

**STATE OF NEW MEXICO  
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT  
OIL CONSERVATION COMMISSION**

**APPLICATION OF GOODNIGHT  
MIDSTREAM PERMIAN LLC FOR APPROVAL  
OF A SALTWATER DISPOSAL WELL,  
LEA COUNTY, NEW MEXICO.**

**COMM. CASE NO. 24123**

**APPLICATIONS OF GOODNIGHT  
MIDSTREAM PERMIAN LLC FOR APPROVAL  
OF SALTWATER DISPOSAL WELLS,  
LEA COUNTY, NEW MEXICO.**

**DIV. CASE NOS. 23614-23617**

**APPLICATION OF GOODNIGHT  
MIDSTREAM PERMIAN, LLC TO AMEND  
ORDER NO. R-22026/SWD-2403 TO INCREASE  
THE APPROVED INJECTION RATE IN ITS  
ANDRE DAWSON SWD #1,  
LEA COUNTY, NEW MEXICO.**

**DIV. CASE NO. 23775**

**APPLICATIONS OF EMPIRE NEW MEXICO LLC  
TO REVOKE INJECTION AUTHORITY,  
LEA COUNTY, NEW MEXICO.**

**DIV. CASE NOS. 24018-24020, 24025**

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**EMPIRE NEW MEXICO LLC'S  
NOTICE OF SUPPLEMENTAL EXHIBITS**

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Empire New Mexico, LLC, through its undersigned counsel, submits the following supplemental exhibits that were admitted into the record during the hearing in these matters on April 11, 2025.

Respectfully submitted,

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**CERTIFICATE OF SERVICE**

I hereby certify that a true and correct copy of the foregoing was served on the following counsel of record by electronic mail on May 14, 2025.

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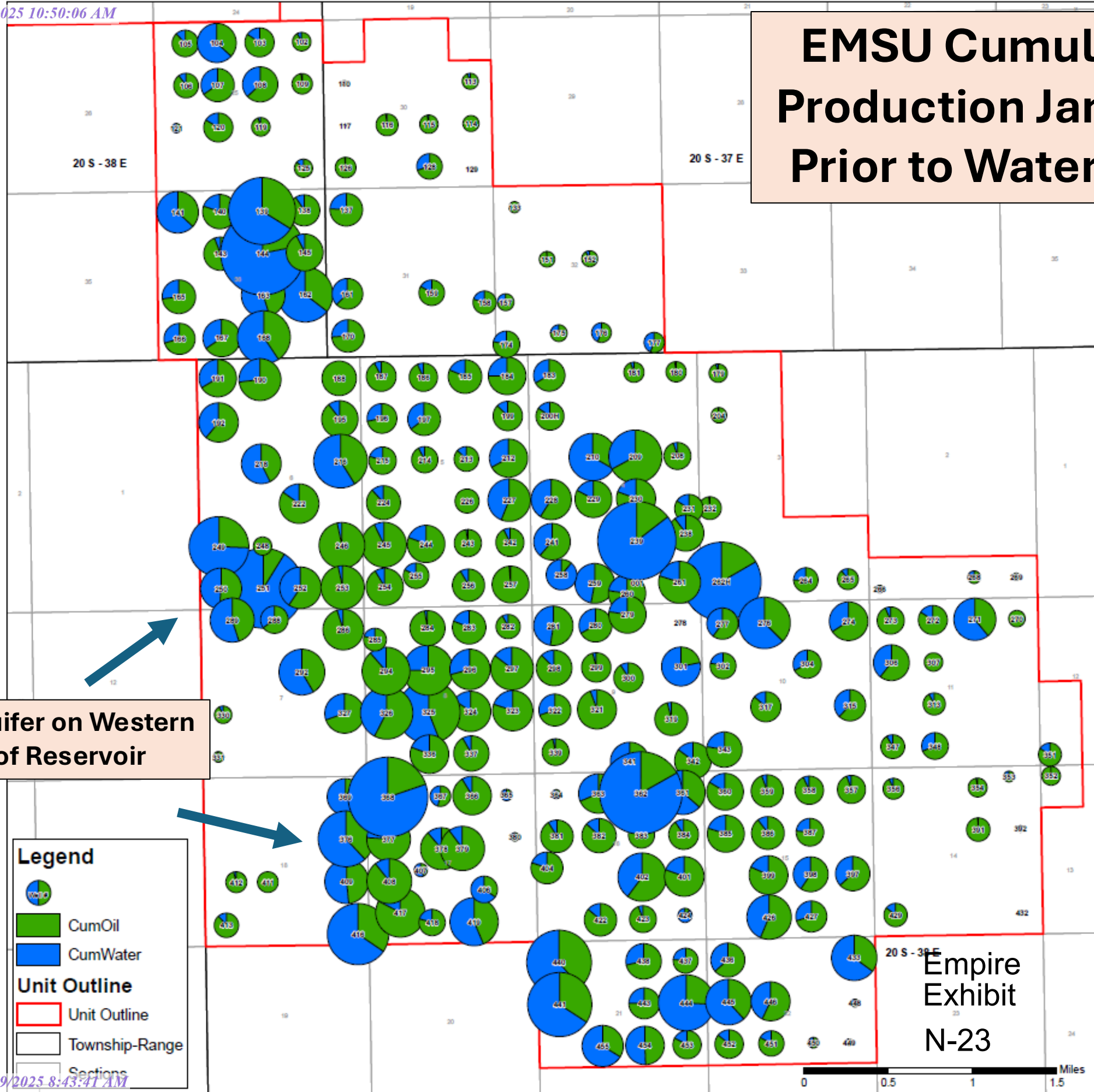
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# EMSU Cumulative Production Jan-1986 Prior to Waterflood

Weak Aquifer on Western  
Edge of Reservoir

## Legend

-  CumOil
-  CumWater
- Unit Outline**
-  Unit Outline
-  Township-Range
-  Sections





# Evidence of Communication Between San Andres & Grayburg

Page 1001 – Dr. Robert Lindsay PhD

In a few well locations in Arrowhead there was also a problem with Upper San Andres Formation bottom-water production that ascended up into the Grayburg Formation strata via vertical plumes of water along swarms of narrow, short-spaced fractures (Figure 9.15).

Page 1004 – Dr. Robert Lindsay PhD

These plumes of vertically-oriented Upper San Andres Formation bottom-water only affected small areas in the unit and in most cases only affected one well, though mapped as if the bottom-water was affecting a larger area (Figure 9.15). Similar vertically-oriented plumes of Upper San Andres Formation bottom-water were also encountered in individual wells further north in Eunice Monument South Unit (EMSU) and Eunice Monument South Unit Expansion Area B (EMSUB).

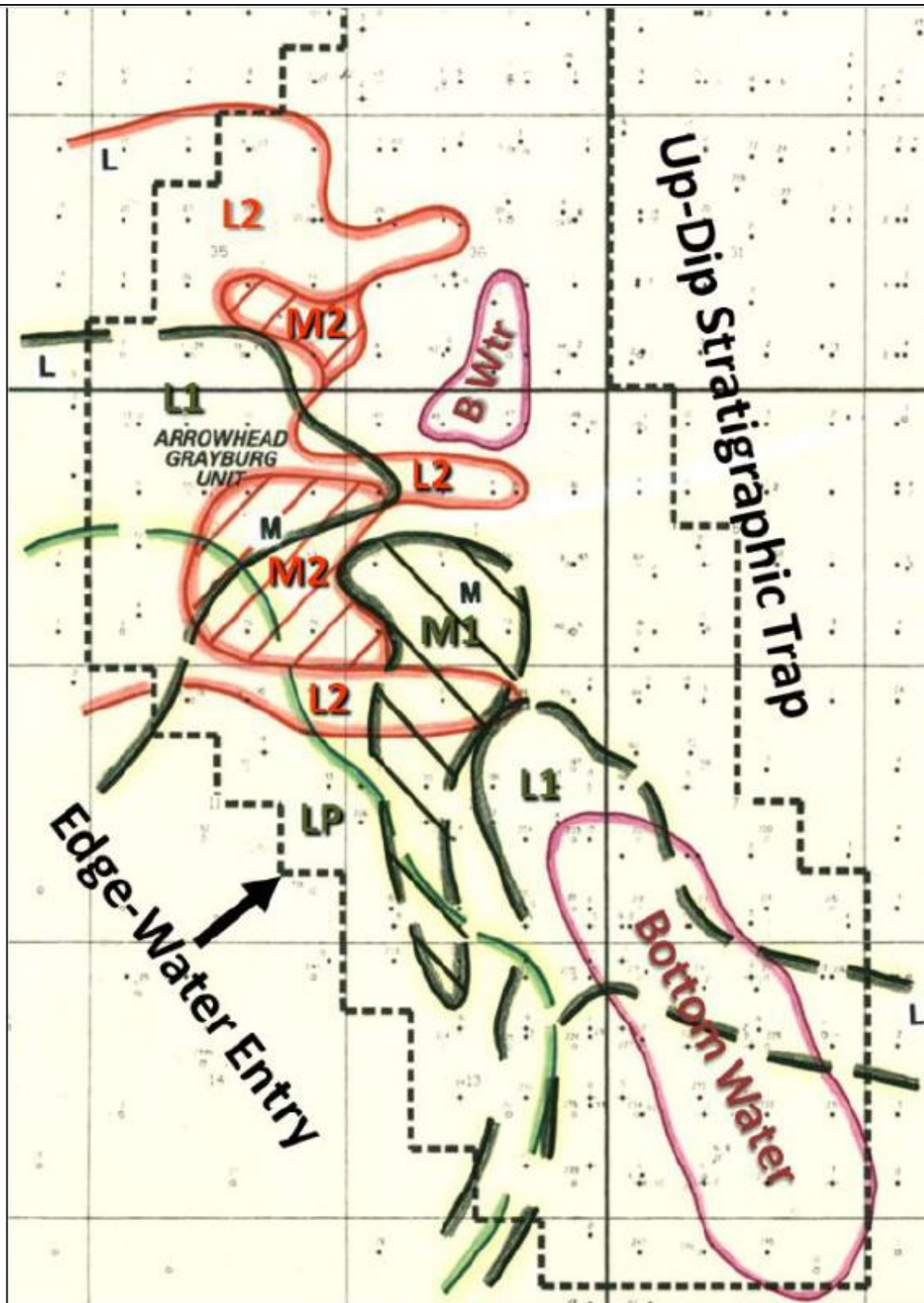


Figure 9.15. Grayburg Formation Arrowhead Grayburg Unit (AGU) with bottom water and four beds of high porosity-permeability dolograstone that are each 0.5 m (1.5 ft) thick. These high perm streaks pulled water up-dip into the reservoir by a drop in reservoir pressure during field production. To avoid high water production these beds were not utilized as part of the waterflood.

# EXISTING & PROPOSED GRAYBURG & SAN ANDRES WATERFLOODS

Lea County, New Mexico

PROPOSED  
MONUMENT

NORTH HOBBS

SOUTH HOBBS

SKAGGS

GREENHILL

EMSUB

EMSU

PROPOSED  
ARROWHEAD

TEXAS

T. 18 S.

T. 19 S.

T. 20 S.

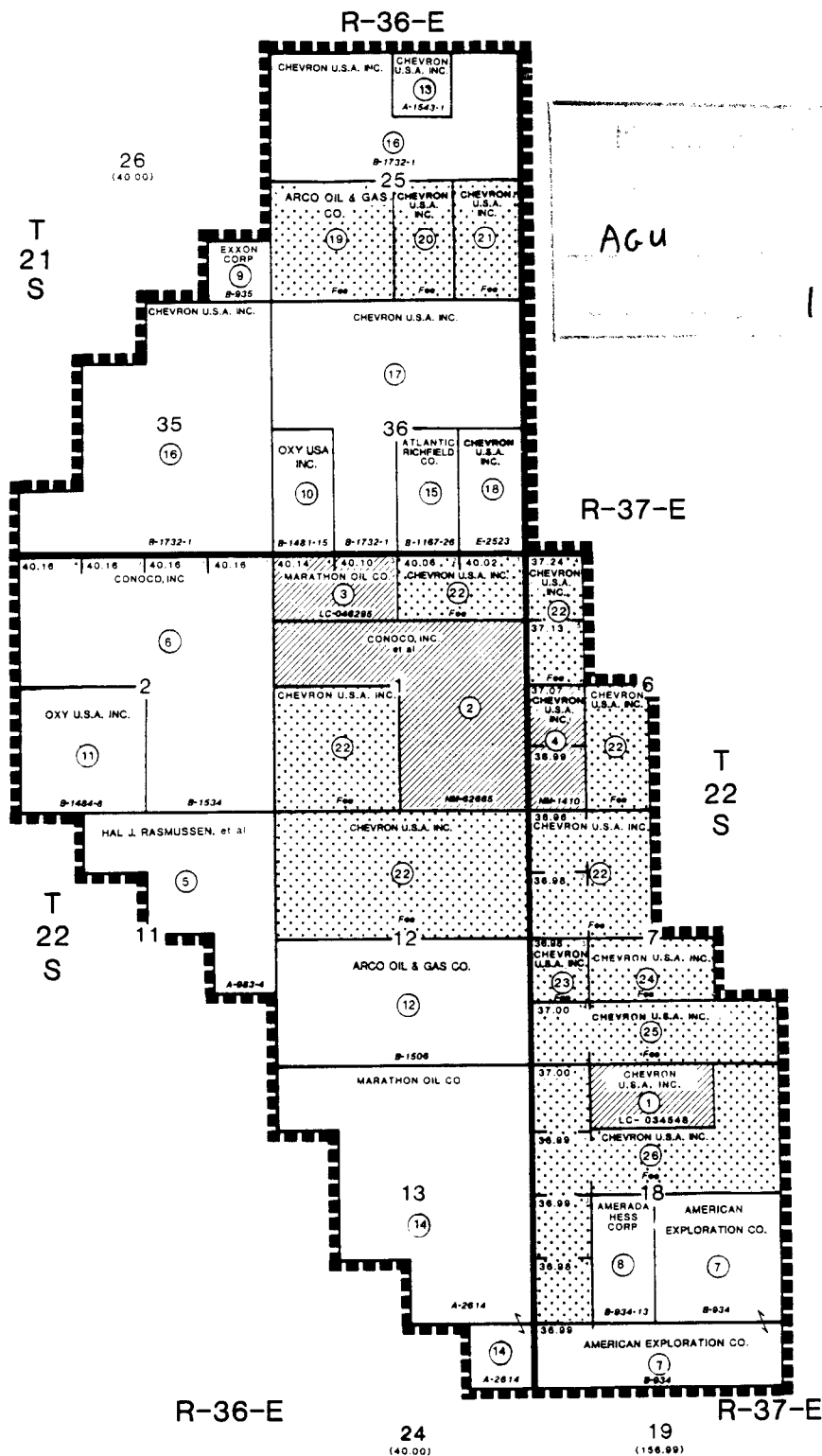
T. 21 S.

T. 22 S.

R. 39 E.

R. 38 E.

INDIAN



**EXHIBIT "A"**  
**ARROWHEAD GRAYBURG**  
**UNIT AREA**  
 LEA COUNTY, NEW MEXICO

CHEVRON U.S.A. INC.  
 MIDLAND TX.

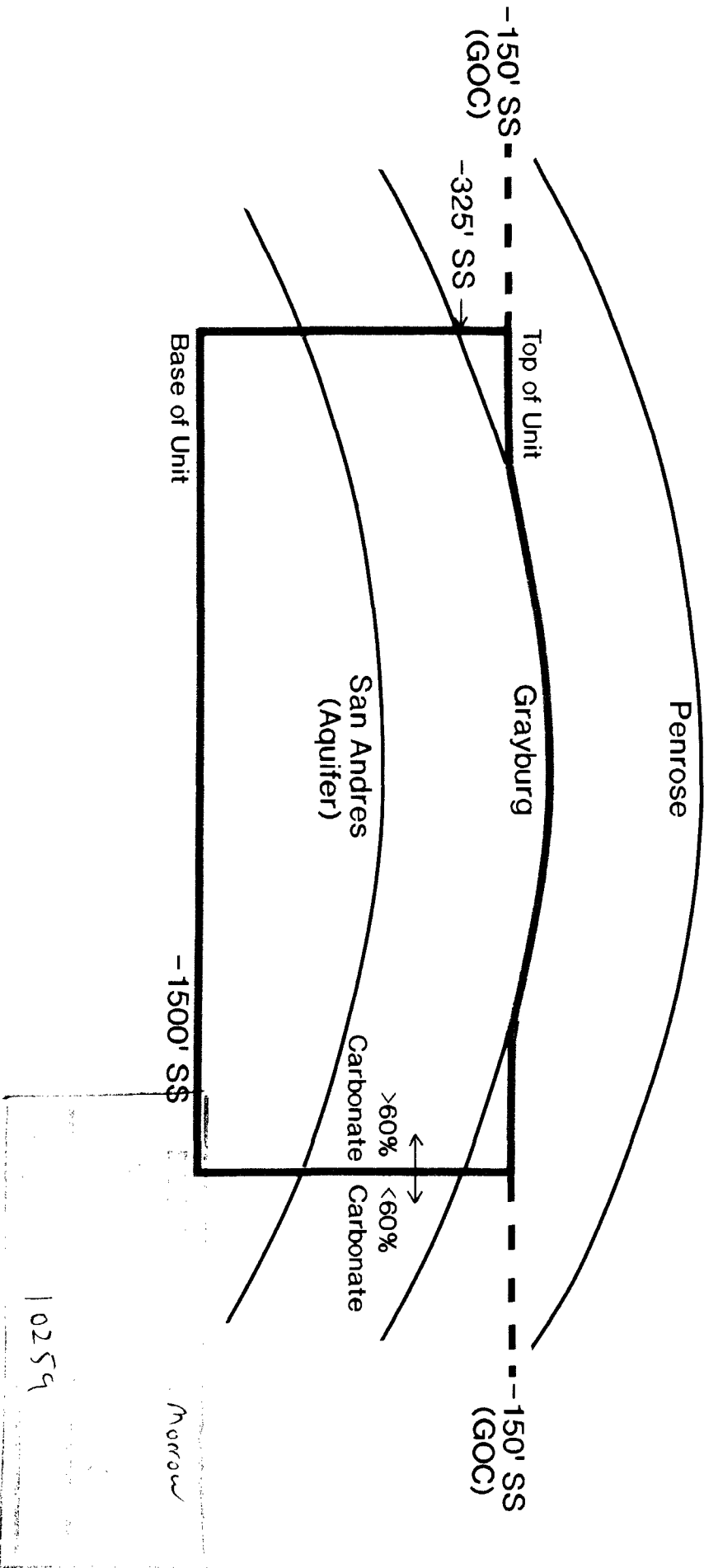
|                | ACREAGE         | PERCENTAGE     |
|----------------|-----------------|----------------|
| FEDERAL LANDS  | 554.30          | 9.36%          |
| STATE LANDS    | 3,597.63        | 60.75%         |
| PATENTED LANDS | 1,770.33        | 29.89%         |
| <b>TOTAL</b>   | <b>5,922.26</b> | <b>100.00%</b> |
| UNIT OUTLINE   |                 |                |
| TRACT NUMBERS  |                 |                |

NOTE: UNLESS OTHERWISE INDICATED, THE VARIOUS SECTIONS ON THIS PLAT CONTAIN 640.00 AC



West East

Horizontal Limits Of Proposed  
Arrowhead Grayburg Unit

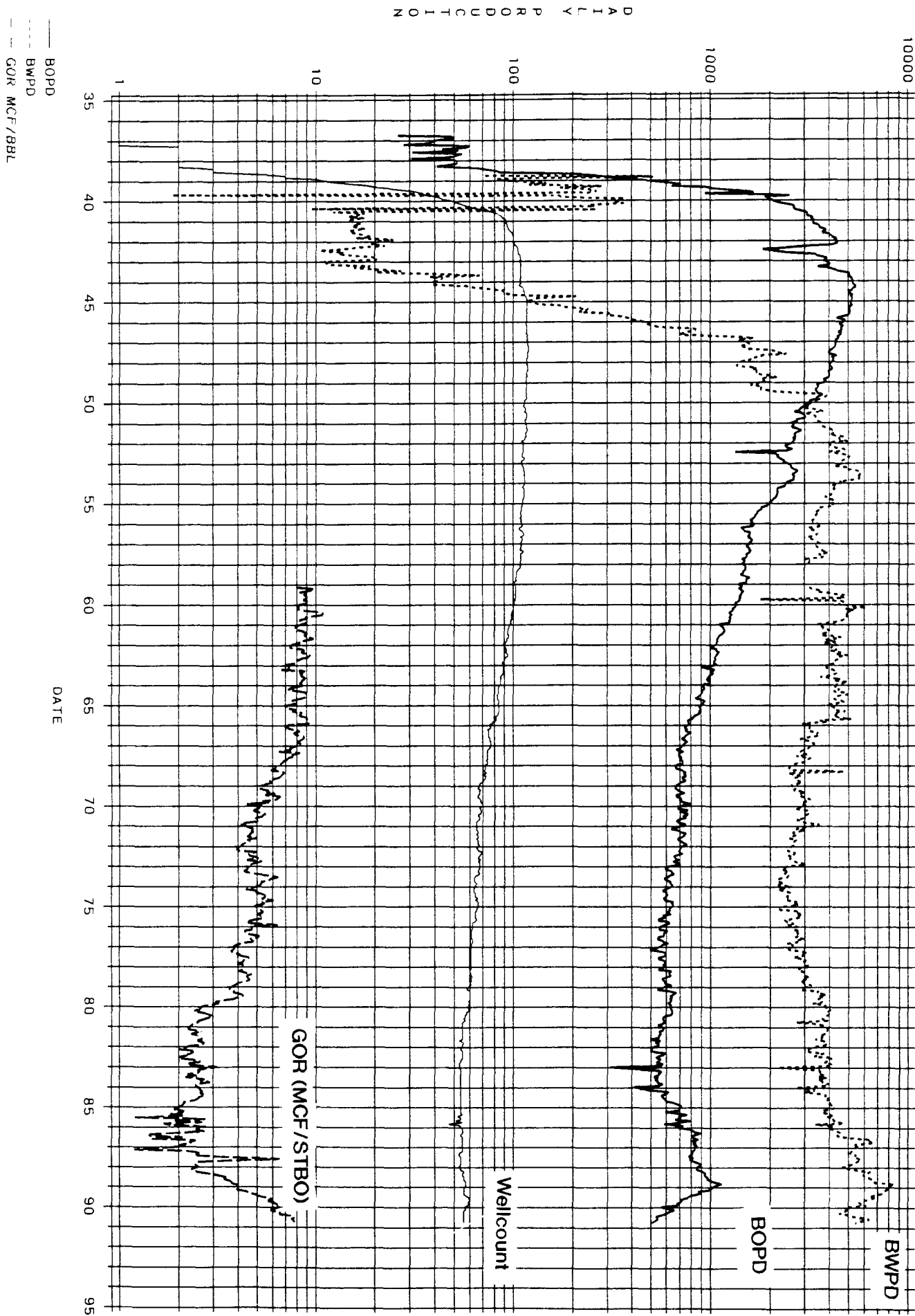


**Schematic of Proposed Unit Limits – Arrowhead Grayburg**

(Not To Scale)

DLL 2/91

PROPOSED ARROWHEAD GRAYBURG UNIT  
PRODUCTION PLOT

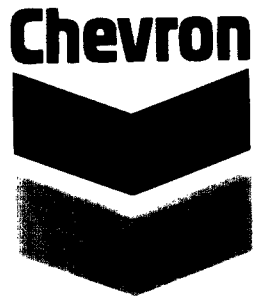


Morrow

AGU

10259

**Technical Committee Report**  
**Proposed Arrowhead Grayburg Unit**  
**Lea County, New Mexico**



**September 1989**

Technical Committee Report  
Proposed Arrowhead Grayburg Unit  
Lea County, New Mexico

September 1989



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## I. INTRODUCTION

This report presents the information that Working Interest Owners charged the Technical Committee to develop concerning unitization and waterflooding of the Arrowhead Grayburg Pool (Figure 1). It includes: (1) recommended Unit boundaries, (2) a secondary recovery plan of action and performance prediction, and (3) parameters for use in negotiating Unit participation.

## II. CONCLUSIONS

- 1) Secondary recovery potential is sufficient to economically justify unitizing and waterflooding the Arrowhead Grayburg Pool for the purpose of increasing ultimate recovery.
- 2) The proposed Unit has produced 30.8 MMSTBO as of January 1, 1989, which is 17.6% of the estimated 175.4 MMSTBO OOIP. Ultimate primary oil production is expected to reach 36.1 MMSTBO, or 20.6% OOIP.
- 3) Incremental reserves for waterflooding are estimated to be 15.0 MMSTBO. This value represents a secondary to ultimate primary recovery ratio of 50% for the "swept" portion of the Unit, and an overall S/P ratio of 41.6%.
- 4) A total investment of \$28.2 MM will be required to install surface production and injection facilities, drill and equip new and replacement wells to develop the recommended waterflood pattern, perform remedial work on existing wells, and install new pumping equipment.
- 5) Incremental economics of the secondary recovery case to the base case of continued primary recovery indicate a discounted cash flow rate-of-return of 20% with a 10% discounted present-worth-profit of \$24.6 MM.



### III. RECOMMENDATIONS

- 1) The 5,922 acre area outlined in Figures 2, 3, and 4 should be unitized for the purpose of increasing ultimate recovery.
- 2) A waterflood project should be initiated in the proposed Unit.
- 3) The vertical limits of the unitized interval should extend from -150 ft from sea level or the top of the Grayburg formation, whichever is shallower, to a depth of -1,500 ft from sea level. The top of the Grayburg formation for unitization purposes is defined as that point at 3,671 ft in the Chevron Harry Leonard (NCT-C) No. 20 (located 660 ft FNL and 990 ft FWL of Section 36, T-21-S, R-36-E, Lea County, New Mexico) as recorded by the Gearhart Compensated Neutron Log measured from the Kelly Drive Bushing elevation of 3,532 ft and dated February 25, 1985.
- 4) The parameter tables (Appendix A) should be used by the Working Interest Owners for negotiation of an equitable participation formula.
- 5) A wellbore dedication incentive method, such as wellbore penalties or a wellbore inventory adjustment, should be adopted by the Working Interest Owners. The value of each useable wellbore should be set at \$80,000 for use in the wellbore dedication incentive.

#### IV. RESERVOIR INFORMATION

##### POOL HISTORY

The Arrowhead Pool, located in Lea County, New Mexico (Figure 3), was discovered on May 24, 1938 by Continental's #1 State J-2 well (located in Section 2, T-22-S, R-36-E). Original reservoir pressure as reported by the Annual Report of the New Mexico Engineering Committee was 1,460 psi. The pool was subsequently developed on 40-acre spacing, with the majority of the wells being drilled and completed during the late 1930's and early 1940's. Completions were typically open-hole and included both the Queen and Grayburg formations. The wells initially flowed, but by the late 1940's and early 1950's, reservoir pressure had dropped, and artificial lift was installed. Peak oil production rate for the pool was 172,300 barrels per month in March of 1944.

In 1953, the New Mexico Oil Conservation Commission created the Eumont and Arrowhead Gas Pools. These pools overlie the existing Arrowhead and Penrose Skelly Oil Pools. The Commission defined the vertical limits of the Eumont and Arrowhead Gas Pools to include the Yates, Seven Rivers, and Queen formations, and contracted the vertical limits of the Arrowhead and Penrose Skelly Oil Pools to include only the Grayburg formation (Figure 5).

In 1956, the Commission subsequently ordered that wells which had completion intervals open across the top of the Grayburg formation (open in both the Arrowhead and Eumont Pools) be identified to the Commission for reclassification. As a result of this action, only a few wells within the proposed Unit were reclassified from the Arrowhead Pool to the Eumont Pool. The Commission did not order remedial work to isolate the two pools but did order that future wells be completed in such a manner as to prevent communication between the oil and gas pools. It is estimated that 40 to 50 of the wells in the proposed Unit have completion intervals which currently or historically have been simultaneously open in both the Queen and Grayburg formations.

##### GEOLOGY

The Arrowhead Pool is located on a northwest-southeast trending structural high (Figure 6), adjacent to and on strike with the Eunice Monument South Unit (EMSU). The productive interval, which is comprised of the Penrose (lowest member of the Queen formation) and the Grayburg formation, is similar in the two areas and consists of interbedded carbonates and siliciclastics deposited during a

period of overall sea level regression. These carbonates have been extensively dolomitized and form the primary reservoir in the Arrowhead Pool. There are a limited number of modern wireline logs and no core data available for the Arrowhead area.

Due to the similarities between these logs and those of the EMSU, the reservoirs are believed to be very comparable, and many of the ideas and conclusions generated from studies of the EMSU can be cautiously applied to the Arrowhead.

There has been a large quantity of data gathered and evaluated for the EMSU. Fifty-four new wells have been drilled, 17 were cored and 19 had Repeat Formation Test (RFT) data taken. Over 230 of the existing wells have also been relogged with modern porosity tools. These data are being used to characterize and evaluate the reservoir.

When the Arrowhead project is implemented, data acquisition will proceed with a program similar to that of the EMSU. There will be over 50 wells redrilled, of which six will be cored, and several will have RFT data taken. Existing wells without modern logs will be relogged using modern porosity tools. Once implementation is completed, the Arrowhead will have an extensive data base for reservoir characterization and management.

From the ongoing EMSU study, it was determined that the dolomites range from mudstones to oolitic grainstones indicating a wide range of depositional energies. The majority of the pay in the EMSU consists of packstones and grainstones with intercrystalline, intergranular, and moldic porosity. The six Grayburg zones that have been defined in the EMSU are also recognized in the Arrowhead (Figure 7).

Dolomite porosity development in the Arrowhead, based on wireline logs, is similar to that of the EMSU and is typical of a progradational depositional environment. On the western flank of the structure, reservoir-quality dolomite porosity extends into the upper Grayburg formation and Penrose. Moving updip to the east, the Penrose becomes sandy, and the dolomites in the upper Grayburg become tight. In the eastern portion of the pool, reservoir-quality dolomite porosity is found in Grayburg Zones 5 and 6.

A percent dolomite map (Figure 8) of Grayburg Zones 1 thru 5 was constructed to demonstrate this decrease in dolomite porosity to the east. It is an indirect way of determining the limits of dolomite porosity development and productivity of the reservoir, made necessary by the limited amount of

wireline porosity data available. A lower percentage of dolomite indicates areas of relatively low wave energy. Carbonate sediments in this environment tend to be fine-grained muds, resulting in non-reservoir mudstones. A higher percentage of dolomite indicates a higher energy environment which is more prone to grainstone deposition.

As in the EMSU, the siliciclastics present in the Grayburg formation are believed to be tight and nonproductive. The total volume of siliciclastic material increases in an easterly direction with an accompanying decrease in net pay. These siliciclastics, for the most part, are not true sandstones but sandy dolomites, usually consisting of less than 50% siliciclastic material, predominantly quartz. These quartz grains are subangular and very uniform in size. They are believed to have been initially deposited by eolian processes and subsequently reworked within the marine shoreline environment. The porosity associated with these siliciclastics is secondary and caused by the dissolution of feldspar grains. This secondary moldic porosity is poorly connected, resulting in non-effective porosity. In the EMSU these siliciclastics intervals have been found to be good vertical permeability barriers, and they should act as barriers in the Arrowhead reservoir as well.

The Arrowhead Pool is a predominantly solution gas drive reservoir that consists of the lower Penrose and Grayburg Zones 1 thru 5. Siliciclastics and tight mudstones which act as vertical permeability barriers are found throughout the reservoir, separating it from the active aquifer present in the Lower Grayburg (Zone 6) and San Andres. Based on the study of production data and individual well completion intervals, the original gas-oil contact (GOC) in the Arrowhead reservoir is believed to have been at approximately -150 feet from sea level. This contact has not changed significantly through time.

The original oil-water contact (OWC) in the Arrowhead is not known. Recent analysis of drill cuttings and core data on the western edge of the EMSU has resulted in an estimated original OWC in Grayburg Zones 1 thru 5 of -550 feet from sea level. After a vigorous well deepening and testing program in the EMSU, oil production has been established below -500 feet in Zone 5, substantiating this contact. Due to the close proximity of the Arrowhead to the EMSU, as well as the similarities of the reservoirs, the Arrowhead should have had a comparable original OWC in Grayburg Zones 1 thru 5.

The present OWC is also difficult to determine due to the limited number of recent deep tests in the Arrowhead reservoir. It is believed that the individual Grayburg zones on the western edge have each developed their own distinct OWC's because of different completion and production histories.

#### PRODUCTION HISTORY

Cumulative oil production for the proposed Unit was 30.8 MMSTBO on January 1, 1989. This value includes production classified as Arrowhead Grayburg, Penrose Skelly, Eumont Oil, Langlie Mattix, and Eunice Southwest San Andres. A total of 138 wells have produced from 134, 40-acre proration units within the proposed Unit. The average cumulative oil production has been 230 MSTBO per proration unit. Figure 9 indicates the historic production performance for the proposed Unit. Figures 10 through 18 present contour maps of cumulative and current production rates for oil, gas, water, water-oil ratio and gas-oil ratio for the proposed Unit.

Remaining primary reserves, calculated from individual tract decline curves, are 5.2 MMSTBO and 16.1 BCF gas. Ultimate primary oil recovery is expected to total 36.1 MMSTBO, which is 20.6% of the estimated OOIP.

Sufficient modern log data are not available to calculate an accurate volumetric OOIP for the Arrowhead Grayburg Pool. However, log to core transforms and reservoir characterizations developed for the EMSU can be applied to the proposed Unit because of the similarities between the two fields. Estimates of reservoir parameters utilizing the EMSU similarities are: porosity = 8%, Hnet = 85 ft, Swi = 25%, and Boi = 1.2 RB/STB. The OOIP calculated for the 5,320 acres that have produced from the proposed Unit, using the estimated reservoir parameters, is 175.4 MMSTBO. A summary of pertinent reservoir data is shown in Table 1.

Although the Arrowhead Pool has produced a significant volume of water, which could indicate a water-drive type recovery, solution gas drive is believed to be the predominant recovery mechanism. This conclusion is based on the pressure depletion of the pool and on the lack of an identifiable water production trend.

At discovery, reservoir pressure was reported to be 1,460 psi. In 1964, the last date pressure records were reported to the State for the Arrowhead Pool, the reservoir pressure had declined to 450 psi. Cumulative oil production at the

end of 1964 was 24.1 MMSTBO, or 67% of the expected ultimate primary production. The corresponding loss from original reservoir pressure at that time was 69%. If a water-drive mechanism exists, it is not of sufficient strength to maintain reservoir pressure and is probably not significantly affecting primary oil recovery.

Cumulative water production has been 54.8 MMBW (excluding production in 1958 when water records were not kept). Water producing rates and cumulatives vary significantly with location, and no single source of the water production is apparent. Figures 12 and 13 indicate cumulative water and cumulative water-oil ratio, respectively, for wells in the proposed Unit.

A portion of the water production is probably attributable to communication of Zones 4 and 5 with the Lower Grayburg and San Andres aquifers. Although siliciclastics between each zone generally prevent vertical communication, in some localized areas of the field they do not act as permeability barriers. When the barriers break down in the lower Grayburg members, the prolific San Andres aquifer can influx into the oil productive horizons resulting in large volumes of water production.

Other water production may be attributable to completions in the Penrose (Lower Queen) which has been found to be influenced by a water drive in the EMSU. Additional portions of the water production can be attributed to casing leaks, which have been identified in 36 wells.

Localized areas of high water production consist of less than five proration units. In most cases, wells adjacent to high water production areas have produced significantly less water. The change in water production appears to be independent of completion depth, both subsea and stratigraphically, and no clear water production trend is identifiable.

Based on the lack of uniform water production and the relationship of pressure depletion to recovery, solution gas drive is thought to be the predominant primary recovery mechanism with water influx having only a minor effect on recovery. The Arrowhead Grayburg Pool is therefore a good candidate for waterflooding with respect to primary recovery mechanism.

#### CURRENT STATUS

The proposed Unit includes all currently active Arrowhead Grayburg wells and several wells classified as Eumont, Langlie Mattix, Penrose Skelly, and Eunice San Andres Southwest.



The current production rate for the proposed Unit is 33,025 BOPM, 251,600 BWPM, and 128,714 MCFPM gas. There are a total of 57 actively producing wells completed in the proposed unitized interval, and 12 wells are shut-in or temporarily abandoned. Other historic completions have either been plugged back to a different horizon or have been permanently abandoned. Seven of the currently active wells are simultaneously producing from beyond the proposed vertical limits of the Unit and will require remedial work to isolate the unitized interval prior to the effective Unit date.



## V. PROPOSED UNIT BOUNDARIES

The proposed limits of the Unit are as follows:

### Vertical Limits:

Defined as the top of the Grayburg formation (defined in Chevron's Harry Leonard (NCT-C) No. 20 well, located 660 ft FNL and 990 ft FWL, Section 36, T-21-S, R-36-E, at a depth of 3,671 feet on Gearhart's Compensated Density and Compensated Neutron Log dated 02/25/85), or -150 feet from sea level (whichever is shallower), to -1,500 feet from sea level.

### Horizontal Limits:

As outlined in Figure 3. Individual tracts are identified by location, operator, and lease in Table 2.

## DISCUSSION

In August 1953, the New Mexico Oil Conservation Commission redefined the Eunice Monument and Arrowhead Pools and created the Eumont and Arrowhead Gas Pools. The Eunice and Monument Oil Pools were combined, and the vertical limits were redefined as the top of the Grayburg to the base of the San Andres, while the Arrowhead Oil Pool was redefined to consist only of the Grayburg formation (Figure 5). Many of the wells in both the Eunice Monument and Arrowhead Oil Pools had completion intervals open across the top of the Grayburg formation into the newly defined Eumont Pool and therefore outside of their defined pool. Some of these wells were reclassified, but most remained in their designated pool. This redefinition of pools in 1953 created complications in the choice of vertical limits for the EMSU as well as the proposed Arrowhead Unit.

## VERTICAL LIMITS

The top of the proposed Arrowhead Unit is defined as the top of the Grayburg formation or -150 feet from the sea level, whichever is shallower. Several of the wells in the proposed Unit have completions that extend above the defined pool, into the Penrose (Eumont Pool). This situation also occurred at the EMSU and was successfully addressed by defining the Unit's upper limit as the top of the Grayburg or -100 feet, avoiding an excessive number of workovers to isolate the two pools. This -100 feet datum is the estimated gas-oil contact (GOC) at the EMSU. The estimated GOC for the Arrowhead Pool, as indicated by completion information, appears to be structurally lower at -150 feet. Typical completion intervals in the Arrowhead

Pool are shown in stick diagrams A-E, in Figures 19 thru 24.

The base of the proposed Unit is -1,500 feet from sea level. This depth ranges between 100 feet to 150 feet above the base of the San Andres formation (top Glorieta). This will include most of the San Andres formation within the Unit which will be an excellent source of make-up injection water. It is desirable to include the water supply in the unitized interval to avoid complications that could arise if the water supply wells produce hydrocarbons. By including the water supply in the unitized interval, hydrocarbon revenue and operating expenses associated with the operation of water supply wells will be shared equitably by the Owners. A subsea depth was chosen rather than a formation pick due to the lack of deep well control and the ease with which it can be applied.

#### HORIZONTAL LIMITS

The horizontal limits of the proposed Unit reflect the structural and stratigraphic components that define this combination trap. The western extent can be defined structurally, whereas the northern and eastern extent of the pool are defined by stratigraphy.

To the west of the proposed Unit, the entire Grayburg is structurally low and wet. Here the productive interval is confined to sandstones in the Queen formation. This flood is targeting the porous dolomites, and therefore, the proposed Unit boundary to the west was limited to areas where oil production was primarily from dolomites within the Grayburg and lower Penrose. From test information, cumulative production data, and cross sections, it has been determined that the productive limit of the Grayburg to the west is at -325 feet. Therefore, all 40-acre proration units on the western flank where the top of the Grayburg is at -325 feet or shallower will be included in the proposed Unit (Figure 6).

The proposed Unit is limited to the south by an existing Langlie Mattix waterflood. The Langlie Mattix Pool is defined from the base of the Grayburg formation to a point 100 feet above the base of the Seven Rivers formation. This waterflood is confined to the Penrose which is within the vertical limits of the proposed Arrowhead Unit. The Arrowhead Unit boundary will be directly offset by two active injectors in this waterflood, and a lease line injection agreement should be obtained upon unitization.

The eastern and northern boundaries of the proposed Unit were delineated using the percent dolomite map (Figure 8), cumulative production map (Figure 10), and cross sections. The percent dolomite map provides an indirect method for determining limits of dolomite porosity development and reservoir productivity. The best cumulative production has been from areas of 60% dolomite or greater. Where dolomite content is less than 60%, the reservoir quality is probably not adequate to be effectively waterflooded. The 60% dolomite contour on the percent dolomite map was used to define the eastern and northern boundaries of the proposed Unit.

#### EXCLUDED WELLS

There are five Arrowhead Grayburg Pool wells that were not included in the proposed Unit. These wells are listed below, along with the reasons for exclusion.

##### American Exploration's #7 and #43 'M' State

Located to the south in Section 19, T-22-S, R-37-E. These wells are within the active Langlie Mattix waterflood.

##### Adobe Oil's #1 State

Located to the east in Section 17, T-22-S, R-37-E. Dolomite content of only 53% (below the 60% cutoff). Cumulative production of only 3,505 BO.

##### Marathon's #15 McDonald State 'AC'

Located to the west in Section 14, T-22-S, R-36-E. Produced from the upper and middle Penrose sands (not the targeted dolomites). Estimated top of the Grayburg is -342 feet (below the -325 feet structural cutoff).

##### Wood, McShane & Tham's #13 'M' State

Located to the southeast in Section 20, T-22-S, R-37-E. Too far removed from the proposed Unit. Dolomite content of 52% (below the 60% cutoff). Cumulative production of only 9,459 BO.

#### OBJECTIONS

Zia Energy, Inc., owner of the deeper rights in Tract 8a, (Figure 4) has indicated opposition to the inclusion of its acreage in the proposed Unit. The Zia 'M' State No. 49

well, in the SE/4 of Section 18, T-22-S R-37-E, currently produces from Grayburg Zone 5 and the Lower Grayburg, classified as Eunice San Andres Southwest. Daily production averages less than 1 BOPD, 180 MCFGPD, and 600 BWPD. Consideration of Zia's desire to be excluded from the Unit should be addressed by the Working Interest Owners.

## VI. SECONDARY RECOVERY POTENTIAL

Due to the absence of quantitative reservoir data, a rigorous conventional secondary recovery analysis cannot be performed. However, based on the geologic and production history similarities between the two fields, EMSU recovery predictions should be applicable to the proposed Arrowhead Unit.

The original EMSU prediction was based on a statistical average of West Texas and Southeast New Mexico carbonate waterflood performance. The EMSU Technical Committee identified typical ranges of performance indicators including: S/P (secondary to ultimate primary) recovery ratios, time to peak response, and peak oil production rate as a percentage of water injection rate. The same typical performance indicators have been applied to predict waterflood performance for the proposed Arrowhead Unit.

To derive a secondary performance prediction for the Unit, the performance indicators used by the EMSU are applied to the proposed waterflood area. This development area is based on the utilization of all currently active wells within the proposed unitized interval. Additionally, proration units that do not have available wells, but where sufficient reserves are believed to exist to justify the drilling of a new well, will be developed. Sufficient reserves to justify drilling are estimated to be 70,000 STBO, which may include additional primary as well as secondary reserves based on the S/P ratio. The proposed development pattern is an 80 acre 5-spot which is the same pattern used at the EMSU. The total project will consist of 52 injectors and 75 producers (Figure 25).

Cumulative production from the enclosed waterflood patterns as of 12/31/88 (including reductions of individual well cumulatives to reflect partial waterflood patterns) was 25.6 MMSTBO. This value represents 83% of the proposed Unit's total production. To determine secondary recovery potential, the S/P ratio used by the EMSU, 50%, is applied to 83% of the proposed Unit's ultimate expected primary recovery of 36.1 MMSTBO. The resulting incremental secondary recovery potential is calculated to be 15.0 MMSTBO. This value could be affected by the additional primary and secondary recovery generated by development of undrilled locations and undeveloped pay in existing wells. Additionally, the S/P ratio of 50% may be conservative. Recent review of Grayburg and San Andres waterfloods indicate that the typical S/P is in excess of 60%.

Injection rates for the proposed waterflood are expected to average 450 BWPD/well with a total injection rate of 23,400 BWPD. This rate is estimated based on the ratio of 85 ft net thickness in the Arrowhead Pool compared to the 134 ft at the EMSU, multiplied by the 700 BWPD per well average injection rate experienced in the EMSU.

Peak oil production rate for the proposed Unit is estimated to be 5,850 BOPD, based on 25% of the anticipated injection rate. Initial oil response is expected to occur three years after initial injection with peak response occurring after six years. The time to response is based on the EMSU performance indicator of initial response at one-half fill-up, peak response at fill-up (ignoring the effects of production during fill-up), and an estimated current gas saturation of 18%. The producing gas-oil ratio is expected to decrease from the current level of 3,000 scf/STBO to 450 scf/STBO as reservoir pressure increases. Figure 26 indicates the anticipated secondary recovery response.

The performance prediction does not include an initial loss in oil production resulting from the conversion of producing wells to water injectors. This is based on the net producing well count increase from 57 to 75. Although several of the currently active wells that are tentatively designated to be water injection wells in the proposed Unit produce higher than average oil rates, the loss from conversion is expected to be offset by the addition of new wells. The increase in the well count may actually result in a higher than current oil production rate.

## VII. CAPITAL REQUIREMENTS

Total capital requirements to install and implement an 80-acre 5-spot waterflood in the Arrowhead Grayburg Pool are estimated to be \$28.2 MM. Cost breakdowns and an investment schedule are shown in Tables 3 through 9.

### SURFACE FACILITIES

Surface facilities costs are expected to total \$9.0 MM. The facilities will include the production gathering system, water injection system, and an electrical distribution system. Cost estimates are based on the tentative well count of 75 producers, 52 injectors, and 2 water supply wells. The production gathering system is designed to handle 500 barrels of fluid per day per well, and the injection system will allow 500 barrels of water per day per injection well at a maximum surface pressure of 1,800 psi.

The production gathering system will consist of five satellite batteries, each with production testing, gas separation and sales capabilities. Oil and water will be transferred to a central battery for separation and oil sales. Fiberglass production flowlines and transfer lines will be utilized, making the system compatible with CO<sub>2</sub> in anticipation of future enhanced recovery operations. The injection system will consist of lined steel and high pressure fiberglass trunk lines distributing the water to metering manifolds. Each metering manifold will connect to four or five injection wells through high pressure fiberglass lines. A cost breakdown for the surface facilities is indicated on Table 4. Figures 27 through 29 present schematics of the surface facility designs.

### DRILL AND COMPLETION COSTS

The total capital requirement estimate includes \$11.45 MM to drill and complete 52 new wells, (34 producers, 16 injectors, and 2 water supply wells). The 52 new wells requirement is based on the availability of 57 currently active wells, eight currently shut-in or inactive wells, and an assumed additional 10 wells made available as a result of a wellbore dedication incentive, for the 129 total tentative well locations, including two water supply wells (Figure 25). The actual drill and completion cost requirements are dependent on the total number of useable wells dedicated to the Unit.

Drill and completion costs per well, including equipment, are estimated to be \$220 M for producers, \$200 M for injectors, and \$385 M for water supply wells. Tables 5 through 7 indicate typical cost breakdowns for each type of well.



### WORKOVER COSTS

Total workover requirements for producers and injectors are estimated to be \$6.9 MM. To estimate workover cost, it was assumed that all wells dedicated to the Unit will require some remedial work. Each of the 67 currently available wells (active and inactive) that may be used in the proposed Unit were evaluated to determine the scope of workover activity that may be desired. The workover activities considered included: deepening, adding perfs, running liners, and adding cement behind pipe. All wells were assumed to require a basic workover including cleaning-out and acidizing. The average workover cost for the wells evaluated was estimated to be \$60,000. The average cost was applied to the 67 available wells and the 10 assumed additional wells. An additional expense of \$27,000 per water injection conversion was included for 36 wells, and a cost of \$35,000 per pumping unit upgrade was included for 40 wells. Table 8 indicates the cost of each workover component.

The workover cost estimate assumes that the majority of the wells will be deepened to Zone 5 and that many liners will need to be run. If early drilling and workover activities indicate that deepenings do not contribute to additional oil production and reserves or that liners are not necessary, this type of activity will cease, reducing workover expenses by as much as \$750 M.

### TESTING & CORING

The total capital requirement includes \$500,000 for the gathering of reservoir information. This cost will include the coring and core analysis on six wells, pressure testing, and reservoir fluid PVT analysis. The data will be used to build an accurate reservoir model. The model can then be used to refine the secondary recovery prediction and optimize future oil recovery through reservoir management.

### WELLBORE DEDICATION INCENTIVE

The drilling, completion, and workover cost estimates assume that a wellbore dedication incentive method will be used and that 10 additional wellbores will be made available to the Unit as a result of the incentive. The additional wells are currently shut-in or producing with marginal economics from other horizons. Securing these additional wells will enhance project economics for the Working Interest Owners as a whole by reducing total well costs by more than \$1.2 MM.

The use of a wellbore dedication incentives is a common practice in modern units. The wellbore penalty method is probably the most widely used incentive. An alternative method is a wellbore inventory adjustment. Both methods are fair and equitable, but the method which is financially best for an individual owner depends on: (1) working interest participation, (2) the number of useable wellbores individually owned and contributed to the Unit, and (3) the total number of wellbores dedicated to the Unit. Determining which method is best for the majority of the Working Interest Owners cannot be done until these factors are established. The Technical Committee is not recommending a particular method but does recommend that a wellbore dedication incentive method be adopted by the Working Interest Owners.

A description of two dedication incentive methods is as follows:

WELLBORE PENALTY: One useable wellbore will be demanded from each proration unit that has historically produced from the unitized interval. Individual Owners will be charged their proportionate share of a wellbore penalty equal to the useable wellbore value for each demand well not contributed. Special allowances can be incorporated for proration units in which all wells were permanently plugged and abandoned prior to a certain date or that produced less than a specific cumulative oil.

WELLBORE INVENTORY: Useable wellbores dedicated to the Unit will be inventoried with a value equal to the "useable wellbore value", and an investment adjustment will be made for each owner based on his proportionate share of the value of all wellbores dedicated and the value of the wellbores he individually contributes.

Useable wellbores are defined for wells with different current status as follows:

- (1) Currently active wells will be accepted as useable if no zones other than the unitized interval are open and the wellbore passes a casing integrity test (500 psi for 30 minutes) upon first entry by the Unit operator. If zones above the unitized interval are open, the non-unitized zones must be cement squeezed to isolate the unitized interval, pressure tested to 500 psi for 30 minutes, and cement in the production casing drilled-out; or, if open-hole, a liner must be run and set with cement to the top of the unitized interval, and the casing tested above the unitized interval to 500 psi for 30 minutes.

- (2) Currently closed-in or TA'd wells will be accepted as useable if no zones other than the unitized interval are open (as above) and the well is free of scale, junk, and debris to the depth of deepest production from the unitized interval prior to being closed-in (PBSD from workovers in the unitized interval prior to shut-in). The well must pass a casing integrity test upon first entry by the Unit operator.
- (3) Currently P&A'd or recompleted wells that have previously produced the unitized interval will be accepted as useable if they are restored to the unitized interval's last producing completion interval, are not open in non-unitized zones, are free of junk, scale and debris down to the PBSD prior to cessation of production, and pass a casing integrity test upon first entry by the Unit operator.
- (4) Alternate wells from existing wellbores will be accepted as useable if all non-unitized zones have been abandoned (deeper zones plugged back with a CIBP or cement retainer capped with 35 ft of cement and pressure tested to 500 psi; shallower zones squeeze cemented, pressure tested and cement drilled-out in the production casing), they penetrate the unitized interval, have sufficient casing size (5½") to be deepened or have at least 4½" casing set through Zone 5 of the Grayburg formation, are adequately cemented, and pass a casing integrity test upon first entry by the Unit operator.
- (5) Newly drilled wells will be accepted as useable if they are drilled to the base of Zone 5, cased to TD with 5½" or larger casing, are cemented from TD to surface, and pass a casing integrity test.

Tables 10 and 11 indicate completion information for wells that are currently or have historically produced from the proposed unitized interval.

The intent of the useable wellbore definition is to insure all wellbores that are dedicated to the Unit are in reasonably good physical condition and can be used by the Unit in ways consistent with its purpose. All wells dedicated to the Unit will be subject to a casing integrity test. If a well is determined to be not useable upon first entry by the Unit operator, the contributor of the well will be given the option of:

- (1) Withdrawal of the wellbore from the Unit, subject to a wellbore penalty or inventory adjustment.

- (2) Repair of the wellbore by the contributor without the removal of liability (wellbore penalty or inventory adjustment) if the wellbore does not meet the useable wellbore definition on the subsequent entry by the Unit operator.
- (3) Repair of the wellbore by the Unit operator at the contributor's expense for up to \$80,000. The Unit operator may elect to not accept a non-useable wellbore for repair if repair cost estimates exceed the value of a useable wellbore.

#### INVESTMENT SCHEDULE

It is estimated that the full-scale waterflood can be installed in 1.5 project years. During the first year, 46 new wells will be drilled, 100% of the surface facilities will be constructed, one water supply well will be drilled, and 75% of the workovers will be completed. During the next one-half year, the remaining wells will be drilled and workovers completed. Tangible expenses for upgrading pumping capacities on producing wells will occur during the first five years of the project as increasing reservoir pressure dictates.

A detailed project investment schedule is indicated in Table 9.

### VIII. ECONOMICS

Economic analysis of the proposed waterflood indicates that the project is profitable for the Unit as a whole. Incremental economics of the waterflood, compared to the base case of remaining primary, indicate a 20% discounted cash flow rate-of-return and a 10% discounted present-worth-profit of \$24.6 MM for the \$28.2 MM investment. Assumptions used for the economic analysis are:

- 1) The base case consists of 57 wells producing 965 BOPD, with remaining reserves of 4.7 MMSTBO as of 7/1/90.
- 2) Incremental oil recovery will total 15.0 MMSTBO.
- 3) The GOR for the incremental case will decline from the current level of 3,000 SCF/STBO to 450 SCF/STBO as the reservoir pressure increases. The base case GOR is held flat at 3,000 SCF/STBO.
- 4) Base case operating expenses are \$35/producing well day held flat for the remaining life. Operating expenses for the proposed case will escalate to \$83/producing well day (including overhead), over the first several years, and decline as injection terminates near the end of the project life.
- 5) Oil and gas prices are held flat at \$18.00/BO and \$1.80/MCF.
- 6) Royalty burdens of 1/8 are assumed for all tracts.
- 7) Estimated drilling and construction overhead charges of \$450,000 were included in the investment.

Economics for individual Working Interest Owners will vary depending on actual royalty burdens, proportionate share of remaining primary and project production, actual investments including wellbore penalties or inventory adjustments, and oil and gas price forecast methods used.

Tables 12 and 13 indicate base case and waterflood case production and expense schedules.

### IX. EQUITY PARAMETERS

The Technical Committee was charged to determine the following parameters for Unit participation negotiations:

- 1) Cumulative Oil Production
- 2) Remaining Primary Oil and Gas Reserves
- 3) Ultimate Primary Oil Reserves
- 4) Current Oil and Gas Production Rates
- 5) Gross Acreage
- 6) Useable Wellbores

Subsequently, the Technical Committee has elected to eliminate the parameter Useable Wellbores from the list.

Actual wellbores that will be contributed to the Unit will not be known until after the effective Unit date, and a wellbore will not be determined as useable until after it is contributed. Therefore, the Unit participation allocations would probably have to be reallocated once it is known which wellbores dedicated to the Unit are "useable". The Technical Committee determined that value for useable wellbores will be more appropriately addressed by using a wellbore dedication incentive.

The equity parameter, Gross Acreage, has been addressed in two different ways: Gross Acre-ft and Surface Acres. The Working Interest Owners should determine what percentage of each term should be included in the participation formula.

The parameter, Gross Acre-ft, was introduced to allow for allocation of ownership on tracts where there is a change in ownership with depth. This term is based on gross thickness and acreage owned in both the hydrocarbon productive interval and aquifer (San Andres) portion of the Unit.

The parameter, Surface Acres, was introduced with allocation of ownership limited to the hydrocarbon productive interval only. Since the actual oil-water contact is not specifically known, this term is based on ownership from the top of the Unit to 325 ft below the top of the Grayburg formation. This term includes the hydrocarbon producing interval across the unit area but excludes the majority of the aquifer ownership.

Appendix A indicates allocations of equity parameters by Tract and by Owner. Appendix C indicates the ownership information used for the allocation of ownership on each tract.

Cumulative oil production is based on values through 12/31/88. No adjustment of cumulative oil production was made for wells with completions simultaneously producing the unitized interval and the non-unitized interval. It is assumed that all production from the non-unitized interval in these wells was gas since the top of the Unit is at the estimated gas-oil contact.

Current oil and gas production rates are based on reported production for the fourth quarter of 1988. Remaining oil and gas reserves are calculated using decline rates based on analysis of individual tract production, applied to appropriate initial production rates for 01/01/89, and extrapolated to an economic limit of 2 BOEG/day per well (Appendix B). Ultimate primary oil recovery is the summation of cumulative and remaining oil reserves.

BCC/pf 07249/09



PROPOSED ARROWHEAD GRAYBURG UNIT  
CHARGES FOR THE TECHNICAL COMMITTEE  
MAY 5, 1988

- 1) Determine the horizontal and vertical boundaries for the proposed Unit, and prepare a base-map indicating the boundaries and Tract numbers within the Unit.
- 2) Develop a plan of secondary recovery for the Unit, including a cost estimate, and a prediction of secondary recovery production rates and reserves.
- 3) Prepare a tabulation of equity parameters to be used for Tract participation negotiations. The parameters should include:
  - a) Cumulative Oil Production
  - b) Remaining Primary Oil & Gas Reserves
  - c) Ultimate Primary Oil Reserves
  - d) Current Oil & Gas Production Rates
  - e) Gross Acreage
  - f) Useable Wellbores

# PROPOSED ARROWHEAD GRAYBURG UNIT

Lea County, New Mexico



## WATERFLOOD PROJECT

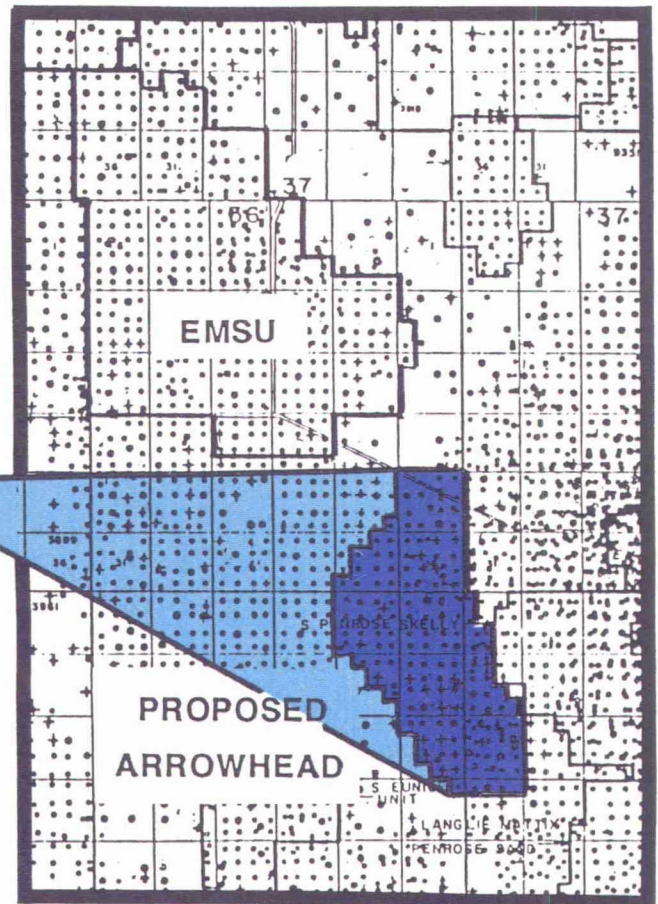
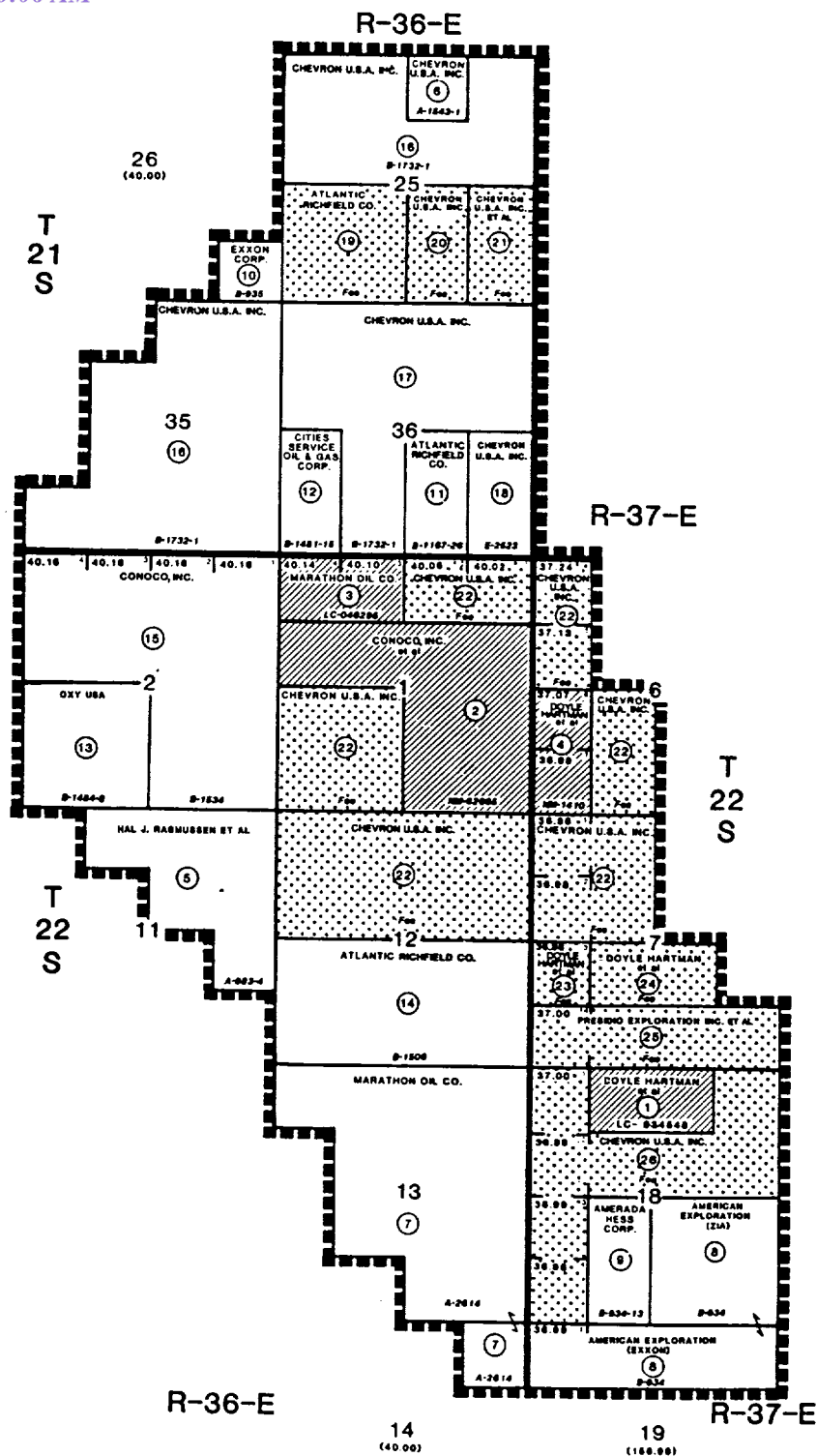


Fig. 2

## R-36-E







**ARROWHEAD GRAYBURG  
UNIT AREA**  
LEA COUNTY, NEW MEXICO

CHEVRON U.S.A. INC.

|                | ACREAGE         | PERCENTAGE     |
|----------------|-----------------|----------------|
| FEDERAL LANDS  | 554.30          | 9.36%          |
| STATE LANDS    | 3,597.63        | 60.75%         |
| PATENTED LANDS | 1,770.33        | 29.89%         |
| <b>TOTAL</b>   | <b>5,922.26</b> | <b>100.00%</b> |

UNIT OUTLINE

TRACT NUMBERS



NOTE: UNLESS OTHERWISE INDICATED, THE VARIOUS SECTIONS ON THIS PLAT CONTAIN 640.00 AC.

Fig. 4

# POOL LIMITS ARROWHEAD STUDY AREA

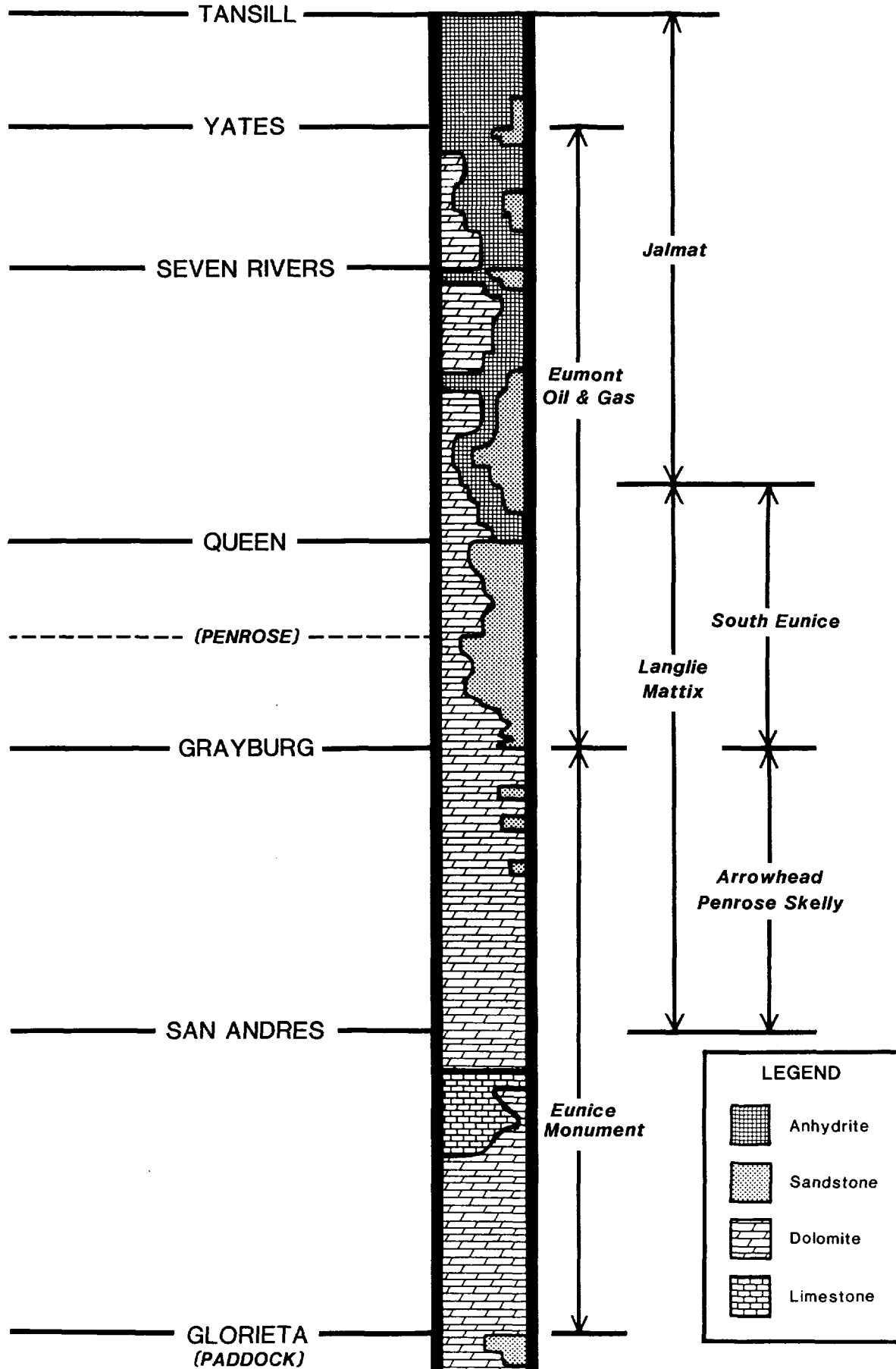


Fig. 5

# Proposed Arrowhead Grayburg Unit Study Area STRUCTURE T/GRAYBURG

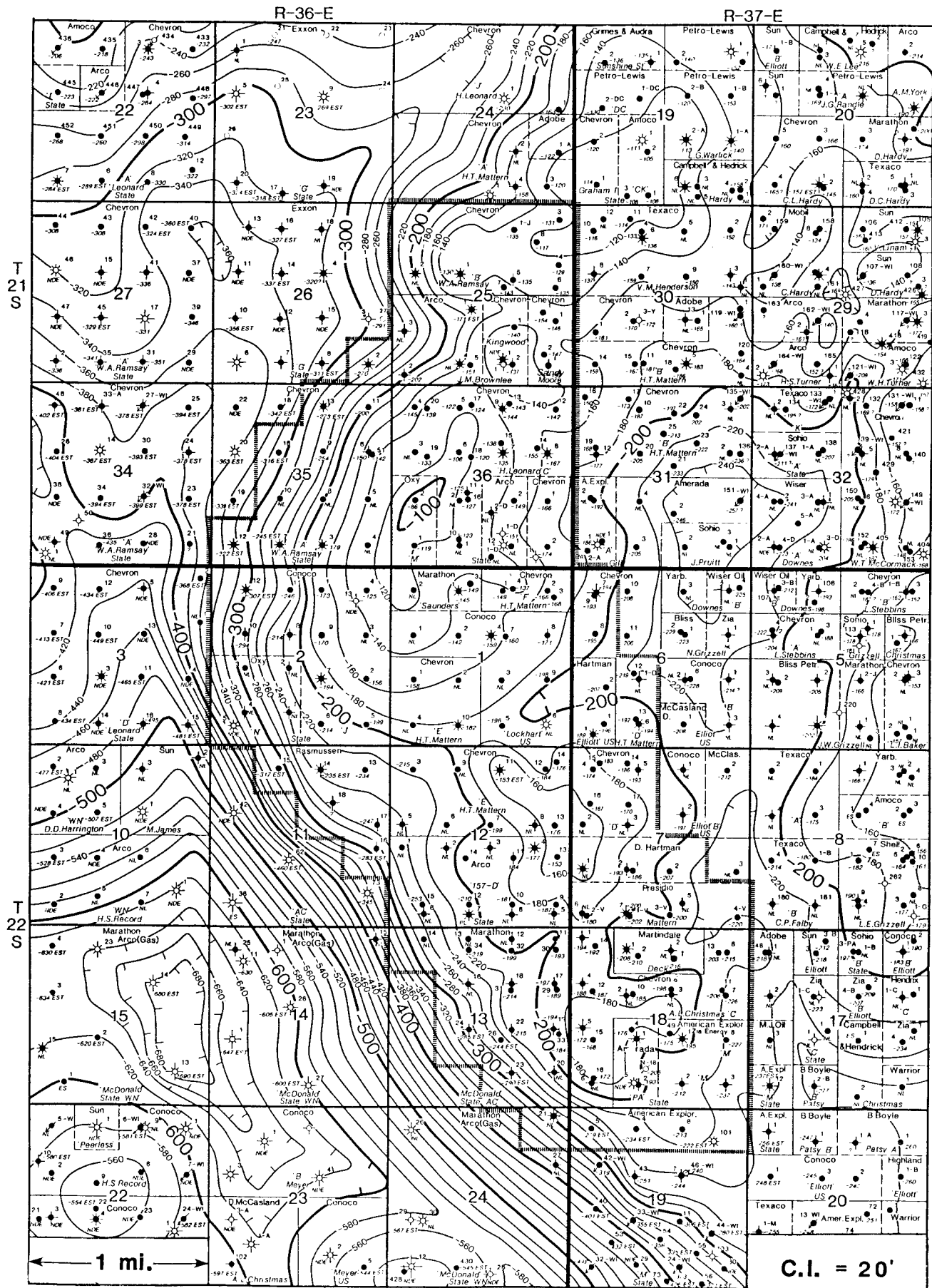


Fig. 6

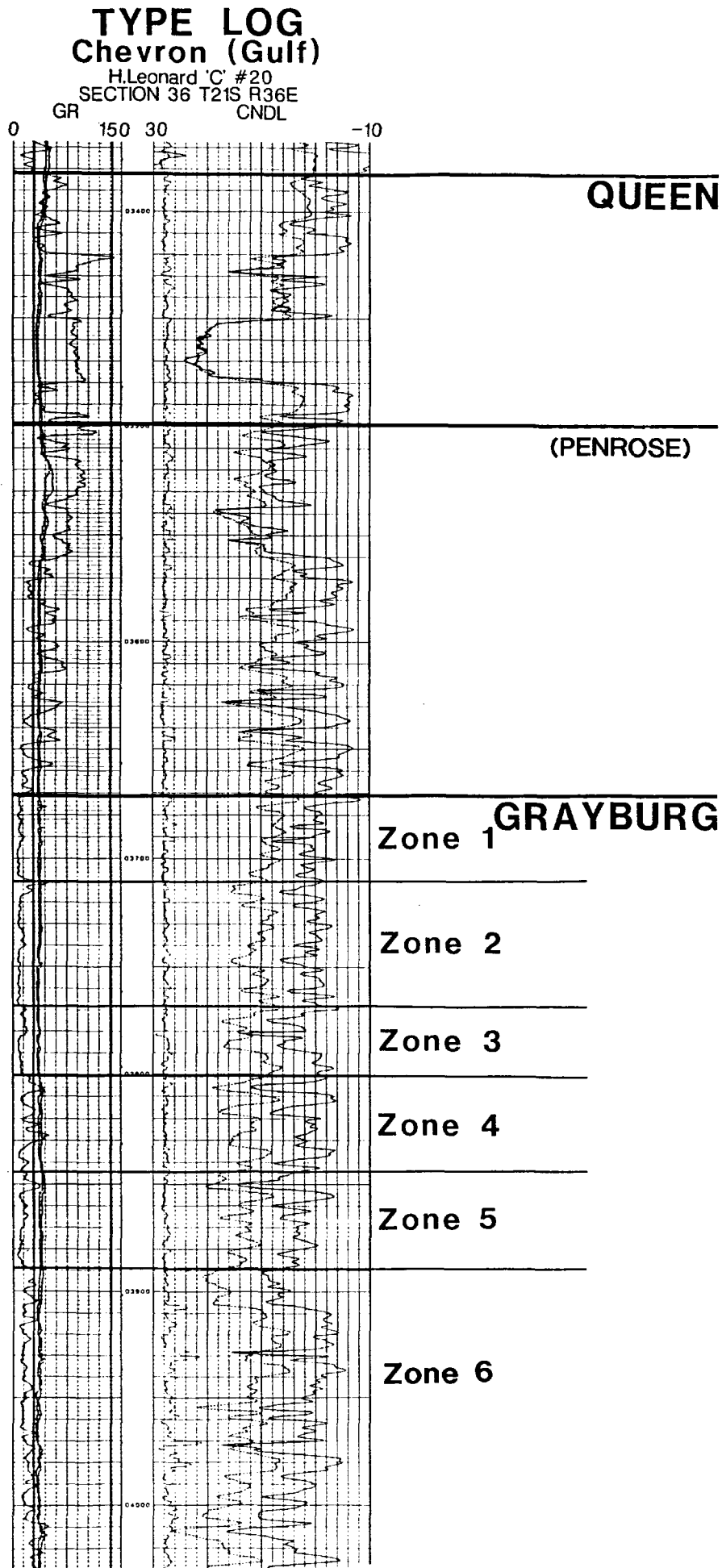


Fig. 7



# Study Area

## % DOLOMITE MAP (GRAYBURG ZONES 1-5)

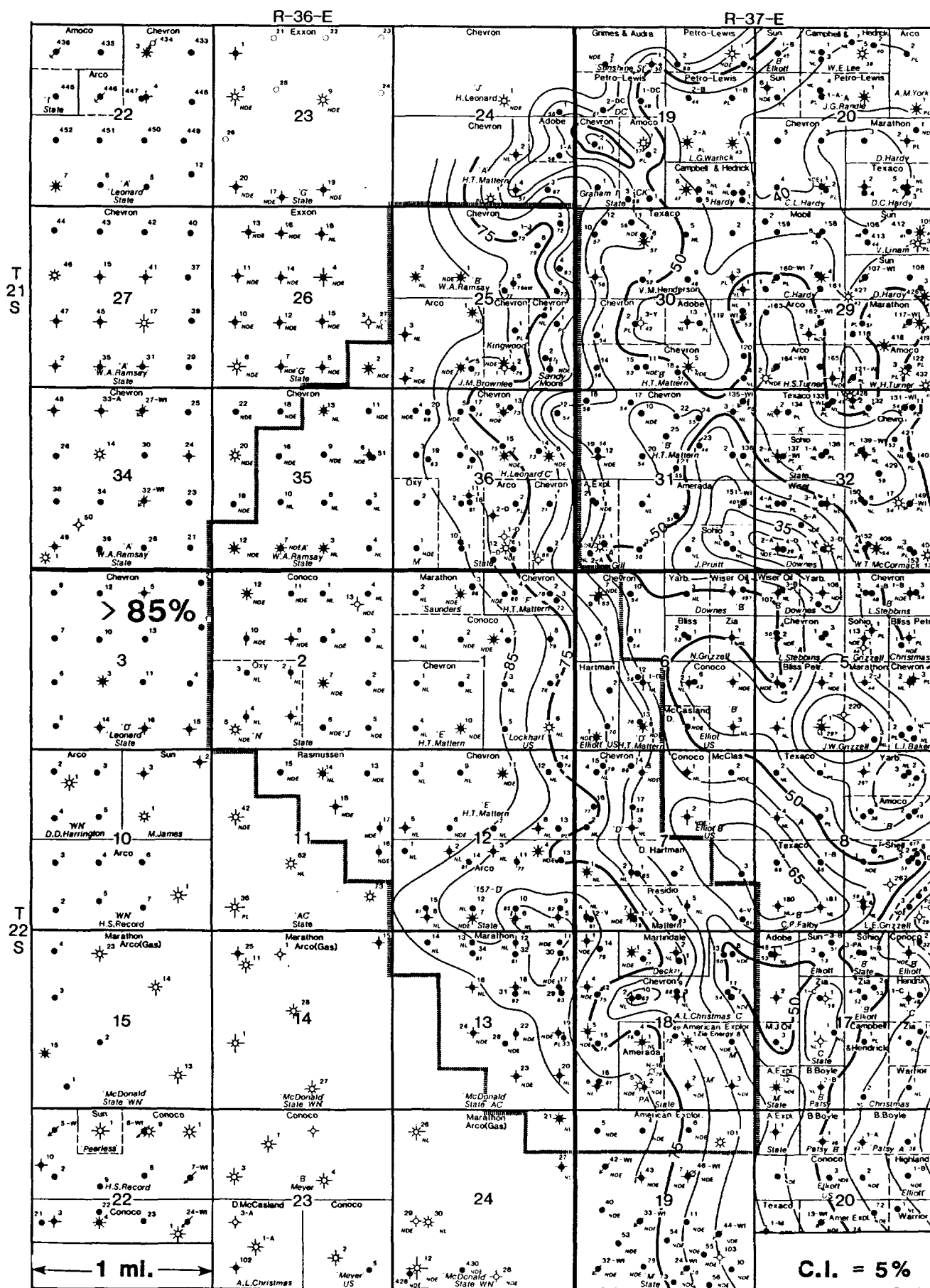


Fig. 8

# PROPOSED ARROWHEAD GRAYBURG UNIT PRODUCTION PLOT

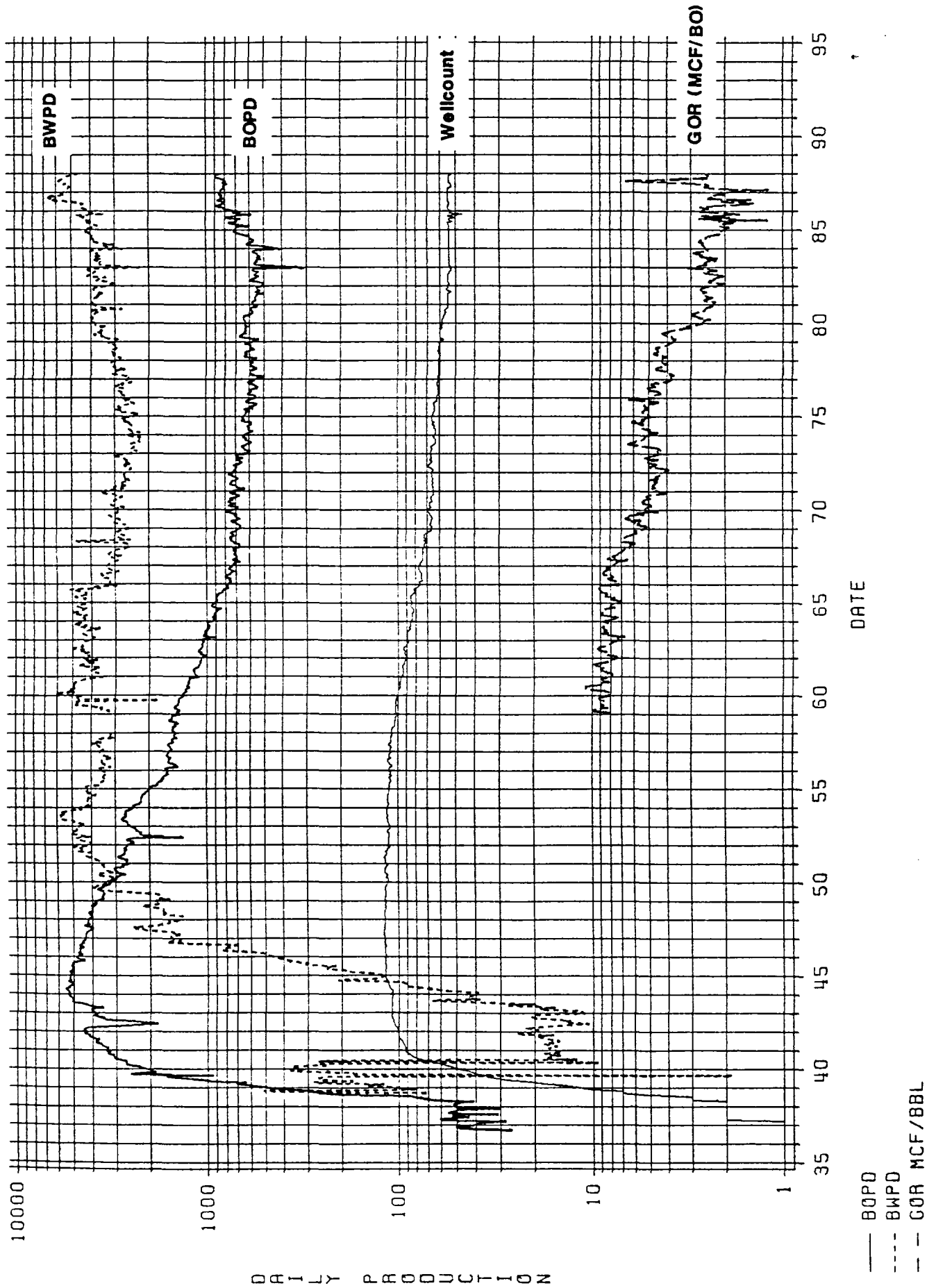


Fig. 9

Proposed Arrowhead Grayburg Unit  
Study Area  
CUMULATIVE OIL (MBO)

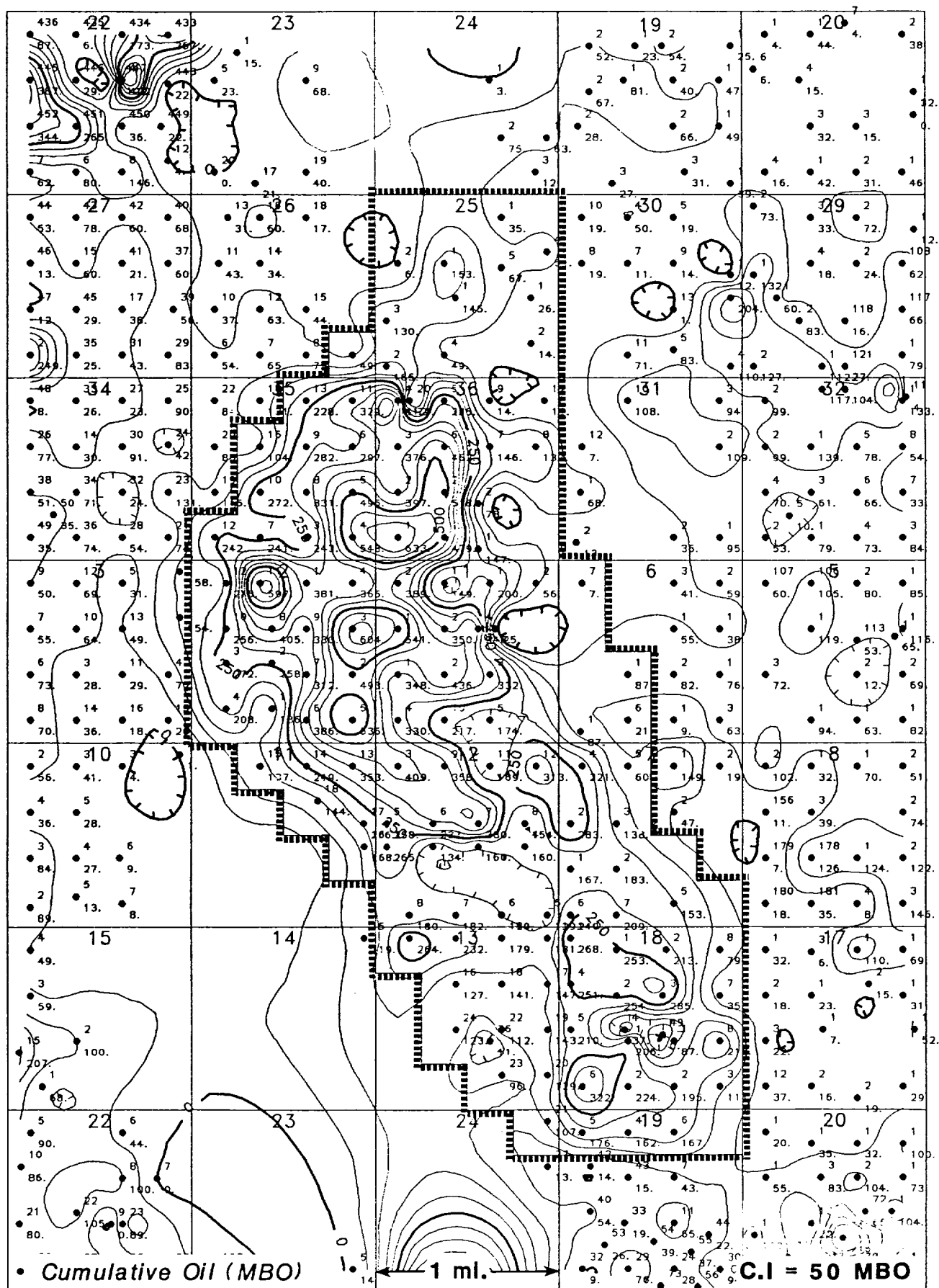


Fig. 10

# Unit Area CUMULATIVE OIL (MBO)

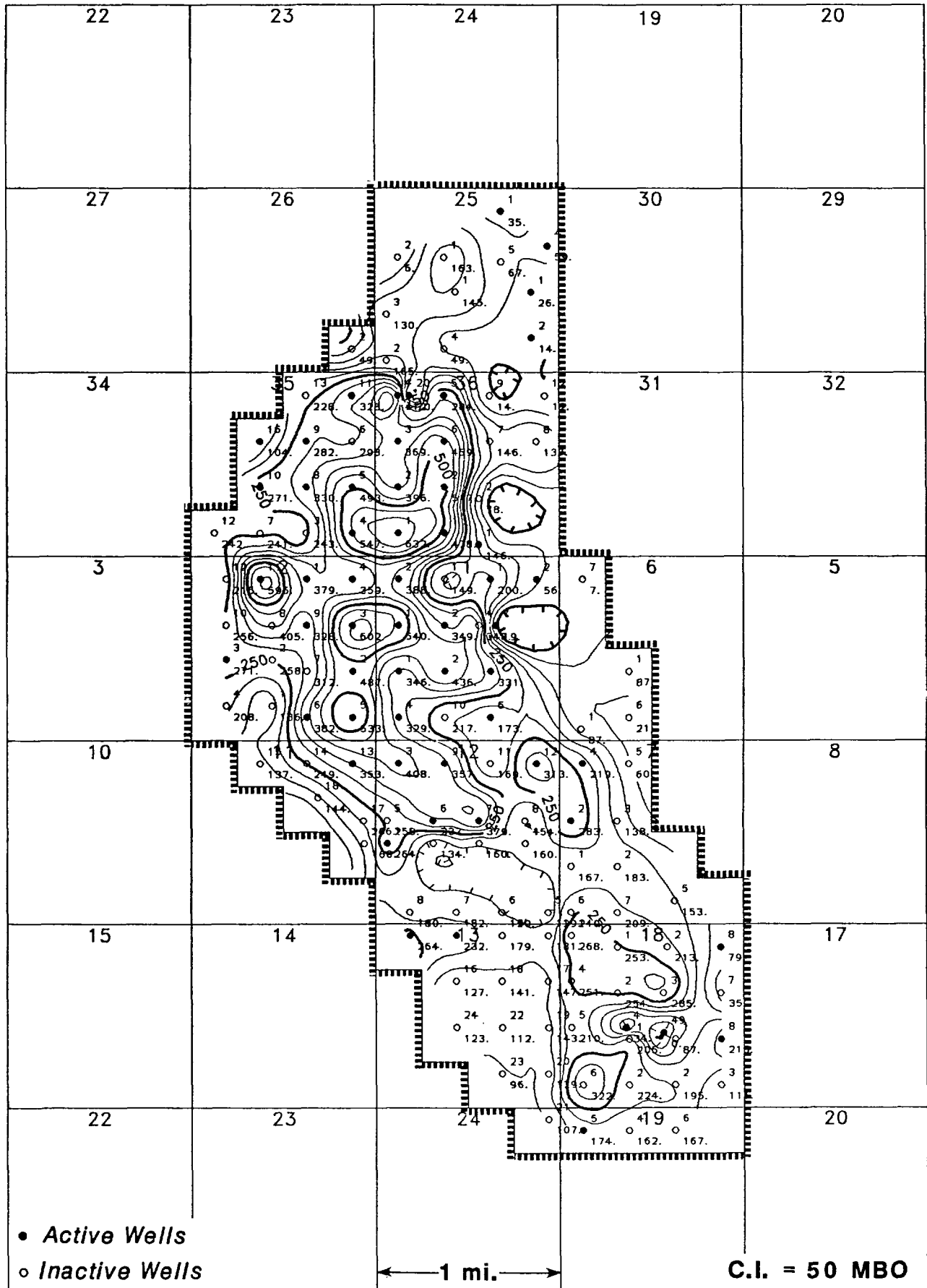


Fig. 11

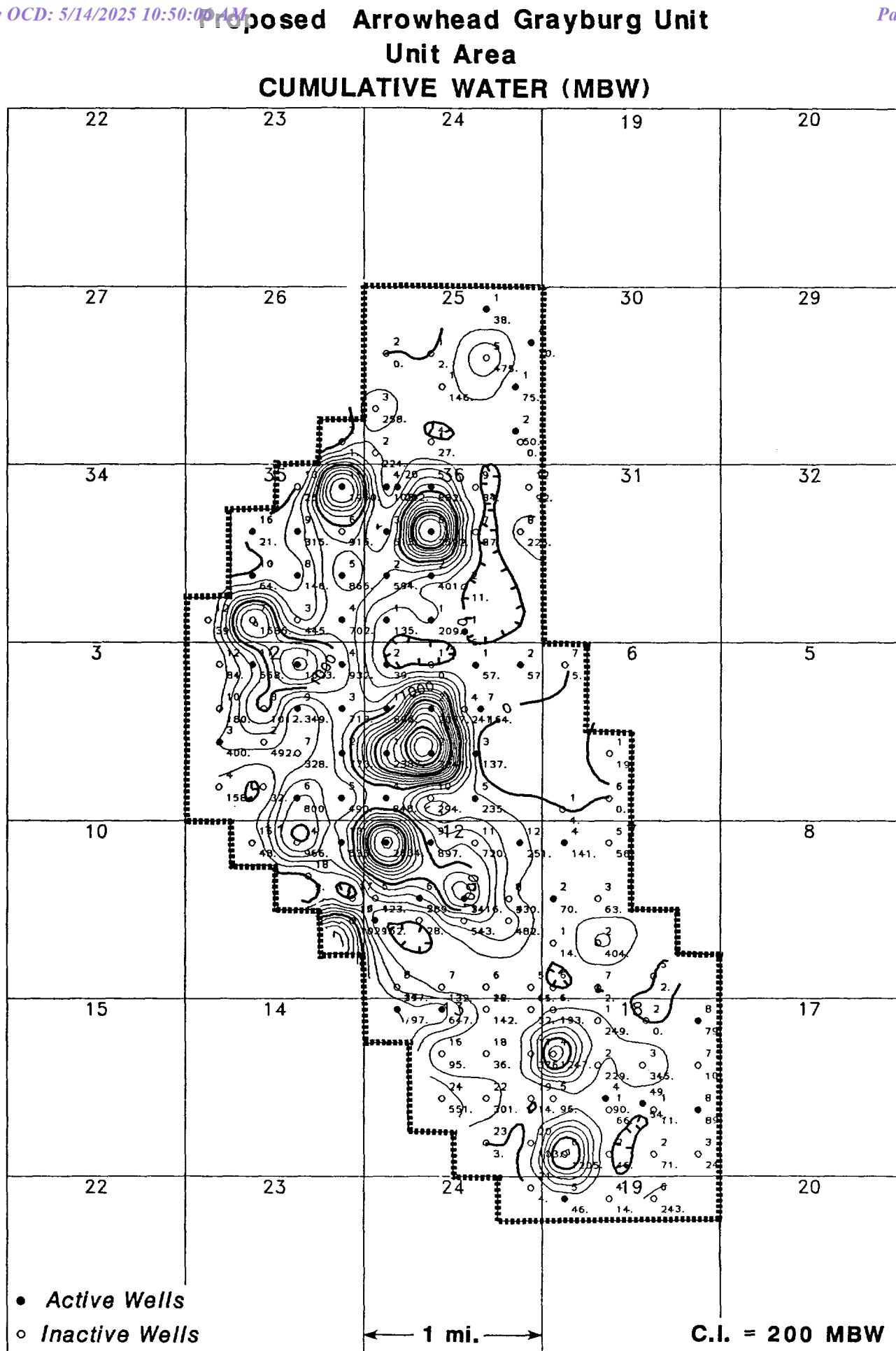


Fig. 12



# Proposed Arrowhead Grayburg Unit Unit Area CUMULATIVE WOR

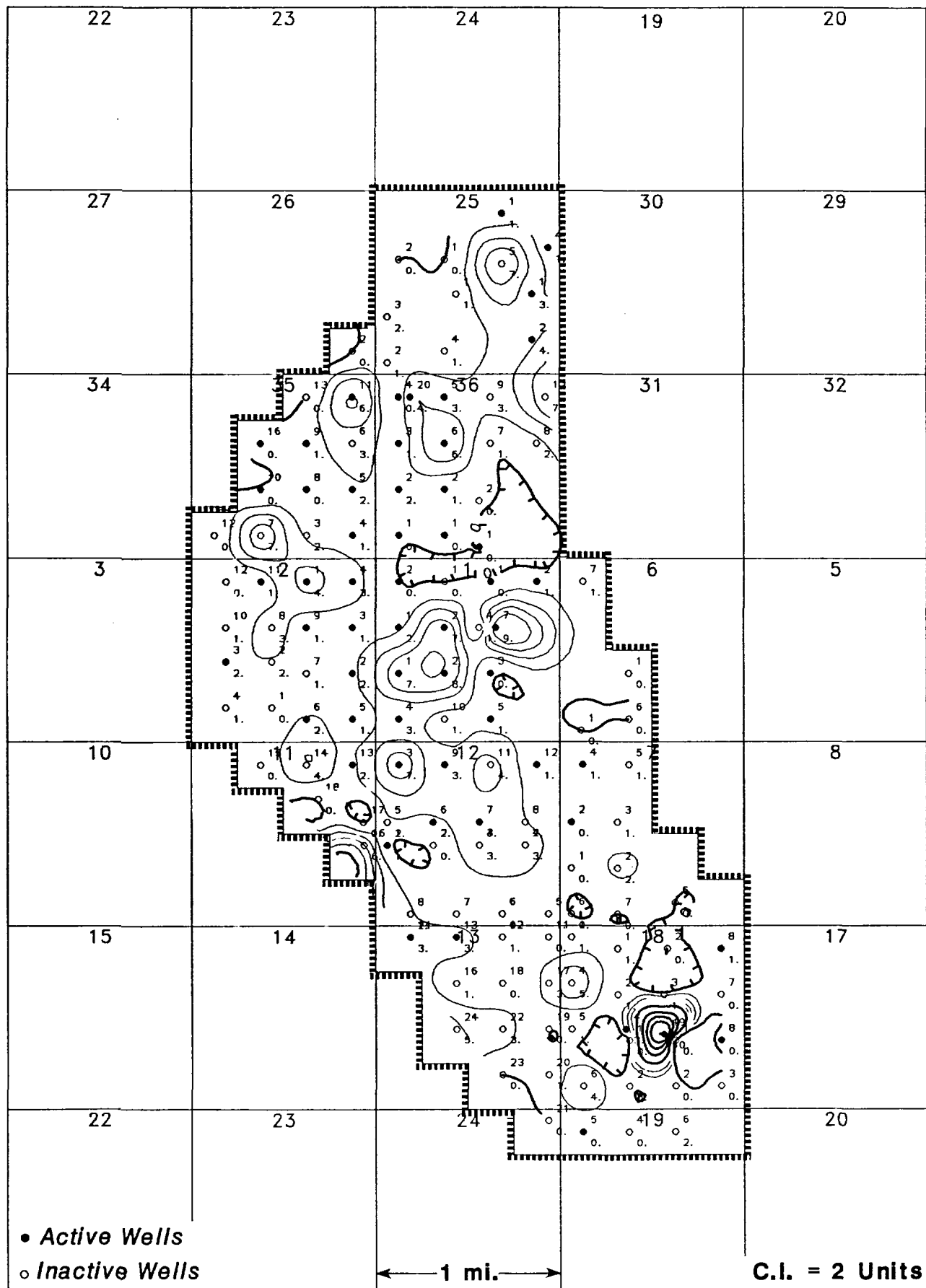


Fig.13



Unit Area

CURRENT OIL PRODUCTION (BOPD)

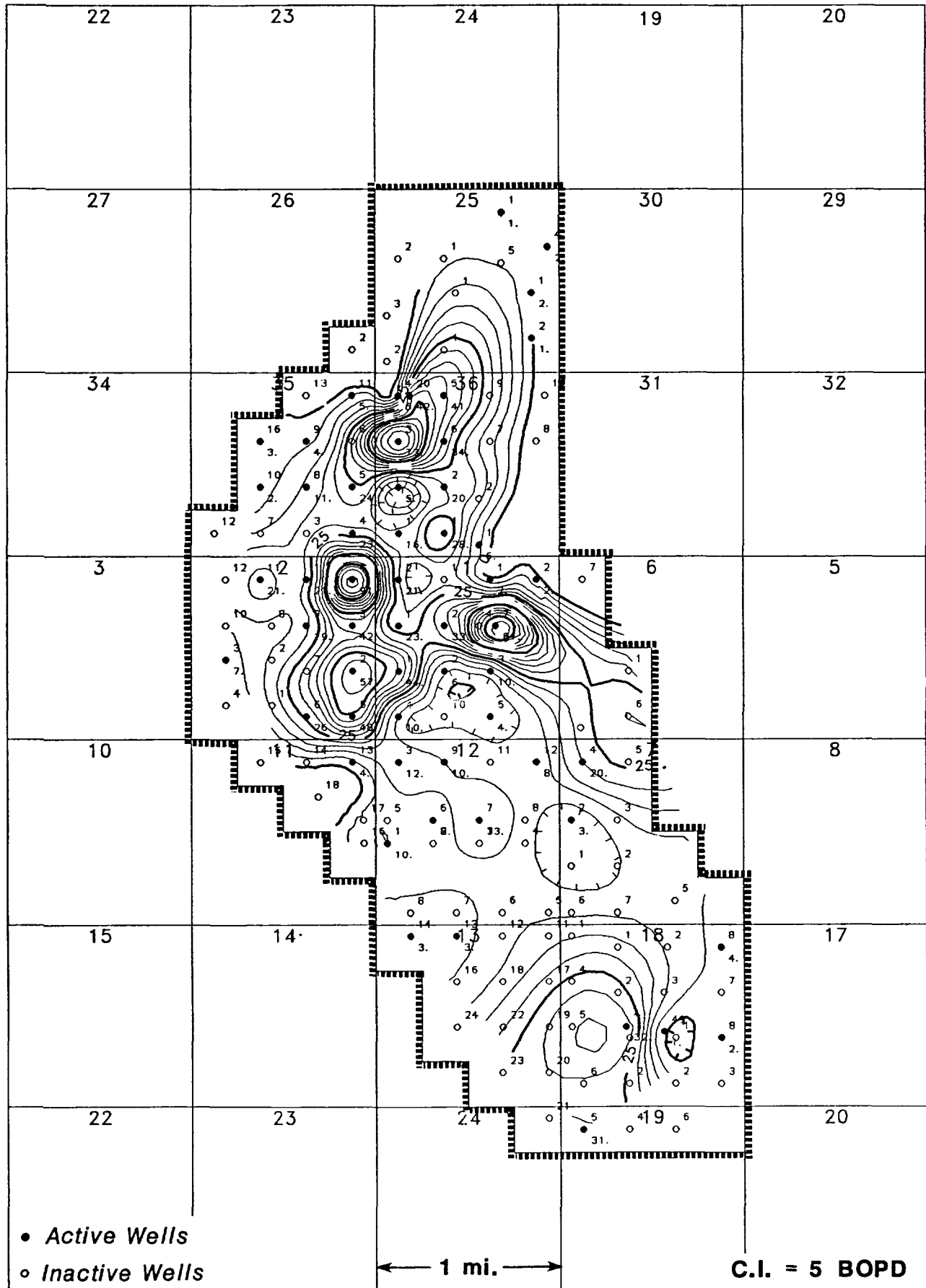


Fig. 14

CURRENT WATER PRODUCTION (BWPD)

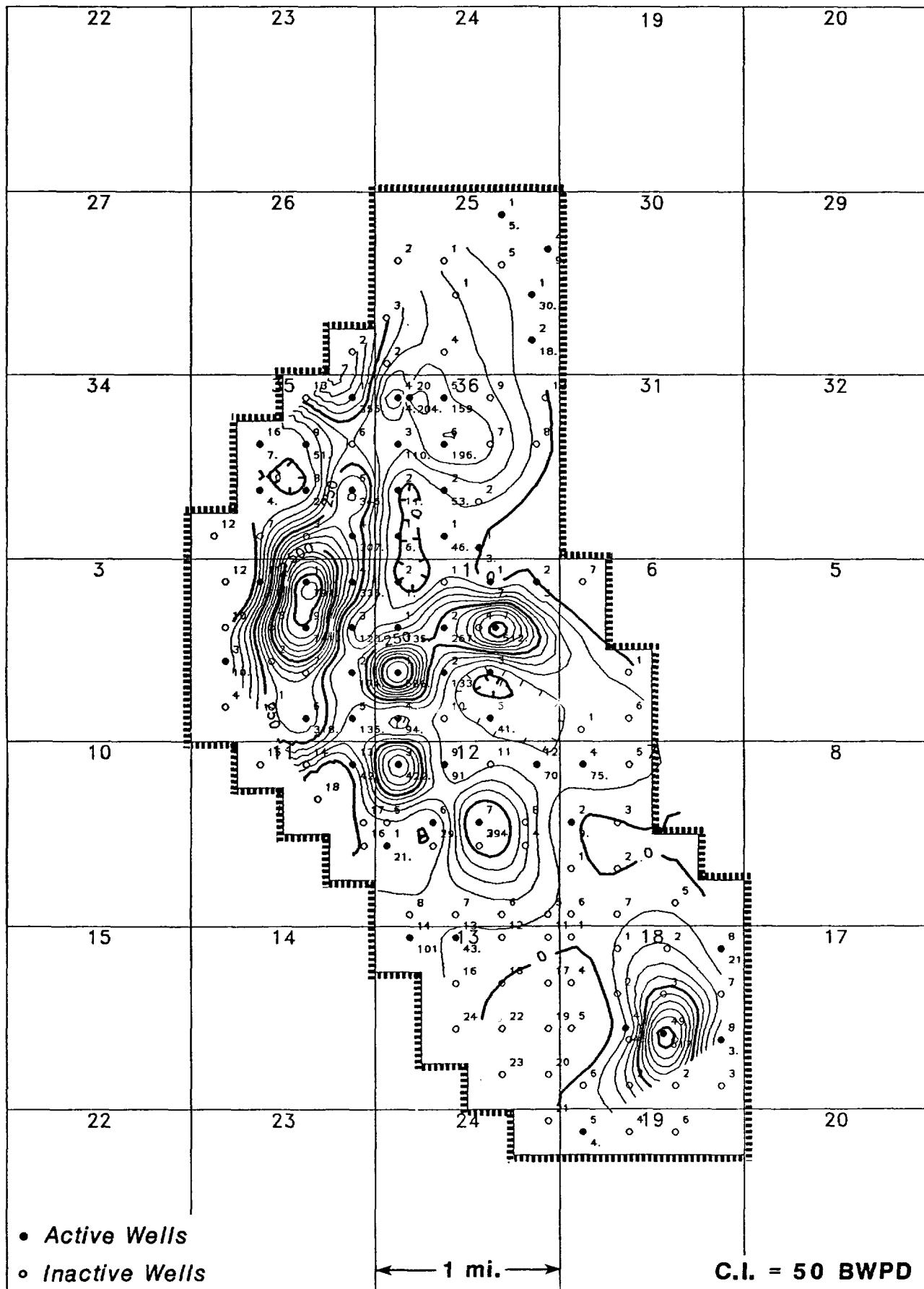


Fig. 15

Unit Area

CURRENT GAS PRODUCTION (MCFPD)

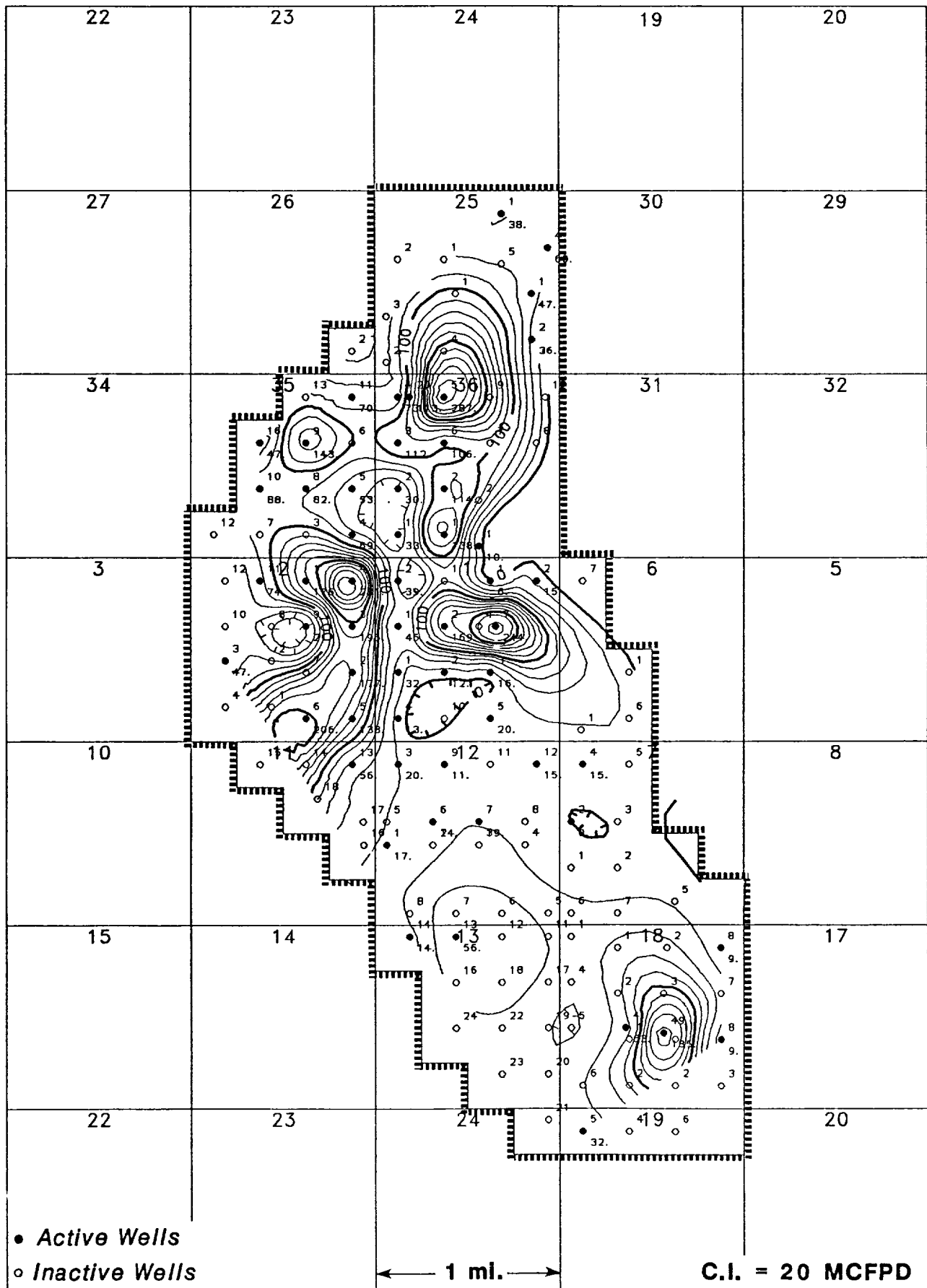


Fig. 16

**Proposed Arrowhead Grayburg Unit**  
**Unit Area**  
**Current Producing Water-Oil Ratio**

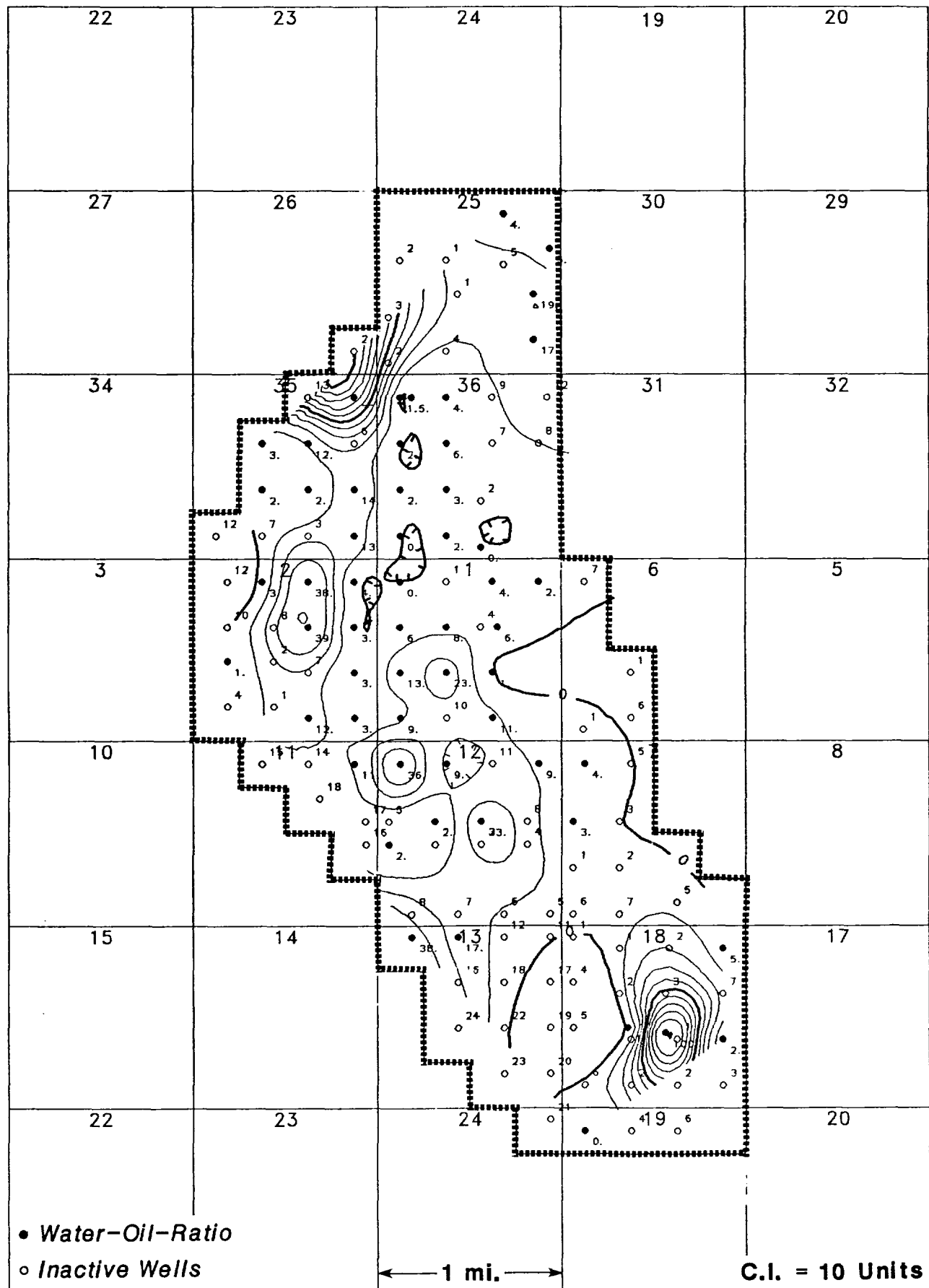


Fig. 17

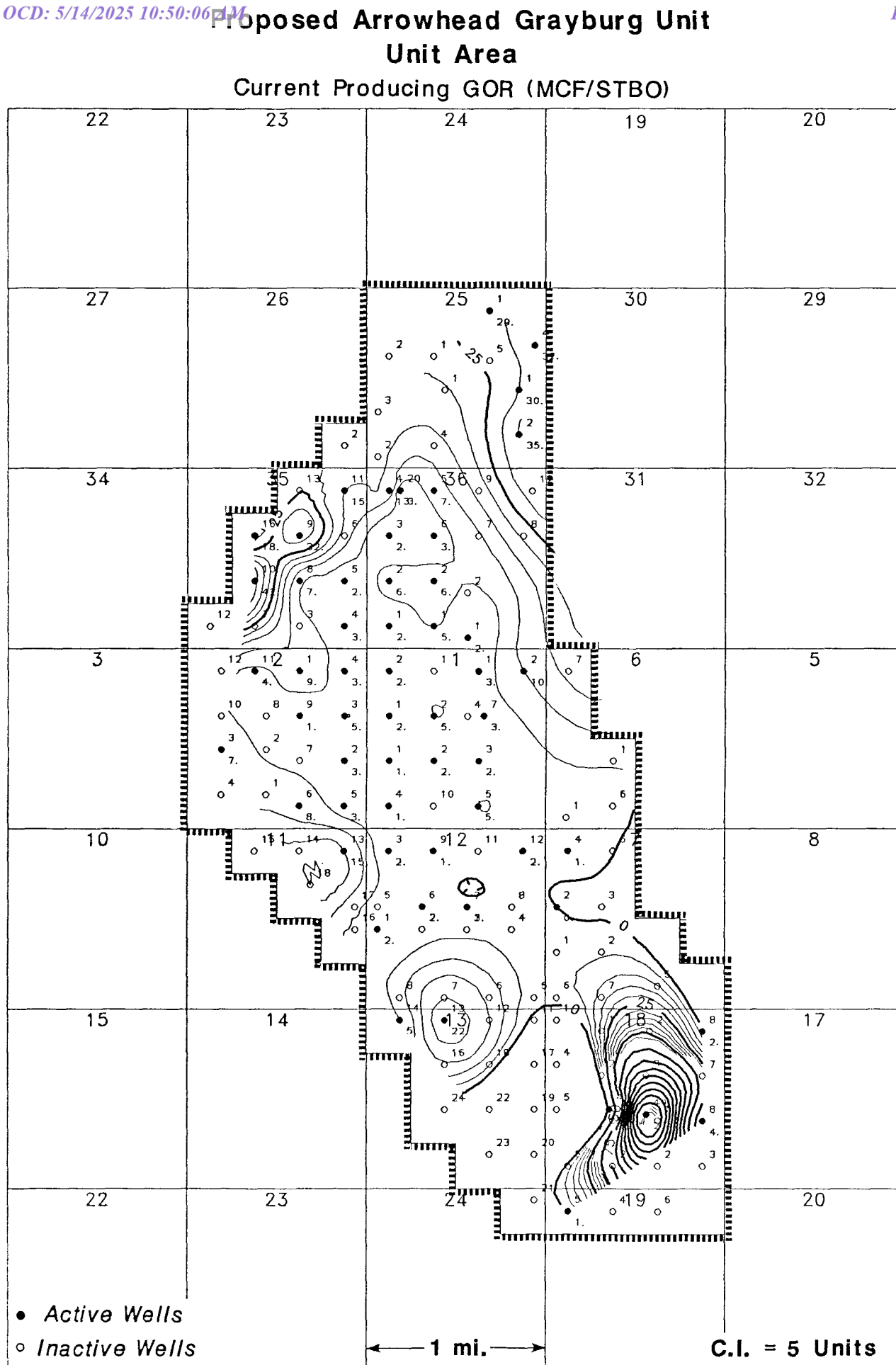


Fig. 18



**Fig. 19**



# PROPOSED ARROWHEAD GRAYBURG UNIT TYPICAL COMPLETION INTERVAL

Stick Diagram 'A' (Index Map - Fig. 19)

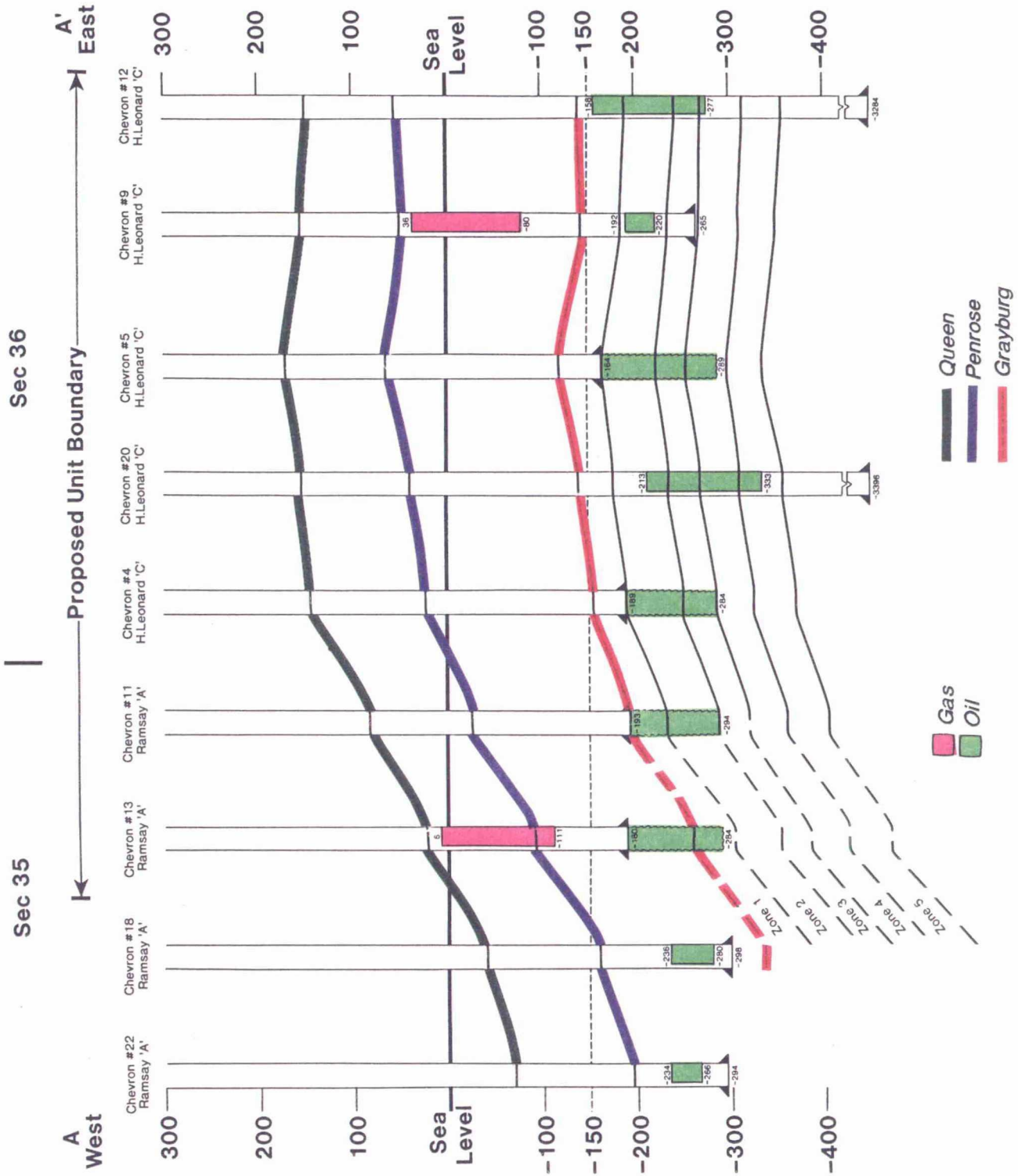


Fig. 20

# PROPOSED ARROWHEAD GRAYBURG UNIT TYPICAL COMPLETION INTERVAL

Stick Diagram 'B' (Index Map - Fig. 19)

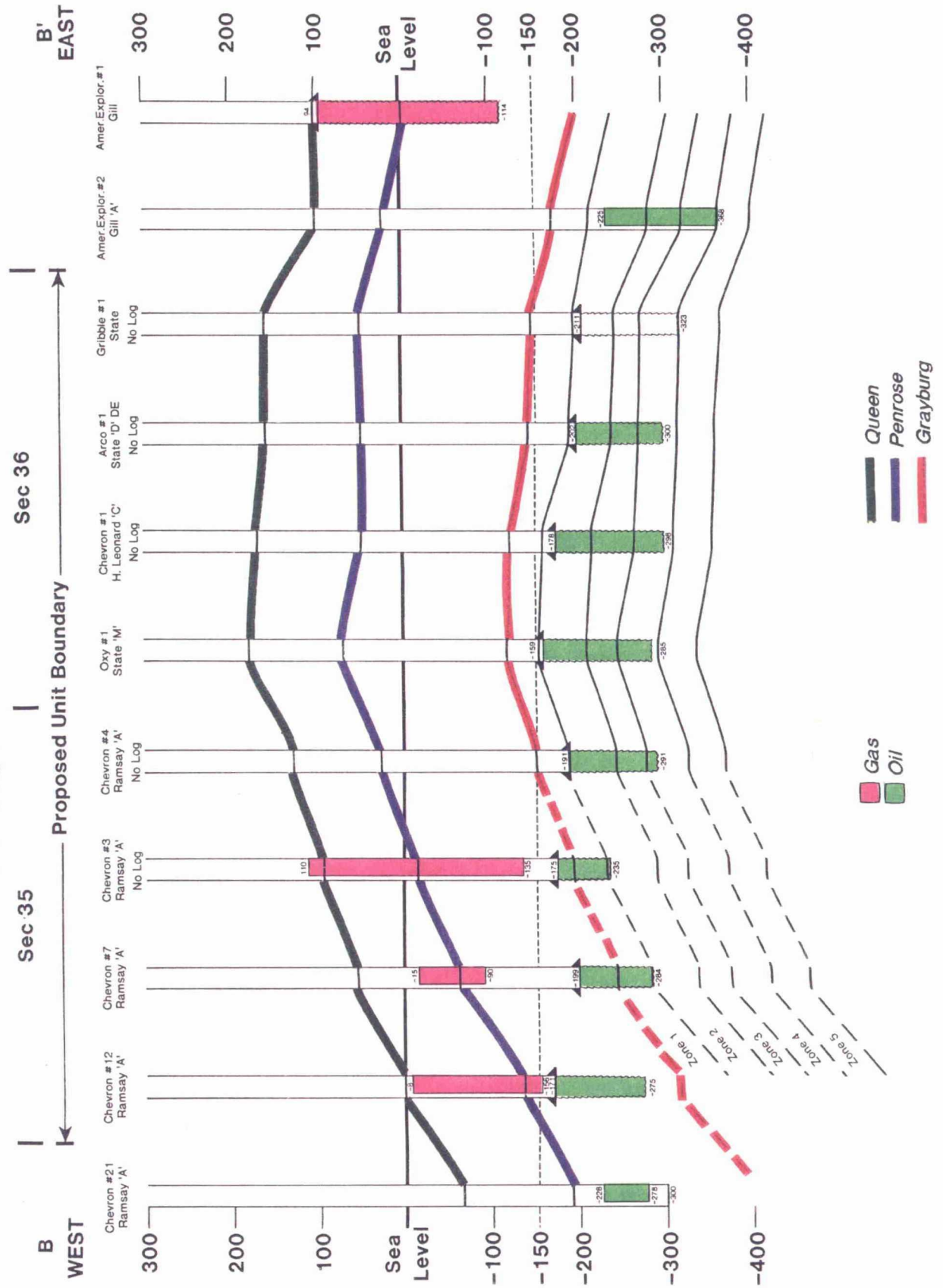


Fig. 21

# PROPOSED ARROWHEAD GRAYBURG UNIT TYPICAL COMPLETION INTERVAL

Stick Diagram 'C' (Index Map - Fig. 19)

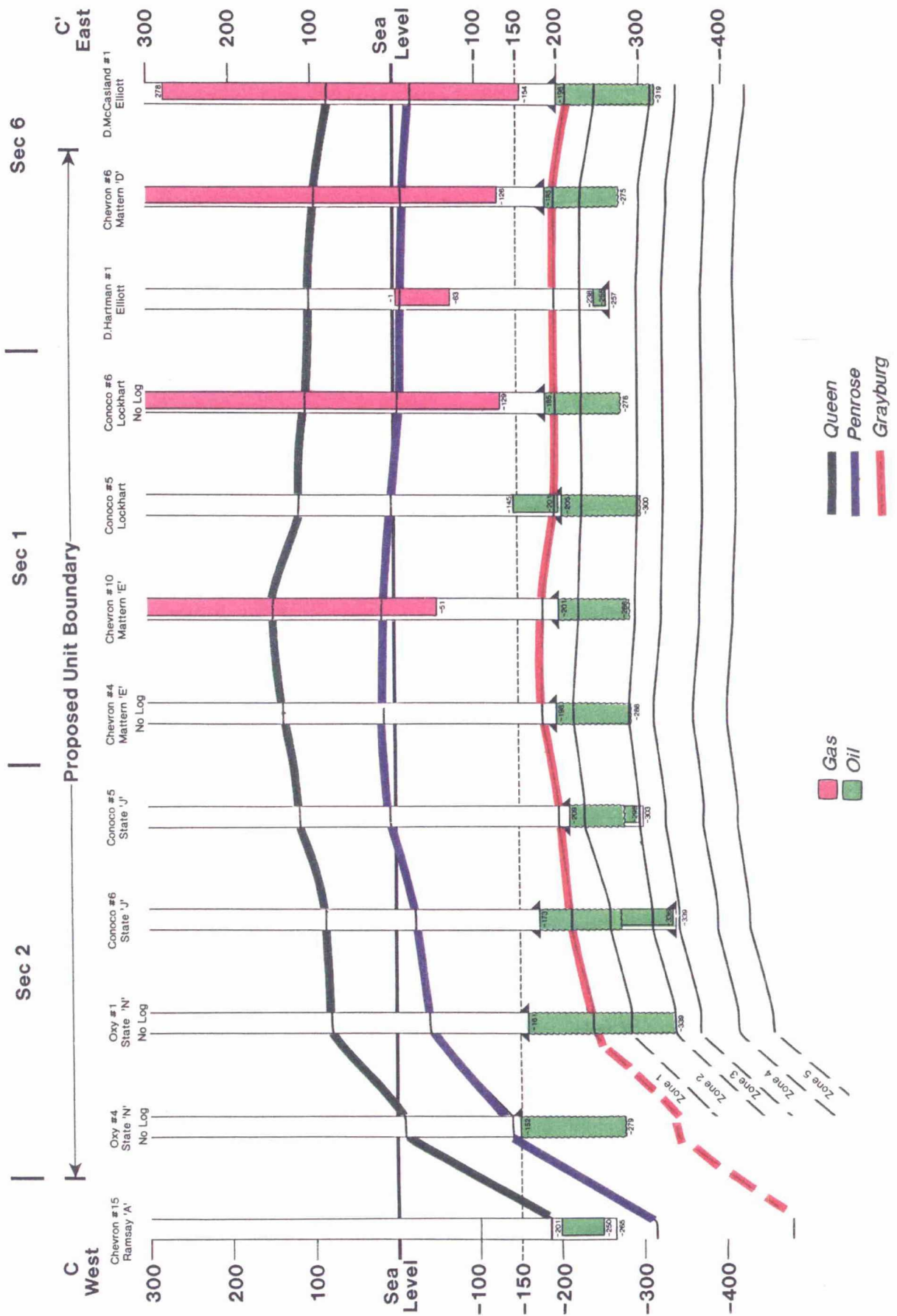


Fig. 22

# PROPOSED ARROWHEAD GRAYBURG UNIT TYPICAL COMPLETION INTERVAL

Stick Diagram 'D' (Index Map - Fig. 19)

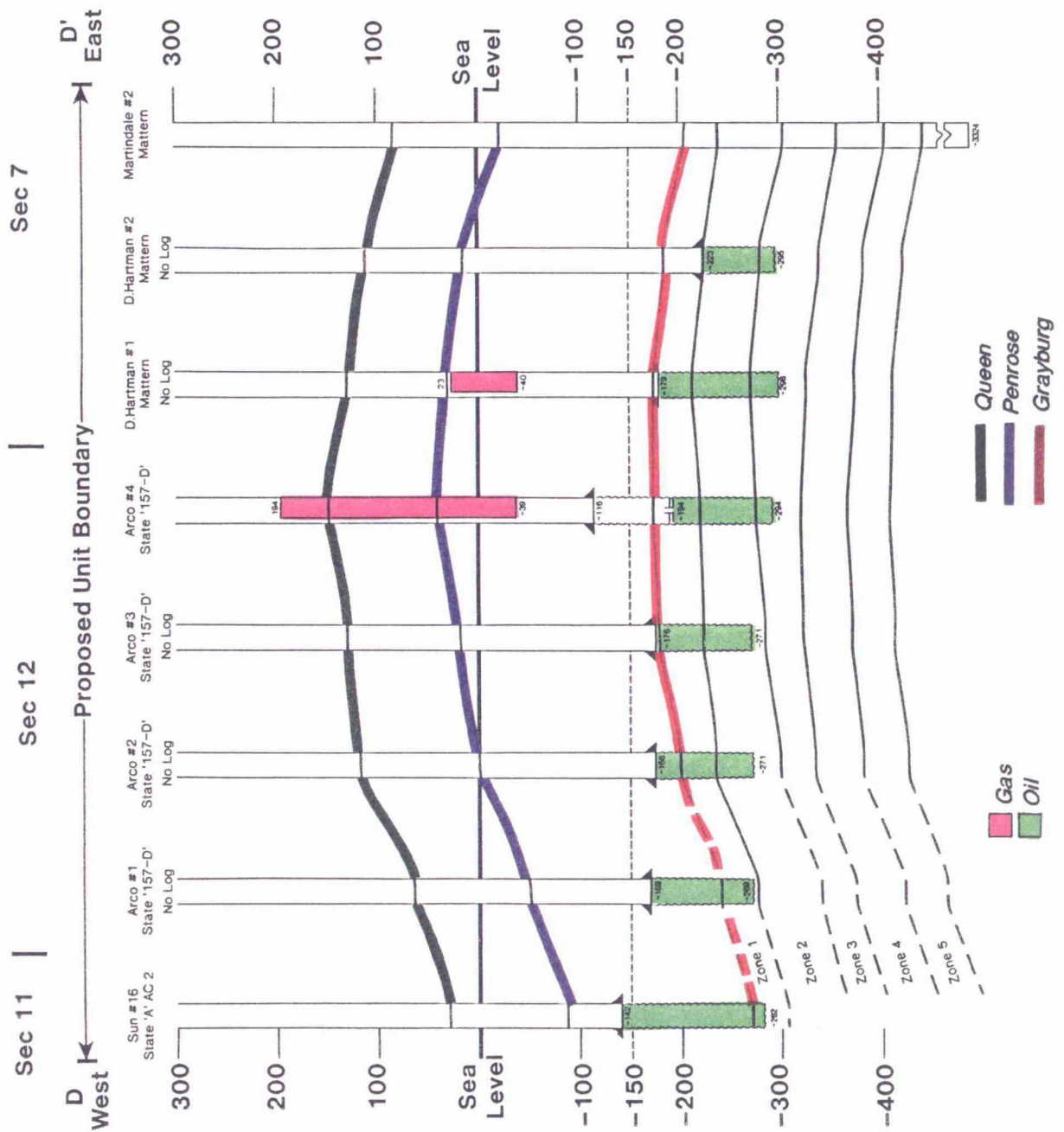


Fig. 23



# PROPOSED ARROWHEAD GRAYBURG UNIT TYPICAL COMPLETION INTERVAL

Stick Diagram 'E' (Index Map - Fig. 19)

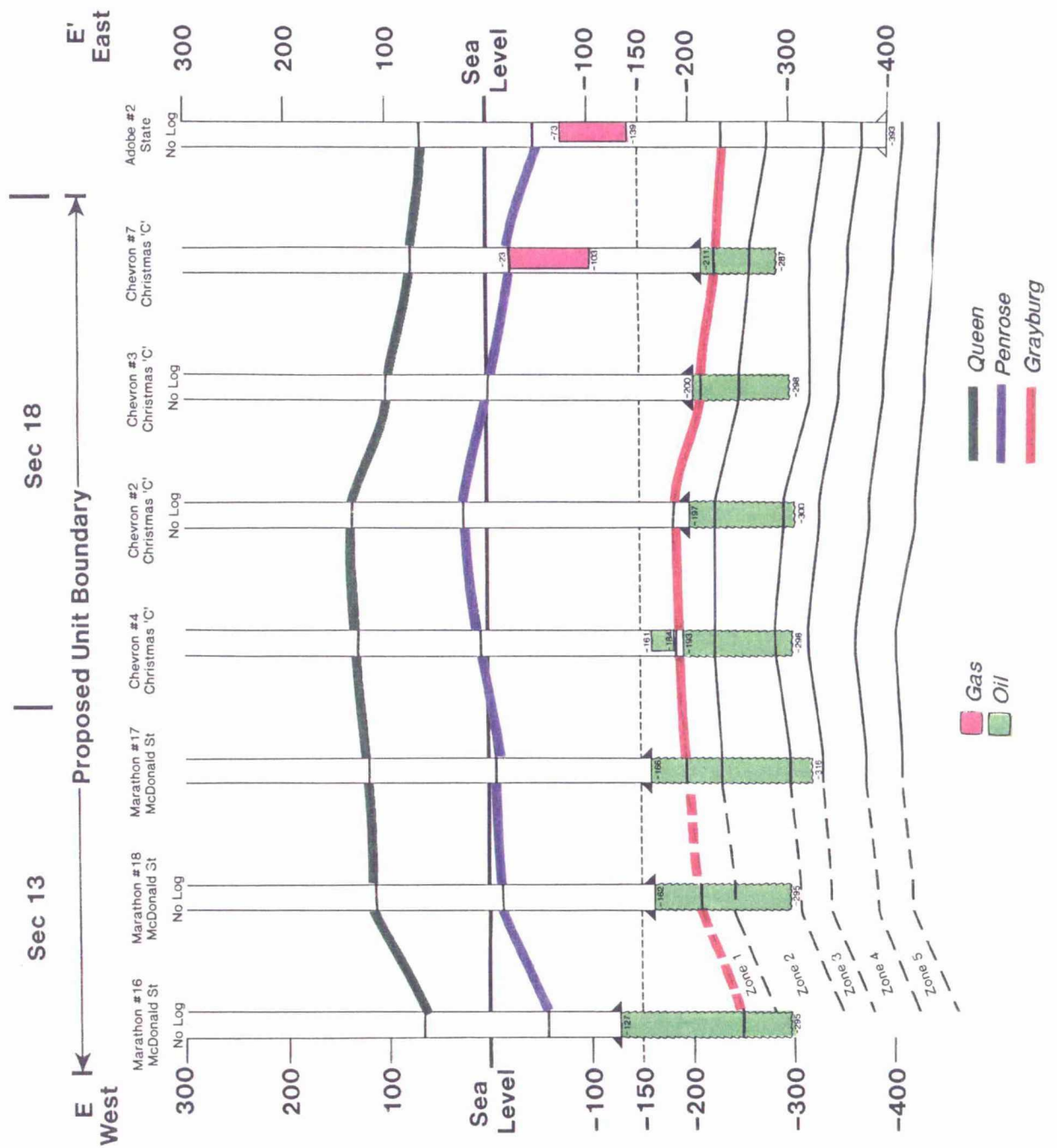


Fig. 24

# PROPOSED ARROWHEAD GRAYBURG UNIT RECOVERY PREDICTION

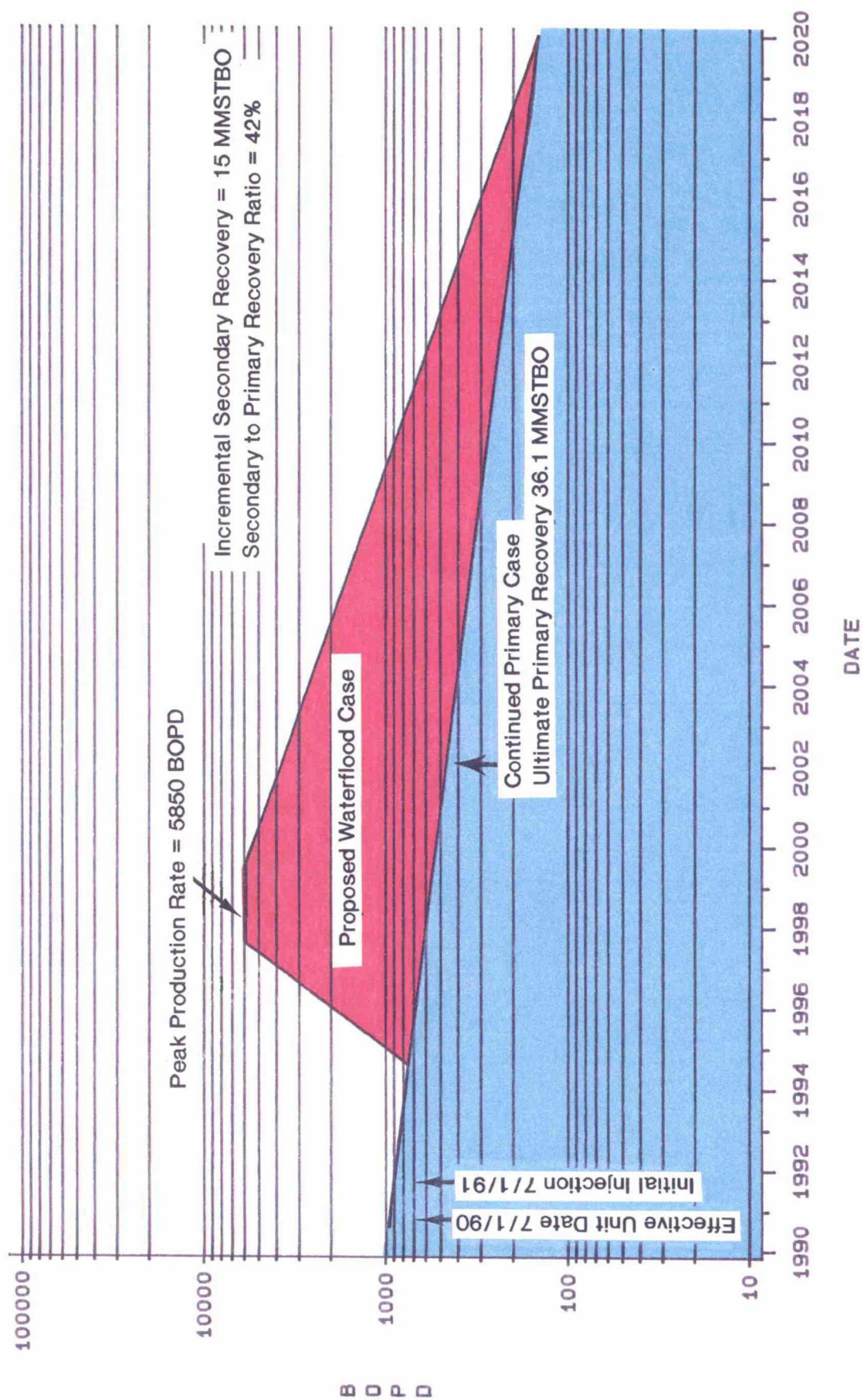


Fig. 26



# Proposed Arrowhead Grayburg Unit Well Locations

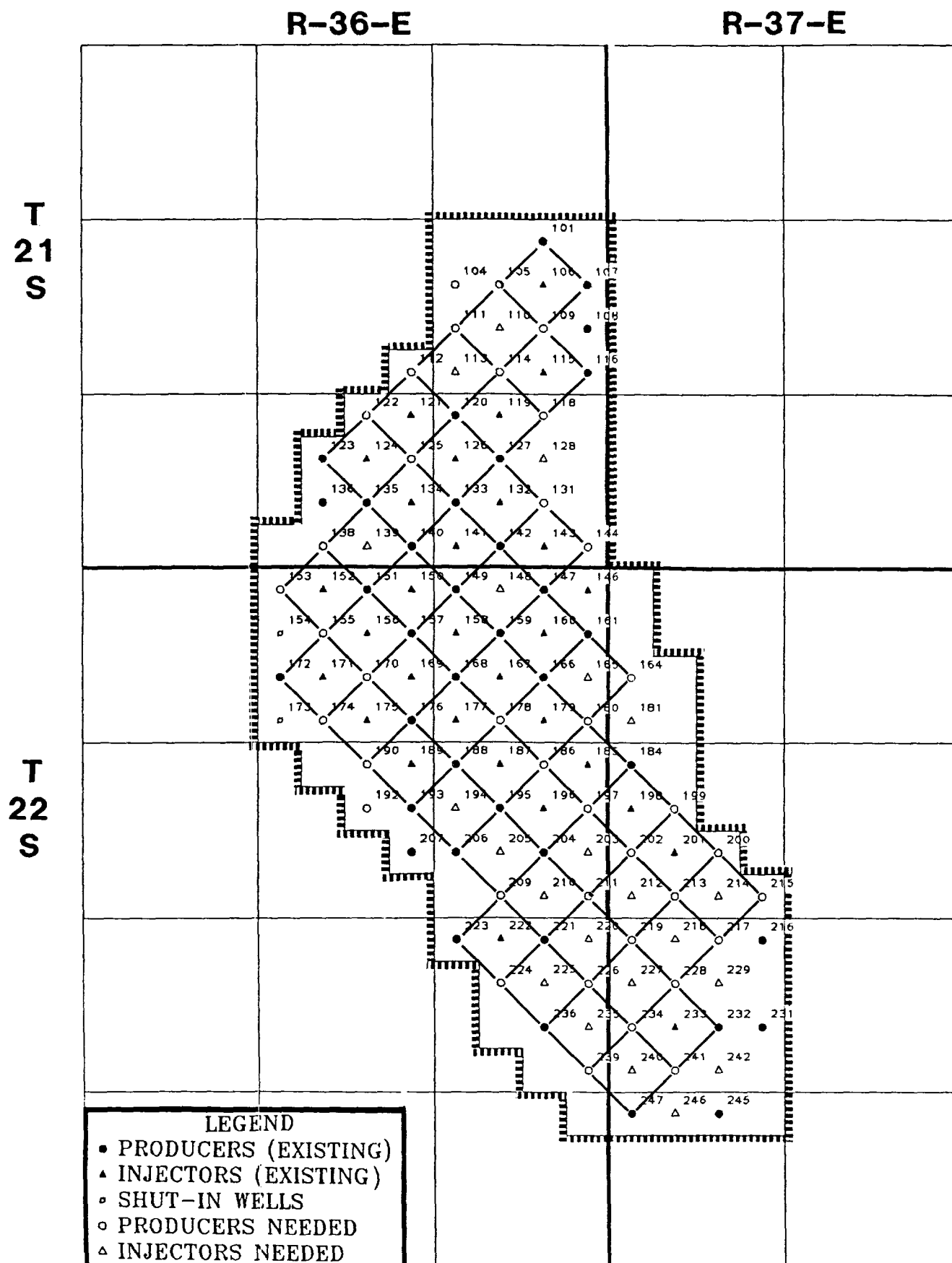


Fig.25

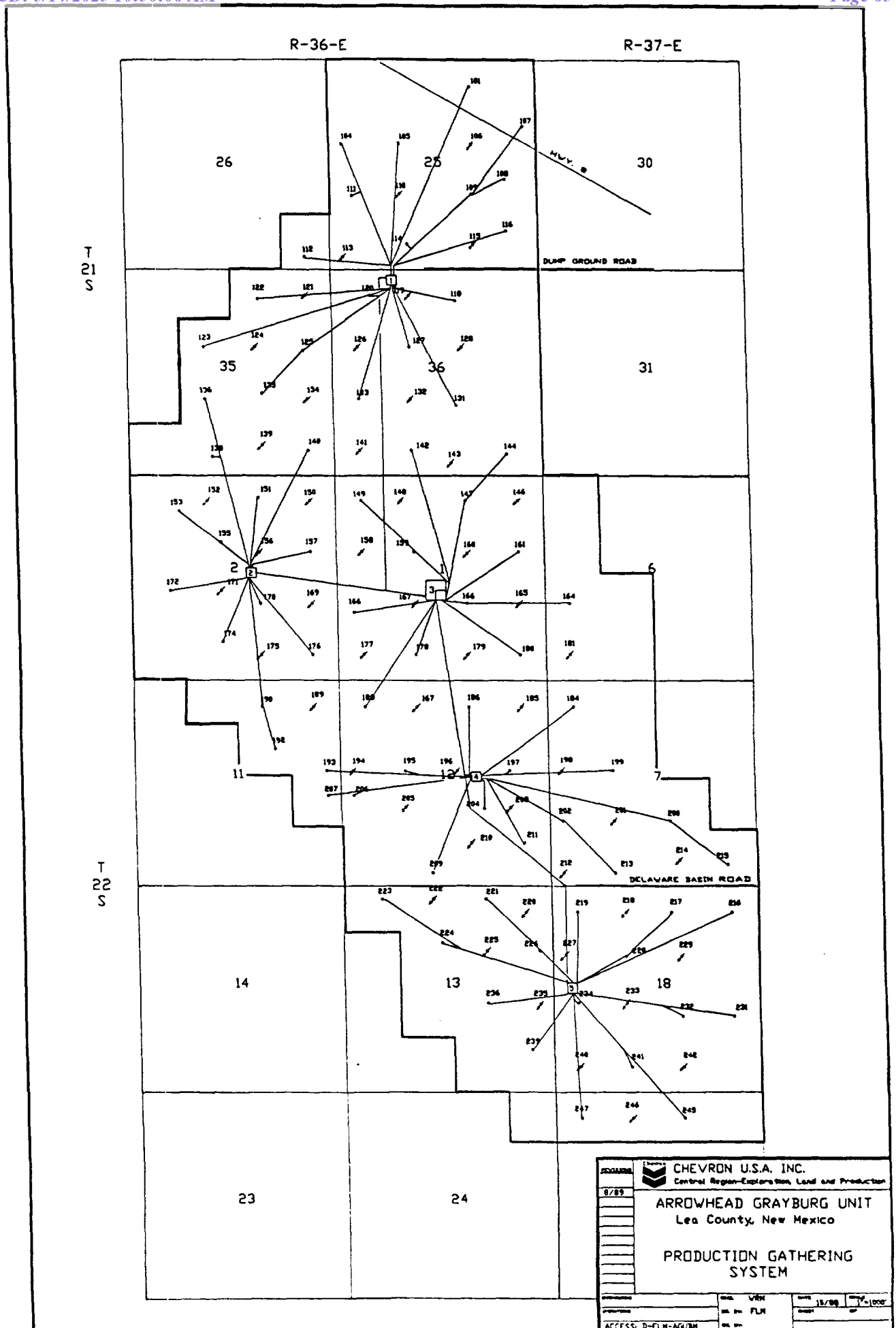


Fig. 27

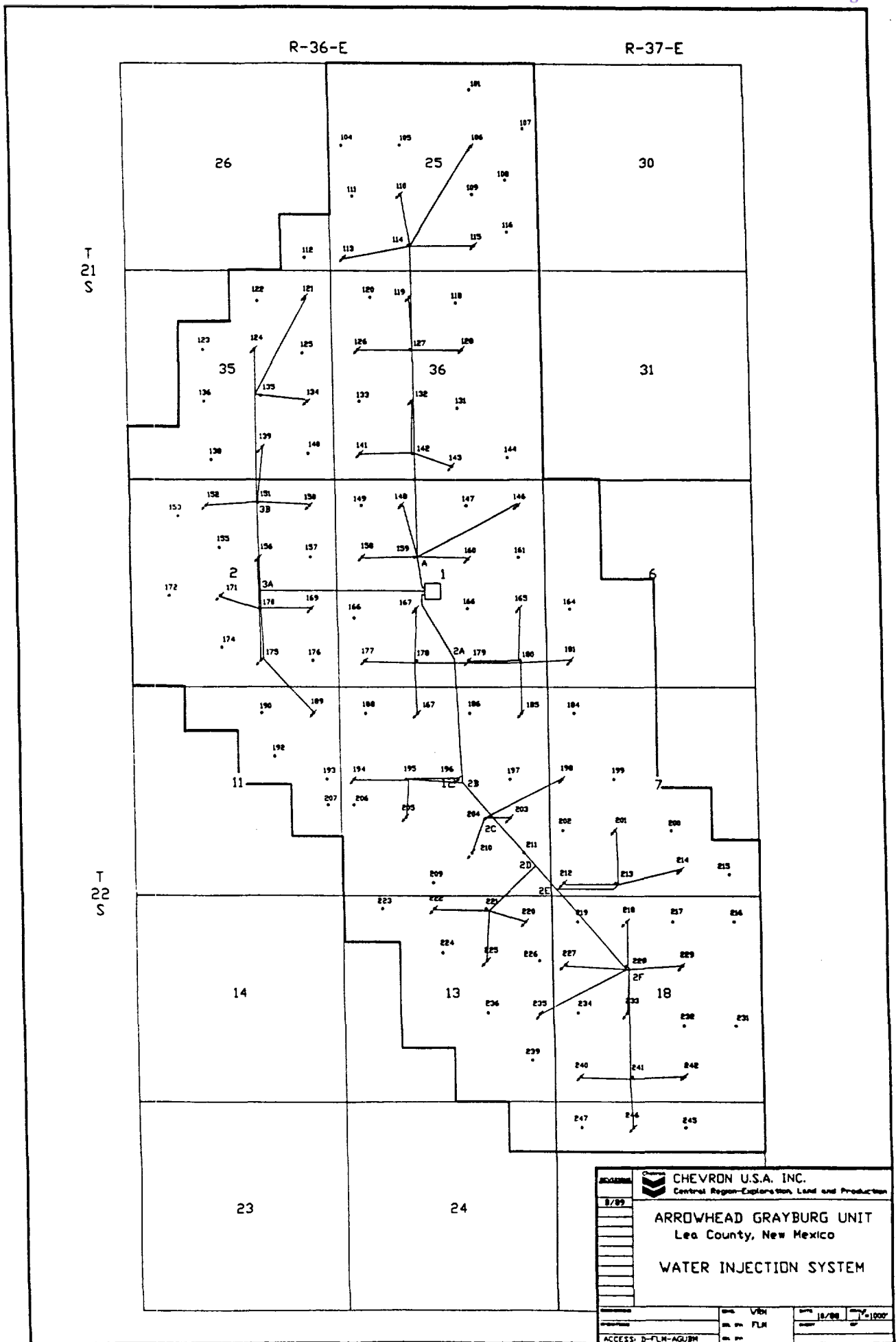


Fig. 28

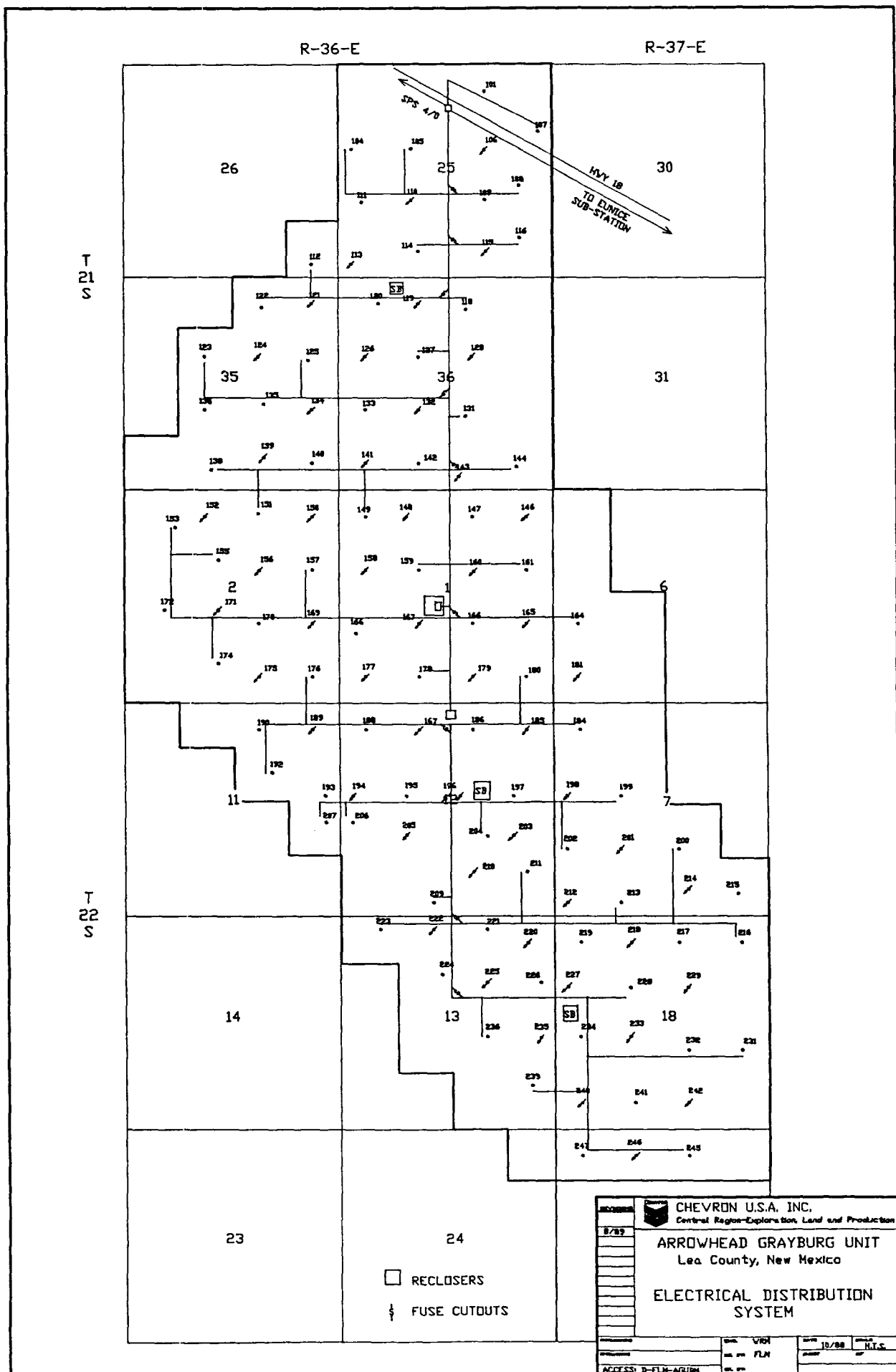


Fig. 29

TABLE 1

PROPOSED ARROWHEAD GRAYBURG UNIT  
PERTINENT RESERVOIR DATA

|                                        |                             |
|----------------------------------------|-----------------------------|
| Pool Discovery Well:                   | Continental State J-2 No. 1 |
| Discovery Date:                        | 5-24-38                     |
| Producing Formation:                   | Grayburg                    |
| Lithology:                             | Dolomite                    |
| Average Porosity:                      | 8%                          |
| Average Net Thickness:                 | 85 ft                       |
| Swi:                                   | 25%                         |
| Initial Reservoir Pressure (250 S.S.): | 1460 psi                    |
| Reservoir Temperature:                 | 90° F                       |
| Oil Gravity (API):                     | 34°                         |
| Cumulative Oil Recovery (12-31-88):    | 30.8 MMSTBO                 |
| Predicted Ultimate Primary Recovery:   | 36.1 MMSTBO                 |
| OOIP:                                  | 175.4 MMSTBO                |

TABLE 2  
PROPOSED ARROWHEAD GRAYBURG UNIT  
TRACT DEFINITIONS

| <u>TRACT</u> | <u>OPERATOR</u>            | <u>LEASE</u>                 | <u>SECTION</u> | <u>TOWNSHIP</u> | <u>RANGE</u> |
|--------------|----------------------------|------------------------------|----------------|-----------------|--------------|
| 1            | Chevron                    | Elliot B 6                   | 18             | 22-S            | 37-E         |
| 2            | Conoco                     | Lockhart B 1                 | 1              | 22-S            | 36-E         |
| 3            | Marathon                   | C. J. Saunders               | 1              | 22-S            | 36-E         |
| 4            | Chevron                    | Ruby Crosby                  | 6              | 22-S            | 37-E         |
| 5            | Hal Rasmussen              | State A                      | 11             | 22-S            | 36-E         |
| 6            | Chevron                    | Graham State (NCT-J)         | 25             | 21-S            | 36-E         |
| 7            | Marathon                   | McDonald State               | 13, 24         | 22-S            | 36-E         |
| 8a           | American Exploration (Zia) | New Mexico M State           | 18             | 22-S            | 37-E         |
| 8b           | American Exploration       | New Mexico M State           | 19             | 22-S            | 37-E         |
| 9            | Amerada Hess               | State PA                     | 18             | 22-S            | 37-E         |
| 10           | Exxon                      | New Mexico G State           | 26             | 21-S            | 36-E         |
| 11           | Arco                       | State D DE                   | 36             | 21-S            | 36-E         |
| 12           | Oxy USA                    | State M                      | 36             | 21-S            | 36-E         |
| 13           | Oxy USA                    | State N                      | 2              | 22-S            | 36-E         |
| 14           | Arco                       | State 157 D                  | 12             | 22-S            | 36-E         |
| 15           | Conoco                     | State J 2                    | 2              | 22-S            | 36-E         |
| 16           | Chevron                    | W A Ramsay (NCT-A & B)       | 25, 35         | 21-S            | 36-E         |
| 17           | Chevron                    | Harry Leonard (NCT-C)        | 36             | 21-S            | 36-E         |
| 18           | Chevron                    | State 36                     | 36             | 21-S            | 36-E         |
| 19           | Arco                       | Brownlee                     | 25             | 22-S            | 36-E         |
| 20           | Chevron                    | Kingwood                     | 25             | 22-S            | 36-E         |
| 21           | Chevron                    | Sandy                        | 25             | 22-S            | 36-E         |
| 22           | Chevron                    | H. T. Mattem (NCT-D, E, & F) | 1, 12 / 6, 9   | 22-S            | 36-E/37-E    |
| 23           | Chevron                    | Mattem                       | 7              | 22-S            | 37-E         |
| 24           | Chevron                    | Mattem                       | 7              | 22-S            | 37-E         |
| 25           | Presidio Exploration       | Mattem                       | 7              | 22-S            | 37-E         |
| 26           | Chevron                    | A. L. Christmas (NCT-C)      | 18             | 22-S            | 37-E         |



TABLE 3  
PROPOSED ARROWHEAD GRAYBURG UNIT  
TOTAL CAPITAL INVESTMENT REQUIREMENTS

|                                       | <u>INTANGIBLES</u>  | <u>TANGIBLES</u>    | <u>TOTAL</u>        |
|---------------------------------------|---------------------|---------------------|---------------------|
| D&C New Producers                     | \$ 3,740,000        | \$ 3,740,000        | \$ 7,480,000        |
| D&C New Injectors                     | 1,760,000           | 1,440,000           | 3,200,000           |
| D&C Water Supply Wells                | 340,000             | 430,000             | 770,000             |
| Producing Well Workovers              | 2,098,000           | 1,445,000           | 3,543,000           |
| Injection Well Workovers              | 2,272,000           | 1,041,000           | 3,313,000           |
| Testing and Coring                    | 500,000             | 0                   | 500,000             |
| Surface Facilities                    | 0                   | 8,950,000           | 8,950,000           |
| Construction and Drilling<br>Overhead | 450,000             | 0                   | 450,000             |
|                                       | <u>\$11,160,000</u> | <u>\$17,046,000</u> | <u>\$28,206,000</u> |

TABLE 4  
PROPOSED ARROWHEAD GRAYBURG UNIT  
SURFACE FACILITIES COST ESTIMATE

|                                              |             |
|----------------------------------------------|-------------|
| Satellite Batteries                          | \$1,000,000 |
| Central Battery and Water<br>Injection Plant | 2,420,000   |
| Production Gathering System                  | 1,600,000   |
| Water Injection System                       | 1,580,000   |
| Electrical Distribution System               | 800,000     |
| Road Construction                            | 350,000     |
| Damages                                      | 300,000     |
| Miscellaneous                                | 900,000     |
| Water Supply                                 |             |
| Dismantling & Restoration                    |             |
| Control & Data System                        |             |
| Surveying                                    |             |
| Engineering and Inspection                   |             |
|                                              | <hr/>       |
|                                              | \$8,950,000 |

TABLE 5  
PROPOSED ARROWHEAD GRAYBURG UNIT  
DRILLING AND COMPLETION COST ESTIMATE  
PRODUCING WELL

|                                                                                                    | <u>Intangible</u> | <u>Tangible</u>  | <u>Total</u>     |
|----------------------------------------------------------------------------------------------------|-------------------|------------------|------------------|
| Contract Drilling - Day Rate<br>Drlg Rig 1 day @ \$4,000<br>Compl Rig 4 days @ \$1,500             | \$ 10,000         | \$ 0             | \$ 10,000        |
| Contract Drilling - Footage Rate<br>4000 feet @ \$10.00                                            | 40,000            | 0                | 40,000           |
| Drilling Supervision<br>8 days @ \$500                                                             | 4,000             | 0                | 4,000            |
| Drilling Fluids                                                                                    | 2,000             | 0                | 2,000            |
| Well Supplies & Non-Salvageable<br>Materials                                                       | 2,000             | 0                | 2,000            |
| Transportation Costs                                                                               | 2,000             | 0                | 2,000            |
| Drill Pipe, Bits and Tools                                                                         | 1,000             | 0                | 1,000            |
| Subsurface Contract Rentals<br>and Services                                                        | 15,000            | 0                | 15,000           |
| Formation Treatment                                                                                | 4,000             | 0                | 4,000            |
| Other Subsurface Costs                                                                             | 4,000             | 0                | 4,000            |
| Logging                                                                                            | 8,000             | 0                | 8,000            |
| Casing & Tubing<br>1350 ft 8-5/8" @ \$12.00<br>4000 ft 5½" @ \$8.00<br>4000 ft 2-7/8" IPC @ \$4.25 | 0                 | 65,000           | 65,000           |
| Wellhead, Rods, TAC                                                                                | 0                 | 15,000           | 15,000           |
| Cement Services                                                                                    | 12,000            | 0                | 12,000           |
| Site Preparation                                                                                   | 6,000             | 0                | 6,000            |
| Pumping Unit, Motor, Controls                                                                      | 0                 | 30,000           | 30,000           |
| Total                                                                                              | <u>\$110,000</u>  | <u>\$110,000</u> | <u>\$220,000</u> |

TABLE 6  
PROPOSED ARROWHEAD GRAYBURG UNIT  
DRILLING AND COMPLETION COST ESTIMATE  
INJECTION WELL

|                                                                                                    | <u>Intangible</u> | <u>Tangible</u>  | <u>Total</u>     |
|----------------------------------------------------------------------------------------------------|-------------------|------------------|------------------|
| Contract Drilling - Day Rate<br>Drlg Rig 1 day @ \$4,000<br>Compl Rig 4 days @ \$1,500             | \$ 10,000         | \$ 0             | \$ 10,000        |
| Contract Drilling - Footage Rate<br>4000 feet @ \$10.00                                            | 40,000            | 0                | 40,000           |
| Drilling Supervision<br>8 days @ \$500                                                             | 4,000             | 0                | 4,000            |
| Drilling Fluids                                                                                    | 2,000             | 0                | 2,000            |
| Well Supplies & Non-Salvageable<br>Materials                                                       | 2,000             | 0                | 2,000            |
| Transportation Costs                                                                               | 2,000             | 0                | 2,000            |
| Drill Pipe, Bits and Tools                                                                         | 1,000             | 0                | 1,000            |
| Subsurface Contract Rentals<br>and Services                                                        | 15,000            | 0                | 15,000           |
| Formation Treatment                                                                                | 4,000             | 0                | 4,000            |
| Other Subsurface Costs                                                                             | 4,000             | 0                | 4,000            |
| Logging                                                                                            | 8,000             | 0                | 8,000            |
| Casing & Tubing<br>1350 ft 8-5/8" @ \$12.00<br>4000 ft 5½" @ \$8.00<br>4000 ft 2-3/8" IPC @ \$6.00 | 0                 | 72,000           | 72,000           |
| Wellhead, Packer                                                                                   | 0                 | 15,000           | 15,000           |
| Cement Services                                                                                    | 12,000            | 0                | 12,000           |
| Site Preparation                                                                                   | 6,000             | 0                | 6,000            |
| Misc. Surface Equipment                                                                            | 0                 | 3,000            | 3,000            |
| Total                                                                                              | <u>\$100,000</u>  | <u>\$ 90,000</u> | <u>\$200,000</u> |

TABLE 7  
PROPOSED ARROWHEAD GRAYBURG UNIT  
DRILLING AND COMPLETION COST ESTIMATE  
WATER SUPPLY WELL

|                                                                                                      | <u>Intangible</u> | <u>Tangible</u>  | <u>Total</u>     |
|------------------------------------------------------------------------------------------------------|-------------------|------------------|------------------|
| Contract Drilling - Day Rate<br>Drlg Rig 2 days @ \$4,000<br>Compl Rig 4 days @ \$1,500              | \$ 14,000         | \$ 0             | \$ 14,000        |
| Contract Drilling - Footage Rate<br>5000 feet @ \$13.00                                              | 65,000            | 0                | 65,000           |
| Drilling Supervision<br>16 days @ \$500                                                              | 8,000             | 0                | 8,000            |
| Drilling Fluids                                                                                      | 5,000             | 0                | 5,000            |
| Well Supplies & Non-Salvageable<br>Materials                                                         | 2,000             | 0                | 2,000            |
| Transportation Costs                                                                                 | 5,000             | 0                | 5,000            |
| Drill Pipe, Bits and Tools                                                                           | 3,000             | 0                | 3,000            |
| Subsurface Contract Rentals<br>and Services                                                          | 15,000            | 0                | 15,000           |
| Formation Treatment                                                                                  | 4,000             | 0                | 4,000            |
| Other Subsurface Costs                                                                               | 4,000             | 0                | 4,000            |
| Logging                                                                                              | 12,000            | 0                | 12,000           |
| Casing & Tubing<br>1350 ft 11-3/4" @ \$15.00<br>4000 ft 8-5/8" @ \$12.00<br>4000 ft 5½ IPC @ \$10.00 | 0                 | 110,000          | 110,000          |
| Wellhead                                                                                             | 0                 | 20,000           | 20,000           |
| Cement Services                                                                                      | 25,000            | 0                | 25,000           |
| Site Preparation                                                                                     | 8,000             | 0                | 8,000            |
| Pumping Unit, Motor, Controls,<br>Submersible Pump                                                   | 0                 | 85,000           | 85,000           |
| Total                                                                                                | <u>\$170,000</u>  | <u>\$215,000</u> | <u>\$385,000</u> |

TABLE 8  
PROPOSED ARROWHEAD GRAYBURG UNIT  
WORKOVER COST ESTIMATE

|                              | <u>Intangibles</u> | <u>Tangibles</u> | <u>Total</u> |
|------------------------------|--------------------|------------------|--------------|
| <u>Basic Workover</u>        |                    |                  |              |
| Cased - hole                 | \$25,000           | \$ 0             | \$25,000     |
| Open - hole                  | 35,000             | 0                | 35,000       |
| <u>Additional Procedures</u> |                    |                  |              |
| Deepening                    | \$12,000           | \$ 0             | \$12,000     |
| Liner                        | 27,000             | 3,000            | 30,000       |
| Add Perfs                    | 8,000              | 0                | 8,000        |
| Cement Squeeze               | 23,000             | 0                | 23,000       |
| WI Conversion                | 0                  | 27,000           | 27,000       |
| Upgrade Pumping Equipment    | 0                  | 35,000           | 35,000       |



TABLE 9  
PROPOSED ARROWHEAD GRAYBURG UNIT  
CAPITAL INVESTMENT SCHEDULE

| YEAR  | DRILLING AND COMPLETION |             | WORKOVERS AND CONVERSIONS |             | SURFACE FACILITY CONSTRUCTION | DRILLING AND CONSTRUCTION OVERHEAD | TOTAL        |
|-------|-------------------------|-------------|---------------------------|-------------|-------------------------------|------------------------------------|--------------|
|       | INTANGIBLE              | TANGIBLE    | INTANGIBLE                | TANGIBLE    |                               |                                    |              |
| 1     | \$5,730,000             | \$4,955,000 | \$3,277,500               | \$1,094,500 | \$8,950,000                   | \$300,000                          | \$24,307,000 |
| 2     | 610,000                 | 655,000     | 1,092,500                 | 551,500     | 0                             | 150,000                            | 3,059,000    |
| 3     | 0                       | 0           | 0                         | 280,000     | 0                             | 0                                  | 280,000      |
| 4     | 0                       | 0           | 0                         | 280,000     | 0                             | 0                                  | 280,000      |
| 5     | 0                       | 0           | 0                         | 280,000     | 0                             | 0                                  | 280,000      |
| 6     | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 7     | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 8     | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 9     | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 10    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 11    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 12    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 13    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 14    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 15    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 16    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 17    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 18    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 19    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 20    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 21    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 22    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 23    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 24    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 25    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 26    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 27    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 28    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 29    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| 30    | 0                       | 0           | 0                         | 0           | 0                             | 0                                  | 0            |
| TOTAL | \$6,340,000             | \$5,610,000 | \$4,370,000               | \$2,486,000 | \$8,950,000                   | \$450,000                          | \$28,206,000 |

Table 10  
Proposed Arrowhead Grayburg Unit  
Completion Data for Existing Wells

| TRACT        | UNIT             | OPERATOR | LEASE            | WELL  | DATE  | TD    | LAST<br>PBD | CASING<br>SIZE | SETTING<br>DEPTH | LINER<br>SIZE | LINER<br>BOTTOM | TOP<br>COMPLETION | SUBSEAL | BOTTOM<br>COMPLETION | SUBSEAL | TOP UNIT |
|--------------|------------------|----------|------------------|-------|-------|-------|-------------|----------------|------------------|---------------|-----------------|-------------------|---------|----------------------|---------|----------|
| =====        | =====            | =====    | =====            | ===== | ===== | ===== | =====       | =====          | =====            | =====         | =====           | =====             | =====   | =====                | =====   | =====    |
| ACTIVE WELLS |                  |          |                  |       |       |       |             |                |                  |               |                 |                   |         |                      |         |          |
| 2            | 158 CONOCO       |          | LOCKHART 'B'     | 1     | 3529  | 3825  | 3825        | 5.5            | 3739             |               |                 | 3739              | -210    | 3825                 | -296    | -125     |
| 2            | 159 CONOCO       |          | LOCKHART 'B'     | 2     | 3524  | 3860  | 3847        | 5.5            | 3731             | 3.5           | 3860            | 3740              | -216    | 3835                 | -311    | -142     |
| 2            | 166 CONOCO       |          | LOCKHART 'B'     | 3     | 3502  | 3840  | 3840        | 5.5            | 3682             |               |                 | 3682              | -180    | 3840                 | -338    | -150     |
| 2            | 8 CONOCO         |          | LOCKHART 'B'     | 5     | 3489  | 3789  | 3789        | 5.5            | 3694             |               |                 | 3634              | -145    | 3789                 | -300    | -150     |
| 2            | 160 CONOCO       |          | LOCKHART 'B'     | 7     | 3506  | 6860  | 6860        | 7              | 6860             |               |                 | 3701              | -195    | 3820                 | -314    | -150     |
| 3            | 149 MARATHON     |          | SAUNDERS         | 2     | 3553  | 3850  | 3850        | 7              | 3747             |               |                 | 3747              | -194    | 3850                 | -297    | -115     |
| 5            | 189 KASHUSSEN    |          | STATE 'A' AC 2   | 13    | 3521  | 3876  | 3876        | 7              | 3705             | 5.5           | 3876            | 3637              | -116    | 3704                 | -183    | -150     |
| 6            | 101 CHEVRON      |          | GRAHAM STATE 'J' | 1     | 3528  | 5270  | 5150        | 4.5            | 5270             |               |                 | 3725              | -197    | 3797                 | -269    | -135     |
| 7            | 222 MARATHON     |          | MCDONALD         | 13    | 3492  | 3760  | 3760        | 5.5            | 3641             |               |                 | 3641              | -149    | 3760                 | -268    | -150     |
| 7            | 223 MARATHON     |          | MCDONALD         | 14    | 3509  | 3800  | 3800        | 5.5            | 3690             |               |                 | 3690              | -181    | 3800                 | -291    | -150     |
| 8A           | 231 AMERICAN     |          | H STATE          | 8     | 3411  | 3693  | 3620        | 5.5            | 3693             |               |                 | 3430              | -19     | 3604                 | -193    | -150     |
| 8A           | 232 21A ENERGY   |          | H STATE          | 49    | 3427  | 6730  | 5400        | 5.5            | 6719             |               |                 | 3806              | -379    | 3909                 | -482    | -150     |
| 8B           | 247 AMERICAN     |          | H STATE          | 5     | 3440  | 3719  | 3718        | 5.5            | 3718             |               |                 | 3540              | -100    | 3715                 | -275    | -150     |
| 8B           | 245 AMERICAN     |          | H STATE          | 6     | 3424  | 3717  | 3637        | 5.5            | 3714             |               |                 | 3603              | -179    | 3633                 | -209    | -150     |
| 9            | 233 AMERADA HESS |          | STATE 'PA'       | 4     | 3436  | 6763  | 3770        | 5.5            | 6762             |               |                 | 3602              | -166    | 3684                 | -248    | -150     |
| 11           | 143 ARCO         |          | STATE 'D' DE     | 1     | 3509  | 3809  | 3800        | 5.5            | 3711             |               |                 | 3711              | -202    | 3800                 | -291    | -150     |
| 12           | 141 OXY USA      |          | STATE 'H'        | 1     | 3544  | 3840  | 3835        | 7              | 3714             | 5             | 3836            | 3782              | -238    | 3815                 | -272    | -119     |
| 12           | 139 OXY USA      |          | STATE 'H'        | 2     | 3555  | 3850  | 3832        | 5.5            | 3700             | 4             | 3832            | 3730              | -175    | 3800                 | -245    | -86      |
| 13           | 172 OXY USA      |          | STATE 'H'        | 3     | 3539  | 3820  | 3820        | 5.5            | 3702             |               |                 | 3702              | -163    | 3820                 | -281    | -150     |
| 14           | 206 ARCO         |          | STATE '157-0'    | 1     | 3507  | 3776  | 3776        | 7              | 3676             |               |                 | 3676              | -169    | 3776                 | -269    | -150     |
| 15           | 151 CONOCO       |          | STATE 'J-2'      | 1     | 3567  | 3835  | 3835        | 5.5            | 3497             | 4             | 3835            | 3756              | -189    | 3826                 | -259    | -150     |
| 15           | 169 CONOCO       |          | STATE 'J-2'      | 2     | 3539  | 3833  | 3833        | 5.5            | 3739             | 4             | 3840            | 3743              | -204    | 3822                 | -283    | -150     |
| 15           | 157 CONOCO       |          | STATE 'J-2'      | 3     | 3554  | 3860  | 3860        | 5.5            | 3728             |               |                 | 3728              | -174    | 3860                 | -306    | -145     |
| 15           | 150 CONOCO       |          | STATE 'J-2'      | 4     | 3563  | 3875  | 3875        | 5.5            | 3738             | 4             | 3875            | 3760              | -197    | 3868                 | -305    | -125     |
| 15           | 176 CONOCO       |          | STATE 'J-2'      | 5     | 3513  | 3810  | 3810        | 5.5            | 3722             | 4             | 3816            | 3744              | -231    | 3808                 | -295    | -150     |
| 15           | 175 CONOCO       |          | STATE 'J-2'      | 6     | 3533  | 3872  | 3872        | 5.5            | 3706             | 4             | 3872            | 3648              | -115    | 3869                 | -336    | -150     |
| 15           | 156 CONOCO       |          | STATE 'J-2'      | 9     | 3549  | 3878  | 3878        | 5.5            | 3712             |               |                 | 3712              | -163    | 3878                 | -329    | -150     |
| 15           | 152 CONOCO       |          | STATE 'J-2'      | 11    | 3572  | 3915  | 3909        | 5.5            | 3715             | 4             | 3915            | 3850              | -278    | 3900                 | -328    | -150     |
| 16           | 140 CHEVRON      |          | WA RANSAY 'A'    | 4     | 3569  | 3860  | 3860        | 6              | 3760             |               |                 | 3760              | -191    | 3860                 | -291    | -130     |
| 16           | 134 CHEVRON      |          | WA RANSAY 'A'    | 5     | 3570  | 3860  | 3860        | 5.5            | 3765             |               |                 | 3765              | -195    | 3860                 | -290    | -140     |
| 16           | 135 CHEVRON      |          | WA RANSAY 'A'    | 8     | 3579  | 3870  | 3870        | 5.5            | 3758             |               |                 | 3758              | -179    | 3870                 | -291    | -150     |
| 16           | 124 CHEVRON      |          | WA RANSAY 'A'    | 9     | 3566  | 3856  | 3811        | 5.5            | 3748             |               |                 | 3748              | -182    | 3811                 | -245    | -150     |
| 16           | 136 CHEVRON      |          | WA RANSAY 'A'    | 10    | 3588  | 3880  | 3864        | 5.5            | 3769             |               |                 | 3769              | -181    | 3864                 | -276    | -150     |
| 16           | 121 CHEVRON      |          | WA RANSAY 'A'    | 11    | 3541  | 3835  | 3835        | 5.5            | 3734             |               |                 | 3734              | -193    | 3835                 | -294    | -150     |
| 16           | 123 CHEVRON      |          | WA RANSAY 'A'    | 16    | 3574  | 3875  | 3872        | 5.5            | 3875             |               |                 | 3804              | -230    | 3864                 | -290    | -150     |
| 16           | 107 CHEVRON      |          | WA RANSAY 'B'    | 4     | 3525  | 5225  | 5100        | 4.5            | 5224             |               |                 | 3720              | -195    | 3789                 | -264    | -133     |

**Table 10**  
**Proposed Arrowhead Grayburg Unit**  
**Completion Data for Existing Wells**

| TRACT          | UNIT | OPERATOR  | LEASE            | WELL | DATE | TD   | LAST PBTD | CASING SIZE | SETTING DEPTH | LINER SIZE | TOP COMPLETION | SUBSEA | BOTTOM COMPLETION | SUBSEA | TOP UNIT SUBSEA |
|----------------|------|-----------|------------------|------|------|------|-----------|-------------|---------------|------------|----------------|--------|-------------------|--------|-----------------|
| 17             | 142  | CHEVRON   | H LEONARD "C"    | 1    | 3523 | 3820 | 3820      | 6           | 3700          |            | 3700           | -177   | 3820              | -297   | -123            |
| 17             | 132  | CHEVRON   | H LEONARD "C"    | 2    | 3528 | 3825 | 3825      | 5.5         | 3719          |            | 3719           | -191   | 3825              | -297   | -128            |
| 17             | 126  | CHEVRON   | H LEONARD "C"    | 3    | 3544 | 3840 | 3840      | 5.5         | 3739          |            | 3739           | -195   | 3800              | -256   | -133            |
| 17             | 120  | CHEVRON   | H LEONARD "C"    | 4    | 3541 | 3825 | 3825      | 5.5         | 3730          |            | 3730           | -189   | 3788              | -247   | -142            |
| 17             | 119  | CHEVRON   | H LEONARD "C"    | 5    | 3511 | 3800 | 3800      | 5.5         | 3675          |            | 3675           | -164   | 3800              | -289   | -123            |
| 17             | 127  | CHEVRON   | H LEONARD "C"    | 6    | 3541 | 3830 | 3830      | 5.5         | 3730          |            | 3730           | -189   | 3830              | -289   | -114            |
| 17             | 120  | CHEVRON   | H LEONARD "C"    | 20   | 3533 | 6930 | 4120      | 5.5         | 3746          |            | 3746           | -213   | 3866              | -333   | -142            |
| 21             | 108  | CHEVRON   | SANDY            | 1    | 3536 | 3899 | 3883      | 5.5         | 3726          |            | 3716           | -180   | 3818              | -282   | -150            |
| 21             | 116  | CHEVRON   | SANDY            | 2    | 3526 | 3930 | 3908      | 5.5         | 3666          |            | 3666           | -140   | 3889              | -363   | -149            |
| 22             | 198  | CHEVRON   | HT MATTERN "D"   | 2    | 3455 | 3740 | 3740      | 5.5         | 3670          |            | 3670           | -215   | 3740              | -285   | -150            |
| 22             | 184  | CHEVRON   | HT MATTERN "D"   | 4    | 3466 | 3755 | 3755      | 5.5         | 3675          |            | 3675           | -209   | 3755              | -289   | -150            |
| 22             | 168  | CHEVRON   | HT MATTERN "E"   | 1    | 3529 | 3790 | 3790      | 6           | 3725          |            | 3725           | -196   | 3790              | -261   | -150            |
| 22             | 167  | CHEVRON   | HT MATTERN "E"   | 2    | 3509 | 3770 | 3770      | 6           | 3695          |            | 3695           | -186   | 3770              | -261   | -150            |
| 22             | 188  | CHEVRON   | HT MATTERN "E"   | 3    | 3501 | 3780 | 3780      | 6           | 3685          |            | 3685           | -198   | 3780              | -288   | -150            |
| 22             | 177  | CHEVRON   | HT MATTERN "E"   | 4    | 3502 | 3790 | 3790      | 6           | 3700          |            | 3700           | -182   | 3790              | -252   | -150            |
| 22             | 195  | CHEVRON   | HT MATTERN "E"   | 6    | 3487 | 3765 | 3739      | 5.5         | 3669          |            | 3669           | -178   | 3739              | -283   | -150            |
| 22             | 196  | CHEVRON   | HT MATTERN "E"   | 7    | 3477 | 3760 | 3760      | 5.5         | 3655          |            | 3655           | -197   | 3760              | -292   | -150            |
| 22             | 187  | CHEVRON   | HT MATTERN "E"   | 9    | 3488 | 3780 | 3780      | 5.5         | 3685          |            | 3685           | -213   | 3780              | -288   | -150            |
| 22             | 185  | CHEVRON   | HT MATTERN "E"   | 12   | 3467 | 3755 | 3755      | 5.5         | 3680          |            | 3680           | -192   | 3755              | -273   | -146            |
| 22             | 147  | CHEVRON   | HT MATTERN "F"   | 1    | 3513 | 3805 | 3786      | 6           | 3705          |            | 3705           | -163   | 3786              | -310   | -150            |
| 22             | 146  | CHEVRON   | HT MATTERN "F"   | 2    | 3489 | 3900 | 3860      | 5.5         | 3900          |            | 3652           | -206   | 3799              | -277   | -150            |
| 26             | 216  | CHEVRON   | AL CHRISTMAS "C" | 8    | 3419 | 3700 | 3697      | 5.5         | 3700          |            | 3625           |        | 3696              |        | -150            |
| INACTIVE WELLS |      |           |                  |      |      |      |           |             |               |            |                |        |                   |        |                 |
| 5              | 207  | RASMUSSEN | STATE "A" AC 2   | 16   | 3520 | 3802 | 3802      | 7           | 3662          |            | 3662           | -142   | 3602              | -282   | -150            |
| 5              | 193  | RASMUSSEN | STATE "A" AC 2   | 17   | 3520 | 3790 | 3755      | 7           | 3665          |            | 3665           | -145   | 3755              | -235   | -150            |
| 7              | 221  | MARATHON  | MCDONALD         | 12   | 3476 | 3760 | 3760      | 5.5         | 3619          |            | 3619           | -143   | 3760              | -284   | -150            |
| 7              | 226  | MARATHON  | MCDONALD         | 17   | 3463 | 3779 | 3779      | 4.5         | 3627          |            | 3627           | -164   | 3779              | -316   | -150            |
| 7              | 236  | MARATHON  | MCDONALD         | 22   | 3473 | 3781 | 3781      | 4.5         | 3724          |            | 3724           | -251   | 3781              | -308   | -150            |
| 13             | 171  | OXY USA   | STATE "N"        | 2    | 3529 | 3810 | 3810      | 5.5         | 3700          |            | 3700           | -171   | 3810              | -281   | -150            |
| 13             | 173  | OXY USA   | STATE "N"        | 4    | 3556 | 3835 | 3835      | 5.5         | 3708          |            | 3708           | -152   | 3835              | -279   | -150            |
| 15             | 154  | CHOCO     | STATE "J-2"      | 10   | 3554 | 3944 | 3809      | 5.5         | 3700          |            | 3662           | -108   | 3944              | -390   | -150            |
| 16             | 106  | CHEVRON   | MT KANSAY "B"    | 5    | 3537 | 3900 | 3855      | 4.5         | 3897          |            | 3730           | -193   | 3796              | -259   | -139            |
| 24             | 201  | MARATHON  | MATTERN          | 2    | 3445 | 3740 | 3740      | 5.5         | 3668          |            | 3668           | -223   | 3740              | -295   | -150            |
| 25             | 214  | PRESIDIO  | MATTERN          | 5    | 3426 | 3746 | 3746      | 5.5         | 3414          | 5.5        | 3454           | -28    | 3746              | -320   | -150            |
| 25             | 212  | PRESIDIO  | MATTERN          | 6    | 3445 | 3740 | 3740      | 5.5         | 3647          |            | 3647           | -202   | 3740              | -295   | -150            |

**Table 11**  
**Proposed Arrowhead Grayburg Unit**  
**Historic Completion Data for Recompleted and P&A'd Wells**

| WELL | UNIT | OPERATOR  | LEASE          | WELL STATUS | DATUM | ID   | LAST PBTD | CASING SIZE | SETTING DEPTH | LINER SIZE | LINER BOTTOM | TOP COMPLETION | SUBSEA COMPLETION | BOTTOM | SUBSEA | TOP UNIT |
|------|------|-----------|----------------|-------------|-------|------|-----------|-------------|---------------|------------|--------------|----------------|-------------------|--------|--------|----------|
| 1    | 218  | HARTMAN   | RUBY CROSBY    | 1           | RC    | 3436 | 3735      | 5.5         | 3638          |            |              | 3638           | -202              | 3735   | -293   | -150     |
| 2    | 217  | HARTMAN   | RUBY CROSBY    | 2           | PH    | 3428 | 3728      | 5.5         | 3638          |            |              | 3638           | -210              | 3728   | -300   | -150     |
| 3    | 160  | CONOCO    | LOCKHART "B"   | 4           | RC    | 3513 | 3800      | 5.5         | 3727          |            |              | 3727           | -214              | 3800   | -207   | -150     |
| 4    | 148  | HARTMAN   | SAUNDERS       | 1           | RC    | 3539 | 3830      | 5.5         | 3700          |            |              | 3700           | -161              | 3830   | -291   | -147     |
| 5    | 160  | HARTMAN   | ELLIOTT        | 1           | RC    | 3467 | 3724      | 5.5         | 3723          |            |              | 3705           | -238              | 3722   | -255   | -150     |
| 6    | 140  | WASHUSSEN | STATE "A" NC 2 | 14          | RC    | 3540 | 3790      | 7           | 3680          |            |              | 3680           | -140              | 3790   | -250   | -150     |
| 7    | 142  | WASHUSSEN | STATE "A" NC 2 | 15          | RC    | 3561 | 3851      | 7           | 3710          |            |              | 3710           | -149              | 3851   | -290   | -150     |
| 8    | 142  | WASHUSSEN | STATE "A" NC 2 | 18          | PH    | 3533 | 3902      | 7           | 3660          | 4.3        | 3902         | 3675           | -142              | 3780   | -247   | -150     |
| 9    | 220  | HARTMAN   | MC DONALD      | 11          | RC    | 3452 | 3735      | 7           | 3632          |            |              | 3632           | -180              | 3735   | -283   | -150     |
| 10   | 224  | HARTMAN   | MC DONALD      | 16          | PH    | 3435 | 3790      | 4.5         | 3622          |            |              | 3642           | -127              | 3790   | -295   | -150     |
| 11   | 224  | HARTMAN   | MC DONALD      | 18          | PH    | 3480 | 3775      | 4.5         | 3642          |            |              | 3642           | -162              | 3775   | -295   | -150     |
| 12   | 235  | HARTMAN   | MC DONALD      | 19          | PH    | 3457 | 3757      | 4.5         | 3720          |            |              | 3720           | -263              | 3757   | -300   | -150     |
| 13   | 239  | HARTMAN   | MC DONALD      | 20          | PH    | 3458 | 3750      | 4.5         | 3682          |            |              | 3682           | -224              | 3750   | -292   | -150     |
| 14   | 239  | HARTMAN   | MC DONALD      | 21          | RC    | 3441 | 3716      | 4.5         | 3503          |            |              | 3503           | -62               | 3716   | -275   | -150     |
| 15   | 239  | HARTMAN   | MC DONALD      | 23          | PH    | 3470 | 3745      | 4.5         | 3553          |            |              | 3552           | -82               | 3745   | -275   | -150     |
| 16   | 239  | HARTMAN   | MC DONALD      | 24          | PH    | 3487 | 3762      | 4.5         | 3553          |            |              | 3553           | -66               | 3762   | -275   | -150     |
| 17   | 232  | AMERICAN  | H STATE        | 1           | RC    | 3422 | 3715      | 7           | 3609          |            |              | 3609           | -187              | 3715   | -293   | -150     |
| 18   | 242  | AMERICAN  | H STATE        | 2           | PH    | 3429 | 3720      | 5.5         | 3617          |            |              | 3617           | -188              | 3720   | -291   | -150     |
| 19   | 246  | AMERICAN  | H STATE        | 3           | PH    | 3410 | 3710      | 5.5         | 3600          |            |              | 3561           | -151              | 3700   | -290   | -150     |
| 20   | 246  | AMERICAN  | H STATE        | 4           | RC    | 3426 | 3714      | 5.5         | 3578          |            |              | 3578           | -152              | 3714   | -288   | -150     |
| 21   | 233  | AMERICAN  | STATE "A"      | 1           | PH    | 3429 | 3724      | 5.5         | 3640          |            |              | 3640           | -211              | 3724   | -295   | -150     |
| 22   | 241  | AMERICAN  | STATE "A"      | 2           | PH    | 3442 | 3724      | 5.5         | 3640          |            |              | 3640           | -198              | 3724   | -282   | -150     |
| 23   | 112  | EXXON     | STATE "G"      | 2           | RC    | 3528 | 3828      | 5.5         | 3828          |            |              | 3726           | -198              | 3816   | -288   | -150     |
| 24   | 131  | ARCO      | STATE "D" DE   | 2           | PH    | 3526 | 3811      | 5.5         | 3715          |            |              | 3715           | -189              | 3811   | -285   | -149     |
| 25   | 174  | OXY USA   | STATE "N"      | 1           | PH    | 3539 | 3878      | 5.5         | 3700          |            |              | 3700           | -161              | 3678   | -339   | -150     |
| 26   | 205  | ARCO      | STATE "157-0"  | 2           | PH    | 3483 | 3759      | 7           | 3656          |            |              | 3656           | -168              | 3759   | -271   | -150     |
| 27   | 204  | ARCO      | STATE "157-0"  | 3           | PH    | 3474 | 3745      | 7           | 3650          |            |              | 3650           | -176              | 3745   | -271   | -150     |
| 28   | 203  | ARCO      | STATE "157-0"  | 4           | RC    | 3456 | 3750      | 7           | 3572          |            |              | 3572           | -116              | 3750   | -294   | -150     |
| 29   | 211  | ARCO      | STATE "157-0"  | 5           | PH    | 3442 | 3726      | 7           | 3569          |            |              | 3569           | -127              | 3726   | -284   | -150     |
| 30   | 210  | ARCO      | STATE "157-0"  | 6           | PH    | 3475 | 3741      | 5.5         | 3602          |            |              | 3602           | -127              | 3741   | -266   | -150     |
| 31   | 209  | ARCO      | STATE "157-0"  | 7           | RC    | 3482 | 3761      | 5.5         | 3650          |            |              | 3650           | -168              | 3700   | -218   | -150     |
| 32   | 14   | ARCO      | STATE "157-0"  | 8           | PH    | 3506 | 3777      | 5.5         | 3674          |            |              | 3674           | -168              | 3777   | -271   | -150     |
| 33   | 170  | CONOCO    | STATE "J-2"    | 7           | RC    | 3531 | 3825      | 5.5         | 3715          | 4          | 3825         | 3808           | -277              | 3822   | -291   | -150     |
| 34   | 155  | CONOCO    | STATE "J-2"    | 8           | PH    | 3531 | 3866      | 5.5         | 3704          | 4          | 3866         | 3847           | -293              | 3861   | -307   | -150     |
| 35   | 153  | CONOCO    | STATE "J-2"    | 12          | RC    | 3574 | 3850      | 5.5         | 3680          | 4          | 3850         | 3791           | -217              | 3820   | -246   | -150     |
| 36   | 139  | CHEVRON   | WA KANSAY "A"  | 3           | RC    | 3576 | 3810      | 6           | 3750          |            |              | 3750           | -174              | 3810   | -234   | -150     |
| 37   | 125  | CHEVRON   | WA KANSAY "A"  | 6           | PH    | 3560 | 3850      | 5.5         | 3750          |            |              | 3718           | -158              | 3758   | -198   | -146     |
| 38   | 138  | CHEVRON   | WA KANSAY "A"  | 7           | RC    | 3586 | 3870      | 5.5         | 3785          |            |              | 3785           | -199              | 3870   | -284   | -150     |

**Table 11**  
**Proposed Arrowhead Grayburg Unit**  
**Historic Completion Data for Recompleted and P&A'd Wells**

| TRACT | UNIT | OPERATOR | LEASE            | WELL | STATUS | DATUM | TD   | LAST<br>PBTD | CASING<br>SIZE | SETTING<br>DEPTH | LINER<br>SIZE | LINER<br>BOTTOM | TOP<br>COMPLETION | SUBSEA | BOTTOM<br>COMPLETION | SUBSEA | TOP<br>UNIT |
|-------|------|----------|------------------|------|--------|-------|------|--------------|----------------|------------------|---------------|-----------------|-------------------|--------|----------------------|--------|-------------|
| 16    | X    | CHEVRON  | WA RAMSAY 'A'    | 12   | RC     | 3590  | 3865 | 3865         | 5.5            | 3761             |               |                 | 3761              | -171   | 3865                 | -275   | -150        |
| 16    | 122  | CHEVRON  | WA RAMSAY 'A'    | 13   | RC     | 3561  | 3845 | 3845         | 5.5            | 3741             |               |                 | 3741              | -180   | 3845                 | -284   | -150        |
| 16    | 105  | CHEVRON  | WA RAMSAY 'B'    | 1    | RC     | 3564  | 3860 | 3860         | 5.5            | 3747             |               |                 | 3747              | -183   | 3860                 | -296   | -130        |
| 16    | 104  | CHEVRON  | WA RAMSAY 'B'    | 2    | RC     | 3562  | 3855 | 3855         | 5.5            | 3746             |               |                 | 3746              | -184   | 3855                 | -293   | -150        |
| 17    | 128  | CHEVRON  | H LEONARD 'C'    | 6    | RC     | 3507  | 3805 | 3805         | 5.5            | 3712             |               |                 | 3712              | -205   | 3805                 | -298   | -137        |
| 17    | X    | CHEVRON  | H LEONARD 'C'    | 8    | RC     | 3487  | 3780 | 3780         | 5.5            | 3700             |               |                 | 3700              | -213   | 3780                 | -293   | -150        |
| 17    | 118  | CHEVRON  | H LEONARD 'C'    | 9    | RC     | 3510  | 3775 | 3740         | 5.5            | 3775             |               |                 | 3702              | -192   | 3730                 | -220   | -141        |
| 17    | X    | CHEVRON  | H LEONARD 'C'    | 12   | RC     | 3515  | 6800 | 6766         | 7              | 5999             | 4             | 6766            | 3674              | -159   | 3793                 | -278   | -142        |
| 19    | 110  | ARCO     | BROWNLEE         | 1    | RC     | 3547  | 3867 | 3867         | 7              | 3730             |               |                 | 3730              | -183   | 3867                 | -320   | -150        |
| 19    | 113  | ARCO     | BROWNLEE         | 2    | PA     | 3515  | 3807 | 3807         | 5.5            | 3723             |               |                 | 3723              | -208   | 3807                 | -292   | -150        |
| 19    | 111  | ARCO     | BROWNLEE         | 3    | PA     | 3538  | 3845 | 3845         | 5.5            | 3755             |               |                 | 3755              | -217   | 3845                 | -307   | -150        |
| 19    | 114  | ARCO     | BROWNLEE         | 4    | RC     | 3522  | 3800 | 3800         | 5.5            | 3691             |               |                 | 3691              | -169   | 3800                 | -278   | -150        |
| 22    | X    | CHEVRON  | HT MATTERN 'D'   | 1    | PA     | 3462  | 3795 | 3775         | 6              | 3420             |               |                 | 3420              | 42     | 3775                 | -313   | -150        |
| 22    | X    | CHEVRON  | HT MATTERN 'D'   | 3    | PA     | 3449  | 3750 | 3750         | 5.5            | 3641             |               |                 | 3641              | -192   | 3750                 | -301   | -150        |
| 22    | X    | CHEVRON  | HT MATTERN 'D'   | 5    | PA     | 3449  | 3745 | 3723         | 5.5            | 3637             |               |                 | 3627              | -178   | 3723                 | -274   | -150        |
| 22    | X    | CHEVRON  | HT MATTERN 'D'   | 6    | RC     | 3470  | 3745 | 3722         | 5.5            | 3655             |               |                 | 3655              | -185   | 3722                 | -252   | -150        |
| 22    | X    | CHEVRON  | HT MATTERN 'D'   | 7    | RC     | 3479  | 3790 | 3790         | 5.5            | 3790             |               |                 | 3712              | -233   | 3786                 | -307   | -150        |
| 22    | 194  | CHEVRON  | HT MATTERN 'E'   | 5    | PA     | 3508  | 3785 | 3785         | 5.5            | 3630             |               |                 | 3630              | -182   | 3785                 | -277   | -150        |
| 22    | 197  | CHEVRON  | HT MATTERN 'E'   | 8    | PA     | 3461  | 3750 | 3736         | 5.5            | 3654             |               |                 | 3654              | -193   | 3736                 | -275   | -150        |
| 22    | 178  | CHEVRON  | HT MATTERN 'E'   | 10   | PA     | 3504  | 3790 | 3756         | 5.5            | 3705             |               |                 | 3705              | -201   | 3756                 | -252   | -150        |
| 22    | 186  | CHEVRON  | HT MATTERN 'E'   | 11   | RC     | 3478  | 3775 | 3775         | 5.5            | 3680             |               |                 | 3680              | -202   | 3775                 | -297   | -150        |
| 23    | 202  | MARTIAN  | MATTERN          | 1    | RC     | 3452  | 3750 | 3733         | 5.5            | 3631             | 4             | 3733            | 3715              | -263   | 3725                 | -273   | -150        |
| 25    | 213  | PRESIDIO | MATTERN          | 7    | RC     | 3438  | 3735 | 3735         | 5.5            | 3640             |               |                 | 3640              | -202   | 3735                 | -297   | -150        |
| 26    | 219  | CHEVRON  | AL CHRISTMAS 'C' | 1    | RC     | 3454  | 3730 | 3638         | 5.5            | 3640             |               |                 | 3615              | -161   | 3636                 | -182   | -150        |
| 26    | 228  | CHEVRON  | AL CHRISTMAS 'C' | 2    | PA     | 3430  | 3730 | 3730         | 5.5            | 3627             |               |                 | 3627              | -197   | 3730                 | -300   | -150        |
| 26    | 229  | CHEVRON  | AL CHRISTMAS 'C' | 3    | PA     | 3422  | 3720 | 3720         | 5.5            | 3622             |               |                 | 3622              | -200   | 3720                 | -298   | -150        |
| 26    | 227  | CHEVRON  | AL CHRISTMAS 'C' | 4    | PA     | 3442  | 3740 | 3740         | 5.5            | 3635             |               |                 | 3635              | -193   | 3740                 | -298   | -150        |
| 26    | 234  | CHEVRON  | AL CHRISTMAS 'C' | 5    | PA     | 3450  | 3745 | 3745         | 5.5            | 3665             |               |                 | 3665              | -215   | 3745                 | -295   | -150        |
| 26    | 240  | CHEVRON  | AL CHRISTMAS 'C' | 6    | PA     | 3448  | 3740 | 3740         | 5.5            | 3665             |               |                 | 3665              | -217   | 3740                 | -292   | -150        |
| 26    | X    | CHEVRON  | AL CHRISTMAS 'C' | 7    | RC     | 3425  | 3700 | 3700         | 5.5            | 3624             |               |                 | 3624              | -199   | 3700                 | -275   | -150        |

\*\* Indicates completions that extend beyond the proposed unit boundaries.

TABLE 12  
PROPOSED ARROWHEAD GRAYBURG UNIT  
PRODUCTION AND EXPENSE SCHEDULE  
REMAINING PRIMARY CASE

| YEAR | OIL PRODUCTION<br>(BOPY) | GAS PRODUCTION<br>(MCFPY) | OPERATING<br>COSTS<br>(\$/YEAR) | ABANDONMENT<br>COSTS<br>(\$/YEAR) |
|------|--------------------------|---------------------------|---------------------------------|-----------------------------------|
| 1    | 341,494                  | 1,053,850                 | \$728,175                       | \$ 0                              |
| 2    | 320,219                  | 988,196                   | 728,175                         | 0                                 |
| 3    | 300,269                  | 926,631                   | 728,175                         | 0                                 |
| 4    | 281,563                  | 868,902                   | 728,175                         | 0                                 |
| 5    | 264,021                  | 814,769                   | 728,175                         | 0                                 |
| 6    | 247,573                  | 764,009                   | 728,175                         | 0                                 |
| 7    | 232,149                  | 716,411                   | 728,175                         | 0                                 |
| 8    | 217,686                  | 671,779                   | 728,175                         | 0                                 |
| 9    | 204,124                  | 629,927                   | 728,175                         | 0                                 |
| 10   | 191,407                  | 590,683                   | 728,175                         | 0                                 |
| 11   | 179,483                  | 553,883                   | 728,175                         | 0                                 |
| 12   | 168,301                  | 519,376                   | 728,175                         | 0                                 |
| 13   | 157,816                  | 487,019                   | 728,175                         | 0                                 |
| 14   | 147,984                  | 456,678                   | 728,175                         | 0                                 |
| 15   | 138,764                  | 428,227                   | 728,175                         | 0                                 |
| 16   | 130,119                  | 401,548                   | 728,175                         | 0                                 |
| 17   | 122,013                  | 376,532                   | 728,175                         | 0                                 |
| 18   | 114,411                  | 353,074                   | 728,175                         | 0                                 |
| 19   | 107,284                  | 331,077                   | 728,175                         | 0                                 |
| 20   | 100,600                  | 310,451                   | 728,175                         | 0                                 |
| 21   | 94,333                   | 291,110                   | 728,175                         | 0                                 |
| 22   | 88,456                   | 272,974                   | 728,175                         | 0                                 |
| 23   | 82,945                   | 255,968                   | 728,175                         | 0                                 |
| 24   | 77,777                   | 240,021                   | 728,175                         | 0                                 |
| 25   | 72,932                   | 225,068                   | 728,175                         | 0                                 |
| 26   | 68,388                   | 211,046                   | 728,175                         | 0                                 |
| 27   | 64,128                   | 197,898                   | 728,175                         | 0                                 |
| 28   | 60,132                   | 185,569                   | 728,175                         | 0                                 |
| 29   | 56,386                   | 174,008                   | 728,175                         | 0                                 |
| 30   | 52,873                   | 163,167                   | 728,175                         | 570,000                           |
|      | 4,685,630                | 14,459,851                | \$21,845,250                    | \$570,000                         |



TABLE 13  
PROPOSED ARROWHEAD GRAYBURG UNIT  
PRODUCTION AND EXPENSE SCHEDULE  
WATERFLOOD CASE

| YEAR | INVESTMENTS<br>(\$) | OIL<br>PRODUCTION<br>BOPY | GAS<br>PRODUCTION<br>(MCFPY) | OPERATING<br>COSTS<br>\$/YEAR | ABANDONMENT<br>COSTS<br>\$/YEAR |
|------|---------------------|---------------------------|------------------------------|-------------------------------|---------------------------------|
| 1    | \$24,307,000        | 341,494                   | 1,051,802                    | \$1,564,900                   | \$ 0                            |
| 2    | 3,059,000           | 320,219                   | 912,624                      | 1,942,530                     | 0                               |
| 3    | 280,000             | 300,269                   | 600,538                      | 2,079,400                     | 0                               |
| 4    | 280,000             | 281,563                   | 366,032                      | 2,216,280                     | 0                               |
| 5    | 280,000             | 391,645                   | 176,240                      | 2,284,718                     | 0                               |
| 6    | 0                   | 777,815                   | 350,017                      | 2,284,718                     | 0                               |
| 7    | 0                   | 1,545,045                 | 695,270                      | 2,284,718                     | 0                               |
| 8    | 0                   | 2,135,250                 | 960,863                      | 2,284,718                     | 0                               |
| 9    | 0                   | 2,135,250                 | 960,863                      | 2,284,718                     | 0                               |
| 10   | 0                   | 1,953,845                 | 879,230                      | 2,284,718                     | 0                               |
| 11   | 0                   | 1,630,484                 | 733,718                      | 2,284,718                     | 0                               |
| 12   | 0                   | 1,360,639                 | 612,288                      | 2,284,718                     | 0                               |
| 13   | 0                   | 1,135,453                 | 510,954                      | 2,284,718                     | 0                               |
| 14   | 0                   | 947,535                   | 426,391                      | 2,284,718                     | 0                               |
| 15   | 0                   | 790,718                   | 355,823                      | 2,284,718                     | 0                               |
| 16   | 0                   | 659,854                   | 296,934                      | 2,284,718                     | 0                               |
| 17   | 0                   | 550,649                   | 247,792                      | 2,284,718                     | 0                               |
| 18   | 0                   | 459,516                   | 206,782                      | 2,284,718                     | 0                               |
| 19   | 0                   | 383,466                   | 172,560                      | 2,284,718                     | 0                               |
| 20   | 0                   | 320,003                   | 144,001                      | 2,284,718                     | 0                               |
| 21   | 0                   | 267,042                   | 120,169                      | 2,284,718                     | 0                               |
| 22   | 0                   | 222,847                   | 100,281                      | 2,284,718                     | 0                               |
| 23   | 0                   | 185,966                   | 83,685                       | 2,284,718                     | 0                               |
| 24   | 0                   | 155,188                   | 69,835                       | 2,284,718                     | 0                               |
| 25   | 0                   | 129,505                   | 58,277                       | 1,828,000                     | 0                               |
| 26   | 0                   | 108,072                   | 48,632                       | 1,523,000                     | 0                               |
| 27   | 0                   | 90,186                    | 40,584                       | 1,218,500                     | 0                               |
| 28   | 0                   | 75,260                    | 33,867                       | 1,218,500                     | 430,000                         |
| 29   | 0                   | 62,804                    | 28,262                       | 1,218,500                     | 430,000                         |
| 30   | 0                   | 52,410                    | 23,585                       | 1,218,500                     | 430,000                         |
|      | \$28,206,000        | 19,769,992                | 11,267,899                   | \$61,722,470                  | \$1,290,000                     |

# Proposed Arrowhead Grayburg Unit Value of Equity Parameters by Tract

| TRACT    | CUMULATIVE OIL<br>(12-31-88) | REMAINING OIL<br>RESERVES<br>(1-1-89) | ULTIMATE<br>PRIMARY<br>OIL RECOVERY | CURRENT<br>OIL RATE<br>(4Q-1988) | CURRENT<br>GAS RATE<br>(4Q-1988) | REMAINING GAS<br>RESERVES<br>(1-1-89) | SURFACE<br>ACRES | GROSS ACRE-FT |
|----------|------------------------------|---------------------------------------|-------------------------------------|----------------------------------|----------------------------------|---------------------------------------|------------------|---------------|
| 1        | 465,366                      | 0                                     | 465,366                             | 0.0                              | 0.0                              | 0                                     | 80.00            | 108,000.00    |
| 2        | 1,759,082                    | 749,143                               | 2,508,225                           | 4,593.3                          | 15,143.0                         | 2,414,487                             | 320.00           | 433,320.00    |
| 3        | 536,424                      | 56,757                                | 593,181                             | 647.0                            | 1,207.7                          | 93,251                                | 80.24            | 109,849.20    |
| 4        | 86,986                       | 0                                     | 86,986                              | 0.0                              | 0.0                              | 0                                     | 74.06            | 99,981.00     |
| 5        | 1,256,799                    | 5,878                                 | 1,262,677                           | 111.7                            | 1,729.3                          | 59,722                                | 240.00           | 324,000.00    |
| 6        | 35,102                       | 3,190                                 | 38,292                              | 40.0                             | 1,175.3                          | 82,481                                | 40.00            | 54,600.00     |
| 7        | 1,980,703                    | 24,046                                | 2,004,749                           | 160.0                            | 2,154.0                          | 278,119                               | 520.00           | 702,000.00    |
| 8A UPPER | 607,293                      | 2,084                                 | 609,377                             | 62.3                             | 270.7                            | 8,363                                 | 107.21           | 41,840.00     |
| 8A LOWER | 83                           | 2,291                                 | 2,374                               | 20.7                             | 5,660.0                          | 518,590                               | 52.79            | 174,160.00    |
| 8B       | 502,537                      | 178,065                               | 680,602                             | 937.7                            | 966.7                            | 177,886                               | 156.99           | 211,936.50    |
| 9        | 462,904                      | 120,566                               | 583,470                             | 987.0                            | 1,636.0                          | 201,706                               | 80.00            | 108,000.00    |
| 10       | 49,446                       | 0                                     | 49,446                              | 0.0                              | 0.0                              | 0                                     | 40.00            | 54,000.00     |
| 11       | 224,314                      | 21,552                                | 245,866                             | 192.0                            | 309.3                            | 32,263                                | 80.00            | 108,040.00    |
| 12       | 1,028,687                    | 129,193                               | 1,157,880                           | 635.7                            | 1,935.7                          | 352,954                               | 80.00            | 111,800.00    |
| 13       | 873,124                      | 53,154                                | 926,278                             | 207.3                            | 1,453.0                          | 354,274                               | 160.00           | 216,000.00    |
| 14       | 1,358,847                    | 27,263                                | 1,386,110                           | 313.0                            | 513.3                            | 42,557                                | 320.00           | 432,000.00    |
| 15       | 4,853,177                    | 1,617,565                             | 6,470,742                           | 9,937.0                          | 38,861.0                         | 4,901,223                             | 480.64           | 650,068.00    |
| 16       | 3,900,755                    | 185,177                               | 4,085,932                           | 2,293.7                          | 18,775.3                         | 1,454,192                             | 760.00           | 1,030,680.00  |
| 17       | 2,897,572                    | 1,309,041                             | 4,206,613                           | 7,459.7                          | 28,858.0                         | 3,616,861                             | 400.00           | 546,560.00    |
| 18       | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 80.00            | 108,000.00    |
| 19       | 489,027                      | 0                                     | 489,027                             | 0.0                              | 0.0                              | 0                                     | 160.00           | 216,000.00    |
| 20       | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 80.00            | 108,920.00    |
| 21       | 39,706                       | 6,820                                 | 46,526                              | 79.7                             | 2,542.3                          | 216,329                               | 80.00            | 108,040.00    |
| 22       | 4,773,017                    | 692,746                               | 5,465,763                           | 4,210.7                          | 5,256.3                          | 984,392                               | 868.39           | 1,172,466.74  |
| 23       | 167,424                      | 0                                     | 167,424                             | 0.0                              | 0.0                              | 0                                     | 36.98            | 49,923.00     |
| 24       | 183,025                      | 0                                     | 183,025                             | 0.0                              | 0.0                              | 0                                     | 80.00            | 108,000.00    |
| 25       | 603,349                      | 0                                     | 603,349                             | 0.0                              | 0.0                              | 0                                     | 157.00           | 211,950.00    |
| 26       | 1,703,938                    | 45,455                                | 1,749,393                           | 136.0                            | 267.3                            | 352,364                               | 307.96           | 415,746.00    |
| TOTAL    | 30,838,687                   | 5,229,986                             | 36,068,673                          | 33,024.5                         | 128,714.2                        | 16,142,034                            | 5,922.26         | 8,015,900.44  |

**Proposed Arrowhead Grayburg Unit**  
**Equity Parameters**  
**Percent of Total by Tract**

| TRACT    | CUMULATIVE OIL<br>(12-31-88) | REMAINING OIL<br>RESERVES<br>(1-1-89) | ULTIMATE<br>PRIMARY<br>OIL RECOVERY | CURRENT<br>OIL RATE<br>(4Q-1988) | CURRENT<br>GAS RATE<br>(4Q-1988) | REMAINING GAS<br>RESERVES<br>(1-1-89) | SURFACE<br>ACRES | GROSS ACRE-FT |
|----------|------------------------------|---------------------------------------|-------------------------------------|----------------------------------|----------------------------------|---------------------------------------|------------------|---------------|
| 1        | 1.509033                     | 0.00000                               | 1.290222                            | 0.00000                          | 0.00000                          | 0.00000                               | 1.350336         | 1.347322      |
| 2        | 5.704140                     | 14.323996                             | 6.954026                            | 13.908765                        | 11.764825                        | 14.957762                             | 5.403343         | 5.405756      |
| 3        | 1.739451                     | 1.085223                              | 1.644588                            | 1.959152                         | 0.938280                         | 0.577691                              | 1.354888         | 1.370391      |
| 4        | 0.282068                     | 0.00000                               | 0.241168                            | 0.00000                          | 0.00000                          | 0.00000                               | 1.250536         | 1.247283      |
| 5        | 4.075397                     | 0.112390                              | 3.500758                            | 0.338234                         | 1.343519                         | 0.369978                              | 4.052507         | 4.041966      |
| 6        | 0.113825                     | 0.060994                              | 0.106164                            | 0.121122                         | 0.913108                         | 0.510970                              | 0.675418         | 0.681146      |
| 7        | 6.422786                     | 0.459772                              | 5.558145                            | 0.484489                         | 1.673475                         | 1.722949                              | 8.780432         | 8.757594      |
| 8A UPPER | 1.969257                     | 0.039847                              | 1.639491                            | 0.188648                         | 0.210311                         | 0.051809                              | 1.810289         | 0.521963      |
| 8A LOWER | 0.000269                     | 0.043805                              | 0.006582                            | 0.062681                         | 4.397339                         | 3.212668                              | 0.891383         | 2.172682      |
| 8B       | 1.629567                     | 3.404694                              | 1.886962                            | 2.839407                         | 0.751044                         | 1.102005                              | 2.650346         | 2.643951      |
| 9        | 1.501050                     | 2.305283                              | 1.617664                            | 2.988690                         | 1.271033                         | 1.249570                              | 1.350336         | 1.347322      |
| 10       | 0.160338                     | 0.00000                               | 0.137088                            | 0.00000                          | 0.00000                          | 0.00000                               | 0.675418         | 0.673661      |
| 11       | 0.727379                     | 0.412085                              | 0.681661                            | 0.581387                         | 0.240300                         | 0.199869                              | 1.350336         | 1.347821      |
| 12       | 3.335703                     | 2.470236                              | 3.210210                            | 1.924935                         | 1.503874                         | 2.186552                              | 1.350336         | 1.394728      |
| 13       | 2.831262                     | 1.016332                              | 2.568096                            | 0.627716                         | 1.128858                         | 2.194730                              | 2.701671         | 2.694644      |
| 14       | 4.406306                     | 0.521282                              | 3.842975                            | 0.947781                         | 0.398790                         | 0.263641                              | 5.403343         | 5.389288      |
| 15       | 15.737301                    | 30.928668                             | 17.940061                           | 30.089782                        | 30.191696                        | 30.363107                             | 8.115821         | 8.109731      |
| 16       | 12.648901                    | 3.540679                              | 11.328202                           | 6.945450                         | 14.586813                        | 9.008728                              | 12.832939        | 12.857944     |
| 17       | 9.395899                     | 25.029532                             | 11.662788                           | 22.588381                        | 22.420215                        | 22.406600                             | 6.754178         | 6.818448      |
| 18       | 0.000000                     | 0.00000                               | 0.00000                             | 0.00000                          | 0.00000                          | 0.00000                               | 1.350336         | 1.347322      |
| 19       | 1.585758                     | 0.00000                               | 1.355822                            | 0.00000                          | 0.00000                          | 0.00000                               | 2.701671         | 2.694644      |
| 20       | 0.000000                     | 0.00000                               | 0.00000                             | 0.00000                          | 0.00000                          | 0.00000                               | 1.350336         | 1.358799      |
| 21       | 0.128754                     | 0.130402                              | 0.128993                            | 0.241336                         | 1.975151                         | 1.340159                              | 1.350336         | 1.347821      |
| 22       | 15.477368                    | 13.245657                             | 15.153768                           | 12.750231                        | 4.083699                         | 6.098314                              | 14.663152        | 14.627012     |
| 23       | 0.542902                     | 0.00000                               | 0.464181                            | 0.00000                          | 0.00000                          | 0.00000                               | 0.624424         | 0.622800      |
| 24       | 0.593492                     | 0.00000                               | 0.507435                            | 0.00000                          | 0.00000                          | 0.00000                               | 1.350336         | 1.347322      |
| 25       | 1.956468                     | 0.00000                               | 1.672778                            | 0.00000                          | 0.00000                          | 0.00000                               | 2.651015         | 2.644120      |
| 26       | 5.525326                     | 0.869123                              | 4.850173                            | 0.411815                         | 0.207669                         | 2.182897                              | 5.200042         | 5.186517      |
| TOTAL    | 100.00000                    | 100.00000                             | 100.00000                           | 100.00000                        | 100.00000                        | 100.00000                             | 100.00000        | 100.00000     |

**Proposed Arrowhead Grayburg Unit  
Value of Equity Parameters by Owner**

| OWNER     | CUMULATIVE OIL<br>(12-31-88) | REMAINING OIL<br>RESERVES<br>(1-1-89) | ULTIMATE<br>PRIMARY<br>OIL RECOVERY | CURRENT<br>OIL RATE<br>(40-1988) | CURRENT<br>GAS RATE<br>(40-1988) | REMAINING GAS<br>RESERVES<br>(1-1-89) | SURFACE<br>ACRES | GROSS ACRE-FT |
|-----------|------------------------------|---------------------------------------|-------------------------------------|----------------------------------|----------------------------------|---------------------------------------|------------------|---------------|
| ABBY      | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 0.00             | 20,087.44     |
| AMERADA   | 462,904                      | 120,566                               | 583,470                             | 987.0                            | 1,636.0                          | 201,706                               | 80.00            | 108,000.00    |
| AMERICAN  | 1,109,830                    | 180,149                               | 1,289,979                           | 1,000.0                          | 1,237.4                          | 186,249                               | 213.46           | 85,593.79     |
| AMOCO     | 439,771                      | 187,286                               | 627,056                             | 1,148.3                          | 3,785.8                          | 603,622                               | 80.00            | 108,330.00    |
| ARCO      | 2,511,959                    | 236,101                               | 2,748,059                           | 1,653.3                          | 4,608.4                          | 678,442                               | 640.00           | 784,020.25    |
| BROWN     | 27,910                       | 0                                     | 27,910                              | 0.0                              | 0.0                              | 0                                     | 10.73            | 10,041.16     |
| BRYANT    | 2,482                        | 426                                   | 2,908                               | 5.0                              | 158.9                            | 13,521                                | 3.48             | 1,137.50      |
| BURR      | 3,612                        | 0                                     | 3,612                               | 0.0                              | 0.0                              | 0                                     | 1.13             | 601.49        |
| CHEVRON   | 14,116,027                   | 2,429,289                             | 16,545,315                          | 15,363.1                         | 60,501.4                         | 7,296,740                             | 2783.54          | 3,702,960.54  |
| CONOCO    | 5,292,948                    | 1,804,851                             | 7,097,798                           | 11,085.3                         | 42,646.8                         | 5,504,845                             | 560.64           | 758,398.00    |
| DASCO     | 162,470                      | 0                                     | 162,470                             | 0.0                              | 0.0                              | 0                                     | 43.45            | 127,327.65    |
| DAVIDSON  | 115,568                      | 0                                     | 115,568                             | 0.0                              | 0.0                              | 0                                     | 36.19            | 19,247.58     |
| ENRON     | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 0.00             | 17,576.51     |
| EXXON     | 49,446                       | 0                                     | 49,446                              | 0.0                              | 0.0                              | 0                                     | 90.74            | 222,182.71    |
| FLETCHER  | 3,612                        | 0                                     | 3,612                               | 0.0                              | 0.0                              | 0                                     | 1.13             | 601.49        |
| HANNIFIN  | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 0.00             | 12,855.96     |
| MARATHON  | 2,517,127                    | 80,803                                | 2,597,930                           | 807.0                            | 3,361.7                          | 371,370                               | 600.24           | 811,849.20    |
| MCBRIDE   | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 0.00             | 27,318.91     |
| MOORE     | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 12.25            | 4,000.00      |
| MUSSETT   | 70,495                       | 0                                     | 70,495                              | 0.0                              | 0.0                              | 0                                     | 16.05            | 44,560.86     |
| NERMYR    | 7,223                        | 0                                     | 7,223                               | 0.0                              | 0.0                              | 0                                     | 2.26             | 1,202.97      |
| OXY       | 1,901,811                    | 182,347                               | 2,084,158                           | 843.0                            | 3,388.7                          | 707,228                               | 240.00           | 327,800.00    |
| PARA MIA  | 147,160                      | 0                                     | 147,160                             | 0.0                              | 0.0                              | 0                                     | 39.91            | 115,176.64    |
| PRESIDIO  | 55,802                       | 0                                     | 55,802                              | 0.0                              | 0.0                              | 0                                     | 21.45            | 20,077.00     |
| RASMUSSEN | 157,100                      | 735                                   | 157,835                             | 14.0                             | 216.2                            | 7,465                                 | 30.00            | 40,500.00     |
| SUMMERS   | 162,470                      | 0                                     | 162,470                             | 0.0                              | 0.0                              | 0                                     | 43.45            | 127,327.66    |
| SUTTON    | 3,612                        | 0                                     | 3,612                               | 0.0                              | 0.0                              | 0                                     | 1.13             | 601.49        |
| VETETO    | 15,312                       | 0                                     | 15,312                              | 0.0                              | 0.0                              | 0                                     | 3.54             | 12,152.43     |
| WALSH     | 402,253                      | 0                                     | 402,253                             | 0.0                              | 0.0                              | 0                                     | 104.67           | 44,195.54     |
| WESTWAY   | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 0.00             | 2,510.93      |
| WILLIAMS  | 1,099,699                    | 5,143                                 | 1,104,842                           | 97.7                             | 1,513.1                          | 52,257                                | 210.00           | 283,500.00    |
| ZIA       | 83                           | 2,291                                 | 2,374                               | 20.7                             | 5,660.0                          | 518,590                               | 52.79            | 174,160.00    |
| TOTAL     | 30,838,687                   | 5,229,986                             | 36,068,673                          | 33,024.5                         | 128,714.2                        | 16,142,034                            | 5,922.26         | 8,015,900.44  |

**Proposed Arrowhead Grayburg Unit**  
**Equity Parameters**  
**Percent of Total by Owner**

| OWNER     | CUMULATIVE OIL<br>(12-31-88) | REMAINING OIL<br>RESERVES<br>(1-1-89) | ULTIMATE<br>PRIMARY<br>OIL RECOVERY | CURRENT<br>OIL RATE<br>(4Q-1988) | CURRENT<br>GAS RATE<br>(4Q-1988) | REMAINING GAS<br>RESERVES<br>(1-1-89) | SURFACE<br>ACRES | GROSS ACRE-FT |
|-----------|------------------------------|---------------------------------------|-------------------------------------|----------------------------------|----------------------------------|---------------------------------------|------------------|---------------|
| ABBY      | 0.0000                       | 0.0000                                | 0.0000                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.0000           | 0.2506        |
| AMERADA   | 1.5010                       | 2.3053                                | 1.6177                              | 2.9887                           | 1.2710                           | 1.2496                                | 1.3508           | 1.3473        |
| AMERICAN  | 3.5988                       | 3.4445                                | 3.5765                              | 3.0281                           | 0.9614                           | 1.1538                                | 3.6044           | 1.0678        |
| AMOCO     | 1.4260                       | 3.5810                                | 1.7385                              | 3.4772                           | 2.9412                           | 3.7394                                | 1.3508           | 1.3514        |
| ARCO      | 8.1455                       | 4.5144                                | 7.6190                              | 5.0064                           | 3.5803                           | 4.2030                                | 10.8067          | 9.7808        |
| BROWN     | 0.0905                       | 0.0000                                | 0.0774                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.1811           | 0.1253        |
| BRYANT    | 0.0080                       | 0.0082                                | 0.0081                              | 0.0151                           | 0.1234                           | 0.0838                                | 0.0588           | 0.0142        |
| BURR      | 0.0117                       | 0.0000                                | 0.0100                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.0191           | 0.0075        |
| CHEVRON   | 45.7738                      | 46.4492                               | 45.8717                             | 46.5204                          | 47.0044                          | 45.2034                               | 47.0014          | 46.1952       |
| CONOCO    | 17.1633                      | 34.5097                               | 19.6786                             | 33.5670                          | 33.1329                          | 34.1025                               | 9.4667           | 9.4612        |
| DASCO     | 0.5268                       | 0.0000                                | 0.4504                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.7337           | 1.5884        |
| DAVIDSON  | 0.3748                       | 0.0000                                | 0.3204                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.6112           | 0.2401        |
| ENRON     | 0.0000                       | 0.0000                                | 0.0000                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.0000           | 0.2193        |
| EXXON     | 0.1603                       | 0.0000                                | 0.1371                              | 0.0000                           | 0.0000                           | 0.0000                                | 1.5321           | 2.7718        |
| FLETCHER  | 0.0117                       | 0.0000                                | 0.0100                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.0191           | 0.0075        |
| HANNIFIN  | 0.0000                       | 0.0000                                | 0.0000                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.0000           | 0.1604        |
| MARATHON  | 8.1622                       | 1.5450                                | 7.2027                              | 2.4436                           | 2.6118                           | 2.3006                                | 10.1353          | 10.1280       |
| MCBRIDE   | 0.0000                       | 0.0000                                | 0.0000                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.0000           | 0.3408        |
| MOORE     | 0.0000                       | 0.0000                                | 0.0000                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.2069           | 0.0499        |
| MUSSETT   | 0.2286                       | 0.0000                                | 0.1954                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.2710           | 0.5559        |
| NERMYR    | 0.0234                       | 0.0000                                | 0.0200                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.0382           | 0.0150        |
| OXY       | 6.1670                       | 3.4866                                | 5.7783                              | 2.5527                           | 2.6327                           | 4.3813                                | 4.0525           | 4.0894        |
| PARA MIA  | 0.4772                       | 0.0000                                | 0.4080                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.6739           | 1.4369        |
| PRESIDIO  | 0.1809                       | 0.0000                                | 0.1547                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.3622           | 0.2505        |
| RASMUSSEN | 0.5094                       | 0.0140                                | 0.4376                              | 0.0423                           | 0.1679                           | 0.0462                                | 0.5066           | 0.5052        |
| SUMMERS   | 0.5268                       | 0.0000                                | 0.4504                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.7337           | 1.5884        |
| SUTTON    | 0.0117                       | 0.0000                                | 0.0100                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.0191           | 0.0075        |
| VETETO    | 0.0497                       | 0.0000                                | 0.0425                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.0598           | 0.1516        |
| WALSH     | 1.3044                       | 0.0000                                | 1.1152                              | 0.0000                           | 0.0000                           | 0.0000                                | 1.7674           | 0.5513        |
| WESTWAY   | 0.0000                       | 0.0000                                | 0.0000                              | 0.0000                           | 0.0000                           | 0.0000                                | 0.0000           | 0.0313        |
| WILLIAMS  | 3.5660                       | 0.0983                                | 3.0632                              | 0.2960                           | 1.1756                           | 0.3237                                | 3.5459           | 3.5367        |
| ZIA       | 0.0003                       | 0.0438                                | 0.0066                              | 0.0627                           | 4.3973                           | 3.2127                                | 0.8914           | 2.1727        |
|           | 100.000                      | 100.000                               | 100.000                             | 100.000                          | 100.000                          | 100.000                               | 100.000          | 100.000       |

**Proposed Arrowhead Grayburg Unit  
Value of Equity Parameters by Owner**

| OWNER         | TRACT                  | WI                                          | CUMULATIVE OIL<br>(12-31-88)               | REMAINING OIL<br>RESERVES<br>(1-1-89) | ULTIMATE<br>PRIMARY<br>OIL RECOVERY        | CURRENT<br>OIL RATE<br>(4Q-1988) | CURRENT<br>GAS RATE<br>(4Q-1988) | REMAINING GAS<br>RESERVES<br>(1-1-89) | SURFACE<br>ACRES                   | GROSS ACRE-FT                                       |
|---------------|------------------------|---------------------------------------------|--------------------------------------------|---------------------------------------|--------------------------------------------|----------------------------------|----------------------------------|---------------------------------------|------------------------------------|-----------------------------------------------------|
| ABBY          | 11*                    | 0.0000                                      | 0                                          | 0                                     | 0                                          | 0.0                              | 0.0                              | 0                                     | 0.00                               | 20,087.44                                           |
| AMERADA       | 9                      | 100.0000                                    | 462,904                                    | 120,566                               | 583,470                                    | 987.0                            | 1,636.0                          | 201,706                               | 80.00                              | 108,000.00                                          |
| AMERICAN      | 8A(U)<br>8B(U)*        | 100.0000<br>100.0000                        | 607,293<br>502,537                         | 2,084<br>178,065                      | 609,377<br>680,602                         | 62.3<br>937.7                    | 270.7<br>966.7                   | 8,363<br>177,886                      | 107.21<br>106.25                   | 41,840.00<br>43,753.79                              |
| COMPANY TOTAL |                        |                                             | 1,109,830                                  | 180,149                               | 1,289,979                                  | 1,000.0                          | 1,237.4                          | 186,249                               | 213.46                             | 85,593.79                                           |
| AMOCO         | 2                      | 25.0000                                     | 439,771                                    | 187,266                               | 627,056                                    | 1,148.3                          | 3,785.8                          | 603,622                               | 80.00                              | 108,330.00                                          |
| ARCO          | 2<br>11*<br>14<br>19   | 25.0000<br>100.0000<br>100.0000<br>100.0000 | 439,771<br>224,314<br>1,358,847<br>489,027 | 187,286<br>21,552<br>27,263<br>0      | 627,056<br>245,866<br>1,386,110<br>489,027 | 1,148.3<br>192.0<br>313.0<br>0.0 | 3,785.8<br>309.3<br>513.3<br>0.0 | 603,622<br>32,263<br>42,557<br>0      | 80.00<br>80.00<br>320.00<br>160.00 | 108,330.00<br>27,690.25<br>432,000.00<br>216,000.00 |
| COMPANY TOTAL |                        |                                             | 2,511,959                                  | 236,101                               | 2,748,059                                  | 1,653.3                          | 4,608.4                          | 678,442                               | 640.00                             | 784,020.25                                          |
| BROWN         | 4*<br>23<br>24*<br>25* | 0.0000<br>16.6700<br>0.0000<br>0.0000       | 0<br>27,910<br>0<br>0                      | 0<br>0<br>0<br>0                      | 0<br>27,910<br>0<br>0                      | 0.0<br>0.0<br>0.0<br>0.0         | 0.0<br>0.0<br>0.0<br>0.0         | 0<br>0<br>0<br>0                      | 0.98<br>6.16<br>1.46<br>2.12       | 365.64<br>8,322.16<br>546.78<br>806.59              |
| COMPANY TOTAL |                        |                                             | 27,910                                     | 0                                     | 27,910                                     | 0.0                              | 0.0                              | 0                                     | 10.73                              | 10,041.16                                           |
| BRYANT        | 21*                    | 6.2500                                      | 2,482                                      | 426                                   | 2,908                                      | 5.0                              | 158.9                            | 13,521                                | 3.48                               | 1,137.50                                            |
| BURR          | 1*<br>4*<br>23<br>24*  | 0.3906<br>0.4883<br>0.3906<br>0.3906        | 1,818<br>425<br>654<br>715                 | 0<br>0<br>0<br>0                      | 1,818<br>425<br>654<br>715                 | 0.0<br>0.0<br>0.0<br>0.0         | 0.0<br>0.0<br>0.0<br>0.0         | 0<br>0<br>0<br>0                      | 0.31<br>0.36<br>0.14<br>0.31       | 134.06<br>140.85<br>195.01<br>131.56                |
| COMPANY TOTAL |                        |                                             | 3,612                                      | 0                                     | 3,612                                      | 0.0                              | 0.0                              | 0                                     | 1.13                               | 601.49                                              |



**Proposed Arrowhead Grayburg Unit  
Value of Equity Parameters by Owner**

| OWNER         | TRACT | WI       | CUMULATIVE OIL<br>(12-31-88) | REMAINING OIL<br>RESERVES<br>(1-1-89) | ULTIMATE<br>PRIMARY<br>OIL RECOVERY | CURRENT<br>OIL RATE<br>(4Q-1988) | CURRENT<br>GAS RATE<br>(4Q-1988) | REMAINING GAS<br>RESERVES<br>(1-1-89) | SURFACE<br>ACRES | GROSS ACRE-FT |
|---------------|-------|----------|------------------------------|---------------------------------------|-------------------------------------|----------------------------------|----------------------------------|---------------------------------------|------------------|---------------|
| CHEVRON       | 1 *   | 35.5469  | 165,423                      | 0                                     | 165,423                             | 0.0                              | 0.0                              | 0                                     | 28.44            | 12,199.69     |
|               | 2     | 25.0000  | 439,771                      | 187,286                               | 627,056                             | 1,148.3                          | 3,785.8                          | 603,622                               | 80.00            | 108,330.00    |
|               | 4 *   | 44.4336  | 38,651                       | 0                                     | 38,651                              | 0.0                              | 0.0                              | 0                                     | 32.91            | 12,817.35     |
|               | 6     | 100.0000 | 35,102                       | 3,190                                 | 38,292                              | 40.0                             | 1,175.3                          | 82,481                                | 40.00            | 54,600.00     |
|               | 16    | 100.0000 | 3,900,755                    | 185,177                               | 4,085,932                           | 2,293.7                          | 18,775.3                         | 1,454,192                             | 760.00           | 1,030,680.00  |
|               | 17    | 100.0000 | 2,897,572                    | 1,309,041                             | 4,206,613                           | 7,459.7                          | 28,858.0                         | 3,616,881                             | 400.00           | 546,560.00    |
|               | 18    | 100.0000 | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 80.00            | 108,000.00    |
|               | 20    | 100.0000 | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 80.00            | 108,920.00    |
|               | 21 *  | 93.7500  | 37,224                       | 6,394                                 | 43,618                              | 74.7                             | 2,383.4                          | 202,808                               | 64.26            | 102,902.50    |
|               | 22    | 100.0000 | 4,773,017                    | 692,746                               | 5,465,763                           | 4,210.7                          | 5,256.3                          | 984,392                               | 868.39           | 1,172,486.74  |
|               | 23    | 35.5469  | 59,514                       | 0                                     | 59,514                              | 0.0                              | 0.0                              | 0                                     | 13.15            | 17,746.07     |
|               | 24 *  | 35.5469  | 65,060                       | 0                                     | 65,060                              | 0.0                              | 0.0                              | 0                                     | 28.44            | 11,972.19     |
|               | 26    | 100.0000 | 1,703,938                    | 45,455                                | 1,749,393                           | 136.0                            | 267.3                            | 352,364                               | 307.96           | 415,746.00    |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| COMPANY TOTAL |       |          | 14,116,027                   | 2,429,289                             | 16,545,315                          | 15,363.1                         | 60,501.4                         | 7,296,740                             | 2783.54          | 3,702,960.54  |
| CONOCO        | 2     | 25.0000  | 439,771                      | 187,286                               | 627,056                             | 1,148.3                          | 3,785.8                          | 603,622                               | 80.00            | 108,330.00    |
|               | 15    | 100.0000 | 4,853,177                    | 1,617,565                             | 6,470,742                           | 9,937.0                          | 38,861.0                         | 4,901,223                             | 480.64           | 650,068.00    |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| COMPANY TOTAL |       |          | 5,292,948                    | 1,804,851                             | 7,097,798                           | 11,085.3                         | 42,646.8                         | 5,504,845                             | 560.64           | 758,398.00    |
| DRSCO         | 1 *   | 14.1667  | 65,927                       | 0                                     | 65,927                              | 0.0                              | 0.0                              | 0                                     | 11.33            | 27,579.98     |
|               | 4 *   | 12.5000  | 10,873                       | 0                                     | 10,873                              | 0.0                              | 0.0                              | 0                                     | 6.28             | 25,173.37     |
|               | 24 *  | 14.4930  | 26,525                       | 0                                     | 26,525                              | 0.0                              | 0.0                              | 0                                     | 10.32            | 25,947.83     |
|               | 25 *  | 9.8024   | 59,144                       | 0                                     | 59,144                              | 0.0                              | 0.0                              | 0                                     | 13.52            | 48,626.48     |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| COMPANY TOTAL |       |          | 162,470                      | 0                                     | 162,470                             | 0.0                              | 0.0                              | 0                                     | 43.45            | 127,327.65    |
| DAVIDSON      | 1 *   | 12.5000  | 58,171                       | 0                                     | 58,171                              | 0.0                              | 0.0                              | 0                                     | 10.00            | 4,290.00      |
|               | 4 *   | 15.6250  | 13,592                       | 0                                     | 13,592                              | 0.0                              | 0.0                              | 0                                     | 11.57            | 4,507.20      |
|               | 23    | 12.5000  | 20,928                       | 0                                     | 20,928                              | 0.0                              | 0.0                              | 0                                     | 4.62             | 6,240.38      |
|               | 24 *  | 12.5000  | 22,878                       | 0                                     | 22,878                              | 0.0                              | 0.0                              | 0                                     | 10.00            | 4,210.00      |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| COMPANY TOTAL |       |          | 115,568                      | 0                                     | 115,568                             | 0.0                              | 0.0                              | 0                                     | 36.19            | 19,247.58     |

**Proposed Arrowhead Grayburg Unit  
Value of Equity Parameters by Owner**

| OWNER         | TRACT        | WI                   | CUMULATIVE OIL<br>(12-31-88) | REMAINING OIL<br>RESERVES<br>(1-1-89) | ULTIMATE<br>PRIMARY<br>OIL RECOVERY | CURRENT<br>OIL RATE<br>(4Q-1988) | CURRENT<br>GAS RATE<br>(4Q-1988) | REMAINING GAS<br>RESERVES<br>(1-1-89) | SURFACE<br>ACRES | GROSS ACRE-FT            |
|---------------|--------------|----------------------|------------------------------|---------------------------------------|-------------------------------------|----------------------------------|----------------------------------|---------------------------------------|------------------|--------------------------|
| ENRON         | 11*          | 0.0000               | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 0.00             | 17,576.51                |
| EXXON         | 88(L)*<br>10 | 0.0000<br>100.0000   | 0<br>49,446                  | 0<br>0                                | 0<br>49,446                         | 0.0<br>0.0                       | 0.0<br>0.0                       | 0<br>0                                | 50.74<br>40.00   | 168,182.71<br>54,000.00  |
| COMPANY TOTAL |              |                      |                              |                                       |                                     |                                  |                                  |                                       |                  |                          |
|               |              |                      | 49,446                       | 0                                     | 49,446                              | 0.0                              | 0.0                              | 0                                     | 90.74            | 222,182.71               |
| FLETCHER      | 1*<br>4*     | 0.3906<br>0.4883     | 1,818<br>425                 | 0<br>0                                | 1,818<br>425                        | 0.0<br>0.0                       | 0.0<br>0.0                       | 0<br>0                                | 0.31<br>0.36     | 134.06<br>140.85         |
|               | 23<br>24*    | 0.3906<br>0.3906     | 654<br>715                   | 0<br>0                                | 654<br>715                          | 0.0<br>0.0                       | 0.0<br>0.0                       | 0<br>0                                | 0.14<br>0.31     | 195.01<br>131.56         |
| COMPANY TOTAL |              |                      |                              |                                       |                                     |                                  |                                  |                                       |                  |                          |
|               |              |                      | 3,612                        | 0                                     | 3,612                               | 0.0                              | 0.0                              | 0                                     | 1.13             | 601.49                   |
| HANNIFIN      | 11*          | 0.0000               | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 0.00             | 12,855.96                |
| MARATHON      | 3<br>7       | 100.0000<br>100.0000 | 536,424<br>1,980,703         | 56,757<br>24,046                      | 593,181<br>2,004,749                | 647.0<br>160.0                   | 1,207.7<br>2,154.0               | 93,251<br>278,119                     | 80.24<br>520.00  | 109,849.20<br>702,000.00 |
| COMPANY TOTAL |              |                      |                              |                                       |                                     |                                  |                                  |                                       |                  |                          |
|               |              |                      | 2,517,127                    | 80,803                                | 2,597,930                           | 807.0                            | 3,361.7                          | 371,370                               | 600.24           | 811,649.20               |
| MCBRIDE       | 11*          | 0.0000               | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 0.00             | 27,318.91                |
| MOORE         | 21*          | 0.0000               | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 12.25            | 4,000.00                 |
| MUSSETT       | 1*<br>4*     | 7.5000<br>0.0000     | 34,902<br>0                  | 0<br>0                                | 34,902<br>0                         | 0.0<br>0.0                       | 0.0<br>0.0                       | 0<br>0                                | 6.00<br>0.00     | 8,100.00<br>5,335.12     |
|               | 24*<br>25*   | 6.5217<br>3.9211     | 11,936<br>23,656             | 0<br>0                                | 11,936<br>23,656                    | 0.0<br>0.0                       | 0.0<br>0.0                       | 0<br>0                                | 4.64<br>5.41     | 11,676.52<br>19,449.22   |
| COMPANY TOTAL |              |                      |                              |                                       |                                     |                                  |                                  |                                       |                  |                          |
|               |              |                      | 70,495                       | 0                                     | 70,495                              | 0.0                              | 0.0                              | 0                                     | 16.05            | 44,560.86                |

**Proposed Arrowhead Grayburg Unit  
Value of Equity Parameters by Owner**

| OWNER         | TRACT | WI       | CUMULATIVE OIL<br><12-31-88> | REMAINING OIL<br>RESERVES<br><1-1-89> | ULTIMATE<br>PRIMARY<br>OIL RECOVERY | CURRENT<br>OIL RATE<br><4Q-1988> | CURRENT<br>GAS RATE<br><4Q-1988> | REMAINING GAS<br>RESERVES<br><1-1-89> | SURFACE<br>ACRES | GROSS ACRE-FT |
|---------------|-------|----------|------------------------------|---------------------------------------|-------------------------------------|----------------------------------|----------------------------------|---------------------------------------|------------------|---------------|
| NERNYR        | 1 *   | 0.7813   | 3,636                        | 0                                     | 3,636                               | 0.0                              | 0.0                              | 0                                     | 0.63             | 268.13        |
|               | 4 *   | 0.9676   | 849                          | 0                                     | 849                                 | 0.0                              | 0.0                              | 0                                     | 0.72             | 281.70        |
|               | 23    | 0.7813   | 1,308                        | 0                                     | 1,308                               | 0.0                              | 0.0                              | 0                                     | 0.29             | 390.02        |
|               | 24 *  | 0.7813   | 1,430                        | 0                                     | 1,430                               | 0.0                              | 0.0                              | 0                                     | 0.63             | 263.13        |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| COMPANY TOTAL |       |          | 7,223                        | 0                                     | 7,223                               | 0.0                              | 0.0                              | 0                                     | 2.26             | 1,202.97      |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| OXY           | 12    | 100.0000 | 1,028,687                    | 129,193                               | 1,157,880                           | 635.7                            | 1,935.7                          | 352,954                               | 80.00            | 111,800.00    |
|               | 13    | 100.0000 | 873,124                      | 53,154                                | 926,278                             | 207.3                            | 1,453.0                          | 354,274                               | 160.00           | 216,000.00    |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| COMPANY TOTAL |       |          | 1,901,811                    | 182,347                               | 2,084,158                           | 843.0                            | 3,388.7                          | 707,228                               | 240.00           | 327,800.00    |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| PARA MIA      | 1 *   | 12.7174  | 59,182                       | 0                                     | 59,182                              | 0.0                              | 0.0                              | 0                                     | 10.17            | 24,946.96     |
|               | 4 *   | 12.5000  | 10,873                       | 0                                     | 10,873                              | 0.0                              | 0.0                              | 0                                     | 8.28             | 23,111.52     |
|               | 24 *  | 13.0435  | 23,873                       | 0                                     | 23,873                              | 0.0                              | 0.0                              | 0                                     | 9.29             | 23,353.04     |
|               | 25 *  | 8.8221   | 53,231                       | 0                                     | 53,231                              | 0.0                              | 0.0                              | 0                                     | 12.17            | 43,765.12     |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| COMPANY TOTAL |       |          | 147,160                      | 0                                     | 147,160                             | 0.0                              | 0.0                              | 0                                     | 39.91            | 115,176.64    |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| PRESIDIO      | 4 *   | 0.0000   | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 1.95             | 731.27        |
|               | 23    | 33.3300  | 55,802                       | 0                                     | 55,802                              | 0.0                              | 0.0                              | 0                                     | 12.33            | 16,639.34     |
|               | 24 *  | 0.0000   | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 2.93             | 1,093.22      |
|               | 25 *  | 0.0000   | 0                            | 0                                     | 0                                   | 0.0                              | 0.0                              | 0                                     | 4.24             | 1,613.17      |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| COMPANY TOTAL |       |          | 55,802                       | 0                                     | 55,802                              | 0.0                              | 0.0                              | 0                                     | 21.45            | 20,077.00     |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| RASINUSSEN    | 5     | 12.5000  | 157,100                      | 735                                   | 157,835                             | 14.0                             | 216.2                            | 7,465                                 | 30.00            | 40,500.00     |
|               |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| SUMMERS       | 1 *   | 14.1667  | 65,927                       | 0                                     | 65,927                              | 0.0                              | 0.0                              | 0                                     | 11.33            | 27,579.99     |
|               | 4 *   | 12.5000  | 10,873                       | 0                                     | 10,873                              | 0.0                              | 0.0                              | 0                                     | 8.28             | 25,173.37     |
|               | 24 *  | 14.4930  | 26,525                       | 0                                     | 26,525                              | 0.0                              | 0.0                              | 0                                     | 10.32            | 25,947.83     |
|               | 25 *  | 9.8024   | 59,144                       | 0                                     | 59,144                              | 0.0                              | 0.0                              | 0                                     | 13.52            | 48,626.48     |
| <hr/>         |       |          |                              |                                       |                                     |                                  |                                  |                                       |                  |               |
| COMPANY TOTAL |       |          | 162,470                      | 0                                     | 162,470                             | 0.0                              | 0.0                              | 0                                     | 43.45            | 127,327.66    |

**Proposed Arrowhead Grayburg Unit  
Value of Equity Parameters by Owner**

| OWNER         | TRACT | WI       | REMAINING OIL                |                      | ULTIMATE<br>PRIMARY<br>OIL RECOVERY | CURRENT<br>OIL RATE<br>(4Q-1988) | CURRENT<br>GAS RATE<br>(4Q-1988) | REMAINING GAS<br>RESERVES<br>(1-1-89) | SURFACE  |               |
|---------------|-------|----------|------------------------------|----------------------|-------------------------------------|----------------------------------|----------------------------------|---------------------------------------|----------|---------------|
|               |       |          | CUMULATIVE OIL<br>(12-31-88) | RESERVES<br>(1-1-89) |                                     |                                  |                                  |                                       | ACRES    | GROSS ACRE-FT |
| SUTTON        | 1 *   | 0.3906   | 1,818                        | 0                    | 1,818                               | 0.0                              | 0.0                              | 0                                     | 0.31     | 134.06        |
|               | 4 *   | 0.4883   | 425                          | 0                    | 425                                 | 0.0                              | 0.0                              | 0                                     | 0.36     | 140.85        |
|               | 23    | 0.3906   | 654                          | 0                    | 654                                 | 0.0                              | 0.0                              | 0                                     | 0.14     | 195.01        |
|               | 24 *  | 0.3906   | 715                          | 0                    | 715                                 | 0.0                              | 0.0                              | 0                                     | 0.31     | 131.56        |
| <hr/>         |       |          |                              |                      |                                     |                                  |                                  |                                       |          |               |
| COMPANY TOTAL |       |          | 3,612                        | 0                    | 3,612                               | 0.0                              | 0.0                              | 0                                     | 1.13     | 601.49        |
| VETETO        | 1 *   | 1.4493   | 6,745                        | 0                    | 6,745                               | 0.0                              | 0.0                              | 0                                     | 1.16     | 2,633.09      |
|               | 4 *   | 0.0000   | 0                            | 0                    | 0                                   | 0.0                              | 0.0                              | 0                                     | 0.00     | 2,061.92      |
|               | 24 *  | 1.4493   | 2,653                        | 0                    | 2,653                               | 0.0                              | 0.0                              | 0                                     | 1.03     | 2,594.78      |
|               | 25 *  | 0.9802   | 5,914                        | 0                    | 5,914                               | 0.0                              | 0.0                              | 0                                     | 1.35     | 4,862.65      |
| <hr/>         |       |          |                              |                      |                                     |                                  |                                  |                                       |          |               |
| COMPANY TOTAL |       |          | 15,312                       | 0                    | 15,312                              | 0.0                              | 0.0                              | 0                                     | 3.54     | 12,152.43     |
| WALSH         | 25 *  | 66.6700  | 402,253                      | 0                    | 402,253                             | 0.0                              | 0.0                              | 0                                     | 104.67   | 44,195.54     |
|               | 11 *  | 0.0000   | 0                            | 0                    | 0                                   | 0.0                              | 0.0                              | 0                                     | 0.00     | 2,510.93      |
| WILLIAMS      | 5     | 87.5000  | 1,099,699                    | 5,143                | 1,104,842                           | 97.7                             | 1,513.1                          | 52,257                                | 210.00   | 263,500.00    |
| ZIA           | 8A(L) | 100.0000 | 83                           | 2,291                | 2,374                               | 20.7                             | 5,660.0                          | 518,590                               | 52.79    | 174,160.00    |
| <hr/>         |       |          |                              |                      |                                     |                                  |                                  |                                       |          |               |
| TOTAL         |       |          | 30,638,687                   | 5,229,986            | 36,068,673                          | 33,024.5                         | 128,714.2                        | 16,142,034                            | 5,922.26 | 8,015,900.44  |

\* Working interests are different for production and acreage equities. Indicated WI is for production equity. Consult ownership information tables (Appendix C) for detail.

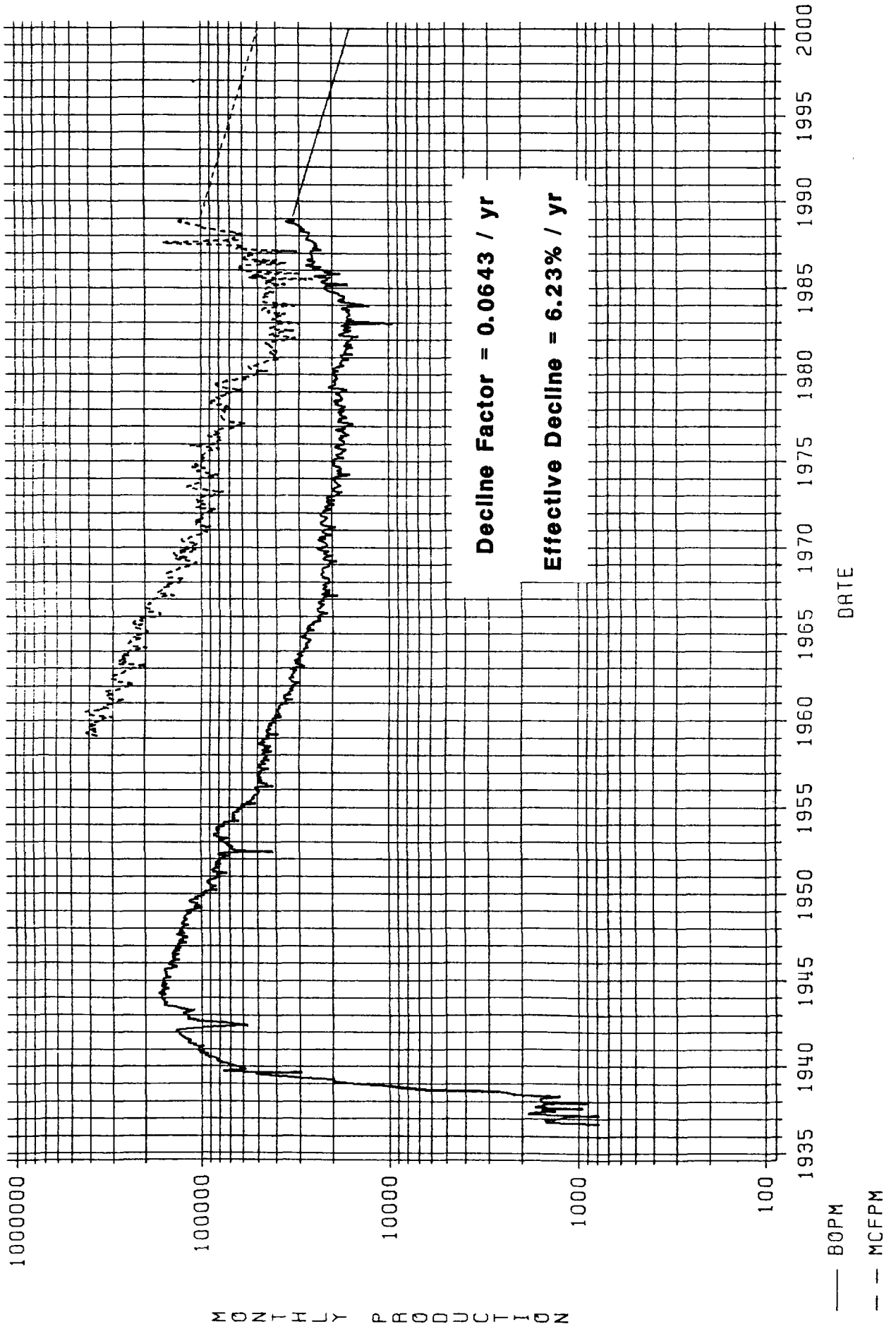
PROPOSED ARROWHEAD GRAYBURG UNIT  
REMAINING RESERVES

| TRACT      | I.P.<br>BOPM OR<br>MCFPM | E.L.<br>BOPM OR<br>MCFPM | DECLINE<br>FACTOR | REMAINING<br>OIL<br>RESERVES | GOR<br>(MCF/BO) | REMAINING<br>GAS<br>RESERVES |
|------------|--------------------------|--------------------------|-------------------|------------------------------|-----------------|------------------------------|
| 1          | 0                        | 0                        | 0.0000            | 0                            | 0               | 0                            |
| 2          | 4160                     | 227                      | 0.0630            | 749,143                      | 3.223           | 2,414,487                    |
| 3          | 647                      | 52                       | 0.1258            | 56,757                       | 1.643           | 93,251                       |
| 4          | 0                        | 0                        | 0.0000            | 0                            | 0               | 0                            |
| 5          | 112                      | 30                       | 0.1674            | 5,878                        | 10.160          | 59,722                       |
| * 6        | 987                      | 433                      | 0.0806            | 3,190                        | 25.853          | 82,481                       |
| 7          | 160                      | 56                       | 0.0519            | 24,046                       | 11.566          | 278,119                      |
| 8A Upper   | 62                       | 43                       | 0.1094            | 2,084                        | 4.013           | 8,363                        |
| * 8A Lower | 6461                     | 575                      | 0.1362            | 2,291                        | 226.398         | 518,590                      |
| 8B         | 929                      | 55                       | 0.0589            | 178,065                      | 0.999           | 177,886                      |
| 9          | 1117                     | 51                       | 0.1061            | 120,566                      | 1.673           | 201,706                      |
| 10         | 0                        | 0                        | 0.0000            | 0                            | 0               | 0                            |
| 11         | 302                      | 52                       | 0.1392            | 21,552                       | 1.497           | 32,263                       |
| 12         | 614                      | 94                       | 0.0483            | 129,193                      | 2.732           | 352,954                      |
| 13         | 300                      | 36                       | 0.0596            | 53,154                       | 6.665           | 354,274                      |
| 14         | 306                      | 52                       | 0.1118            | 27,263                       | 1.561           | 42,557                       |
| 15         | 9669                     | 368                      | 0.0690            | 1,617,565                    | 3.030           | 4,901,223                    |
| 16         | 2147                     | 269                      | 0.1217            | 185,177                      | 7.853           | 1,454,192                    |
| 17         | 7496                     | 329                      | 0.0657            | 1,309,041                    | 2,763           | 3,616,881                    |
| 18         | 0                        | 0                        | 0.0000            | 0                            | 0               | 0                            |
| 19         | 0                        | 0                        | 0.0000            | 0                            | 0               | 0                            |
| 20         | 0                        | 0                        | 0.0000            | 0                            | 0               | 0                            |
| * 21       | 2228                     | 912                      | 0.0730            | 6,820                        | 31.721          | 216,329                      |
| 22         | 4036                     | 630                      | 0.0590            | 692,746                      | 1.421           | 984,392                      |
| 23         | 0                        | 0                        | 0.0000            | 0                            | 0               | 0                            |
| 24         | 0                        | 0                        | 0.0000            | 0                            | 0               | 0                            |
| 25         | 0                        | 0                        | 0.0000            | 0                            | 0               | 0                            |
| 26         | 134                      | 34                       | 0.0264            | 45,455                       | 7.752           | 352,364                      |
| TOTAL      |                          |                          |                   | 5,229,984                    |                 | 16,142,035                   |

\* Denotes reserves based on gas decline.

# PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT  
TRACT=UNIT TOTAL

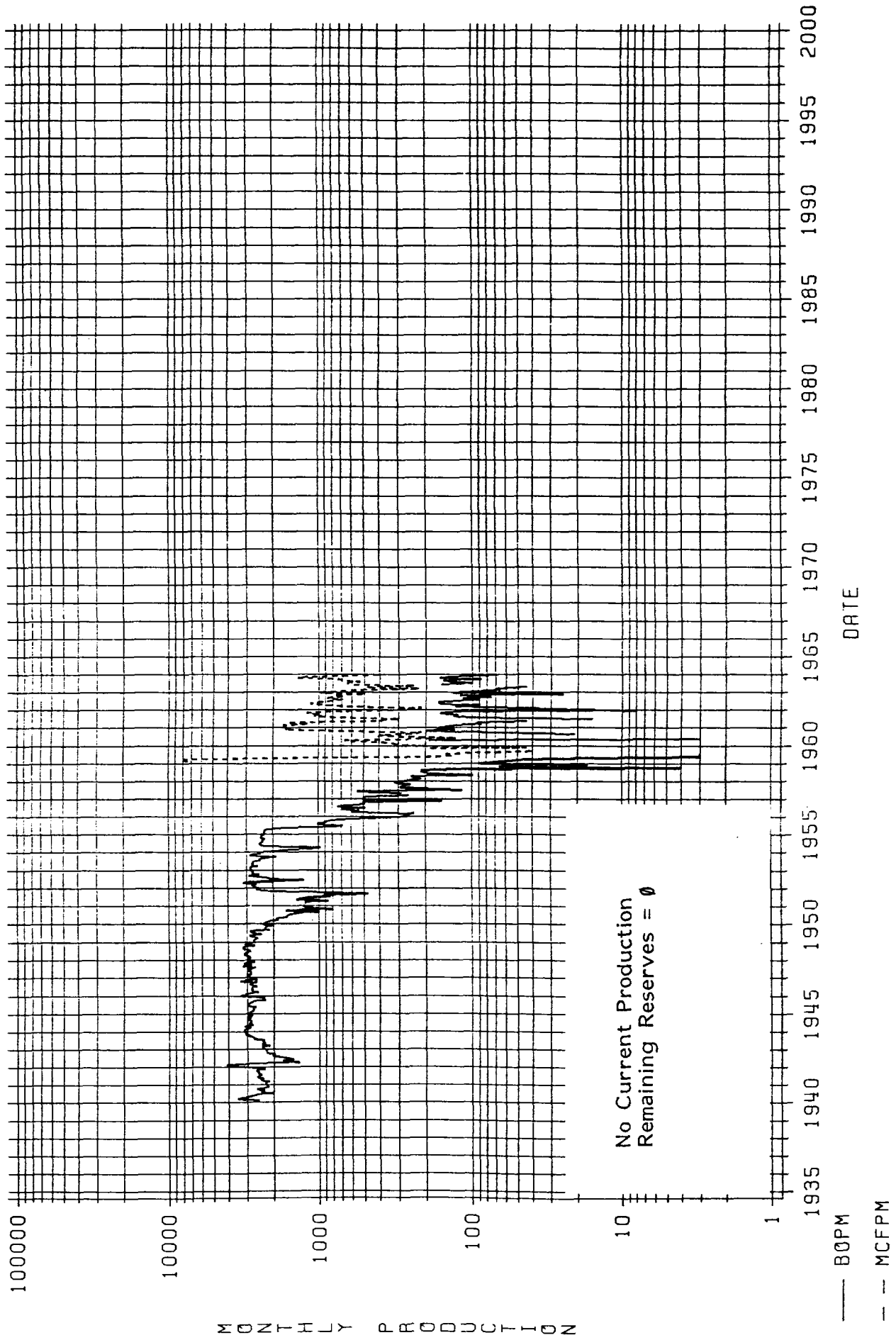




## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

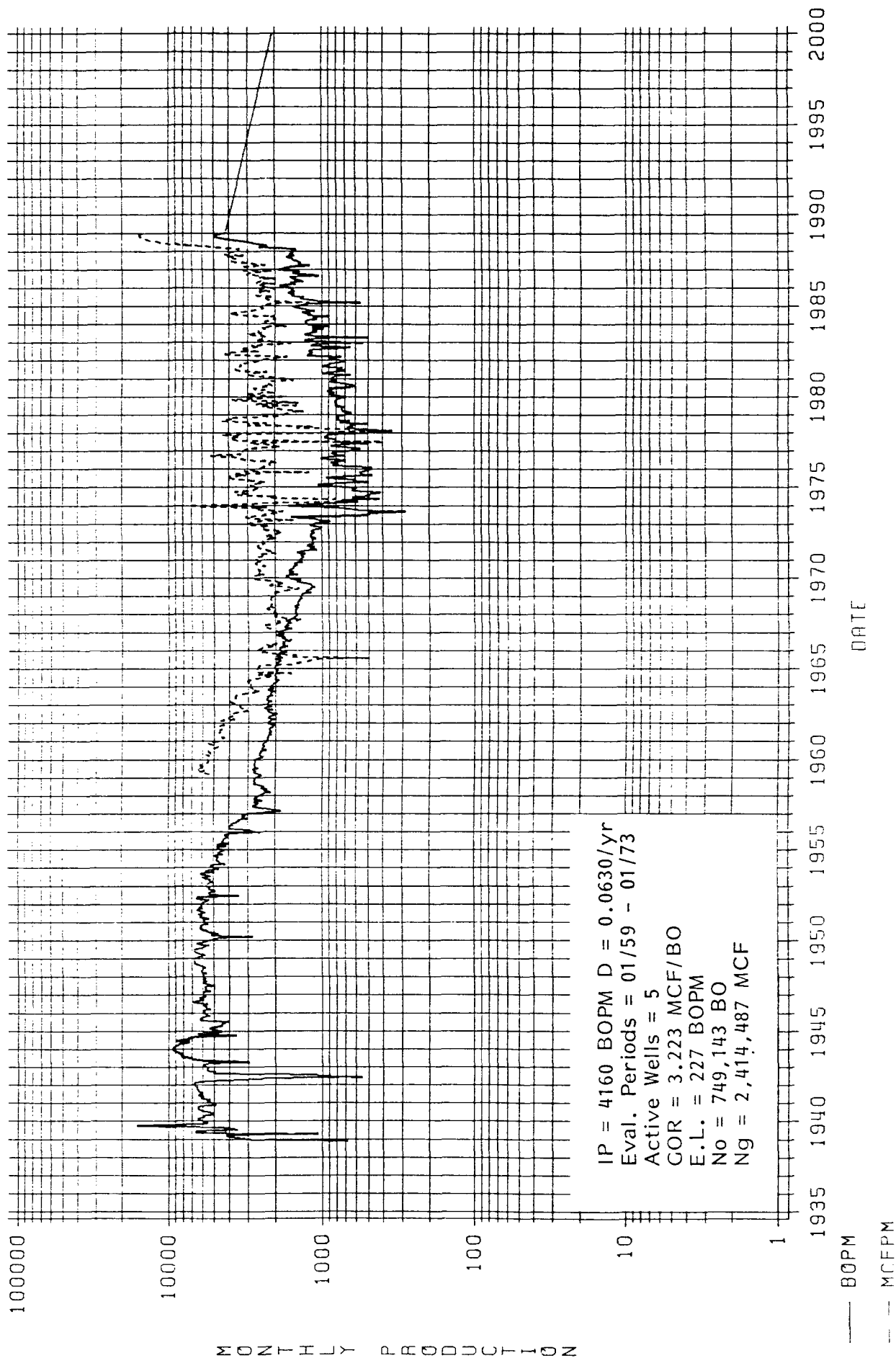
TRACT=1 OPERNA=HARTMAN LEASE=RUBY CROSBY



## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

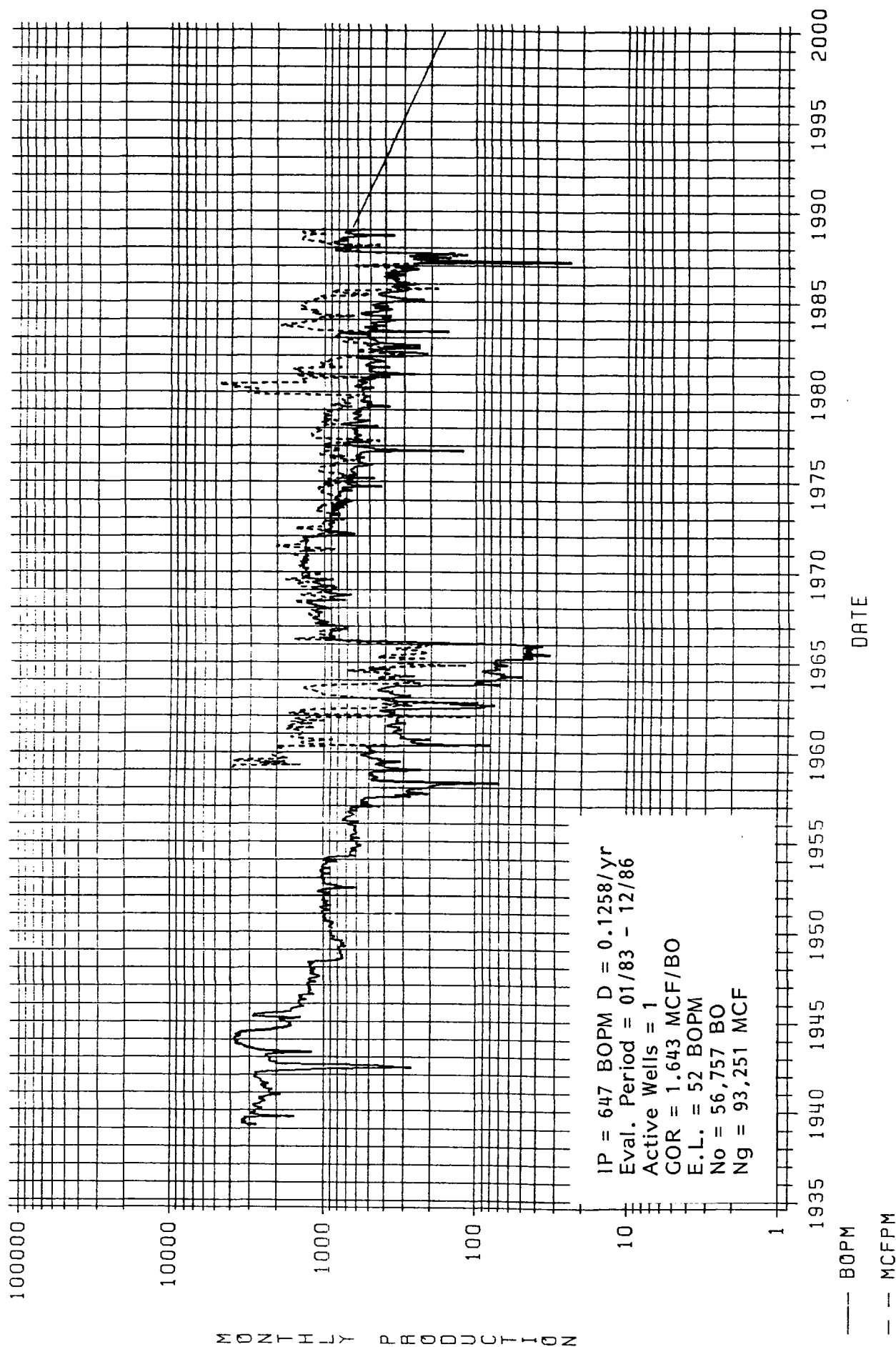
TRACT=2 OPERNA=CONOCO LEASE=LOCKHART B FED



## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

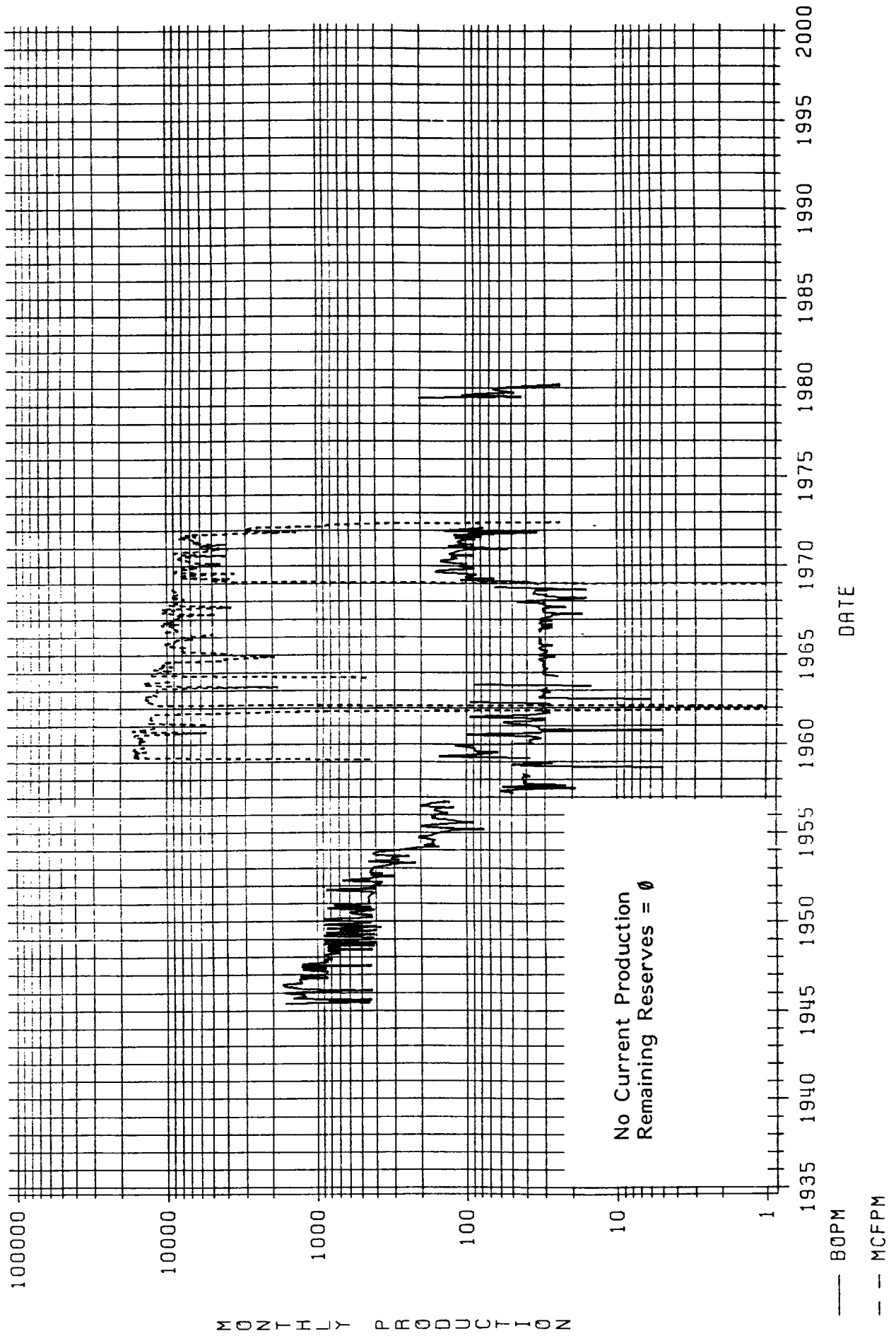
TRACT=3 OPERNA=MARATHON LEASE=SAUNDERS



## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

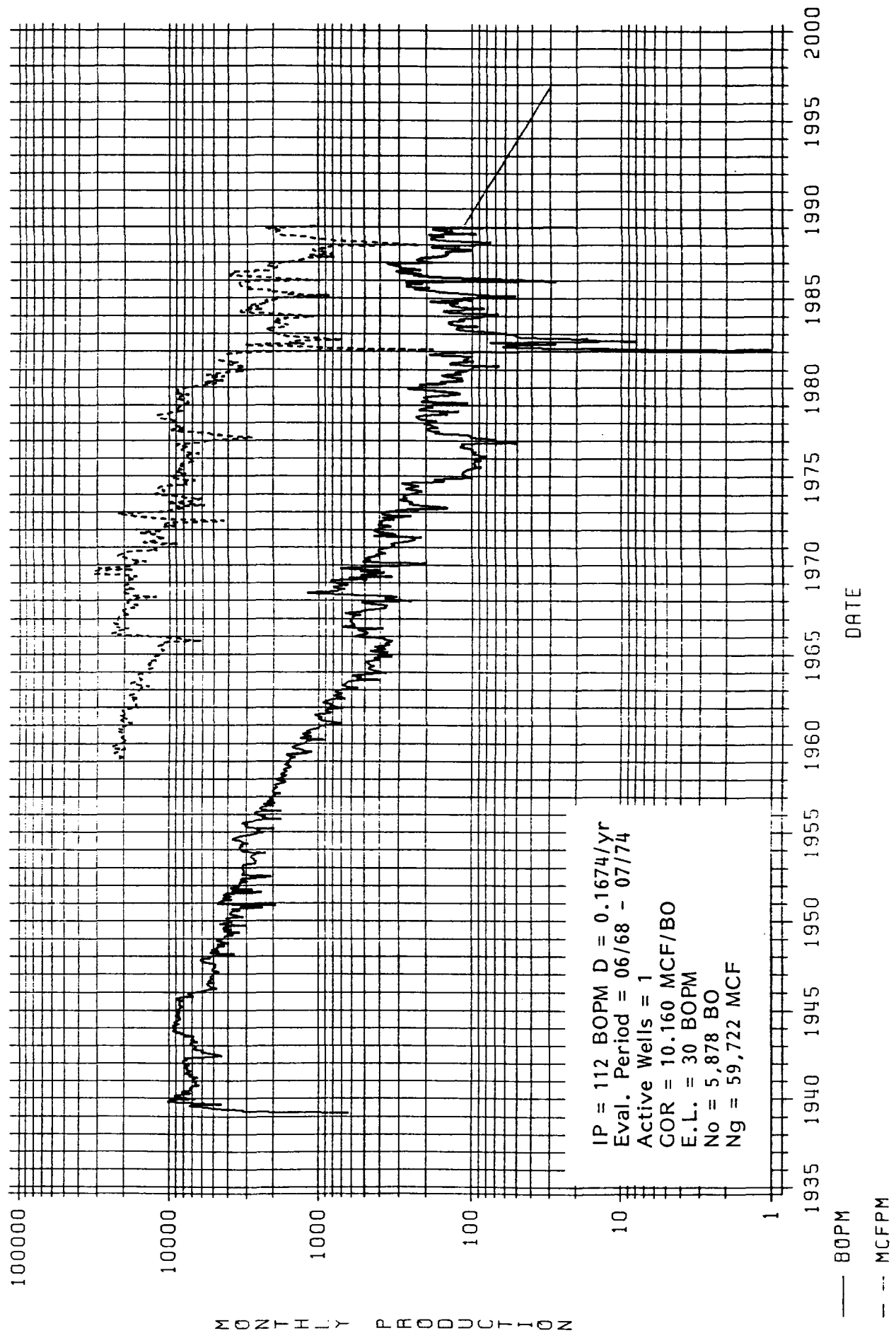
TRACT=4 OPERNA=HARTMAN LEASE=ELLIOTT U.S.



## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

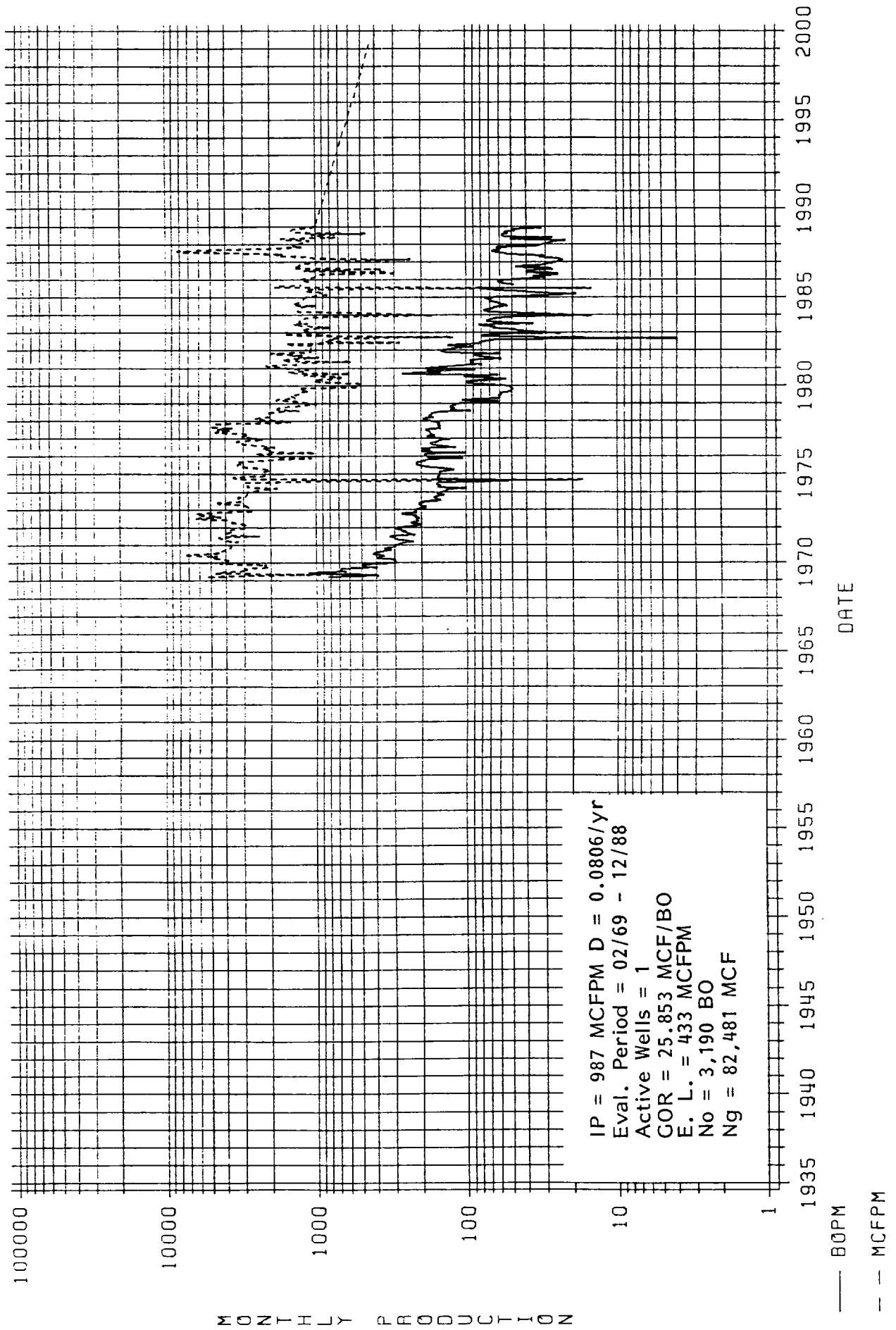
TRACT=5 OPERNA=RASMUSSEN LEASE=STATE AC





## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT  
TRACT=6 OPERNA=CHEVRON LEASE=GRAHAM STATE J

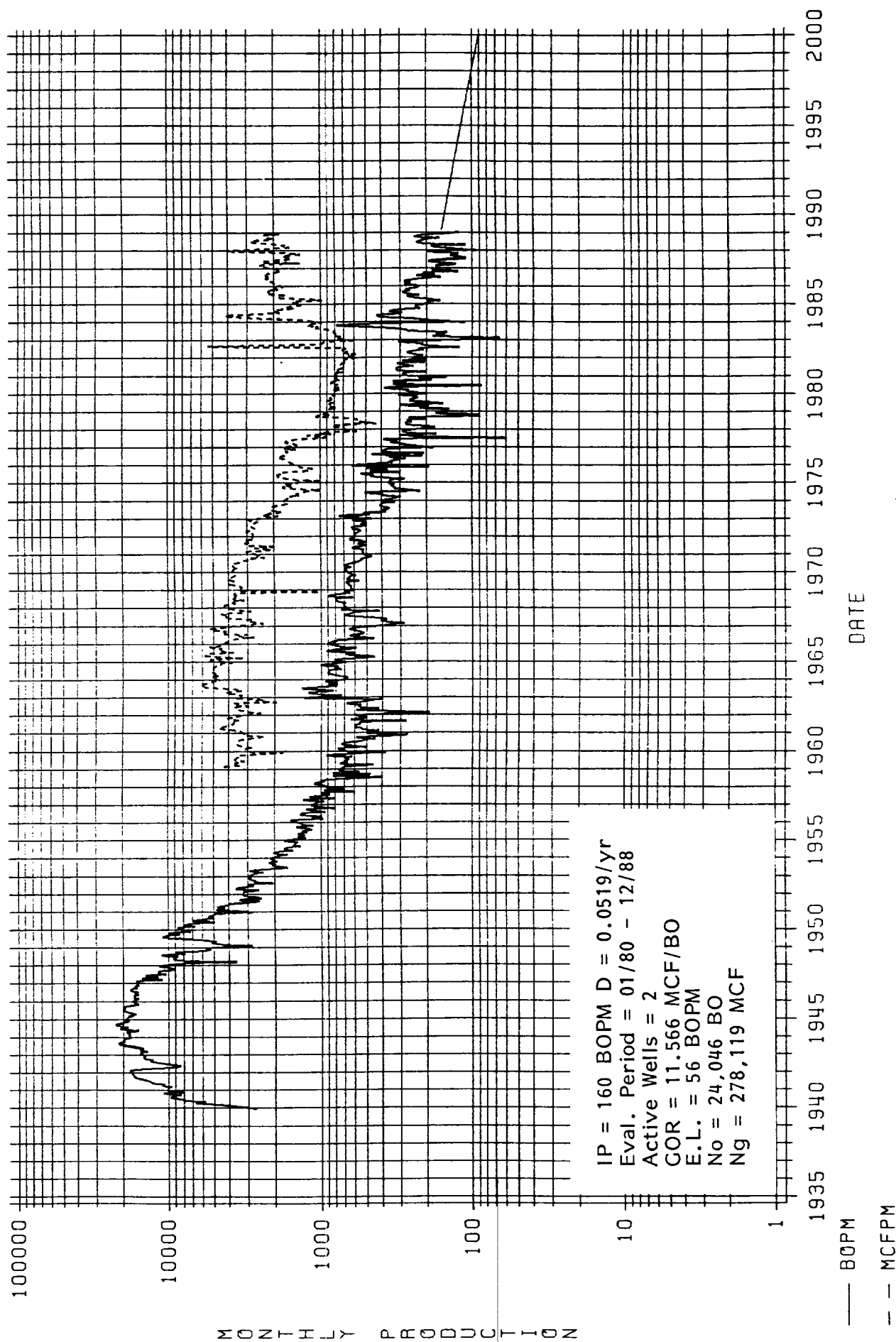




## PROPOSED ARROWHEAD GRAYBURG UNIT

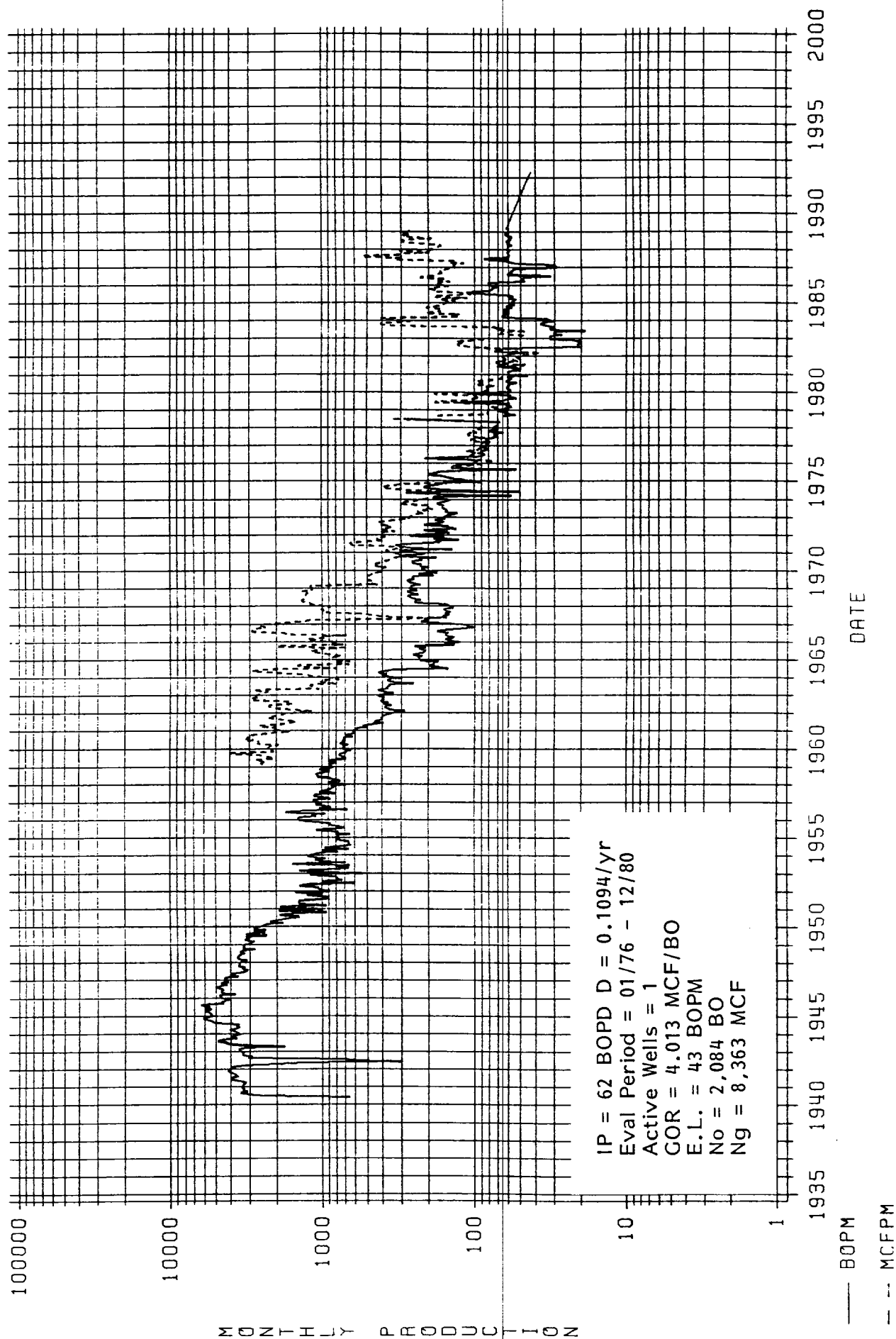
PRODUCTION PLOT

TRACT=7 OPERA=MARATHON LEASE=MCDONALD STATE

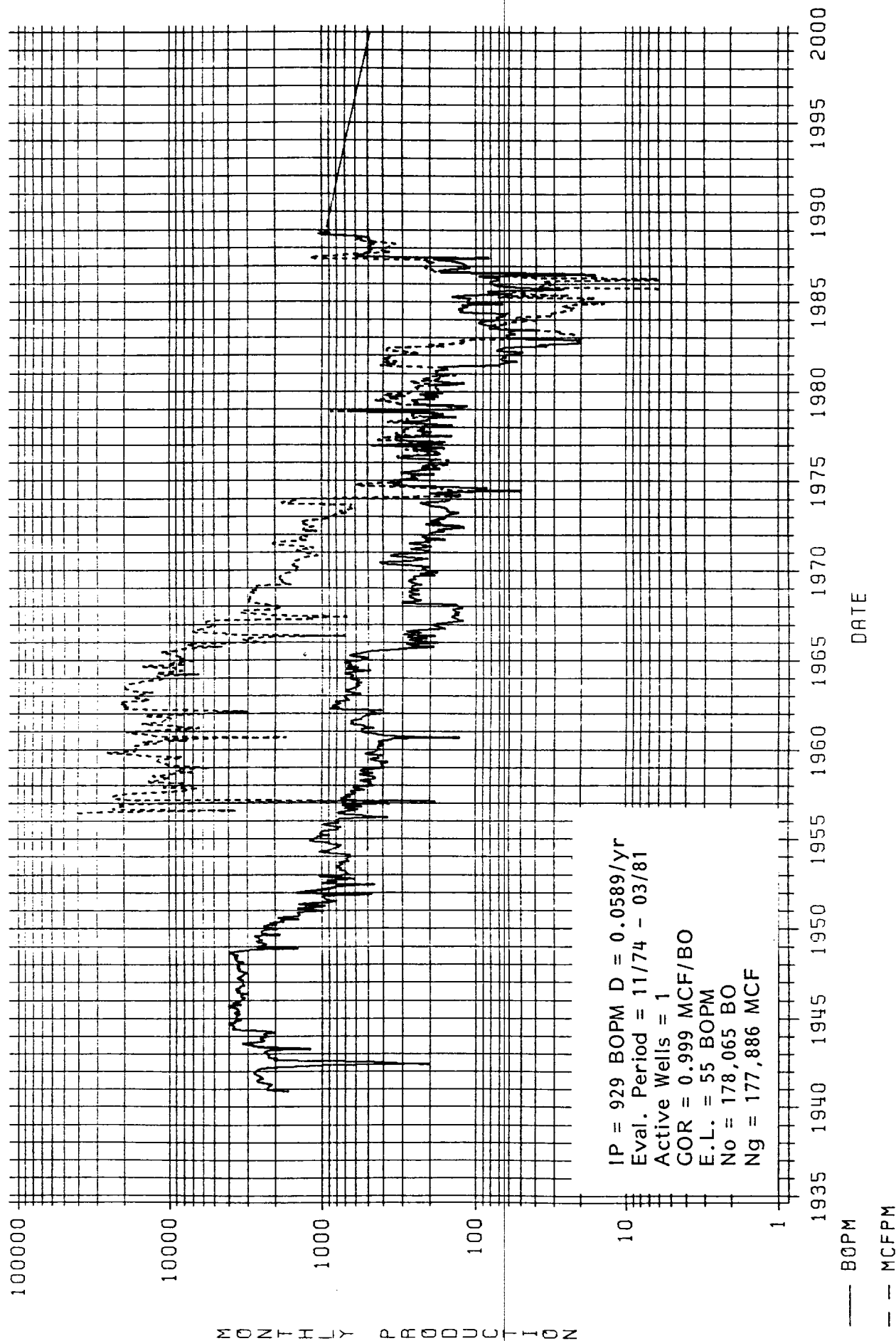


## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT  
TRACT=8.1 OPERNA=AMERICAN EXPLORATION LEASE=STATE M

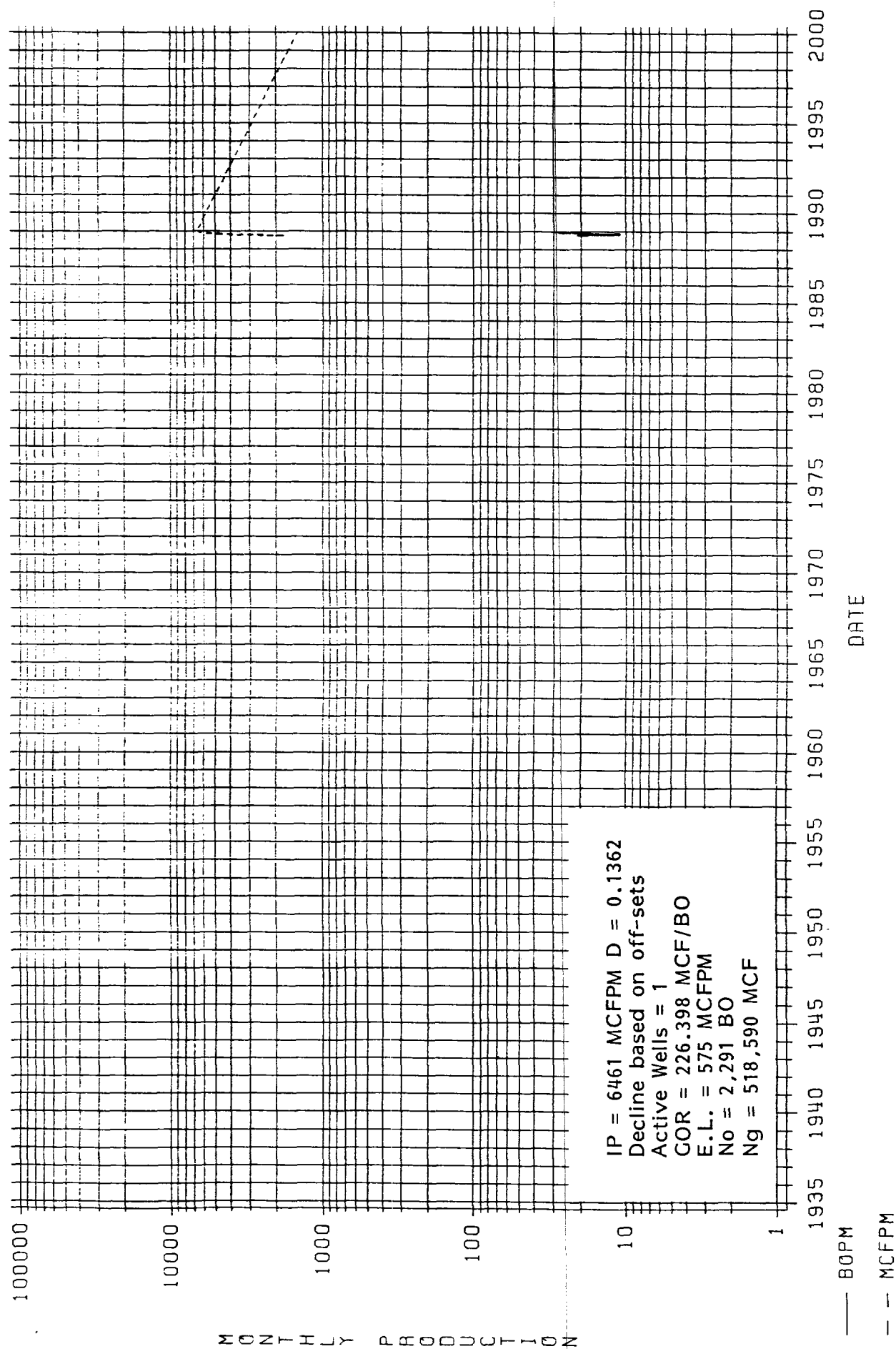


## PROPOSED ARROWHEAD GRAYBURG UNIT

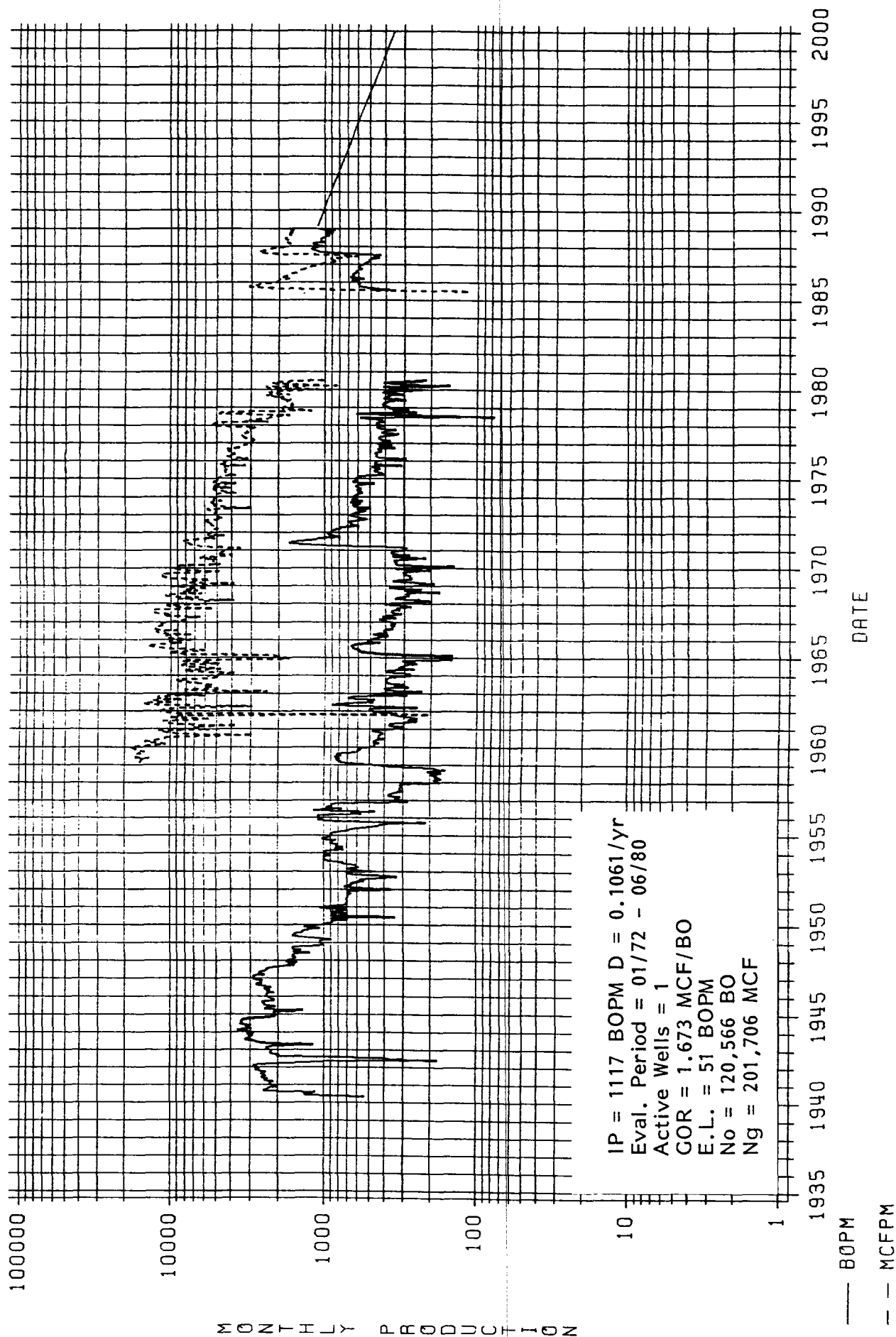
PRODUCTION PLOT  
TRACT=8.2 UPERNA=AMERICAN EXPLORATION LEASE=STATE M

## PROPOSED ARROWHEAD GRAYBURG UNIT

TRACT=8.3 OPERNA-ZIA ENERGY LEASE=STATE M



PROPOSED ARROWHEAD GRAYBURG UNIT  
PRODUCTION PLOT  
TRACT=9 OPERNA=AMERADA LEASE=STATE PA

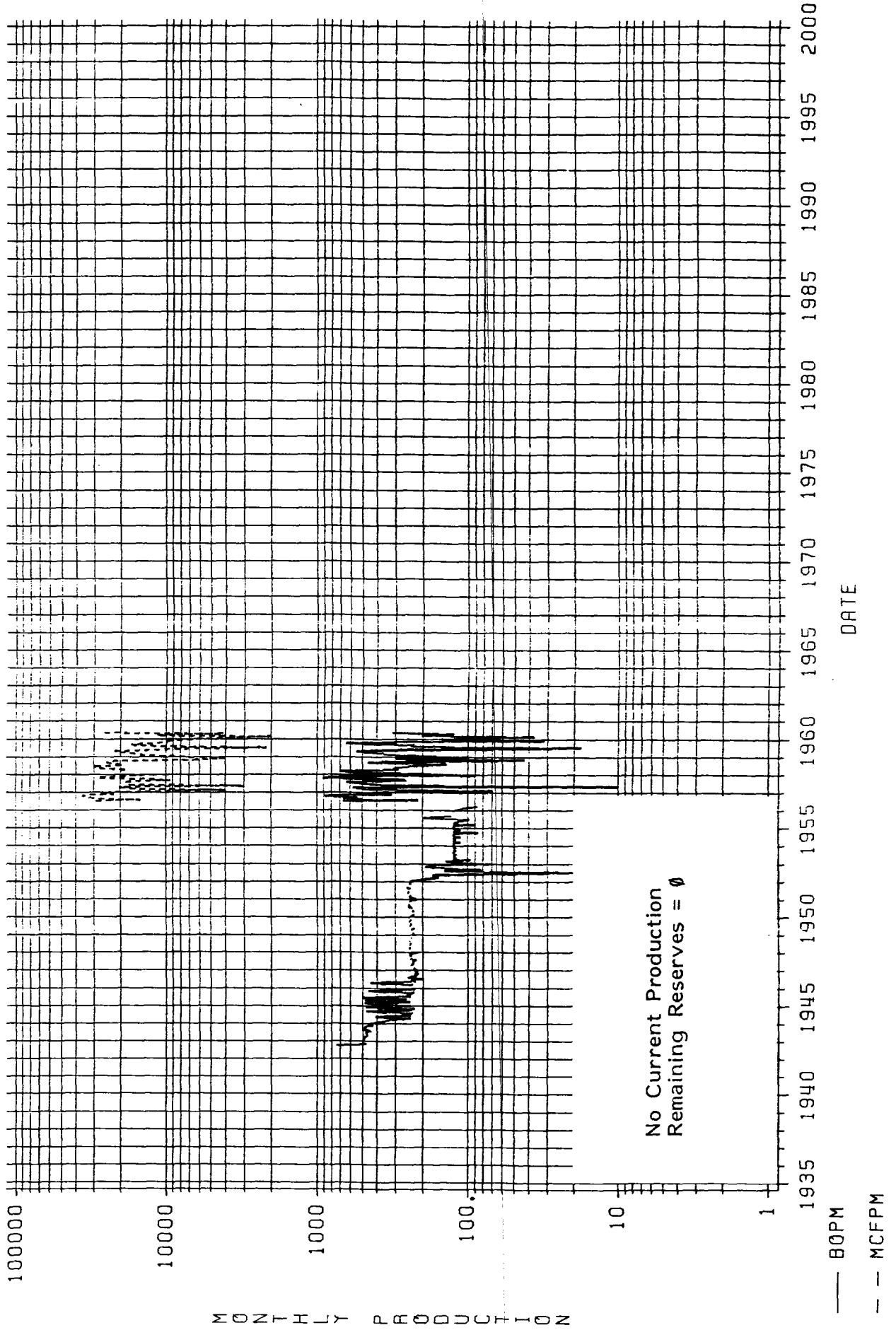




# PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

TRACT=10 OPERNA=EXXON LEASE=STATE G

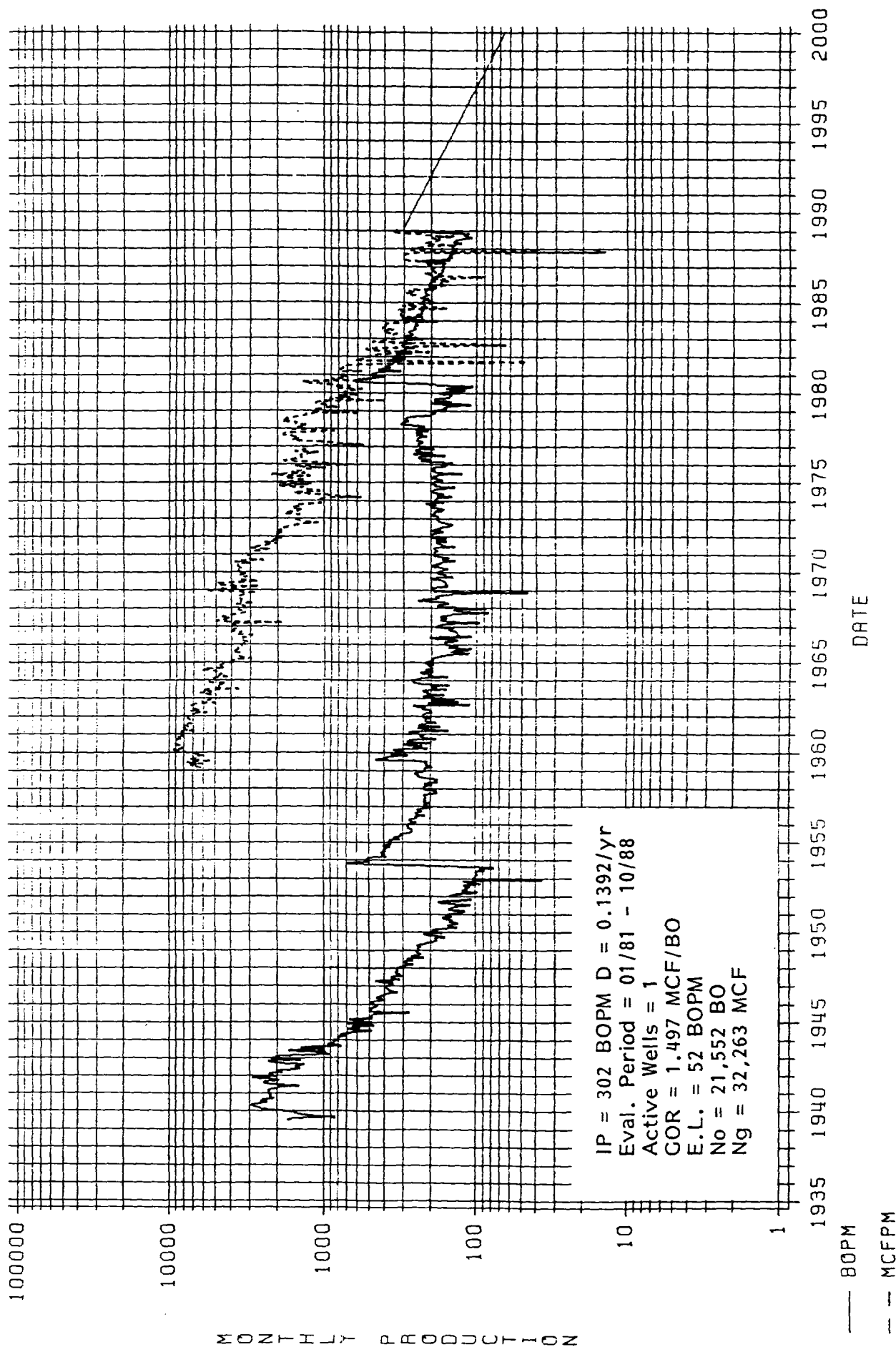




## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

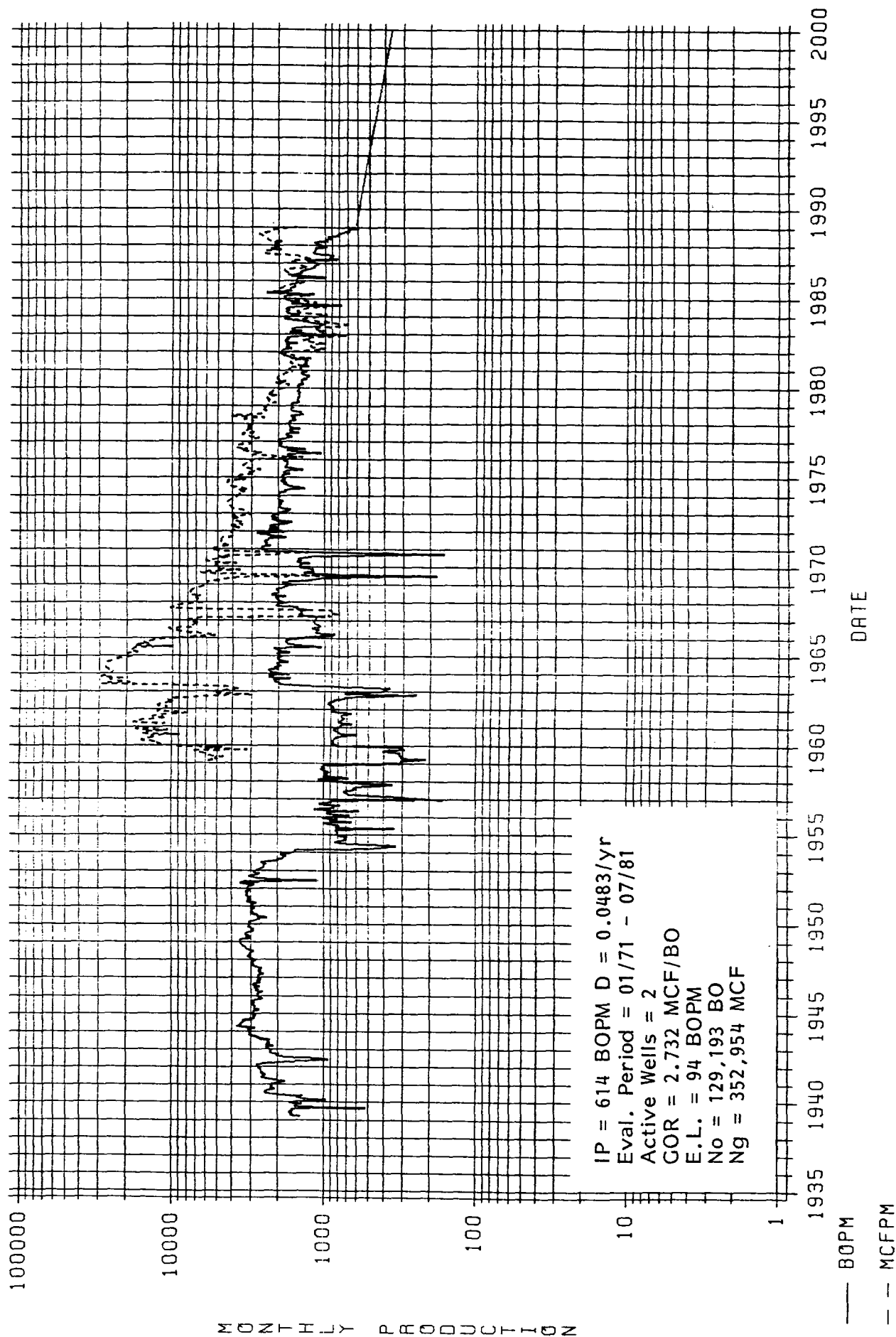
TRACT=11 OPERNA=HRCO LEHSE=STATE D DE



## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

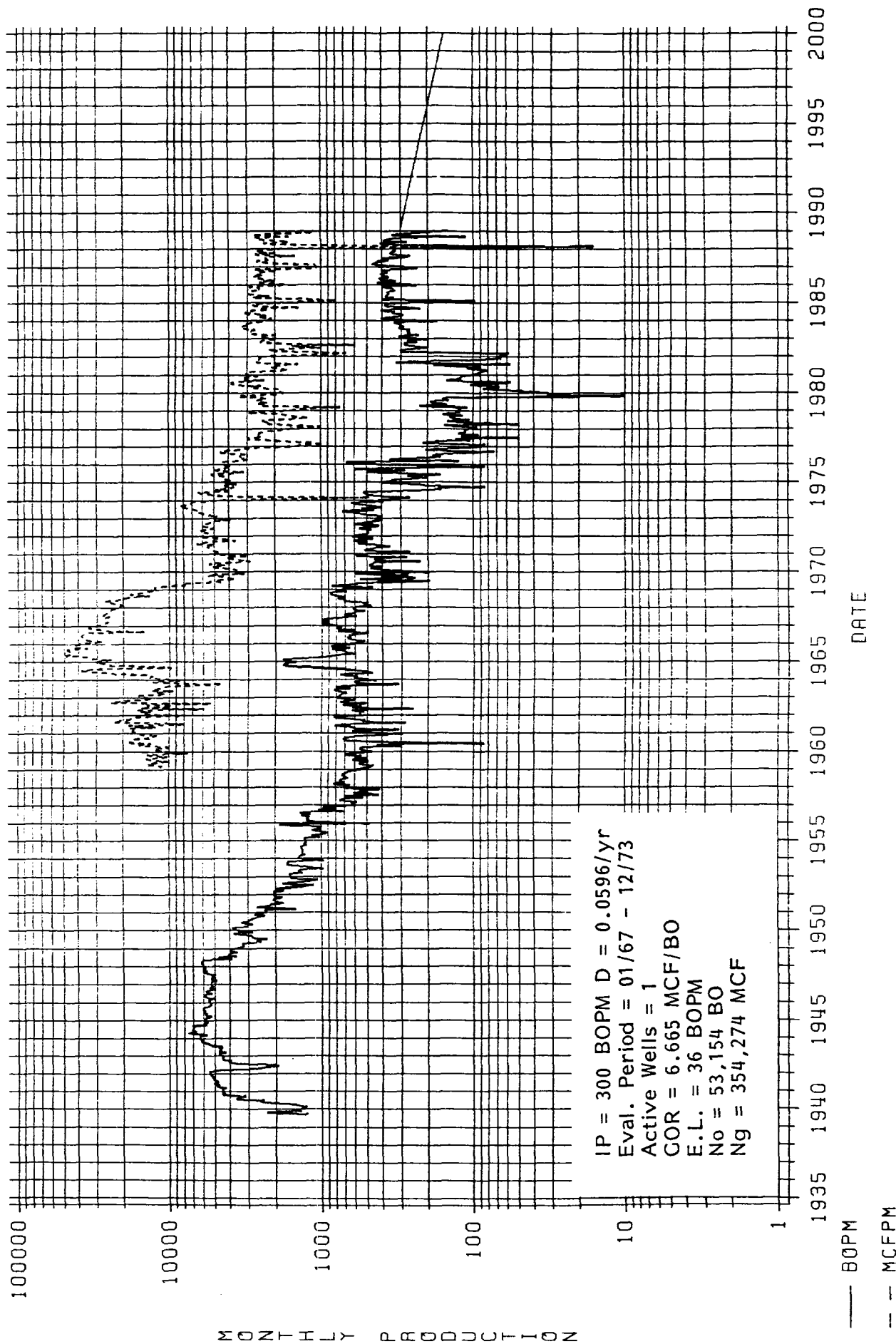
TRACT=12 OPERNA=0XY USA LEASE=STATE M



## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

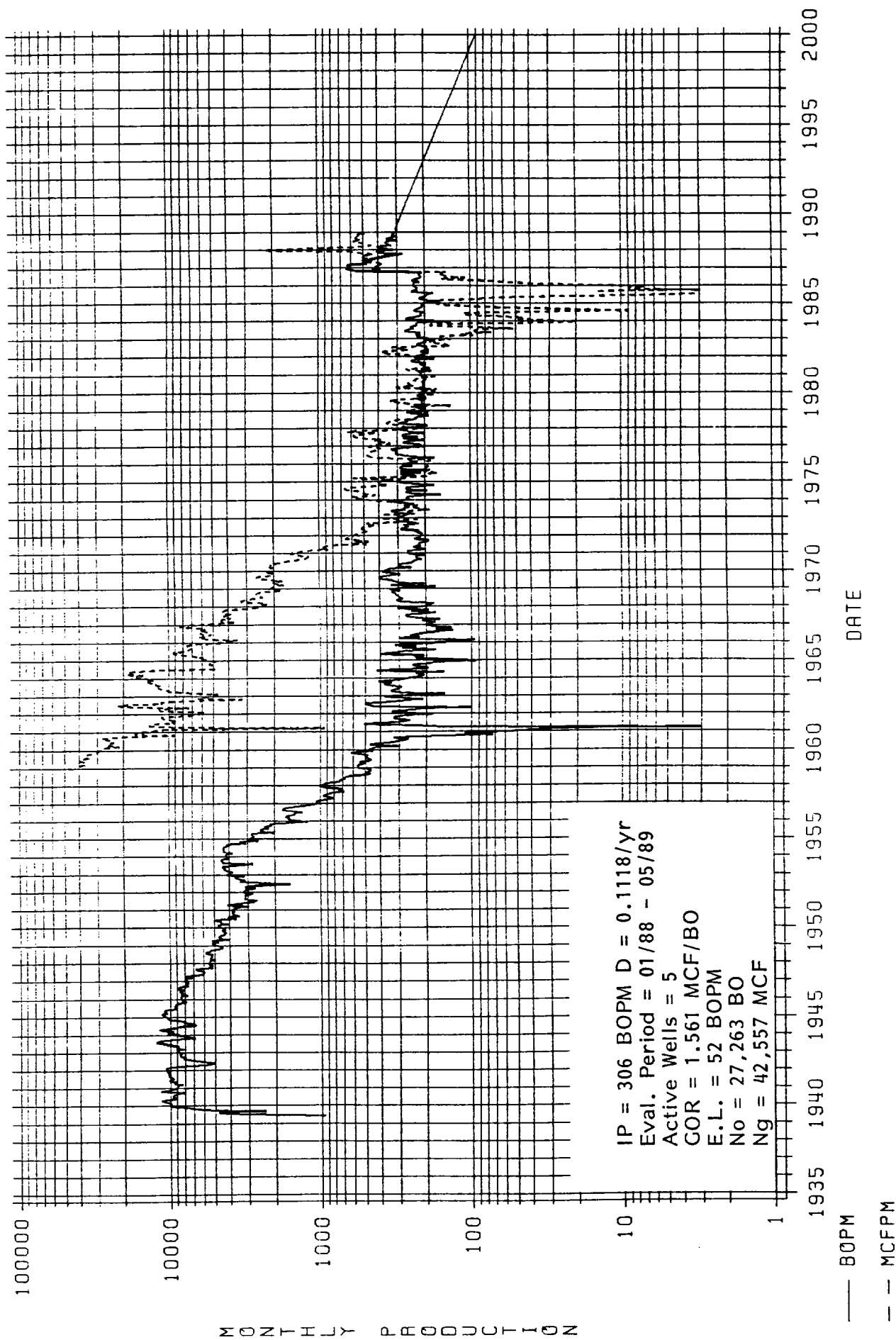
TRACT=13 OPERNA=0XY USA LEASE=STATE N



## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

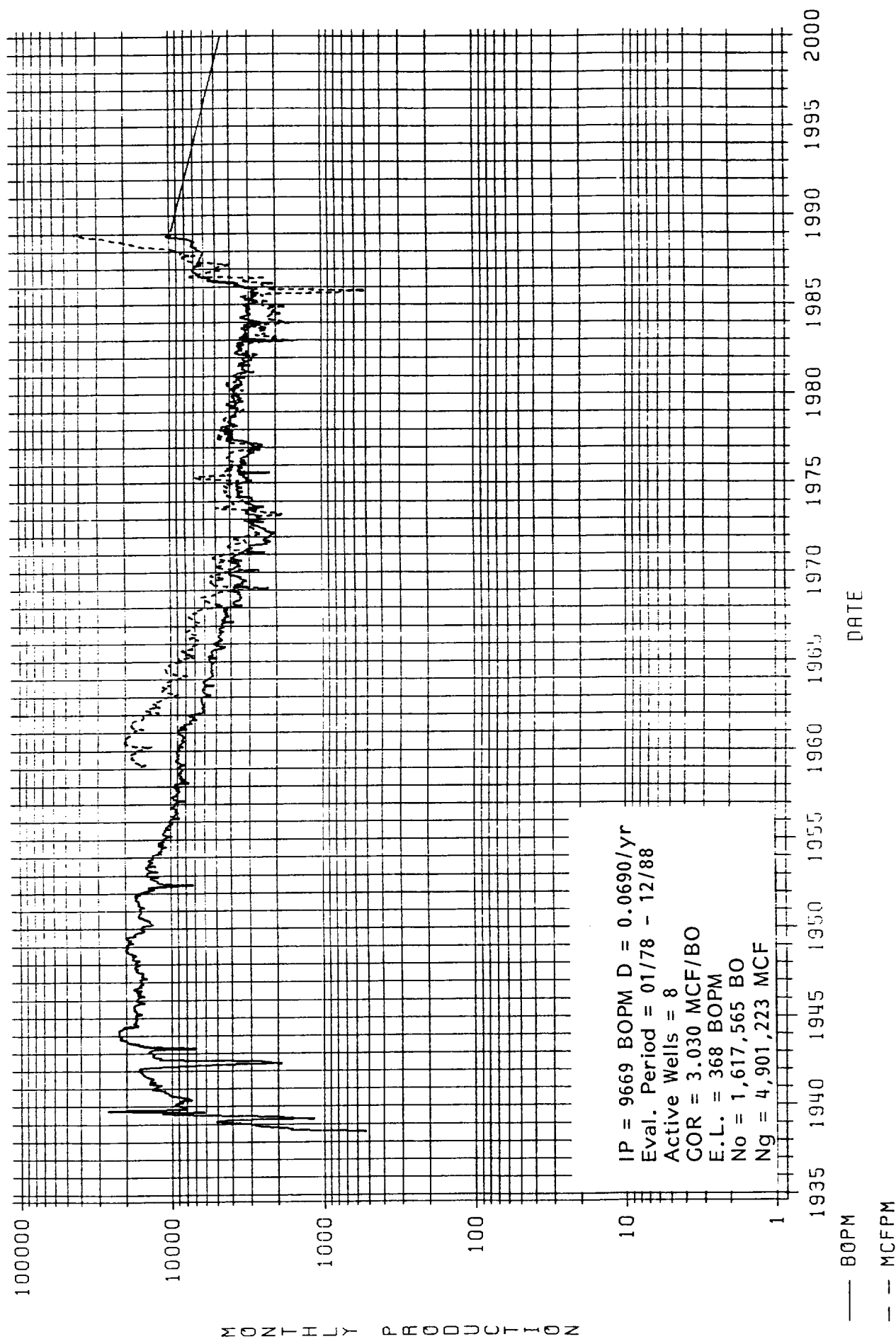
TRACT=14 OPERNR=ARCO LEASE=STATE 157-D



## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

TRACT=15 OPERNA=CONOCO LEASE=STATE J

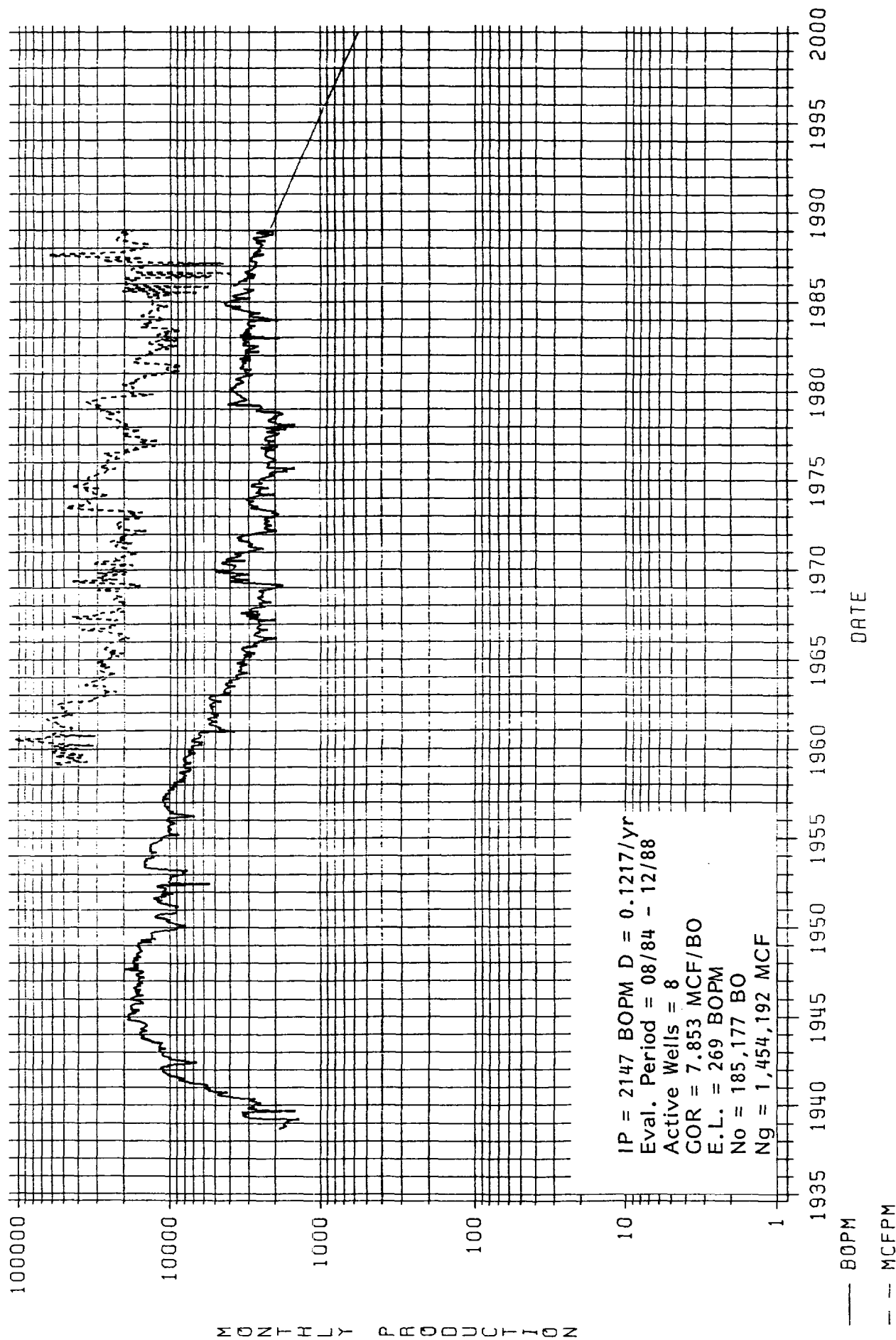




## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

TRACT=16 OPERNA=CHEVRON LEASE=W A RAMSAY

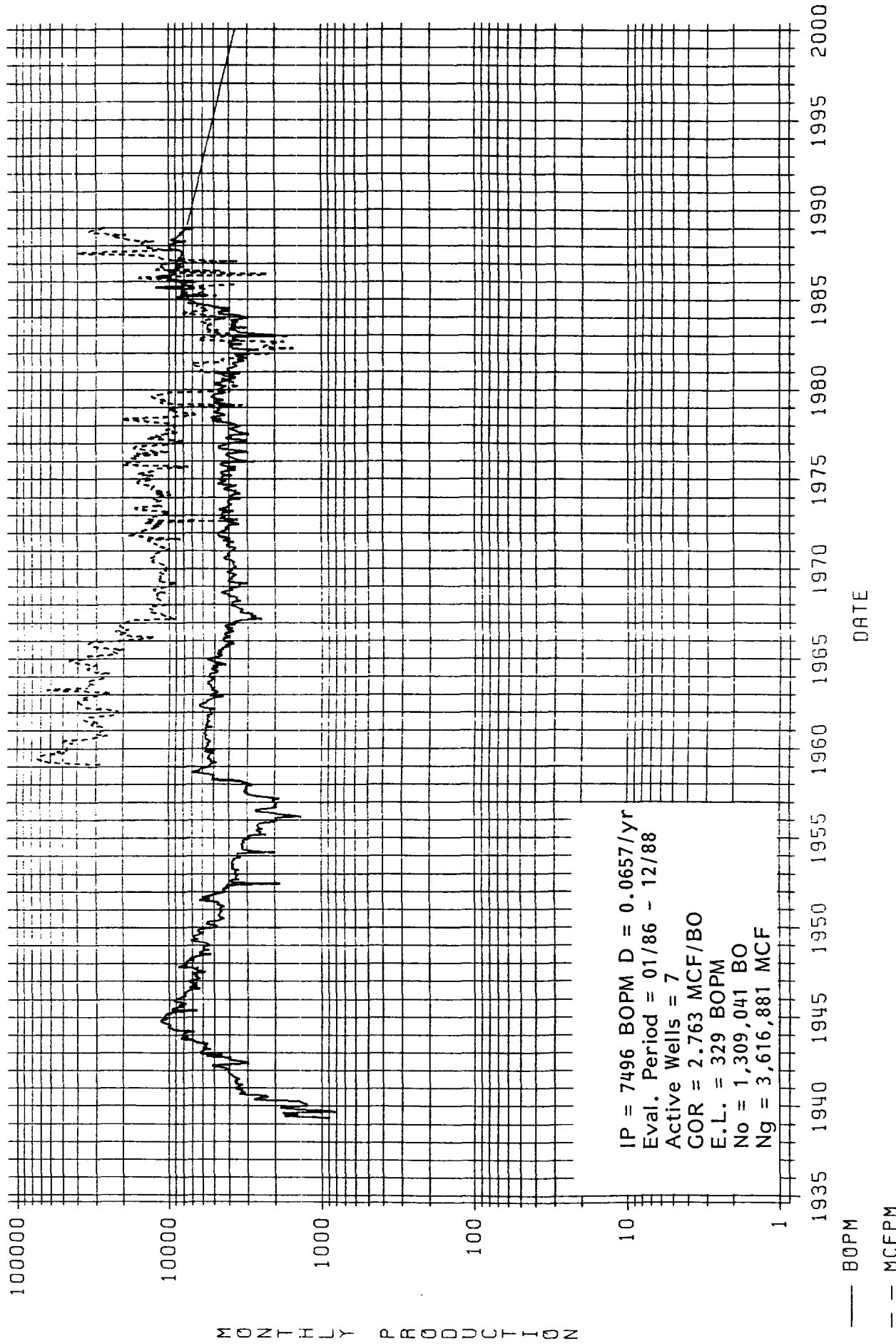




## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

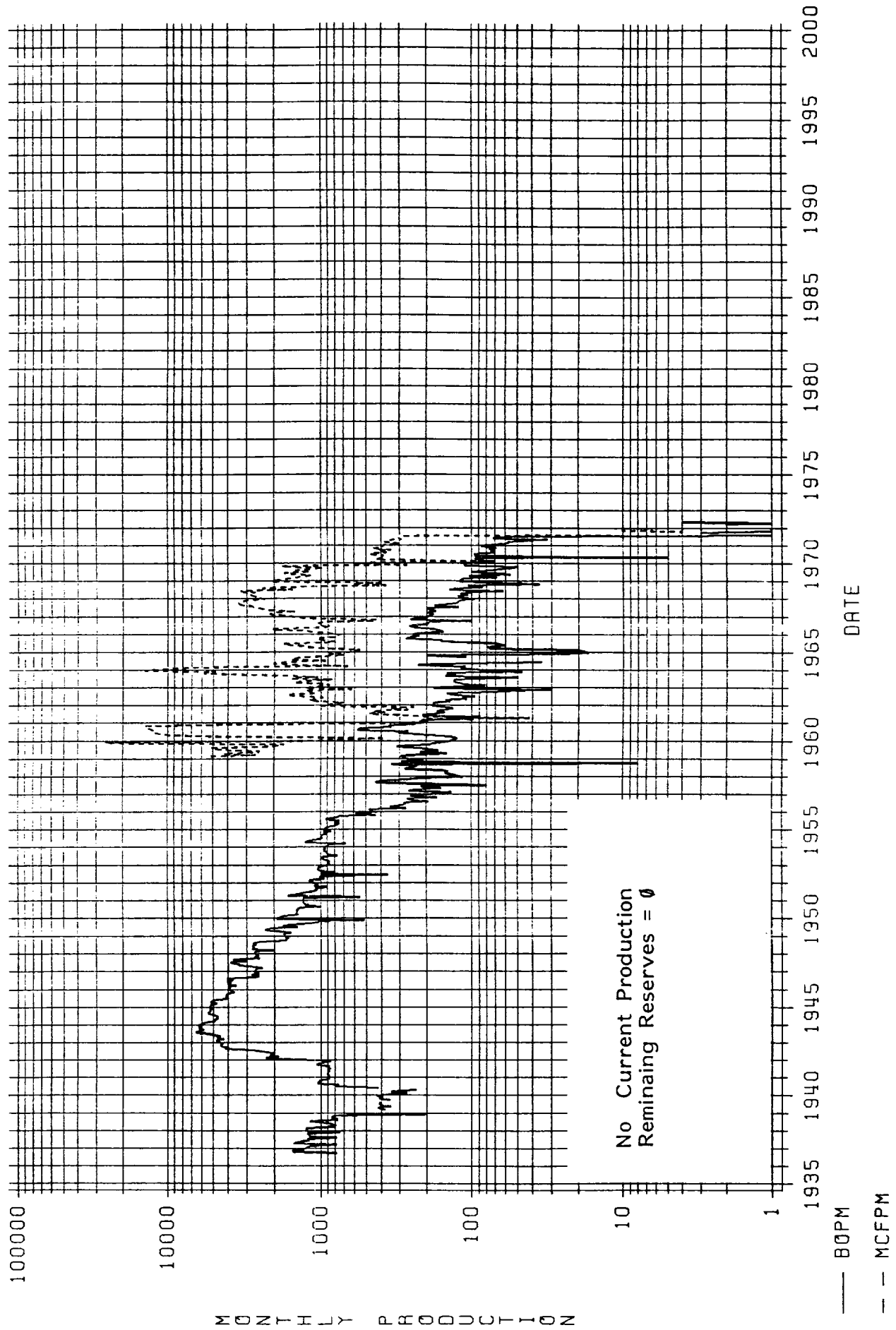
TRACT=17 OPERNA=CHEVRON LEASE=H LEONARD C



## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

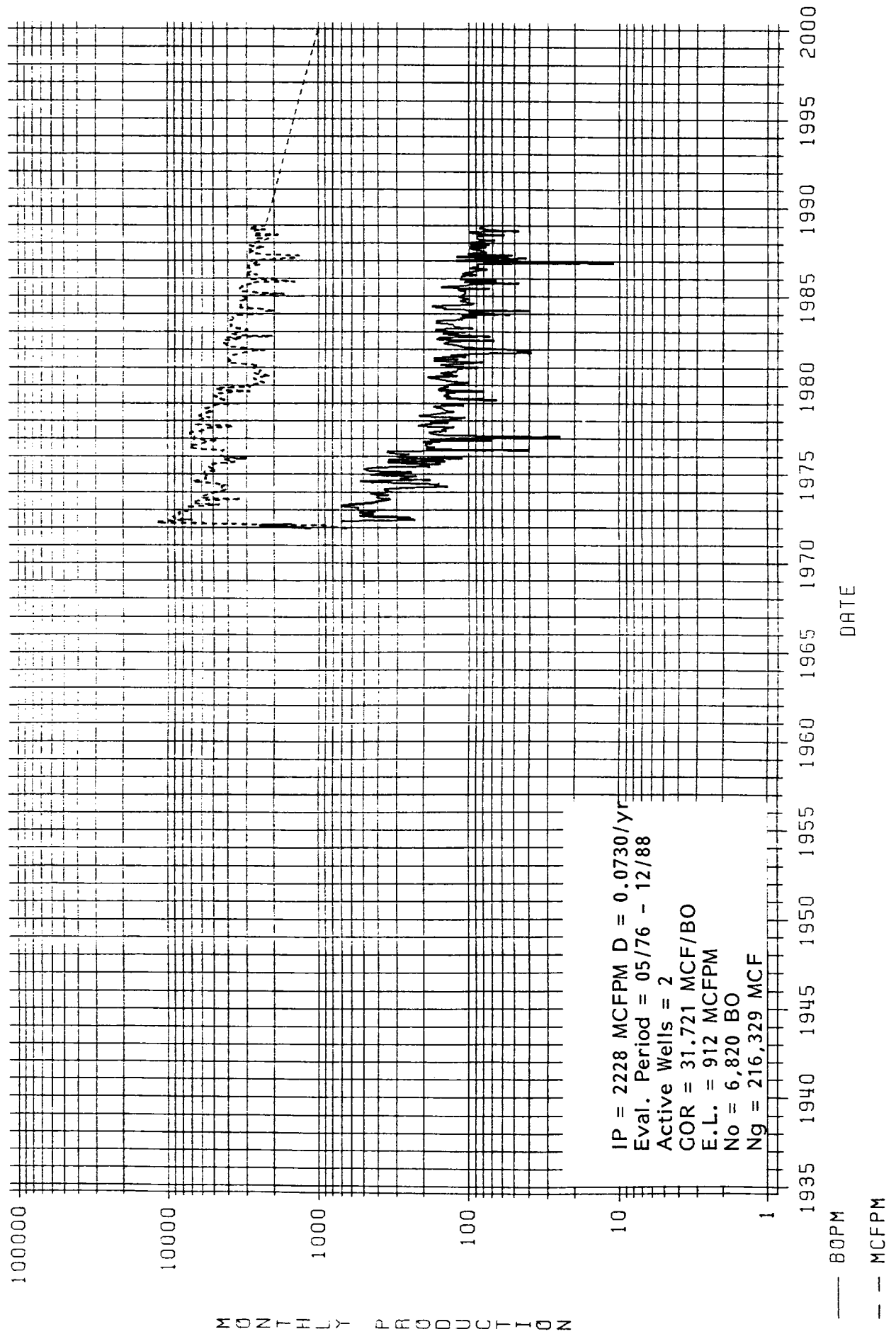
TRACT=19 OPERNA=ARCO LEASE=J M BROWNLEE



## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

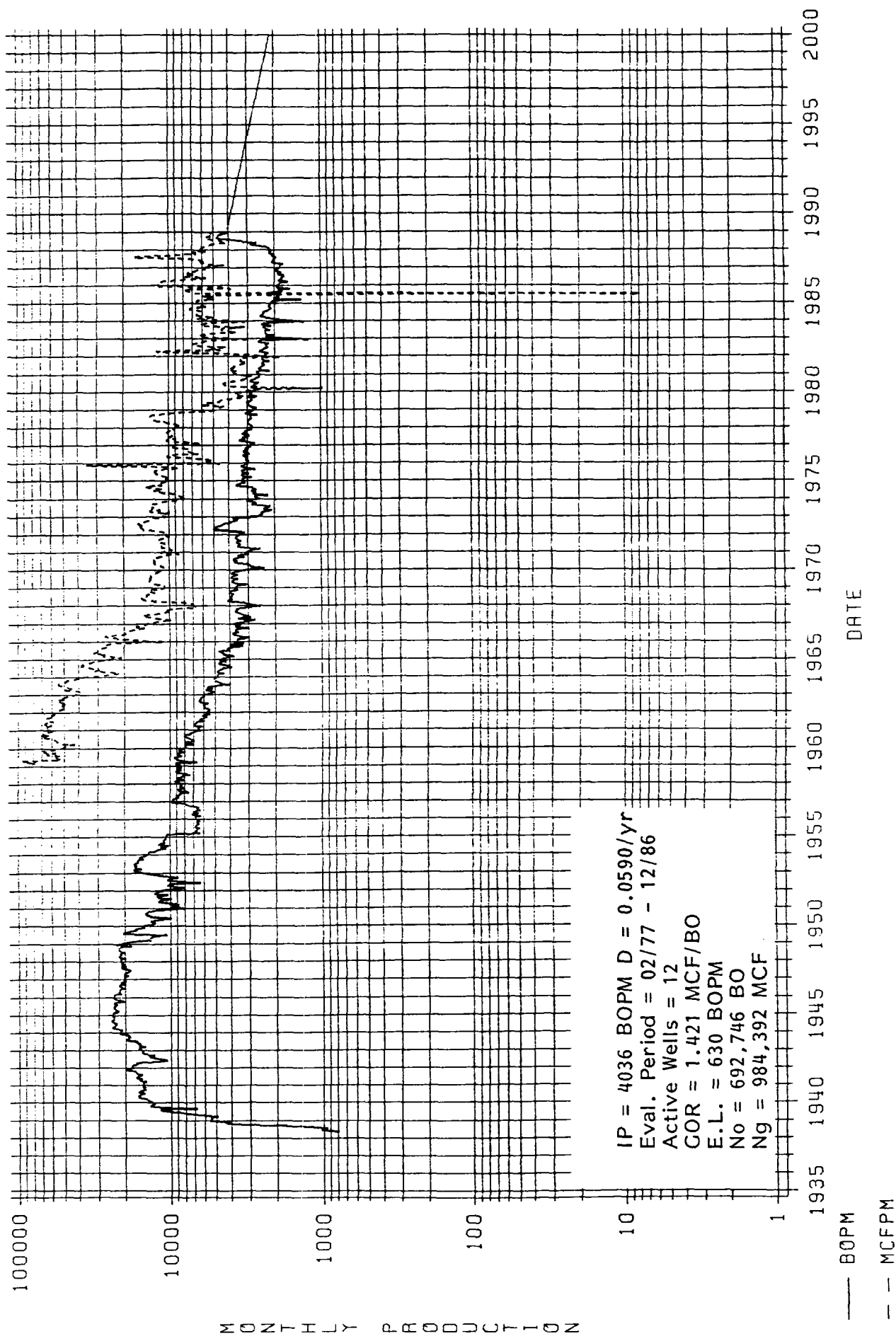
TRACT=21 OPERNH-CHEVRON LEASE=SANDY



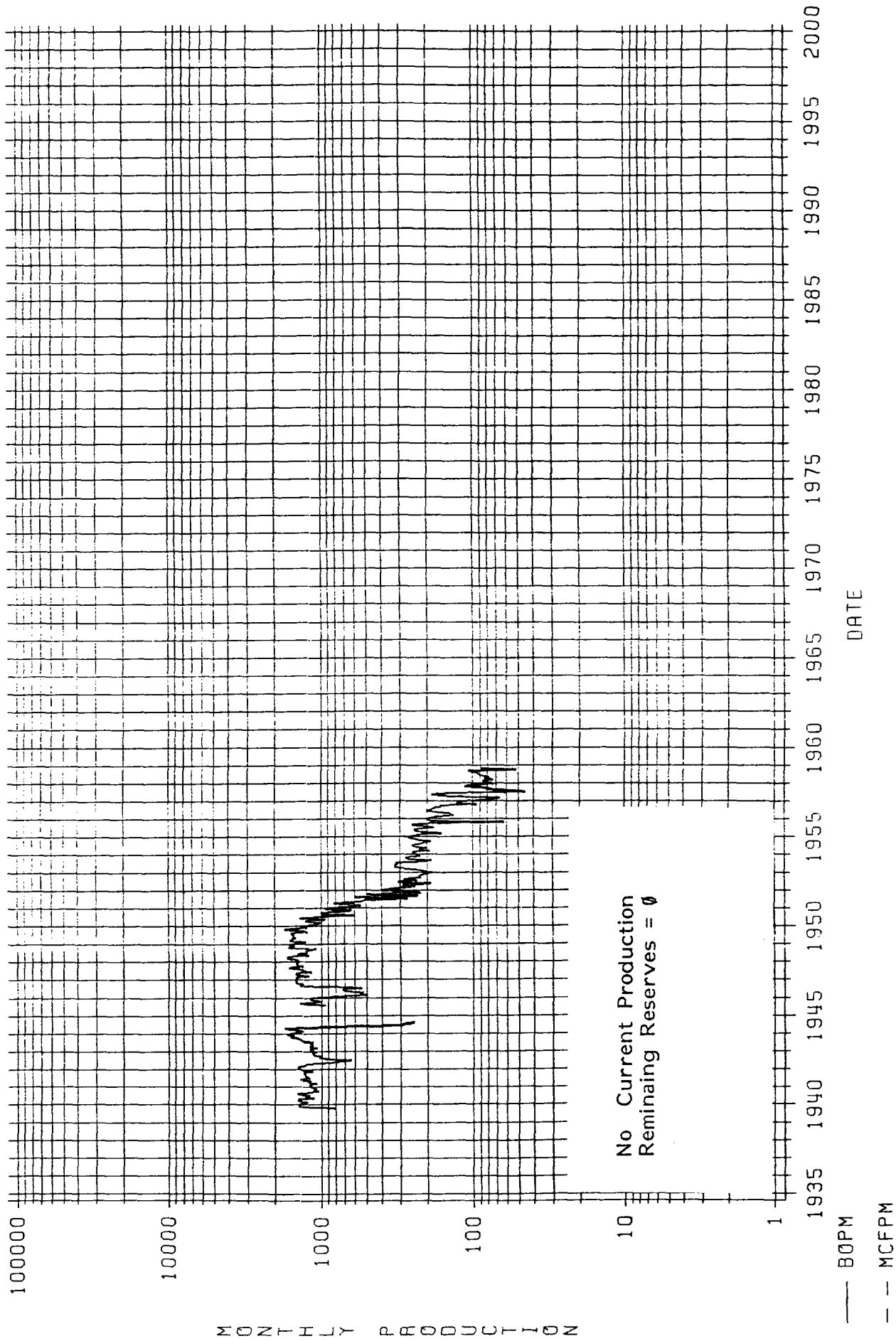
## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

TRACT=22 OPERNO-CHEVRON LEASE=H T MATTERN



PROPOSED ARROWHEAD GRAYBURG UNIT  
PRODUCTION PLOT  
TRACT=23 OPERNA=HARTMAN LEASE=MATTERN

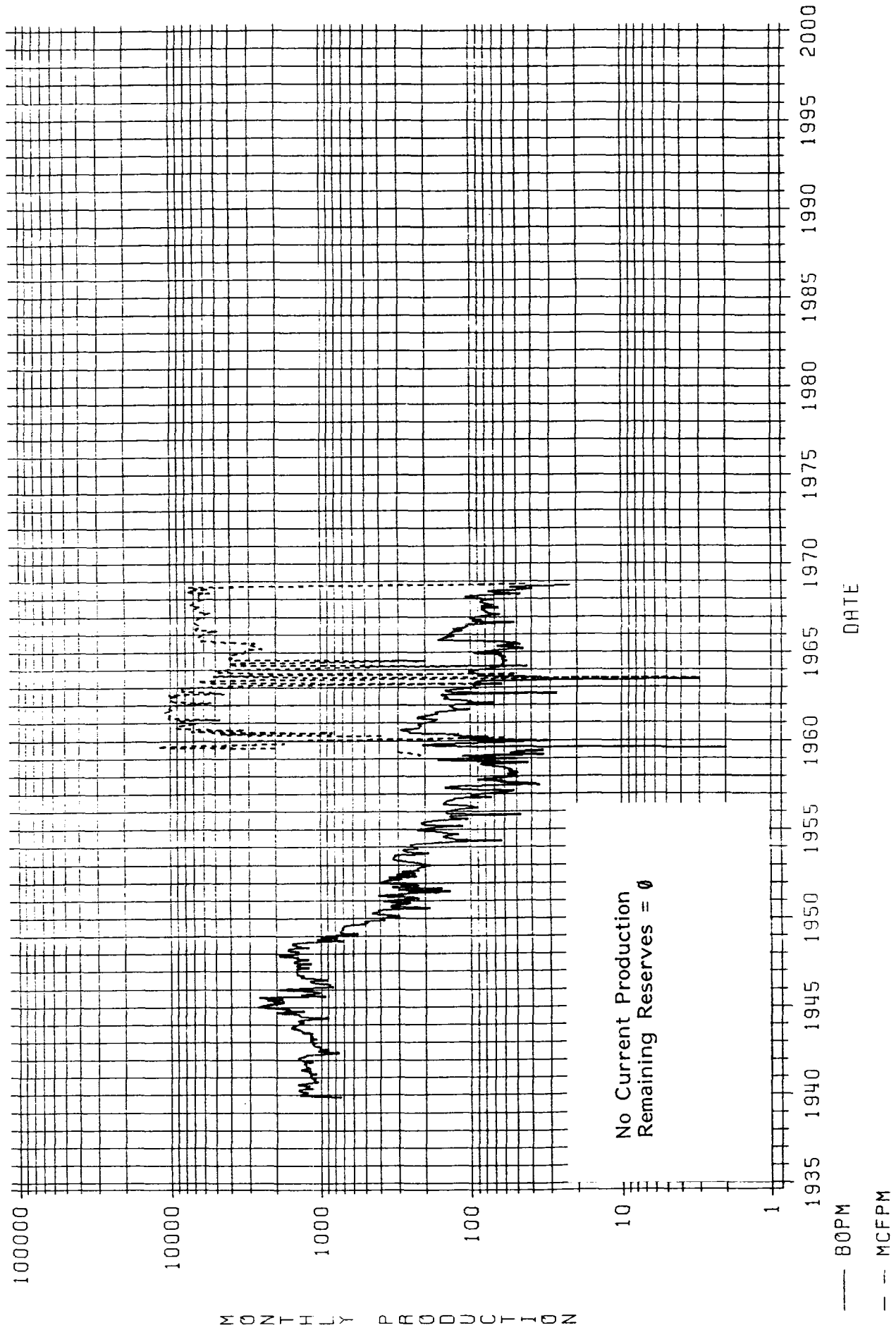




## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

TRACT=24 OPERNA=HARTMAN LEASE=MATTERN

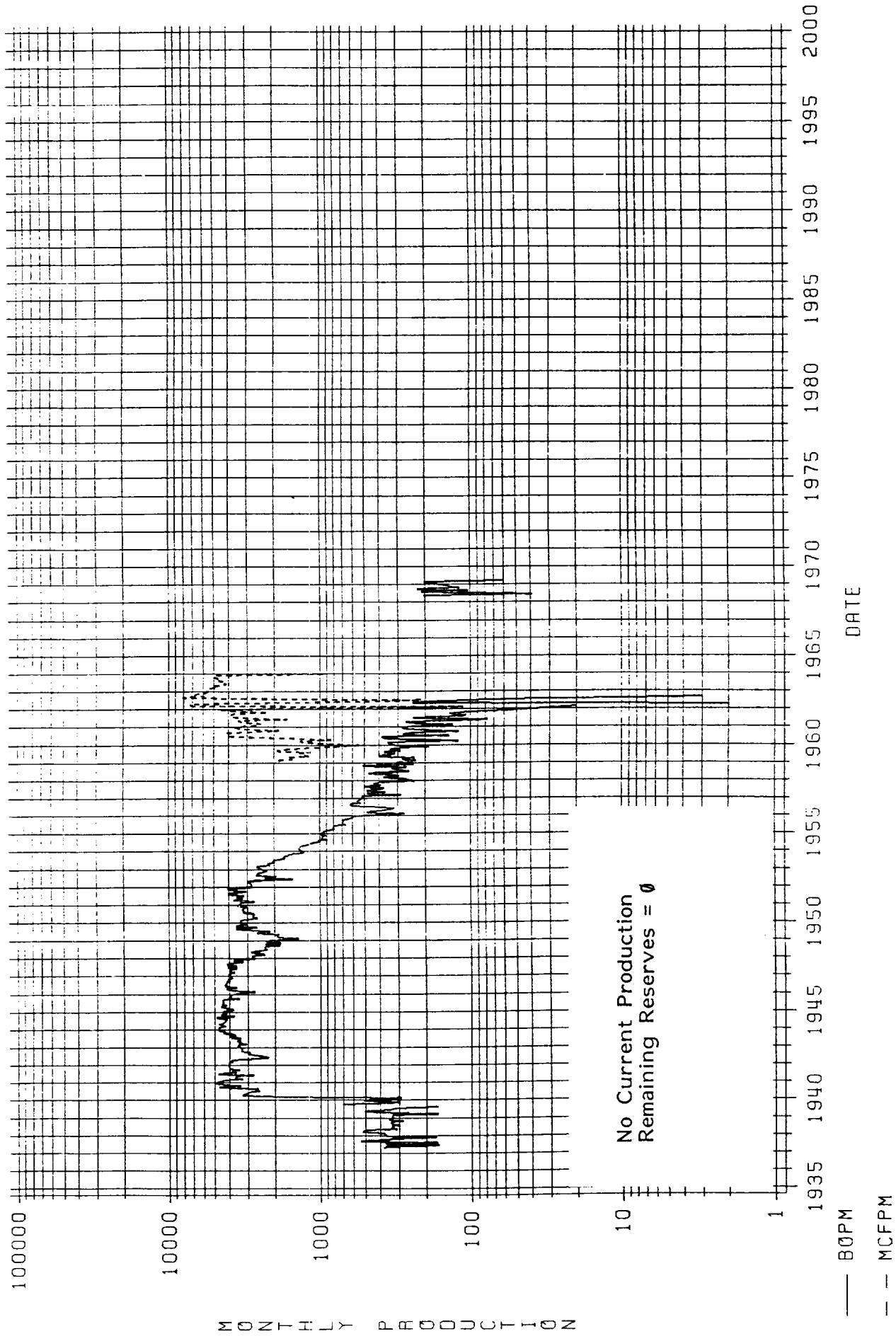




## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

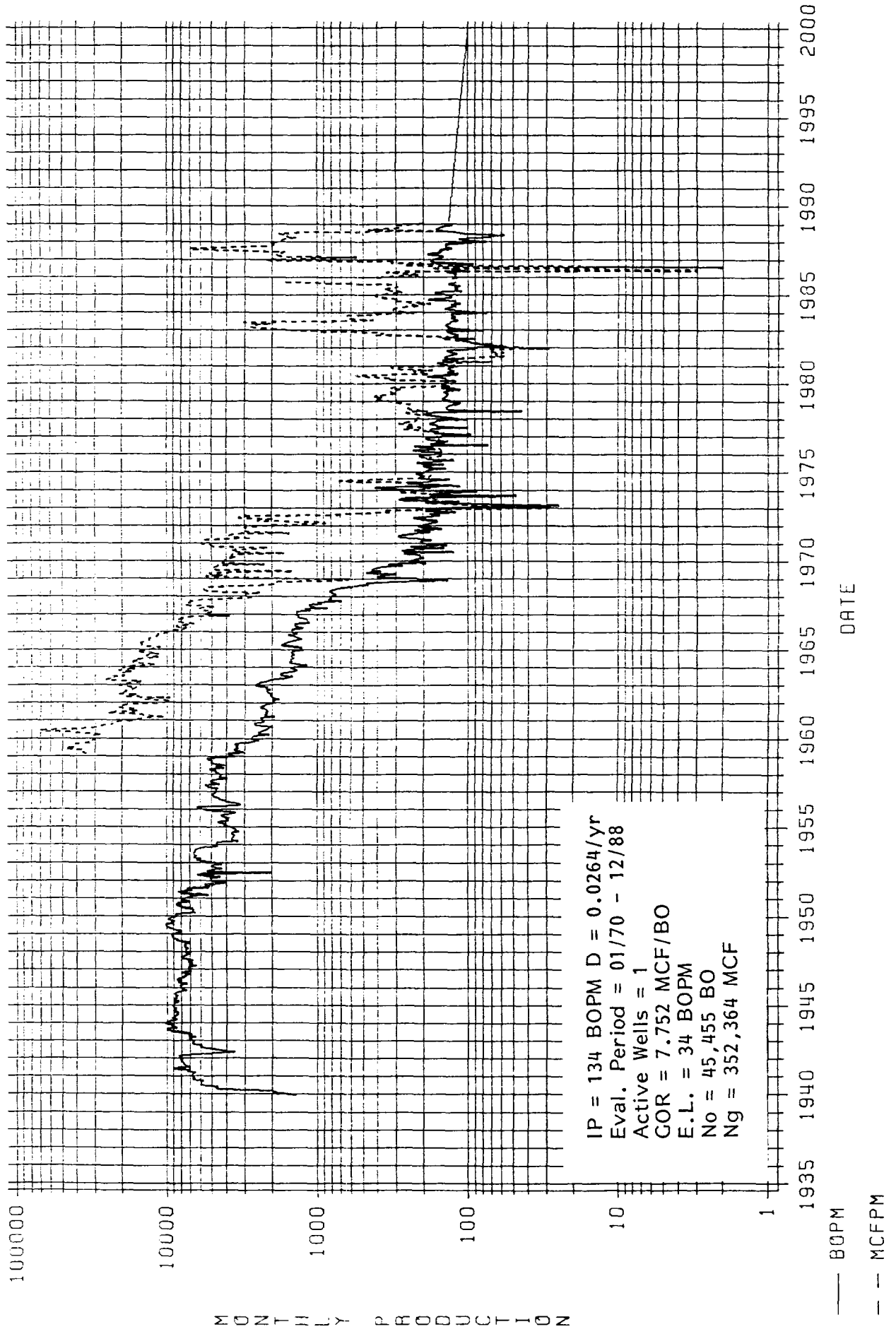
TRACT=25 OPERNR=PIESID10 LEASE=MATTEARN



## PROPOSED ARROWHEAD GRAYBURG UNIT

PRODUCTION PLOT

TRACT=26 O'PERNA-CHEVRON LEASE-H L CHRISTMAS C



Tract No. 1

Operator: Chevron U.S.A.

Lease: Ruby Crosby

Description: NE4 NW4 & NW4 NE4  
Sec. 18, T-22-S, R-37-E,  
Lea County, NM

Acreage: 80 acres

|            |                       |                           |                    |
|------------|-----------------------|---------------------------|--------------------|
| WI Owners: | <u>3435' to 4000'</u> | Chevron U.S.A.*           | 35.546875%         |
|            |                       | James A. Davidson         | 12.500000%         |
|            |                       | Ruth Sutton               | 0.390625%          |
|            |                       | Larry Nermyr              | 0.781250%          |
|            |                       | James E. & Laveta T. Burr | 0.390625%          |
|            |                       | Jack Fletcher             | 0.390625%          |
|            |                       | Dasco Energy              | 14.166670%         |
|            |                       | Para Mia                  | 12.717370%         |
|            |                       | Jack Mussett              | 7.500000%          |
|            |                       | Burton Veteto             | 1.449300%          |
|            |                       | Louise C. Summers         | 14.166700%         |
|            |                       |                           | <u>100.000040%</u> |
|            | <u>4000'-6800'+</u>   | Para Mia                  | 27.934800%         |
|            |                       | Burton Veteto             | 2.898600%          |
|            |                       | Jack Mussett              | 7.500000%          |
|            |                       | Dasco Energy              | 30.833300%         |
|            |                       | Louise C. Summers         | 30.833300%         |
|            |                       |                           | <u>100.000000%</u> |

|                                      |                   |
|--------------------------------------|-------------------|
| Cumulative Oil Production (12-31-87) | 465,366 BO        |
| Oil Production 1988                  | 0 BO              |
| Cumulative Oil Production (12-31-88) | <u>465,366 BO</u> |

Comments: \*Ownership limited to the proposed unitized interval only.

Tract No. 2

Operator: Conoco Inc.

Lease: Lockhart B 1 Federal

Description: S2 N2 & SE4,  
Sec. 1, T-22-S, R-36-E,  
Lea County, NM

Acreage: 320 acres

|            |                      |             |
|------------|----------------------|-------------|
| WI Owners: | Conoco Inc.          | 25%         |
|            | Chevron U.S.A.       | 25%         |
|            | Amoco Production Co. | 25%         |
|            | ARCO Oil & Gas       | 25%         |
|            |                      | <u>100%</u> |

|                                      |                     |
|--------------------------------------|---------------------|
| Cumulative Oil Production (12-31-87) | 1,718,511 BO        |
| Oil Production 1988                  | 40,571 BO           |
| Cumulative Oil Production (12-31-88) | <u>1,759,082 BO</u> |

Tract No. 3

Operator: Marathon Oil Company

Lease: C. J. Saunders

Description: N2 NW4  
Sec. 1, T-22-S, R-36-E,  
Lea County, NM

Acreage: 80.24 acres

WI Owners: Marathon Oil Company 100%

|                                      |                   |
|--------------------------------------|-------------------|
| Cumulative Oil Production (12-31-87) | 528,238 BO        |
| Oil Production 1988                  | 8,186 BO          |
| Cumulative Oil Production            | <u>536,424 BO</u> |

Tract No. 4

Operator: Chevron U.S.A.

Lease: Elliott B 6

Description: W2 SW4  
Sec. 6, T-22-S, R-37-E,  
Lea County, NM

Acreage: 74.06 acres

WI Owners: Surface to 3650'

|                           |                      |
|---------------------------|----------------------|
| Chevron U.S.A.*           | 44.43359375%         |
| James A. Davidson         | 15.62500000%         |
| Ruth Sutton               | 0.48828125%          |
| Larry Nermyr              | 0.97656250%          |
| James E. & Laveta T. Burr | 0.48828125%          |
| Jack Fletcher             | 0.48828125%          |
| Presidio Oil Co.          | 25.00000000%         |
| Trust U/D Donaldson Brown | 12.50000000%         |
|                           | <u>100.00000000%</u> |

3650' to 4000'

|                           |                      |
|---------------------------|----------------------|
| Chevron U.S.A.            | 44.43359375%         |
| James A. Davidson         | 15.62500000%         |
| Ruth Sutton               | 0.48828125%          |
| Larry Nermyr              | 0.97656250%          |
| James E. & Laveta T. Burr | 0.48828125%          |
| Jack Fletcher             | 0.48828125%          |
| Para Mia                  | 12.50000000%         |
| Dasco Energy              | 12.50000000%         |
| Louise C. Summers         | 12.50000000%         |
|                           | <u>100.00000000%</u> |

4000' to 6900'

|                   |                    |
|-------------------|--------------------|
| Para Mia          | 27.934800%         |
| Burton Veteto     | 2.898600%          |
| Jack Mussett      | 7.500000%          |
| Dasco Energy      | 30.833300%         |
| Louise C. Summers | 30.833300%         |
|                   | <u>100.000000%</u> |

|                                      |                  |
|--------------------------------------|------------------|
| Cumulative Oil Production (12-31-87) | 86,986 BO        |
| Oil Production 1988                  | 0 BO             |
| Cumulative Oil Production (12-31-88) | <u>86,986 BO</u> |

Comments: \*Ownership limited to the proposed unitized interval only.



Tract No. 5

Operator: Hal J. Rasmussen Operating, Inc.

Lease: State A AC 2

Description: NE4 & NE4 NW4 & NE4 SE4  
Sec. 11, T-22-S, R-36-E,  
Lea County, NM

Acreage: 240 acres

|            |                          |               |
|------------|--------------------------|---------------|
| WI Owners: | Hal J. Rasmussen         | 12.5%         |
|            | The Williams Partnership | 87.5%         |
|            |                          | <u>100.0%</u> |

|                                      |                 |
|--------------------------------------|-----------------|
| Cumulative Oil Production (12-31-87) | 1,255,146 BO    |
| Oil Production 1988                  | <u>1,653 BO</u> |
| Cumulative Oil Production (12-31-88) | 1,256,799 BO    |

Tract No. 6

Operator: Chevron U.S.A.

Lease: Graham State (NCT-J)

Description: NW4 NE4  
Sec. 25, T-21-S, R-36-E,  
Lea County, NM

Acreage: 40 acres

WI Owners: Chevron U.S.A. 100%

|                                      |                  |
|--------------------------------------|------------------|
| Cumulative Oil Production (12-31-87) | 34,585 BO        |
| Oil Production 1988                  | 517 BO           |
| Cumulative Oil Production (12-31-88) | <u>35,102 BO</u> |

Comments: Production classified as Penrose Skelly Grayburg.

Tract No. 7

Operator: Marathon Oil Company

Lease: McDonald State

Description: E2 & E2 NW4 & NW4 NW4 & NE4 SW4  
Sec. 13, & NE4 NE4  
Sec. 24, T-22-S, R-36-E,  
Lea County, NM

Acreage: 520 acres

WI Owners: Marathon Oil Co. 100%

|                                      |                     |
|--------------------------------------|---------------------|
| Cumulative Oil Production (12-31-87) | 1,978,513 BO        |
| Oil Production 1988                  | 2,190 BO            |
| Cumulative Oil Production (12-31-88) | <u>1,980,703 BO</u> |

Tract No. 8a (Upper)

Operator: American Exploration Co.

Lease: New Mexico M State

Description: SE4  
Sec. 18, T-22-S, R-37-E,  
Lea County, NM

Acreage: 160 acres

WI Owners: Surface to the Top of the San Andres

American Exploration 100%

|                                      |                   |
|--------------------------------------|-------------------|
| Cumulative Oil Production (12-31-87) | 606,576 BO        |
| Oil Production 1988                  | 717 BO            |
| Cumulative Oil Production (12-31-88) | <u>607,293 BO</u> |

Comments: 'M' State No. 8 classified as Langlie Mattix.

Tract No. 8a (Lower)

Operator: Zia Energy

Lease: New Mexico M State

Description: SE4  
Sec. 18, T-22-S, R-37-E,  
Lea County, NM

Acreage: 160 acres

WI Owners: Below the Top of the San Andres

Zia Energy

100%

|                                      |              |
|--------------------------------------|--------------|
| Cumulative Oil Production (12-31-87) | 0 BO         |
| Oil Production 1988                  | <u>83 BO</u> |
| Cumulative Oil Production (12-31-88) | 83 BO        |

Comments: 'M' State No. 49 classified as Eunice, San Andres, Southwest

Tract No. 8b

Operator: American Exploration Co.

Lease: New Mexico M State

Description: N2 N2  
Sec. 19, T-22-S, R-37-E,  
Lea County, NM

Acreage: 156.99 acres

WI Owners: Surface to the Top of the San Andres

American Exploration 100%

Below the Top of the San Andres

Exxon 100%

|                                      |                 |
|--------------------------------------|-----------------|
| Cumulative Oil Production (12-31-87) | 494,726 BO      |
| Oil Production 1988                  | <u>7,811 BO</u> |
| Cumulative Oil Production (12-31-88) | 502,537 BO      |

Comments: Production classified as Arrowhead Grayburg and  
Langlie Mattix.



Tract No. 9

Operator: Amerada Hess Corp.

Lease: State PA

Description: E2 SW4  
Sec. 18, T-22-S, R-37-E,  
Lea County, NM

Acreage: 80 acres

WI Owners: Amerada Hess Corp. 100%

|                                      |                  |
|--------------------------------------|------------------|
| Cumulative Oil Production (12-31-87) | 450,799 BO       |
| Oil Production 1988                  | <u>12,105 BO</u> |
| Cumulative Oil Production (12-31-88) | 462,904 BO       |

Tract No. 10

Operator: Exxon

Lease: New Mexico G State

Description: SE4 SE4  
Sec. 26, T-21-S, R-36-E,  
Lea County, NM

Acreage: 40 acres

WI Owners: Exxon 100%

|                                      |                  |
|--------------------------------------|------------------|
| Cumulative Oil Production (12-31-87) | 49,446 BO        |
| Oil Production 1988                  | 0 BO             |
| Cumulative Oil Production (12-31-88) | <u>49,446 BO</u> |

Tract No. 11

Operator: ARCO Oil & Gas

Lease: State D DE

Description: W2 SE4  
 Sec. 36, T-21-S, R-36-E,  
 Lea County, NM

Acreage: 80 acres

WI Owners: Surface to 4000' ARCO Oil & Gas 100.000%

|                    |                         |                 |
|--------------------|-------------------------|-----------------|
| <u>Below 4000'</u> | McBride Oil & Gas       | 24.000%         |
|                    | Hanson-McBride Pet. Co. | 10.000%         |
|                    | Abby Corporation        | 25.000%         |
|                    | Barbara Hannifin        | 16.000%         |
|                    | ENRON                   | 21.875%         |
|                    | Westway Petroleum       | 3.125%          |
|                    |                         | <u>100.000%</u> |

|                                      |                 |
|--------------------------------------|-----------------|
| Cumulative Oil Production (12-31-87) | 222,586 BO      |
| Oil Production 1988                  | <u>1,728 BO</u> |
| Cumulative Oil Production (12-31-88) | 224,314 BO      |

Tract No. 12

Operator: OXY U.S.A.

Lease: State M

Description: W2 SW4  
Sec. 36, T-21-S, R-36-E,  
Lea County, NM

Acreage: 80 acres

WI Owners: OXY U.S.A. 100%

|                                      |                 |
|--------------------------------------|-----------------|
| Cumulative Oil Production (12-31-87) | 1,018,763 BO    |
| Oil Production 1988                  | <u>9,924 BO</u> |
| Cumulative Oil Production (12-31-88) | 1,028,687 BO    |

Tract No. 13

Operator: OXY U.S.A.

Lease: State N

Description: SW4  
Sec. 2, T-22-S, R-36-E,  
Lea County, NM

Acreage: 160 acres

WI Owners: OXY U.S.A. 100%

|                                      |                 |
|--------------------------------------|-----------------|
| Cumulative Oil Production (12-31-87) | 870,010 BO      |
| Oil Production 1988                  | <u>3,114 BO</u> |
| Cumulative Oil Production (12-31-88) | 873,124 BO      |

Tract No. 14

Operator: ARCO Oil & Gas

Lease: State 157 D

Description: S2  
Sec. 12, T-22-S, R-36-E,  
Lea County, NM

Acreage: 320 acres

WI Owners: ARCO Oil & Gas 100%

|                                      |                 |
|--------------------------------------|-----------------|
| Cumulative Oil Production (12-31-87) | 1,354,846 BO    |
| Oil Production 1988                  | <u>4,001 BO</u> |
| Cumulative Oil Production (12-31-88) | 1,358,847 BO    |



Tract No. 15

Operator: Conoco Inc.

Lease: State J 2

Description: N2 & SE4  
Sec. 2, T-22-S, R-36-E,  
Lea County, NM

Acreage: 480.64 acres

WI Owners: Conoco Inc. 100%

|                                      |                     |
|--------------------------------------|---------------------|
| Cumulative Oil Production (12-31-87) | 4,759,163 BO        |
| Oil Production 1988                  | 94,014 BO           |
| Cumulative Oil Production (12-31-88) | <u>4,853,177 BO</u> |

Tract No. 16

Operator: Chevron U.S.A.

Lease: W. A. Ramsay (NCT-A & B)

Description: NW4 & NE4 NE4 & S2 NE4, Sec. 25,  
& E2 & SE4 NW4 & NE4 SW4 & S2 SW4  
Sec. 35, T-21-S, R-36-E,  
Lea County, NM

Acreage: 760 acres

WI Owners: Chevron U.S.A. 100%

|                                      |                     |
|--------------------------------------|---------------------|
| Cumulative Oil Production (12-31-87) | 3,871,847 BO        |
| Oil Production 1988                  | 28,908 BO           |
| Cumulative Oil Production (12-31-88) | <u>3,900,755 BO</u> |

Tract No. 17

Operator: Chevron U.S.A.

Lease: Harry Leonard (NCT-C)

Description: N2 & E2 SW4  
Sec. 36, T-21-S, R-36-E,  
Lea County, NM

Acreage: 400 acres

WI Owners: Chevron U.S.A. 100%

|                                      |                     |
|--------------------------------------|---------------------|
| Cumulative Oil Production (12-31-87) | 2,797,952 BO        |
| Oil Production 1988                  | 99,620 BO           |
| Cumulative Oil Production (12-31-88) | <u>2,897,572 BO</u> |

Tract No. 18

Operator: Chevron U.S.A.

Lease: State 36

Description: E2 & SE4,  
Sec. 36, T-21-S, R-36-E,  
Lea County, NM

Acreage: 80 acres

WI Owners: Chevron U.S.A. 100.00%

|                                      |      |
|--------------------------------------|------|
| Cumulative Oil Production (12-31-87) | 0 BO |
| Oil Production 1988                  | 0 BO |
| Cumulative Oil Production (12-31-88) | 0 BO |

Tract No. 19

Operator: ARCO Oil & Gas

Lease: J. M. Brownlee

Description: SW4  
Sec. 25, T-21-S, R-36-E,  
Lea County, NM

Acreage: 160 acres

WI Owners: ARCO Oil & Gas 100%

|                                      |                   |
|--------------------------------------|-------------------|
| Cumulative Oil Production (12-31-87) | 489,027 BO        |
| Oil Production 1988                  | 0 BO              |
| Cumulative Oil Production (12-31-88) | <u>489,027 BO</u> |

Tract No. 20

Operator: Chevron U.S.A.

Lease: Kingwood

Description: W2 SE4,  
Sec. 25, T-21-S, R-36-E,  
Lea County, NM

Acreage: 80 acres

WI Owners: Chevron U.S.A. 100.00%

|                                      |      |
|--------------------------------------|------|
| Cumulative Oil Production (12-31-87) | 0 BO |
| Oil Production 1988                  | 0 BO |
| Cumulative Oil Production (12-31-88) | 0 BO |

Tract No. 21

Operator: Chevron U.S.A.

Lease: Sandy

Description: E2 SE4,  
Sec. 25, T-21-S, R-36-E,  
Lea County, NM

Acreage: 80 acres

|            |                                     |                |
|------------|-------------------------------------|----------------|
| WI Owners: | <u>Top of the Grayburg to 3900'</u> |                |
|            | Chevron U.S.A.                      | 93.75%         |
|            | John Bryant                         | 6.25%          |
|            |                                     | <u>100.00%</u> |
|            | <u>3900'-3950'</u>                  | J. H. Moore    |
|            |                                     | 100.00%        |
|            | <u>3950'-6250'</u>                  | Chevron U.S.A. |
|            |                                     | 100.00%        |

|                                      |                  |
|--------------------------------------|------------------|
| Cumulative Oil Production (12-31-87) | 38,777 BO        |
| Oil Production 1988                  | 929 BO           |
| Cumulative Oil Production (12-31-88) | <u>39,706 BO</u> |

Comments: Production classified as Penrose Skelly Grayburg



Tract No. 22

Operator: Chevron U.S.A.

Lease: H. T. Mattern (NCT-D, E, & F)

Description: N2 NE4 & SW4 Sec. 1,  
& N2 Sec. 12, T-22-S, R-36-E,  
& W2 NW4 & E2 SW4 Sec. 6,  
& NW4 Sec. 7, T-22-S, R-37-E,  
Lea County, NM

Acreage: 868.39 acres

WI Owners: Chevron U.S.A. 100%

|                                      |                  |
|--------------------------------------|------------------|
| Cumulative Oil Production (12-31-87) | 4,729,801 BO     |
| Oil Production 1988                  | <u>43,216 BO</u> |
| Cumulative Oil Production (12-31-88) | 4,773,017 BO     |

Tract No. 23

Operator: Chevron U.S.A.

Lease: Mattern

Description: NW4 SW4  
Sec. 7, T-22-S, R-37-E,  
Lea County, NM

Acreage: 36.98 acres

|            |                           |                    |
|------------|---------------------------|--------------------|
| WI Owners: | Presidio Oil Co.          | 33.330000%         |
|            | Trust U/D Donaldson Brown | 16.670000%         |
|            | Chevron U.S.A.*           | 35.546875%         |
|            | James A. Davidson         | 12.500000%         |
|            | James E. Burr             | 0.390625%          |
|            | Larry E. Nermyr           | 0.781250%          |
|            | Jack Fletcher             | 0.390625%          |
|            | Ruth Sutton               | 0.390625%          |
|            |                           | <u>100.000000%</u> |

|                                      |                   |
|--------------------------------------|-------------------|
| Cumulative Oil Production (12-31-87) | 167,424 BO        |
| Oil Production 1988                  | 0 BO              |
| Cumulative Oil Production (12-31-88) | <u>167,424 BO</u> |

Comments: \*Ownership limited to the proposed unitized interval only.

Tract No. 24

Operator: Chevron U.S.A.

Lease: Mattern

Description: NE4 SW4 & NW4 SE4  
Sec. 7, T-22-S, R-37-E,  
Lea County, NM

Acreage: 80 acres

WI Owners: Surface to 3620'

|                           |                    |
|---------------------------|--------------------|
| Presidio Oil Co.          | 33.330000%         |
| Trust U/D Donaldson Brown | 16.670000%         |
| Chevron U.S.A.*           | 35.546875%         |
| James A. Davidson         | 12.500000%         |
| James E. Burr             | 0.390625%          |
| Larry Nermyr              | 0.781250%          |
| Jack Fletcher             | 0.390625%          |
| Ruth Sutton               | 0.390625%          |
|                           | <u>100.000000%</u> |

3620'-4000'

|                   |                    |
|-------------------|--------------------|
| Chevron U.S.A.    | 35.5468750%        |
| James A. Davidson | 12.5000000%        |
| James E. Burr     | 0.3906250%         |
| Larry Nermyr      | 0.7812500%         |
| Jack Fletcher     | 0.3906250%         |
| Ruth Sutton       | 0.3906250%         |
| Para Mia          | 13.0434780%        |
| Dasco Energy      | 14.4927535%        |
| Louise C. Summers | 14.4927535%        |
| Burton Veteto     | 1.4492750%         |
| Jack Mussett      | 6.5217390%         |
|                   | <u>99.9999990%</u> |

4000' to 6500'+

|                   |                    |
|-------------------|--------------------|
| Para Mia          | 26.0869560%        |
| Dasco Energy      | 28.9855070%        |
| Louise C. Summers | 28.9855070%        |
| Burton Veteto     | 2.8985500%         |
| Jack Mussett      | 13.0434780%        |
|                   | <u>99.9999980%</u> |

|                                      |                   |
|--------------------------------------|-------------------|
| Cumulative Oil Production (12-31-87) | 183,025 BO        |
| Oil Production 1988                  | 0 BO              |
| Cumulative Oil Production (12-31-88) | <u>183,025 BO</u> |

Comments: \*Ownership limited to the proposed unitized interval only.

Tract No. 25

Operator: Presidio Oil Co.

Lease: Mattern

Description: S2 S2  
Sec. 7, T-22-S, R-37-E,  
Lea County, NM

Acreage: 157.00 acres

WI Owners: Surface to 3610'\*

|                           |                      |
|---------------------------|----------------------|
| Mary Walsh                | 66.67000000%         |
| Presidio Oil Co.          | 22.22000000%         |
| Trust U/D Donaldson Brown | 11.11000000%         |
|                           | <u>100.00000000%</u> |

3610'-4000'

|                   |                     |
|-------------------|---------------------|
| Mary Walsh        | 66.67000000%        |
| Para Mia          | 8.82265741%         |
| Dasco Energy      | 9.80266437%         |
| Louise C. Summers | 9.80266437%         |
| Burton Veteto     | 0.98026643%         |
| Jack Mussett      | 3.92078895%         |
|                   | <u>99.99904153%</u> |

4000' to 6800'+

|                   |                     |
|-------------------|---------------------|
| Para Mia          | 26.47061930%        |
| Dasco Energy      | 29.41093420%        |
| Louise C. Summers | 29.41093420%        |
| Burton Veteto     | 2.94109340%         |
| Jack Mussett      | 11.76354320%        |
|                   | <u>99.99712430%</u> |

|                                      |                   |
|--------------------------------------|-------------------|
| Cumulative Oil Production (12-31-87) | 603,349 BO        |
| Oil Production 1988                  | 0 BO              |
| Cumulative Oil Production (12-31-88) | <u>603,349 BO</u> |

Comments: \*Ownership changes at 3630' in SE SE,  
3620' in SW SE,  
3635' in SE SW,  
3610' in SW SW.

Tract No. 26

Operator: Chevron U.S.A.

Lease: A. L. Christmas (NCT-C)

Description: W2 W2 & SE4 NW4 & SW4 NE4 & E2 NE4  
Sec. 18, T-22-S, R-37-E,  
Lea County, NM

Acreage: 307.96 acres

WI Owners: Chevron U.S.A. 100%

|                                      |                     |
|--------------------------------------|---------------------|
| Cumulative Oil Production (12-31-87) | 1,702,534 BO        |
| Oil Production 1988                  | 1,404 BO            |
| Cumulative Oil Production (12-31-88) | <u>1,703,938 BO</u> |

Comments: Production classified as Arrowhead and Eumont for  
Well No. 1.

BCC/pf 4704/06278/03

FIRST TECHNICAL COMMITTEE MEETING  
PROPOSED ARROWHEAD GRAYBURG UNIT  
AUGUST 4, 1988

A Technical Committee meeting for the proposed Arrowhead Grayburg Unit was held at 9:30 a.m. on August 4, 1988, at Chevron's Division office in Hobbs, New Mexico. Fifteen attendees, representing 11 companies and 90.8% of the cumulative oil produced as of 12-31-87, were present and are shown on the attached list.

Mr. T. A. Etchison, Chevron, welcomed the attendees and briefly reviewed the agenda for the meeting. He then reviewed the events of the Working Interest Owners' meeting held on May 5, 1988. Mr. Etchison recommended that the voting procedure of 75% cumulative oil as of 12-31-87 for approval, as adopted by the Working Interest Owners, be used by the Technical Committee. Mr. Etchison asked if there was any objection and there was none. He also emphasized that the Technical Committee was a working group and that votes by the Technical Committee representatives would not be binding on the WIO's.

Mr. Etchison then reviewed the charges for the Technical Committee as set by the Working Interest Owners. He pointed out that due to variations in ownership with depth on several tracts, the acreage equity parameter could be more readily handled if it were to be changed to be gross acre-ft. Mr. Don Jacks, Exxon, asked if the variations in ownership occurred within the limits of the Grayburg, and Mr. Etchison responded yes. Mr. Etchison then asked if there was any objection to changing the equity parameter of "Gross Acreage" to "Gross Acre-ft" and there was none.

Mr. Etchison then presented a tentative timetable for the Technical Committee study (attached). He stated that a completed Technical Committee report to the WIO's could be ready as early as April of 1989, but to do this, all parties' dedicated efforts will be needed. He stressed that the timetable was tentative, and that the Technical Committee proceedings may take longer. He also pointed out that it is planned to postpone the calculation of the Unit equity parameter table until the other charges were nearly complete.

Mr. R. A. Smith, Chevron, presented the geological information used by Chevron to select the proposed Unit boundaries. He stated that the proposed vertical limits extend from -150' s.s. or the top of the Grayburg formation to -1500' s.s. Mr. Smith stated that these boundaries minimize the number of workovers required to isolate Penrose production in wells that produce from the Queen and Grayburg formation. It was also pointed out that -150' s.s. appeared

to be the gas-oil contact. He noted that this was the same approach used in the EMSU. Mr. Smith stated that extending the Unit to -1500' s.s. would include the greater part of the San Andres formation, to within 100' of the Glorietta. The purpose for inclusion of the San Andres was to ensure adequate water supply and to simplify accounting should a water supply well produce hydrocarbons.

Mr. Smith then continued by defining the method used to establish the areal boundaries. He stated that the western edge was defined structurally by -325' s.s. The eastern boundaries were defined by a percent dolomite evaluation of the pay interval. Mr. Smith stated that wells with less than 60% dolomite (greater than 40% sand) would have poor pay quality and probably not be waterfloodable. This was reenforced by an iso-cumulative oil production map which indicated that cumulative oil production is related to percent dolomite.

Mr. Jay Vashler, Conoco, asked if the San Andres was being included for water supply only. Mr. Etchison responded that there had been some discrepancies on the call for the top of the San Andres, and that the entire oil column would be evaluated for waterflooding. The major part of the San Andres which is not oil productive will be unitized solely for water supply. Ms. Cindy Ellis, ARCO, questioned if Chevron planned to waterflood the Queen formation where it is included in the western portion of the Unit. She expressed concern about damage to the Eumont gas interval, and stated that the top of the Grayburg may be a better unit boundary. Bryan Cotner, Chevron, pointed out that it would be impossible to allocate production to the Grayburg for wells that have produced both Queen and Grayburg, supporting the proposed boundary at -150' s.s. which does not require an allocation. He remarked that excluding water injection from the Queen to protect gas reserves above the Unit could be handled in operation of the waterflood. After brief additional discussion, Mr. T. A. Etchison sought approval of the boundaries as proposed by Chevron to be the area subject to the Technical Committee report. There was no objection. The Unit boundaries for the Technical Committee report are shown on the attached plat, and have vertical limits of a depth of -150 ft. s.s. or the top of the Grayburg formation, whichever is shallower, to a depth of -1500 ft. s.s.

Mr. Bryan Cotner then reviewed information packets distributed to attendees. He asked each committee representative to review the cumulative oil and ownership data for accuracy, and to contact him if there was a discrepancy. He also stated that the cumulatives were based on the New Mexico Oil & Gas Engineering Committee reports.

Mr. Etchison then requested that the Unit area operators complete wellbore data sheets supplied. The information is to be used to construct wellbore diagrams and to estimate drilling and recompletion costs for the proposed Unit. Representatives were asked to complete the forms for any



wells that they operate in, or within a  $\frac{1}{2}$  mile radius beyond, the areal boundaries of the Unit.

Mr. Steve Burke, Chevron, then distributed Division Order and Payee List data sheets to be completed by the Unit area operators. Mr. Burke stated that the ownership sheets would be used to verify and correct information that Chevron has already compiled, and to obtain addresses of the royalty owners.

After several comments and questions concerning the proposed unit boundaries the meeting was adjourned at 11:00 a.m.

If you have any questions, additions or corrections concerning the above minutes, please contact Mssrs. T. A. Etchison or B. C. Cotner at (505) 393-4121.

BCC:bdw

PROPOSED ARROWHEAD GRAYBURG UNIT  
FIRST TECHNICAL COMMITTEE MEETING  
HOBBS, NEW MEXICO  
AUGUST 4, 1988

## LIST OF ATTENDEES

| <u>NAME</u>           | <u>COMPANY</u>         | <u>TITLE</u>          |
|-----------------------|------------------------|-----------------------|
| <u>Bryan Cotner</u>   | <u>Chevron</u>         | <u>Reservoir Eng.</u> |
| <u>Randy Smith</u>    | <u>Chevron</u>         | <u>Geologist</u>      |
| <u>John Lawrence</u>  | <u>OXY U.S.A., Inc</u> | <u>Reservoir Eng.</u> |
| <u>David Mussett</u>  | <u>Jack Mussett</u>    | <u></u>               |
| <u>Don Jacks</u>      | <u>Exxon Joint Int</u> | <u>Reservoir Eng.</u> |
| <u>Greg Cielinski</u> | <u>Sun E &amp; P</u>   | <u>Reservoir Eng.</u> |
| <u>Jerry Hoover</u>   | <u>Conoco</u>          | <u>Sr. Res. Eng.</u>  |
| <u>Jay Vashler</u>    | <u>Conoco</u>          | <u>Engineer</u>       |
| <u>George Ricks</u>   | <u>DASCO</u>           | <u></u>               |
| <u>Don Bratton</u>    | <u>Zia</u>             | <u>Engineer</u>       |
| <u>Bob Anthony</u>    | <u>Amerada Hess</u>    | <u>Oper. Engineer</u> |
| <u>Tom Zapatka</u>    | <u>Marathon</u>        | <u>Oper. Engineer</u> |
| <u>Ted Etchison</u>   | <u>Chevron</u>         | <u>Sr. Pet. Eng.</u>  |
| <u>Steve Burke</u>    | <u>Chevron</u>         | <u>Land Rep.</u>      |
| <u>Cindy Ellis</u>    | <u>ARCO</u>            | <u>Engineer</u>       |
| <u></u>               | <u></u>                | <u></u>               |
| <u></u>               | <u></u>                | <u></u>               |
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SECOND TECHNICAL COMMITTEE MEETING  
PROPOSED ARROWHEAD GRAYBURG UNIT

October 27, 1988

A Technical Committee meeting for the proposed Arrowhead Grayburg Unit (AGU) was held at 9:30 a.m. on October 27, 1988. Nineteen attendees representing 11 companies and 88% of the cumulative oil production as of 12-31-87 were present and are shown on the attached list.

Mr. T. A. Etchison, Chevron, welcomed the attendees and briefly reviewed the agenda for the meeting. He reviewed the events of the First Working Interest Owners' meeting, the First Technical Committee meeting, and the charges for the Technical Committee. Mr. Etchison then reviewed the responses to the wellbore and Division Order information requests that have been received by Chevron. He stated that the wellbore information that Chevron has received represents 75% of the wellbores within the proposed unit.

Mr. Bryan Cotner, Chevron, reviewed the secondary recovery prediction originally presented at the May 5, 1988 Working Interest Owners' meeting. He reiterated that the prediction was based on the same analogies used by the Eunice Monument South Unit (EMSU) and that the resulting incremental secondary recovery for the AGU is estimated to be 17 MMSTBO.

Mr. Cotner then discussed the basis of the tentative well locations for the proposed unit. He stated that the initial plan would call for an 80-acre 5-spot consisting of 74 producers and 52 injectors. Future adjustments to the pattern may be made based on experience in the EMSU or based on possible pulse testing work in the AGU. The tentative locations utilize all actively producing wells within the unit, and any "new drills" will have to be thought to have sufficient reserves to justify drilling. The reserves will be based on both primary and secondary potential. Mr. Cotner gave examples of several wells that were plugged-back out of the Grayburg while producing at rates that would be commercial to produce today. Some of the wells were abandoned because they stopped flowing or because they started producing moderate amounts of water. When asked if the offsetting producers would have produced the remainder of the reserves left in the plugged-back well, Mr. Cotner made reference to the recent Conoco recompletion of the Lockhart 'B' No. 7 which is producing around 80 BOPD, and which is on the same proration unit as the No. 4 which was plugged back in 1974.

Mr. Cotner stated that 69 of the 124 tentative locations will come from existing completions, requiring 55 additional

wells to come from plugbacks, re-entries, or redrills. Because of the significant need for additional wells, some method of wellbore dedication incentive should be used. He estimated that 5 to 10 additional wellbores would be contributed with an incentive, reducing total unit costs by approximately \$1.5MM.

Mr. Russell Miller, Chevron, gave an overview of the surface production and injection facilities based on the tentative well locations and preliminary performance predictions. The production gathering system will consist of five production testing satellite batteries and one central treating and sales battery. The production gathering system will consist of 270,000 feet of low pressure fiberglass pipe, including 2" and 3" flowlines and 6" liquid transfer lines. The injection system will consist of 15 injection manifolds, 106,000 feet of 2" through 4" high pressure fiberglass pipe, and 18,000 feet of 6" lined steel trunk line. The water injection plant will initially consist of de-staged vertical cam pumps, with stages added as pressure requirements dictate. The electrical distribution system will consist of 25 miles of new electrical lines. He also estimated that 18 batteries would be dismantled. Mr. Miller estimated total surface facilities costs at \$8.95MM and that construction could be complete within one year of commencement. The original cost estimate presented to the Working Interest Owners was \$9.2MM.

Mr. Etchison outlined recent production tests in Tract 8a located in the SE/4 of Section 18, T-22-S, R-37-E. Zia Energy has completed the State No. 49 'M' in Grayburg Zone 5 and lower Grayburg (as defined by Chevron) classified as Eunice, S.W. San Andres. Zia's ownership begins at the top of Zone 5. The well has produced at rates as high as 3.5 BOPD + 305 MCFPD + 752 BWPD. It is currently producing 1 BOPD + 150 MCFPD + 500 BWPD. Mr. Etchison stated that this was being brought to the attention of the Technical Committee for informational purposes. After discussion concerning the consequences of deleting Zia's acreage from the unit, Mr. Don Bratton of Zia Energy said that they were testing the interval to determine its value, and their participation in the unit would be dependent on whether or not they would have fair compensation for their gas value. If not, they would seek removal from the unit.

Mr. Etchison then discussed the need and complexity of defining useable wellbores. He stated that, generally, wells currently producing or plugged-back wells that are restored to their previously producing environments would be considered as useable. He stated that new or alternate wells would have to be compatible with the needs of the unit, in terms of depth and ability to be worked on. The

topic will be discussed at the next Technical Committee meeting at which time Chevron will propose a set of definitions.

Mr. Etchison then discussed the drawbacks of the use of wellbores as an equity parameter in participation negotiations, and recommended that it be removed from the equity parameters to be calculated. He proposed that a wellbore dedication incentive, such as wellbore penalties, would be more appropriate than the use of useable wellbores in the participation formula. A wellbore value of between \$100M and \$120M was presented as the probable value to be used in the incentive method. After a brief discussion concerning wellbore penalties, Chevron moved that useable wellbores be removed from the equity parameter list, and that the Technical Committee recommend a wellbore dedication incentive method. The motion was seconded by Conoco and passed with 80.2% voting for, 8.2% voting against, and 11.6% not voting (absent). Following the vote there was additional discussion concerning wellbore penalties and wellbore inventories as methods of incentive. It was decided that various wellbore dedication incentive scenarios will be discussed at the next meeting.

Mr. Etchison asked if there were any other items for discussion. Mr. Don Bratton asked if a cut-off date for production that is to be used for equity calculations had been considered. Mr. Etchison commented that a cut-off date has been delayed until as late in the Technical Committee proceedings as possible as current production and remaining reserves will be the last equity parameters addressed.

Mr. Etchison then re-capped the accomplishments of the meeting and stated that the next meeting was tentatively scheduled for late January or early February 1989. He said items for discussion at the next meeting would include: defining useable wellbores, wellbore contribution incentives, estimates of drilling and workover costs for the unit, an updated secondary recovery prediction, and equity parameter calculations. The meeting adjourned at 11:15 a.m.

If you have any questions, additions or corrections concerning the minutes, please contact Mr. T. A. Etchison or Mr. B. C. Cotner at (505) 393-4121.

PROPOSED ARROWHEAD GRAYBURG UNIT  
SECOND TECHNICAL COMMITTEE MEETING  
HOBBS, NEW MEXICO  
October 27, 1988

LIST OF ATTENDEES

| <u>NAME</u>    | <u>COMPANY</u>       | <u>TITLE</u>        |
|----------------|----------------------|---------------------|
| Bryan Cotner   | Chevron              | Reservoir Engineer  |
| Ted Etchison   | Chevron              | Sr. Petr. Engineer  |
| Randy Smith    | Chevron              | Geologist           |
| Bob Anthony    | Amerada Hess         | Operations Engineer |
| Jay Vashler    | Conoco               | Engineer            |
| Jerry Hoover   | Conoco               | Sr. Reservoir Engr. |
| Cindy Ellis    | Arco                 | Sr. Reservoir Engr. |
| David Mussett  | J. D. Mussett        | Geologist           |
| Bob Hogan      | American Exploration | Engineer            |
| Tom Zapatka    | Marathon             | Engineer            |
| Chris Gros     | Chevron              | Sr. D&C Engineer    |
| Greg Cielinski | Sun                  | Reservoir Engineer  |
| Gary Greer     | Amerada Hess         | District Engineer   |
| Russel Miller  | Chevron              | D&C Engineer        |
| Don Bratton    | Zia                  | Engineer            |
| George Ricks   | DASCO                |                     |
| Ron Henderson  | Presidio Oil Co.     | Operations Engineer |
| Jim Hefley     | Amerada Hess Corp.   | Unit Manager        |
| Bruce Mailey   | Amerada Hess Corp.   | Unit Engineer       |

PROPOSED ARROWHEAD GRAYBURG UNIT  
SECOND TECHNICAL COMMITTEE MEETING  
HOBBS, NEW MEXICO  
October 27, 1988

Motion made by T. A. Etchison, Chevron, to delete "useable wellbores" from the equity parameters, and instead, the Technical Committee should make a recommendation to the Working Interest Owners concerning a wellbore dedication incentive program. Motion seconded by Jerry Hoover, Conoco. Votes were as follows:

| <u>WI OWNER</u>      | <u>% CUM OIL</u> | <u>FOR</u>   | <u>AGAINST</u> | <u>ABSENT</u> |
|----------------------|------------------|--------------|----------------|---------------|
| Amerada Hess         | 1.48150010       | X            |                |               |
| American Exploration | 3.61930490       | X            |                |               |
| Amoco Production     | 1.41192318       |              |                | X             |
| Arco Oil & Gas       | 8.20310777       |              | X              |               |
| Trust U/D D Brown    | 0.09172169       |              |                | X             |
| John Bryant          | 0.00796476       |              |                | X             |
| James Burr           | 0.01186883       |              |                | X             |
| Chevron U.S.A. Inc.  | 44.70374102      | X            |                |               |
| Conoco Inc.          | 17.05237598      | X            |                |               |
| DASCO Energy         | 0.53393472       | X            |                |               |
| James Davidson       | 0.37980264       |              |                | X             |
| Jack Fletcher        | 0.01186898       |              |                | X             |
| Doyle Hartman        | 1.08006370       |              |                | X             |
| Marathon Oil Company | 8.23815463       | X            |                |               |
| Jack Mussett         | 0.23168061       | X            |                |               |
| Larry Nermyr         | 0.02373766       |              |                | X             |
| Oxy U.S.A.           | 6.20723958       |              |                | X             |
| Para Mia Inc.        | 0.48361360       |              |                | X             |
| Presidio             | 0.18338836       | X            |                |               |
| R. L. Summers Est.   | 0.53393516       |              |                | X             |
| Sun E & P Company    | 4.12489586       | X            |                |               |
| Ruth Sutton          | 0.01186940       |              |                | X             |
| Burton Veteto        | 0.05031918       |              |                | X             |
| Mary F. Walsh        | 1.32195842       |              |                | X             |
| Zia Energy           | 0.00000000       | X            |                |               |
| <hr/>                |                  |              |                |               |
| TOTAL                | 99.99997073%     | 80.16897618% | 8.20310777%    | 11.62788678%  |

Motion carried.



Third Technical Committee Meeting  
Proposed Arrowhead Grayburg Unit  
February 24, 1989

The Third Technical Committee meeting for the proposed Arrowhead Grayburg Unit (AGU) was held at 9:30 a.m., February 24, 1989. Fourteen attendees representing nine companies and 89.9% of the cumulative oil production as of 12/31/87 were present and are shown on the attached list.

Mr. T. A. Etchison, Chevron, welcomed attendees and briefly reviewed the agenda for the meeting. He reviewed the charges for the Technical Committee, as set by the Working Interest Owners, and discussed accomplishments to date. Mr. Etchison then pointed out a typographical error on the interim voting interest tabulation (cumulative oil 12/31/87) that was attached to the letter to Exxon dated Jan. 20, 1989. Copies of the letter were mailed to all WIO's. The erroneous table indicates that Enron has cumulative oil of 49,446 BO and 0.16% voting interest, and that Exxon has 0 cumulative and 0% interest. The table should have indicated that Enron has 0 cumulative oil and percent interest and Exxon has 49,446 BO cumulative which equates to 0.16223508% interest.

Mr. B. C. Cotner, Chevron, then reviewed the original secondary recovery prediction presented at the WIO's meeting in May 1988. He stated that the prediction was based on the same analogy that was used for the Eunice Monument South Unit (EMSU) prediction, which assumes a secondary to primary ratio of 0.5. The original prediction assumed an incremental secondary recovery of 17 MMSTBO based on an ultimate primary recovery of 34 MMSTBO. Mr. Cotner then presented a tentative 80-acre 5-spot well location map which is based on currently active wells completed in the unitized interval, and all additional locations that can be justified to drill based on secondary and additional primary recovery potential. He stated that the secondary recovery potential for the additional locations is estimated based on 50% of the ultimate primary recovery from the "swept" area, assuming no areal sweep beyond the confines of the peripheral patterns.

Mr. Cotner stated that the revised secondary recovery prediction based on the "swept" area obtained from the tentative well locations is 15 MMSTBO. He then presented an updated recovery prediction curve and referred to the predicted recovery table in the information packet.

Mr. Cotner then presented well cost estimates. He stated that of the 129 tentative wells, 67 would come from existing completions and that 62 additional wells will be required. The first case he presented assumed that all 62 additional wells would be "new-drills". In addition to the drill and completion costs for the new wells, there will be workover expenses for the existing wells, including some deepenings, liners, water injection conversions,

and upgrading of pumping equipment. Mr. Cotner said that estimates of workover requirements were based on the wellbore data supplied by the operators or obtained from the New Mexico OCD well files. He then presented a probable case estimate that is based on 10 additional wells being dedicated to the unit, reducing the number of "new-drills" to 52. The total well cost for the high case is estimated to be \$20,038 M with a total project cost of \$28,988 M. For the probable case the total well cost is estimated to be \$18,806 M and the total project cost is estimated to be \$27,756 M. Mr. Cotner said the \$1.2 MM savings from having 10 additional wells dedicated to the unit indicates the benefit of some type of wellbore dedication incentive. He then presented investment schedules which assumed that the project will be installed over 1 1/2 years and that the pumping equipment upgrades will occur during the first five years.

Mr. Cotner then proposed a definition of useable wellbores which would accept all active producing wells that are limited to production from the unitized interval. Other wells would be accepted if they meet specific criteria. All wells will be required to pass a casing integrity test to be acceptable. Mr. Etchison stated that the intention of the definition was to insure that the WIO's well costs are not unnecessarily increased by the contribution of wellbores in substandard condition. Ms. Cindy Ellis, Arco, asked if the definition that was presented will be incorporated in the Unit operating agreement. Mr. Cotner responded that the useable wellbore definition in the Unit agreement will reflect the intent of the definition he presented, but may be worded differently. Mr. John Lawrence, OXY U.S.A., asked if the proposed definition was the same as used by the EMSU. Mr. Etchison stated that the EMSU agreement was less specific. When Mr. Etchison asked for a motion to accept the definition, Mr. Jerry Hoover, Conoco, suggested that it be tabled until the next meeting to allow further evaluation by the Technical Committee members.

Mr. Cotner then presented a proposed wellbore valuation of \$80,000, based on anticipated workover costs for existing wells compared to the cost to drill and complete a new well. Mr. Hoover, Conoco, suggested that voting on acceptance of \$80,000 as the wellbore value also be postponed until the next meeting.

Cut-off dates for production equity parameters were then discussed. Mr. Etchison moved that 12/31/88 be used for the cut-off date for cumulative oil. Jerry Hoover, Conoco, seconded the motion, and it passed unanimously. Mr. Etchison then moved that remaining reserves be calculated from 1/1/89. Jerry Hoover, Conoco, seconded. After a brief discussion the motion passed unanimously. Mr. Etchison then proposed that current oil and gas rates be based on the monthly averages for 1988. After discussing the effect of workovers over the last couple of years, it was recommended that production from December 1988 be used. George Ricks, Dasco, recommended that data for different scenarios,

including monthly average for the last 1 year, the last six months, and for December be presented. He suggested that the WIO's will decide which current rate should be used for equity negotiations. Mr. Etchison stated that current oil and gas rates based on December 1988 production, the last six months of 1988, and the monthly average for 1988 will be presented at the next meeting.

Mr. Cotner then reviewed the vertical limits of the proposed unit and presented a map that indicates the subsea depth of top of the unit for each proration unit. He then reviewed tracts that have changes in ownership with depth within the proposed unitized interval. He also reviewed tabulated data of gross-acre feet by tract and proration unit.

Mr. Etchison then recapped the events of the meeting. He stated that the next meeting would be in late April or early May, at which time we would try to establish remaining oil and gas reserves for each tract and finalize a wellbore definition and value. The meeting adjourned at 11:00 a.m.

If you have any additions or corrections to the minutes, please contact B. C. Cotner at (505) 393-4121.

Proposed Arrowhead Grayburg Unit  
Third Technical Committee Meeting  
February 24, 1989

| <u>Name</u>            | <u>List of Attendees<br/>Company</u> | <u>Title</u>                |
|------------------------|--------------------------------------|-----------------------------|
| <u>Bryan C. Cotner</u> | <u>Chevron U.S.A. Inc.</u>           | <u>Reservoir Engineer</u>   |
| <u>Randy A. Smith</u>  | <u>Chevron U.S.A. Inc.</u>           | <u>Geologist</u>            |
| <u>T. A. Etchison</u>  | <u>Chevron U.S.A. Inc.</u>           | <u>Sr. Petroleum Engr.</u>  |
| <u>John Lawrence</u>   | <u>OXY U.S.A., Inc.</u>              | <u>Reservoir Engineer</u>   |
| <u>Craig Kent</u>      | <u>Marathon</u>                      | <u>Production Engineer</u>  |
| <u>Bob Hogan</u>       | <u>American Exploration</u>          | <u>Reservoir Engineer</u>   |
| <u>Cindy Ellis</u>     | <u>ARCO</u>                          | <u>O/A Engineer</u>         |
| <u>Bob Anthony</u>     | <u>Amerada Hess Corp.</u>            | <u>Oper. Engineer</u>       |
| <u>Don Bratton</u>     | <u>Zia Energy</u>                    | <u>Engineer</u>             |
| <u>George Ricks</u>    | <u>Dasco Energy</u>                  |                             |
| <u>Jay Vashler</u>     | <u>Conoco</u>                        | <u>Engineer</u>             |
| <u>Jerry Hoover</u>    | <u>Conoco</u>                        | <u>Sr. Reservoir Engr.</u>  |
| <u>Russell Miller</u>  | <u>Chevron U.S.A. Inc.</u>           | <u>D&amp;C Engineer</u>     |
| <u>John Ladd</u>       | <u>Chevron U.S.A. Inc.</u>           | <u>Sr. D&amp;C Engineer</u> |

Fourth Technical Committee Meeting  
Proposed Arrowhead Grayburg Unit  
May 25, 1989

The Fourth Technical Committee Meeting for the proposed A.G.U. (Arrowhead Grayburg Unit) was held at 9:30 a.m., May 25, 1989 at the Chevron office in Hobbs, New Mexico. Fourteen attendees representing 9 companies and 89.9% of the voting interest (cumulative oil production as of 12/31/87) were present and are shown on the attached list.

Introduction.

Mr. T. A. Etchison, Chevron, welcomed attendees and briefly reviewed the agenda for the meeting. He reviewed the charges for the Technical Committee, as set by the Working Interest Owners (WIO's) and discussed which charges had been accomplished to date.

Useable Wellbore Definition and Wellbore Value

Mr. Etchison reviewed the need for a wellbore dedication incentive to decrease the total capital investment for the Unit. He referred to a wellbore penalty method and a wellbore inventory method. He proposed that the Technical Committee not recommend a specific method to the WIO's, but that it be recommended that a dedication incentive be used. After a brief discussion of the differences between the wellbore penalty method and the wellbore inventory method, Mr. Etchison reviewed the \$80,000 useable wellbore value and useable wellbore definition proposed at the Third Technical Committee meeting.

Mr. Etchison clarified that operators dedicating wellbores determined to be not "useable" by the Unit operator, would be liable for \$80,000 of the expense, plus their proportionate share (working interest) of the Unit's expense, to make the well "useable". It was also stated that operators would have the option to repair their wells at their own expense and risk, but they would still be obligated for the first \$80,000 if the well was still not "useable" when dedicated to the Unit.

Mr. Etchison then made the motion: A useable wellbore, for wellbore dedication incentives, will be defined based on the criteria presented at the Fourth Technical Committee meeting (attached), and the value of a useable wellbore will be \$80,000. Ms. Cindy Ellis, Arco, seconded the motion. The motion passed with 88.41% approval.

Gross Acre-ft

Mr. Etchison reviewed the equity parameter Gross Acre-ft. He stated that the unitized interval has been defined as the top of the Grayburg formation or -150 feet from sea level (fsl), whichever is shallower, to -1500 ft fsl. He stated that the purpose of including depths to -1500 ft was to include the water supply aquifer, so, if in event the water supply wells were to produce hydrocarbons, the revenues from those hydrocarbons could be properly distributed. Mr. Etchison stated that Chevron had received several comments from Technical Committee members expressing concerns about the allocation of acreage equity for the proposed Unit. They were concerned about a disproportionate share of the acreage equity being proportioned to owners having rights below the limits of commercial production.

Mr. Etchison presented an alternative to the Gross Acre-ft parameter, based on surface acres, and allocated to owners based on rights from the top of the Unit to 325 ft below the top of the Grayburg formation. He then reviewed the allocation of acreage equity under Gross Acre-ft and the new proposal.

Chevron made a motion to replace the Gross Acre-ft equity parameter with surface acres and to base ownership in tracts with a vertical split in ownership on rights from the top of the Unit to 325 ft below the top of the Grayburg. There was no second.

Further discussion of the proposal included the question of proper treatment of the San Andres aquifer if it is determined to be commercially productive of hydrocarbons. Mr. Etchison stated that the Unit should include the water supply horizon, but if it is subsequently determined to be commercially productive of hydrocarbons, the Unit orders and boundaries can be amended.

During the discussions concerning the inclusion of the San Andres formation as a water supply source within the boundaries of the Unit, Mr. Don Bratton, Zia Energy, discussed production from the Eunice San Andres Southwest in the State M. No. 49. He suggested that the base of the Unit be defined as the top of the San Andres formation and that Chevron situate the water-supply wells on their own acreage to handle the production of hydrocarbons from water supply wells. He stated that Zia would prefer to be excluded from the Unit.



Mr. George Ricks, Dasco, made the motion to add the acreage parameter of Surface Acres, with allocation of ownership as Mr. Etchison presented, to the equity parameter list (in addition to Gross Acre-ft). Mr. Bob Hogan, American Exploration, seconded the motion. The motion passed with 89.9% approval.

#### Cumulative Oil

Mr. Etchison referred to the cumulative oil data provided in the information packets distributed at the meeting. He mentioned that cumulative oil through 12-31-88 was listed by well, by tract and by owner (based on ownership take-off information). There were no objections to the data, as presented.

#### Current Oil & Gas Rates

Mr. Etchison referred to the current oil and gas production rate tables that indicate production based on on: 1) all of 1988, 2) last one-half of 1988, 3) last quarter 1988, and 4) December 1988. He stated that the gas rate tables mailed with the announcement of the meeting contained a typographical error that has since been corrected. Mr. Etchison proposed that the Committee choose one value of current rate to supply in the Technical Committee Report.

Chevron moved that the last one-half of 1988 average monthly rates be used. There was no second. Mr. Etchison then suggested that each time period for current rate be voted on, and the one with the greatest percentage approval would be used in the report. Current oil rates based on the average active monthly production for the last quarter 1988 were selected with 81.68% approval. (The voting summary is attached).

Mr. Bob Hogan, American Exploration, moved that the current gas rate also be based on the last-quarter 1988 average active monthly gas production, (same as current oil). Mr. Donald Price, Marathon, seconded the motion. The motion carried with 81.68% approval.

#### Remaining Oil and Gas Reserves

Mr. Bryan Cotner, Chevron, presented estimates of remaining oil and gas reserves for each tract. He reviewed the assumptions made in Chevron's estimations of remaining reserves. He noted that inactive tracts (no current production), were assumed to have no remaining reserves. Mr. Cotner suggested that the Committee review each tract and adjust the decline or make whatever change in the general assumptions necessary to equitably determine remaining reserves for that tract.



The finalized remaining oil and gas reserves are shown in the attached table and were accepted with approval by 89.36% of the voting interest.

Other Business

Mr. Etchison stated that the meeting completed the basic work charged to the Technical Committee. He said that Chevron would use the work from the four Technical Committee meetings to compile the Technical Committee Report. Additionally, he stated that an updated secondary recovery performance prediction based on EMSU simulation may also be included in the report. He estimated that the report would be finished during late summer, at which time it would be distributed to the Technical Committee members with a letter ballot for acceptance. Once 75% of the voting interest in the Technical Committee accepts the report, the second WIO's meeting will be called. Mr. Etchison stated that there will only be another Technical Committee meeting if it is necessary to accept the report. The meeting adjourned at 3:00 p.m.

If you have any additions or corrections to the minutes, please contact B. C. Cotner at (505)393-4121.

BCC/sad 05309/01

Proposed Arrowhead Grayburg Unit  
Fourth Technical Committee Meeting  
May 25, 1989

List of Attendees

| <u>Name</u>       | <u>Company</u> | <u>Title</u>           |
|-------------------|----------------|------------------------|
| Randy A. Smith    | Chevron USA    | Geologist              |
| Ted A. Etchison   | Chevron USA    | Sr. Petroleum Engineer |
| Bryan C. Cotner   | Chevron USA    | Reservoir Engineer     |
| Bruce Mailey      | Amerada        | Unit Engineer          |
| Bob Anthony       | Amerada        | Operating Engineer     |
| Don Bratton       | Zia            | Engineer               |
| Jay Vashler       | Conoco         | Production Engineer    |
| Jerry Hoover      | Conoco         | Sr. Reservoir Engineer |
| Donald Price      | Marathon       | Production Engineer    |
| George Ricks      | DASCO          |                        |
| Cindy Ellis       | Arco           | O/A Engineer           |
| John. J. Lawrence | Oxy            | Reservoir Engineer     |
| Bob Hogan         | AEC            | Engineer               |
| John Prindle      | Chevron USA    | NOJV Coordinator       |

BCC/sad 05309/01

Arrowhead Grayburg Unit  
Useable Well  
Definition

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(1) Active Wells (Producing 12-88)

Will be accepted as useable if no zones other than the unitized interval are open. If zones above the unitized interval are open, the owners must squeeze the non-unit zone, drill out the cement in the production casing, or set a liner to the top of the unitized interval\*, and pressure test the casing above the unitized interval to 500 psi for 30 minutes.

(2) Closed in or TA'd Wells

Will be acceptable as useable if no zones other than the unitized interval are open (as above) and the well is free of scale, junk, and debris to a depth of the deepest production from the unitized interval prior to being closed-in. (PBTD from workovers in the unitized interval prior to shutting in.)

(3) Re-entries of P&A'd or Recompleted Wells That Previously Produced the Unitized Interval.

Will be accepted as useable if they have been restored to the previous unitized interval producing condition (completion interval, depth), are not open in non-unitized zones, and are free of scale, junk and debris down to the PBTD prior to the cessation of production from the unitized interval.

(4) Alternate Wells from Existing Wellbores

Will be accepted as useable if all non-unitized formations have been abandoned, (deeper zones plugged back with CIBP, or cement retainer, shallower zones cement squeezed and pressure tested), they penetrate the unitized interval, and have sufficient casing size (5 1/2") to be deepened or have at least 4 1/2" casing set through Zone 5 of the Grayburg formation, and are adequately cemented.

(5) Alternate Wells (new)

Will be accepted if they are drilled to a depth equivalent to the base of Zone 5, cased to TD with 5 1/2" or larger casing, and cemented from TD to surface.

The intent of the useable wellbore definition is to insure that all wellbores that are dedicated are in reasonably good physical condition and can be used in ways consistent with the purpose of the Unit. All wells dedicated will be subject to a casing integrity test. Any well failing a casing integrity test upon the initial entry by the Unit operator, will be repaired or replaced at Working Interest Owner's expense, not to exceed \$80,000.

\* If a well requires a liner to isolate the unitized interval, the Unit operator may assume the responsibility to set it, if doing so is consistent with the proposed workovers for the well.

# PROPOSED ARROWHEAD GRAYBURG UNIT EQUITY PARAMETERS

| TRACT    | CUMULATIVE OIL<br>(12-31-88)<br>STBO | REMAINING OIL<br>RESERVES<br>(1-1-89)<br>STBO | ULTIMATE<br>PRIMARY<br>RECOVERY<br>STBO | CURRENT<br>OIL RATE<br>(4th Q- 1988)<br>BOPM | CURRENT<br>GAS RATE<br>(4th Q- 1988)<br>MCFPM | REMAINING GAS<br>RESERVES<br>(1-1-89)<br>MCF | SURFACE<br>ACRES | GROSS ACRE-FT |
|----------|--------------------------------------|-----------------------------------------------|-----------------------------------------|----------------------------------------------|-----------------------------------------------|----------------------------------------------|------------------|---------------|
| 1        | 465,366                              | 0                                             | 465,366                                 | 0.0                                          | 0.0                                           | 0                                            | 80.00            | 108,000.00    |
| 2        | 1,759,082                            | 749,143                                       | 2,508,225                               | 4,593.3                                      | 15,143.0                                      | 2,414,487                                    | 320.00           | 433,320.00    |
| 3        | 536,424                              | 56,757                                        | 593,181                                 | 647.0                                        | 1,207.7                                       | 93,251                                       | 80.24            | 109,849.20    |
| 4        | 86,986                               | 0                                             | 86,986                                  | 0.0                                          | 0.0                                           | 0                                            | 74.06            | 99,981.00     |
| 5        | 1,256,799                            | 5,878                                         | 1,262,677                               | 111.7                                        | 1,729.3                                       | 59,722                                       | 240.00           | 324,000.00    |
| 6        | 35,102                               | 3,190                                         | 38,292                                  | 40.0                                         | 1,175.3                                       | 82,481                                       | 40.00            | 54,600.00     |
| 7        | 1,980,703                            | 24,046                                        | 2,004,749                               | 160.0                                        | 2,154.0                                       | 278,119                                      | 520.00           | 702,000.00    |
| 8A UPPER | 607,293                              | 2,084                                         | 609,377                                 | 62.3                                         | 270.7                                         | 8,363                                        | 107.06           | 41,839.96     |
| 8A LOWER | 83                                   | 2,291                                         | 2,374                                   | 20.7                                         | 5,660.0                                       | 518,590                                      | 52.94            | 174,160.04    |
| 88       | 502,537                              | 178,065                                       | 680,602                                 | 937.7                                        | 966.7                                         | 177,886                                      | 156.99           | 211,936.50    |
| 9        | 462,904                              | 120,566                                       | 583,470                                 | 987.0                                        | 1,636.0                                       | 201,706                                      | 80.00            | 108,000.00    |
| 10       | 49,446                               | 0                                             | 49,446                                  | 0.0                                          | 0.0                                           | 0                                            | 40.00            | 54,000.00     |
| 11       | 224,314                              | 21,552                                        | 245,866                                 | 192.0                                        | 309.3                                         | 32,263                                       | 80.00            | 108,040.00    |
| 12       | 1,028,687                            | 129,193                                       | 1,157,880                               | 635.7                                        | 1,935.7                                       | 352,954                                      | 80.00            | 111,800.00    |
| 13       | 873,124                              | 53,154                                        | 926,278                                 | 207.3                                        | 1,453.0                                       | 354,274                                      | 160.00           | 216,000.00    |
| 14       | 1,358,847                            | 27,263                                        | 1,386,110                               | 313.0                                        | 513.3                                         | 42,557                                       | 320.00           | 432,000.00    |
| 15       | 4,853,177                            | 1,617,565                                     | 6,470,742                               | 9,937.0                                      | 38,861.0                                      | 4,901,223                                    | 480.64           | 650,069.00    |
| 16       | 3,900,755                            | 185,177                                       | 4,085,932                               | 2,293.7                                      | 18,775.3                                      | 1,454,192                                    | 760.00           | 1,030,680.00  |
| 17       | 2,897,572                            | 1,309,041                                     | 4,206,613                               | 7,459.7                                      | 28,858.0                                      | 3,616,881                                    | 400.00           | 546,560.00    |
| 18       | 0                                    | 0                                             | 0                                       | 0.0                                          | 0.0                                           | 0                                            | 80.00            | 108,000.00    |
| 19       | 489,027                              | 0                                             | 489,027                                 | 0.0                                          | 0.0                                           | 0                                            | 160.00           | 216,000.00    |
| 20       | 0                                    | 0                                             | 0                                       | 0.0                                          | 0.0                                           | 0                                            | 80.00            | 108,920.00    |
| 21       | 39,706                               | 6,820                                         | 46,526                                  | 79.7                                         | 2,542.3                                       | 216,329                                      | 80.00            | 108,040.00    |
| 22       | 4,773,017                            | 692,746                                       | 5,465,763                               | 4,210.7                                      | 5,256.3                                       | 984,392                                      | 868.39           | 1,172,486.74  |
| 23       | 167,424                              | 0                                             | 167,424                                 | 0.0                                          | 0.0                                           | 0                                            | 36.98            | 49,923.00     |
| 24       | 183,025                              | 0                                             | 183,025                                 | 0.0                                          | 0.0                                           | 0                                            | 80.00            | 108,000.00    |
| 25       | 603,349                              | 0                                             | 603,349                                 | 0.0                                          | 0.0                                           | 0                                            | 157.00           | 211,950.00    |
| 26       | 1,703,938                            | 45,455                                        | 1,749,393                               | 136.0                                        | 267.3                                         | 352,364                                      | 307.96           | 415,746.00    |
| TOTAL    | 30,838,687                           | 5,229,986                                     | 36,068,673                              | 33,024.5                                     | 128,714.2                                     | 16,142,034                                   | 5,922.26         | 8,015,900.44  |

Proposed Arrowhead Grayburg Unit  
Fourth Technical Committee Meeting  
Vote Tally  
Based On 12-31-87 Cumulative Oil

Motion by Chevron:

Accept Useable Wellbore Definition and Establish the Useable  
Wellbore Value of \$80,000.

Seconded by Arco.

| WI Owner             | % CUM OIL   | VOTE    | % FOR     |
|----------------------|-------------|---------|-----------|
| -----                | -----       | -----   | -----     |
| ABBY CORPORATION     | 0.00000000  |         | 0         |
| AMERADA HESS         | 1.47909659  | Abstain | 0         |
| AMERICAN EXPLORATION | 3.61343311  | For     | 3.6134331 |
| AMOCO PRODUCTION     | 1.40963254  |         | 0         |
| ARCO OIL & GAS       | 8.18979945  | For     | 8.1897994 |
| TRUST U/D D BROWN    | 0.09157289  |         | 0         |
| JOHN BRYANT          | 0.00795184  |         | 0         |
| JAMES BURR           | 0.01184958  |         | 0         |
| CHEVRON USA          | 44.63121587 | For     | 44.631215 |
| CONOCO INC           | 17.02471104 | For     | 17.024711 |
| DASCO ENERGY         | 0.53306849  | For     | 0.5330684 |
| JAMES DAVIDSON       | 0.37918647  |         | 0         |
| ENRON                | 0.00000000  |         | 0         |
| EXXON COMPANY        | 0.16223508  |         | 0         |
| JACK FLETCHER        | 0.01184973  |         | 0         |
| HANNIFIN             | 0.00000000  |         | 0         |
| HANSON OPERATING CO. | 0.00000000  |         | 0         |
| HANSON-MCBRIDE       | 0.00000000  |         | 0         |
| DOYLE HARTMAN        | 1.07831153  |         | 0         |
| MARATHON OIL CO.     | 8.22478945  | For     | 8.2247894 |
| J H MOORE            | 0.00000000  |         | 0         |
| JACK MUSSETT         | 0.23130474  |         | 0         |
| LARRY NERMYR         | 0.02369915  |         | 0         |
| OXY U.S.A.           | 6.19716926  | For     | 6.1971692 |
| PARA MIA INC.        | 0.48282901  |         | 0         |
| PRESIDIO             | 0.18309084  |         | 0         |
| HAL RASMUSSEN        | 0.51477548  |         | 0         |
| L. C. SUMMERS        | 0.53306893  |         | 0         |
| RUTH SUTTON          | 0.01184958  |         | 0         |
| BURTON VETETO        | 0.05023755  |         | 0         |
| MARY F. WALSH        | 1.31981374  |         | 0         |
| WESTWAY              | 0.00000000  |         | 0         |
| WILLIAMS PARTNERS.   | 3.60342836  |         | 0         |
| ZIA ENERGY           | 0.00000000  | Against | 0         |
|                      | -----       |         | -----     |
|                      | 99.9999703  |         | 88.41419  |

Proposed Arrowhead Grayburg Unit  
Fourth Technical Committee Meeting  
Vote Tally  
Based On 12-31-87 Cumulative Oil

Motion by Dasco:

Add Surface Acres allocated based on Owership from the Top of  
the Unit to 325 ft. Below the Top of the Grayburg Formation  
to the List of Equity Parameters.

Seconded by American Exploration.

| WI Owner             | % CUM OIL   | VOTE | FOR       | AGAINST |
|----------------------|-------------|------|-----------|---------|
| ABBY CORPORATION     | 0.00000000  |      | 0         | 0       |
| AMERADA HESS         | 1.47909659  | For  | 1.4790965 | 0       |
| AMERICAN EXPLORATION | 3.61343311  | For  | 3.6134331 | 0       |
| AMOCO PRODUCTION     | 1.40963254  |      | 0         | 0       |
| ARCO OIL & GAS       | 8.18979945  | For  | 8.1897994 | 0       |
| TRUST U/D D BROWN    | 0.09157289  |      | 0         | 0       |
| JOHN BRYANT          | 0.00795184  |      | 0         | 0       |
| JAMES BURR           | 0.01184958  |      | 0         | 0       |
| CHEVRON USA          | 44.63121587 | For  | 44.631215 | 0       |
| CONOCO INC           | 17.02471104 | For  | 17.024711 | 0       |
| DASCO ENERGY         | 0.53306849  | For  | 0.5330684 | 0       |
| JAMES DAVIDSON       | 0.37918647  |      | 0         | 0       |
| ENRON                | 0.00000000  |      | 0         | 0       |
| EXXON COMPANY        | 0.16223508  |      | 0         | 0       |
| JACK FLETCHER        | 0.01184973  |      | 0         | 0       |
| HANNIFIN             | 0.00000000  |      | 0         | 0       |
| HANSON OPERATING CO. | 0.00000000  |      | 0         | 0       |
| HANSON-MCBRIDE       | 0.00000000  |      | 0         | 0       |
| DOYLE HARTMAN        | 1.07831153  |      | 0         | 0       |
| MARATHON OIL CO.     | 8.22478945  | For  | 8.2247894 | 0       |
| J H MOORE            | 0.00000000  |      | 0         | 0       |
| JACK MUSSETT         | 0.23130474  |      | 0         | 0       |
| LARRY NERMYR         | 0.02369915  |      | 0         | 0       |
| OXY U.S.A.           | 6.19716926  | For  | 6.1971692 | 0       |
| PARA MIA INC.        | 0.48282901  |      | 0         | 0       |
| PRESIDIO             | 0.18309084  |      | 0         | 0       |
| HAL RASMUSSEN        | 0.51477548  |      | 0         | 0       |
| L. C. SUMMERS        | 0.53306893  |      | 0         | 0       |
| RUTH SUTTON          | 0.01184958  |      | 0         | 0       |
| BURTON VETETO        | 0.05023755  |      | 0         | 0       |
| MARY F. WALSH        | 1.31981374  |      | 0         | 0       |
| WESTWAY              | 0.00000000  |      | 0         | 0       |
| WILLIAMS PARTNERS.   | 3.60342836  |      | 0         | 0       |
| ZIA ENERGY           | 0.00000000  |      | 0         | 0       |
|                      | 99.9999703  |      | 89.89328  | 0.00000 |

Proposed Arrowhead Grayburg Unit  
Fourth Technical Committee Meeting  
Vote Tally  
Based On 12-31-87 Cumulative Oil

Motion: Current oil rate based on average monthly for all of 1988.

| WI Owner             | % CUM OIL   | VOTE    | FOR       | AGAINST      |
|----------------------|-------------|---------|-----------|--------------|
| ABBY CORPORATION     | 0.00000000  |         | 0         | 0            |
| AMERADA HESS         | 1.47909659  | For     | 1.4790965 | 0            |
| AMERICAN EXPLORATION | 3.61343311  | Against | 0         | 3.6134331142 |
| AMOCO PRODUCTION     | 1.40963254  |         | 0         | 0            |
| ARCO OIL & GAS       | 8.18979945  | Against | 0         | 8.189799454  |
| TRUST U/D D BROWN    | 0.09157289  |         | 0         | 0            |
| JOHN BRYANT          | 0.00795184  |         | 0         | 0            |
| JAMES BURR           | 0.01184958  |         | 0         | 0            |
| CHEVRON USA          | 44.63121587 | For     | 44.631215 | 0            |
| CONOCO INC           | 17.02471104 | Against | 0         | 17.024711041 |
| DASCO ENERGY         | 0.53306849  | Abstain | 0         | 0            |
| JAMES DAVIDSON       | 0.37918647  |         | 0         | 0            |
| ENRON                | 0.00000000  |         | 0         | 0            |
| EXXON COMPANY        | 0.16223508  |         | 0         | 0            |
| JACK FLETCHER        | 0.01184973  |         | 0         | 0            |
| HANNIFIN             | 0.00000000  |         | 0         | 0            |
| HANSON OPERATING CO. | 0.00000000  |         | 0         | 0            |
| HANSON-MCBRIDE       | 0.00000000  |         | 0         | 0            |
| DOYLE HARTMAN        | 1.07831153  |         | 0         | 0            |
| MARATHON OIL CO.     | 8.22478945  | For     | 8.2247894 | 0            |
| J H MOORE            | 0.00000000  |         | 0         | 0            |
| JACK MUSSETT         | 0.23130474  |         | 0         | 0            |
| LARRY NERMYR         | 0.02369915  |         | 0         | 0            |
| OXY U.S.A.           | 6.19716926  | For     | 6.1971692 | 0            |
| PARA MIA INC.        | 0.48282901  |         | 0         | 0            |
| PRESIDIO             | 0.18309084  |         | 0         | 0            |
| HAL RASMUSSEN        | 0.51477548  |         | 0         | 0            |
| L. C. SUMMERS        | 0.53306893  |         | 0         | 0            |
| RUTH SUTTON          | 0.01184958  |         | 0         | 0            |
| BURTON VETETO        | 0.05023755  |         | 0         | 0            |
| MARY F. WALSH        | 1.31981374  |         | 0         | 0            |
| WESTWAY              | 0.00000000  |         | 0         | 0            |
| WILLIAMS PARTNERS.   | 3.60342836  |         | 0         | 0            |
| ZIA ENERGY           | 0.00000000  |         | 0         | 0            |
|                      | 99.9999703  |         | 60.53227  | 28.82794     |



Proposed Arrowhead Grayburg Unit  
Fourth Technical Committee Meeting  
Vote Tally  
Based On 12-31-87 Cumulative Oil

Motion: Current Oil rate based on the last-half 1988 average monthly.

| WI Owner             | % CUM OIL   | VOTE    | FOR       | AGAINST     |
|----------------------|-------------|---------|-----------|-------------|
| ABBY CORPORATION     | 0.00000000  |         | 0         | 0           |
| AMERADA HESS         | 1.47909659  | Against | 0         | 1.47909659  |
| AMERICAN EXPLORATION | 3.61343311  | Against | 0         | 3.61343311  |
| AMOCO PRODUCTION     | 1.40963254  |         | 0         | 0           |
| ARCO OIL & GAS       | 8.18979945  | Against | 0         | 8.18979945  |
| TRUST U/D D BROWN    | 0.09157289  |         | 0         | 0           |
| JOHN BRYANT          | 0.00795184  |         | 0         | 0           |
| JAMES BURR           | 0.01184958  |         | 0         | 0           |
| CHEVRON USA          | 44.63121587 | For     | 44.631215 | 0           |
| CONOCO INC           | 17.02471104 | Against | 0         | 17.02471104 |
| DASCO ENERGY         | 0.53306849  | Abstain | 0         | 0           |
| JAMES DAVIDSON       | 0.37918647  |         | 0         | 0           |
| ENRON                | 0.00000000  |         | 0         | 0           |
| EXXON COMPANY        | 0.16223508  |         | 0         | 0           |
| JACK FLETCHER        | 0.01184973  |         | 0         | 0           |
| HANNIFIN             | 0.00000000  |         | 0         | 0           |
| HANSON OPERATING CO. | 0.00000000  |         | 0         | 0           |
| HANSON-MCBRIDE       | 0.00000000  |         | 0         | 0           |
| DOYLE HARTMAN        | 1.07831153  |         | 0         | 0           |
| MARATHON OIL CO.     | 8.22478945  | Against | 0         | 8.22478945  |
| J H MOORE            | 0.00000000  |         | 0         | 0           |
| JACK MUSSETT         | 0.23130474  |         | 0         | 0           |
| LARRY NERMYR         | 0.02369915  |         | 0         | 0           |
| OXY U.S.A.           | 6.19716926  | Against | 0         | 6.19716926  |
| PARA MIA INC.        | 0.48282901  |         | 0         | 0           |
| PRESIDIO             | 0.18309084  |         | 0         | 0           |
| HAL RASMUSSEN        | 0.51477548  |         | 0         | 0           |
| L. C. SUMMERS        | 0.53306893  |         | 0         | 0           |
| RUTH SUTTON          | 0.01184958  |         | 0         | 0           |
| BURTON VETETO        | 0.05023755  |         | 0         | 0           |
| MARY F. WALSH        | 1.31981374  |         | 0         | 0           |
| WESTWAY              | 0.00000000  |         | 0         | 0           |
| WILLIAMS PARTNERS.   | 3.60342836  |         | 0         | 0           |
| ZIA ENERGY           | 0.00000000  |         | 0         | 0           |
|                      | 99.9999703  |         | 44.63122  | 44.72900    |

Proposed Arrowhead Grayburg Unit  
Fourth Technical Committee Meeting  
Vote Tally  
Based On 12-31-87 Cumulative Oil

Motion: Current oil rate based on last quarter 1988 average monthly.

| WI Owner             | % CUM OIL   | VOTE    | FOR       | AGAINST    |
|----------------------|-------------|---------|-----------|------------|
| ABBY CORPORATION     | 0.00000000  |         | 0         | 0          |
| AMERADA HESS         | 1.47909659  | Against | 0         | 1.47909659 |
| AMERICAN EXPLORATION | 3.61343311  | For     | 3.6134331 | 0          |
| AMOCO PRODUCTION     | 1.40963254  |         | 0         | 0          |
| ARCO OIL & GAS       | 8.18979945  | For     | 8.1897994 | 0          |
| TRUST U/D D BROWN    | 0.09157289  |         | 0         | 0          |
| JOHN BRYANT          | 0.00795184  |         | 0         | 0          |
| JAMES BURR           | 0.01184958  |         | 0         | 0          |
| CHEVRON USA          | 44.63121587 | For     | 44.631215 | 0          |
| CONOCO INC           | 17.02471104 | For     | 17.024711 | 0          |
| DASCO ENERGY         | 0.53306849  | Abstain | 0         | 0          |
| JAMES DAVIDSON       | 0.37918647  |         | 0         | 0          |
| ENRON                | 0.00000000  |         | 0         | 0          |
| EXXON COMPANY        | 0.16223508  |         | 0         | 0          |
| JACK FLETCHER        | 0.01184973  |         | 0         | 0          |
| HANNIFIN             | 0.00000000  |         | 0         | 0          |
| HANSON OPERATING CO. | 0.00000000  |         | 0         | 0          |
| HANSON-MCBRIDE       | 0.00000000  |         | 0         | 0          |
| DOYLE HARTMAN        | 1.07831153  |         | 0         | 0          |
| MARATHON OIL CO.     | 8.22478945  | For     | 8.2247894 | 0          |
| J H MOORE            | 0.00000000  |         | 0         | 0          |
| JACK MUSSETT         | 0.23130474  |         | 0         | 0          |
| LARRY NERMYR         | 0.02369915  |         | 0         | 0          |
| OXY U.S.A.           | 6.19716926  | Against | 0         | 6.19716926 |
| PARA MIA INC.        | 0.48282901  |         | 0         | 0          |
| PRESIDIO             | 0.18309084  |         | 0         | 0          |
| HAL RASMUSSEN        | 0.51477548  |         | 0         | 0          |
| L. C. SUMMERS        | 0.53306893  |         | 0         | 0          |
| RUTH SUTTON          | 0.01184958  |         | 0         | 0          |
| BURTON VETETO        | 0.05023755  |         | 0         | 0          |
| MARY F. WALSH        | 1.31981374  |         | 0         | 0          |
| WESTWAY              | 0.00000000  |         | 0         | 0          |
| WILLIAMS PARTNERS.   | 3.60342836  |         | 0         | 0          |
| ZIA ENERGY           | 0.00000000  |         | 0         | 0          |
|                      | 99.9999703  |         | 81.68395  | 7.67627    |

Proposed Arrowhead Grayburg Unit  
Fourth Technical Committee Meeting  
Vote Tally  
Based On 12-31-87 Cumulative Oil

Motion: Current oil rate based on December 1988 production.

| WI Owner             | % CUM OIL   | VOTE    | FOR       | AGAINST    |
|----------------------|-------------|---------|-----------|------------|
| ABBY CORPORATION     | 0.00000000  |         | 0         | 0          |
| AMERADA HESS         | 1.47909659  | For     | 1.4790965 | 0          |
| AMERICAN EXPLORATION | 3.61343311  | For     | 3.6134331 | 0          |
| AMOCO PRODUCTION     | 1.40963254  |         | 0         | 0          |
| ARCO OIL & GAS       | 8.18979945  | For     | 8.1897994 | 0          |
| TRUST U/D D BROWN    | 0.09157289  |         | 0         | 0          |
| JOHN BRYANT          | 0.00795184  |         | 0         | 0          |
| JAMES BURR           | 0.01184958  |         | 0         | 0          |
| CHEVRON USA          | 44.63121587 | For     | 44.631215 | 0          |
| CONOCO INC           | 17.02471104 | Against | 0         | 17.0247110 |
| DASCO ENERGY         | 0.53306849  | Abstain | 0         | 0          |
| JAMES DAVIDSON       | 0.37918647  |         | 0         | 0          |
| ENRON                | 0.00000000  |         | 0         | 0          |
| EXXON COMPANY        | 0.16223508  |         | 0         | 0          |
| JACK FLETCHER        | 0.01184973  |         | 0         | 0          |
| HANNIFIN             | 0.00000000  |         | 0         | 0          |
| HANSON OPERATING CO. | 0.00000000  |         | 0         | 0          |
| HANSON-MCBRIDE       | 0.00000000  |         | 0         | 0          |
| DOYLE HARTMAN        | 1.07831153  |         | 0         | 0          |
| MARATHON OIL CO.     | 8.22478945  | Against | 0         | 8.22478945 |
| J H MOORE            | 0.00000000  |         | 0         | 0          |
| JACK MUSSETT         | 0.23130474  |         | 0         | 0          |
| LARRY NERMYR         | 0.02369915  |         | 0         | 0          |
| OXY U.S.A.           | 6.19716926  | Against | 0         | 6.19716926 |
| PARA MIA INC.        | 0.48282901  |         | 0         | 0          |
| PRESIDIO             | 0.18309084  |         | 0         | 0          |
| HAL RASMUSSEN        | 0.51477548  |         | 0         | 0          |
| L. C. SUMMERS        | 0.53306893  |         | 0         | 0          |
| RUTH SUTTON          | 0.01184958  |         | 0         | 0          |
| BURTON VETETO        | 0.05023755  |         | 0         | 0          |
| MARY F. WALSH        | 1.31981374  |         | 0         | 0          |
| WESTWAY              | 0.00000000  |         | 0         | 0          |
| WILLIAMS PARTNERS.   | 3.60342836  |         | 0         | 0          |
| ZIA ENERGY           | 0.00000000  |         | 0         | 0          |
|                      | 99.9999703  |         | 57.91355  | 31.44667   |

Proposed Arrowhead Grayburg Unit  
Fourth Technical Committee Meeting  
Vote Tally  
Based On 12-31-87 Cumulative Oil

Motion by American Exploration:

Use last quarter average active monthly gas production for  
current gas production rate ( same as current oil).

Seconded by Marathon.

| WI Owner             | % CUM OIL   | VOTE    | FOR       | AGAINST    |
|----------------------|-------------|---------|-----------|------------|
| ABBY CORPORATION     | 0.00000000  |         | 0         | 0          |
| AMERADA HESS         | 1.47909659  | Against | 0         | 1.47909659 |
| AMERICAN EXPLORATION | 3.61343311  | For     | 3.6134331 | 0          |
| AMOCO PRODUCTION     | 1.40963254  |         | 0         | 0          |
| ARCO OIL & GAS       | 8.18979945  | For     | 8.1897994 | 0          |
| TRUST U/D D BROWN    | 0.09157289  |         | 0         | 0          |
| JOHN BRYANT          | 0.00795184  |         | 0         | 0          |
| JAMES BURR           | 0.01184958  |         | 0         | 0          |
| CHEVRON USA          | 44.63121587 | For     | 44.631215 | 0          |
| CONOCO INC           | 17.02471104 | For     | 17.024711 | 0          |
| DASCO ENERGY         | 0.53306849  | Abstain | 0         | 0          |
| JAMES DAVIDSON       | 0.37918647  |         | 0         | 0          |
| ENRON                | 0.00000000  |         | 0         | 0          |
| EXXON COMPANY        | 0.16223508  |         | 0         | 0          |
| JACK FLETCHER        | 0.01184973  |         | 0         | 0          |
| HANNIFIN             | 0.00000000  |         | 0         | 0          |
| HANSON OPERATING CO. | 0.00000000  |         | 0         | 0          |
| HANSON-MCBRIDE       | 0.00000000  |         | 0         | 0          |
| DOYLE HARTMAN        | 1.07831153  |         | 0         | 0          |
| MARATHON OIL CO.     | 8.22478945  | For     | 8.2247894 | 0          |
| J H MOORE            | 0.00000000  |         | 0         | 0          |
| JACK MUSSETT         | 0.23130474  |         | 0         | 0          |
| LARRY NERMYR         | 0.02369915  |         | 0         | 0          |
| OXY U.S.A.           | 6.19716926  | Against | 0         | 6.19716926 |
| PARA MIA INC.        | 0.48282901  |         | 0         | 0          |
| PRESIDIO             | 0.18309084  |         | 0         | 0          |
| HAL RASMUSSEN        | 0.51477548  |         | 0         | 0          |
| L. C. SUMMERS        | 0.53306893  |         | 0         | 0          |
| RUTH SUTTON          | 0.01184958  |         | 0         | 0          |
| BURTON VETETO        | 0.05023755  |         | 0         | 0          |
| MARY F. WALSH        | 1.31981374  |         | 0         | 0          |
| WESTWAY              | 0.00000000  |         | 0         | 0          |
| WILLIAMS PARTNERS.   | 3.60342836  |         | 0         | 0          |
| ZIA ENERGY           | 0.00000000  |         | 0         | 0          |
|                      | 99.9999703  |         | 81.68395  | 7.67627    |

Proposed Arrowhead Grayburg Unit  
Fourth Technical Committee Meeting  
Vote Tally  
Based On 12-31-87 Cumulative Oil

Motion: Establish Remaining Oil & Gas Reserves as Specified on  
the Attached Table.

| WI Owner             | % CUM OIL   | VOTE | FOR       | AGAINST |
|----------------------|-------------|------|-----------|---------|
| ABBY CORPORATION     | 0.00000000  |      | 0         | 0       |
| AMERADA HESS         | 1.47909659  | For  | 1.4790965 | 0       |
| AMERICAN EXPLORATION | 3.61343311  | For  | 3.6134331 | 0       |
| AMOCO PRODUCTION     | 1.40963254  |      | 0         | 0       |
| ARCO OIL & GAS       | 8.18979945  | For  | 8.1897994 | 0       |
| TRUST U/D D BROWN    | 0.09157289  |      | 0         | 0       |
| JOHN BRYANT          | 0.00795184  |      | 0         | 0       |
| JAMES BURR           | 0.01184958  |      | 0         | 0       |
| CHEVRON USA          | 44.63121587 | For  | 44.631215 | 0       |
| CONOCO INC           | 17.02471104 | For  | 17.024711 | 0       |
| DASCO ENERGY         | 0.53306849  |      | 0         | 0       |
| JAMES DAVIDSON       | 0.37918647  |      | 0         | 0       |
| ENRON                | 0.00000000  |      | 0         | 0       |
| EXXON COMPANY        | 0.16223508  |      | 0         | 0       |
| JACK FLETCHER        | 0.01184973  |      | 0         | 0       |
| HANNIFIN             | 0.00000000  |      | 0         | 0       |
| HANSON OPERATING CO. | 0.00000000  |      | 0         | 0       |
| HANSON-MCBRIDE       | 0.00000000  |      | 0         | 0       |
| DOYLE HARTMAN        | 1.07831153  |      | 0         | 0       |
| MARATHON OIL CO.     | 8.22478945  | For  | 8.2247894 | 0       |
| J H MOORE            | 0.00000000  |      | 0         | 0       |
| JACK MUSSETT         | 0.23130474  |      | 0         | 0       |
| LARRY NERMYR         | 0.02369915  |      | 0         | 0       |
| OXY U.S.A.           | 6.19716926  | For  | 6.1971692 | 0       |
| PARA MIA INC.        | 0.48282901  |      | 0         | 0       |
| PRESIDIO             | 0.18309084  |      | 0         | 0       |
| HAL RASMUSSEN        | 0.51477548  |      | 0         | 0       |
| L. C. SUMMERS        | 0.53306893  |      | 0         | 0       |
| RUTH SUTTON          | 0.01184958  |      | 0         | 0       |
| BURTON VETETO        | 0.05023755  |      | 0         | 0       |
| MARY F. WALSH        | 1.31981374  |      | 0         | 0       |
| WESTWAY              | 0.00000000  |      | 0         | 0       |
| WILLIAMS PARTNERS.   | 3.60342836  |      | 0         | 0       |
| ZIA ENERGY           | 0.00000000  |      | 0         | 0       |
|                      | 99.9999703  |      | 89.36021  | 0.00000 |

Proposed Arrowhead Grayburg Unit  
Remaining Reserves

| TRACT      | IP<br>(12-88) | E.L.  | DECLINE<br>FACTOR | REMAINING<br>OIL<br>RESERVES | 1988<br>GOR<br>(MCF/BO) | REMAINING<br>GAS<br>RESERVES |
|------------|---------------|-------|-------------------|------------------------------|-------------------------|------------------------------|
| =====      | =====         | ===== | =====             | =====                        | =====                   | =====                        |
| 1          | 0             | 0     | 0.0000            | 0                            | 0                       | 0                            |
| 2          | 4160          | 227   | 0.0630            | 749,143                      | 3.223                   | 2,414,487                    |
| 3          | 647           | 52    | 0.1258            | 56,757                       | 1.643                   | 93,251                       |
| 4          | 0             | 0     | 0.0000            | 0                            | 0                       | 0                            |
| 5          | 112           | 30    | 0.1674            | 5,878                        | 10.160                  | 59,722                       |
| * 6        | 987           | 433   | 0.0806            | 3,190                        | 25.853                  | 82,481                       |
| 7          | 160           | 56    | 0.0519            | 24,046                       | 11.566                  | 278,119                      |
| 8A UPPER   | 62            | 43    | 0.1094            | 2,084                        | 4.013                   | 8,363                        |
| * 8A LOWER | 6461          | 575   | 0.1362            | 2,291                        | 226.398                 | 518,590                      |
| 8B         | 929           | 55    | 0.0589            | 178,065                      | 0.999                   | 177,886                      |
| 9          | 1117          | 51    | 0.1061            | 120,566                      | 1.673                   | 201,706                      |
| 10         | 0             | 0     | 0.0000            | 0                            | 0                       | 0                            |
| 11         | 302           | 52    | 0.1392            | 21,552                       | 1.497                   | 32,263                       |
| 12         | 614           | 94    | 0.0483            | 129,193                      | 2.732                   | 352,954                      |
| 13         | 300           | 36    | 0.0596            | 53,154                       | 6.665                   | 354,274                      |
| 14         | 306           | 52    | 0.1118            | 27,263                       | 1.561                   | 42,557                       |
| 15         | 9669          | 368   | 0.0690            | 1,617,565                    | 3.030                   | 4,901,223                    |
| 16         | 2147          | 269   | 0.1217            | 185,177                      | 7.853                   | 1,454,192                    |
| 17         | 7496          | 329   | 0.0657            | 1,309,041                    | 2.763                   | 3,616,881                    |
| 18         | 0             | 0     | 0.0000            | 0                            | 0                       | 0                            |
| 19         | 0             | 0     | 0.0000            | 0                            | 0                       | 0                            |
| 20         | 0             | 0     | 0.0000            | 0                            | 0                       | 0                            |
| * 21       | 2228          | 912   | 0.0730            | 6,820                        | 31.721                  | 216,329                      |
| 22         | 4036          | 630   | 0.0590            | 692,746                      | 1.421                   | 984,392                      |
| 23         | 0             | 0     | 0.0000            | 0                            | 0                       | 0                            |
| 24         | 0             | 0     | 0.0000            | 0                            | 0                       | 0                            |
| 25         | 0             | 0     | 0.0000            | 0                            | 0                       | 0                            |
| 26         | 134           | 34    | 0.0264            | 45,455                       | 7.752                   | 352,364                      |
|            |               |       |                   | =====                        |                         | =====                        |
| TOTAL      |               |       |                   | 5,229,984                    |                         | 16,142,035                   |

\* Denotes Tracts based on Gas Decline

# Evidence of Communication Between San Andres & Grayburg

- **1996 Chevron paper "Utilization of Geological Mapping Techniques to Track Scaling Tendencies in the Eunice Monument South Unit Waterflood, Lea County, New Mexico"**

During the time of primary production prior to unitization and initiating the waterflood in the Eunice Monument field, barium sulfate scale deposition was experienced in a number of producing wells. Although the drilling was confined to the Penrose and Grayburg formations, apparently some **San Andres water was finding its way into the wellbore of these wells** and resulted in a barium sulfate scale, barite, deposition problem.

Technical Committee Report  
Proposed Arrowhead Grayburg  
Lea County, New Mexico



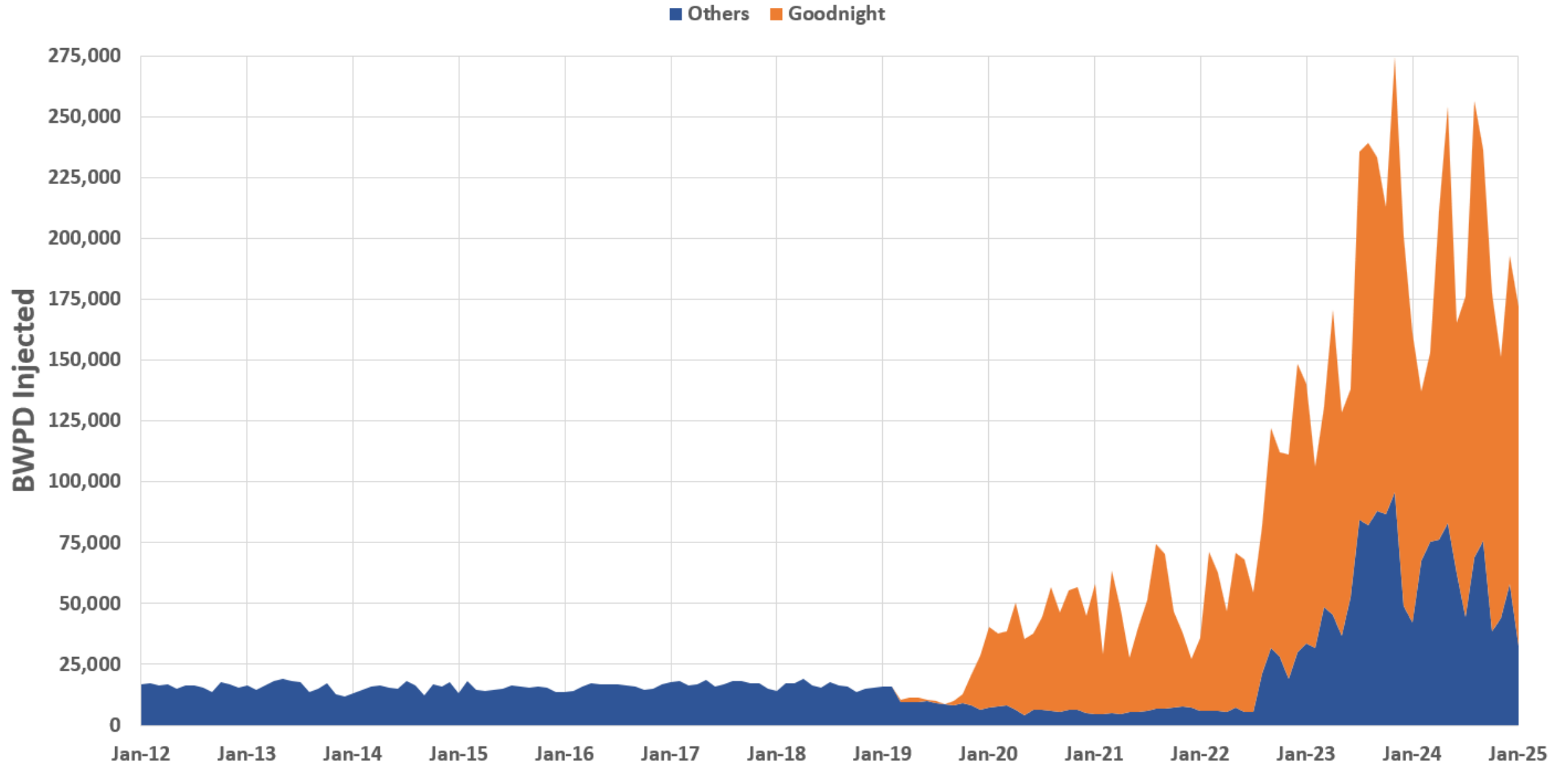
Although the Arrowhead Pool has produced a significant volume of water, which could indicate a water-drive type recovery, **solution gas drive** is believed to be the predominant recovery mechanism. This conclusion is based on the pressure depletion of the pool and on the lack of an identifiable water production trend.

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A portion of the water production is probably attributable to communication of Zones 4 and 5 with the Lower Grayburg and San Andres aquifers. Although siliciclastics between each zone generally prevent vertical communication, in some localized areas of the field they do not act as permeability barriers. When the barriers break down in the lower Grayburg members, the prolific San Andres aquifer can influx into the oil productive horizons resulting in large volumes of water production.



## Total Disposal Volumes inside EMSU & Within 1 Mile



# Empire Exhibit N-28

## San Andres Water Balance - Includes SWD Wells Within 1 mile of EMSU and 5 Application SWD's

