STRATIFICATION OF OIL PRODUCING ZONES OF THE NIOBRARA MEMBER OF THE MANCOS FORMATION IN THE PUERTO CHIQUITO POOLS OF RIO ARRIBA COUNTY, NEW MEXICO

Benson-Montin-Greer Drilling Corp. has drilled and/or operated 89 wells in the East and West Puerto Chiquito pools. A large number of the wells drilled early in the life of the pools were drilled through the pay zones with cable tools or with rotary tools using air, natural gas or nitrogen for the circulating fluid. Wells drilled in this fashion permit the determination of fluid entry into the wellbore as it is encountered.

In no instance where natural production was encountered was it found to increase gradually with depth below the top of the A zone (as would be the case if a long section of the reservoir was productive throughout): rather production increased abruptly upon penetrating one of the stratigraphic intervals as indicated on the type log on the facing page. In West Puerto Chiquito in the A zone typically free gas would be encountered with oil; sometimes this occurred in the B zone. Where the C zone produced natural, it typically contained oil with only dissolved gas - no free gas.

In West Puerto Chiquito then, considerable evidence was collected showing stratification. On the contrary, in Gavilan, in nearly all wells , operators have drilled through all the pay zones with mud before running casing and testing. Typically all zones are fraced: either separately or with one frac treatment before production testing commences. Most of the treatments are at fairly high rates; and as a consequence it is to be expected that the A, B and C zones will be "tied together" with the frac treatment behind the pipe such that it is virtually impossible to accurately assess the stratification issue of these zones in the Gavilan wells.

Since the vertical fractures induced by the fracture treatments can tie the zones together away from the wellbore and flow of oil and gas to the wellbore through these fractures will be at a low pressure differential, then it is to be expected that a high degree of segregation of gas and oil will occur in these vertical fractures as the oil and gas move to the wellbore. As a consequence of the above, oil from an upper zone can enter the wellbore through perforations low in the wellbore and gas from a lower zone can enter the wellbore in higher perforations.

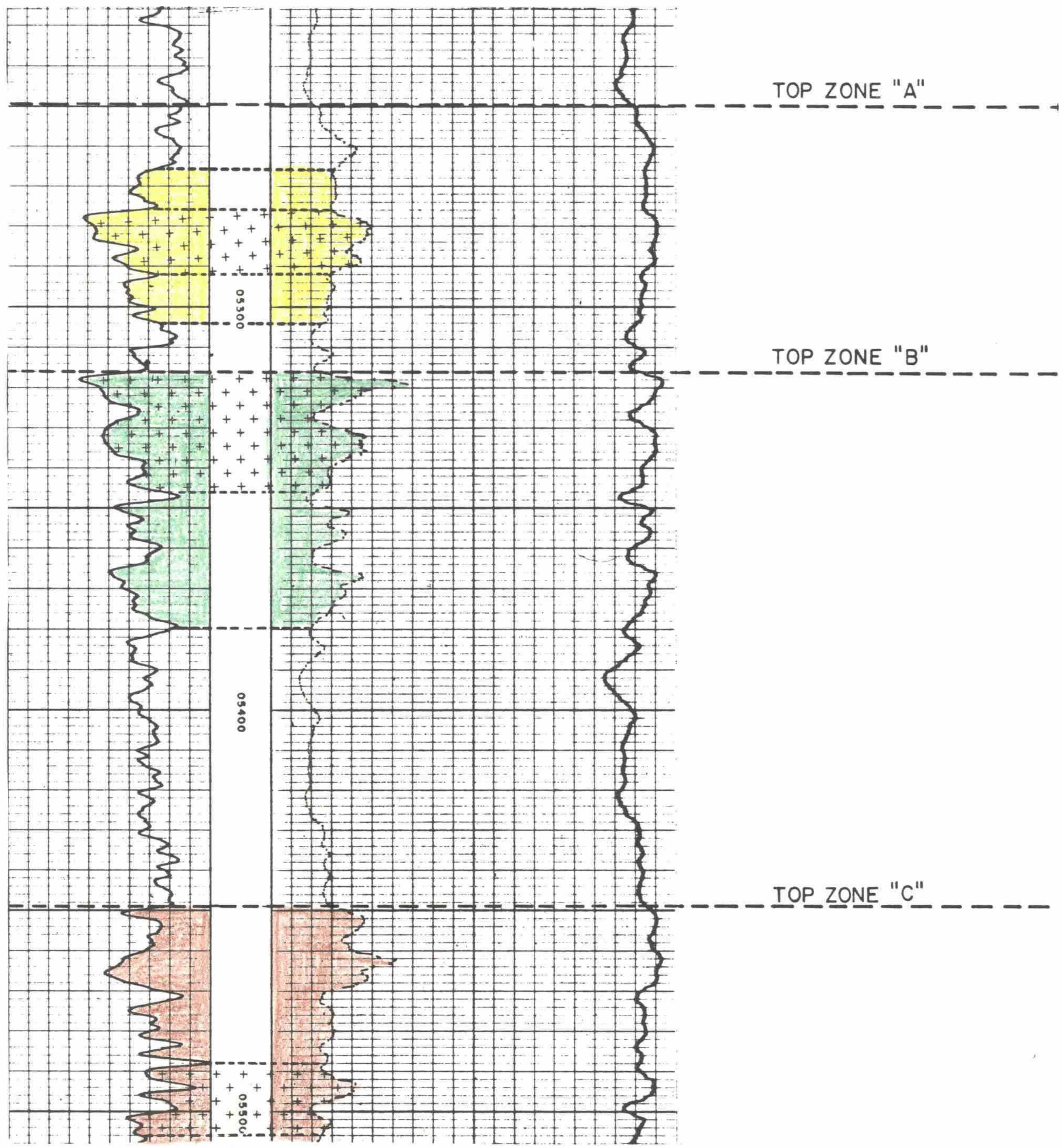
The basal zones of the Niobrara are far enough removed and that part of the frac treatment entering these zones is low enough that typically it is to be expected that these zones will be separated from the upper main pay zones. Here, with properly undertaken testing, production logging can have some value in interpreting stratification of these zones as compared to the main zones.

The overriding matter with respect to the stratification issue is whether the oil can flow vertically by gravity throughout the reservoir or whether it must follow the stratigraphic dip of the zones - not whether the zones are tied together with an occasional fault or through fractures induced in stimulation treatments.

IDENTIFICATION OF MAIN PRODUCING ZONES
NORTHEAST PUERTO CHIQUITO
AND
SOUTHWEST PUERTO CHIQUITO

BENSON-MONTIN-GREER DRLG. CORP.

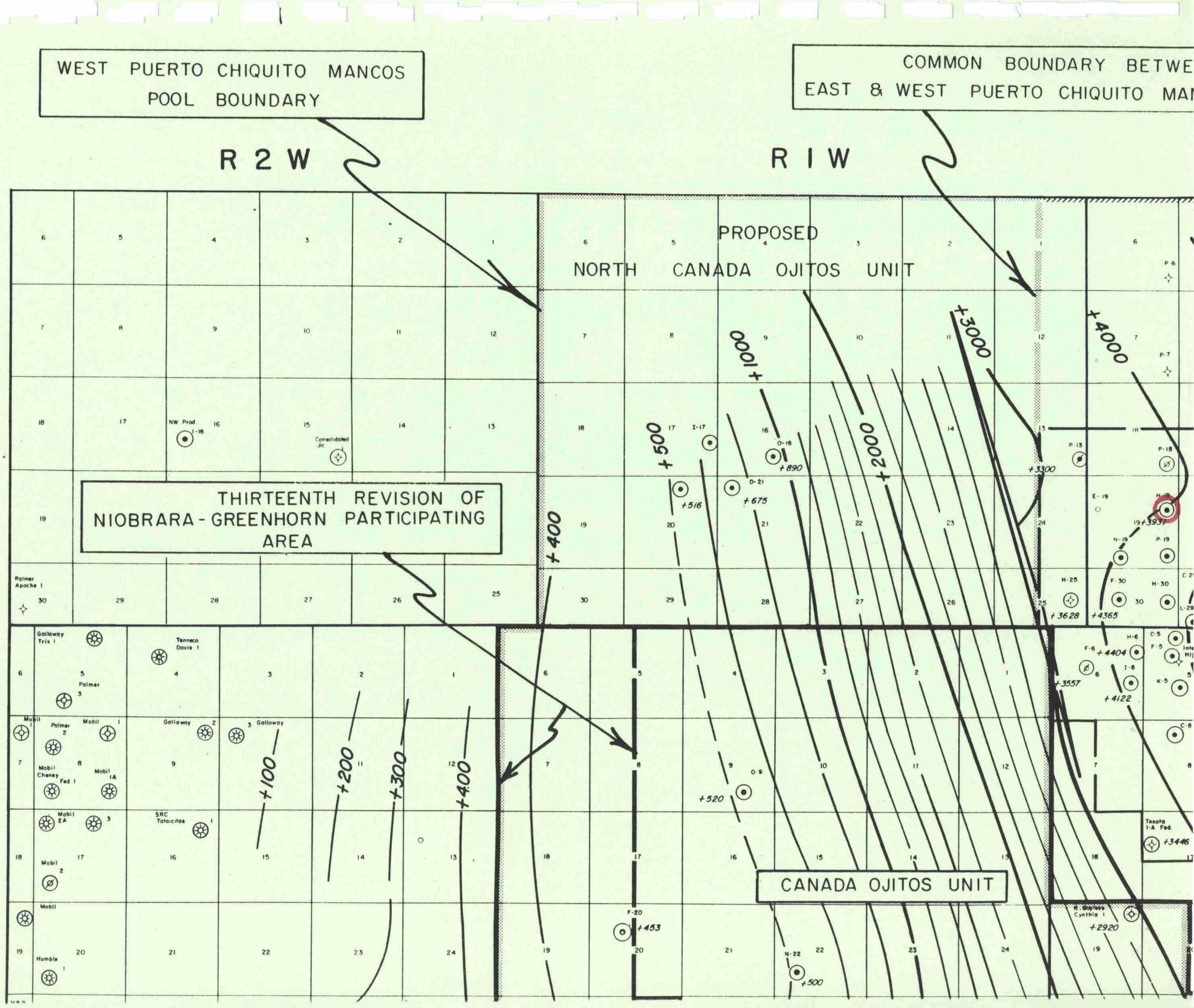
CAÑADA OJITOS UNIT NO. B-18



EVIDENCE OF STRATIFICATION OF PRODUCING ZONES IN THE BENSON-MONTIN-GREER JICARILLA 237 #H-19 SECTION 19, TOWNSHIP 27 NORTH, RANGE 1 EAST

The Jicarilla 237 #H-19 was drilled through the Niobrara pay zones with cable tools; and although this well is not in the West Puerto Chiquito Mancos pool (see plat on the facing page), the producing formation has the same lithologic characteristics and the producing reservoir is of the same fractured nature as West Puerto Chiquito. The East Puerto Chiquito reservoir has been separated from West Puerto Chiquito by faulting after the beds were deposited. This separation does not alter the reservoir's basic lithologic characteristics; and accordingly the issue of stratification of the Niobrara pay zones can be evaluated here as well as in the West Puerto Chiquito wells.

This well has been chosen as one example because it shows not only stratification, but also one in whcih the "gray zone" was separately tested so that the typically poor performance of this "gray zone" is clearly documented.



WEST PUERTO CHIQUITO MANCOS POOL BOUNDARY
COMMON BOUNDARY BETWE
EAST & WEST PUERTO CHIQUITO MAN
R 2 W
R I W
T 27 N
T 26 N
PROPOSED NORTH CANADA OJITOS UNIT
THIRTEENTH REVISION OF NIOBRARA - GREENHORN PARTICIPATING AREA
CANADA OJITOS UNIT
+100
+200
+300
+400
+500
+1000
+2000
+3000
+4000
+3300
+516
+675
+890
+520
+453
+500
+3628
+4365
+4404
+3557
+4122
+2920
+3446
+3931
Palmer Apache 1
Galloway Trix 1
Tenneco Davis 1
Palmer 3
Palmer 2
Mobil
Mobil Cheney Fed. 1
Mobil 1A
Mobil 2A
Mobil 2
Humble 1
SRC Tatacitos
Galloway
NW Prod. 1-16
Consolidated Jic.
Texota 1-A Fed.
R. Bayless Cynthia 1

Separation of the "gray" zone from the A and B zones was evidenced by the following:

1. Upon drilling with cable tools, oil was encountered in the gray zone; the drilling interrupted and the well put on a 3-month pumping test in the spring of 1964, which showed a rapid decline in productivity from about 30 barrels a day to about 10 barrels a day, suggesting a limited reservoir.

2. After completion of drilling, running liner and stage fracing the A and B zones together and the gray zone separately, the gray zone was again tested by itself and again showed a rapid decline in productivity to about 20 BOPD.

3. Upon drilling the bridge plug between the gray zone and the A and B zones and recovering frac oil, the production rate from the combined zones was in excess of 200 BOPD.

SCHLUMBERGER

INDUCTION-ELECTRICAL LOG
/
INDUCTION - GAMMA RAY LOG

SCHLUMBERGER WELL SURVEYING CORPORATION
Houston, Texas

COUNTY RIO ARRIBA, N.M.
FIELD or LOCATION WILDCAT
WELL JICARILLA H-19
COMPANY BENSON-MONTIN & GREER DRILLING CORPORATION

COMPANY BENSON-MONTIN & GREER DRILLING CORPORATION

WELL JICARILLA H-19

FIELD WILDCAT

LOCATION SEC. 19-27N-1E

COUNTY RIO ARRIBA

STATE NEW MEXICO

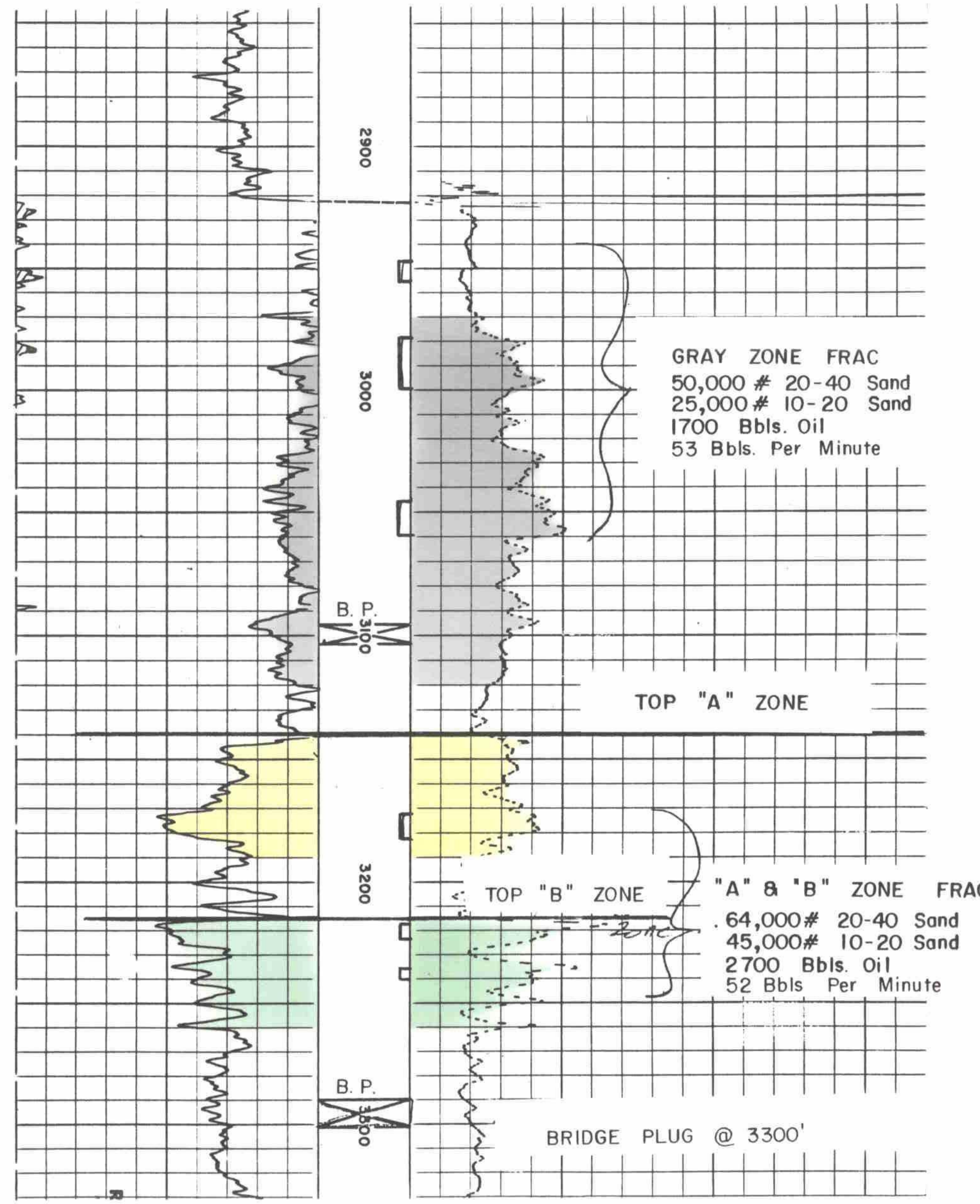
Location of Well

660' FEL
1980' FNL

Elevation: K.B.: 7073'
D.F.: 7072'
or G.L.: 7064'

FILING No.

RUN No.	ONE-IES	TWO-IGR	THREE-IGR
Date	11-21-63	6-11-64	6-22-64
First Reading	2699	3384	3894
Last Reading	100	2699	3384
Feet Measured	2599	685	510
Csg. Schlum.	--	2922	3389
Csg. Driller	95	2929	3380
Depth Reached	2700	3389	3899
Bottom Driller	2700	3380	3890
Depth Datum	KB	KB	KB
Mud Nat.	CHEM-GEL	OIL	AIR DRILLED
" Density	9.5	---	---
" Viscosity	61	---	---
" Resist.	2 @ 70 °F	-- @ -- °F	---
" Res. BHT	1.5 @ 90 °F	-- @ -- °F	---
" pH	-- @ -- °F	-- @ -- °F	---
" Wtr. Loss	- CC 30 min.	-- CC 30 min.	---
Max. Temp. °F	90	TSM	129
Bit Size	8 3/4	*	5
SPCGS. AM	16"	--	---
MN	34'6"	--	---
IND	6FF40	5FF27	5FF27
Opr. Rig Time	2 HOURS	1½ HOURS	1 HOUR
Truck No.	4542	4543	3520
Recorded By	DILLI	MAXWELL	MAXWELL
Witness	MR. STOABS	MR. STOABS	MR. STOABS



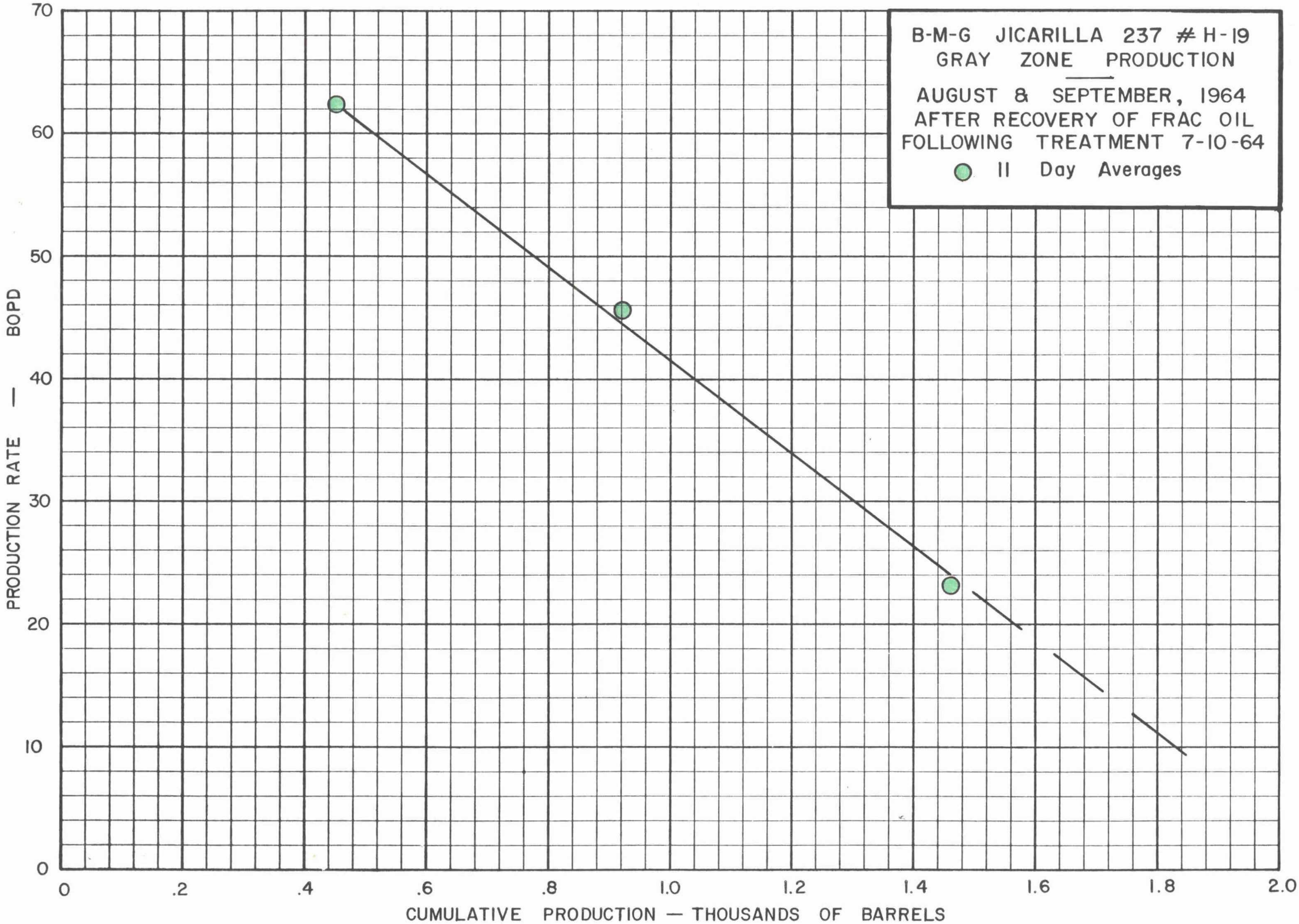
EVIDENCE OF STRATIFICATION OF PRODUCING ZONES
IN THE BENSON-MONTIN-GREER JICARILLA 237 #H-19
SECTION 19, TOWNSHIP 27 NORTH, RANGE 1 EAST

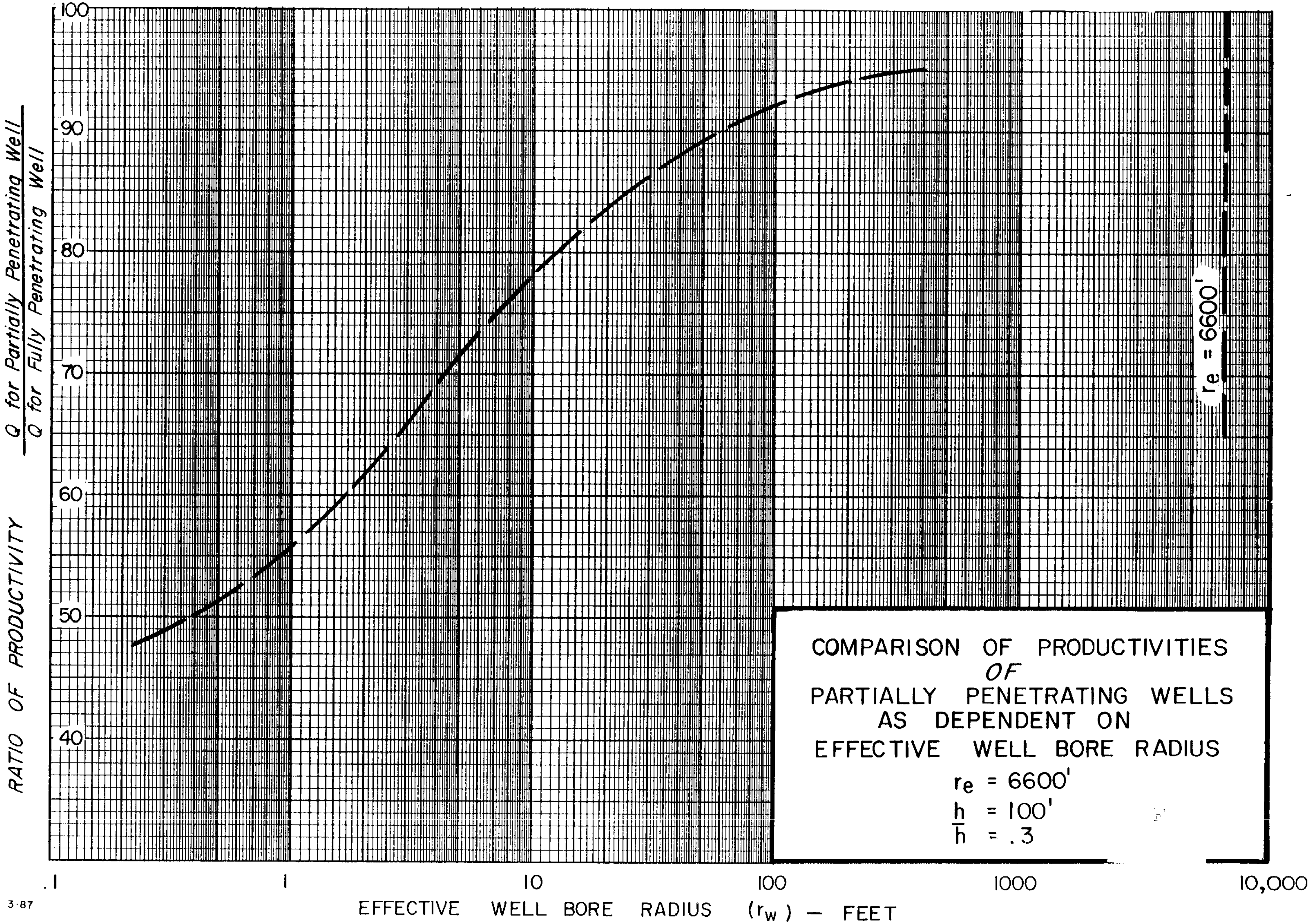
The plot of oil production rate versus cumulative production for the H-19 (plot on facing page) clearly indicates a limited reservoir in the gray zone. The plot suggests total ultimate recovery on the order of 2000 barrels of oil.

After drilling the bridge plug and the productivity increased to more than 200 barrels per day the well has continued to produce with a low rate of decline and as of 1987 had produced in excess of 800,000 barrels of oil. Clearly the gray zone is separated from the A and B zones.

Without providing the details, reference was made to this well (among others generally) in Cases 8946 and 8950 in August 1986 and the fact that the production increased upon drilling of the bridge plug and that this indicated stratification. Mallon's and Mesa Grande's engineer, Mr. Hueni countered this by stating "You complete in the larger section, you get more productivity..."

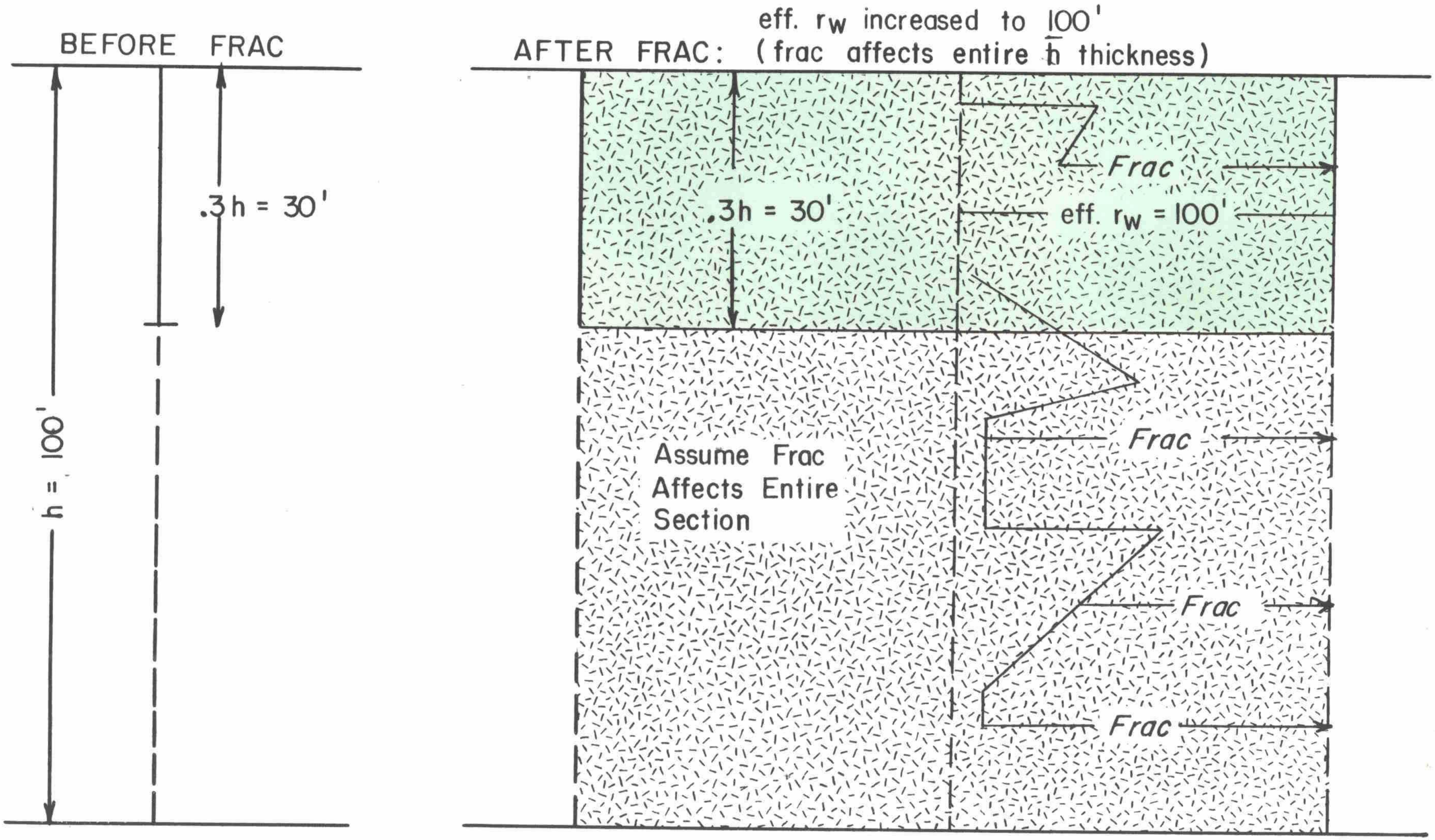
We note that this judgment by Mr. Hueni was made without knowledge of the facts peculiar to this particular well. We believe the facts in this example warrant more consideration than Mr. Hueni's simplistic assessment. Given the facts, Mr. Hueni might have made a different interpretation.


B-M-G JICARILLA 237 # H-19
GRAY ZONE PRODUCTION
AUGUST & SEPTEMBER, 1964
AFTER RECOVERY OF FRAC OIL
FOLLOWING TREATMENT 7-10-64
11 Day Averages
PRODUCTION RATE — BOPD
70
60
50
40
30
20
10
0
0
.2
.4
.6
.8
1.0
1.2
1.4
1.6
1.8
2.0
CUMULATIVE PRODUCTION — THOUSANDS OF BARRELS



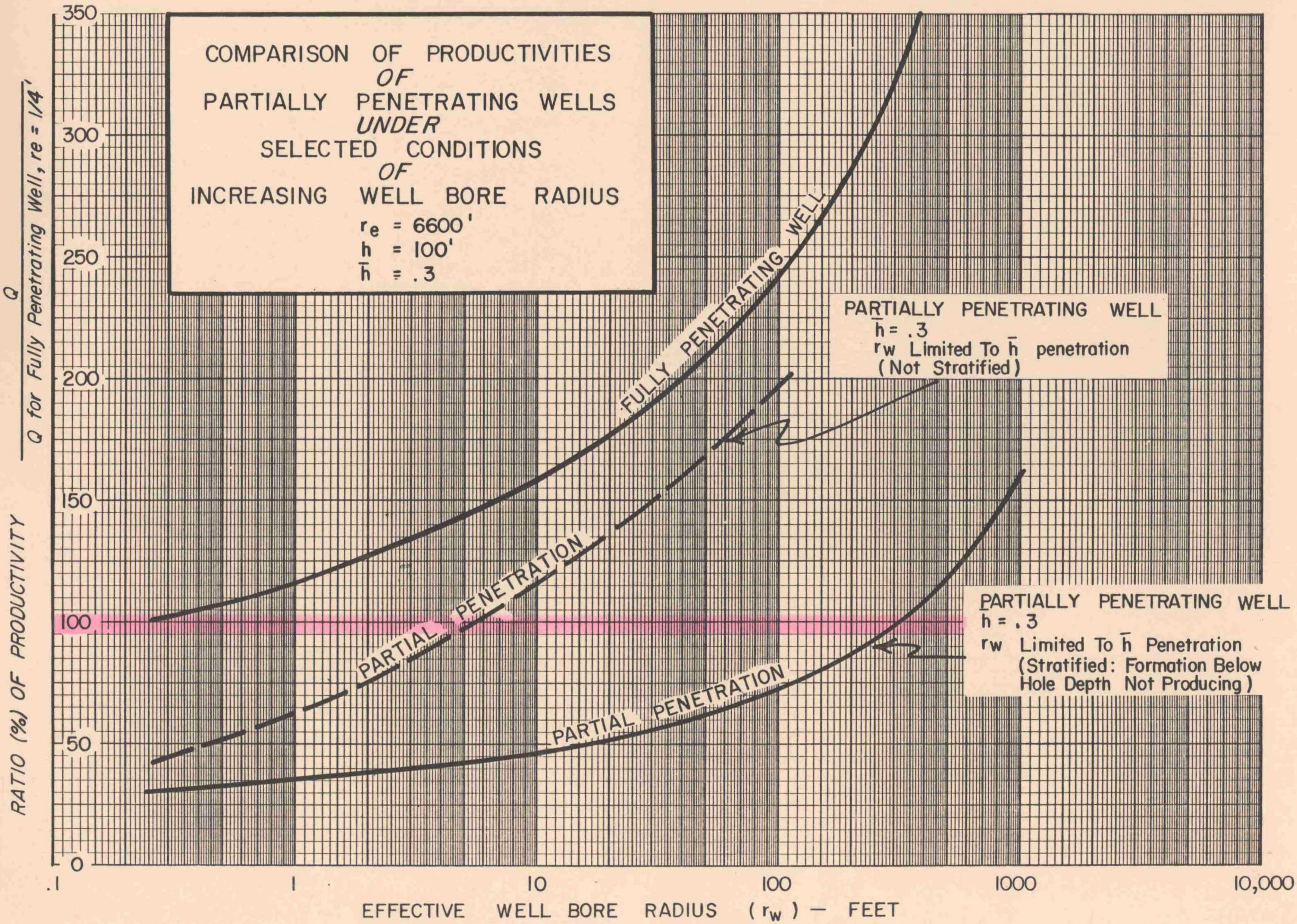
RATIO OF PRODUCTIVITY
Q for Partially Penetrating Well / Q for Fully Penetrating Well
100
90
80
70
60
50
40
r_e = 6600'
COMPARISON OF PRODUCTIVITIES OF PARTIALLY PENETRATING WELLS AS DEPENDENT ON EFFECTIVE WELL BORE RADIUS
r_e = 6600'
h = 100'
$\frac{h}{\bar{h}}$ = .3
.1
1
10
100
1000
10,000
EFFECTIVE WELL BORE RADIUS (r_w) — FEET
3·87

PRODUCTION RATES FOR PARTIALLY PENETRATING WELLS

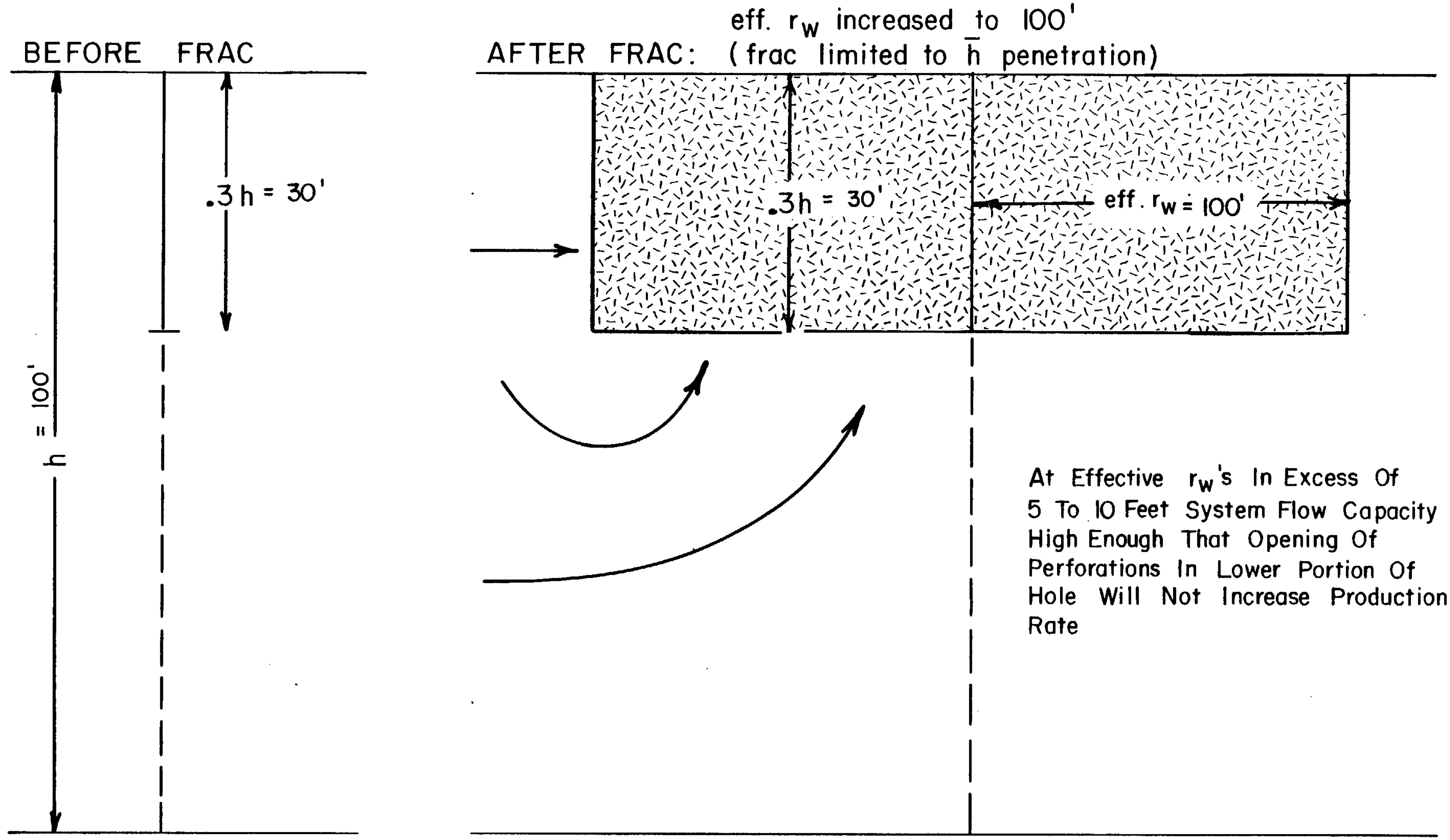


$Q/Q_0 = \pm 45\%$

$Q/Q_0 = 90\% +$


COMPARISON OF PRODUCTIVITIES
OF
PARTIALLY PENETRATING WELLS
UNDER
SELECTED CONDITIONS
OF
INCREASING WELL BORE RADIUS
r_e = 6600'
h = 100'
$\bar{h}$ = .3
FULLY PENETRATING WELL
PARTIAL PENETRATION
PARTIAL PENETRATION
PARTIALLY PENETRATING WELL
$\bar{h}$ = .3
r_w Limited To $\bar{h}$ penetration
(Not Stratified)
PARTIALLY PENETRATING WELL
h = .3
r_w Limited To $\bar{h}$ Penetration
(Stratified: Formation Below
Hole Depth Not Producing)
RATIO (%) OF PRODUCTIVITY $\frac{Q}{Q \text{ for Fully Penetrating Well}, re = 1/4'}$
0
50
100
150
200
250
300
350
.1
1
10
100
1000
10,000
EFFECTIVE WELL BORE RADIUS (r_w) — FEET

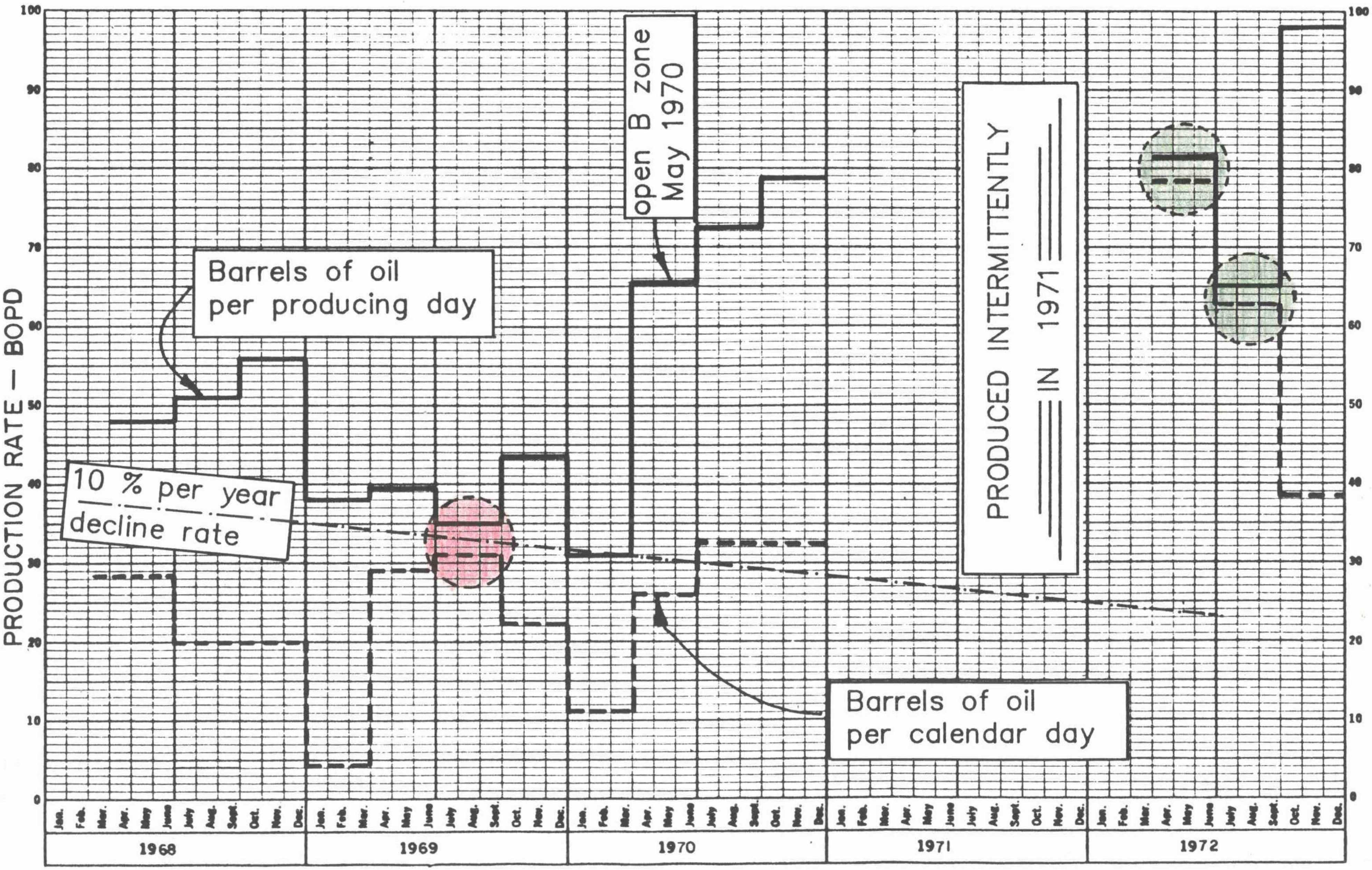
PRODUCTION RATES FOR PARTIALLY PENETRATING WELLS



For
$h = 100'$
$r_e = 6600'$
$r_w = 1/4'$
$\bar{h} = .3$

$$\frac{(Q_{part.\ pen})}{(Q\ total\ pen)} = \pm 45\%$$

B.M.G. JIC 200# D-21 Sec. 21-T 27 N-R1W



The bridge plug was drilled in May 1970 and the well showed an immediate productivity increase in an amount approximating the rate of production attributable to the B zone from initial swabbing tests. (See graph on facing page.)

The well was produced intermittently until 1972 at which time in the second and third quarters the well was produced continuously enough to permit a reasonable productivity determination. This showed an increase in oil productivity from 35 BOPD to 65 BOPD as a consequence of the B zone production being added by drilling the bridge plug.

Whether this increase in productivity is a consequence of stratification or simply that more pay section is opened to production is addressed on the following pages with respect to the relative productivities of partially penetrating wells as applied to this example.

SCHLUMBERGER

INDUCTION ELECTRICAL LOG
INDUCTION-GAMMA RAY LOG

COUNTY RIO ARRIBA, N.M.
FIELD or LOCATION WILDCAT
WELL JICARILLA 200 #D-21
COMPANY B.M. & G.

COMPANY BENSON, MONTIN, & GREER
WELL JICARILLA 200 #D-21
FIELD WILDCAT
COUNTY RIO ARRIBA STATE NEW MEXICO
LOCATION 660 FNL 825 FWL
Sec. 21 Twp. 27N Rge. 1W
Other Services: FDC/GR

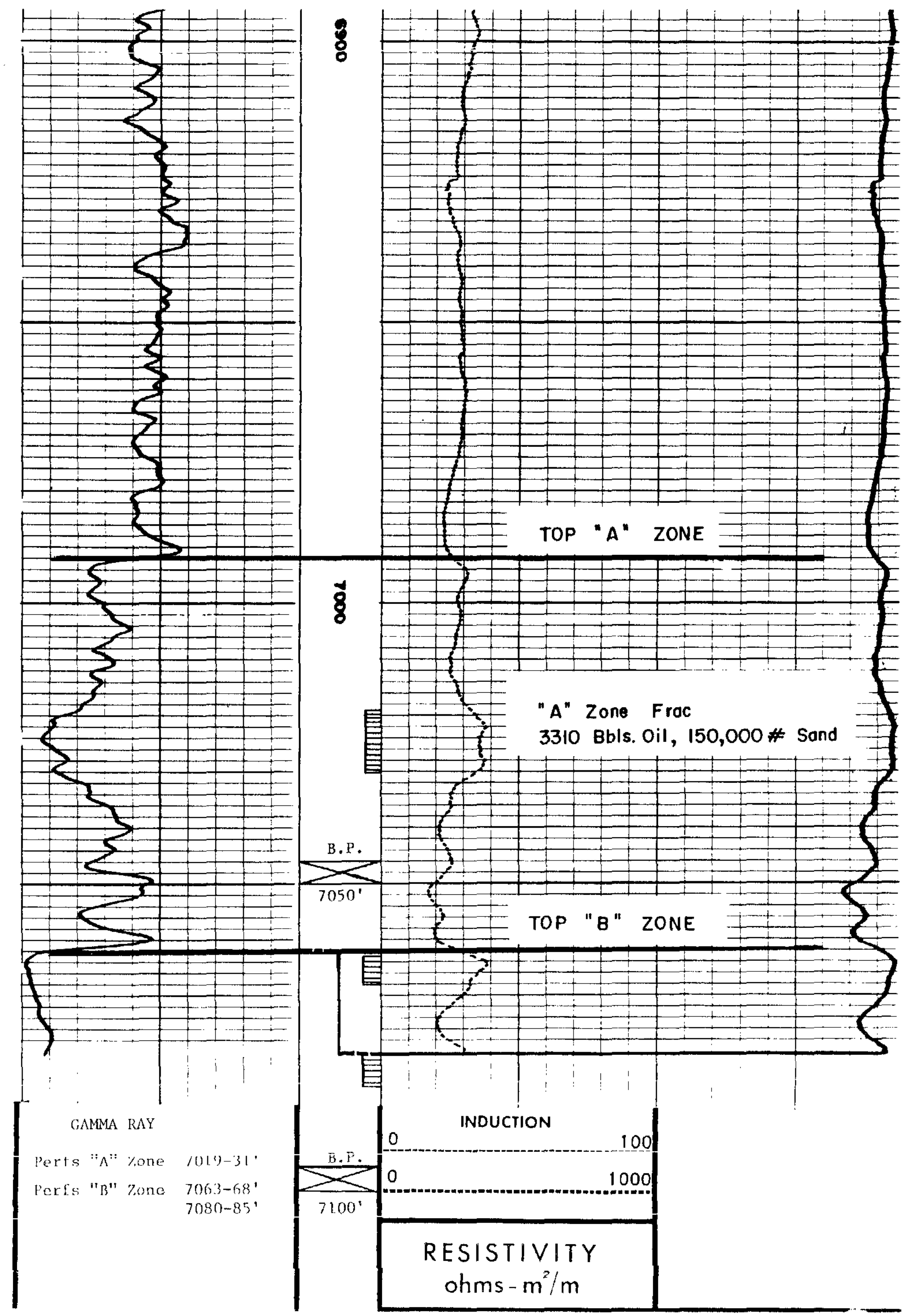
Permanent Datum: GL, Elev. 7655
Log Measured From KB, 14.5 Ft. Above Perm. Datum
Drilling Measured From KB
Elev.: K.B. 7669.5 D.F. 7668 G.L. 7655

Date	6/16/66	6/30/66		
Run No.	ONE	THREE		
Depth—Driller	6500	7200		
Depth—Logger	6503	**		
Btm. Log Interval	6502	7081		
Top Log Interval	313	6498		
Casing—Driller	13 3/8 @ 311	7 5/8 @ 6500	@	@
Casing—Logger	313	6498		
Bit Size	9 7/8"	6 3/4"		
Type Fluid in Hole	FRESH GEL CHEMICALS	OIL EMULSION STARCH		
Dens. / Visc.	8.8 / 74	7.5 / 150		
pH / Fluid Loss	8.5 / 5.0 ml	NA / -- ml	ml	ml
Source of Sample	FLOW LINE	--		
R_m @ Meas. Temp.	2.2 @ 75 °F	-- @ -- °F	@ °F	@ °F
R_{mf} @ Meas. Temp.	0.9 @ 141 °F	-- @ -- °F	@ °F	@ °F
R_{mc} @ Meas. Temp.	1.15 @ 141 °F	-- @ -- °F	@ °F	@ °F
Source: R_{mf} / R_{mc}	C / C	-- / --		
R_m @ BHT	1.17 @ 141 °F	-- @ -- °F	@ °F	@ °F
Time Since Circ.	4 HRS.	3 HRS.		
Max. Rec. Temp.	141 °F	-- °F	°F	°F
Equip. / Location	4538 / G.J.	4542 / FARM		
Recorded By	MONTGOMERY	KIMBALL		
Witnessed By	STOABS	BOLACK - STOABS		

By Frac Length: Effective Well Bore Radius:
If 400' Fracture Length: eff. r_w = 100'

By Pore Volume: If 3000 Bbls. Hydrocarbon Pore Space Per Acre & Frac Just Fills Pore Space (± 1 acre): eff. r_w = 125'

From Above Assume: Minimum r_w = 100'



EVIDENCE OF STRATIFICATION OF PRODUCING ZONES
IN THE BENSON-MONTIN-GREER JICARILLA 200 #D-21
SECTION 21, TOWNSHIP 27 NORTH, RANGE 1 WEST

The D-21 was drilled with air through the A zone and the upper part of the B zone. (See log on facing page.)

Oil with a relatively high volume of gas was encountered in the A zone. Additional oil was encountered in the B zone.

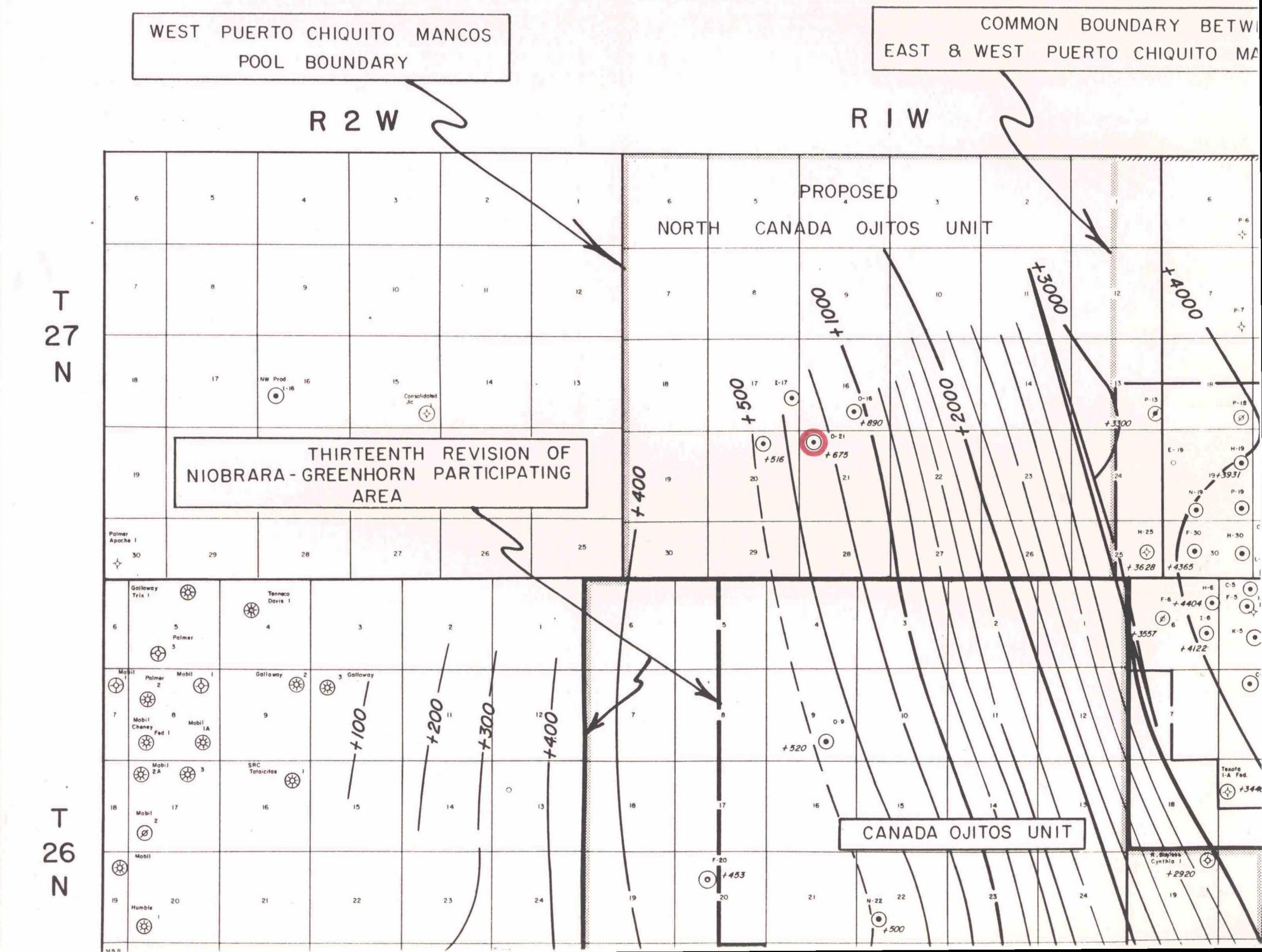
The lower part of the B zone was drilled with oil, a liner run to the top of the C zone, the C zone was drilled with air and fraced with oil and found to be non-productive. A bridge plug was set in the liner at the base of the B zone. The A and B zones were perforated and the well tested by swabbing.

Swab test showed about 3 barrels fluid per hour.

A bridge plug was set between the A and B zones and production testing resumed by swabbing. Swab rate from the A zone alone was approximately 1-1/4 barrels fluid per hour.

The A zone was fraced by itself with 3310 barrels oil and 100,000# sand.

After 2 years of production, the production rate from the A zone was approximately 33 barrels per day. (See graph next following.)


WEST PUERTO CHIQUITO MANCOS POOL BOUNDARY
COMMON BOUNDARY BETW
EAST & WEST PUERTO CHIQUITO MA
R 2 W
R I W
T 27 N
T 26 N
PROPOSED NORTH CANADA OJITOS UNIT
THIRTEENTH REVISION OF NIOBRARA - GREENHORN PARTICIPATING AREA
CANADA OJITOS UNIT
+100
+200
+300
+400
+500
+1000
+2000
+3000
+4000
+3300
+516
+675
+890
+520
+453
+500
+3628
+4365
+3931
+4404
+4122
+3557
+2920
NW Prod 1-16
Consolidated Jic
Palmer Apache 1
Galloway Trix 1
Tenneco Davis 1
Palmer 3
Mobil
Palmer 2
Galloway
Mobil Cheney Fed 1
Mobil 1A
Mobil 2A
SRC Totacitos
Mobil 2
Humble
R. Bayless Cynthia 1
Texota 1-A Fed.

EVIDENCE OF STRATIFICATION OF PRODUCING ZONES IN THE BENSON-MONTIN-GREER JICARILLA 200 #D-21 SECTION 21, TOWNSHIP 27 NORTH, RANGE 1 WEST

The D-21 was the first well in the West Puerto pool drilled in Township 27 North, Range 1 West. (See plat on facing page.)

Separation of the A and B zones in this well was evidenced by three separate happenings:

1. Initial drilling with air.
2. Swabbing tests of the zones jointly and separately.
3. Production history of the well with the zones separately and jointly produced.

Although not a "large" well by West Puerto Chiquito statistics, it has produced over 150,000 barrels of oil - an adequate "sample" by which to assess reservoir behavior.

EVIDENCE OF STRATIFICATION OF PRODUCING ZONES IN THE BENSON-MONTIN-GREER CANADA OJITOS UNIT F-30 SECTION 30, TOWNSHIP 25 NORTH, RANGE 1 WEST

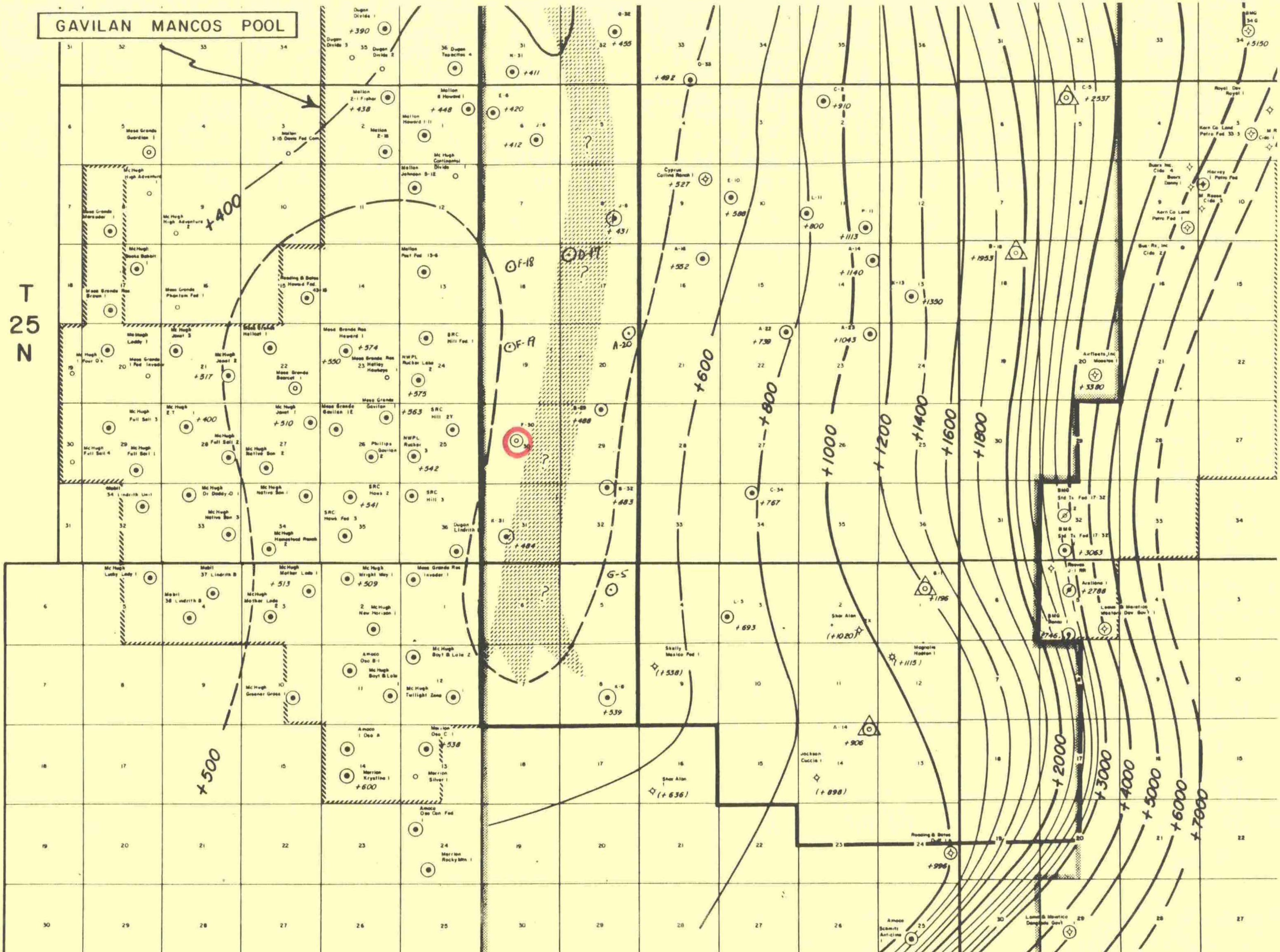
Production logging was conducted on the Canada Ojitos Unit F-30 well March 5 and 6, 1987; which logging shows absence of vertical communication of the lower zones with the upper zones.

The well was carefully conditioned for this production logging by pulling the tubing 200' above the pay zones and flowing the well at a reasonably steady rate for several days prior to the testing as follows:

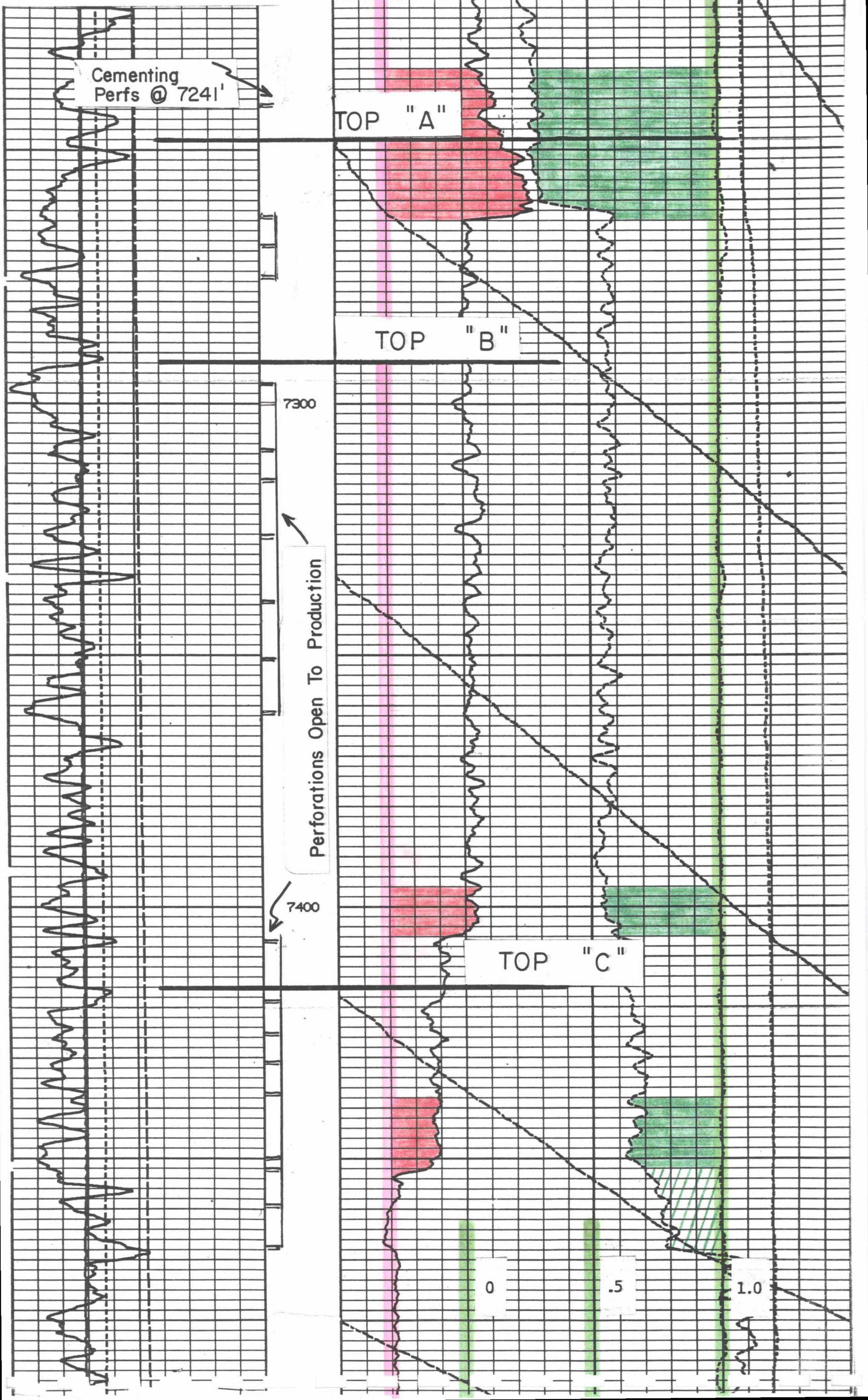
February 25, 1987	390 BOPD	March 1, 1987	442 BOPD
February 26, 1987	470 BOPD	March 2, 1987	400 BOPD
February 27, 1987	432 BOPD	March 3, 1987	444 BOPD
February 28, 1987	418 BOPD	March 4, 1987	438 BOPD

At the time of the test, the well was flowing at a rate of approximately 435 BOPD with a surface GOR of 1030 cubic feet per barrel (separator pressure 180 psig).

The well has shown no water production since November 14, 1986.


GAVILAN MANCOS POOL
T 25 N
T 24 N
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000

COU #30 (F-30)



Cementing Perfs @ 7241'
TOP "A"
TOP "B"
7300
Perforations Open To Production
7400
TOP "C"
0
.5
1.0

EVIDENCE OF STRATIFICATION OF PRODUCING ZONES
IN THE BENSON-MONTIN-GREER CANADA OJITOS UNIT F-30
SECTION 30, TOWNSHIP 25 NORTH, RANGE 1 WEST
PAGE 2

(Complete log is on file with OCD Aztec office)

(3 spinner "down" runs at 30, 60 and 90 FPM were made and one "up" run - best for fluid density. On ~~facing~~ page is section from 60 FPM down run).

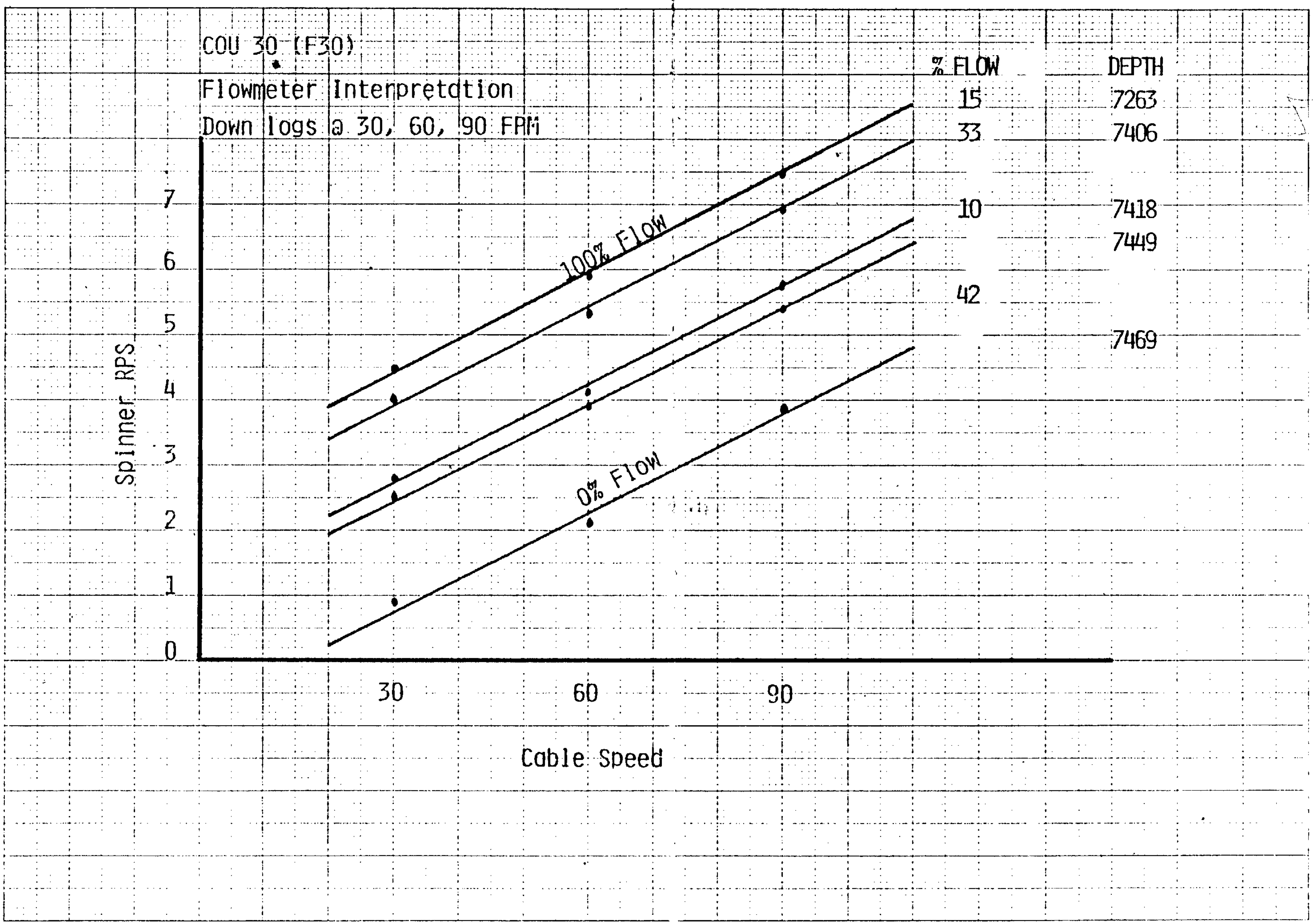
Although the basal Niobrara zones (Sanostee) were opened to the wellbore by perforating and separately acidizing those individual perforations and following with limited entry frac treatment, these zones showed no production. Perforations of these zones are at 7799', 7876' and 7886' (about 350' below the C zone).

That no production is coming from intervals below the C zone is evidenced by both the spinner flow rate measurement and the fluid density measurement; and then confirmed by the radioactive fluid travel log. Zero flow rate line for the spinner is the vertical pink line on the section of the log facing this page; increases in flow are reflected by this line moving to the right (red shading). Scales for fluid specific gravity are the vertical green lines on the log. The fluid travel log is not shown here.

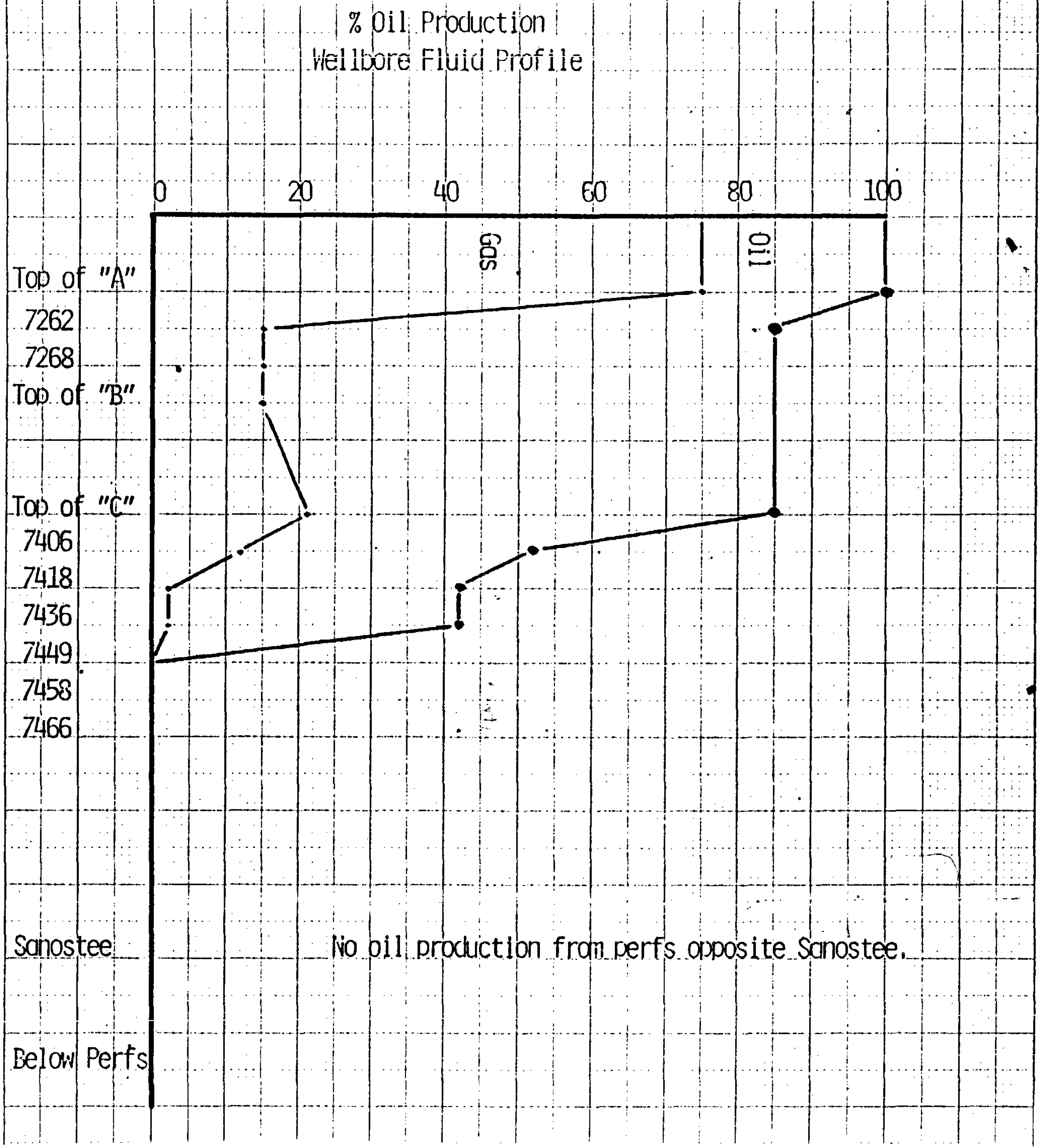
The spinner is limited in its ability to detect small flow rates. Here, one division represents about 100 BOPD. To confirm the apparent zero flow rate below the C zone, the radioactive fluid travel log was run.

It is clear that only water exists below the base of the C zone; and since the well has produced no water since November 1986 it must be concluded that no production - water, oil or gas - is coming from below the C zone.

This is one of the wells which Mesa Grande's geologist, Alan Emmendorfer, described in his testimony as having vertical fractures through the entire section as evidenced by the "fracture log" run on this well; and, accordingly showed the entire section to be a common, communicative reservoir. This log shows such not to be the case.


COU 30 (F30)
Flowmeter Interpretation
Down logs @ 30, 60, 90 FPM
% FLOW
DEPTH
15
7263
33
7406
10
7418
7449
42
7469
100% Flow
0% Flow
Spinner RPS
0
1
2
3
4
5
6
7
30
60
90
Cable Speed

COU #30 (F-30)


% Oil Production
Wellbore Fluid Profile
0
20
40
60
80
100
Gas
Oil
Top of "A"
7262
7268
Top of "B"
Top of "C"
7406
7418
7436
7449
7458
7466
Sanostee
No oil production from perfs opposite Sanostee.
Below Perfs

COU NO. 30 (F-30)

ZONE	PERFORATION	BY SPINNER ZONE	BY SPINNER CUMULATIVE	BY FLUID TRAVEL LOG ZONE	BY FLUID TRAVEL LOG CUMULATIVE	(g/cc) FLUID DENSITY 30 FPM UP LOG	FLUID DENSITY INTERPRETATION %OIL	FLUID DENSITY INTERPRETATION %GAS	FLUID DENSITY INTERPRETATION %WATER
"A" ZONE TOTALS		15%	100%	33%	100%				
	7240'	0%	100%	0%	100%	.23	25%	75%	0%
	7262'	15%	85%	33%	67%	.23	25%	75%	0%
	7268'	0%	85%	0%	67%	.59	78%	22%	0%
	7274'	0%	85%	0%	67%	.59	78%	22%	0%
"B" ZONE TOTALS		0%	85%	0%	67%				
	7295'	0%	85%	0%	67%	.59	78%	22%	0%
	7300'	0%	85%	0%	67%	.59	78%	22%	0%
	7308'	0%	85%	0%	67%	.59	78%	22%	0%
	7314'	0%	85%	0%	67%	.52	68%	32%	0%
	7325'	0%	85%	0%	67%	.52	68%	32%	0%
	7338'	0%	85%	0%	67%	.52	68%	32%	0%
	7350'	0%	85%	0%	67%	.52	68%	32%	0%
	7360'	0%	85%	0%	67%	.51	69%	31%	0%
"C" ZONE TOTALS		85%	85%	67%	67%				
	7406'	33%	52%	22%	45%	.53	69%	31%	0%
	7418'	10%	42%	3%	42%	.70	94%	6%	0%
	7424'	0%	42%	0%	42%	.70	94%	6%	0%
	7430'	0%	42%	0%	42%	.70	94%	6%	0%
	7436'	0%	42%	0%	42%	.70	94%	6%	0%
	7449'	42%	*	17%	25%	.70	94%	6%	0%
	7451'	*	*	0%	25%	.81	76%	0%	24%
	7458'	*	*	0%	25%	.81	76%	0%	24%
	7466'	*	*	25%	0%	.81	76%	0%	24%
SANOSTEE TOTALS		0%	0%	0%	0%	1.03	0%	0%	100%
	7800'	0%	0%	0%	0%	1.03	0%	0%	100%
	7877'	0%	0%	0%	0%	1.03	0%	0%	100%
	7887'	0%	0%	0%	0%	1.03	0%	0%	100%

* Inconclusive

OIL = .74 GAS = .065
WATER = 1.03

EVIDENCE OF STRATIFICATION OF PRODUCING ZONES
IN THE BENSON-MONTIN-GREER CANADA OJITOS UNIT N-31
SECTION 31, TOWNSHIP 26 NORTH, RANGE 1 WEST

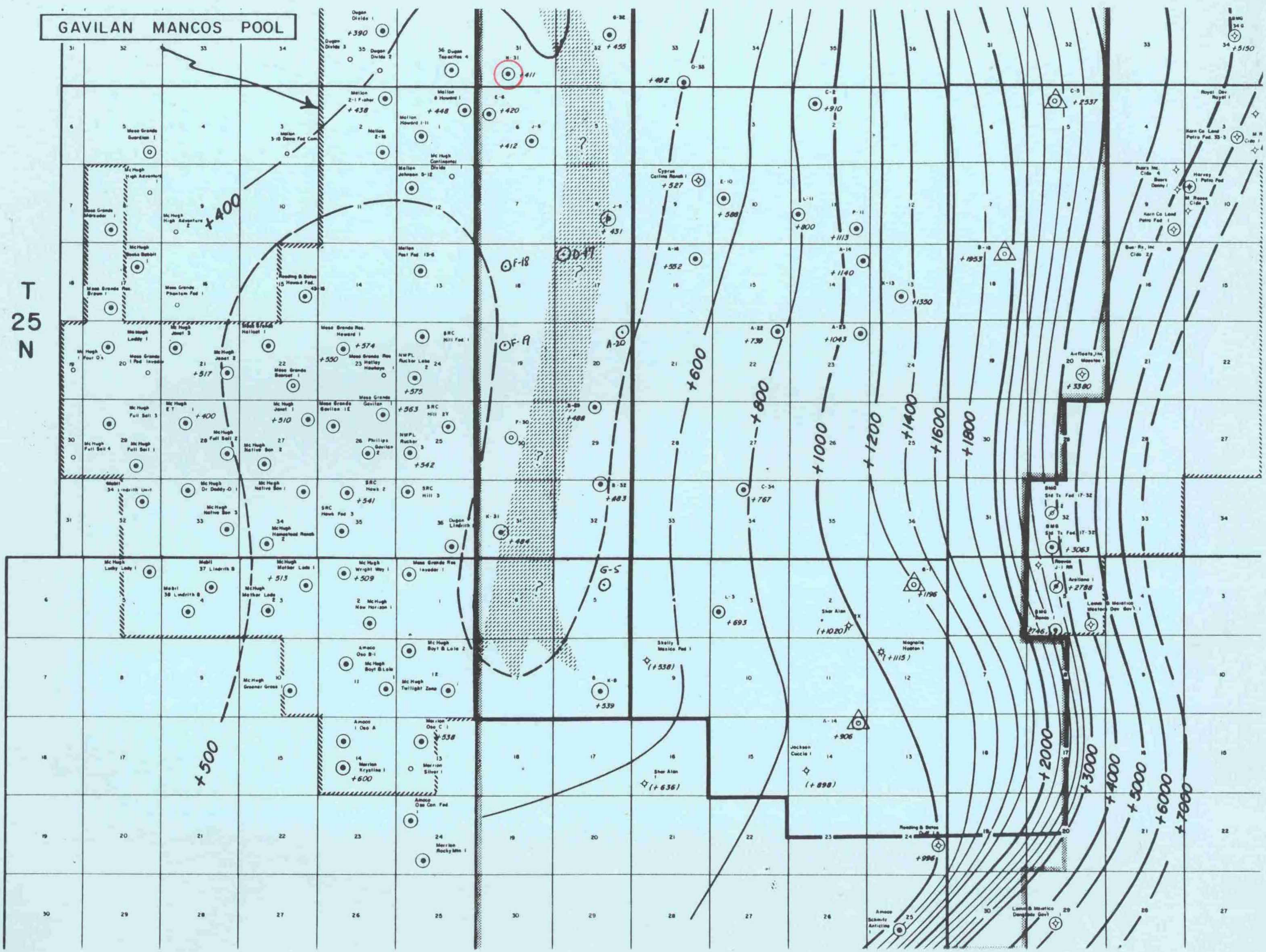
Production logging was conducted on the Canada Ojitos Unit N-31 well March 8 through 10, 1987; which logging shows absence of vertical communication of the lower zones with the upper zones.

The well was carefully conditioned for this production logging by pulling the tubing 200' above the pay zones and flowing the well at a reasonably steady rate for several days prior to the testing as follows (uncorrected for temperature):

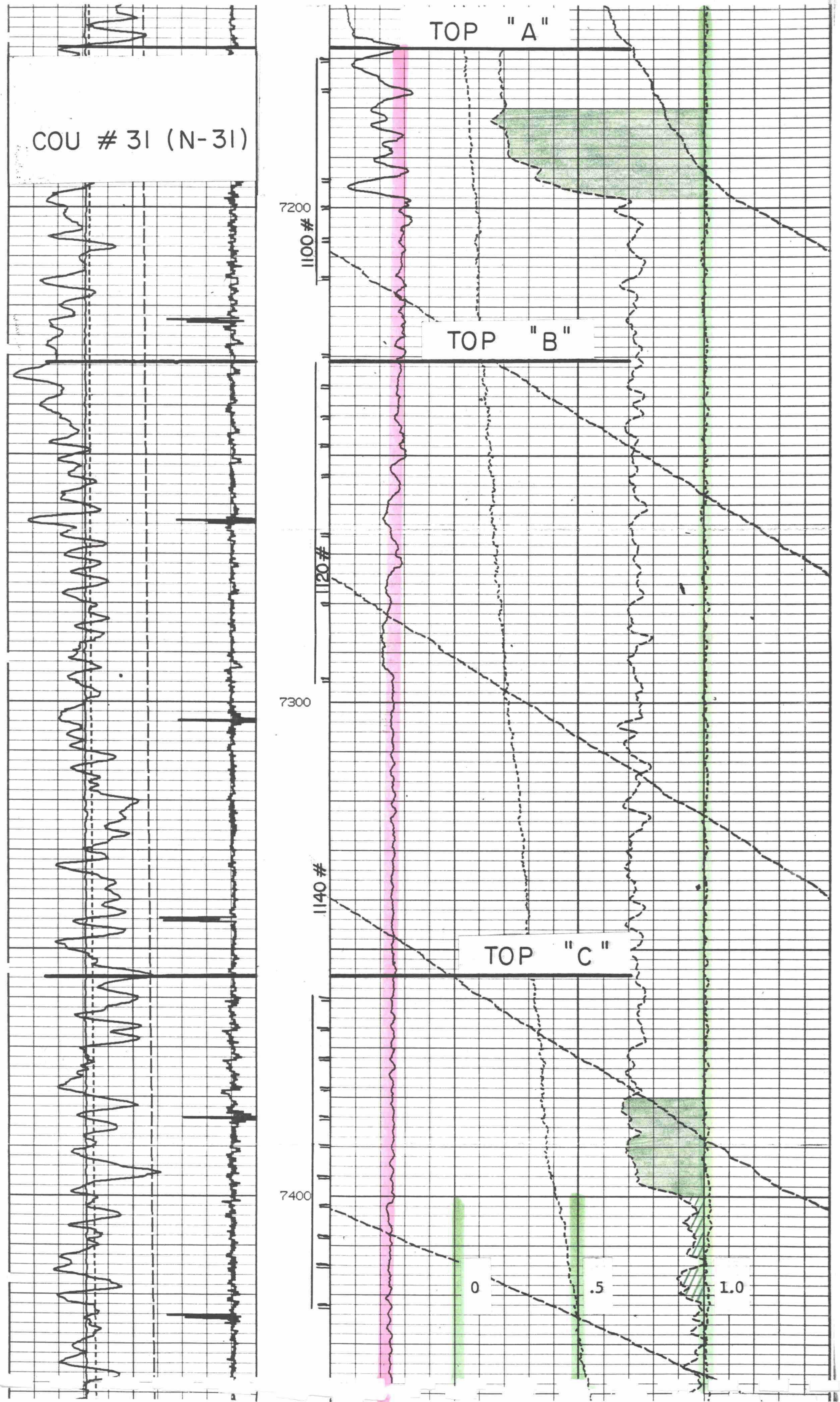
March 3, 1987	132 BOPD
March 4, 1987	131 BOPD
March 5, 1987	128 BOPD
March 6, 1987	126 BOPD
March 7, 1987	127 BOPD

At the time of the test, the well was flowing at a rate of approximately 121 BOPD (corrected for measuring temperature) with a surface GOR of 2340 cubic feet per barrel (separator pressure 185 psig).

The well has shown no water production since November 28, 1986.



GAVILAN MANCOS POOL
T 25 N
T 24 N
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000


COU # 31 (N-31)
TOP "A"
TOP "B"
TOP "C"
7200
7300
7400
1100 #
1120 #
1140 #
0
.5
1.0

EVIDENCE OF STRATIFICATION OF PRODUCING ZONES
IN THE BENSON-MONTIN-GREER CANADA OJITOS UNIT N-31
SECTION 31, TOWNSHIP 26 NORTH, RANGE 1 WEST

(Complete log is on file with OCD Aztec office)

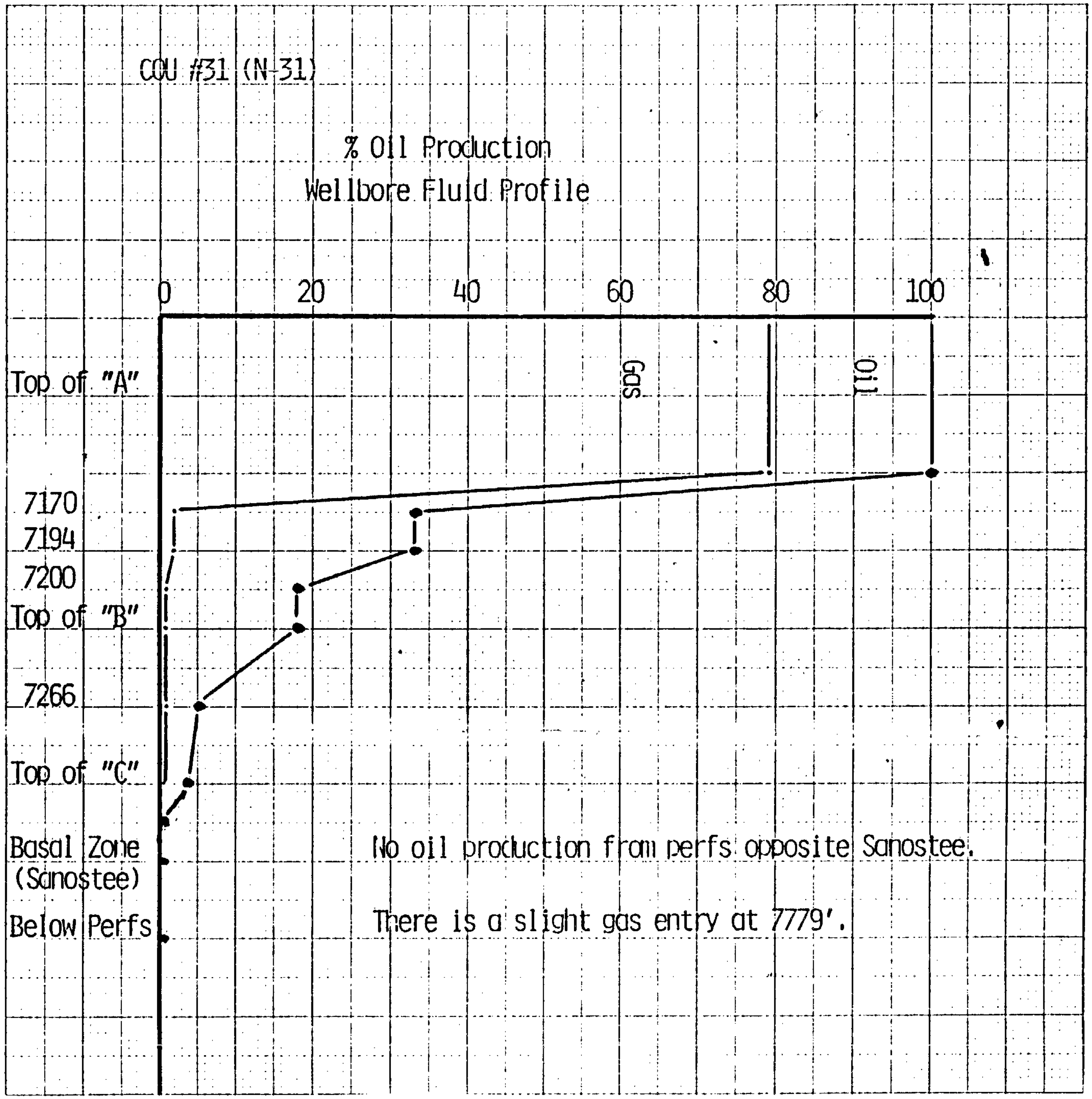
(3 spinner "down" runs at 60, 90 and 120 FPM were made and one "up" run - best for fluid density. On facing page is section from 60 FPM down run).

Although the basal Niobrara zones (Sanostee) were opened to the wellbore by perforating and separately acidizing those individual perforations and following with limited entry frac treatment, these zones showed no production. Perforations of these zones are at 7688', 7696', 7706', 7768', 7774' and 7779' (about 350' below the C zone).

That no production is coming from intervals below the C zone is evidenced by both the spinner flow rate measurement and the fluid density measurement; and then confirmed by the radioactive fluid travel log. Zero flow rate line for the spinner is the vertical pink line on the section of the log facing this page. Scales for fluid specific gravity are the vertical green linesssn the log. The fluid travel log is not shown here.

The spinner is limited in its ability to detect small flow rates; and at the low flow rate of 120 BOPD, the spinner results are inconclusive. To confirm the apparent zero flow rate below the C zone, the radioactive fluid travel log was run.

It is clear that only water, with possibly a small amount of gas, exists below the base of the C zone; and since the well has produced no water since November 1986 it must be concluded that no oil production is coming from below the C zone.


COU #31 (N-31)
% Oil Production
Wellbore Fluid Profile
0
20
40
60
80
100
Gas
Oil
Top of "A"
7170
7194
7200
Top of "B"
7266
Top of "C"
Basal Zone
(Sanostee)
Below Perfs
No oil production from perfs opposite Sanostee.
There is a slight gas entry at 7779'.

Benson, Montin, Greer

COU Well No. 31 (N-31)

FLUID DENSITY INTERPRETATION

ZONE	PERFORATION	% OF TOTAL OIL PRODUCTION BY FLUID TRAVEL LOG ZONE	CUMULATIVE	FLUID DENSITY (g/cc) 30 FPM UP LOG	%OIL	%GAS	%WATER
"A"		83%	100%				
	7170	0%	100%	.20	21%	79%	
	7176	67%	33%	.20	21%	79%	
	7194	0%	33%	.20	21%	79%	
	7200	15%	18%	.20	21%	79%	
	7206	0%	18%	.70	94%	6%	
	7214	0%	18%	.70	94%	6%	
"B"		14%	18%				
	7230	**		.71	96%	4%	0%
	7236	**		.71	96%	4%	0%
	7242	**		.71	96%	4%	0%
	7248	**		.71	96%	4%	0%
	7254	**		.72	97%	3%	0%
	7266	< 1%	< 5%	.72	97%	3%	0%
	7280	0%		.72	97%	3%	0%
	7295	0%		.72	97%	3%	0%
"C"		< 4%	< 4%				
	7360			.72	97%	3%	0%
	7366			.72	97%	3%	0%
	7372			.72	97%	3%	0%
	7378			.72	97%	3%	0%
	7284			.72	97%	3%	0%
	7390			.72	97%	3%	0%
	7396		0%	.72	97%	3%	0%
	7402	0%	0%	.98	0%	5%	95%
	7408	0%	0%	.98	0%	5%	95%
	7414	0%	0%	.98	0%	5%	95%
	7422	0%	0%	.98	0%	5%	95%
	7478	0%	0%	.98	0%	5%	95%

OIL = .74 GAS = .065 WATER = 1.03

FLUID DENSITY INTERPRETATION

ZONE	PERFORATION	% OF TOTAL OIL PRODUCTION BY FLUID TRAVEL LOG ZONE	CUMULATIVE	FLUID DENSITY (g/cc) 30 FPM UP LOG	%OIL	%GAS	%WATER
Sanostee		0%	0%				
	7688	0%	0%	.98	0%	5%	95%
	7696	0%	0%	.98	0%	5%	95%
	7706	0%	0%	.98	0%	5%	95%
	7768	0%	0%	.98	0%	5%	95%
	7774	0%	0%	.98	0%	5%	95%
	7779	0%	*	.98	0%	5%	95%
Below Perfs				1.03	0%	0%	100%

* This zone is making a small amount of gas.

** Approximately 14% of the oil production is from this interval. The exact perforation was not determined. The Spinner indicates it is coming from the perf at 7254'and 7280'.

OIL = .74   GAS = .065   WATER = 1.03

RESERVOIR MECHANICS: DISAGREEMENT WITH HUENI HYPOTHESIS

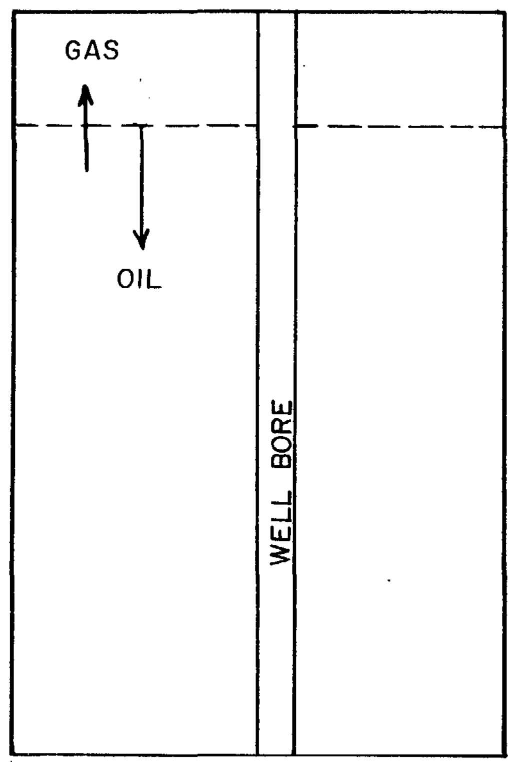
Mr. Hueni's model (Case 8946) presumes a 600' section communicative vertically and shows oil and gas to segregate by gravity: oil vertically down and gas vertically up - but no lateral movement of oil or gas.

We disagree that the reservoir is a 600' vertically communicative section; but even if it were and oil could migrate vertically down as Hueni postulates, the reservoir mechanics cannot end here. It is necessary for the oil to move to the wellbore; and to do this it must move laterally, with this flow being essentially solution gas drive as shown on the following pages.

SEGREGATION BY GRAVITY

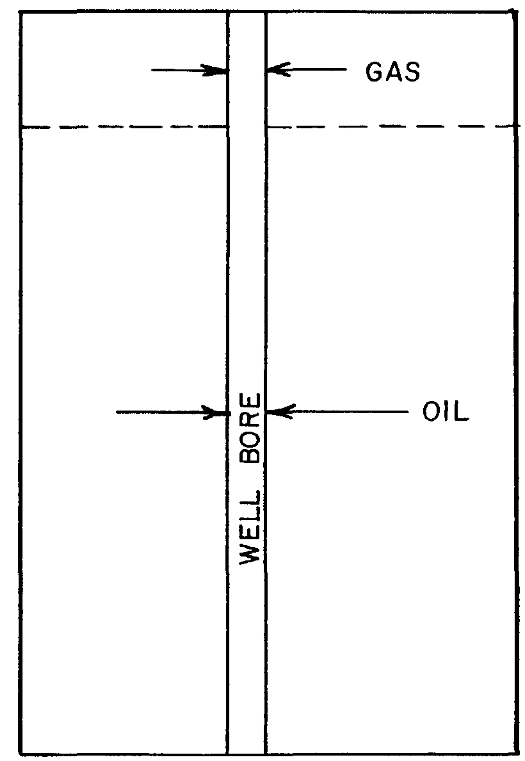
Oil Goes Down
And
Gas Goes Up

Free Gas Zone Forms
At Top Of Reservoir



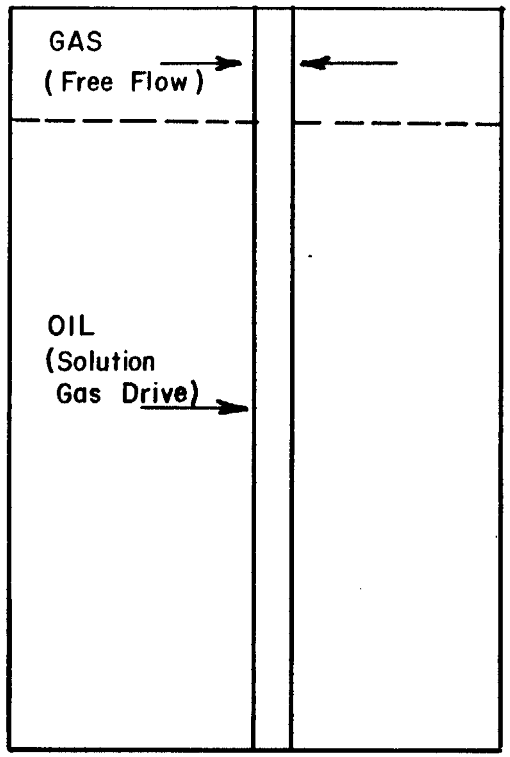
I

TO REACH WELL BORE
GAS AND OIL
MUST FLOW LATERALLY



II

CONSEQUENT PRODUCING MECHANISM



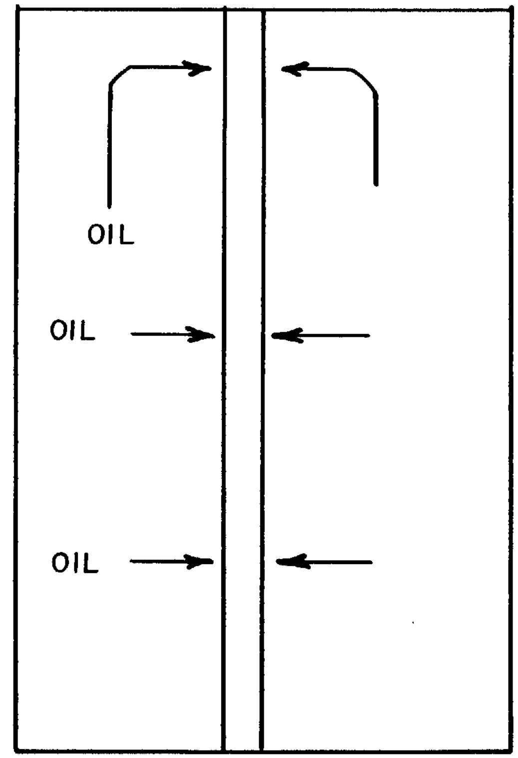
III

INEFFICIENT
SOLUTION GAS DRIVE

Part Of Gas Not Doing Work To Move Oil

OR

A Tendency To Perform Like This



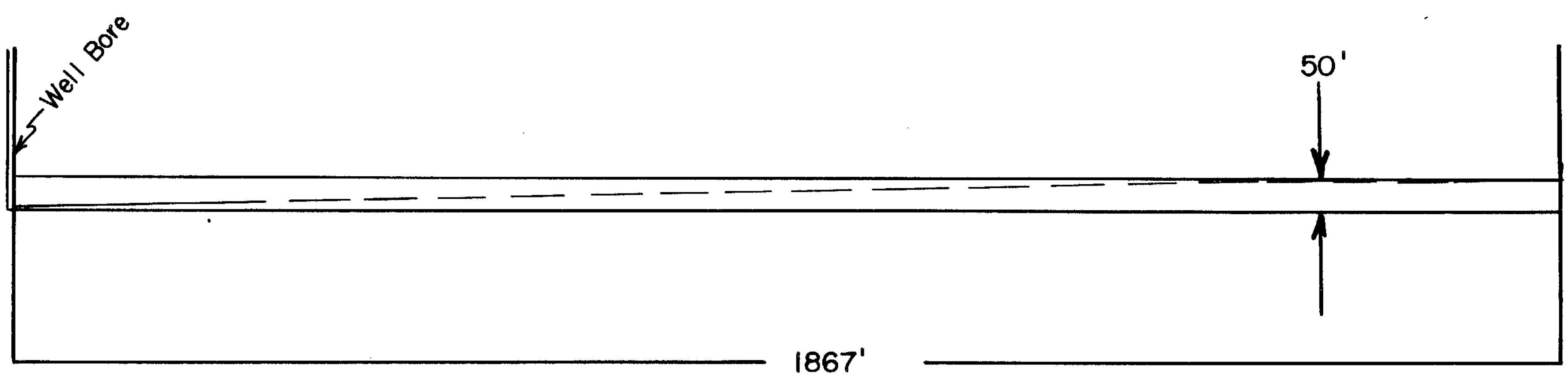
IV

Since Gas Will Void Reservoir Space Faster Than Oil And The Pressure Will Drop Faster In The Gas Zone Than In The Oil Zone, Oil Will Tend To Expand Into The Gas Zone And Continue Under Solution Gas Drive

THE FOREGOING BASIC SOLUTION GAS DRIVE MECHANISM
WILL BE SUPPLEMENTED WITH
GRAVITY DRAINAGE DOWN STRUCTURE
PLUS A COMPONENT OF
GRAVITY DRAINAGE "DOWN PAY THICKNESS"

THESE GRAVITY DRAINAGE CONTRIBUTIONS ARE RATE SENSITIVE

Example Of "Down Pay Thickness" Gravity Drainage
For 50' Of Pay & 1867' Well To Reservoir Mid-Point



GRAVITY DRAINAGE POTENTIAL HEAD FOR "DOWN PAY THICKNESS" GRAVITY DRAINAGE FOR THE FOLLOWING PAY THICKNESSES

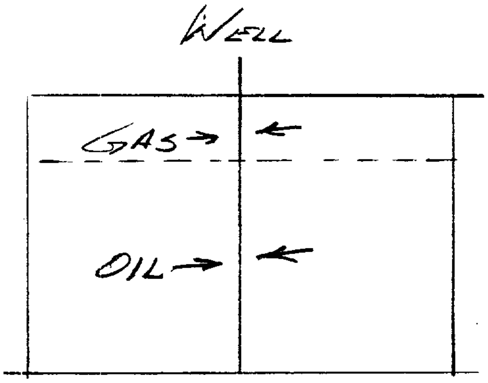
Pay Thickness (Feet)	Oil Fluid Head Expressed in Feet per Mile at: Minimum Mid-Point Distance Between Wells (1867') *		Maximum Mid-Point Distance Between Wells (2640') *	
	From	To	From	To
10'	0	28 feet/mile	0	20 feet/mile
50'	0	140 feet/mile	0	100 feet/mile
100'	0	280 feet/mile	0	200 feet/mile
500'	0	1400 feet/mile	0	1000 feet/mile

* Averages for 320 acre spacing.

RATES OF PRESSURE DECLINE: PARALLEL ZONES OF OIL AND GAS

In the foregoing examples, it was noted that the pressure in the gas zone would drop faster than in the oil zone. On the following pages are elementary calculations evidencing this.

PARALLEL FLOW OIL & GAS



Use: $\mu_o = .65$ cp
$\mu_g = .015$ cp
$B_o = 1.3$
$T = 620°R$

$$Q_{MCF/D} = \frac{.3\,Kh\,(P_1^2 - P_2^2)}{\mu_g\,T\,Z\,\log_{10}\frac{r_e}{r_w}}$$

P in psia
$P_1 = 1500$

(Kh & $\log_{10}\frac{r_e}{r_w}$ will later cancel)

Bbl gas/MCF @ reservoir conditions:

$$\frac{P_1 V_1}{Z_1 T_1} = \frac{P_2 V_2}{Z_2 T_2} \qquad V_2 = \frac{P_1 V_1 Z_2 T_2}{P_2 Z_1 T_1} = \frac{15 \times 1 \times .85 \times 620}{1500 \times 1 \times 520}$$

$$= .0101 \text{ Res cf/scf}$$

$$\frac{.0101 \times 1000}{5.615} = 1.80 \text{ bbl res. space per MCF}$$

$$Q_{\text{Gas flow rate in bbl reservoir space/day}} = \frac{.3 \times 1.80\,(P_1^2 - P_2^2)\,Kh}{\mu\,T\,Z\,\log_{10}\frac{r_e}{r_w}}$$

$$= \frac{.3 \times 1.80\,(P_1^2 - P_2^2)}{.015 \times 620 \times .85}\left(\frac{Kh}{\log_{10}\frac{r_e}{r_w}}\right)$$

$$= .0683\,(P_1^2 - P_2^2) \times \left(\frac{Kh}{\log_{10}\frac{r_e}{r_w}}\right)$$

OIL RATE

$$Q_{\substack{BOPD \\ STB}} = \frac{3.07\, Kh\,(P_1 - P_2)}{\mu B \log_{10} \frac{r_e}{r_w}} = \frac{3.07\,(P_1 - P_2)}{(.65)(1.3)} \left(\frac{Kh}{\log_{10} \frac{r_e}{r_w}}\right)$$

$$= 3.63\,(P_1 - P_2) \left(\frac{Kh}{\log_{10} \frac{r_e}{r_w}}\right)$$

$$Q_{\substack{BOPD \\ \text{reservoir bbl}}} = STB \times 1.3 = 1.3 \times 3.63\,(P_1 - P_2) \left(\frac{Kh}{\log_{10} \frac{r_e}{r_w}}\right)$$

$$= 4.72\,(P_1 - P_2) \times \left(\frac{Kh}{\log_{10} \frac{r_e}{r_w}}\right)$$

RATIO of FLOW RATES (Reservoir) GAS/OIL

GIVES RATIO of RESERVOIR VOIDAGE

$$\frac{\text{RESERVOIR Bbls GAS/DAY}}{\text{RESERVOIR Bbls OIL/DAY}} = \frac{.0683\,(P_e^2 - P_w^2)}{4.72\,(P_e - P_w)} \frac{\left(\frac{Kh}{\log_{10} r_e/r_w}\right)}{\left(\frac{Kh}{\log_{10} r_e/r_w}\right)}$$

$$= \frac{.0145\,(P_e^2 - P_w^2)}{(P_e - P_w)}$$

$$= .0145\,(P_e + P_w)$$

CONVERT RATIO OF RESERVOIR VOIDAGE to RATIO OF RATES OF PRESSURE DECLINE

(ASSUME $K_g = K_o$)

P_e = pressure at external boundary
P_w = " " effective well bore radius

DETERMINE VOIDAGE RATIO				DETERMINE PRESSURE DROP RATIO						
						RESERVOIR AVG. PRESS		COMPRESSIBILITY @Avg P ($\times 10^{-6}$)		
P_e	P_w	$P_e + P_w$	RATIO GAS/OIL	P_w/P_e	r_e/r_w	GAS	OIL	GAS	OIL	ΔP GAS / ΔP OIL
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1500	100	1600	23.2	.07	20	(.945) 1417	.905 1358	788	241	8.5
"	500	2000	29.0	.33	"	.952 1428	.932 1398	782	288	10.6
"	1000	2500	36.2	.67	"	.97 1455	.967 1450	769	280	13.1

Col 4 = .0145 ($P_e + P_w$) = col (3) x .0145

Col 5 = col (2) ÷ col (1)

col 6 = r_e for 320 acre spacing (± 2000')
& r_w = 100' (effective r_w)

col 7: from col 5 & col 6 enter green graph following

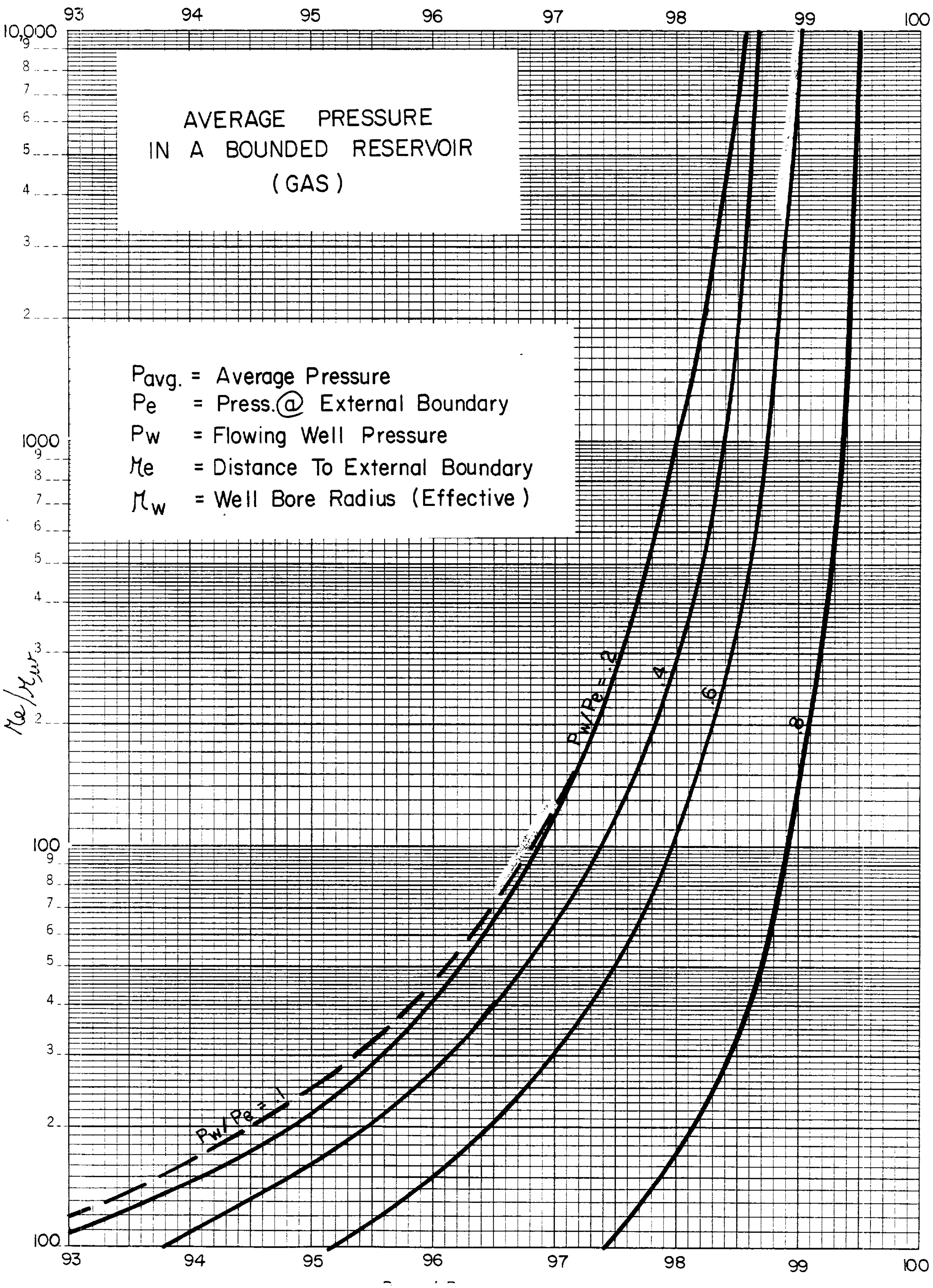
col 8: " " " " " " blue " "

(multiply factors from graphs by 1500)

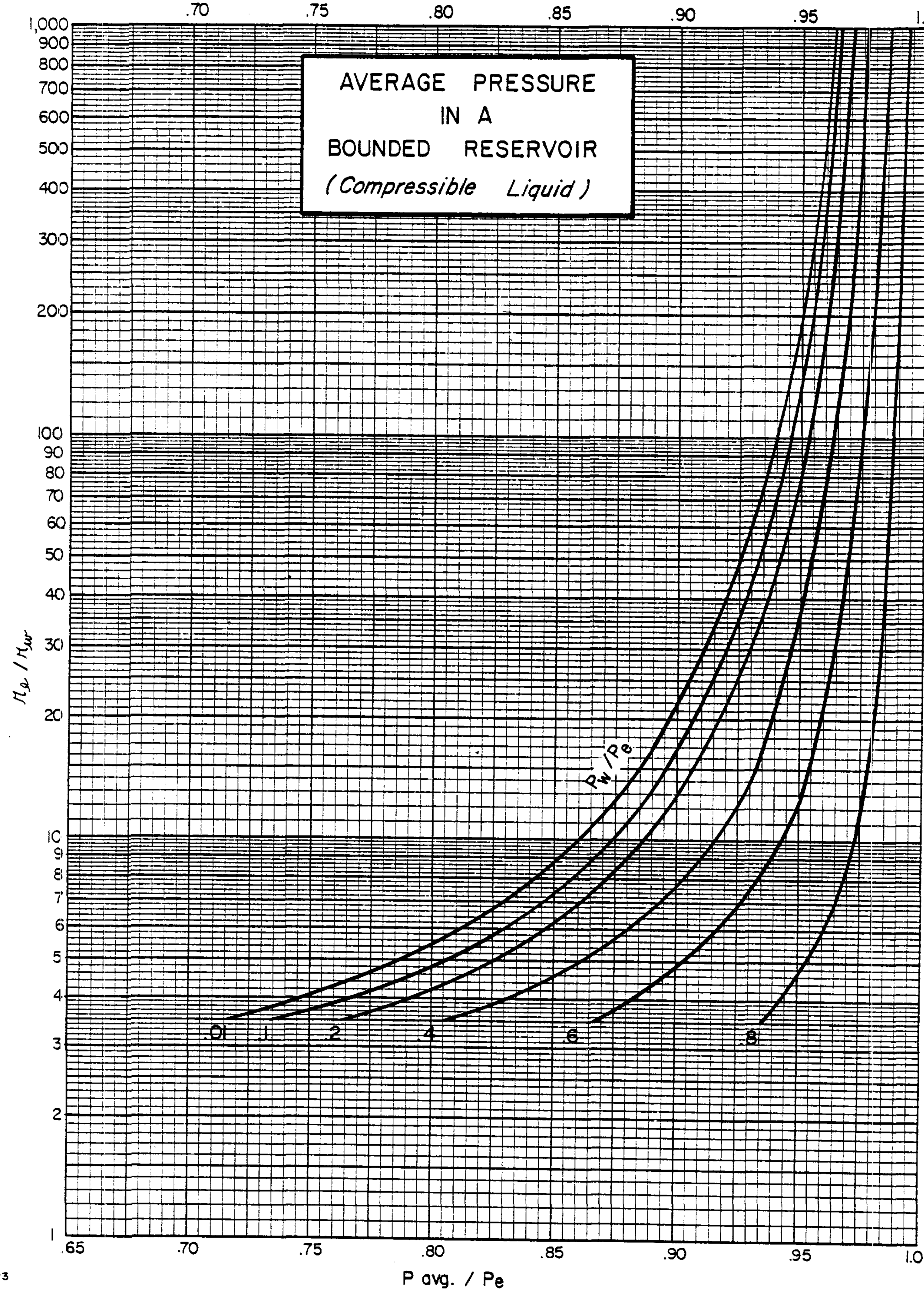
col 9: from avg press col (7) enter 2nd yellow graph following

col 10: " " " col (8) " 3rd pink " "

col 11: col (4) ÷ col (9) x col (10)



AVERAGE PRESSURE
IN A BOUNDED RESERVOIR
(GAS)
Pavg. = Average Pressure
Pe = Press. @ External Boundary
Pw = Flowing Well Pressure
re = Distance To External Boundary
rw = Well Bore Radius (Effective)
re/rw
Pw/Pe = .1
Pw/Pe = .2
.4
.6
.8
93
94
95
96
97
98
99
100
10,000
1000
100



AVERAGE PRESSURE
IN A
BOUNDED RESERVOIR
(Compressible Liquid)
.70
.75
.80
.85
.90
.95
1.0
1,000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
Pw / Pe
.01
.1
.2
.4
.6
.8
.65
.70
.75
.80
.85
.90
.95
1.0
P avg. / Pe

3

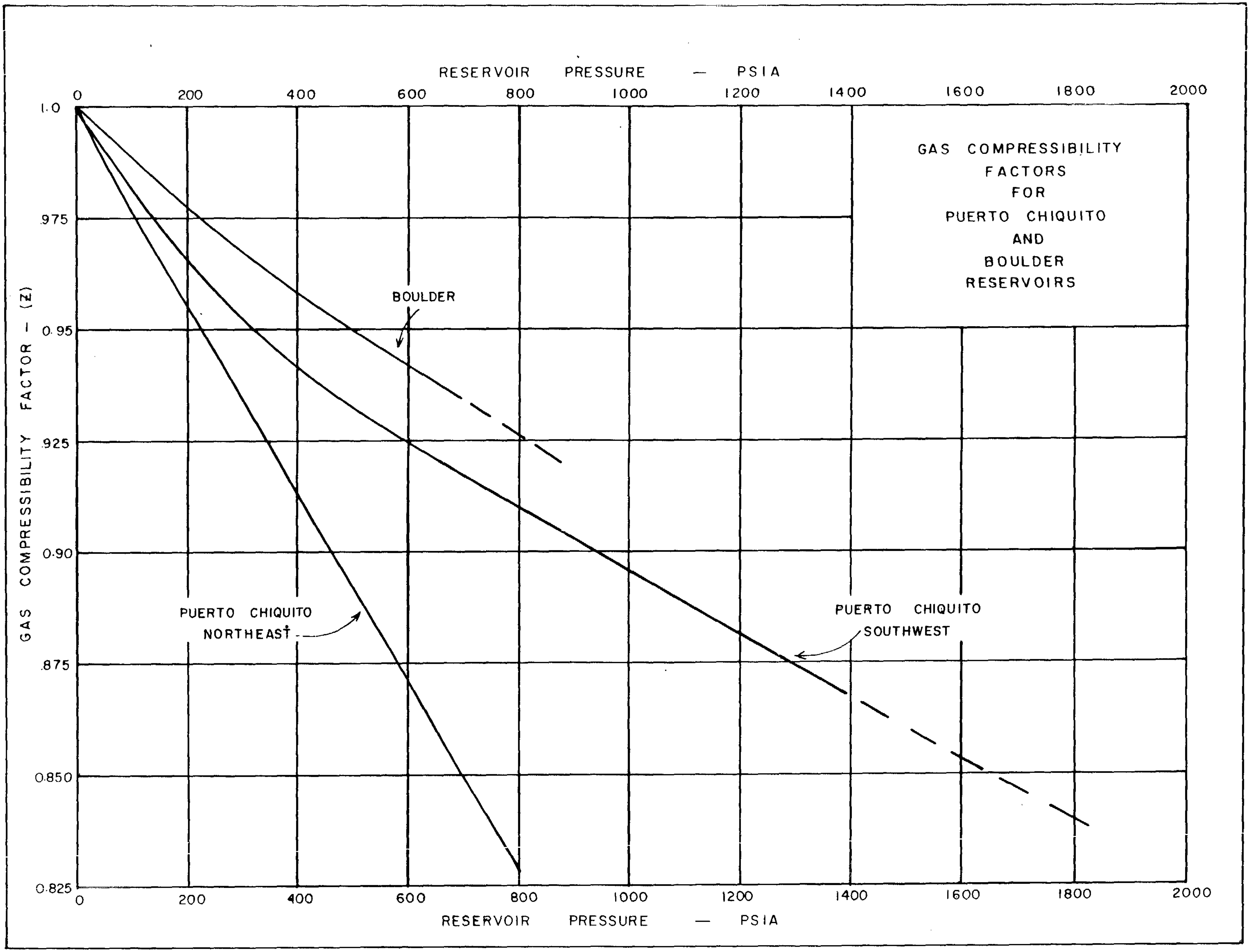
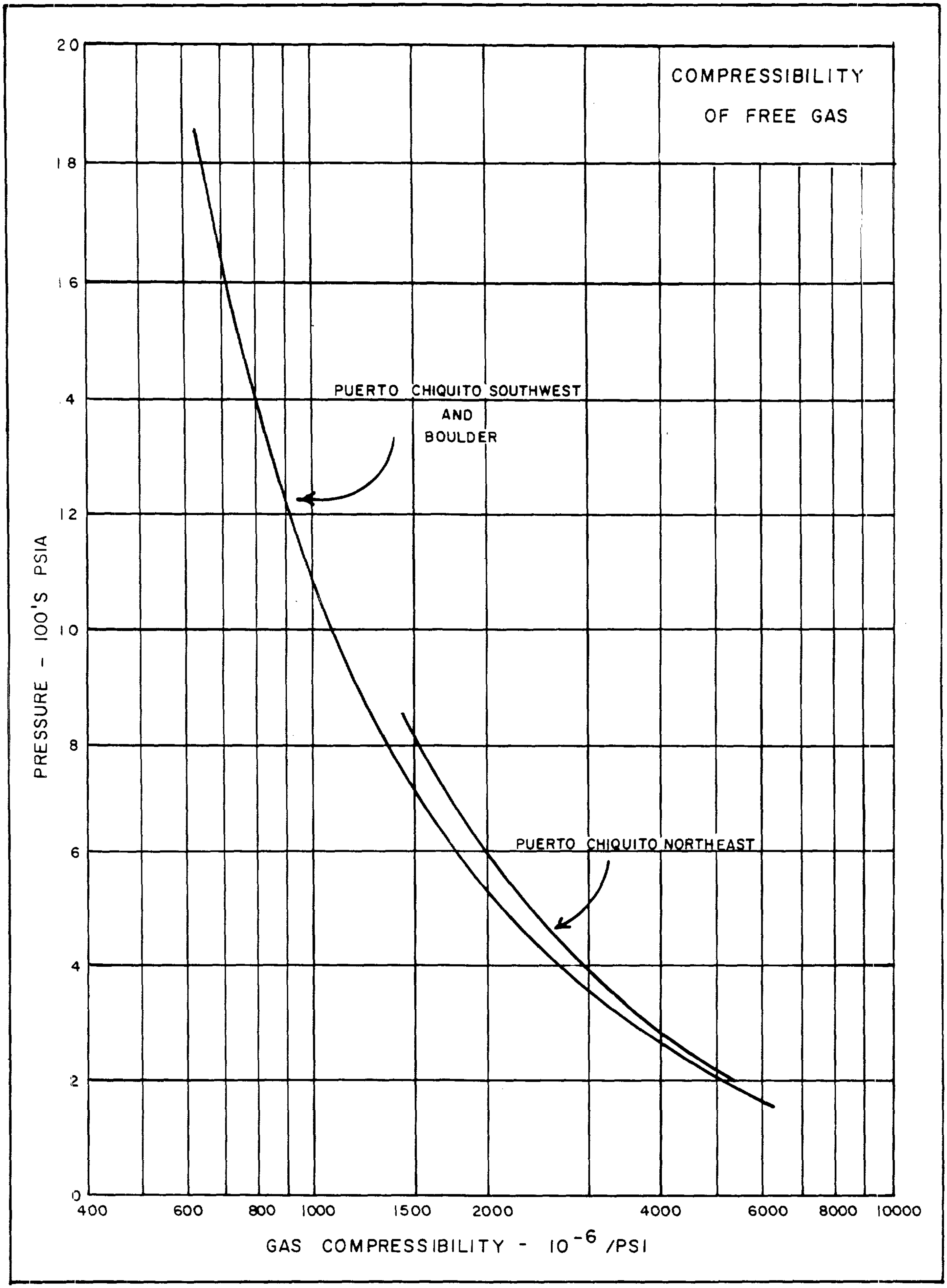
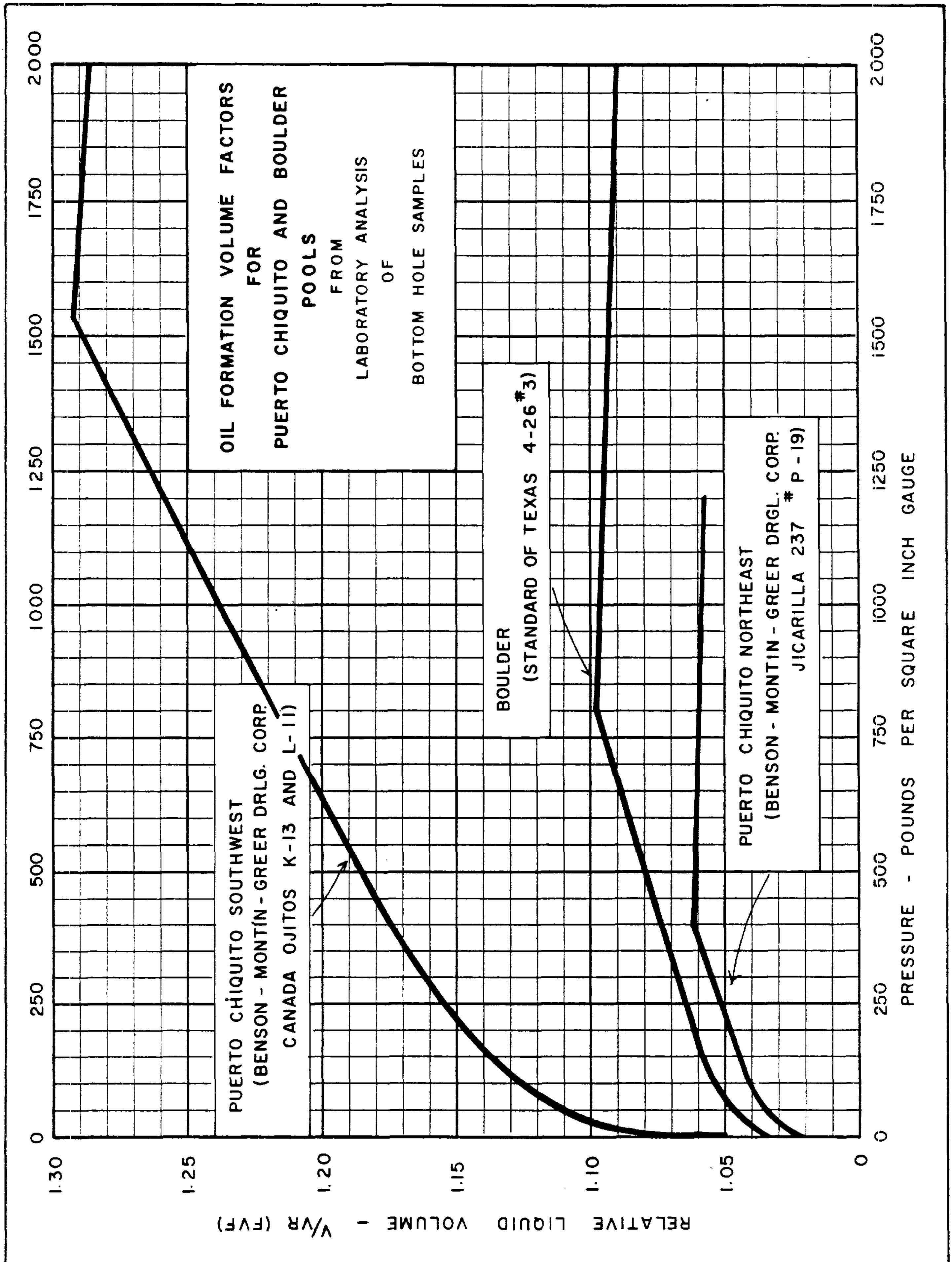

GAS COMPRESSIBILITY FACTORS FOR PUERTO CHIQUITO AND BOULDER RESERVOIRS
RESERVOIR PRESSURE — PSIA
GAS COMPRESSIBILITY FACTOR — (Z)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
1.0
.975
0.95
.925
0.90
.875
0.850
0.825
BOULDER
PUERTO CHIQUITO NORTHEAST†
PUERTO CHIQUITO SOUTHWEST

 Fig 2



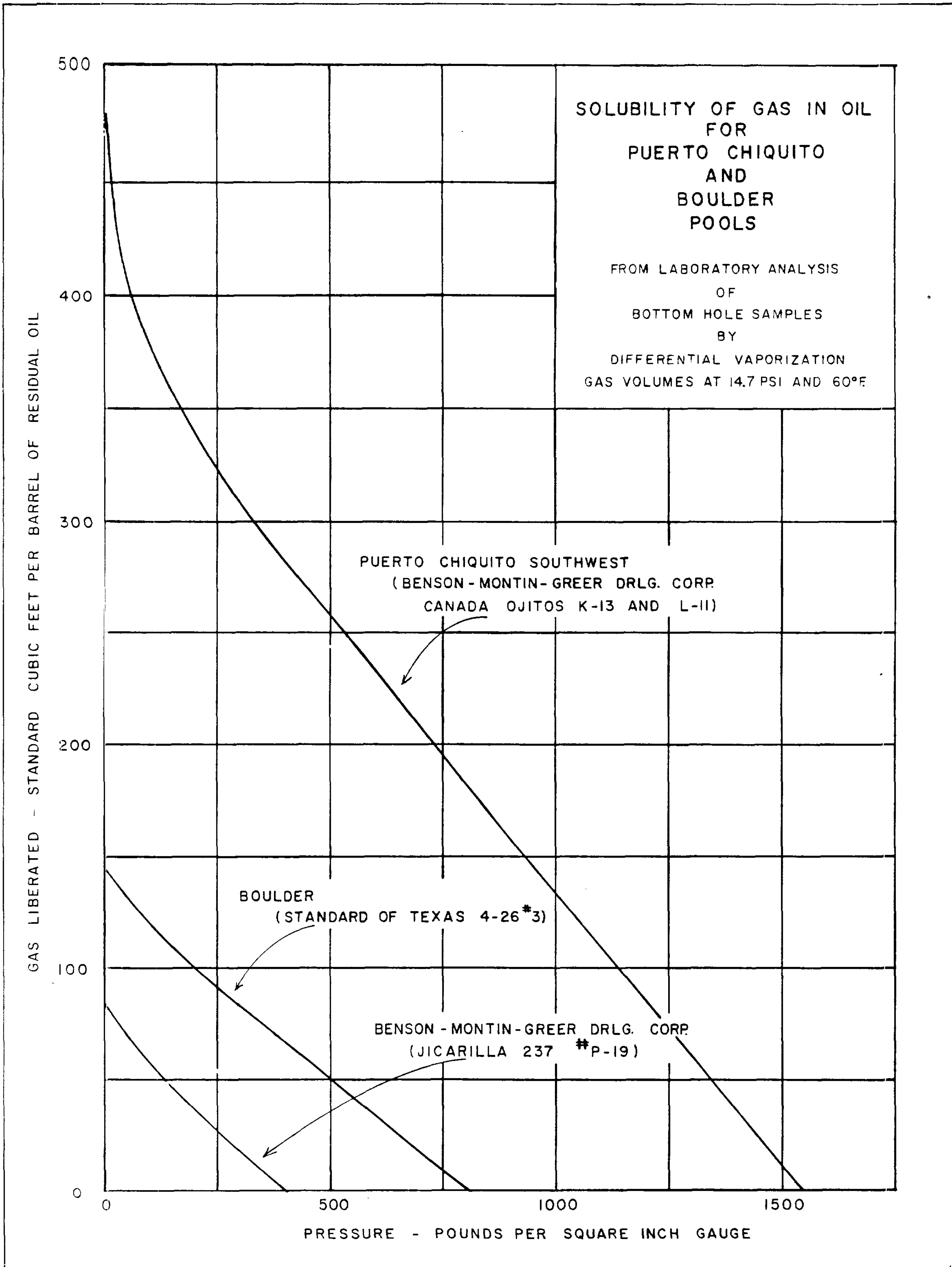
COMPRESSIBILITY
OF FREE GAS
PUERTO CHIQUITO SOUTHWEST
AND
BOULDER
PUERTO CHIQUITO NORTHEAST
PRESSURE - 100'S PSIA
20
18
16
14
12
10
8
6
4
2
0
400
600
800
1000
1500
2000
4000
6000
8000
10000
GAS COMPRESSIBILITY - 10^-6 /PSI

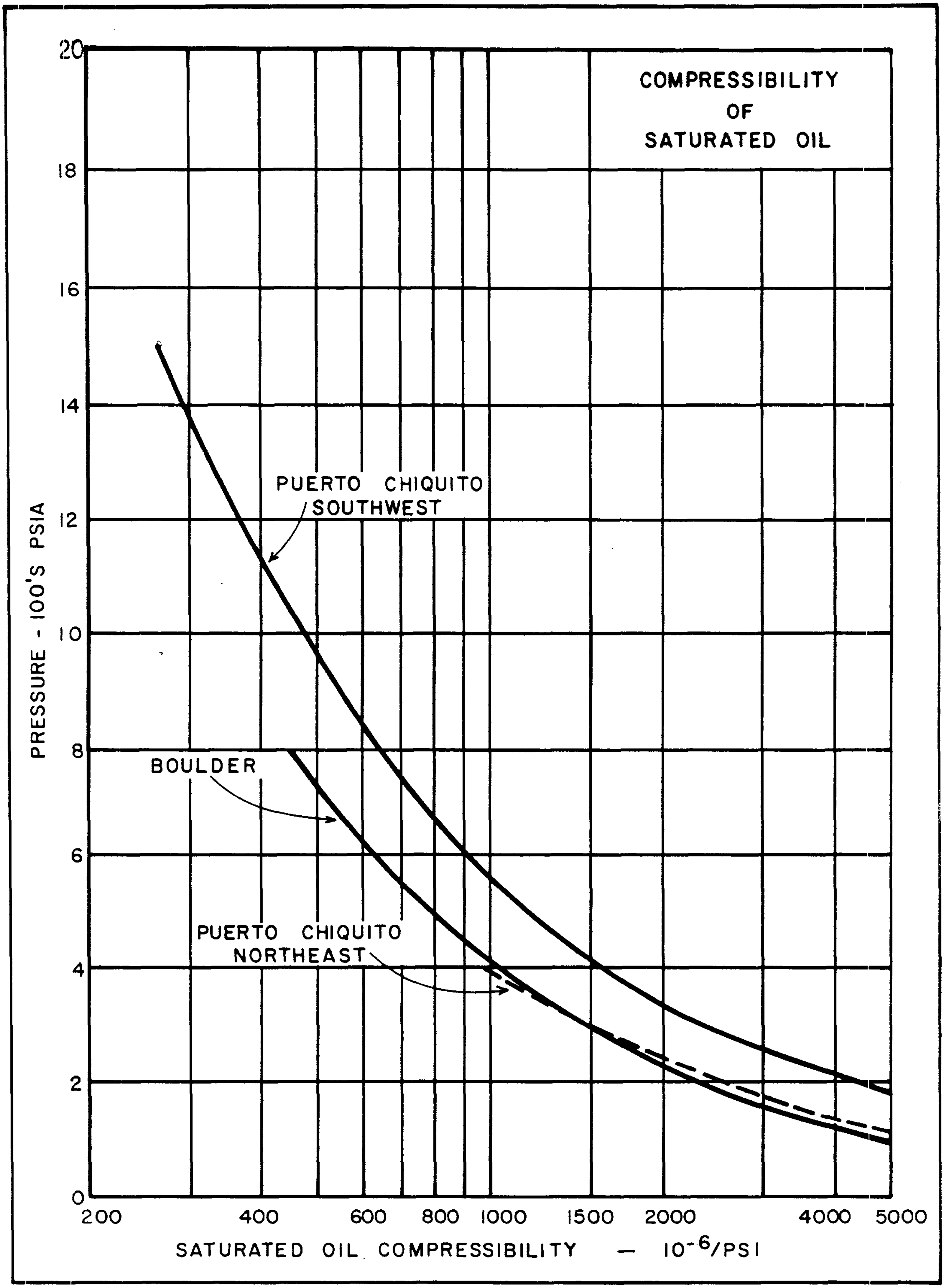
Fig. 3

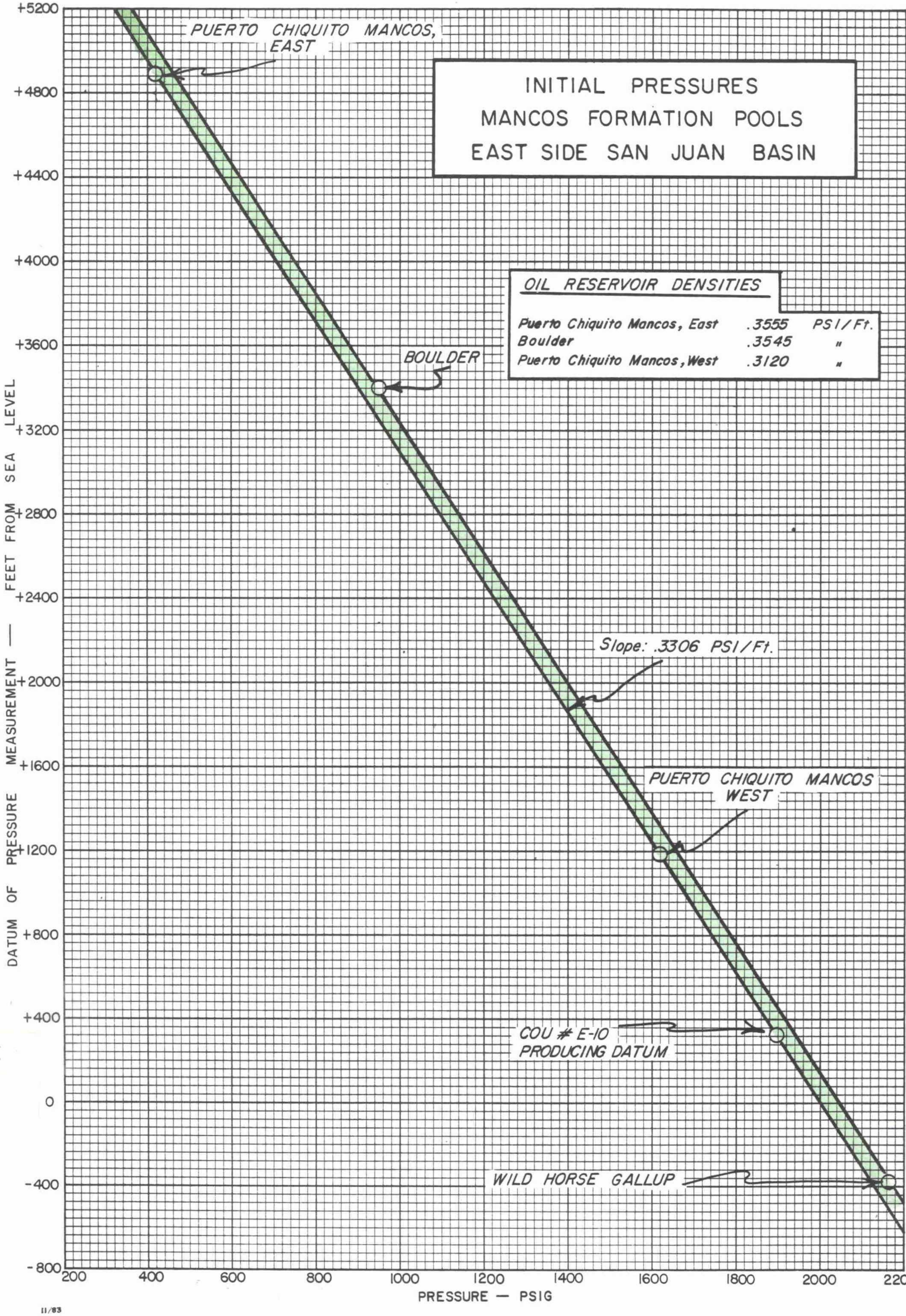

OIL FORMATION VOLUME FACTORS
FOR
PUERTO CHIQUITO AND BOULDER
POOLS
FROM
LABORATORY ANALYSIS
OF
BOTTOM HOLE SAMPLES
BOULDER
(STANDARD OF TEXAS 4-26 #3)
PUERTO CHIQUITO NORTHEAST
(BENSON - MONTIN - GREER DRGL. CORP.
JICARILLA 237 # P-19)
PUERTO CHIQUITO SOUTHWEST
(BENSON - MONTÍN - GREER DRLG. CORP.
CANADA OJITOS K-13 AND L-11)
PRESSURE - POUNDS PER SQUARE INCH GAUGE
RELATIVE LIQUID VOLUME - V/VR (FVF)
0
250
500
750
1000
1250
1500
1750
2000
0
1.05
1.10
1.15
1.20
1.25
1.30

48A

Fig. 4


SOLUBILITY OF GAS IN OIL
FOR
PUERTO CHIQUITO
AND
BOULDER
POOLS
FROM LABORATORY ANALYSIS
OF
BOTTOM HOLE SAMPLES
BY
DIFFERENTIAL VAPORIZATION
GAS VOLUMES AT 14.7 PSI AND 60°F
PUERTO CHIQUITO SOUTHWEST
(BENSON-MONTIN-GREER DRLG. CORP.
CANADA OJITOS K-13 AND L-11)
BOULDER
(STANDARD OF TEXAS 4-26 #3)
BENSON-MONTIN-GREER DRLG. CORP.
(JICARILLA 237 #P-19)
GAS LIBERATED - STANDARD CUBIC FEET PER BARREL OF RESIDUAL OIL
PRESSURE - POUNDS PER SQUARE INCH GAUGE
0
100
200
300
400
500
0
500
1000
1500


COMPRESSIBILITY OF SATURATED OIL
PUERTO CHIQUITO SOUTHWEST
BOULDER
PUERTO CHIQUITO NORTHEAST
PRESSURE - 100'S PSIA
20
18
16
14
12
10
8
6
4
2
0
200
400
600
800
1000
1500
2000
4000
5000
SATURATED OIL COMPRESSIBILITY — 10⁻⁶/PSI

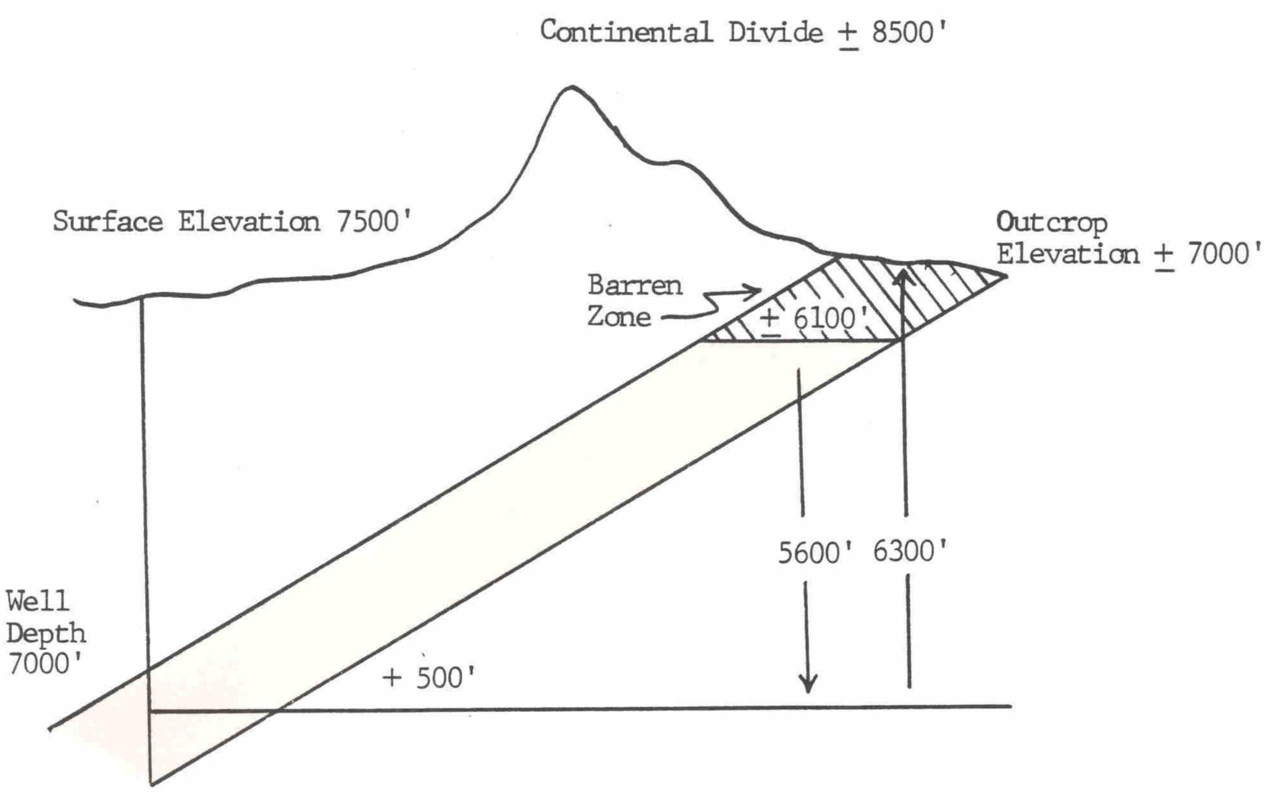


INITIAL PRESSURES
MANCOS FORMATION POOLS
EAST SIDE SAN JUAN BASIN
OIL RESERVOIR DENSITIES
Puerto Chiquito Mancos, East .3555 PSI/Ft.
Boulder .3545 "
Puerto Chiquito Mancos, West .3120 "
PUERTO CHIQUITO MANCOS, EAST
BOULDER
Slope: .3306 PSI/Ft.
PUERTO CHIQUITO MANCOS WEST
COU # E-10 PRODUCING DATUM
WILD HORSE GALLUP
DATUM OF PRESSURE MEASUREMENT — FEET FROM SEA LEVEL
+5200
+4800
+4400
+4000
+3600
+3200
+2800
+2400
+2000
+1600
+1200
+800
+400
0
-400
-800
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
PRESSURE — PSIG
11/83

VIRGIN RESERVOIR PRESSURE
MANCOS FORMATION POOLS
EAST SIDE OF THE SAN JUAN BASIN

Although there are areas of tight zones that laterally isolate some pools from others so that no communication is perceptible during the time man produces these pools, there is nevertheless sufficient permeability in the fractured Mancos that, over geologic time, the pressure of the pools in the eastern San Juan Basin have been equalized.

In the same fashion that the pressure of a highly permeable water sand reflects the hydrostatic force as measured by the vertical distance from its outcrop on the surface, so do the pressures of the main producing zone of the Niobrara reflect the "oil static" pressure differential from the elevation of its outcrop (less 800' to 900' of apparent "barren" formation).

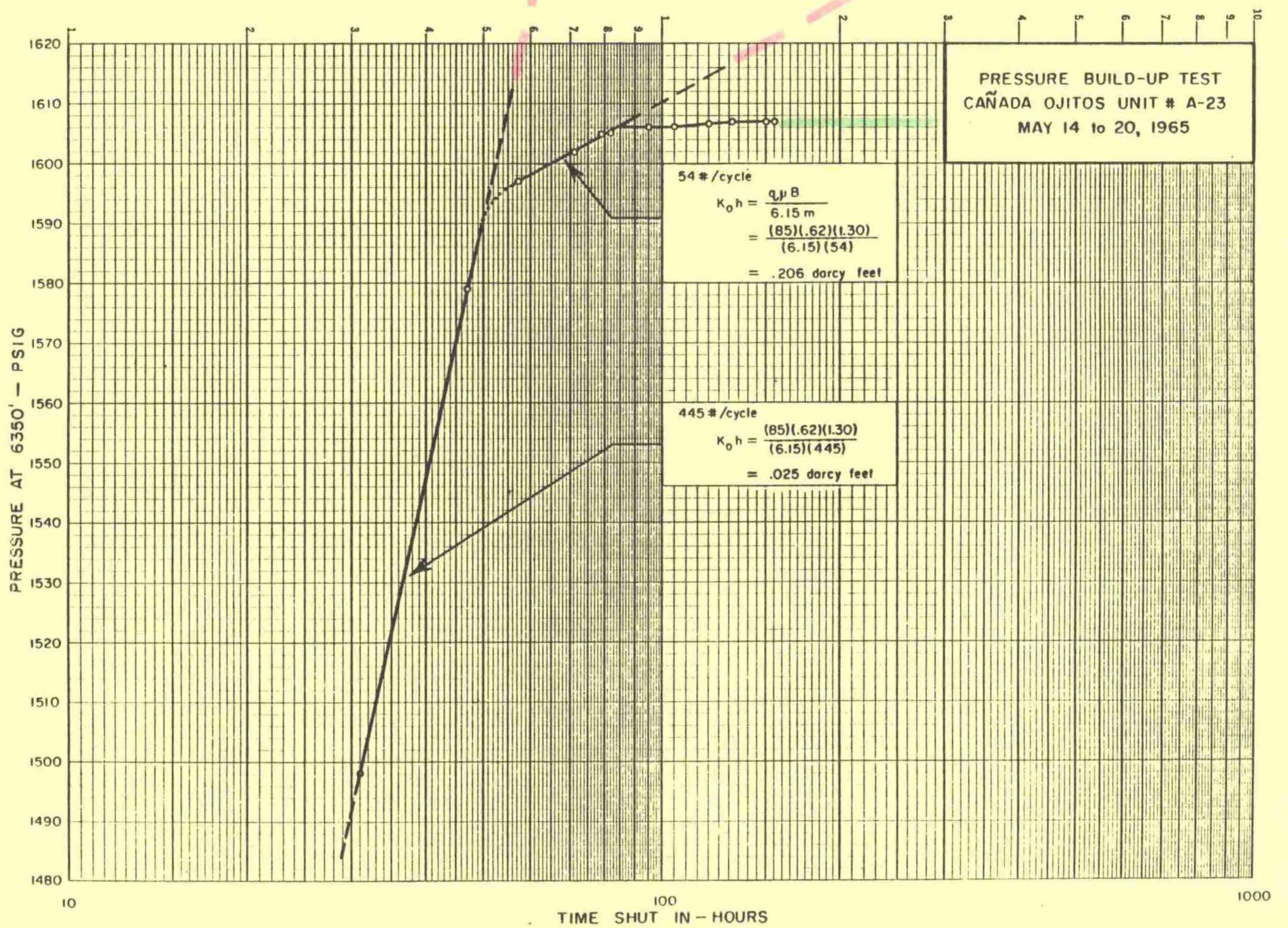


Reservoir pressure ± .33 psi/ft x 5600
= ± 1850#

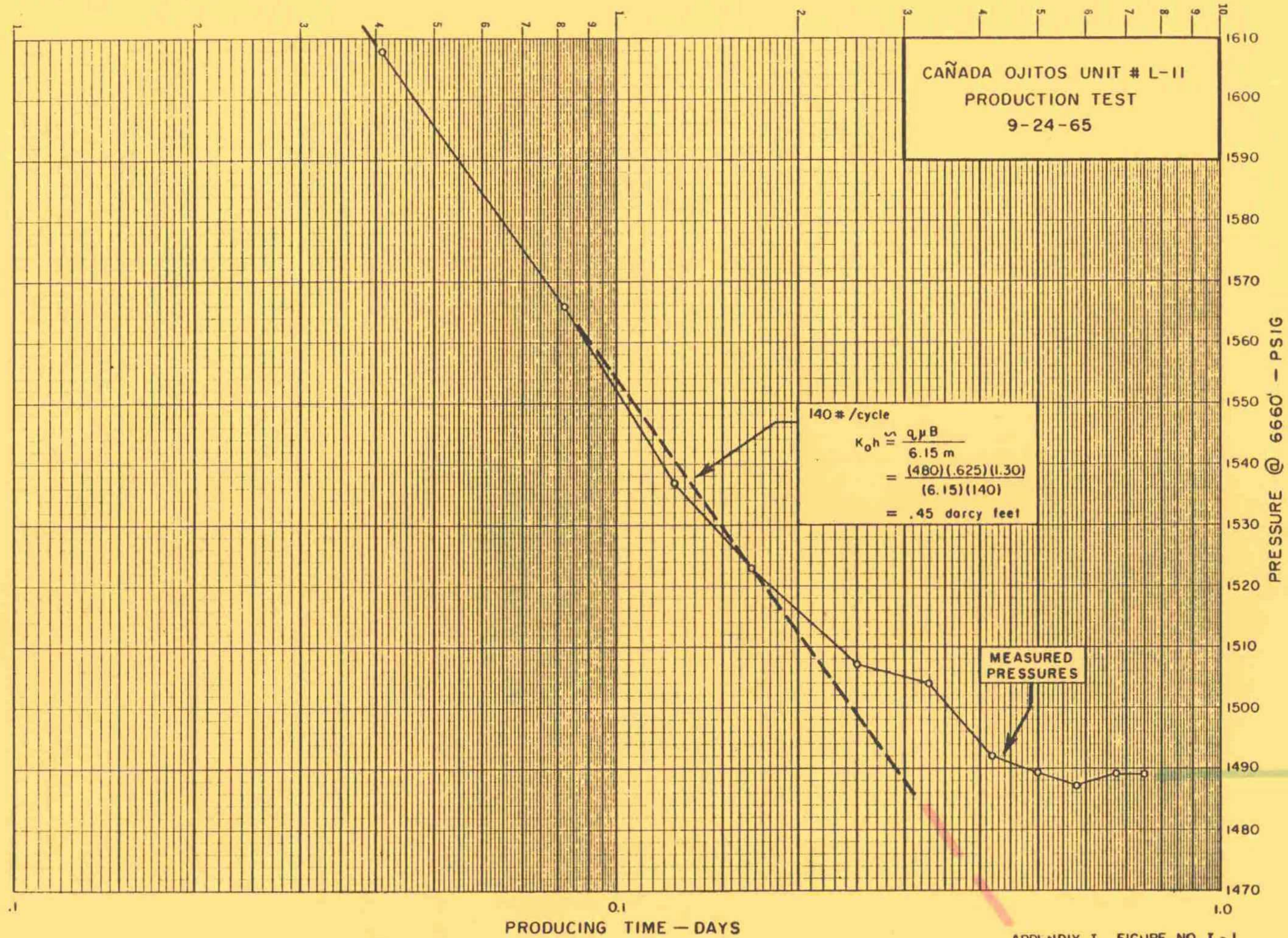
EXTRAPOLATION OF BOTTOM HOLE PRESSURE BUILD-UP SURVEYS BY CONVENTIONAL METHODS TO ESTIMATE MAXIMUM RESERVOIR PRESSURES IS OF EXTREMELY LIMITED VALUE FOR ANALYSES OF WELLS IN THE WEST PUERTO CHIQUITO MANCOS RESERVOIR

The graph on the facing page is not a Horner plot (such plots are of limited use in this reservoir), but if constructed as a Horner plot, and the survey ended while the pressure was still building along one of the pink lines, the extrapolation to P* would be somewhere in the direction of the pink dashed lines: clearly unsuitable for estimating maximum reservoir pressures.

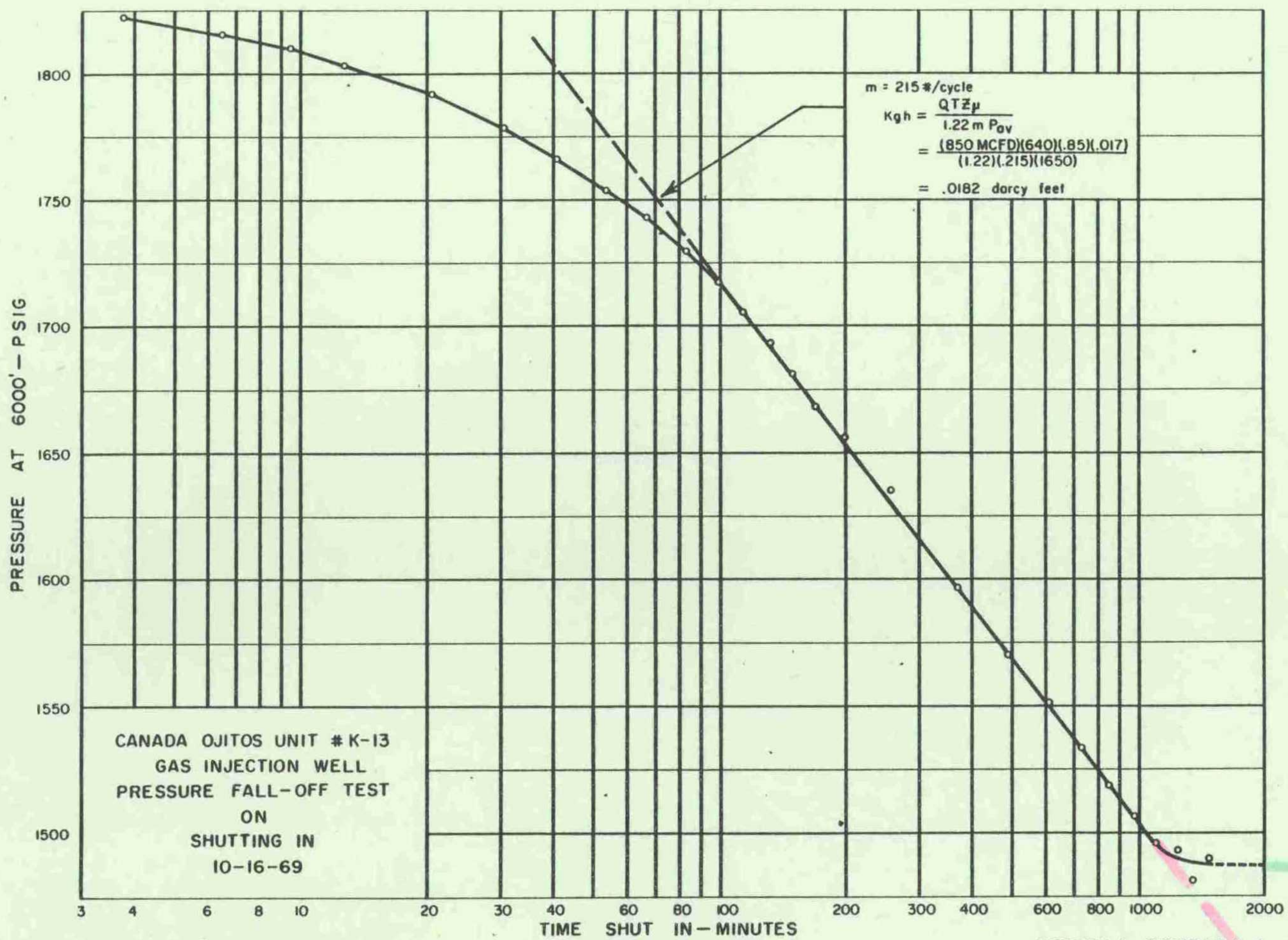
In the example on the opposite page, the well pressure reaches the reservoir pressure in a short time (about 4 days); but if the tight block in which it is completed were larger, a longer time would be required, and one never knows when to cease the survey - other than until stabilization has occurred.



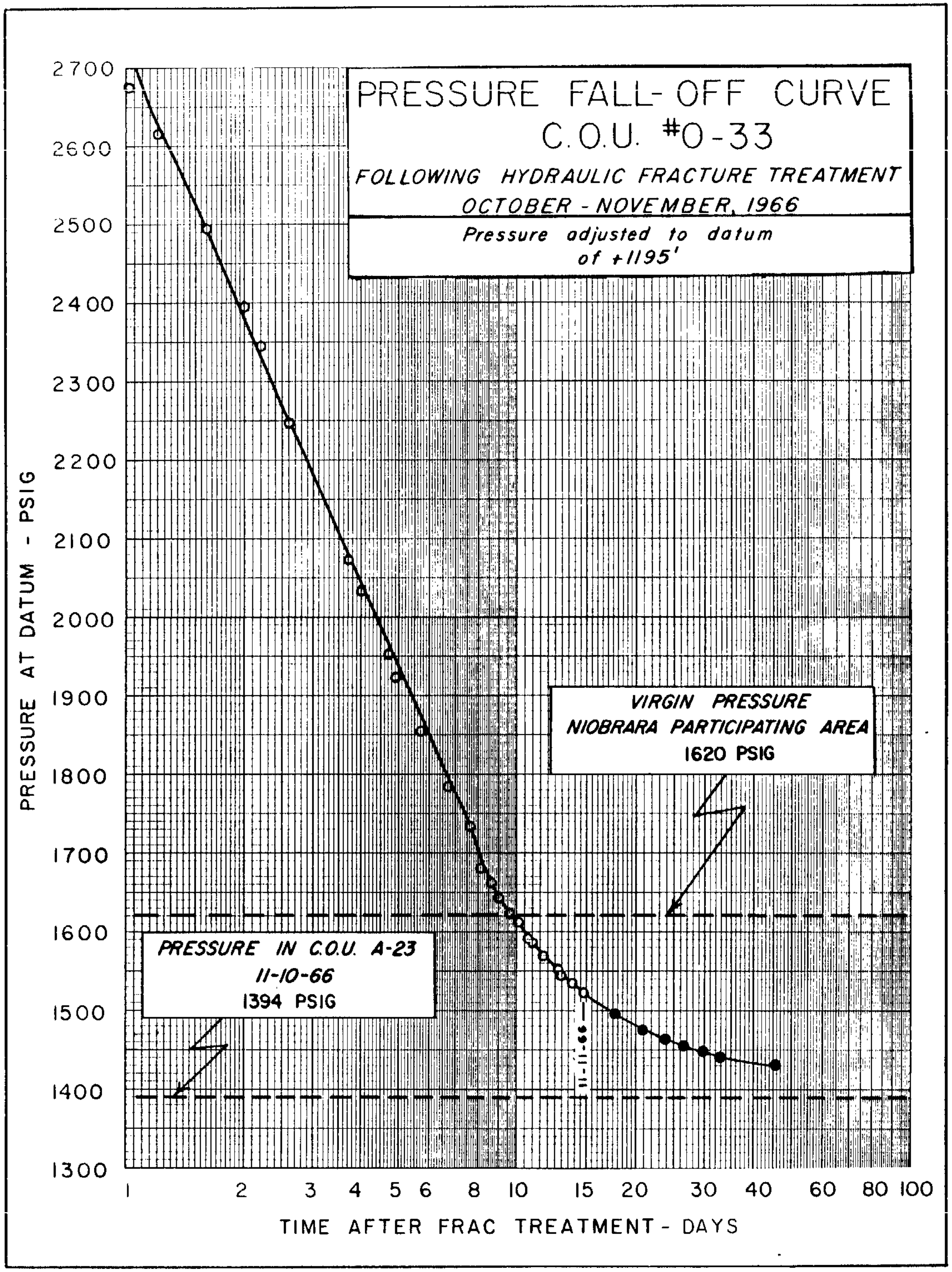
APPENDIX I FIGURE NO. I-2



APPENDIX I FIGURE NO. I - 1

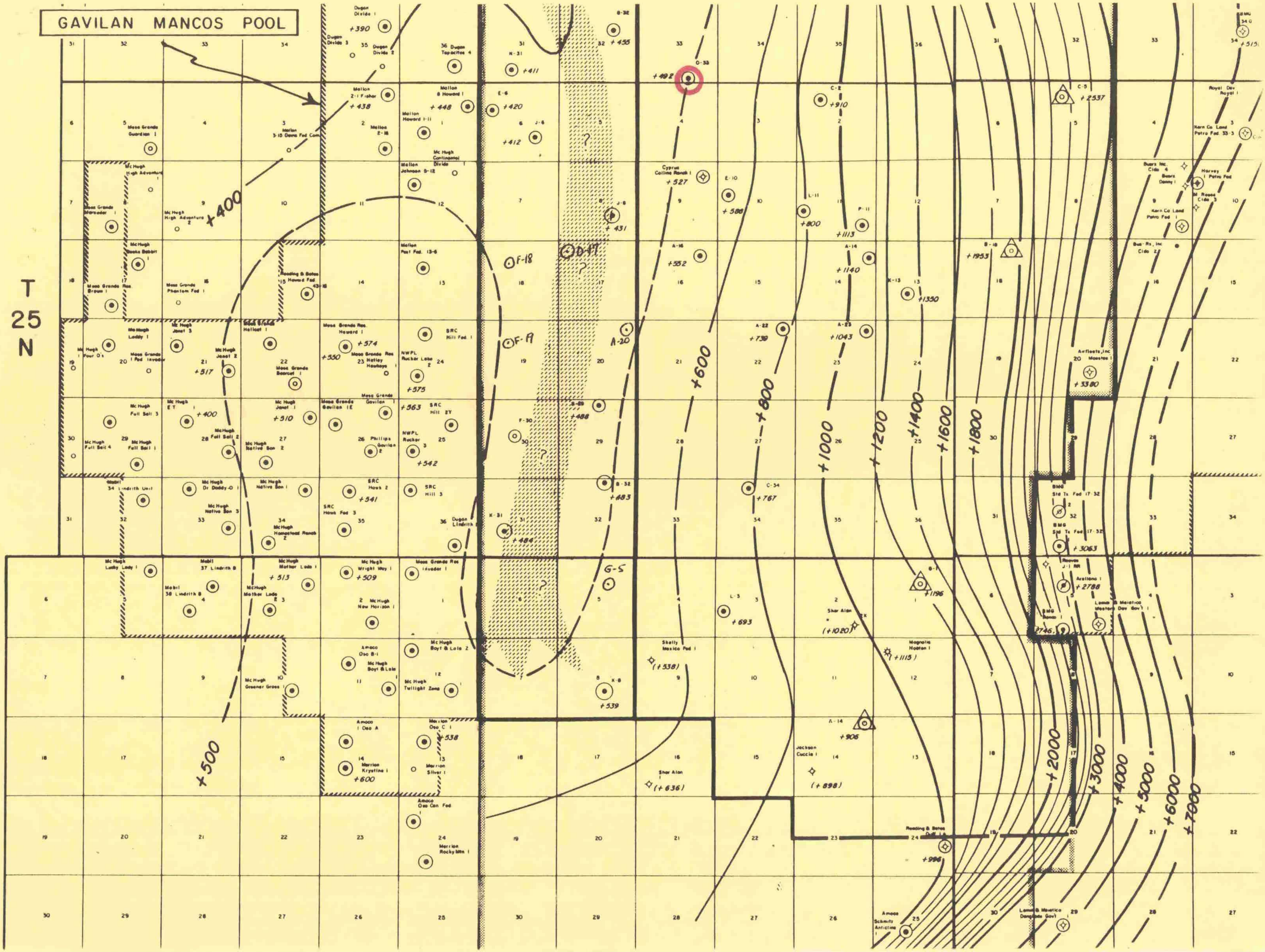


APPENDIX I FIGURE NO. I-3

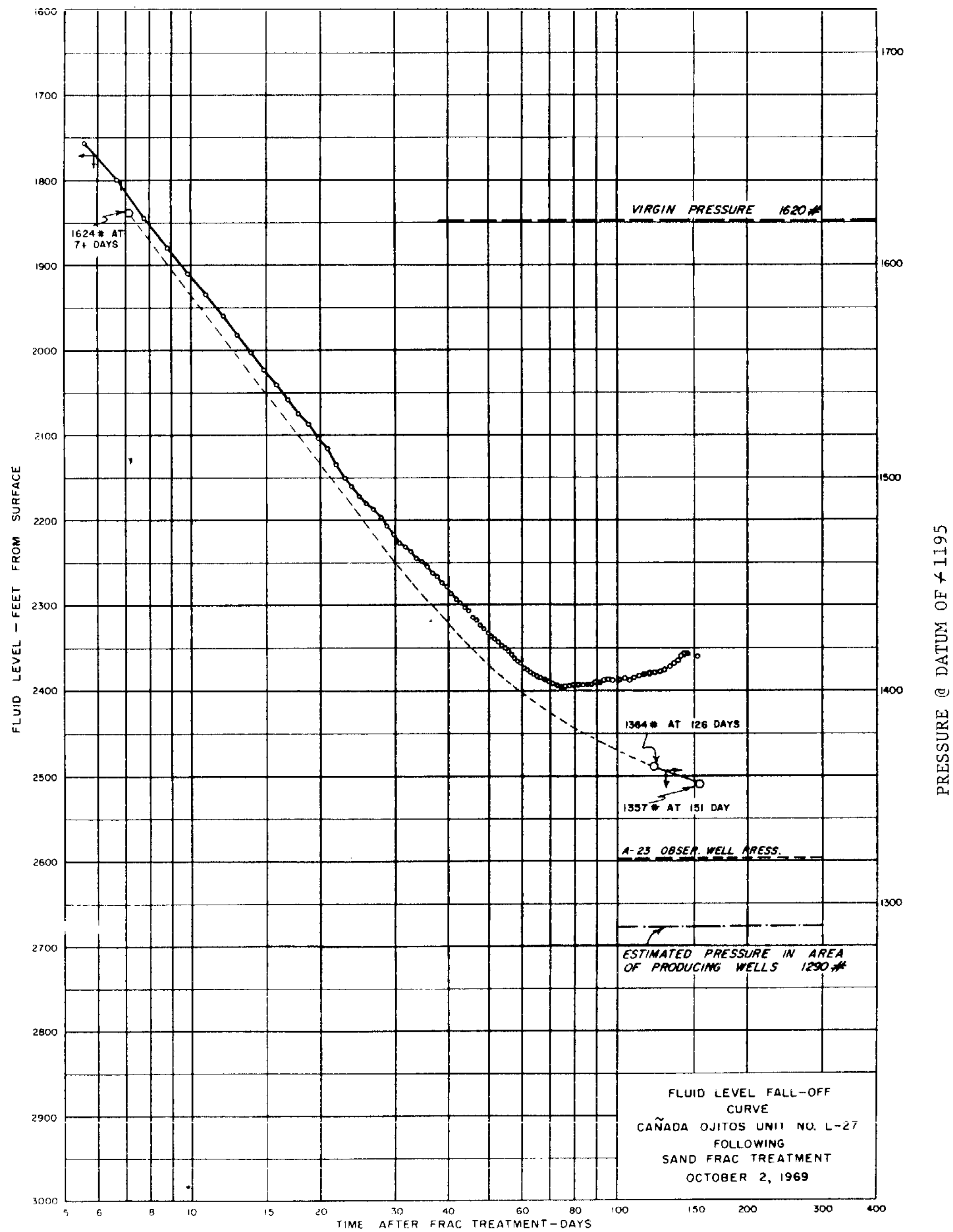


PRESSURE FALL-OFF CURVE
C.O.U. #0-33
FOLLOWING HYDRAULIC FRACTURE TREATMENT
OCTOBER - NOVEMBER, 1966
Pressure adjusted to datum of +1195'
VIRGIN PRESSURE
NIOBRARA PARTICIPATING AREA
1620 PSIG
PRESSURE IN C.O.U. A-23
11-10-66
1394 PSIG
11-11-66
PRESSURE AT DATUM - PSIG
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1 2 3 4 5 6 8 10 15 20 30 40 60 80 100
TIME AFTER FRAC TREATMENT - DAYS

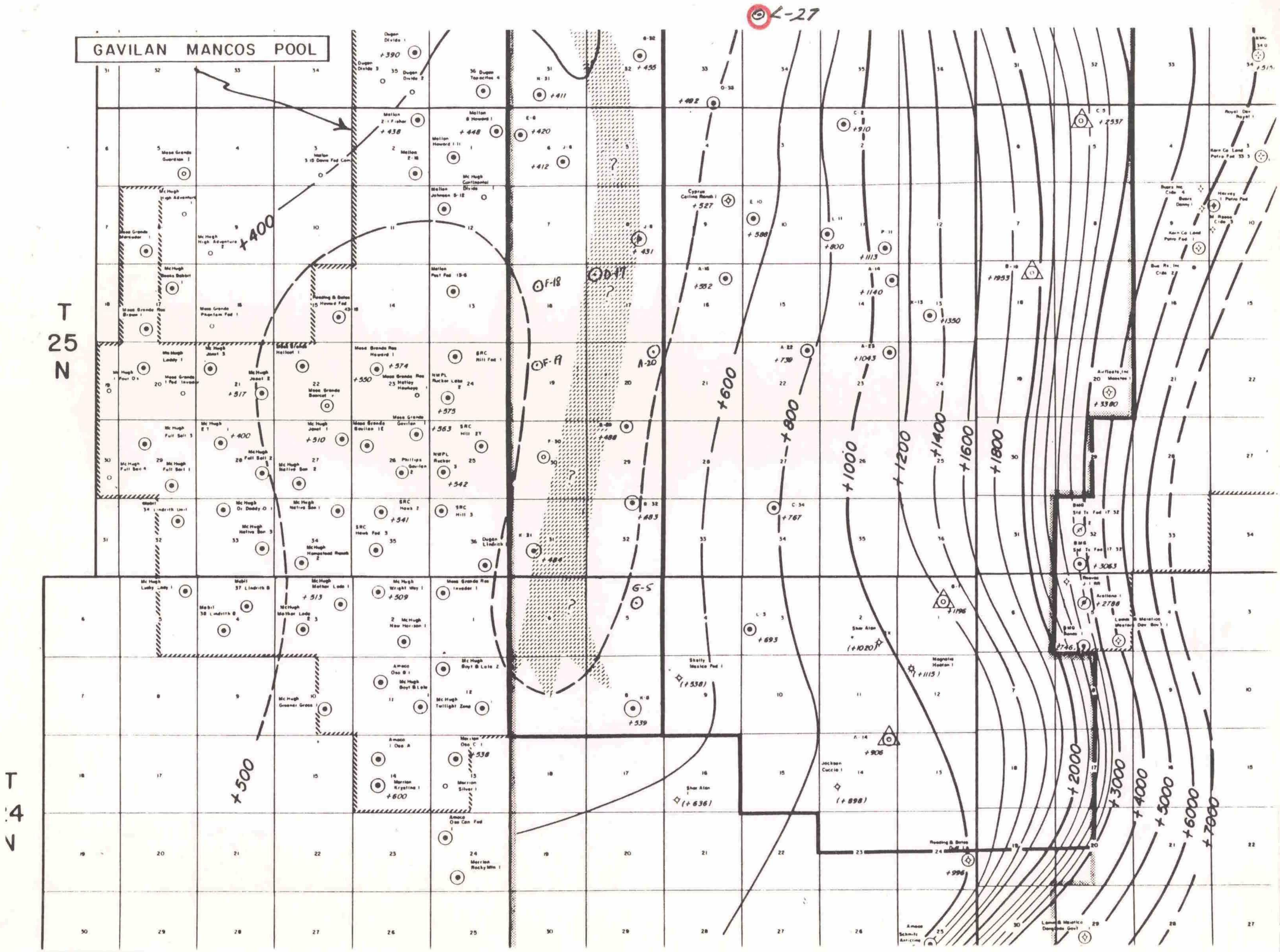
22A

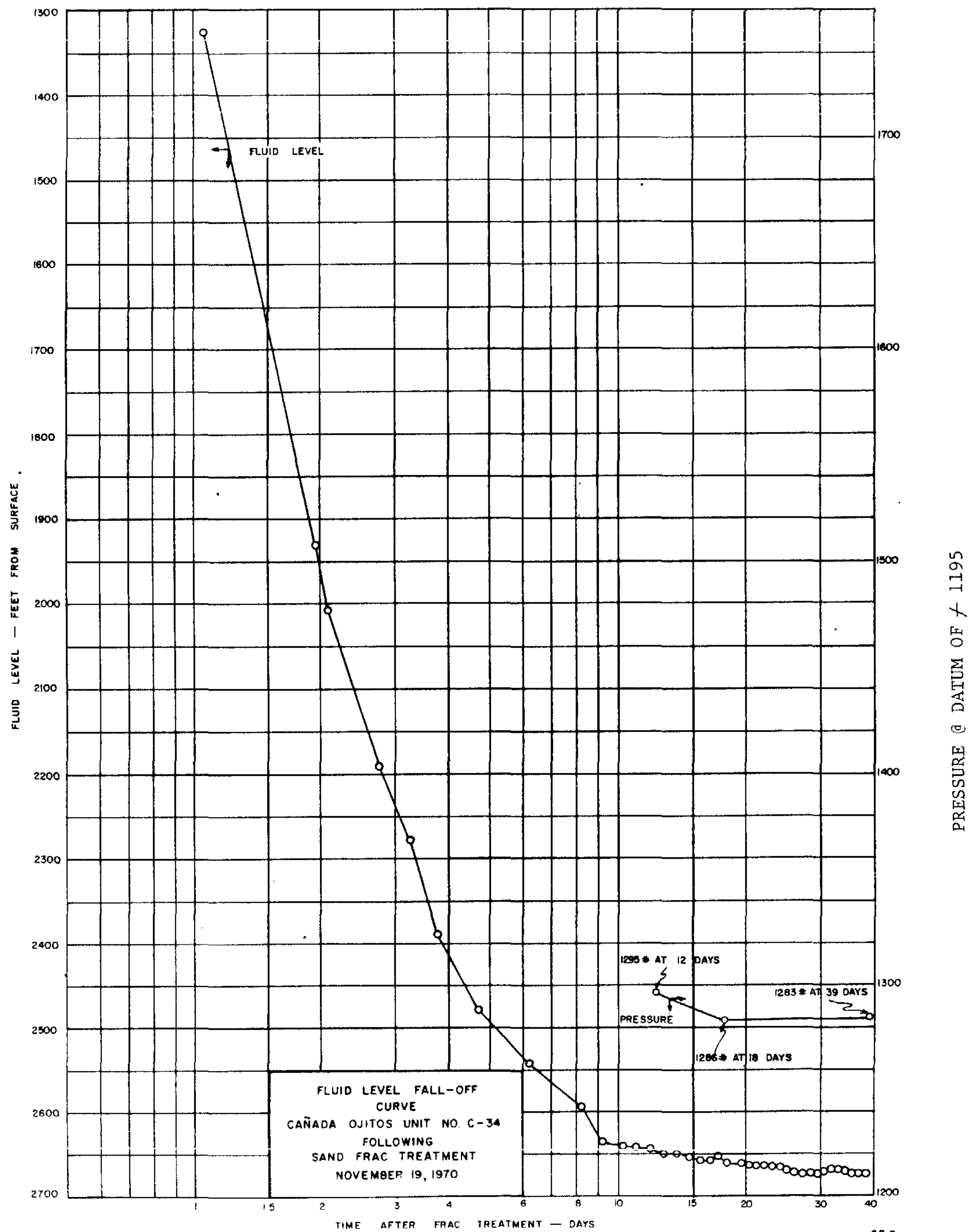


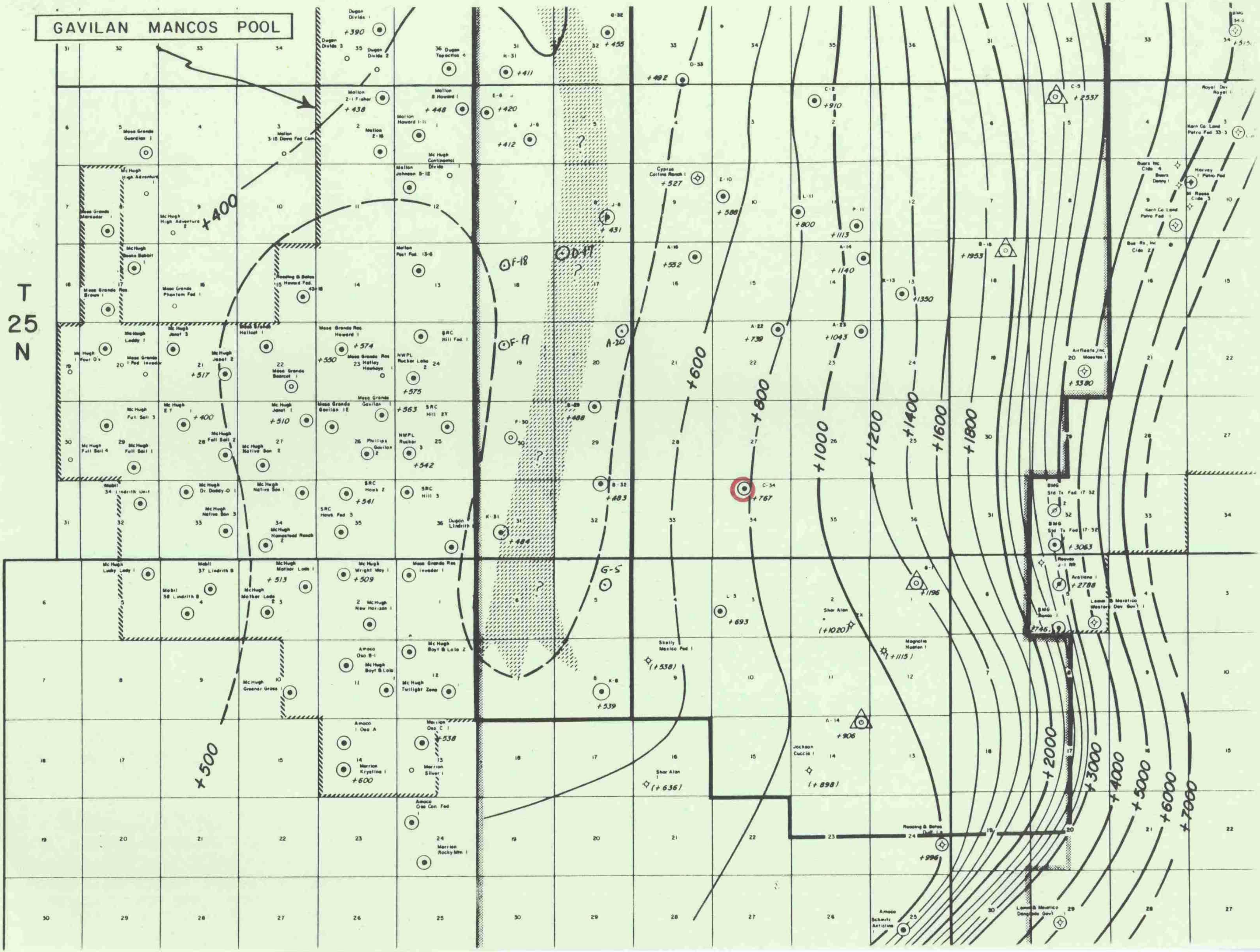
GAVILAN MANCOS POOL
T 25 N
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000

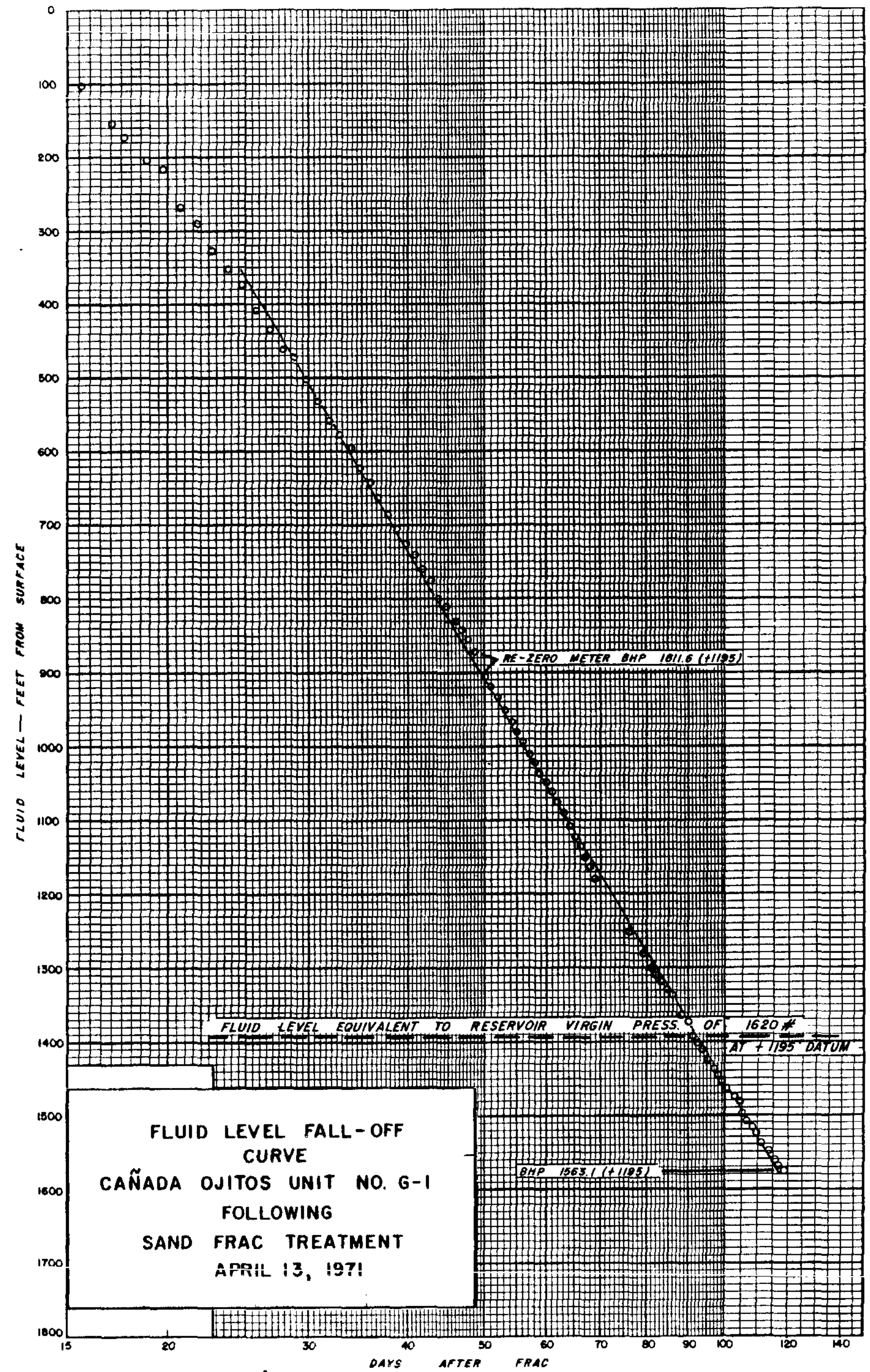


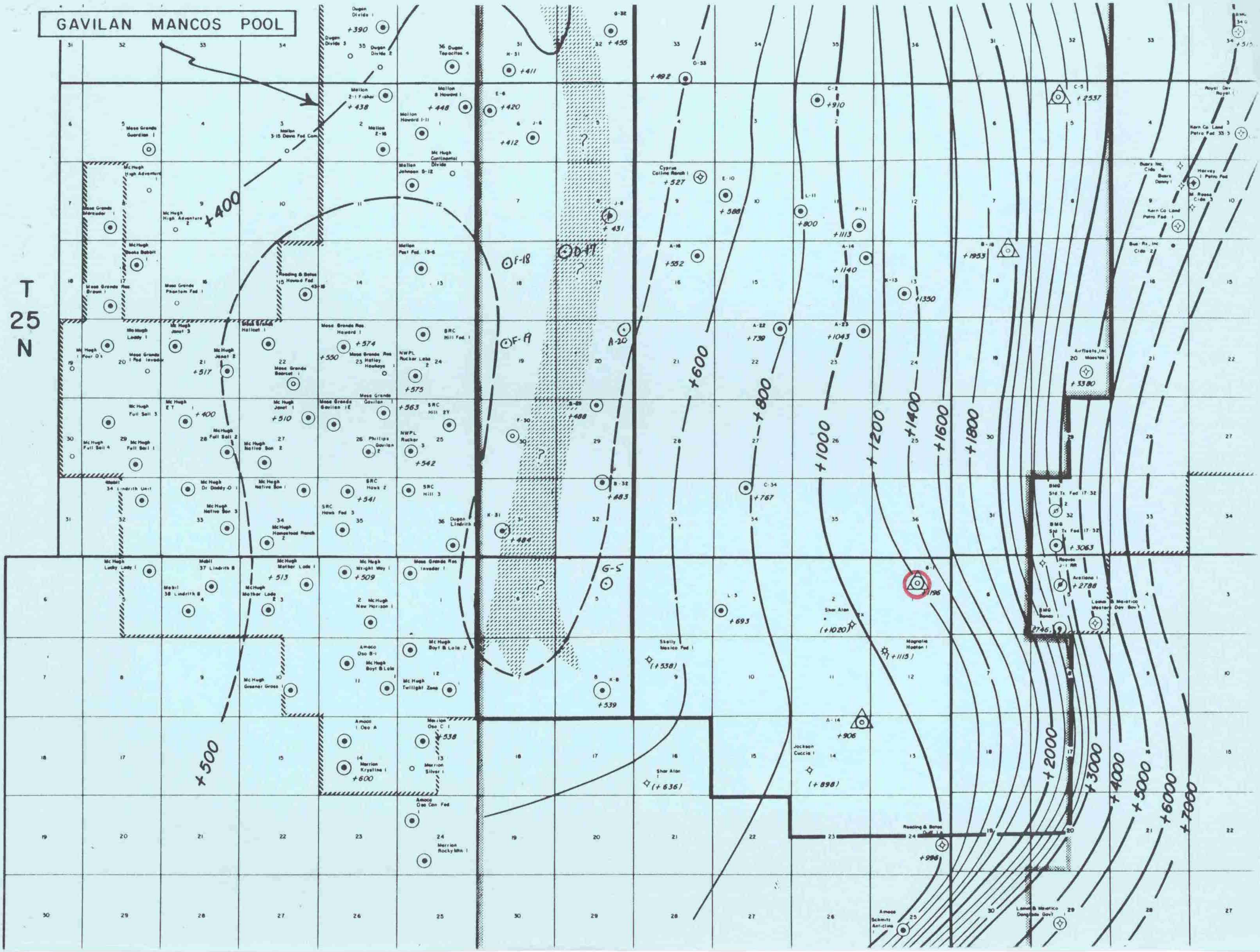
FLUID LEVEL – FEET FROM SURFACE
PRESSURE @ DATUM OF + 1195
TIME AFTER FRAC TREATMENT–DAYS
VIRGIN PRESSURE 1620#
1624# AT 7+ DAYS
1364# AT 126 DAYS
1357# AT 151 DAY
A-23 OBSER. WELL PRESS.
ESTIMATED PRESSURE IN AREA OF PRODUCING WELLS 1290#
FLUID LEVEL FALL-OFF CURVE
CAÑADA OJITOS UNIT NO. L-27
FOLLOWING
SAND FRAC TREATMENT
OCTOBER 2, 1969


GAVILAN MANCOS POOL
T 25 N
T 24 N
L-27
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000
F-18
D-17
F-19
G-5
A-20

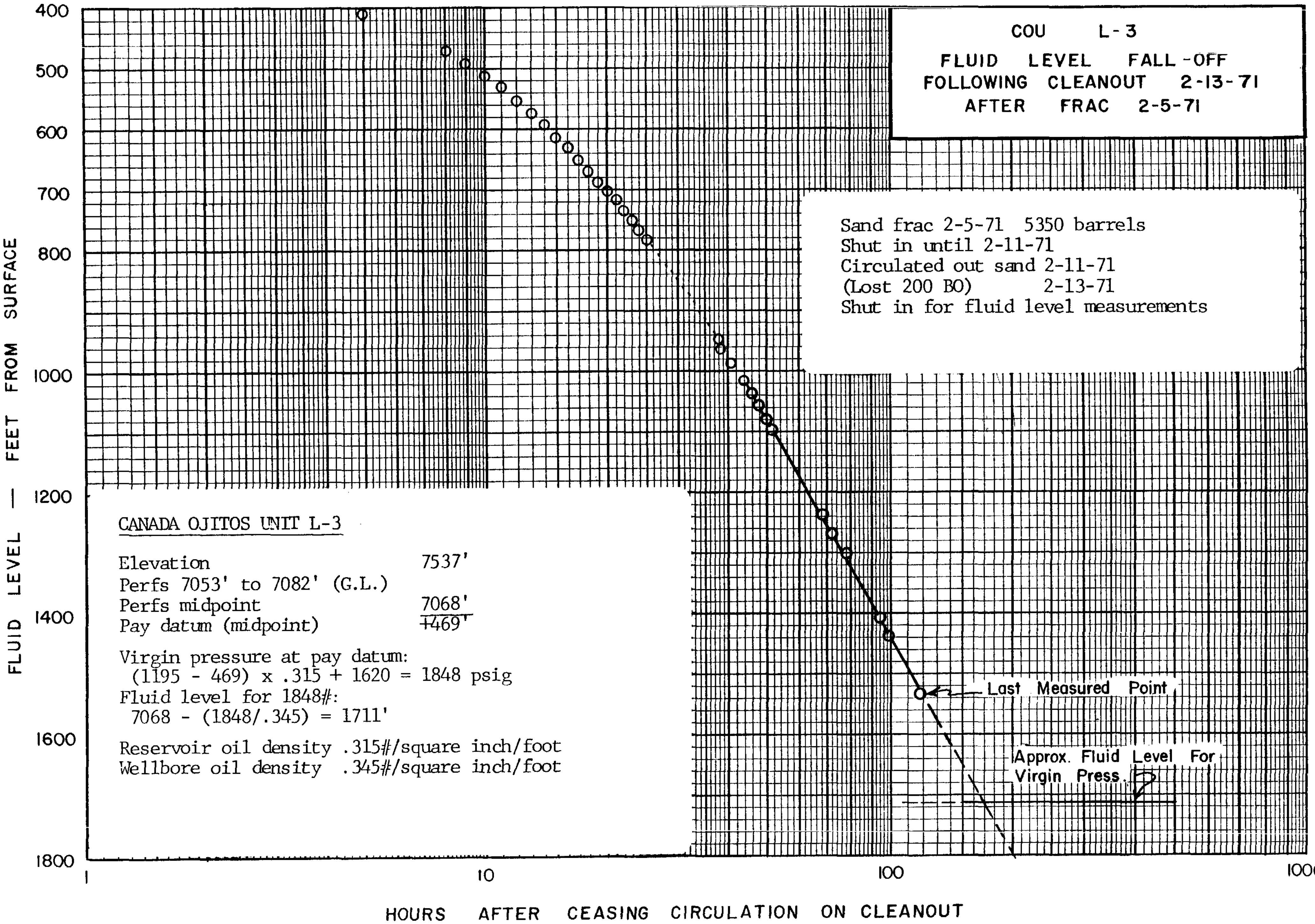

FLUID LEVEL FALL-OFF
CURVE
CAÑADA OJITOS UNIT NO. C-34
FOLLOWING
SAND FRAC TREATMENT
NOVEMBER 19, 1970
FLUID LEVEL — FEET FROM SURFACE
TIME AFTER FRAC TREATMENT — DAYS
PRESSURE @ DATUM OF + 1195
FLUID LEVEL
PRESSURE
1295# AT 12 DAYS
1286# AT 18 DAYS
1283# AT 39 DAYS

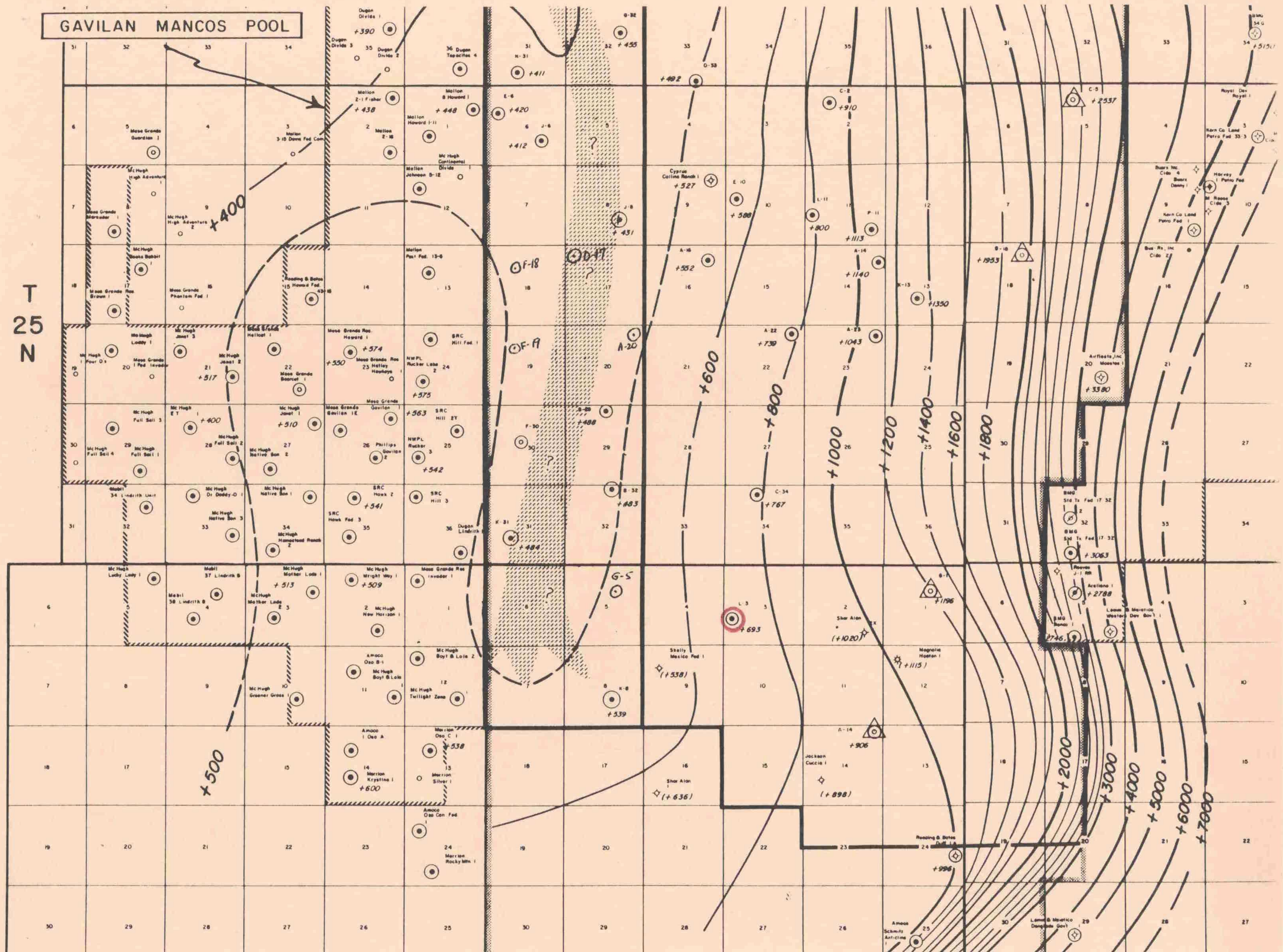

GAVILAN MANCOS POOL
T
25
N
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000
F-18
D-17
F-19
A-20
G-5
C-34
+767

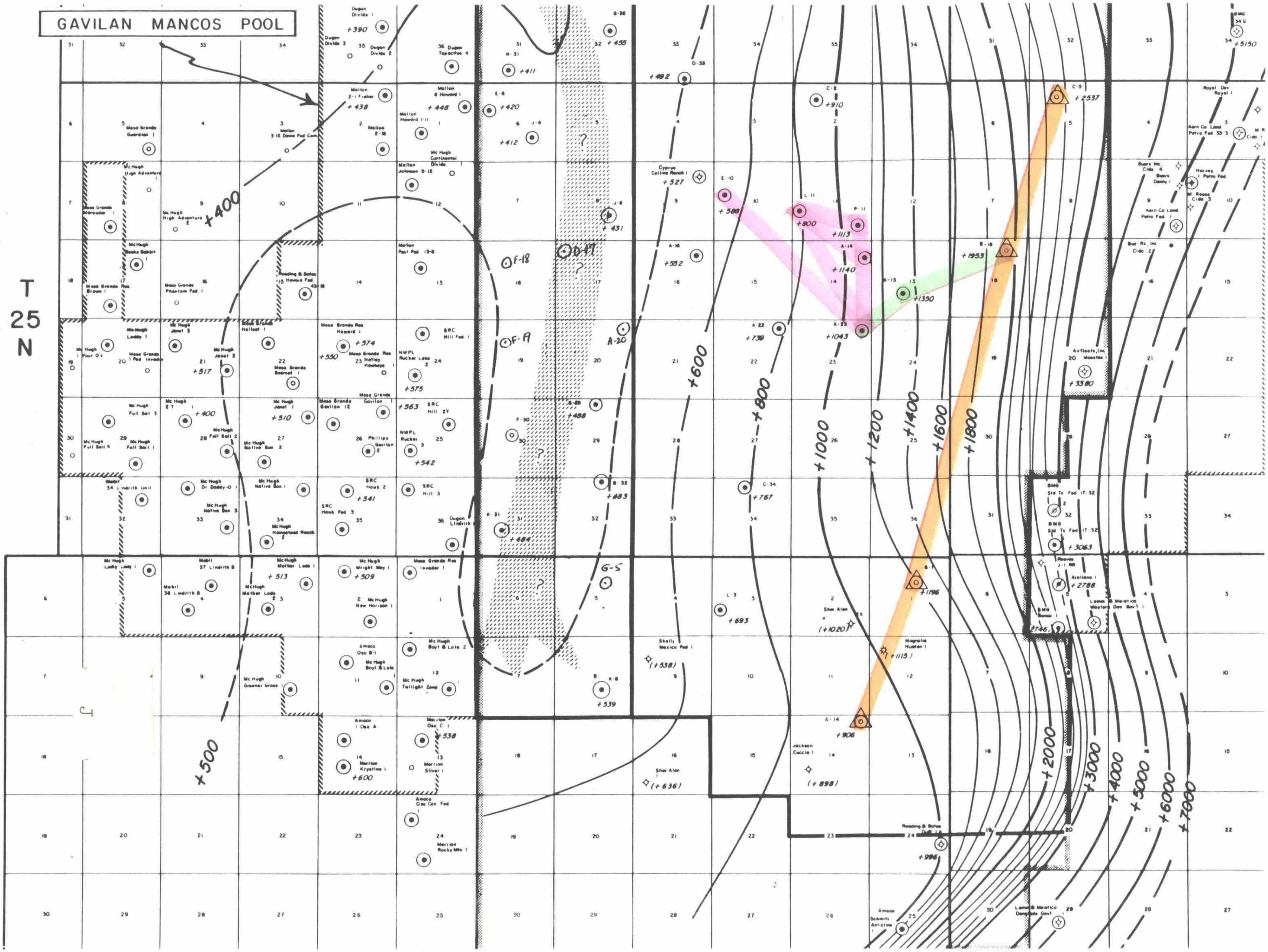

FLUID LEVEL FALL-OFF
CURVE
CAÑADA OJITOS UNIT NO. G-1
FOLLOWING
SAND FRAC TREATMENT
APRIL 13, 1971
RE-ZERO METER BHP 1811.6 (+1195)
FLUID LEVEL EQUIVALENT TO RESERVOIR VIRGIN PRESS. OF 1620 #
AT + 1195 DATUM
BHP 1563.1 (+1195)
FLUID LEVEL — FEET FROM SURFACE
DAYS AFTER FRAC
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
15
20
30
40
50
60
70
80
90
100
120
140

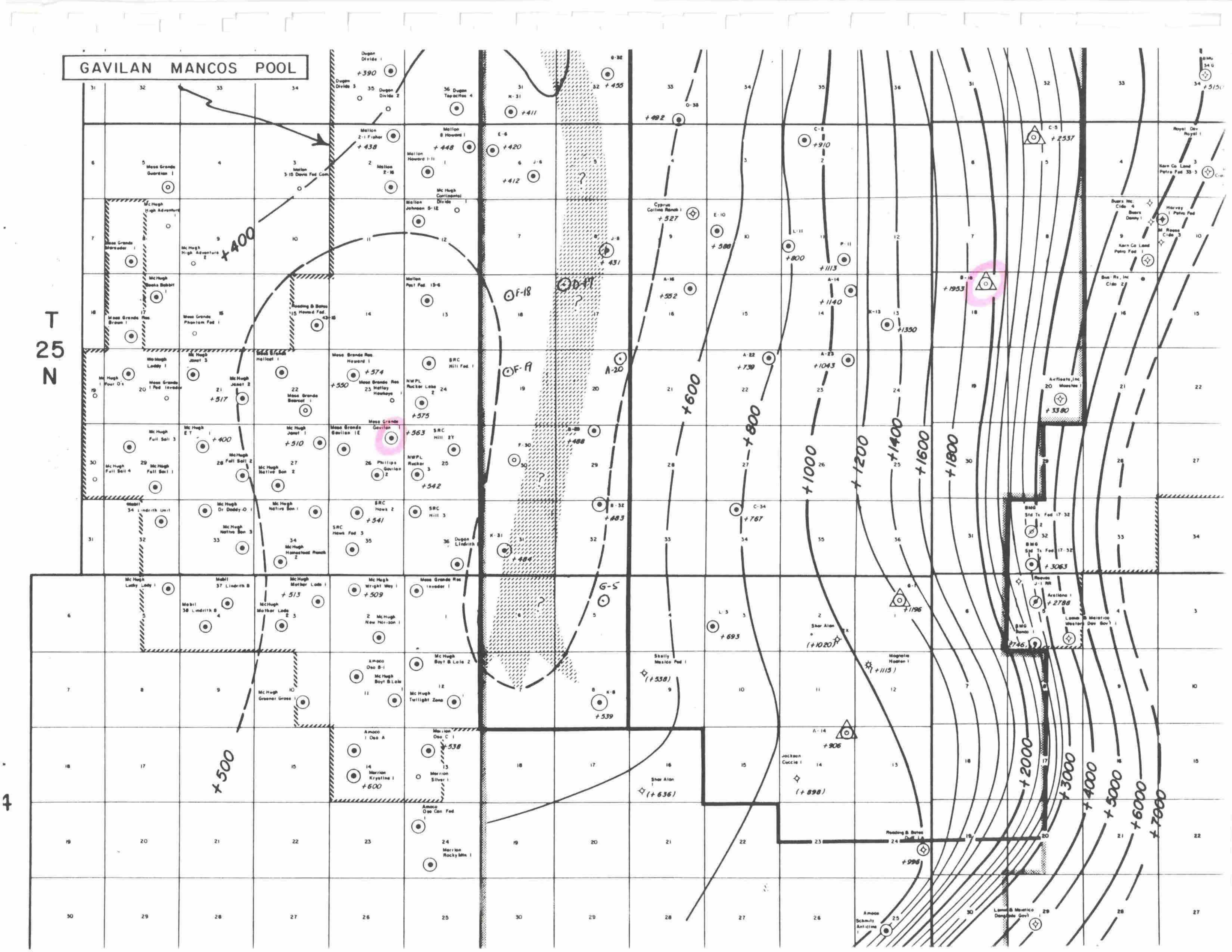


GAVILAN MANCOS POOL
T
25
N
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000

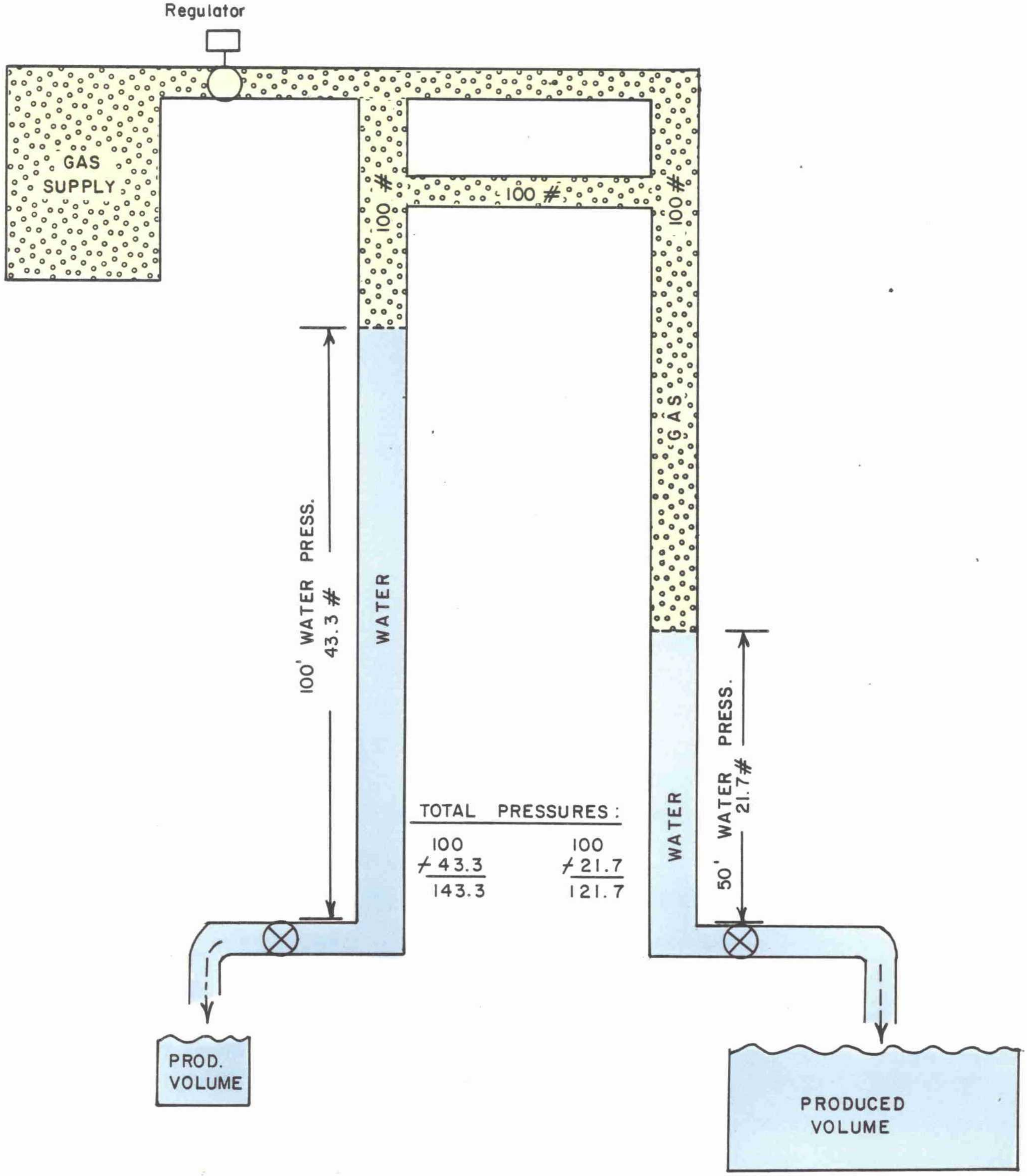

COU L-3
FLUID LEVEL FALL-OFF
FOLLOWING CLEANOUT 2-13-71
AFTER FRAC 2-5-71
Sand frac 2-5-71 5350 barrels
Shut in until 2-11-71
Circulated out sand 2-11-71
(Lost 200 BO) 2-13-71
Shut in for fluid level measurements
CANADA OJITOS UNIT L-3
Elevation 7537'
Perfs 7053' to 7082' (G.L.)
Perfs midpoint 7068'
Pay datum (midpoint) +469'
Virgin pressure at pay datum:
(1195 - 469) x .315 + 1620 = 1848 psig
Fluid level for 1848#:
7068 - (1848/.345) = 1711'
Reservoir oil density .315#/square inch/foot
Wellbore oil density .345#/square inch/foot
Last Measured Point
Approx. Fluid Level For Virgin Press.
400
500
600
700
800
1000
1200
1400
1600
1800
FLUID LEVEL — FEET FROM SURFACE
1
10
100
HOURS AFTER CEASING CIRCULATION ON CLEANOUT


GAVILAN MANCOS POOL
T
25
N
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000
F-18
D-17
F-19
A-20
G-5


GAVILAN MANCOS POOL
T 25 N
T 24 N
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000


GAVILAN MANCOS POOL
T 25 N
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000

SKETCH SHOWING VARIABLE PRESSURES IN VERTICAL PIPES WHICH ARE EQUALIZED AT TOP

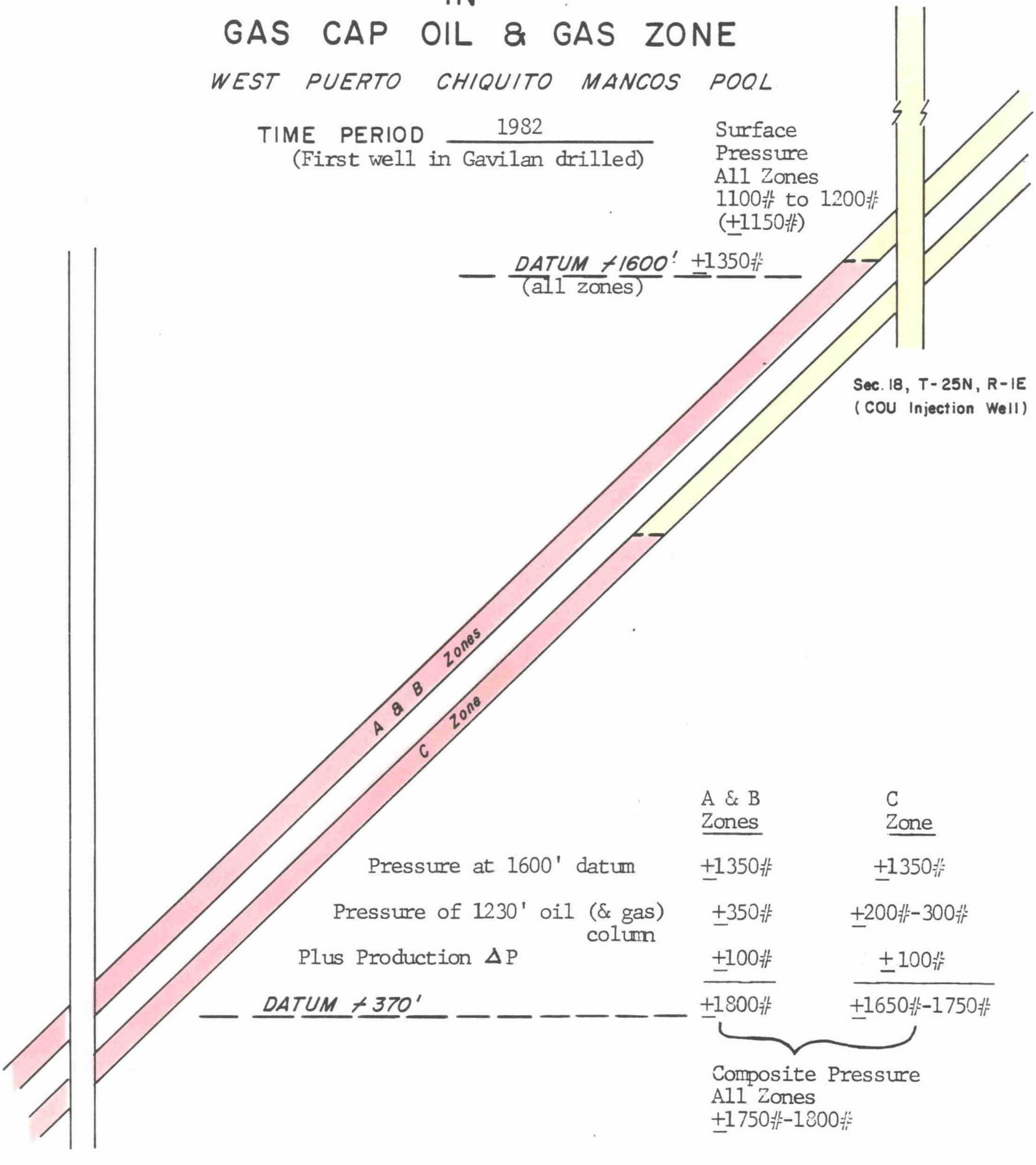


2-87 CS

SKETCH SHOWING PRESSURES IN GAS CAP OIL & GAS ZONE

WEST PUERTO CHIQUITO MANCOS POOL

TIME PERIOD 1982
(First well in Gavilan drilled)



	A & B Zones	C Zone
Pressure at 1600' datum	±1350#	±1350#
Pressure of 1230' oil (& gas) column	±350#	±200#-300#
Plus Production ΔP	±100#	±100#
DATUM +370'	±1800#	±1650#-1750#

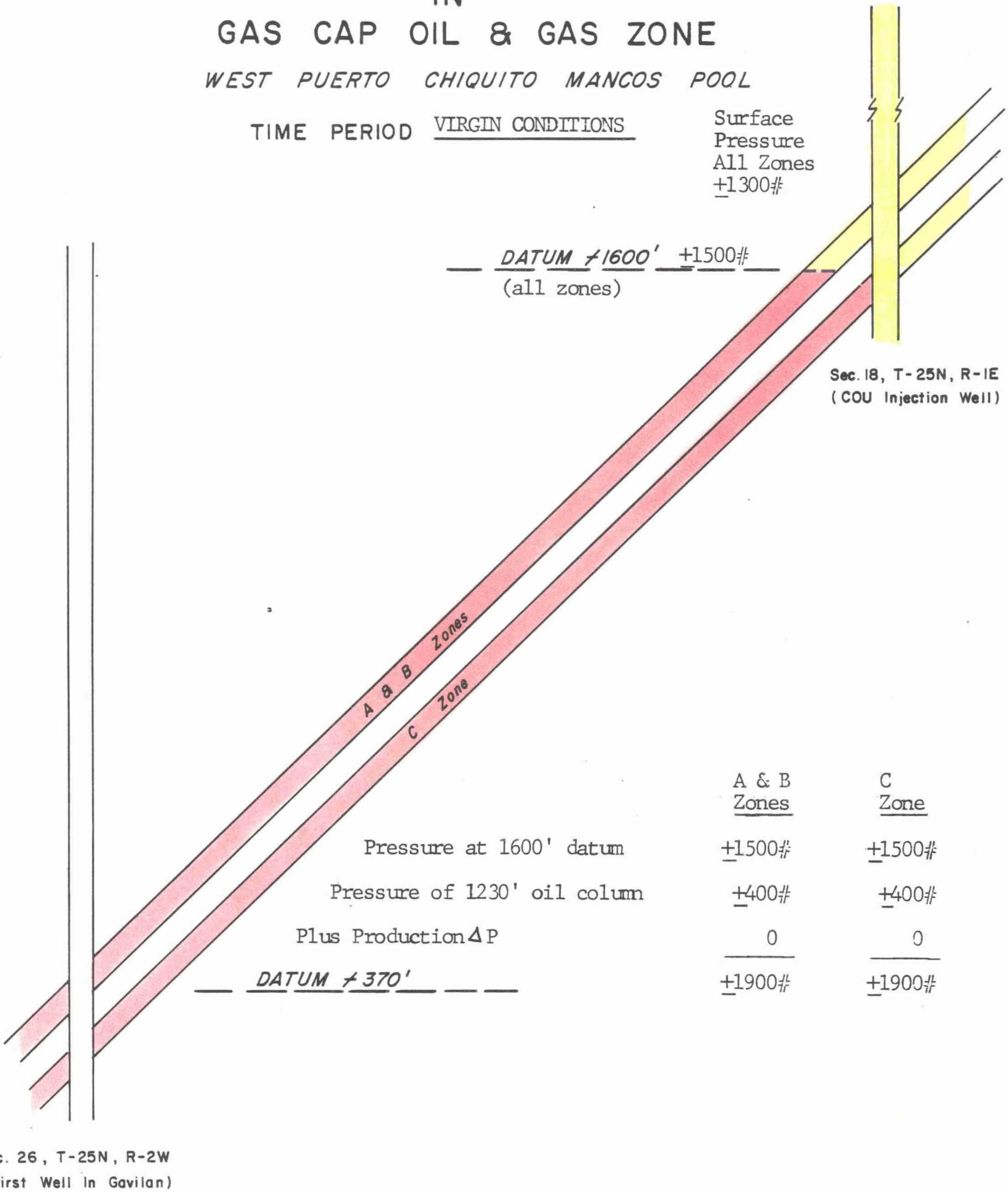
Composite Pressure
All Zones
±1750#-1800#

2-87 cs

SKETCH SHOWING PRESSURES IN GAS CAP OIL & GAS ZONE

WEST PUERTO CHIQUITO MANCOS POOL

TIME PERIOD VIRGIN CONDITIONS



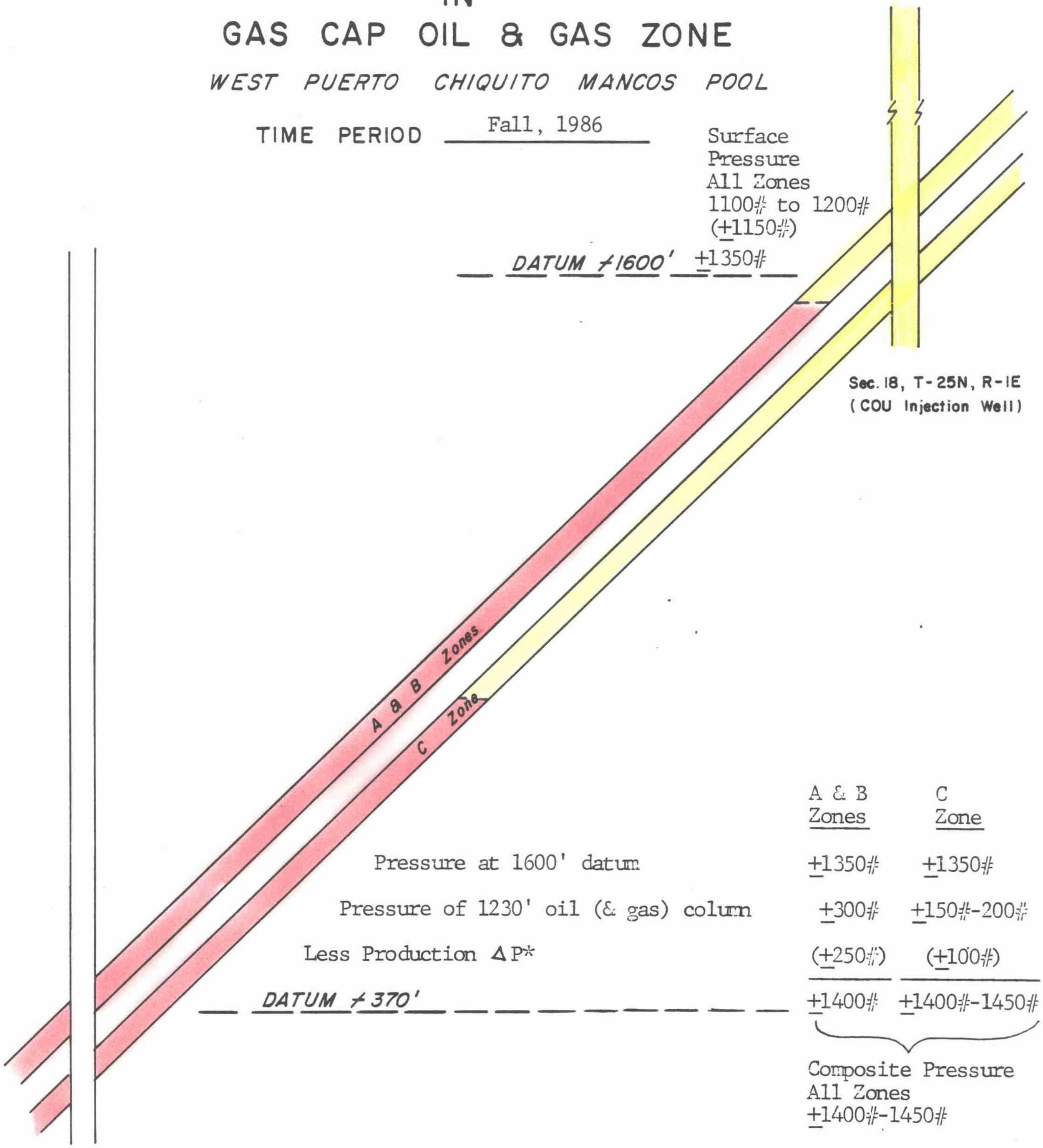
	A & B Zones	C Zone
Pressure at 1600' datum	±1500#	±1500#
Pressure of 1230' oil column	±400#	±400#
Plus Production ΔP	0	0
DATUM +370'	±1900#	±1900#

2-87 cs

SKETCH SHOWING PRESSURES IN GAS CAP OIL & GAS ZONE

WEST PUERTO CHIQUITO MANCOS POOL

TIME PERIOD Fall, 1986

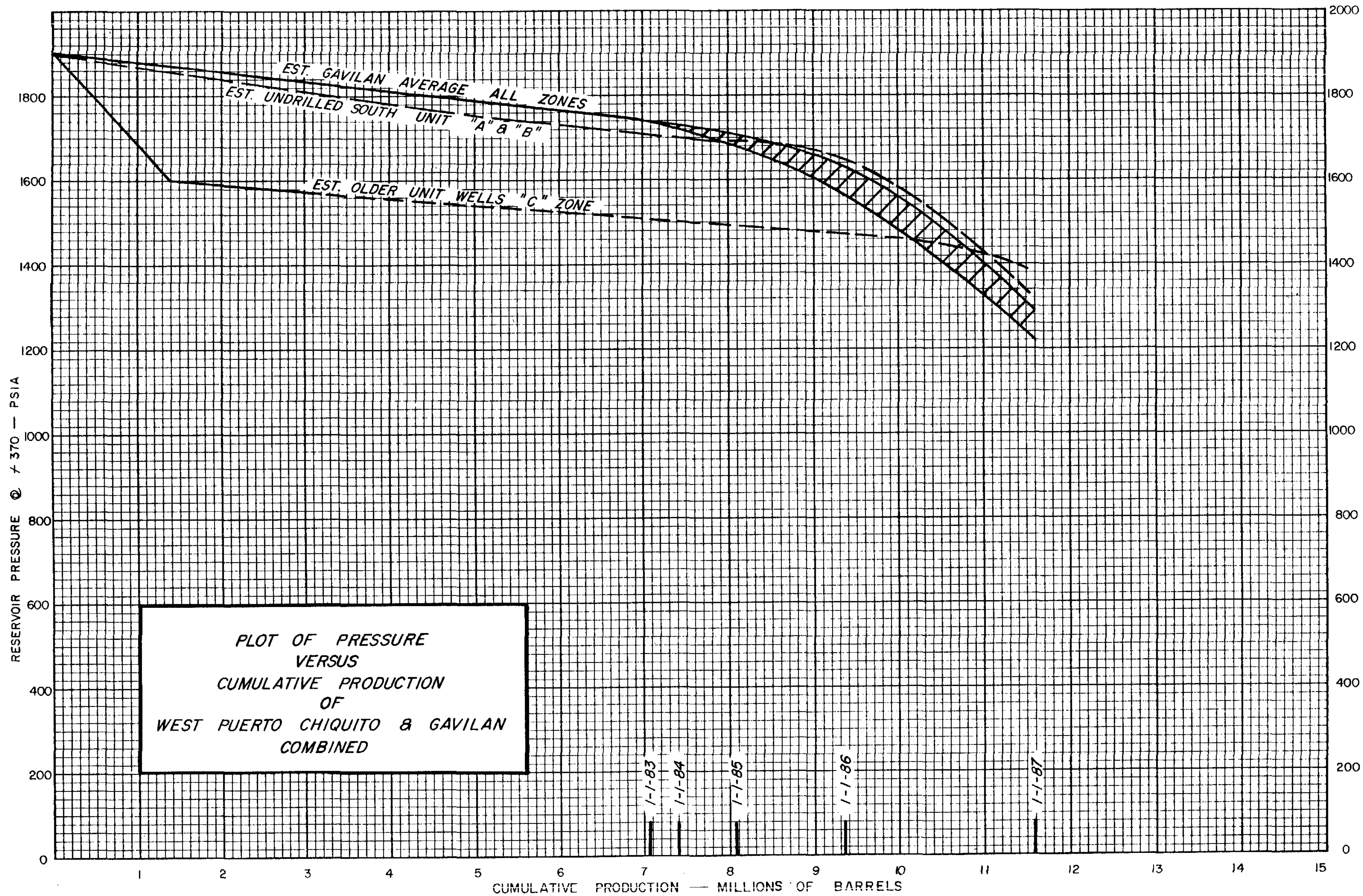


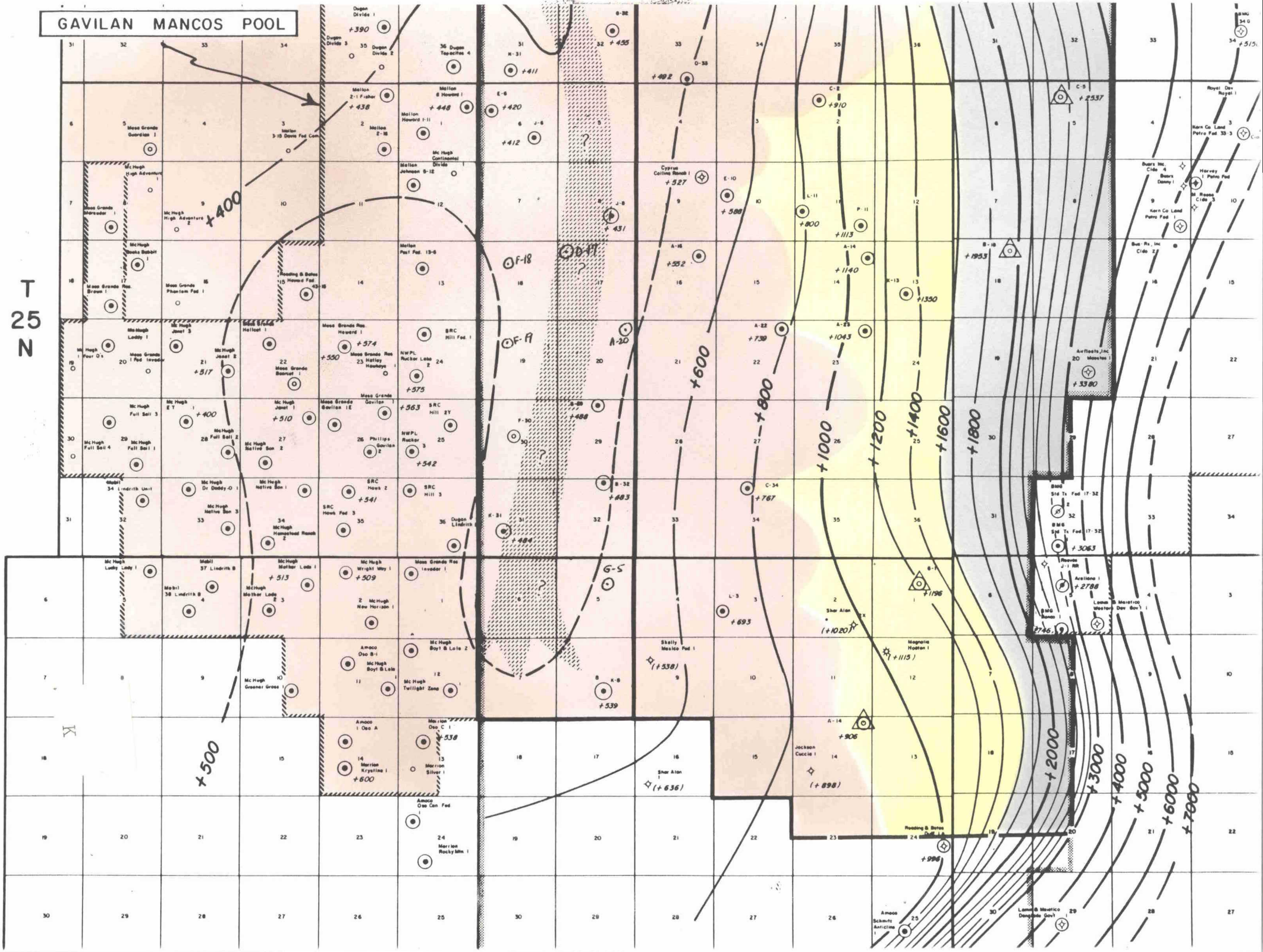
	A & B Zones	C Zone
Pressure at 1600' datum	±1350#	±1350#
Pressure of 1230' oil (& gas) column	±300#	±150#-200#
Less Production ΔP*	(±250#)	(±100#)
DATUM +370'	±1400#	±1400#-1450#

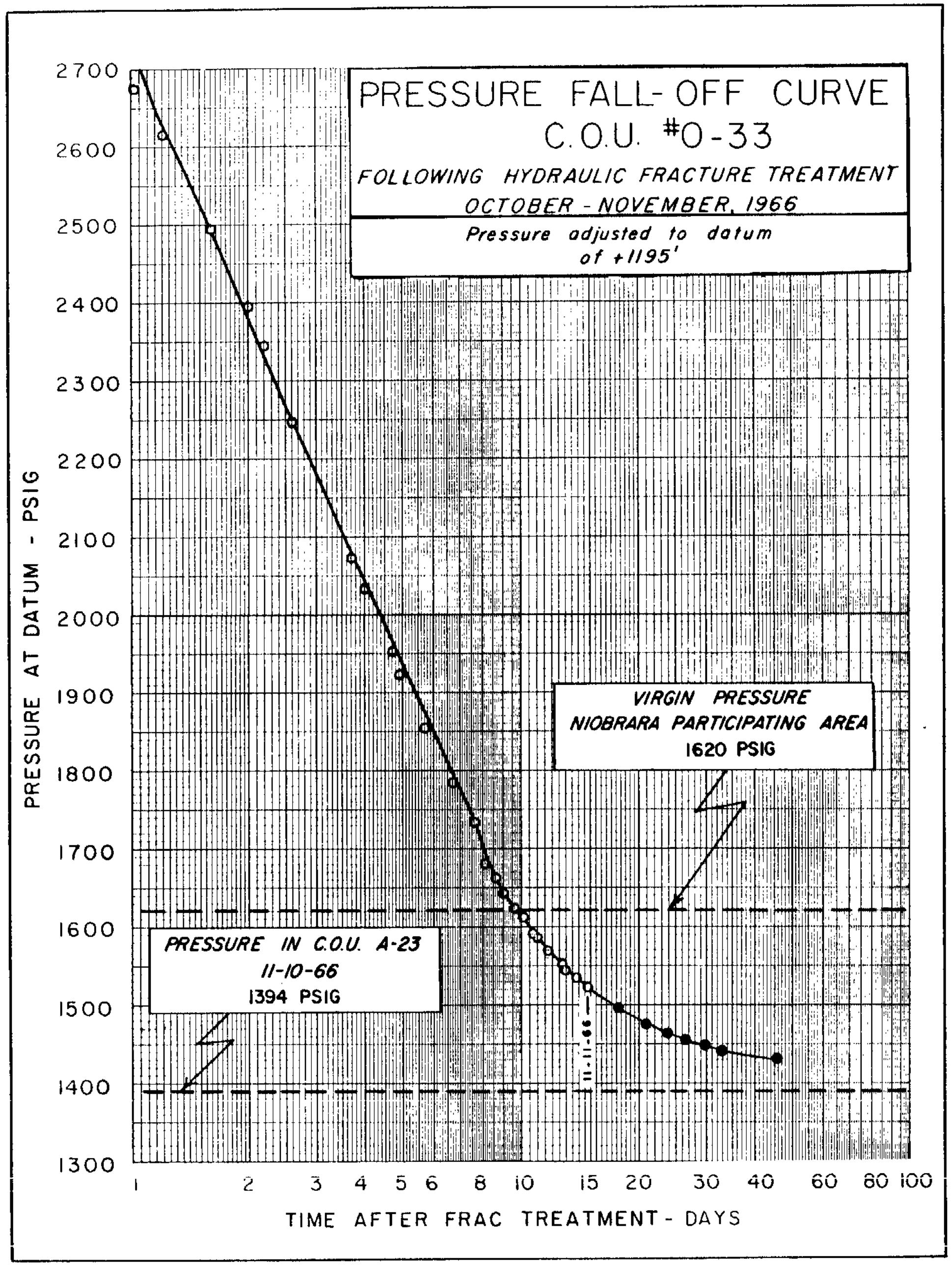
Composite Pressure
All Zones
±1400#-1450#

* Pressure differential reversed from that of previous sketches
(Gavilan withdrawals now 10,000 to 20,000 reservoir bbls/day)
(Canada Ojitos Unit net withdrawals zero to 1000 reservoir bbls/day)

2-87 cs

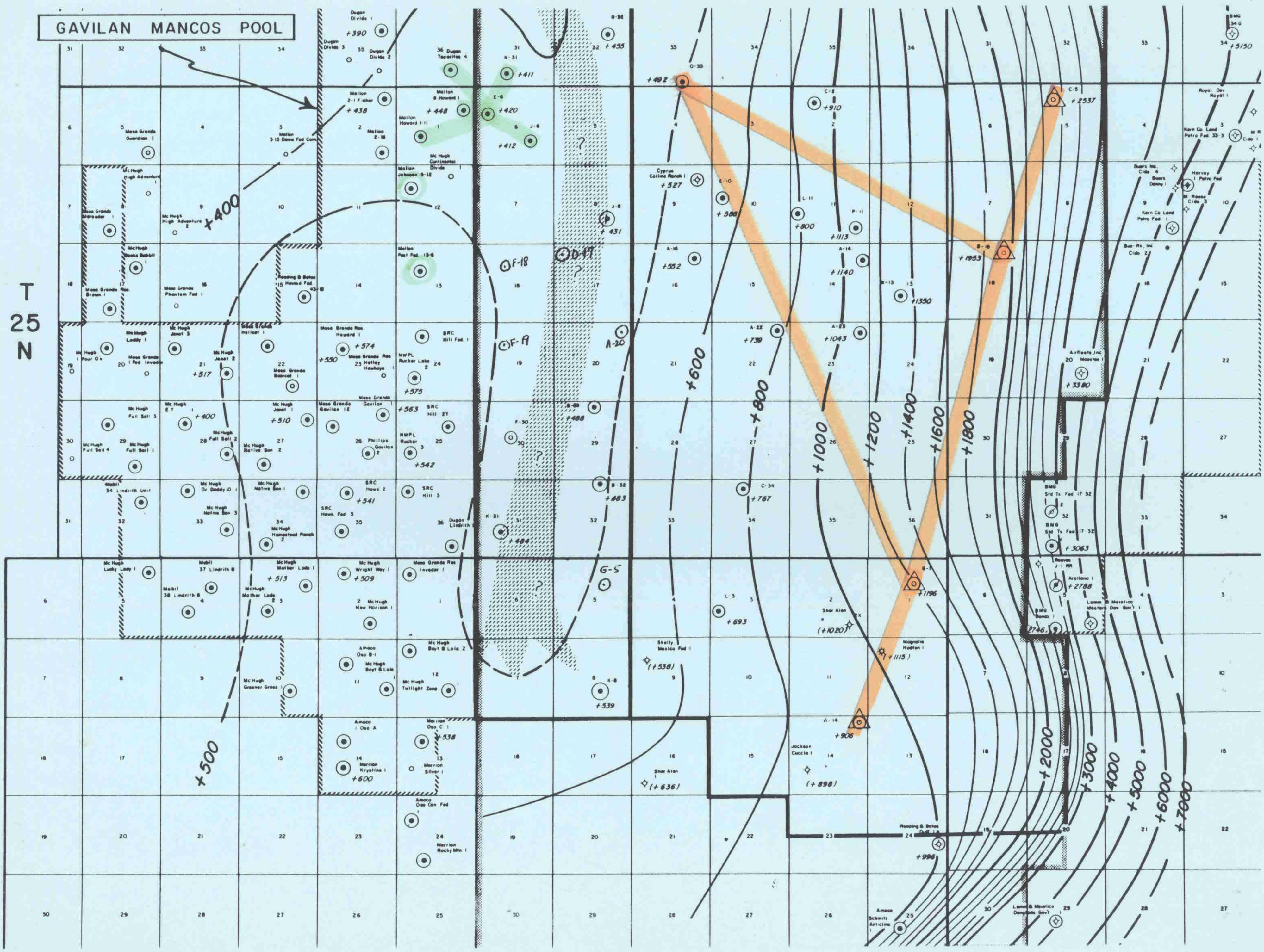

PLOT OF PRESSURE
VERSUS
CUMULATIVE PRODUCTION
OF
WEST PUERTO CHIQUITO & GAVILAN
COMBINED
EST. GAVILAN AVERAGE ALL ZONES
EST. UNDRILLED SOUTH UNIT "A" & "B"
EST. OLDER UNIT WELLS "C" ZONE
1-1-83
1-1-84
1-1-85
1-1-86
1-1-87
RESERVOIR PRESSURE @ +370 — PSIA
CUMULATIVE PRODUCTION — MILLIONS OF BARRELS
0
200
400
600
800
1000
1200
1400
1600
1800
2000
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15


GAVILAN MANCOS POOL
T 25 N
T 24 N
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000

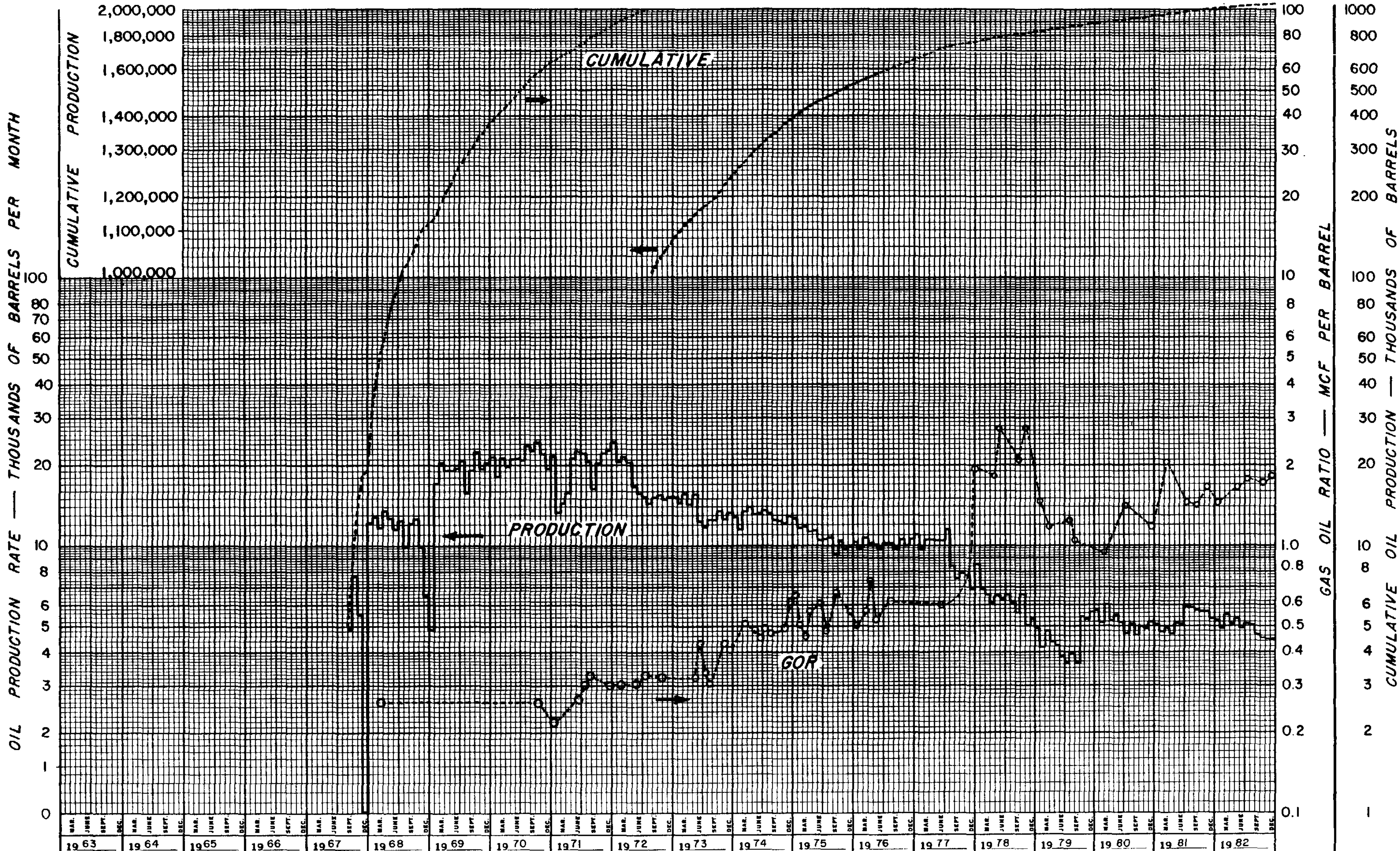


PRESSURE FALL-OFF CURVE
C.O.U. #O-33
FOLLOWING HYDRAULIC FRACTURE TREATMENT
OCTOBER - NOVEMBER, 1966
Pressure adjusted to datum of +1195'
VIRGIN PRESSURE
NIOBRARA PARTICIPATING AREA
1620 PSIG
PRESSURE IN C.O.U. A-23
11-10-66
1394 PSIG
11-11-66
PRESSURE AT DATUM - PSIG
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
TIME AFTER FRAC TREATMENT - DAYS
1
2
3
4
5
6
8
10
15
20
30
40
60
80
100

77A



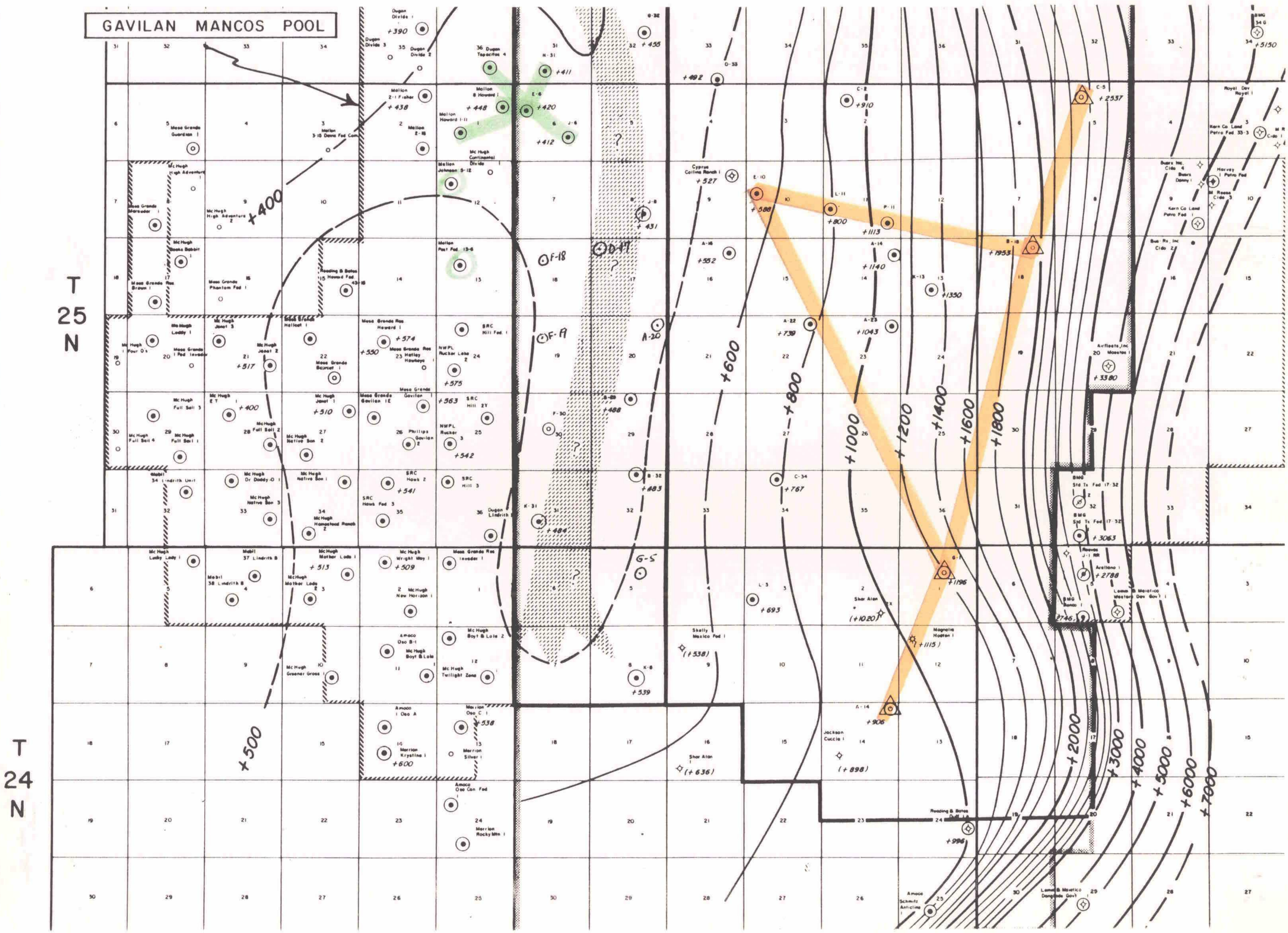
GAVILAN MANCOS POOL
T 25 N
T 24 N
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000



PRODUCTION HISTORY
CANADA OJITOS UNIT WELL E-10

S. 10 - 25N - 1W

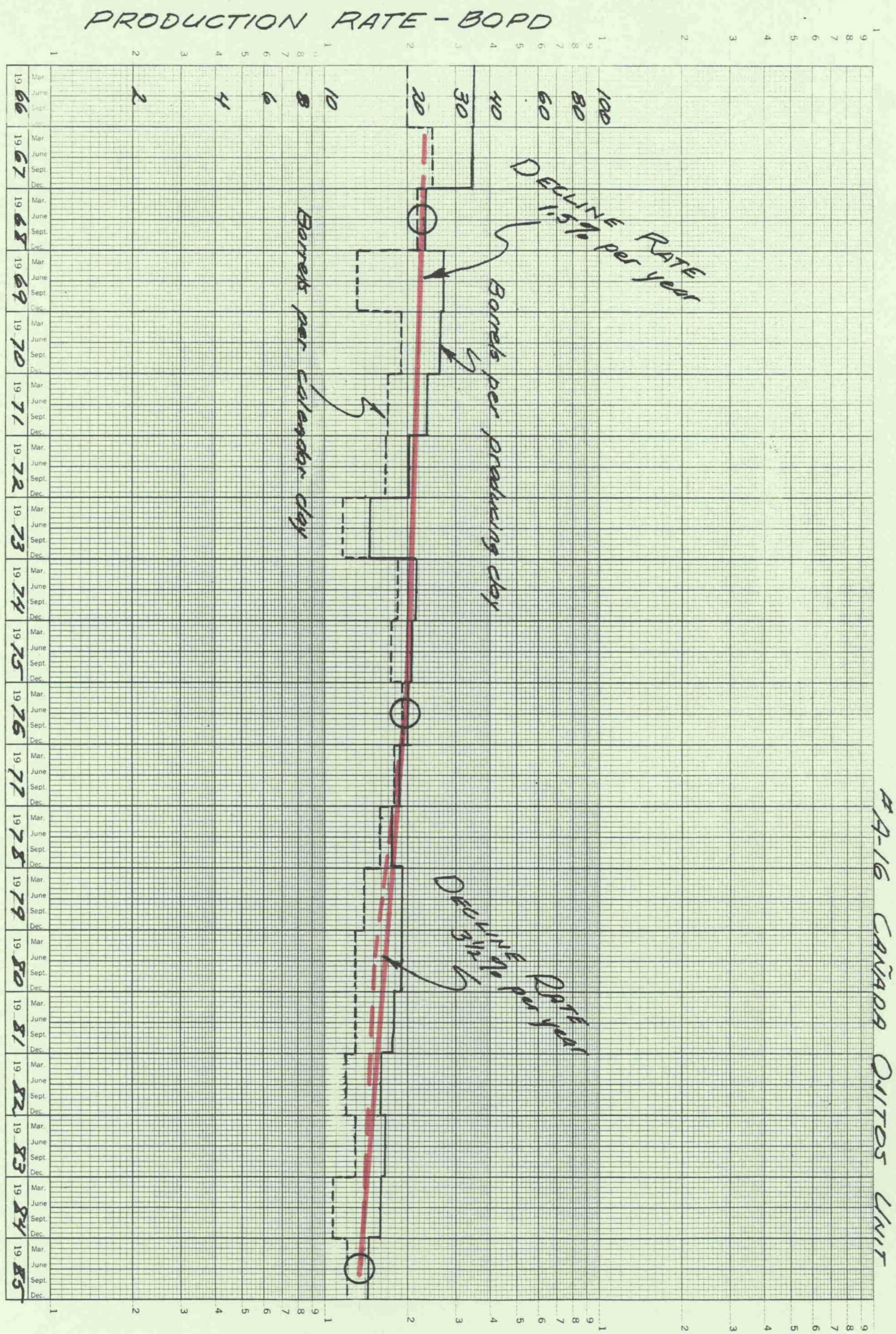
C.O.U. E-10
PRODUCTION
HISTORY

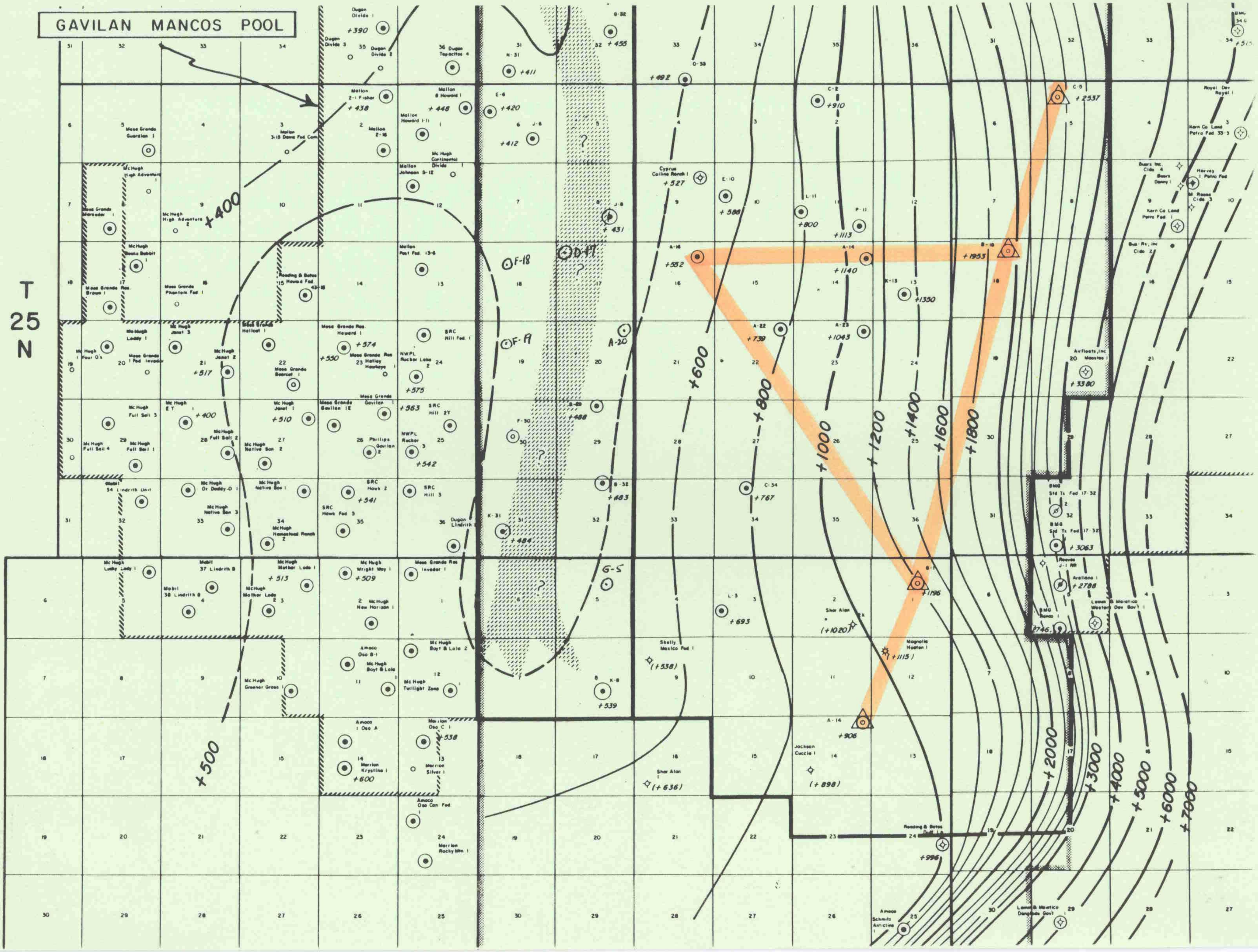


GAVILAN MANCOS POOL
T 25 N
T 24 N
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000

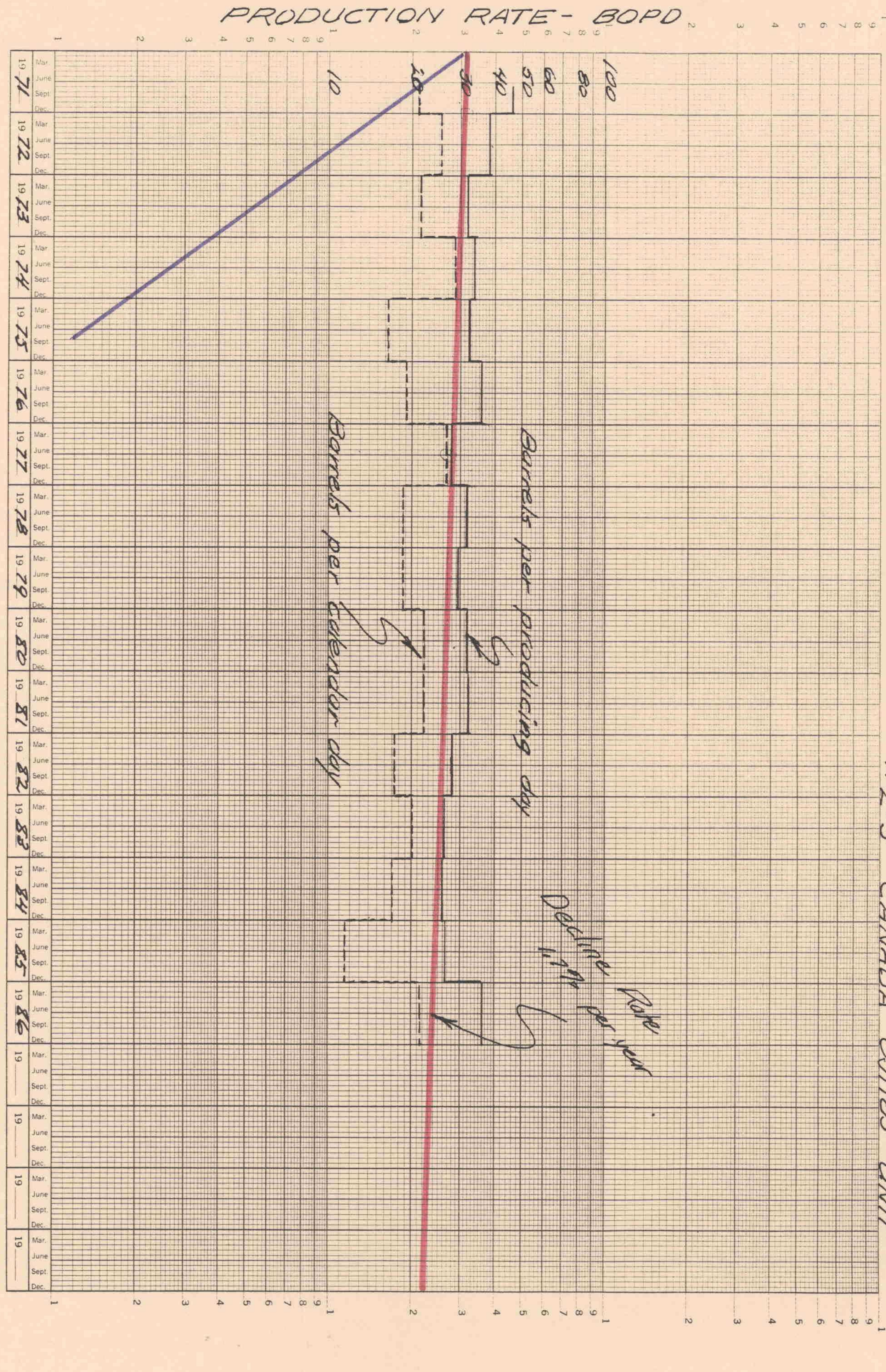
K+E 20 YEARS BY MONTHS X 3 LOG CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

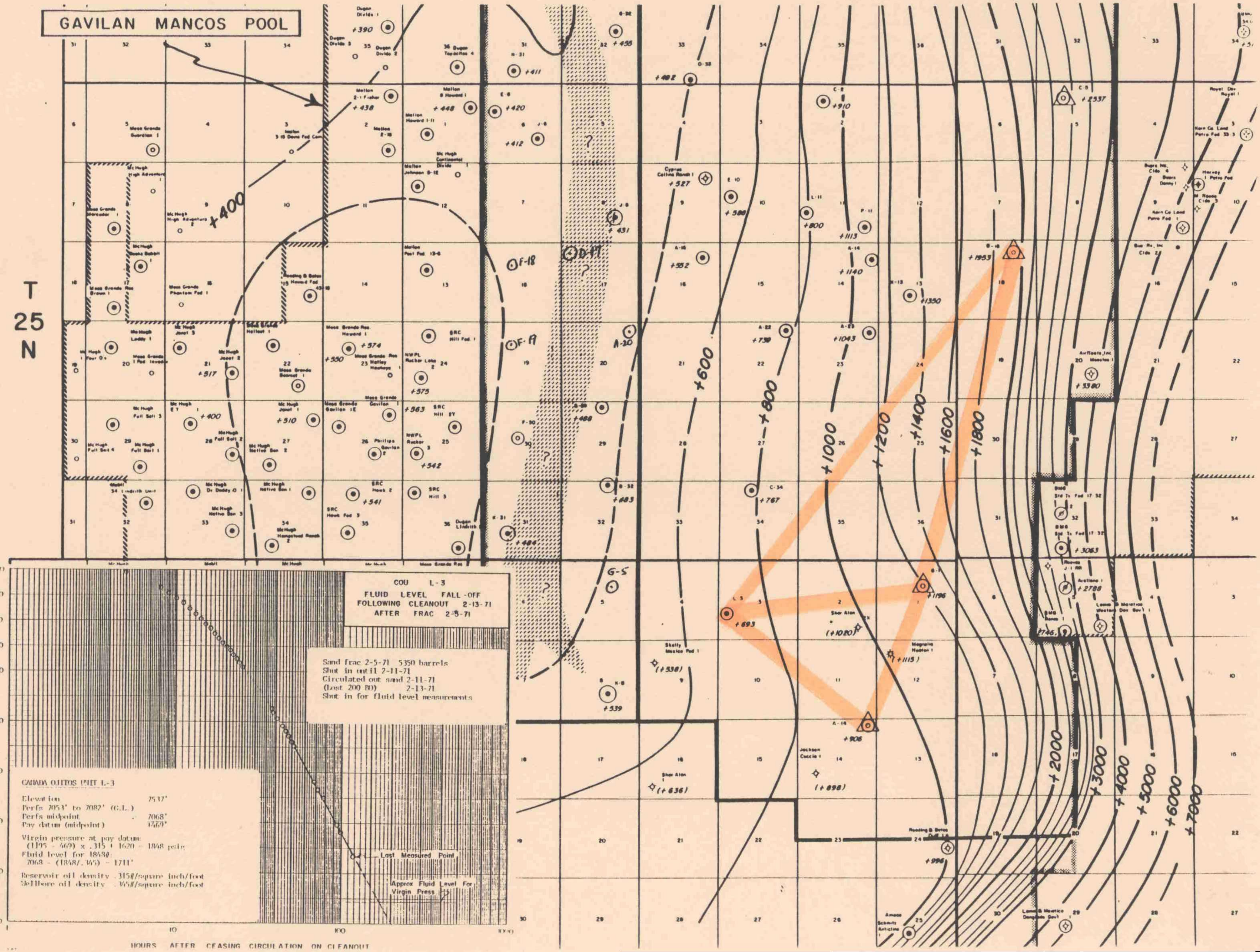
47 6843





GAVILAN MANCOS POOL
T 25 N
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000


PRODUCTION RATE - BOPD
10
20
30
40
50
60
80
100
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
Mar.
June
Sept.
Dec.
Barrels per calendar day
Barrels per producing day
Decline Rate
1.7% per year
#L-3 CAÑADA QUITOS UNIT

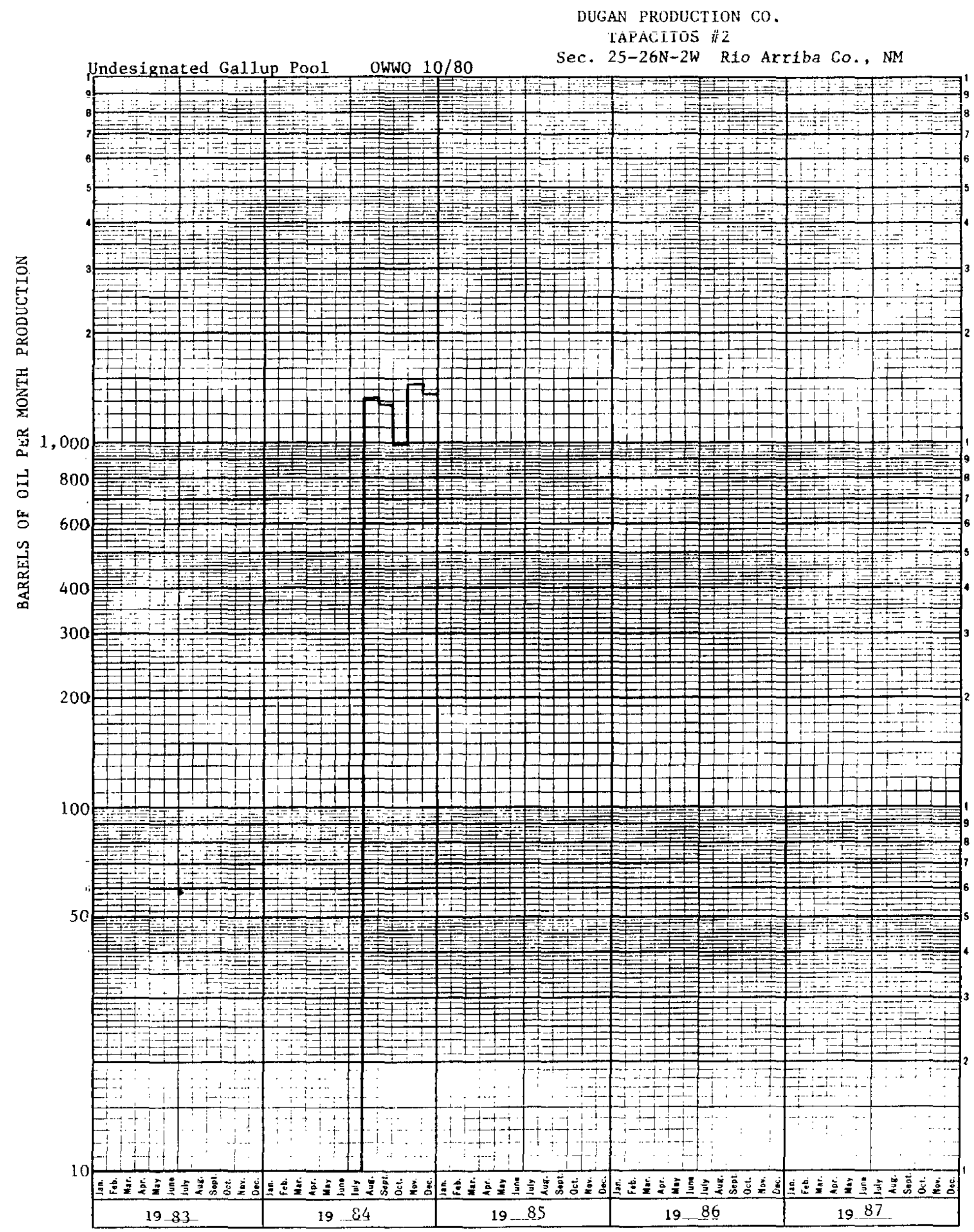


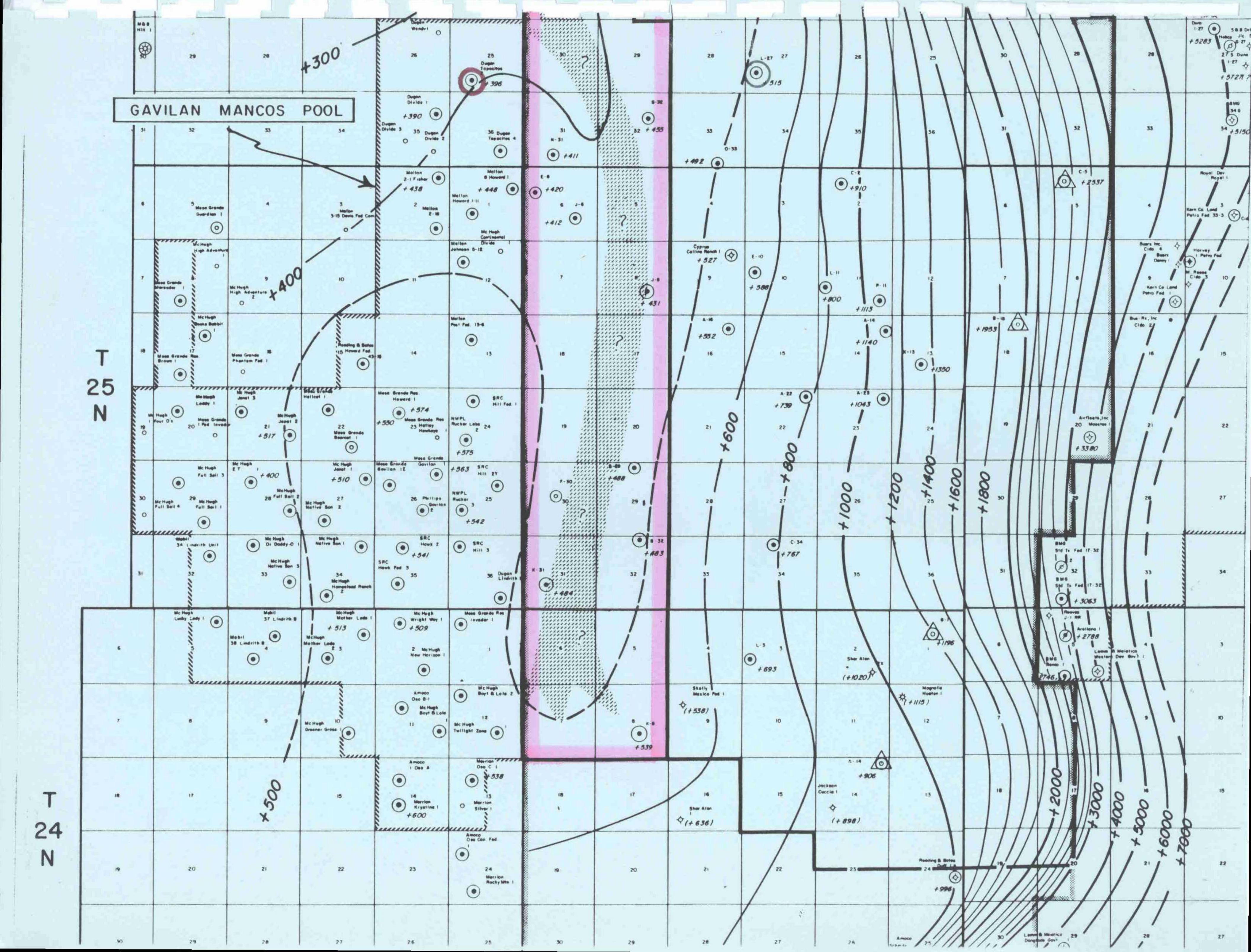
GAVILAN MANCOS POOL
T
25
N
+400
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000
COU L-3
FLUID LEVEL FALL-OFF
FOLLOWING CLEANOUT 2-13-71
AFTER FRAC 2-5-71
Sand frac 2-5-71 5350 barrels
Shut in until 2-11-71
Circulated out sand 2-11-71
(Lost 200 BO) 2-13-71
Shut in for fluid level measurements
CANADA OJITOS UNIT L-3
Elevation 7537'
Perfs 7053' to 7082' (G.L.)
Perfs midpoint 7068'
Pay datum (midpoint)
Virgin pressure at pay datum
(1195 - 469) x .315 + 1620 = 1848 psig
Fluid level for 1848#:
7068 - (1848/.365) = 1711'
Reservoir oil density .315#/square inch/foot
Wellbore oil density .365#/square inch/foot
Last Measured Point
Approx Fluid Level For Virgin Press
FLUID LEVEL — FEET FROM SURFACE
HOURS AFTER CEASING CIRCULATION ON CLEANOUT

EVIDENCE OF COMMUNICATION: DUGAN TAPACITOS AREA

The flat production decline rate for the Tapacitos 2 in the last half of 1984 suggests that it is completed in a fractured reservoir. The well was producing on pump below a packer on the tubing: meaning that its production rate will be particularly sensitive to either increasing gas-oil ratio or decreasing reservoir pressure. Under these conditions, the flat production decline rate is particularly significant in defining the reservoir as being of the same fractured nature as found in West Puerto Chiquito.

This production behavior plus the similar electric log characteristics in the Niobrara B zone strongly suggested that the Niobrara reservoir of West Puerto Chiquito extended west to the Dugan Tapacito area at the time the application was made for approval of the 13th expansion of the participating area in the Canada Ojitos Unit. This was part of the evidence submitted to the authorities in requesting approval of the 13th expansion of the participating area (that part of the 13th expansion located on the plat on the facing page is outlined thereon).




GAVILAN MANCOS POOL
T 25 N
T 24 N
+300
+400
+500
+600
+800
+1000
+1200
+1400
+1600
+1800
+2000
+3000
+4000
+5000
+6000
+7000

MALLON AREA: EVIDENCE OF COMMUNICATION

In both formal hearings and informal meetings of the Oil Conservation Division, both Mallon and Koch have emphasized their "exploratory" efforts and the discovering of "new reserves" in the Gavilan area and the consequent importance of these efforts to the State of New Mexico.

However, analysis of the communication data of the Mallon area reveals something else: namely, Mallon's first wells were drilled in a partially depleted reservoir discovered some 25 years earlier.

Mallon's first well was hardly more than a direct offset to the 13th expansion of the Canada Ojitos Unit participating area - an expansion approved before Mallon started drilling this well; and for which expansion area the Canada Ojitos Unit owners had earlier approved a seven million dollar development program. (See plat on facing page.)