PROD.<br>OIL      | PROD.<br>OIL       |
| HEYCO    | SO. TAYLOR 13 #3     | ESDU #1               | 30-15-25741 | 13-T18S-R31E | 430' FSL<br>1650' FEL  | PROD.<br>OIL      | INJECTOR           |
| ST. MARY | CONOCO #1            | ESDU #3               | 30-25-29694 | 18-T18S-R32E | 330' FSL<br>330' FWL   | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | JADE #1              | ESDU #12              | 30-25-29939 | 19-T18S-R32E | 1650' FNL<br>1650' FWL | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | INCA #1              | ESDU #7               | 30-25-29887 | 19-T18S-R32E | 760' FNL<br>440' FWL   | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | INCA #2              | ESDU #11              | 30-25-29940 | 19-T18S-R32E | 1700' FNL<br>330' FWL  | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | INCA #3              | ESDU #8               | 30-25-29978 | 19-T18S-R32E | 660' FNL<br>1650' FWL  | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | CONOCO #3            | ESDU #15              | 30-25-30187 | 19-T18S-R32E | 2310' FSL<br>660' FWL  | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | MOHAWK #1            | ESDU #16              | 30-25-30111 | 19-T18S-R32E | 2310' FSL<br>1650' FWL | PROD.<br>OIL      | PROD.<br>OIL       |
| ST. MARY | ESDU #17             | ESDU #17              | NA          | 24-T18S-R31E | 248' FNL<br>302' FEL   | NOT<br>DRILLED    | INJECTOR           |
| ST. MARY | ESDU #18             | ESDU #18              | NA          | 19-T18S-R32E | 190' FNL<br>1045' FWL  | NOT<br>DRILLED    | INJECTOR           |
| ST. MARY | ESDU #19             | ESDU #19              | NA          | 24-T18S-R31E | 1288' FNL<br>1361' FEL | NOT<br>DRILLED    | INJECTOR           |
| ST. MARY | ESDU #20             | ESDU #20              | NA          | 24-T18S-R31E | 1250' FNL<br>303' FEL  | NOT<br>DRILLED    | INJECTOR           |
| ST. MARY | ESDU #21             | ESDU #21              | NA          | 19-T18S-R32E | 1193' FNL<br>1018' FWL | NOT<br>DRILLED    | INJECTOR           |
| ST. MARY | ESDU #22             | ESDU #22              | NA          | 24-T18S-R31E | 2330' FNL<br>1320' FEL | NOT<br>DRILLED    | INJECTOR           |
| ST. MARY | ESDU #23             | ESDU #23              | NA          | 24-T18S-R31E | 2322' FNL<br>248' FEL  | NOT<br>DRILLED    | INJECTOR           |
| ST. MARY | ESDU #24             | ESDU #24              | NA          | 19-T18S-R32E | 2322' FNL<br>1073' FWL | NOT<br>DRILLED    | INJECTOR           |

*Estimated location*

*ST. Mary EX-101 25*  
*NO. 12207/2208*





100  
ON DIVISION

*St. Mary*  
EXHIBIT **26**

CASE NO. **12207/12208**

shugcap

# EAST SHUGART DELAWARE UNIT CAPITAL

|                                         | <u>M\$</u>    |
|-----------------------------------------|---------------|
| Drill 8 wells @ 400 M\$ ea.             | 3200.0        |
| Facilities                              | 420.0         |
| Conversion                              | 40.0          |
| Add pay & frac 16 wells @ 124.3 M\$ ea. | <u>1988.8</u> |
| <b>TOTAL</b>                            | <b>5648.8</b> |

NEW MEXICO  
OIL CONSERVATION DIVISION  
St. Mary EXHIBIT 27  
CASE NO. 12207/12208

# EAST SHUGART DELAWARE

## WATERFLOOD UNIT

OCD FORM C-108

OPERATOR

ST. MARY LAND AND EXPLORATION

BEFORE EXAMINER CATANACH

OIL CONSERVATION DIVISION

EXHIBIT NO. 29

CASE NO. 12207/12208

January 1999

Prepared by  
**LEE ENGINEERING**  
Midland, Texas

**APPLICATION FOR AUTHORIZATION TO INJECT**

- I. PURPOSE: ☒ Secondary Recovery ☐ Pressure Maintenance ☐ Disposal ☐ Storage  
Application qualifies for administrative approval? ☐ Yes ☒ No
- II. OPERATOR: St. Mary Land & Exploration Company  
ADDRESS: 1776 Lincoln St., Ste. 1100, Denver Co. 80203  
CONTACT PARTY: Mr. Bob Bachman PHONE: (303)-863-4327  
Mr. Robert Lee (915)-682-1251
- III. WELL DATA: Complete the data required on the reverse side of this form for each well processed for injection.  
Additional sheets may be attached, if necessary.
- IV. Is this an expansion of an existing project: ☐ Yes ☒ No  
If yes, give the Division order number authorizing the project \_\_\_\_\_
- V. Attach a map that identifies all wells and leases within two miles of any proposed injection well within a one-half mile radius circle drawn around each proposed injection well. This circle identifies the well's area of review.
- VI. Attach a tabulation of data on all wells of public record within the area of review which penetrate the proposed injection zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of completion, and a schematic of any plugged well illustrating all plugging detail.
- VII. Attach data on the proposed operation, including:
1. Proposed average and maximum daily rate and volume of fluids to be injected;
  2. Whether the system is open or closed;
  3. Proposed average and maximum injection pressure;
  4. Sources and an appropriate analysis of injection fluid and compatibility with the receiving formation if other than reinjected produced water; and
  5. If injection is for disposal purposes into a zone not productive of oil or gas at or within one mile of the proposed well, attach a chemical analysis of the disposal zone formation water (may be measured or inferred from existing literature, studies, nearby wells, etc.).
- \*VIII. Attach appropriate geological data on the injection zone including appropriate lithologic detail, geological name, thickness and depth. Give the geologic name, and depth to bottom of all underground sources of drinking water (aquifers containing waters with total dissolved solids concentrations of 10,000 mg/l or less) overlying the proposed injection zone as well as any such sources known to be immediately underlying the injection interval.
- IX. Describe the proposed stimulation program, if any.
- \*X. Attach appropriate logging and test data on the well. (If well logs have been filed with the Division, they need not be resubmitted.)
- \*XI. Attach a chemical analysis of fresh water from two or more fresh water wells (if available and producing) within one mile of any injection or disposal well showing location of wells and dates samples were taken.
- XII. Applicants for disposal wells must make an affirmative statement that they have examined available geologic and engineering data and find no evidence of open faults or any other hydrologic connection between the disposal zone and any underground source drinking water.
- XIII. Applicants must complete the "Proof of Notice" section on the reverse side of this form.
- XIV. Certifications: I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.
- NAME: Robert Lee TITLE: Consulting Engineer  
SIGNATURE: Robert Lee DATE: January 25, 1999

\* If the information required under Section VI, VIII, X, and XI above has been previously submitted, it need not be resubmitted. Please show the date and circumstances of the earlier submittal. \_\_\_\_\_

### III. WELL DATA

A. The following well data must be submitted for each injection well covered by this application. The data must be both in tabular and schematic form and shall include:

- (1) Lease name; Well No.; Location by Section, Township, and Range; and footage location within the section.
- (2) Each casing string used with its size, setting depth, sacks of cement used, hole size, top of cement, and how such top was determined.
- (3) A description of the tubing to be used including its size, lining material, and setting depth.
- (4) The name, model, and setting depth of the packer used or a description of any other seal system or assembly used.

Division District Offices have supplies of Well Data Sheets which may be used or which may be used as models for this purpose. Applicants for several identical wells may submit a "typical data sheet" rather than submitting the data for each well.

B. The following must be submitted for each injection well covered by this application. All items must be addressed for the initial well. Responses for additional wells need be shown only when different. Information shown on schematics need not be repeated.

- (1) The name of the injection formation and, if applicable, the field or pool name.
- (2) The injection interval and whether it is perforated or open-hole.
- (3) State if the well was drilled for injection or, if not, the original purpose of the well.
- (4) Give the depths of any other perforated intervals and detail on the sacks of cement or bridge plugs used to seal off such perforations.
- (5) Give the depth to and name of the next higher and next lower oil or gas zone in the area of the well, if any.

### XIV. PROOF OF NOTICE

All applicants must furnish proof that a copy of the application has been furnished, by certified or registered mail, to the owner of the surface of the land on which the well is to be located and to each leasehold operator within one-half mile of the well location.

Where an application is subject to administrative approval, a proof of publication must be submitted. Such proof shall consist of a copy of the legal advertisement which was published in the county in which the well is located. The contents of such advertisement must include:

- (1) The name, address, phone number, and contact party for the applicant;
- (2) The intended purpose of the injection well; with the exact location of single wells or the section, township, and range location of multiple wells;
- (3) The formation name and depth with expected maximum injection rates and pressures; and
- (4) A notation that interested parties must file objection or requests for hearing with the Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico 87504-2088 within 15 days.

NO ACTION WILL BE TAKEN ON THE APPLICATION UNTIL PROPER PROOF OF NOTICE HAS BEEN SUBMITTED.

---

NOTICE: Surface owners or offset operators must file any objections or requests for hearing of administrative applications within 15 days from the date this application was mailed to them.





SOUTH TAYLOR 13 #3  
CONVERT TO INJECTION  
NMOCD Form C-108 Section III

III. Data on injection well(s)

A. Injection well information (see attached schematic)

Tabular data

1. Lease: South Taylor 13  
  
Well No: 3 (To be renamed ESDU #1)  
  
Location: 430' FSL & 1650' FEL, Sec 13 T-18-S  
R-31-E, Eddy County, NM
2. Casing: 8 5/8", 24 #/ft, surface @ 366' in 12 1/4" hole ,  
cemented w/230 sx. TOC @ surf.  
  
5 1/2", 15.5 #/ft, production casing @ 5450' in  
7 7/8" hole, cemented w/ 1950 sx. TOC @ surf.
3. Injection tubing: + or - 156 jts 2 3/8", 4.7 lb/ft,  
J-55 Duoline PVC lined tubing.:
4. Packer: An internally plastic coated Baker-Loc Set  
injection packer set @ +/- 5000'.

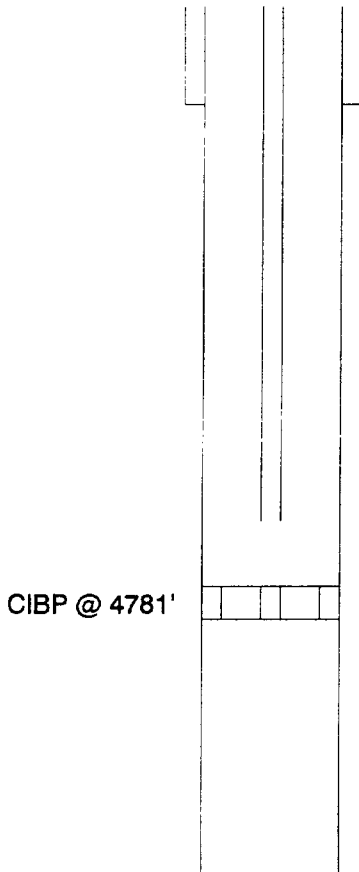
B. Other well information

1. Injection formation: Delaware  
  
Field: East Shugart
2. Existing perforations: 4848-70 & 4330-4428 ( These will be  
squeezed off with cement.)  
  
Proposed perfs: 5090-5420 w/ 2 JSPF
3. This well was drilled as a Delaware oil well.
4. There are no other perfed or tested intervals in  
this well.
5. Within the area of this well the Grayburg is productive at a  
depth of 4300'. The Bone Spring is productive at a depth of  
7800'.

# ST. MARY LAND & EXPLORATION CURRENT

WELL: SOUTH TAYLOR 13 #3  
FIELD: EAST SHUGART  
INTERVAL: DELAWARE

LOCATION:  
430' FSL & 1650' FEL  
SECTION 13  
TWP-18-S, RNG-31-E  
EDDY COUNTY, NM



SURFACE CASING:  
RAN 24# 8 5/8" J-55 CSG, SET @ 366' CMT W/230 SXS  
TOC @ SURFACE.

PRESENT COMPLETION INTERVAL:

DELAWARE- 4848-70'  
GRAYBURG- 4330-4428'

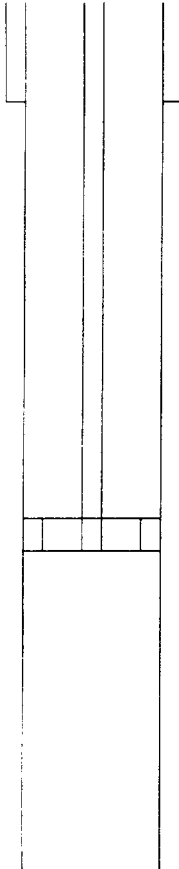
PRODUCTION CASING:  
RAN 15.5# 5 1/2" J-55 CSG, SET @ 5450'.  
CMT W/1950 SXS, TOC @ SURFACE.

TD: 5450'  
PBTD: 4781'

# ST. MARY LAND & EXPLORATION PROPOSED

WELL: ESDU #1 (FORMERLY SOUTH TAYLOR 13 #3)  
FIELD: EAST SHUGART  
INTERVAL: DELAWARE

LOCATION:  
430' FSL & 1650' FEL  
SECTION 13  
TWP-18-S, RNG-31-E  
EDDY COUNTY, NM



## SURFACE CASING:

RAN 24# 8 5/8" J-55 CSG, SET @ 366' CMT W/230 SXS  
TOC @ SURFACE.

## PROPOSED COMPLETION INTERVAL:

SQUEEZE OFF GRAYBURG AND CHERRY CANYON  
PERFS WITH CEMENT.

PERFORATE THE BRUSHY CANYON AT  
5090-5420'

2 3/8" PLASTIC COATED TUBING SET @ 5000' WITH A  
PLASTIC COATED BAKER LOC-SET PACKER

## PRODUCTION CASING:

RAN 15.5# J-55 CSG, SET @ 5450'.  
CMT W/1950 SXS, TOC @ SURFACE.

TD: 5450'  
PBTD: 4781'

ESDU #17  
DRILL AS INJECTOR  
NMOCD Form C-108 Section III

III. Data on injection well(s)

A. Injection well information (see attached schematic)

Tabular data

1. Lease: East Shugart Delaware Unit (ESDU)  
  
Well No: 17  
  
Location: 248' FNL & 302' FEL, Sec 24 T-18-S  
R-31-E, Eddy County, NM
2. Casing: 8 5/8", 24 #/ft, surface @ 350' in 12 1/4" hole.  
TOC @ surf.  
  
5 1/2", 15.5 #/ft, production casing @ 5500' in  
7 7/8" hole, TOC @ surf.
3. Injection tubing: + or - 156 jts 2 3/8", 4.7 lb/ft,  
J-55 Duoline PVC lined tubing.
4. Packer: An internally plastic coated Baker Loc-set  
injection packer set @ +/- 5000'.

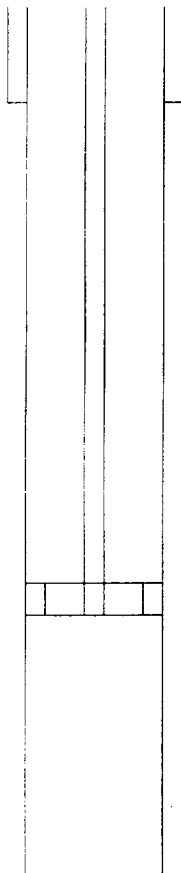
B. Other well information

1. Injection formation: Delaware  
  
Field: East Shugart
2. Proposed perfs: 5030'-5310' w/ 2 JSPF
3. This well will be drilled as a Delaware injection well.
4. No other intervals will be perfed or tested in this well.
5. Within the area of this well the Grayburg is productive at a  
depth of 4300'. The Bone Spring is productive at a depth of  
7800'.

**ST. MARY LAND & EXPLORATION  
PROPOSED  
(TO BE DRILLED)**

WELL: ESDU #17  
FIELD: EAST SHUGART  
INTERVAL: DELAWARE

LOCATION:  
248' FNL & 302' FEL  
SECTION 24  
TWP-18-S, RNG-31-E  
EDDY COUNTY, NM



SURFACE CASING:  
24#, J-55, 8 5/8" CSG, SET @ 350'  
TOC @ SURFACE.

PROPOSED COMPLETION INTERVAL:

DELAWARE - 5030' - 5310'

2 3/8" DUOLINE PVC LINED TUBING SET @ 5000' WITH A  
PLASTIC COATED BAKER LOC-SET PACKER

PRODUCTION CASING:  
15.5#, J-55, 5 1/2" CSG, SET @ 5500'.  
TOC @ SURFACE.

TD= 5500'

ESDU #18  
DRILL AS INJECTOR  
NMOCD Form C-108 Section III

III. Data on injection well(s)

A. Injection well information (see attached schematic)

Tabular data

1. Lease: East Shugart Delaware Unit (ESDU)  
  
Well No: 18  
  
Location: 190' FNL & 1045' FWL, Sec 19 T-18-S  
R-32-E, Lea County, NM
2. Casing: 8 5/8", 24 #/ft, surface @ 350' in 12 1/4" hole  
TOC @ surf.  
  
5 1/2", 15.5 #/ft, production casing @ 5500' in  
7 7/8" hole, TOC @ surf.
3. Injection tubing: + or - 156 jts 2 3/8", 4.7 lb/ft,  
J-55 Duoline PVC lined tubing.:
4. Packer: An internally plastic coated Baker Loc-set  
injection packer set @ +/- 5000'.

B. Other well information

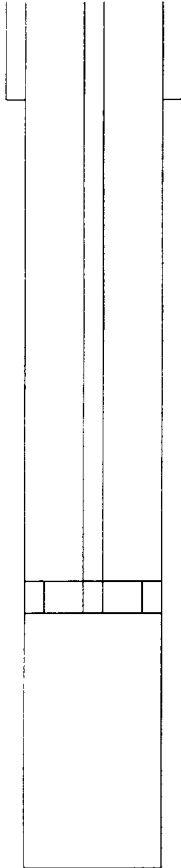
1. Injection formation: Delaware  
  
Field: East Shugart
2. Proposed perfs: 5065'- 5320' w/ 2 JSPF
3. This well will be drilled as a Delaware injection well.
4. No other intervals will be perfed or tested in this well.
5. Within the area of this well the Grayburg is productive at a  
depth of 4300'. The Bone Spring is productive at a depth of  
7800'.



**ST. MARY LAND & EXPLORATION  
PROPOSED  
(TO BE DRILLED)**

WELL: ESDU #18  
FIELD: EAST SHUGART  
INTERVAL: DELAWARE

LOCATION:  
190' FNL & 1045' FWL  
SECTION 19  
TWP-18-S, RNG-32-E  
LEA COUNTY, NM



SURFACE CASING:  
24#, J-55, 8 5/8" CSG, SET @ 350'  
TOC @ SURFACE.

PROPOSED COMPLETION INTERVAL:

DELAWARE - 5065' - 5320'

2 3/8" DUOLINE PVC LINED TUBING SET @ 5000' WITH A  
PLASTIC COATED BAKER LOC-SET PACKER

PRODUCTION CASING:  
15.5#, J-55, 5 1/2" CSG, SET @ 5500'.  
TOC @ SURFACE.

TD= 5500'

ESDU #19  
DRILL AS INJECTOR  
NMOCD Form C-108 Section III

III. Data on injection well(s)

A. Injection well information (see attached schematic)

Tabular data

1. Lease: East Shugart Delaware Unit (ESDU)  
  
Well No: 19  
  
Location: 1288' FNL & 1361' FEL, Sec 24 T-18-S  
R-31-E, Eddy County, NM
2. Casing: 8 5/8", 24 #/ft, surface @ 350' in 12 1/4" hole  
TOC @ surf.  
  
5 1/2", 15.5 #/ft, production casing @ 5550' in  
7 7/8" hole, TOC @ surf.
3. Injection tubing: + or - 156 jts 2 3/8", 4.7 lb/ft,  
J-55 Duoline PVC lined tubing.:
4. Packer: An internally plastic coated Baker Loc-set  
injection packer set @ +/- 5000'.

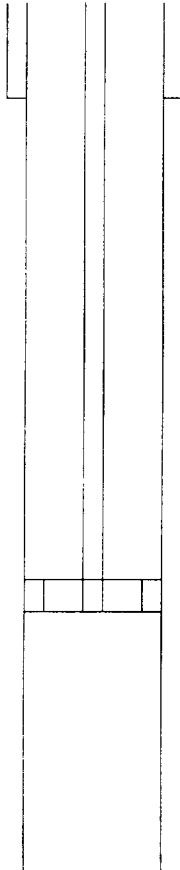
B. Other well information

1. Injection formation: Delaware  
  
Field: East Shugart
2. Proposed perfs: 5020' - 5310' w/ 2 JSPF
3. This well will be drilled as a Delaware injection well.
4. No other intervals will be perfed or tested in this well.
5. Within the area of this well the Grayburg is productive at a  
depth of 4300'. The Bone Spring is productive at a depth of  
7800'.

**ST. MARY LAND & EXPLORATION  
PROPOSED  
(TO BE DRILLED)**

WELL: ESDU #19  
FIELD: EAST SHUGART  
INTERVAL: DELAWARE

LOCATION:  
1288' FNL & 1361' FEL  
SECTION 24  
TWP-18-S, RNG-31-E  
EDDY COUNTY, NM



SURFACE CASING:  
24#, J-55, 8 5/8" CSG, SET @ 350'  
TOC @ SURFACE.

PROPOSED COMPLETION INTERVAL:

DELAWARE - 5020' - 5310'

2 3/8" DUOLINE PVC LINED TUBING SET @ 5000' WITH A  
PLASTIC COATED BAKER LOC-SET PACKER

PRODUCTION CASING:  
15.5#, J-55, 5 1/2" CSG, SET @ 5500'.  
TOC @ SURFACE.

TD= 5500'

ESDU #20  
DRILL AS INJECTOR  
NMOCD Form C-108 Section III

III. Data on injection well(s)

A. Injection well information (see attached schematic)

Tabular data

1. Lease: East Shugart Delaware Unit (ESDU)  
  
Well No: 20  
  
Location: 1250' FNL & 303' FEL, Sec 24 T-18-S  
R-31-E, Eddy County, NM
2. Casing: 8 5/8", 24 #/ft, surface @ 350' in 12 1/4" hole  
TOC @ surf.  
  
5 1/2", 15.5 #/ft, production casing @ 5550' in  
7 7/8" hole, TOC @ surf.
3. Injection tubing: + or - 156 jts 2 3/8", 4.7 lb/ft,  
J-55 Duoline PVC lined tubing.:
4. Packer: An internally plastic coated Model R Lockset  
injection packer set @ +/- 5000'.

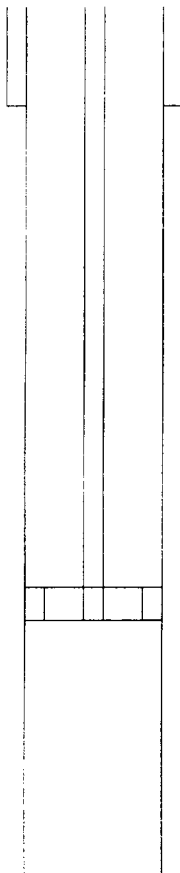
B. Other well information

1. Injection formation: Delaware  
  
Field: East Shugart
2. Proposed perfs: 5020' - 5310' w/ 2 JSPF
3. This well will be drilled as a Delaware injection well.
4. No other intervals will be perfed or tested in this well.
5. Within the area of this well the Grayburg is productive at a  
depth of 4300'. The Bone Spring is productive at a depth of  
7800'.

**ST. MARY LAND & EXPLORATION  
PROPOSED  
(TO BE DRILLED)**

WELL: ESDU #20  
FIELD: EAST SHUGART  
INTERVAL: DELAWARE

LOCATION:  
1250' FNL & 303' FEL  
SECTION 24  
TWP-18-S, RNG-31-E  
EDDY COUNTY, NM



SURFACE CASING:  
24#, J-55, 8 5/8" CSG, SET @ 350'  
TOC @ SURFACE.

PROPOSED COMPLETION INTERVAL:

DELAWARE - 5020' - 5310'

2 3/8" DUOLINE PVC LINED TUBING SET @ 5000' WITH A  
PLASTIC COATED BAKER LOC-SET PACKER

PRODUCTION CASING:  
15.5#, J-55, 5 1/2" CSG, SET @ 5500'.  
TOC @ SURFACE.

TD= 5500'

ESDU #21  
DRILL AS INJECTOR  
NMOC Form C-108 Section III

III. Data on injection well(s)

A. Injection well information (see attached schematic)

Tabular data

1. Lease: East Shugart Delaware Unit (ESDU)  
  
Well No: 21  
  
Location: 1193' FNL & 1018' FWL, Sec 19 T-18-S  
R-32-E, Lea County, NM
2. Casing: 8 5/8", 24 #/ft, surface @ 350' in 12 1/4" hole  
TOC @ surf.  
  
5 1/2", 15.5 #/ft, production casing @ 5550' in  
7 7/8" hole, TOC @ surf.
3. Injection tubing: + or - 156 jts 2 3/8", 4.7 lb/ft,  
J-55 Duoline PVC lined tubing.
4. Packer: An internally plastic coated Baker Loc-set  
injection packer set @ +/- 5000'.

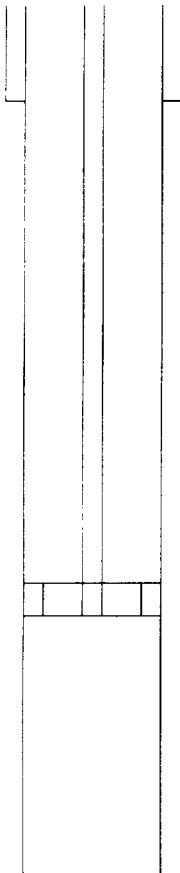
B. Other well information

1. Injection formation: Delaware  
  
Field: East Shugart
2. Proposed perfs: 5015' - 5330' w/ 2 JSPF
3. This well will be drilled as a Delaware injection well.
4. No other intervals will be perfed or tested in this well.
5. Within the area of this well the Grayburg is productive at a  
depth of 4300'. The Bone Spring is productive at a depth of  
7800'.

**ST. MARY LAND & EXPLORATION  
PROPOSED  
(TO BE DRILLED)**

WELL: ESDU #21  
FIELD: EAST SHUGART  
INTERVAL: DELAWARE

LOCATION:  
1193' FNL & 1018' FWL  
SECTION 19  
TWP-18-S, RNG-32-E  
LEA COUNTY, NM



SURFACE CASING:  
24#, J-55, 8 5/8" CSG, SET @ 350'  
TOC @ SURFACE.

PROPOSED COMPLETION INTERVAL:

DELAWARE - 5015' - 5330'

2 3/8" DUOLINE PVC LINED TUBING SET @ 5000' WITH A  
PLASTIC COATED BAKER LOC-SET PACKER

PRODUCTION CASING:  
15.5#, J-55, 5 1/2" CSG, SET @ 5500'.  
TOC @ SURFACE.

TD= 5500'

ESDU #22  
DRILL AS INJECTOR  
NMOCD Form C-108 Section III

III. Data on injection well(s)

A. Injection well information (see attached schematic)

Tabular data

1. Lease: East Shugart Delaware Unit (ESDU)  
  
Well No: 22  
  
Location: 2330' FNL & 1320' FEL, Sec 24 T-18-S  
R-31-E, Eddy County, NM
2. Casing: 8 5/8", 24 #/ft, surface @ 350' in 12 1/4" hole  
TOC @ surf.  
  
5 1/2", 15.5 #/ft, production casing @ 5550' in  
7 7/8" hole, TOC @ surf.
3. Injection tubing: + or - 156 jts 2 3/8", 4.7 lb/ft,  
J-55 Duoline PVC lined tubing.:
4. Packer: An internally plastic coated Baker Loc-set  
injection packer set @ +/- 5000'.

B. Other well information

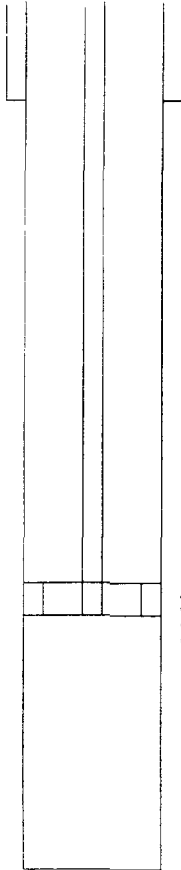
1. Injection formation: Delaware  
  
Field: East Shugart
2. Proposed perfs: 5030' - 5340' w/ 2 JSPF
3. This well will be drilled as a Delaware injection well.
4. No other intervals will be perfed or tested in this well.
5. Within the area of this well the Grayburg is productive at a  
depth of 4300'. The Bone Spring is productive at a depth of  
7800'.



**ST. MARY LAND & EXPLORATION  
PROPOSED  
(TO BE DRILLED)**

WELL: ESDU #22  
FIELD: EAST SHUGART  
INTERVAL: DELAWARE

LOCATION:  
2330' FNL & 1320' FEL  
SECTION 24  
TWP-18-S, RNG-31-E  
EDDY COUNTY, NM



**SURFACE CASING:**  
24#, J-55, 8 5/8" CSG, SET @ 350'  
TOC @ SURFACE.

**PROPOSED COMPLETION INTERVAL:**

DELAWARE - 5030' - 5340'

2 3/8" DUOLINE PVC LINED TUBING SET @ 5000' WITH A  
PLASTIC COATED BAKER LOC-SET PACKER

**PRODUCTION CASING:**  
15.5#, J-55, 5 1/2" CSG, SET @ 5500'.  
TOC @ SURFACE.

TD= 5500'

ESDU #23  
DRILL AS INJECTOR  
NMOC Form C-108 Section III

III. Data on injection well(s)

A. Injection well information (see attached schematic)

Tabular data

1. Lease: East Shugart Delaware Unit (ESDU)  
  
Well No: 23  
  
Location: 2322' FNL & 248' FEL, Sec 24 T-18-S  
R-31-E, Eddy County, NM
2. Casing: 8 5/8", 24 #/ft, surface @ 350' in 12 1/4" hole  
TOC @ surf.  
  
5 1/2", 15.5 #/ft, production casing @ 5500' in  
7 7/8" hole, TOC @ surf.
3. Injection tubing: + or - 156 jts 2 3/8", 4.7 lb/ft,  
J-55 Duoline PVC lined tubing.:
4. Packer: An internally plastic coated Baker Loc-set  
injection packer set @ +/- 5000'.

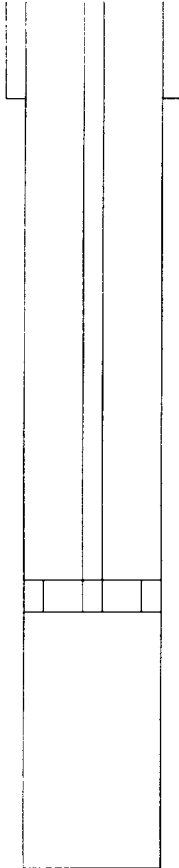
B. Other well information

1. Injection formation: Delaware  
  
Field: East Shugart
2. Proposed perfs: 5025' - 5345' w/ 2 JSPF
3. This well will be drilled as a Delaware injection well.
4. No other intervals will be perfed or tested in this well.
5. Within the area of this well the Grayburg is productive at a  
depth of 4300'. The Bone Spring is productive at a depth of  
7800'.

**ST. MARY LAND & EXPLORATION  
PROPOSED  
(TO BE DRILLED)**

WELL: ESDU #23  
FIELD: EAST SHUGART  
INTERVAL: DELAWARE

LOCATION:  
2322' FNL & 248' FEL  
SECTION 24  
TWP-18-S, RNG-31-E  
EDDY COUNTY, NM



SURFACE CASING:  
24#, J-55, 8 5/8" CSG, SET @ 350'  
TOC @ SURFACE.

PROPOSED COMPLETION INTERVAL:  
  
DELAWARE - 5025' - 5345'

2 3/8" DUOLINE PVC LINED TUBING SET @ 5000' WITH A  
PLASTIC COATED BAKER LOC-SET PACKER

PRODUCTION CASING:  
15.5#, J-55, 5 1/2" CSG, SET @ 5500'.  
TOC @ SURFACE.

TD= 5500'

ESDU #24  
DRILL AS INJECTOR  
NMOCD Form C-108 Section III

III. Data on injection well(s)

A. Injection well information (see attached schematic)

Tabular data

1. Lease: East Shugart Delaware Unit (ESDU)  
  
Well No: 24  
  
Location: 2322' FNL & 1073' FWL, Sec 19 T-18-S  
R-32-E, Lea County, NM
2. Casing: 8 5/8", 24 #/ft, surface @ 350' in 12 1/4" hole  
TOC @ surf.  
  
5 1/2", 15.5 #/ft, production casing @ 5500' in  
7 7/8" hole, TOC @ surf.
3. Injection tubing: + or - 156 jts 2 3/8", 4.7 lb/ft,  
J-55 Duoline PVC lined tubing.:
4. Packer: An internally plastic coated Baker Loc-set  
injection packer set @ +/- 5000'.

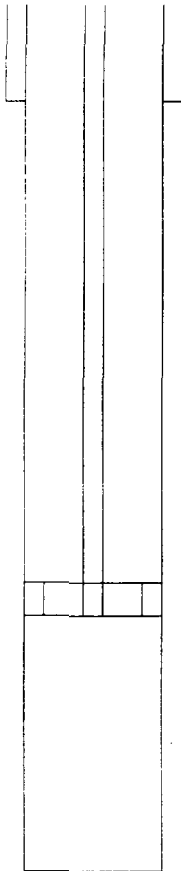
B. Other well information

1. Injection formation: Delaware  
  
Field: East Shugart
2. Proposed perfs: 5030' - 5360' w/ 2 JSPF
3. This well will be drilled as a Delaware injection well.
4. No other intervals will be perfed or tested in this well.
5. Within the area of this well the Grayburg is productive at a  
depth of 4300'. The Bone Spring is productive at a depth of  
7800'.

**ST. MARY LAND & EXPLORATION  
PROPOSED  
(TO BE DRILLED)**

WELL: ESDU #24  
FIELD: EAST SHUGART  
INTERVAL: DELAWARE

LOCATION:  
2322' FNL & 1073' FWL  
SECTION 19  
TWP-18-S, RNG-32-E  
LEA COUNTY, NM



SURFACE CASING:  
24#, J-55, 8 5/8" CSG, SET @ 350'  
TOC @ SURFACE.

PROPOSED COMPLETION INTERVAL:

DELAWARE - 5030' - 5360'

2 3/8" DUOLINE PVC LINED TUBING SET @ 5000' WITH A  
PLASTIC COATED BAKER LOC-SET PACKER

PRODUCTION CASING:  
15.5#, J-55, 5 1/2" CSG, SET @ 5500'.  
TOC @ SURFACE.

TD = 5500'









| OPERATOR    | CURRENT WELL NAME | API #       | S-T-R        | LOCATION               |                                  |
|-------------|-------------------|-------------|--------------|------------------------|----------------------------------|
| ST. MARY    | ARCO #1           | 30-15-25218 | 24-T18S-R31E | 1830' FNL<br>660' FWL  | D<br>PD<br>:PD                   |
| ST. MARY    | GERONIMO #1       | 30-15-24927 | 24-T18S-R31E | 2310' FNL<br>2310' FEL | D<br>PD<br>:PD                   |
| ST. MARY    | GERONIMO #3       | 30-15-25385 | 24-T18S-R31E | 890' FNL<br>990' FEL   | D<br>PD<br>:PD                   |
| ST. MARY    | GERONIMO #4       | 30-15-25457 | 24-T18S-R31E | 1650' FNL<br>990' FEL  | D<br>PD<br>:PD                   |
| ST. MARY    | GERONIMO #5       | 30-15-25546 | 24-T18S-R31E | 765' FNL<br>1980' FEL  | D<br>PD<br>:PD                   |
| ST. MARY    | GERONIMO #8       | 30-15-25652 | 24-T18S-R31E | 2310' FSL<br>990' FEL  | D<br>PD<br>:PD                   |
| ST. MARY    | GERONIMO #9       | 30-15-25723 | 24-T18S-R31E | 1730' FNL<br>1650' FEL | D<br>PD<br>:PD                   |
| ST. MARY    | GERONIMO #10      | 30-15-25735 | 24-T18S-R31E | 2310' FSL<br>1650' FEL | D<br>PD<br>:PD                   |
| ST. MARY    | GERONIMO #11      | 30-15-25803 | 24-T18S-R31E | 990' FSL<br>330' FEL   | D<br>PD<br>:PD                   |
| ST. MARY    | GERONIMO #12      | 30-15-26022 | 24-T18S-R31E | 990' FNL<br>1650' FEL  | D<br>PD<br>:PD                   |
| K. O BUTLER | GHANDI #1         | 30-15-26243 | 24-T18S-R31E | 990' FNL<br>330' FWL   | D<br>PD<br>:PD                   |
| HEYCO       | SO. TAYLOR 13 #1  | 30-15-25594 | 13-T18S-R31E | 330' FSL<br>990' FEL   | D<br>PD<br>:PD<br>D<br>PD<br>:PD |
| HEYCO       | SO. TAYLOR 13 #2  | 30-15-25847 | 13-T18S-R31E | 330' FSL<br>330' FEL   | D<br>PD<br>:PD                   |
| HEYCO       | SO. TAYLOR 13 #3  | 30-15-25741 | 13-T18S-R31E | 430' FSL<br>1650' FEL  | D<br>PD<br>:PD<br>D<br>PD<br>:PD |
| HEYCO       | SO. TAYLOR 13 #4  | 30-15-26150 | 13-T18S-R31E | 1650' FSL<br>660' FEL  | D<br>PD<br>:PD                   |
| WESTALL     | BUFFALO #1        | 30-25-29985 | 18-T18S-R32E | 1650' FSL<br>330' FWL  | D<br>PD<br>:PD                   |
| WESTALL     | BUFFALO #2        | 30-25-30013 | 18-T18S-R32E | 330' FSL<br>1650' FWL  | D<br>PD<br>:PD                   |
| ST. MARY    | CONOCO #1         | 30-25-29694 | 18-T18S-R32E | 330' FSL<br>330' FWL   | D<br>PD<br>:PD                   |
| ST. MARY    | JADE #1           | 30-25-29939 | 19-T18S-R32E | 1650' FNL<br>1650' FWL | D<br>PD<br>:PD                   |
| ST. MARY    | INCA #1           | 30-25-29887 | 19-T18S-R32E | 760' FNL<br>440' FWL   | D<br>PD<br>:PD                   |
| ST. MARY    | INCA #2           | 30-25-29940 | 19-T18S-R32E | 1700' FNL<br>330' FWL  | D<br>PD<br>:PD                   |
| ST. MARY    | INCA #3           | 30-25-29978 | 19-T18S-R32E | 660' FNL<br>1650' FWL  | D<br>PD<br>:PD                   |
| ST. MARY    | CONOCO #3         | 30-25-30187 | 19-T18S-R32E | 2310' FSL<br>660' FWL  | D<br>PD<br>:PD                   |
| ST. MARY    | MOHAWK #1         | 30-25-30111 | 19-T18S-R32E | 2310' FSL<br>1650' FWL | D<br>PD<br>:PD                   |

## THE FOLLOWING WELLS ARE WITHIN THE AREA OF REVIEW BUT DID NOT PENETRATE THE DELAWARE.

| OPERATOR                | CURRENT<br>WELL NAME | API #           | S-T-R        | LOCATION               | STATUS          | SPUD<br>DATE | COMP.<br>DATE | TD    | PBTD  |
|-------------------------|----------------------|-----------------|--------------|------------------------|-----------------|--------------|---------------|-------|-------|
| ST. MARY                | ARCO #2              | 30-15-<br>25624 | 24-T18S-R31E | 950' FNL<br>2310' FWL  | PROD            | 6/2/86       | 6/21/86       | 4500' | 4487' |
| ST. MARY                | GERONIMO #2          | 30-15-<br>25244 | 24-T18S-R31E | 950' FNL<br>2310' FEL  | INJ.            | 4/3/86       | 4/26/85       | 4702' | 4691' |
| ST. MARY                | GERONIMO #6          | 30-15-<br>25597 | 24-T18S-R31E | 790' FNL<br>940' FEL   | PROD            | 4/10/86      | 4/26/86       | 4450' | 4407' |
| ST. MARY                | GERONIMO #7          | 30-15-<br>25598 | 24-T18S-R31E | 1750' FNL<br>990' FEL  | INJ             | 4/21/86      | 5/6/86        | 4500' | 4489' |
| ST. MARY                | JADE #2              | 30-25-<br>30038 | 19-T18S-R32E | 1650' FNL<br>1750' FWL | PROD            | 12/15/87     | 1/25/88       | 4525' | 4320' |
| ST. MARY                | INCA #4              | 30-25-<br>30039 | 19-T18S-R32E | 760' FNL<br>430' FWL   | INJ             | 1/7/88       | 2/5/88        | 4500' | 4244' |
| THUNDERBOL<br>PETROLEUM | ORION #1             | 30-25-<br>33140 | 19-T18S-R32E | 2310' FSL<br>500' FWL  | PROD            | 11/12/95     | 2/2/96        | 4500' | 4454' |
| WESTALL                 | KEOHANE FED #2       | 30-15-<br>25441 | 24-T18S-R31E | 2310' FSL<br>2200' FEL | PROD            | 10/18/85     | 12/11/85      | 4500' |       |
| WESTALL                 | KEOHANE FED #3       | 30-15-<br>25814 | 24-T18S-R31E | 2200' FSL<br>990' FEL  | PROD            | 10/30/87     | 11/25/87      | 4500' |       |
| ST. MARY                | BLACKHAWK #1         | 30-15-<br>25235 | 24-T18S-R31E | 2310' FSL<br>1650' FWL | SHUT IN<br>PROD | 3/24/85      | 4/18/85       | 4527' | 4485' |
| ST. MARY                | BLACKHAWK #2         | 30-15-<br>25360 | 24-T18S-R31E | 2310 FNL<br>1980' FWL  | SHUT IN<br>PROD | 8/4/85       | 9/5/85        | 4500' | 4490' |
| ST. MARY                | BLACKHAWK #7         | 30-15-<br>26500 | 24-T18S-R31E | 2630' FNL<br>2310' FWL | INJ             | 11/23/90     | 11/23/90      | 4500' | 4455' |
| ST. MARY                | CONOCO #2            | 30-25-<br>29803 | 18-T18S-R32E | 400' FSL<br>400' FWL   | PROD            | 12/13/86     | 1/12/87       | 4500' | 4487' |
| ST. MARY                | KEOHANE FED #1       | 30-15-<br>NA    | 24-T18S-R31E | 330' FNL<br>2260' FEL  | P & A           | 3/12/61      | 5/3/61        | 4232' |       |



NMOCD Form C-108 Sections VII thru XII

VII. Data on proposed operation.

1. Proposed average injection rate: 150 BWPD per well  
Proposed maximum injection rate: 300 BWPD per well
2. The system will be a closed system.
3. Proposed average injection pressure: 700 PSI  
Proposed maximum injection pressure: 1000 PSI  
(This complies with the .2 psi/ft injection pressure limitation. If greater pressures are necessary in the future the appropriate step rate tests will be performed and submitted.)
4. The proposed injection fluid is produced water and is compatible with the reservoir fluids in the proposed injection horizon. This is shown on the attached compatibility analysis.
5. A chemical analysis of the formation water in the proposed injection horizon is attached.

VIII. The proposed injection interval is located in the Delaware Sand formation. The Shugart East Field is located within Sections 13 and 24, T-18-S, R-31-E, Eddy County and Sections 18 and 19 T-18-S, R-32-E, Lea County New Mexico. Production is from the lower Guadalupian (Permian) Brushy Canyon Formation of the Delaware Mountain Group.

The Brushy Canyon reservoirs of the Shugart East Field are combination stratigraphic-structural traps. Ten (10) discrete sand packages are draped over a structural high. A depositional model is a sand rich submarine fan/channel complex. The sands are sourced from the north and northeast.

The Shugart East structure is an asymmetrical high with about 75' of closure centered in the NE/4 Section 24, T-18-S, R-31-E. The closure is probably due to differential compaction of the sand thicks versus the surrounding shale interval. The productive interval has a gross thickness of 300 to 400' at a depth of 5000' to 5400'. Individual sand bodies vary in thickness from 10' to over 100'. Porosity in the producing intervals range from 14% to 20% with an average of 17%.

There are no fresh water zones within the area of these injection wells above or below the proposed injection horizon.

- IX. It is anticipated the South Taylor 13 #3 will have additional pay perfed and fraced from 5090-5420' prior to conversion to injection.
- X. Logs have previously been submitted to the OCD.
- XI. There are no fresh water wells of record within one mile of the proposed injection wells.
- XII. An examination of this area has determined there are no open faults or other hydrologic connection between the disposal zone and any underground drinking water.



[illegible]







## Water Analysis Report by Baker Petrolite

**COASTAL  
GERONIMO  
WATER PLANT  
TANK**

Account Manager  
**WAYNE PETERSON**

| Summary                                              |                  | Analysis of Sample 106238 @ 75°F |        |       |                |       |       |
|------------------------------------------------------|------------------|----------------------------------|--------|-------|----------------|-------|-------|
| Sampling Date                                        | 1/6/99           | <b>Anions</b>                    | mg/l   | meq/l | <b>Cations</b> | mg/l  | meq/l |
| Analysis Date                                        | 1/13/99          | Chloride                         | 153487 | 4329  | Sodium         | 79884 | 3475  |
| Analyst                                              | ORCILA HERNANDEZ | Bicarbonate                      | 82.8   | 1.02  | Magnesium      | 2670  | 211   |
|                                                      |                  | Carbonate                        | 0.00   | 0.00  | Calcium        | 12651 | 631   |
| TDS (mg/l or g/m <sup>3</sup> )                      | 250813           | Sulfate                          | 900    | 18.7  | Strontium      | 339   | 7.74  |
| Density (g/cm <sup>3</sup> or tonne/m <sup>3</sup> ) | 1.163            | Phosphate                        | N/A    | N/A   | Barium         | 0.30  | 0.00  |
| Anion/Cation Ratio                                   | 1.00             | Borate                           | N/A    | N/A   | Iron           | 5.50  | 0.20  |
|                                                      |                  | Silicate                         | N/A    | N/A   | Potassium      | 919   | 23.5  |
| Carbon Dioxide                                       | 210 PPM          |                                  |        |       | Aluminum       | N/A   | N/A   |
| Oxygen                                               |                  | Hydrogen Sulfide                 |        | 2 PPM | Chromium       | N/A   | N/A   |
|                                                      |                  |                                  |        |       | Copper         | N/A   | N/A   |
|                                                      |                  | pH at time of sampling           |        | 6.90  | Lead           | N/A   | N/A   |
|                                                      |                  | pH at time of analysis           |        |       | Manganese      | N/A   | N/A   |
|                                                      |                  | pH used in Calculations          |        | 6.90  | Nickel         | N/A   | N/A   |

| Conditions |              | Values Calculated at the Given Conditions - Amounts of Scale in lb/1000bbl |        |                                                 |        |                                |        |                                |        |                             |                           |
|------------|--------------|----------------------------------------------------------------------------|--------|-------------------------------------------------|--------|--------------------------------|--------|--------------------------------|--------|-----------------------------|---------------------------|
| Temp.      | Gauge Press. | Calcite<br>CaCO <sub>3</sub>                                               |        | Gypsum<br>CaSO <sub>4</sub> · 2H <sub>2</sub> O |        | Anhydrite<br>CaSO <sub>4</sub> |        | Celestite<br>SrSO <sub>4</sub> |        | Barite<br>BaSO <sub>4</sub> | CO <sub>2</sub><br>Press. |
| °F         | psi          | Index                                                                      | Amount | Index                                           | Amount | Index                          | Amount | Index                          | Amount | Index                       | Amount                    |
| 80         | 0.           | 0.60                                                                       | 2.67   | -5.08                                           |        | 0.00                           | 3.20   | -0.00                          |        | -0.01                       | 0.05                      |
| 100        | 0.           | 0.62                                                                       | 3.06   | -0.13                                           |        | -0.01                          |        | -0.08                          |        | -0.21                       | 0.06                      |
| 120        | 0.           | 0.63                                                                       | 3.49   | -0.20                                           |        | -0.01                          |        | -0.10                          |        | -0.39                       | 0.08                      |
| 140        | 0.           | 0.64                                                                       | 3.97   | -0.26                                           |        | 0.02                           | 19.1   | -0.10                          |        | -0.54                       | 0.11                      |

Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered.

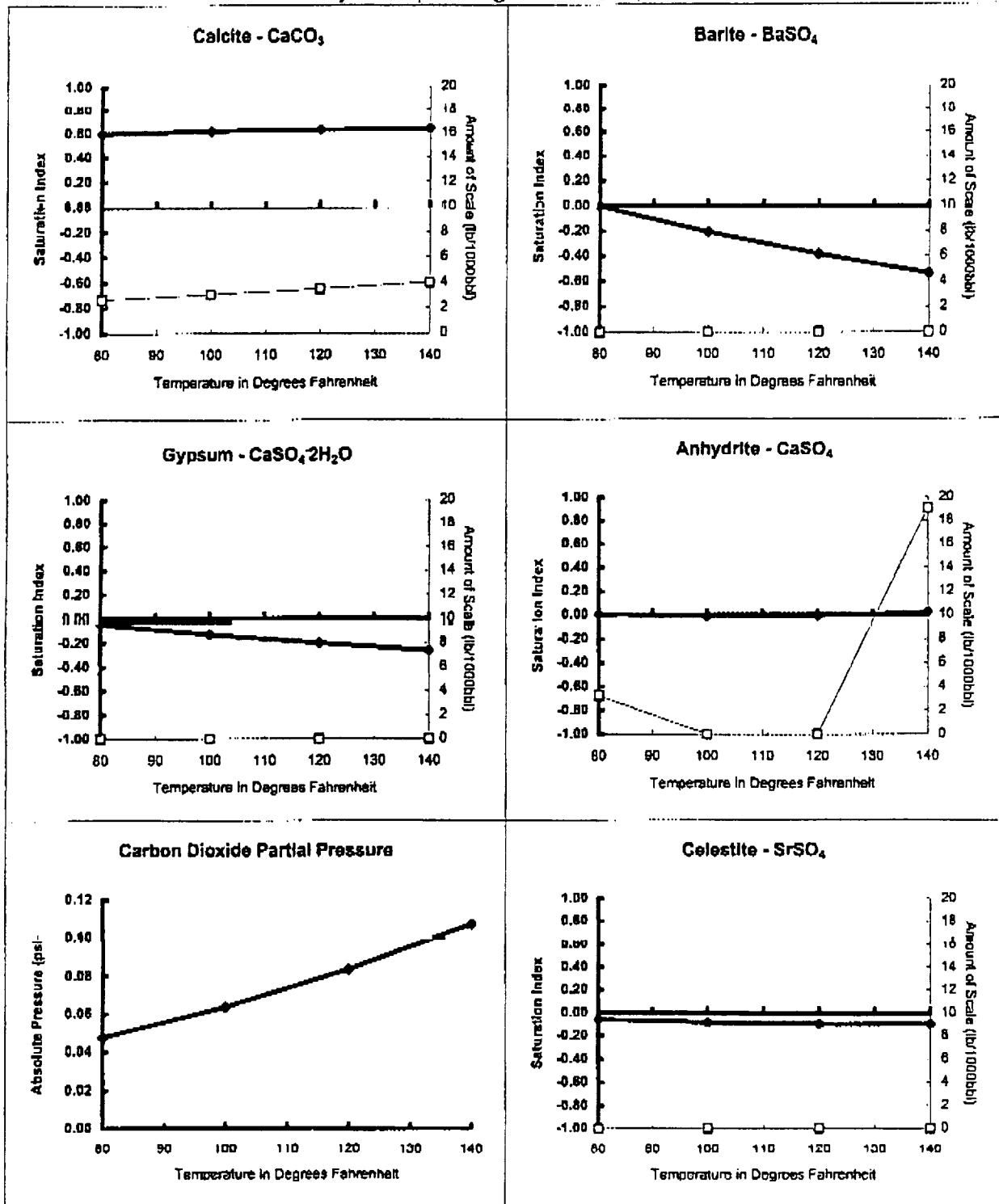
Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the five scales.

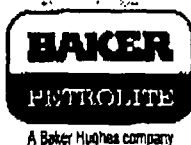
Note 3: The reported CO<sub>2</sub> pressure is actually the calculated CO<sub>2</sub> fugacity. It is usually nearly the same as the CO<sub>2</sub> partial pressure.



## Scale Predictions from Baker Petrolite

Analysis of Sample 108238 @ 75°F for COASTAL, Jan/13/99





## Water Analysis Report by Baker Petrolite

**MARATHON**  
TORANO  
WATER PLANT  
TANK

Account Manager  
**WAYNE PETERSON**

| Summary                                              |                  | Analysis of Sample 106237 @ 75°F |       |       |                |       |       |
|------------------------------------------------------|------------------|----------------------------------|-------|-------|----------------|-------|-------|
| Sampling Date                                        | 1/6/99           | <b>Anions</b>                    | mg/l  | meq/l | <b>Cations</b> | mg/l  | meq/l |
| Analysis Date                                        | 1/13/99          | Chloride                         | 89691 | 2530  | Sodium         | 51718 | 2250  |
| Analyst                                              | SHEILA HERNANDEZ | Bicarbonate                      | 187   | 3.08  | Magnesium      | 1340  | 110   |
|                                                      |                  | Carbonate                        | 0.00  | 0.00  | Calcium        | 4395  | 219   |
| TDS (mg/l or g/m <sup>3</sup> )                      | 150848           | Sulfate                          | 2929  | 61.0  | Strontium      | 122   | 2.78  |
| Density (g/cm <sup>3</sup> or tonne/m <sup>3</sup> ) | 1.096            | Phosphate                        | N/A   | N/A   | Barium         | 0.10  | 0.00  |
| Anion/Cation Ratio                                   | 1.00             | Borate                           | N/A   | N/A   | Iron           | 4.50  | 0.16  |
|                                                      |                  | Silicate                         | N/A   | N/A   | Potassium      | 462   | 11.8  |
| Carbon Dioxide                                       | 135 PPM          |                                  |       |       | Aluminum       | N/A   | N/A   |
| Oxygen                                               |                  | Hydrogen Sulfide                 |       | 9 PPM | Chromium       | N/A   | N/A   |
|                                                      |                  |                                  |       |       | Copper         | N/A   | N/A   |
|                                                      |                  | pH at time of sampling           |       | 7.10  | Lead           | N/A   | N/A   |
|                                                      |                  | pH at time of analysis           |       |       | Manganese      | N/A   | N/A   |
|                                                      |                  | pH used in Calculations          |       | 7.10  | Nickel         | N/A   | N/A   |

| Conditions |              | Values Calculated at the Given Conditions - Amounts of Scale in lb/1000bbl |        |                                                 |        |                                |        |                                |        |                             |        |                           |
|------------|--------------|----------------------------------------------------------------------------|--------|-------------------------------------------------|--------|--------------------------------|--------|--------------------------------|--------|-----------------------------|--------|---------------------------|
| Temp.      | Gauge Press. | Calcite<br>CaCO <sub>3</sub>                                               |        | Gypsum<br>CaSO <sub>4</sub> · 2H <sub>2</sub> O |        | Anhydrite<br>CaSO <sub>4</sub> |        | Celestite<br>SrSO <sub>4</sub> |        | Barite<br>BaSO <sub>4</sub> |        | CO <sub>2</sub><br>Press. |
| °F         | psi          | Index                                                                      | Amount | Index                                           | Amount | Index                          | Amount | Index                          | Amount | Index                       | Amount | psi                       |
| 80         | 0.           | 0.70                                                                       | 11.1   | 0.07                                            | 216    | 0.08                           | 177    | 0.24                           | 33.5   | 0.26                        | 0.02   | 0.11                      |
| 100        | 0.           | 0.73                                                                       | 13.0   | 0.01                                            | 27.4   | 0.08                           | 181    | 0.21                           | 30.9   | 0.06                        | 0.01   | 0.16                      |
| 120        | 0.           | 0.76                                                                       | 15.0   | -0.04                                           |        | 0.10                           | 240    | 0.20                           | 29.5   | -0.11                       |        | 0.21                      |
| 140        | 0.           | 0.79                                                                       | 17.2   | -0.09                                           |        | 0.15                           | 338    | 0.20                           | 29.2   | -0.25                       |        | 0.29                      |

Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered.

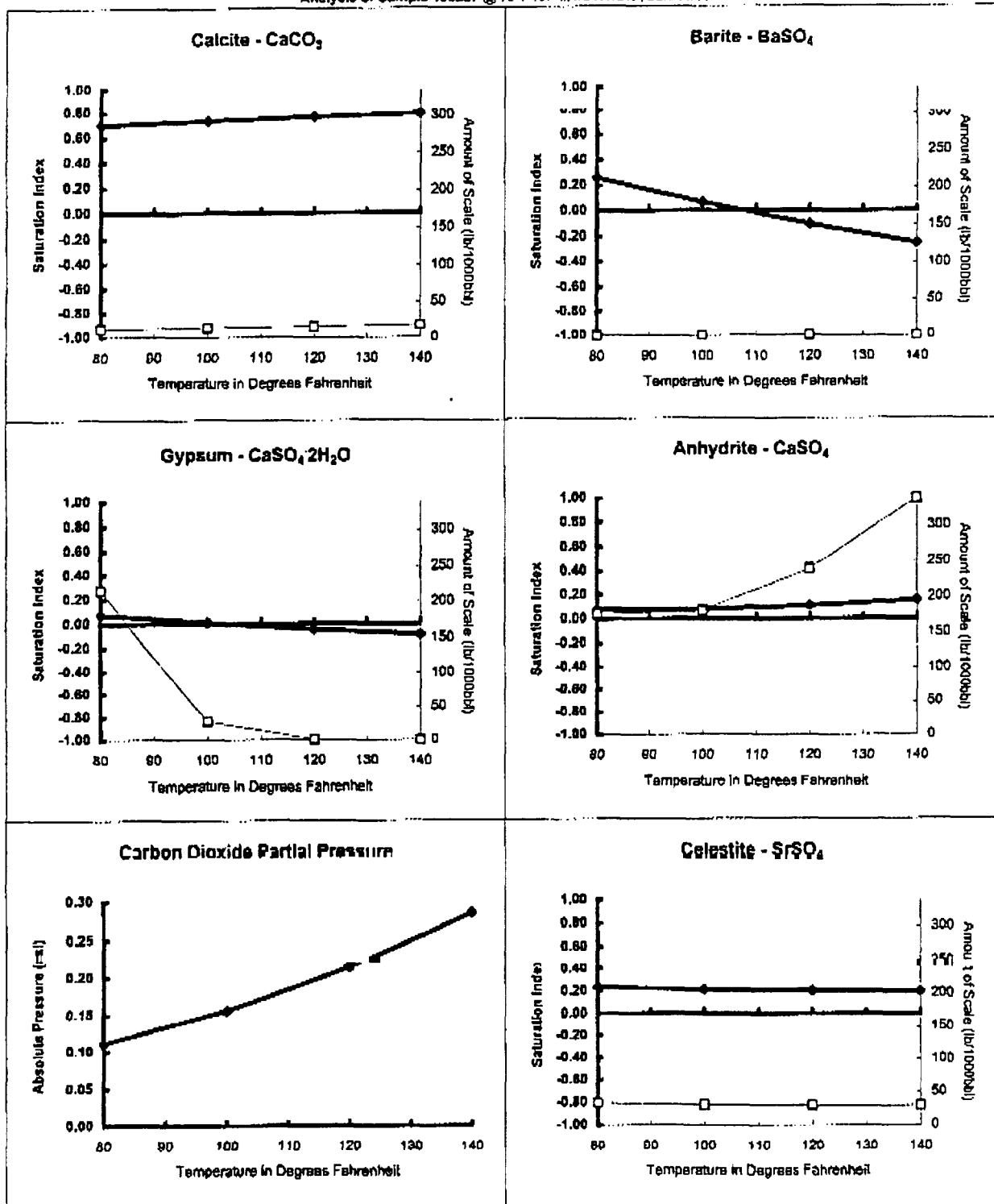
Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the five scales.

Note 3: The reported CO<sub>2</sub> pressure is actually the calculated CO<sub>2</sub> fugacity. It is usually nearly the same as the CO<sub>2</sub> partial pressure.



## Scale Predictions from Baker Petrolite

Analysis of Sample 105237 @ 75°F for MARATHON, Jan/13/98

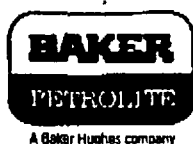




Analysis: 22546

## Water Analysis Report from Baker Petrolite

| Summary of Mixing Waters |                  |                  |                |
|--------------------------|------------------|------------------|----------------|
| Sample Number            | 106238           | 106237           | 106640         |
| Company                  | COASTAL          | MARATHON         | HEYCO          |
| Lease                    | GERONIMO         | TORANO           | YOUNG DEEP     |
| Well                     | WATER PLANT      | WATER PLANT      |                |
| Sample Location          | TANK             | TANK             | I.P.D.         |
| <b>Anions (mg/L)</b>     |                  |                  |                |
| Chloride                 | 153,482          | 89,691           | 106,932        |
| Bicarbonate              | 62.0             | 187              | 354            |
| Carbonate                | 0.00             | 0.00             | 0.00           |
| Sulfate                  | 900              | 2,929            | 1,416          |
| Phosphate                | 0.00             | 0.00             | 0.00           |
| Borate                   | 0.00             | 0.00             | 0.00           |
| Silicate                 | 0.00             | 0.00             | 0.00           |
| <b>Cations (mg/L)</b>    |                  |                  |                |
| Sodium                   | 79,884           | 51,718           | 54,936         |
| Magnesium                | 2,570            | 1,340            | 1,975          |
| Calcium                  | 12,651           | 4,395            | 8,961          |
| Strontium                | 339              | 122              | 188            |
| Barium                   | 0.30             | 0.10             | 0.20           |
| Iron                     | 5.50             | 4.50             | 4.00           |
| Potassium                | 919              | 462              | 1,869          |
| Aluminum                 | 0.00             | 0.00             | 0.00           |
| Chromium                 | 0.00             | 0.00             | 0.00           |
| Copper                   | 0.00             | 0.00             | 0.00           |
| Lead                     | 0.00             | 0.00             | 0.00           |
| Manganese                | 0.00             | 0.00             | 0.00           |
| Nickel                   | 0.00             | 0.00             | 0.00           |
| Anion/Cation Ratio       | 1.00             | 1.00             | 1.00           |
| TDS (mg/L)               | 250,813          | 150,848          | 176,635        |
| Density (g/cm)           | 1.16             | 1.10             | 1.12           |
| Sampling Date            | 1/6/99           | 1/6/99           | 8/3/98         |
| Account Manager          | WAYNE PETERSON   | WAYNE PETERSON   | FRANK WONER    |
| Analyst                  | SHEILA HERNANDEZ | SHEILA HERNANDEZ | SHEILA DEARMAN |
| Analysis Date            | 1/13/99          | 1/13/99          | 8/6/98         |
| pH at time of sampling   | 6.90             | 7.10             | 6.45           |
| pH at time of analysis   | 6.90             | 7.10             | 6.45           |
| pH used in Calculations  | 6.90             | 7.10             | 6.45           |



Analysis: 22546

## Water Analysis Report from Baker Petrolite

Mixes at 80°F and 0 psi with 106237

| Predictions of Carbon Dioxide Pressure, Saturation Index and Amount of Scale in lb/1000bbl |        |                 |                              |        |                                                |        |                                |        |                                |        |                             |        |
|--------------------------------------------------------------------------------------------|--------|-----------------|------------------------------|--------|------------------------------------------------|--------|--------------------------------|--------|--------------------------------|--------|-----------------------------|--------|
| Mix Waters                                                                                 |        | CO <sub>2</sub> | Calcite<br>CaCO <sub>3</sub> |        | Gypsum<br>CaSO <sub>4</sub> ·2H <sub>2</sub> O |        | Anhydrite<br>CaSO <sub>4</sub> |        | Celestite<br>SrSO <sub>4</sub> |        | Barite<br>BaSO <sub>4</sub> |        |
| 106238                                                                                     | 106640 | psi             | Index                        | Amount | Index                                          | Amount | Index                          | Amount | Index                          | Amount | Index                       | Amount |
| 20%                                                                                        | 40%    | 0.39            | 0.57                         | 15.4   | 0.10                                           | 200    | 0.11                           | 182    | 0.16                           | 36.9   | 0.24                        | 0.04   |

Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered.

Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the five scales.

Note 3: CO<sub>2</sub> Pressure is absolute pressure. Total Pressure is gauge pressure.

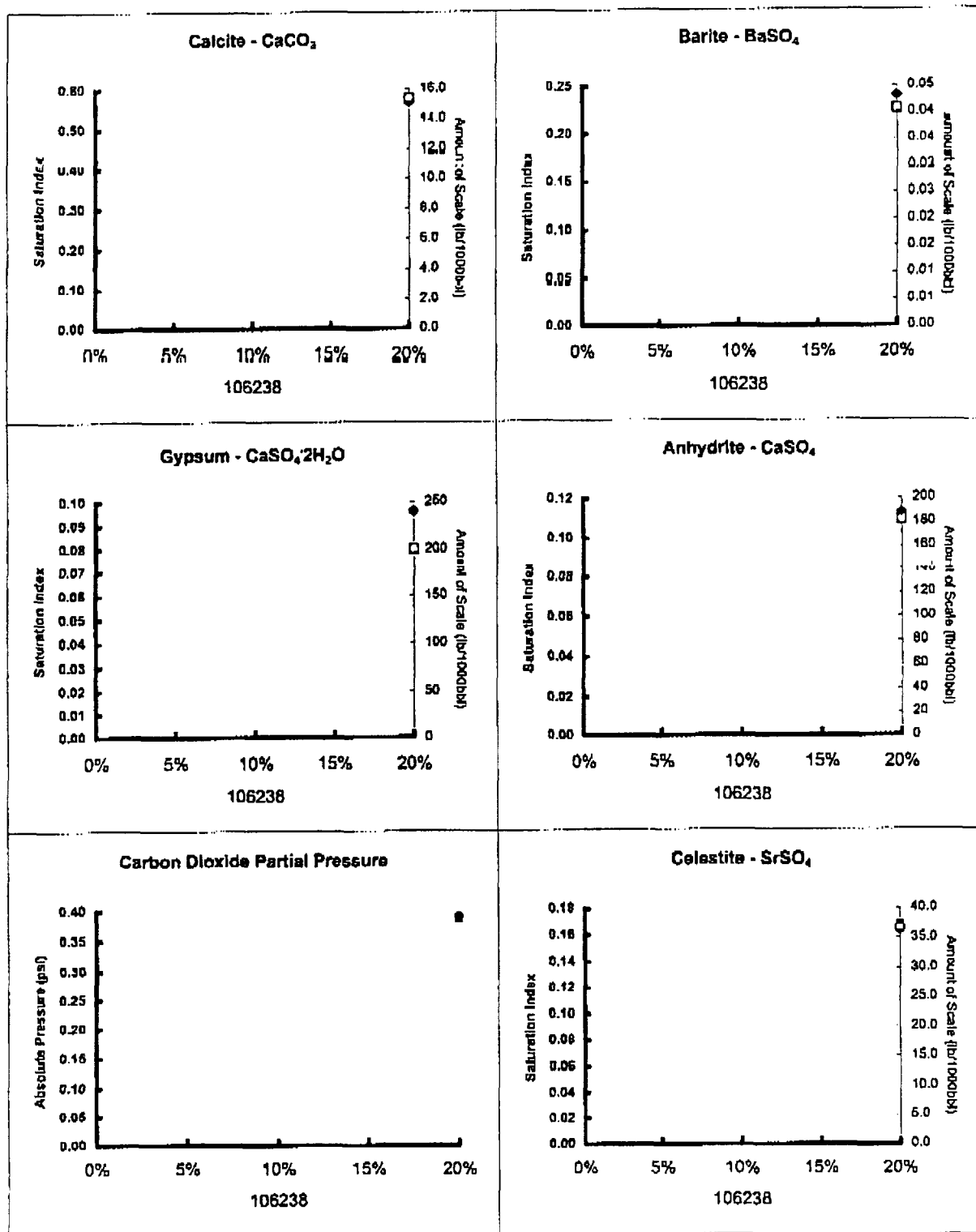
| Compositions of the Mixed Waters used for the Calculations |        |        |
|------------------------------------------------------------|--------|--------|
| 106238                                                     | 106237 | 106640 |
| 20.0%                                                      | 40.0%  | 40.0%  |

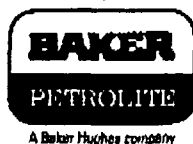


Analysis: 22546

## Mixture Predictions from Baker-Petrolite

106238 with 106237 and with 106640 at 80°F and 0 psi





Analysis: 22546

## Water Analysis Report from Baker Petrolite

Mixes at 100°F and 0 psi with 106237

### Predictions of Carbon Dioxide Pressure, Saturation Index and Amount of Scale in lb/1000bbl

| Mix Waters |        | CO <sub>2</sub> | Calcite<br>CaCO <sub>3</sub> |        | Gypsum<br>CaSO <sub>4</sub> ·2H <sub>2</sub> O |        | Anhydrite<br>CaSO <sub>4</sub> |        | Celestite<br>SrSO <sub>4</sub> |        | Barite<br>BaSO <sub>4</sub> |        |
|------------|--------|-----------------|------------------------------|--------|------------------------------------------------|--------|--------------------------------|--------|--------------------------------|--------|-----------------------------|--------|
| 106238     | 106640 | psi             | Index                        | Amount | Index                                          | Amount | Index                          | Amount | Index                          | Amount | Index                       | Amount |
| 20%        | 40%    | 0.49            | 0.64                         | 17.9   | 0.03                                           | 61.4   | 0.11                           | 178    | 0.14                           | 32.3   | 0.04                        | 0.01   |

Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered.

Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the five scales.

Note 3: CO<sub>2</sub> Pressure is absolute pressure. Total Pressure is gauge pressure.

### Compositions of the Mixed Waters used for the Calculations

| 106238 | 106237 | 106640 |
|--------|--------|--------|
| 20.0%  | 40.0%  | 40.0%  |

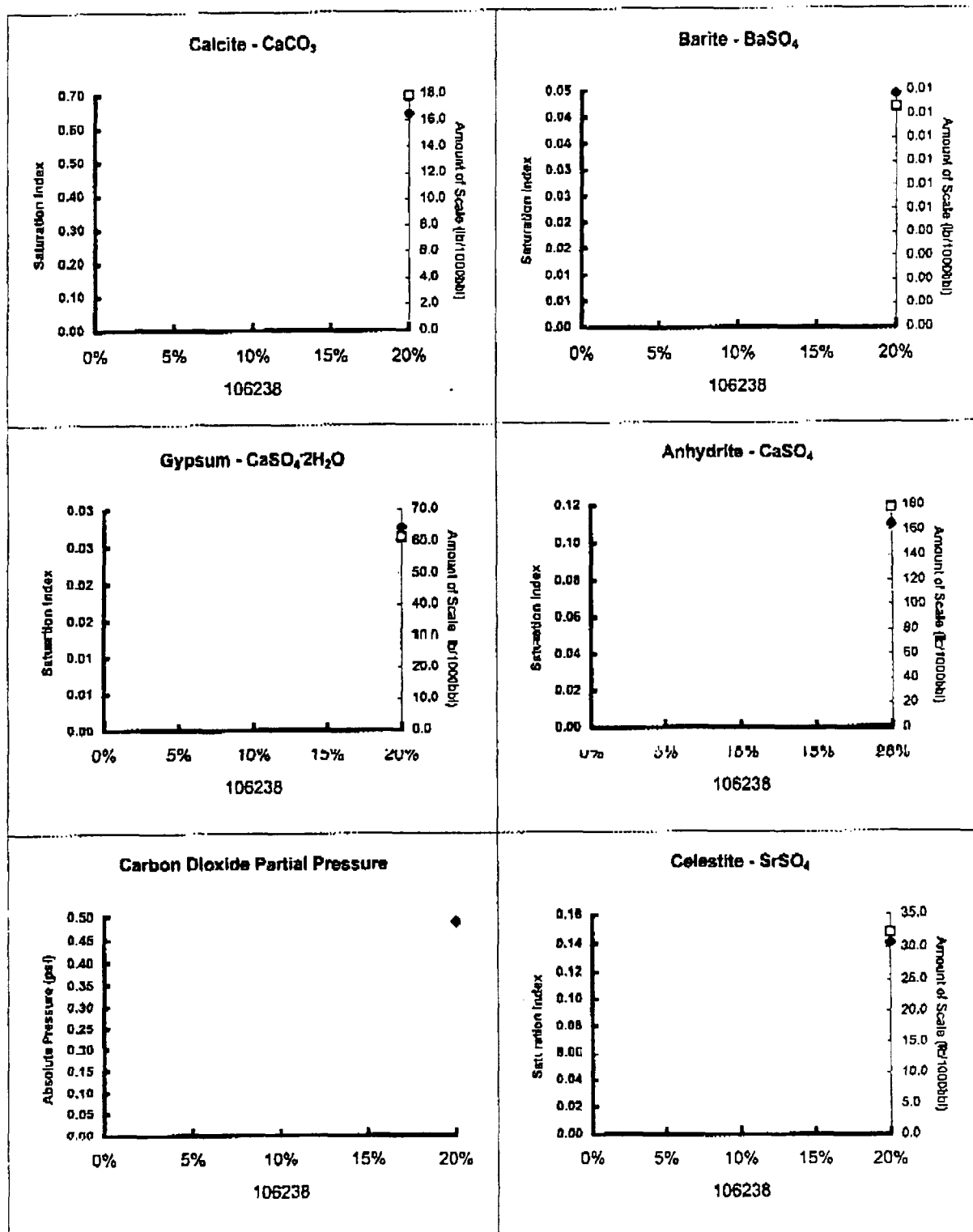




Analysis: 22546

# Mixture Predictions from Baker-Petrolite

106238 with 106237 and with 106640 at 100°F and 0 psi





Analysis: 22546

## Water Analysis Report from Baker Petrolite

Mixes at 120°F and 0 psi with 106237

### Predictions of Carbon Dioxide Pressure, Saturation Index and Amount of Scale in lb/1000bbl

| Mix Waters |        | CO <sub>2</sub> | Calcite<br>CaCO <sub>3</sub> |        | Gypsum<br>CaSO <sub>4</sub> ·2H <sub>2</sub> O |        | Anhydrite<br>CaSO <sub>4</sub> |        | Celestite<br>SrSO <sub>4</sub> |        | Barite<br>BaSO <sub>4</sub> |        |
|------------|--------|-----------------|------------------------------|--------|------------------------------------------------|--------|--------------------------------|--------|--------------------------------|--------|-----------------------------|--------|
| 106238     | 106640 | psi             | Index                        | Amount | Index                                          | Amount | Index                          | Amount | Index                          | Amount | Index                       | Amount |
| 20%        | 40%    | 0.59            | 0.71                         | 20.5   | -0.03                                          |        | 0.13                           | 210    | 0.13                           | 30.1   | -0.13                       |        |

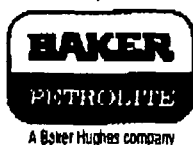
Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered.

Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the five scales.

Note 3: CO<sub>2</sub> Pressure is absolute pressure. Total Pressure is gauge pressure.

### Compositions of the Mixed Waters used for the Calculations

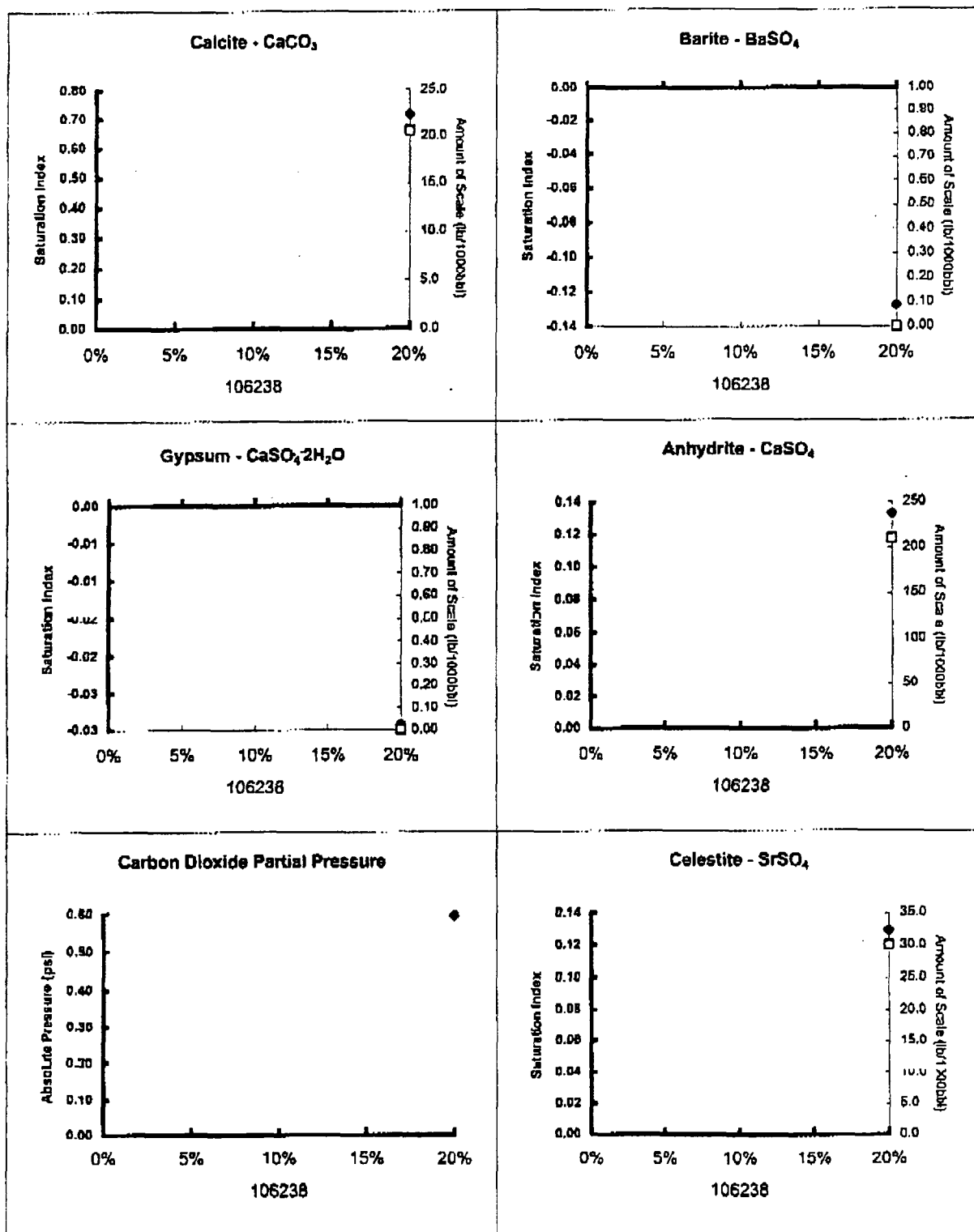
| 106238 | 106237 | 106640 |
|--------|--------|--------|
| 20.0%  | 40.0%  | 40.0%  |



Analysis: 22546

**Mixture Predictions from Baker-Petrolite**

106230 with 106237 and with 106640 at 120°F and 0 psi





Analysis: 22546

## Water Analysis Report from Baker Petrolite

Mixes at 140°F and 0 psi with 106237

### Predictions of Carbon Dioxide Pressure, Saturation Index and Amount of Scale in lb/1000bbl

| Mix Waters |        | CO <sub>2</sub> | Calcite<br>CaCO <sub>3</sub> | Gypsum<br>CaSO <sub>4</sub> ·2H <sub>2</sub> O | Anhydrite<br>CaSO <sub>4</sub> | Celestite<br>SrSO <sub>4</sub> | Barite<br>BaSO <sub>4</sub> |
|------------|--------|-----------------|------------------------------|------------------------------------------------|--------------------------------|--------------------------------|-----------------------------|
| 106238     | 106640 | psi             | Index Amount                 | Index Amount                                   | Index Amount                   | Index Amount                   | Index Amount                |
| 20%        | 40%    | 0.71            | 0.78 23.3                    | -0.05                                          | 0.18 269                       | 0.13 29.8                      | -0.20                       |

Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered.

Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the five scales.

Note 3: CO<sub>2</sub> Pressure is absolute pressure. Total Pressure is gauge pressure.

### Compositions of the Mixed Waters used for the Calculations

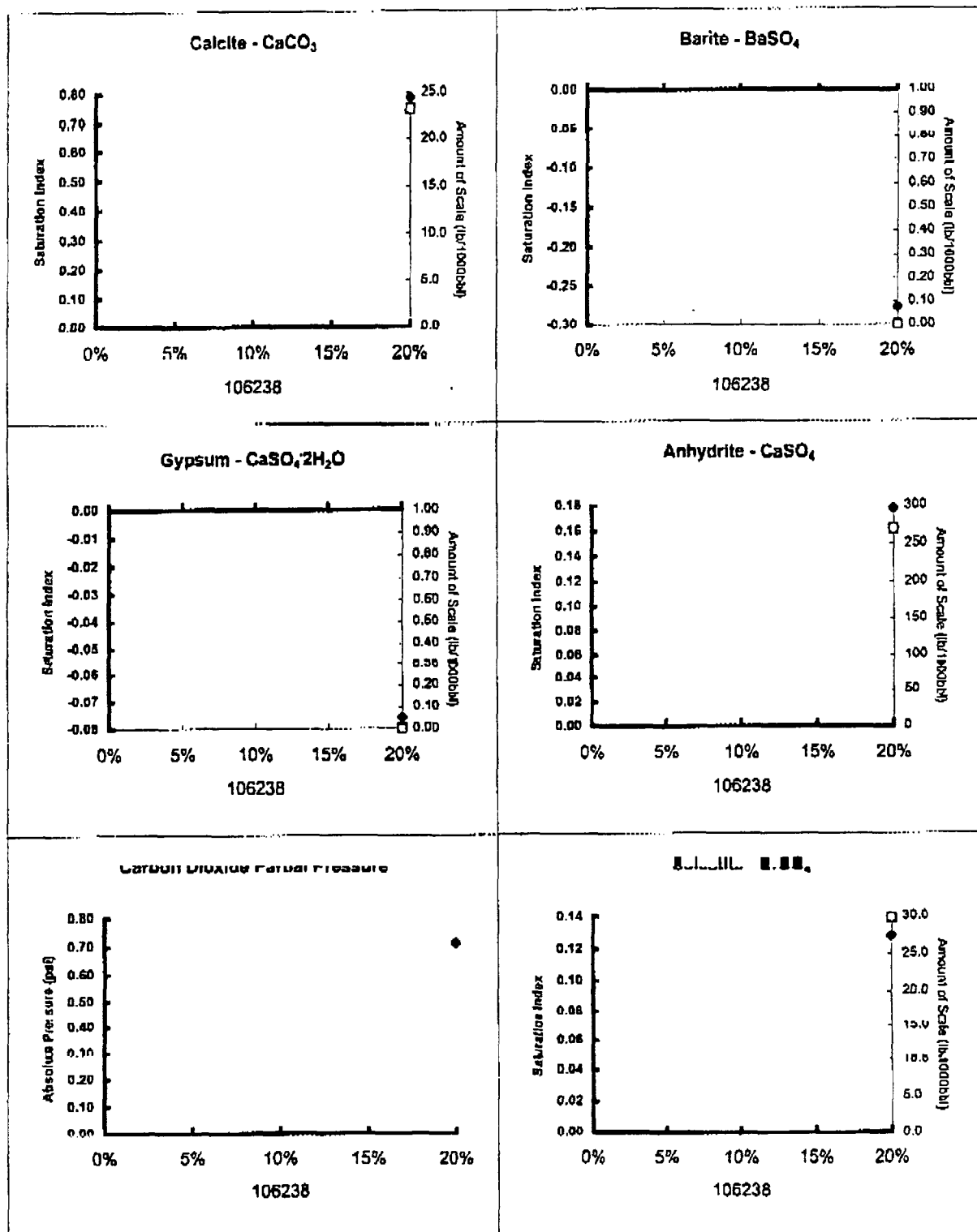
| 106238 | 106237 | 106640 |
|--------|--------|--------|
| 20.0%  | 40.0%  | 40.0%  |



Analysis: 22546

## Mixture Predictions from Baker-Petrolite

106238 with 106237 and with 106640 at 140°F and 0 psi





Analysis: 22535

## Water Analysis Report from Baker Petrolite

| Summary of Mixing Waters          |                               |                                 |
|-----------------------------------|-------------------------------|---------------------------------|
| <b>Sample Number</b>              | 106237                        | 106238                          |
| <b>Company</b>                    | MARATHON                      | COASTAL                         |
| <b>Lease Well Sample Location</b> | TORANO<br>WATER PLANT<br>TANK | GERONIMO<br>WATER PLANT<br>TANK |
| <b>Anions (mg/L)</b>              |                               |                                 |
| Chloride                          | 89,691                        | 153,482                         |
| Bicarbonate                       | 187                           | 62.0                            |
| Carbonate                         | 0.00                          | 0.00                            |
| Sulfate                           | 2,929                         | 900                             |
| Phosphate                         | 0.00                          | 0.00                            |
| Borate                            | 0.00                          | 0.00                            |
| Silicate                          | 0.00                          | 0.00                            |
| <b>Cations (mg/L)</b>             |                               |                                 |
| Sodium                            | 51,718                        | 79,884                          |
| Magnesium                         | 1,340                         | 2,570                           |
| Calcium                           | 4,395                         | 12,651                          |
| Strontium                         | 122                           | 339                             |
| Barium                            | 0.10                          | 0.30                            |
| Iron                              | 4.50                          | 5.50                            |
| Potassium                         | 462                           | 919                             |
| Aluminum                          | 0.00                          | 0.00                            |
| Chromium                          | 0.00                          | 0.00                            |
| Copper                            | 0.00                          | 0.00                            |
| Lead                              | 0.00                          | 0.00                            |
| Manganese                         | 0.00                          | 0.00                            |
| Nickel                            | 0.00                          | 0.00                            |
| <b>Anion/Cation Ratio</b>         | 1.00                          | 1.00                            |
| <b>TDS (mg/L)</b>                 | 150,848                       | 250,813                         |
| <b>Density (g/cm)</b>             | 1.10                          | 1.16                            |
| <b>Sampling Date</b>              | 1/6/99                        | 1/6/99                          |
| <b>Account Manager</b>            | WAYNE PETERSON                | WAYNE PETERSON                  |
| <b>Analyst</b>                    | SHEILA HERNANDEZ              | SHEILA HERNANDEZ                |
| <b>Analysis Date</b>              |                               | 1/13/99                         |
| <b>pH at time of sampling</b>     | 7.10                          | 6.90                            |
| <b>pH at time of analysis</b>     |                               |                                 |
| <b>pH used in Calculations</b>    | 7.10                          | 6.90                            |



Analysis: 22535

## Water Analysis Report from Baker Petrolite

Mixes at 80°F and 0 psi

| Predictions of Carbon Dioxide Pressure, Saturation Index and Amount of Scale in lb/1000bbl |        |                 |                              |        |                                                |        |                                |        |                                |        |                             |        |
|--------------------------------------------------------------------------------------------|--------|-----------------|------------------------------|--------|------------------------------------------------|--------|--------------------------------|--------|--------------------------------|--------|-----------------------------|--------|
| Mix Waters                                                                                 |        | CO <sub>2</sub> | Calcite<br>CaCO <sub>3</sub> |        | Gypsum<br>CaSO <sub>4</sub> ·2H <sub>2</sub> O |        | Anhydrite<br>CaSO <sub>4</sub> |        | Celestite<br>SrSO <sub>4</sub> |        | Barite<br>BaSO <sub>4</sub> |        |
| 106237                                                                                     | 106238 | psi             | Index                        | Amount | Index                                          | Amount | Index                          | Amount | Index                          | Amount | Index                       | Amount |
| 0%                                                                                         | 100%   | 0.05            | 0.60                         | 2.7    | -0.05                                          |        | 0.00                           | 3      | -0.06                          |        | -0.01                       |        |
| 10%                                                                                        | 90%    | 0.06            | 0.65                         | 3.6    | 0.01                                           | 14     | 0.06                           | 56     | 0.02                           | 6.7    | 0.07                        | 0.02   |
| 20%                                                                                        | 80%    | 0.06            | 0.68                         | 4.5    | 0.05                                           | 79     | 0.10                           | 106    | 0.08                           | 26.4   | 0.13                        | 0.03   |
| 30%                                                                                        | 70%    | 0.07            | 0.71                         | 5.5    | 0.09                                           | 141    | 0.12                           | 153    | 0.13                           | 39.7   | 0.18                        | 0.04   |
| 40%                                                                                        | 60%    | 0.08            | 0.73                         | 6.6    | 0.11                                           | 197    | 0.14                           | 195    | 0.17                           | 47.7   | 0.22                        | 0.05   |
| 50%                                                                                        | 50%    | 0.09            | 0.74                         | 7.6    | 0.12                                           | 245    | 0.15                           | 230    | 0.20                           | 51.7   | 0.25                        | 0.05   |
| 60%                                                                                        | 40%    | 0.09            | 0.75                         | 8.5    | 0.13                                           | 283    | 0.15                           | 257    | 0.23                           | 52.4   | 0.27                        | 0.04   |
| 70%                                                                                        | 30%    | 0.10            | 0.75                         | 9.4    | 0.13                                           | 307    | 0.15                           | 271    | 0.24                           | 50.5   | 0.28                        | 0.04   |
| 80%                                                                                        | 20%    | 0.10            | 0.74                         | 10.2   | 0.12                                           | 311    | 0.13                           | 288    | 0.25                           | 48.4   | 0.29                        | 0.04   |
| 90%                                                                                        | 10%    | 0.11            | 0.73                         | 10.8   | 0.10                                           | 286    | 0.11                           | 241    | 0.25                           | 40.6   | 0.28                        | 0.03   |
| 100%                                                                                       | 0%     | 0.11            | 0.70                         | 11.1   | 0.07                                           | 218    | 0.08                           | 178    | 0.24                           | 33.4   | 0.26                        | 0.02   |

Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered.

Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the five scales.

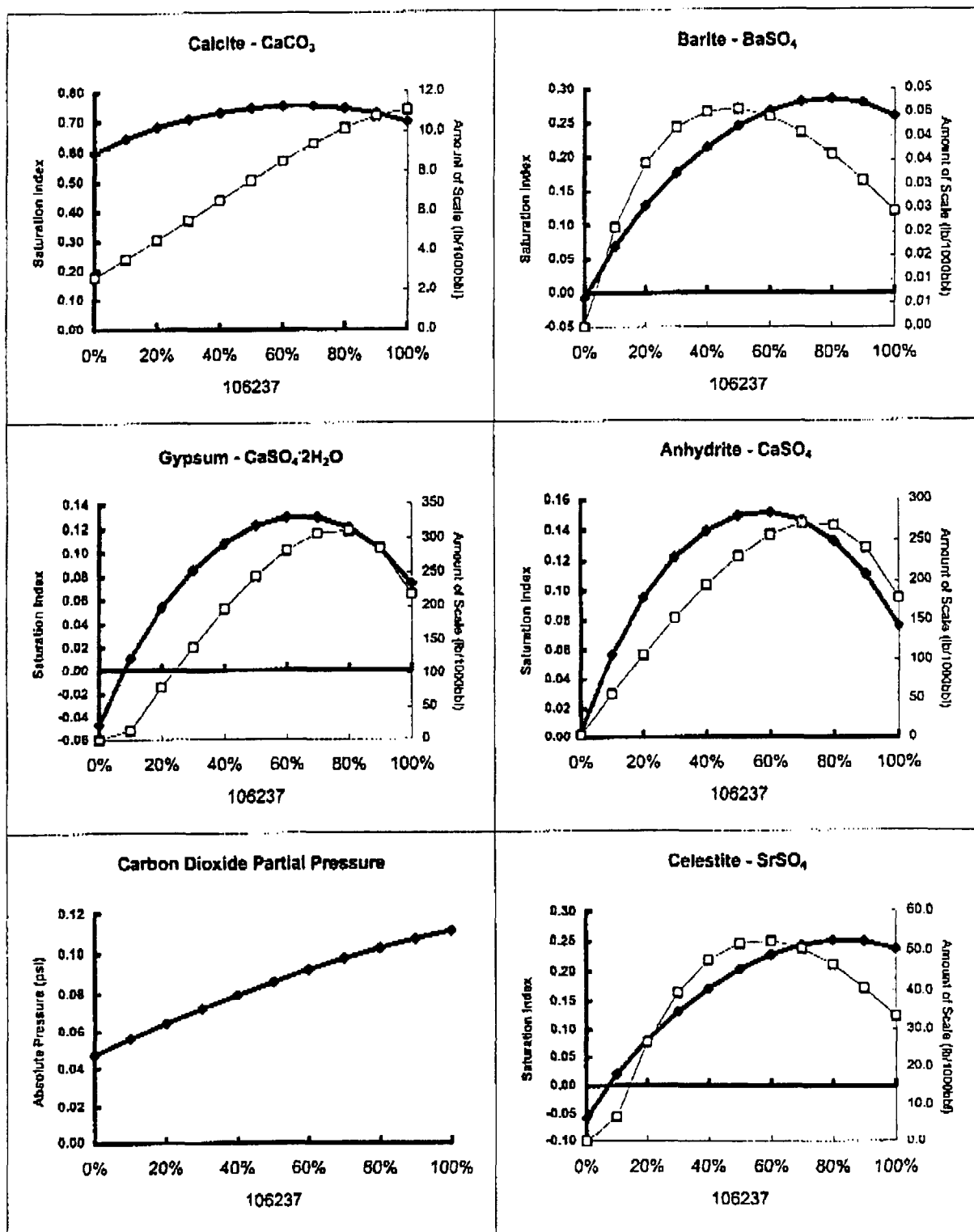
Note 3: CO<sub>2</sub> Pressure is absolute pressure. Total Pressure is gauge pressure.



Analysis: 22535

## Mixture Predictions from Baker-Petrolite

106237 with 106238 at 80°F and 0 psi







Analysis: 22535

## Water Analysis Report from Baker Petrolite

Mixes at 100°F and 0 psi

### Predictions of Carbon Dioxide Pressure, Saturation Index and Amount of Scale in lb/1000bbl

| Mix Waters |        | CO <sub>2</sub> | Calcite<br>CaCO <sub>3</sub> |        | Gypsum<br>CaSO <sub>4</sub> ·2H <sub>2</sub> O |        | Anhydrite<br>CaSO <sub>4</sub> |        | Celestite<br>SrSO <sub>4</sub> |        | Barite<br>BaSO <sub>4</sub> |        |
|------------|--------|-----------------|------------------------------|--------|------------------------------------------------|--------|--------------------------------|--------|--------------------------------|--------|-----------------------------|--------|
| 106237     | 106238 | psi             | Index                        | Amount | Index                                          | Amount | Index                          | Amount | Index                          | Amount | Index                       | Amount |
| 0%         | 100%   | 0.06            | 0.62                         | 3.0    | -0.13                                          |        | -0.01                          |        | -0.08                          |        | -0.21                       |        |
| 10%        | 90%    | 0.08            | 0.66                         | 4.1    | -0.07                                          |        | 0.04                           | 41     | -0.01                          |        | -0.13                       |        |
| 20%        | 80%    | 0.09            | 0.70                         | 5.2    | -0.03                                          |        | 0.08                           | 92     | 0.05                           | 18.3   | -0.07                       |        |
| 30%        | 70%    | 0.10            | 0.73                         | 6.3    | 0.01                                           | 13     | 0.11                           | 139    | 0.10                           | 32.5   | -0.02                       |        |
| 40%        | 60%    | 0.11            | 0.75                         | 7.5    | 0.03                                           | 63     | 0.13                           | 163    | 0.15                           | 41.5   | 0.02                        | 0.00   |
| 50%        | 50%    | 0.12            | 0.77                         | 8.6    | 0.05                                           | 104    | 0.14                           | 219    | 0.18                           | 46.3   | 0.05                        | 0.01   |
| 60%        | 40%    | 0.13            | 0.78                         | 9.7    | 0.06                                           | 135    | 0.15                           | 248    | 0.20                           | 47.7   | 0.07                        | 0.01   |
| 70%        | 30%    | 0.13            | 0.78                         | 10.8   | 0.06                                           | 150    | 0.14                           | 265    | 0.22                           | 46.4   | 0.08                        | 0.02   |
| 80%        | 20%    | 0.14            | 0.77                         | 11.7   | 0.05                                           | 144    | 0.13                           | 265    | 0.23                           | 42.9   | 0.09                        | 0.01   |
| 90%        | 10%    | 0.15            | 0.76                         | 12.5   | 0.04                                           | 109    | 0.11                           | 241    | 0.23                           | 37.6   | 0.08                        | 0.01   |
| 100%       | 0%     | 0.16            | 0.73                         | 12.9   | 0.01                                           | 30     | 0.08                           | 182    | 0.21                           | 30.8   | 0.06                        | 0.01   |

Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered.

Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the five scales.

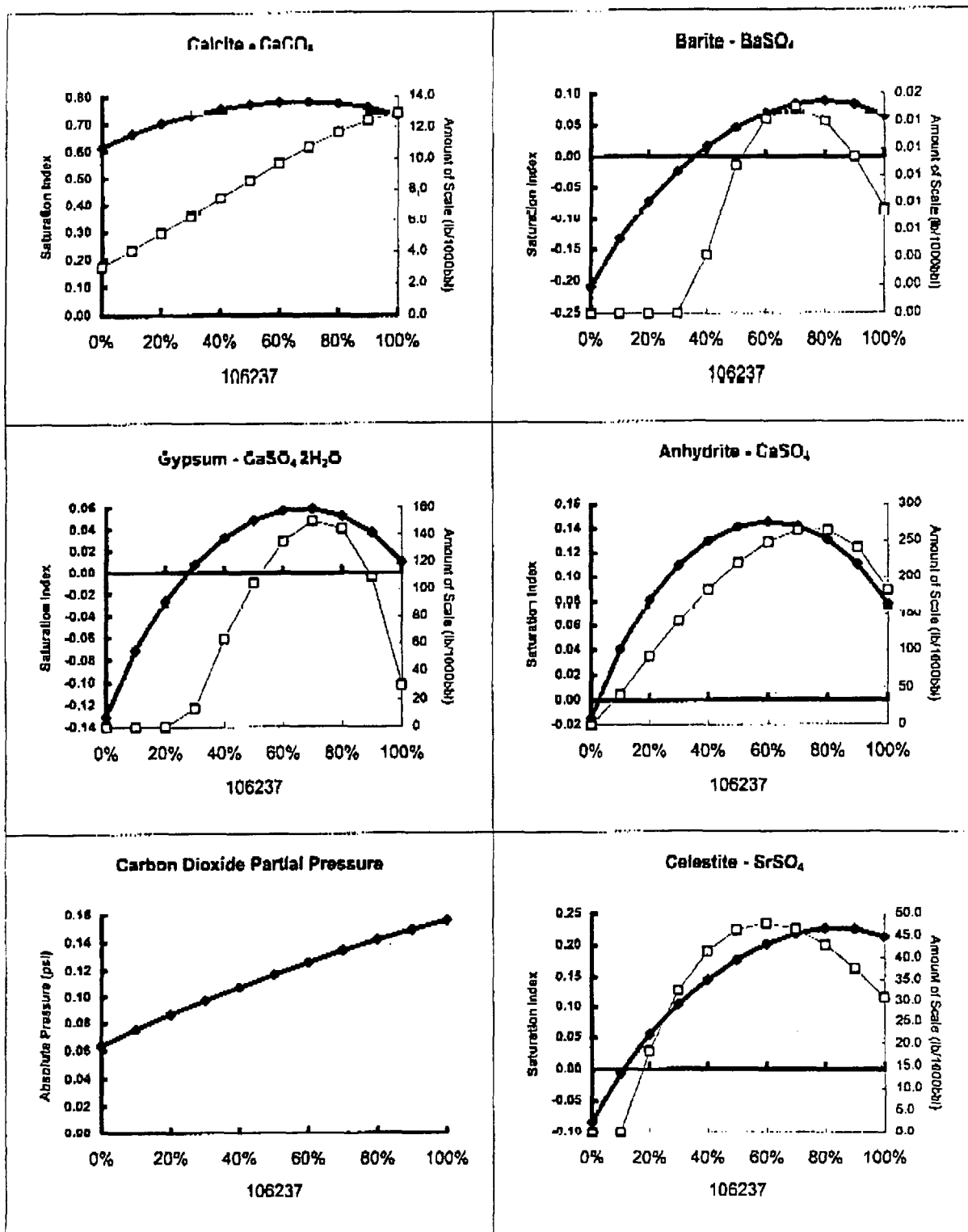
Note 3: CO<sub>2</sub> Pressure is absolute pressure. Total Pressure is gauge pressure.



Analysis: 22535

## Mixture Predictions from Baker-Petrolite

106237 with 106238 at 100°F and 0 psi





Analysis: 22535

## Water Analysis Report from Baker Petrolite

Mixes at 120°F and 0 psi

| Predictions of Carbon Dioxide Pressure, Saturation Index and Amount of Scale in lb/1000bbl |        |                 |                              |        |                                                |        |                                |        |                                |        |                             |        |
|--------------------------------------------------------------------------------------------|--------|-----------------|------------------------------|--------|------------------------------------------------|--------|--------------------------------|--------|--------------------------------|--------|-----------------------------|--------|
| Mix Waters                                                                                 |        | CO <sub>2</sub> | Calcite<br>CaCO <sub>3</sub> |        | Gypsum<br>CaSO <sub>4</sub> ·2H <sub>2</sub> O |        | Anhydrite<br>CaSO <sub>4</sub> |        | Celestite<br>SrSO <sub>4</sub> |        | Barite<br>BaSO <sub>4</sub> |        |
| 106237                                                                                     | 106238 | psi             | Index                        | Amount | Index                                          | Amount | Index                          | Amount | Index                          | Amount | Index                       | Amount |
| 0%                                                                                         | 100%   | 0.08            | 0.63                         | 3.5    | -0.20                                          |        | -0.01                          |        | -0.10                          |        | -0.39                       |        |
| 10%                                                                                        | 90%    | 0.10            | 0.68                         | 4.6    | -0.14                                          |        | 0.05                           | 50     | -0.02                          |        | -0.31                       |        |
| 20%                                                                                        | 80%    | 0.11            | 0.72                         | 5.8    | -0.09                                          |        | 0.09                           | 103    | 0.04                           | 14.2   | -0.25                       |        |
| 30%                                                                                        | 70%    | 0.13            | 0.75                         | 7.1    | -0.06                                          |        | 0.12                           | 154    | 0.09                           | 28.9   | -0.20                       |        |
| 40%                                                                                        | 60%    | 0.14            | 0.77                         | 8.4    | -0.03                                          |        | 0.14                           | 201    | 0.13                           | 38.3   | -0.16                       |        |
| 50%                                                                                        | 50%    | 0.16            | 0.79                         | 9.7    | -0.01                                          |        | 0.16                           | 242    | 0.16                           | 43.5   | -0.13                       |        |
| 60%                                                                                        | 40%    | 0.17            | 0.80                         | 11.0   | -0.00                                          |        | 0.16                           | 276    | 0.19                           | 45.3   | -0.10                       |        |
| 70%                                                                                        | 30%    | 0.18            | 0.80                         | 12.2   | 0.00                                           | 2.28   | 0.16                           | 298    | 0.21                           | 44.3   | -0.09                       |        |
| 80%                                                                                        | 20%    | 0.19            | 0.80                         | 13.3   | -0.00                                          |        | 0.15                           | 305    | 0.21                           | 41.1   | -0.08                       |        |
| 90%                                                                                        | 10%    | 0.20            | 0.79                         | 14.3   | -0.02                                          |        | 0.14                           | 290    | 0.21                           | 36.1   | -0.09                       |        |
| 100%                                                                                       | 0%     | 0.21            | 0.76                         | 14.9   | -0.04                                          |        | 0.11                           | 241    | 0.20                           | 29.4   | -0.11                       |        |

Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered.

Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the five scales.

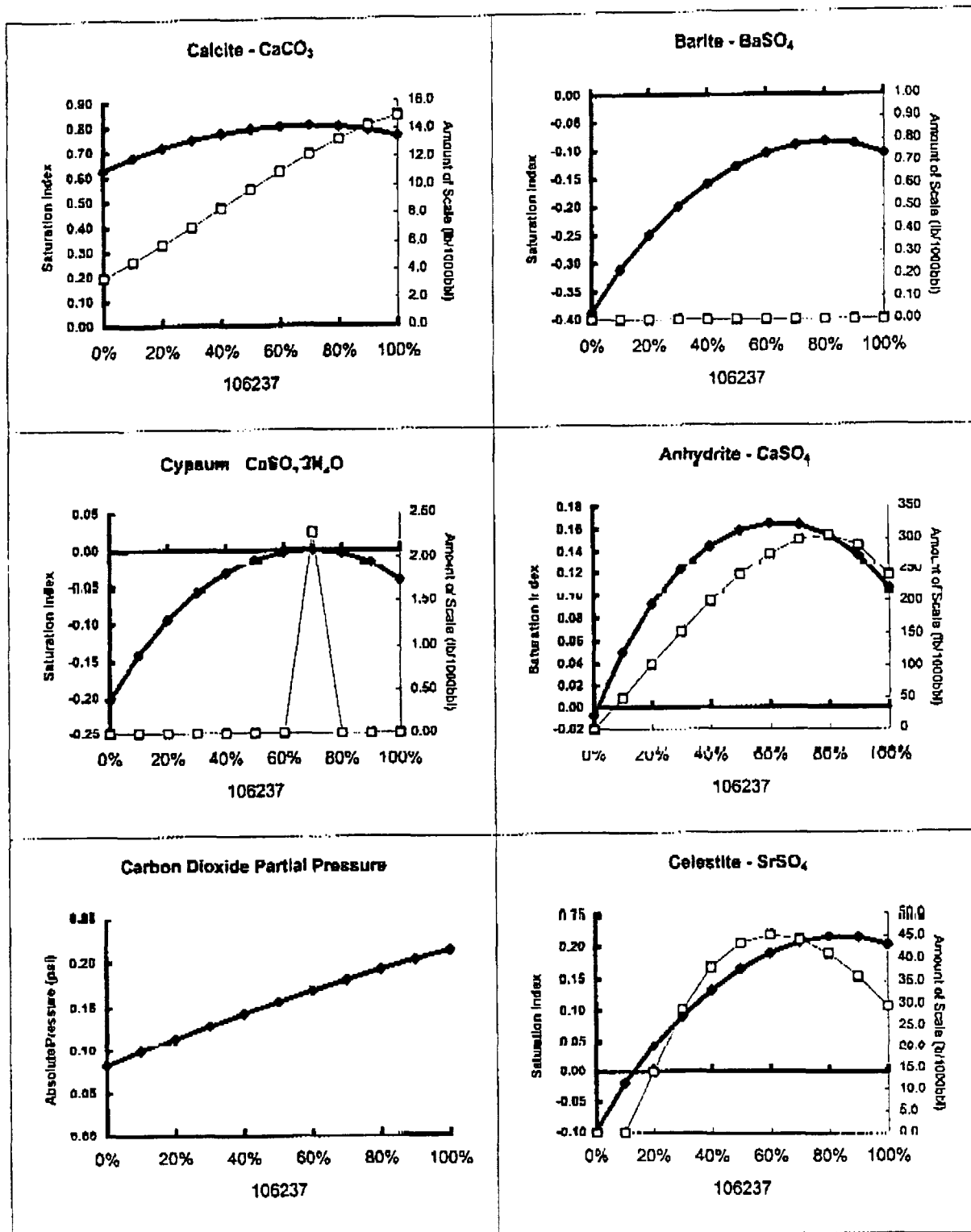
Note 3: CO<sub>2</sub> Pressure is absolute pressure. Total Pressure is gauge pressure.



Analysis: 22535

## Mixture Predictions from Baker-Petrolite

106237 with 106238 at 120°F and 0 psi





Analysis: 22535

## Water Analysis Report from Baker Petrolite

Mixes at 140°F and 0 psi

mixes at 140 °F and 0 psi

| Predictions of Carbon Dioxide Pressure, Saturation Index and Amount of Scale in lh/1000hbl |        |                 |                              |        |                                                |        |                                |        |                                |        |                             |        |
|--------------------------------------------------------------------------------------------|--------|-----------------|------------------------------|--------|------------------------------------------------|--------|--------------------------------|--------|--------------------------------|--------|-----------------------------|--------|
| Mix Waters                                                                                 |        | CO <sub>2</sub> | Calcite<br>CaCO <sub>3</sub> |        | Gypsum<br>CaSO <sub>4</sub> ·2H <sub>2</sub> O |        | Anhydrite<br>CaSO <sub>4</sub> |        | Celestite<br>SrSO <sub>4</sub> |        | Barite<br>BaSO <sub>4</sub> |        |
| 106237                                                                                     | 106238 | psi             | Index                        | Amount | Index                                          | Amount | Index                          | Amount | Index                          | Amount | Index                       | Amount |
| 0%                                                                                         | 100%   | 0.11            | 0.64                         | 3.9    | -0.26                                          |        | 0.02                           | 19     | -0.10                          |        | -0.54                       |        |
| 10%                                                                                        | 90%    | 0.13            | 0.69                         | 5.2    | -0.20                                          |        | 0.08                           | 79     | -0.02                          |        | -0.46                       |        |
| 20%                                                                                        | 80%    | 0.15            | 0.73                         | 6.6    | -0.15                                          |        | 0.13                           | 136    | 0.04                           | 13.4   | -0.40                       |        |
| 30%                                                                                        | 70%    | 0.17            | 0.77                         | 8.0    | -0.11                                          |        | 0.16                           | 192    | 0.09                           | 28.1   | -0.35                       |        |
| 40%                                                                                        | 60%    | 0.19            | 0.79                         | 9.5    | -0.09                                          |        | 0.18                           | 244    | 0.13                           | 37.6   | -0.31                       |        |
| 50%                                                                                        | 50%    | 0.20            | 0.81                         | 10.9   | -0.07                                          |        | 0.20                           | 291    | 0.16                           | 42.9   | -0.28                       |        |
| 60%                                                                                        | 40%    | 0.22            | 0.82                         | 12.4   | -0.05                                          |        | 0.21                           | 331    | 0.19                           | 44.7   | -0.26                       |        |
| 70%                                                                                        | 30%    | 0.24            | 0.83                         | 13.8   | -0.05                                          |        | 0.21                           | 362    | 0.20                           | 43.8   | -0.24                       |        |
| 80%                                                                                        | 20%    | 0.25            | 0.82                         | 15.1   | -0.05                                          |        | 0.20                           | 379    | 0.21                           | 40.7   | -0.23                       |        |
| 90%                                                                                        | 10%    | 0.27            | 0.81                         | 16.3   | -0.06                                          |        | 0.18                           | 375    | 0.21                           | 35.7   | -0.24                       |        |
| 100%                                                                                       | 0%     | 0.29            | 0.79                         | 17.1   | -0.09                                          |        | 0.16                           | 339    | 0.20                           | 29.2   | -0.25                       |        |

Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered.

Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the five scales.

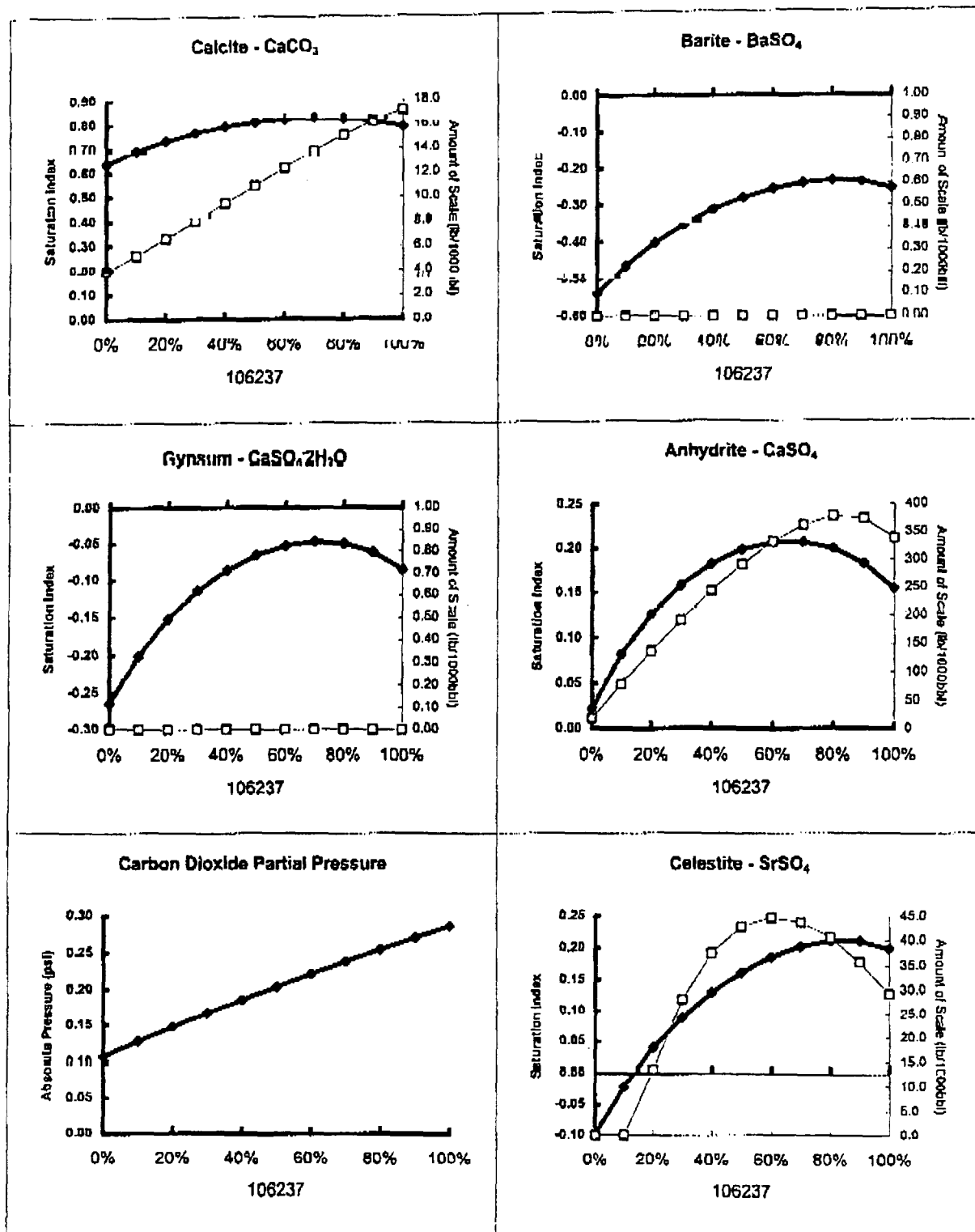
Note 3: CO<sub>2</sub> Pressure is absolute pressure. Total Pressure is gauge pressure.



Analysis: 22535

## Mixture Predictions from Baker-Petrolite

106237 with 106238 at 140°F and 0 psi



**RESERVOIR SIMULATION STUDY  
EAST SHUGART (Delaware) FIELD  
Eddy & Lea Counties, New Mexico**

**RESERVOIR DATA**

- ★ **Computerized analysis of modern logs from 19 wells**
- ★ **Geologic maps - Structure top, gross thickness, net thickness & porosity**
- ★ **Well Completion Reports**
- ★ **Acoustic Buildup tests from Geronimo 4, Conoco 1 & Inca 2 wells**
- ★ **Production Test Data**
- ★ **Allocated Monthly Production Data by well**

NEW MEXICO  
OIL CONSERVATION DIVISION

\_\_\_\_\_ EXHIBIT 30 \_\_\_\_\_

CASE NO. \_\_\_\_\_

**Table 1**

**RESERVOIR PROPERTIES  
East Shugart (Delaware) Field  
Eddy & Lea Counties, New Mexico**

| <b>Reservoir Properties</b>                  | <b>Value</b> |
|----------------------------------------------|--------------|
| Discovery Date                               | 10/05/85     |
| Average Depth, feet                          | 5000         |
| Productive Area, acres                       | 380          |
| Gross Thickness, feet                        | 438          |
| Net Thickness, feet                          | 174          |
| Average Porosity, %                          | 16.8         |
| Average Permeability, md.                    | 3.9          |
| Average Water Saturation, %                  | 55.2         |
| Initial Reservoir Pressure, psia             | 1830         |
| Reservoir Temperature, °F                    | 115          |
| API Gravity @ 60 °F                          | 38.9         |
| Bubble Point Pressure ( $p_b$ ), psia        | 1830         |
| Oil Formation Volume Factor @ $p_b$ , RB/STB | 1.2204       |
| Oil Viscosity @ $p_b$ , cp                   | 0.855        |
| Solution GOR @ $p_b$ , SCF/STB               | 481          |
| OOIP/acre-foot, STB/ac-ft                    | 478          |
| OOIP, MSTB                                   | 31645        |

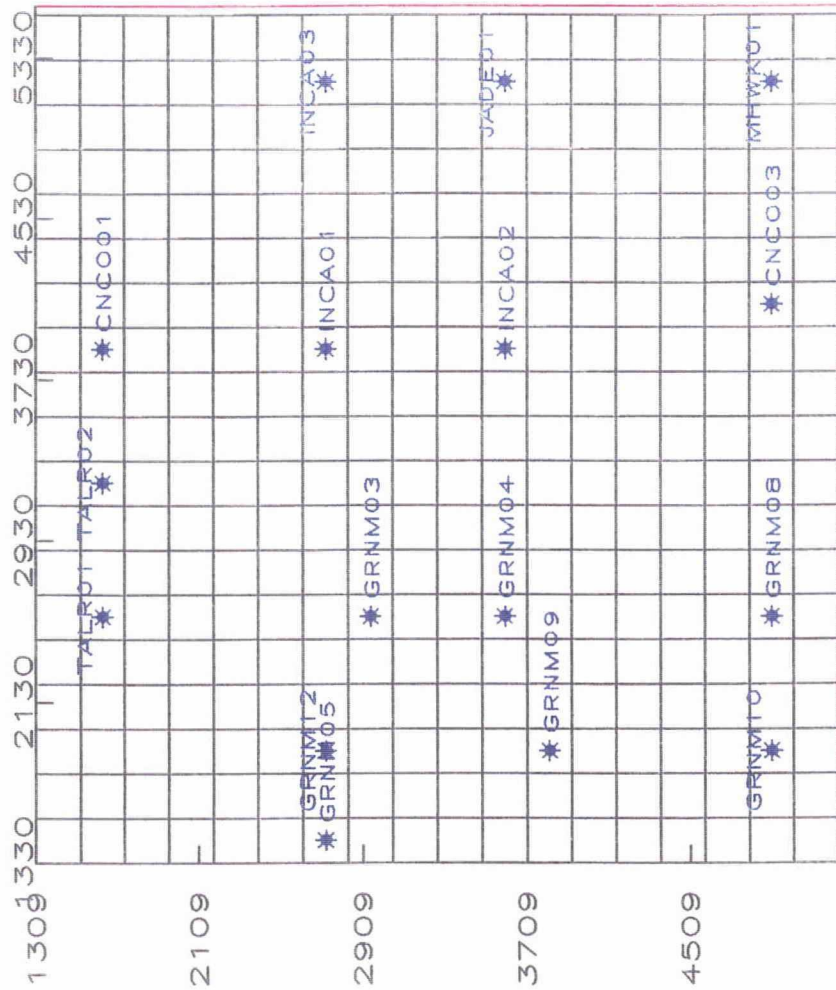
NEW MEXICO  
OIL CONSERVATION DIVISION

EXHIBIT 31



WELLS at step 83 4474 DAYS

\* Producer  
 • Shut in well  
 \* Injector



NEW MEXICO  
OIL CONSERVATION DIVISION

EXHIBIT

32

CASE NO.

GRID MAP

EAST SHUGART (DELAWARE) FIELD

EDDY & LEA COUNTIES, NEW MEXICO

FIGURE 4

EXHIBIT 33

CASE NO. \_\_\_\_\_

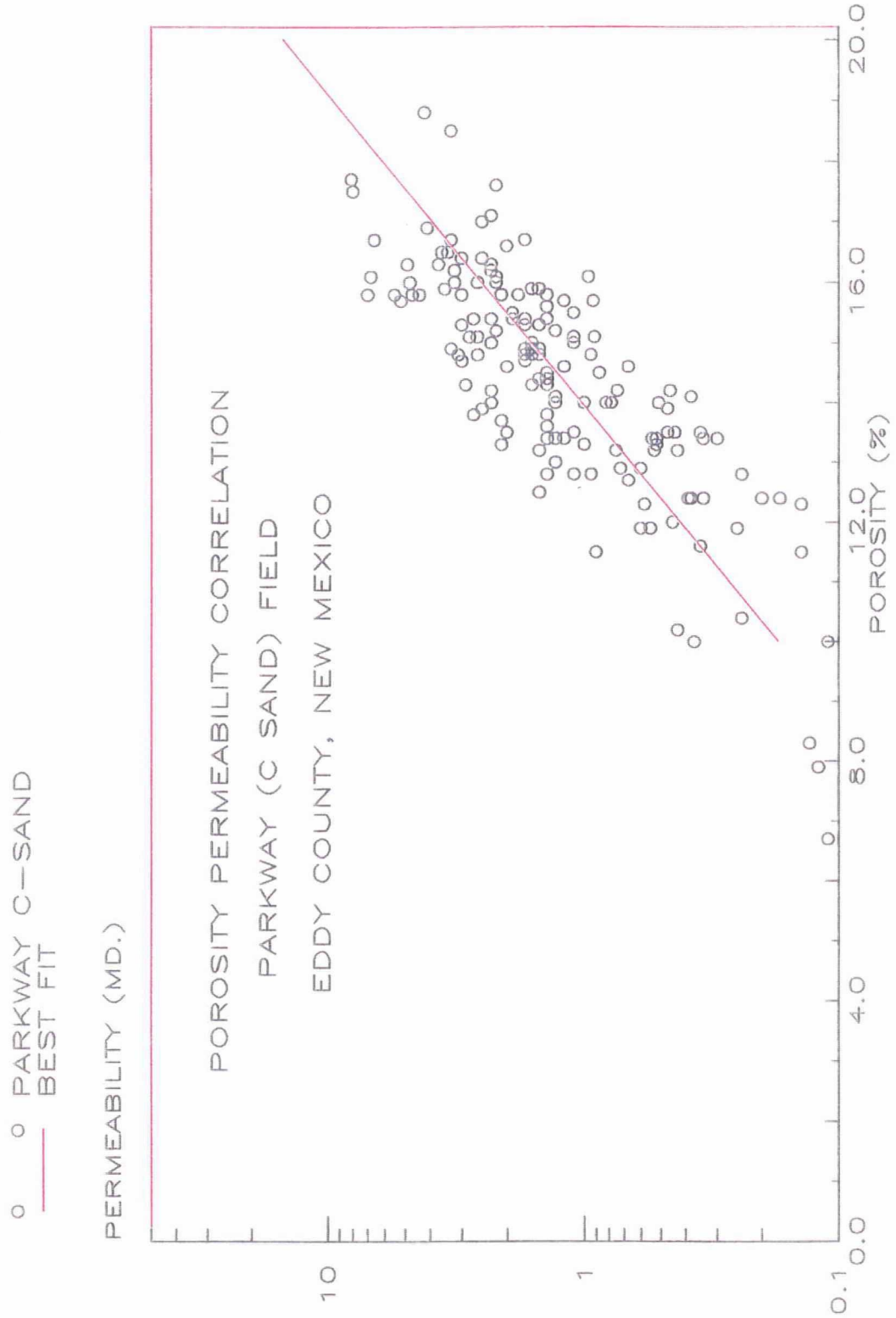


FIGURE 5

**RESERVOIR SIMULATION STUDY  
EAST SHUGART (Delaware) FIELD  
Eddy & Lea Counties, New Mexico**

**HISTORY MATCH RESULTS**

| <b>Cum Prod<br/>thru' 9/31/97</b> | <b>Model</b> | <b>Historical</b> | <b>% Error</b> |
|-----------------------------------|--------------|-------------------|----------------|
| <b>Oil</b>                        | <b>2240</b>  | <b>2172</b>       | <b>3.1</b>     |
| <b>Gas</b>                        | <b>4906</b>  | <b>4747</b>       | <b>3.3</b>     |
| <b>Water</b>                      | <b>1081</b>  | <b>1788</b>       | <b>39.5</b>    |

**The above match was obtained with very little changes  
in Log Derived reservoir data**

**Net pay derived from logs were reduced by 20% for  
GERONIMO LEASE**

RECEIVED BY ON DIVISION  
EXHIBIT 34  
CASE NO. \_\_\_\_\_

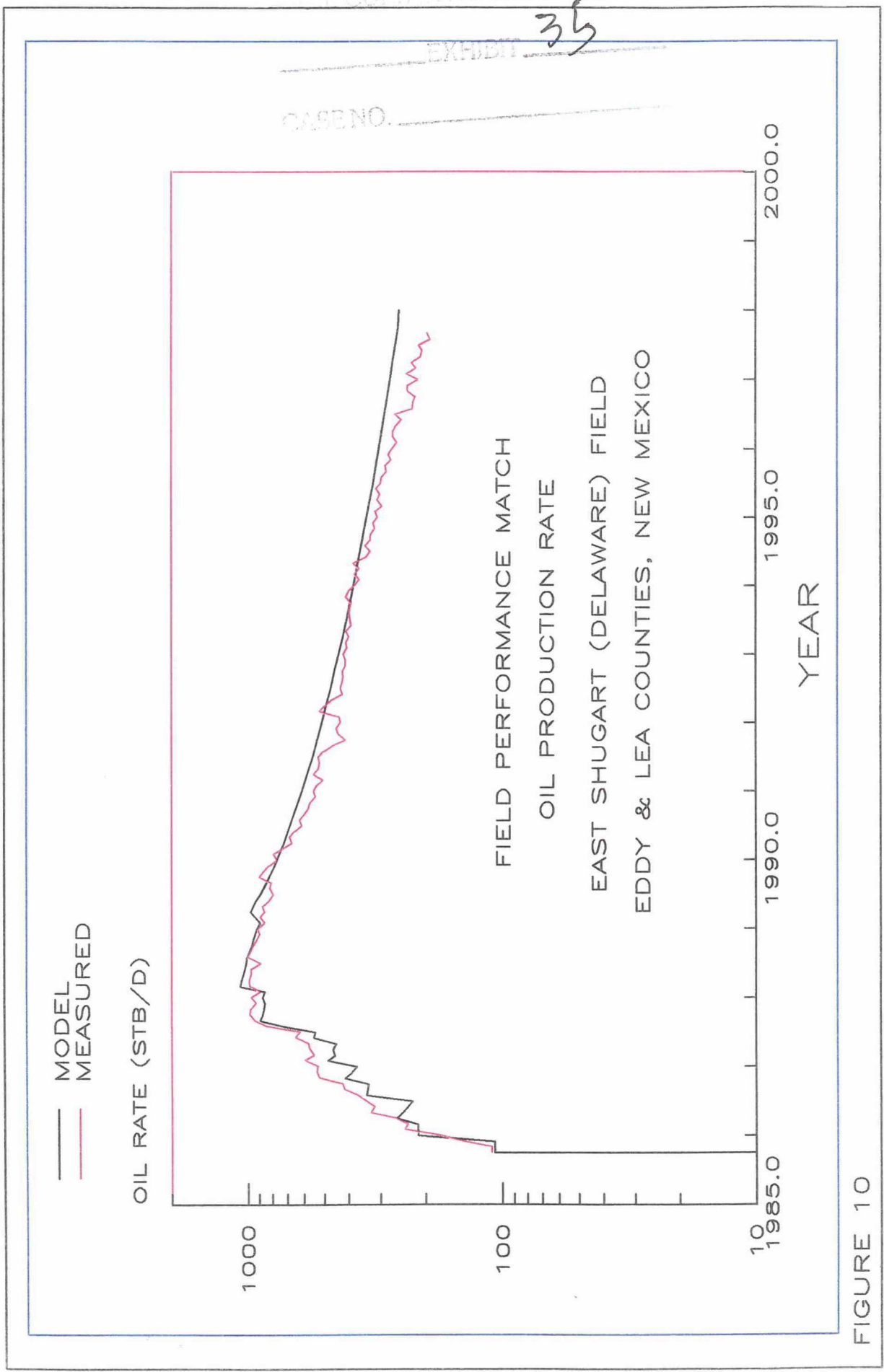


FIGURE 10

shugbu

# EAST SHUGART DELAWARE

## BUILD-UP DATA

| WELL NAME   | DATE OF TEST     | FRACTURE LENGTH   | ORIGINAL COMPLETION                                         | COMP DATE |
|-------------|------------------|-------------------|-------------------------------------------------------------|-----------|
| Inca #1     | May-97           | 0'                | Acidize w/ 2000 gal.<br>Frac w/ 75,000 gal & 133,800 # sand | May-87    |
| Inca #2     | May-97           | 0'                | Acidize w/ 1000 gal.<br>Frac w/ 23,000 gal & 46,000 # sand  | Jun-87    |
| Jade #1     | May-97           | 0'                | Acidize w/ 2000 gal.<br>Frac w/ 73,000 gal & 111,300 # sand | Jun-87    |
| Geronimo #4 | Jul-94<br>Oct-97 | 126' to 77'<br>0' | Acidize w/ 1000 gal.<br>Frac w/ 32,000 gal & 62,000 # sand  | Dec-85    |

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DATE NO. \_\_\_\_\_

37

EXHIBIT

CASE NO. \_\_\_\_\_

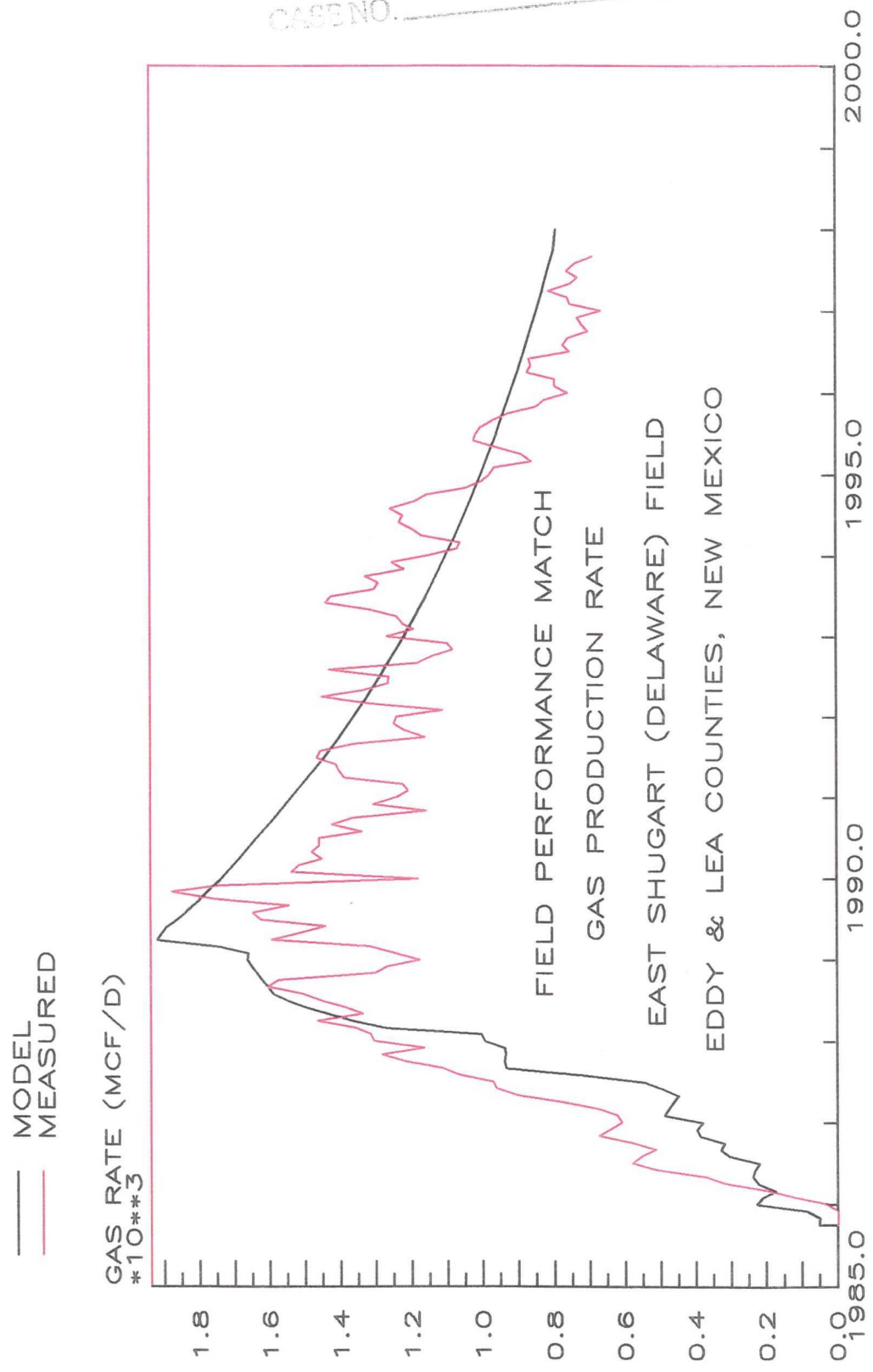


FIGURE 12

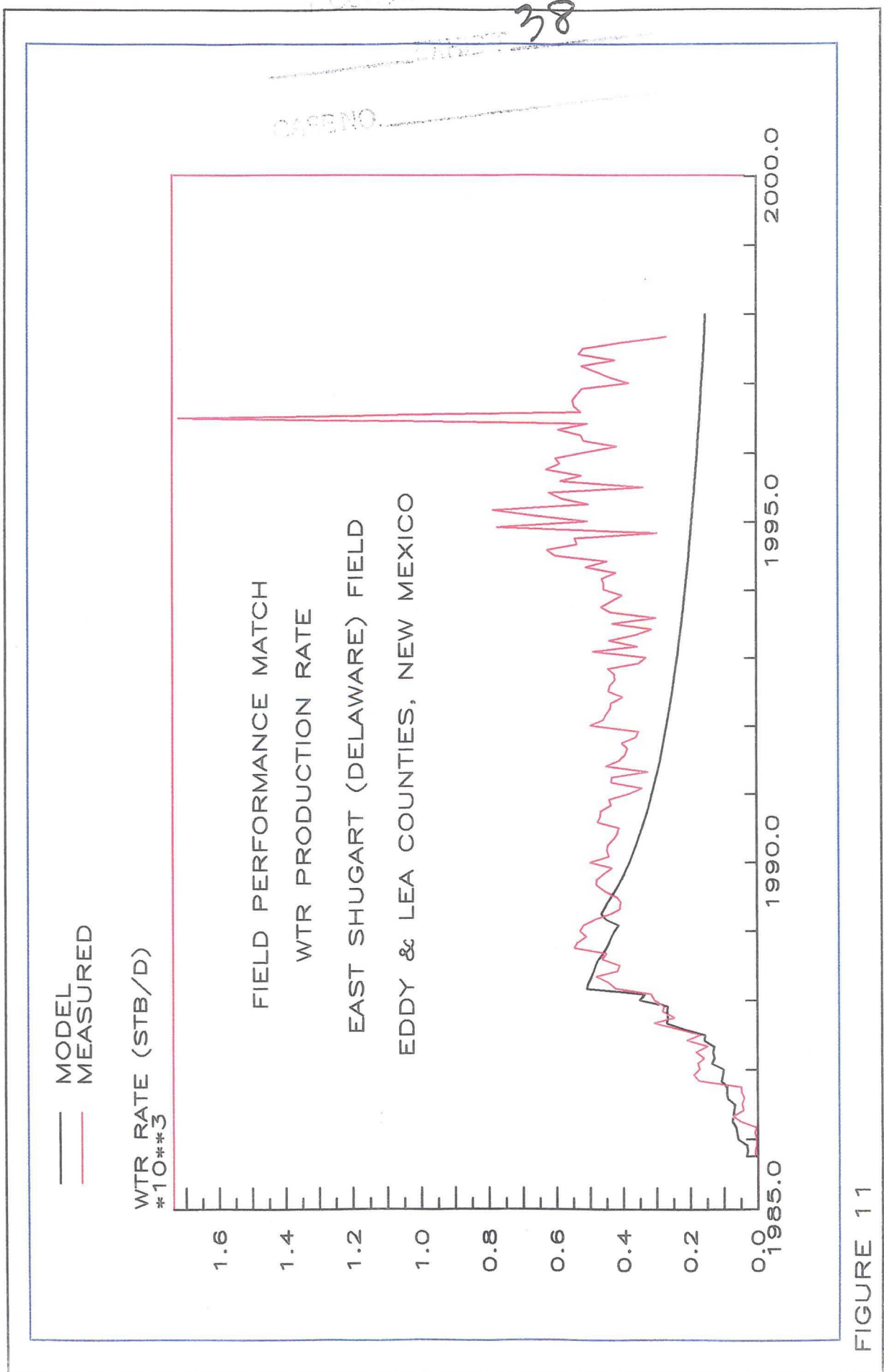
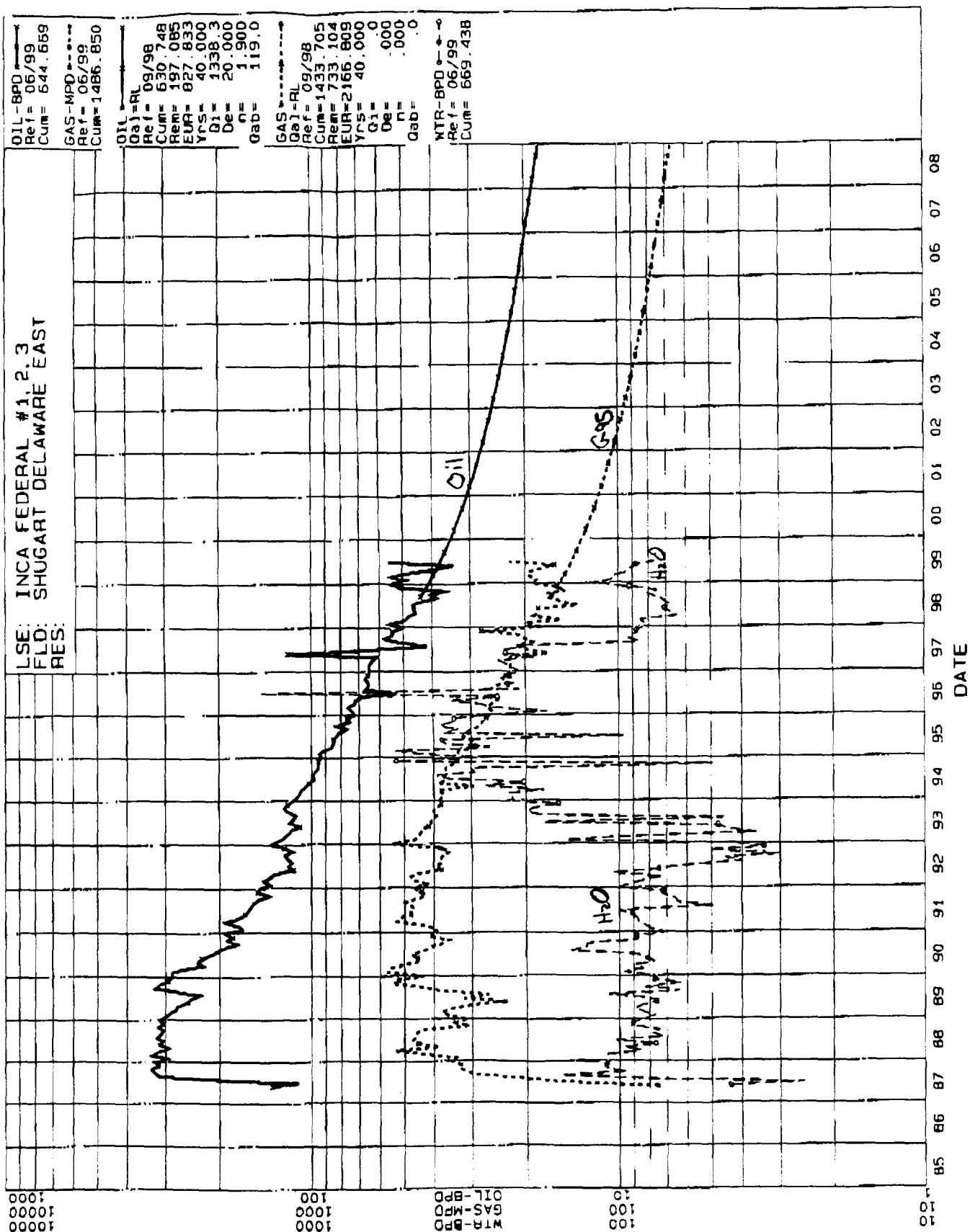


FIGURE 11





39  
ON 3/20/80  
EXHIBIT

PRESSURE MATCH  
EAST SHUGART (DELAWARE) FIELD  
EDDY & LEA COUNTIES, NEW MEXICO

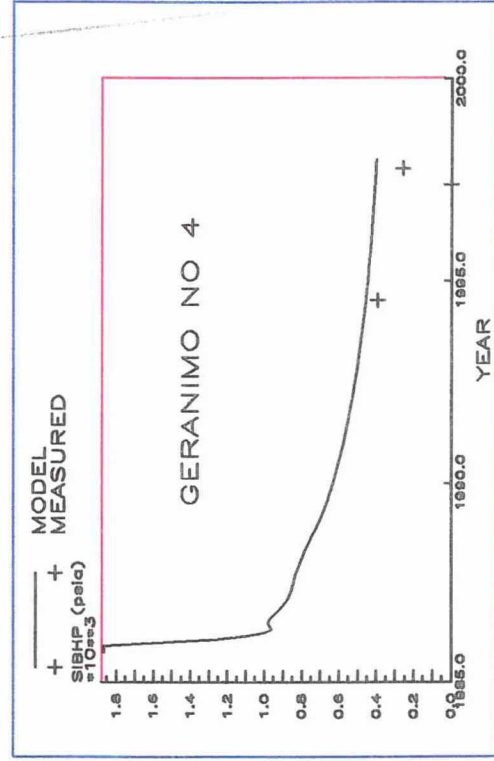
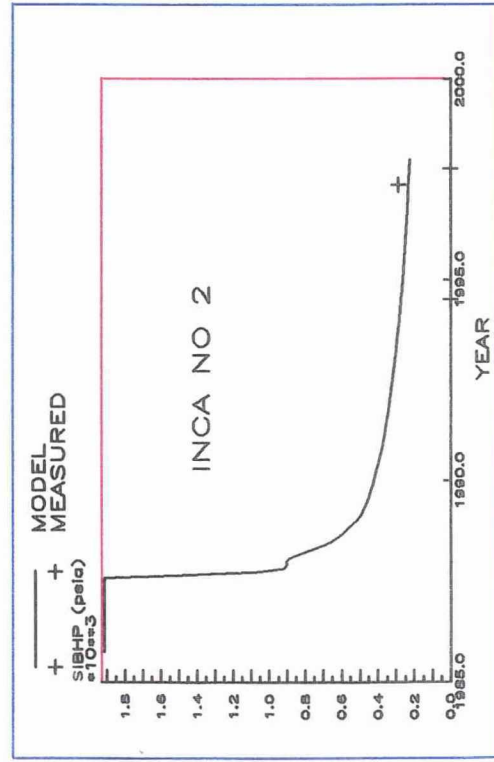
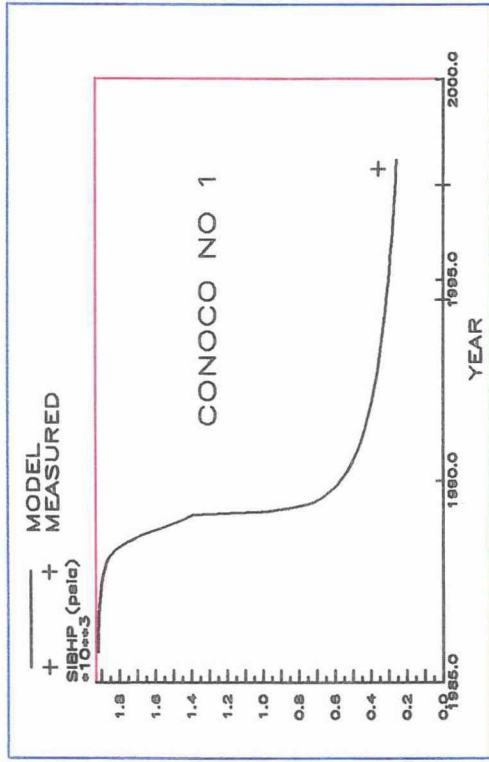


FIGURE 15

**RESERVOIR SIMULATION STUDY  
EAST SHUGART (Delaware) FIELD  
Eddy & Lea Counties, New Mexico**

**PERFORMANCE PREDICTIONS**

**Four prediction cases were run. These are:**

- ★ Primary depletion with existing perforations.**
- ★ Primary depletion with existing plus added perforations.**
- ★ Secondary depletion (Waterflood) using existing perforations and drilling nine (9) injection wells and converting Taylor 3 to injector.**
- ★ Secondary depletion using existing plus added perforations and drilling nine (9) injection wells and converting Taylor 3 to injector.**

APPROVED \_\_\_\_\_  
DATE \_\_\_\_\_  
40  
PAGE \_\_\_\_\_

EXHIBIT

41

CASE NO. \_\_\_\_\_

— BASE  
--- ADD-PRF  
..... WTRFLD  
- - - - - MEASURED  
OIL RATE (STB/D)

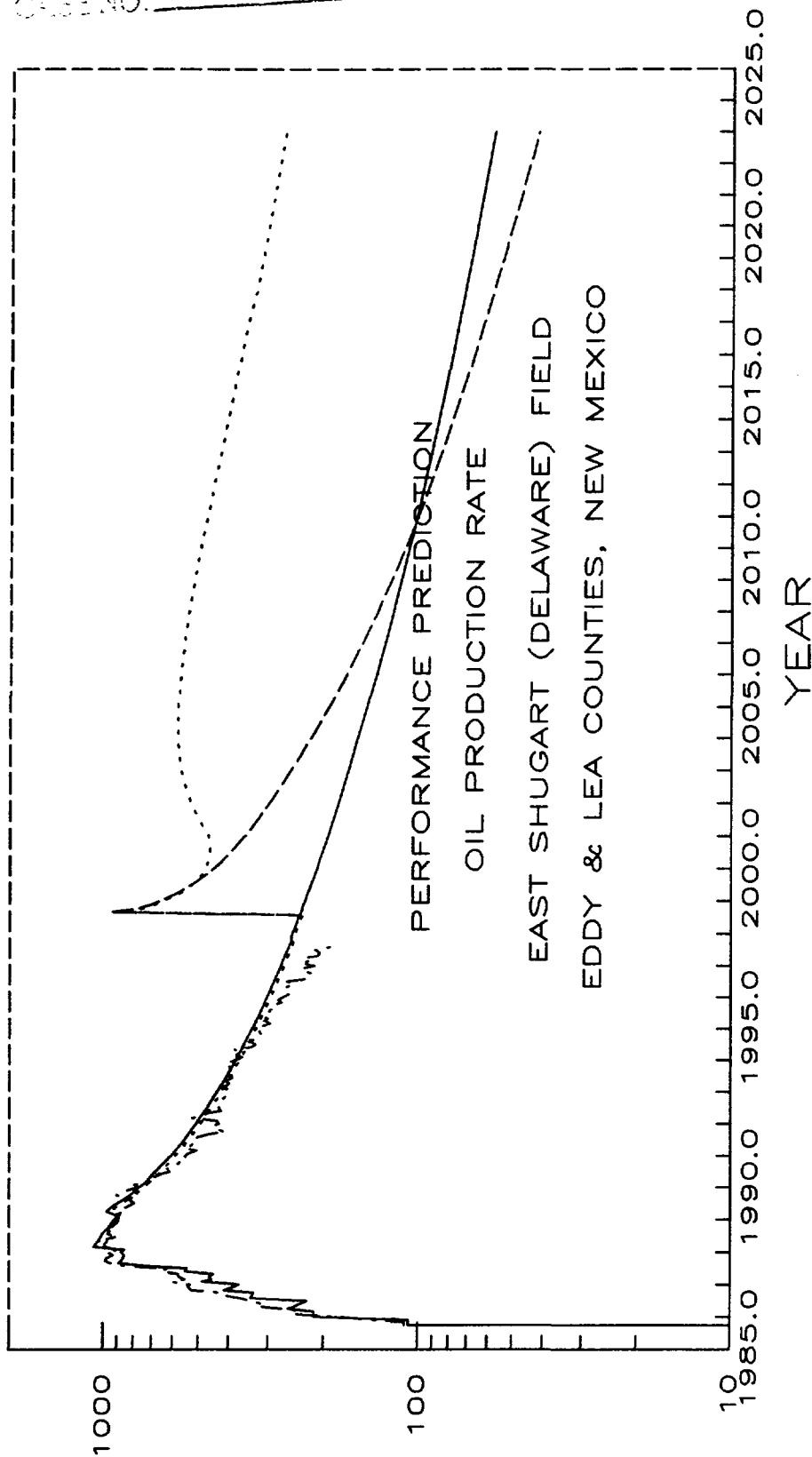


FIGURE 16

Oil & Gas Division  
A2  
EXHIBIT

CASE NO.

# **RESERVOIR SIMULATION STUDY EAST SHUGART (Delaware) FIELD Eddy & Lea Counties, New Mexico**

## **CONCLUSIONS**

- ★ **It is feasible to waterflood the Delaware zone of East Shugart Field.**
- ★ **Primary reserves for the existing perforations are calculated to be 1015.9 MSTB.**
- ★ **Primary reserves for the behind pipe zones within the Delaware formation are calculated to be 361.2 MSTB.**
- ★ **Secondary reserves using existing perforations are calculated to be 1305.3 MSTB.**
- ★ **Secondary reserves for the behind pipe zones are calculated to be 1282.5 MSTB.**
- ★ **Total reserves including primary (Existing perfs + behind pipe) and secondary (existing perfs + behind pipe) are 3964.9 MSTB.**

**Note: These reserves are estimated as of 8/1/98 and are calculated for production through year 2022**

SHUGART

# SHUGART WATERFLOOD WATERFLOOD PARAMETERS

| WELL NAME       | ACRES | % OF<br>ACRES | ACRES<br>% OF<br>UNIT | OOIP<br>MBO | % OF<br>OOIP | OOIP<br>% OF<br>UNIT | CUM OIL | % OF<br>CUM OIL | CUM OIL<br>% OF<br>UNIT | REM RES<br>PRIM. | % OF<br>REM RES<br>PRIM. | REM RES<br>% OF<br>UNIT | RATE<br>1 to 5/98 | % OF<br>RATE | RATE<br>% OF<br>UNIT | TRACT<br>UNIT<br>% |
|-----------------|-------|---------------|-----------------------|-------------|--------------|----------------------|---------|-----------------|-------------------------|------------------|--------------------------|-------------------------|-------------------|--------------|----------------------|--------------------|
| Conoco #1       | 41.01 | 0.0679        | 0.0034                | 1581        | 0.051        | 0.0204               | 232.327 | 0.1077          | 0.0162                  | 83.6             | 0.1176                   | 0.0176                  | 2912              | 0.111        | 0.0277               | 0.0853             |
| Conoco #3       | 41.04 | 0.0679        | 0.0034                | 2096        | 0.068        | 0.0270               | 61.687  | 0.0286          | 0.0043                  | 52.3             | 0.0736                   | 0.0110                  | 1359              | 0.052        | 0.0129               | 0.0587             |
| Geronimo #3     | 40    | 0.0662        | 0.0033                | 3461        | 0.111        | 0.0446               | 344.146 | 0.1595          | 0.0239                  | 99.1             | 0.1394                   | 0.0209                  | 3245              | 0.124        | 0.0309               | 0.1237             |
| Geronimo #4     | 40    | 0.0662        | 0.0033                | 3392        | 0.109        | 0.0437               | 214.007 | 0.0992          | 0.0149                  | 47               | 0.0661                   | 0.0099                  | 1581              | 0.060        | 0.0151               | 0.0869             |
| Geronimo #5     | 20    | 0.0331        | 0.0017                | 950         | 0.031        | 0.0122               | 63.232  | 0.0293          | 0.0044                  | 1.3              | 0.0018                   | 0.0003                  | 460               | 0.018        | 0.0044               | 0.0229             |
| Geronimo #8     | 40    | 0.0662        | 0.0033                | 1323        | 0.043        | 0.0170               | 45.005  | 0.0209          | 0.0031                  | 9.1              | 0.0128                   | 0.0019                  | 680               | 0.026        | 0.0065               | 0.0319             |
| Geronimo #9     | 40    | 0.0662        | 0.0033                | 2076        | 0.067        | 0.0267               | 117.993 | 0.0547          | 0.0082                  | 58.4             | 0.0821                   | 0.0123                  | 1745              | 0.067        | 0.0166               | 0.0672             |
| Geronimo #10    | 40    | 0.0662        | 0.0033                | 692         | 0.022        | 0.0089               | 30.654  | 0.0142          | 0.0021                  | 14.8             | 0.0208                   | 0.0031                  | 626               | 0.024        | 0.0060               | 0.0234             |
| Geronimo #12    | 20    | 0.0331        | 0.0017                | 950         | 0.031        | 0.0122               | 39.609  | 0.0184          | 0.0028                  | 3.8              | 0.0053                   | 0.0008                  | 460               | 0.018        | 0.0044               | 0.0218             |
| Inca #1         | 40.69 | 0.0674        | 0.0034                | 2652        | 0.085        | 0.0342               | 259.954 | 0.1205          | 0.0181                  | 58.2             | 0.0818                   | 0.0123                  | 2698              | 0.103        | 0.0257               | 0.0936             |
| Inca #2         | 40.69 | 0.0674        | 0.0034                | 3832        | 0.123        | 0.0494               | 221.764 | 0.1028          | 0.0154                  | 58.2             | 0.0818                   | 0.0123                  | 2898              | 0.110        | 0.0276               | 0.1080             |
| Inca #3         | 40.69 | 0.0674        | 0.0034                | 1782        | 0.057        | 0.0230               | 142.78  | 0.0662          | 0.0099                  | 58.2             | 0.0818                   | 0.0123                  | 1770              | 0.067        | 0.0169               | 0.0654             |
| Inca #1         | 40    | 0.0662        | 0.0033                | 2263        | 0.073        | 0.0292               | 159.99  | 0.0742          | 0.0111                  | 93.3             | 0.1312                   | 0.0197                  | 2899              | 0.110        | 0.0276               | 0.0909             |
| Mohawk #1       | 40    | 0.0662        | 0.0033                | 1031        | 0.033        | 0.0133               | 30.251  | 0.0140          | 0.0021                  | 16.7             | 0.0235                   | 0.0035                  | 591               | 0.023        | 0.0056               | 0.0279             |
| South Taylor #2 | 40    | 0.0662        | 0.0033                | 1938        | 0.062        | 0.0250               | 193.865 | 0.0899          | 0.0135                  | 57.1             | 0.0803                   | 0.0120                  | 2316              | 0.088        | 0.0221               | 0.0759             |
| South Taylor #3 | 40    | 0.0662        | 0.0033                | 1030        | 0.033        | 0.0133               | 0       | 0.0000          | 0.0000                  | 0                | 0.0000                   | 0.0000                  | 0                 | 0.000        | 0.0000               | 0.0166             |

TOTAL FIELD 604.12 1.000 0.050 31049 1.000 0.400 2157.264 1.000 0.150 711 1.000 0.150 26240 1.000 0.250 1.000  
PARAMETER % 0.05 0.4 0.15 0.25

Model 1b.

AP 2  
6/1/98  
David's Data

David's Data

BEFORE EXAMINER CATANACH  
OIL CONSERVATION DIVISION  
EXHIBIT NO. 43  
CASE NO. \_\_\_\_\_

## East Shugart Delaware Unit

Page 1

EXHIBIT NO.

**BEFORE EXAMINER CATANACH**  
**OIL CONSERVATION DIVISION**

shugintoil

**EAST SHUGART DELAWARE UNIT  
COMPARING UNIT vs. JADE #1  
INTOIL INTEREST**

|                                             | <b>TOTAL UNIT<br/>Primary +<br/>W/O +<br/><u>Waterflood</u></b> | <b><u>JADE #1</u></b> |
|---------------------------------------------|-----------------------------------------------------------------|-----------------------|
| W. I.                                       | 4.54%                                                           | 50.00%                |
| R. I.                                       | 3.98%                                                           | 43.75%                |
| <b>Intoil Net Reserves</b>                  | 172 MBO<br>138 MMCF                                             | 38 MBO<br>106 MMCF    |
| <b>Current Production<br/>at March 1999</b> |                                                                 |                       |
| BOPD                                        | 174(G) 7(N)                                                     | 16(G) 7(N)            |
| MCFPD                                       | 550(G) 22(N)                                                    | 48(G) 21(N)           |
| <b>Undisc. Net<br/>Cash Flow</b>            | 2966 M\$                                                        | 574 M\$               |

BEFORE EXAMINER CATIONACH

OIL CONSERVATION DIVISION

EXHIBIT NO. 45

PAGE NO. \_\_\_\_\_

10000  
1000

1000  
100

GAS-MPD  
OIL-BPD

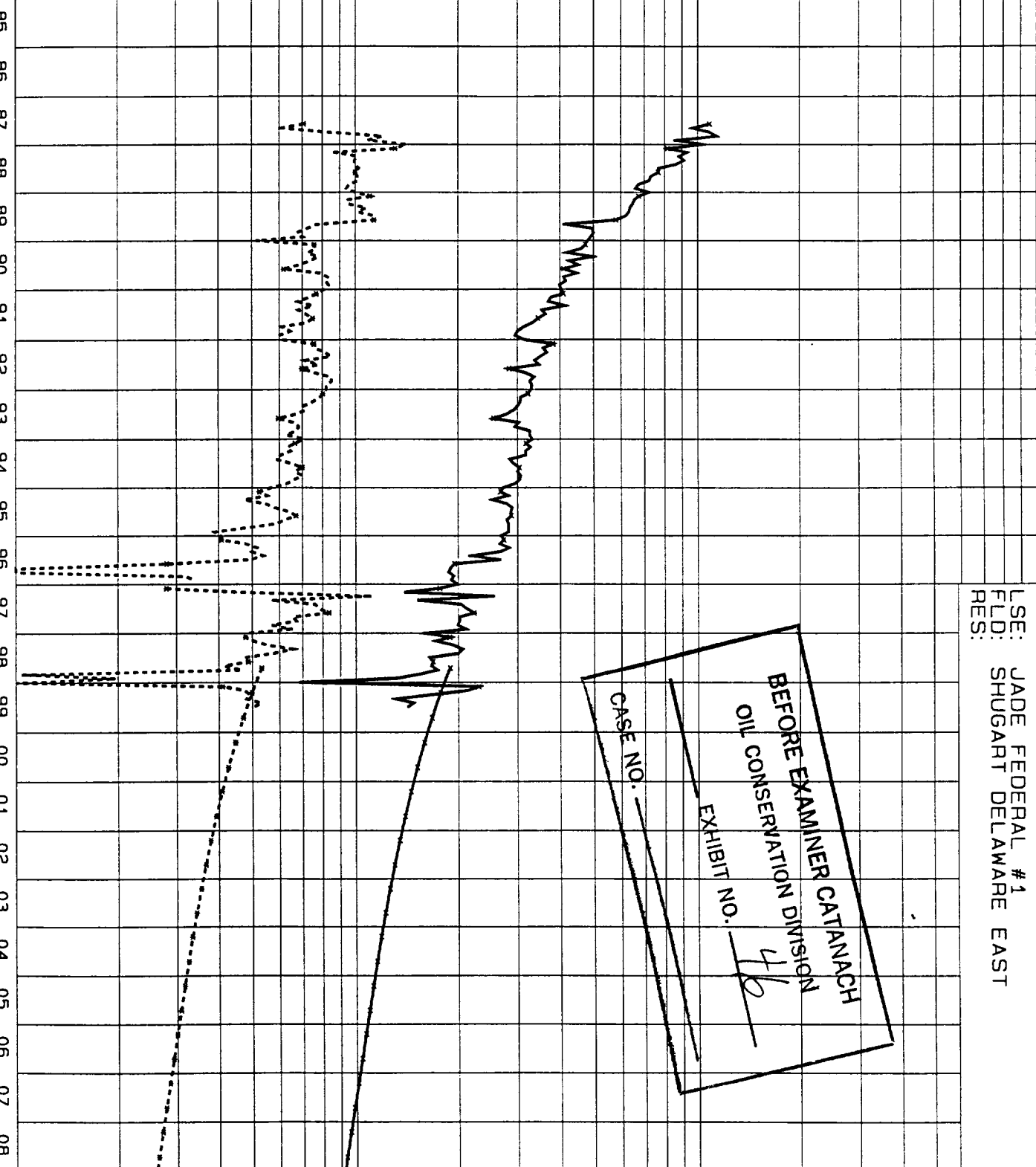
100  
10

10  
1

LSE: JADE FEDERAL #1  
FLD: SHUGART DELAWARE EAST  
RES:

BEFORE EXAMINER CATANACH  
OIL CONSERVATION DIVISION  
EXHIBIT NO. 46  
CASE NO.

DATE



|               |             |
|---------------|-------------|
| OIL-BPD       | Ref = 06/99 |
| Cum = 166.225 |             |
| GAS-MPD       | Ref = 06/99 |
| Cum = 297.799 |             |
| OIL           | Ref = 09/98 |
| Cum = 161.676 |             |
| Rem = 99.092  |             |
| EUR = 260.768 |             |
| YPS = 40.000  |             |
| Q1 = 577.9    |             |
| De = 13.000   |             |
| n = 1.900     |             |
| Qad = 61.2    |             |
| GAS           | Ref = 09/98 |
| Cum = 287.048 |             |
| Rem = 279.198 |             |
| EUR = 566.246 |             |
| YPS = 40.000  |             |
| Q1 = 0        |             |
| De = .000     |             |
| n = .000      |             |
| Qad = .0      |             |



INJ-BPD  
WTR-BPD  
GAS-MPD  
OIL-BPD

100  
1000  
100  
10

10  
100  
10  
1

1  
10  
1  
10

1  
1  
1  
01

LSE: JADE FEDERAL  
FLD: SHUGART YATES 7RVRS ON GRAYBURG  
RES:  
WEL: 000002  
OPR: ST MARY LAND & EXPLOR

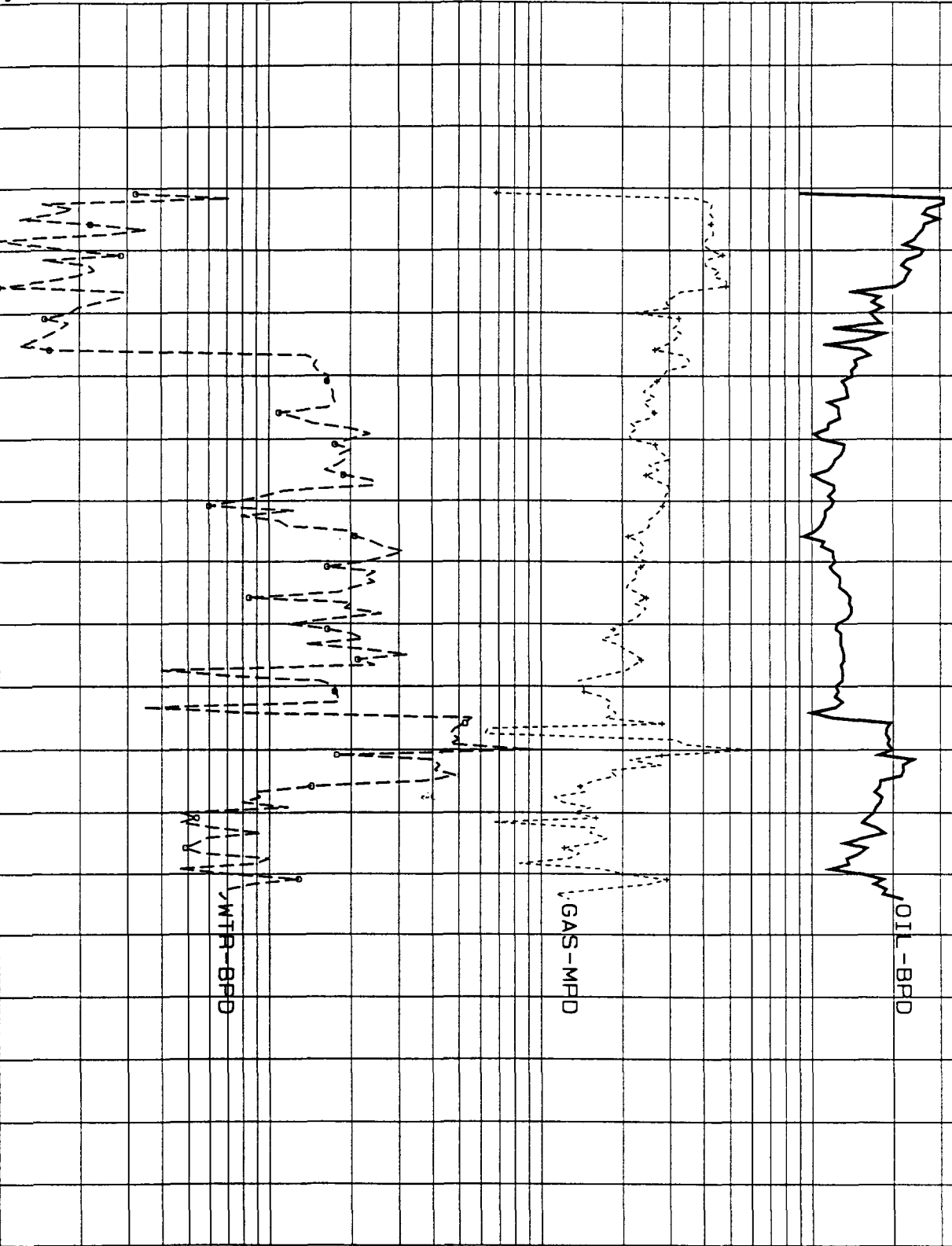
OIL-BPD

GAS-MPD

WTR-BPD

DATE

85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04



10000  
100

1000  
10

GAS-MPD  
OIL-BPD

100  
1

10  
1

LSE: GERONIMO FEDERAL #9  
FLD: SHUGART DELAWARE EAST  
RES:

OIL-BPD  
Ref= 06/99  
Cum= 123.633

GAS-MPD  
Ref= 06/99  
Cum= 386.465

OIL  
Ref= 09/98  
Cum= 118.979  
Rem= 65.399  
EUR= 184.378  
Yrs= 40.000  
Q1= 381.4  
De= 13.000  
n= 1.900  
Gab= 40.4

GAS  
Ref= 09/98  
Cum= 381.886  
Rem= 104.118  
EUR= 486.004  
Yrs= 40.000  
Q1= 0  
De= .000  
n= .000  
Gab= .0

DATE

