BEFORE THE
OIL CONSERVATION DIVISION
Santa Fe, New Mexico

Case Nos. 10869 and 10881 Exhibit No. 1

Submitted by: Yates Petroleum Corporation

Hearing Date: December 2, 1993

BEFORE THE

OIL CONSERVATION DIVISION

NEW MEXICO DEPARTMENT OF ENERGY, MINERALS AND NATURAL RESOURCES

IN THE MATTER OF THE APPLICATION
OF YATES PETROLEUM CORPORATION
FOR AMENDMENT OF THE SPECIAL
RULES AND REGULATIONS OF THE SOUTH
DAGGER DRAW-UPPER PENNSYLVANIAN
ASSOCIATED POOL (DIVISION ORDER NO. R-5353),
EDDY COUNTY, NEW MEXICO. CASE NO. 10869

AFFIDAVIT

STATE OF NEW MEXICO)
) ss.
COUNTY OF SANTA FE)

William F. Carr, attorney in fact and authorized representative of Yates Petroleum Corporation, the Applicant herein, being first duly sworn, upon oath, states that in accordance with the notice provisions of Rule 1207 of the New Mexico Oil Conservation Division the Applicant has attempted to find the correct addresses of all interested persons entitled to receive notice of this application and that notice has been given at the addresses shown on Exhibit "A" attached hereto as provided in Rule 1207.

William F. Carr

William F. Carr

SUBSCRIBED AND SWORN to before me this 1st day of December, 1993.

Notary Public

My Commission Expires:

August 19, 1995

EXHIBIT A

Clifford Cone
Post Office Box 1629
Lovington, NM 88260

Kenneth G. Cone
Post Office Box 11310
Midland, TX 79702

D.C. Trust
Marilyn Cone, Trustee
Post Office Box 64244
Lubbock, TX 79464

Cathie Cone Auvenshine
Post Office Box 658
Dripping Springs, TX 78620-0658

McKay Oil Corporation
Post Office Box 2014
Roswell, NM 88201

Nearburg Producing Company
2200 North "A" Street, #8100
Midland, TX 79705-5421

Conoco Inc.
10 Desta Drive West
Midland, TX 79705

Marathon Oil Company
Post Office Box 552
Midland, TX 79702

Read & Stevens, Inc.
Post Office Box 1518
Roswell, NM 88202-1518

BEFORE THE
OIL CONSERVATION DIVISION
Santa Fe, New Mexico

Case Nos. 10869 and 10881 Exhibit No. 1

Submitted by: Yates Petroleum Corporation

Hearing Date: December 2, 1993

Citation Oil & Gas Corporation
8223 Willow Place South, Suite 250
Houston, TX 77070-5623

Barbara Fasken
303 W. Wall Avenue, Suite 1900
Midland, TX 79701-5116

CAMPBELL, CARR, BERGE
& SHERIDAN, P.A.
LAWYERS

MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C. BERGE
MARK F. SHERIDAN
WILLIAM P. SLATTERY

PATRICIA A. MATTHEWS
MICHAEL H. FELDEWERT
DAVID B. LAWRENZ
TANYA M. TRUJILLO

JACK M. CAMPBELL
OF COUNSEL

JEFFERSON PLACE
SUITE 1 - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

October 28, 1993

CERTIFIED MAIL -
RETURN RECEIPT REQUESTED

Clifford Cone
Post Office Box 1629
Lovington, NM 88260

Re: Application of Yates Petroleum Corporation for Amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool, Eddy County, New Mexico

Dear Mr. Cone:

This letter is to advise you that Yates Petroleum Corporation has filed the enclosed application with the New Mexico Oil Conservation Division seeking amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool by deletion of Rule 5(b) thereby authorizing the simultaneous dedication of both gas wells and oil wells to the same spacing unit.

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Parties appearing in cases have been requested by the Division (Memorandum 2-90) to file a Pre-hearing Statement substantially in the form prescribed by the Division. Pre-hearing statements should be filed by 4:00 o'clock p.m., on the Friday before a scheduled hearing.

Very truly yours,

William F. Carr

WILLIAM F. CARR
ATTORNEY FOR YATES PETROLEUM CORPORATION
WFC:mlh
Enclosure

SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.
Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.

1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*
2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to: Clifford Cone Post Office Box 1629 Lovington, NM 88260	4. Article Number P 176 017 070 Type of Service: ☐ Registered ☐ Insured ☒ Certified ☐ COD ☐ Express Mail ☒ Return Receipt for Merchandise Always obtain signature of addressee or agent and DATE DELIVERED.
5. Signature — Address X Bobbie Linford	8. Addressee's Address *(ONLY if requested and fee paid)*
6. Signature — Agent X	
7. Date of Delivery 11-1-93	

PS Form **3811**, Mar. 1988 ★ U.S.G.P.O. 1988-212-865 **DOMESTIC RETURN RECEIPT**

P 176 017 070

Receipt for Certified Mail
No Insurance Coverage P...

Clifford Cone
Post Office Box 1629
Lovington, NM 88260

Posta...	$
Cert...	
Spec...	
Rest...	
Retur... to W...	
Retu... Date...	
TOTA... & Fee...	$
Postm... or Date	

October 28, 1993

PS Form **3800**, June 1991

P 176 017 071

Receipt for
Certified Mail
No Insurance Coverage Provided

Kenneth G. Cone
Post Office Box 11310
Midland, TX 79702

Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, and Addressee's Address	
TOTAL Postage & Fees	$
Postmark or Date	October 28, 1993

PS Form 3800, June 1991

SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.
Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.
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2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to:

Kenneth G. Cone
Post Office Box 11310
Midland, TX 79702

4. Article Number
P176 017 071

Type of Service:
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☒ Return Receipt for Merchandise

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature – Address
X

6. Signature – Agent
X
R Shapiro

7. Date of Delivery
NOV - 1 1993

8. Addressee's Address *(ONLY if requested and fee paid)*

PS Form 3811, Mar. 1988 ★ U.S.G.P.O. 1988-212-865 DOMESTIC RETURN RECEIPT

CAMPBELL, CARR, BERGE
& SHERIDAN, P.A.
LAWYERS

MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C. BERGE
MARK F. SHERIDAN
WILLIAM P. SLATTERY

PATRICIA A. MATTHEWS
MICHAEL H. FELDEWERT
DAVID B. LAWRENZ
TANYA M. TRUJILLO

JACK M. CAMPBELL
OF COUNSEL

JEFFERSON PLACE
SUITE I - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

October 28, 1993

CERTIFIED MAIL -
RETURN RECEIPT REQUESTED

D.C. Trust
Marilyn Cone, Trustee
Post Office Box 64244
Lubbock, TX 79464

Re: Application of Yates Petroleum Corporation for Amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool, Eddy County, New Mexico

Dear Ms Cone:

This letter is to advise you that Yates Petroleum Corporation has filed the enclosed application with the New Mexico Oil Conservation Division seeking amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool by deletion of Rule 5(b) thereby authorizing the simultaneous dedication of both gas wells and oil wells to the same spacing unit.

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Parties appearing in cases have been requested by the Division (Memorandum 2-90) to file a Pre-hearing Statement substantially in the form prescribed by the Division. Pre-hearing statements should be filed by 4:00 o'clock p.m., on the Friday before a scheduled hearing.

Very truly yours,

William F. Carr

WILLIAM F. CARR
ATTORNEY FOR YATES PETROLEUM CORPORATION
WFC:mlh

SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.
Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.

1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*
2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to:

D.C. Trust
Marilyn Cone, Trustee
Post Office Box 64244
Lubbock, TX 79464

4. Article Number
P176 017 072

Type of Service:
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☒ Return Receipt for Merchandise

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature — Address
X [signature]

6. Signature — Agent
X

7. Date of Delivery

8. Addressee's Address *(ONLY if requested and fee paid)*

NOV 1993 USPO

PS Form 3811, Mar. 1988 ★ U.S.G.P.O. 1988-212-865 DOMESTIC RETURN RECEIPT

P 176 017 072

Receipt for Certified Mail
No Insurance Coverage Provided

D.C. Trust
Marilyn Cone, Trustee
Post Office Box 64244
Lubbock, TX 79464

Postage	$
Certified	
Special	
Restricted	
Return to Whom	
Return Date,	
TOTAL & Fees	$
Postmark Date	

October 27, 1993

PS Form 3800, June 1991

CAMPBELL, CARR, BERGE
& SHERIDAN, P.A.
LAWYERS

MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C. BERGE
MARK F. SHERIDAN
WILLIAM P. SLATTERY

PATRICIA A. MATTHEWS
MICHAEL H. FELDEWERT
DAVID B. LAWRENZ
TANYA M. TRUJILLO

JACK M. CAMPBELL
OF COUNSEL

JEFFERSON PLACE
SUITE 1 - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

October 28, 1993

CERTIFIED MAIL -
RETURN RECEIPT REQUESTED

Kenneth G. Cone
Post Office Box 11310
Midland, TX 79702

Re: Application of Yates Petroleum Corporation for Amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool, Eddy County, New Mexico

Dear Mr. Cone:

This letter is to advise you that Yates Petroleum Corporation has filed the enclosed application with the New Mexico Oil Conservation Division seeking amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool by deletion of Rule 5(b) thereby authorizing the simultaneous dedication of both gas wells and oil wells to the same spacing unit.

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Very truly yours,

WILLIAM F. CARR
ATTORNEY FOR YATES PETROLEUM CORPORATION
WFC:mlh
Enclosure

CAMPBELL, CARR, BERGE
& SHERIDAN, P.A.
LAWYERS

MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C. BERGE
MARK F. SHERIDAN
WILLIAM P. SLATTERY

PATRICIA A. MATTHEWS
MICHAEL H. FELDEWERT
DAVID B. LAWRENZ
TANYA M. TRUJILLO

JACK M. CAMPBELL
OF COUNSEL

JEFFERSON PLACE
SUITE 1 - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

October 28, 1993

CERTIFIED MAIL -
RETURN RECEIPT REQUESTED

Cathie Cone Auvenshine
Post Office Box 658
Dripping Springs, TX 78620-0658

Re: Application of Yates Petroleum Corporation for Amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool, Eddy County, New Mexico

Dear Ms Cone:

This letter is to advise you that Yates Petroleum Corporation has filed the enclosed application with the New Mexico Oil Conservation Division seeking amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool by deletion of Rule 5(b) thereby authorizing the simultaneous dedication of both gas wells and oil wells to the same spacing unit.

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Very truly yours,

WILLIAM F. CARR
ATTORNEY FOR YATES PETROLEUM CORPORATION
WFC:mlh
Enclosure

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Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.

1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*
2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to: Cathie Cone Auvenshine Post Office Box 658 Dripping Springs, TX 78620-0658	4. Article Number P 176 017 073 Type of Service: ☐ Registered ☐ Insured ☒ Certified ☐ COD ☐ Express Mail ☒ Return Receipt for Merchandise Always obtain signature of addressee or agent and DATE DELIVERED.
5. Signature — Address X Jeff Auvenshine	8. Addressee's Address (ONLY if requested and fee paid)
6. Signature — Agent X	DRIPPING SPRINGS 78620 1993 USPS
7. Date of Delivery	

PS Form 3811, Mar. 1988 ★ U.S.G.P.O. 1988-212-865 **DOMESTIC RETURN RECEIPT**

P 176 017 073

Receipt for Certified Mail
No Insurance Coverage Provided

Cathie Cone Auvenshine
Post Office Box 658
Dripping Springs, TX 78620-0658

Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, and Address	
TOTAL Postage & Fees	$
Postmark or Date October 28, 1993	

PS Form 3800, June 1991

CAMPBELL, CARR, BERGE
& SHERIDAN, P.A.
LAWYERS

MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C. BERGE
MARK F. SHERIDAN
WILLIAM P. SLATTERY

PATRICIA A. MATTHEWS
MICHAEL H. FELDEWERT
DAVID B. LAWRENZ
TANYA M. TRUJILLO

JACK M. CAMPBELL
OF COUNSEL

JEFFERSON PLACE
SUITE 1 - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

October 28, 1993

CERTIFIED MAIL -
RETURN RECEIPT REQUESTED

McKay Oil Corporation
Post Office Box 2014
Roswell, NM 88201

Re: Application of Yates Petroleum Corporation for Amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool, Eddy County, New Mexico

Gentlemen:

This letter is to advise you that Yates Petroleum Corporation has filed the enclosed application with the New Mexico Oil Conservation Division seeking amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool by deletion of Rule 5(b) thereby authorizing the simultaneous dedication of both gas wells and oil wells to the same spacing unit.

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Very truly yours,

William F. Carr

WILLIAM F. CARR
ATTORNEY FOR YATES PETROLEUM CORPORATION
WFC:mlh
Enclosure

P 176 017 074

Receipt for Certified Mail
No Insurance Coverage Provided

McKay Oil Corporation
Post Office Box 2014
Roswell, NM 88201

Postage		$
Certified Fee		
Special Delivery Fee		
Restricted Delivery Fee		
Return Receipt Showing to Whom & Date Delivered		
Return Receipt Showing to Whom, Date, and Addressee's Address		
TOTAL Postage & Fees		$
Postmark or Date	October 28, 1993	

PS Form 3800, June 1991

SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.
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1. ☐ Show to whom delivered, date, and addressee's address. (Extra charge)
2. ☐ Restricted Delivery (Extra charge)

3. Article Addressed to:
McKay Oil Corporation
Post Office Box 2014
Roswell, NM 88201

4. Article Number
P176 017 074

Type of Service:
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☒ Return Receipt for Merchandise

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature – Address
X

6. Signature – Agent
X

7. Date of Delivery

8. Addressee's Address (ONLY if requested and fee paid)

1993
88201

PS Form 3811, Mar. 1988 * U.S.G.P.O. 1988-212-865 DOMESTIC RETURN RECEIPT

CAMPBELL, CARR, BERGE
& SHERIDAN, P.A.
LAWYERS

MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C. BERGE
MARK F. SHERIDAN
WILLIAM P. SLATTERY

PATRICIA A. MATTHEWS
MICHAEL H. FELDEWERT
DAVID B. LAWRENZ
TANYA M. TRUJILLO

JACK M. CAMPBELL
OF COUNSEL

JEFFERSON PLACE
SUITE 1 - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

October 28, 1993

CERTIFIED MAIL -
RETURN RECEIPT REQUESTED

Nearburg Producing Company
2200 North "A" Street, #8100
Midland, TX 79705-5421

Re: Application of Yates Petroleum Corporation for Amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool, Eddy County, New Mexico

Gentlemen:

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Very truly yours,

William F. Carr

WILLIAM F. CARR
ATTORNEY FOR YATES PETROLEUM CORPORATION
WFC:mlh
Enclosure

P 176 017 075

eceipt f
rtified Ma
Insuranc   age Provid

Nearburg Producing Company
2200 North "A" Street, #8100
Midland, TX 79705-5421

Postage		$
Certified Fee		
Special De		
Restricted De		
Return Rece to Whom &		
Return Rece Date, and A		
TOTAL Posta & Fees		$

Postmark or

October 28, 1993

PS Form 3800, June 1991

● SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.
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1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*
2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to:

Nearburg Producing Company
2200 North "A" Street, #8100
Midland, TX 79705-5421

4. Article Number
P176 017 075

Type of Service:
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☒ Return Receipt for Merchandise

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature – Address
X

6. Signature – Agent
X [signature]

7. Date of Delivery
11-1-93

8. Addressee's Address *(ONLY if requested and fee paid)*

PS Form 3811, Mar. 1988 * U.S.G.P.O. 1988-212-865 DOMESTIC RETURN RECEIPT

CAMPBELL, CARR, BERGE
& SHERIDAN, P.A.
LAWYERS

MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C. BERGE
MARK F. SHERIDAN
WILLIAM P. SLATTERY

PATRICIA A. MATTHEWS
MICHAEL H. FELDEWERT
DAVID B. LAWRENZ
TANYA M. TRUJILLO

JACK M. CAMPBELL
OF COUNSEL

JEFFERSON PLACE
SUITE 1 - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

October 28, 1993

CERTIFIED MAIL -
RETURN RECEIPT REQUESTED

Conoco Inc.
10 Desta Drive West
Midland, TX 79705

Re: Application of Yates Petroleum Corporation for Amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool, Eddy County, New Mexico

Gentlemen:

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Very truly yours,

William F. Carr

WILLIAM F. CARR
ATTORNEY FOR YATES PETROLEUM CORPORATION
WFC:mlh
Enclosure

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2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to:

Conoco Inc.
10 Desta Drive West
Midland, TX 79705

4. Article Number
P 176 017 076

Type of Service:
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☒ Return Receipt for Merchandise

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature — Address
X

6. Signature — Agent
X A. Gonzales

7. Date of Delivery

8. Addressee's Address (ONLY if requested and fee paid)

MIDLAND, TX ... DESTA STA. ... NOV 1 1993 ... USPS

PS Form 3811, Mar. 1988 ★ U.S.G.P.O. 1988-212-865 DOMESTIC RETURN RECEIPT

P 176 017 076

Receipt for
Certified Mail
No Insurance Coverage Provided

Conoco Inc.
10 Desta Drive West
Midland, TX 79705

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TOTAL Postage & Fees	$
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October 28, 1993

PS Form 3800, June 1991

CAMPBELL, CARR, BERGE
& SHERIDAN, P.A.
LAWYERS

MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C BERGE
MARK F SHERIDAN
WILLIAM P. SLATTERY

PATRICIA A. MATTHEWS
MICHAEL H. FELDEWERT
DAVID B. LAWRENZ
TANYA M. TRUJILLO

JACK M. CAMPBELL
OF COUNSEL

JEFFERSON PLACE
SUITE I - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

October 28, 1993

CERTIFIED MAIL -
RETURN RECEIPT REQUESTED

Marathon Oil Company
Post Office Box 552
Midland, TX 79702

Re: Application of Yates Petroleum Corporation for Amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool, Eddy County, New Mexico

Gentlemen:

This letter is to advise you that Yates Petroleum Corporation has filed the enclosed application with the New Mexico Oil Conservation Division seeking amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool by deletion of Rule 5(b) thereby authorizing the simultaneous dedication of both gas wells and oil wells to the same spacing unit.

This application has been set for hearing before an Examiner of the Oil Conservation Division on December 2, 1993. As the operator of a well within this pool, or the operator of a well in the Upper Pennsylvanian formation within a mile of the pool, or an unleased mineral owner in the South Dagger Draw-Upper Pennsylvanian Pool, you may appear and present testimony. Failure to appear at that time or otherwise become a party of record will prevent you from challenging this application at a later date.

Parties appearing in cases have been requested by the Division (Memorandum 2-90) to file a Pre-hearing Statement substantially in the form prescribed by the Division. Pre-hearing statements should be filed by 4:00 o'clock p.m., on the Friday before a scheduled hearing.

Very truly yours,

William F. Carr

WILLIAM F. CARR
ATTORNEY FOR YATES PETROLEUM CORPORATION
WFC:mlh
Enclosure

SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.
Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.

1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*
2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to:

Marathon Oil Company
Post Office Box 552
Midland, TX 79702

4. Article Number
P176 017 077

Type of Service:
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☒ Return Receipt for Merchandise

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature — Address
X

6. Signature — Agent

7. Date of Delivery
NOV - 1 1993

8. Addressee's Address *(ONLY if requested and fee paid)*

PS Form **3811**, Mar. 1988 ★ U.S.G.P.O. 1988-212-865 **DOMESTIC RETURN RECEIPT**

P 176 017 077

Receipt for
Certified Mail
No Insurance Coverage Provided

Marathon Oil Company
Post Office Box 552
Midland, TX 79702

Postage		$
Certified Fee		
Special Delivery Fee		
Restricted Delivery Fee		
Return Receipt Showing to Whom & Date Delivered		
Return Receipt Showing to Whom, Date, and Addressee's Address		
TOTAL Postage & Fees		$
Postmark or Date		

October 28, 1993

PS Form **3800**, June 1991

CAMPBELL, CARR, BERGE
& SHERIDAN, P.A.
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POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

October 28, 1993

CERTIFIED MAIL -
RETURN RECEIPT REQUESTED

Read & Stevens, Inc.
Post Office Box 1518
Roswell, NM 88202-1518

Re: Application of Yates Petroleum Corporation for Amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool, Eddy County, New Mexico

Gentlemen:

This letter is to advise you that Yates Petroleum Corporation has filed the enclosed application with the New Mexico Oil Conservation Division seeking amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool by deletion of Rule 5(b) thereby authorizing the simultaneous dedication of both gas wells and oil wells to the same spacing unit.

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Very truly yours,

William F. Carr

WILLIAM F. CARR
ATTORNEY FOR YATES PETROLEUM CORPORATION
WFC:mlh
Enclosure

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1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*
2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to: Read & Stevens, Inc. Post Office Box 1518 Roswell, NM 88202-1518	**4. Article Number** P 176 017 090 **Type of Service:** ☐ Registered ☐ Insured ☒ Certified ☐ COD ☐ Express Mail ☒ Return Receipt for Merchandise **Always obtain signature of addressee or agent and DATE DELIVERED.**
5. Signature — Address X	**8. Addressee's Address** *(ONLY if requested and fee paid)*
6. Signature — Agent Rose	NOV 1993
7. Date of Delivery	

PS Form 3811, Mar. 1988 ★ **U.S.G.P.O. 1988–212–865** **DOMESTIC RETURN RECEIPT**

P 176 017 090

Receipt for Certified Mail
No Insurance Coverage Provided

Read & Stevens, Inc.
Post Office Box 1518
Roswell, NM 88202-1518

Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, and Addressee's Address	
TOTAL Postage & Fees	$
Postmark or Date	October 28, 1993

PS Form 3800, June 1991

CAMPBELL, CARR, BERGE
& SHERIDAN, P.A.
LAWYERS

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OF COUNSEL

JEFFERSON PLACE
SUITE 1 - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

October 28, 1993

CERTIFIED MAIL -
RETURN RECEIPT REQUESTED

Citation Oil & Gas Corporation
8223 Willow Place South, Suite 250
Houston, TX 77070-5623

Re: Application of Yates Petroleum Corporation for Amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool, Eddy County, New Mexico

Gentlemen:

This letter is to advise you that Yates Petroleum Corporation has filed the enclosed application with the New Mexico Oil Conservation Division seeking amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool by deletion of Rule 5(b) thereby authorizing the simultaneous dedication of both gas wells and oil wells to the same spacing unit.

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Very truly yours,

William F. Carr

WILLIAM F. CARR
ATTORNEY FOR YATES PETROLEUM CORPORATION
WFC:mlh
Enclosure

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1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*
2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to:

Citation Oil & Gas Corporation
8223 Willow Place South, Suite 250
Houston, TX 77070-5623

4. Article Number
P 176 017 091

Type of Service:
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☒ Return Receipt for Merchandise

84

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature – Address
X

6. Signature – Agent
X R. Perry

7. Date of Delivery

8. Addressee's Address *(ONLY if requested and fee paid)*

PS Form 3811, Mar. 1988 ★ U.S.G.P.O. 1988-212-865 DOMESTIC RETURN RECEIPT

P 176 017 091

Receipt for Certified Mail
No Insurance Coverage Provided

Citation Oil & Gas Corporation
8223 Willow Place South, Suite 250
Houston, TX 77070-5623

Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
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TOTAL Postage & Fees	$
Postmark or Date	

October 28, 1993

PS Form 3800, June 1991

CAMPBELL, CARR, BERGE
& SHERIDAN, P.A.
LAWYERS

MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C. BERGE
MARK F. SHERIDAN
WILLIAM P SLATTERY

PATRICIA A. MATTHEWS
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DAVID B LAWRENZ
TANYA M TRUJILLO

JACK M. CAMPBELL
OF COUNSEL

JEFFERSON PLACE
SUITE 1 - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

October 28, 1993

CERTIFIED MAIL -
RETURN RECEIPT REQUESTED

Barbara Fasken
303 W. Wall Avenue, Suite 1900
Midland, TX 79701-5116

Re: Application of Yates Petroleum Corporation for Amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool, Eddy County, New Mexico

Dear Ms Fasken:

This letter is to advise you that Yates Petroleum Corporation has filed the enclosed application with the New Mexico Oil Conservation Division seeking amendment of the Special Rules and Regulations for the South Dagger Draw-Upper Pennsylvanian Pool by deletion of Rule 5(b) thereby authorizing the simultaneous dedication of both gas wells and oil wells to the same spacing unit.

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Very truly yours,

William F. Carr

WILLIAM F. CARR
ATTORNEY FOR YATES PETROLEUM CORPORATION
WFC:mlh
Enclosure

SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.

Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.

1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*
2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to: Barbara Fasken 303 W. Wall Avenue, Suite 1900 Midland, TX 79701-5116	4. Article Number P176 017 092
	Type of Service: ☐ Registered ☐ Insured ☒ Certified ☐ COD ☐ Express Mail ☒ Return Receipt for Merchandise
	Always obtain signature of addressee or agent and DATE DELIVERED.
5. Signature — Address X	8. Addressee's Address *(ONLY if requested and fee paid)*
6. Signature — Agent X W Hopkins	
7. Date of Delivery 11-1-93	

PS Form **3811**, Mar. 1988 ★ U.S.G.P.O. 1988-212-865 DOMESTIC RETURN RECEIPT

P 176 017 092

Receipt for
Certified Mail
No Insurance Coverage Provided

Barbara Fasken
303 W. Wall Avenue, Suite 1900
Midland, TX 79701-5116

Postage		$
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Special Delivery Fee		
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Return Receipt Showing to Whom & Date Delivered		
Return Receipt Showing to Whom, Date, and Addressee's Address		
TOTAL Postage & Fees		$
Postmark or Date		

October 28, 1993

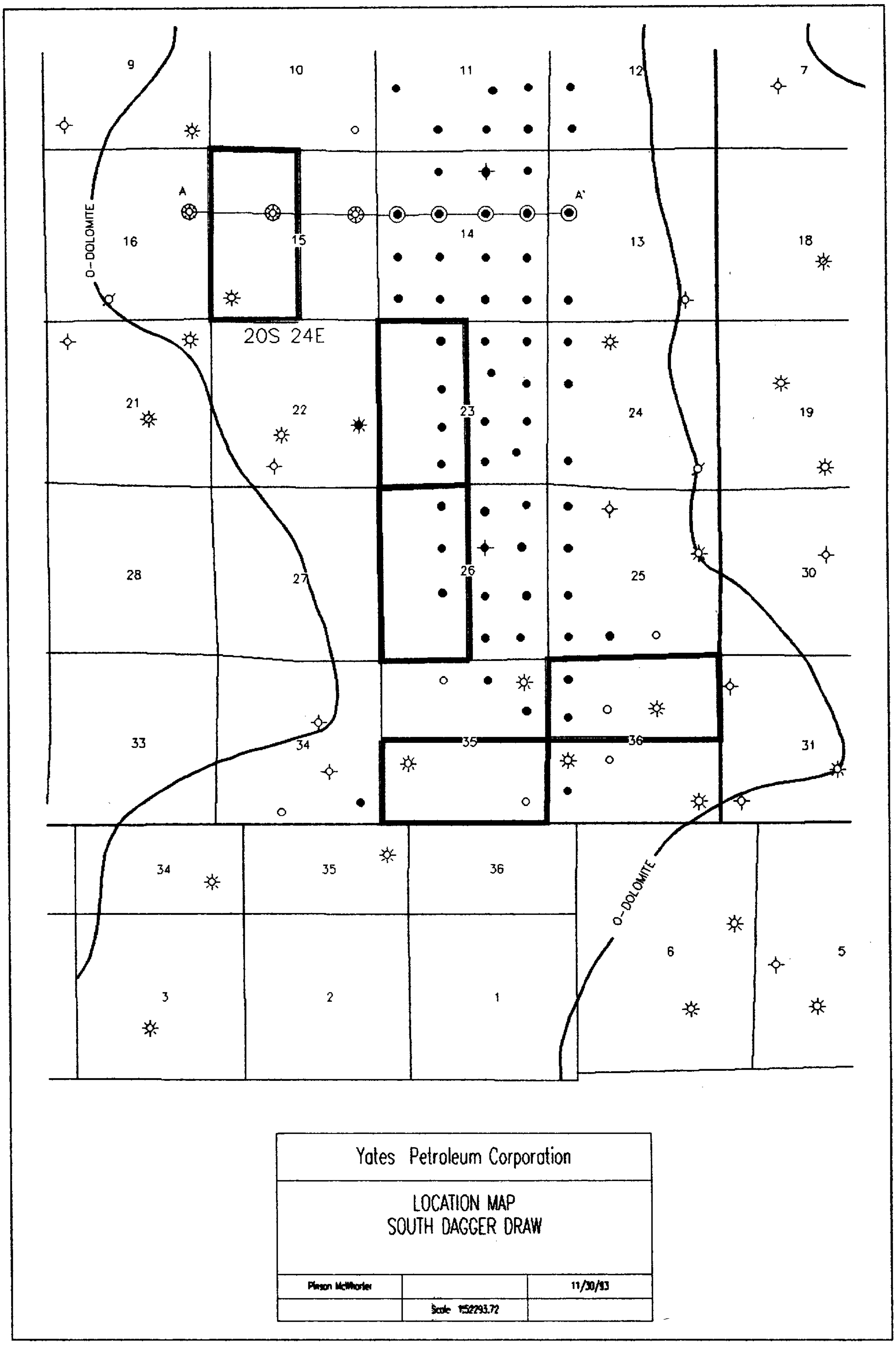
PS Form **3800**, June 1991

BEFORE THE
OIL CONSERVATION DIVISION
Santa Fe, New Mexico

Case Nos. 10869 and 10881 Exhibit No. 1

Submitted by: Yates Petroleum Corporation

Hearing Date: December 2, 1993



BEFORE THE
OIL CONSERVATION DIVISION
Santa Fe, New Mexico

Case Nos. 10869 and 10881 Exhibit No. 2

Submitted by: Yates Petroleum Corporation

Hearing Date: December 2, 1993

BEFORE THE
OIL CONSERVATION DIVISION
Santa Fe, New Mexico

Case Nos. 10869 and 10881 Exhibit No. 3

Submitted by: Yates Petroleum Corporation

Hearing Date: December 2, 1993

South Dagger Draw

Oil Well GOR

	Well Name	Location	PRODUCTION July, 1993 Oil	Gas	August, 1993 Oil	Gas	September, 1993 Oil	Gas	GAS-OIL RATIO Jul-93 Scf/Bbl	Aug-93 Scf/Bbl	Sep-93 Scf/Bbl
1	Saguaro AGS Federal Com #10	C 26-20S-24E	1848	37347	894	31732	1570	27559	20,209	35,494	17,554
2	Charolette McKay Federal Com #2	D 25-20S-24E	2084	37778	2668	37818	2701	36145	18,128	14,175	13,382
3	Ceniza AGZ Com #2	M 12-20S-24E	125	1733	107	1308	117	1144	13,864	12,224	9,778
4	Indian Hills State Com #3	D 36-20S-24E	1884	21725	755	15562	1865	29732	11,531	20,612	15,942
5	Conoco AGK Federal #9	P 26-20S-24E	4433	47141	4475	49358	3956	46002	10,634	11,030	11,628
6	Hillview AHE Federal Com #6	B 23-20S-24E	607	6054	555	6482	486	5958	9,974	11,679	12,259
7	Saguaro AGS Federal Com #5	F 23-20S-24E	1603	15971	1589	15631	1599	15081	9,963	9,837	9,432
8	Hillview AHE Federal Com #5	A 23-20S-24E	1422	13582	1117	14477	992	11048	9,551	12,961	11,137
9	John AGU #7	E 14-20S-24E	1359	12465	1186	17996	1069	14643	9,172	15,174	13,698
10	Saguaro AGS Federal Com #1	L 11-20S-24E	1220	10663	1150	10504	1063	8818	8,740	9,134	8,295
11	Sara AHA Com #4	O 11-20S-24E	922	7638	912	7451	816	6525	8,284	8,170	7,996
12	Dahlia ALA Com #1	L 25-20S-24E	2167	16590	1982	15529	1790	13554	7,656	7,835	7,572
13	Indian Hills State Com #4	E 36-20S-24E	2827	20682	3021	22706	3175	25132	7,316	7,516	7,916
14	Conoco AGK Federal Com #10	J 11-20S-24E	920	6479	854	7054	804	6104	7,042	8,260	7,592
15	Hillview AHE Federal #8	P 14-20S-24E	747	5060	725	4764	500	4162	6,774	6,571	8,324
16	Sara AHA Com #5	N 11-20S-24E	2253	14404	2103	14845	1931	13612	6,393	7,059	7,049
17	John AGU #4	H 14-20S-24E	1711	10086	1524	8758	1312	7938	5,895	5,747	6,050
18	John AGU #3	G 14-20S-24E	668	3646	637	3367	593	3024	5,458	5,286	5,099
19	Conoco AGK Federal #11	J 26-20S-24E	2697	14633	2457	15163	2292	14560	5,426	6,171	6,353
20	Ceniza AGZ Com #3	E 13-20S-24E	49	251	76	958	57	886	5,122	12,605	15,544
21	Prickly Pear AIE Federal Com #1	P 23-20S-24E	3955	19130	3599	19673	3043	18307	4,837	5,466	6,016
22	Hillivew AHE Federal Com #16	M 14-20S-24E	539	2519	490	2227	473	1892	4,673	4,545	4,000
23	Conoco AGK Federal #2	G 26-20S-24E	3228	13733	3196	10720	2875	8581	4,254	3,354	2,985
24	Saguaro AGS Federal Com #8	O 14-20S-24E	2310	9389	2428	9063	2112	9470	4,065	3,733	4,484
25	Hillview AHE Federal Com #4	J 23-20S-24E	1694	6571	1630	5621	1242	9023	3,879	3,448	7,265
26	Hillview AHE Federal Com #10	H 23-20S-24E	1401	5329	953	4944	735	4306	3,804	5,188	5,859
27	Conoco AGK Federal #4	A 26-20S-24E	4261	15767	3746	15277	3319	14286	3,700	4,078	4,304
28	Hillview AHE Federal Com #2	G 23-20S-24E	1630	5869	1407	5559	1190	5454	3,601	3,951	4,583
29	Saguaro AGS Federal Com #9	C 23-20S-24E	2148	7728	2025	8266	1824	7302	3,598	4,082	4,003
30	Charolette McKay Federal Com #4	E 25-20S-24E	3098	10609	1540	6226	687	9310	3,424	4,043	13,552
31	John AGU #1	C 14-20S-24E	3730	12460	3534	11767	2944	10499	3,340	3,330	3,566
32	Hillview AHE Federal Com #3	N 23-20S-24E	4364	14516	4255	15205	3881	14823	3,326	3,573	3,819
33	Hillview AHE Federal Com #13	I 14-20S-24E	1549	5151	1476	5015	1210	4395	3,325	3,398	3,632

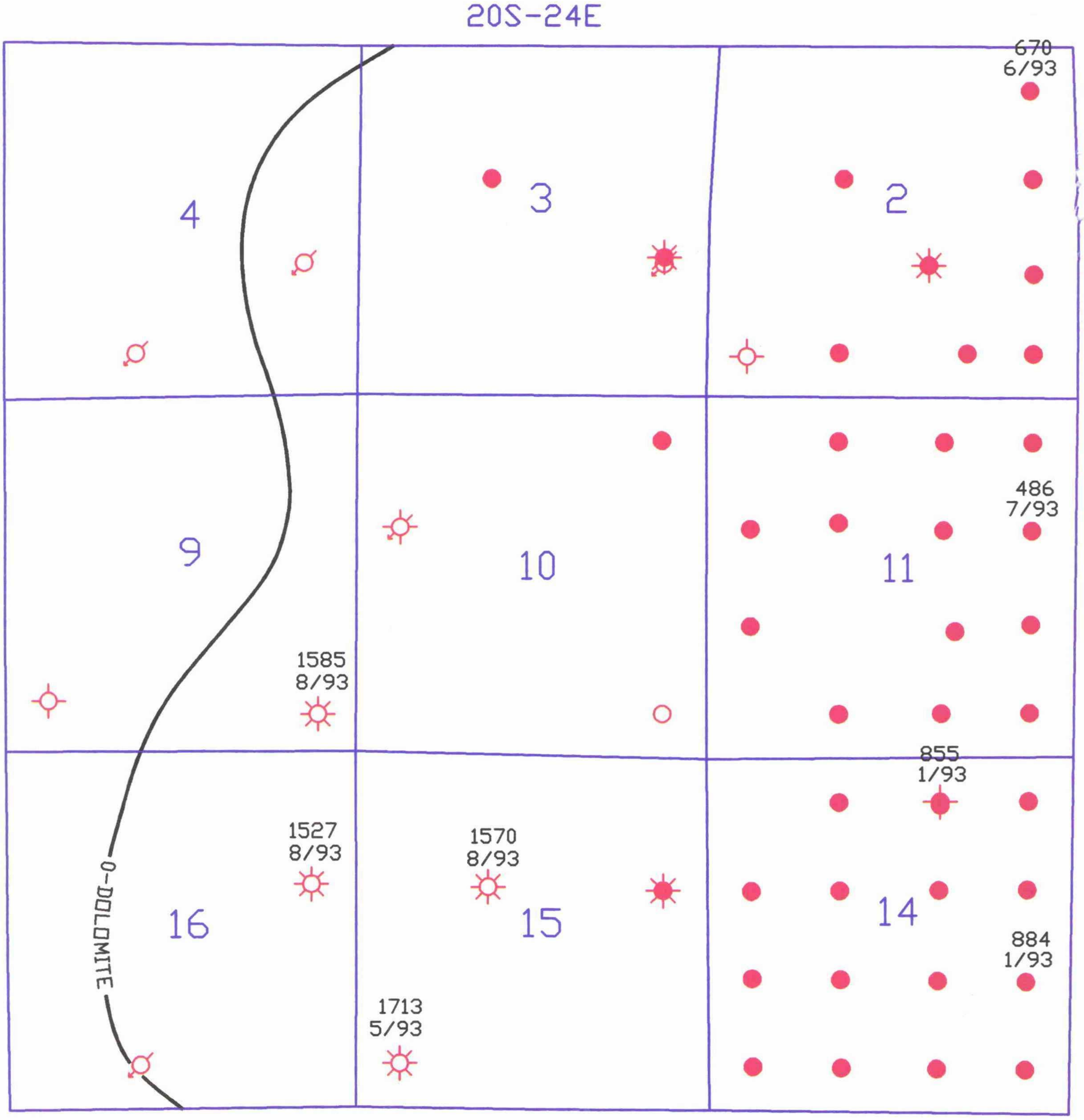
South Dagger Draw

Oil Well GOR

	Well Name	Location	PRODUCTION July, 1993 Oil	Gas	August, 1993 Oil	Gas	September, 1993 Oil	Gas	GAS-OIL RATIO Jul-93 Scf/Bbl	Aug-93 Scf/Bbl	Sep-93 Scf/Bbl
34	Senita AIP Federal Com #2	N 14-20S-24E	1928	6329	1789	6249	1485	5436	3,283	3,493	3,661
35	Senita AIP Federal Com #1	K 14-20S-24E	1489	4884	1327	4816	1088	4503	3,280	3,629	4,139
36	John AGU #2	A 14-20S-24E	1847	5989	1775	5614	1445	4275	3,243	3,163	2,958
37	Sara AHA Com #1	I 11-20S-24E	457	1443	326	746	138	889	3,158	2,288	6,442
38	Staghorn AJG Federal Com #1	M 25-20S-24E	2778	8308	2586	7750	2206	6277	2,991	2,997	2,845
39	John AGU #5	F 14-20S-24E	2916	8197	2439	7645	1924	7272	2,811	3,134	3,780
40	Ceniza AGZ Com #4	L 12-20S-24E	1964	5342	1805	5215	1466	4533	2,720	2,889	3,092
41	Saguaro AGS Federal Com #12	L 14-20S-24E	1780	4534	1706	4512	1275	2800	2,547	2,645	2,196
42	Conoco AGK Federal #5	B 26-20S-24E	11886	28434	10375	26857	8223	22734	2,392	2,589	2,765
43	Saguaro AGS Federal Com #4	J 14-20S-24E	1633	3850	1431	3749	1242	3575	2,358	2,620	2,878
44	Hillview AHE Federal Com #12	I 23-20S-24E	6871	16158	5147	12523	4521	11817	2,352	2,433	2,614
45	John AGU #6	B 14-20S-24E	3395	7687	3305	7585	2987	7288	2,264	2,295	2,440
46	Conoco AGK Federal Com #6	K 26-20S-24E	1499	3330	1644	3346	1530	2913	2,221	2,035	1,904
47	Conoco AGK Federal #8	H 26-20S-24E	2925	5506	2816	5048	2387	4418	1,882	1,793	1,851
48	Conoco AGK Federal #15	O 26-20S-24E	7614	13994	7043	17670	6074	16984	1,838	2,509	2,796
49	Conoco AGK Federal #3	I 26-20S-24E	6567	11336	6428	10091	5343	9524	1,726	1,570	1,783
50	Palo Verde AJV Federal #1	M 24-20S-24E	781	1335	705	1132	628	815	1,709	1,606	1,298
51	Hillview AHE Federal Com #17	O 23-20S-24E	5177	8163	3458	5891	3572	5822	1,577	1,704	1,630
52	Staghorn AJG Federal Com #2	N 25-20S-24E	1230	1685	1211	1613	1032	1364	1,370	1,332	1,322
53	Sara AHA Com #6	P 11-20S-24E	2235	2117	1959	1670	1720	1637	947	852	952
54	Mayer 24 #1	E 24-20S-24E	0	27	0	0	0	320	0	0	0
55	Hillview AHE Federal Com #7	M 13-20S-24E	3	0	0	0	1	0	0	0	0
56	Mayer 24 #2	D 24-20S-24E	0	0	0	38	0	0	0	0	0
	Oil Well Totals		**132428**	**581347**	**118341**	**560786**	**104510**	**534471**	**4,390**	**4,739**	**5,114**

7 of 56 wells ≥ 10,000:1 (12.5%)

22 of 56 wells > 4500:1 (39%)



12/93 (VM)
DRAFT\A93033D

BOTTOM HOLE PRESSURE
-4000 DATUM
EDDY COUNTY, NEW MEXICO

ENG: PINSON MCWHORTER
SCALE: 1"=2000'

BEFORE THE
OIL CONSERVATION DIVISION
Santa Fe, New Mexico

Case Nos. 10869 and 10881 Exhibit No. 4

Submitted by: Yates Petroleum Corporation

Hearing Date: December 2, 1993

BEFORE THE
OIL CONSERVATION DIVISION
Santa Fe, New Mexico

Case Nos. 10869 and 10881 Exhibit No. 5

Submitted by: Yates Petroleum Corporation

Hearing Date: December 2, 1993

SCIENTIFIC SOFTWARE-INTERCOMP

Advanced Technology for the Petroleum Industry

RESERVOIR SIMULATION STUDY
3-D SECTOR AREA

CANYON RESERVOIR
DAGGER DRAW FIELD, NEW MEXICO

FINAL REPORT

NOVEMBER 1993

PERFORMED FOR:

YATES PETROLEUM CORPORATION

PERFORMED BY:

SCIENTIFIC SOFTWARE-INTERCOMP, INC.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

LIST OF TABLES

LIST OF FIGURES

SUMMARY

SSI was authorized by Yates to perform a reservoir simulation study on the Canyon reservoir, Dagger Draw field in New Mexico. The objective of the study was to determine the effect of gas cap depletion on down dip oil production.

SSI constructed a representative 3-D simulation model containing one row of wells (east-west) extending from the gas cap through the oil and water column. The simulation model was calibrated by performing history match simulation runs. After the simulation model was properly calibrated for the history period (January 1990 through October 1992), three 26-year prediction runs were made to investigate the effect of gas cap depletion on oil production down dip.

The following table summarizes the 26 year oil recoveries obtained from each prediction case:

	CASE 1	CASE 2	CASE 3
End of Case	December, 2018	December, 2018	December, 2018
Oil, MSTB	682	684	682
Gas, BSCF	19.5	9.7	21.5

Case 1 - Continued Depletion

Case 2 - Continued Depletion without Gas Cap Depletion

Case 3 - Continued depletion with Gas Cap Infills

Operational changes in the management of the gas cap have little effect on oil recoveries in the oil leg down dip. This is consistent with the geological evaluation that indicated a tortuous lateral connection (with some sedimentary barriers) between the gas cap and the oil leg.

The simulations in this study were performed using SSI's SimBest II simulator. The simulator was run in single porosity, three phase (black oil) mode. The simulation and post-processor modules of WorkBench were used in construction of the initial reservoir model, in making modifications to the model during history matching, and in the display of the results (tables, plots, and maps) of all simulations.

The 3-D sector reservoir simulation model consisted of 552 grid cells (23 x 3 x 8). The model contained eight layers corresponding to the correlation units derived from geologic evaluation. The initial reservoir rock properties (net thickness, porosity, permeability, relative permeability, and capillary pressure) and fluid properties of the simulation model were derived from the results of geological, petrophysical, and engineering analyses.

The initial simulation model was calibrated through a history matching procedure. Well oil rates were specified in the model, and pressures, gas rates, and water rates were calculated by the simulation model. In order to account for high volumes of water production in the up dip portion of the reservoir, a modeling scheme was required to create high initial water saturations up dip without adversely affecting oil and gas production in the mid dip and down dip portions of the reservoir.

The resulting model utilized isolated model layers with high capillary pressures in Layers 5 and 6. This resulted in high water saturation values up dip for Layers 5 and 6. Layer 4 contained most of the hydrocarbon volumes. The initial input porosity and permeability values were modified accordingly to obtain history matches on pressure, gas production and water production. This calibrated model was then used for the prediction simulations.

The discussion section contains more detailed descriptions of the simulation model and the simulation runs.

DISCUSSION

RESERVOIR SIMULATION

The following sections of this report describe the construction of the initial reservoir simulation model and the calibration of the reservoir characterization within the model during history matching. The history period was defined as January, 1990 to the end of October, 1992.

The simulations in this study were performed using SimBest II (version 3.1 I5), SSI's three-dimensional, multi-phase, dual porosity reservoir simulator. The simulator was run in single-porosity, three-phase (black oil) mode. The simulation and post-processor modules of WorkBench were used in construction of the initial reservoir model, in making modifications to the model during history matching, and in the display of the results (tables, plots, and maps) of all simulations.

The methods and results of the simulation phases of this study are discussed in the following sections of this report and illustrated in the accompanying tables, figures, and appendices. In addition, listings of the final input and output data for all simulations have been provided to Yates in tape format.

Model Construction

The initial reservoir rock and fluid properties of the simulation model were derived from the results of the geological, petrophysical, and engineering analyses. The 3-D sector model covers an area 13,800 by 1,800 feet (2.6 by 0.3 miles). The grid is shown in Figures 1 and 2. The model contains one row of wells (east-west) extending from the gas cap (wells AIG 1, SAG 2, and SARA 2) through the oil column and into the water column (wells JOHN 5, JOHN 3, JOHN 4, and CEN 3). The grid contains 23 cells in the x-direction (east-west) and 3 cells in the y-direction (north-south). The model contains eight layers. This results in a total of 552 cells, but not all of these cells are active. The areal dimensions of each cell are 600 by 600 feet. Square cells were used to minimize the numerical dispersion effects of rectangular cells.

The structural depths of each of the layers at each grid location were determined from the structure and gross thickness maps constructed during the initial geological analyses.

The characteristics of the reservoir rock are defined in the simulator on a cell-by-cell basis. The reservoir characteristics include the following:

- net reservoir thickness
- effective porosity
- effective permeability (in the x, y and z directions)
- relative permeability
- capillary pressure

All the properties listed above are representative of the net reservoir. For example, the values of effective porosity are average values for the net reservoir rock and do not include porosities which are below the cutoffs.

Net thickness maps were input in digital form to the initial reservoir simulation model. Net thickness values are used in the model primarily in the calculation of volumetrics and conductivity. Any changes to the volumetrics (ϕh) or conductivity (kh) during history matching may imply change to the net thickness, porosity, or permeability. Changes to conductivity due to stratigraphic or structural barriers were implemented in the model as modifications to transmissibility between cells since these barriers do not require changes to the reservoir rock permeability.

Effective porosity maps were digitized and input into the initial reservoir simulation model. These values were entered on a cell-by- cell basis and are representative of the net reservoir, not the gross reservoir. These initial porosity values were used in the initial estimation of horizontal permeabilities. The primary effect of porosity in the simulation model is on the calculation of volumetrics. Porosities were modified heavily during the history matching phase.

The effective horizontal permeabilities used in the initial reservoir description of the simulation model were calculated on a cell-by-cell basis from the porosity-permeability relationships derived from cross plots of porosity and permeability. Plots of air permeability vs. core porosity were made for each simulation model layer (Appendix I). Core data were not available for Layer 1. Based on these plots, the following equations were derived and used to transform average porosity for each simulation cell in each layer to horizontal permeability:

LAYER	HORIZONTAL PERMEABILITY EFFECTIVE POROSITY RELATIONSHIP
1	Log K = 22.9885 * (ϕ) - 1.0555
2	Log K = 22.9885 * (ϕ) - 1.0555
3	Log K = 60.6061 * (ϕ) - 2.1079
4	Log K = 45.4545 * (ϕ) - 1.5017
5	Log K = 23.2558 * (ϕ) - 1.1367
6	Log K = 16.6436 * (ϕ) - 0.9393
7	Log K = 20 * (ϕ) - 0.8
8	Log K = 26.3158 * (ϕ) - 0.8697

Three permeability arrays were input to the reservoir simulation model. These correspond to permeabilities in the x, y, and z direction. There were no data to suggest that x and y permeabilities should differ. As far as the z direction permeability, vertical transmissibility between layers was reduced to zero to reflect the presence of permeability reductions and sealing barriers within the model layers.

The laboratory core analysis performed by Scal, Inc. (Appendix II) was the basis for the relative permeability used in the simulation model. The Scal relative permeability analysis was performed on extracted cores. Since the core samples were not preserved, the Scal analysis was used only as a starting point to determine saturation and relative permeability endpoints.

Through cross-sectional model simulation, pseudo relative permeability curves were developed in order to match oil and water rates in the reservoir. In particular, the water relative permeability at residual oil saturation was increased to .5947. This change was necessary for the model to calculate and match the high volumes of water produced throughout the reservoir especially in the up dip areas within the gas cap. Also the oil relative permeability at critical gas saturation was increased to .7174 in order to match oil production rates in the mid dip areas of the reservoir.

Segregated flow was assumed, and straight-line relative permeabilities were used as depicted in Figure 3. Table 1 summarizes the relative permeability endpoints that were used for the water-oil and gas-oil relative permeability data in the simulation model.

High capillary pressure was used in Layers 5 and 6 to create a large water-oil transition zone in those layers in order to allow up dip water production in the simulation model. Figure 4 illustrates and Table 2 summarizes the capillary pressures which were used in the simulation model.

Only one set of fluid properties was required by the simulation model to characterize the fluids in this reservoir. These properties were derived from available fluid data and correlations. The saturated oil properties (gas-oil ratio, formation volume factor, compressibility, and viscosity) and the gas properties (formation volume factor and viscosity) were assigned to the model based on saturation pressure. Undersaturated oil properties were calculated by the model from the saturation pressure, the reservoir pressure, the compressibility, and the modified undersaturated viscosity slope. Table 3 and Figures 5 through 9 summarize the PVT data input.

Yates provided SSI with a Core Labs' reservoir fluid analysis report. This report is included in Appendix III. The analysis was performed in April 1990. At that time the reservoir pressure had dropped below 2000 psia, and the saturation pressure that was reported in the analysis was 2003 psig.

The original pressure of the reservoir is believed to be 3000 psig. The saturation pressure is also believed to be equal to the original reservoir pressure. Therefore, SSI used correlations provided within WorkBench to create PVT "data" giving a saturation pressure of 3015 psia and oil API gravity of 42.7, etc.

For wells located within the gas cap (wells Algerita 1, Saguaro 2, and Sara 2), gas production rates were specified in the simulation model. For all other wells in the model, oil production rates were specified. The production data were derived from the monthly production reports provided by Yates. The production data were specified in the model on a quarterly basis.

Wells were completed in model layers according to perforation depths supplied by Yates. Since fracture treatments were performed on all wells, these initial well completions were not considered completely reliable. In order to account for hydraulic fracture production near the wellbore, well completions were altered as needed during the history match.

History Matching Procedure

Most of the initial reservoir description was based, by necessity, on measurements made at the points in the reservoir which were penetrated by wells. Most of these measurements do not reveal information about the reservoir characteristics between and beyond wells. Due to the small percentage of the reservoir that is directly sampled, and the range of accuracy of some of the measurements themselves, even a carefully derived initial reservoir description may not represent the actual reservoir with complete accuracy.

The objective of the history matching phase of this study was to adjust the reservoir description to a more accurate representation of the field. Mathematical reservoir simulators have proven to be reliable in reproducing the physical processes taking place in petroleum reservoirs. The quality of the results derived from a simulator depends primarily on the quality of the final reservoir description. The quality of this final description depends partially on the quality and quantity of the basic data used to derive the initial description.

The quality of the simulation results also depends on the quality and quantity of the measurements of historical reservoir behavior and quality of the match of these measurements by the simulator. The quality of measurements of historical behavior is average for this reservoir. Oil, gas, and water volumes seem to be measured very well. However, pressure data are limited. Only a handful of wells within the study area have pressure data. Those wells that have pressure data have only one pressure point in time. In addition, there are no pressure data for isolated layers or zones. The length of the history period for most wells is two or three years, which is a fairly short period for a history match. These facts, combined with the moderate quantity and quality of the data used to determine the initial reservoir description, indicate that the final reservoir description derived from a satisfactory history match can be used with moderate confidence to predict future reservoir behavior. The limitations imposed by the short history period for most wells and the quality of the initial reservoir description should be remembered when interpreting the results of the prediction cases.

It is through the iterative process of "matching" the measured reservoir behavior that the initial reservoir description is adjusted to its final form. Adjustments in this study were made only to reservoir characteristics which were not known with accuracy. Changes to these characteristics were maintained within a reasonable range for the particular parameter.

The history match parameters for this study were:

- reservoir pressure
- gas production
- water production

The oil production rates were specified by well on a quarterly basis in the simulator. The three parameters listed above were calculated by the simulator for each well and compared to the values measured in the field. For wells within the gas cap, gas production was specified, and reservoir pressure and water production were calculated by the simulator for each well and compared to field measured data. The following section of this report discusses the procedures followed to match each of the parameters listed above.

Reservoir Pressure Match

As mentioned previously, there was not an abundance of pressure data available for the sector area. However, the data that were available indicated that reservoir pressure had dropped quickly from an initial value of 3000 psig to around 1000 psig in three years of sustained field production.

Areal averages of pressure were made from existing pressure data so that well pressures could be matched to some "ball park" number depending upon the well's location within the sector area. In general pressures taken in the fall of 1992 were around 1800 psig for the up dip region of the gas cap, 1200 psig for the mid dip region and 800 to 1000 psig for the down dip region.

Since so few wells had pressure data and only a few had two pressure points, less emphasis was placed on pressure matching. The goal was to obtain pressures which were reasonable for each well, given its location within the reservoir.

Early simulation runs were made with all three phases (oil, gas, and water rates) specified. This was done to insure proper voidage in the early stages of history matching. With the proper voidage rate specified for each well, calculated pressures were compared to actual pressures and "ball park" estimates for each well. Most wells required porosity adjustments to all completed layers to correct the pressure level. Some wells required permeability adjustments to all completed layers to correct the shape of the pressure curve.

These porosity and permeability adjustments were first made on an areal basis and then on a well-by-well basis. Modifications were made equally to all completed layers since historical pressure data for isolated layers were not available.

Saturation Match (Gas and Water Production)

Better data were available for historical gas and water production. In the saturation match simulation runs, only oil rate was specified, and the simulation calculated pressures, gas rates, and water rates were compared to observed data. However for the gas cap wells, gas rate was specified, and the simulation calculated pressures and water rates were compared to observed data.

The biggest problem to overcome in history matching this reservoir was modeling water production up dip in the gas cap without affecting gas and oil production in the mid dip and down dip regions. The simulation model consisted of isolated layers with no vertical transmissibility between layers.

Layers 5 and 6 were assigned a very high capillary pressure to create a large water-oil transition zone resulting in high initial water saturations up dip in these layers.

With this model, most of the hydrocarbon production was obtained from Layer 4. By modifying permeabilities for Layers 4, 5 and 6, the correct mix of oil and water could be achieved in all wells up dip or down dip.

Similarly, additional gas production could be obtained by modifying permeabilities in Layers 2 and 3. In addition, well completions were altered if the existing completions could not allow for the proper production. This was within reason since all wells were fractured upon completion, and arguments could be made for communication with non completed layers close to the wellbore.

Table 4 summarizes the initial volumes in place by layer and for the entire simulation model. Note that Layer 4 has the highest oil and gas volumes in place, while Layers 5 and 6 contain very high volumes of initial water in place.

Figure 10 illustrates the quality of the history match with respect to model oil, gas, and water cumulative production data. The observed data is plotted as circles and the simulation calculated results are plotted as lines. If oil rates had been specified for all wells, the calculated oil production would match exactly with the observed oil production data. As can be seen in Fiugre 10, this is not the case because gas production was specified in the simulation for the three gas cap wells (Algerita 1, Saguaro 2, and Sara 2). However, the figure does illustrate that a satisfactory match was obtained for oil, gas, and water production.

Plots of individual well history matches are given for each well in the study area in Appendix IV. Aactual observed data is plotted as circles and the calculated simulation results are plotted as lines. A review of each individual well plot reveals that most wells were matched very well.

The plots contained in Appendix IV illustrate the quality of the history match more clearly. For the gas cap wells (Algerita 1, Saguaro 2, and Sara 2) gas production was specified, and the quality of the match is measured by inspecting the oil and water production curves and the pressure plots.

The plots for these three gas cap wells show very good matches for water production and pressure. These three wells have associated condensate production that was not matched, as seen on the oil production plot. However, this associated condensate production is a negligible amount (less than 10 MSTB of cumulative oil production per well).

For the remaining wells, oil rate was specified in the simulation, and the history match quality is measured by inspecting the gas and water production curves and the pressure plots. As the remaining plots in Appendix IV illustrate, satisfactory history matches were obtrained on all remaining wells (John 5, John 3, John 4, and Ceniza 3).

Predictions

Well Productivity Calibration

Prior to simulation of the prediction cases, a productivity match was performed for each well. During history match runs, all wells have a specified oil rate or gas rate and are constrained by that rate. However, during the prediction runs, the wells must be pressure constrained since rates are being predicted.

All wells within the study area are produced with beam pumping units. Yates provided SSI with fluid level data for the wells, and these data were converted to bottomhole pressure (BHP) data.

For the productivity match, all wells were assigned their respective BHP's. In addition, each well was assigned an oil rate far above the rate it is capable of producing. This forces the well to be pressure constrained in the simulator. The productivity match run duration was short, about five days. Through an iterative process, well indices (WI's) were altered for each well until the calculated rate for each well (under bottomhole pressure constraint) matched the observed oil rate at the end of history.

Prediction Case Descriptions

All prediction cases were simulated for a total of 26 years beginning in November 1992 and continuing through December 2018. No economic limit was input for any of the runs.

The completion intervals for new wells were determined from neighboring wells. Similarly the PI or WI values assigned to the new wells were average values for the given location of each new well.

Since current water cuts are above 90 percent for most wells in the study area, oil producing wells were assigned a maximum water cut limit of 99 percent. Oil wells were also assigned a maximum GOR limit of 100,000 SCF/STB. In the event that these limits are reached for a given well, the simulator shuts-in layers one by one to improve the water cut and/or GOR until there is only one layer completed. When only one layer remains completed and a limit is exceeded, the well is shut-in.

The following paragraphs briefly describe the characteristics of each prediction case. Unless otherwise specified, the general guidelines just discussed are applicable to each case.

Prediction Case 1 (Continued Depletion - Base Case)

This case continued the existing depletion of the reservoir with the existing wells.

Prediction Case 2 (Continued Depletion without Gas Cap Depletion)

In order to determine the effect of gas cap production on field oil production, all gas cap wells were shut-in while the rest of the wells were allowed to deplete. The wells that were shut-in during this run were: Algerita 1, Saguaro 2, and Sara 2.

Prediction Case 3 (Continued Depletion with Gas Cap Infills)

Two additional gas cap wells were drilled in order to deplete the gas cap at an increased rate. One well was placed between Sara 2 and Saguaro 2 in grid cell x = 8, y = 2. The other well was placed between Saguaro 2 and Algerita 1 in grid cell x = 4, y = 2 (see Figure 11).

Prediction Case Results

Prediction case results can be evaluated on several levels. The most common types of evaluations are based on:

- cumulative oil recovery
- rate of oil recovery
- recovery efficiency
- economics

Although a great deal of importance is frequently given to the final oil recovery the items shown above should all be taken into consideration. The results of economic analyses should normally control the development of a reservoir, rather than simply trying to maximize ultimate oil recovery. The optimum development scheme is frequently different for each of the criteria listed above. In some situations, outside factors may take precedence over the need for economic efficiency. An example is the case where contractual obligations require production at a certain rate over a given period of time. Yates should include any such external factors in their final evaluation of the results of this study. A comparison of case results, according to the categories above, is discussed in the following sections of this report.

Case Comparisons

Table 5 shows a comparison of the cumulative recoveries at the end of each of the prediction cases. Note that the recoveries in Table 5 and those discussed in the text that follows are 26-year recoveries. Note that there is little difference in oil recovery with and without gas cap depletion (Cases 1 and 2). Also note that accelerated depletion of the gas cap with two additional gas cap wells (Case 3) does not affect ultimate oil recoveries. The case comparison plot in Figure 12 illustrates that gas cap management does not affect oil production down dip. Although cumulative gas production varies for each of the three prediction cases, the ultimate oil recovery is the same.

Since the oil recoveries for all three prediction cases are very similar (Table 5), plots of model oil, gas, and water production have been provided only for prediction Case 1 (continued depletion) (Figures 13 through 15). Plots of individual well production for Case 1 are given in Appendix V. Also, plots of individual well production for Case 3 (Gas Cap Infills) are included in Appendix VI including production plots for the two infill gas cap wells (NEW 1 and NEW 2).

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Table 1
Relative Permeability Endpoints
Canyon Reservoir - Dagger Draw Field

Water-Oil Relative Permeability

	Scal Sample 3	Scal Sample 4w	Simulation Model
Swc	.3103	.2456	.2456
Sorw	.3992	.3019	.3019
krocw	1.0000	1.0000	1.0000
krwro	.1886	.1330	.5947

Gas-Oil Relative Permeability

	Scal Sample 3	Scal Sample 4w	Simulation Model
Slr	.6437	.5969	.5476
Sgc	.2076	.1305	.0000
krgro	.1240	.0490	.0490
krogc	.1230	.4160	.7174

Table 2
Water-Oil and Gas-Oil Contacts &
Water-Oil Capillary Pressure Endpoints
Canyon Reservoir - Dagger Draw Field

Model Layer	Model GOC (subsea feet)	Model WOC (subsea feet)	Model Pcow at Swc (psia)
1	3832	4053	20
2	4030	4092	20
3	3997	4123	20
4	3959	4179	20
5	4020	4228	200
6	4285	4343	200
7	4125	4366	20
8	4158	4403	20

Table 3
Reservoir Fluid Properties
Canyon Reservoir - Dagger Draw Field

RESERVOIR GAS PROPERTIES

Pressure psia	FVF rb/mscf	Viscosity cp
14.6	205.83	0.012
99.7	29.86	0.012
214.6	13.62	0.012
414.6	6.83	0.012
614.7	4.47	0.012
814.7	3.27	0.013
1014.7	2.55	0.013
1214.7	2.07	0.014
1414.7	1.73	0.015
1614.7	1.49	0.016
1814.7	1.30	0.017
2017.7	1.16	0.018
2114.6	1.10	0.018
2214.6	1.05	0.019
2314.6	1.00	0.019
2514.6	0.92	0.020
2714.6	0.86	0.022
2914.6	0.81	0.023
*3014.6	0.79	0.023
3514.6	0.70	0.026
4014.6	0.65	0.029
4514.6	0.61	0.031
5014.6	0.58	0.034
5514.6	0.55	0.036
6014.6	0.53	0.038

RESERVOIR OIL PROPERTIES

Pressure psia	Rso scf/stb	FVF rb/stb	Viscosity cp
14.6	9.79	1.026	1.285
99.7	36.12	1.034	1.197
214.6	65.03	1.044	1.133
414.6	112.25	1.061	1.027
614.7	159.12	1.080	0.933
814.7	206.81	1.100	0.873
1014.7	255.78	1.122	0.818
1214.7	306.26	1.145	0.765
1414.7	358.41	1.170	0.715
1614.7	412.35	1.197	0.668
1814.7	468.15	1.225	0.624
2017.7	526.79	1.255	0.583
2114.6	555.54	1.270	0.565
2214.6	585.69	1.286	0.547
2314.6	616.35	1.302	0.530
2514.6	679.29	1.335	0.498
2714.6	744.43	1.371	0.468
2914.6	811.82	1.407	0.441
*3014.6	846.38	1.426	0.428
3514.6	1028.25	1.526	0.369
4014.6	1226.04	1.635	0.320
4514.6	1441.02	1.753	0.277
5014.6	1674.56	1.881	0.238
5514.6	1928.22	2.017	0.203
6014.6	2203.74	2.164	0.171

* Values extrapolated beyond Bubble Point for simulation purposes

Table 4
Simulation Model - Initial in Place Volumes and Pressures
Canyon Reservoir - Dagger Draw Field

	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7	Layer 8	Total
Oil (MMSTB)	0.325	0.019	0.257	4.788	0.372	0.000	0.224	0.137	6.122
Water (MMSTB)	0.698	0.539	0.775	8.442	20.347	8.261	0.510	0.703	40.276
Gas (BSCF)	0.878	1.139	1.580	21.621	3.593	1.325	0.190	0.116	30.442
Free Gas (BSCF)	0.603	1.123	1.362	17.565	3.278	1.325	0.000	0.000	25.256
Average Pressure	3033	3002	3011	3017	3017	3001	3064	3074	3016

TABLE 5

PREDICTION SIMULATIONS - RESERVOIR PERFORMANCE SUMMARY
CANYON RESERVOIR, DAGGER DRAW FIELD , NEW MEXICO

	CASE 1	CASE 2	CASE 3
End of Case	**December, 2018**	**December, 2018**	**December, 2018**
Oil, MSTB	**682**	**684**	**682**
Gas, BSCF	**19.5**	**9.7**	**21.5**
Water, MSTB	**7435**	**4890**	**8398**

Case 1 - Continued Depletion

Case 2 - Continued Depletion without Gas Cap Depletion

Case 3 - Continued Depletion with Gas Cap Infills

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Figure 1
Sector Model Grid - Plan View
Canyon Reservoir - Dagger Draw Field

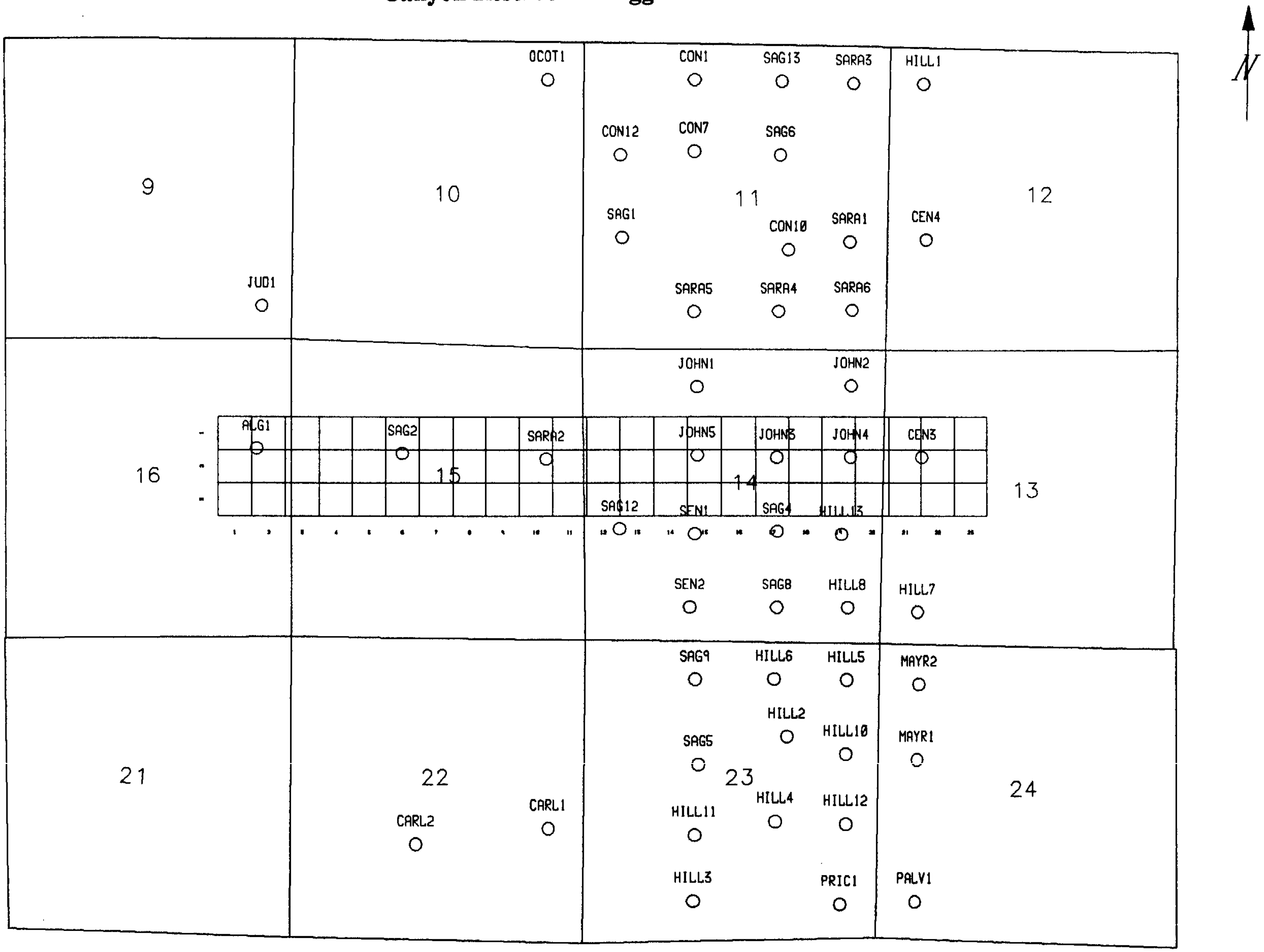


Figure 2
Sector Model Grid - Cross Section (J = 2)
Canyon Reservoir - Dagger Draw Field

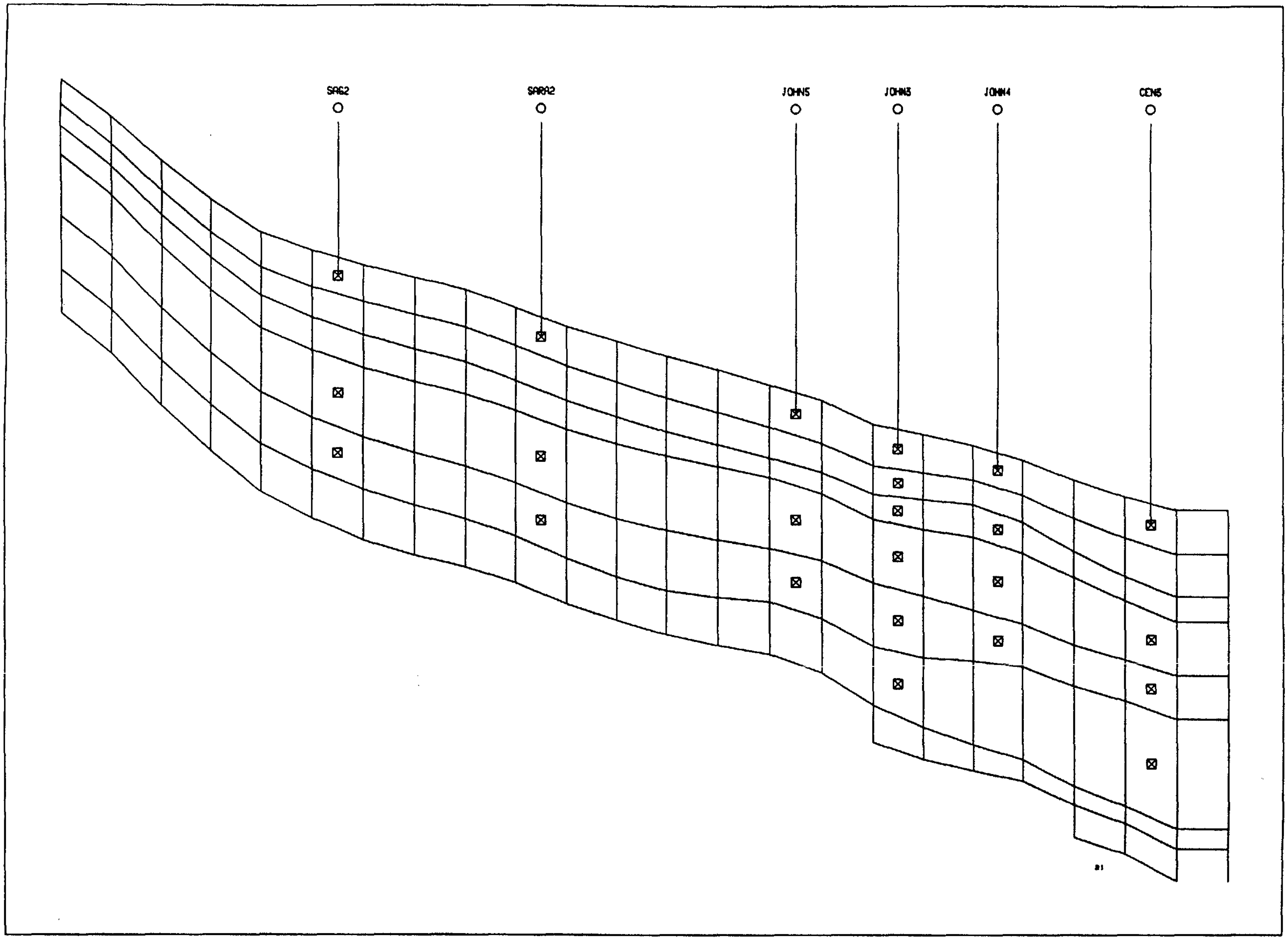
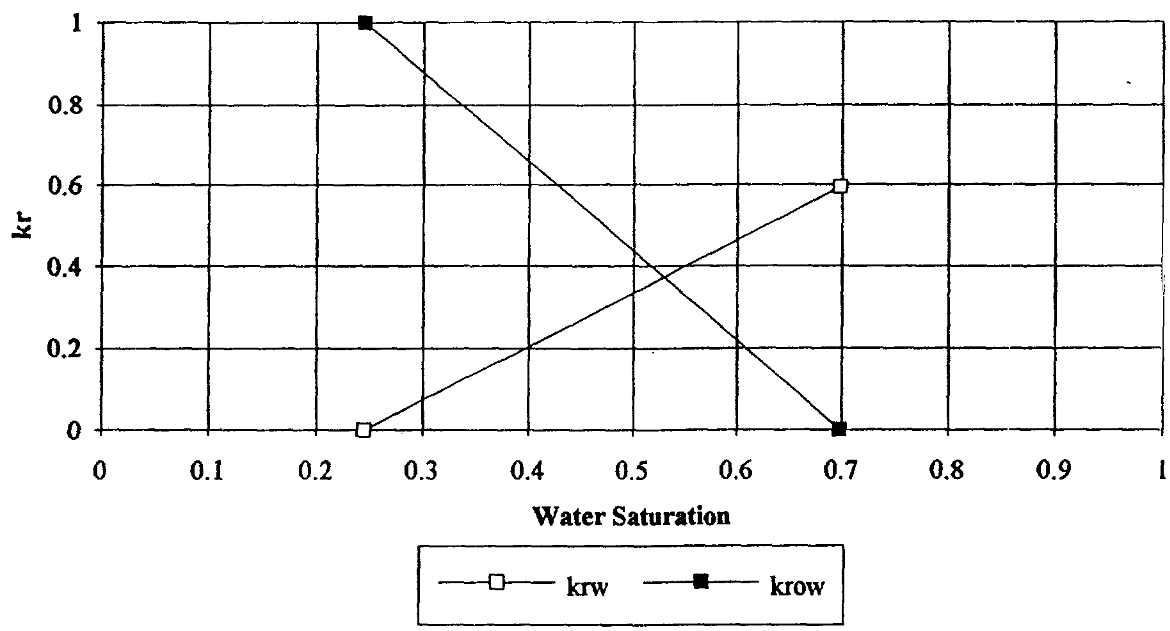


Figure 3

Water - Oil Relative Permeability - Simulation



Gas - Liquid Relative Permeability - Simulation

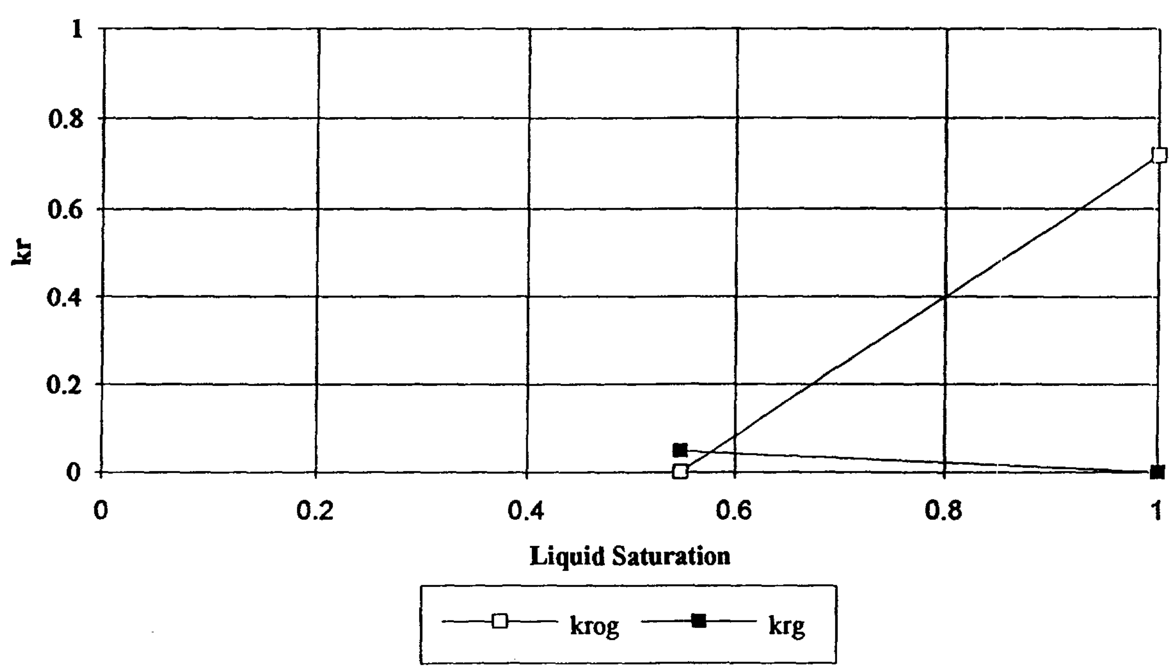


Figure 4
Water - Oil Capillary Pressure - Simulation

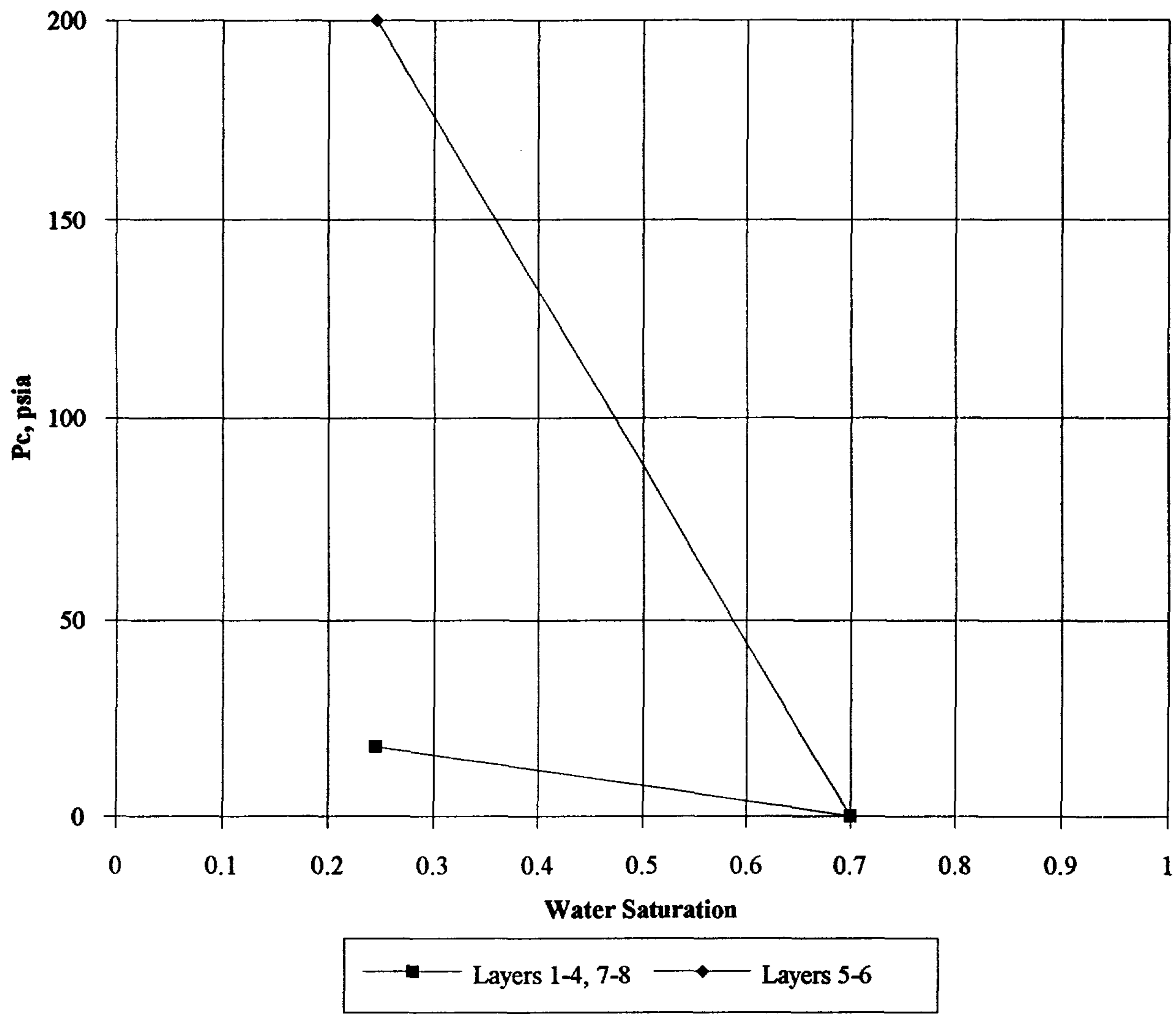


Figure 5

Oil Formation Volume Factor vs Pressure - Simulation

Canyon Reservoir - Dagger Draw Field

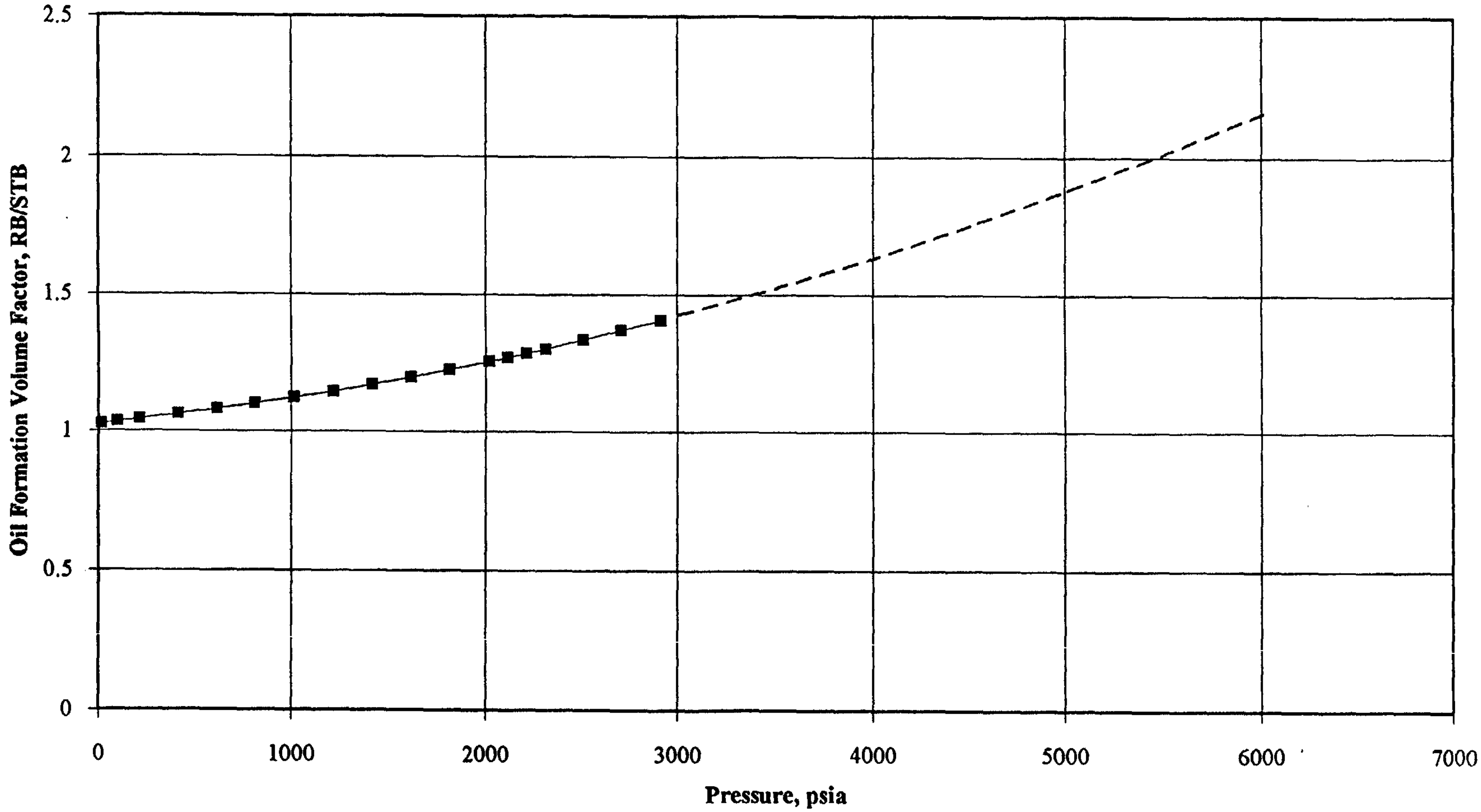


Figure 6
Solution Gas Oil Ratio vs Pressure - Simulation
Canyon Reservoir - Dagger Draw Field

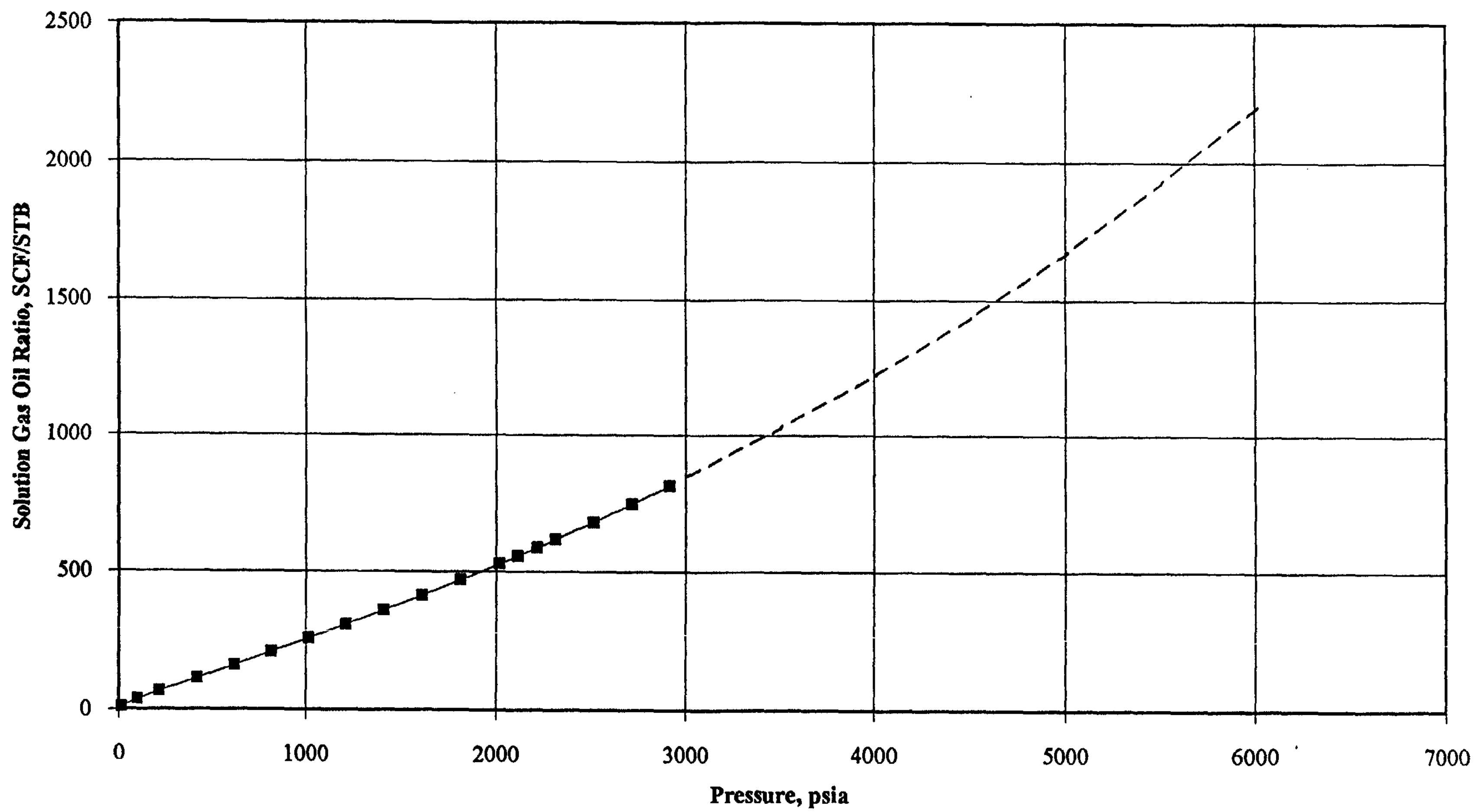


Figure 7
Oil Viscosity vs Pressure - Simulation
Canyon Reservoir - Dagger Draw Field

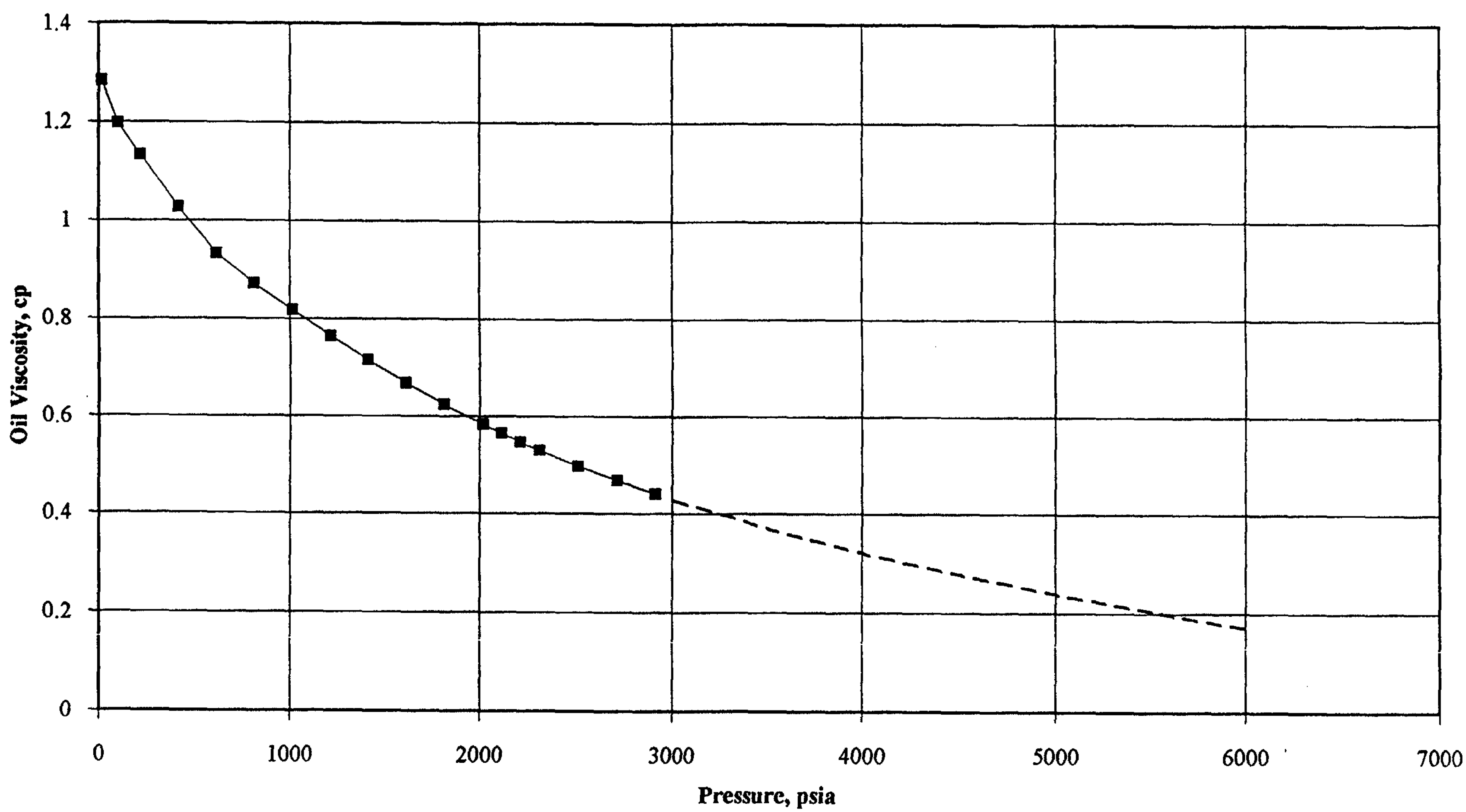


Figure 8

Gas Formation Volume Factor vs Pressure - Simulation

Canyon Reservoir - Dagger Draw Field

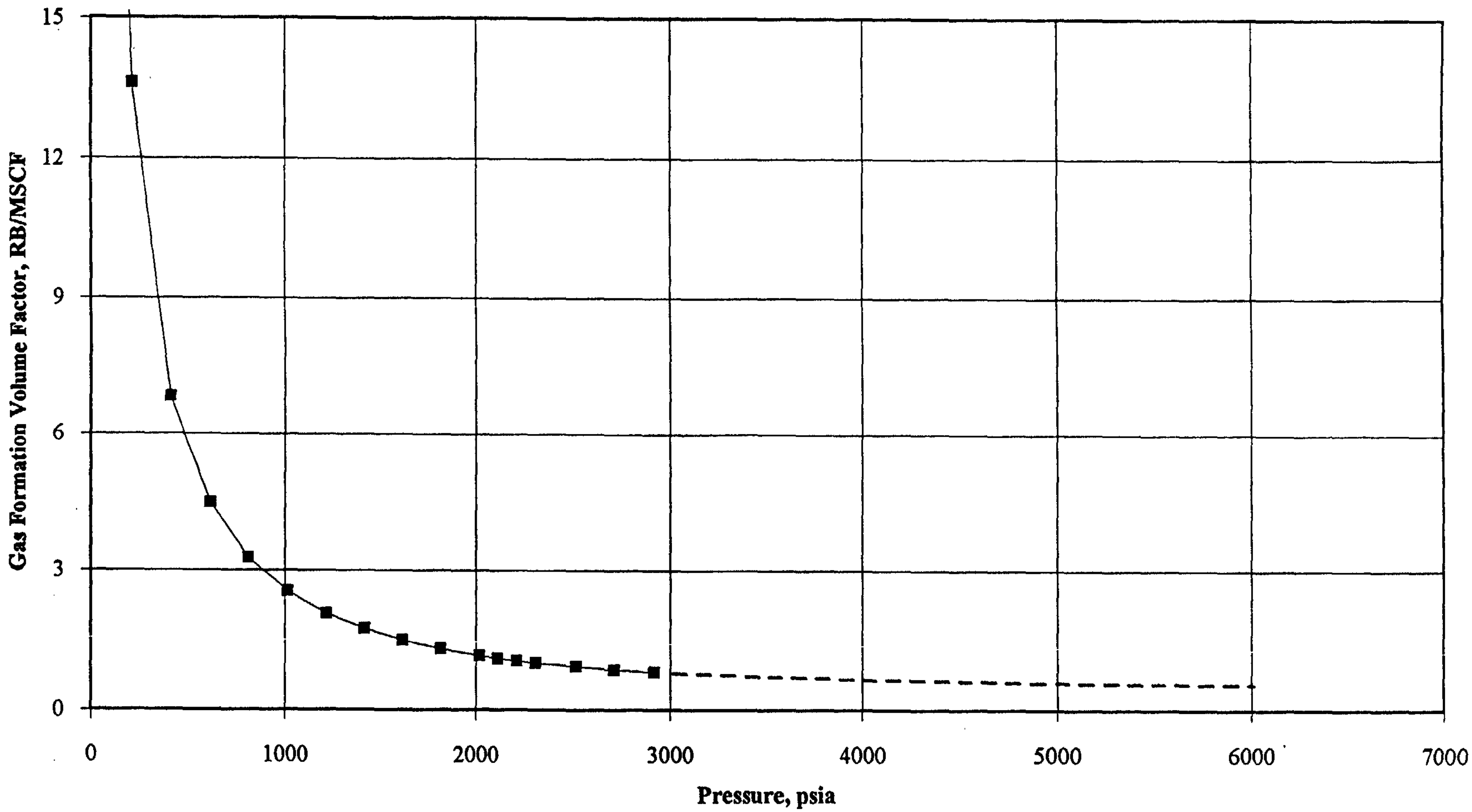
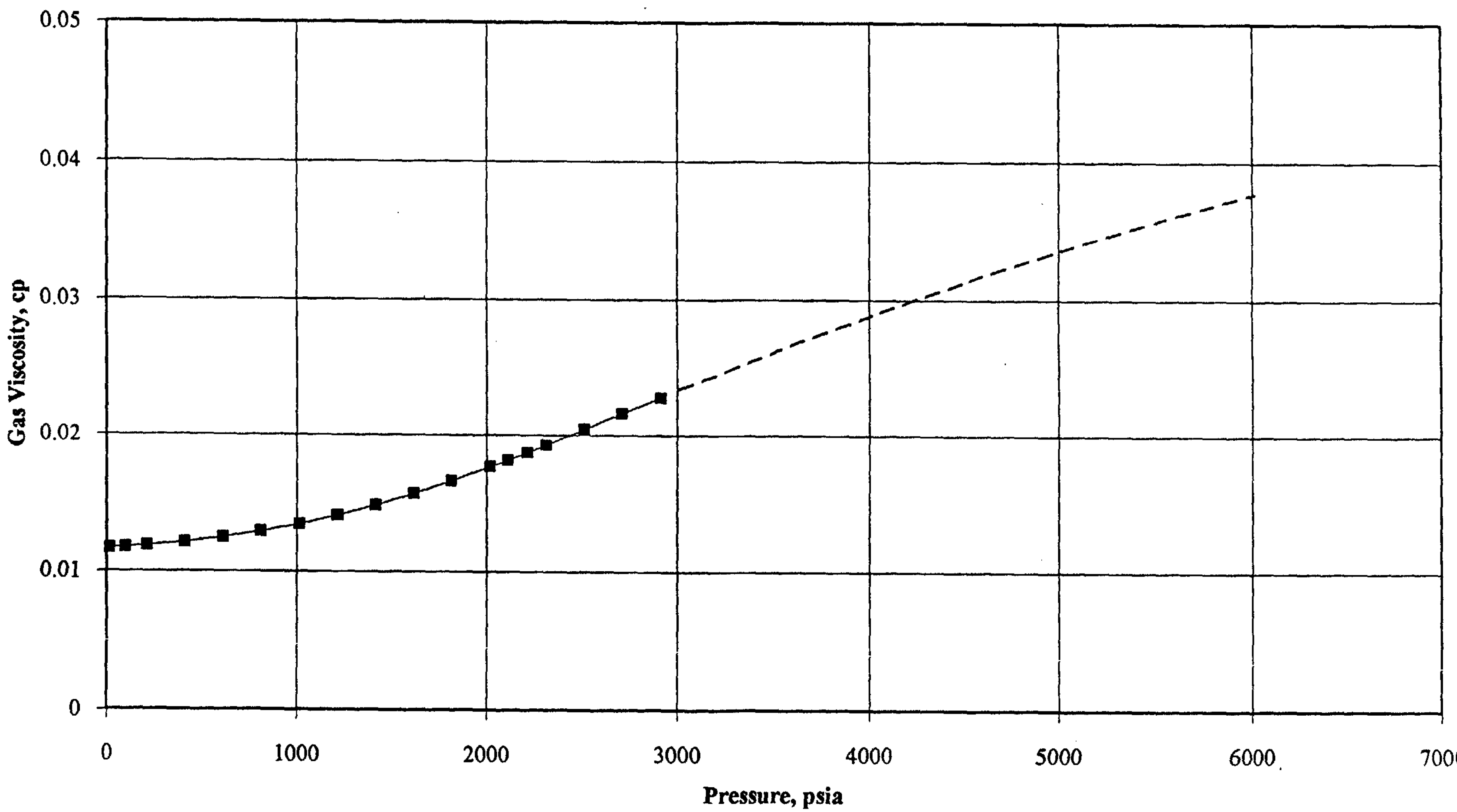


Figure 9

Gas Viscosity vs Pressure - Simulation
Canyon Reservoir - Dagger Draw Field



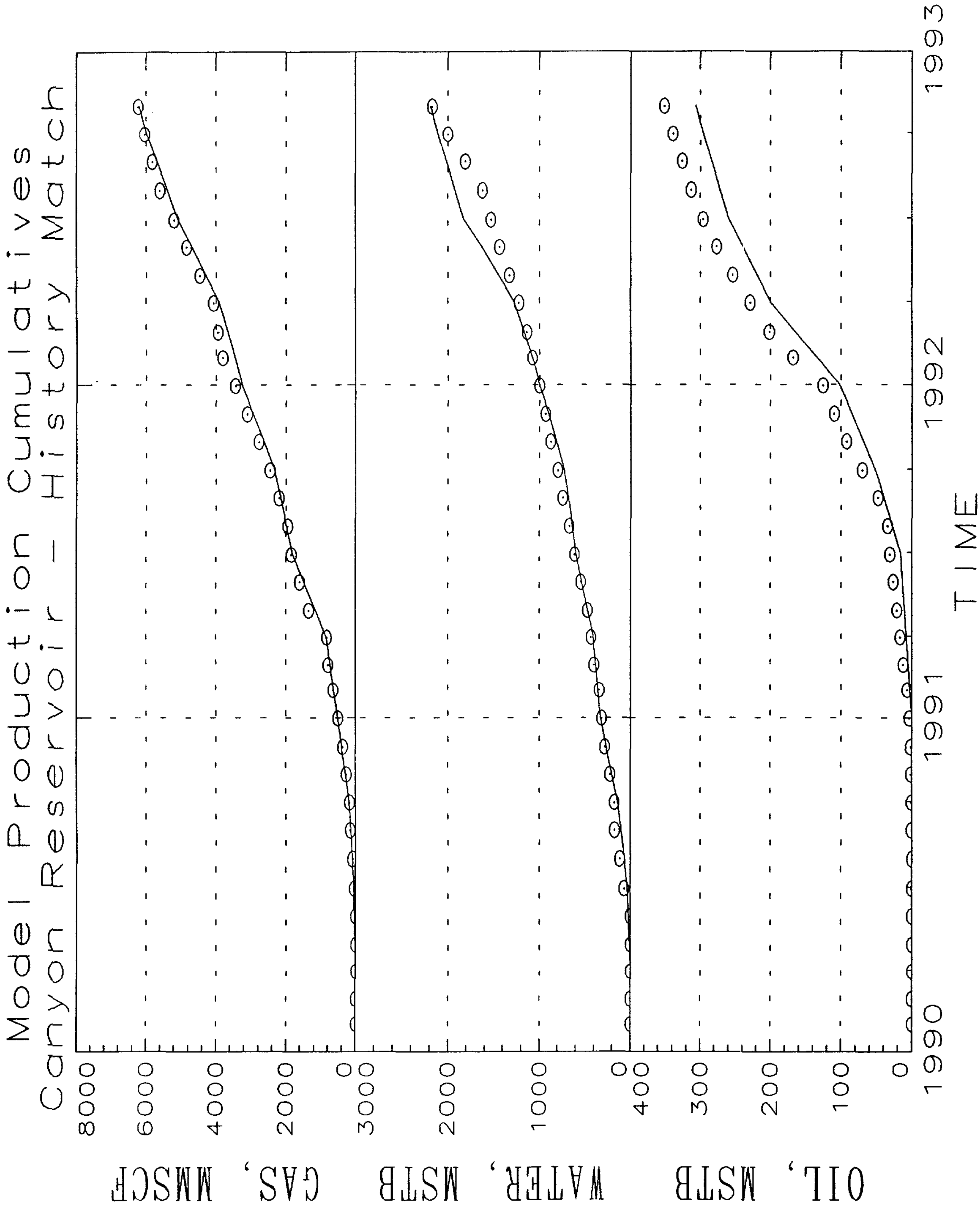
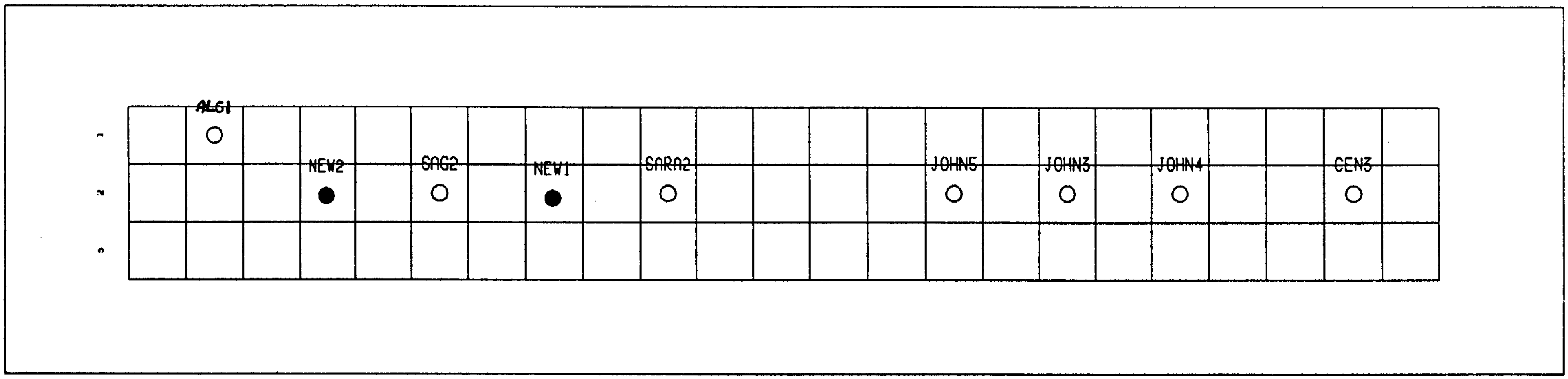
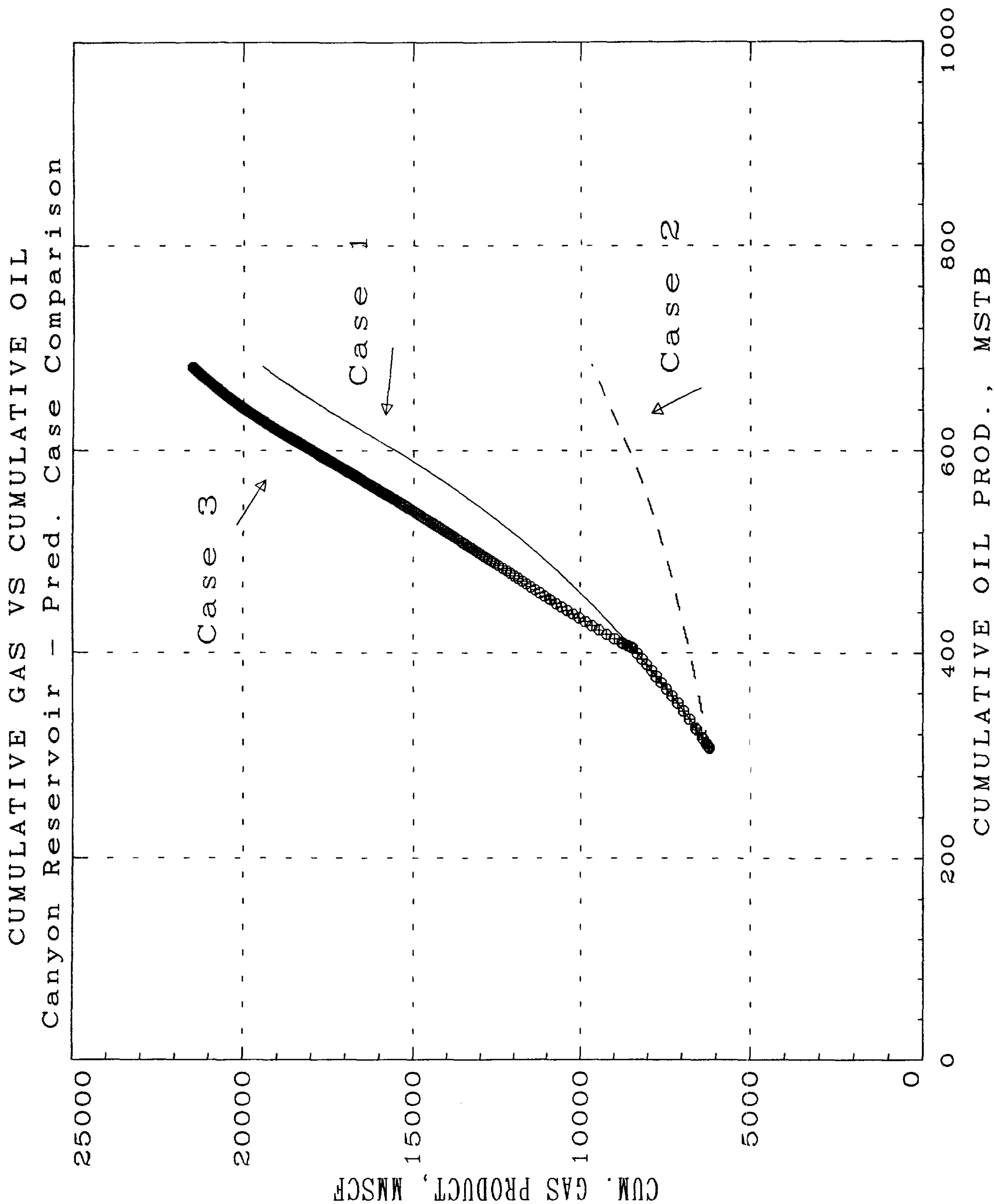

Model Production Cumulatives
Canyon Reservoir - History Match
GAS, MMSCF
WATER, MSTB
OIL, MSTB
8000
6000
4000
2000
0
3000
2000
1000
0
400
300
200
100
0
1990
1991
1992
1993
TIME

Figure 10

Figure 11
Sector Model Grid - Plan View
Prediction Case 3
Canyon Reservoir - Dagger Draw Field





CUMULATIVE GAS VS CUMULATIVE OIL
Canyon Reservoir - Pred. Case Comparison
Case 1
Case 2
Case 3
25000
20000
15000
10000
5000
0
CUM. GAS PRODUCT, MMSCF
0
200
400
600
800
1000
CUMULATIVE OIL PROD., MSTB

Figure 12

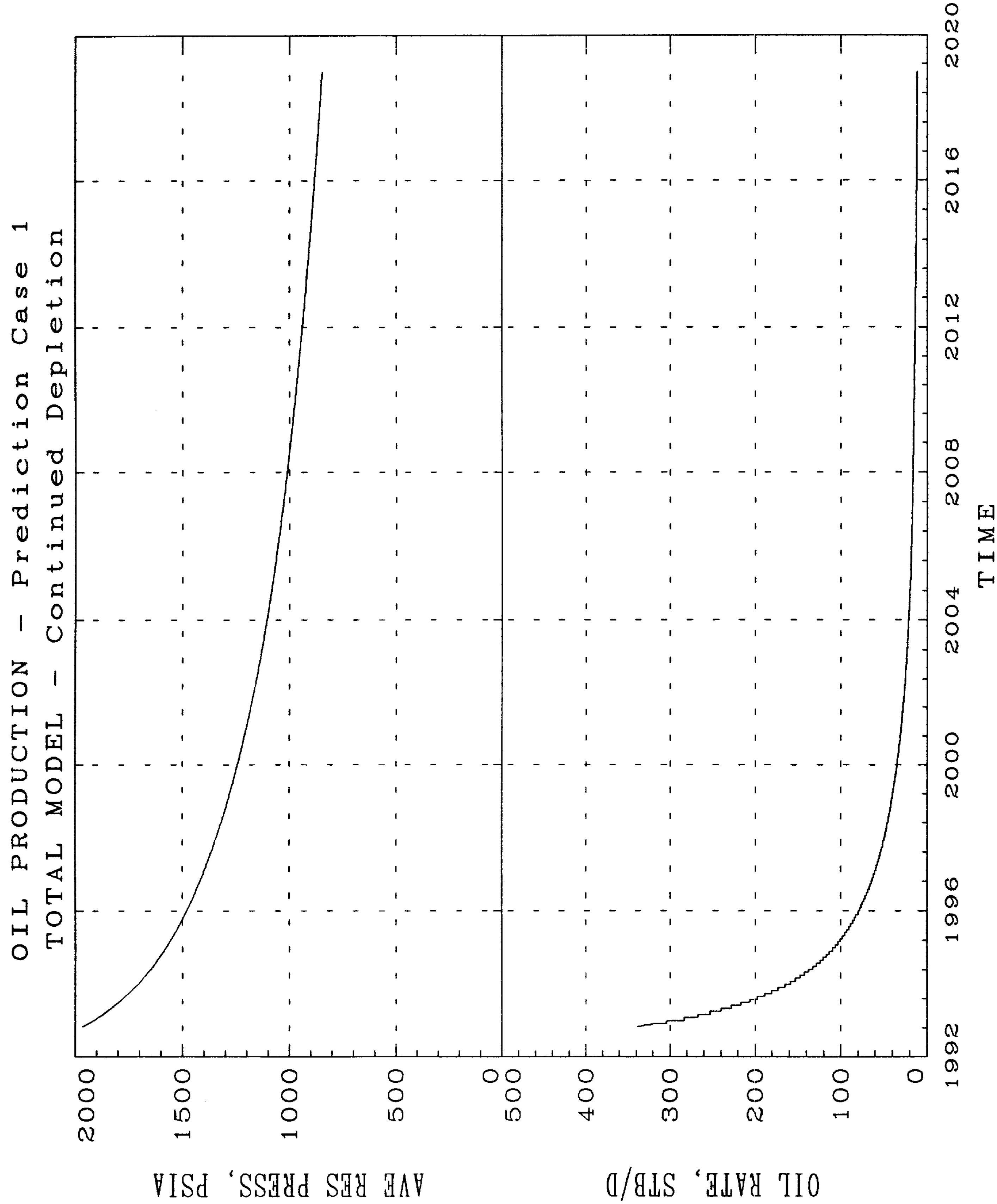
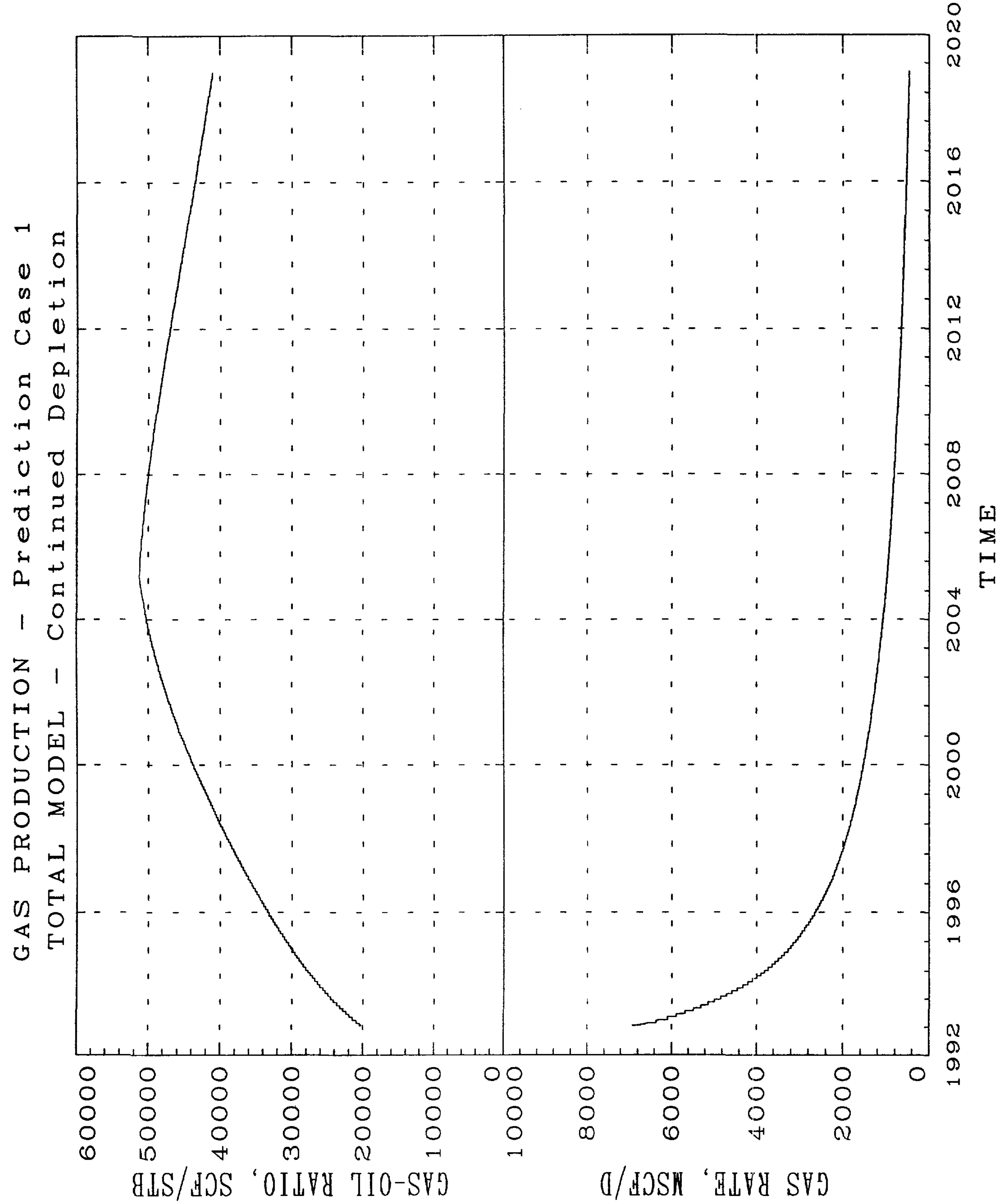
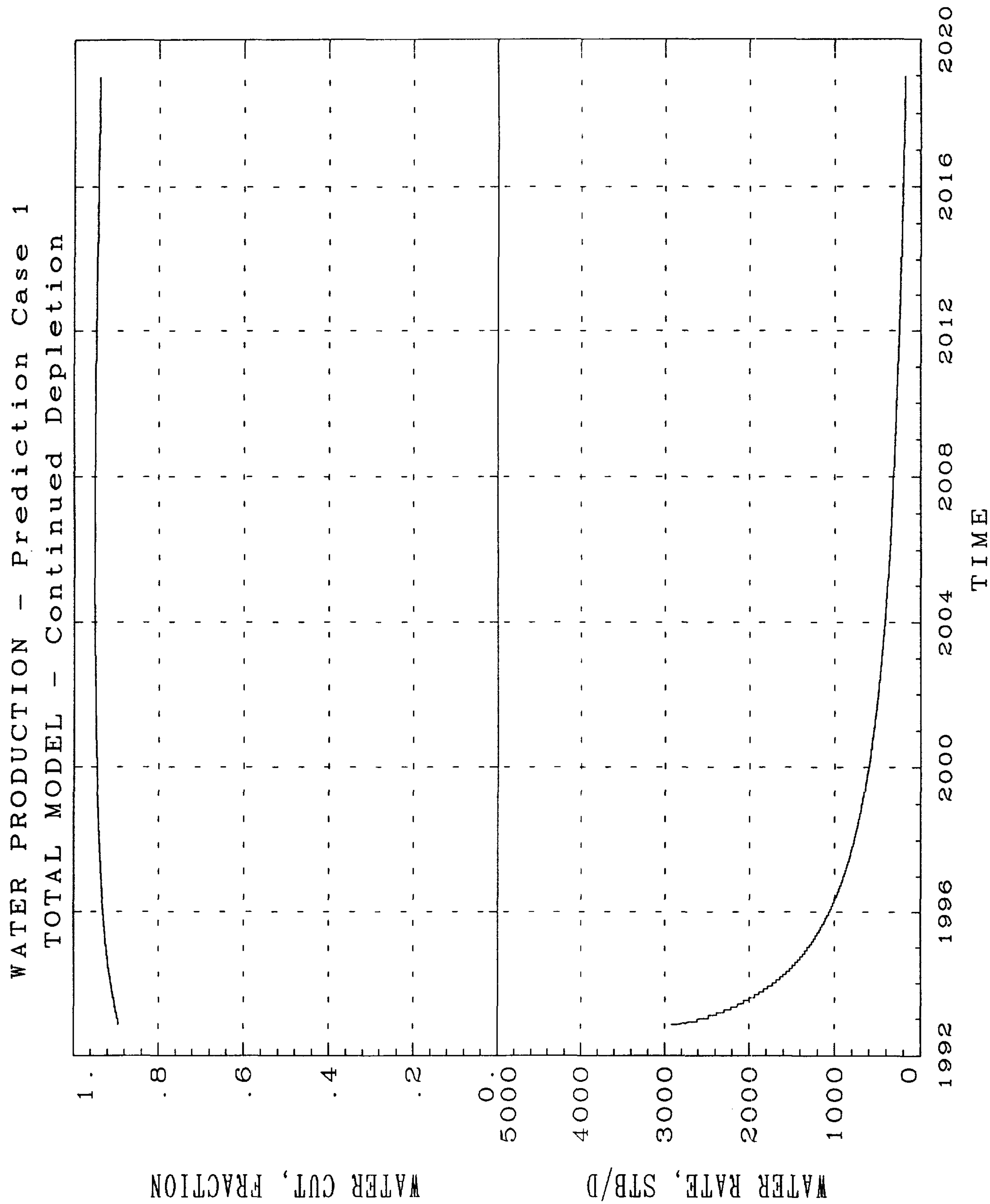

OIL PRODUCTION - Prediction Case 1
TOTAL MODEL - Continued Depletion
AVE RES PRESS, PSIA
OIL RATE, STB/D
TIME
2000
1500
1000
500
0
500
400
300
200
100
0
1992
1996
2000
2004
2008
2012
2016
2020

Figure 13



GAS PRODUCTION - Prediction Case 1
TOTAL MODEL - Continued Depletion
GAS-OIL RATIO, SCF/STB
60000
50000
40000
30000
20000
10000
0
GAS RATE, MSCF/D
10000
8000
6000
4000
2000
0
1992
1996
2000
2004
2008
2012
2016
2020
TIME

Figure 14

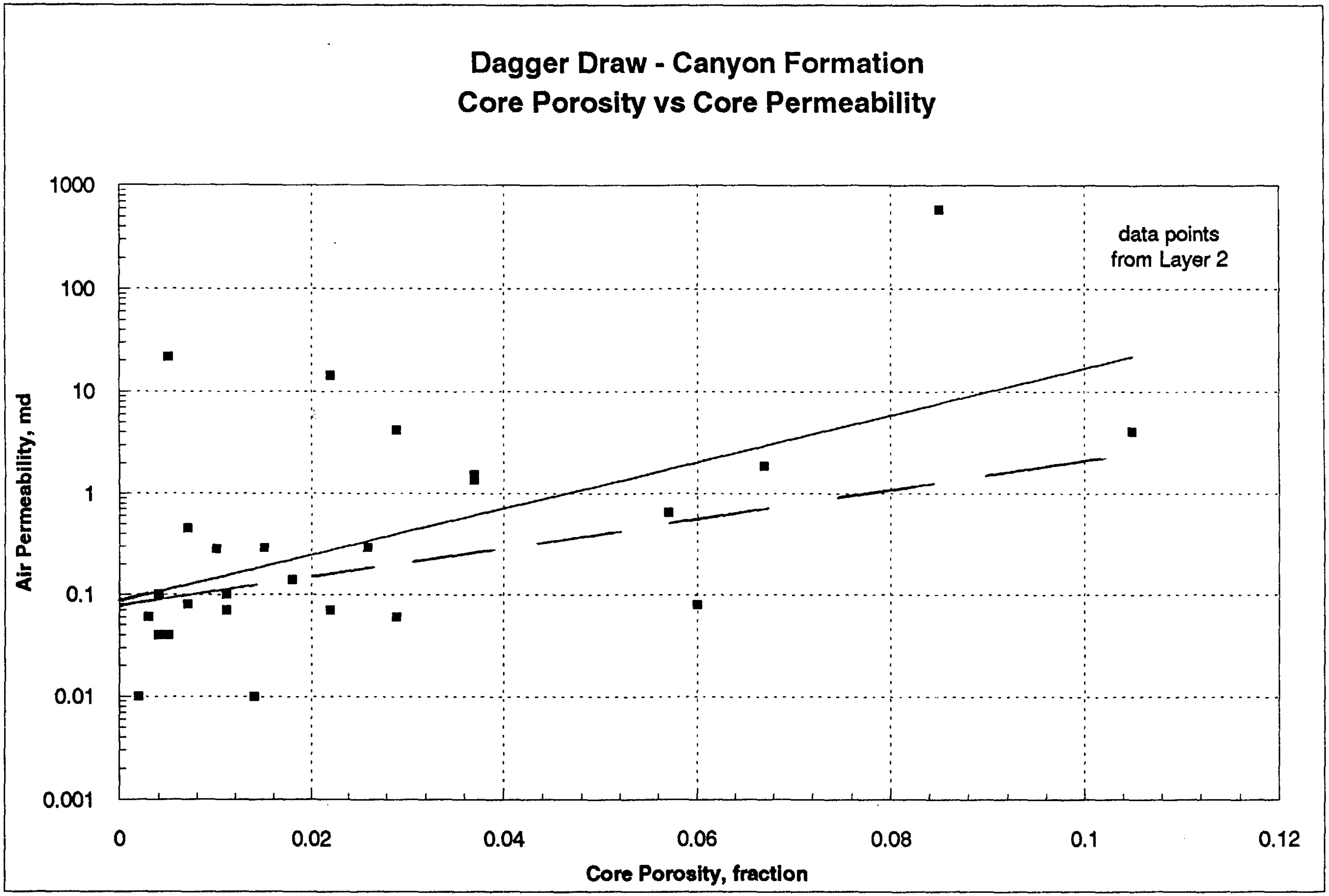


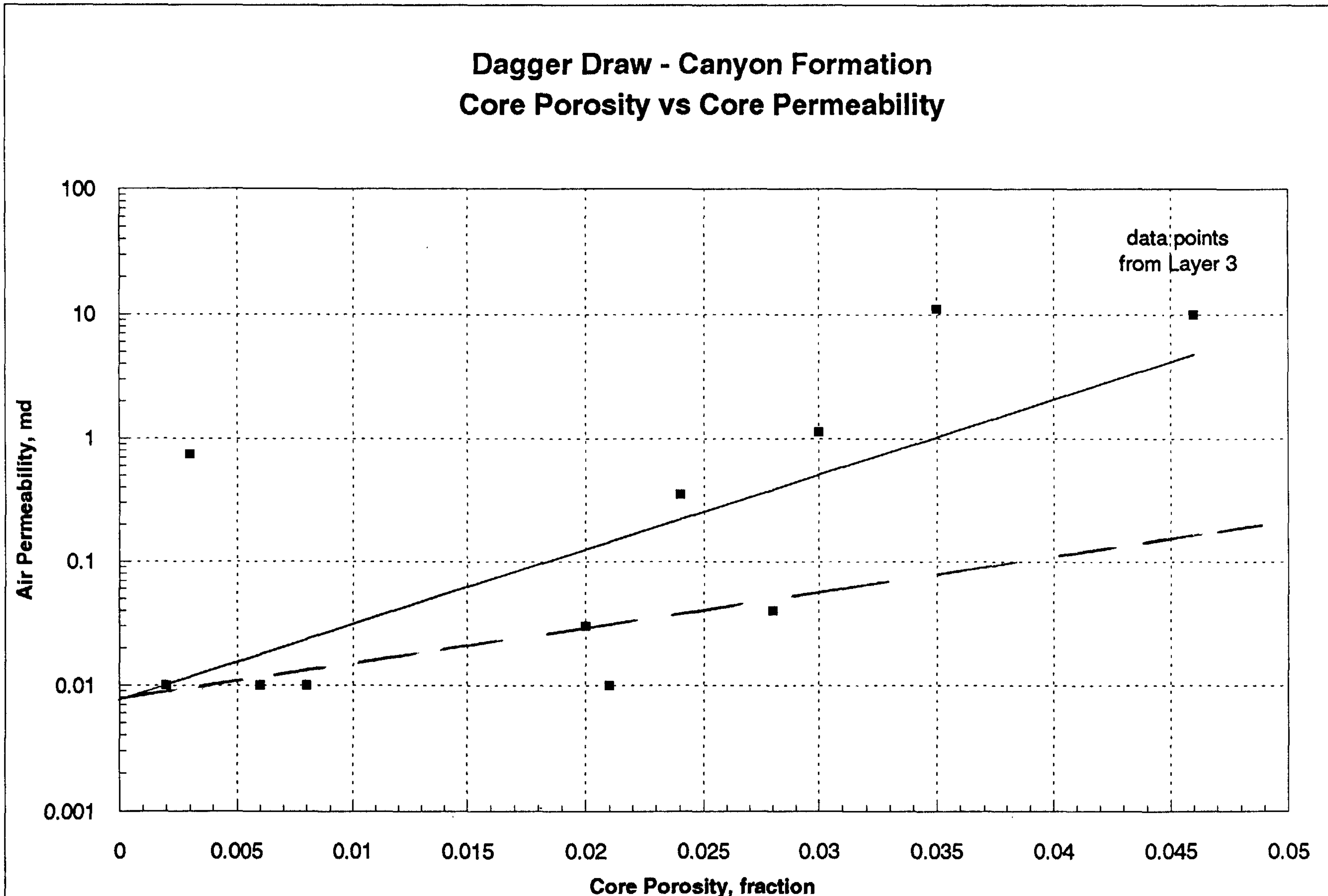
WATER PRODUCTION - Prediction Case 1
TOTAL MODEL - Continued Depletion
WATER CUT, FRACTION
WATER RATE, STB/D
TIME
1.
.8
.6
.4
.2
0.
5000
4000
3000
2000
1000
0
1992
1996
2000
2004
2008
2012
2016
2020

Figure 15

APPENDIX I

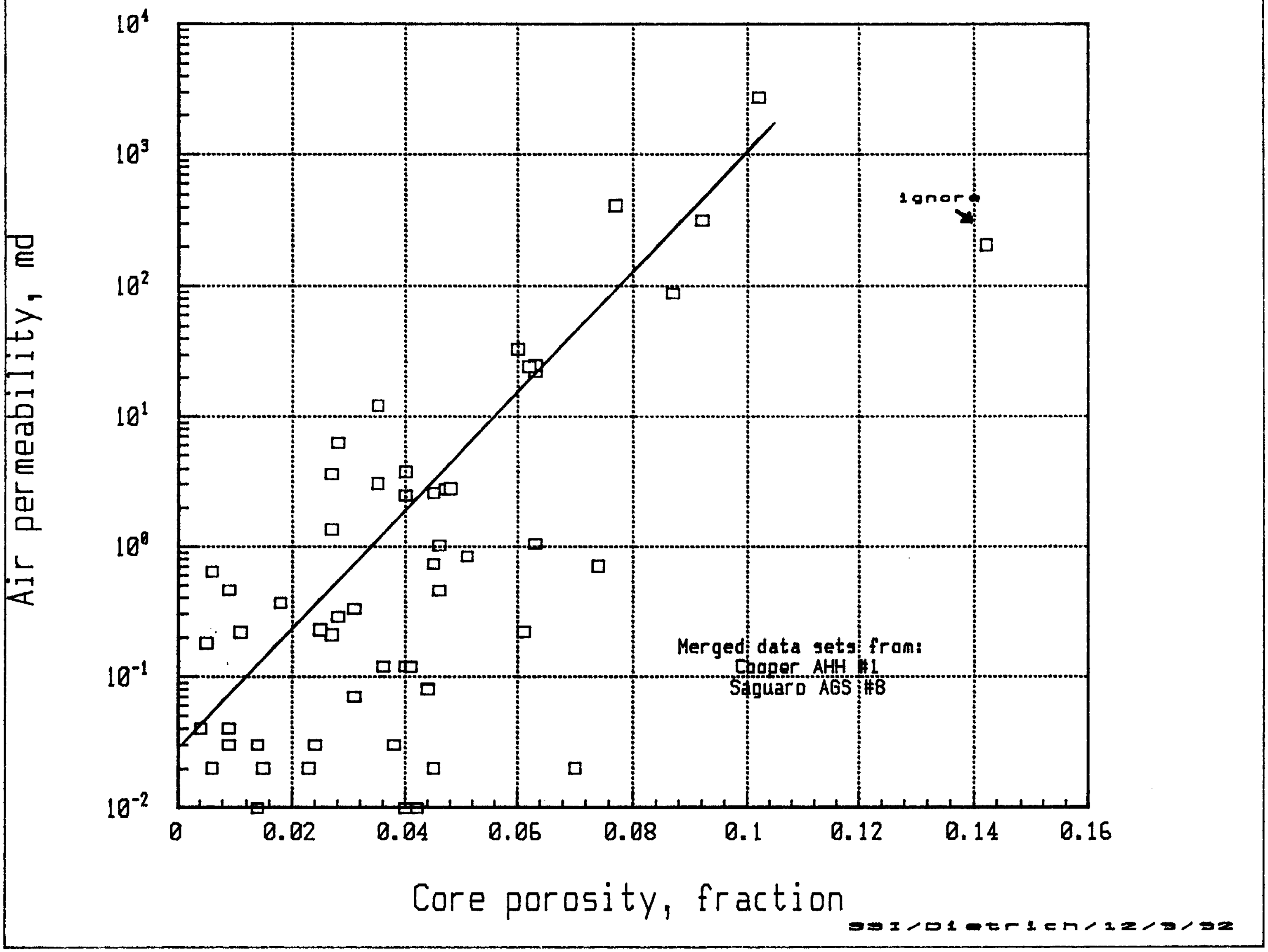
CORE ANALYSIS PLOTS

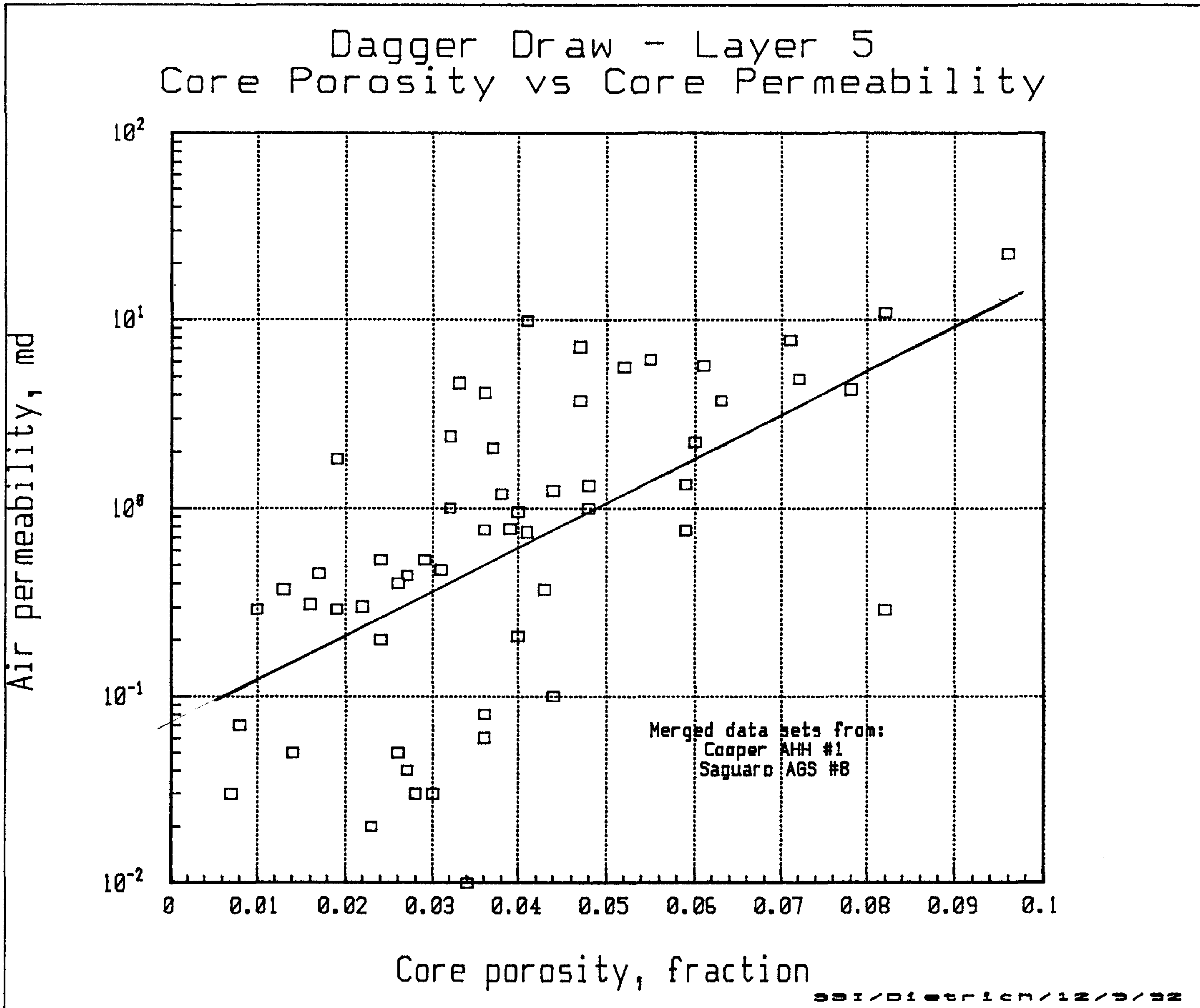

Dagger Draw - Canyon Formation
Core Porosity vs Core Permeability
data points
from Layer 2
Air Permeability, md
1000
100
10
1
0.1
0.01
0.001
0
0.02
0.04
0.06
0.08
0.1
0.12
Core Porosity, fraction



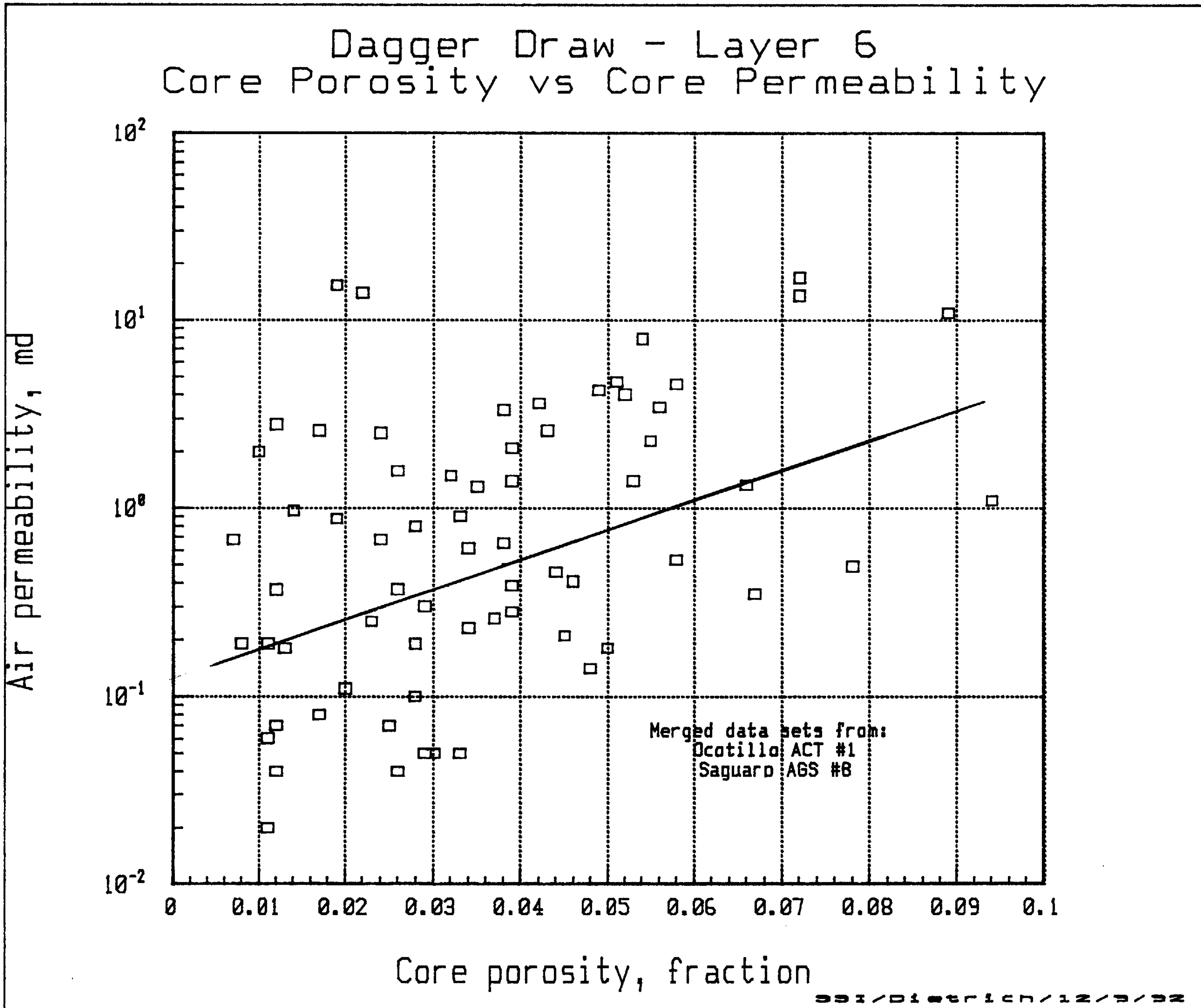
Dagger Draw - Canyon Formation
Core Porosity vs Core Permeability
data points
from Layer 3
Air Permeability, md
100
10
1
0.1
0.01
0.001
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045
0.05
Core Porosity, fraction

Dagger Draw - Layer 4
Core Porosity vs Core Permeability

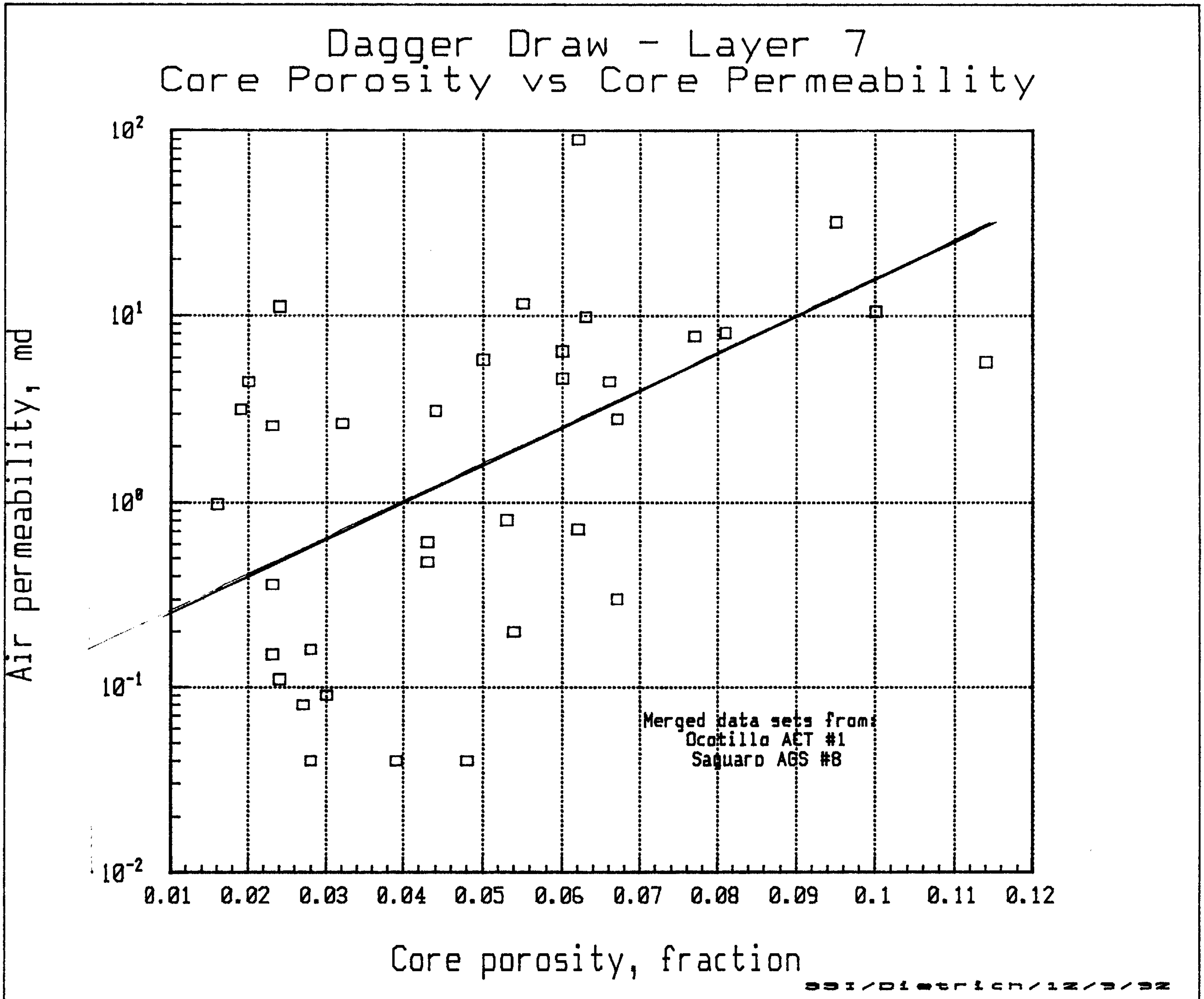


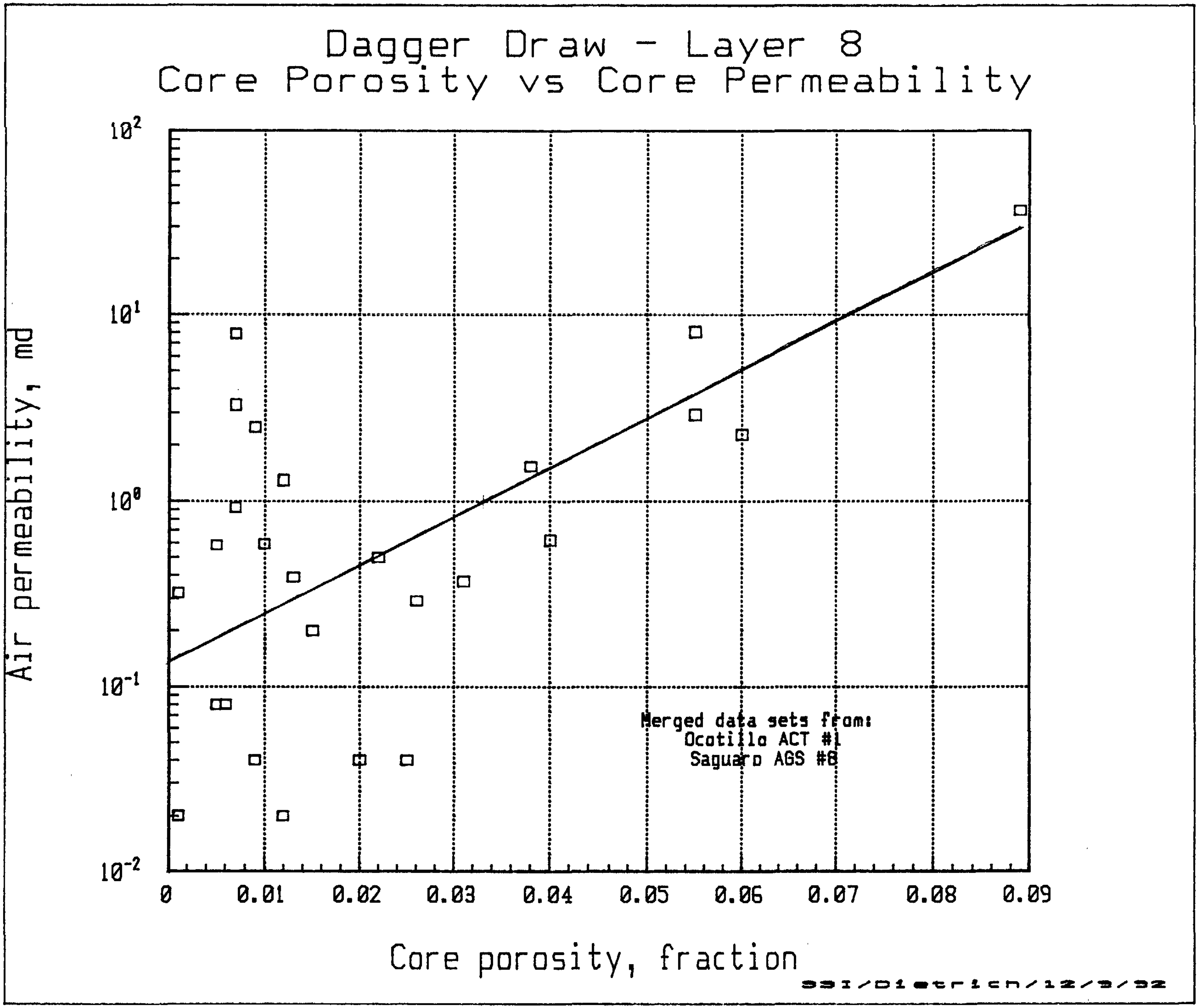


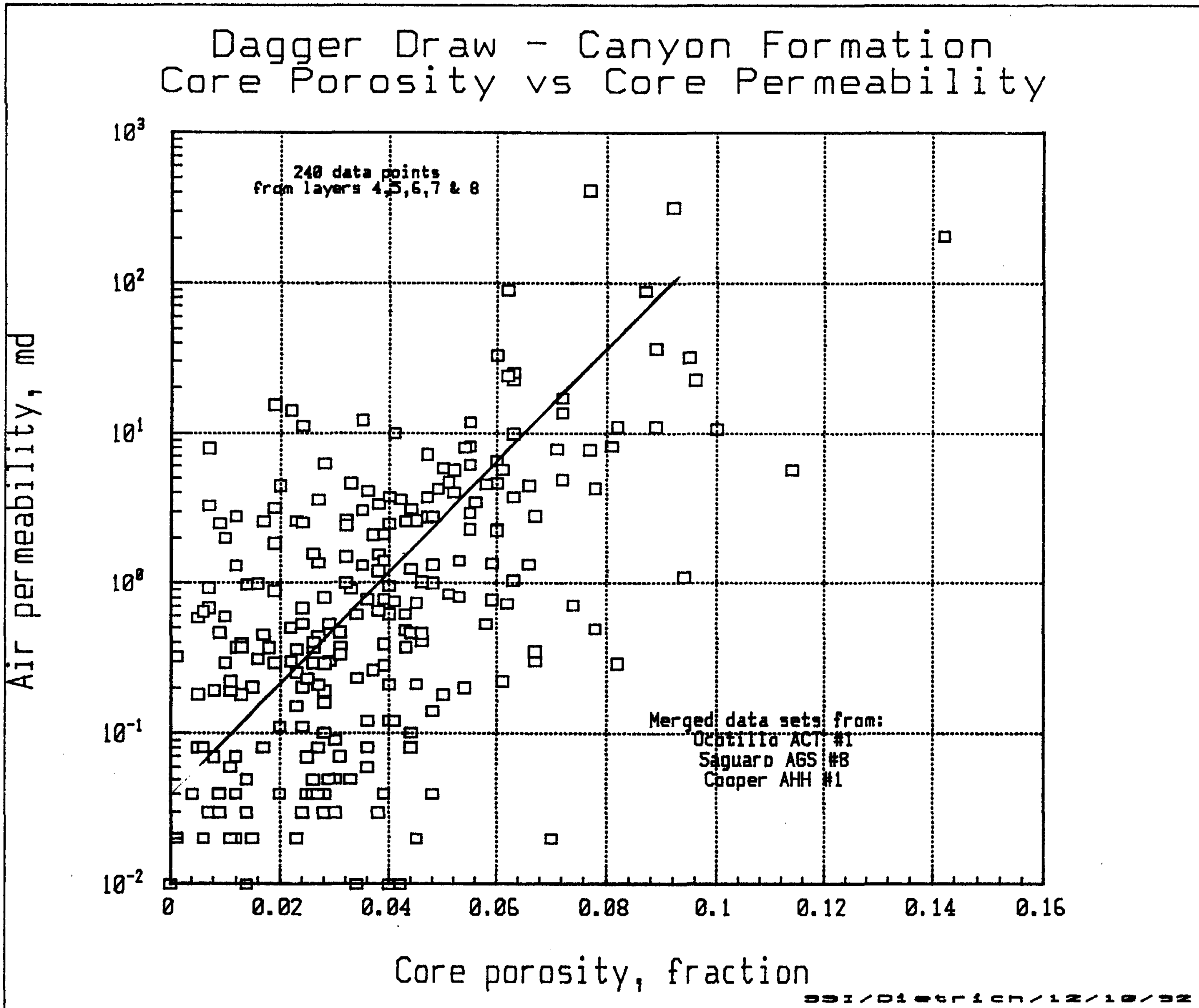
Dagger Draw - Layer 5
Core Porosity vs Core Permeability
10^2
10^1
10^0
10^-1
10^-2
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
Air permeability, md
Core porosity, fraction
Merged data sets from:
Cooper AHH #1
Saguaro AGS #8
SSI/Dietrich/12/9/92



Dagger Draw - Layer 6
Core Porosity vs Core Permeability
Air permeability, md
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
Core porosity, fraction
Merged data sets from:
Ocotillo ACT #1
Saguaro AGS #8
SSI/Dietrich/12/3/92


Dagger Draw - Layer 7
Core Porosity vs Core Permeability
Air permeability, md
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.1 0.11 0.12
Core porosity, fraction
Merged data sets from:
Ocotillo ACT #1
Saguaro AGS #8
SSI/Dietrich/12/3/92


Dagger Draw - Layer 8
Core Porosity vs Core Permeability
Air permeability, md
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
Core porosity, fraction
Merged data sets from:
Ocotillo ACT #1
Saguaro AGS #8



Dagger Draw - Canyon Formation
Core Porosity vs Core Permeability
240 data points
from layers 4,5,6,7 & 8
Merged data sets from:
Ocotillo ACT #1
Saguaro AGS #B
Cooper AHH #1
Air permeability, md
10^3
10^2
10^1
10^0
10^{-1}
10^{-2}
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
Core porosity, fraction
SSI/Dietrich/12/10/92

APPENDIX II

SCAL, INC.

RELATIVE PERMEABILITY LAB ANALYSIS

SCAL, INC.
SPECIAL CORE ANALYSIS LABORATORIES

Gas-Oil Relative Permeability

Dagger Draw
Federal No. 12
Eddy County, New Mexico

P.O. BOX 9730 • MIDLAND, TX 79708-2730 • (915) 561-5406 • FAX (915) 561-5339

Unsteady-State Gas-Oil Relative Permeability

Company :	Conoco Inc.			
Field :	Dagger Draw			
Well Name :	Dagger Draw Federal # 12 Eddy County, New Mexico			
Sample :	3		Porosity :	9.82 %
Depth :	7658' 11"		Permeability :	507 mD
Temperature :	22.00	deg. C	Keo @ Siw :	72.9 mD
Oil Viscosity :	22.40	cP	Keg @ Sro :	9.04 mD
Gas Viscosity :	0.018	cP	Siw	31.03 %
			Sro	33.34 %

TEST RESULTS

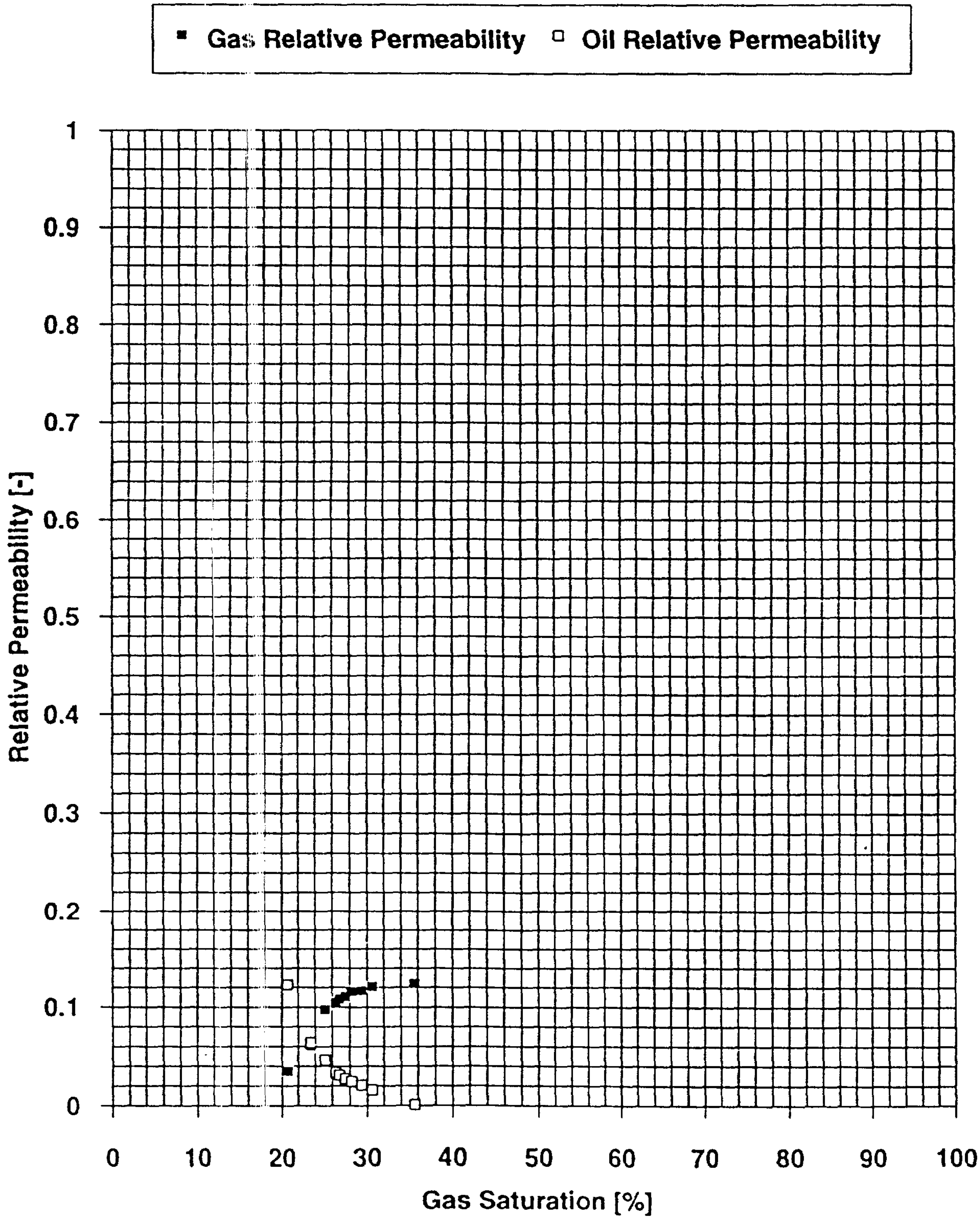
No.	Sg	* Krg	* Kro	Krg/Kro
-	%	-	-	-
1	20.76	0.034	0.123	0.280
2	23.51	0.061	0.064	0.959
3	25.17	0.097	0.046	2.106
4	26.41	0.104	0.033	3.170
5	26.84	0.108	0.031	3.521
6	27.54	0.110	0.027	4.124
7	28.23	0.115	0.024	4.781
8	29.43	0.117	0.020	5.698
9	30.62	0.120	0.016	7.675
10	35.63	0.124	0.000	

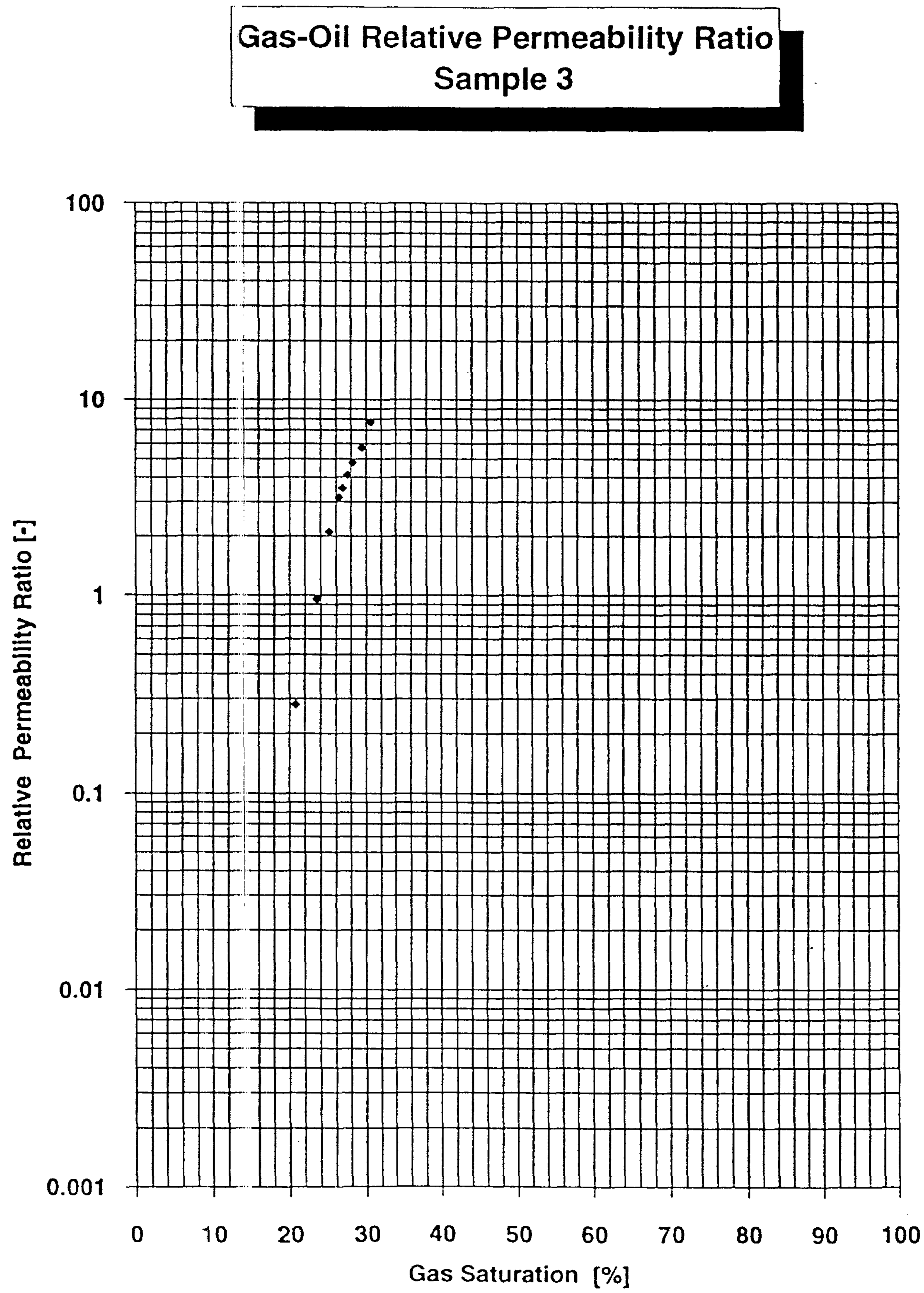
* Relative to Keo @ Swi

Notations:

Keo	Effective Oil Permeability
Keg	Effective Gas Permeability
Sro	Residual Oil Saturation
Siw	Irreducible Water Saturation

Unsteady-State Gas-Oil Relative Permeability
Sample 3




Gas-Oil Relative Permeability Ratio
Sample 3
100
10
1
0.1
0.01
0.001
Relative Permeability Ratio [-]
0
10
20
30
40
50
60
70
80
90
100
Gas Saturation [%]

Unsteady-State Gas-Oil Relative Permeability

Company :	Conoco Inc.			
Field :	Dagger Draw			
Well Name :	Dagger Draw Federal # 12 Eddy County, New Mexico			
Sample :	4W		Porosity :	10.27 %
Depth :	7806' 6"		Permeability :	29.8 mD
Temperature :	22.00	deg. C	Keo @ Siw :	11.7 mD
Oil Viscosity :	22.40	cP	Keg @ Sro :	0.57 mD
Gas Viscosity :	0.018	cP	Siw	24.56 %
			Sro	35.13 %

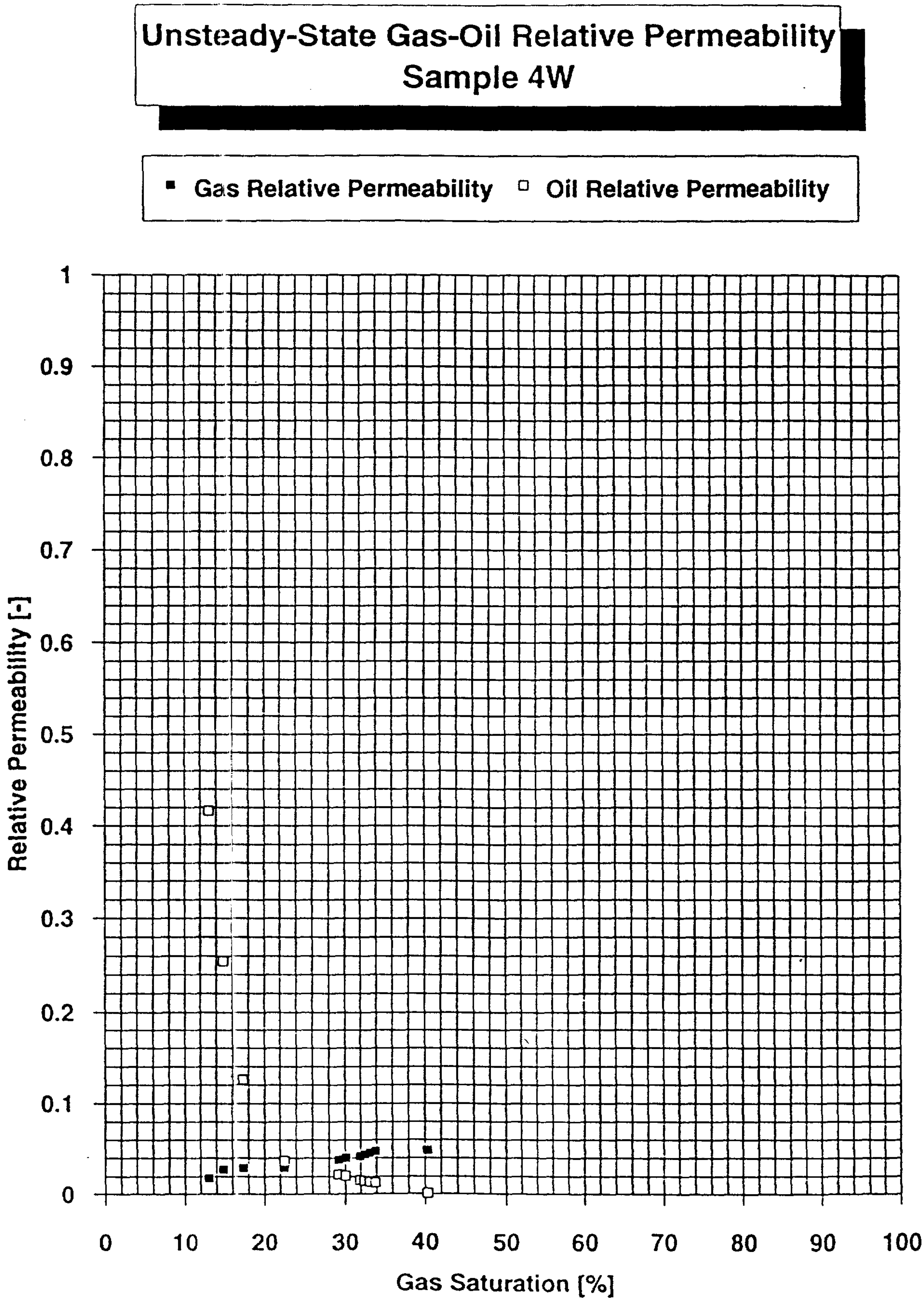
TEST RESULTS

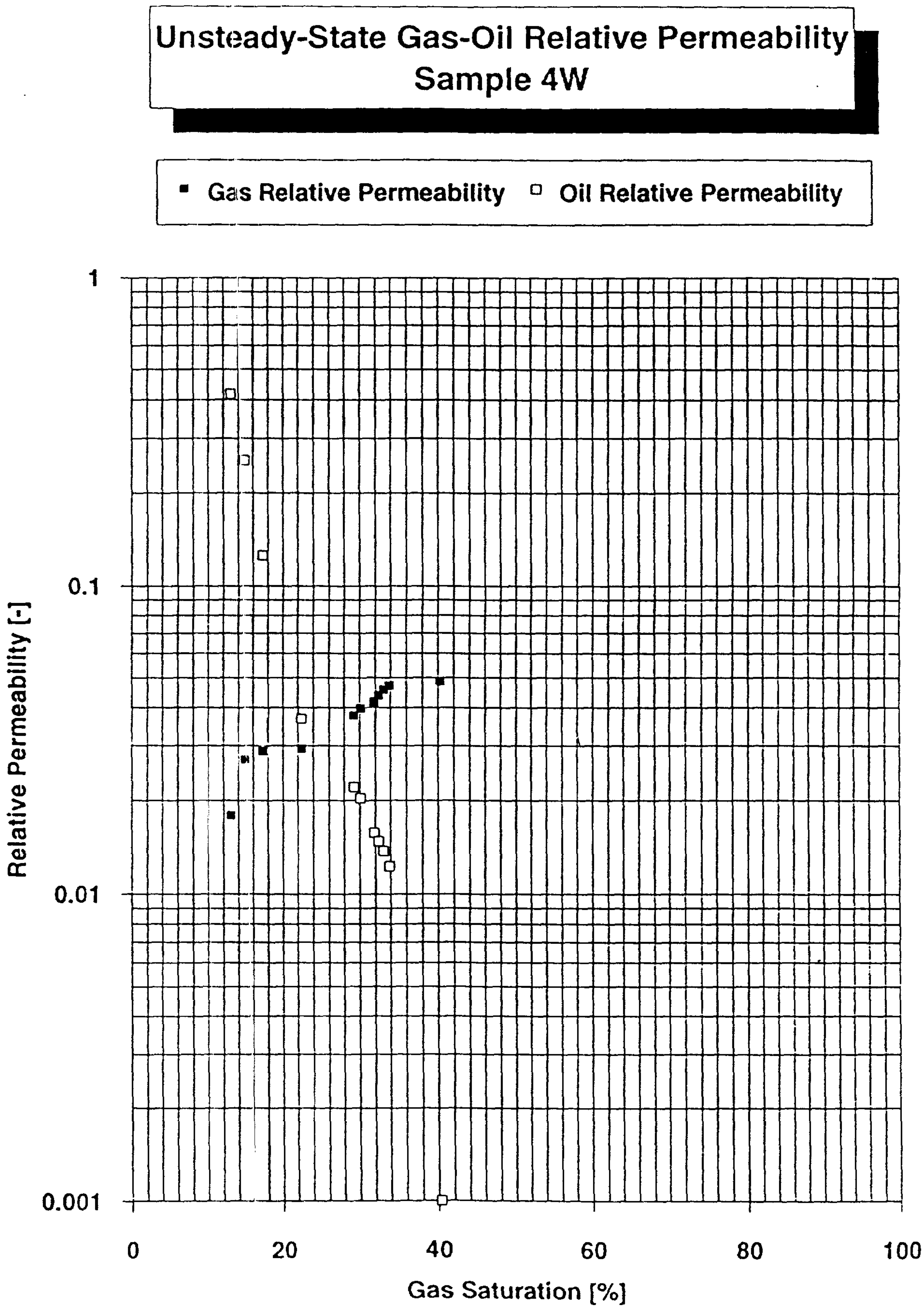
No.	Sg	* Krg	* Kro	Krg/Kro
-	%	-	-	-
1	13.05	0.018	0.416	0.043
2	14.90	0.027	0.254	0.106
3	17.34	0.029	0.126	0.229
4	22.50	0.029	0.037	0.796
5	29.23	0.038	0.022	1.708
6	30.11	0.040	0.020	1.961
7	31.88	0.042	0.016	2.650
8	32.49	0.044	0.015	2.964
9	33.12	0.046	0.014	3.327
10	33.88	0.047	0.012	3.838
11	40.31	0.049	0.000	

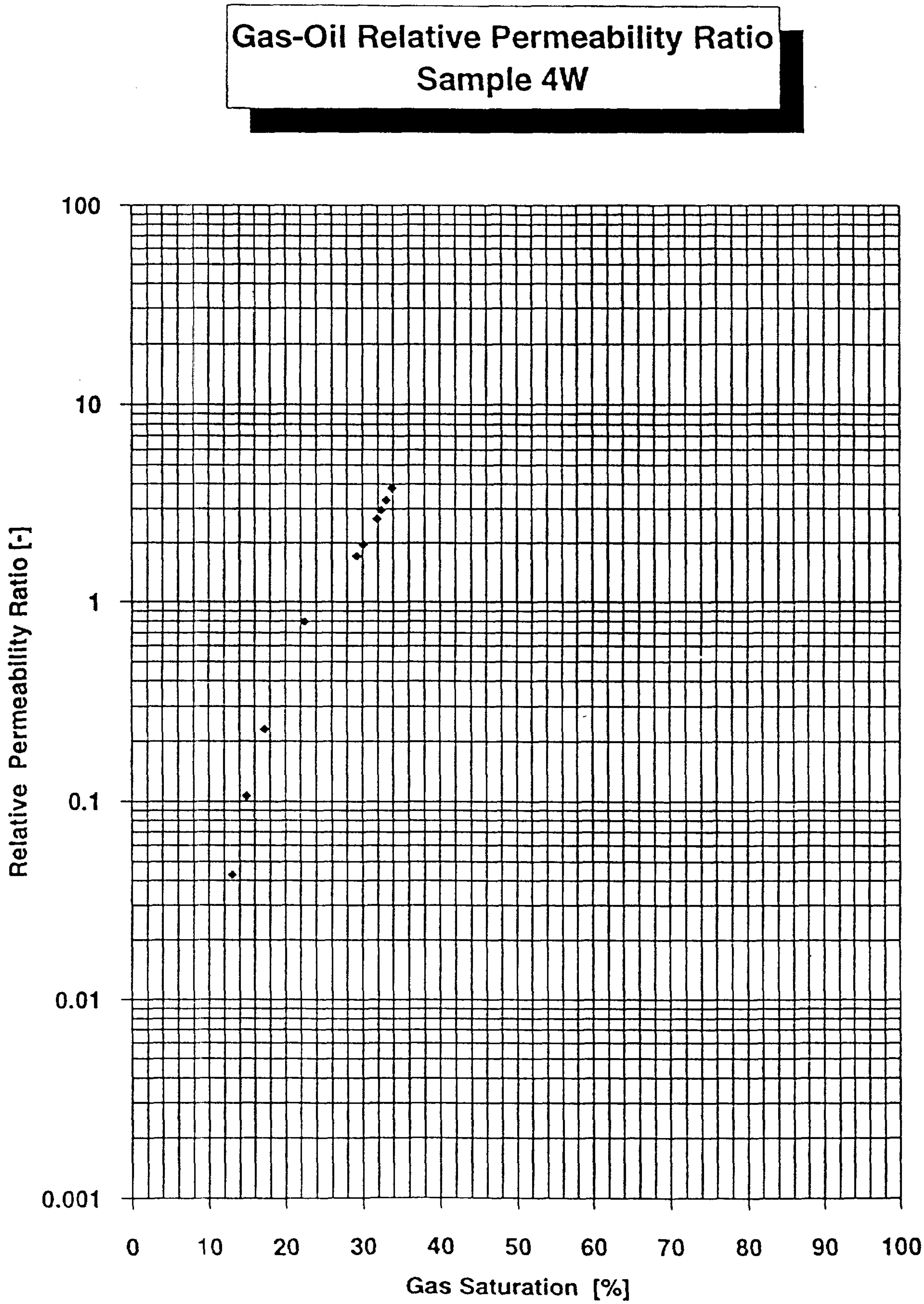
* Relative to Keo @ Swi

Notations:

Keo	Effective Oil Permeability
Keg	Effective Gas Permeability
Sro	Residual Oil Saturation
Siw	Irreducible Water Saturation


Unsteady-State Gas-Oil Relative Permeability
Sample 4W
Gas Relative Permeability
Oil Relative Permeability
Relative Permeability [-]
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
Gas Saturation [%]


Unsteady-State Gas-Oil Relative Permeability
Sample 4W
Gas Relative Permeability
Oil Relative Permeability
Relative Permeability [-]
1
0.1
0.01
0.001
0
20
40
60
80
100
Gas Saturation [%]



Gas-Oil Relative Permeability Ratio
Sample 4W
Relative Permeability Ratio [-]
100
10
1
0.1
0.01
0.001
0
10
20
30
40
50
60
70
80
90
100
Gas Saturation [%]

SCAL, INC.
SPECIAL CORE ANALYSIS LABORATORIES

Water-Oil Relative Permeability

Dagger Draw
Federal No. 12
Eddy County, New Mexico

P.O BOX 9730 • MIDLAND, TX 79708-2730 • (915) 561-5406 • FAX (915) 561-5339

Unsteady-State Water-Oil Relative Permeability

Company :	Conoco Inc.		
Field :	Dagger Draw		
Location :	Dagger Draw Federal # 12		
Well Name :	Eddy County, New Mexico		
Sample :	3	Porosity :	9.82 %
Depth :	7658' 11"	Permeability :	507 mD
Temperature :	22 deg. C	Keo @ Siw :	72.9 mD
Oil Viscosity :	22.4 cP	Kew @ Sro :	13.8 mD
Brine Viscosity :	1.03 cP		

TEST RESULTS :

No.	Sw	* Krw	* Kro	Krw/Kro
_	%	_	-	-
1	31.03	0.0000	1.0000	0.000
2	34.22	0.0697	0.6272	0.111
3	41.89	0.0996	0.2391	0.417
4	43.80	0.1049	0.1625	0.646
5	45.33	0.1112	0.1182	0.940
6	48.33	0.1387	0.0708	1.958
7	52.78	0.1426	0.0215	6.625
8	54.12	0.1637	0.0176	9.292
9	55.89	0.1742	0.0084	20.792
10	60.08	0.1886	0.0000	

* Relative to Keo @ Siw

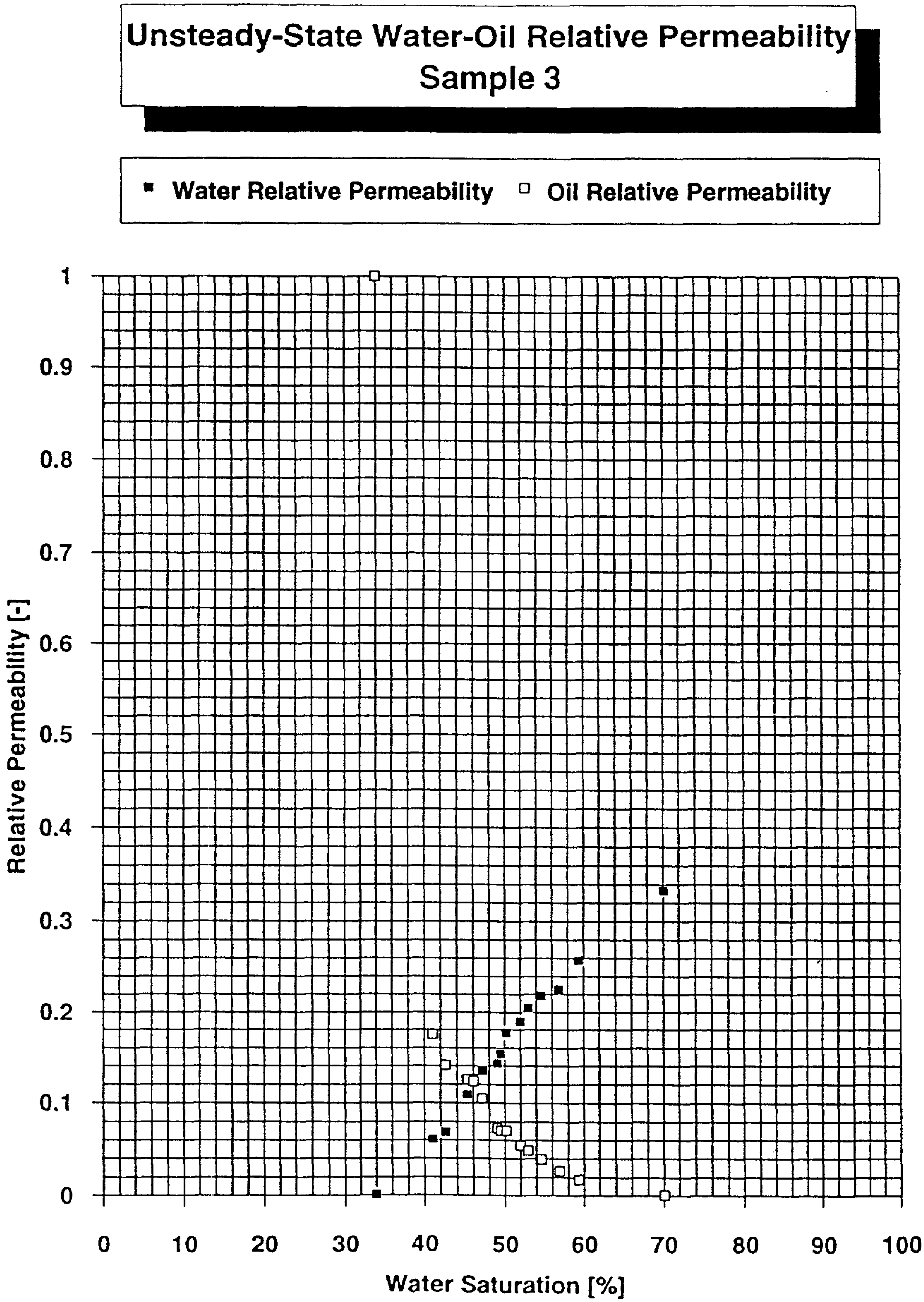
Notations:

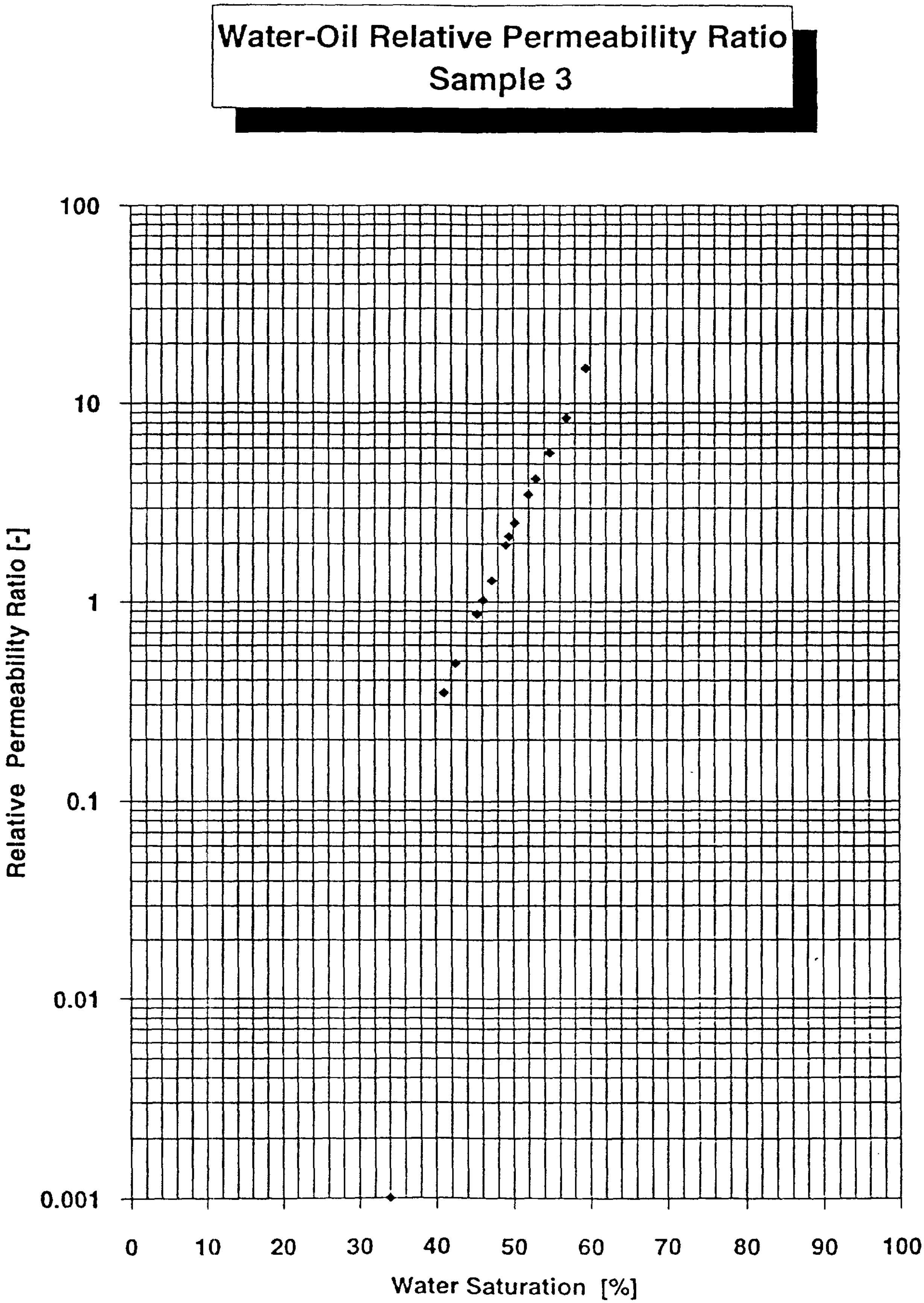
Keo Effective Oil Permeability

Kew Effective Water Permeability

Sro Residual Oil Saturation

Siw Irreducible Water Saturation


Unsteady-State Water-Oil Relative Permeability
Sample 3
Water Relative Permeability
Oil Relative Permeability
Relative Permeability [-]
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
10
20
30
40
50
60
70
80
90
100
Water Saturation [%]



Water-Oil Relative Permeability Ratio
Sample 3
Relative Permeability Ratio [-]
100
10
1
0.1
0.01
0.001
0
10
20
30
40
50
60
70
80
90
100
Water Saturation [%]

Unsteady-State Water-Oil Relative Permeability

Company :	Conoco Inc.		
Field :	Dagger Draw		
Location :	Dagger Draw Federal # 12		
Well Name :	Eddy County, New Mexico		
Sample :	4W	Porosity :	10.27 %
Depth :	7806' 6"	Permeability :	29.8 mD
Temperature :	22 deg. C	Keo @ Siw :	11.7 mD
Oil Viscosity :	22.4 cP	Kew @ Sro :	1.556 mD
Brine Viscosity :	1.03 cP		

TEST RESULTS :

No.	Sw	* Krw	* Kro	Krw/Kro
_	%	_	-	-
1	24.56	0.0000	1.0000	0.000
2	31.12	0.0331	0.9084	0.036
3	43.21	0.0953	0.4085	0.233
4	44.75	0.0987	0.3268	0.302
5	46.88	0.1021	0.2451	0.417
6	49.60	0.1055	0.1634	0.646
7	52.91	0.1089	0.0817	1.333
8	57.39	0.1157	0.0411	2.815
9	59.24	0.1177	0.0237	4.958
10	62.37	0.1227	0.0132	9.292
11	69.81	0.1330	0.0000	

* Relative to Keo @ Siw

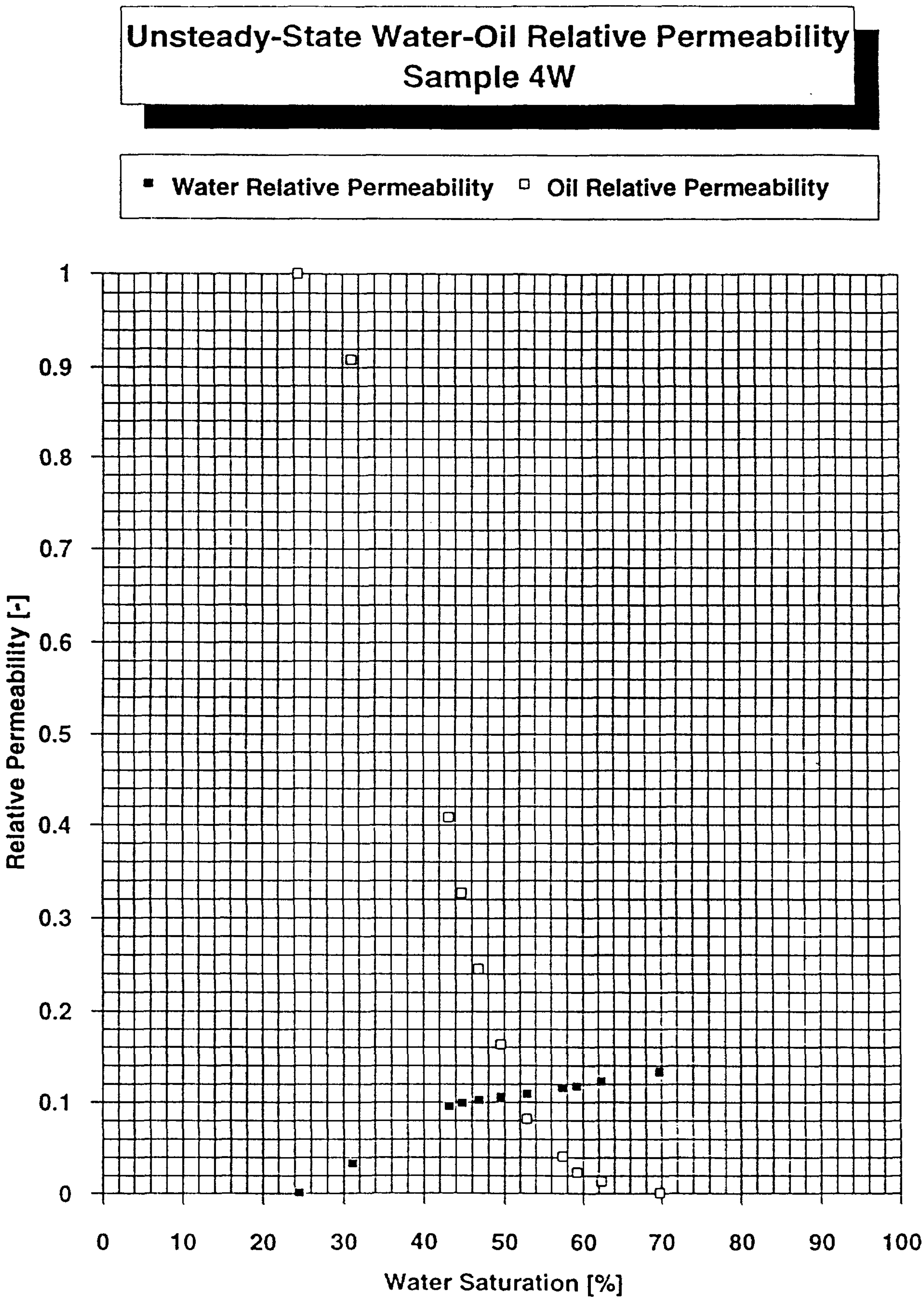
Notations:

Keo Effective Oil Permeability

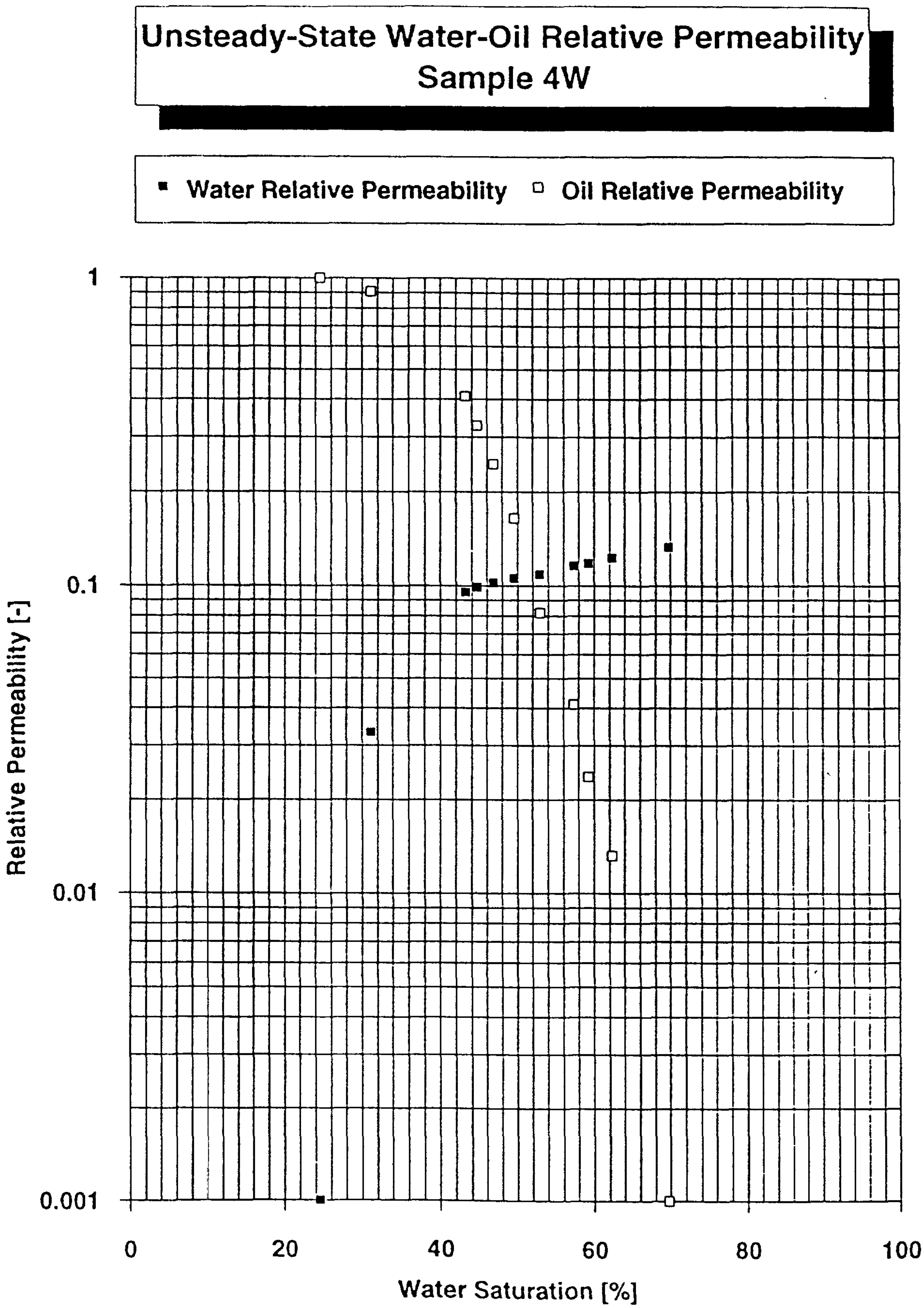
Kew Effective Water Permeability

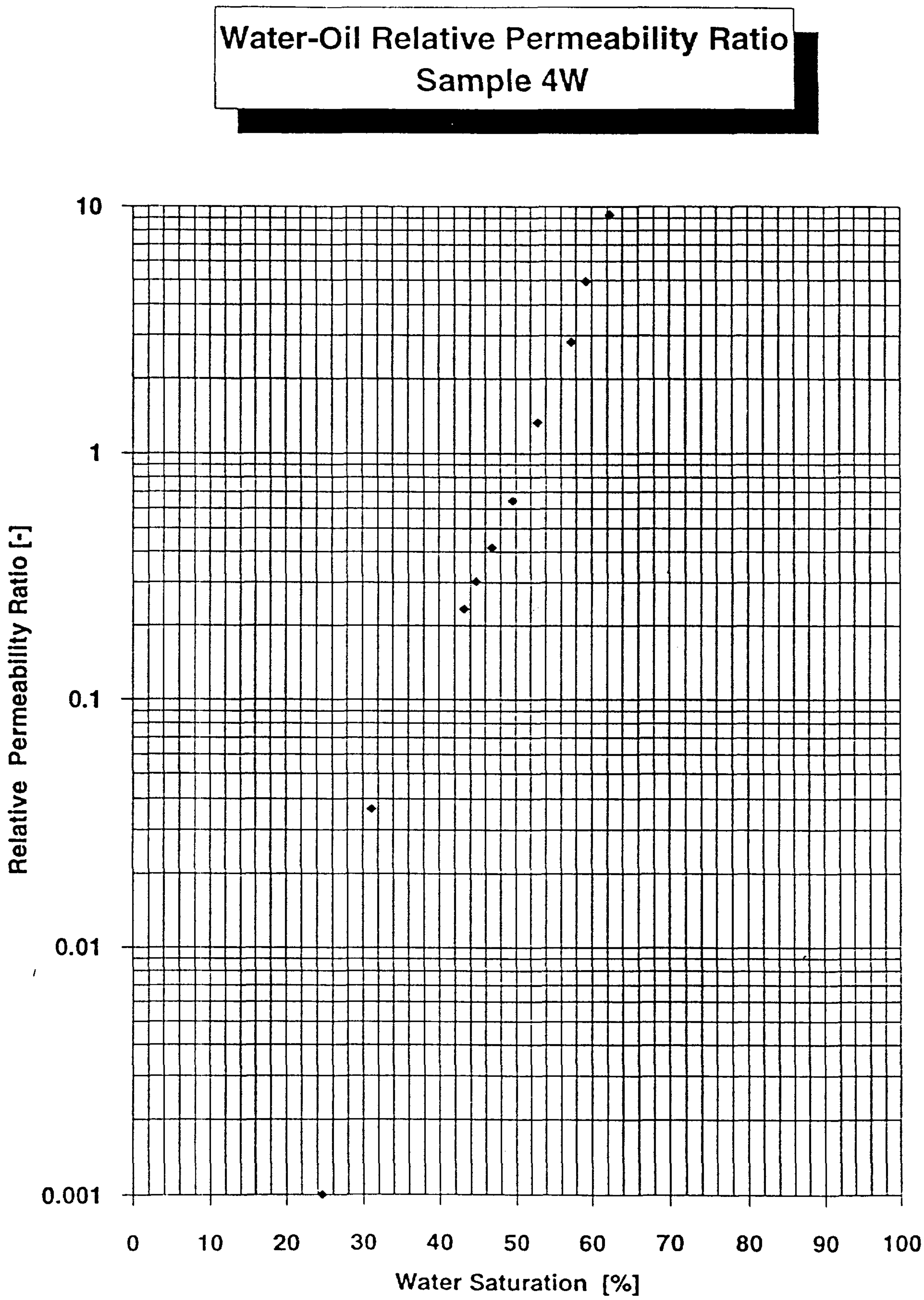
Sro Residual Oil Saturation

Siw Irreducible Water Saturation



Unsteady-State Water-Oil Relative Permeability
Sample 4W
Water Relative Permeability
Oil Relative Permeability
Relative Permeability [-]
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
Water Saturation [%]


Unsteady-State Water-Oil Relative Permeability
Sample 4W
Water Relative Permeability
Oil Relative Permeability
1
0.1
0.01
0.001
Relative Permeability [-]
0
20
40
60
80
100
Water Saturation [%]



Water-Oil Relative Permeability Ratio
Sample 4W
10
1
0.1
0.01
0.001
Relative Permeability Ratio [-]
0
10
20
30
40
50
60
70
80
90
100
Water Saturation [%]

APPENDIX III

CORE LABS RESERVOIR DATA FLUID ANALYSIS

RESERVOIR FLUID ANALYSIS

FOR

YATES PETROLEUM CORPORATION
State CO #2
Dagger Draw North Field
Eddy County, New Mexico

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

April 3, 1990

YATES PETROLEUM CORPORATION
105 South 4th Street
Artesia, New Mexico 88210

Attention: Mr. Pinson McWhorter

Subject: Reservoir Fluid Study
State CO #2
Dagger Draw North Field
Eddy County, New Mexico
File: RFLM 90017

Gentlemen:

Duplicate separator liquid and gas samples were collected from the subject well and were submitted to our Midland laboratory on December 1, 1989 for use in a reservoir fluid study. Presented in the following report are the results of this study as requested by Yates Petroleum Corporation.

The subject well is currently producing a gas/oil ratio greater than what is expected for this reservoir. This indicates that there is free-gas production associated with the solution gas. Therefore, it was decided to recombine the separator products to create a reservoir fluid that has a bubble point of 2000 psig at 130°F. This fluid was used for the remainder of the study.

The hydrocarbon composition of the reservoir fluid was determined by spike-flash/chromatographic technique. The results in terms of both mol percent and weight percent are presented on page four.

A small quantity of the reservoir fluid was charged to a high pressure windowed cell and thermally expanded to the reservoir temperature of 130°F. During a constant composition expansion at this temperature, the fluid was found to have a bubble point pressure of 2003 psig. The results of the pressure-volume measurements at reservoir temperature may be found on page seven.

2001 Commerce Drive, P. O. Box 4337, Midland, Texas 79704, (915) 694-7761

When subjected to differential pressure depletion at the reservoir temperature. The fluid evolved a total of 485 cubic feet of gas at 15.025 psia and 60°F. per barrel of residual oil at 60°F. The resulting relative oil volume factor was 1.247 barrels of saturated fluid per barrel of residual oil. The oil density and the properties of the evolved gases were measured at each point during the differential pressure depletion and these data are included in the summary of the differential depletion data on page eight.

The viscosity of the reservoir fluid was measured over a wide range of pressures at 130°F. in a rolling ball viscosimeter. The viscosity of the fluid was found to vary from a minimum of 0.77 centipoise at the saturation pressure to a maximum of 1.92 centipoise at atmospheric pressure. The results of the viscosity measurements are tabulated on page fifteen.

One multi-stage separator test was performed to measure gas-oil ratio, stock tank oil gravity, and formation volume factor. The results of the separator test can be found on page eleven.

For your convenience, differential data has been adjusted to separator conditions. The results can be found on page twelve.

Thank you for the opportunity to be of service to Yates Petroleum Corporation. If you have any question or if we may be of further assistance in any way, please feel free to call upon us.

Very truly yours,

CORE LABORATORIES, a division of
WESTERN ATLAS INTERNATIONAL, INC.

Richard Hulme

Richard Hulme
Supervisor
Reservoir Fluid Lab

File RFLM 90017

YATES PETROLEUM CORPORATION
State CO #2
Dagger Draw North Field

Date Sampled: December 1, 1989
Eddy County, New Mexico

TABLE OF CONTENTS

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

2001 Commerce Drive
P. O. Box 4337
Midland, Texas
79704
(915) 694-7761

File RFLM 90017
State CO #2

Date Sampled: December 1, 1989

FORMATION CHARACTERISTICS

Formation Name	Canyon
Date First Well Completed	N/A
Original Reservoir Pressure	3010 psig @ 7572 ft.
Original Produced Gas/Liquid Ratio	N/A SCF/Bbl
Production Rate	N/A Bbls/Day
Separator Pressure and Temperature	N/A psig N/A°F.
Liquid Gravity at 60°F.	N/A °API
Datum	N/A ft. Subsea

WELL CHARACTERISTICS

Elevation	3618 ft. KB, 3605 ft. GL
Total Depth	9427 ft. TD 8800 ft. PBTD
Producing Interval	7751-7843 ft.
Tubing Size and Depth	2 7/8 In. to 7699 ft.
Open Flow Potential	409 BOPD,817 MCFD,979 BWPD
Last Reservoir Pressure	2000 psig @ N/A ft.
Date	N/A
Reservoir Temperature	130°F. @ 7565 ft.
Status of Well	N/A
Pressure Gauge	N/A

SAMPLING CONDITIONS

Flowing Tubing Pressure		331 psig
Flowing Bottom Hole Pressure		931 psig
Primary Separator Pressure		67 psig
Primary Separator Temperature		100°F.
Secondary Separator Pressure		29 psig
Secondary Separator Temperature		108°F.
Field Stock Tank Liquid Gravity		44.5°API @ 60°F.
Primary Separator Gas Production Rate		709.711 MSCF/Day
Pressure Base	15.025 psia	
Temperature Base	60°F.	
Compressibility Factor (Fpv)	1.000	
Gas Gravity (Laboratory)	0.737	
Gas Gravity Factor (Fg)	1.000	
Stock Tank Liquid Production Rate @ 60°F.		735.55 Bbls/Day
Primary Separator Gas/Stock Tank Liquid Ratio		965 SCF/Bbl

Sampled by Teftteller Inc.
REMARKS:

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SUMMARY OF RESERVOIR FLUID PVT DATA

Volumetric Data

Bubble point pressure (Pb) at 130°F. = 2003 psig

Thermal expansion of reservoir fluid at 5000 psig = $\frac{\text{V at 130°F.}}{\text{V at 67°F.}}$ = 1.03111

Compressibility of reservoir fluid at 130°F.
from 3000 psig to 2500 psig = 9.45 x 10^{-6} V/V/psi
from 2500 psig to 2003 psig = 10.06 x 10^{-6} V/V/psi

Differential Vaporization Data

Solution gas/oil ratio at 2003 psig and 130°F. = 485 standard cubic feet of gas at 15.025 psia and 60°F. per barrel of residual oil at 60°F.

Relative oil volume at 2003 psig and 130°F. = 1.247 barrels of oil per barrel of residual oil at 60°F.

Density of reservoir fluid at 2003 psig and 130°F. = 0.7177 gm/cc

Viscosity Data

Viscosity of reservoir fluid at 2003 psig and 130°F. = 0.77 centipoise

Separator Test Data

Separator Conditions	Bo(1)	Rs(2)	Tank Oil Gravity API at 60°F.
67 psig and 100°F. to 29 psig and 110°F. to 0 psig and 68°F.	1.233	430	42.7

(1) Formation volume factor, barrels of oil at 2003 psig and 130°F. per barrel of stock tank oil at 60°F.
(2) Total solution gas/oil ratio at 2003 psig and 130°F., total standard cubic feet of gas at 15.025 psia and 60°F. per barrel of stock tank oil at 60°F.

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SUMMARY OF QUALITY CONTROL DATA OF SEPARATOR LIQUID SAMPLES

Cylinder Number	Sampling Conditions Pressure, PSIG	Temperature, °F.	Laboratory Bubble point Pressure, PSIG	Temperature, °F.
1*	28	108	20	68
2	28	108	18	68

* Selected for use in study.

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HYDROCARBON ANALYSIS OF RESERVOIR FLUID SAMPLE

Component	Mol Percent	Weight Percent	Density	API	Mol Weight
Hydrogen Sulfide	0.00	0.00			
Carbon Dioxide	0.34	0.14			
Nitrogen	0.18	0.05			
Methane	37.33	5.56			
Ethane	4.96	1.38			
Propane	3.43	1.40			
iso-Butane	1.03	0.56			
n-Butane	2.36	1.27			
iso-Pentane	1.27	0.85			
n-Pentane	1.43	0.96			
Hexanes	1.33	1.04			
Heptanes plus	46.34	86.79	0.8240	40.1	202.
	100.00	100.00			

Sample Molecular Weight = 107.8

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HYDROCARBON ANALYSIS OF SEPARATOR GAS SAMPLE

Component	Mol Percent	GPM
Hydrogen	0.00	
Hydrogen Sulfide	1.24	
Carbon Dioxide	0.74	
Nitrogen	0.39	
Methane	80.17	
Ethane	8.43	2.242
Propane	4.38	1.200
iso-Butane	0.94	0.306
n-Butane	1.77	0.555
iso-Pentane	0.56	0.204
n-Pentane	0.53	0.191
Hexanes	0.42	0.162
Heptanes	0.29	0.121
Octanes	0.12	0.054
Nonanes	0.01	0.005
Decanes	0.00	0.000
Undecanes	0.01	0.006
Dodecanes	0.00	0.000
	100.00	5.046

Calculated Gas Gravity = 0.737

Calculated Gross Heating Value = 1248 BTU per cubic foot of dry gas at 15.025 and 60°F.

Collected at 67 psig and 99°F.

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VOLUMETRIC DATA OF RESERVOIR FLUID SAMPLE

Saturation pressure (bubble point pressure) = 2003 PSIG 130°F.

Specific volume at saturation pressure = 0.02223 ft^3/lb @ 130°F.

Thermal expansion @ 5000 PSIG = 1.03111 V @ 130°F./V @ 67°F.

Compressibility @ 130°F.:

From 5000 PSIG to 4000 PSIG = 7.65×10^{-6} V/V/PSI

From 4000 PSIG to 3000 PSIG = 9.29×10^{-6} V/V/PSI

From 3000 PSIG to 2500 PSIG = 9.45×10^{-6} V/V/PSI

From 2500 PSIG to 2003 PSIG = 10.06×10^{-6} V/V/PSI

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PRESSURE-VOLUME RELATIONS OF RESERVOIR FLUID AT 130°F.
(Constant Composition Expansion)

Pressure PSIG	Relative Volume(1)	Y Function(2)	Density Gm/cc
5000	0.9736		0.7372
4500	0.9771		0.7345
4000	0.9811		0.7315
3500	0.9856		0.7282
3000	0.9903		0.7247
2500	0.9950		0.7213
2400	0.9961		0.7205
2300	0.9972		0.7197
2200	0.9981		0.7191
2100	0.9992		0.7183
2003 Pb	1.0000		0.7177
1971	1.0029		
1948	1.0050		
1925	1.0070		
1900	1.0091		
1858	1.0205		
1760	1.0448	3.057	
1600	1.0855	2.918	
1422	1.1462	2.766	
1249	1.2286	2.609	
1088	1.3355	2.473	
955	1.4590	2.354	
869	1.5631	2.278	
765	1.7274	2.182	
683	1.8929	2.118	
533	2.3541	1.981	
410	3.0023	1.872	
300	4.0356	1.781	

(1) Relative Volume: V/Vsat is barrels at indicated pressure barrel at saturation pressure.

(2)
$$\text{Y Function} = \frac{(Psat-P)}{(Pabs)(V/Vsat-1)}$$

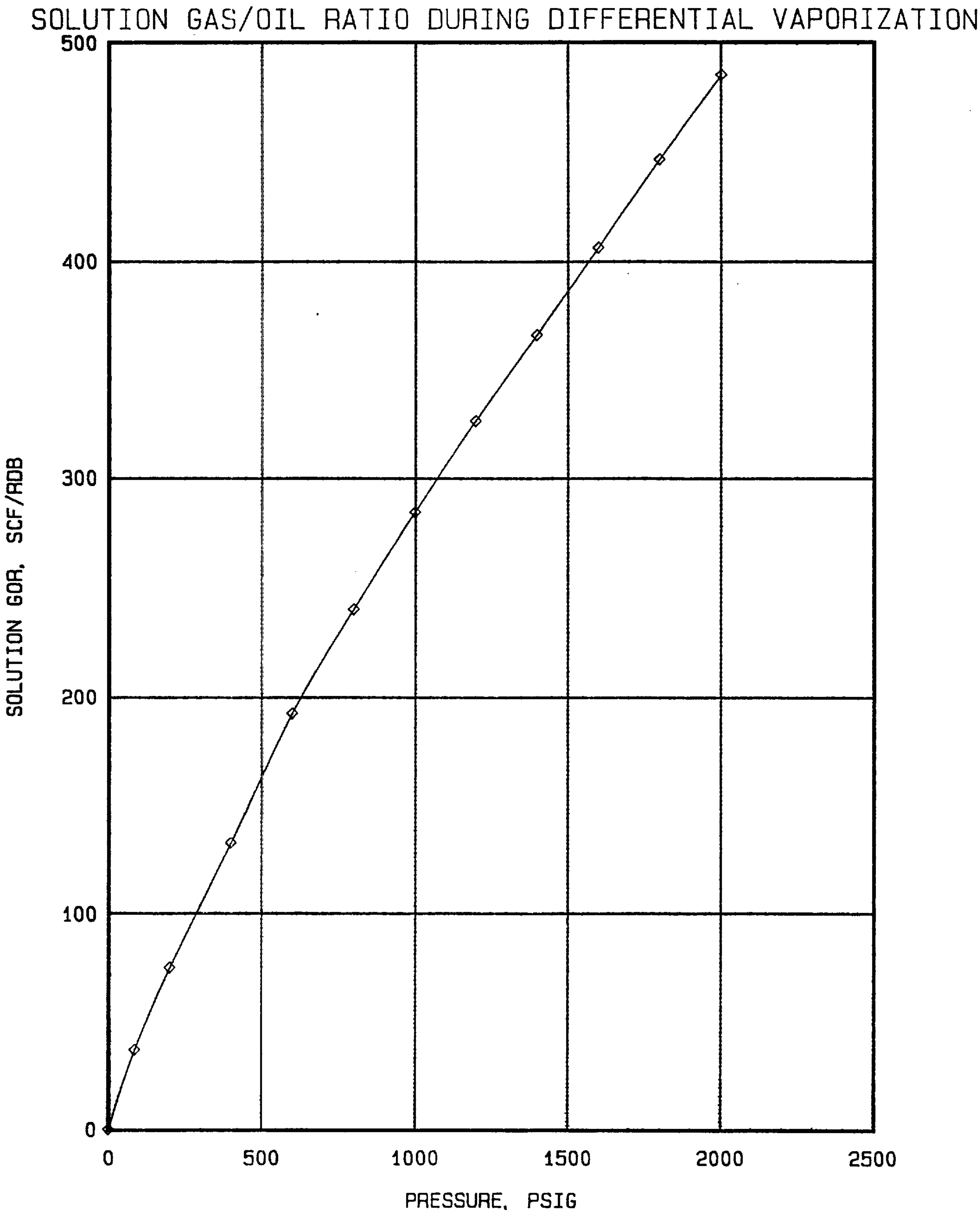
DIFFERENTIAL VAPORIZATION AT 130°F

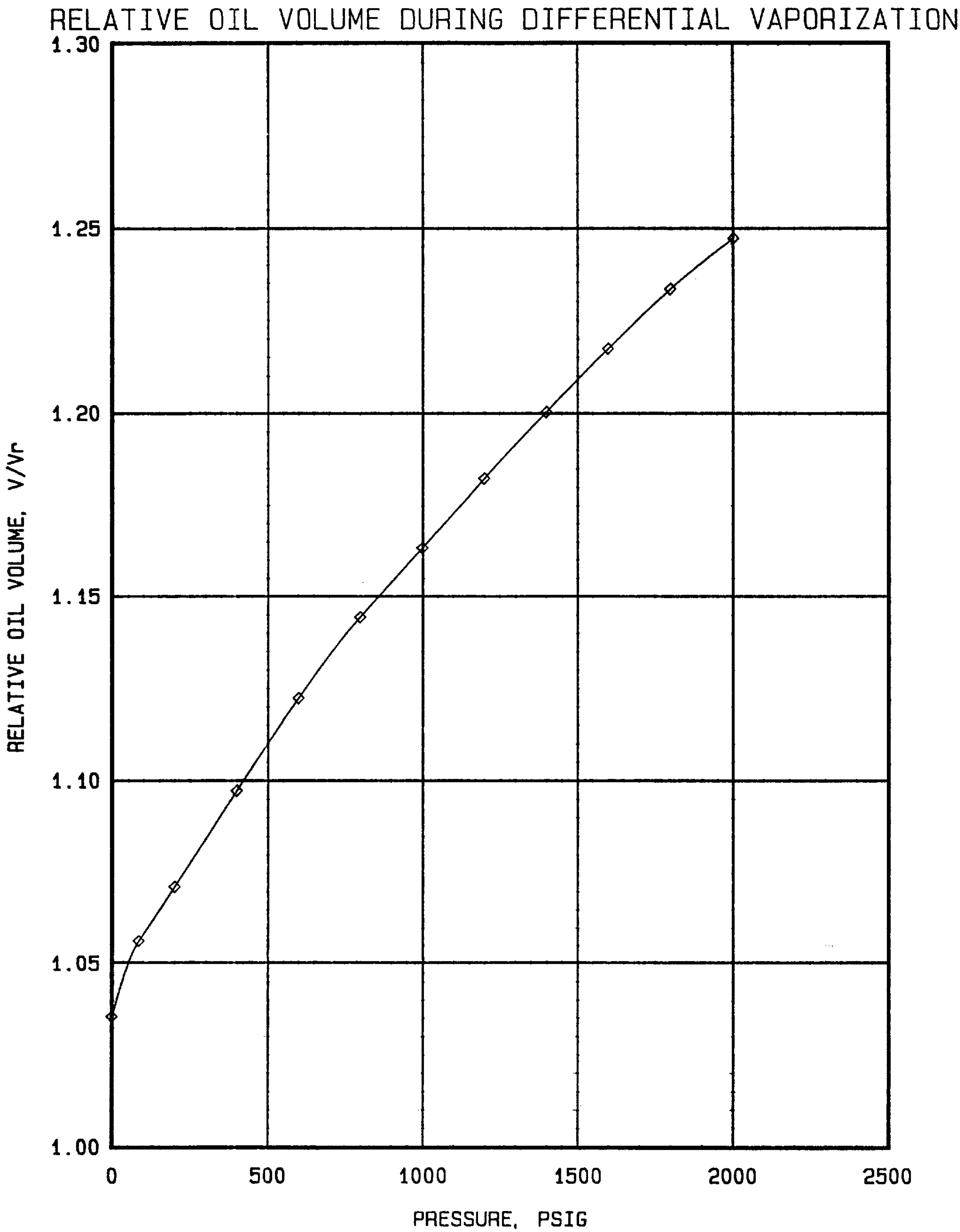
Pressure, psig	Solution Gas/Oil Ratio, Rsd(1)	Relative Oil Volume, Bod(2)	Relative Total Volume(3)	Oil Density, Gm/Cc	Deviation Factor, Z	Gas Formation Volume Factor(4)	Incremental Gas Gravity
2003 Pb	485	1.247	1.247	0.7177			
1800	446	1.233	1.288	0.7218	0.841	0.00790	0.651
1600	406	1.217	1.344	0.7269	0.852	0.00899	0.651
1400	366	1.200	1.420	0.7323	0.863	0.01040	0.652
1200	326	1.182	1.530	0.7382	0.877	0.01231	0.655
1000	284	1.163	1.700	0.7442	0.893	0.01500	0.659
800	240	1.144	1.974	0.7507	0.909	0.01901	0.667
600	192	1.122	2.463	0.7577	0.927	0.02570	0.681
400	132	1.097	3.545	0.7656	0.948	0.03894	0.708
200	75	1.071	6.699	0.7743	0.972	0.07707	0.768
85	37	1.056	14.482	0.7798	0.987	0.16826	0.834
0	0	1.035		0.7846			1.614

at 60°F = 1.000

Gravity of Residual Oil = 42.5°API @ 60°F.

(1) Cubic feet of gas at 15.025 psia and 60°F. per barrel of residual oil at 60°F.
(2) Barrels of oil at indicated pressure and temperature per barrel of residual oil at 60°F.
(3) Barrels of oil plus liberated gas at indicated pressure and temperature per barrel of residual oil at 60°F.
(4) Cubic feet of gas at indicated pressure and temperature per cubic foot at 15.025 psia and 60°F.


SOLUTION GAS/OIL RATIO DURING DIFFERENTIAL VAPORIZATION
500
400
300
200
100
0
SOLUTION GOR, SCF/RDB
0
500
1000
1500
2000
2500
PRESSURE, PSIG


RELATIVE OIL VOLUME DURING DIFFERENTIAL VAPORIZATION
1.30
1.25
1.20
1.15
1.10
1.05
1.00
RELATIVE OIL VOLUME, V/Vr
0
500
1000
1500
2000
2500
PRESSURE, PSIG

SEPARATOR TEST OF RESERVOIR FLUID SAMPLE

Separator Pressure, PSI Gauge	Separator Temperature, °F	Gas/Oil Ratio (1)	Gas/Oil Ratio (2)	Stock Tank Gravity, API @ 60°F	Formation Volume Factor, Bofb(3)	Separator Volume Factor (4)	Specific Gravity of Flashed Gas
67	100	386	404			1.048	0.724
to							
29	110	3	3			1.054	0.868*
to							
0	68	23	23	42.7	1.233	1.004	1.148
		Rsfb =	430				

* Theoretical value

(1) Gas/Oil Ratio in cubic feet of gas @ 60°F. and 15.025 PSI absolute per barrel of oil @ indicated pressure and temperature.
(2) Gas/Oil Ratio in cubic feet of gas @ 60°F. and 15.025 PSI absolute per barrel of stock tank oil @ 60°F.
(3) Formation Volume Factor is barrels of saturated oil @ 2003 PSI gauge and 130°F. per barrel of stock tank oil @ 60°F.
(4) Separator Volume Factor is barrels of oil @ indicated pressure and temperature per barrel of stock tank oil @ 60°F.

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DIFFERENTIAL VAPORIZATION DATA ADJUSTED TO SEPARATOR CONDITIONS*

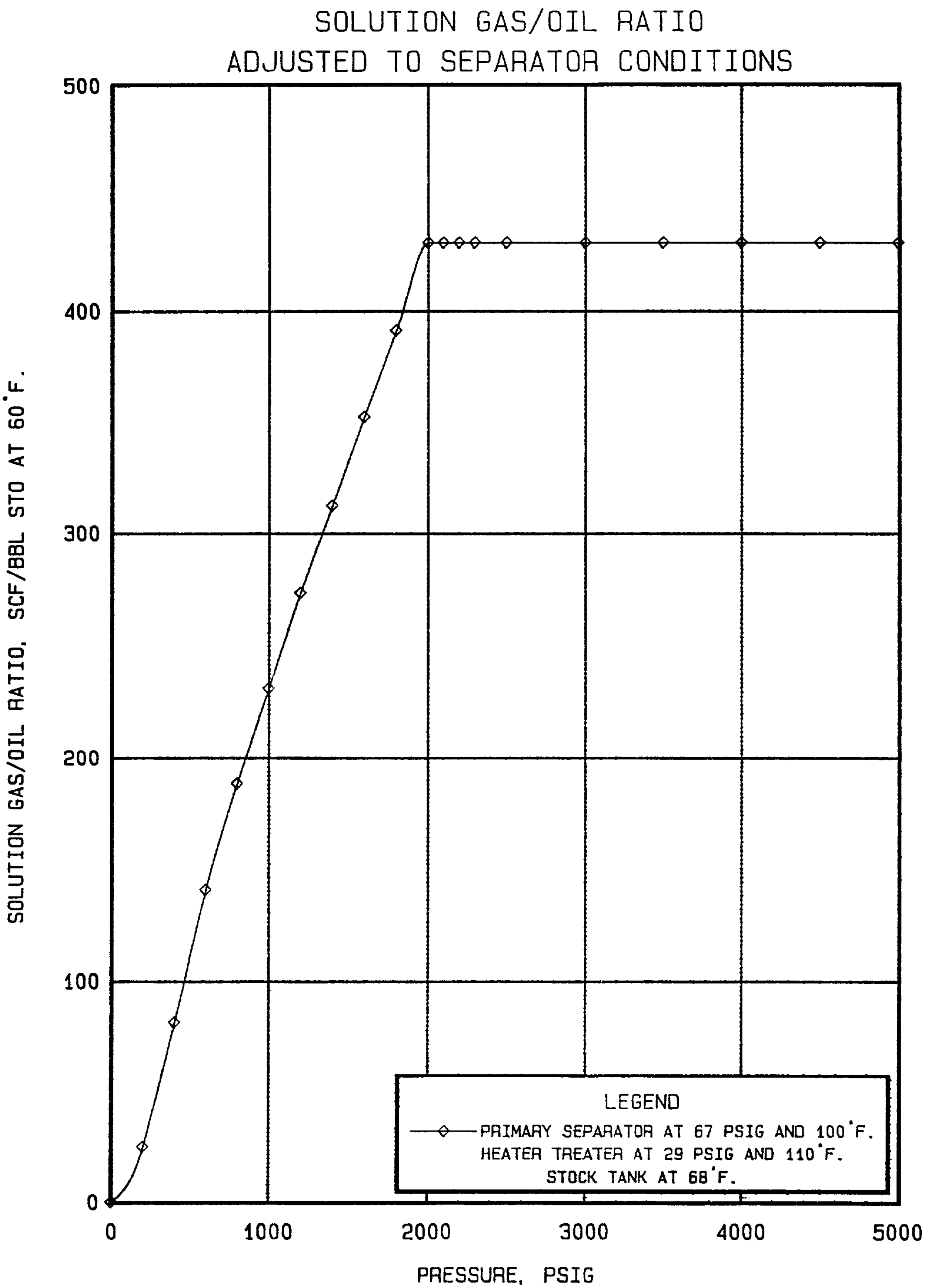
Pressure, psig	Solution Gas/Oil Ratio, Rs(1)	Formation Volume Factor, Bo(2)	Gas Formation Volume Factor, Bg(3)	Oil Density, gm/cc	Oil/Gas Viscosity Ratio
5000	430	1.200		0.7372	
4500	430	1.205		0.7345	
4000	430	1.210		0.7315	
3500	430	1.215		0.7282	
3000	430	1.221		0.7247	
2500	430	1.227		0.7213	
2300	430	1.223		0.7197	
2200	430	1.231		0.7191	
2100	430	1.232		0.7183	
2003 Pb	430	1.233		0.7177	
1800	391	1.219	0.00790	0.7218	49.7
1600	352	1.203	0.00899	0.7269	54.5
1400	312	1.187	0.01040	0.7323	60.5
1200	273	1.169	0.01231	0.7382	66.7
1000	231	1.150	0.01500	0.7442	73.5
800	188	1.131	0.01901	0.7507	81.7
600	140	1.109	0.02570	0.7577	91.3
400	81	1.085	0.03894	0.7656	103.3
200	25	1.059	0.07707	0.7743	126.7
85	0	1.044	0.16826	0.7798	150.0
0	0	1.023			223.3

@ 60°F. = 1.000

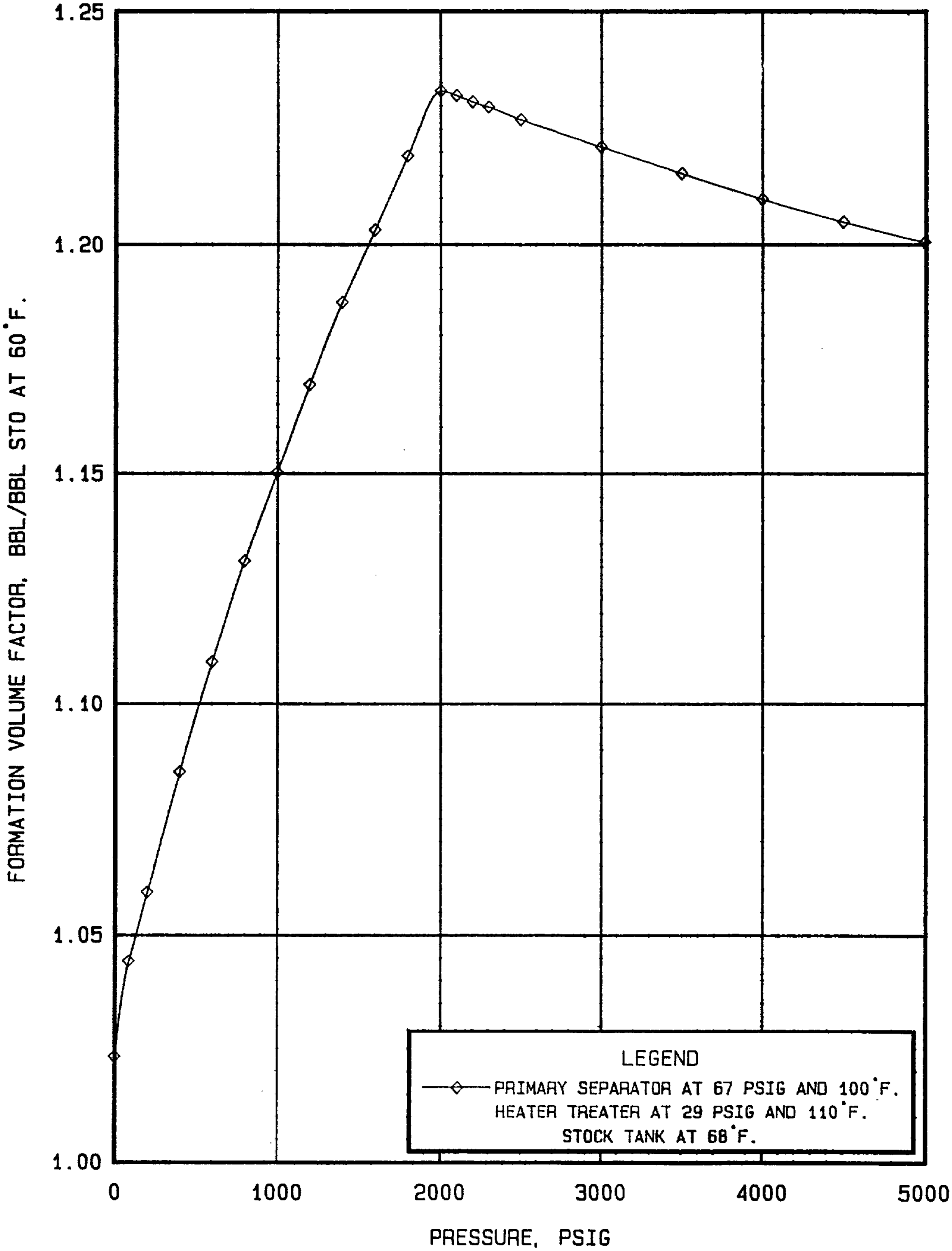
Gravity of Stock Tank Oil = 42.7°API @ 60°F.

*Separator Conditions: Separator at 67 psig and 100°F., Heater Treater at 29 psig and 110°F., stock tank at 68°F.

(1) Cubic feet of gas at 15.025 psia and 60°F. per barrel of stock tank oil at 60°F.
(2) Barrels of oil at indicated pressure and 130°F. per barrel of stock tank oil at 60°F.
(3) Cubic feet of gas at indicated pressure and 130°F. per cubic foot at 15.025 psia and 60°F.


SOLUTION GAS/OIL RATIO
ADJUSTED TO SEPARATOR CONDITIONS
SOLUTION GAS/OIL RATIO, SCF/BBL STO AT 60°F.
0
100
200
300
400
500
0
1000
2000
3000
4000
5000
PRESSURE, PSIG
LEGEND
PRIMARY SEPARATOR AT 67 PSIG AND 100°F.
HEATER TREATER AT 29 PSIG AND 110°F.
STOCK TANK AT 68°F.

FORMATION VOLUME FACTOR ADJUSTED TO SEPARATOR CONDITIONS



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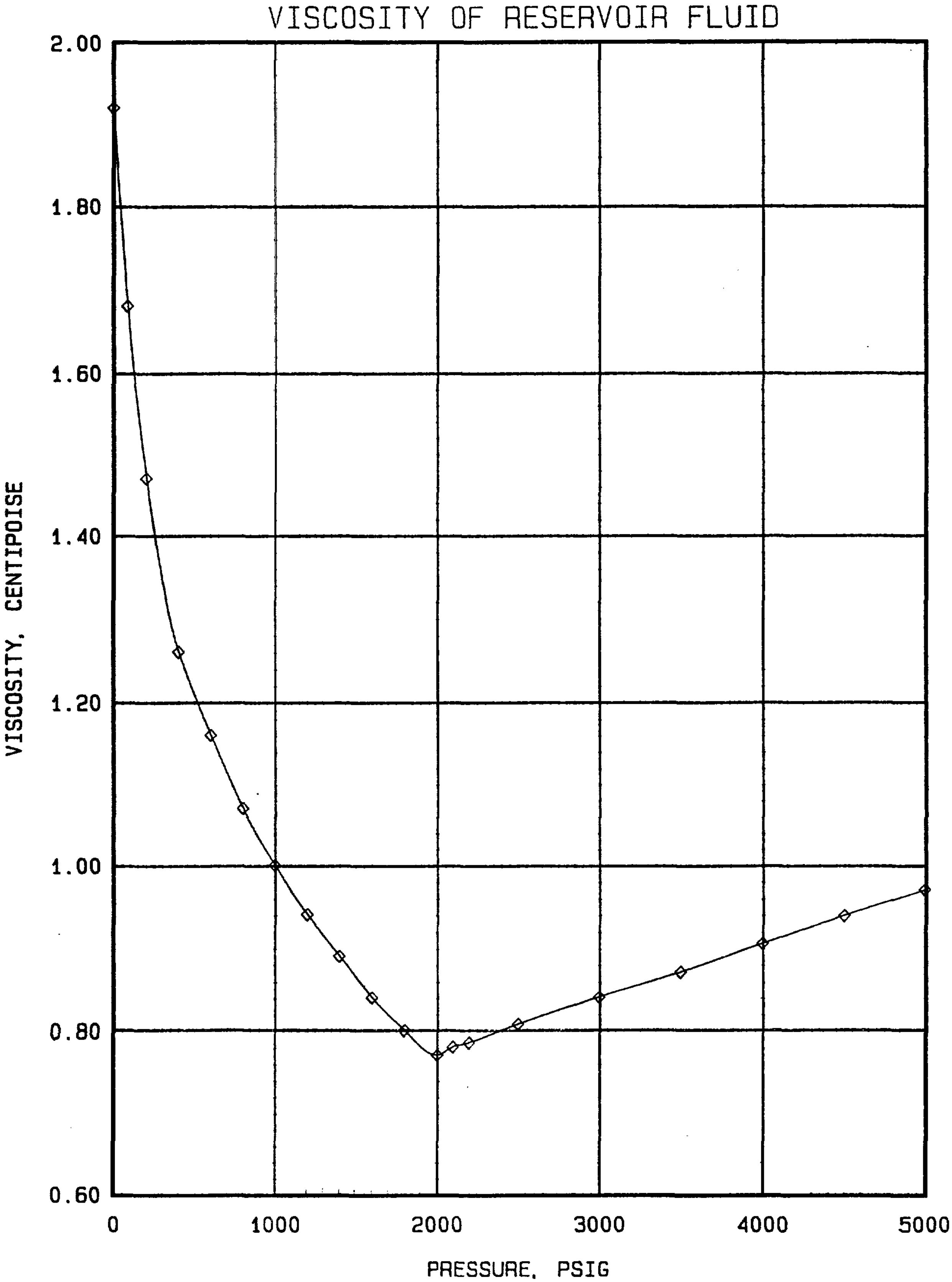
VISCOSITY DATA AT 130°F

Pressure, psig	Oil Viscosity Centipoise	Calculated Gas Viscosity, Centipoise	Oil/Gas Viscosity Ratio
5000	0.97		
4500	0.94		
4000	0.90		
3500	0.87		
3000	0.84		
2500	0.80		
2200	0.78		
2100	0.78		
2003 Pb	0.77		
1800	0.80	0.0161	49.7
1600	0.84	0.0154	54.5
1400	0.89	0.0147	60.5
1200	0.94	0.0141	66.7
1000	1.00	0.0136	73.5
800	1.07	0.0131	81.7
600	1.16	0.0127	91.3
400	1.26	0.0122	103.3
200	1.47	0.0116	126.7
85	1.68	0.0112	150.0
0	1.92	0.0086	223.3


VISCOSITY OF RESERVOIR FLUID
VISCOSITY, CENTIPOISE
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0
1000
2000
3000
4000
5000
PRESSURE, PSIG

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NOMENCLATURE AND EQUATIONS TO ADJUST DIFFERENTIAL VAPORIZATION DATA TO SURFACE CONDITIONS

Pb = Bubble point pressure

Bo = Oil formation volume factor

Bofb = Formation volume factor from field conditions (or optimum) separator flash test.

Bob = Relative oil volume from differential vaporization test.

Bodb = Value of Bod at the bubble point pressure.

R.V. = Relative volume from pressure-volume relations test.

For Bo above the bubble point pressure:

Bo = R.V. x Bofb

For Bo below the bubble point pressure:

Bo = (Bod)(Bofb/Bodb)

Rs = Gas in solution, standard cubic feet per barrel of stock tank oil.

Rsfb = Sum of separator gas and the stock tank gas from field conditions (or optimum) separator flash test, standard cubic feet per barrel of stock tank oil.

Rsd = The gas in solution from the differential vaporization test.

Rsdb = The value of Rsd at the bubble point pressure.

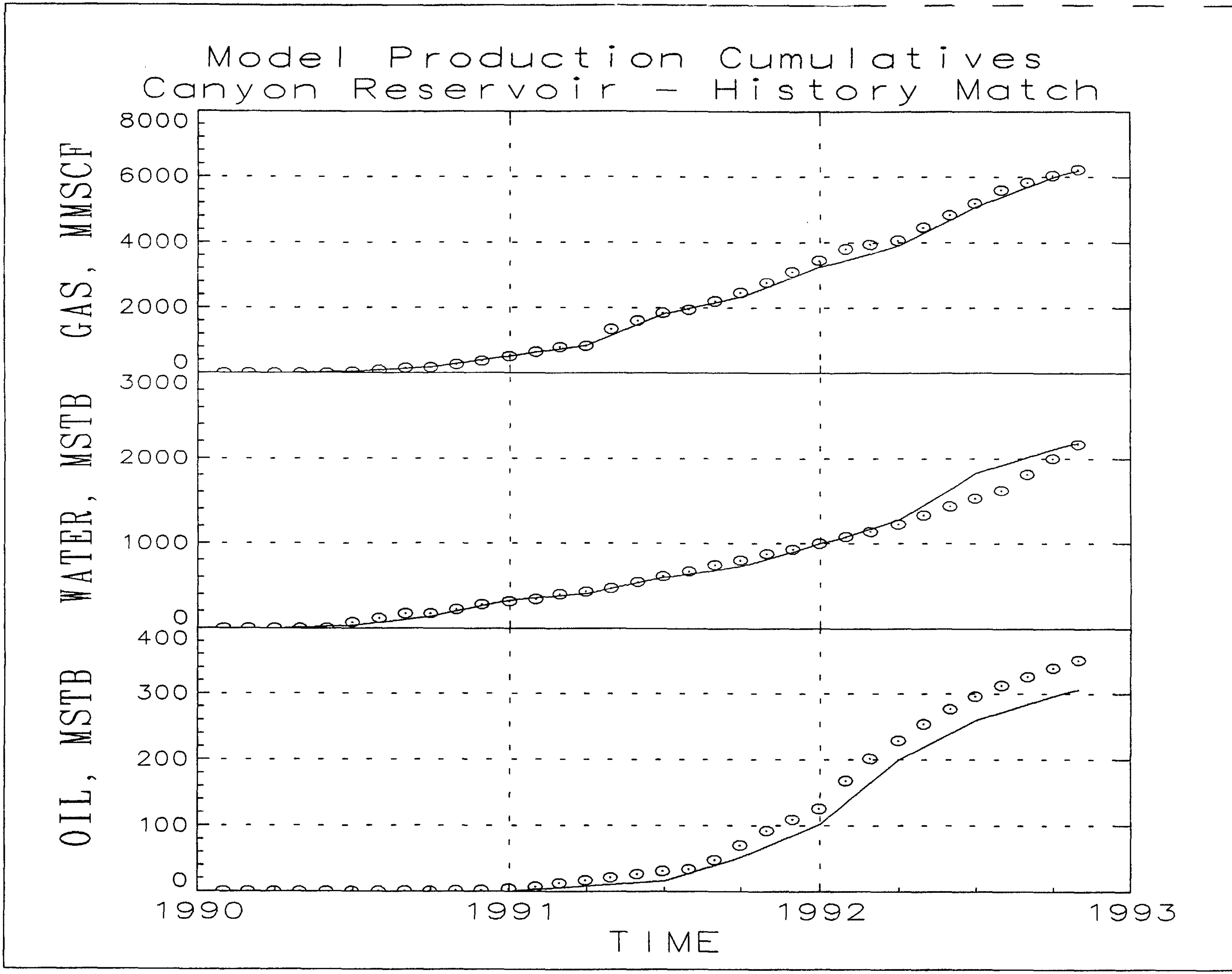
Rs - Rsfb - [(Rsdb - Rsd)(Bofb/Bodbl)]

APPENDIX IV

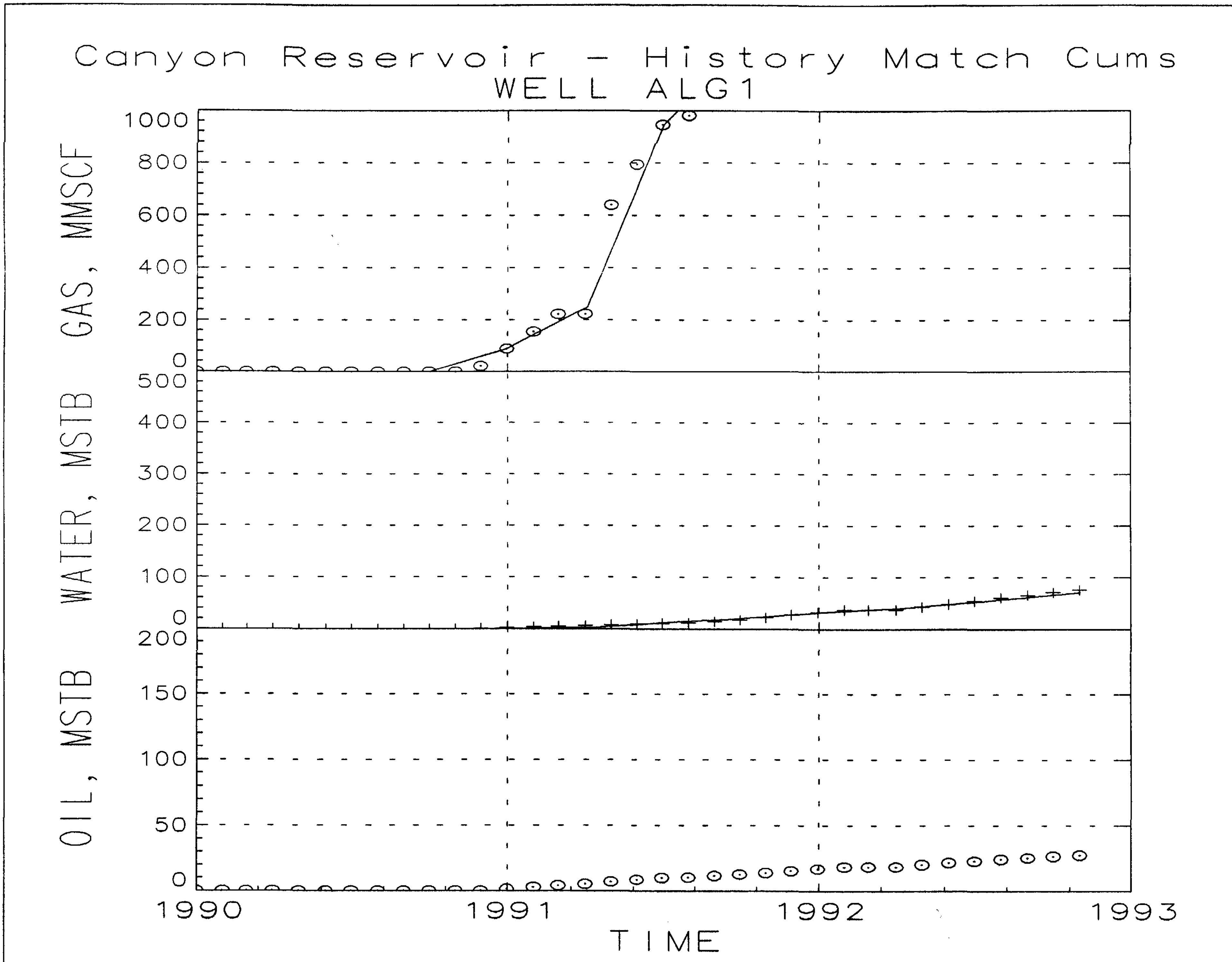
HISTORY MATCH

Model Performance Plot

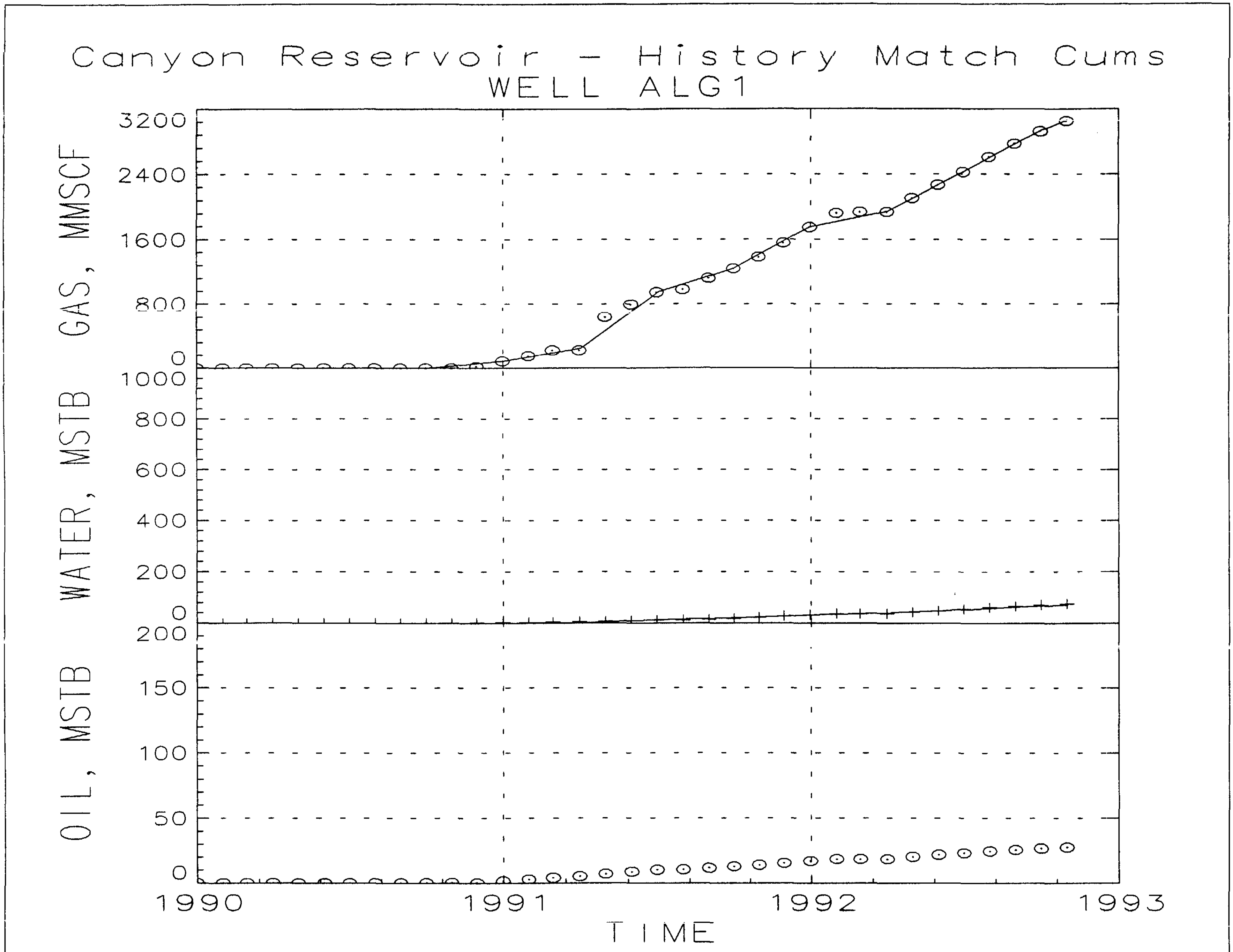
Well Performance Plots



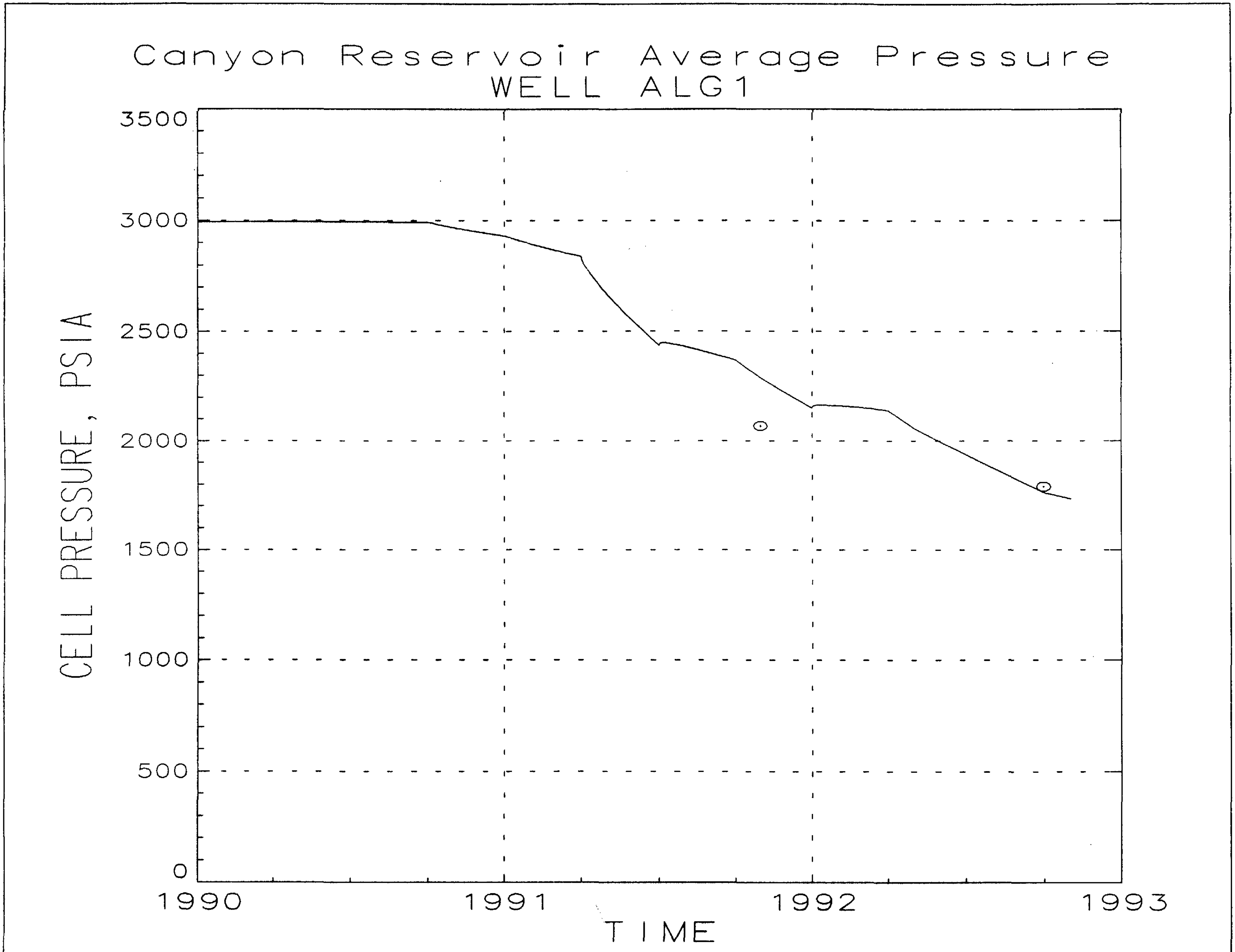
Model Production Cumulatives
Canyon Reservoir - History Match
GAS, MMSCF
WATER, MSTB
OIL, MSTB
8000
6000
4000
2000
0
3000
2000
1000
0
400
300
200
100
0
1990
1991
1992
1993
TIME

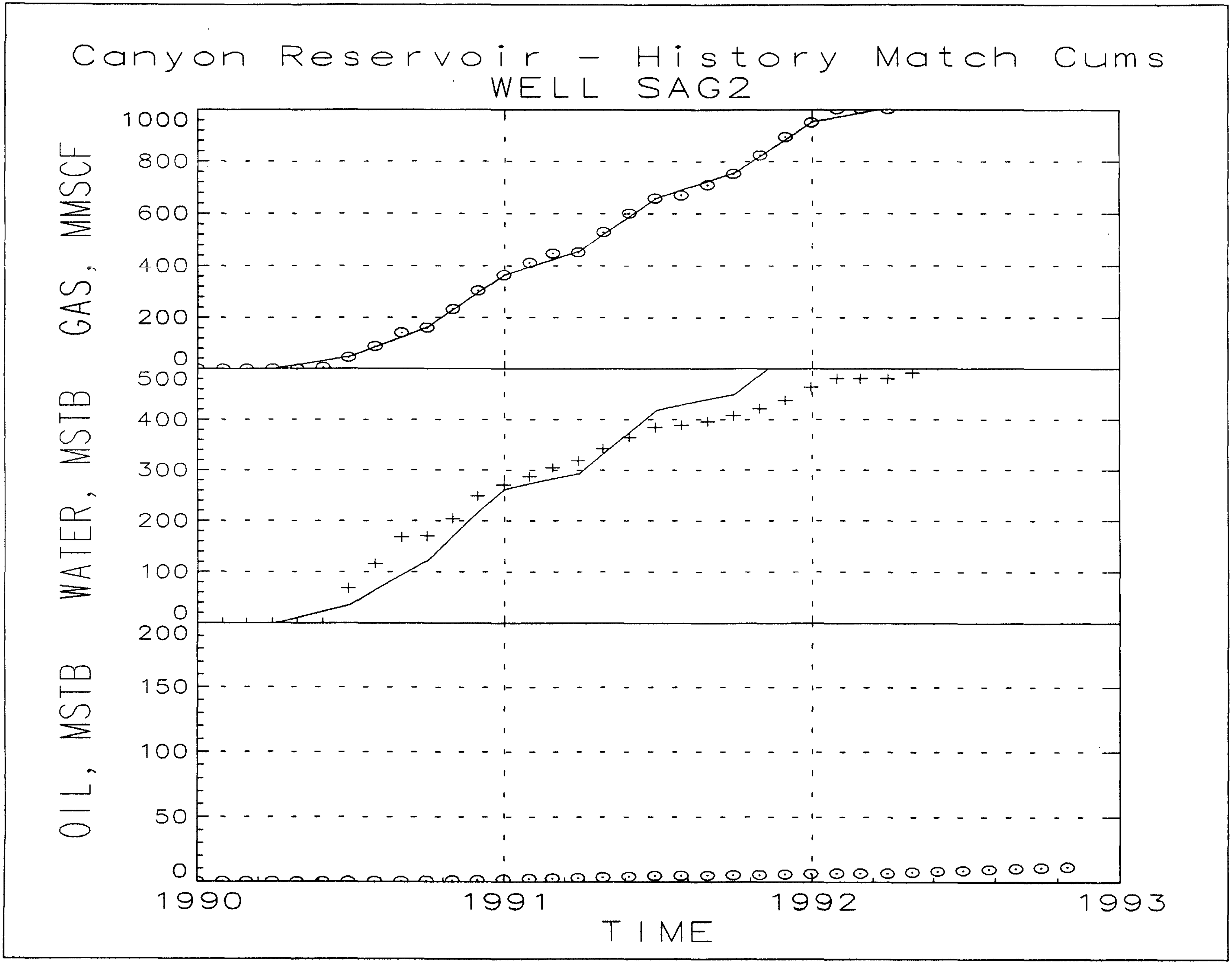


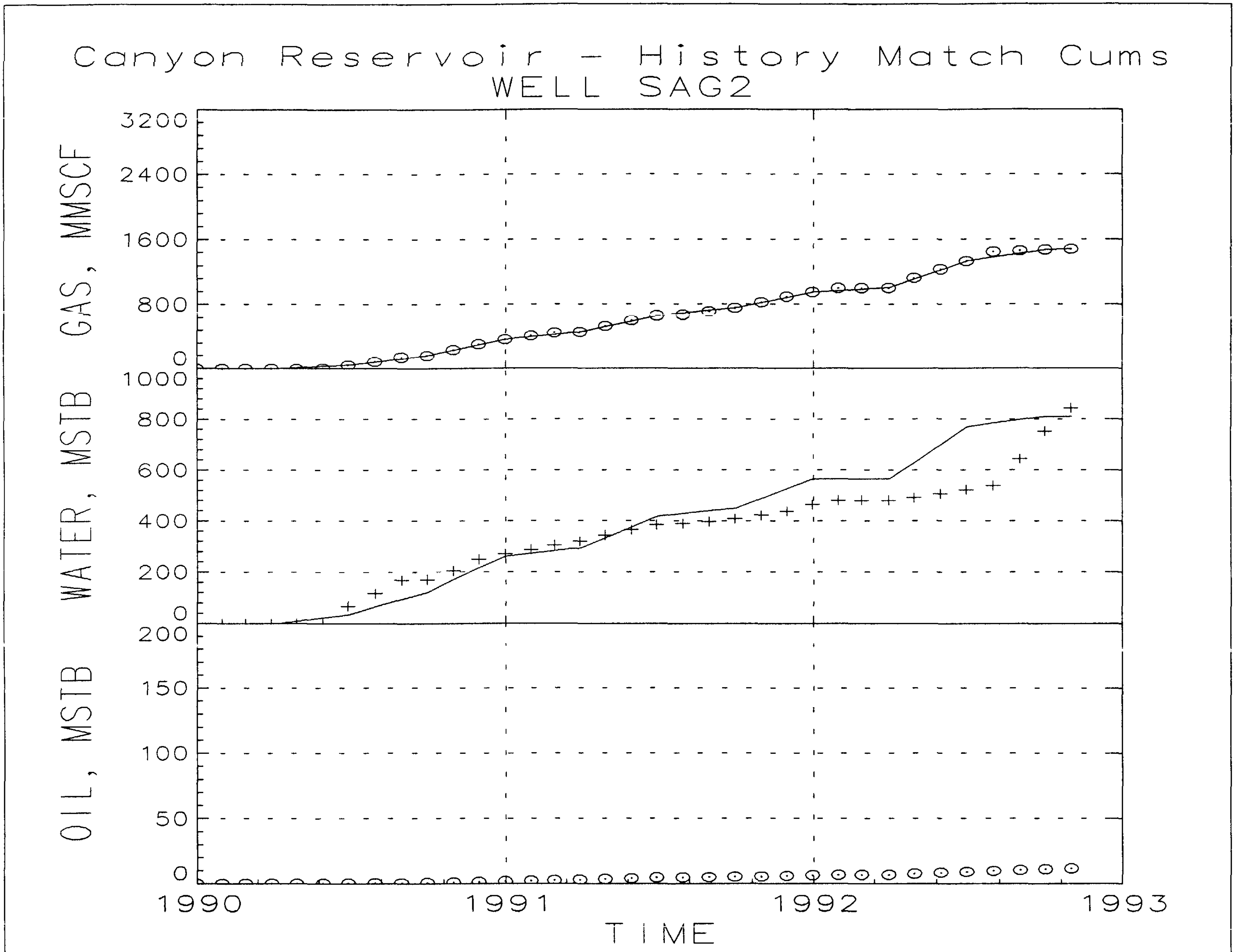
Canyon Reservoir - History Match Cums
WELL ALG1
GAS, MMSCF
WATER, MSTB
OIL, MSTB
1000
800
600
400
200
0
500
400
300
200
100
0
200
150
100
50
0
1990
1991
1992
1993
TIME

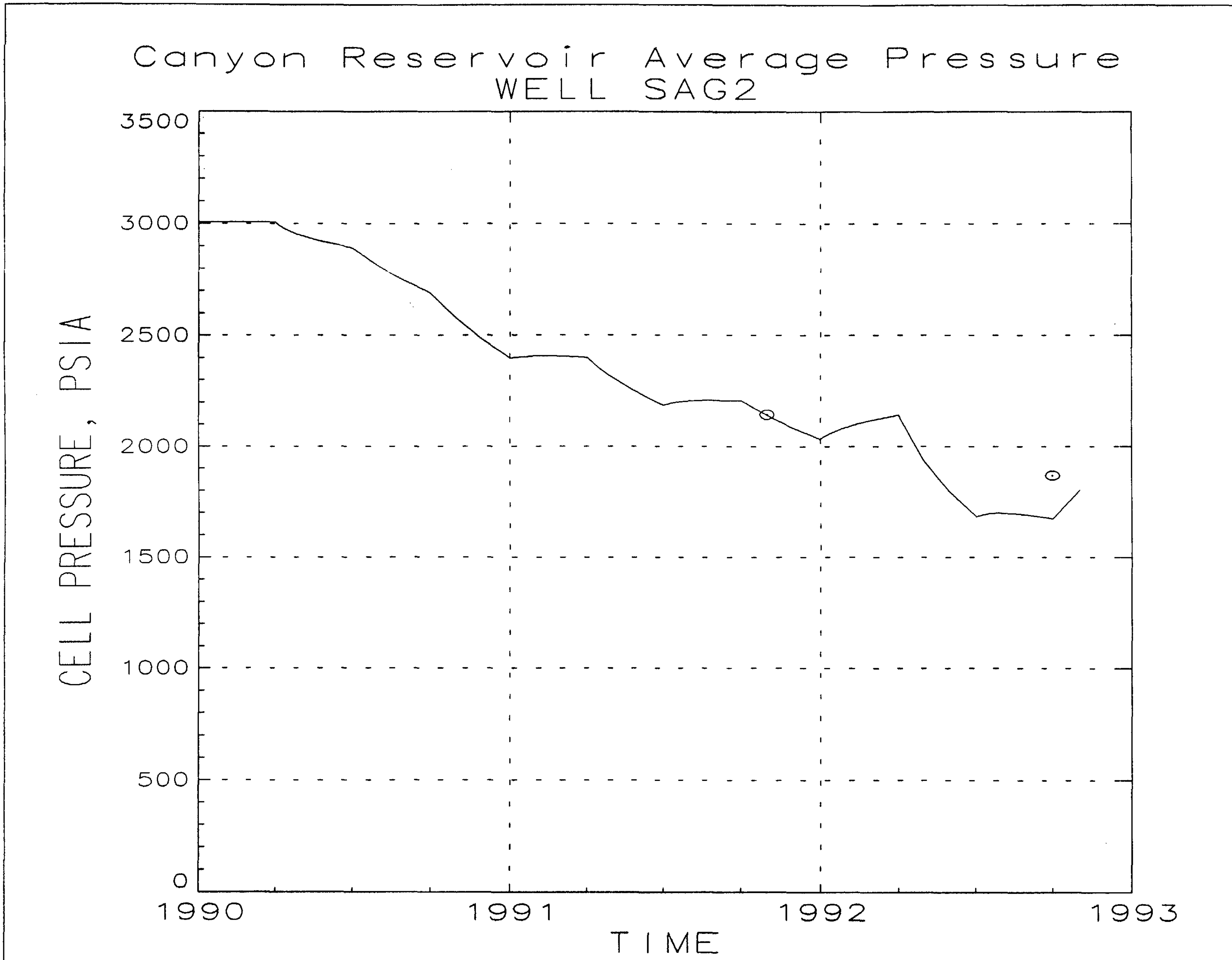


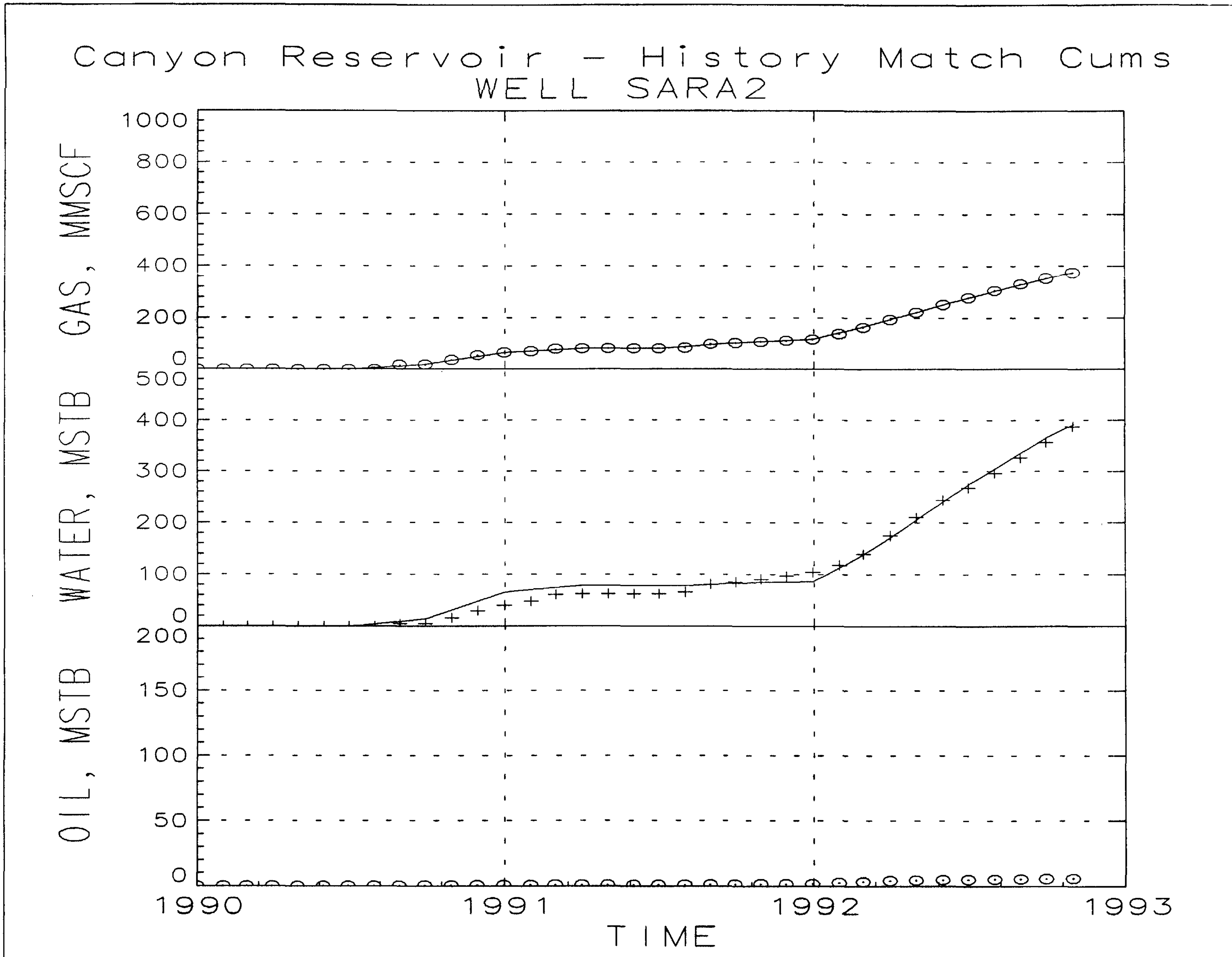
Canyon Reservoir - History Match Cums
WELL ALG1
GAS, MMSCF
3200
2400
1600
800
0
WATER, MSTB
1000
800
600
400
200
0
OIL, MSTB
200
150
100
50
0
1990
1991
1992
1993
TIME


Canyon Reservoir Average Pressure
WELL ALG1
3500
3000
2500
2000
1500
1000
500
0
CELL PRESSURE, PSIA
1990
1991
1992
1993
TIME

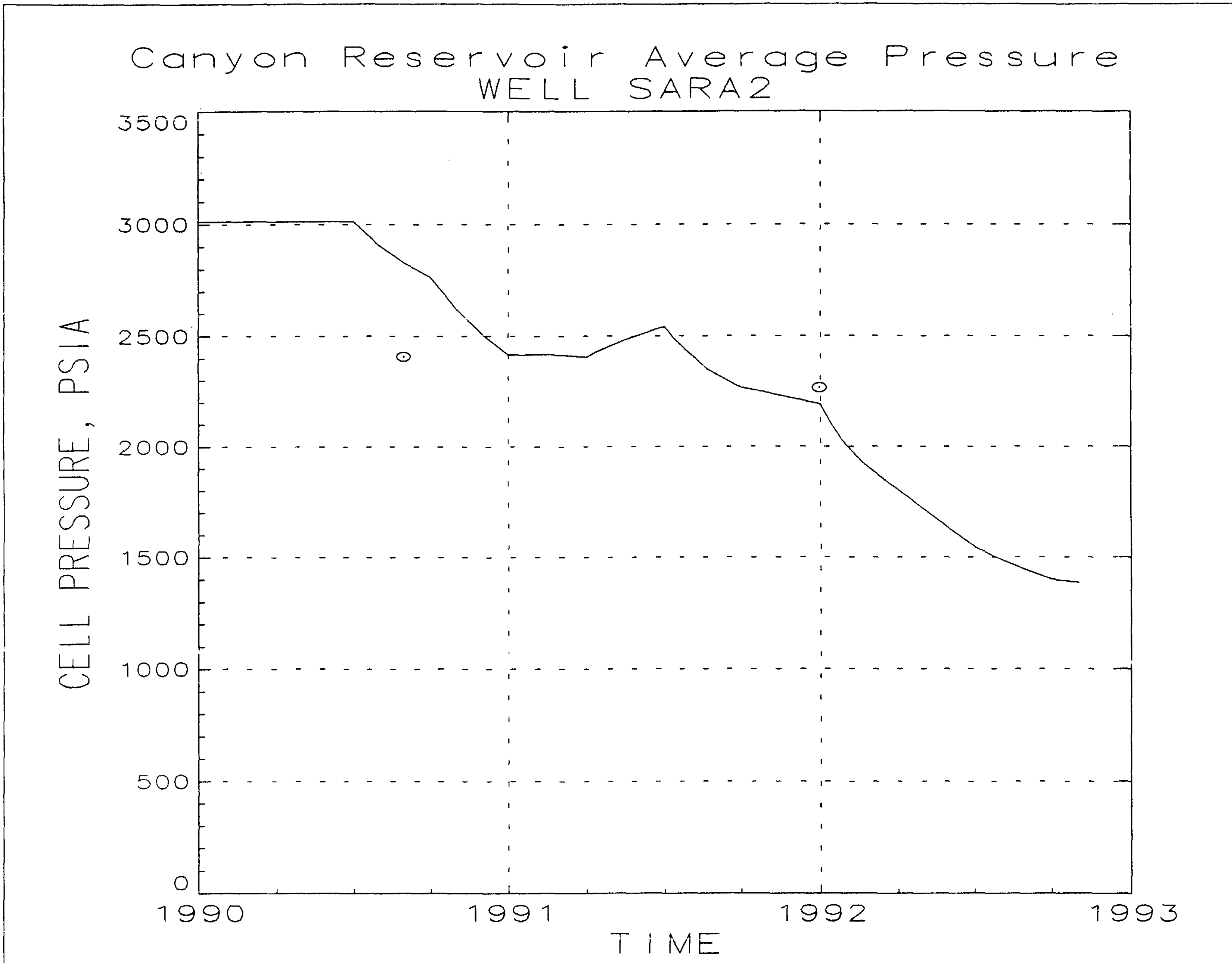

Canyon Reservoir - History Match Cums
WELL SAG2
GAS, MMSCF
1000
800
600
400
200
0
WATER, MSTB
500
400
300
200
100
0
OIL, MSTB
200
150
100
50
0
1990
1991
1992
1993
TIME

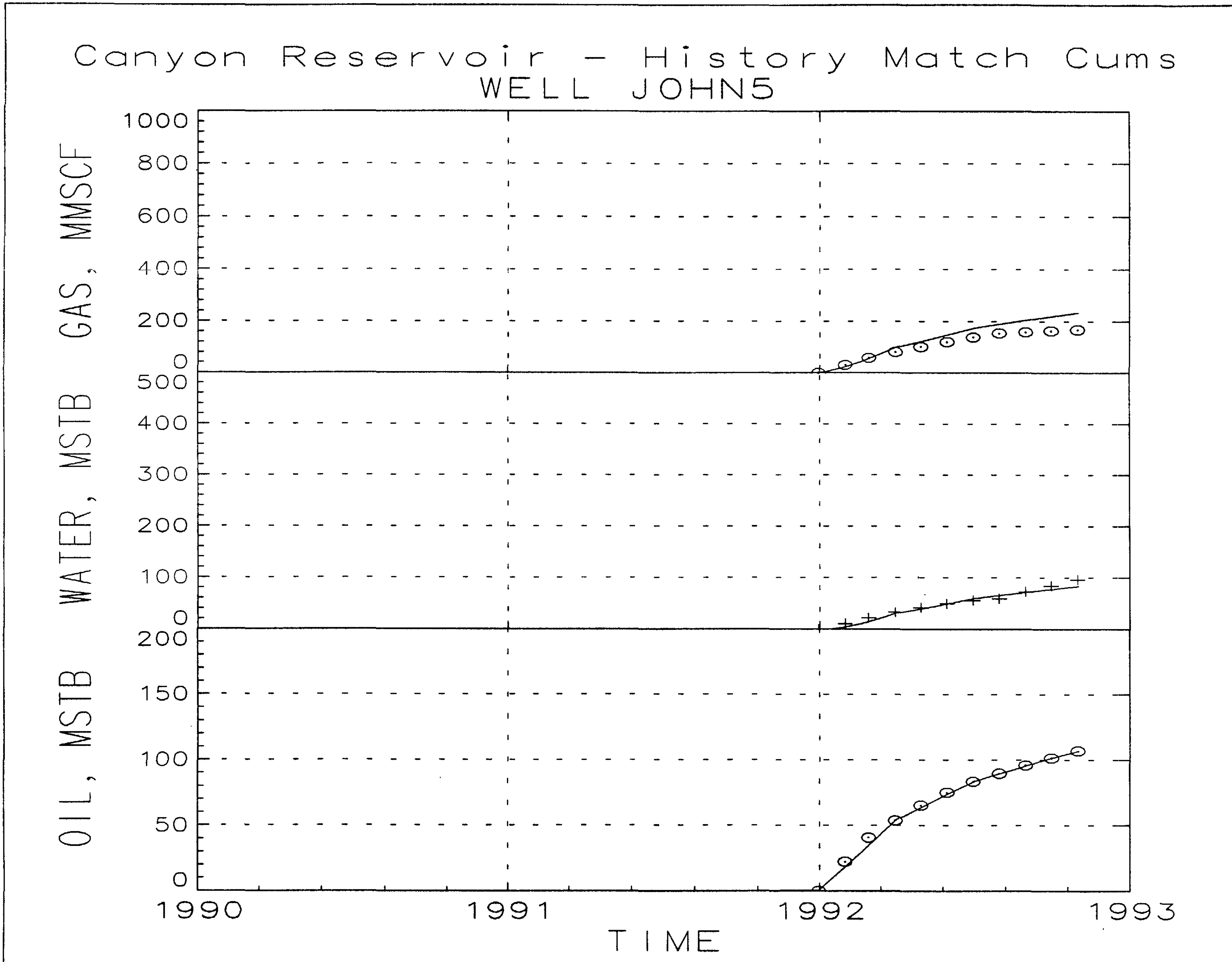

Canyon Reservoir - History Match Cums
WELL SAG2
GAS, MMSCF
3200
2400
1600
800
0
WATER, MSTB
1000
800
600
400
200
0
OIL, MSTB
200
150
100
50
0
1990
1991
1992
1993
TIME

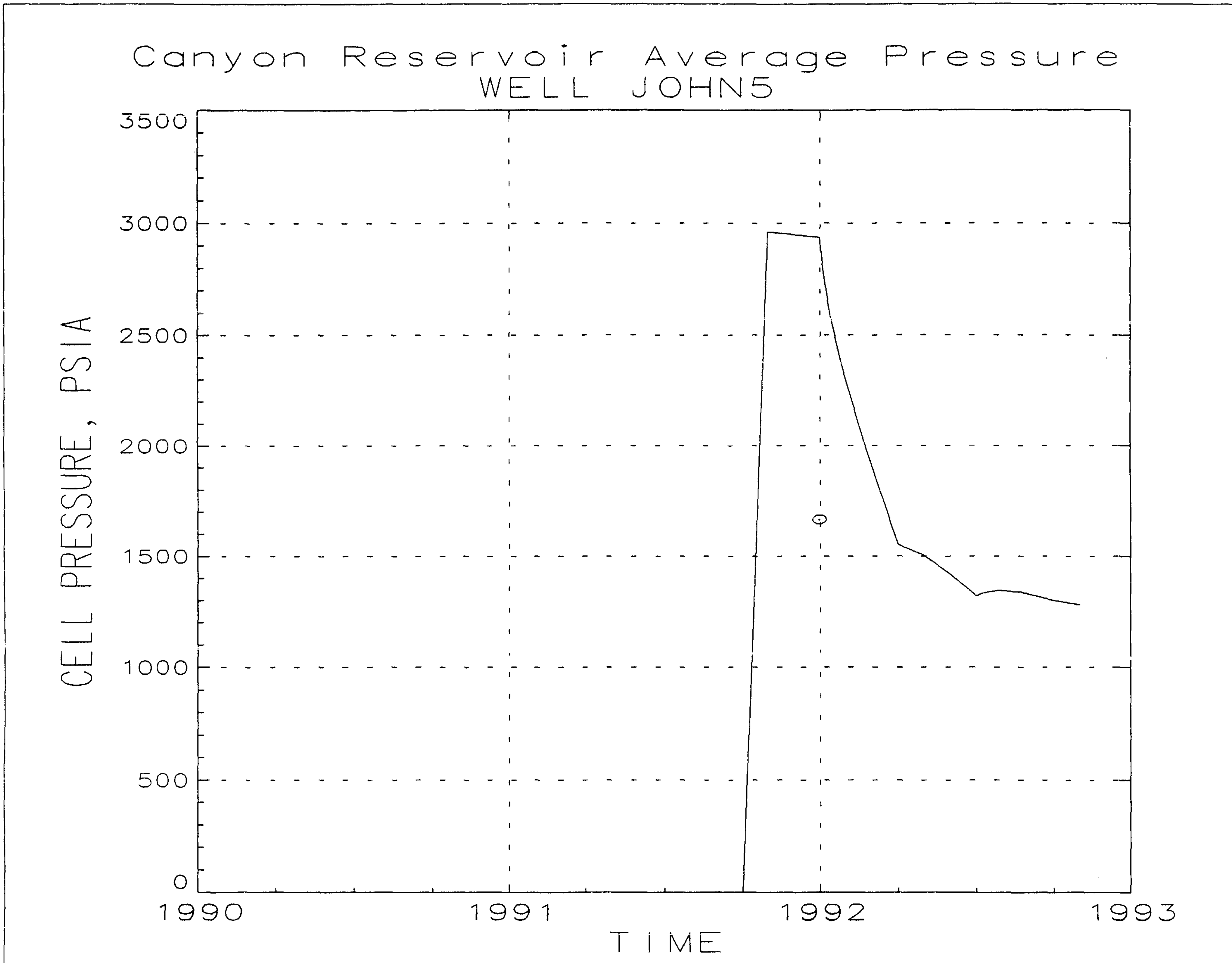

Canyon Reservoir Average Pressure
WELL SAG2
CELL PRESSURE, PSIA
3500
3000
2500
2000
1500
1000
500
0
1990
1991
1992
1993
TIME

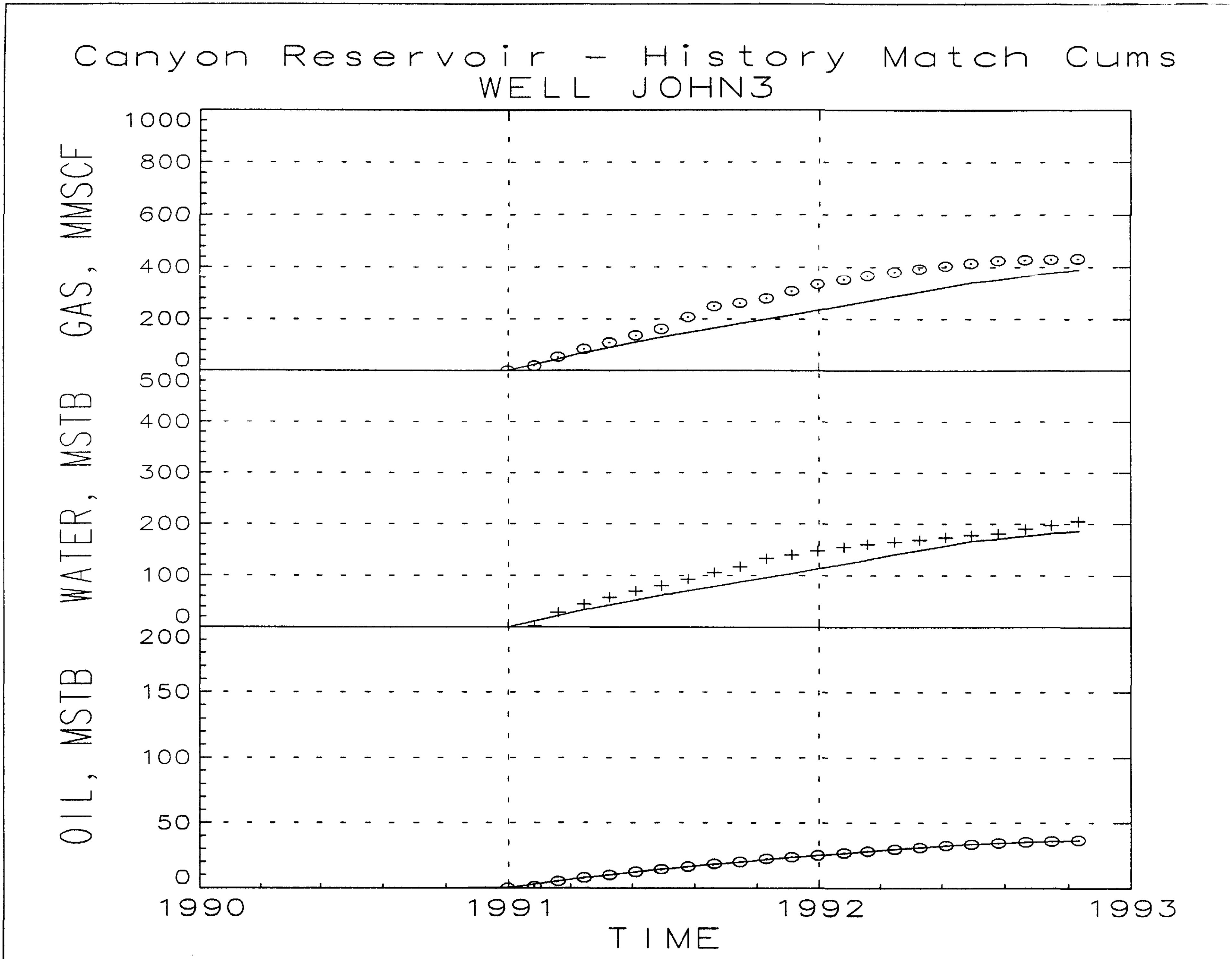


Canyon Reservoir - History Match Cums
WELL SARA2
GAS, MMSCF
1000
800
600
400
200
0
WATER, MSTB
500
400
300
200
100
0
OIL, MSTB
200
150
100
50
0
1990
1991
1992
1993
TIME

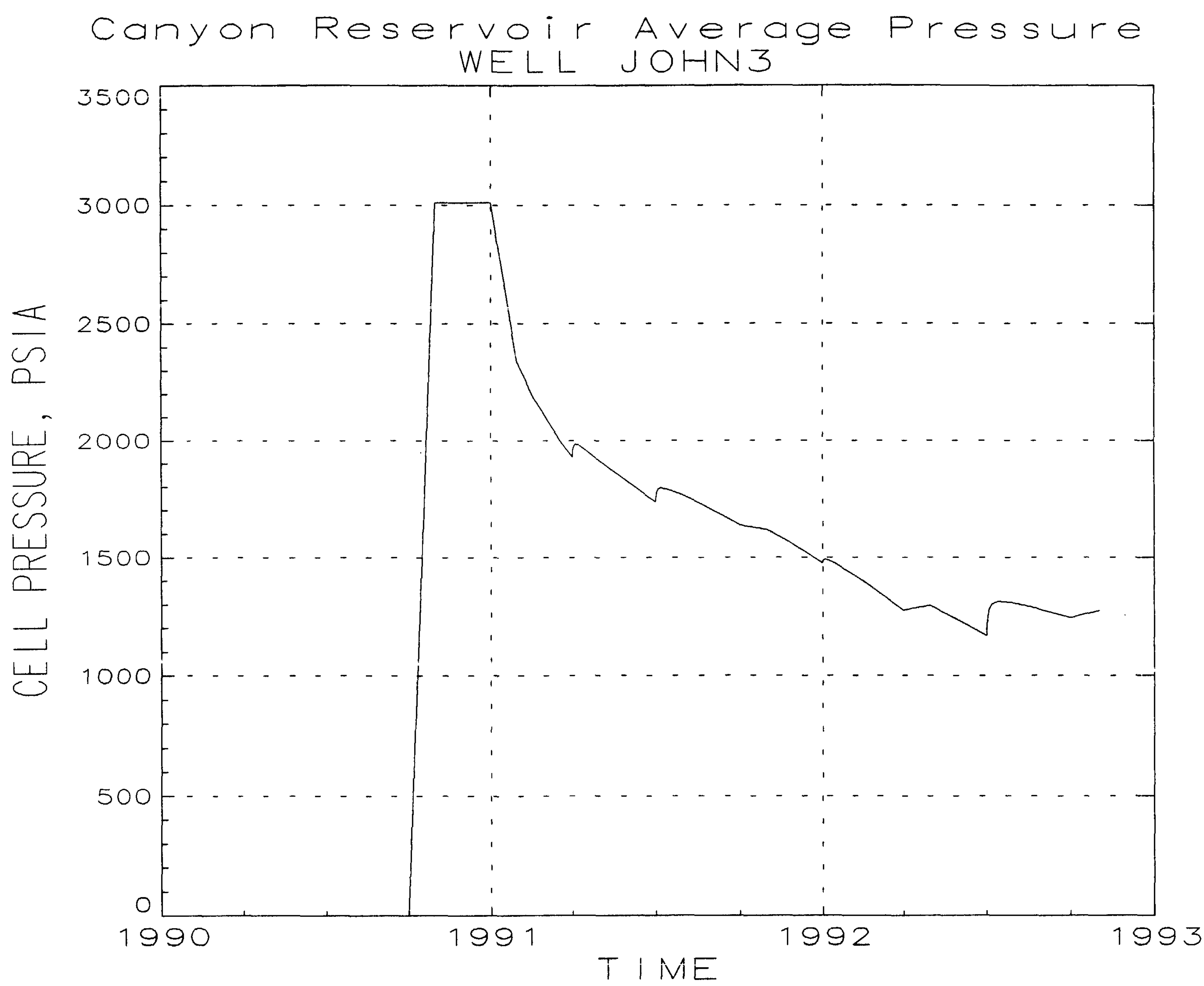

Canyon Reservoir Average Pressure
WELL SARA2
CELL PRESSURE, PSIA
3500
3000
2500
2000
1500
1000
500
0
1990
1991
1992
1993
TIME

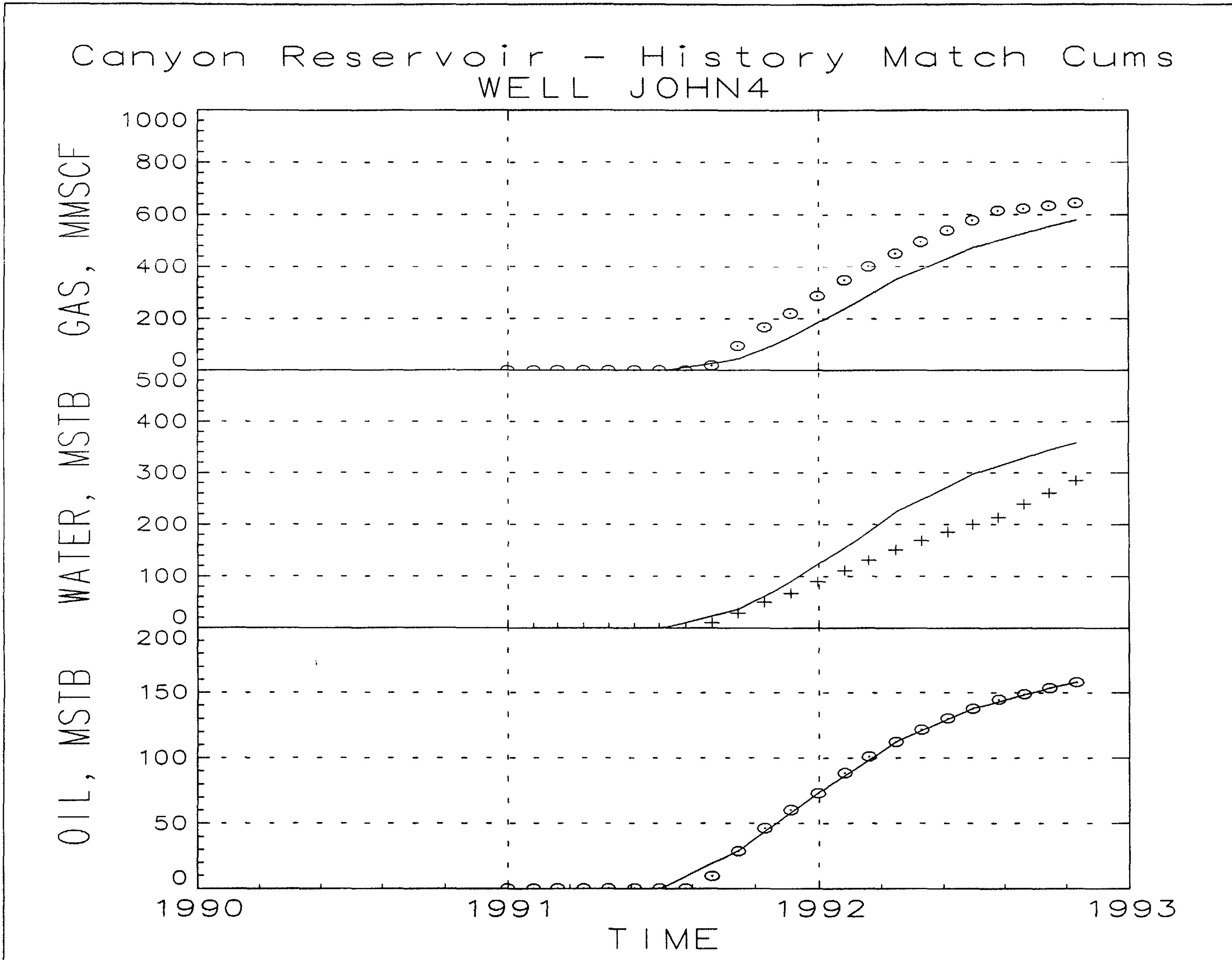

Canyon Reservoir - History Match Cums
WELL JOHN5
GAS, MMSCF
1000
800
600
400
200
0
WATER, MSTB
500
400
300
200
100
0
OIL, MSTB
200
150
100
50
0
1990
1991
1992
1993
TIME


Canyon Reservoir Average Pressure
WELL JOHN5
CELL PRESSURE, PSIA
3500
3000
2500
2000
1500
1000
500
0
1990
1991
1992
1993
TIME

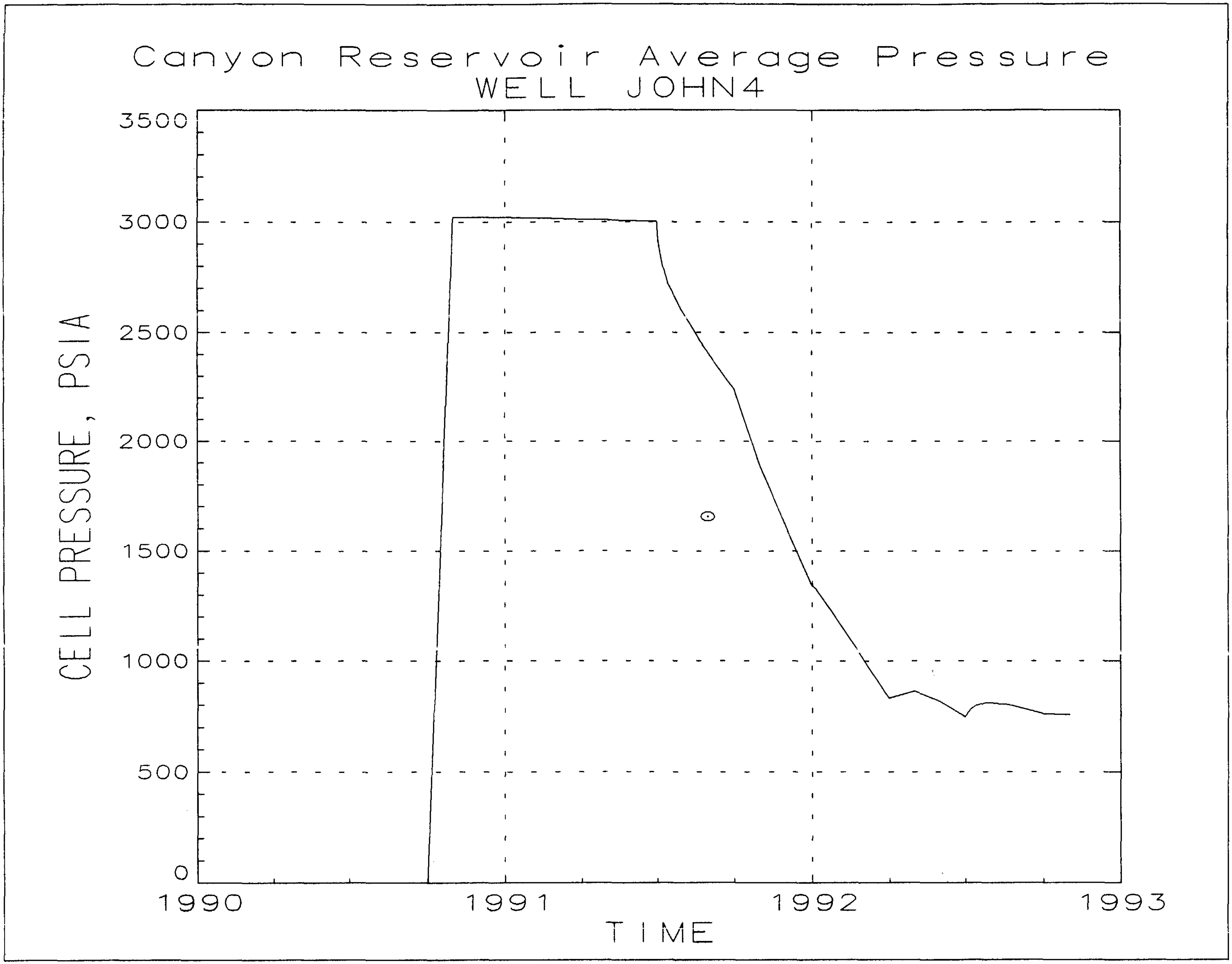


Canyon Reservoir - History Match Cums
WELL JOHN3
GAS, MMSCF
1000
800
600
400
200
0
WATER, MSTB
500
400
300
200
100
0
OIL, MSTB
200
150
100
50
0
1990
1991
1992
1993
TIME

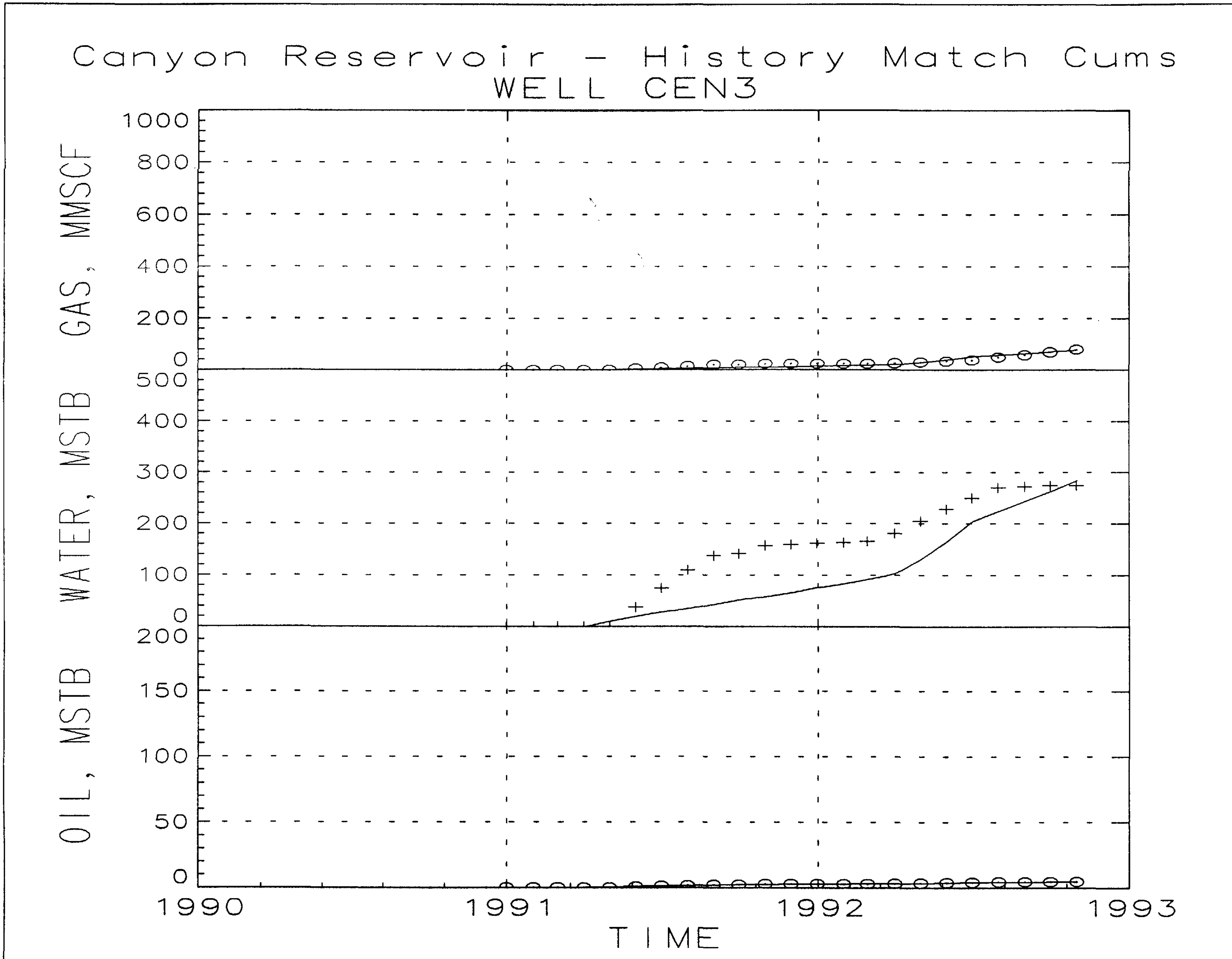

Canyon Reservoir Average Pressure
WELL JOHN3
CELL PRESSURE, PSIA
3500
3000
2500
2000
1500
1000
500
0
1990
1991
1992
1993
TIME

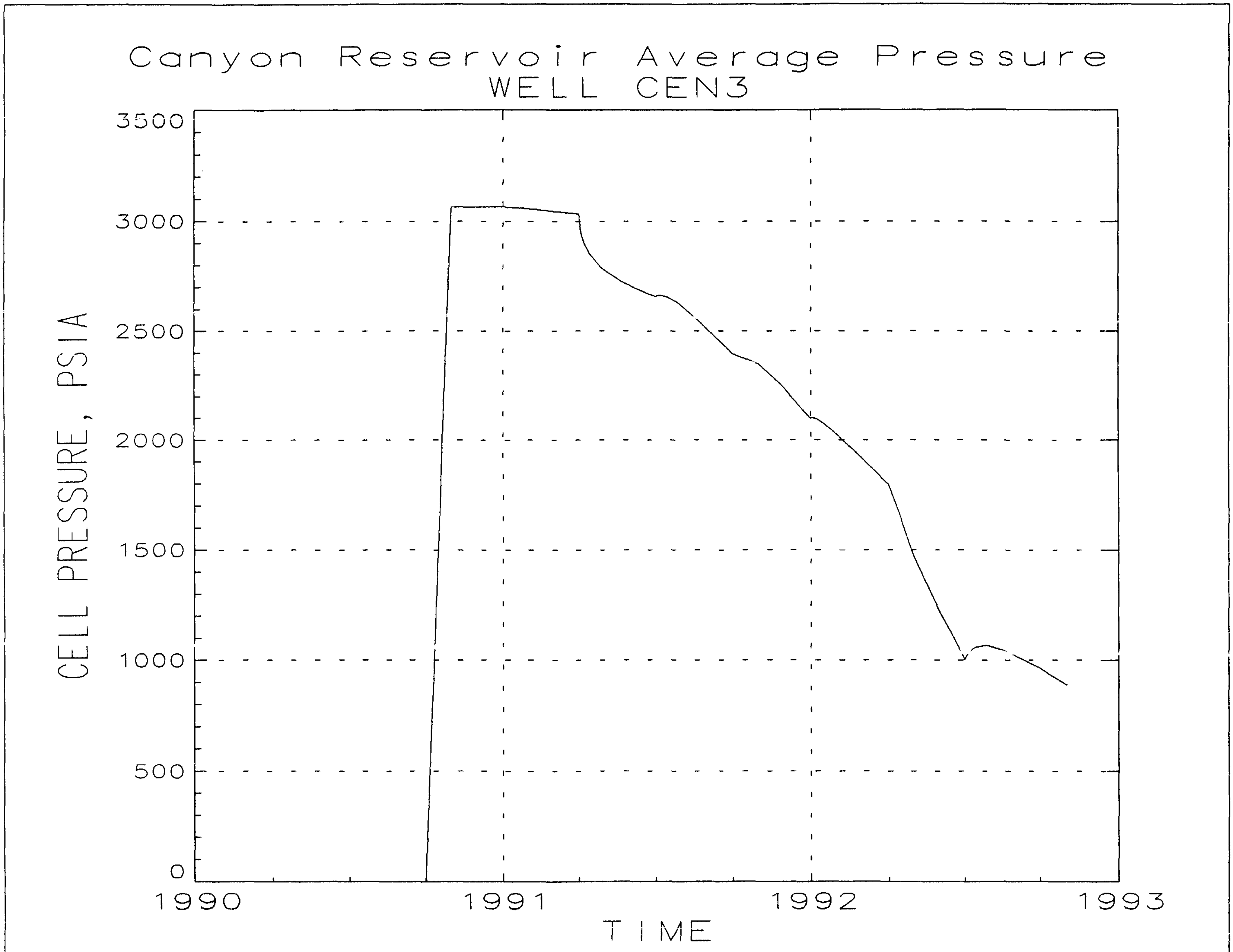


Canyon Reservoir - History Match Cums
WELL JOHN4
GAS, MMSCF
1000
800
600
400
200
0
WATER, MSTB
500
400
300
200
100
0
OIL, MSTB
200
150
100
50
0
1990
1991
1992
1993
TIME



Canyon Reservoir Average Pressure
WELL JOHN4
CELL PRESSURE, PSIA
3500
3000
2500
2000
1500
1000
500
0
1990
1991
1992
1993
TIME


Canyon Reservoir - History Match Cums
WELL CEN3
GAS, MMSCF
1000
800
600
400
200
0
WATER, MSTB
500
400
300
200
100
0
OIL, MSTB
200
150
100
50
0
1990
1991
1992
1993
TIME



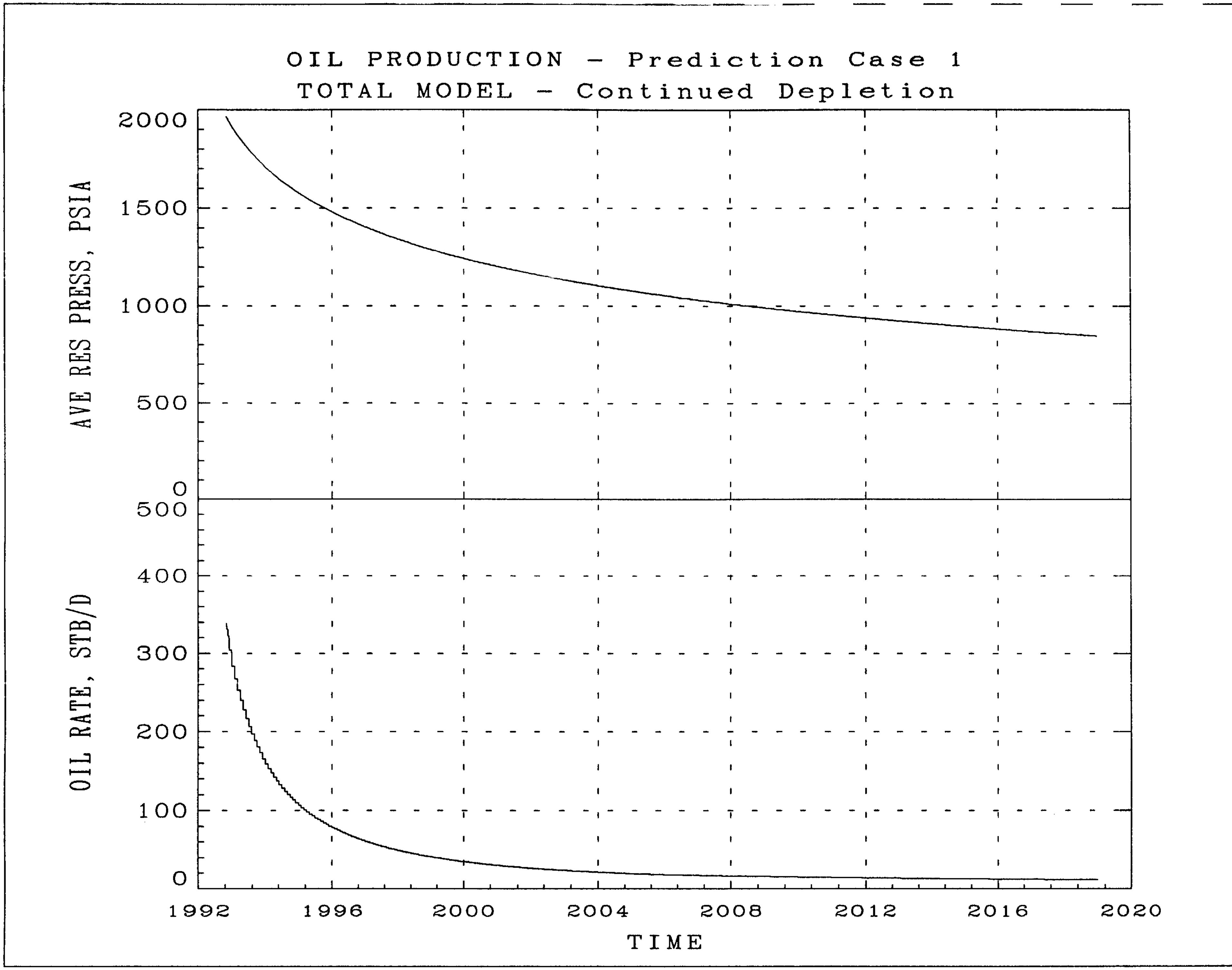
Canyon Reservoir Average Pressure
WELL CEN3
3500
3000
2500
2000
1500
1000
500
0
CELL PRESSURE, PSIA
1990
1991
1992
1993
TIME

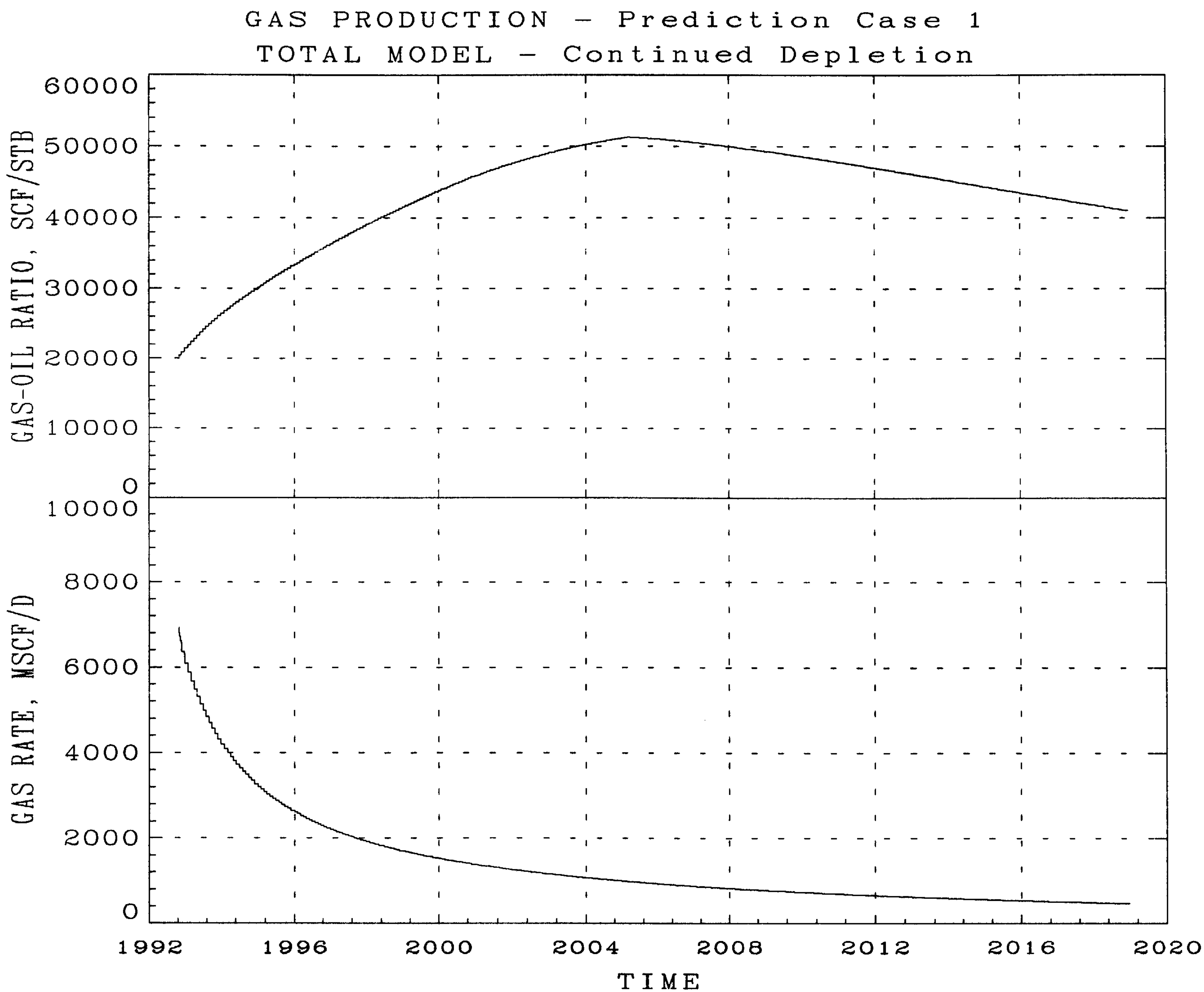
APPENDIX V

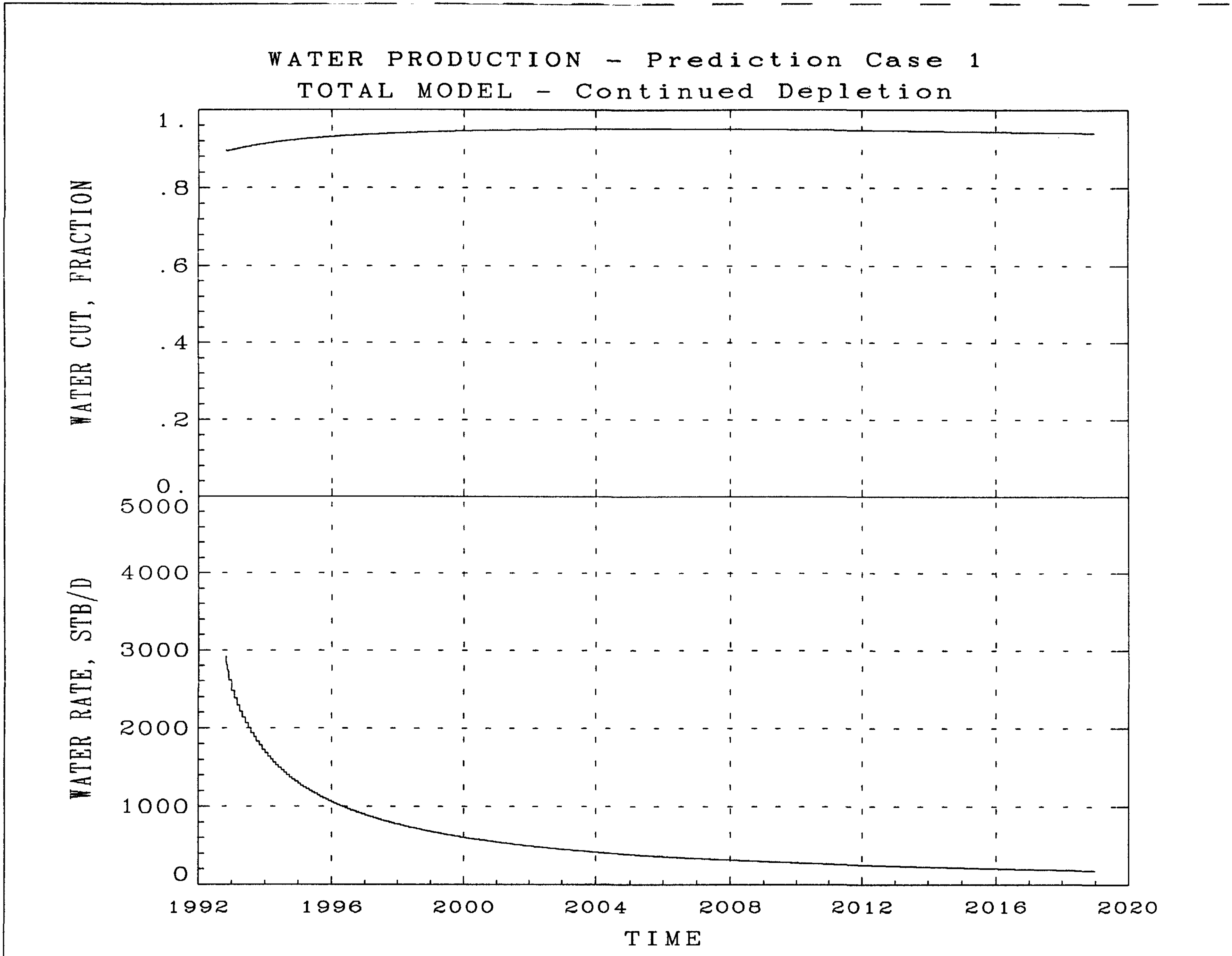
PREDICTION CASE 1

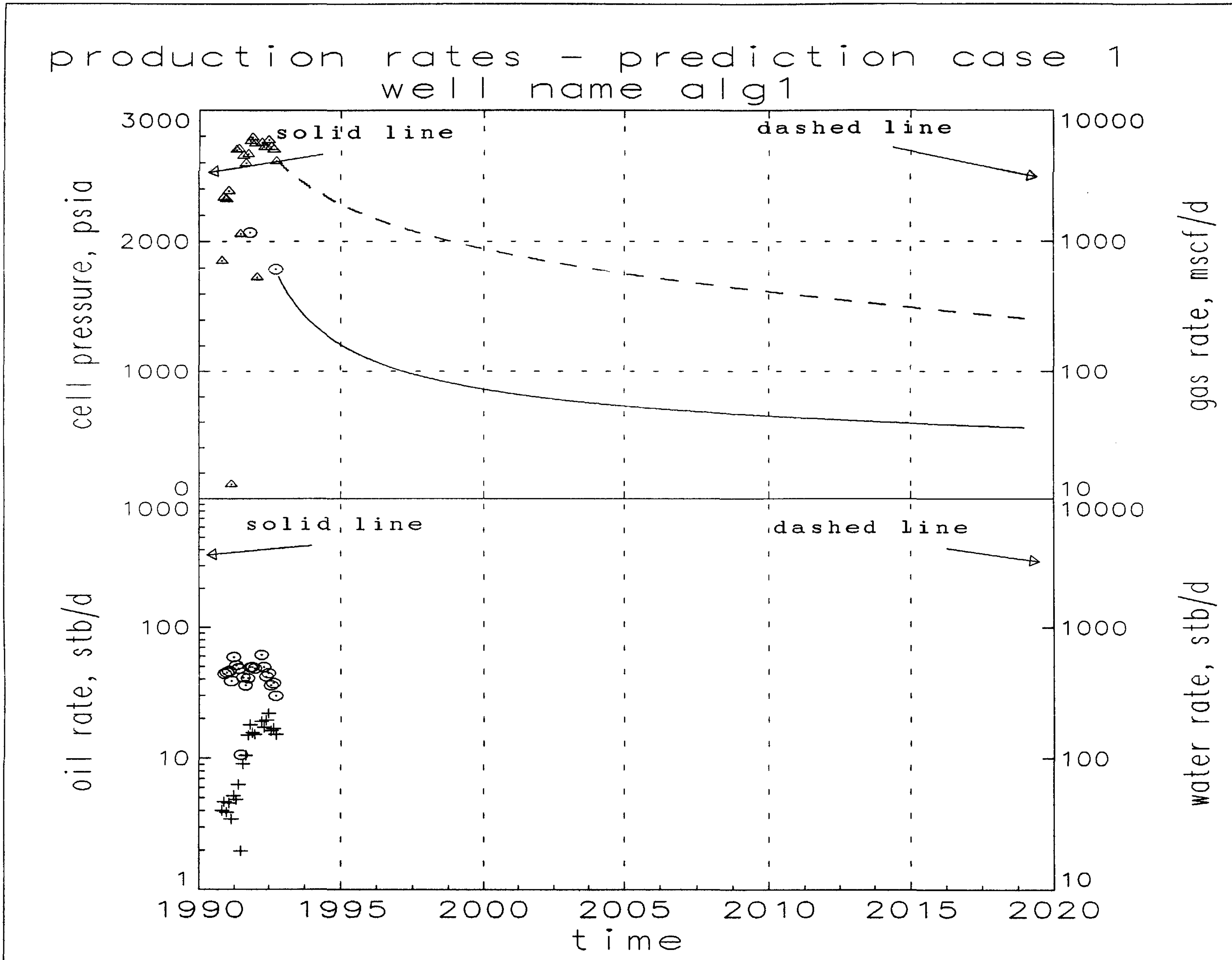
Model Performance Plots

Well Performance Plots

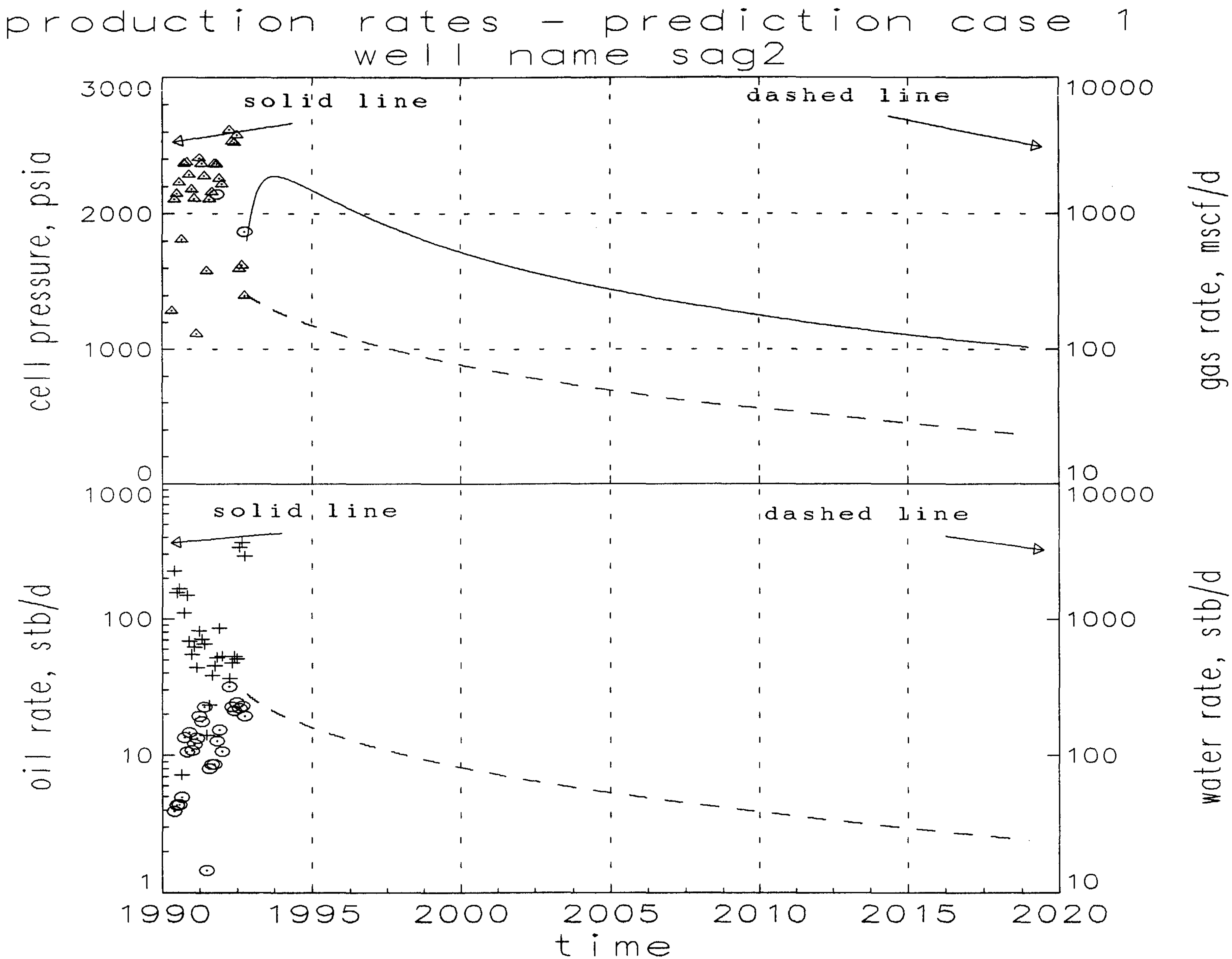

OIL PRODUCTION - Prediction Case 1
TOTAL MODEL - Continued Depletion
AVE RES PRESS, PSIA
2000
1500
1000
500
0
OIL RATE, STB/D
500
400
300
200
100
0
1992
1996
2000
2004
2008
2012
2016
2020
TIME


GAS PRODUCTION - Prediction Case 1
TOTAL MODEL - Continued Depletion
GAS-OIL RATIO, SCF/STB
60000
50000
40000
30000
20000
10000
0
GAS RATE, MSCF/D
10000
8000
6000
4000
2000
0
1992
1996
2000
2004
2008
2012
2016
2020
TIME

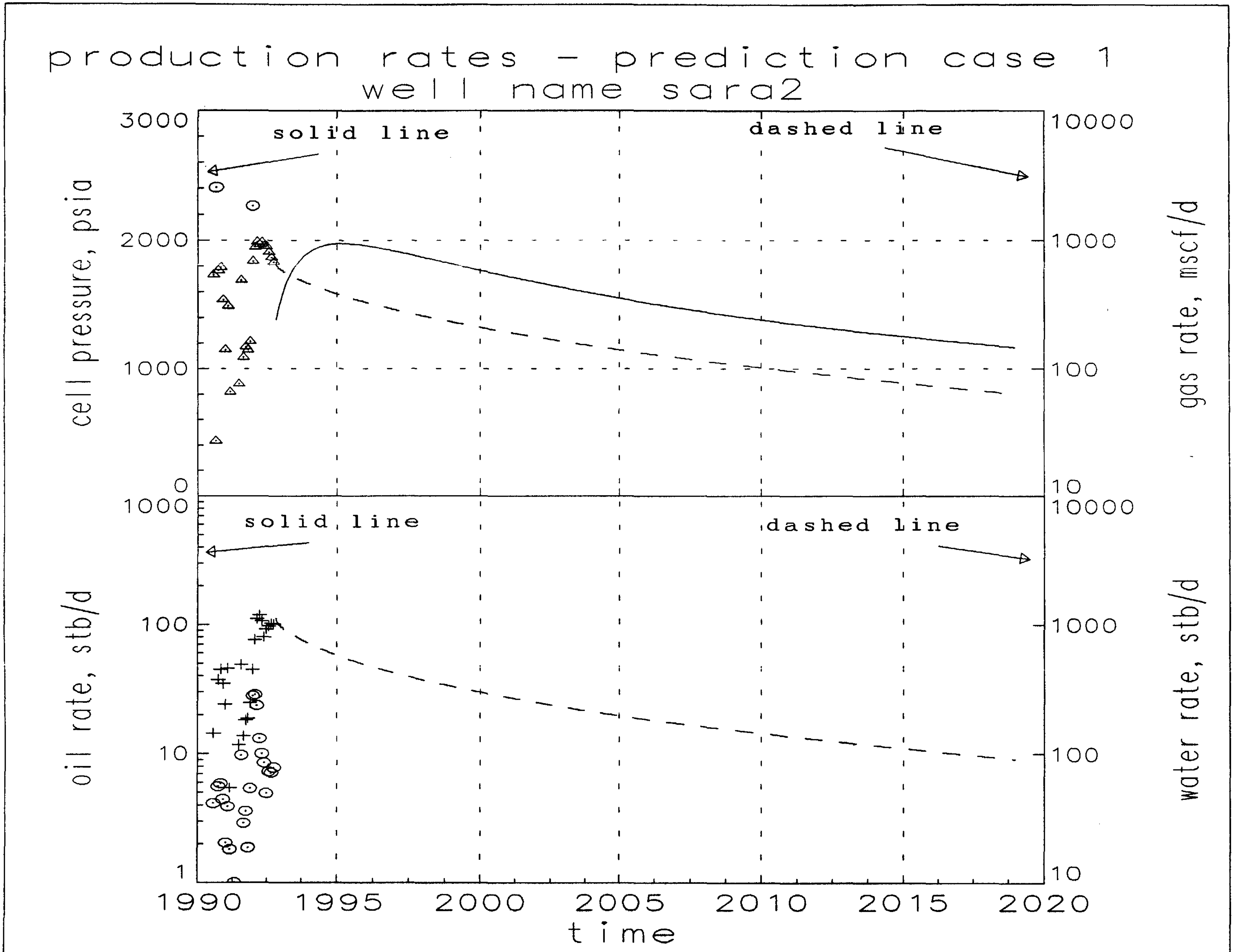

WATER PRODUCTION - Prediction Case 1
TOTAL MODEL - Continued Depletion
WATER CUT, FRACTION
1.
.8
.6
.4
.2
0.
WATER RATE, STB/D
5000
4000
3000
2000
1000
0
1992
1996
2000
2004
2008
2012
2016
2020
TIME

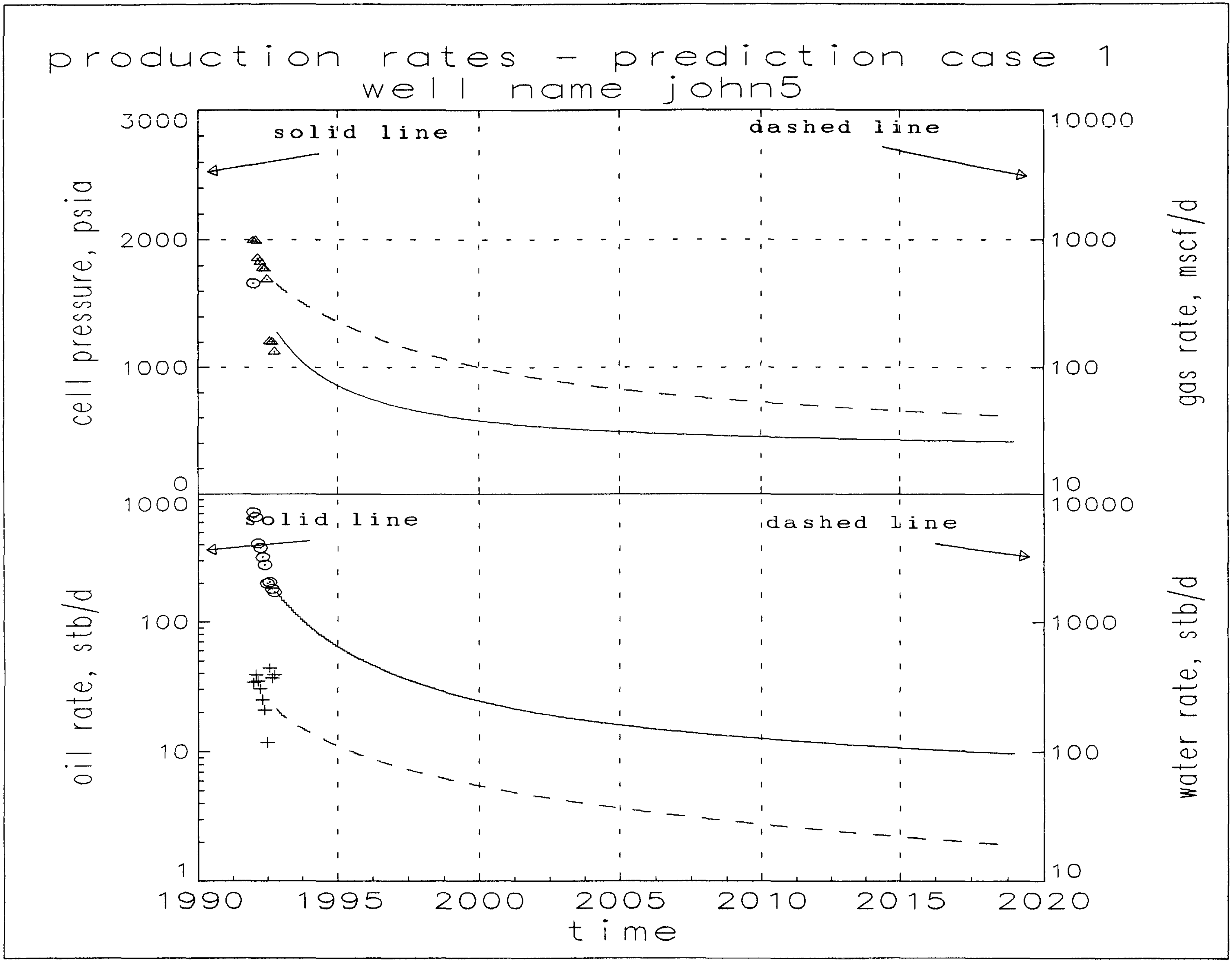


production rates - prediction case 1
well name alg1
cell pressure, psia
gas rate, mscf/d
solid line
dashed line
oil rate, stb/d
water rate, stb/d
solid line
dashed line
time
3000
2000
1000
0
10000
1000
100
10
1000
100
10
1
10000
1000
100
10
1990
1995
2000
2005
2010
2015
2020

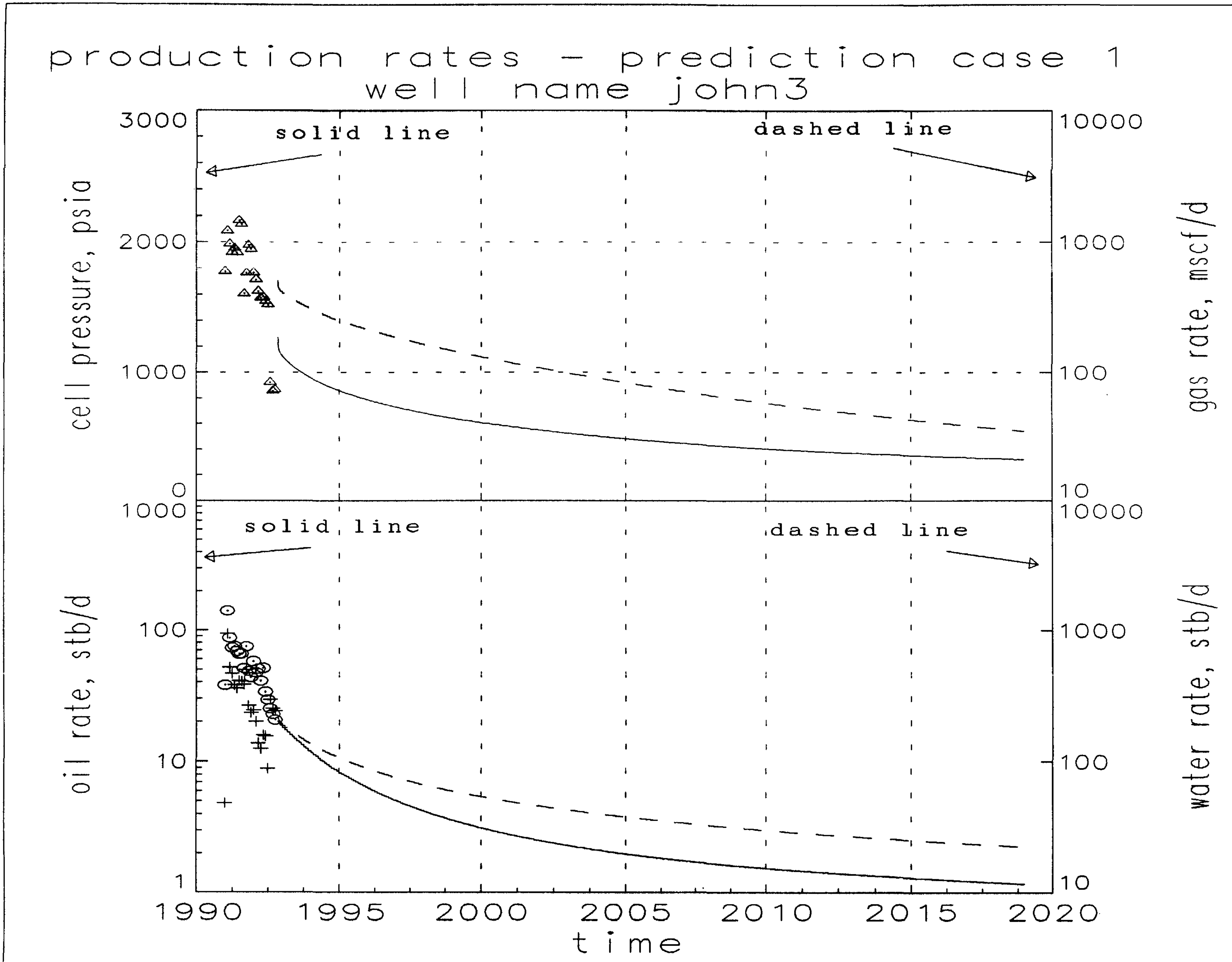


production rates - prediction case 1
well name sag2
cell pressure, psia
gas rate, mscf/d
solid line
dashed line
3000
2000
1000
0
10000
1000
100
10
oil rate, stb/d
water rate, stb/d
1000
100
10
1
10000
1000
100
10
1990
1995
2000
2005
2010
2015
2020
time

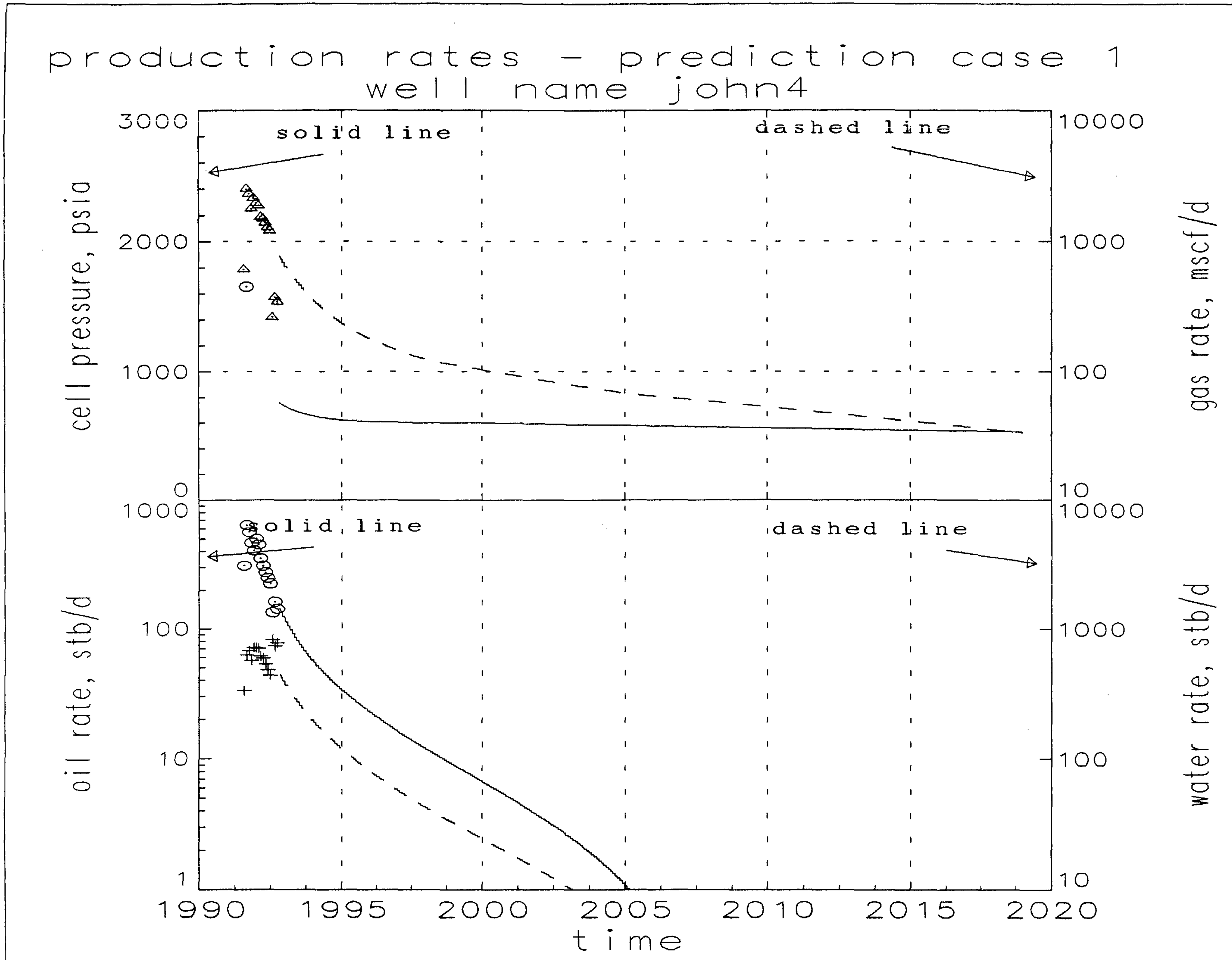

production rates - prediction case 1
well name sara2
cell pressure, psia
gas rate, mscf/d
oil rate, stb/d
water rate, stb/d
solid line
dashed line
solid line
dashed line
3000
2000
1000
0
10000
1000
100
10
1000
100
10
1
10000
1000
100
10
1990
1995
2000
2005
2010
2015
2020
time

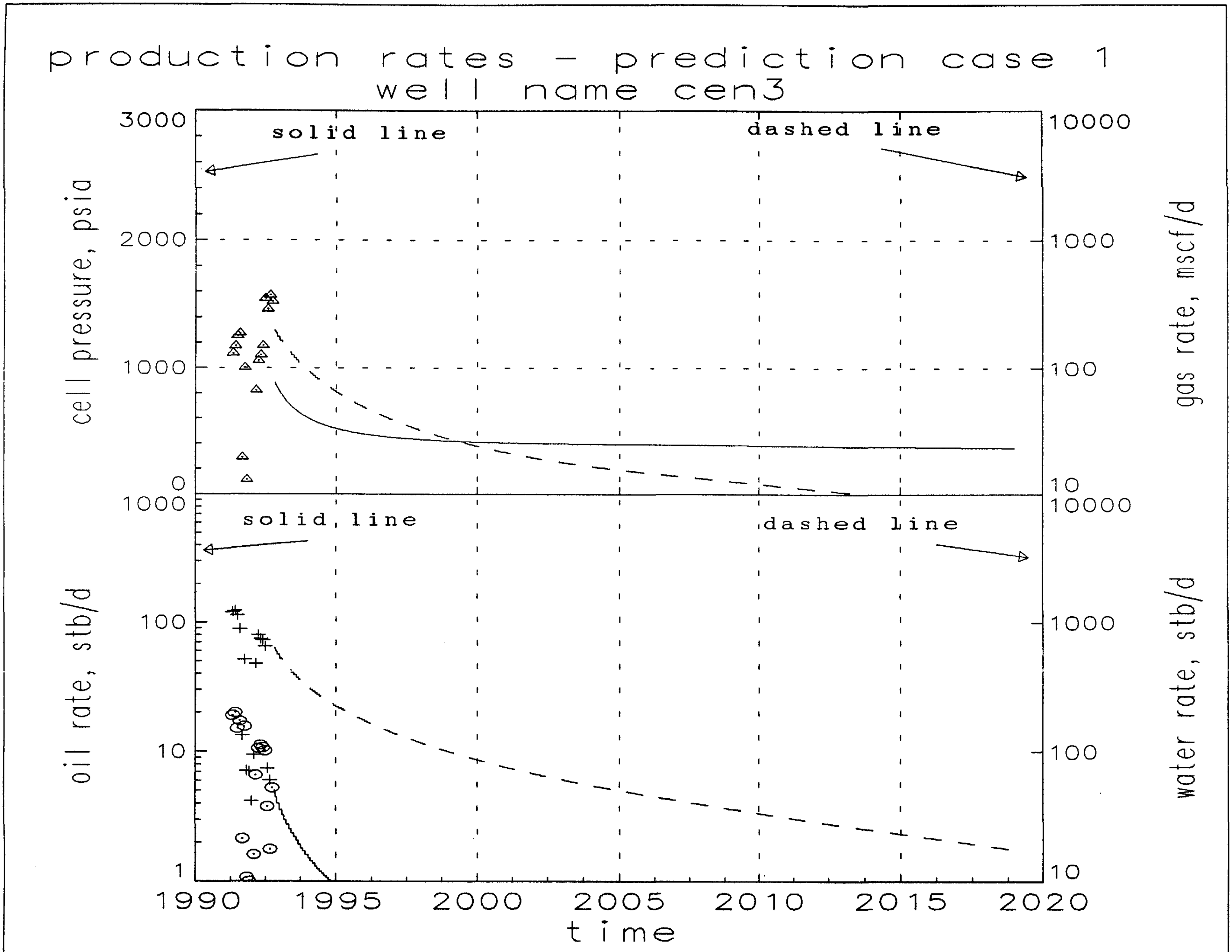


production rates - prediction case 1
well name john5
solid line
dashed line
cell pressure, psia
gas rate, mscf/d
3000
2000
1000
0
10000
1000
100
10
solid line
dashed line
oil rate, stb/d
water rate, stb/d
1000
100
10
1
10000
1000
100
10
1990
1995
2000
2005
2010
2015
2020
time



production rates - prediction case 1
well name john3
solid line
dashed line
cell pressure, psia
gas rate, mscf/d
oil rate, stb/d
water rate, stb/d
3000
2000
1000
0
10000
1000
100
10
1000
100
10
1
10000
1000
100
10
1990
1995
2000
2005
2010
2015
2020
time


production rates - prediction case 1
well name john4
solid line
dashed line
cell pressure, psia
gas rate, mscf/d
oil rate, stb/d
water rate, stb/d
time
3000
2000
1000
0
10000
1000
100
10
1
1990
1995
2000
2005
2010
2015
2020

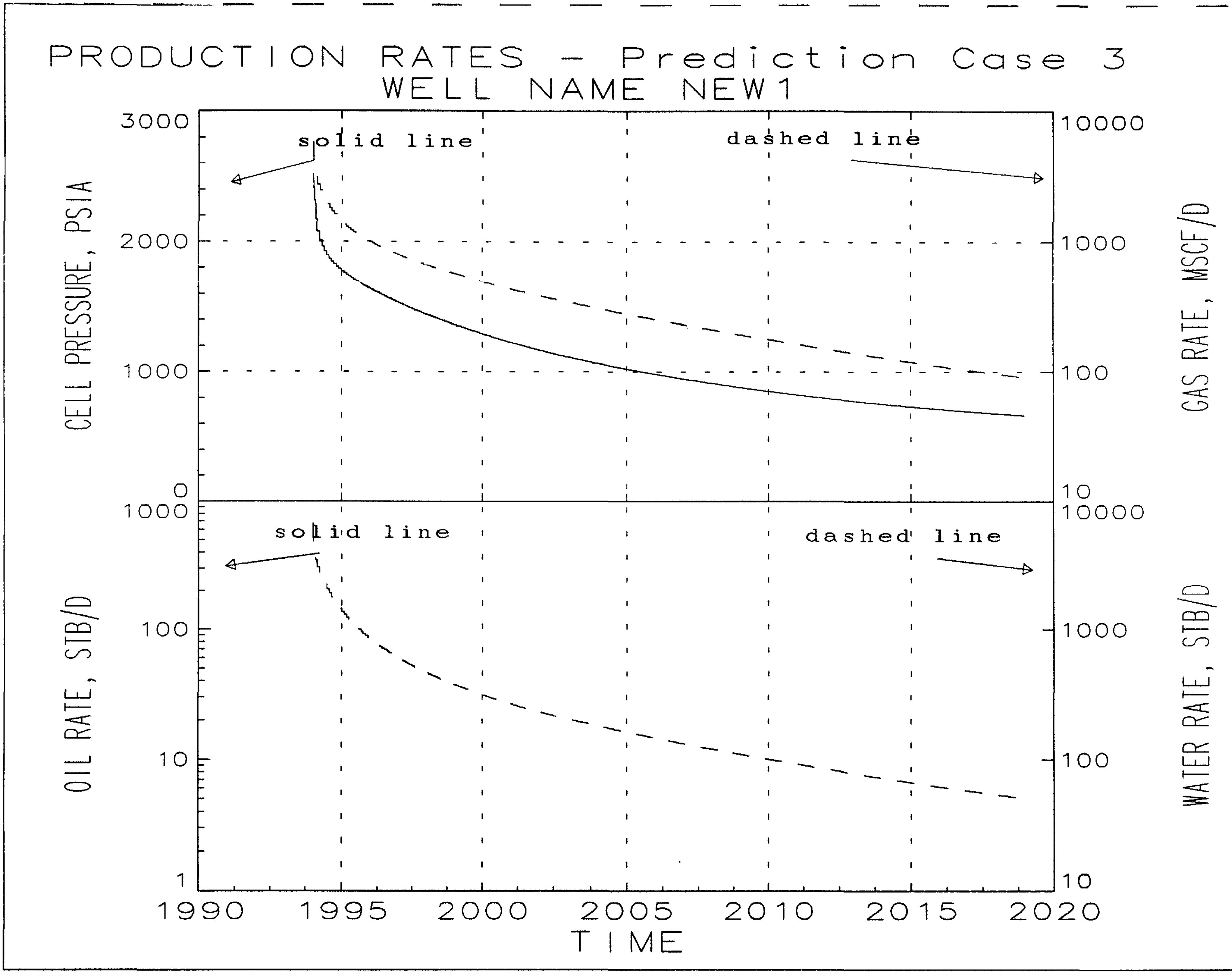


production rates - prediction case 1
well name cen3
solid line
dashed line
cell pressure, psia
gas rate, mscf/d
3000
2000
1000
0
10000
1000
100
10
solid line
dashed line
oil rate, stb/d
water rate, stb/d
1000
100
10
1
10000
1000
100
10
1990
1995
2000
2005
2010
2015
2020
time

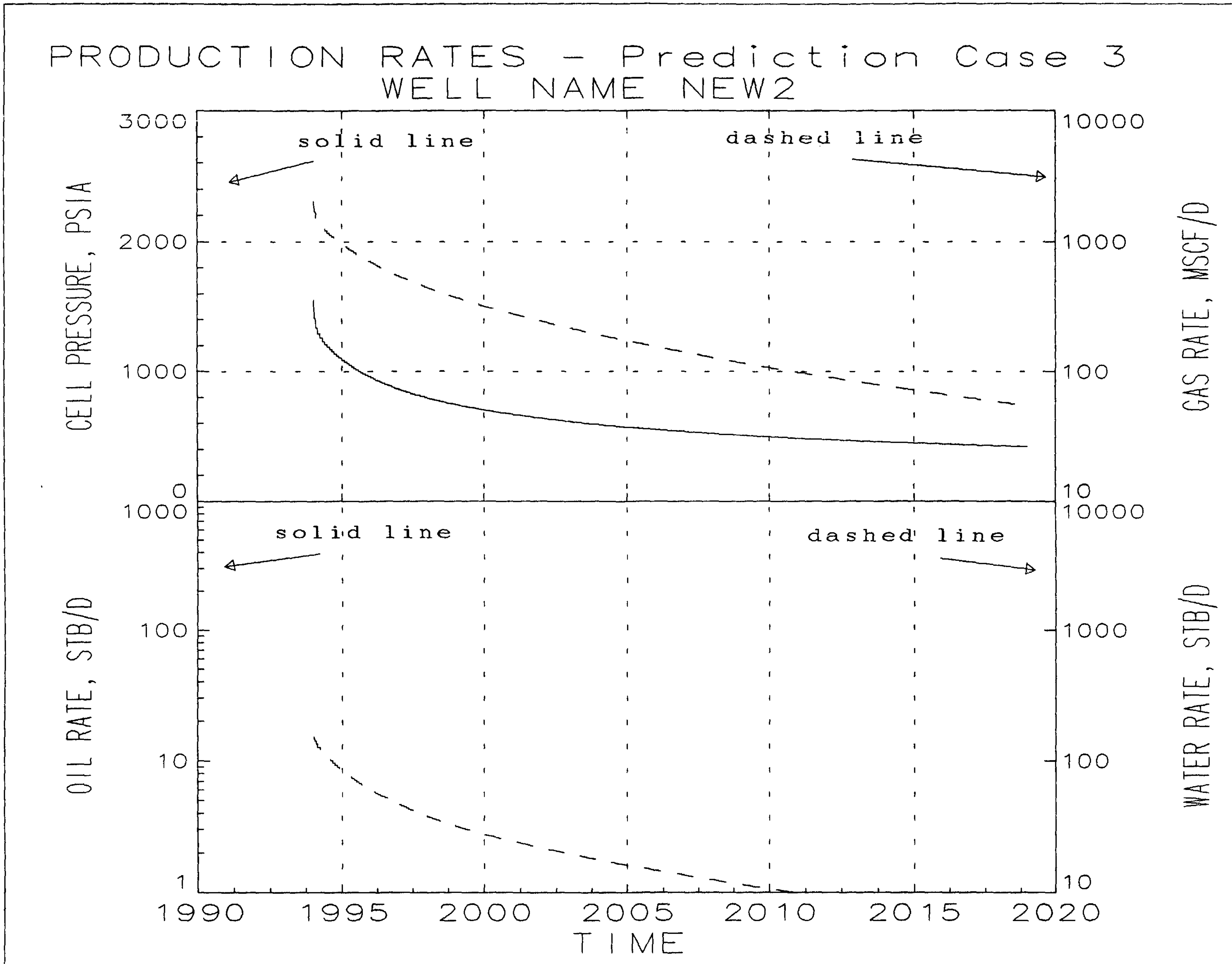
APPENDIX VI

PREDICTION CASE 3

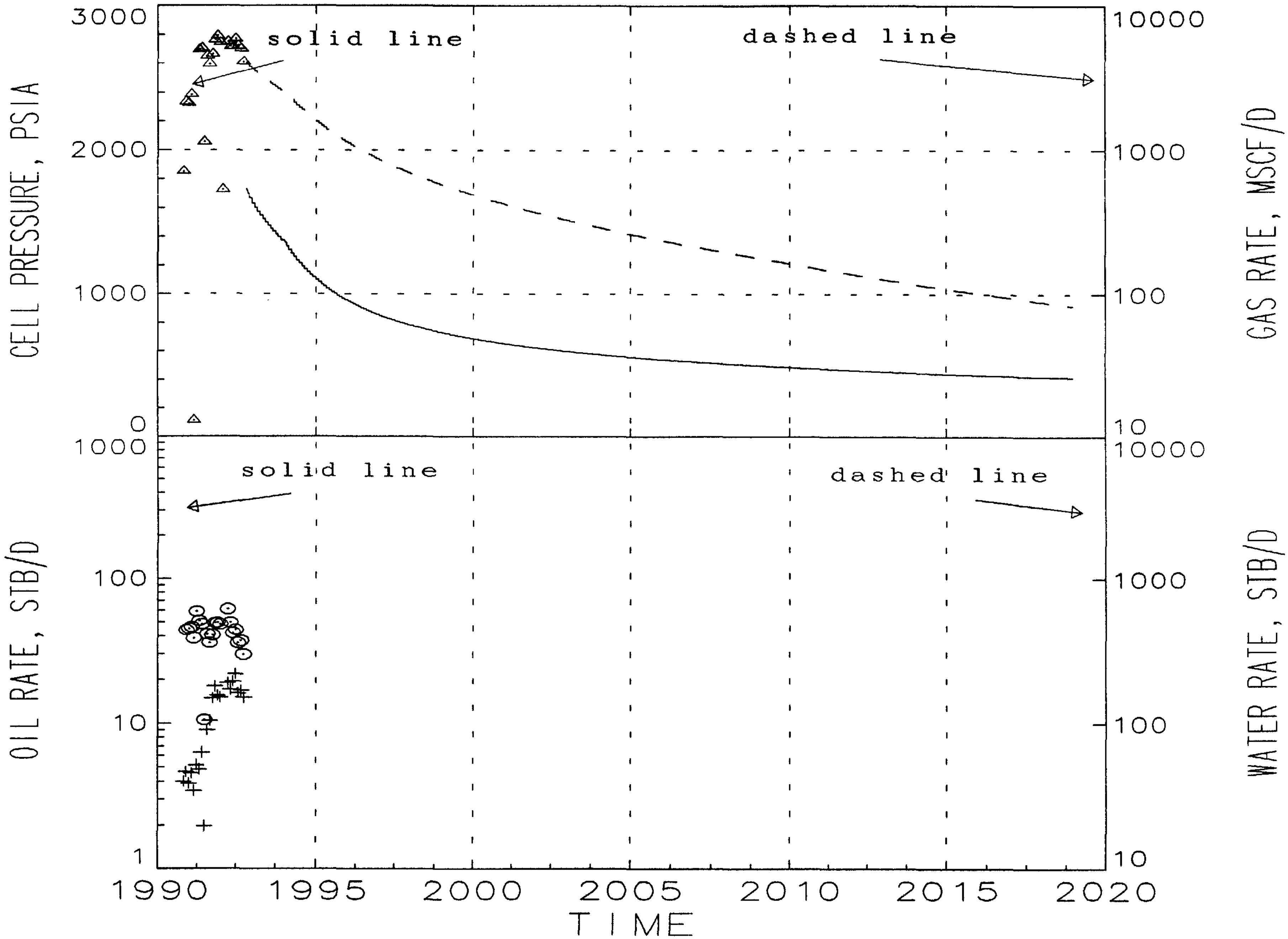
Well Performance Plots

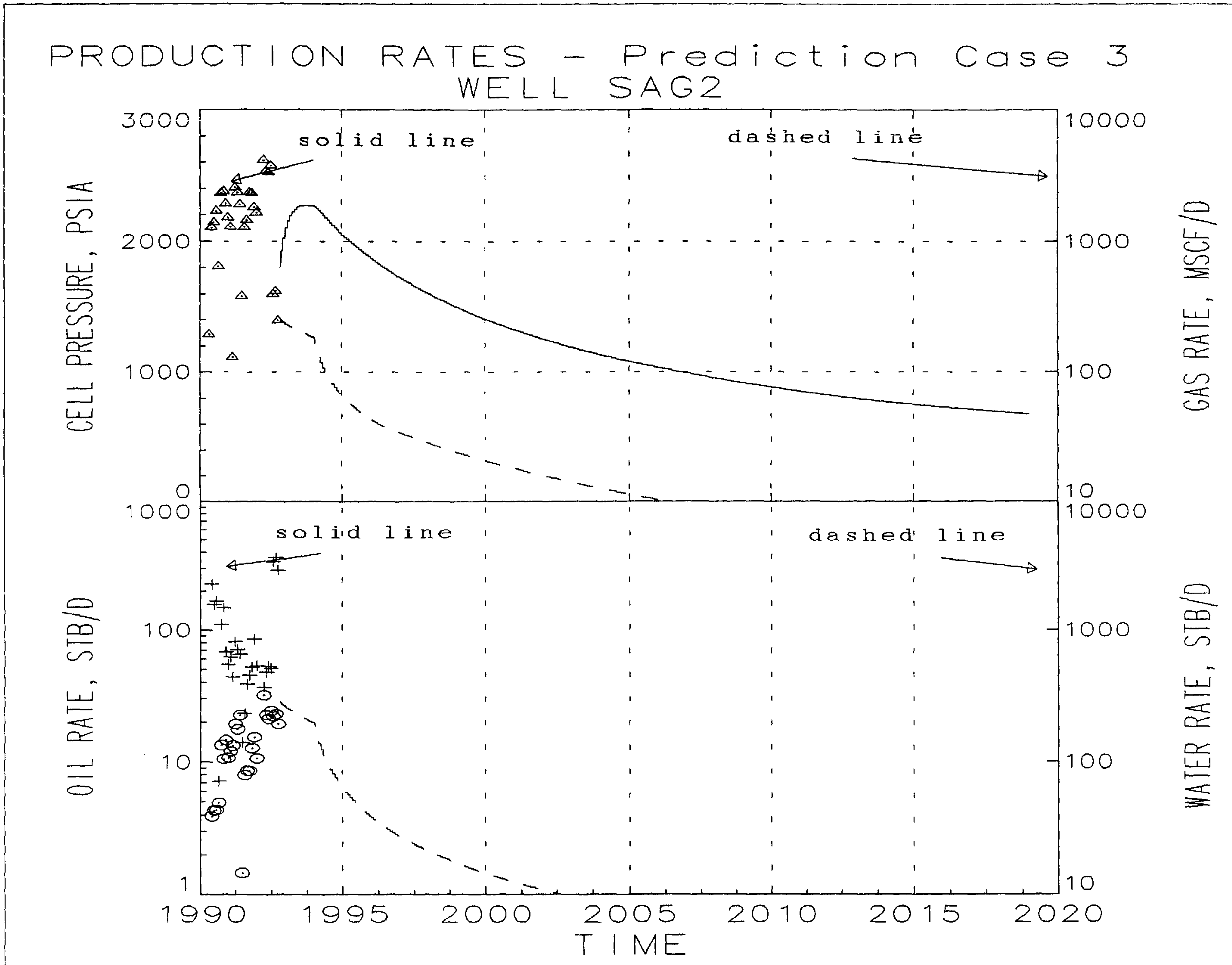


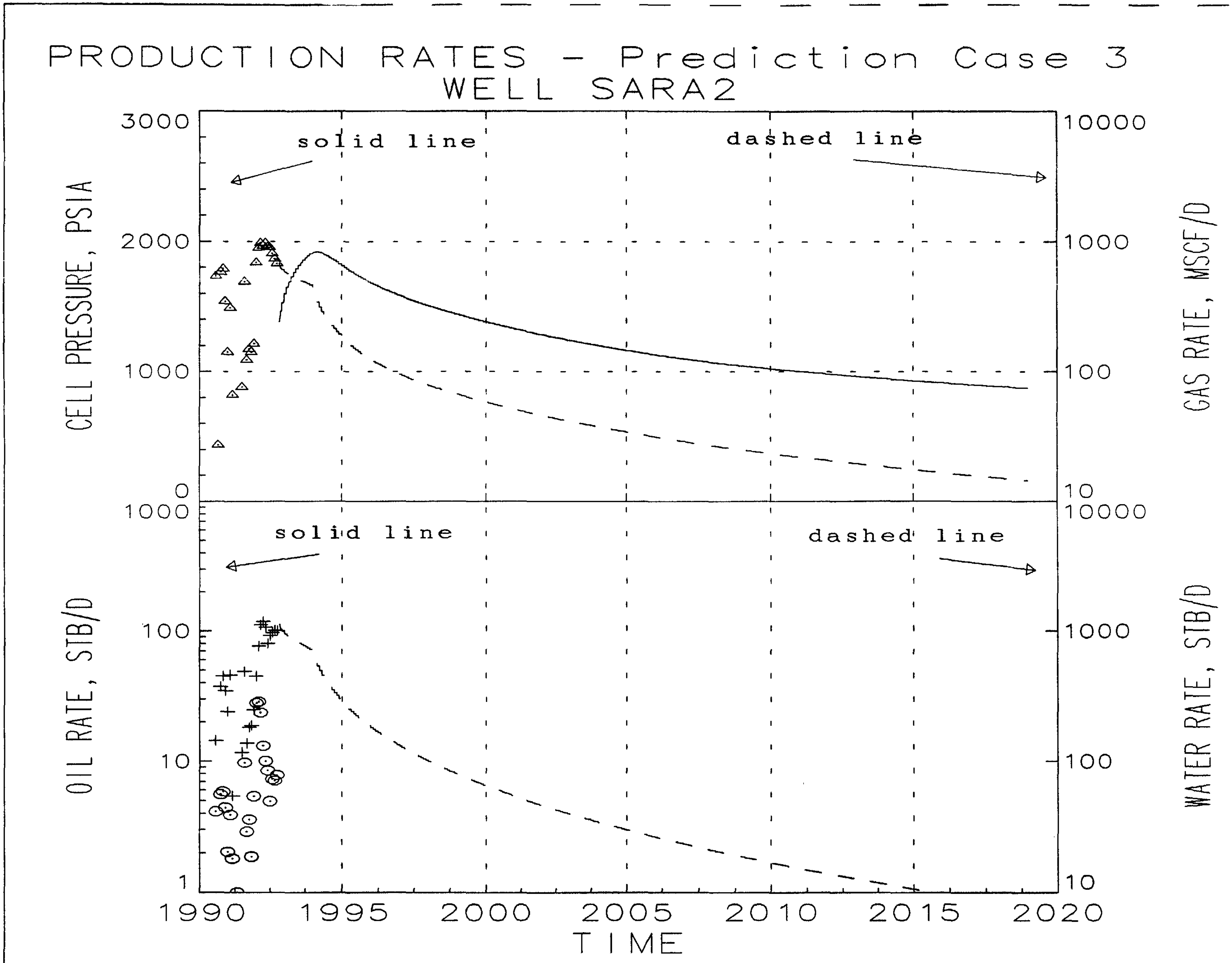
PRODUCTION RATES - Prediction Case 3
WELL NAME NEW1
solid line
dashed line
CELL PRESSURE, PSIA
GAS RATE, MSCF/D
OIL RATE, STB/D
WATER RATE, STB/D
3000
2000
1000
0
10000
1000
100
10
1000
100
10
1
10000
1000
100
10
1990
1995
2000
2005
2010
2015
2020
TIME


PRODUCTION RATES - Prediction Case 3
WELL NAME NEW2
CELL PRESSURE, PSIA
GAS RATE, MSCF/D
OIL RATE, STB/D
WATER RATE, STB/D
solid line
dashed line
solid line
dashed line
3000
2000
1000
0
10000
1000
100
10
1000
100
10
1
10000
1000
100
10
1990
1995
2000
2005
2010
2015
2020
TIME

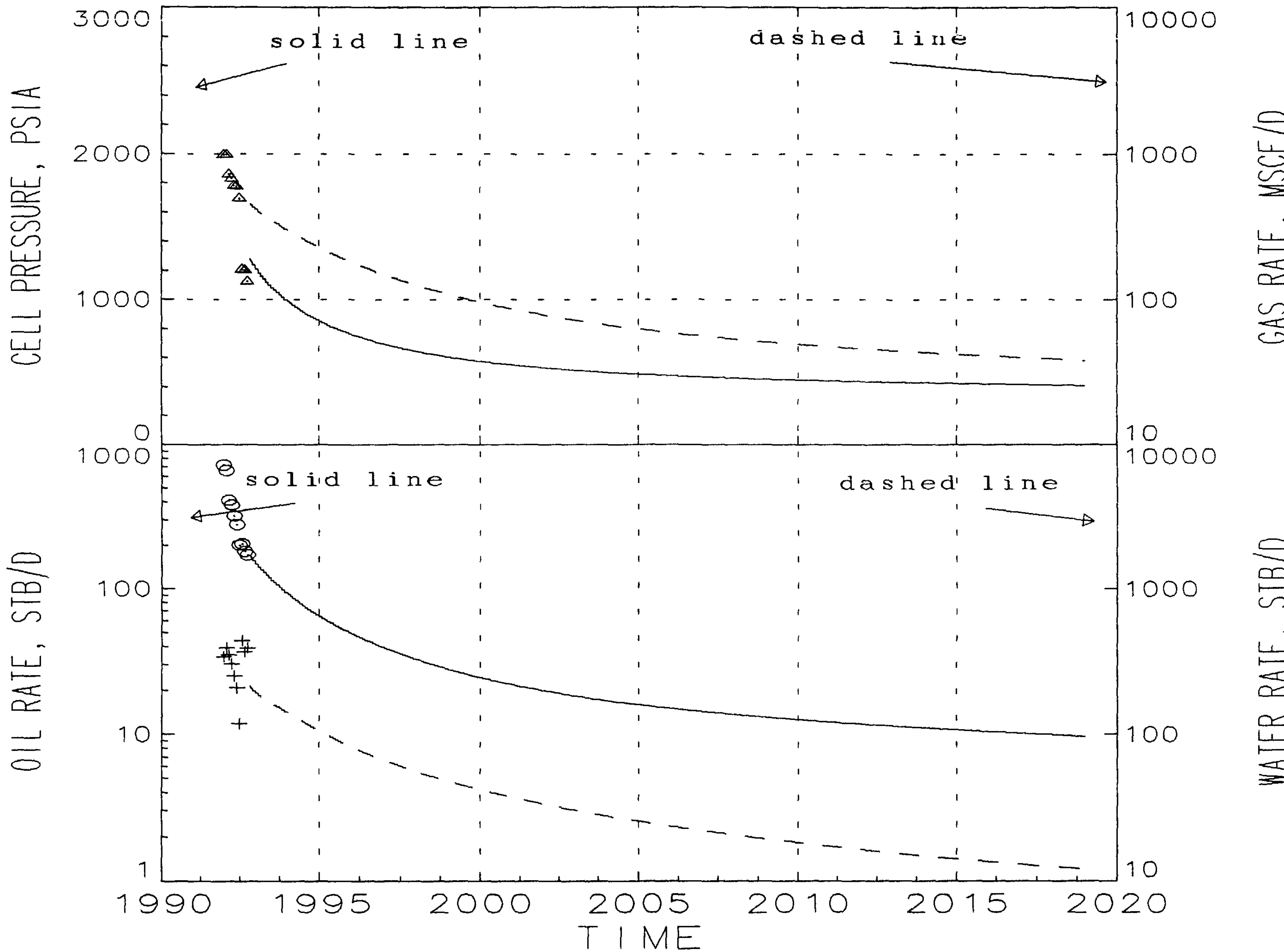
PRODUCTION RATES - Prediction Case 3
WELL ALG1



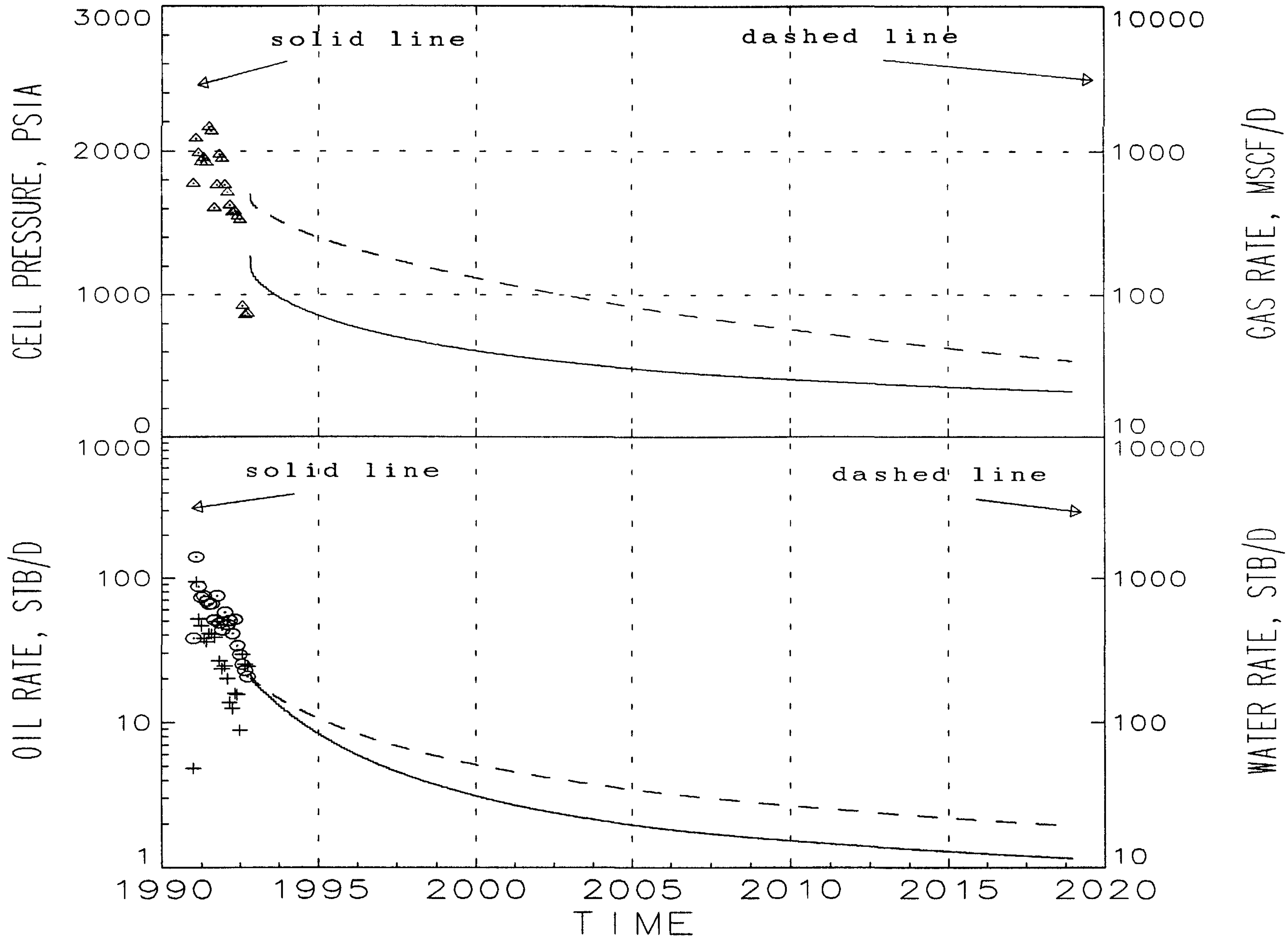

PRODUCTION RATES - Prediction Case 3
WELL SAG2
CELL PRESSURE, PSIA
GAS RATE, MSCF/D
OIL RATE, STB/D
WATER RATE, STB/D
solid line
dashed line
solid line
dashed line
3000
2000
1000
0
10000
1000
100
10
1000
100
10
1
10000
1000
100
10
1990
1995
2000
2005
2010
2015
2020
TIME

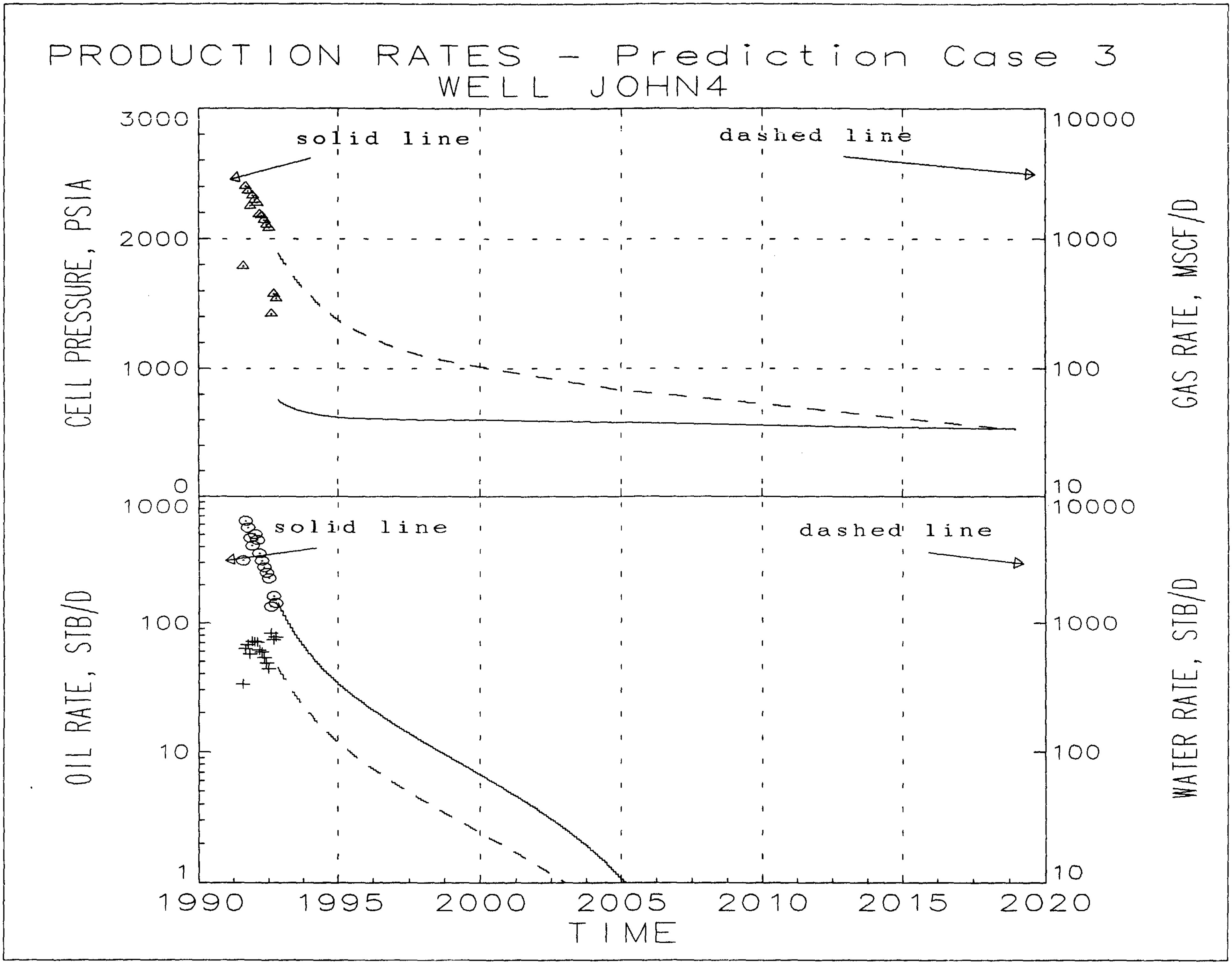

PRODUCTION RATES - Prediction Case 3
WELL SARA2
CELL PRESSURE, PSIA
GAS RATE, MSCF/D
OIL RATE, STB/D
WATER RATE, STB/D
solid line
dashed line
solid line
dashed line
3000
2000
1000
0
10000
1000
100
10
1000
100
10
1
10000
1000
100
10
1990
1995
2000
2005
2010
2015
2020
TIME

PRODUCTION RATES - Prediction Case 3
WELL JOHN5

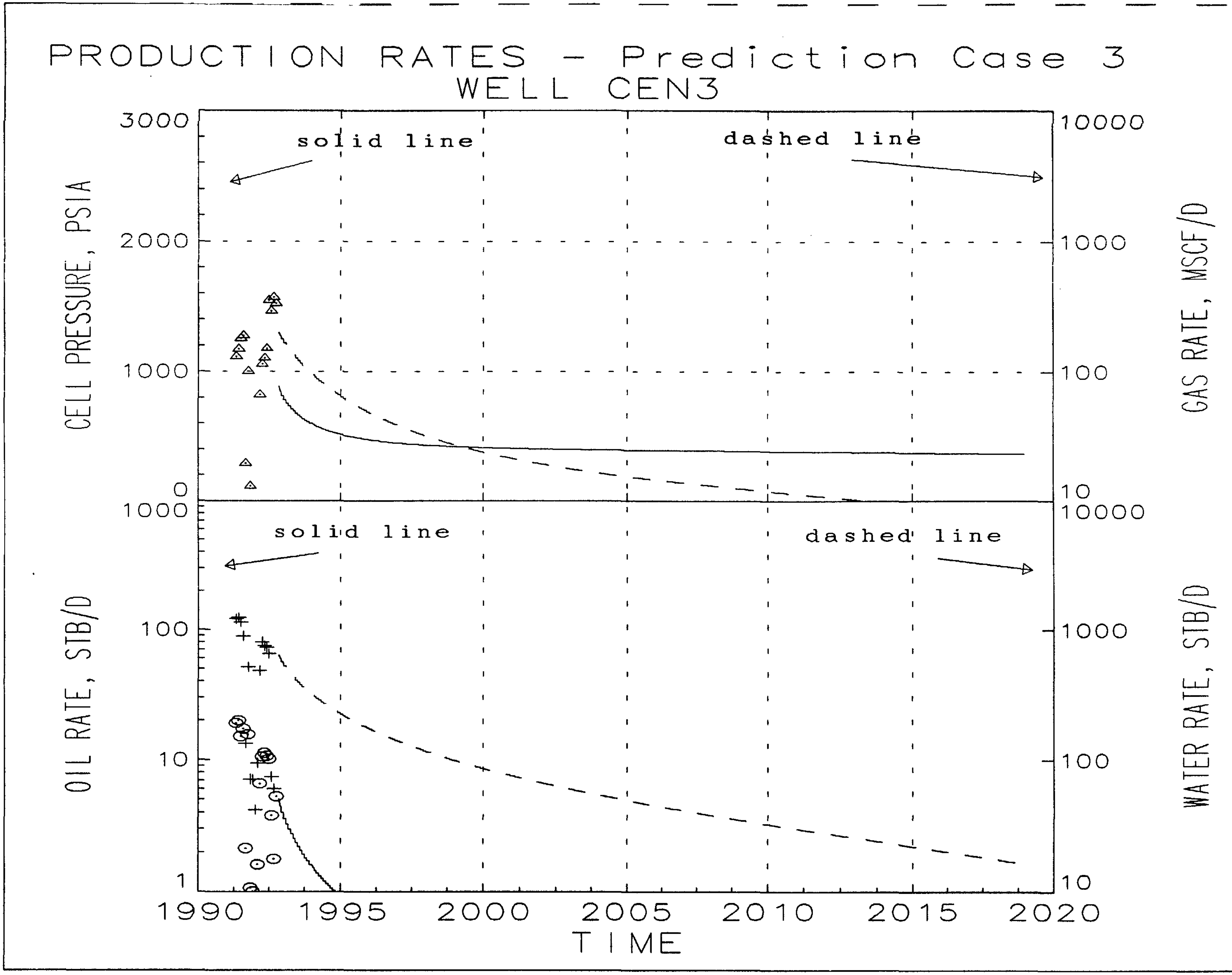


PRODUCTION RATES - Prediction Case 3
WELL JOHN3





PRODUCTION RATES - Prediction Case 3
WELL JOHN4
CELL PRESSURE, PSIA
GAS RATE, MSCF/D
OIL RATE, STB/D
WATER RATE, STB/D
solid line
dashed line
solid line
dashed line
3000
2000
1000
0
10000
1000
100
10
1000
100
10
1
10000
1000
100
10
1990
1995
2000
2005
2010
2015
2020
TIME


PRODUCTION RATES - Prediction Case 3
WELL CEN3
solid line
dashed line
CELL PRESSURE, PSIA
GAS RATE, MSCF/D
OIL RATE, STB/D
WATER RATE, STB/D
3000
2000
1000
0
10000
1000
100
10
1000
100
10
1
10000
1000
100
10
1990
1995
2000
2005
2010
2015
2020
TIME

Economic Analyses
Gas Cap Drainage Scenarios
Dagger Draw South (Upper Penn)

Continue with Current Operations:

Oil	**682**	MBO
Gas	**19450**	MMCF
Present Worth Profit	**10490**	M$

Continue Oil Production and Shut In Gas Wells:

Oil	**684**	MBO
Gas	**9682**	MMCF
Present Worth Profit	**6750**	M$

Continue Oil Production and Accelerate Gas Well Production:

Oil	**682**	MBO
Gas	**21490**	MMCF
Present Worth Profit	**11080**	M$

BEFORE THE
OIL CONSERVATION DIVISION
Santa Fe, New Mexico

Case Nos. 10869 and 10881 Exhibit No. 6

Submitted by: Yates Petroleum Corporation

Hearing Date: December 2, 1993

* Discount rate = 5%