

UNITED STATES
DEPARTMENT OF THE INTERIOR
✓ Harold L. Ickes, Secretary
U.S. GEOLOGICAL SURVEY
William E. Wrather, Director

ENGINEERING REPORT ON
GRAYBURG COOPERATIVE AND UNIT AREA

Eddy County, New Mexico

by

John A. Barnett and Merwin H. Soyster
(Conservation Branch - Oil & Gas Leasing Division)

Engineering Report on
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- - -

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This report covers the area committed to the Grayburg Cooperative and Unit Agreement (I-Sec. 370) approved by the Assistant Secretary of the Interior on October 5, 1943, hereafter referred to as the "unit area", embracing 4,769.44 acres of public land in T. 17 S., Rs. 29 and 30 E., Eddy County, New Mexico. The area includes portions of the Anderson, Grayburg-Jackson, and Leonard oil fields as defined for proration purposes by the New Mexico Oil Conservation Commission. The unit area is covered by Federal oil and gas leases owned by the Grayburg Oil Company of New Mexico and the Western Production Company, Inc. The Grayburg Unit Association has been formed and designated to conduct and manage all operations in the unit area. As of December 31, 1943, there were forty-six producing oil wells within the unit area.

The report has been prepared for the purpose of assisting the Grayburg Unit Association in determining the proper locations of gas-injection wells and the best methods for future operation of the pressure-maintenance system that is being installed for the purpose of retarding the reservoir pressure decline and increasing the ultimate recovery of oil from the Grayburg Zone defined in the above-mentioned agreement as formations not more than 3300 feet below the surface. Data used in the report were obtained from records on file in the Geological Survey office at Roswell, New Mexico, and from the records of the Western Production Company and the Grayburg Oil Company. All data were carefully checked as to accuracy with engineers and fields representatives of both companies.

Maps, cross-sections and curves.

Included with this report are the following illustrations:

1. Well-record map, showing boundaries of the Cooperative and Unit Area, well locations, ownership and serial numbers of Federal oil and gas leases, and a type log of subsurface formations penetrated. In addition, the elevations, geologic correlation points, and other pertinent data are indicated for each well.
2. Structure map, contoured on top of the "Red Sand".
3. Production zone map. This map was prepared by correlation of all sample logs and electrical logs available. An index to the zones will be found in the type log included with the maps of the area.

4. Bottom-hole pressure map. The pressures, corrected to a datum of 800 feet above sea level, were taken during the period October 4, 1943, to January 8, 1944. For a few wells, current pressures were not available. For those wells the last available pressure tests were used (taken within the past year) and so indicated.

5. Production chart, indicating the annual oil production, cumulative oil production, and number of wells producing at the end of each year.

6. Production decline curve. This curve was constructed by plotting individual production declines of several representative wells that are believed to have been produced with practically unrestricted flow, and by interpolating a family decline curve therefrom. The normal future rate of production decline, using primary producing methods, was then obtained by projecting the curve on logarithmic cross-section paper.

7. Bottom-hole pressure decline curve. This curve was obtained by averaging the rates of pressure decline of all wells, plotted with reference to the time elapsed between the completion of each well and the recording of bottom-hole pressures. The future rate of pressure decline was then estimated by logarithmic projection.

8. Cross-section A-A', showing the geology and details of the producing formations along a line of wells from the west to the east side of the unit area,

9. Cross-section B-B' - a northwest-southeast down-dip section.

10. Cross-section C-C' - a northwest-southeast down-dip section.

History.

The first oil production in the unit area was obtained in 1929 by Grayburg Oil Company in its Burch No. 2-A well, located 1980 feet from the south line and 660 feet from the west line of sec. 19, T. 17 S., R. 30 E. This well was drilled to a total depth of 3142 feet and completed on June 27, 1929, for an initial production of 50 barrels of 36.3 API gravity oil per day. It was subsequently deepened to 3204 feet without encountering water or additional oil.

Owing to adverse business conditions, lack of knowledge as to the extent of the productive area, and other factors, drilling in this area was conducted sporadically up to August 1937. During that period only eight wells were completed, averaging one well per year. Between August 1, 1937, and September 1, 1941, a total of 12 wells were completed, an average of 3 wells per year. From September 1, 1941, to January 1, 1944, a total of 26 wells were completed for an average of slightly less than 12 wells per year.

The area has been developed with a well-spacing pattern of one well to each 40-acre subdivision. All recent drilling has been in the center of such subdivisions. Production has ranged from the unrestricted yield of earlier wells to a maximum daily allowable of less than 30 barrels per well, and more recently has been at a maximum daily well allowable of 48 barrels, which is the current top allowable for wells in other fields in southeastern New Mexico, as determined by the New Mexico Oil Conservation Commission.

Stratigraphy.

The surface of the unit area consists largely of small shifting sand hills, which preclude a determination of surface structure by examination of outcrops. The stratigraphy consequently has been determined by a study and correlation of samples of formations drilled, together with the correlation of electrical logs. Nomenclature, correlations and formation intervals used in this report are based on studies of southeast New Mexico and West Texas by Dickey^{1/}, King^{2/} and others^{3/}.

The surface sand is underlain by approximately 250 feet of sandstone and red shale which is undifferentiated but generally classified as belonging to the Dockum group of Triassic age. The lower portion of these beds, usually sandstone or sandy red shale, may be the Dewey Lake redbeds of Permian age. Below this horizon all formations penetrated thus far are of Permian age.

Unconformably below the Dewey Lake (?) redbeds occurs the Rustler formation, approximately 100 to 200 feet in thickness, composed mainly of anhydrite, with limestone present in some areas.

The Salado formation, commonly known as the "salt section", consists of 400 to 500 feet of salt, often potash-bearing, with occasional thin beds of anhydrite.

^{1/} Dickey, R. I., Geologic section from Fisher County through Andrews County, Texas, to Eddy County, New Mexico: Amer. Assoc. Petrol. Geol. Bull., Vol. 24, No. 1, pp. 37-51, January 1940.

^{2/} King, P. B., Permian of West Texas and southeastern New Mexico: Amer. Assoc. Petrol. Geol. Bull., Vol. 26, No. 4, April 1942.

^{3/} The Oil and Gas Resources of New Mexico, Second Edition: New Mexico School of Mines, State Bureau of Mines and Mineral Resources, Bull. 18, 1942.

Formations below the Salado are shown in detail on the cross-sections and type log. It will be noted that a system of numbers for the producing zones in the San Andres formation is shown. This is in conformity with a system originated in many other southeastern New Mexico fields by the Roswell office of the Oil and Gas Leasing Division, Conservation Branch, Geological Survey^{4/}, and now commonly used by many New Mexico operators, geologists, and engineers. As most of the oil found in the unitized area occurs in the San Andres formation, there are indicated on the cross-sections only the correlations of zones 7, 8, 9 and 10, which are the zones known to produce oil in the San Andres. Only four wells in the area produce oil from the Grayburg formation--two from zone 5 and two from zone 6. Below the eighth zone correlations are made almost entirely on the occurrence of oil pays rather than on stratigraphy or lithology. In some areas, it is quite likely that oil pays in zones 9 and 10 may be inter-communicative. Particularly in the western portion of the unit area, zones 9 and 10 are closely related and somewhat difficult to correlate, and for production and engineering purposes might properly be considered as one zone.

Structure.

Subsurface contours on top of the "Red Sand" show the structure within the unit area to be an eastward plunging anticline, slightly asymmetrical, with a steeper south flank, from which flank the greater portion of oil has been produced. The regional dip is approximately 50 feet to the mile in a southeastward direction, and the local dip of the southeastern flank of the anticline is approximately 200 feet per mile. There is no evidence of faulting. It is quite probable that, although structure has been a general factor influencing the accumulation of oil, the very irregular nature of the accumulations of oil is due to variations in permeability and cementation of the reservoir rock, and to minor structural flexures that serve as barriers or stratigraphic traps.

Reservoir Conditions.

As stated above, the major portion of the oil produced is from the San Andres formation. The amount of production from each well is dependent upon the porosity and permeability of the producing zones, which often vary greatly from well to well. No cores have been taken in the unit area, and it is not possible to state the range of porosities and permeabilities.

Productive zones, consisting of porous dolomite in the San Andres formation, are relatively thin. Several wells have thus far produced in excess of 150,000 barrels of oil, and some in excess of 350,000 barrels. On the other hand, some wells in the area will probably not yield 50,000 barrels ultimately. This is indicative of the wide range in porosity and permeability of the producing zones.

^{4/} Barnett, John A., Maljamar Pool, The Oil and Gas Resources of New Mexico, New Mexico School of Mines, State Bureau of Mines and Mineral Resources, Bull. 18, pp. 243-244, 1942.

It is ordinarily necessary to shoot the formations above the San Andres, where found productive, in order to establish commercial production. It is likewise necessary to acidize under pressure the producing zones encountered in the San Andres formation, in most wells. A few wells have been drilled that require neither shooting nor acidizing.

Water.

Water in varying amounts is generally encountered at a short distance above the top of the salt, but no water is known to have been encountered below the salt. The production of water with the oil in the unit area has never been a problem. Lack of core data precludes the possibility of determining the amount of connate or interstitial water in the oil sands. Estimates based on neighboring fields where determinations have been made, indicate a probability of 15 to 30 percent connate water. There is no evidence of either a direct or an indirect water drive in the area.

Drilling and production methods.

All wells in the unit area have been drilled with cable-tool drilling equipment, usually portable machines. The average cost of drilling and completing a well for production is approximately \$15,000.

The usual drilling program provides for a string of 10-3/4-inch or 8-5/8-inch casing set in the anhydrite immediately above the top of the Salado or "salt section" at depths ranging from 300 to 500 feet, and cemented with 50 sacks of cement, preceded by mud circulated to the surface. This serves as an "anchor string", and affords protection to the potash-bearing salt beds from infiltration of upper waters. It also affords protection against caving of the upper strata. A string of 7-inch or 5-3/16-inch casing is then set at a point approximately 100 feet above the first producing zone, and cemented with 100 sacks of cement, preceded by mud circulated to the surface.

Although wells are sometimes swabbed into production and completed naturally, it is usually necessary to stimulate production by acidizing the dolomite pay zones under pressure, in order to obtain production in commercial quantities. The oil is generally produced through 2-inch tubing, set about 20 or 30 feet above the pay zone.

All wells in the unit area are flowing except Grayburg Oil Company No. 9-A Burch, which is being pumped. The oil is usually produced intermittently through surface chokes on the tubing, in order to conserve gas. No bottom-hole chokes have been used, although it is contemplated that such practice may be resorted to in the future in order that the production may be attained without pumping equipment after bottom-hole pressures have been further reduced. Under present practices, approximately 215 pounds

per square inch is the minimum pressure at which the wells will continue to flow. It may be noted by reference to the bottom-hole pressure map accompanying this report that bottom-hole pressures in the unit area range from 230 to 1,018 pounds per square inch, depending upon the location and age of the wells.

Production data.

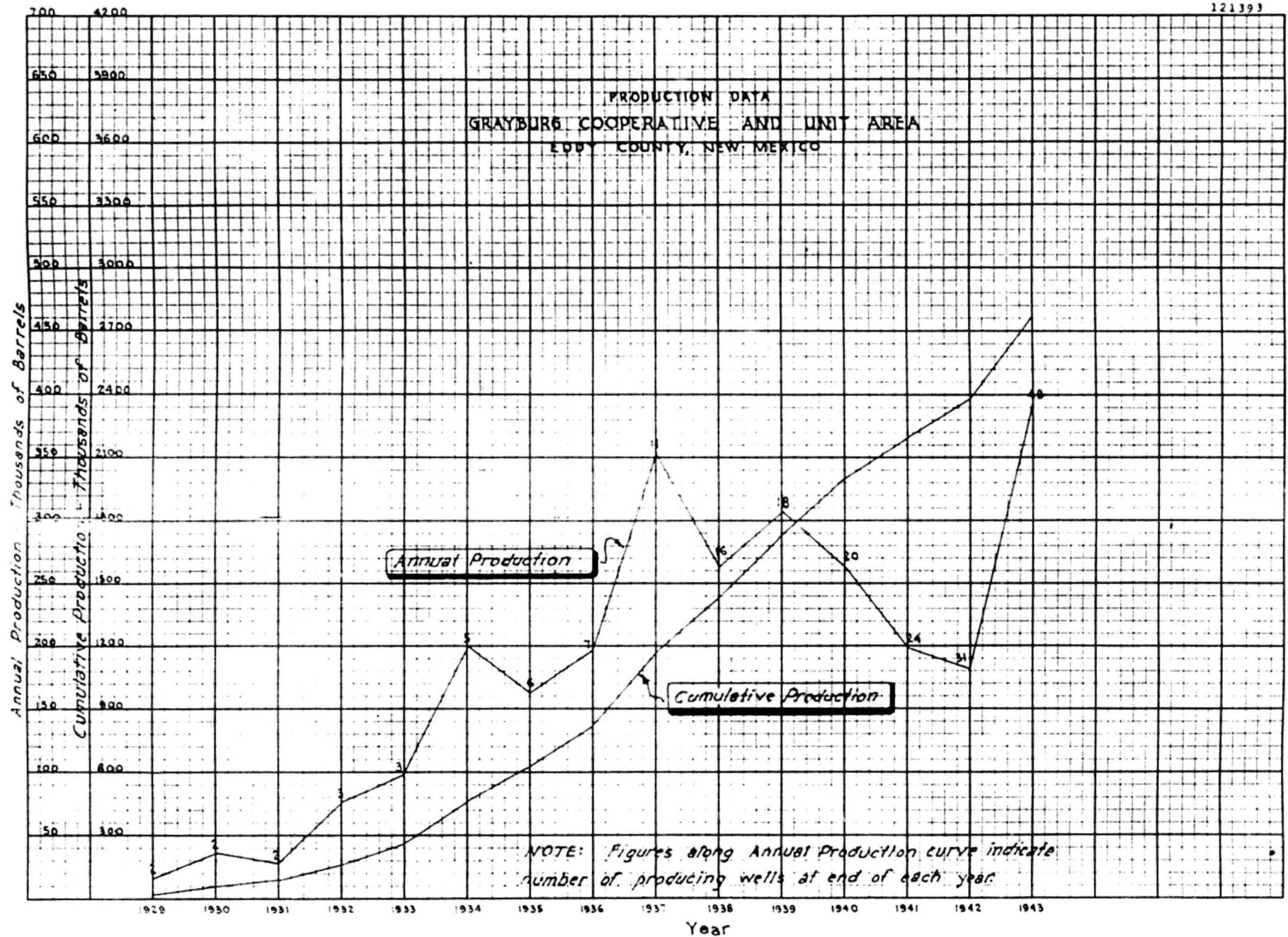
To January 1, 1944, a total of 2,766,150 barrels of oil had been produced from 1,920 acres of proved oil land in the unit area, which represents an average recovery of approximately 1,440 barrels per acre. However, most of the wells in the area have been drilled in recent years, and one well that has been producing for almost 10 years has yielded more than 11,000 barrels per acre and still produces more than 40 barrels of oil per day.

The initial, cumulative, and present daily production data on each well in the unitized area are tabulated below:

OIL PRODUCTION DATA--GRAYBURG COOPERATIVE AND UNIT AREA

<u>Company</u>	<u>Lease</u>	<u>Well</u>	<u>Date of completion</u>	<u>Initial production Barrels, dly.</u>	<u>Cumulative production through 1943- Barrels</u>	<u>Average production December 1943- Barrels, daily</u>
Grayburg	Burch	2-A	6-27-29	50	142,631	14.5
"	"	3-A	5 -6-32	520	255,966	17.2
"	"	4-A	1-15-34	425	373,386	35.1
"	"	5-A	5 -5-34	525	453,996	46.2
"	"	6-A	4-11-35	341	196,109	30.6
"	"	7-A	8-30-36	440	139,879	31.2
"	"	8-A	11 -4-37	20	18,391	3.3
"	"	9-A	12-10-37	25	29,200	13.7
"	"	10-A	2- 5-38	35	19,797	3.2
"	"	11-A	4-11-38	105	65,186	14.2
"	"	12-A	7-11-39	175	92,455	25.6
"	"	13-A	12-20-39	206	60,681	18.7
"	"	14-A	11-30-43	16	243	7.8
"	"	1-B	8-27-41	32	23,032	25.1
"	"	2-B	11- 9-41	80	24,698	26.4
"	"	3-B	1 -9-42	150	23,406	26.0
"	"	4-B	3 -7-42	70	19,990	26.2
"	"	5-B	7 -2-42	125	17,637	26.1
"	"	6-B	4-29-42	100	24,359	47.6R
"	"	7-B	9-14-42	206	18,380	37.1
"	"	8-B	3-26-43	125	10,702	36.8
"	Keely	2-A	11 -5-29	280	303,663	18.3
"	"	3-A	7-29-37	155	73,728	18.3
"	"	4-A	3-21-38	100	47,951	22.7
"	"	5-A	6 -3-40	28	25,753	23.0
"	"	6-A	9-29-43	200	4,795	53.3R
"	"	7-A	9-29-43	200	4,763	51.4R

PRODUCTION DATA
GRAYBURG COOPERATIVE AND UNIT AREA
EDDY COUNTY, NEW MEXICO



Grayburg	Keely	8-A	11-11-43	700	2,631	50.6R
"	"	9-A	12-11-43	100	839	52.4R
"	"	1-B	5-5-43	250	10,528	41.3R
"	"	2-B	5-24-43	338	10,142	41.7R
"	"	3-B	9-8-43	360	5,240	43.6R
Western	Burch	1-C	6-3-38	50	33,937	11.8
"	"	2-C	9-14-38	26	33,856	11.9
"	"	3-C	9-21-41	30	18,965	15.9
"	"	4-C	12-9-42	32	8,430	17.0
"	"	5-C	1-20-43	130	12,321	22.9
"	"	6-C	2-14-43	125	11,654	33.3
"	"	7-C	4-26-43	30	4,597	16.3
"	"	8-C	5-10-43	50	3,933	15.3
"	Keely	1-C	9-17-37	108	78,681	30.4
"	"	4-C	11-12-42	215	17,510	39.5R
"	"	5-C	3-13-43	354	12,406	39.5R
"	"	6-C	2-27-43	262	14,106	45.7R
"	"	7-C	6-22-43	240	9,283	46.3R
"	"	8-C	8-12-43	300	6,314	46.1R
Total					2,766,150	

Note: R after Average production for December 1943 indicates that well production was restricted by proration.

Oil analyses.

The following analyses were made by the U. S. Geological Survey at Casper, Wyoming, in accordance with the U. S. Bureau of Mines Hempel method. Although one sample of oil was taken from zone 9 and the other sample represents a mixture of oil from zones 9 and 10, the analyses are quite similar, indicating the probability that intercommunication does exist between some of the zones, at least in certain areas.

Sample No. 44-038, Grayburg Oil Co. No. 6-A Keely well, sec.
24, T. 17 S., R. 29 E. From lower portion zone 9 and zone 10.

Specific Gravity..	.836	A.P.I. Gravity	37.8
Percent sulphur...	.90	Pour point....	Below 5° F.
Saybolt Univ. Viscosity at 70° F.	43 sec.	Color.....	Green
Saybolt Univ. Viscosity at 100° F.	39 sec.	Base.....	Intermediate

DISTILLATION, BUREAU OF MINES, HEMPEL METHOD

Distillation at atmospheric pressure 632 mm.

First Drop 75° F,

Fraction No.	Cut at °F.	Per cent	Sum percent	°A.P.I. 60° F.	C.I.	S.U. Visc. 100° F.	Cloud Test °F.
1	122	2.5	2.5	81.0	--		
2	167	4.4	6.9	74.2	18		
3	212	7.2	14.1	65.9	22		
4	257	8.5	22.6	57.2	29		
5	302	7.0	29.6	51.3	32		
6	347	4.5	34.1	47.8	32		
7	392	4.3	38.4	44.9	32		
8	437	5.3	43.7	42.6	32		
9	482	5.4	49.1	39.4	34		
10	527	6.0	55.1	36.2	36		

Distillation continued at 40 mm.

11	392	--	--	--	--		
12	437	5.8	60.9	30.8	40	46	25
13	482	4.7	65.6	28.9	42	56	45
14	527	4.3	69.9	27.0	44	78	65
15	572	6.4	76.3	25.2	46	134	85

Residuum 20.3 96.6 16.2

Carbon residue of residuum 7.6% Carbon residue of crude 1.8%

APPROXIMATE SUMMARY

	Percent	°A.P.I. 60° F.	Viscosity, secs.
Light gasoline.....	14.1	70.9	
Total gasoline and naphtha.....	38.4	58.2	
Kerosene distillate.....	5.3	42.6	
Gas oil.....	16.4	35.6	Below 50
Nonviscous lubricating distillate.....	9.8	30.0 - 26.3	50-100
Medium lubricating distillate.....	6.4	26.3 - 23.2	100-200
Viscous lubricating distillate.....	---	---	Above 200
Residuum.....	20.3	16.2	
Distillation loss.....	3.4	---	

Sample No. 44-039, Grayburg Oil Co. No. 8-B Burch well, sec. 23,
T. 17 S., R. 29 E. From zone 9.

Specific gravity... .839	A.P.I. gravity... 37.2
Percent sulphur.... .97	Pour point..... Below 5° F.
Saybolt Univ. Viscosity at 70° F. 42 sec.	Color..... Green
Saybolt Univ. Viscosity at 100° F. 39 sec.	Base..... Intermediate

DISTILLATION, BUREAU OF MINES, HEMMEL METHOD

Distillation at atmospheric pressure 635 mm. First Drop 93° F.

Fraction No.	Cut at °F.	Per cent	Sum percent	°A.P.I. 60° F.	C.I.	S.U. Visc. 100° F.	Cloud Test °F.
1	122	1.1	1.1)				
2	167	3.8	4.9)	71.2	--		
3	212	7.6	12.5	65.3	23		
4	257	7.7	20.2	56.4	30		
5	302	4.5	24.7	50.9	33		
6	347	6.6	31.3	48.3	31		
7	392	4.7	36.0	45.6	31		
8	437	5.3	41.3	43.0	31		
9	482	5.5	46.8	39.4	34		
10	527	6.3	53.1	36.2	36		

Distillation continued at 40 mm.

11	392	0.1	53.2)				
12	437	6.0	59.2)	31.0	40	48	25
13	482	5.0	64.2	28.9	42	56	45
14	527	4.1	68.3	26.8	44	78	65
15	572	6.2	74.5	25.2	46	124	85

Residuum 21.8 96.3 16.1

Carbon residue of residuum 7.6% Carbon residue of crude 1.9%

APPROXIMATE SUMMARY

	Percent	°A.P.I. 60° F.	Viscosity, secs.
Light gasoline.....	12.5	67.5	
Total gasoline and naphtha.....	36.0	56.4	
Kerosene distillate.....	5.3	43.0	
Gas oil.....	16.1	36.0	Below 50
Nonviscous lubricating distillate.....	11.2	30.4 - 26.1	50-100
Medium lubricating distillate.....	5.8	26.1 - 24.3	100-200
Viscous lubricating distillate.....	---	---	Above 200
Residuum.....	21.8	16.1	
Distillation loss.....	3.7	---	

Gas-oil ratios

Gas-oil ratios in the unit area range from 500 to 4300 cubic feet of gas per barrel of oil. During January 1944 on test, the total gas volume

from the unit area averaged 1,354,000 cubic feet with an average production of 1,425 barrels of oil per day, and a gas-oil ratio for the unit of 947 cubic feet per barrel.

Bottom-hole pressures.

From the bottom-hole pressure map it may be noted that bottom-hole pressures in the unit area range from a low of 230 to a high of 1,018 pounds per square inch. The average bottom-hole pressure for the area has been computed as approximately 530 pounds per square inch during December 1943. For purposes of this report, low, intermediate, and high pressure areas have been designated and are indicated by appropriate hachures on the bottom-hole pressure map. The low pressure area includes all wells with bottom-hole pressures of less than 400 pounds and the high pressure area includes all wells with more than 700 pounds.

Pressure maintenance program.

The Grayburg Unit Association contemplates the initial injection of about one million cubic feet of available casing-head gas per day recovered from the producing oil wells in the unit area. For this purpose there have been installed three compressors with a total of 330 horse power and a capacity of 1,250,000 cubic feet of gas operating under 20-pound intake pressure and 800-pound discharge pressure. Initial injection pressures are not expected to exceed 700 pounds per square inch.

The determination of wells most suitable for gas injection is a matter of prime importance in the inception of any pressure maintenance program. With the volume of gas available and the number of producing wells in the unit area it was determined that five oil wells could reasonably be converted into input wells to give maximum recovery of oil for the amount of gas used. It will undoubtedly be necessary to use additional input wells as more oil wells are completed and more gas becomes available for injection within the unit area.

Criteria for determination of gas input wells include such factors as structure, bottom-hole pressures, gas-oil ratios, lithology, permeability, and other characteristics of the producing formation. Thorough study and detailed correlations were made of sample, electric, and drillers' logs, as well as all other available data obtained of the area, before the five proposed gas injection wells indicated on the bottom-hole pressure map were selected. The zones from which the wells are producing oil were considered, it being the object to centralize each injection well in a group of wells in the same zone or zones. As stated before, practically all the oil produced in the unit area is obtained from zones 9 and 10 and consideration was given to the injection of gas into those two zones only, so that the gas would not be dissipated into barren zones ~~or~~ upper zones of porosity or sands that could act in some instances as "thief sands" as indicated by Dowell Electric Pilot surveys. To insure this further, it is planned to inject gas through tubing with packers set in the injection wells immediately above zone 9.

Four of the five injection wells selected are located between low pressure areas that have been producing for some time, and high pressure areas recently drilled. It is anticipated that this will serve to retard the rate of decline in high pressure areas and at the same time build up or repressure the low pressure areas, thereby materially benefitting the recovery of oil in the entire unit area.

It is intended that the average field gas-oil ratio shall be maintained below 2,000 cubic feet per barrel, and that where ratios become excessive the oil production will be adjusted, remedial work done, or the offending wells shut in to conserve gas and maintain reservoir energy.

Estimate of future production.

The success of a pressure maintenance project is measured by the amount of oil recovered after gas injection as compared with a reasonable estimate of the amount of oil that would have been recovered without the return of gas to the producing formations.

Two decline curves have been prepared, that should aid in evaluating this increased production at a later date, namely, a bottom-hole pressure decline curve and a production decline curve. All data and varying conditions were considered in arriving at the information plotted on these curves and it is believed that they represent average conditions for the unit area. After injection of gas, it is quite probable that both curves will assume new rates of decline. The intervals between the new curves and those that we would normally expect under primary producing methods will represent the benefits derived from the secondary recovery project.

The following tabulation has been prepared from the production decline curve, and provides in readily usable form an estimate of normally expected future production, based on primary recovery methods, for wells of different potentials. However, in using this tabulation, it is necessary that the "Present daily production" be construed as the settled average daily capacity of a well over a period of several weeks rather than the flush potential as determined by a short test.

ESTIMATED FUTURE PRODUCTION CHART FOR INDIVIDUAL WELLS

Based on primary recovery methods and
economic limit of three barrels of oil daily.

Present daily production (Bbl.)	Estimated Future life (Yr.-Mo.)	Estimated future production (Bbl.)
150	17 - 10	186,643
125	17 - 4	162,553
100	16 - 10	141,018
90	16 - 6	130,068
80	16 - 1	116,414
70	15 - 8	105,491
60	15 - 1	91,226

50	14 - 4	76,535
45	13 - 10	67,714
40	13 - 4	60,231
35	12 - 11	54,300
30	12 - 4	47,700
25	11 - 8	41,008
20	10 - 10	34,043
15	9 - 4	24,645
10	7 - 2	14,988
5	3 - 0	4,270

BOTTOM HOLE PRESSURE POUNDS PER SQUARE INCH (Datum +800)

1200

1000

800

600

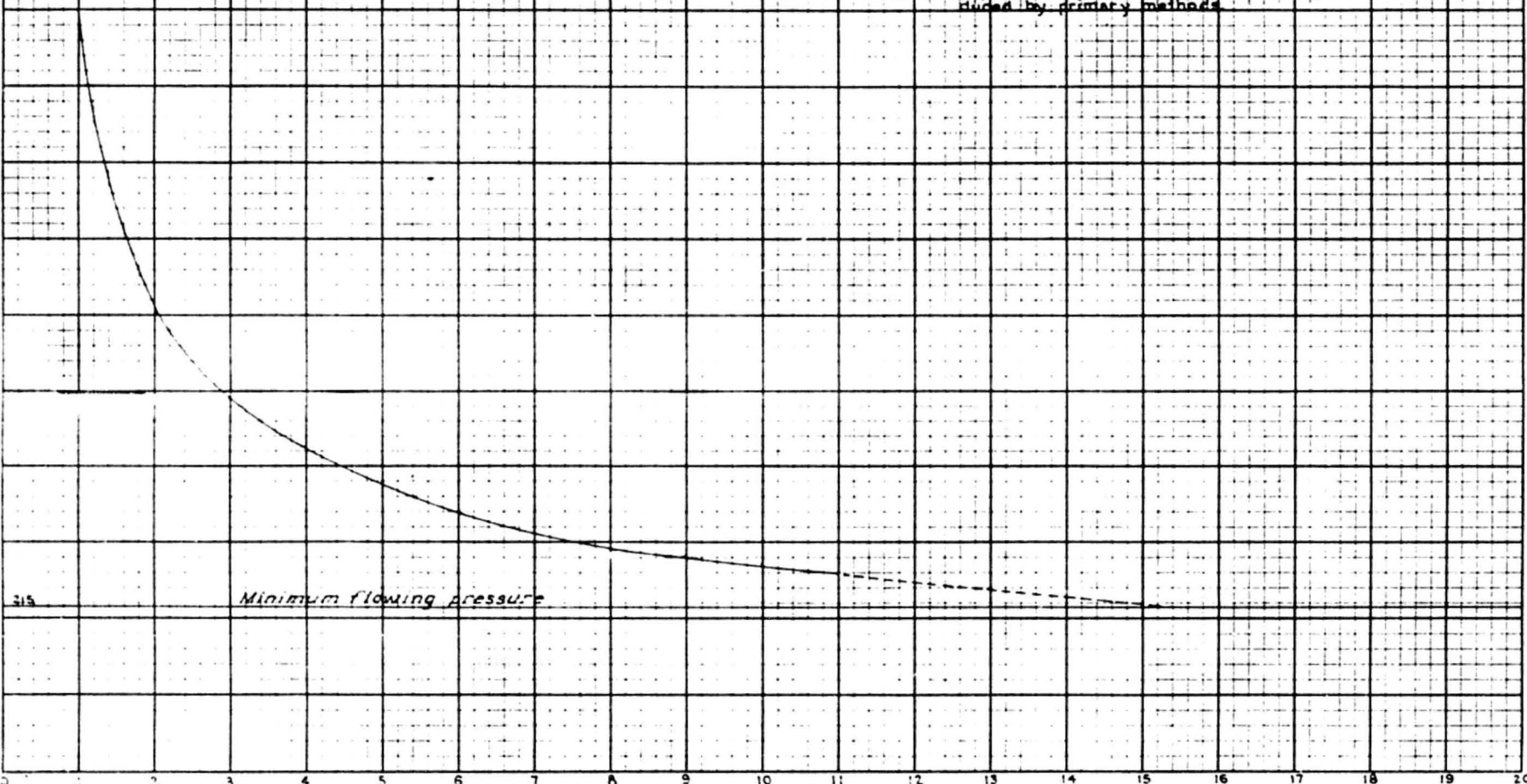
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200

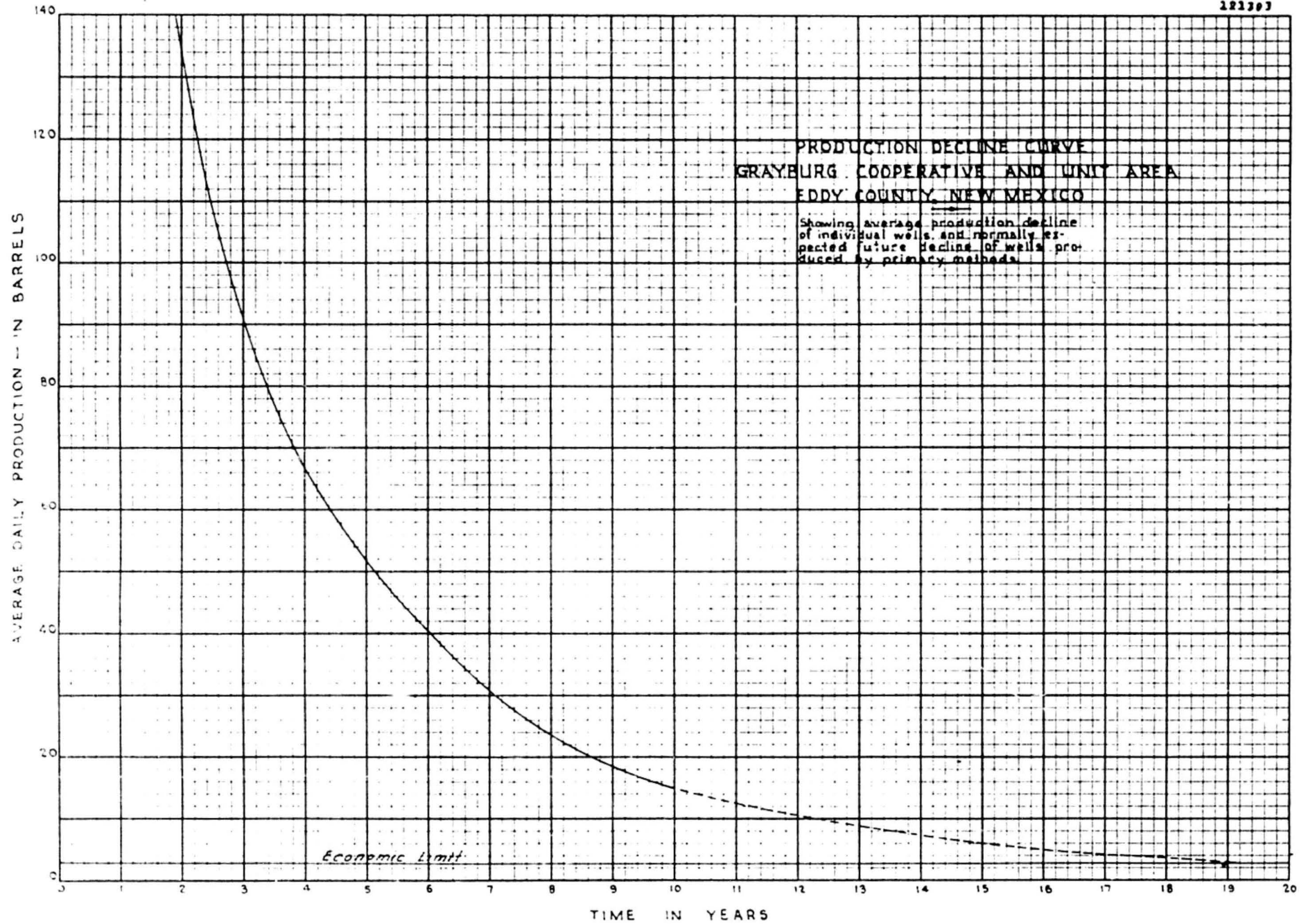
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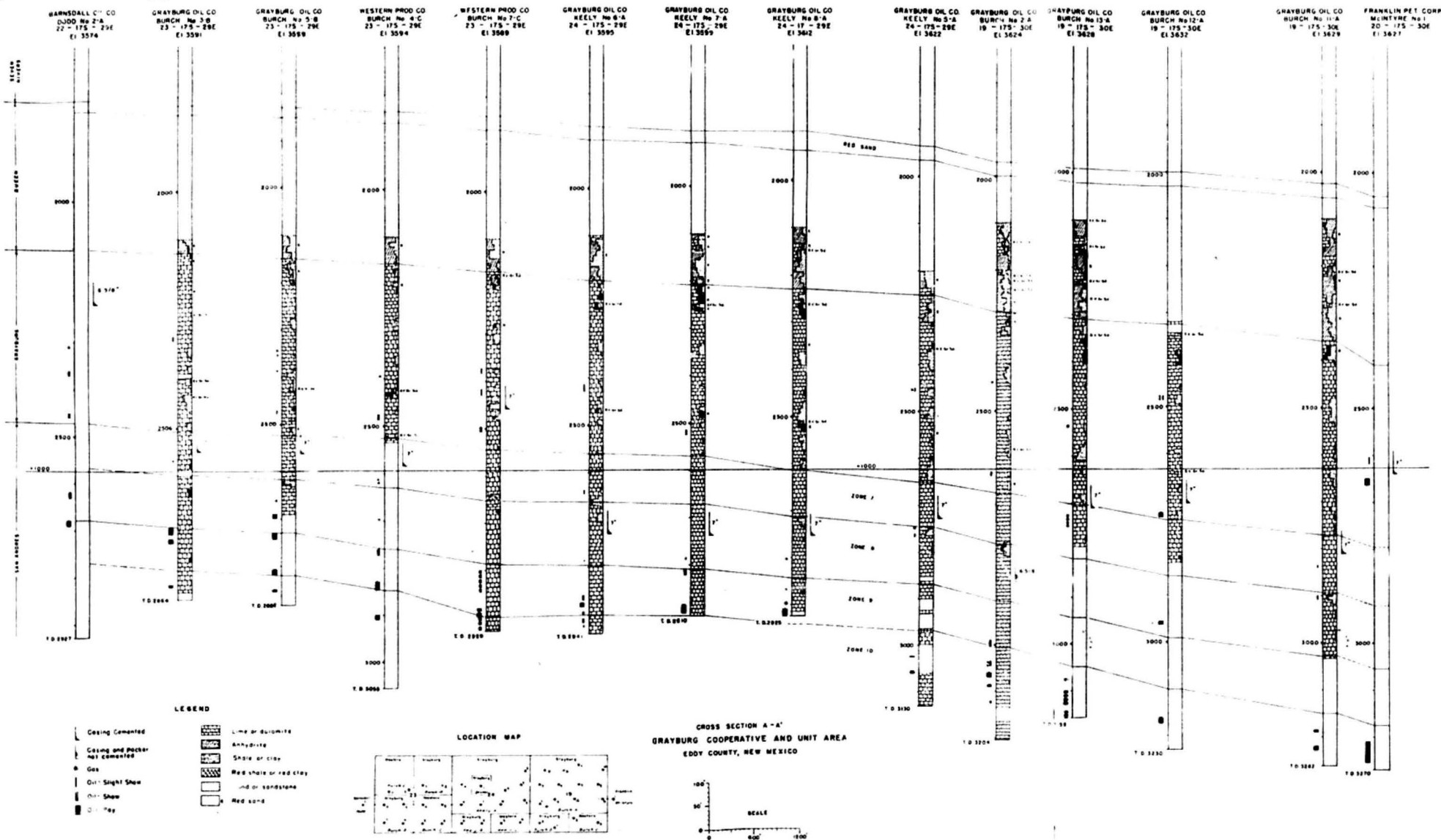
BOTTOM-HOLE PRESSURE DECLINE CURVE
GRAYBURG COOPERATIVE AND UNIT AREA
EDDY COUNTY, NEW MEXICO

Showing average bottom-hole pressure
decline of individual wells, and normally
expected future decline of wells pro-
duced by primary methods



TIME IN YEARS



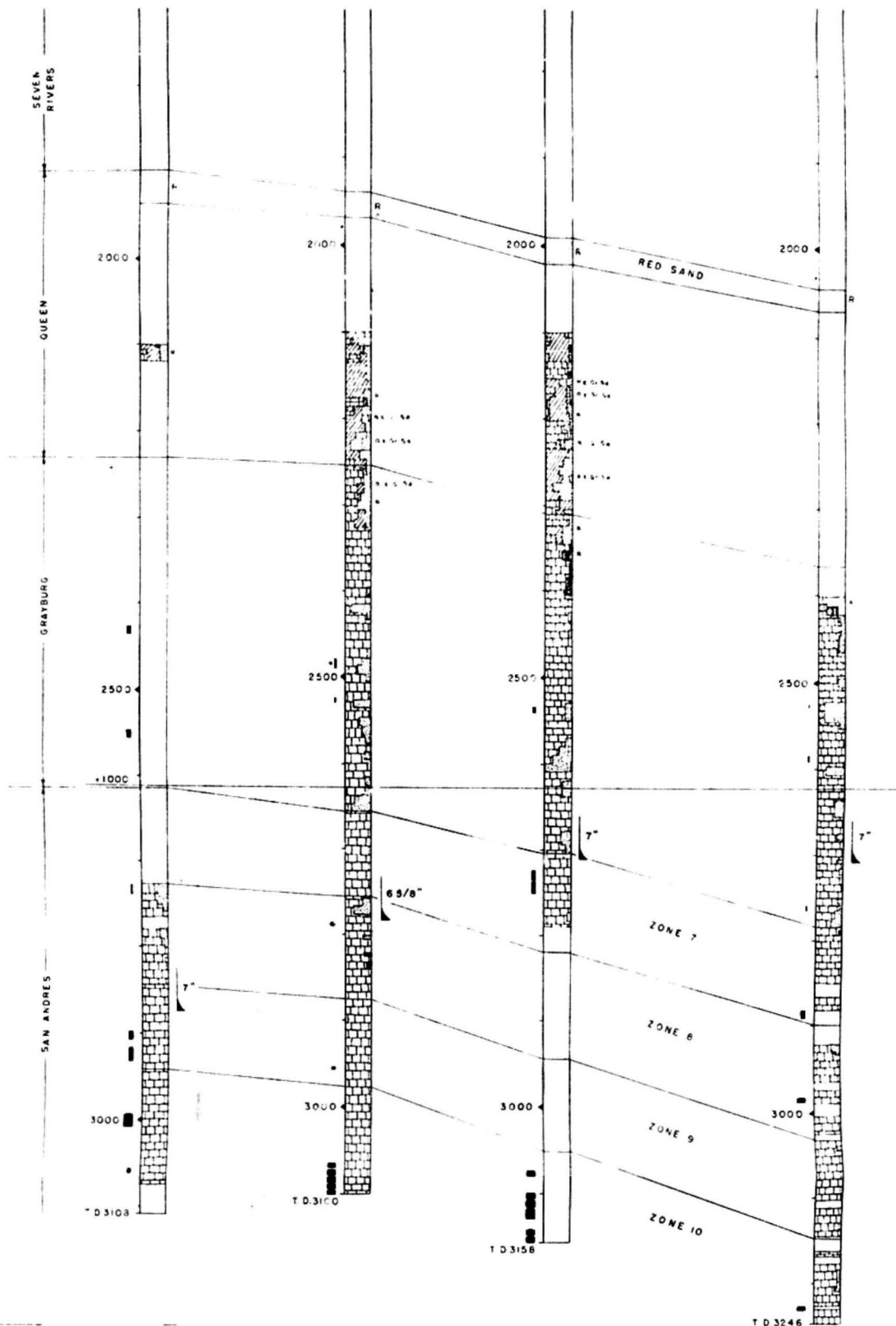


GRAYBURG OIL CO
KEELY No. 3-A
24-17S-29E
E1. 3611

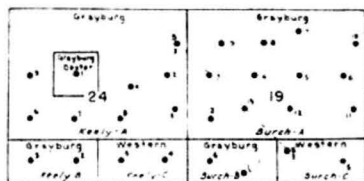
GRAYBURG OIL CO
BURCH No. 3-A
19-17S-30E
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GRAYBURG OIL CO
BURCH No. 13-A
19-17S-30E
E1. 3628

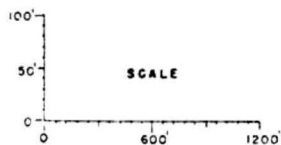
WESTERN PROD. CO
BURCH No. 3-C
19-17S-30E
E1. 3622



LOCATION MAP



GROSS SECTION B-B'
GRAYBURG COOPERATIVE AND UNIT AREA
EDDY COUNTY, NEW MEXICO

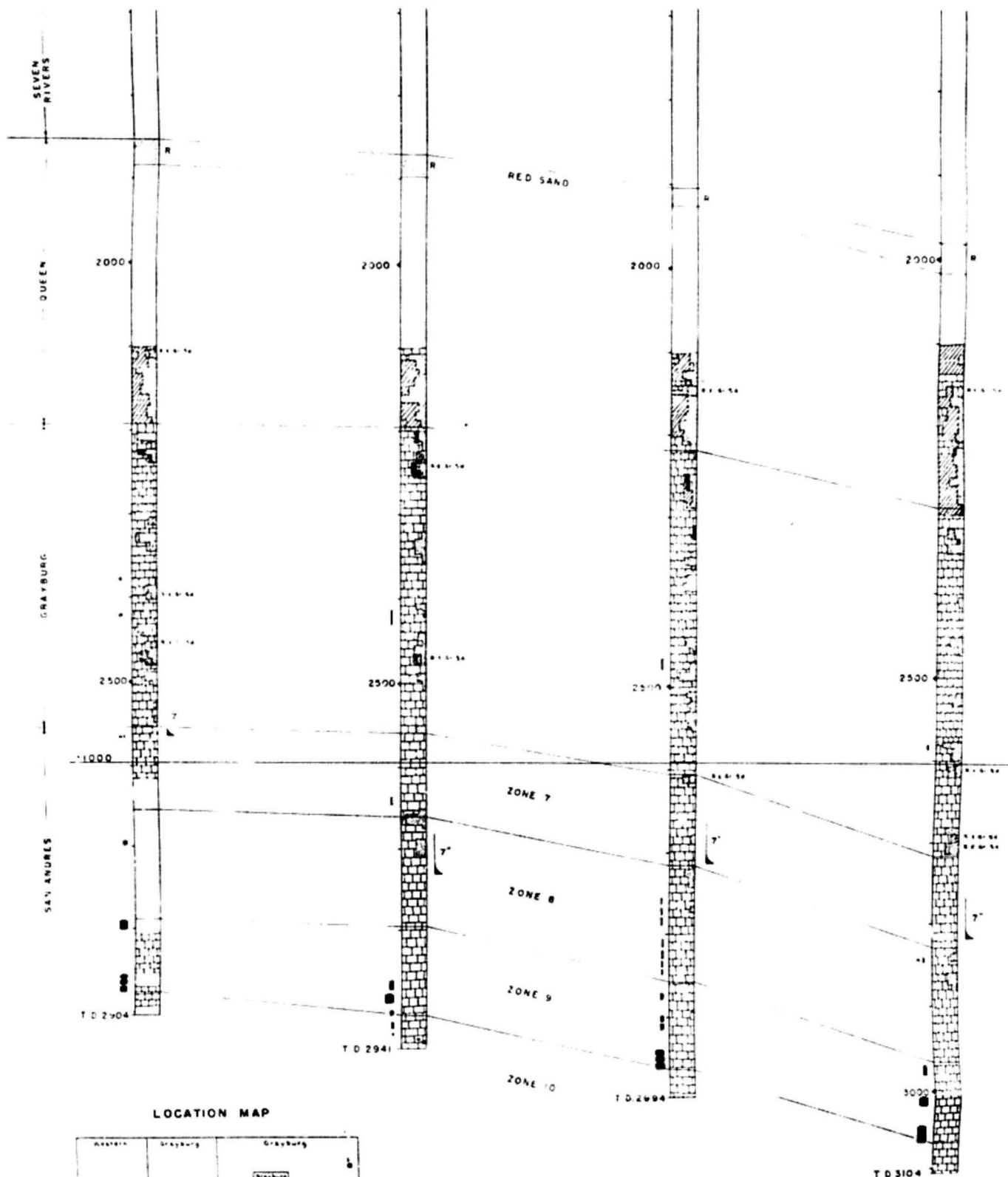


GRAYBURG OIL CO
BURCH No 8-B
23 - 17S - 29E
E1.3598

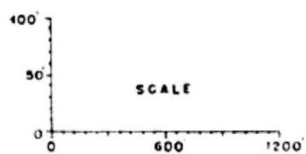
GRAYBURG OIL CO
KEELY No 6-A
23 - 17S - 29E
E1.3595

GRAYBURG OIL CO
KEELY No 2-B
24 - 17S - 29E
E1.3591

WESTERN PROD. CO
KEELY No 7-C
25 - 17S - 29E
E1.3603



CROSS SECTION C-C'
GRAYBURG COOPERATIVE AND UNIT AREA
EDDY COUNTY, NEW MEXICO



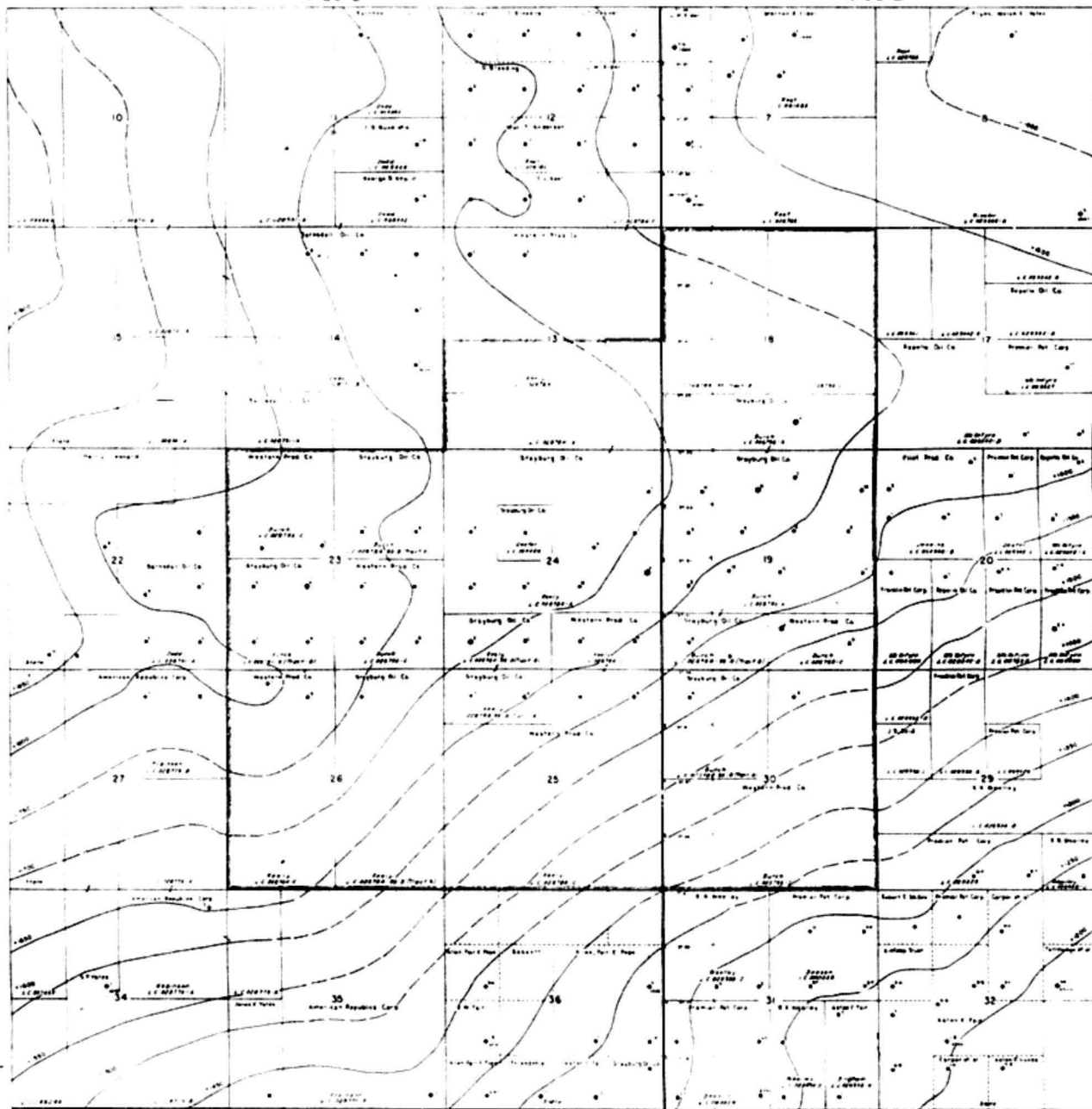
TYPE LOG

Showing Correlations
to Key Zones



R 29 E

R 30 E



EXPLANATION



LEGEND

- WELL
- SHALLOW WELL
- SHALLOW WELL SUSPENSE
- PRODUCING OIL WELL
- ABANDONED OIL WELL
- ABANDONED OIL WELL
- GRAYBURG COOPERATIVE & UNIT AREA
- ABANDONED GAS WELL
- EXHAUSTION OIL & GAS WELL
- ABANDONED EXHAUSTION WELL
- NOO HOLE
- NOO HOLE

SCALE MILES

STRUCTURE MAP

CONTINUED ON TOP OF WELL LOG
© PROPERTY OF U.S. GEOLOGICAL SURVEY

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
OIL & GAS OPERATIONS

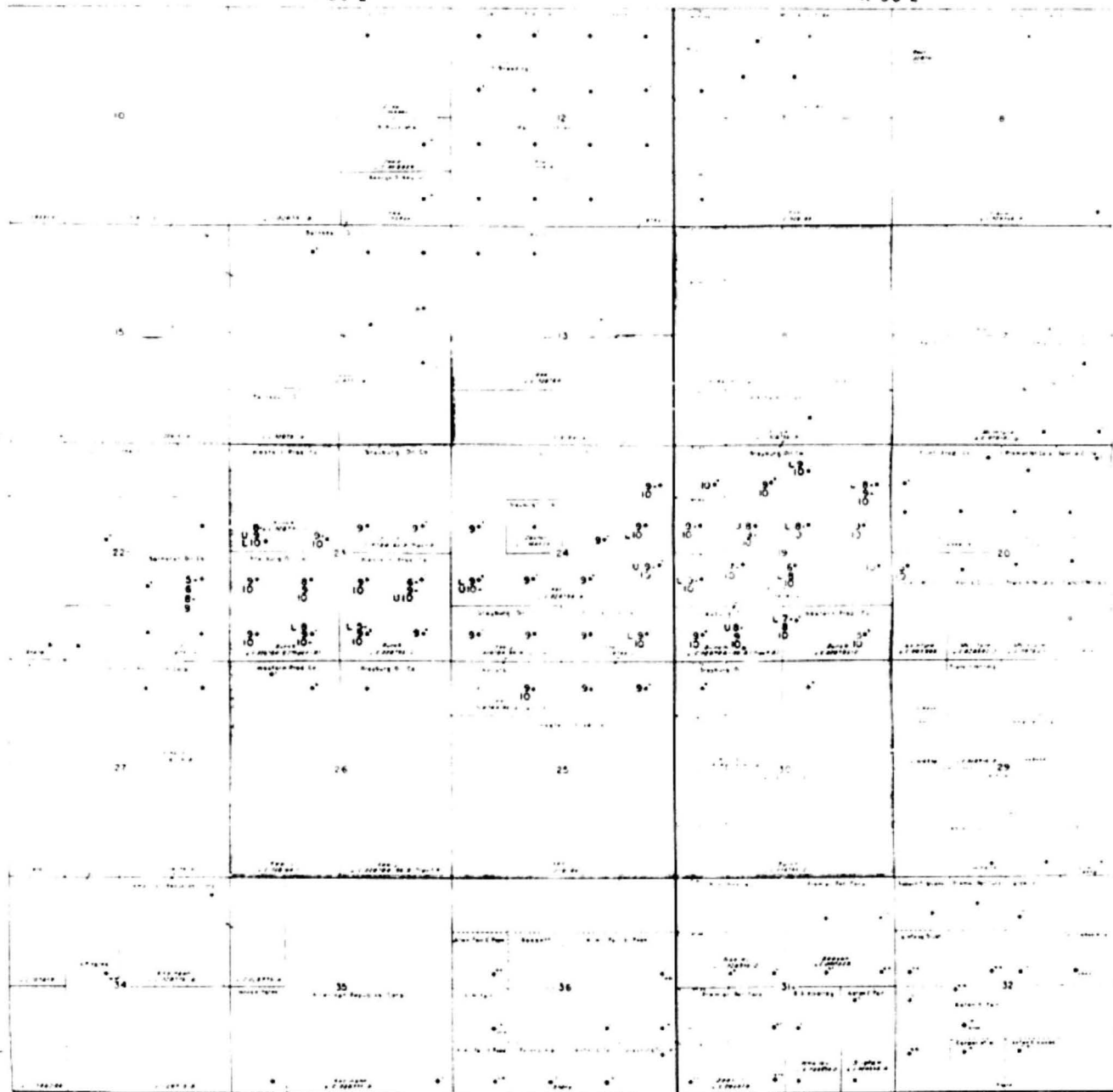
BASE MAP OF GRAYBURG COOPERATIVE & UNIT AREA EDDY COUNTY, NEW MEXICO

MAP OF L. M. STEVENSON, JR. DODGELL, NEW MEXICO

FEBRUARY 1944
MAP NO. DODGELL-30

R 29 E

R 30 E



EXPLANATION

LEGEND

- | | |
|---------------------------------------|-----------------------------|
| 1. COALITION | 2. GAS WELL |
| 3. DRILLING WELL | 4. ABANDONED GAS WELL |
| 5. DRILLING WELL/COALITION | 6. COALITION DRILLING WELL |
| 7. DRILLING WELL/COALITION | 8. ABANDONED COALITION WELL |
| 9. ABANDONED DRILLING WELL | 10. GAS WELL |
| 11. COALITION COOPERATIVE & UNIT AREA | |

SCALE - MILES

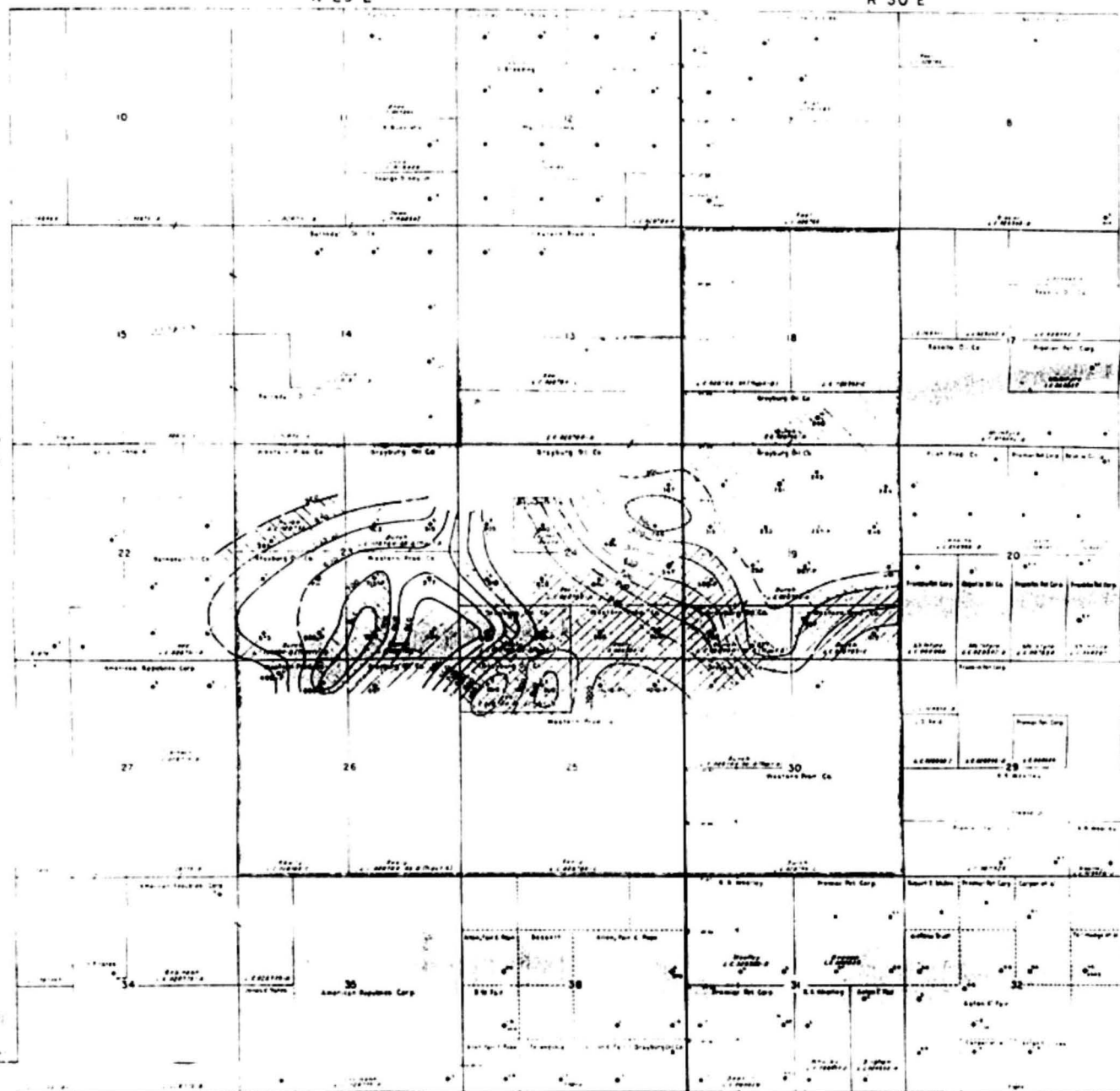


ZONE MAP

Large figures indicate producing zones
Small figures indicate production in upper or
lower portion of zone
Wells indicate good show of oil

DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY
OIL & GAS OPERATIONS
BASE MAP OF
GRAYBURG COOPERATIVE & UNIT AREA
EDDY COUNTY, NEW MEXICO

Drawn by L. W. STEVENSON, JR. RICHMOND, NEW MEXICO
FEBRUARY, 1925
MAP NO. 10000-20

T
17
ST
17
S

R 29 E

R 30 E

EXPLANATION

- 1. Location
- 2. Drilling well
- 3. Drilling well suspended
- 4. Drilling well
- 5. Drilling well
- 6. Drilling well
- 7. Drilling well
- 8. Drilling well
- 9. Drilling well
- 10. Drilling well
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- 13. Drilling well
- 14. Drilling well
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- 29. Drilling well
- 30. Drilling well

LEGEND

- 1. Location
- 2. Drilling well
- 3. Drilling well suspended
- 4. Drilling well
- 5. Drilling well
- 6. Drilling well
- 7. Drilling well
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- 26. Drilling well
- 27. Drilling well
- 28. Drilling well
- 29. Drilling well
- 30. Drilling well

SCALE - MILES

BOTTOM-HOLE PRESSURE MAP

DECEMBER 1943

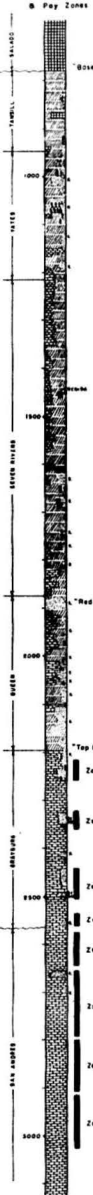
Bottom-hole pressures corrected to 1000 feet datum.
Figures indicate pounds per square inch.
P after pressure indicates pressure taken within past year -
current pressure not available.

DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY
OIL & GAS OPERATIONS
BASE MAP OF
GRAYBURG COOPERATIVE & UNIT AREA
EDDY COUNTY, NEW MEXICO

DRAWN BY L. D. STEVENSON, JR. ROSS, NEW MEXICO
FEBRUARY 1944
MAP NO. 1000-1-44

TYPE LOG

Stratigraphic Correlations
& Pay Zones



Note: Names and correlations shown on this map are based on the U.S. Geological Survey Oil & Gas Operations (1940). All formations shown are of Permian age.

EXPLANATION

LEGEND

- LOCATION
- DRILLING WELL
- DRILLING WELL SUSPENDED
- PRODUCING OIL WELL
- ABANDONED OIL WELL
- GAS WELL
- ABANDONED GAS WELL
- COMBINATION OIL & GAS WELL
- ABANDONED COMBINATION WELL
- DRY HOLE
- GRAYBURG COOPERATIVE & UNIT AREA

SCALE - MILES



REVISIONS	
SUBJECT	REVISOR

WELL RECORD MAP OF GRAYBURG COOPERATIVE & UNIT AREA EDDY COUNTY, NEW MEXICO

SCALE 1" = 1000'

DRAWN BY L. M. STEVENSON, JR. ROSWELL, NEW MEXICO

MAY 1940
MAP NO. ROSWELL-31

R 29 E.

R 30 E.

T 17 S

T 17 S

