OIL AND GAS FIELDS OF THE FOUR CORNERS AREA

Volume I

JAMES E. FASSETT
Editor

NICK D. THOMAIDIS
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MARVIN L. MATHENY
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FOUR CORNERS GEOLOGICAL SOCIETY

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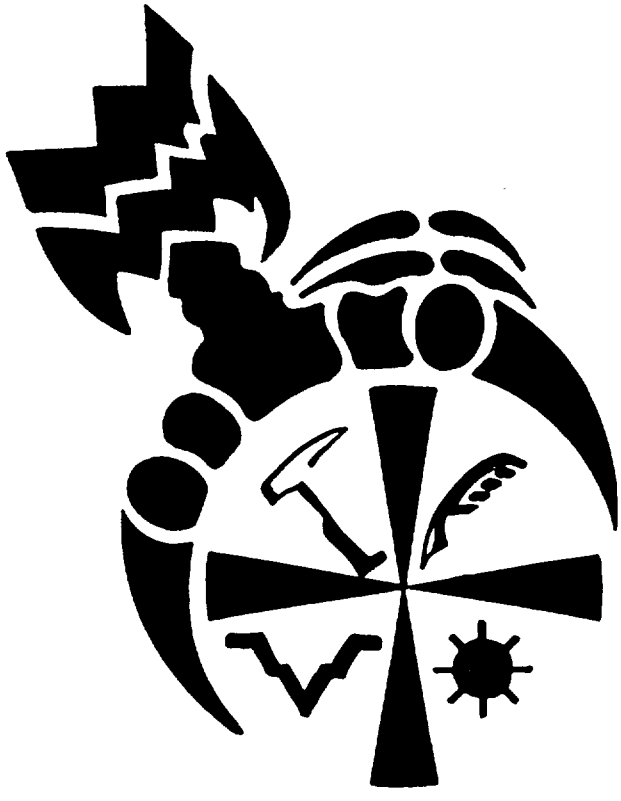

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OIL AND GAS FIELDS OF THE FOUR CORNERS AREA

Volume III

JAMES E. FASSETT
Editor

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1983

BLANCO FRUITLAND

(Gas)

T. 29-30 N., R. 8-9 W., NMPM
San Juan County, New Mexico

By: T. Lynn Malone
El Paso Natural Gas Company

GEOLOGY

Regional Setting: San Juan Basin, northwest New Mexico

Surface Formations: Tertiary, Nacimiento and San Jose Formations

Explorations Method Leading to Discovery: Subsurface geology, plug-back of Pictured Cliffs test

Type of Trap: Stratigraphic

Producing Formation: Cretaceous, Fruitland Formation

Gross Thickness and Lithology of Reservoir Rocks: 15 to 35 feet of sandstone

Geometry of Reservoir Rock: Channel deposits

Other Significant Shows: Dakota Sandstone, Mesaverde Group, and Pictured Cliffs Sandstone

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Dakota Sandstone

DISCOVERY WELL

Name: Tenneco Oil Co. No. 1 Florence

Location: SE¼ sec. 29, T. 30 N., R. 8 W., NMPM

Elevation (KB): 6,180 feet

Date of Completion: March 1, 1968

Total Depth: 3,010 feet; plugged back to 2,860 feet

Production Casing: 8 5/8" at 123 feet; 3½" at 3,002 feet

Perforations: 2,580 to 2,585 feet; 2,599 to 2,607 feet

Stimulation: Sand water-fracture with 30,000 gallons water, 20,000 lbs. sand; breakdown pressure 2,030 psi; injection rate 29 bbls./minute

Initial Potential: Flow 2,077 MCFGD; calculated absolute open flow 2,136 MCFGD

Bottom Hole Pressure: Shut in casing pressure 1,008 psi

DRILLING AND COMPLETION PRACTICES

Set surface casing; drill to base of Fruitland, run logs, run 2 7/8" casing to total depth, perforate selected intervals, break down and sand-water fracture. The Fruitland Formation could possibly be dually completed with the Pictured Cliffs or Mesaverde in this area.

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 1,280 acres
Unproved: 4,480 acres
Approved Spacing: 160 acres
No. of Producing Wells: 8
No. of Abandoned Wells: 0
No. of Dry Holes: 0

Average Net Pay: 20 feet

Porosity: 8 to 15 percent

Permeability: 3.8 millidarcies (calcuated from logs)

Water Saturation: 40 percent

Initial Field Pressure: 950 psi

Type of Drive: Gas expansion

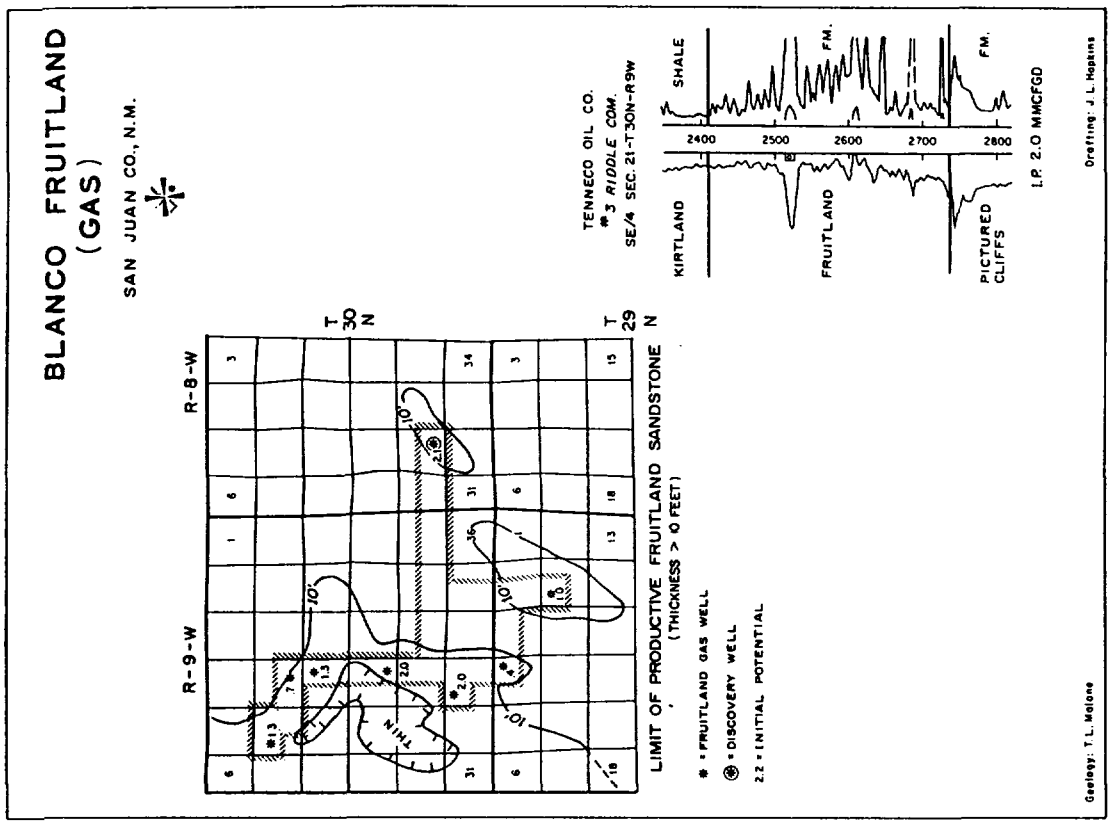
Gas Characteristics and Analysis: 1,121 Btu; (in molecular percentage): methane 88.68, ethane 7.18, propane 2.33; specific gravity 0.641

Associated Water Characteristics and Analysis: Unknown

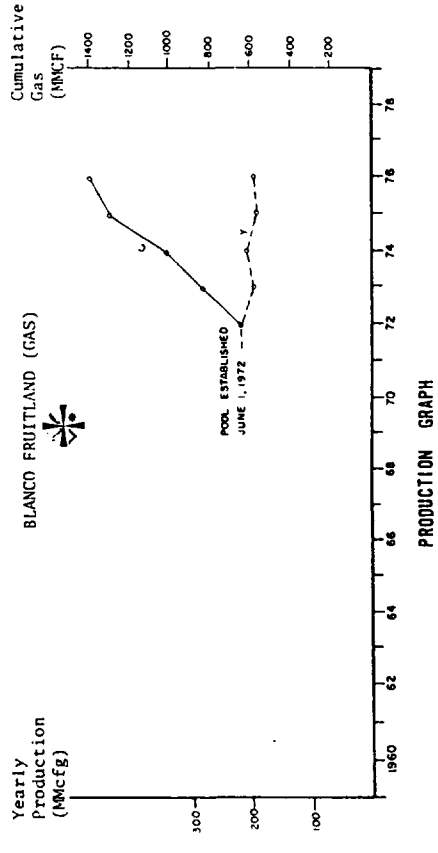
Estimated Recovery: 11,400,000 MCFG

Present Daily Average Production: 525 MCFGD

Market Outlets: El Paso Natural Gas Company



NUMBER OF WELLS AT YEARS END				– PRODUCTION – OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD.	S.I./ABN.	ANNUAL	CUMULATIVE
1960	Gas				
	Oil				
1961	Gas				
	Oil				
1962	Gas				
	Oil				
1963	Gas				
	Oil				
1964	Gas				
	Oil				
1965	Gas				
	Oil				
1966	Gas				
	Oil				
1967	Gas				
	Oil				
1968	Gas				
	Oil				
1969	Gas				
	Oil				
1970	Gas				
	Oil				
1971	Gas	8		212,227	632,228
	Oil			3,995	10,619
1972	Gas	8		189,017	821,245
	Oil			2,471	13,090
1973	Gas	8		200,239	1,021,484
	Oil			1,543	14,633
1974	Gas	8		187,326	1,208,810
	Oil			1,396	16,029
1975	Gas	8		191,404	1,400,214
	Oil			1,438	17,467
1976					



CONNER FRUITLAND

(Gas)

T. 30 N., R. 14 W., NMPM

San Juan County, New Mexico

By: T. Lynn Malone
El Paso Natural Gas Company

GEOLOGY

Regional Setting: San Juan Basin

Surface Formations: Cretaceous, Kirtland Shale

Exploration Method Leading to Discovery: Subsurface geology, plug-back of abandoned Dakota Sandstone well

Type of Trap: Stratigraphic

Producing Formation: Cretaceous, Fruitland Formation

Gross Thickness and Lithology of Reservoir Rocks: 20 feet of fluvial sandstone

Geometry of Reservoir Rock: Channel sandstone deposits

Other Significant Shows: Cretaceous, Pictured Cliffs Sandstone and Dakota Sandstone

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Dakota Sandstone

DISCOVERY WELL

Name: Odessa No. 1 Little Federal (Formerly, Shar Alan Oil No. 3 Dick Hunt Federal)

Location: NE SW (1920' FSL and 1565' FWL) sec. 1, T. 30 N., R. 14 W., NMPM

Elevation (KB): 5,746 feet

Date of Completion: December 28, 1976

Total Depth: Original total depth, 6,275 feet; plugged back to 1,406 feet

Production Casing: 8 5/8" at 250 feet; 4½" at 1,406 feet

Perforations: 1,171 feet to 1,179 feet; 1,181 feet to 1,185 feet; 1,191 feet to 1,194 feet

Stimulation: Sand-water fracture with 23,000 gallons of water and 25,000 lbs sand

Initial Potential: 297 MCFGD

Bottom Hole Pressure: Shut-in casing pressure 419 psi

DRILLING AND COMPLETION PRACTICES

Set surface casing, drill to base of the Fruitland Formation, run logs, set casing at total depth, perforate selected intervals, break-down formation and sand-water fracture.

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 640 acres
Unproved: 0 acres
Approved Spacing: 160 acres
No. of Producing Wells: 4
No. of Abandoned Wells: 0
No. of Dry Holes: 0

Average Net Pay: 15 feet

Porosity: 12 to 16 percent

Permeability: Unknown

Water Saturation: 30 percent

Initial Field Pressure: 450 psi

Type of Drive: Gas expansion

Gas Characteristics and Analysis: 1,059 Btu/cu. ft.; (in molecular percentage) methane 94.14, ethane 4.21, propane 0.62; specific gravity 0.60

Associated Water Characteristics and Analysis: Very little produced water

Estimated Recovery: 200,000 MCFG

Present Daily Average Production: 30 MCFGD

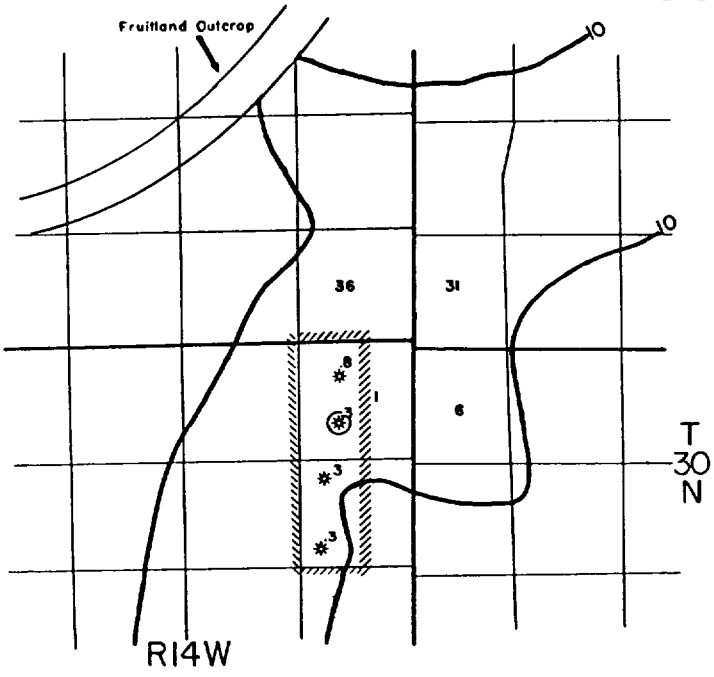
Market Outlets: El Paso Natural Gas Company

PRODUCTION

Conner Fruitland first produced in May, 1977. Cumulative production through December 1977 was 7,971 MCFG with production declining rapidly.

CONNER FRUITLAND
(GAS)

SAN JUAN CO., N.M.



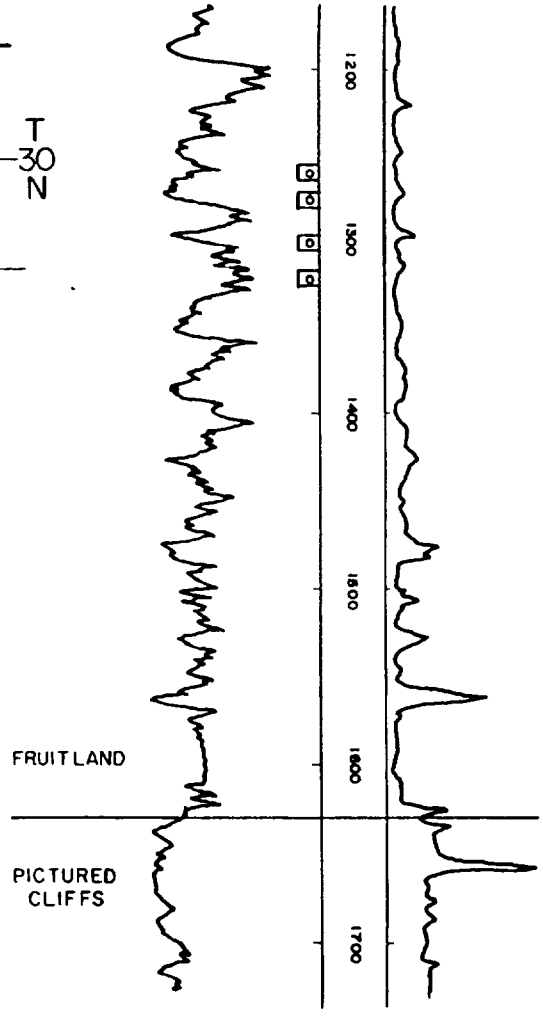
Limit of Productive Fruitland Sandstone

(Thickness > 10 feet)

* Fruitland Wells

⊛ Discovery Well

.3 I.P. in Mmcf



ODESSA NATURAL CORP.
No. 5 Little Federal
NW 12-30N-14W
I.P. 0.3 Mmcfgd

Geology : T.L. Malone

Drafting: M.D. Chambers

FLORA VISTA FRUITLAND

(Gas)

T. 30 N., R. 12 W., NMPM

San Juan County, New Mexico

By: T. Lynn Malone
El Paso Natural Gas Company

GEOLOGY

Regional Setting: San Juan Basin

Surface Formations: Tertiary, Nacimiento Formation

Exploration Method Leading to Discovery: Subsurface geology; plug-back of Pictured Cliffs Sandstone well

Type of Trap: Stratigraphic

Producing Formation: Cretaceous, Fruitland Formation

Gross Thickness and Lithology of Reservoir Rocks: 10 to 50 feet of sandstone

Geometry of Reservoir Rock: Channel fluvial deposits

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

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Dakota Sandstone

DISCOVERY WELL

Name: Northwest Production Corporation, No. 3 Blanco 30-12 A

Location: NW SW (1510' FSL and 990' FWL) sec. 10, T. 30 N., R. 12 W.

Elevation (KB): 5,723 feet

Date of Completion: December 29, 1956

Total Depth: 4,568 feet, plugged back to 1,786 feet

Production Casing: 10¾" at 228 feet; 5½" at 4,568 feet

Perforations: 1,754 feet to 1,774 feet

Stimulation: Sand-water fracture with 20,550 gallons of water, 20,000 lbs sand; break-down pressure, 1,000 psi, injection rate 62.3 bbls/min

Initial Potential: 4,528 MCFGD; calculated absolute open flow 9,047 MCFGD

Bottom Hole Pressure: Shut-in tubing pressure 602 psi

DRILLING AND COMPLETION PRACTICES

Set surface casing, drill to base of Fruitland Formation, run logs, run 2 7/8" casing to total depth, perforate selected intervals, break-down and sand-water fracture.

The Fruitland Formation in this area could possibly be dually completed with the Pictured Cliffs Sandstone or the Mesaverde Group.

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 960 acres
Unproved: 1,280 acres
Approved Spacing: 160 acres
No. of Producing Wells: 5
No. of Abandoned Wells: 1
No. of Dry Holes: 0

Average Net Pay: 30 feet

Porosity: 8 to 16 percent

Permeabilty: Not available

Water Saturation: 40 percent

Initial Field Pressure: 650 psi

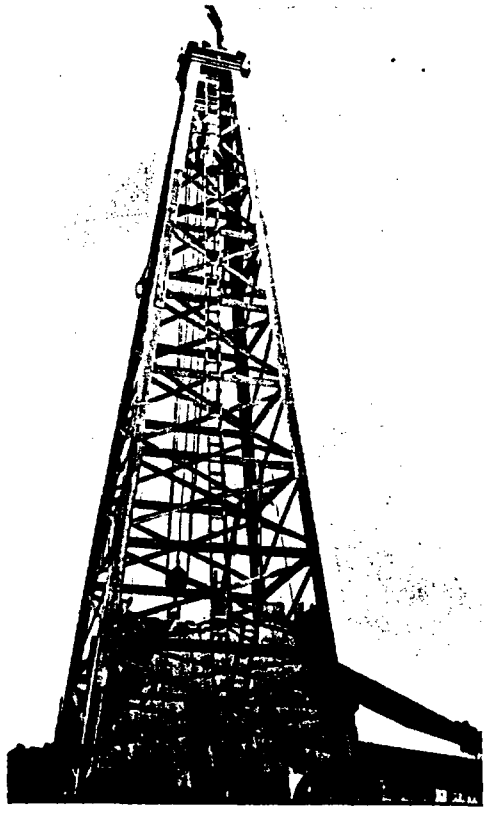
Type of Drive: Gas expansion

Gas Characteristics and Analysis: Btu 1,122; (in molecular percentage) methane 88.93, ethane 4.80, propane 3.04; specific gravity 0.651

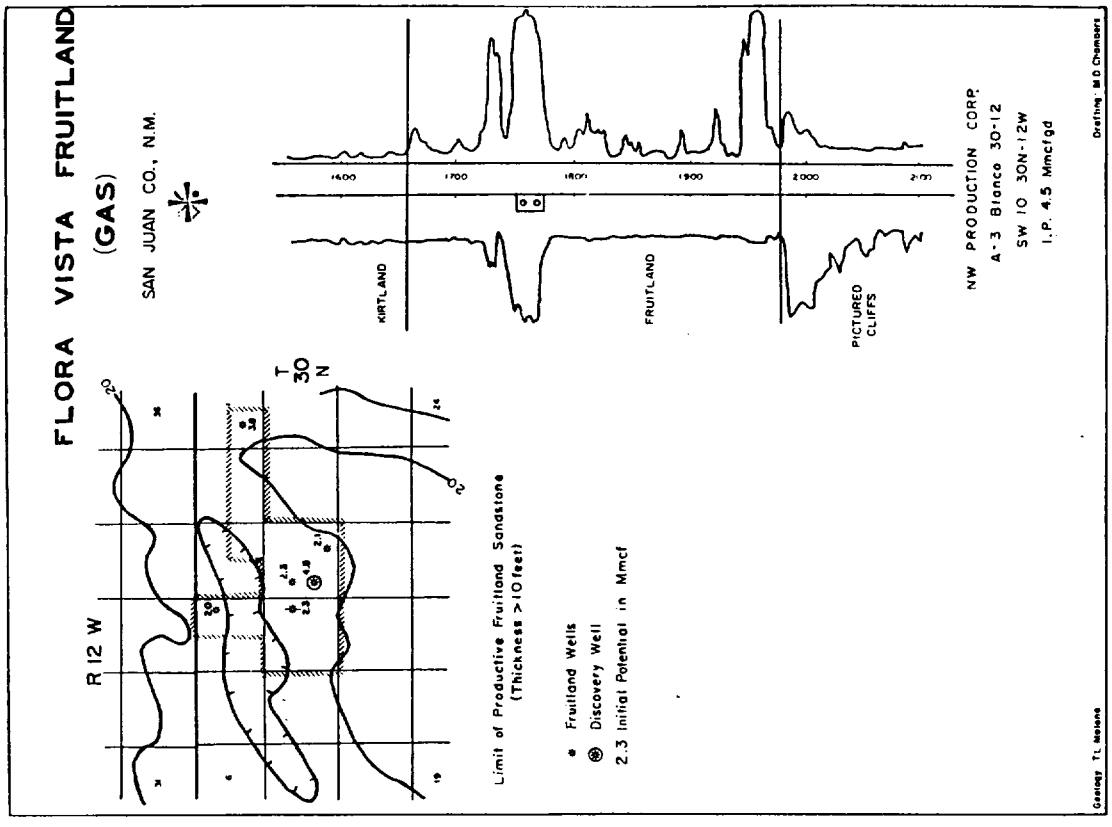
Associated Water Characteristics and Analysis: little produced water

Estimated Recovery: 1,700,000 MCFG

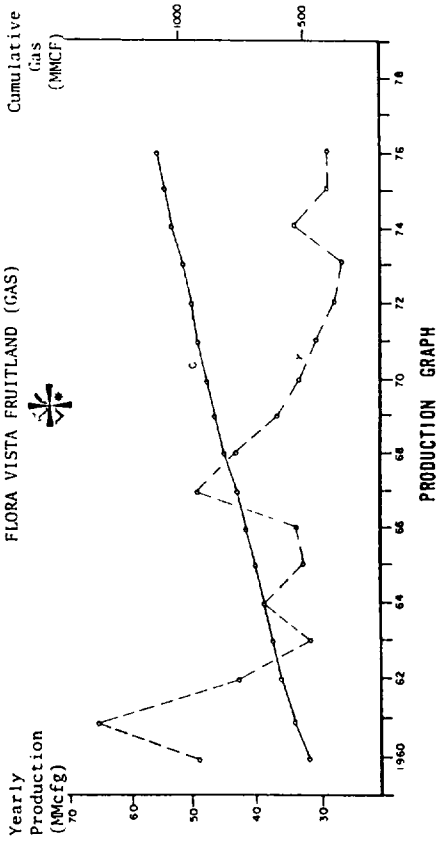
Market Outlets: El Paso Natural Gas Company



Wooden derrick in early drilling days near Farmington, New Mexico. (Photo courtesy of Tom Dugan)



NUMBER OF WELLS AT YEARS END				- PRODUCTION - OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD.	S.I./ABN.	ANNUAL	CUMULATIVE
1960	Gas	5		49,485	491,349
	Oil				
1961	Gas	5		66,068	557,617
	Oil				
1962	Gas	5		42,845	600,462
	Oil				
1963	Gas	5		30,147	630,609
	Oil				
1964	Gas	5		38,096	668,705
	Oil				
1965	Gas	5		32,382	701,087
	Oil				
1966	Gas	5		33,186	734,273
	Oil				
1967	Gas	5		49,445	783,718
	Oil				
1968	Gas	5		44,191	827,909
	Oil				
1969	Gas	5		36,781	864,690
	Oil				
1970	Gas	5	1	32,484	897,174
	Oil				
1971	Gas	4	2	30,160	927,334
	Oil				
1972	Gas	4	2	27,618	954,952
	Oil				
1973	Gas	4	2	25,852	980,804
	Oil				
1974	Gas	5	1	34,779	1,332,241
	Oil				
1975	Gas	5	1	27,920	1,360,161
	Oil				
1976	Gas	5	1	28,160	1,388,321



GALLEGOS FRUITLAND

(Gas)

T. 27 N., R. 11 W., NMPM

San Juan County, New Mexico

By: P. S. Hopson
Gulf Oil Exploration and Production Company

GEOLOGY

Regional Setting: San Juan Basin

Surface Formations: Tertiary, Nacimiento Formation

Exploration Method Leading to Discovery: Subsurface mapping

Type of Trap: Lenticular sandstone bodies

Producing Formation: Cretaceous, Fruitland Formation

Gross Thickness and Lithology of Reservoir Rocks: 20 feet, sandstone

Geometry of Reservoir Rock: Isolated lenticular sandstone bodies

Other Significant Shows: None

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Pictured Cliffs Sandstone

DISCOVERY WELL

Name: British-American No. 2 Douthit (Gulf Oil, present operator)

Location: NW NW (990' FNL and 990' FWL) sec. 27, T. 27 N., R. 11 W.

Elevation (KB): 6,360 feet

Date of Completion: March 16, 1952

Total Depth: 2,042 feet; plugged-back to 1,910 feet

Production Casing: 5½" at 1,956 feet

Perforations: 1,672 feet to 1,682 feet with 24 shots

Stimulation: None

Initial Potential: 1,300 MCFGD

Bottom Hole Pressure: 800 psi

DRILLING AND COMPLETION PRACTICES

Surface casing: 10¾" at 100 feet with 90 sacks of cement

Production String: 5½" at 1,956 feet with 85 sacks of cement

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 160 acres
Unproved: 0 acres
Approved Spacing: None
No. of Producing Wells: One
No. of Abandoned Wells: 0
No. of Dry Holes: 0

Average Net Pay: 12 feet

Porosity: No porosity logs run

Permeability: Unknown

Water Saturation: Unknown

Initial Field Pressure: 757 psi (shut-in tubing pressure)

Type of Drive: Gas expansion

Gas Characteristics and Analysis: Unknown

Oil Characteristics and Analysis: Unknown

Associated Water Characteristics and Analysis: Unknown

Original Gas, Oil, and Water Contact Datums: None

Estimated Ultimate Recovery: Unknown

Present Daily Average Production: 19.7 MCFGD (December, 1977)

Market Outlets: Gas Company of New Mexico

FIELD COMMENTARY

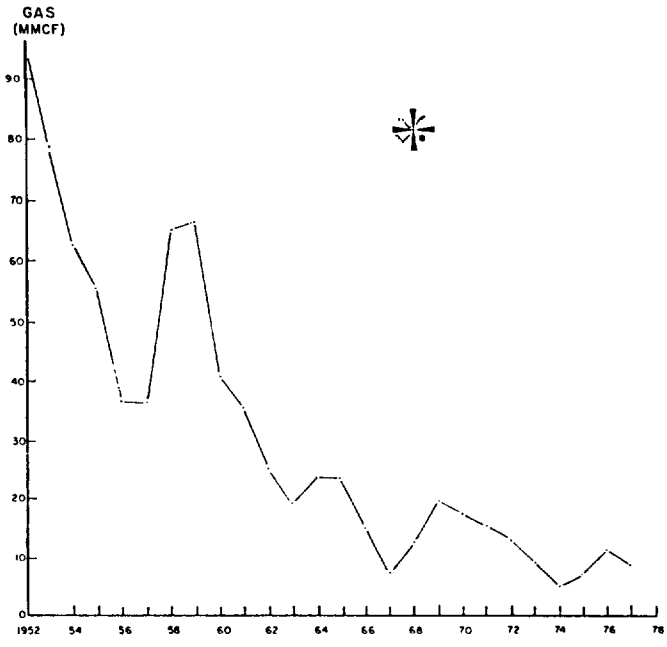
The No. 2 Douthit was originally drilled by British-American as a development well in the South Kutz Pictured Cliffs gas field. While tripping at 1,778 feet the well blew out, requiring 10.6 pound mud to kill the well. Logs indicated the blow-out zone to be a sandstone at 1,670 feet, identified as a stray sand in the Fruitland Formation. At the time there was considerable skepticism whether the sand was just another high pressure-low volume reservior; after 26 years of continuous production and 800 million cubic feet of gas, the skepticism is no longer mentioned.

The producing zone is a lenticular sandstone within the Fruitland shale section having approximately 12 feet of porosity in the discovery well; the west offset (NE NE of sec. 28) has approximately 13 feet of porosity. The sandstone lense in isopach appears to be a northeast trending sandstone body approximately 1½ miles long and ½ mile wide. The No. 2 Douthit is the only well that has been completed in this Fruitland sandstone. All other wells in the immediate vicinity are either Pictured Cliffs or Dakota Sandstone gas wells.

REFERENCES

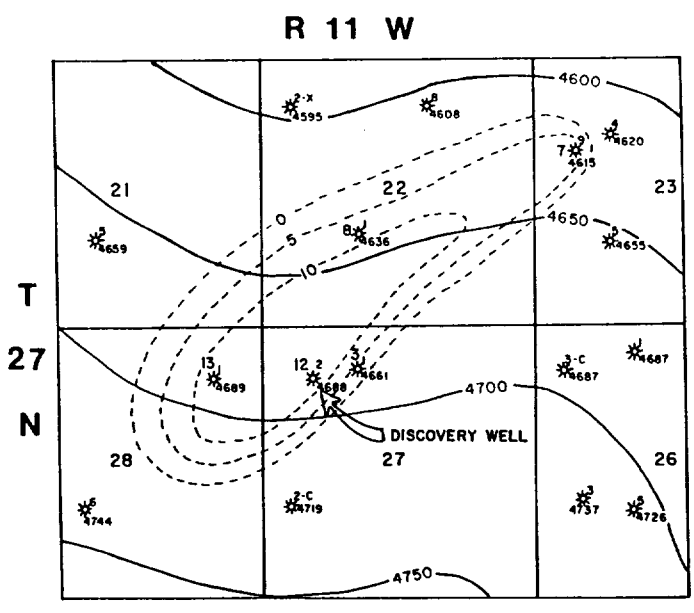
Operator's file.
State of New Mexico monthly and annual production report.

NUMBER OF WELLS AT YEARS END				PRODUCTION OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD	S I/ABN	ANNUAL	CUMULATIVE
1952	GAS	1	0	94,816	94,816
53	GAS	1	0	78,585	173,401
54	GAS	1	0	62,135	235,537
55	GAS	1	0	55,796	291,333
56	GAS	1	0	36,631	327,964
57	GAS	1	0	36,334	364,298
58	GAS	1	0	64,620	428,918
59	GAS	1	0	66,331	495,249
60	GAS	1	0	41,129	536,398
61	GAS	1	0	35,635	572,013
62	GAS	1	0	25,073	597,086
63	GAS	1	0	19,290	616,372
64	GAS	1	0	23,827	640,203
65	GAS	1	0	23,735	663,938
66	GAS	1	0	14,817	678,755
67	GAS	1	0	7,958	686,713
68	GAS	1	0	12,167	698,880
69	GAS	1	0	19,229	718,109
70	GAS	1	0	17,668	735,777
71	GAS	1	0	15,798	751,775
72	GAS	1	0	12,753	764,328
73	GAS	1	0	8,650	772,978
74	GAS	1	0	5,248	778,226
75	GAS	1	0	6,776	785,002
76	GAS	1	0	11,419	796,421
77	GAS	1	0	8,228	804,649



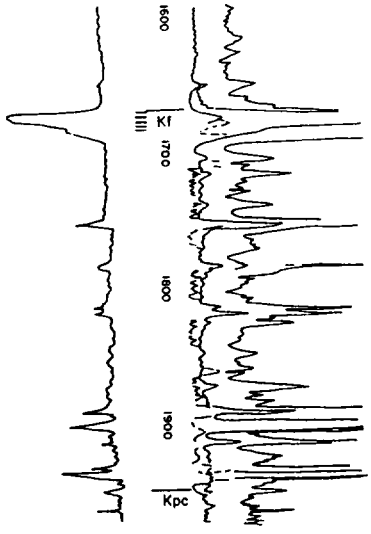
GALLEGOS FRUITLAND FIELD
STRUCTURE MAP

WITH 5' NET SAND CONTOURS SUPERIMPOSED



DATUM:
TOP OF FRUITLAND FORMATION

SAN JUAN CO. NEW MEXICO



British American No.2 *Douthitt*
990' FNL 990 FWL
Sec. 27, T-27-N R-11-N
San Juan County, New Mexico
Elev. 6360 KB
T.D. 2042 P.B. 1910 Completed 3-16-52

GALLEGOS FRUITLAND, SOUTH

(Gas)

T. 26-27 N., R. 11-12 W., NMPM

San Juan County, New Mexico

By: John Bircher
Wexpro Company

GEOLOGY

Regional Setting: Southwest flank San Juan Basin

Surface Formations: Tertiary, Ojo Alamo Sandstone

Exploration Method Leading to Discovery: Recompletion in the Fruitland Formation of a depleted "Gallup" sandstone oil well

Type of Trap: Stratigraphic

Producing Formation: Cretaceous, Fruitland Formation

Gross Thickness and Lithology of Reservoir Rocks: Approximately 40 feet of channel sandstones and 15 feet of interbedded siltstones and coals

Geometry of Reservoir Rock: Lenticular channel sandstones, and uniform interbedded siltstones and coals

Other Significant Shows: Cretaceous, Farmington Sandstone Member of the Kirtland Shale

Oldest Stratigraphic Horizon Penetrated: Jurassic, Morrison Formation

DISCOVERY WELL

Name: Skelly Oil No. 1G Navajo

Location: SW NE SW (1770' FSL and 1770' FWL) sec. 12, T. 26 N., R. 12 W.

Elevation (KB): 5,949 feet

Date of Completion: May 27, 1968 (Fruitland Formation)

Total Depth: 5,115 feet (plug-back depth 1,150 feet)

Production Casing: 5½" at 5,114 feet with 125 sacks of cement

Perforations: 1,100 feet to 1,113 feet (52 shots)

Stimulation: Treated perforations with 500 gallons mud acid, fractured with 12,852 gallons water and 10,000 pounds 20-40 sand, maximum treating pressure 1,080 psi, minimum treating pressure 800 psi, average injection rate 38 barrels per minute

Initial Potential: Flow 1,767 MCFGD, no water, flowing tubing pressure 111 psi, casing pressure 163 psi

Bottom Hole Pressure: 350 psi

DRILLING AND COMPLETION PRACTICES

The first wells in the Gallegos Fruitland, South field were recompleted "Gallup" oil wells. A sandstone in the Lower Fruitland was perforated and fractured with a range of 7,000 to 40,000 gallons of water and 8,500 to 35,000 pounds of 20-40 sand. Injection rates averaged 40 barrels per minute. Breakdown pressures were 1,600 to 1,700 psi.

Current wells are drilled using the slim-hole technique with drilling mud as the circulating medium. Two joints of 5½" pipe are set for surface casing with 10 sacks of cement. If the well is found to be capable of production, 2 7/8" tubing is set at total depth with approximately 75 sacks of cement. After fracturing, the wells are produced through 1¼" tubing.

Fracture treatments for the more recent wells consist of approximately 3,200 gallons of water, 16,500 pounds of 10-20 sand, 87,500 standard cubic feet of nitrogen, and 24 gallons of Adafoam. Average injection pressures are around 1,800 psi, and injection rates are around 20 barrels per minute. Prior to fracturing, the Fruitland perforations are treated with about 300 gallons of 15 percent hydrochloric acid.

RESERVOIR DATA

Productive Area:
Proved: 2,500 acres
Unproved: 1,800 acres
Approved Spacing: 160 acres
No. of Producing Wells: 14
No. of Abandoned Wells: 0
No. of Dry Holes: 1

Average Net Pay: 12 feet

Porosity: Not available

Permeability: Not available

Water Saturation: Not available

Initial Field Pressure: 350 psi (shut-in tubing pressure on discovery well)

Gas Characteristics and Analysis: Composition by molecular percent: carbon dioxide 0.03, nitrogen 1.04, methane 97.16, ethane 1.39, propane 0.23, butane 0.10, pentane 0.01, hexane plus 0.04, Btu 1,022, specific gravity 0.571, liquids 0.488 gallons per MCFG

Oil Characteristics and Analysis: None

Associated Water Characteristics and Analysis: None reported. Only one well on the eastern boundary of the field produces a very small amount of water along with the gas.

Original Gas, Oil, and Water Contact Datums: None

Estimated Primary Recovery: 10,000,000 MCFG (85 percent)

Type of Secondary Recovery: None planned

Estimated Ultimate Recovery: 10,000,000 MCFG (85 percent)

Present Daily Average Production: 1,754 MCFGD (December, 1977)

Market Outlets: El Paso Natural Gas Company

FIELD COMMENTARY

The Gallegos Fruitland, South field is located 13.5 miles south-southeast of Farmington, New Mexico, and 3.3 miles northwest of the Carson Trading Post in San Juan County. Geologically, the field is situated on the southwest flank of the San Juan Basin. Regional dip is to the northeast at approximately 100 feet per mile. The field was discovered in 1968 when Skelly Oil Company recompleted a depleted "Gallup" well (Navajo No. 1G) in a Fruitland channel sandstone. The initial potential for the Fruitland completion was

1,767 MCFGD, with a shut-in tubing pressure of 350 psi. Within the same year, several other depleted "Gallup" wells were recompleted in this Fruitland channel. Additional wells, drilled to the Pictured Cliffs, have been completed in several other intervals of the Fruitland Formation.

Gallegos Fruitland, South production is obtained from three separate sandstone intervals and an interval of interbedded siltstones and coals. The sandstones are channel or channel associated and laterally discontinuous. The discovery was completed in the middle sandstone. This sandstone trends eastward across the central part of the field, and terminates near the eastern boundary. The upper sandstone, producing in the Nassau No. 5R (NE NE sec. 36, T. 27 N., R. 12 W.) and the Western Federal No. 6 (NW SE sec. 7, T. 26 N., R. 11 W.) wells, appears to have a south-southeast trend. At the southern end of the field, the Chaco Plant No. 8 (SW SE sec. 25, T. 26 N., R. 12 W.) well is completed in a third sandstone just above the lower Fruitland coal. The trend of this sandstone appears to be southeast. The interbedded siltstones and coals produce a substantial amount of gas and have a greater areal extent. Production from the interbedded siltstone and coal sequence is located in the northeastern part of the field.

The other zone of interest in the Gallegos Fruitland, South field is the Farmington Sandstone Member of the Kirtland Shale. This sandstone was perforated and tested in the Ben Franklin No. 1 (NE NE sec. 10, T. 26 N., R. 12 W.) on the western side of the field. The production and potential of this interval is discussed in the Gallegos Farmington, South field paper elsewhere in this publication.

REFERENCES

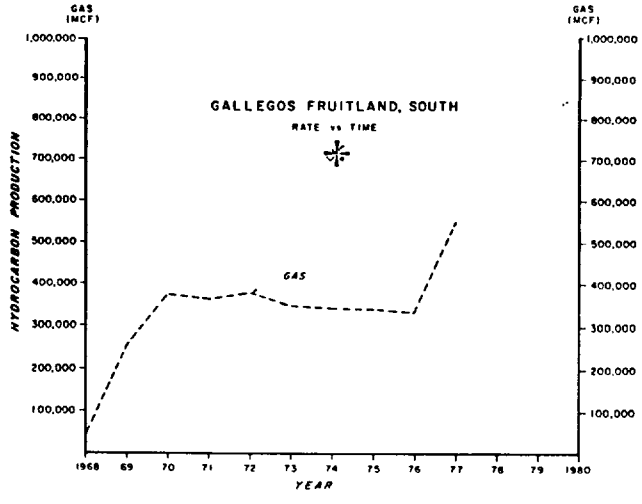
Fassett, J. E., and Hinds, J. S., 1971, Geology and Fuel Resources of the Fruitland Formation and Kirtland Shale of the San Juan Basin, New Mexico and Colorado: U.S. Geological Survey Professional Paper 676, 76 p.

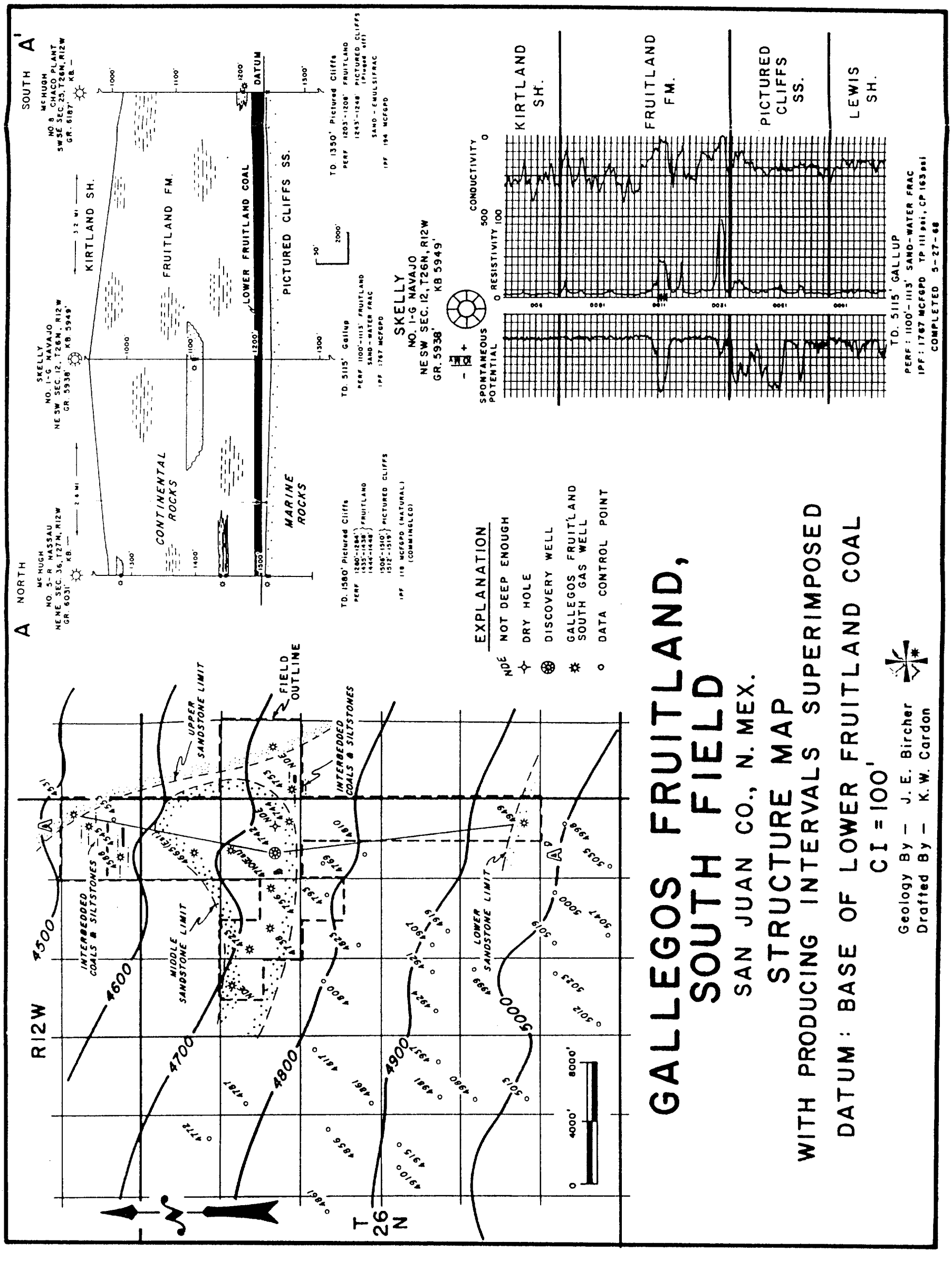
Molenaar, C. M., 1977, Stratigraphy and Depositional History of Upper Cretaceous Rocks of the San Juan Basin Area, New Mexico and Colorado, with a note on Economic Resources: New Mexico Geological Society Guidebook, 28th Field Conference, p. 159-166.

New Mexico Oil Conservation Commission records.

Personal communications with operators and others.

NO. OF WELLS @ YR. END				HYDROCARBON PRODUCTION OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD.	SI/ABN	ANNUAL	CUMULATIVE
1968	OIL				
	GAS	1		40,186	40,186
1969	OIL				
	GAS	3		253,898	294,084
1970	OIL				
	GAS	4		375,478	669,562
1971	OIL				
	GAS	4		364,674	1,034,236
1972	OIL				
	GAS	5		380,333	1,414,569
1973	OIL				
	GAS	5		349,003	1,763,572
1974	OIL				
	GAS	6		343,064	2,106,636
1975	OIL				
	GAS	6		341,722	2,448,358
1976	OIL				
	GAS	8		334,106	2,782,464
1977	OIL				
	GAS	13		551,216	3,333,680





GALLEGOS FRUITLAND, SOUTH FIELD

SAN JUAN CO., N. MEX.

STRUCTURE MAP

WITH PRODUCING INTERVALS SUPERIMPOSED

DATUM: BASE OF LOWER FRUITLAND COAL

CI = 100'

Geology By — J. E. Bircher

Drafted By — K. W. Cardon

[Four Corners Geological Society

LA JARA FRUITLAND

(Gas)

T. 30 N., R. 5-6 W., NMPM

Rio Arriba County, New Mexico

By: T. Lynn Malone
El Paso Natural Gas Company

GEOLOGY

Regional Setting: San Juan Basin

Surface Formations: Tertiary, San Jose Formation

Exploration Method Leading to Discovery: Subsurface geology, blow-out while drilling well to Mesaverde Group

Type of Trap: Stratigraphic

Producing Formation: Cretaceous, Fruitland Formation (did not produce)

Gross Thickness and Lithology of Reservoir Rocks: Thin coals and sandstone

Geometry of Reservoir Rock: Noncontinuous

Other Significant Shows: Cretaceous, Mesaverde Group and Dakota Sandstone

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Dakota Sandstone

DISCOVERY WELL

Name: El Paso Natural Gas Co. No. 1 Abraham

Location: NW NE (990' FNL and 1450' FEL) sec. 13, T. 30 N., R. 6 W., NMPM

Elevation (KB): 6,417 feet

Date of Completion: June 15, 1955 (shut-in)

Total Depth: 3,485 feet

Production Casing: 9 5/8" at 176 feet; 7" at 3,485 feet

Perforations: 3,092 feet to 3,110 feet

Stimulation: Natural

Initial Potential: 2,530 MCFGD

Bottom Hole Pressure: 1,368 psi

PRODUCTION

The La Jara Fruitland pool never produced; the discovery well was deepened to the Mesaverde Group and renamed the San Juan 30-6 Unit No. 39. It was completed for 1,948 MCFGD on June 16, 1955. The Fruitland gas responsible for the blow-out probably was from overpressured fractured coals. These reservoirs are generally noncommercial and have a limited volume.

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 0 acres
Unproved: 2,560 acres
Approved Spacing: 160 acres
No. of Producing Wells: 0
No. of Abandoned Wells: 1
No. of Dry Holes: 0

Average Net Pay: 10 feet

Porosity: Not available

Permeability: Not available

Water Saturation: Not available

Initial Field Pressure: 1,368 psi

Type of Drive: Gas expansion

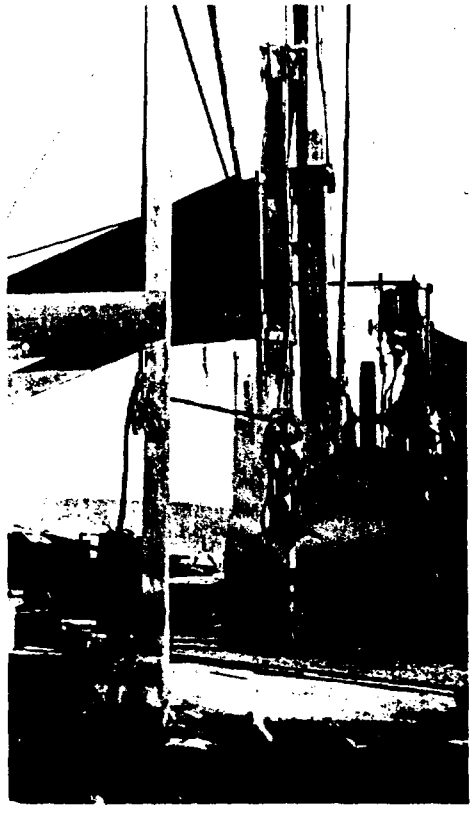
Gas Characteristics and Analysis: Not available

Associated Water Characteristics and Analysis: Not available

Estimated Recovery: Insignificant with present technology

Present Daily Average Production: Abandoned

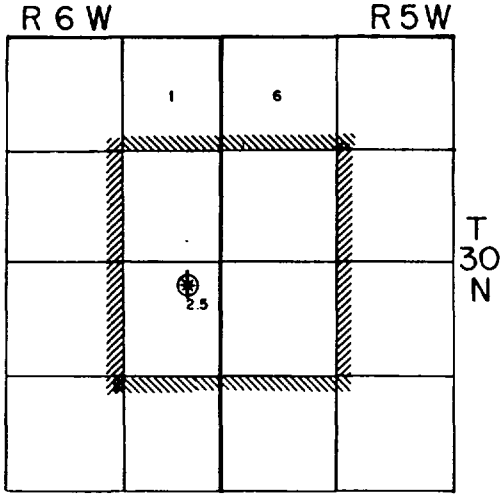
Market Outlets: Northwest Energy Company Pipeline

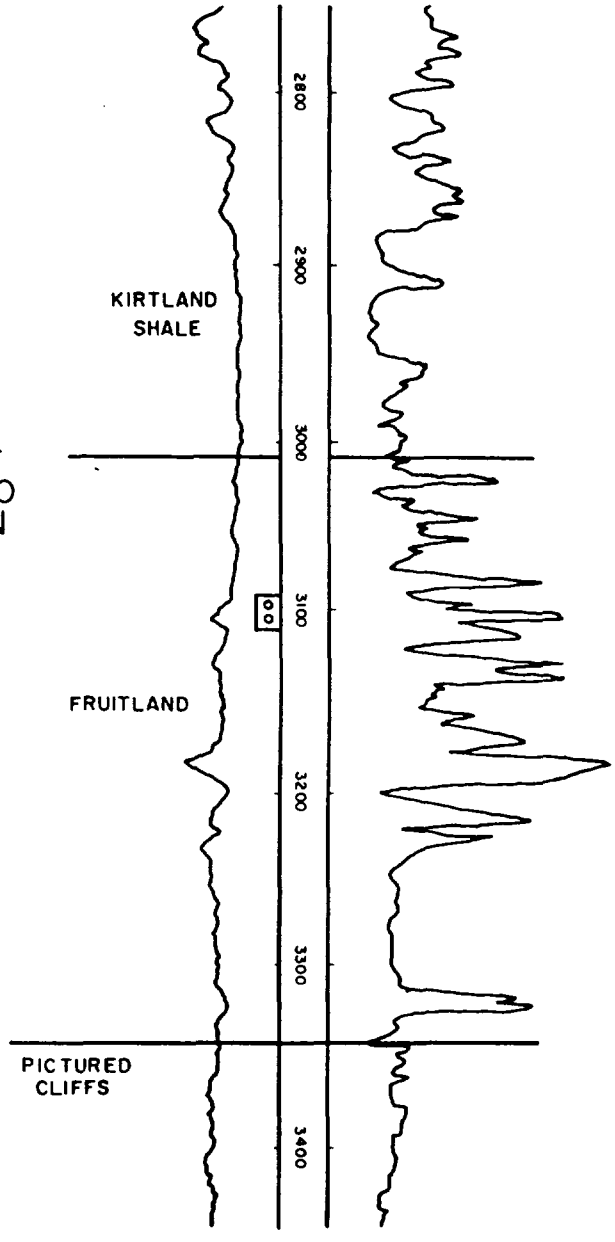


Gas blow in early San Juan Basin well. (Photo courtesy of Tom Dugan)

LA JARA FRUITLAND (GAS)

RIO ARRIBA CO., N.M.





✱ Abandoned Well

⊛ Discovery Well

2.5 Initial Potential in Mmcfgd

E.P.N.G. CO.

No. 1 Abraham

NE 13-30N-6W

I. P. 2.5 Mmcf

Geology: T.L. Malone

Drafting: M.D. Chambers

[Four Corners Geological Society

PINON FRUITLAND

(Gas)

T. 28 N., R. 11 W., NMPM

San Juan County, New Mexico

By: Jim Maynard
Amoco Production Company

GEOLOGY

Regional Setting: Northwest San Juan Basin, east of Hogback Monocline

Surface Formations: Cretaceous, McDermott Member of the Animas Formation

Exploration Method Leading to Discovery: Seismic

Type of Trap: Stratigraphic

Producing Formation: Cretaceous, Fruitland Formation

Gross Thickness and Lithology of Reservoir Rocks: 117 feet, friable sandstone with clay matrix

Geometry of Reservoir Rock: Lenticular, channel sandstone

Other Significant Shows: None

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Pictured Cliffs Sandstone

DISCOVERY WELL

Name: Amoco No. 220 Gallegos Canyon Unit

Location: NE SE (1850' FSL and 790' FEL) sec. 13, T. 28 N., R. 12 W.

Elevation (KB): 5,587 feet

Date of Completion: June 14, 1966

Total Depth: 1,332 feet

Production Casing: 4½" at 1,332 feet with 150 sacks of cement

Perforations: 1,242 to 1,252 feet with 4 shots per foot

Stimulation: Acidized with 500 gallons; sand-water fractured with 30,000 lbs sand and 30,000 gallons of water

Initial Potential: 4,300 MCFD

Bottom Hole Pressure: 515 psi

DRILLING AND COMPLETION PRACTICES

Drill with mud, set casing, perforate, acidize and fracture with sand-water

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 1,920 acres
Unproved: 0 acres
Approved Spacing: 160 acres
No. of Producing Wells: 12
No. of Abandoned Wells: 2
No. of Dry Holes: 0

Average Net Pay: 26 feet

Porosity: 14.6 percent

Permeability: .1 millidarcy

Water Saturation: 41 percent

Initial Field Pressure: 480 psi

Type of Drive: Volumetric

Gas Characteristics and Analysis: (Percent) CO_2 .13, N_2 .36, methane 89.96, ethane 5.66, propane 2.32, iso-butane .48, normal butane .56, iso-pentane .21, normal pentane .14, hexane plus .18; Btu 1,129

Oil Characteristics and Analysis: Not available

Associated Water Characteristics and Analysis: Not available

Original Gas, Oil, and Water Contact Datums: Unknown

Estimated Primary Recovery: See Ultimate Recovery

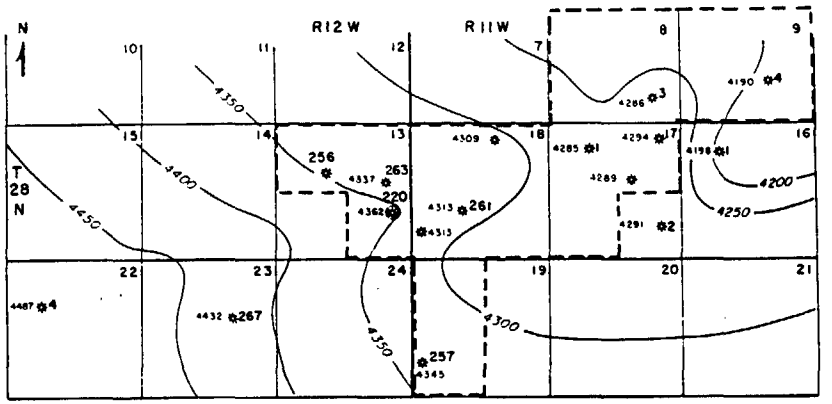
Type of Secondary Recovery: None

Estimated Ultimate Recovery: 3,079,000 MCFG for 5 Amoco wells and 2,327,000 MCFG from other wells by ratio with daily production, total 5,406,000 MCFG

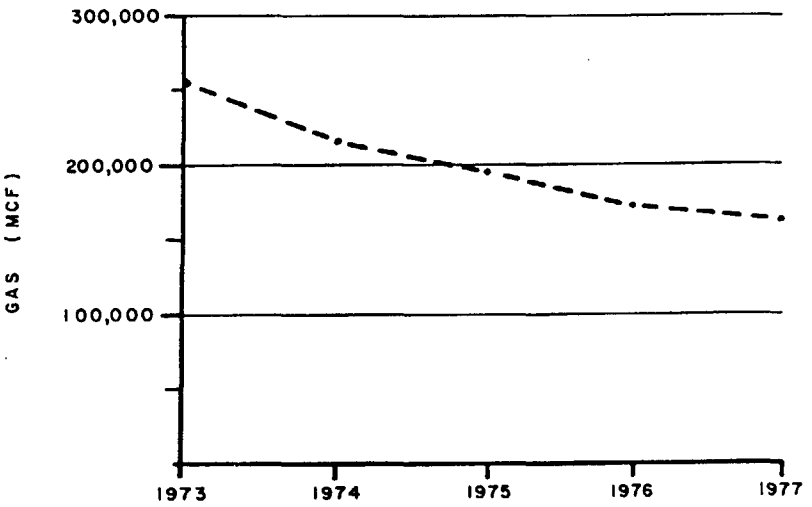
Present Daily Average Production: 925 MCFGD

Market Outlets: El Paso Natural Gas

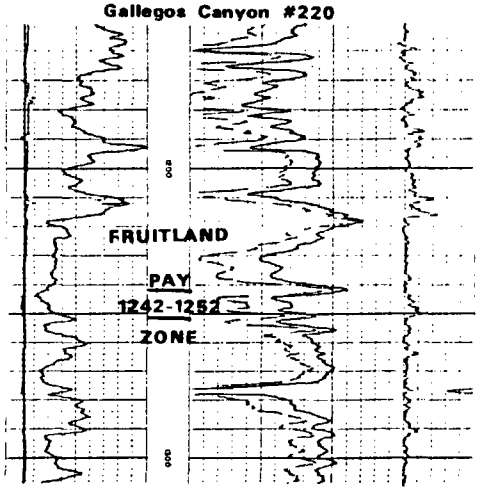
NO. OF WELLS @ YR. END				PRODUCTION OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD.	SI/ABN	ANNUAL	CUMULATIVE
1973	Oil				
	Gas	5		254,157	2,983,381
1974	Oil				
	Gas	5		216,161	3,199,542
1975	Oil				
	Gas	5		196,788	3,396,330
1976	Oil				
	Gas	5		173,445	3,569,775
1977	Oil				
	Gas	6		164,787	3,734,562



PINON FIELD
San Juan Co., New Mexico
Contoured on Top of Fruitland
C.I. = 50'
0 1 2 3 4 5
Scale: Thousands Feet



FORMATION DENSITY LOG
Gallegos Canyon #220



WAW FRUITLAND-PICTURED CLIFFS

(Gas)

T. 26-27 N., R. 13 W., NMPM

San Juan County, New Mexico

By: K. Fagrelius
Dugan Production Corporation

GEOLOGY

Regional Setting: Southwest flank, San Juan Basin

Surface Formations: Tertiary, Ojo Alamo Sandstone and Nacimiento Formation

Exploration Method Leading to Discovery: Subsurface study

Type of Trap: Stratigraphic

Producing Formation: Cretaceous, Fruitland Formation and Pictured Cliffs Sandstone

Gross Thickness and Lithology of Reservoir Rocks: 15 feet, sandstone

Geometry of Reservoir Rock: Lenticular sandstone bodies

Other Significant Shows: None

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Pictured Cliffs Sandstone

DISCOVERY WELL

Name: Dugan Production Corporation No. 1 WAW

Location: NW SW (1500' FSL and 950' FWL) sec. 32, T. 27 N., R. 13 W.

Elevation (KB): 6,175 feet

Date of Completion: June 30, 1970

Total Depth: 1,411 feet

Production Casing: 2 7/8" set at 1,400 feet with 50 sacks of cement

Perforations: 1,325 to 1,329 feet

Stimulation: Sand-water fracture, 10,000 lbs sand and 360 barrels water

Initial Potential: 603 MCFGD (absolute open flow)

Bottom Hole Pressure: 200 psia

DRILLING AND COMPLETION PRACTICES

The discovery well was sand-water fractured but it has subsequently been learned that fracturing does not greatly enhance producibility from these wells. Dugan Production now spuds a 7 7/8" hole and sets one joint of 5½" casing cemented to surface. A 4¾" hole is then drilled with water or minimum mud to a total depth of approximately 125 feet into the Pictured Cliffs Sandstone. An Induction Electrical log is then run to total depth, and 2 7/8" tubing is run for production casing and cemented with a lightweight cement slurry with lost circulation material to avoid formation damage. The drilling rig is then released and after waiting at least 48 hours, a swabbing unit is moved in. A gamma-ray correlation and collar log is run, and the 2 7/8" casing is swabbed down to within 300 to 400 feet of the interval to be perforated. After perforating with 2 1/8" glass jet charges of selected intervals, the casing is swabbed down. If commercial production is indicated at this point 1¼" tubing is run and the well completed ready for production. If natural production is not indicated or of very slight amount, a small job of 250 gallons of 15 percent regular HCl acid followed by enough water to displace the acid into the formation is performed. The well is then swabbed in and tubing run. This field is located in an area of relatively flat terrain making it possible to use truck-mounted shot-hole rigs and requires a minimum of road and location building.

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 8,960 acres (August 1, 1978)
Unproved: 1,920 acres
Approved Spacing: None
No. of Producing Wells: 30 (plus 7 wells drilling)
No. of Abandoned Wells: 10
No. of Dry Holes: 7

Average Net Pay: 10 feet

Porosity: 18 percent

Permeability: 1 to 100 millidarcies (estimate)

Water Saturation: 50 percent

Initial Field Pressure: 250 psia

Type of Drive: Gas expansion

Gas Characteristics and Analysis: Btu 1,050, 90 percent methane

Associated Water Characteristics and Analysis: Not available

Original Gas, Oil, and Water Contact Datums: Unknown

Estimated Primary Recovery: 4,000,000 MCFG

Type of Secondary Recovery: Not available

Estimated Recovery: Unknown

Present Daily Average Production: 750 MCFGD (January 1, 1978)

Market Outlets: El Paso Natural Gas Co.

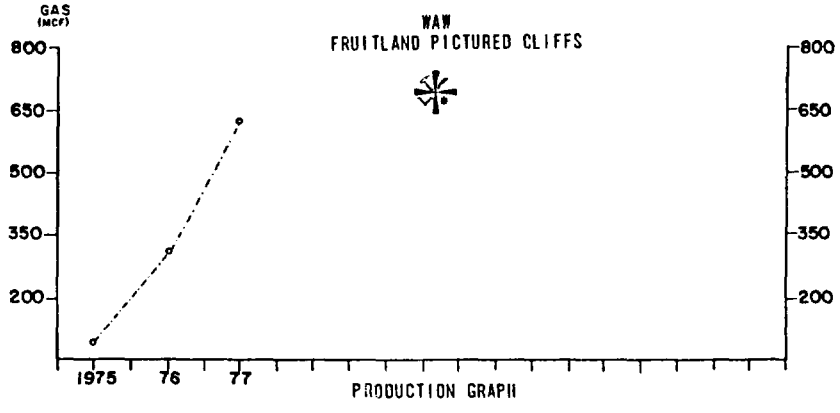
FIELD COMMENTARY

The WAW Pictured Cliffs Pool was discovered by the drilling of the Dugan Production Corp. WAW No. 1 well. This well was spudded May 19, 1970, on a farmout from Aztec Oil and Gas Company, hence the well name "WAW" (Wild Aztec Well). A 7 7/8" hole was drilled to 14 feet and 5½" casing run and cemented to surface with 5 sacks of cement; a 4¾" hole was then drilled to a total depth of 1,411 feet with water and minimum mud; an electric log was run; and 2 7/8" tubing run and cemented for casing. The well was perforated from 1,325 to 1,329 feet. This well was sand-water fractured with 10,000 pounds of sand and 260 barrels of water; 1¼" tubing was set at 1,303 feet. The well tested on a one point back pressure test for an absolute open flow of 603 MCFGD on June 30, 1970 with a seven-day shut-in pressure of 193 psig.

Because of the remote location of the discovery well from existing gas gathering facilities, a contract could not be

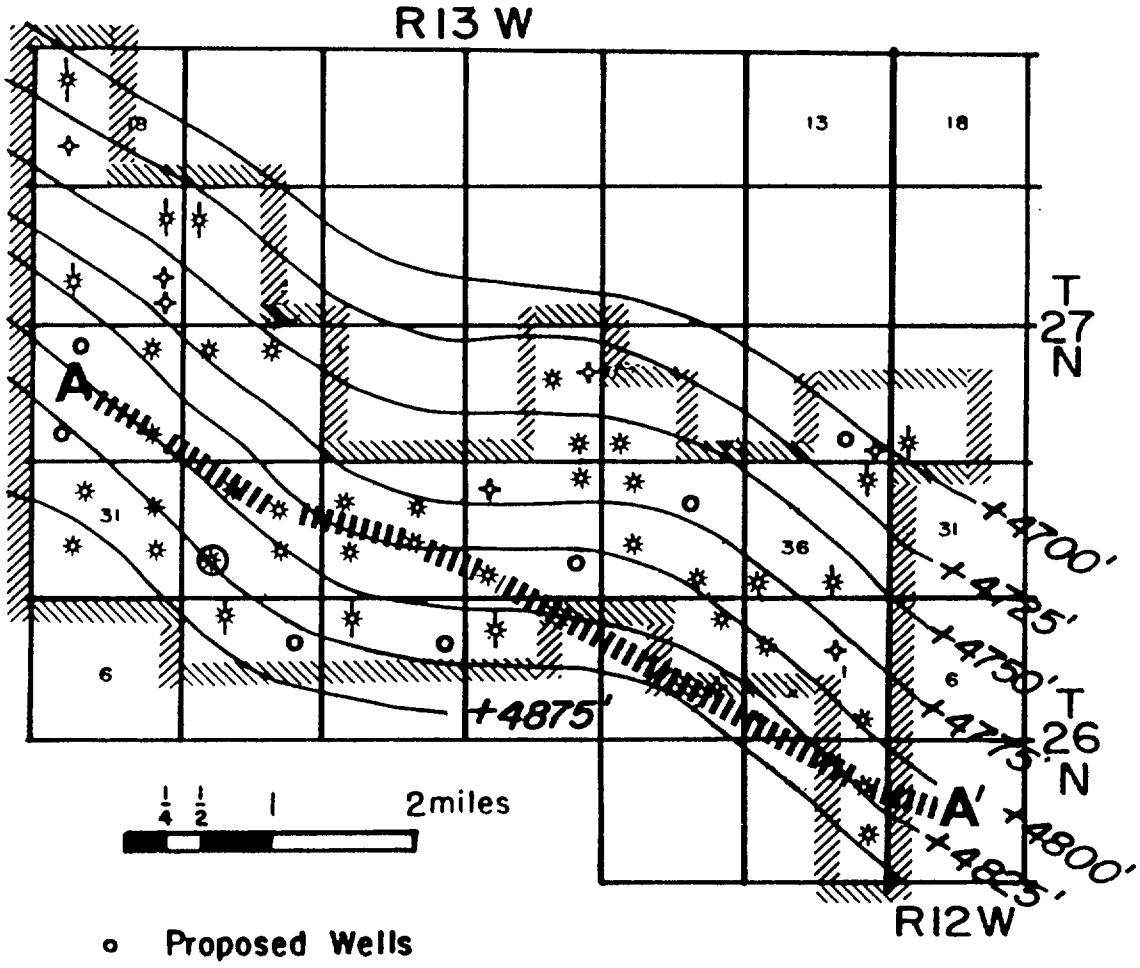
secured for the sale of gas from the discovery well. In December, 1974, Dugan Production Corp. made an application to the Bureau of Land Managemet to secure a pipeline right-of-way to lay approximately 4 miles of pipeline to tie into the El Paso Natural Gas Company low pressure gathering facility located in the NE¼ sec. 35, T. 27 N., R. 13 W. This application was granted April 15, 1975, and a 3″ fiberglass line was laid to connect the WAW No. 1 and the Notsowaw No. 1 well, which was completed April 12, 1975. During the remainder of 1975 and 1976, Dugan Production completed 13 additional wells for which more right-of-way was secured and there are now 15 wells operated by Dugan producing into the pipeline system. Two additional wells have been completed in the field by Kirby Exploration, neither of which has gas sales outlets at this writing, and one well has been completed by Dietrich Exploration Company for which approximately one mile of pipeline was laid.

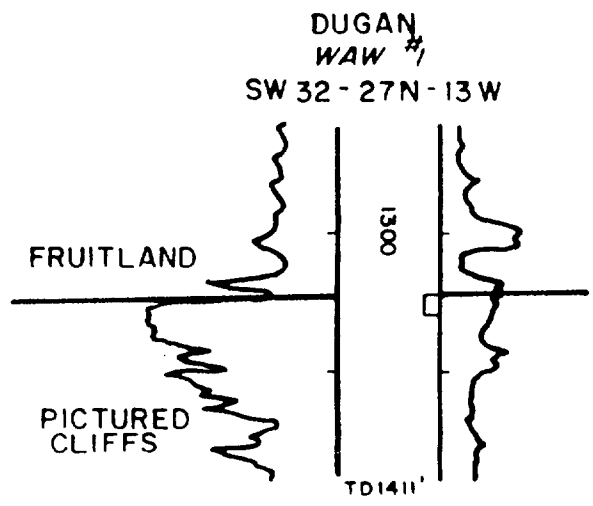
NUMBER OF WELLS AT YEARS END				– PRODUCTION – OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD	SI/ABN	ANNUAL	CUMULATIVE
1975	Gas	2	0	58,657	58,657
1976	Gas	16	1	250,799	309,456
1977	Gas	16	1	316,894	626,412



WAW FRUITLAND PICTURED CLIFFS

SAN JUAN CO., N.M.

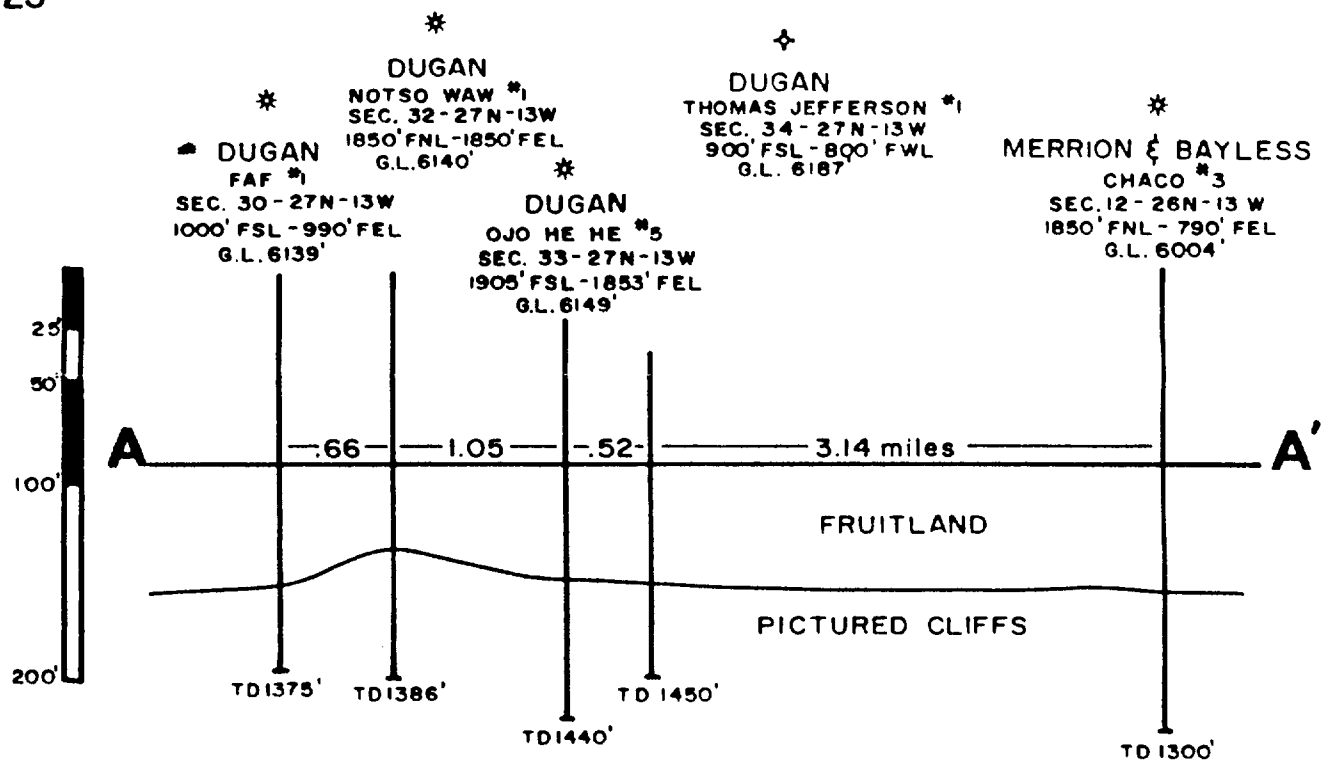




- o Proposed Wells
- Abandoned Wells
- ⊛ Discovery Well
- Producing Wells
- ✧ Dry Holes

DATUM: Top Pictured Cliffs Fm.

C.I. = 25'



Geology: K. Fagrelius

Drafting: M.D. Chambers

HARPER HILL FRUITLAND AND PICTURED CLIFFS

(Gas)

T. 29 N., R. 14 W., NMPM

San Juan County, New Mexico

By: Tom Dugan and Kurt Fagrelius
Dugan Production Corporation

GEOLOGY

Regional Setting: West-central edge, San Juan Basin

Surface Formations: Cretaceous, Kirtland Shale

Exploration Method Leading to Discovery: Subsurface geology

Type of Trap: Stratigraphic

Producing Formation: Cretaceous, Pictured Cliffs Sandstone and Fruitland Formation commingled

Gross Thickness and Lithology of Reservoir Rocks: 200 feet, silicious sandstone

Geometry of Reservoir Rock: Uniform throughout field; tabular

Other Significant Shows: None

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Pictured Cliffs Sandstone

DISCOVERY WELL

Name: Dugan Production Corporation No. 4 Federal I

Location: NE NW (1100' FNL and 1600' FWL), sec. 1, T. 29 N., R. 14 W.

Elevation (GL): 5,552 feet

Date of Completion: February 24, 1969

Total Depth: 1,274 feet

Production Casing: 2 7/8" at 1,268 feet with 75 sacks of cement

Perforations: 860 to 865 feet and 1,203 to 1,208 feet with 2 shots per foot

Stimulation: Sand-water fracture

Initial Potential: Single point back pressure test; absolute open flow 1,069 MCFGD

Bottom Hole Pressure: 367 psig

DRILLING AND COMPLETION PRACTICES

Surface casing 5½" set at 44 feet with 25 sacks of cement; 2 7/8" production string set at 1,268 feet cemented with 75 sacks of cement. Fruitland and Pictured Cliffs zones perforated with 2 shots per foot and sand-water fractured.

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 320 acres
Unproved: 1,280 acres
Approved Spacing: 160 acres
No. of Producing Wells: 2
No. of Abandoned Wells: 0
No. of Dry Holes: 0

Average Net Pay: 10 feet

Porosity: 15 percent (estimate)

Permeability: 5 to 25 millidarcies (estimate)

Water Saturation: 48 percent (estimate)

Initial Field Pressure: 365 psi

Type of Drive: Gas expansion

Gas Characteristics and Analysis: (Dry basis at 14.73 psi and 60°F) Btu 1,101; specific gravity .635; composition (molecular percent): CO_2 0.47, H_2S .0, N_2 .34, methane 95.84, ethane 2.15, propane .67, butane .27, pentane .10, hexane .16; liquids 2.01 gallons per MCFG

Associated Water Characteristics and Analysis: Unknown

Original Gas, Oil, and Water Contact Datums: Unknown

Estimated Primary Recovery: 3,900,000 MCFG

Type of Secondary Recovery: None

Estimated Recovery: 3,900,000 MCFG

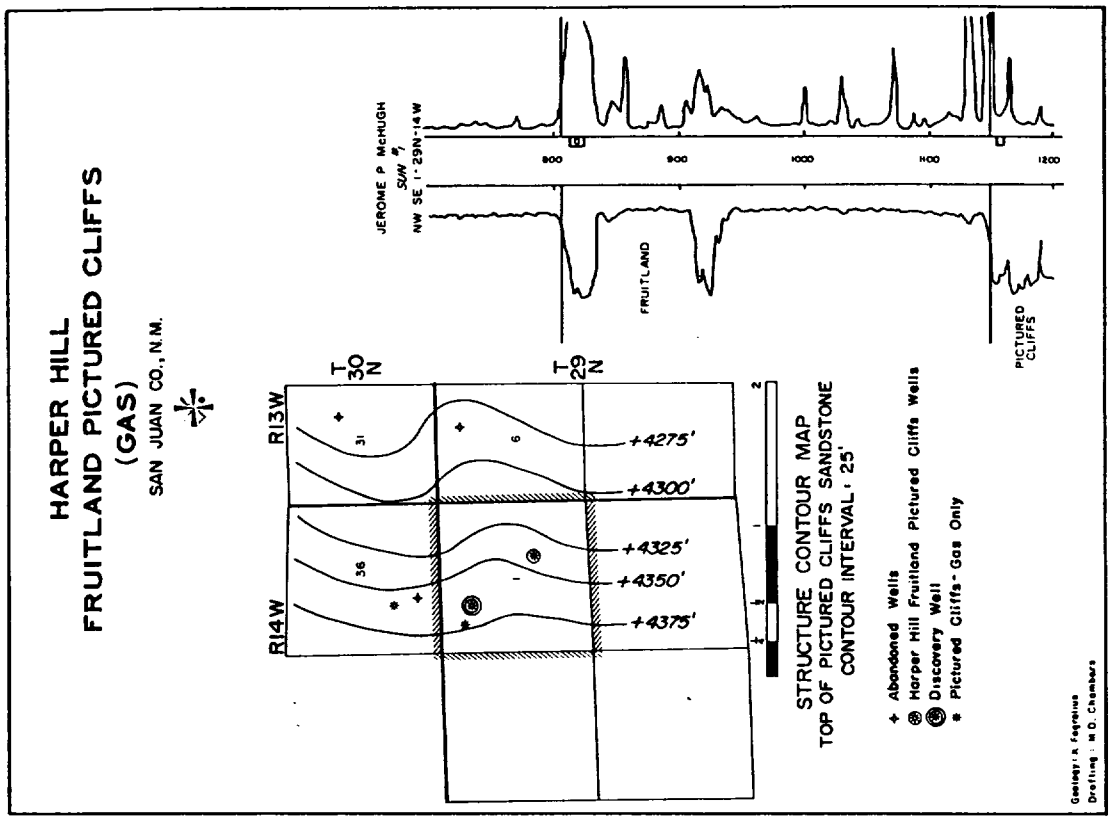
Present Daily Average Production: 270 MCFGD

Market Outlets: El Paso Natural Gas Co. Pipeline

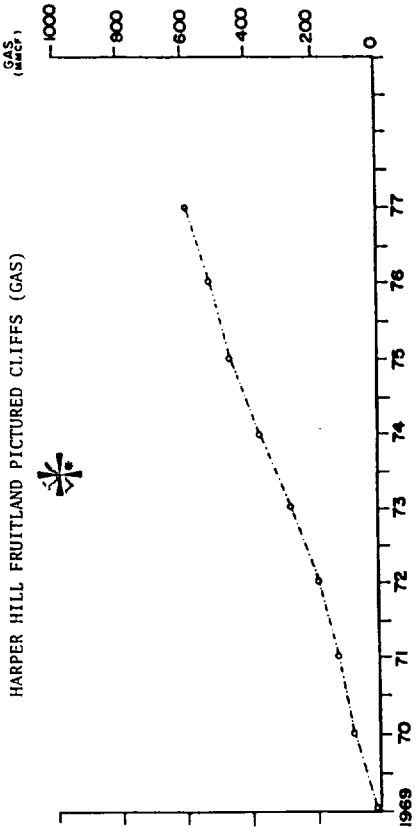
FIELD COMMENTARY

The Harper Hill Pictured Cliffs-Fruitland pool is located on the northwest outskirts of Farmington, New Mexico. The Federal I No. 4, the discovery well, was drilled after a study of the logs from several Dakota wells in the area indicated possible production from the Fruitland Formation and Pictured Cliffs Sandstone. It was necessary to set 7" casing through surface boulders with a cable tool rig; a small rotary seismograph-type rig was used to drill a 4¼" hole through the Pictured Cliffs Sandstone. An open hole log was not run on the Federal I No. 4 because of its proximity to the Federal I No. 3.

The Pictured Cliffs Sandstone was perforated and stimulated with 15,000 gallons of water and 10,000 lbs of 10-20 sand. Next, the Fruitland Formation was perforated, the Pictured Cliffs Sandstone was balled off, and the Fruitland was stimulated with 15,000 gallons of water and 10,000 lbs of 10-20 sand. The well kicked off after fracturing without swabbing and gauged 2,700 MCFGD with a heavy spray of water. Later a bridge plug was set between the Pictured Cliffs and Fruitland to isolate the zones. The Fruitland Formation tested 394 MCFGD with no water. A request was made and approval received from the New Mexico Oil Conservation Commission to commingle both zones in the wellbore. The bridge plug was removed and the well was completed.



NUMBER OF WELLS AT YEARS END				- PRODUCTION - OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD	S I/ABN	ANNUAL	CUMULATIVE
1969	Gas	2		13,710	13,710
1970	Gas	2		61,550	75,260
1971	Gas	2		48,983	124,203
1972	Gas	2		73,932	198,135
1973	Gas	2		81,570	279,705
1974	Gas	2		83,188	362,893
1975	Gas	2		86,493	449,386
1976	Gas	2		70,922	520,308
1977	Gas	2		79,158	599,466



JASIS CANYON FRUITLAND

(Gas)

T. 28-29 N., R. 7-8 W., NMPM

San Juan County, New Mexico

By: David P. Hamilton
Mesa Petroleum Company

GEOLOGY

Regional Setting: Central San Juan Basin

Surface Formations: Tertiary, San Jose Formation

Exploration Method Leading to Discovery: Old well workover, subsurface geology

Type of Trap: Stratigraphic, lateral permeability and porosity pinch-out

Producing Formation: Unnamed sandstone member of Cretaceous Fruitland Formation

Gross Thickness and Lithology of Reservoir Rocks: 46 feet, fine-grained sandstone

Geometry of Reservoir Rock: Northwest trending fluvial sandstone body

Other Significant Shows: Cretaceous, Pictured Cliffs Sandstone, Mesaverde Group, and Dakota Sandstone (all gas)

Oldest Stratigraphic Horizon Penetrated: Jurassic, Morrison Formation at about 7,500 feet

DISCOVERY WELL

Name: Mesa Petroleum Company No. 39 State Comm.

Location: NE NW (990' FNL and 1850' FWL) sec. 36, T. 29 N., R. 8 W., NMPM

Elevation (KB): 6,175 feet

Date of Completion: June 6, 1976

Total Depth: 2,980 feet

Production Casing: 3½" at 2,960 feet with 400 sacks of cement

Perforations: Fruitland: 2,594 feet to 2,618 feet; 24 feet with 2 holes per foot

Stimulation: Acidize perforations; fracture with 27,000 gallons of water and 25,000 lbs of sand

Initial Potential: 965 MCFGD

Bottom Hole Pressure: 1,132 psig

DRILLING AND COMPLETION PRACTICES

Set 8 5/8" surface casing at 140 feet with 90 sacks of cement; 3½" production string set at 2,700 feet with 400 sacks of cement; perforate with 2 holes per foot and sand-water fracture the Fruitland sandstone.

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 160 acres
Unproved: 750 acres as determined by net sandstone isopach
Approved Spacing: 160 acres
No. of Producing Wells: 1
No. of Abandoned Wells: 0
No. of Dry Holes: 0

Average Net Pay: Approximately 20 feet

Porosity: 13.5 percent, average

Permeability: Unknown

Water Saturation: 28 percent (calculated using resistivity of 0.25 ohm)

Initial Field Pressure: 1,144 psia

Type of Drive: Volumetric gas reservoir

Gas Characteristics and Analysis: Dry, sweet; Btu 1,140; 64° API gravity

Oil Characteristics and Analysis: No oil produced

Associated Water Characteristics and Analysis: No formation water produced

Original Gas, Oil, and Water Contact Datums: No gas-water contact

Estimated Primary Recovery: 400,000 MCFG (by analogy)

Type of Secondary Recovery: None

Estimated Ultimate Recovery: Same as primary

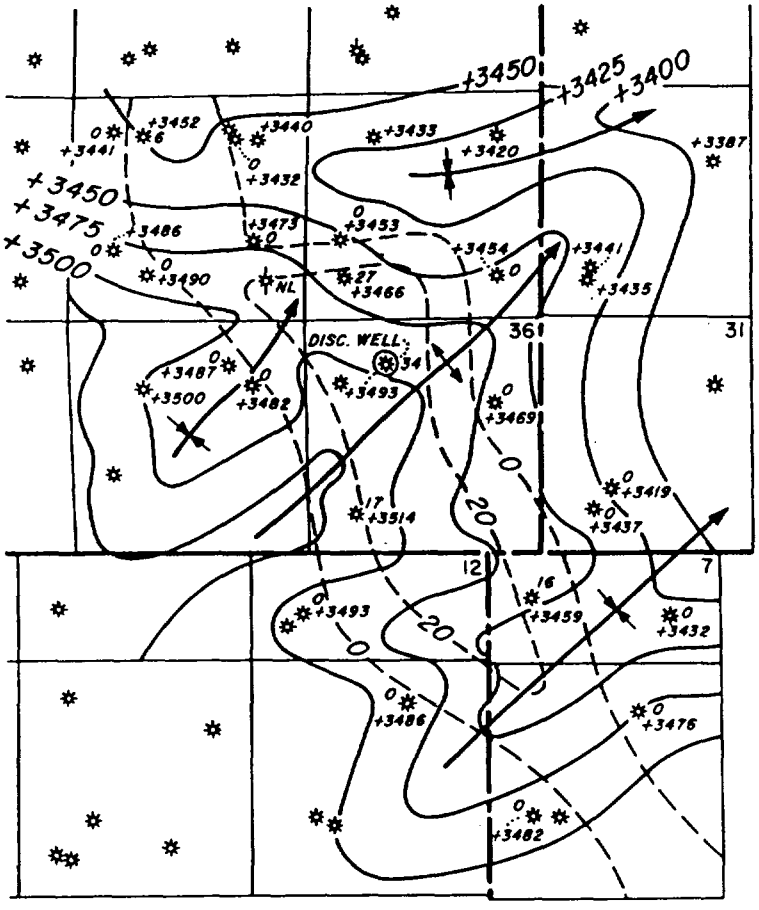
Present Daily Average Production: 100 MCFGD

Market Outlets: Gas gatherer, El Paso Natural Gas Company

REFERENCES

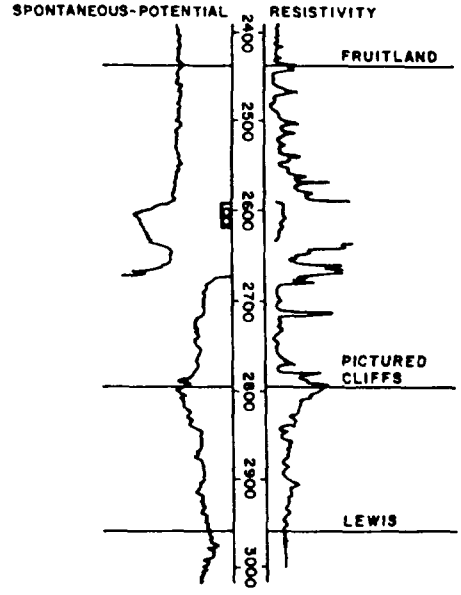
Mesa Petroleum Co. geologic and well files.

NO. OF WELLS @ YR. END				PRODUCTION OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD.	SI/ABN	ANNUAL	CUMULATIVE
1976	Oil				
	Gas	1		75,392	75,392(6 mos.)
1977	Oil				
	Gas	1		34,549	109,941
	Oil				(to 9-1-77)
	Gas				
	Oil				
	Gas				
	Oil				
	Gas				



TYPE LOG

PUBCO PETROLEUM CORPORATION
Pubco State "Com" 39
SAN JUAN CO., NEW MEXICO
Sec. 36 Twp. 29 N Rge. 8 W
990' FNL & 1850' FWL
Elev.: K.B. 6175' G.L. 6163'



JASIS CANYON FRUITLAND FIELD

SAN JUAN CO., NEW MEXICO

—+3400— STRUCTURE MAP: FRUITLAND MARKER: C.I. = 25'

---20--- ISOPACH: FRUITLAND NET SAND: C.I. = 20'

GEOLOGY BY: D.P. HAMILTON

SCALE: 1" = 4000'

KUTZ FRUITLAND

(Gas)

T. 28 N., R. 10-11 W., NMPM

San Juan County, New Mexico

By: T. Lynn Malone
El Paso Natural Gas Company

GEOLOGY

Regional Setting: San Juan Basin

Surface Formations: Tertiary, Nacimiento Formation

Exploration Method Leading to Discovery: Subsurface geology, plug-back of Pictured Cliffs well

Type of Trap: Stratigraphic

Producing Formation: Cretaceous, Fruitland Formation

Gross Thickness and Lithology of Reservoir Rocks: 10 to 35 feet, sandstone

Geometry of Reservoir Rock: Channel sandstones

Other Significant Shows: Cretaceous, Farmington Sandstone Member of Kirtland Shale, Pictured Cliffs Sandstone, and Dakota Sandstone

DISCOVERY WELL

Name: R & G Drilling Company No. 25 Schlosser(dual completion, Pictured Cliffs-Fruitland)

Location: NW SE (1850' FSL and 1850' FEL) sec. 27, T. 28 N., R. 11 W., NMPM

Elevation (KB): 5,628 feet

Date of Completion: October 30, 1956

Total Depth: 1,610 feet

Production Casing: 8 5/8" at 95 feet; 5½" at 1,609 feet

Perforations: Pictured Cliffs, 1,535 to 1,545 feet and 1,557 to 1,572 feet; Fruitland, 1,330 to 1,345 feet

Stimulation: Sand-water fracture at 1,535 to 1,572 feet with 10,000 gallons water, 10,000 lbs sand, injection rate 40 barrels per minute, break-down pressure 2,000 psi; sand-water fracture at 1,330 to 1,345 feet with 10,000 gallons water, 10,000 lbs sand, breakdown pressure 2,250 psi.

Initial Potential: Pictured Cliffs 2,000 MCFGD; Fruitland, 5,000 MCFGD

Bottom Hole Pressure: Shut-in casing pressure 670 psi

DRILLING AND COMPLETION PRACTICES

A single completion Fruitland well: set surface casing, drill to base of Fruitland Formation, run logs, run 2 7/8" casing to total depth, perforate selected intervals, breakdown and sand-water fracture (in this area the Fruitland could possible be dually completed with the Farmington Sandstone or Pictured Cliffs Sandstone).

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 2,080 acres
Unproved: 2,560 acres
Approved Spacing: 160 acres
No. of Producing Wells: 13
No. of Abandoned Wells: 0
No. of Dry Holes: 0

Average Net Pay: 20 feet

Porosity: 10 to 16 percent

Permeability: Not available

Water Saturation: 40 percent

Initial Field Pressure: 650 psi

Type of Drive: Gas expansion

Gas Characteristics and Analysis: Btu 1,133; in molecular percentage: methane 88.73, ethane 6.11, propane 3.06; specific gravity 0.647

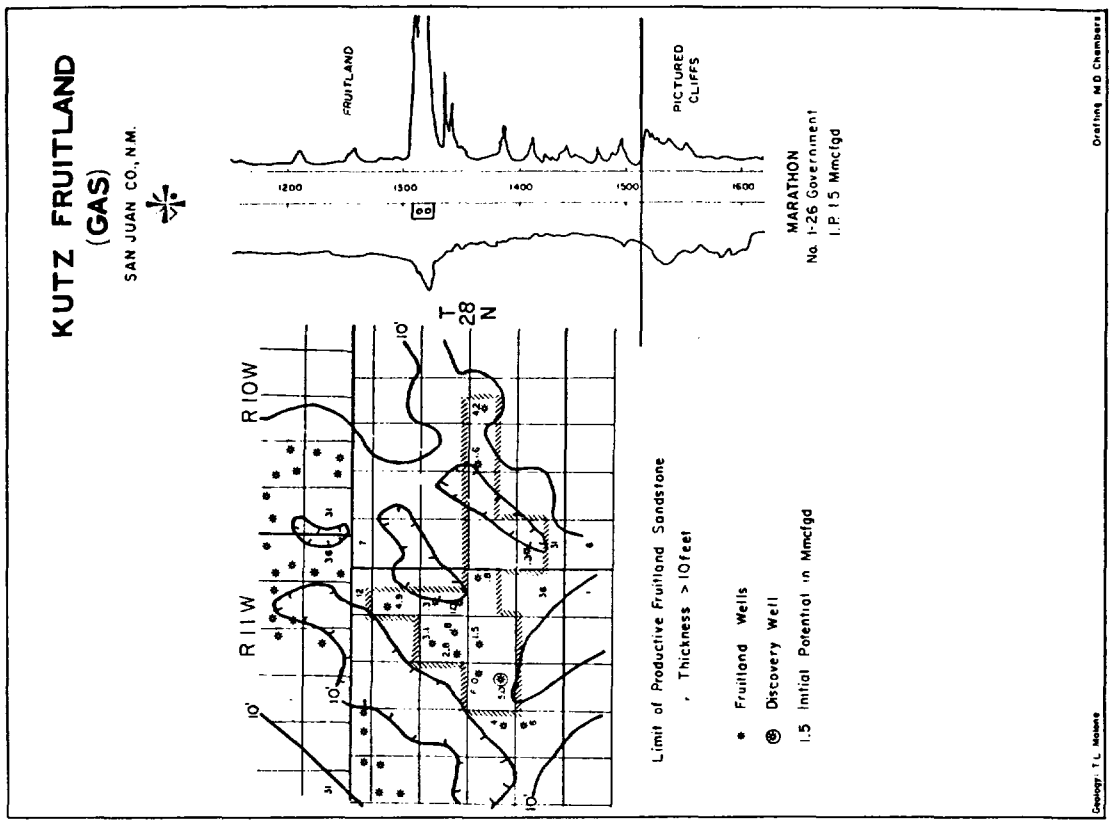
Associated Water Characteristics and Analysis: Resistivity .38 ohm at 74°F; total dissolved solids, 17,448 ppm

Estimated Recovery: 16,000,000 MCFG

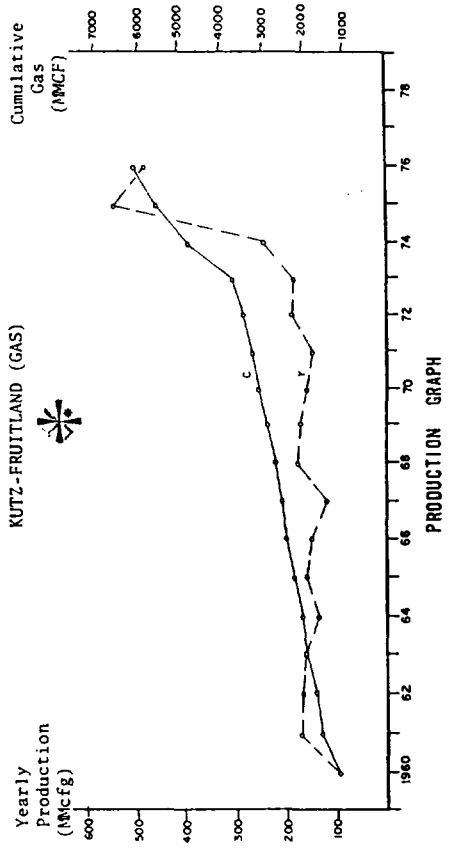
Present Daily Average Production: 1,328 MCFGD (January 1, 1977)

Market Outlets: El Paso Natural Gas Company, Southern Union Gas Company

Collapsed rig on wildcat well 11½ miles northeast of the Hospah field, 1927. (Photo courtesy of Tom Dugan)



NUMBER OF WELLS AT YEARS END				- PRODUCTION - OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD.	S.I./ABN.	ANNUAL	CUMULATIVE
1960	Gas	2		85,055	317,451
	Oil				912
	Gas	4		170,174	1,518,197
	Oil				228
1961	Gas	4		165,018	1,683,218
	Oil				228
1962	Gas	4		160,733	1,843,948
	Oil			684	912
1963	Gas	4		133,148	1,977,096
	Oil				912
1964	Gas	4		155,149	2,132,245
	Oil				912
1965	Gas	4		148,405	2,280,650
	Oil				912
1966	Gas	4		141,974	2,422,624
	Oil				912
1967	Gas	4		172,644	2,595,268
	Oil				912
1968	Gas	5		169,652	2,799,972
	Oil				912
1969	Gas	5		152,530	2,952,502
	Oil				912
1970	Gas	5		146,004	3,098,506
	Oil				912
1971	Gas	7		187,013	3,396,113
	Oil				912
1972	Gas	7		186,582	3,582,695
	Oil				912
1973	Gas	8		241,845	4,725,249
	Oil				912
1974	Gas	11		547,790	5,470,020
	Oil				912
1975	Gas	13		484,603	5,963,750
	Oil				912
1976					



FARMER FRUITLAND

(Gas)

T. 30 N., R. 11 W., NMPM

San Juan County, New Mexico

By: D. B. Fortner and R. W. Jentgen
Bureau of Land Management
and
A. Allen Middleman
Southland Royalty Co.

GEOLOGY

Regional Setting: North-central San Juan Basin

Surface Formations: Tertiary, Nacimiento Formation

Exploration Method Leading to Discovery: Discovered while drilling to Pictured Cliffs Sandstone in Aztec field

Type of Trap: Stratigraphic

Producing Formation: Upper Cretaceous, Fruitland Formation

Gross Thickness and Lithology of Reservoir Rocks: 0 to 18 feet; sandstone

Other Significant Shows: Cretaceous, Farmington Sandstone member of Kirtland Shale and Pictured Cliffs Sandstone

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Dakota Sandstone

DISCOVERY WELL

Name: No. 1 Bobbie Herrera

Location: NE SW (1,830' FSL, 1,620' FWL) sec. 4, T. 30 N., R. 11 W., NMPM

Elevation (GL): 5,743 feet

Date of Completion: February 14, 1979

Total Depth: 2,350 feet (plugged back to 2,312 feet)

Production Casing: 2⅞" at 2,312 feet with 300 sacks of cement

Perforations: 1,950 to 1,956 feet and 2,053 to 2,055 feet (with 1 shot per foot)

Stimulation: Sand-water fracture

Initial Potential: 830 MCFGD after 3 hours (back-pressure testing method)

Bottom Hole Pressure: 722 psi (shut-in pressure casing)

DRILLING AND COMPLETION PRACTICES

The discovery well was drilled to 78 feet with a cable tool rig and 7 inch surface casing was set and cemented with 80 sacks of cement. The remainder of the 4¾" hole was drilled with a rotary drilling rig to a total depth of 2,350 feet. 2⅞" production casing was run to 2,312 feet and cemented with 300 sacks of cement. The pay zones in the Fruitland and Pictured Cliffs were selected from open hole logs (I-SFL, FDC-GR) and were perforated. Both zones were sand-water fractured separately. 1¼" tubing was run to 2,229 feet and a compression packer was set at 2,068 feet. The Pictured Cliffs produces up the tubing and the Fruitland produces up the annulus in this dual completion.

RESERVOIR DATA

Productive Area:
Approved Spacing: 160 acres
No. of Producing Wells: 4
No. of Abandoned Wells: 0
No. of Dry Holes: 0
Shut-in Wells: 2

Average Net Pay: Two pay zones totaling 8 feet

Porosity: 12 percent (average of 3 wells)

Permeability: Unknown

Water Saturation: 27 percent; 41 percent, average of 3 wells

Initial Field Pressure: 722 psi

Type of Drive: Gas expansion

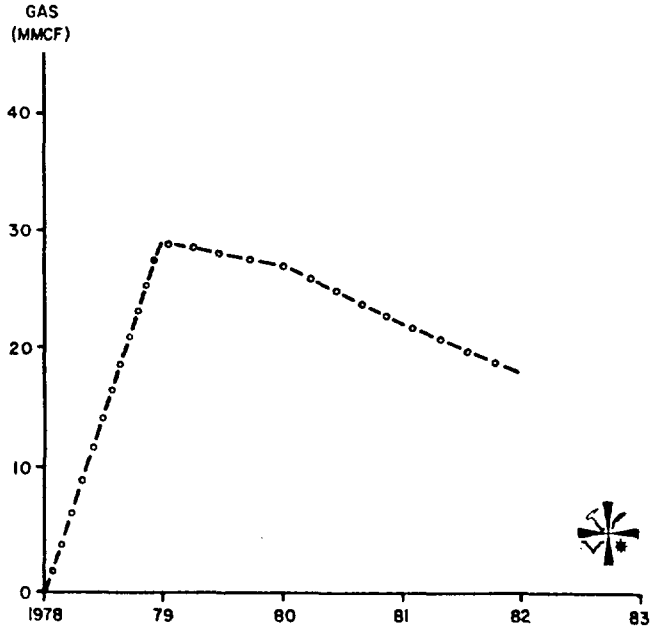
Gas Characteristics and Analysis: None

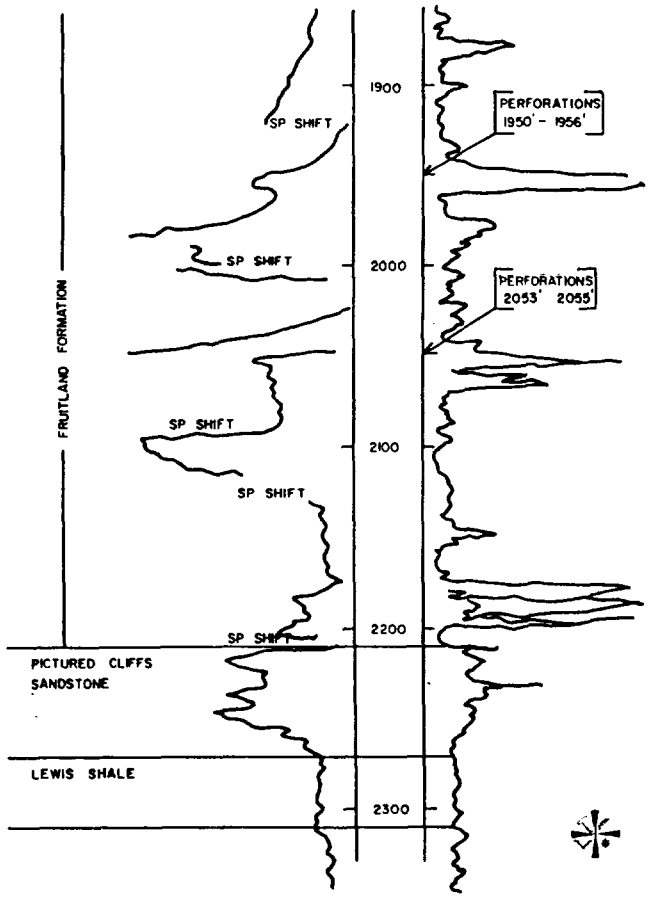
Market Outlets: El Paso Natural Gas Co. pipeline

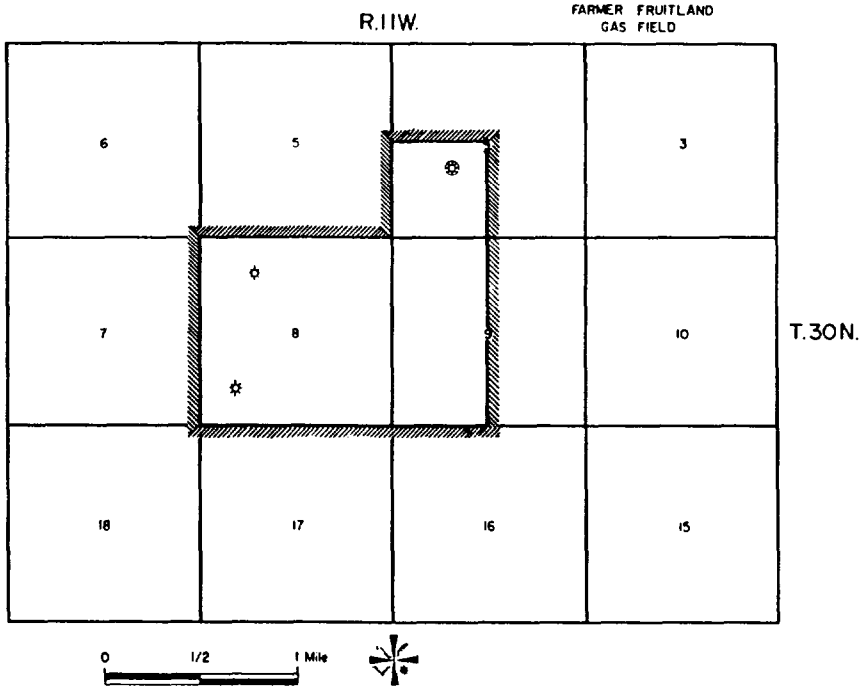
FIELD COMMENTARY

The Farmer Fruitland field is located adjacent to, and within the city limits of Aztec, New Mexico. The field produces from the Fruitland Formation which represents sedimentation that occurred along a deltaic plain covered by numerous swamps and drained by streams. Gas production is from distributary channel sandstones and overbank deposits. The erratic distribution of the sandstone sequences makes correlation of beds and confident mapping difficult. The discovery well, the Manana No. 1 Bobby Herrera, was completed in two intervals of the Fruitland: the upper zone is a well developed fining-upward channel sequence capped by a coal and may represent an abandoned river meander which eventually silted up and was covered by swamp deposits.

The C & E No. 8 Aztec (SW sec. 8) and the C & E No. 8-A Fee (NW sec. 8) appear to be completed in the same sandstone interval. The No. 1 Bobby Herrera (SW sec. 4) and the C & E No. 9 Aztec (SW sec. 9) appear to be completed at the same stratigraphic level but in a different sandstone bed from the two wells mentioned previously. Three of the four wells in this field produce gas from the Fruitland commingled with Pictured Cliffs production and are listed under the Aztec Pictured Cliffs field, even though they are within the boundaries of the Farmer Fruitland field.







AZTEC FRUITLAND

(Gas)

T. 29-30 N., R. 10-11 W., NMPM

San Juan County, New Mexico

By: T. Lynn Malone
El Paso Natural Gas Company

GEOLOGY

Regional Setting: San Juan Basin, northwest New Mexico

Surface Formations: Tertiary, Nacimiento Formation

Exploration Method Leading to Discovery: Subsurface geology, plug-back of Pictured Cliffs well

Type of Trap: Stratigraphic

Producing Formation: Fruitland Formation

Gross Thickness and Lithology of Reservoir Rocks: 10 to 60 feet of sandstone

Geometry of Reservoir Rock: Discontinuous fluvial deposits

Other Significant Shows: Farmington Sandstone Member of Kirtland Shale, Pictured Cliffs Sandstone, "Chacra" sandstones, Mesaverde Group, and Dakota Sandstone

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Dakota Sandstone

DISCOVERY WELL

Name: Francis L. Harvey No. 1 Hare

Location: SE SE (770' FSL and 1270' FEL) sec. 14, T. 29 N., R. 11 W., NMPM

Elevation: 5,540 feet

Date of Completion: June 20, 1952

Total Depth: 1,880 feet; plugged back to 1,747 feet

Production Casing: 8 5/8" at 100 feet; 5½" at 1,786 feet

Perforations: 1,563 to 1,587 feet; 1,593 to 1,605 feet

Stimulation: Natural

Initial Potential: 500 MCFGD, gauge with pitot tube

Bottom Hole Pressure: Shut in casing pressure, 638 psi

DRILLING AND COMPLETION PRACTICES

For single completion, set surface casing, drill to base of Fruitland Formation, run wireline logs, run 2 7/8" casing to total depth, perforate selected intervals, break down and sand-water fracture. The Fruitland could possibly be dually completed with the Pictured Cliffs, "Chacra," or Mesaverde in this area.

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 8,160 acres
Unproved: 2,720 acres
Approved Spacing: 160 acres
No. of Producing Wells: 49
No. of Abandoned Wells: 2
No. of Dry Holes: 0

Average Net Pay: 30 feet

Porosity: 10 to 18 percent

Permeability: Not known

Water Saturation: 40 percent

Initial Field Pressure: 650 psi

Type of Drive: Gas expansion

Gas Characteristics and Analysis: 1,146 Btu; in molecular percentage: methane 87.72, ethane 6.90, propane 2.88; specific gravity 0.650

Associated Water Characteristics: Rw .38 ohm, total dissolved solids 17,480 ppm

Estimated Recovery: 33,600,000 MCFG

Present Daily Average Production: 2,473 MCFGD

Market Outlets: El Paso Natural Gas Company

FIELD COMMENTARY

Cretaceous strata above the Pictured Cliffs comprising the Fruitland and Kirtland Formations are nonmarine and contain sandstones with limited lateral extent. Close control is needed to delineate the stratigraphic trends in these upper formations.

A transition zone lay between the Pictured Cliffs sea and the continental conditions to the west. The sediments which were deposited in this transitional environment now comprise the Fruitland Formation. Lush vegetation which existed in this swampy area is now represented in the rock record as coal and carbonaceous shale. Much of the floor of the swamp was covered with still-standing waters. Small sluggish streams flowed through these waters, perpendicular to the Pictured Cliffs strandline.

A massive coal bed is often present near the base of the Fruitland. Overlying this coal is a shale-silt sequence approximately 50 feet thick which is overlain by a 200-foot section of the Fruitland which contains the sandstones of economic potential. The upper portion of the Fruitland Formation is comprised of siltstone and shale and grades into the overlying Kirtland Shale.

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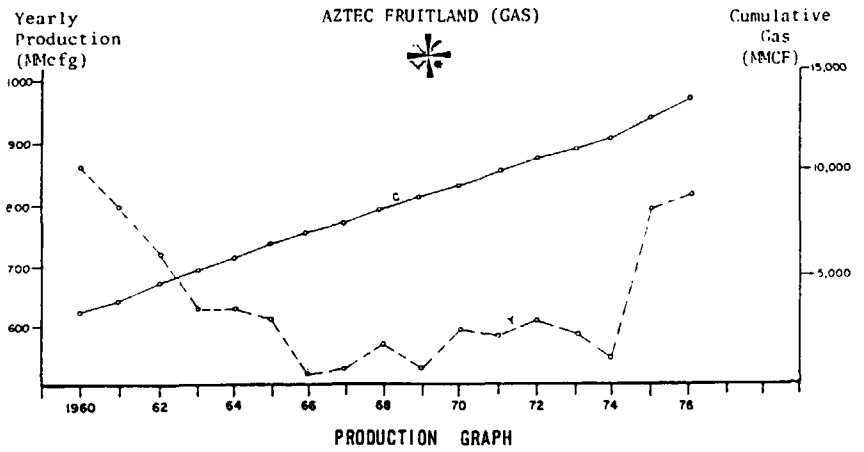
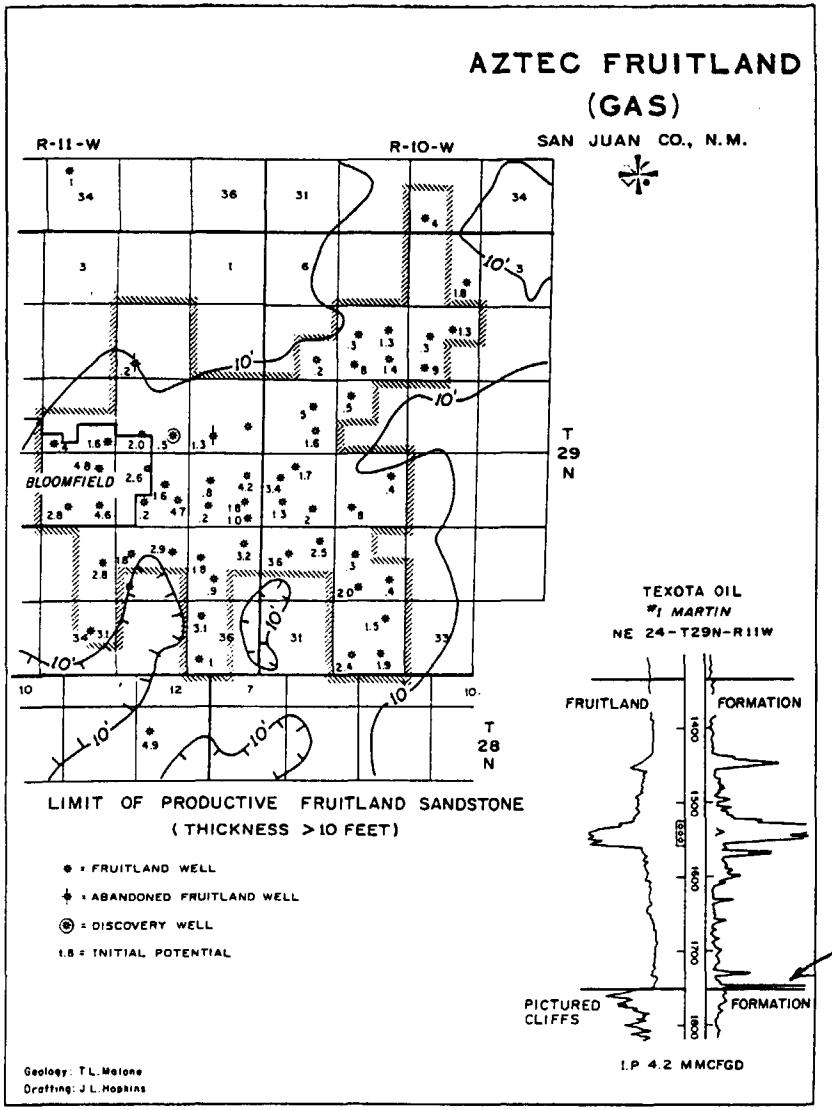
Malone, 1978

NUMBER OF WELLS AT YEARS END				- PRODUCTION - OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD.	S.I./ABN.	ANNUAL	CUMULATIVE
1960	Gas	30		855,187	3,495,124
	Oil				2,114
1961	Gas	31		789,315	4,272,555
	Oil				2,114
1962	Gas	32		706,251	4,978,586
	Oil				2,114
1963	Gas	32		626,248	5,605,107
	Oil				2,114
1964	Gas	32		623,021	6,227,785
	Oil				2,114
1965	Gas	32		606,361	6,834,146
	Oil				2,114
1966	Gas	33		519,338	7,353,484
	Oil				2,114
1967	Gas	33		524,711	7,878,195
	Oil				2,114
1968	Gas	33		565,981	8,444,176
	Oil				2,114
1969	Gas	33		520,720	8,964,896
	Oil				
1970	Gas	33		588,541	9,553,437
	Oil				
1971	Gas	33		571,312	10,124,749
	Oil				
1972	Gas	34		599,743	10,784,655
	Oil				
1973	Gas	34		573,674	11,358,329
	Oil				
1974	Gas	37		538,070	11,896,399
	Oil				
1975	Gas	48		780,818	12,793,143
	Oil				
1976	Gas	49		799,608	13,607,752
	Oil				



PRODUCTION GRAPH



Ma Base Coal

KUTZ FRUITLAND, WEST

(Gas)

T. 29 N., R. 12-13 W.

San Juan County, New Mexico

By: Michael F. Conlon
Energy Reserves Group

GEOLOGY

Regional Setting: West-central San Juan Basin

Surface Formations: Tertiary, Ojo Alamo Sandstone; Cretaceous, Kirtland Shale

Exploration Method Leading to Discovery: Subsurface geology

Type of Trap: Stratigraphic

Producing Formation: Cretaceous, Fruitland Formation

Gross Thickness and Lithology of Reservoir Rocks: 20 feet, sandstone

Geometry of Reservoir Rock: Elongate, lenticular, sandstone lense; northwest depositional strike

Other Significant Shows: Cretaceous, Pictured Cliffs Sandstone and Dakota Sandstone produce in the area

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Dakota Sandstone

DISCOVERY WELL

Name: Locke-Taylor Drilling Co. No. 1 Tycksen

Location: NE NE (990' FNL and 990' FEL) sec. 23, T. 29 N., R. 13 W.

Elevation (KB): 5,300 feet (estimate)

Date of Completion: October 22, 1952

Total Depth: 1,230 feet

Production Casing: 5" at about 900 feet

Perforations: Open hole completion, 900 to 975 feet

Stimulation: Nitroglycerine

Initial Potential: 370 MCFGD

Bottom Hole Pressure: 350 psi

DRILLING AND COMPLETION PRACTICES

Well is drilled into the Pictured Cliffs where 5½" casing is set and a completion is attempted. If the Pictured Cliffs is nonproductive, the well is plugged back and perforated in the Fruitland. Treatment is a sand-water fracture consisting of 21,000 gallons of water and 30,000 lbs of sand.

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 500 acres
Unproved: 2,000 acres (The boundary between Kutz, West, and Pinon, North is not defined. Combined total unproved area for both fields is 3,300 acres.)
Approved Spacing: None
No. of Producing Wells: 2
No. of Abandoned Wells: 0
No. of Dry Holes: 0

Average Net Pay: 12 feet

Porosity: 16 percent (estimated)

Permeability: Unknown

Water Saturation: 40 percent (estimated)

Initial Field Pressure: 382 psia

Type of Drive: Pressure depletion

Gas Characteristics and Analysis: Specific gravity 0.664

Oil Characteristics and Analysis: None

Associated Water Characteristics and Analysis: 3,000 to 5,000 ppm NaCl

Original Gas, Oil, and Water Contact Datums: Unknown

Estimated Primary Recovery: 1,370,000 MCFG (80 percent)

Type of Secondary Recovery: None

Present Daily Average Production: 115 MCFGD

Market Outlets: El Paso Natural Gas

REFERENCES

New Mexico Oil and Gas Engineering Committee records.
Operator's files.

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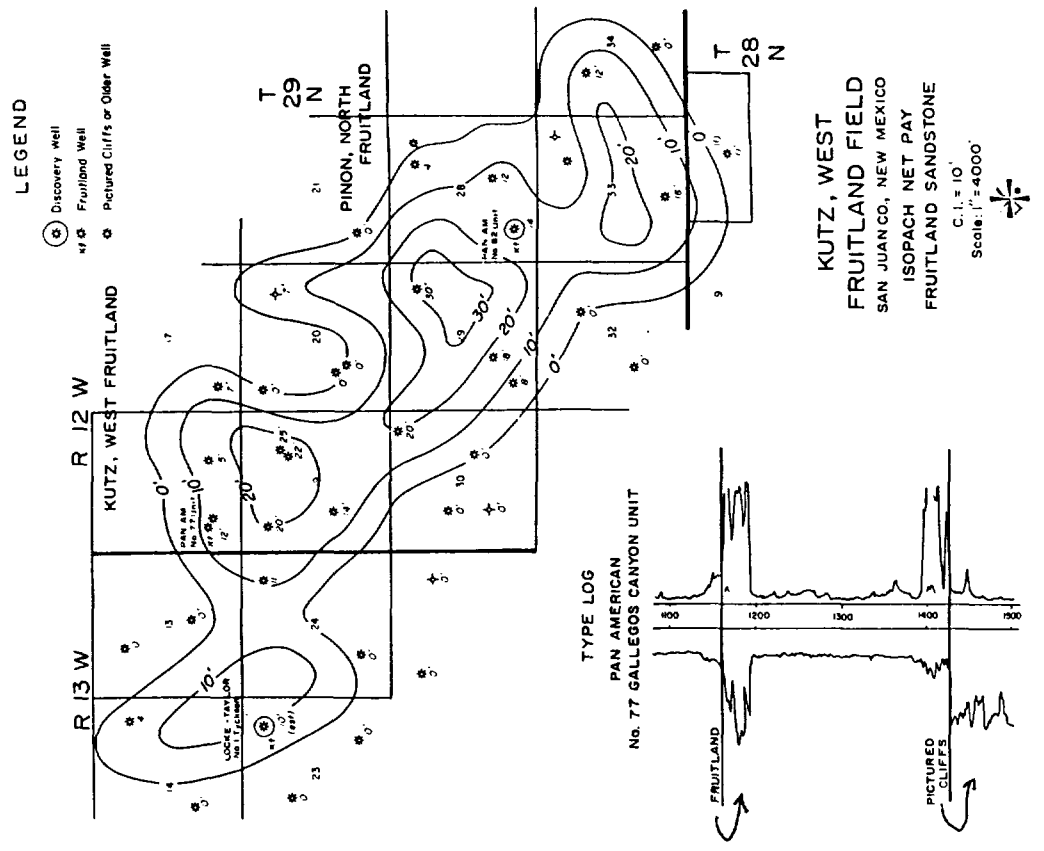
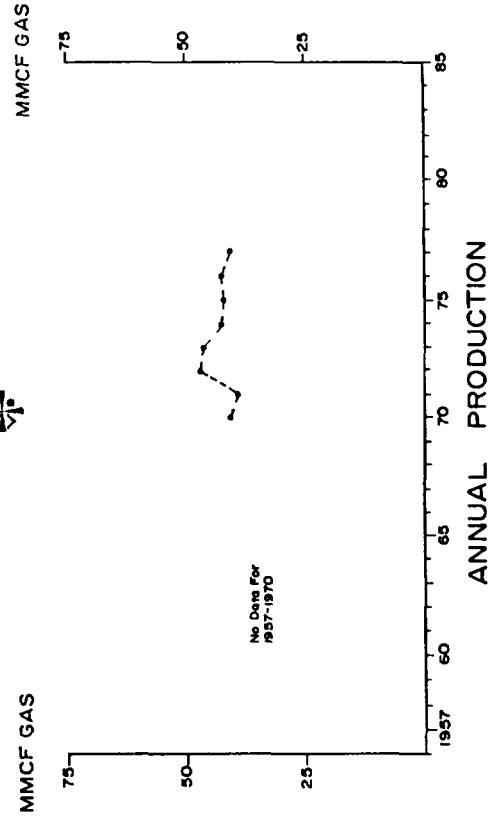


NO. OF WELLS @ YR. END				PRODUCTION OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD.	SI/ABN	ANNUAL	CUMULATIVE
1957-1958	OIL	1		No Data	
	GAS				
1959-1969	OIL	2		No Data	
	GAS				
1970	OIL	2		40,475	473,487
	GAS				
1971	OIL	2		38,431	511,918
	GAS				
1972	OIL	2		47,427	559,345
	GAS				
1973	OIL	2		47,231	606,576
	GAS				
1974	OIL	2		43,024	649,600
	GAS				
1975	OIL	3		42,680	692,280
	GAS				
1976	OIL	2		43,016	735,296
	GAS				
1977	OIL	2		41,290	776,586
	GAS				



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PINON FRUITLAND, NORTH

(Gas)

T. 29 N., R. 12 W., NMPM

San Juan County, New Mexico

By: Michael F. Conlon
Energy Reserves Group

GEOLOGY

Regional Setting: West central San Juan Basin

Surface Formations: Tertiary, Ojo Alamo Sandstone; Cretaceus, Kirtland Shale

Exploration Method Leading to Discovery: Subsurface geology

Type of Trap: Stratigraphic

Producing Formation: Cretaceous, Fruitland Formation

Gross Thickness and Lithology of Reservoir Rocks: 20 feet, sandstone

Geometry of Reservoir Rock: Elongate lenticular sandstone with northwest depositional strike

Other Significant Shows: Cretaceous, Pictured Cliffs Sandstone and Dakota Sandstone produce in the area

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Dakota Sandstone

DISCOVERY WELL

Name: Pan American No. 82 Gallegos Canyon Unit

Location: SW SW (790' FSL and 1190' FWL) sec. 28, T. 29 N., R. 12 W.

Elevation (KB): 5,334 feet

Date of Completion: Plugged and abandoned January, 1961; re-entered and completed in Fruitland August, 1966

Total Depth: 1,304 feet

Production Casing: 5½" to 1,304 feet with 200 sacks of cement

Perforations: 950 to 964 feet

Stimulation: Sand-water fracture; 18,400 gallons water, 20,000 lbs sand.

Initial Potential: 900 MCFGD, ¾" choke

Bottom Hole Pressure: 399 psia

DRILLING AND COMPLETION PRACTICES

Well is drilled into the Pictured Cliffs where 5½" casing is set and a completion is attempted. If the Pictured Cliffs is non-productive, the well is plugged back and perforated in the Fruitland. Treatment is a sand-water fracture consisting of 18,400 gallons of water and 20,000 lbs of sand.

RESERVOIR DATA

Productive Area:
Proved (as determined geologically): 320 acres
Unproved: 1,300 acres (The boundary between Pinon, North and Kutz, West is not defined. Total combined unproved area for both fields is 3,300 acres.)
Approved Spacing: None
No. of Producing Wells: 1
No. of Abandoned Wells: 0
No. of Dry Holes: 0

Average Net Pay: 14 feet

Porosity: 16 percent (estimated)

Permeability: Unknown

Water Saturation: 40 percent (estimated)

Initial Field Pressure: 399 psia

Type of Drive: Pressure depletion

Gas Characteristics and Analysis: Unknown

Associated Water Characteristics and Analysis: 3,000 to 5,000 ppm NaCl

Original Gas, Oil, and Water Contact Datums: Unknown

Estimated Primary Recovery: 180,000 MCFG 75 percent of gas in place

Type of Secondary Recovery: None

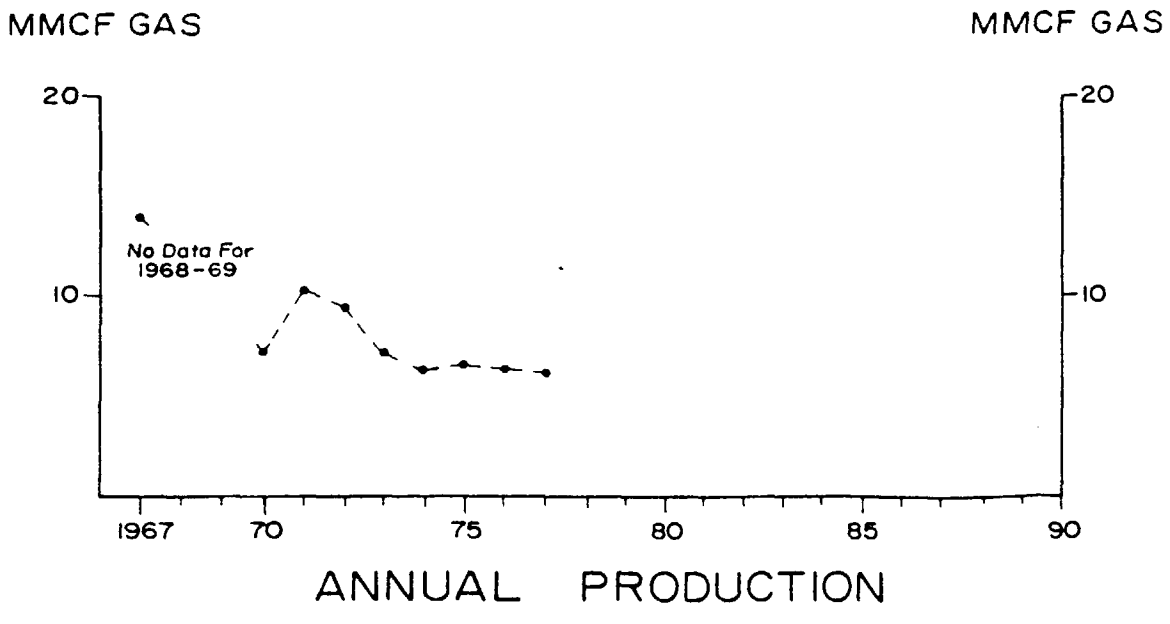
Present Daily Average Production: 20 MCFGD

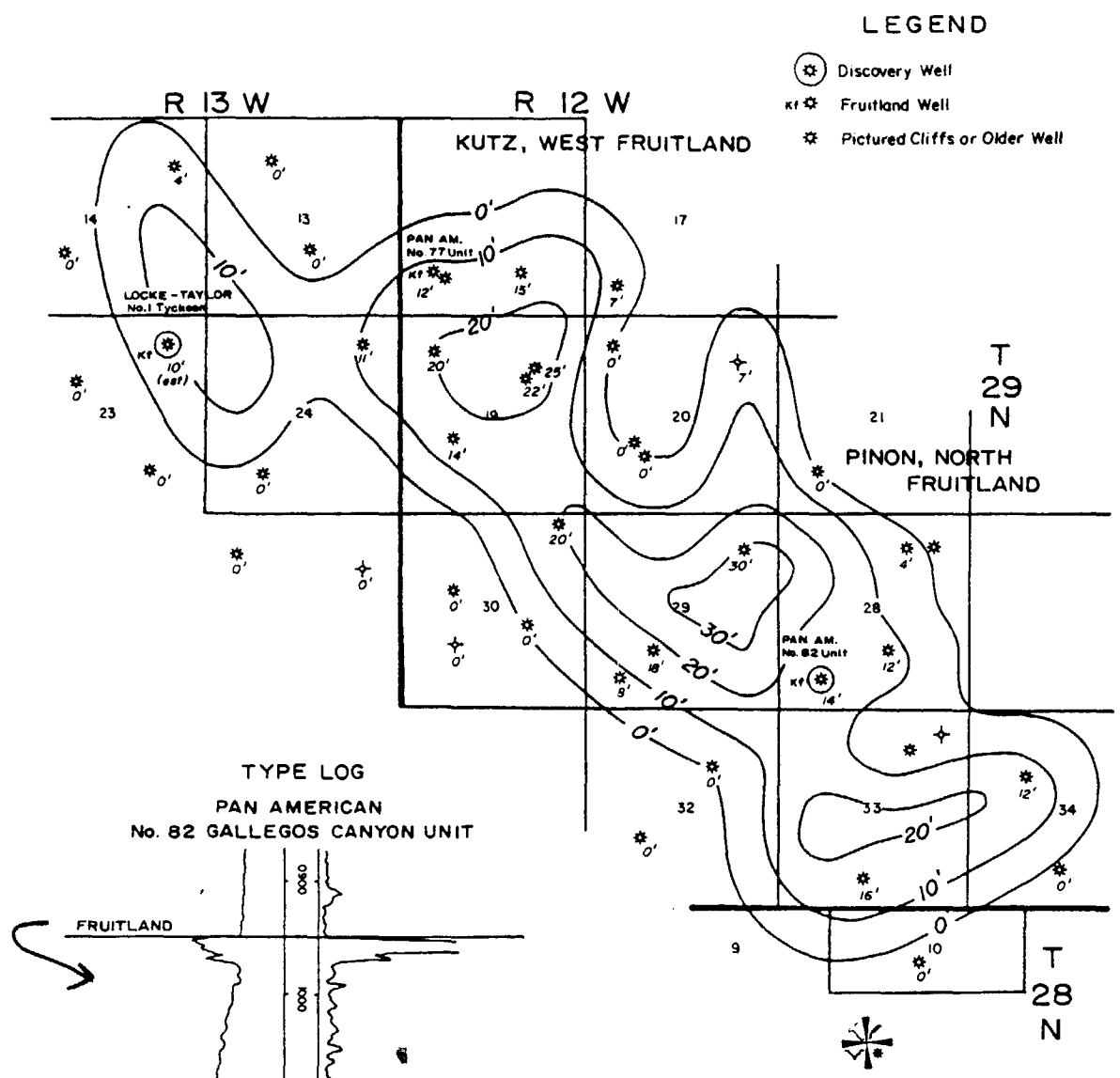
Market Outlets: El Paso Natural Gas

REFERENCES

Engineering Committee records.
Operator's files.

NO. OF WELLS @ YR. END				PRODUCTION OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD.	SI/ABN	ANNUAL	CUMULATIVE
1967	OIL				
	GAS	1		14,037	14,037
1968	OIL				
	GAS	1		No Data	
1969	OIL				
	GAS	1		No Data	
1970	OIL				
	GAS	1		7,220	40,965
1971	OIL				
	GAS	1		10,400	51,365
1972	OIL				
	GAS	1		9,703	61,068
1973	OIL				
	GAS	1		7,031	68,099
1974	OIL				
	GAS	1		6,472	74,571
1975	OIL				
	GAS	1		6,805	81,376
1976	OIL				
	GAS	1		6,600	87,976
1977	OIL				
	GAS	1		6,240	94,216





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CROUCH MESA FRUITLAND

(Gas)

T. 29 N., R. 12 W., NMPM

San Juan County, New Mexico

By: Elliott A. Riggs
Independent Petroleum Geologist

GEOLOGY

Regional Setting: Western part, San Juan Basin

Surface Formations: Tertiary, Ojo Alamo Sandstone

Exploration Method Leading to Discovery: Subsurface; found on logs during deeper drilling

Type of Trap: Stratigraphic, local sandstone lense

Producing Formation: Well was dual completion, Fruitland Formation and Pictured Cliffs Sandstone both producing

Gross Thickness and Lithology of Reservoir Rocks: Fruitland sandstone bed 10 feet, light gray sandstone; Pictured Cliffs, 25 feet, light gray, fine- to medium-grained, tight dirty sandstone

Geometry of Reservoir Rock: Fruitland, erratic sandstone body encased in shale; Pictured Cliffs, typical complex sandstone varies from location to location through 50 to 75 foot thick interval

Other Significant Shows: None

Oldest Stratigraphic Horizon Penetrated: Cretaceous, Pictured Cliffs Sandstone

DISCOVERY WELL

Name: Devonian Gas and Oil Co. No. 1 Federal

Location: SE NW sec. 4, T. 29 N., R. 12 W.

Elevation (KB): 5,731 feet

Date of Completion: June 26, 1959

Total Depth: 1,856 feet

Production Casing: 5½" to 1,856 feet with 150 sacks of cement for dual completion

Perforations: Fruitland 1,566 to 1,576 feet; Pictured Cliffs 1,776 to 1,800 feet

Stimulation: Both zones were sand-water fractured

Initial Potential: Fruitland 1,500 MCFGD; Pictured Cliffs 1,300 MCFGD

Bottom Hole Pressure: Fruitland 410 psi (shut-in casing pressure); Pictured Cliffs 327 psi (shut-in casing pressure)

DRILLING AND COMPLETION PRACTICES

Set approximately 112 feet of 8⅝" surface casing. Drill out with fresh water mud to total depth and run electric logs. If sandstone development on logs warrants, run 5½" casing to base of Pictured Cliffs Sandstone. Selectively perforate Pictured Cliffs and Fruitland. Sand-water fracture each zone. Set production packer to isolate Pictured Cliffs and Fruitland intervals. Run 1" tubing siphon string to approximately 1,656 feet to produce Fruitland. Set 1¼" tubing siphon string to approximately 1,785 feet through packer to produce Pictured Cliffs Sandstone. Completion of Fruitland interval depends primarily on satisfactory appearance of the interval on electric logs.

Productive Area:

Proved (as determined geologically): Less than 160 acres
Unproved: 0
Approved Spacing: 160 acres
No. of Producing Wells: 1
No. of Abandoned Wells: 0
No. of Dry Holes: 0

Average Net Pay: 10 feet

Porosity: Estimated 13 percent

Permeability: Unknown

Water Saturation: 30 percent

Initial Field Pressure: Fruitland shut-in casing pressure at completion was 410 psi

Type of Drive: Gas expansion

Gas Characteristics and Analysis: Sweet, 1,100 to 1,200 Btu

Oil Characteristics and Analysis: None

Associated Water Characteristics and Analysis: Fresh

Original Gas, Oil, and Water Contact Datums: None

Estimated Primary Recovery: 124,000 MCFG

Type of Secondary Recovery (existing or planned): None

Estimated Ultimate Recovery: 124,000 MCFG

Present Daily Average Production: Varies according to pipeline pressure and market conditions, averages currently 3 MCFGD

Market Outlets: Gas is sold to both Northwest Pipeline Corp. and El Paso Natural Gas Corp.

FIELD COMMENTARY

The Crouch Mesa Fruitland gas field is a one well field completed in the Pictured Cliffs Sandstone and the Fruitland Formation as a dual well. The Fruitland gas sandstone zone was discovered on electric logs when the original well was drilled in 1959. This is typical of Fruitland completions in the San Juan Basin, as the reservoirs tend to be limited in areal extent, discontinuous, and elusive. The sandstone bodies are traditionally so small that there is some difficulty in mapping most of them from section to section. Some seem to be bar-like; however, others give the definite impression of sinuosity and perhaps represent fluvial channels. This well was purchased by Riggs Oil and Gas Corporation in 1968 and has been operated by that firm since that time. Production has continued to decline along with reservoir pressure. The well is probably non-commercial at the present time; however, the zone's economics are assisted by Pictured Cliffs production. Further development in the area will be hampered by encroaching urban development. Structure is not a key factor in the Crouch Mesa Fruitland accumulation. There are no known gas-water contacts. There is almost no water production. Regional dip is to the northeast at ½ degree to 1 degree per mile.

REFERENCES

New Mexico Oil & Gas Engineering Committee, annual production figures.
Riggs, E. A., personal files and geologic data.

CROUCH MESA FRUITLAND

NO. OF WELLS @ YR. END				PRODUCTION OIL IN BARRELS GAS IN MCF	
YEAR	TYPE	PROD.	SI/ABN	ANNUAL	CUMULATIVE
1959	Oil				
	Gas		1 SI	0	0
1960	Oil				
	Gas	1		19,571	19,571
1961	Oil				
	Gas	1		9,669	29,240
1962	Oil				
	Gas	1		7,078	36,318
1963	Oil				
	Gas	1		4,484	40,802
1964	Oil				
	Gas	1		6,922	47,724
1965	Oil				
	Gas	1		5,925	53,649
1966	Oil				
	Gas	1		4,986	58,635
1967	Oil				
	Gas	1		4,216	62,851
1968	Oil				
	Gas	1		4,601*	67,452
1969	Oil				
	Gas	1		7,410	74,862
1970	Oil				
	Gas	1		5,498	80,360
1971	Oil				
	Gas	1		6,461	86,821
1972	Oil				
	Gas	1		5,451	92,272
1973	Oil				
	Gas	1		4,853	97,125
1974	Oil				
	Gas	1		4,172	101,297
1975	Oil				
	Gas	1		3,656	104,953
1976	Oil				
	Gas	1		3,196	108,149
1977	Oil				
	Gas	1		4,885	113,034
1978	Oil				
	Gas	1		3,095	116,129
1979	Oil				
	Gas	1		2,215	118,344
1980	Oil				
	Gas	1		1,173	120,117
1981	Oil				
	Gas	1		1,977	122,094
1982	Oil				
	Gas	1		881	122,975

R.T.S.

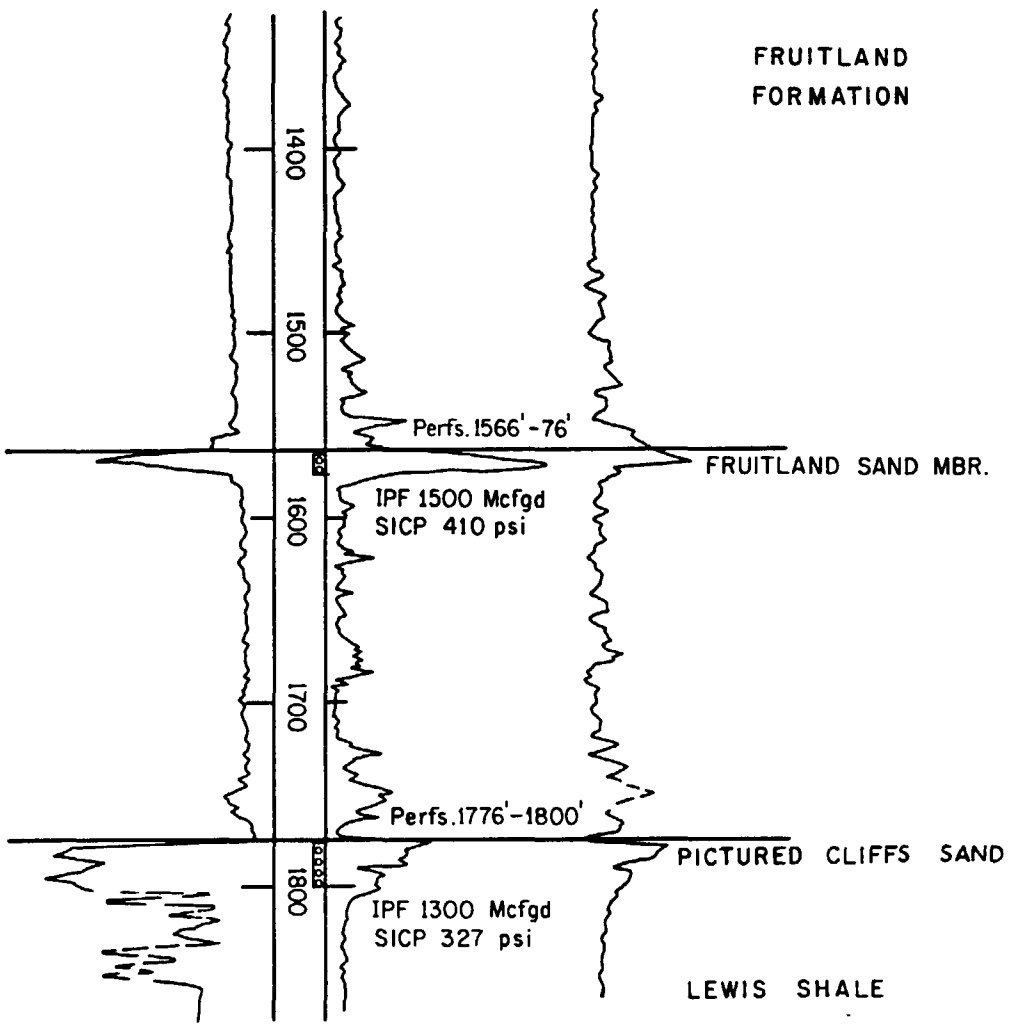
*operator changed to Riggs Oil & Gas Corporation.

DEVONIAN GAS & OIL CO.

#1 Federal

SE¼ NW¼ Sec. 4-T29N-R12W

San Juan Co., New Mexico



GEOLOGIST: Elliott A. Riggs

DRAFTING: James L. Hopkins

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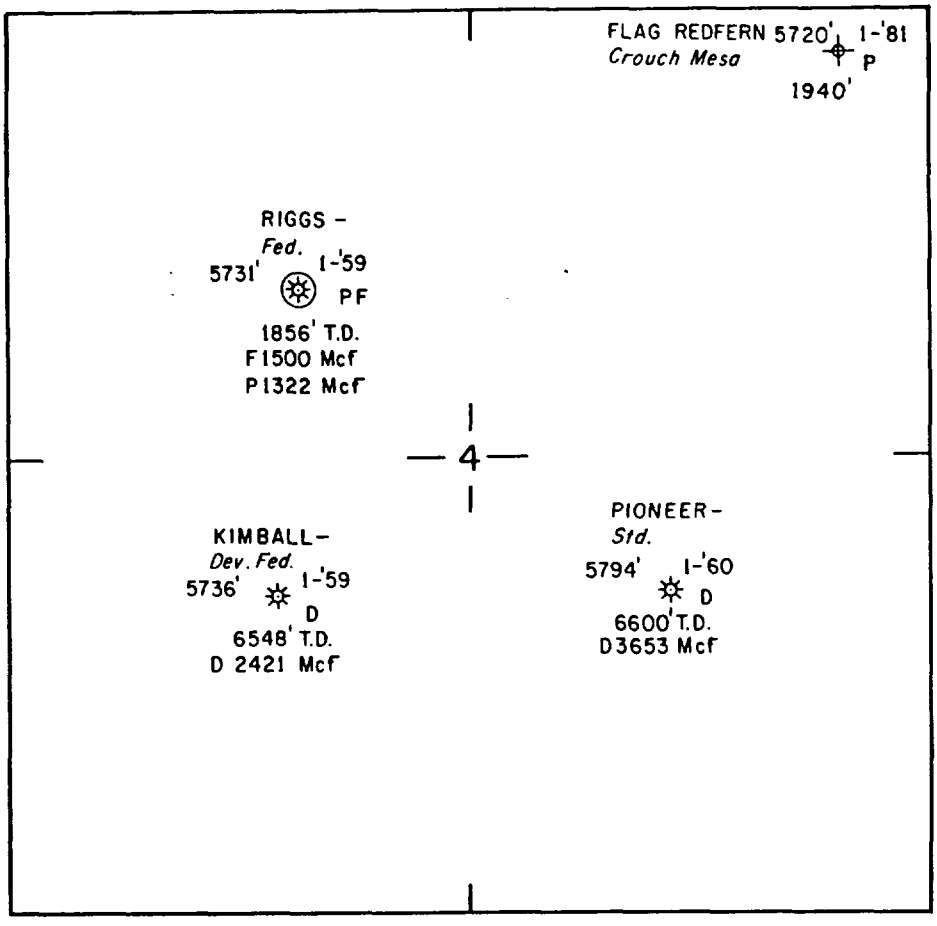
CROUCH MESA FRUITLAND
(GAS)
SAN JUAN CO., NEW MEXICO



F = FRUITLAND COMPLETION
P = PICTURED CLIFFS "
D = DAKOTA "

DISCOVERY WELL

Sec. 4, T29N, R12W.

GEOLOGIST: Elliott A. Riggs

DRAFTING: James L. Hopkins

Oil and Gas Fields of the Four Corners Area]

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