# 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).

Continental Divide + 8500'

Surface Elevation 7500'

Outcrop *East*
Elevation + 7000'

Barren
Zone ± 6100'

5600' 6300'

Well
Depth
7000'

+ 500'
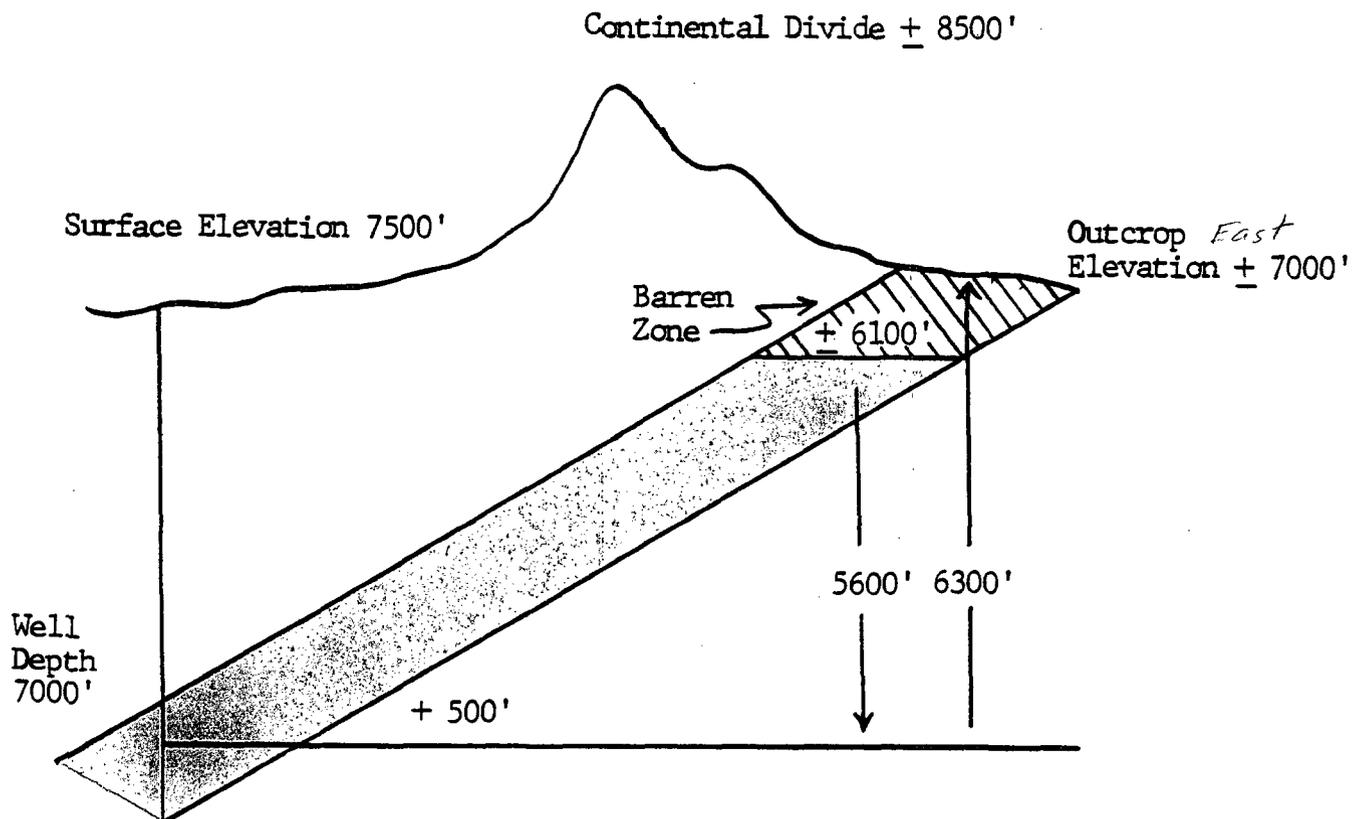
Reservoir pressure ± .33 psi/ft x 5600
= ± 1850#

PRESSURE PRODUCTION HISTORY
BOULDER MANCOS POOL
RIO ARRIBA COUNTY

LEGEND

△ Standard of Texas 4-26 #2,3,4 (datum +3300')

⊙ Mobil #12-14 (datum +3300')

☐ Mobil #23-14 (datum +3300')

✤ Standard of Texas 4-26 #5 (Gas Well) Sept. 1962
    measured BHP at 3600' depth

Remaining pressures estimated for 3600'
depth from surface pressures
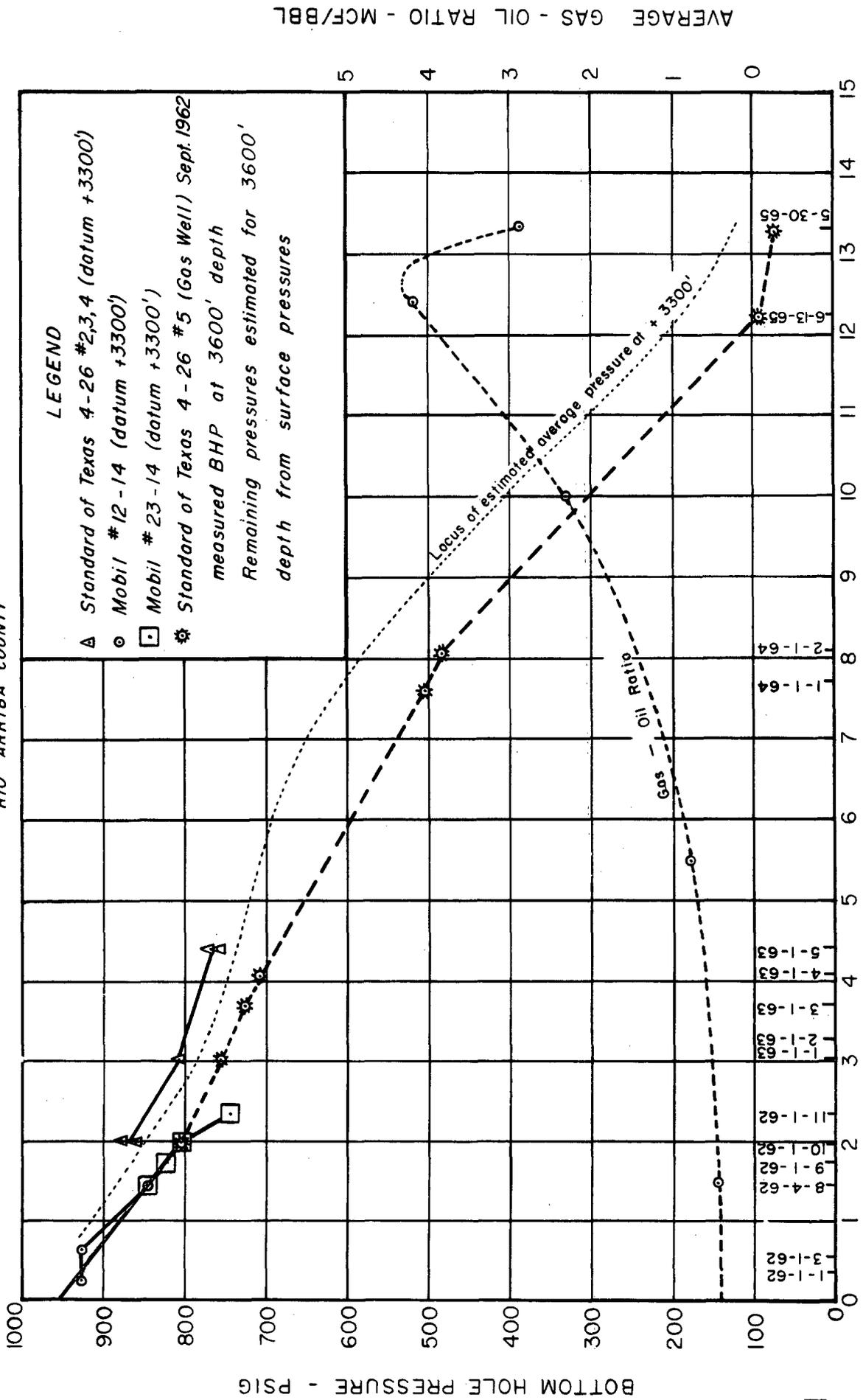
AVERAGE GAS - OIL RATIO - MCF/BBL

BOTTOM HOLE PRESSURE - PSIG

CUMULATIVE PRODUCTION - HUNDREDS OF THOUSANDS OF BARRELS

Locus of estimated average pressure at + 3300'

Gas — Oil Ratio

III - 1   15A

WILDHORSE GALLUP
(Gas)
T. 26 N., R. 3-4 W., NMPM
Rio Arriba County, New Mexico

By: Marvin L. Matheny
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GEOLOGY

Regional Setting: Southeast edge, San Juan Basin

Surface Formations: Tertiary, San Jose Formation

Exploration Method Leading to Discovery: Subsurface geology

Type of Trap: Stratigraphic

Producing Formation: Cretaceous, "Gallup" sandstone

Gross Thickness and Lithology of Reservoir Rocks: 20 feet, fine- to medium-grained sandstone

Geometry of Reservoir Rock: Northwest trending linear offshore sandstone bodies

Other Significant Shows: Cretaceous, Pictured Cliffs Sandstone, Mesaverde Group, and Dakota Sandstone also produce gas

Oldest Stratigraphic Horizon Penetrated: Jurassic, Morrison Formation

DISCOVERY WELL

Name: Southern Union No. 6 Jicarilla "E"

Location: NW NE (890' FNL and 1650' FEL) sec. 21, T. 26 N., R. 4 W.

Elevation (KB): 6,796 feet

Date of Completion: January 6, 1957

Total Depth: 8,023 feet (Morrison Formation)

Production Casing: 5½" at 8,022 feet with 300 sacks of cement

Perforations: 7,140 feet to 7,153 feet with 52 shots

Stimulation: None, natural completion

Initial Potential: 5,663 MCFGD and light spray distillate

Bottom Hole Pressure: 1,732 psi (shut-in casing pressure, 7 day test)

DRILLING AND COMPLETION PRACTICES

Completion practices vary considerably within the field area because there are four producing horizons. Dual completions are common practice. 10¼" surface casing is usually set at around 250 feet with around 200 sacks of cement. 7 5/8" intermediate casing is set through the Pictured Cliffs Sandstone with about 250 sacks of cement and 5½" production casing is set at total depth with about 400 sacks of cement. A 5½" liner is often hung in the 7 5/8" intermediate casing instead of running a full production string. The dual completions may be almost any combination of Pictured Cliffs, Mesaverde, "Gallup," and Dakota pay horizons. Most completion techniques utilize individual zone treatments with perforations and sandwater fracture treatments. An average fracture treatment would be about 40,000 gallons of treated water and 40,000 lbs of sand. Breakdown pressures are usually around 2,000 psi with injection rates of 50 barrels per minute.

RESERVOIR DATA

Productive Area:
    Proved (as determined geologically): 3,840 acres
    Unproved: Unknown
    Approved Spacing: 160 acres
    No. of Producing Wells: 13
    No. of Abandoned Wells: 1
    No. of Dry Holes: 0

Average Net Pay: 15 feet

Porosity: 15 percent (average)

Permeability: 82 millidarcies (average)

Water Saturation: 31 percent (average)

Initial Field Pressure: 1,732 psi

Type of Drive: Gas expansion

Gas Characteristics and Analysis: (Wet basis 14.7 psi at 60°F) Btu 1,231; specific gravity .725; liquids 2.447 gallons per MCFG; (composition by molecular percentage) carbon dioxide .80, hydrogen sulfide nil, nitrogen .21, methane 79.28, ethane 11.75, propane 4.54, butane through hexane 3.42

Oil Characteristics and Analysis: 65° API gravity, low sulfur, sweet

Associated Water Characteristics and Analysis: None

Original Gas, Oil, and Water Contact Datums: None

Estimated Primary Recovery: 37,000,000 MCFG (75 percent), 190,000 BO

Type of Secondary Recovery: None

Estimated Ultimate Recovery: same as primary recovery

Present Daily Average Production: 2,913 MCFGD, 17 BOD

Market Outlets: Gas: Northwest Pipeline Corporation, Gas Company of New Mexico; oil: Plateau Incorporated

FIELD COMMENTARY

The Wildhorse Gallup gas field is in the southern part of the San Juan Basin about 28 miles north and slightly west of Cuba, New Mexico. It produces from the lower part of the Tocito Sandstone Lentil of the Mancos Shale or "Gallup" sandstone. The producing horizon is the upper of two sandstone units which form an extensive trend across the southwest flank of the San Juan Basin. Only the upper unit is present at Wildhorse. Both units are northwest trending linear offshore deposits. Where both are present, they are parallel and are often in vertical alignment, with about forty feet of marine shale in between. Their distribution and lithologic character are similar, but they differ slightly in geometry and origin. The lower unit was deposited on a pre-Niobrara erosion surface in linear topographic depressions which were probably formed by longshore currents. It is asymmetrical with an abrupt landward pinchout to the southwest. The upper sandstone is an offshore bar-type unit which was deposited on the marine shale that buried the pre-Niobrara erosion surface and overlying lower pay sandstone.

CALCULATE BHP WILD HORSE GALLUP
DISC. WELL 5,4, #6 JIL "E" ELEV. 6796 KB

COMPONENT	MOLE FRACTION	OR CRIT TEMP	PSIA CRIT PRESS	PSEUDO CRITICAL TEMP T_c	PSEUDO CRITICAL PRESS P_c
C_1H_4	.7928	344	673	272.7	533.6
C_2H_6	.1175	549	712	64.5	83.7
C_3H_8	.0454	666	617	30.2	28.0
C_4+	.0342	± 800	± 520	27.4	17.8
CO_2	.0080	547	1071	4.4	8.6
N_2	.0021	227	492	0.5	1.0
				399.7	672.7

SURFACE PRESS: 1732 psig

DEPTH: 7145 (−349)

AVG. GAS TEMP $(60+180) \div 2 = 120 + 460 = 580°R$

1ST EST. AVG PRESS. $1732 \text{ psig} + 12 + 230 = 1974$

$$Sp. Gty = .725$$

$$T_R = 580 \div 399.7 = 1.45$$
$$P_R = 1974 \div 672.7 = 2.93$$
$$\Bigg\} Z = .745$$

$$\log_{10} P_2 = \log_{10} P_1 + \frac{.008152 \, GL}{Z \cdot T}$$

$$= \log_{10} 1744 + \frac{(.008157)(.725)(7145)}{(.745)(580)}$$

$$P_2 = 2184 \text{ psia} = 2122 \text{ psig}$$
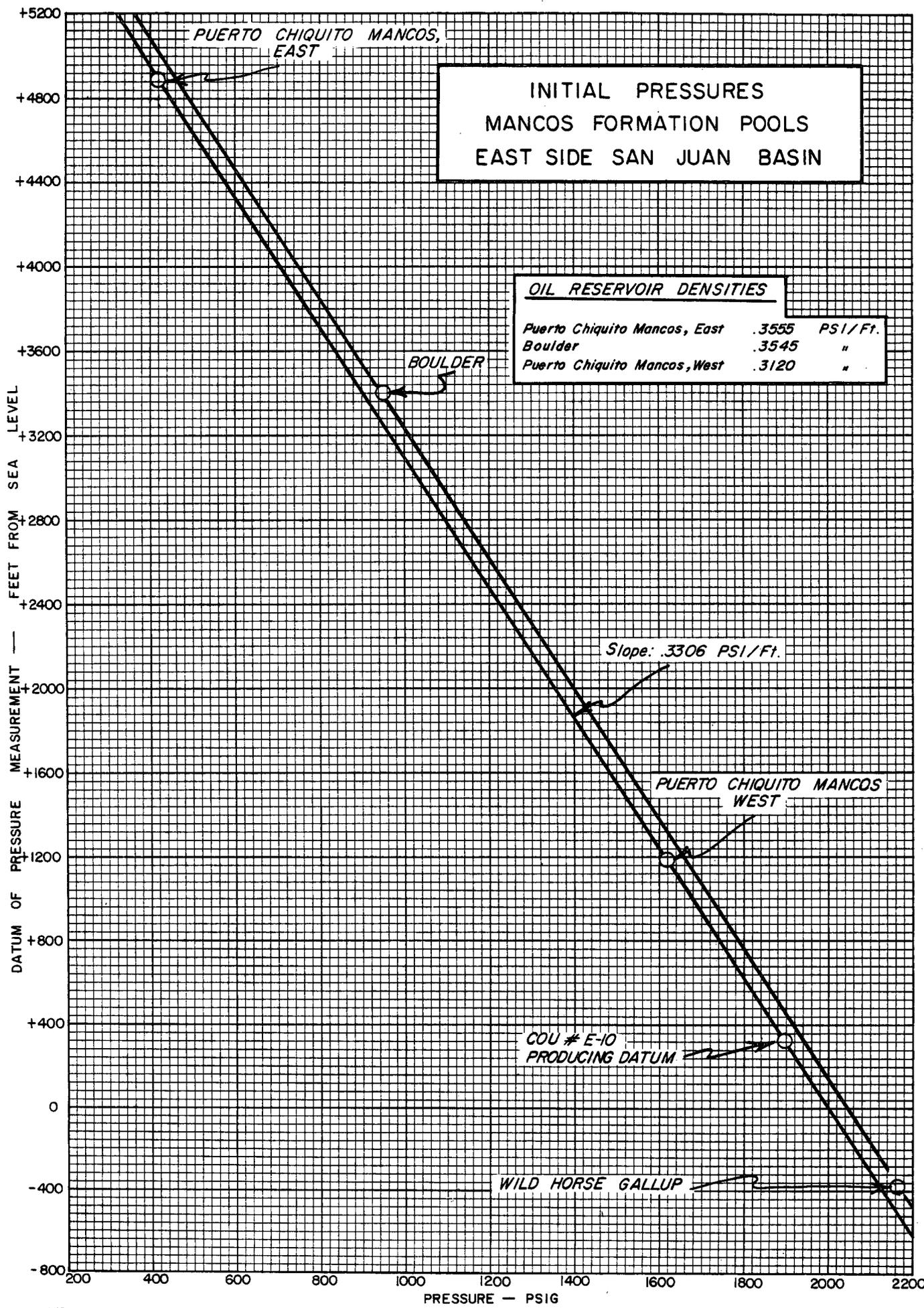
INITIAL PRESSURES
MANCOS FORMATION POOLS
EAST SIDE SAN JUAN BASIN

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

FEET FROM SEA LEVEL

DATUM OF PRESSURE MEASUREMENT

PRESSURE — PSIG

11/63