STATE OF OHIO
FRANK J. LAUSCHE, Governor
DEPARTMENT OF NATURAL RESOURCES
A. W. MARION, Director
DIVISION OF GEOLOGICAL SURVEY
JOHN H. MELVIN, Chief

REPORT OF INVESTIGATIONS NO. 22
PETROLEUM AND NATURAL GAS SERIES NO. 6

OIL AND GAS IN MORGAN COUNTY

By
BYRON D. MAGBEE
And
ROBERT L. ALKIRE

Columbus
1954

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OTHER PUBLICATIONS

IN THE

PETROLEUM AND NATURAL GAS SERIES

R. I. No. 8 (Petroleum and Natural Gas Series No. 1) - Part 1. Ohio oil and gas well drilling statistics for 1950; Part 2. Oil and gas production, history, regulation, secondary recovery, and bibliography by Robert L. Alkire and others. 132 pp., illus., maps, 1951. (out of print)

R. I. No. 10 (Petroleum and Natural Gas Series No. 2) - Oil and gas in Perry County, by Robert L. Alkire. 64 pp., 8 figs., 4 pls. including location, structure, and production maps, 1952.

R. I. No. 13 (Petroleum and Natural Gas Series No. 3) - Part 1. Oil and gas well drilling statistics for 1951, by Robert L. Alkire; Part 2. Oriskany sand study, by John F. Hall; Canton gas pool, by Henry Belden; Wells drilled in Ohio 1888-1951; Oil and gas production charts; Well sample cuttings index; and Excerpts from previous reports. 137 pp., illus., maps, 1952.

R. I. No. 19 (Petroleum and Natural Gas Series No. 4) - Part 1. Oil and gas well drilling statistics for 1952; Part 2. Historical review of oil and gas developments in Ohio, compiled by Robert L. Alkire. 68 pp., map, 1953.

R. I. No. 20 (Petroleum and Natural Gas Series No. 5) - Part 1. Oil and gas well drilling statistics for 1953; Part 2. The development of underground storage in Ohio, by J. J. Schmidt and K. C. Cottingham; Rotary vs. cable tool drilling in Ohio, by Robert L. Alkire; Oil, gas, and water well cuttings received during 1953. 53 pp., maps, 1954.

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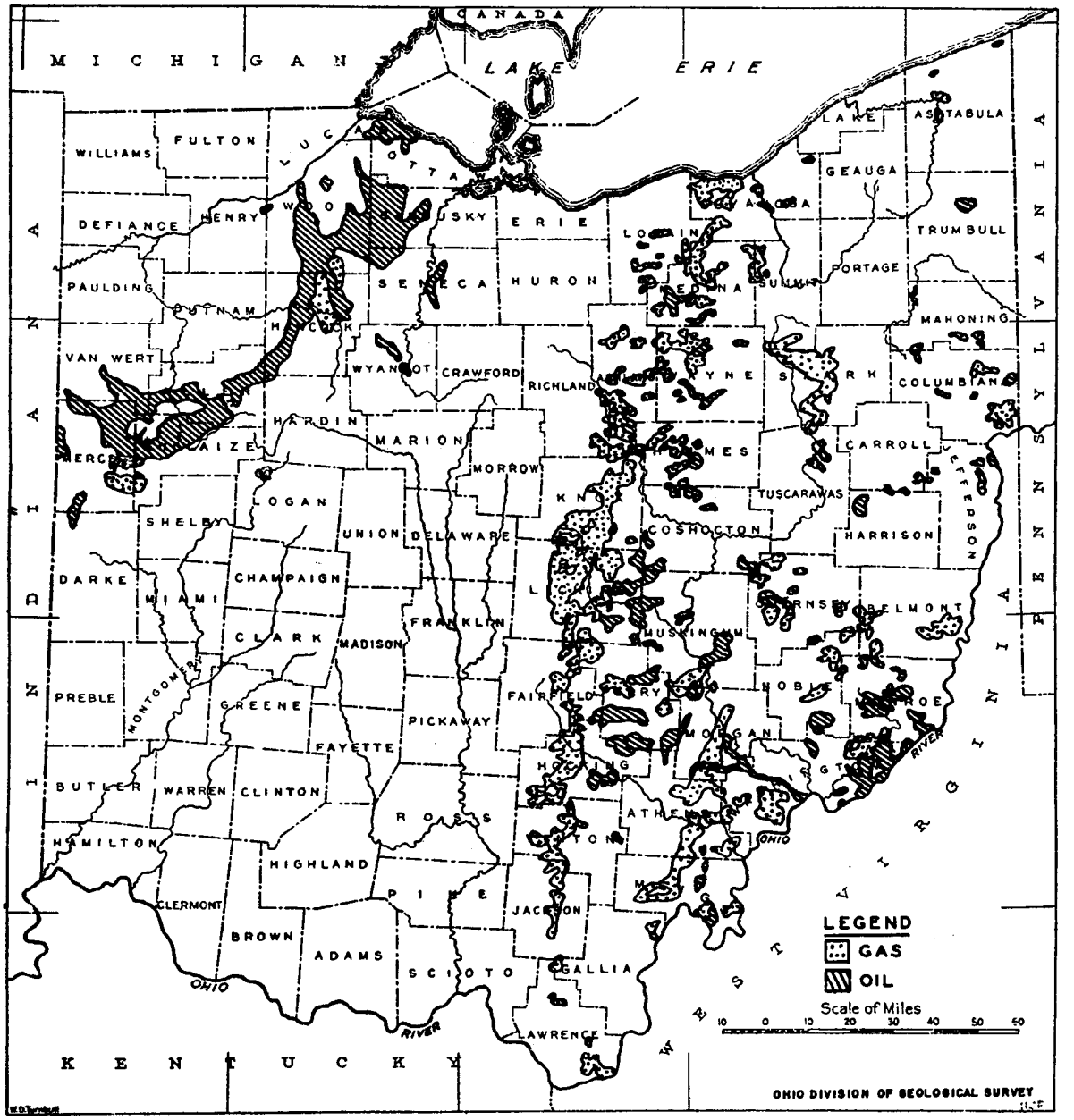


Figure 1. Oil and gas fields

ILLUSTRATIONS

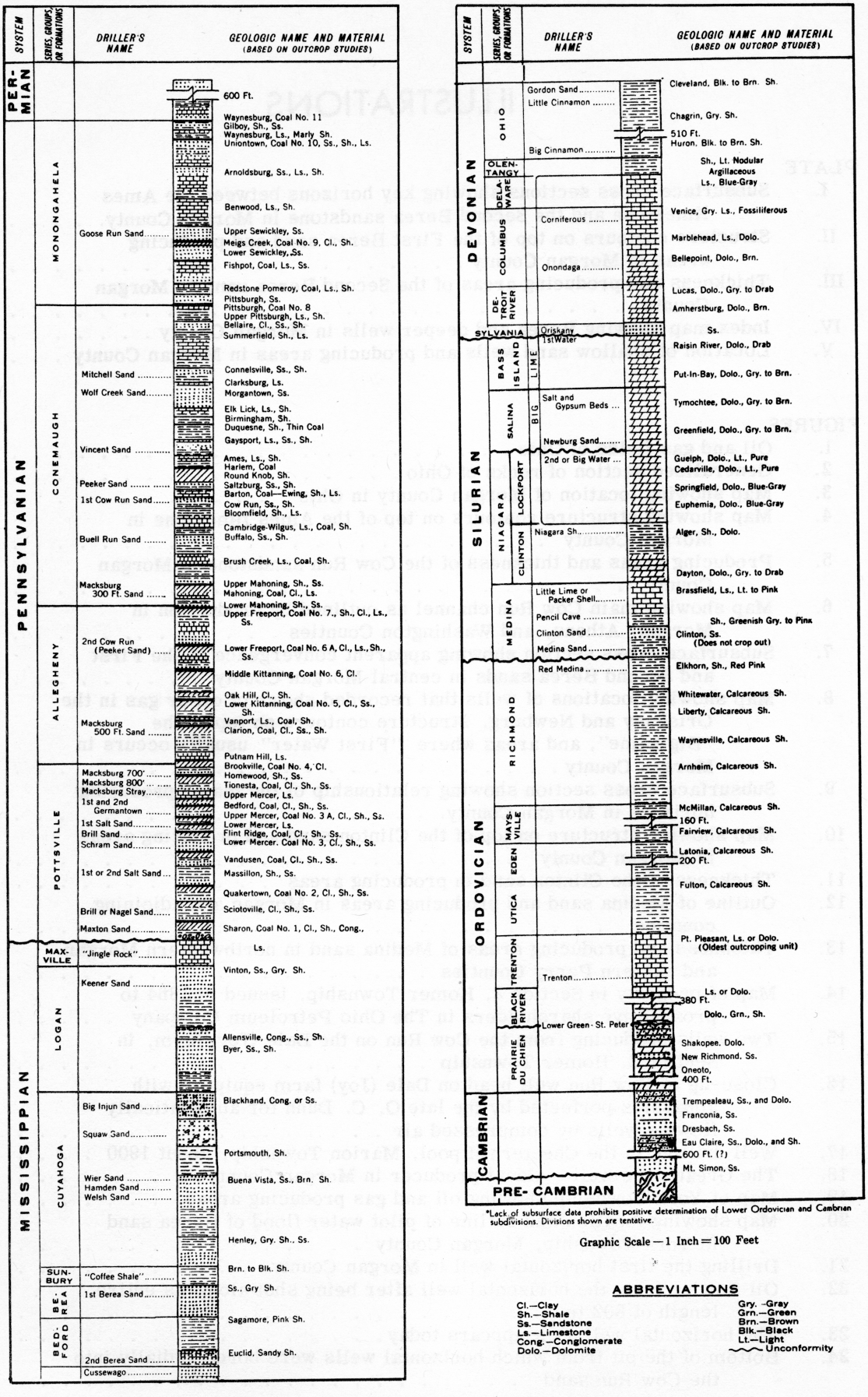


Fig. 2. Generalized section of rocks of Ohio.

INTRODUCTION

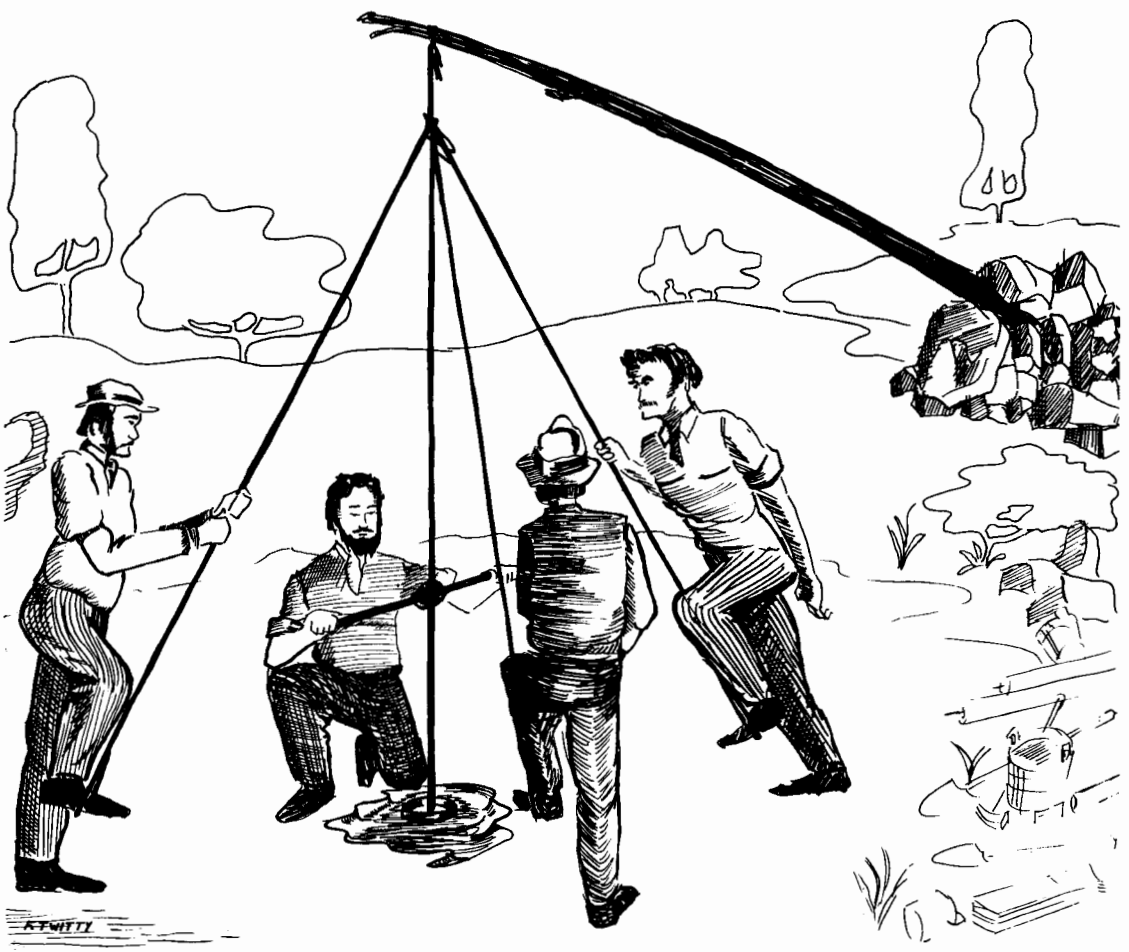
Ohio became an oil producing state only a few months after the Drake well was completed in 1859 at Titusville, Pennsylvania. Noble, Monroe, and Morgan Counties, and especially the area about Macksburg in Washington County, were the principal scenes of these early operations. Production was found at very shallow depths and thousands of holes were "kicked" down by the spring-pole method and later by the cable tool drilling machine as greater depths were sought. The value of a descriptive record or log of the rocks penetrated by these drills was little appreciated. Consequently very few records were made and many that were prepared were lost in the intervening years to 1931. In that year the Ohio legislature enacted a law requiring that a drillers' log and the location of each well drilled in a coal-bearing county must be filed with the Ohio Division of Mines. Fortunately, Morgan County and most of the other major producing areas, with the exception of the Lima-Indiana oil and gas field in northwestern Ohio, lay within the jurisdiction of the new law. Information as to wells drilled since 1931, therefore, was readily available. For wells prior to that date, The Ohio Fuel Gas Company and The Pure Oil Company permitted the use of their maps and files. Further assistance was received from Orton C. Dunn, Jr., of Marietta, who loaned records of his father's early operations in Morgan and Athens Counties. Clyde M. Foraker, of New Lexington and Columbus, for many years an operator in central Ohio, also contributed much Berea, Clinton, and Medina sand development information. Many others, mainly citizens of Morgan County, aided by recounting experiences which led to a better understanding of production, particularly in the shallow sands.

Although studies of the surface geology of Morgan County have been carried on from time to time through the years, for the most part they were so specialized that little information of county-wide scope is available for reference. The first report was prepared by E. B. Andrews (1) in 1873 and is concerned with outcroppings of coal. In 1912, D. Dale Condit (2) described many of the surface rocks in the western half of the county in "The Conemaugh Formation of Ohio." And, in 1950, John Bartlett (3), in his "Geology of Union Township," presented a detailed study of that area. In addition to the above information, a number of measured surface sections and coal outcrop data are in the files of The Ohio Geological Survey. Such information was employed whenever possible as an aid in the interpretation of the subsurface geology presented herein.

Oil and gas in Morgan County is the second county report to be presented in the Petroleum and Natural Gas Series of Reports of Investigation. The first, Series No. 2, R. I. No. 10, published in 1952, dealt with the history and development of "Oil and Gas in Perry County." The producing sands in Perry County are the Berea, Clinton, and Medina. In addition to these, Morgan County contains the so-called shallow sands of southeastern Ohio. These highly lenticular sands of Pennsylvanian and Mississippian age have long presented identification difficulties to both the driller and the geologist. Very little published data is available which could be helpful in efforts toward a solution of this perplexing problem. In attacking it in this report it was soon realized that drillers' logs would have to serve as the principal source of data for the preparation of subsurface cross sections. The limited amount of information available in surface geology studies, well cuttings, etc. was used wherever possible to add to the accuracy of these sections. Thus the final sections are believed to represent a reasonably true picture of the succession of rocks down to and including the Second Berea sand as they are recognized by the driller. Errors will be found, as drillers' logs are sometimes very confusing, but it is believed they will be relatively minor. As other counties in the shallow sand area are studied and additional surface and subsurface data becomes available the problem of sand identification in southeastern Ohio will gradually disappear.

No attempt was made to present a detailed study of oil or gas production in this review. Generally, in the Appalachian area, this information is difficult to obtain because no published production reports are available. Other important factors, such as pay thickness, are also not known in many instances. However, some general statements can be made as to recoveries. The Second Berea sand productive gas area covers about 40 square miles of Morgan County and has produced approximately 1,600,000 cubic feet of gas per acre. The Clinton sand gas area includes about 25 square miles with average per acre recovery of 2,400,000 cubic feet. The Medina sand productive area comprises nearly 5 square miles and recoveries have been approximately 2,700,000 cubic feet of gas per acre. Only one Medina sand oil well and several small Clinton sand oil pools have been found in Morgan County to date. Recovery per acre from the Clinton oil pools will probably not exceed 1,000 barrels per acre. This figure will also apply to the First Berea sand oil pool in central York Township. Recoveries per acre from the shallow sands would be difficult to obtain and would also probably be quite erratic. The First Cow Run sand in the vicinity of Joy, after a history of 80 years of production, both primary and secondary, is reported to have produced over 6,000 barrels of oil per acre on one 400 acre tract.

There has been no significant activity in the Clinton-Medina producing areas in Morgan County since 1950. Current drilling is restricted to the shallow sands, which remain a constant lure to the independent operator, and to the marginal gas area of the Second Berea sand which has responded very favorably to hydraulic fracturing.



"....and thousands of holes were "kicked" down by the spring-pole method"

CHAPTER 1

GEOGRAPHY AND GEOLOGY

OUTLINE OF GEOGRAPHY

Morgan County is located in the southeastern part of Ohio (Fig. 3). Its surface features are shown on portions of nine United States Geological Survey 15 minute quadrangle maps which are, Zanesville, Philo, Cumberland, Caldwell, McConnelsville, New Lexington, Athens, Chesterhill, and Parkersburg. McConnelsville, with a population of approximately 2,000, is both the largest town and the County seat. Other principal villages are Malta, Stockport, Pennsville, and Chesterhill. Most of the populace of the county are engaged in farming, although much of its rugged surface is scarcely suited for cultivation. Agriculture in the Muskingum River Valley is devoted chiefly to truck farming and raising corn and wheat. The hill country products are derived from dairying and grazing.

In the past, Malta and McConnelsville were bustling industrial centers and shipping points. River boats docked and loaded oil, wool, cattle, and farm produce to be transported to points along the Ohio and Mississippi Rivers. Within the two cities once were located an oil refinery, several wood working factories, a plow factory, cigar factories, and feed mills. Today only the wood working factories and a more recent meat packing plant remain. Before the turn of the century, oil and gas production was an important industry but, by 1900 most of the shallow producing pools of Morgan County had been overshadowed by richer strikes elsewhere. Coal mining also was a major industry in the eastern and southern parts of the county. However, as the better coal became scarce and production costs rose, many of the mines were forced to close.

Today a rejuvenation of industry in the Ohio and Muskingum River valleys is directly affecting Morgan County. Manufacturers are attracted by the ample labor force available, good transportation facilities, and cheap electric power. Two miles north of McConnelsville a new plant for the production of metal bearings has recently been completed and ten miles to the southeast, near Beverly, an electric power plant recently began operation. The fuel for this plant is obtained by strip-mining the Meigs Creek No. 9 coal in eastern Meigsville Township and transporting it, via conveyor belt, a distance of some six to eight miles to the plant.

A brief outline of the surface features of Morgan County as presented by Condit (2) follows:

> "Drainage. - Morgan County is traversed by Muskingum River, which flows in a wandering route southeastward across the middle portion. At the Washington County line the river makes a large bend and flows north for several miles. Throughout its course in Morgan County there are no tributaries of any considerable size. Other drainage lines in the county lie roughly parallel to the Muskingum and are separated from it and each other by high ridges. In the eastern part are Meigs and Olive Creeks, which join the Muskingum at the Big Bend. Wolf Creek drains much of the area west of the river, but in the extreme western and southwestern parts there are branches of Federal and Sunday Creeks, which are tributaries of Hocking River.
>
> "All of the valleys in this region are narrow and have little bottom land. This is true of Muskingum River as well as the small streams, there being few places where its valley is over one-half mile wide. So narrow a valley with a stream as large as the Muskingum is abnormal and needs explanation. The same river, about three miles north of Zanesville, has a valley three

Fig. 3. Map showing location of Morgan County in Ohio.

times as wide as at McConnelsville. Investigation has shown that the channel in Morgan County is postglacial in origin and represents the work of the Muskingum since the recession of the continental ice sheet. Previous to the coming of the glaciers the course of the river was westward into Licking County, but the valley in that region was occupied by the ice and filled with drift, forming a dam so effective that the ponded waters were forced to cut a new channel to the southward past the location of Zanesville and down through Morgan County; hence the youthful appearance of the valley in this region.

"Relief. - The streams of Morgan County have carved the surface into hills and valleys whose difference in elevation constitutes the relief. The land is comparatively rugged, and the hills are steep throughout the county. As has already been stated, the main divides trend northwest - southeast. Branching out from these are many ridges separated by deep hollows. The most gentle topography is found west of the Muskingum in the central part of the county where Wolf Creek and its tributaries flow in shallow valleys with gentle slopes, giving considerable gently rolling upland.

"The highest hills, lying in the northwestern corner, have a maximum altitude of about 1,175 feet above sea level. There are few localities in the northeastern part where an elevation of 1,100 feet is reached. In the central and southern portion are few ridges over 1,050 feet. The least altitude along Muskingum River is about 620 feet. This gives a range of 555 feet for the county."

OUTLINE OF GEOLOGY

The surface rocks of western Morgan County are composed of the Allegheny, Conemaugh, and Monongahela formations of the Pennsylvanian system. East of the Muskingum River the hills are capped with rocks of the lower Permian system. The strata dip eastward toward the Appalachian geosyncline approximately 30 feet per mile and are relatively unaffected by structural features except for the Parkersburg-Lorain syncline in the extreme eastern part of the county. Three of the more easily identifiable strata are the Ames, Cambridge, and Brush Creek marine limestones of the Conemaugh formation. The Ames, the most useful of these for correlation work, lies approximately 175 feet below the Pittsburgh (No. 8) coal and averages two feet in thickness. It is a hard crystalline limestone, light gray in color, and contains abundant crinoid fragments. Figure 4 is a structure contour map of the Ames or its horizon where it is absent. The Cambridge, a less persistent limestone, lies 90 to 110 feet below the Ames. It is a brown limestone which averages 5 feet in thickness, and contains an abundance of marine fossil fauna. Outcrops are found in northern Deerfield, York, and Bloom Townships. The Brush Creek occurs approximately 120 feet below the Ames and is a brown cherty limestone known to drillers as the "flint." In most areas in the county it is made up of two members separated by thin layers of shale. The Brush Creek is often confused with the Cambridge by the driller.

The major portion of the outcropping strata in the western area of the county are members of the Conemaugh formation. A generalized section of this formation, prepared by Condit (1), follows:

"General Section of the Conemaugh Formation in Morgan County

Pittsburgh or No. 8 coal, basal member of the Monongahela formation, thin in most localities.

	Ft.	In.
Conemaugh formation		
22. Clay with a number of beds of limestone.	13	-
21. Shale, sandy, sandstone in some localities	35	-
20. Limestone, Summerfield, several beds interlain with clay. . . .	4	-
19. Clay shale, mostly red, with nodular limestone and hematite. A few beds of sandstone in some localities.	45	-
18. Sandstone, shaly.	30	-
17. Shale, sandy, with one or more layers of impure, fossiliferous limestone. Skelley horizon.	16	-
16. Shale, sandy, sandstone in some localities	21	-
15. Limestone, Ames or "Crinoidal," a gray, fossiliferous rock.	1	6
14. Shale, sandy.	11	-
13. Coal, Harlem.	1	-
12. Shale, sandy and shaly sandstone	24	-
Limestone, Ewing, with many minute fossils and fish bones. The limestone is missing in some localities and in others is represented by a conglomerate.	3	-
11. Sandstone, Cow Run, massive, prominent along the Muskingum Valley. This is the "First Cow Run sand" of oil men. There is shale at this horizon in the western part of the county.	25	-
10. Shale, carbonaceous, with marine fossils. Portersville horizon.	4	-
9. Coal, Anderson, disturbed by erosion in some localities and its place occupied by sandstone.	1	8
8. Clay shale, with calcareous concretions.	10	-
7. Clay, with nodules of fossiliferous limestone, Cambridge horizon.	4	-

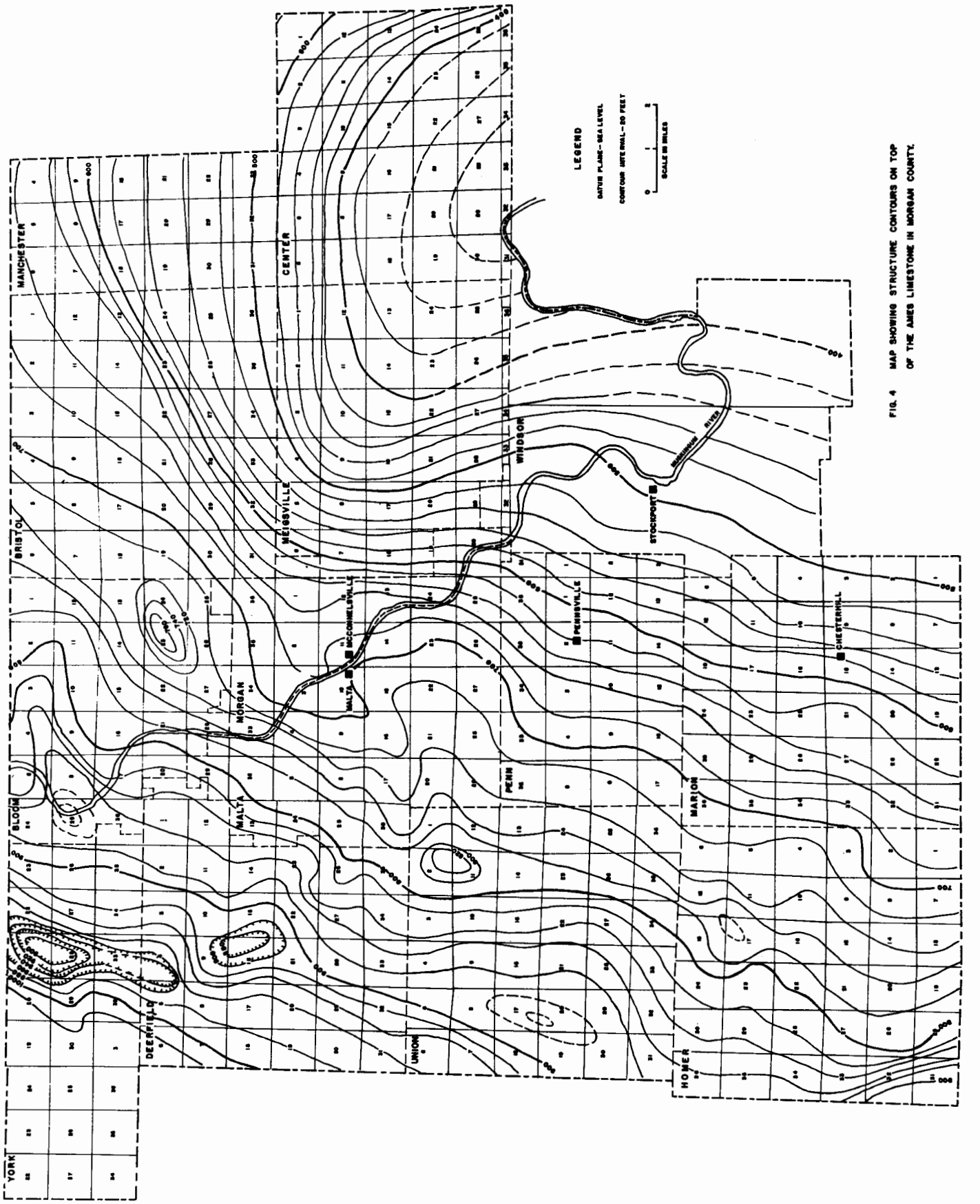


FIG. 4 MAP SHOWING STRUCTURE CONTOURS ON TOP OF THE AMES LIMESTONE IN MORGAN COUNTY.

		Ft.	In.
6. Shale, sandy.		28	-
5. Upper fossiliferous beds. Sandy, impure limestone in layers or nodules	Brush Creek horizon	6	-
Shale, sandy.		18	-
Lower fossiliferous beds. Cherty, sandy limestone in layers		5	-
4. Coal, Mason, thin		-	-
3. Sandstone, shaly.		19	-
2. Limestone and clay, horizon of Mahoning coal.		3	-
1. Sandstone, Mahoning, shaly.		37	-
Upper Freeport or No. 7 coal, top member of the Allegheny formation.			

The principal structural feature in eastern Ohio is the Parkersburg-Lorain syncline. The axis of this syncline crosses the Ohio River between Parkersburg and Marietta, then extends northward to the city of Lorain on Lake Erie. Structure contours on top of the Ames limestone show the axis of this syncline extending northwest-southeast through the extreme eastern portion of Morgan County. The Berea contour map indicates that the axis lies just over the Morgan-Noble County line, or a distance of about five miles to the east of the axis of the Ames. No expression of the syncline is apparent on top of the "Big Lime" (Fig. 8). Two reasons appear possible for the diminishing effect of the syncline with depth. They are, that the 1,900 feet of Devonian shales, which thicken to the east as much as 40 feet per mile, absorbed the stresses which caused the deformation, or that the syncline was formed by tangential forces whose intensity diminished with depth.

The effect of the Parkersburg-Lorain syncline on the accumulation of oil and gas in Morgan County remains uncertain. No significant production has been found in the area of the synclinal axis from central Washington County north through eastern Morgan, western Noble, eastern Muskingum, and south central Coshocton Counties. It appears that the syncline may be responsible for this territory being barren, at least in the shallower sands.

CHAPTER 2

OIL GAS PRODUCING HORIZONS

The 16 known oil and gas producing strata in Morgan County range in age from Pennsylvanian to basal Silurian. With few exceptions these productive rocks are sandstones that have been found from a few feet to as much as 4,500 feet below the surface. During the 93 years of drilling in Morgan County and southeastern Ohio, many names have been applied to these subsurface formations by the driller. Limited attempts have been made through the years to extend these driller-named horizons to the surface so that they could be definitely identified. Additional efforts are made in this report in the hope that existing confusion in the shallow sands may be further clarified.

THE SHALLOW SANDS

There are 14 producing horizons in Morgan County lying above the Berea sandstone. All are Pennsylvanian in age with the exception of the Big Injun and Berea, which are Mississippian. Generally, they are lenticular bodies without lateral continuity, which may be replaced by shale or siltstone within very short distances. This makes it difficult to identify a formation in one locality and then attempt to locate it some distance away. Two steps have been employed in studying continuity of sands in this report. They were the identification of the persistent limestones and coals on the outcrop and the establishment of intervals between these persistent formations and the producing horizons.

The most easily identified surface strata in Morgan County are the Ames and the Cambridge limestones. The Ames rarely exceeds two feet and the Cambridge averages five feet in thickness. The interval between the two varies from 90 to 120 feet. Both are marine limestones easily recognized by the driller because their hardness causes a metallic ring when struck by the tools. Unfortunately, heavier tools, employed when drilling to the Clinton or Medina sands, pass through these thin limestones with ease; therefore they are usually not recorded on the logs of deep wells. Several additional stratigraphic markers in Morgan County are the Upper Freeport or No. 7 coal, the Middle Kittanning or No. 6 coal, and the Mahoning sandstone. The interval between the coals varies from 90 to 110 feet. The massive Mahoning sandstone averages 30 to 40 feet in thickness and lies immediately over the No. 7 coal.

Subsurface cross sections of Morgan County are shown on Plate I. The datum plane employed in preparing these sections is the Ames limestone which was converted to horizontal position so that relationships between the various formations could be more easily understood. When the Ames was found missing from a desired well log, the elevation of the horizon was calculated by using intervals from known outcropping formations or from the log of a nearby well. The cross sections illustrate the lensing nature of the sands, the persistency of the Ames and Cambridge limestones, and their constant interval. On the following page is a generalized section which shows the average interval between the Ames limestone and some of the more prominent underlying strata in Morgan County.

Very little production has been found in Morgan County in sands above the Ames limestone. One sand lens, occupying the position of the Ames intermittently across Penn, Union, and Marion Townships, has produced small amounts of oil. The geological name of this member, called the "Fossil" sand by the driller, is not known.

System	Formations	Geologic name of member	Drillers' name	Avg. no. of ft. below Ames
Pennsylvanian	Conemaugh	Ames limestone	Fossil or Crinoidal lime	0
		Saltzburg sandstone	Peeker	30
		Cow Run sandstone	First Cow Run	52
		Cambridge limestone	Flint	105
		Brush Creek limestone	Flint	125
		Mahoning sandstone	Macksburg 300'	180
	Allegheny	No. 7 coal		220
		Lower Freeport sandstone	Second Cow Run	250
		No. 6 coal		310
		No. 5 coal		335
		Kittanning sandstone	Second Cow Run	350
		Clarion sandstone	Second Cow Run or Macksburg 500'	400
	Pottsville	Homewood sandstone	Macksburg 700' or "Stray"	475
		Upper Massillon sandstone	Salt	540
		Lower Massillon sandstone	Brill	600
		Sharon conglomerate	Maxton	645
Mississippian	Logan		Keener	variable
	Cuyahoga	Black Hand	Big Injun	790
	Berea	Berea	Berea	1,250
	Bedford	Second Berea	Second Berea	1,300

Saltzburg Sand

Approximately 30 feet below the Ames limestone lies the Saltzburg sandstone. It is usually recognized by the driller as Peeker sand, but in some areas it is occasionally mistaken as Cow Run. In recent years, as better well records were kept and additional outcrop studies were made, the Saltzburg or Peeker has been recognized as a definite sand body which is separated from the Cow Run by shale. Most of the productive Peeker sand wells have been found in Penn Township. The sand, in many instances here, is in contact with the underlying Cow Run so that they are often logged as one sand. In western Windsor, northeast Marion, and southwest Malta Townships the Peeker averages 10 feet in thickness and is separated from the Cow Run by 10 to 20 feet of shale.

Cow Run Sand

The Cow Run sandstone, a member of the Conemaugh formation, is found approximately 60 feet under the Ames limestone, 40 feet above the Cambridge limestone, and averages 20 feet in thickness. In Morgan County the sand outcrops in western Union, Deerfield, York, and Malta Townships and dips eastward to a depth of more than 500 feet below the surface in eastern Windsor Township. Most of the shallow wells drilled in southeastern Ohio search for production in this sand.

The Cow Run sand has probably produced more oil than any other formation in Morgan County. The history of its production dates back to 1860, shortly after oil was discovered at Macksburg in Washington County. The earliest settlers in the region knew of oil seeps from this sandstone along Oil Spring Run in Malta Township and in the valley of Wolf Creek in Union Township. Today oil may still be seen oozing from the outcrop of this coarse sand in the ravine of Oil Spring Run. The first wells drilled for oil in the Cow Run were in Homer Township near Joy and in northeastern Union Township along the valley of Buck Run. These wells were less than 100 feet deep and five barrels per day was considered a good producer. The price of oil was high and the resulting extensive drilling quickly defined the productive limits of the pools.

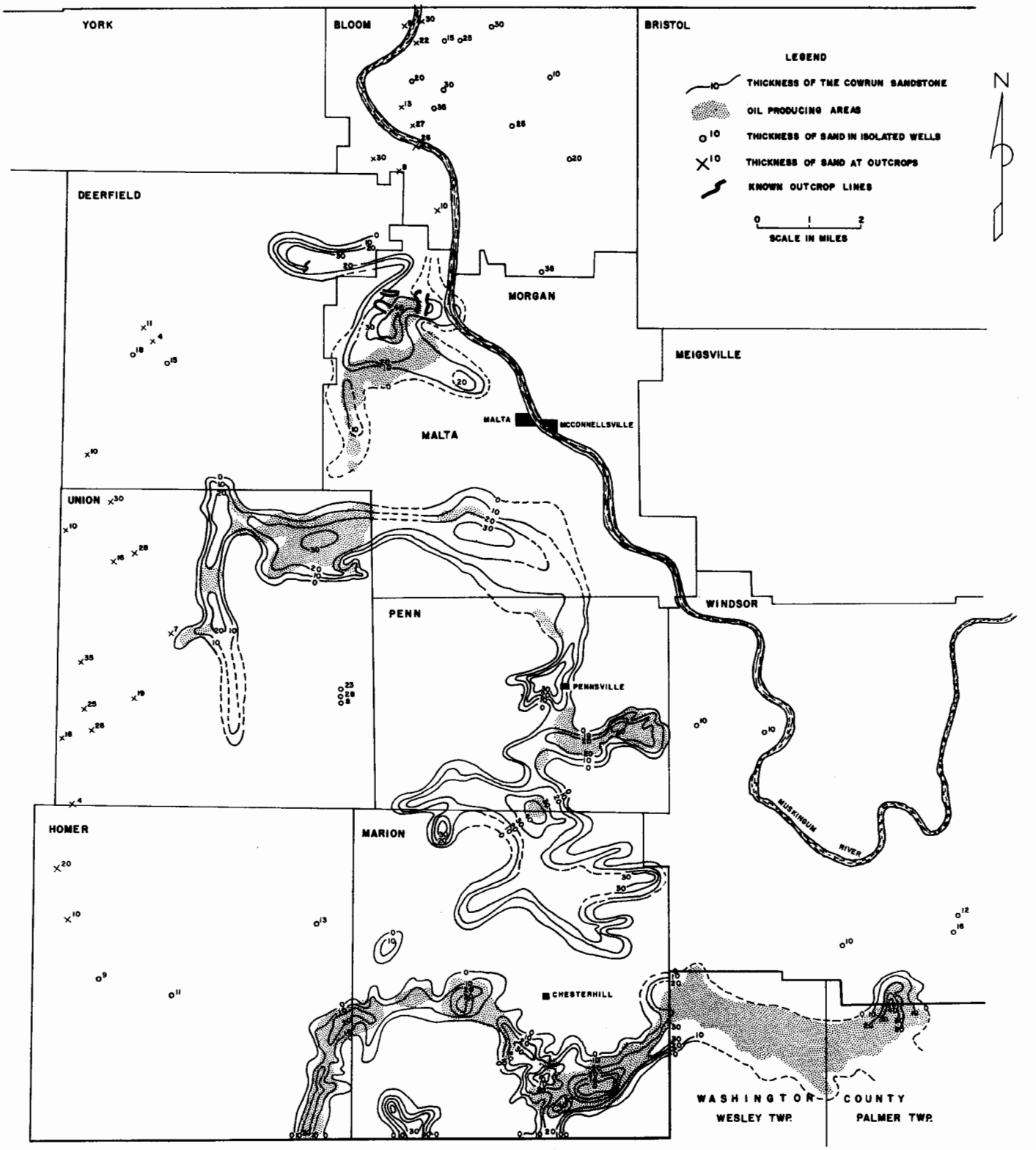


FIG. 5 PRODUCING AREAS AND THICKNESS OF COW RUN SANDSTONE IN MORGAN COUNTY

Producing wells usually reported 15 to 20 feet of sand and the dry holes found no sand. The Cow Run sandstone has been found to be an irregular, sinuous deposit that extends from northern Ames Township in Athens County northward into Morgan County and then eastward to the banks of the Ohio River just south of Marietta. It has been found in other southeastern Ohio counties and in West Virginia, but not as a continuous sand deposit. Figure 5 shows the extent of this sand in Morgan County. In Malta, Marion, and Penn Townships, the presence of the Cow Run is noted in deeper wells but no oil or gas shows were recorded. In many instances records were poorly kept so that sand characteristics and production data are not known.

The outline of the sand across Morgan and Washington Counties may be seen in Figure 6. It suggests the course of an ancient stream with sand-filled channels. The character of the sand also supports this idea. The grains are coarse, sub-angular to angular, and are poorly sorted to size. In the main body of the channel the sandstone has good porosity and permeability and is light in color, varying from pure white to light gray and tan. It is composed principally of quartz but other minerals, such as pyrite and mica, are present at many places. A conglomerate is usually found at the base. Outcrop studies of the Cow Run were made by Laubach (4) in Athens County. His conclusions regarding the depositional environment are as follows:

> "Field relation, such as the disconformable lower contact, the local presence of conglomerate and plant fossils, and its lenticular nature, mark the Cow Run as a cut-and-fill type of sand body associated with a deltaic environment. Deposition probably occurred in stream channels on the sub-areal portion of a distributary system...."

The Saltzburg or Peeker sand seems to have had a similar history although on a smaller scale and at a later time. Because of poorly kept well records and confusion withthe Cow Run, the extent of the Saltzburg sand is not definitely known.

Production from the Cow Run is high-grade Pennsylvania crude of light green to amber color. In the past it has commanded a higher price than any other oil in Ohio. In the early days of development of the Cow Run pools enough gas was usually encountered to throw oil above the

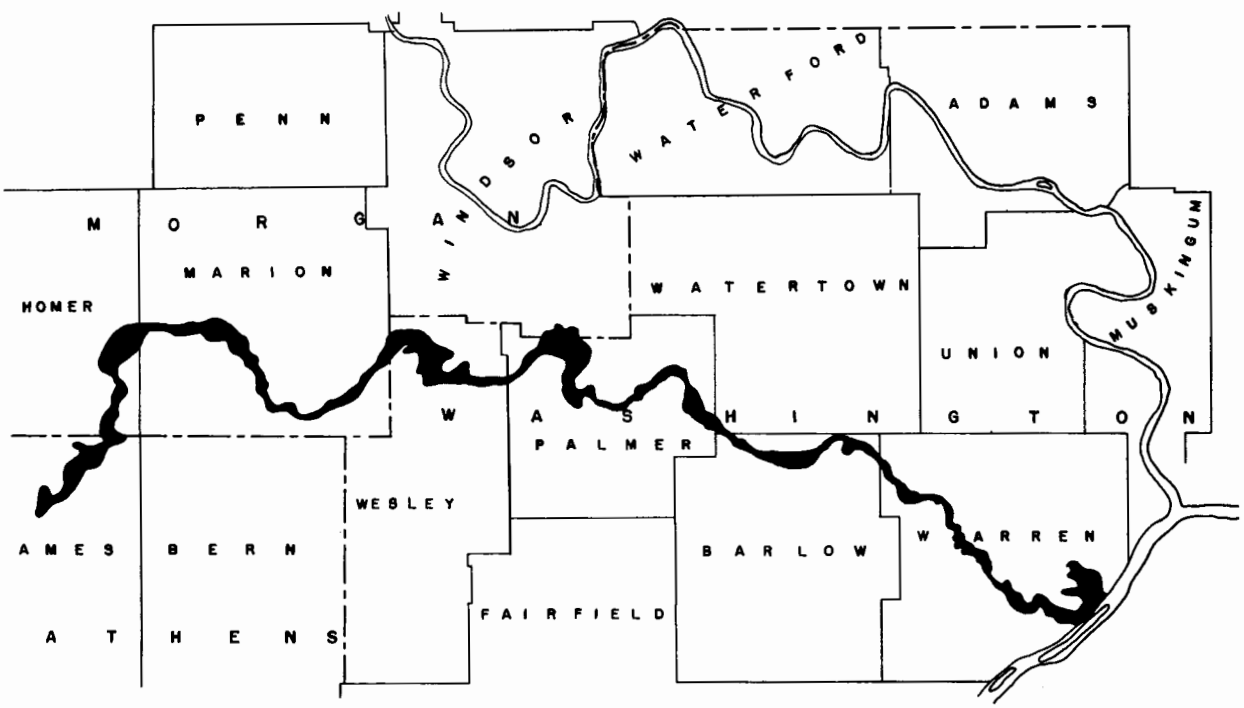


Fig. 6. Map showing main Cow Run channel as outlined by production in Morgan, Athens, and Washington Counties.

derricks. But it was soon exhausted because of overdrilling and "flaring," so that by 1910, when the second or third "crop" of wells were drilled, it was necessary to obtain gas from deeper horizons to operate the boilers of the drilling rigs. The greatest Cow Run oil pool in Morgan County was found near Browns' Mills in southern Windsor Township. The discovery well was drilled in March 1900 on the Yarnell farm where several later wells produced more than 1,000 barrels the first day after shot.

The future for primary production from the Cow Run sand in Morgan County is not encouraging. No important discoveries have been made for many years and reservoir pressures are nearly exhausted. The use of compressed air to create artificial reservoir energy was initiated 40 years ago and has since been used to force thousands of barrels of additional oil from many of the pools. Several attempts have been made to increase oil recovery by water flooding techniques but to date they have failed in the Cow Run sand in Morgan County.

Mahoning Sandstone and the No. 7 Coal

The Mahoning sandstone is the basal member of the Conemaugh, and has been named the Macksburg 300 foot sand by the driller. Although it is very persistent, averaging 30 feet in thickness, it has produced very little oil or gas in Morgan County. Some isolated wells have found enough gas to supply a dwelling and several are at present being utilized for that purpose.

The No. 7 or Upper Freeport coal has been named the top member of the Allegheny formation. The coal ranges from one to seven feet in thickness and from 200 to 300 feet in depth. It is a small producer of gas in southwestern Malta, southeastern Deerfield, and northeastern Union Townships. The first wells in this area were drilled in search of gas to operate boilers during development of the Buck Run pool in Union Township. Gas is usually found at the contact of the No. 7 coal and the overlying Mahoning sandstone. The small amount found in the Mahoning sandstone probably originated in the coal and subsequently migrated upward into the sand. Gas wells in the No. 7 coal average 15,000 cubic feet per day and, since they are used primarily by farm homes, they last for many years.

Productive Sandstones of the Allegheny Formation

A study of many drillers' logs has revealed three producing sandstone members in the Allegheny formation. In descending order they are the Lower Freeport sandstone, the Kittanning sandstone, and the Clarion sandstone. Their production in Morgan County has been comparatively small, but the Lower Freeport and the Clarion have been prolific producers elsewhere. Considerable confusion sometimes results when drillers erroneously name these sandstones on their logs. As an example, by using intervals as a basis for identification, the author has found that the name Second Cow Run has been applied to three distinct sand bodies in Morgan County.

The Lower Freeport sandstone lies approximately 250 feet below the Ames limestone and between the No. 7 and the No. 6 coals. It is considered here as being the true Second Cow Run. The sand was discovered in the subsurface in 1866 when a second producing sand was found at Cow Run in Washington County. The sand was first thought to be the same as the one producing oil at Macksburg, Washington County, and was identified as the Macksburg 500 foot. It was later determined by Minshall (5) to be 83 feet lower stratigraphically and so was named the Second Cow Run. Laubach (4) has studied the surface geology of the sandstone member in Athens County and affirms the belief that the Lower Freeport sandstone and the Second Cow Run are the same. Production from this sand is primarily gas and the producing area in Morgan County begins in south central Malta Township, extends southward across Penn Township, and into Marion Township. It was discovered between 1880 and 1890 as the Malta and McConnelsville Gas Company attempted to develop a gas pool in the vicinity of those two cities. Wells were being drilled to the Second Berea and occasionally sizable gas flows were encountered in the Second Cow Run. The better wells were saved and produced until the gas was exhausted. Drilling was then continued to the Second Berea. Many wells drilled in Penn Township in the years between 1920 and 1930 recorded open flows up to 750,000 cubic feet of gas per day natural from the Second Cow

Run. The sand is light buff to tan in color. It gives up its gas easily and the wells are usually exhausted in less than five years. Rock pressures seldom exceed 200 p. s. i. The Second Cow Run ranges in depth from 400 to 600 feet below the surface in its producing area of Morgan County.

The Kittanning sandstone is directly beneath the Lower Kittanning or No. 5 coal. Drillers usually record it as the Second Cow Run. It is similar in character to the Lower Freeport sandstone which produces gas in approximately the same areas in south central Malta Township. The sand is found in most deep wells in the county but has been productive only to a small degree in Malta Township.

The Clarion sandstone has been named the Macksburg 500 foot sand by the driller. It is a persistent member which is found beneath the No. 4a or Clarion coal and forms the base of the Allegheny formation. The Macksburg 500 foot has been a good producer of oil and gas in Washington, Meigs, Noble, and Monroe Counties. In Morgan County production to date has been limited to small gas pools in Marion, Penn, Union, Windsor, and York Townships. Nearly a dozen gas wells drilled in central Marion Township have been reported as Second Cow Run but a study of sand intervals indicates that these wells are producing from the Macksburg 500 foot or Clarion. The pool in York Township resulted from a search for gas to be used in repressuring in the First Berea oil pool. Production was small and the life of the wells short, as is true of most of the Macksburg 500 foot gas production in Morgan County.

Productive Sandstones of the Pottsville Formation

In Morgan County sands of Lower Pennsylvanian age are very difficult to identify by existing methods of investigation. The No. 6 coal is the deepest stratum that can be correlated with any degree of certainty and it is not always present. The top of the Mississippian is known to be a disconformity having as much as 200 feet of relief, so it offers little definite identification assistance. Despite the many obstacles in the way of positive recognition it is possible to trace certain persistent members by using a reasonable number of drillers' logs. The top and bottom of these sands are extremely irregular and the intervals often change between wells. Cross sections made from drillers' logs (Plate I) show that, although intervals may change within short distances, the strata may be traced across the county with some degree of certainty. By employing this method, four producing horizons appear to be identifiable. In descending order they are, the Homewood sandstone, two members of the Massillon sandstone, and the Sharon conglomerate. These porous sands produce only gas in Morgan County. The producing area extends across Penn Township southward through Marion Township into Athens and Washington Counties. The wells are comparatively short-lived.

The Homewood sand in Morgan County has been called the Macksburg Stray by the driller. It has been traced southward and eastward into Washington County where it was recognized by the local drillers as Macksburg 700 foot. It consists of localized lenses and produces gas in a few isolated spots in Morgan County. In Section 5 of Deerfield Township approximately six wells appear to have produced from the Homewood. Records for these wells were poorly kept so the producing horizon is not certain. In Marion Township several isolated wells have small gas production from the Macksburg Stray. In Penn Township, in Sections 11 and 12, four wells were drilled to a gas producing horizon on the Harris farm. It was named the Harris gas sand by local operators. These "stray" sands have been correlated with the Homewood, or Macksburg 700 foot of the driller. It is usually found just above the Mercer limestones although in Morgan County the driller seldom records a limestone at this horizon.

The Massillon sandstone is one of the most persistent members of the Pottsville formation. It ranges up to 50 feet in thickness and carries large amounts of salt water. Quite naturally it was named the Salt sand by the drillers. This stratum is a moderate producer of gas in scattered areas from Meigs County northeastward to Columbiana County. Production in Morgan County is localized in Penn and Marion Townships. In southern Marion Township there appears to be two members of the Massillon. The upper is the Salt sand and the lower, separated by a few feet of shale, is the Brill sand of the driller. The author believes these two

sandstones are Massillon. The Salt sand and the underlying Brill have been developed as producers in a manner somewhat similar to that of the Second Cow Run. Drilling between 1920 and 1930 in Penn and Marion Townships was primarily in search of Second Berea gas. Many wells obtained such strong flows of gas in the Salt sand at depths from 800 to 1,000 feet that operations were stopped and the wells produced. Often the wells lasted only a few years, but usually they were profitable because of the large volumes of gas yielded. Open flows of many exceeded 1,000,000 cubic feet per day after shot and rock pressures varied from 200 to 300 p. s. i. As the Salt sand gas was exhausted most of the wells were extended to the Second Berea. Gas pools in the Massillon or Salt sand may be localized accumulations above salt water in areas of greatest sand thickness. The Brill sand is very similar to the Salt sand in productive characteristics and lithology. Both are white sands that are relatively free of foreign material and with considerable variance in grain size. The Brill has been identified only in south central Marion Township where the wells average 200,000 cubic feet the first day after shot. In other areas the Salt sand is more easily recognized because of its normal position 70 feet below the Mercer limestone and just above the Quakertown coal. Neither of these strata is reported in wells in Morgan County.

The Maxton sand is the drillers' name for the Sharon conglomerate, which occurs at the base of the Pottsville formation. In northern Morgan County the Maxton sand is generally not recorded. In its place is found the Maxville limestone which is considered to be the top member of the Mississippian system in Ohio. Regarding the Sharon or Maxton, Stout and others (6) state:

> "The Sharon member occurs only in the pre-Pennsylvanian trough-like basins which were eroded deeply into the Mississippian floor. When the seas of early Pennsylvanian time entered Ohio, they first filled the low depressions with thick beds of quartz sand and pebbles now representing the Sharon conglomerate. The thickness of these deposits ranges from 10 to 200 feet, the texture from that of coarse conglomerate to fine-grained sandstone."

In Morgan County the Maxton has been a producer only in Marion Township. Here it is often logged with the Massillon as 100 feet of continuous sand which usually contains salt water near the base.

Big Injun Sand and the Mississippian - Pennsylvanian Contact

The Maxville limestone is the top formation of the Mississippian system. It outcrops north and west of Morgan County in Perry, Muskingum, Licking, and Hocking Counties and although it is missing in some areas it has been found by most wells in southeastern Ohio. In Morgan County, the northwestern townships, including York, Deerfield, Malta, Morgan, and Bloom, the Maxville is consistently present. It gradually thins (Plate I) southward and is missing entirely in the area from the Malta-Penn Township line to central Washington County.

The Pennsylvanian-Mississippian contact is difficult to locate where the Maxville limestone is absent. It is an ancient erosional surface which is so irregular in some areas as to allow Mississippian rocks to extend as much as 200 feet into the overlying Pennsylvanian rocks. The bottom strata of the latter are composed of material eroded from upper Mississippian beds and therefore resemble them very closely.

The Big Injun sand has been the only productive horizon in the Mississippian system above the Berea in Morgan County. It is tentatively correlated with the Black Hand conglomerate which outcrops in Licking, Fairfield, and Hocking Counties. However, it is possible that the sand called the Big Injun in some localities could be another member of the Cuyahoga formation or even one of the sandstones in the overlying Logan formation. In Morgan County the Big Injun is a coarse-grained sandstone averaging 50 feet in thickness and usually contains salt water. The only significant production found to date occurred in eastern Marion Township where several gas wells were drilled 55 years ago. There are no records of these wells but several of the older local residents report that a pipe line was laid a distance of 10 miles to the village of Malta and that the wells supplied gas for a number of years.

THE FIRST BEREA SAND

The Berea sandstone, commonly known as the "grit," is of Mississippian age and is one of the most extensive sandstone formations in the Appalachian region. In Ohio the outcrop extends from Pennsylvania, a few miles south of Lake Erie, westward to the center of the State and then southward across the Ohio River and into Kentucky. Thicknesses range from 200 feet in the northern part of the State to about 40 feet in the south. It underlies nearly all of eastern Ohio and has long been one of its most important producers of oil and gas.

In Morgan County, the Berea ranges from approximately 1,100 feet below the surface in the west to 1,650 feet in the southeast. It is easily recognized by the driller because of the sharp contrast in hardness between it and the soft brownish-gray shales of the overlying Sunbury formation. This formation, called the "Coffee shale" by the driller, is from 30 to 50 feet thick. Beneath the First Berea are the red or gray shales of the Bedford formation.

Figure 7 illustrates a section across central Morgan County. The First Berea sand thickness varies from a maximum 90 feet in the eastern part of the county to as little as 8 feet in western York Township. In Section 22, Meigsville Township, the Clyde Foraker - Claude Murray No. 1 well logged 70 feet of Berea sand, but produced only a hole full of water and a small show of gas. Farther east, in Section 12 of the same township, the John Morrow - L. F. Murrey No. 1 well logged 45 feet of Berea sand. Microscopic examination of the cuttings (See Appendix I) from this well showed, however, that 45 feet of siltstone was penetrated below the sand which was logged by the driller as shale. The siltstone is also Berea so that the total sand thickness in this well should be 90 feet. The presence of siltstone in the lower portion of the sand and the prevalence of salt water as found in these two wells are characteristic of the First Berea east of the Muskingum River in this county.

The character of the First Berea sand in Morgan County is variable. The upper 2 feet, known as the cap rock, occurs throughout the county as a very fine-grained, gray, hard siltstone. Below this is found from 6 to 60 feet of fine- to medium-grained, light brown to gray sand which normally contains the "pay" zone. East of the Muskingum River a lower member is present consisting of as much as 50 feet of very fine-grained, light gray siltstone.

Oil and gas accumulations in the First Berea sand in Morgan County apparently are largely controlled by differences in porosity and permeability. A possible exception may be the York Township pool where production is found in bowl-shaped depressions up dip from a monocline or terrace-like structure (Plate II). Gas is usually found up dip from the oil. Initial production after shot for gas wells averaged 200,000 cubic feet and for oil wells 30 barrels per day after shot. The largest oil wells were found in the bowl-shaped depressions. The average life of the gas wells has proved to be from 15 to 20 years and for the oil wells 25 to 30 years.

Salt water is generally found in the First Berea sand in Bristol, Center, Manchester, Marion, Meigsville, Windsor, the eastern half of Penn, and southeastern portion of Homer Townships. Water has also been encroaching from the southwest upon the oil production in western Deerfield and northwestern Union Townships. The sand in the central and northern parts of the county is mostly free from salt water.

The prospects for future production from the First Berea sand in Morgan County appear to be limited to those townships lying outside of the water-bearing area. The most favorable area appears to be from central Union Township southward to north central Homer Township. Of the six wells drilled in this area, two reported shows of oil and gas.

THE SECOND BEREA SAND

The Second Berea is a lenticular sand deposit, approximately 70 miles long and six miles wide, which extends northeastward from Gallia County through Meigs, Athens, Morgan, and into central Muskingum County. DeWitt (7) has described this elongated sand body as an off-shore bar laid down in a sea which covered eastern Ohio and western Pennsylvania during Bedford time, (Lower Mississippian.) Although this period was devoted chiefly to the deposition of shale, some fine sand was carried in and subsequently sorted by currents along the shore and concentrated into a bar. Pepper (8) states that the shore was a delta which extended from Canada into south central Ohio and that the Second Berea sand bar was formed off the southeastern shore of this delta. Development of the bar was halted when the shore line or water level was altered. It is believed that most of the fine sediments and clays of late Bedford time which were deposited in the Morgan County area were trapped in the lagoon between the bar and the shore. Bedford time came to a close when the sediments reached the approximate level of the top of the sand bar.

The Bedford shale interval between the First and Second Berea sands in Morgan County varies from ten feet in the area of thickest Second Berea sand to an average of 45 feet west of the bar. The upper five to ten feet of shale, west of the crest of the bar, is red. Regarding this Pepper (8) says: "The sediments deposited above water in the main body of this delta retained their red color; those deposited under water were bleached to gray." Figure 7 illustrates the relationship between the First and Second Berea sands and particularly the apparent convergence of the sands at the crest of the Second Berea bar in central Morgan County.

The Second Berea sand is a much finer-grained sandstone than the First Berea. The grains are well sorted and, though porosity is good, permeability is low. Initial open flows, therefore, are usually low. Wells drilled during development of the field normally produced about 20,000 cubic feet of gas per day natural with rock pressure varying from 400 to 600 p. s. i. Production normally increased four to five times after shot. The average life of the wells has been 30 years.

The new hydraulic fracture method of well completion has been very successful in this "tight" sand formation. In the summer of 1953, one of the major gas companies in the State treated several of their older gas wells in Athens County by this process with such encouraging results that it was applied to several new wells. Results indicated that wells with shows of 5,000 cubic feet of gas per day natural could be increased to as much as 200,000 cubic feet of

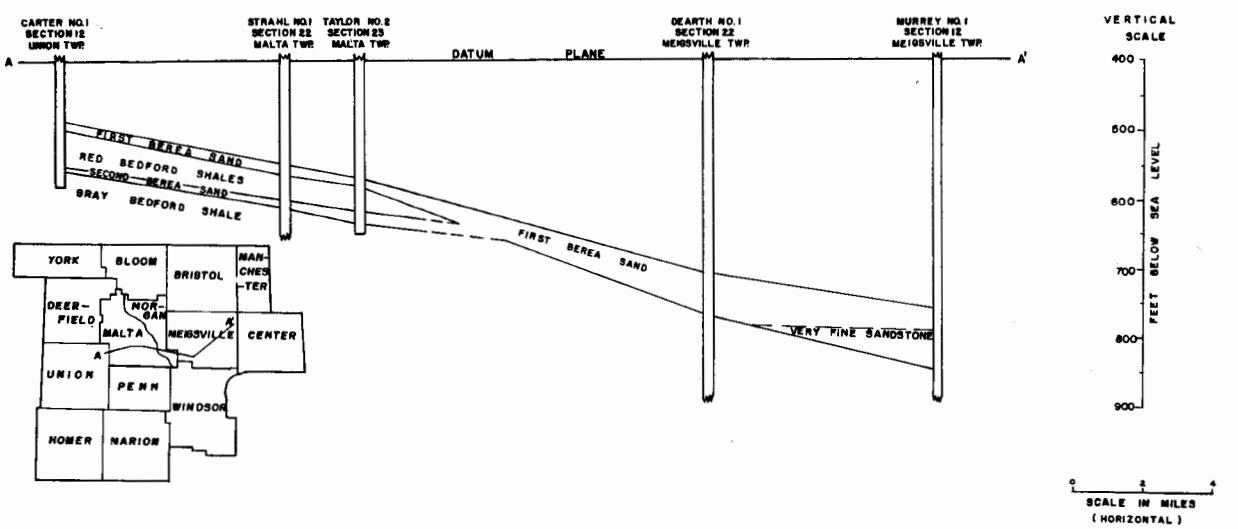


Fig. 7. Subsurface cross section showing apparent convergence of the First and Second Berea sands in central Morgan County.

gas per day after fracture. Leasing has been going on at a rapid rate over the entire length of the Second Berea trend and a number of successful new wells have been completed recently.

A large percentage of this lenticular sand body has been found to contain gas though only in small amounts where the sand is less than ten feet thick. In Morgan County, commercial quantities are nearly always encountered where the sand is 20 feet or more thick. On Plate III it will be noted that the principal producing zone is almost entirely within the 20 foot thickness line.

DeWitt (7) points out that water currents were more effective in sorting the sand from the clays and silts along the western or near-shore side than on the eastern side of the Second Berea bar. A number of facts tend to verify this opinion. One is that studies of the few available sand samples from wells drilled in the area indicate more favorable sand conditions for oil or gas accumulation exist west of the crest of the bar. Another is that the largest wells were found along the west flanks and that similar open flows tended to align in a northeast-southwest direction or parallel to the crest. The most favorable area for additional Second Berea production appears to be along the western margin of the bar where sand characteristics and thickness may be expected to be favorable. Recent drilling in Ames Township, Athens County, tends to confirm this idea. Other areas considered as prospective are western Bloom, northwestern Deerfield, northwestern Morgan, and the extreme northern portion of Malta Townships, where the sand averages 20 feet in thickness (Plate III). Most of the wells in these areas were drilled to test the Clinton or Medina sands but the majority recorded shows of 5,000 to 10,000 cubic feet of gas per day in the Second Berea. These shows were not considered sufficient under the shot method for increasing production. The new hydraulic fracture method of completion may increase these small shows to commercial producers in areas where the rock pressures are favorable.

THE "BIG LIME"

The term "Big Lime," as it is used by the driller in eastern Ohio, includes approximately 1,000 feet of strata. Geologically it includes all formations from the base of the Ohio Shale (Devonian) down to the top of the Clinton group (lower Silurian). To the geologist this sequence of rocks contains many unanswered questions as to correlation, formation names, and age boundaries. In Morgan County it is approximately 975 feet thick along the western edge and 1,200 feet at the eastern border—a thickening of 8 feet per mile eastward. Figure 8 shows structure contours on top of the "Big Lime." No prominent features are indicated and the dip to the southeast is approximately 50 feet per mile. A general description of these rocks in Morgan County may be obtained in the following analysis by G. G. Shearrow (see Appendix I) of the Murrey well, Section 12, Meigsville Township:

100	feet, hard, brown to buff limestone and chert.
25	feet, fine-grained, white to buff sandstone, Oriskany.
100	feet, hard, gray to buff limestone and chert.
700	feet, hard, buff to brown dolomite, chert and anhydrite.
-	feet, Newburg horizon.
200	feet, hard, gray to brown limestone, shale, traces of gypsum.
1,125	feet

The Oriskany horizon contained a small quantity of gas in the Murrey well, but in this area it is usually dry or contains small quantities of salt water, known to the driller as the "First" or "Little" water. The extent and productivity of the Oriskany in Ohio are presented in "Oriskany Sand Study" by John Hall in Report of Investigations No. 13, Ohio Geological Survey, 1952.

Although the Newburg horizon is not distinguishable in the Murrey well, it normally occurs about 200 feet above the base of the "Big Lime." It is believed to be the zone of the "Second" or "Big" water of the driller and is generally a prolific producer of salt water in southeastern Ohio.

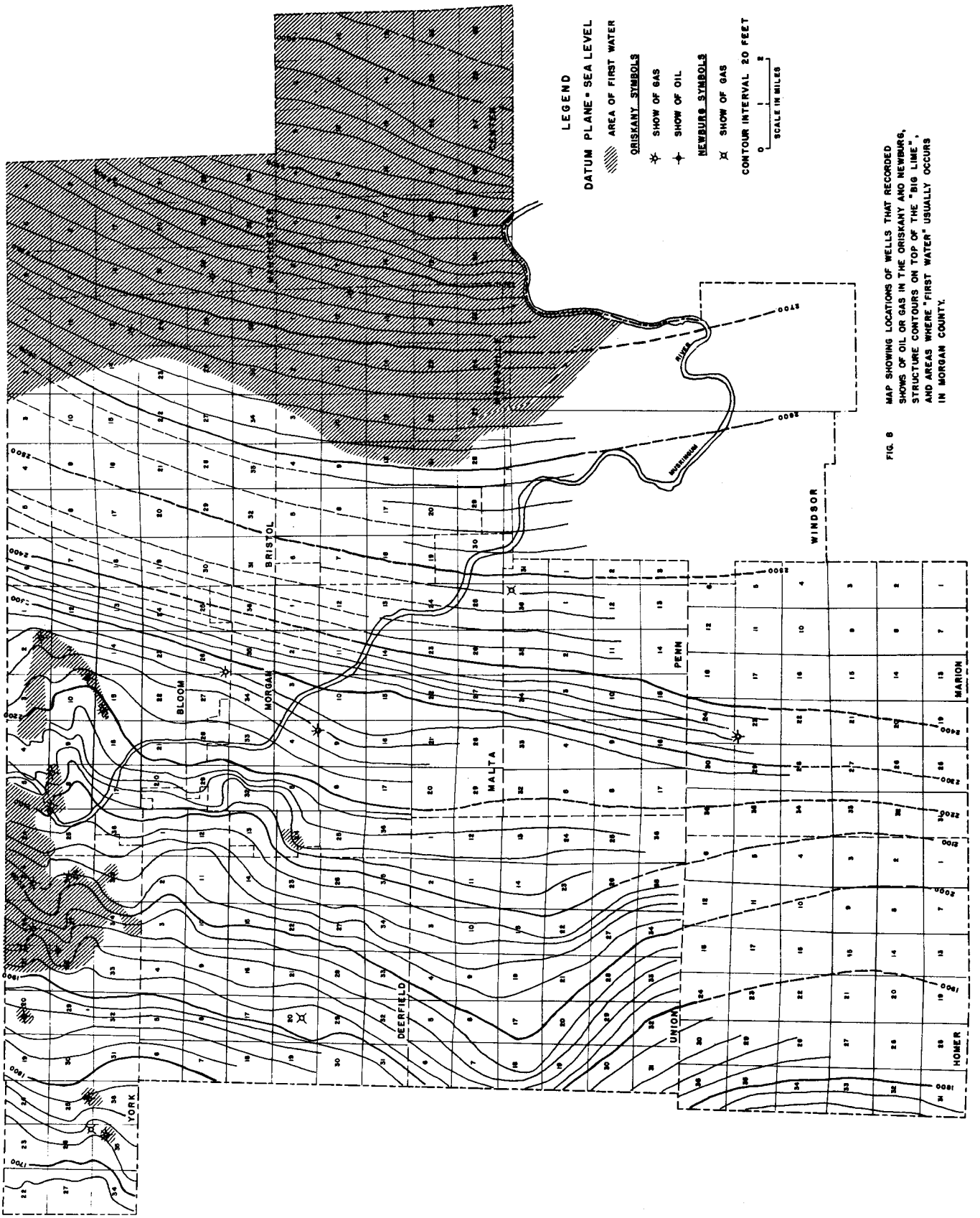


FIG. 8 MAP SHOWING LOCATIONS OF WELLS THAT RECORDED SHOWS OF OIL OR GAS IN THE ORISKANY AND NEWBURG, STRUCTURE CONTOURS ON TOP OF THE "BIG LIME", AND AREAS WHERE "FIRST WATER" USUALLY OCCURS IN MORGAN COUNTY.

Oil and gas production from the Oriskany or Newburg is believed due to accumulations in localized "highs" or in favorable porosity-permeability controlled stratigraphic traps usually above or adjacent to salt water. These productive areas are comparatively small and are mostly found by wells drilling to the Clinton sand. The largest production recorded from either of these horizons in Morgan County was in 1944 by the Palm Oil Corporation - Thomas Lyons Well No. 1 in Section 15, Bloom Township. It reported 750,000 cubic feet of gas natural from the Oriskany and blew open four days before a successful shut off could be made so drilling could proceed to the Clinton. On the basis of existing information, the outlook for future production from the Oriskany or Newburg horizons in Morgan County is not favorable.

THE CLINTON SAND

The Clinton sand is found under most of eastern Ohio. It does not crop out in the State, so is known only by cuttings brought to the surface during the drilling of oil and gas test wells. It has been found at depths ranging from 8,000 feet in eastern Washington County to 2,000 feet in central Ohio, where it gradually changes to shale. The sand "pinch out" line has been defined by numerous dry holes along the western edge of the great Clinton sand gas belt, which extends from Cleveland to within a few miles of Ironton on the Ohio River. The discovery of this extensive gas-producing area occurred in 1887 near Lancaster, Fairfield County, in a well which proposed to test the Trenton limestone. Many of the earlier wells had open flows in excess of 8,000,000 cubic feet per day. Today, the field is largely depleted and Clinton sand drilling has moved eastward.

The exact correlation of this sand is difficult but on the basis of well sample studies and drillers' logs, it is generally considered to belong to the Medina group of rocks which mark the base of the Silurian system. The name Clinton sand as applied here should not be confused with the geologic term Clinton given to a group of formations in the lower Niagaran series of the Silurian. Orton (9) named this sand in 1887 as he believed it was a member of the Clinton group of Niagaran limestones which outcrop in New York state. It has since been established that the rock is probably older than the Clinton group. However, the use of the term has become widespread and any attempt to change it would probably result in confusion.

In Morgan County, the Clinton sand occurs from 160 to 200 feet below the base of the "Big Lime." (See Fig. 9.) The intervening section contains approximately 40 feet of shales and the Brassfield limestone or "Packer Shell." Beneath the sand are 50 to 70 feet of blue gray shale and the Medina sand. In the absence of the latter these shales are in direct contact with the underlying Ordovician rocks.

The Clinton is quite changeable in character, but usually is a "tight" fine-grained sandstone of variable hardness both laterally and vertically. Porosity and permeability can vary appreciably within short distances, and shale breaks are common. Although the sand is known to be absent in some areas, all wells drilled to date in Morgan County have found it present. It is usually about 3,500 feet below the surface in western York Township and more than 5,000 feet in Manchester Township, and dips approximately 60 feet per mile to the southeast.

The exact conditions under which the Clinton sand was laid down have not been determined. The erratic porosity and permeability, the inconsistent shale breaks, and varying positions of the pay within the sand present a very confusing picture. Many ideas and theories of deposition have been expressed only to be proved false as new wells were drilled. J. F. Swain, (10) has presented a logical reconstruction of Clinton sedimentation, although certain portions of this work were subsequently found erroneous. He believed the sand to have been deposited in an early Silurian sea which was advancing westward. Along the shoreline, between high and low tide, wave action washed the sand free of all foreign material, leaving a clean pure deposit. As the sea moved westward it covered this clean sand with less pure sand. Another such deposit was then made along a new shoreline and so on, thus forming a series of clean sand lenses surrounded by less pure sand or shale. These lenses are now the potential "pay" zones. Irregularity

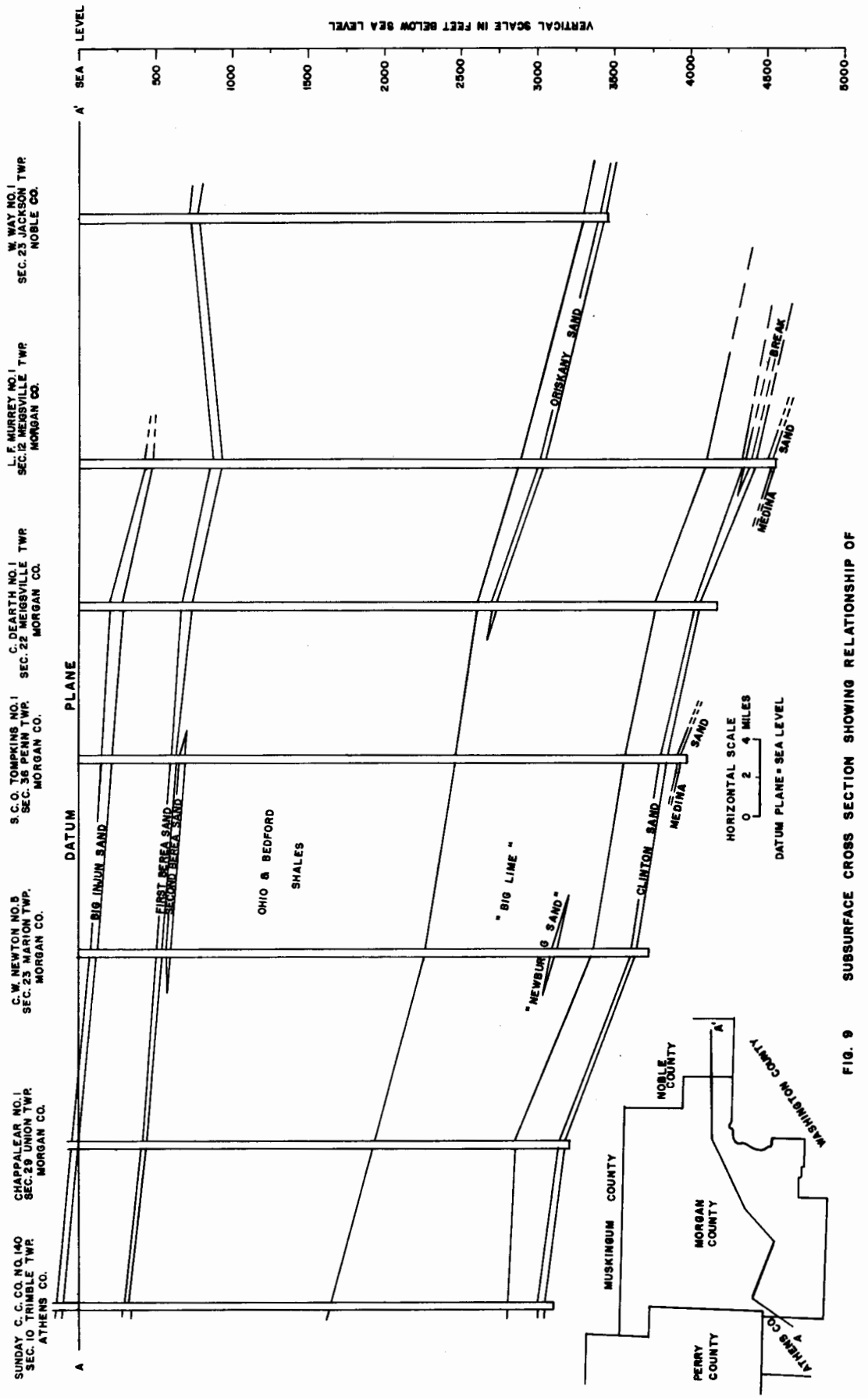


FIG. 9 SUBSURFACE CROSS SECTION SHOWING RELATIONSHIP OF THE MAJOR PRODUCING HORIZONS IN MORGAN COUNTY.

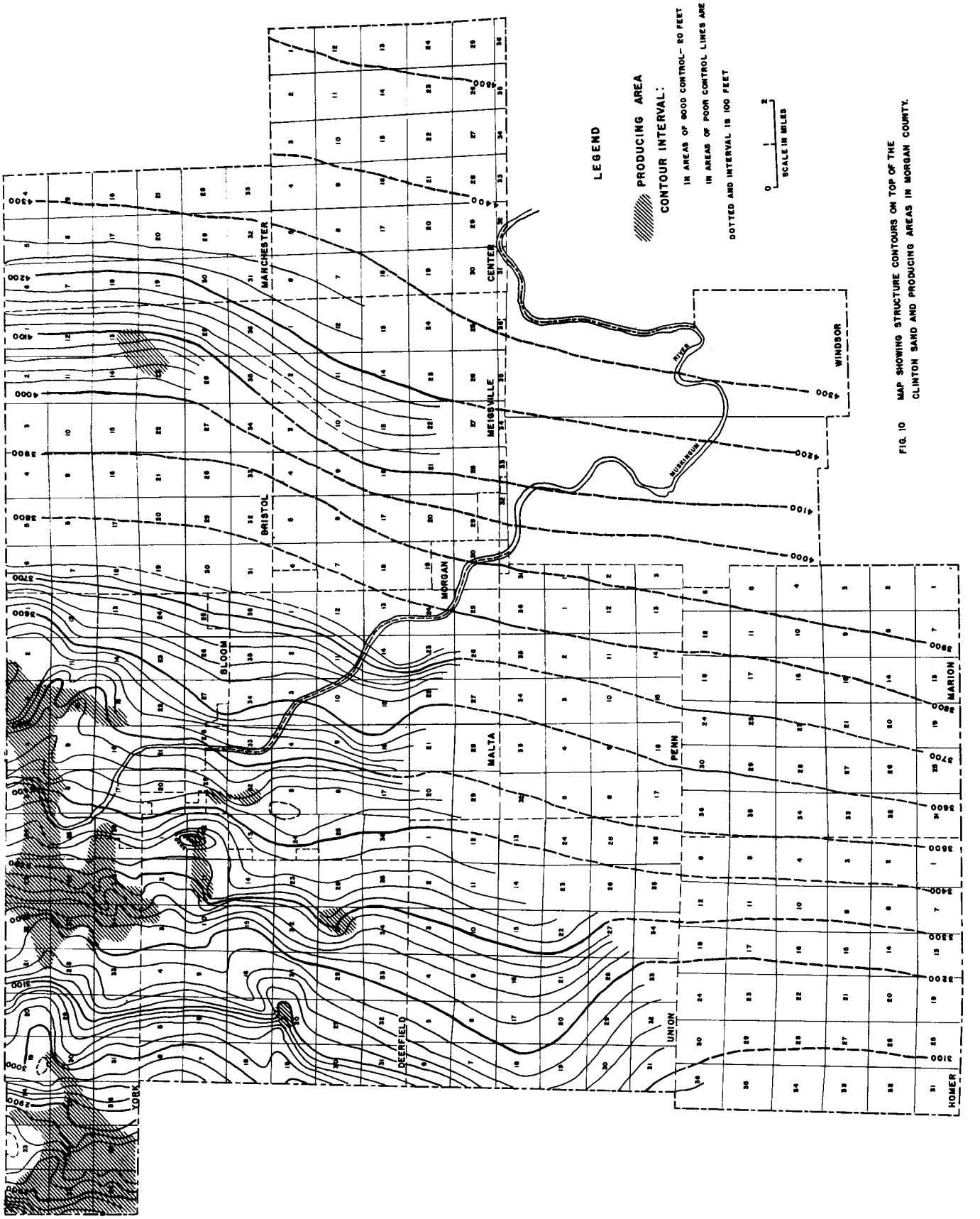


FIG. 10 MAP SHOWING STRUCTURE CONTOURS ON TOP OF THE CLINTON SAND AND PRODUCING AREAS IN MORGAN COUNTY.

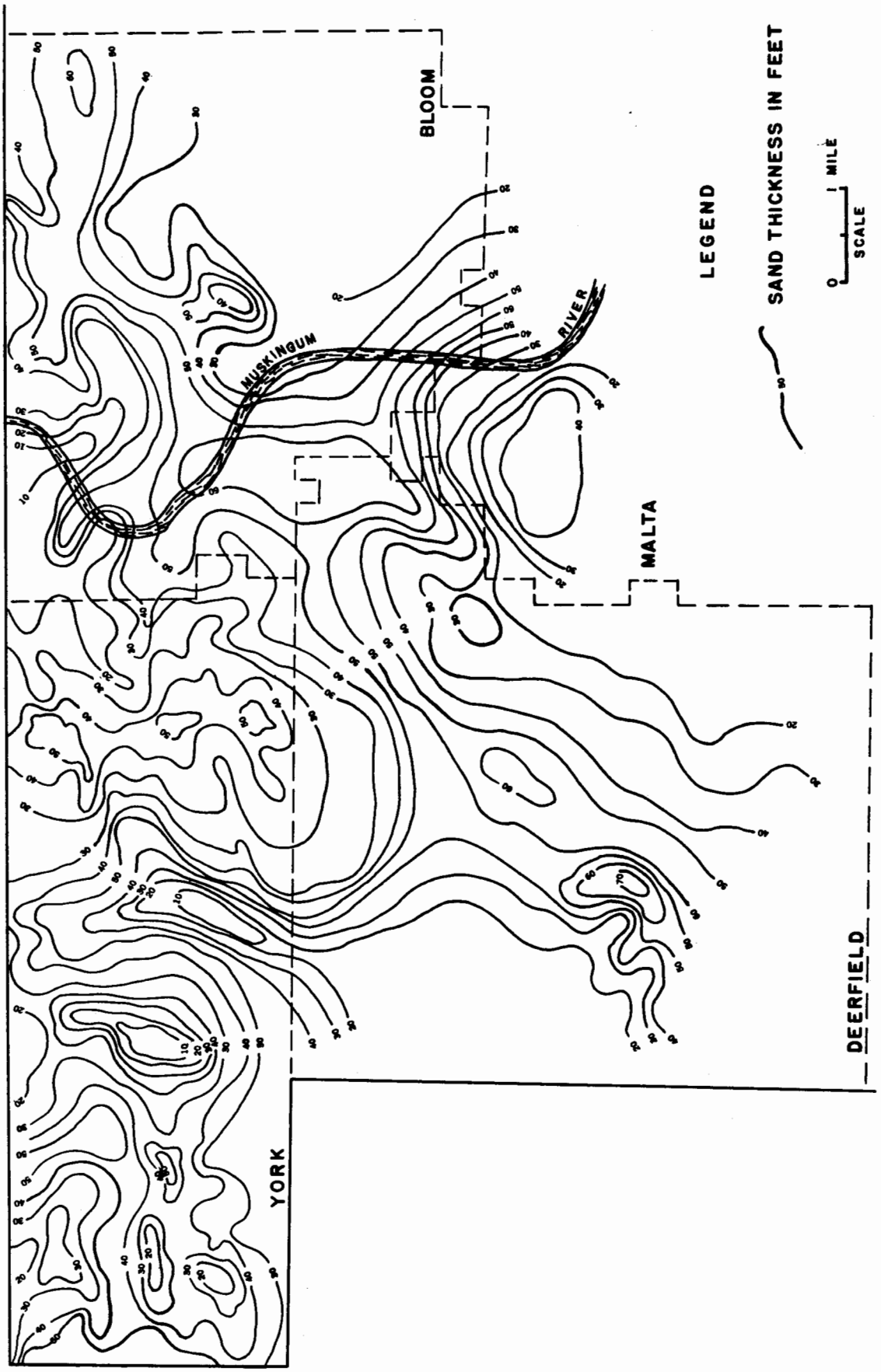


FIG. 11 THICKNESS OF THE CLINTON SAND IN PRODUCING AREAS

of the shorelines caused similar erratic outlines in the sand lenses and to the present location of production. As a result of these conditions, locating new pools in the Clinton sand is extremely hazardous.

Production from the Clinton sand in Morgan County is limited to the northwestern portion (see Plate IV). Two reasons for this are: (1) drilling in this area extended from the Crooksville pool, immediately to the west in Perry County; (2) the sand lies less than 4,500 feet and depths in excess of this figure tend to be too expensive for the local operators. Figures 10 and 11 show that there is little relationship between structure, sand thickness, and the location of production. The Clinton sand has been tested by 248 wells in Morgan County, 16 of which produced oil, 108 produced gas, 106 were dry, and 18 found production in the underlying Medina sand. Oil has been discovered in Sections 2 and 3 of Bloom Township, where five wells averaged 25 barrels per day after shot, in Sections 22 W, 35 W, and 36 W of York Township, where ten wells averaged 40 barrels per day, and in Section 20 of Deerfield Township, where one well produced 117 barrels the first 24 hours after shot. Gas production is more widely distributed. The principal gas pool extends in an east-west direction across York and Bloom Townships. Wells in this area came in as high as 12,000,000 cubic feet per day natural and the average for the pool is 500,000 cubic feet of gas per day per well. The Clinton is found at depths ranging from 3,700 to 4,500 feet and the original reservoir pressure was approximately 1,150 p. s. i. Most of the drilling took place between 1942 and 1950.

Prospective areas for future drilling are difficult to select because much of the county remains to be tested for Clinton sand production. The sand has been found present and free of water in the few scattered test wells which have been drilled. One promising area, on the basis of existing information, appears to be in eastern Bristol Township where two wells a mile apart found production. These wells, drilled by the Wittmer Oil and Gas Company in 1948, are the W. D. Wortman No. 1 in Section 24 and the Ivan E. Morris No. 1 in Section 13. The Wortman well found the Clinton at 4,840 feet and produced 1,047,000 cubic feet of gas natural with a pressure of 1,140 p. s. i. The Morris well found the Clinton at 4,855 feet and made 452,000 cubic feet natural with a rock pressure of 1,250 p. s. i. During the summer of 1954 the Wiser Oil Company, present owner of these wells, plugged the Morris No. 1 because of declining production and low rock pressure.

There have been no Clinton tests drilled in Morgan County since the advent of hydraulic fracturing. In the summer of 1953 an attempt was made to fracture an old oil well in Section 35W of York Township. This well, the Foraker Drilling Company - Harry Gibbs No. 1, was down to stripper production when the fracture treatment was given. A faulty casing seat prevented satisfactory results so production was not increased. In the future it is probable that additional production from the Clinton may result from the use of this method in completing new wells.

THE MEDINA SAND

The Medina sand, as referred to here, is a sandstone formation lying 90 to 100 feet below the top of the Clinton sand in Morgan County. Where present, it forms the bottom of the Medina group and the base of the Silurian system. Beneath it is a red shale, known to the driller as the "Red Medina," which is the Queenston shale of the Richmond group in the Upper Ordovician system. Due to the lack of sufficient conclusive evidence, no attempt is made here to definitely correlate the Medina sand. It is placed at the bottom of the Silurian system in this report because such evidence as is available indicates this to be a logical conclusion. The lithology of this sequence of rocks, as well as the intervals between the various members, seem to correlate reasonably well with the type locality of the Medina formations in western New York State. So, until sufficient work can be done to prove or disprove these apparent correlations, continued use of the New York terms in Ohio are advisable and convenient.

The probable area in which the Medina sand may be found is outlined in Figure 12. It is not entirely defined because many of the wells were not drilled deep enough to reach the sand.

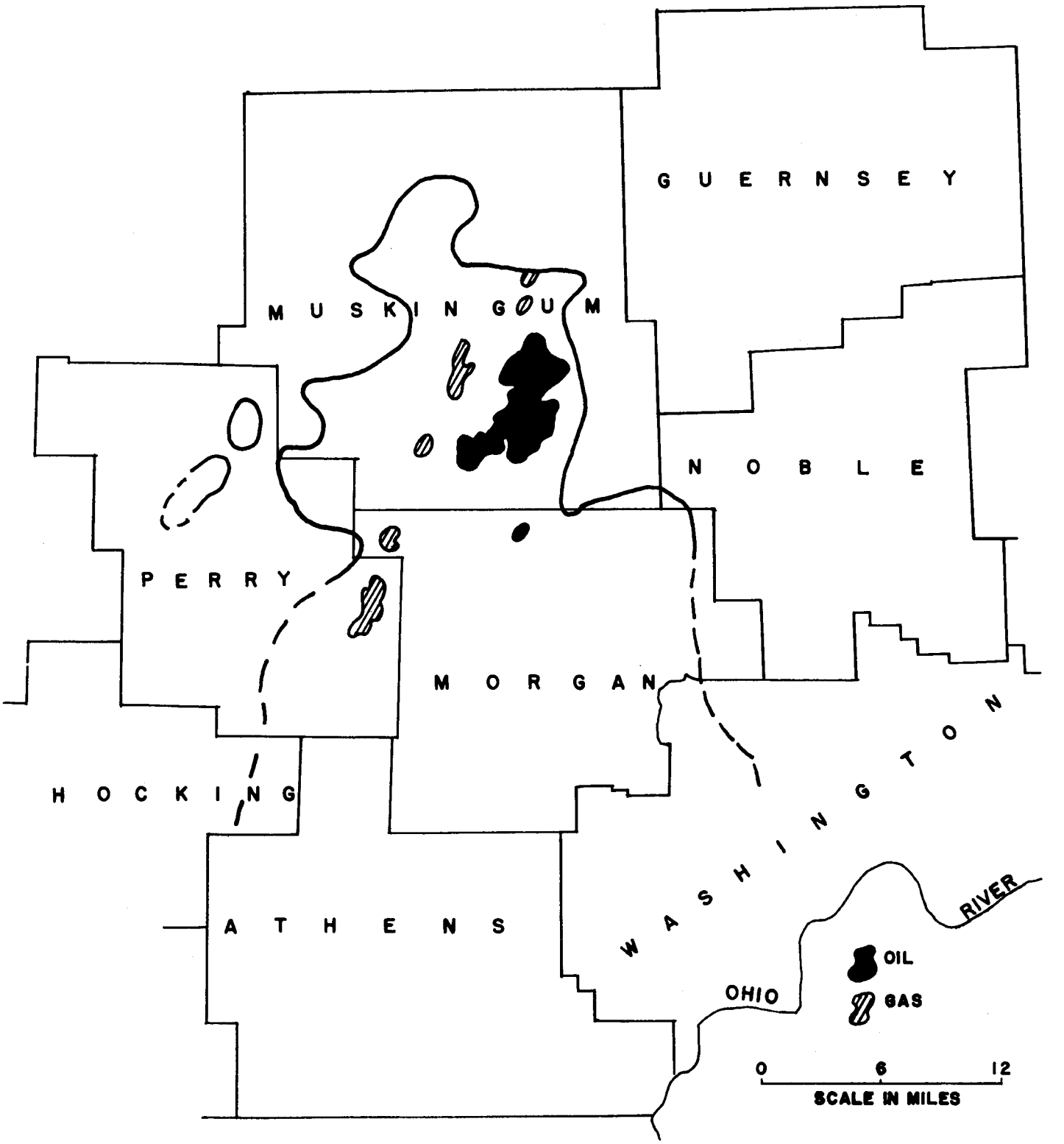


FIG. 12 OUTLINE OF MEDINA SAND AND PRODUCING AREAS IN MORGAN AND ADJOINING COUNTIES. SOUTHERN LIMITS UNDETERMINED BECAUSE OF INSUFFICIENT NUMBER OF TEST WELLS.

Development of production in the Medina sand areas has been slow due to its depth and the presence of oil or gas in the overlying Clinton. Drilling usually stopped when the latter sand was found to be productive. Furthermore, few Medina wells have been large producers, so the "pay-outs" are long.

The Medina sand is found under most of Morgan County, but to date production has been limited to southwestern York Township (See Fig. 13). The first Medina sand test well in the county was drilled by The Ohio Fuel Gas Company in 1930, in Section 24, York Township, on the R. S. Cosgrove farm. A small show of gas was found, but it was considered insufficient and the well was plugged back to produce an oil show in the Clinton. During the next ten years many dry Clinton test wells were deepened to the Medina, but the only rewarding areas were found in Sections 25 and 26W of York Township and Section 9 of Bloom Township. Eleven gas wells in York Township had an average initial open flow of 440,000 cubic feet of gas per day after shot and an average rock pressure of 1,150 p. s. i. The sand averages six feet thick and 3,975 feet deep. In Section 9 of Bloom Township the National Gas & Oil Corporation - Stewart & Huffman No. 1 well, drilled in 1944, found the Clinton dry and was extended to test the Medina. The top of the sand was struck at 4,470 feet and the "pay" penetrated from 4,476 to 4,479 feet. After shot, this well made 33 barrels the first 24 hours and is still producing.

The Medina sand, as found in wells in Morgan County, varies from brown to gray in color and is very fine-grained. In some wells the driller records two members of the sand, as in the Stewart & Huffman well. The top six feet is red and the bottom three feet is white. An examination of the samples from the National Gas & Oil Corporation - Maynard Barnes No. 1 well shows the sand to be very fine-grained and light gray in color from 4,394 to 4,401 feet in depth (see Appendix I). It gradually changes to a gray siltstone from 4,401 to 4,411 feet where the red shales of the Ordovician were penetrated.

The conditions under which the Medina sand were deposited are not known. Swain (11) states that the source sediments were the underlying Queenston from the eastern limb of the Cincinnati arch which was raised above drainage at the close of Ordovician time. Subsequent erosion then carried away large amounts of Queenston shales and silts and deposited them in a sea that extended eastward into central New York and southern Ontario. Swain further believed that the Medina sand is a phase of this deposition in which sand was sorted from the finer material and deposited in southeastern Ohio. Whether or not this hypothesis is correct is beyond the scope of this report.

Future Medina production in Morgan County depends, as it has in the past, on Clinton drilling. The rewards from the Medina sand to date have not been great enough to warrant wildcat drilling. However, all unsuccessful Clinton tests in outlying areas in southeastern Ohio should be extended to test the Medina horizon. Very few Medina sand wells have been subjected to hydraulic fracturing in Ohio therefore the probable results of such a treatment are not known. This new method for increasing production, which has been so successful in the Clinton sand, may prove a stimulus to further Medina sand drilling.

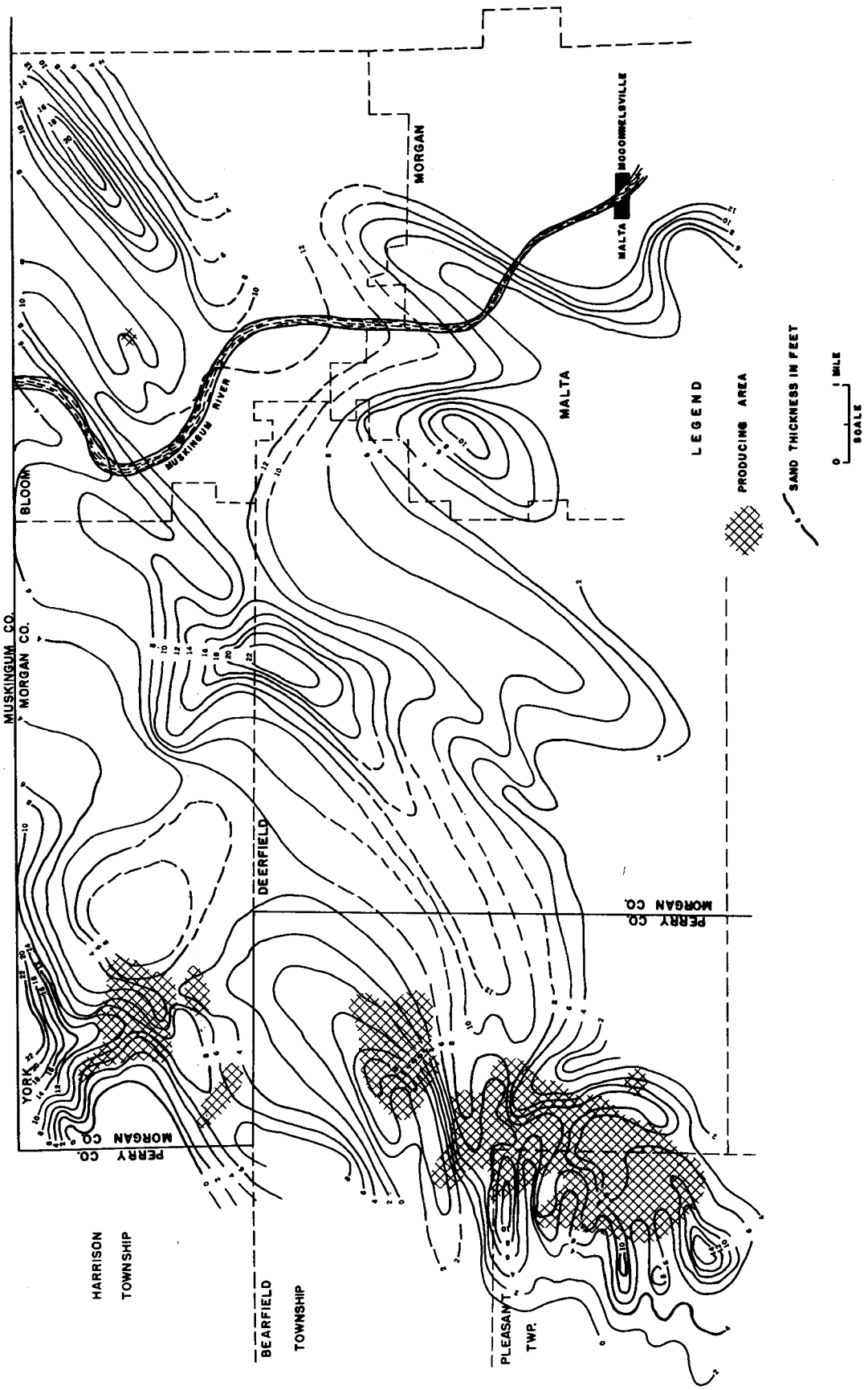


FIG. 13 THICKNESS AND PRODUCING AREAS OF MEDINA SAND IN NORTHWESTERN MORGAN AND EASTERN PERRY COUNTIES.

CHAPTER 3

DEVELOPMENT BY TOWNSHIPS

The first commercial oil wells drilled in Ohio were located on the banks of Duck Creek and Cow Run in neighboring Washington County (Minshall, 5). These wells were drilled in the late summer of 1860 by the use of a treadle and spring-pole. The work was hard but the rewards were great, as a barrel of oil delivered to a refinery in St. Louis brought approximately twenty dollars. The excitement caused by these discoveries spread over all of southeastern Ohio.

By the fall of 1860 a number of companies had organized in McConnelsville for the purpose of leasing land and drilling for oil. Several holes were started immediately, with the result that oil was found near the town by November. The production was small but it stimulated the drilling of approximately a dozen wells in other parts of the county. This activity resulted in the discovery of two of the most important pools in the region at that time. They were the Federal Creek oil field in southeast Homer Township and Buck Run oil field in northeast Union Township. The latter was soon extended to include another rich pool a mile to the east on Wolf Creek.

During the Civil War the drilling of new wells was suspended. However, in Morgan County previously developed pools continued to produce so much oil that it became necessary to build a refinery at McConnelsville. On August 29, 1861, the village newspaper, The Weekly Enquirer, announced the opening of the McConnelsville Carbon Oil Company's new plant. The refined oil was sold principally for lubricating purposes and brought 50 cents per single gallon or 40 cents per gallon by the barrel. This refinery remained in operation until 1873 when a decline in the oil market forced it into bankruptcy.

After three years of inactivity due to the war, prospecting for new pools began again. New strikes on Buck Run and at Joy created much excitement and on November 25, 1864, the Morgan County Herald of McConnelsville ran the following article: "The oil fever has just broken out and now it has become epidemic and is raging to a fearful extent. This county abounds in oil springs and in 1860 and 1861 many wells were put down with springpoles to depths of 18 to 40 feet. The war and low price of oil stopped nearly all operations." The boom lasted for five to six years until declining oil prices caused drilling to stop once again. No important oil discoveries were made in Morgan County in the period between 1870 and 1900. However, during this time a gas pool, which later became part of the Second Berea gas field, was developed in the immediate vicinity of Malta and McConnelsville. In 1900, oil excitement was renewed as the result of several big wells drilled in southern Windsor Township. This new activity lasted for several years, during which nearly all the older pools were redrilled with a "second crop" of wells. By 1910, when the industry was nearly at a standstill in Morgan County, a new method of obtaining oil from the reservoir was attempted. The late Orton Dunn of Marietta perfected a means of introducing compressed air into the producing formation and forcing the oil out. As air compressors were put to work another flurry of drilling hit the old pools. By 1920 most of the better pools in Morgan County were being "aired" and attention was turned to drilling a strip about three miles wide and 25 miles long extending northeast-southwest through Marion, Penn, Malta, and Morgan Townships. This was the Second Berea gas field which was developed in the years 1920 to 1930. An important First Berea sand oil pool was discovered in York Township in 1922 and was developed principally by The Pure Oil Company and the Sun Oil Company. In 1934 the Clinton and Medina sand development in Bearfield and Pleasant Townships, Perry County, moved northeastward into Morgan County. The limits of this pool were defined by 1948 and since that time there has been little activity. Recent favorable results from several hydraulic fracture treatments of edge wells in the southern part of the county have caused operators to take a new look at the Second Berea gas field.

BLOOM TOWNSHIP

The search for oil in Bloom Township began in 1865 when rich strikes on Federal Creek in Homer Township and Buck Run in Union Township stimulated drilling in all parts of Morgan County. In October of that year a 15-barrel well was struck on the Jewett farm in the northeast quarter of Section 8, Bloom Township. The well was 163 feet deep and produced from the Cow Run sand. Approximately ten wells were drilled in Section 8 and nine wells in Section 14. Other than their location, no information about these wells has been found. The only other known shallow production in the township was discovered in a proposed Clinton test well drilled in 1943 on the Richardson farm in Section 10. The well was stopped when a good show of gas was encountered in the Big Injun sand at 759 feet. It was shot and gauged 500,000 cubic feet of gas per day. The production dropped rapidly, however, and the well was plugged after three months.

There has been no commercial production in the First or Second Berea sands in Bloom Township. In the north and west portion, a number of Clinton and Medina sand test wells found shows of gas in the Second Berea. Water has been found in the First Berea in the eastern part of the township but its extent is not known because of the lack of test wells. The author believes the central and eastern areas of Bloom Township are good prospective Second Berea drilling territories because of the 15 to 20 feet of sand present. The Second Berea gas field (Plate III) indicates this thickness of sand is favorable for gas accumulation.

The first deep test in Bloom Township was drilled in 1927 by the Logan Gas Company. This well, the Wilkie Huffman No. 1, located in the southwest quarter of Section 26, was the first attempt since 1908 to find Clinton sand production in Morgan County. The sand occurred from 4,595 to 4,621 feet but was dry. This discouraged further deep drilling in the township until 1941 when the Ohio Fuel Gas Company drilled on the C. E. Mercer farm in the southwest quarter of Section 24 in an attempt to extend the Clinton gas pool in eastern York Township. A show of gas was found in the sand, 4,139 to 4,169 feet, but it soon blew out. Drilling was continued to the Medina sand which was penetrated from 4,231 to 4,239 feet, but contained only salt water. The hole was plugged back to the Clinton and shot. It yielded 200,000 cubic feet of gas per day and produced for five years.

The portion of the pool in Bloom Township now comprises 19 gas wells, 4 oil wells, and 22 dry holes. The top of the Clinton sand varied from 4,300 to 4,500 feet in depth, initial production averaged 500,000 cubic feet of gas per day after shot, and the original reservoir pressure was approximately 1,150 p. s. i. Reservoir sand conditions appear to be extremely variable as some wells had natural open flows as high as 12,000,000 cubic feet of gas per day but "blew down" very rapidly. Others made 200,000 cubic feet of gas per day and lasted for several years. Only eight of the original 23 successful wells drilled since 1941 are still producing. Dry holes have defined the boundaries except to the northeast where four oil wells were found in Sections 2 and 3. Offsets to these wells have not been drilled because of the 4,500 feet depth and the expected average initial production of 20 barrels of oil per day after shot is not encouraging. Favorable territory surrounding this small oil pool is believed to be the north half of Sections 1 and 2 in Bloom Township and the adjoining portion of Sections 35 and 36 in Blue Rock Township, Muskingum County. The new hydraulic fracture method of well completion may increase the potential of new offset wells and thus make them profitable.

Nearly all of the unsuccessful Clinton tests in Bloom Township were deepened to the Medina sand. The only well that found production was the Industrial Gas Corporation - Stewart and Huffman No. 1 in Section 9. This well, completed in 1944, penetrated the Medina from 4,470 to 4,490 feet, and produced 33 barrels of oil per day after shot. It is still producing.

BRISTOL TOWNSHIP

There has been little drilling in Bristol except in Section 31, in the southwest corner of the township. Two Clinton, two Medina, 18 Berea, and five shallow sand wells are known to have

been drilled in the township, the earliest being an unsuccessful Cow Run test in 1866. The locations are all that is known of the five shallow wells.

The southwest corner of the township marks the northern boundary of the Second Berea gas field. Development of this portion of the field took place between 1895 and 1910. The pay was found from 1,500 to 1,600 feet and production averaged 80,000 cubic feet of gas per day after shot.

Four deep wells have been drilled in the township. Three tested the Medina sand and found it dry and two discovered gas in the Clinton. The latter are discussed in Chapter 2 under the heading, "The Clinton Sand." Though the "pay" sand is in excess of 4,800 feet deep it appears possible that profitable wells can be drilled in this area.

CENTER TOWNSHIP

Much of Center Township remains to be tested for oil and gas. There have been 34 Berea tests, two Oriskany, and no Clinton or Medina sand tests drilled in the township. Several scattered shallow wells have been drilled but no information was found concerning them. The lack of deep wells in the township is probably due to the depth of the Clinton which lies in excess of 4,500 feet below sea level. The Oriskany tests, drilled in Sections 9 and 30, found sand at 3,707 feet and at 3,728 feet respectively but also a hole full of water.

There has been some First Berea development in the southeast part of Center Township. This area was first tested by the Carter Oil Company shortly after 1900. Two wells in Section 23 and 24 made over 1,000,000 cubic feet of gas after shot but were troubled by water and soon had to be plugged. Since that time many attempts have been made in the area to find production free of water but only five wells, located in Sections 23 and 24, produce enough oil to be profitable. These wells, drilled 10 to 15 years ago, each makes less than a barrel of oil per day and is pumping many times more water than oil. The oil is Pennsylvania grade and comes from the First Berea sand at approximately 1,600 feet in depth.

DEERFIELD TOWNSHIP

Very little oil and gas production in the shallow sands has been discovered in Deerfield Township. A few small, widely scattered, gas wells have been found in sands lying less than 400 feet in depth. Several attempts have been made to find Cow Run oil but either the sand was missing or production was so small that the wells were not economical.

Southwestern Deerfield Township lies within the limits of the Corning Berea sand oil pool of Monroe Township, Perry County, which was discovered at Corning in 1890 (Bownocker, 12). Drilling moved into Morgan County by 1893 but the productive area was limited to Sections 30 and 31 in Deerfield Township. Most of the wells were drilled and operated by the firm of Ralston and Maynard of Corning. The sand is approximately 1,500 feet below the surface, averages 25 feet in thickness, and has a pay zone of eight feet. An estimated 125 wells were drilled in Sections 30 and 31, but little is known of their productive history and the majority are now abandoned. At present the remaining operating leases are owned by Leon Keller of New Lexington. He states that they pump the wells a few hours a day using a central power plant and that six to eight times as much salt water as oil is being produced. The salt water appears to be advancing from the southwest and is believed due to either faulty casing or improperly plugged wells within the main body of the Corning pool.

Approximately two miles northeast of the Corning pool in Deerfield Township a First Berea gas pool, composed of 16 gas wells and five dry holes, was found soon after 1920. The sand was found at 1,200 to 1,400 feet below the surface and the wells produced as much as 1,000,000 cubic feet of gas per day after shot with an original reservoir pressure of 500 p. s. i.

Development of the pool has been slow as wells were being completed as recent as 1948.

Future Berea sand drilling in Deerfield Township seems to hold the most promise in the unexplored areas of Sections 4 and 5 to the north of the gas pool. It is possible that this pool may connect with the oil production to the north in York Township.

Clinton sand production in Deerfield has been spotty. The only pool of note to date is located in Sections 11 and 12 where six gas wells and six dry holes have been drilled. The discovery well was the Industrial Gas Corporation - Florence Martin No. 1 completed in 1945 in the northwest quarter of Section 11. It found the Clinton sand from 4,314 to 4,338 feet below the surface and produced over 300,000 cubic feet of gas per day after shot, with rock pressure of 900 p. s. i. This well proved to be located on the western edge of the pool as an offset to the west was dry. The producing wells lie in an irregular east-west line across Sections 11 and 12 and attempts to find production by offset wells to the north and south have failed. The largest well was the Ackerman Development Company - J. C. Benanti No. 1 in the southwest quarter of Section 12. It was drilled in 1948 and had an initial production of 4,000,000 cubic feet of gas per day natural. The Clinton was penetrated from 4,134 to 4,160 feet and the reservoir pressure was 960 p. s. i.

The National Gas and Oil Corporation - Herbert Bankes No. 2 in Section 20 is the only Clinton sand oil well in Deerfield Township. It was drilled in 1947 and produced 117 barrels of oil the first day after shot. Unsuccessful offsets have been drilled on three sides but the west side still remains untested.

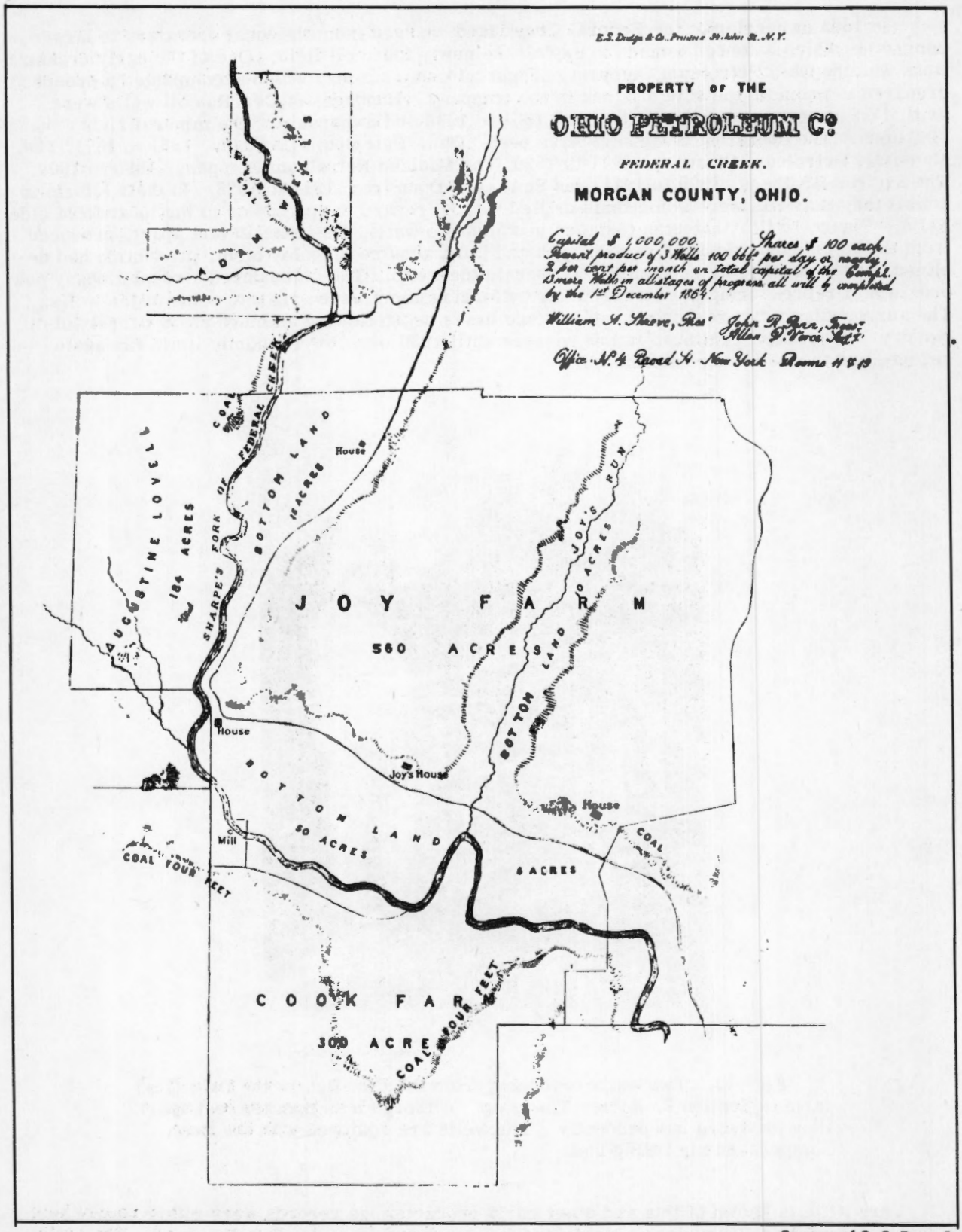
In the southwest quarter of Section 12 the National Gas and Oil Corporation completed a Clinton test on the Maynard Barnes farm in 1947. When the Clinton was found to have only a show of gas, drilling was continued an additional 2,300 feet to the "St. Peter" horizon. The total depth of the well was 6,644 and all formations below the Clinton were dry. A microscopic analysis of the samples from this well is presented in the Appendix.

HOMER TOWNSHIP

The first big oil strike in Morgan County occurred on the banks of Federal Creek in southeastern Homer Township. The discovery well was completed June 4, 1861, in the Cow Run sand on the farm of James Joy in Section 2. In the March 10, 1865, issue of the Morgan County Herald, which was published at McConnelsville, the following interesting article appears:

> "Federal Creek Oil Region - Although the existence of oil has been known here for forty years or more it was not until 1861 that any attention was paid to its development. In June, 1861, Messrs. Alderman, Ellis & Co. after drilling to a depth of 71 feet struck a vein of oil which astonished the gratified borers and created an excitement in the neighborhood never before or since equaled. The oil rushed from the well——expanding in volume as it rose to a height of nearly 60 feet——presenting in the sunlight a grander exhibition than was ever produced by any or all the Panoramas of the artist. It continued to flow in this way during 2 or 3 days saturating the ground with the oil which for want of tanks could not all be saved. However, soon as barrels could be procured 103 of them were filled with the oil which had been so lavishly poured out upon the earth about the well. About 1,000 barrels were pumped from this well when it was abandoned on account of the low price of oil..... Land to the amount of 860 acres on this creek, formerly owned by Mr. Joy and for which he would have taken $35.00 per acre before oil development, together with a few leases, has since the oil excitement began sold for the sum of $1,000,000 and land in the immediate vicinity is still selling at marvelous prices."

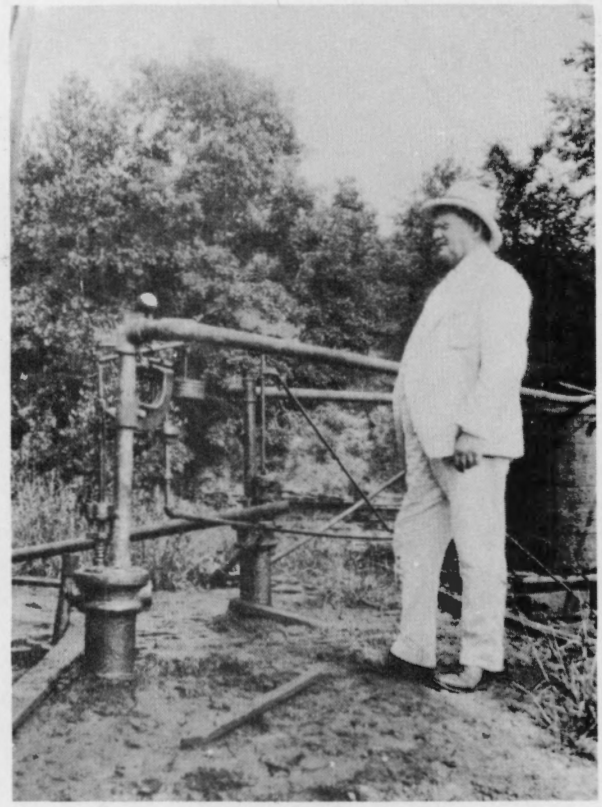
Following the Civil War oil continued to be found in Sections 1 and 2. Development then moved north into Section 3, east to Chesterhill, and to the south into Athens County (Bownocker, 12).



Courtesy of O. C. Dunn, Jr.

Fig. 14. Map of property in Section 2, Homer Township, issued in 1864 to prospective shareholders in the Ohio Petroleum Company. Oil was produced on this farm from the Cow Run sand until 1938.

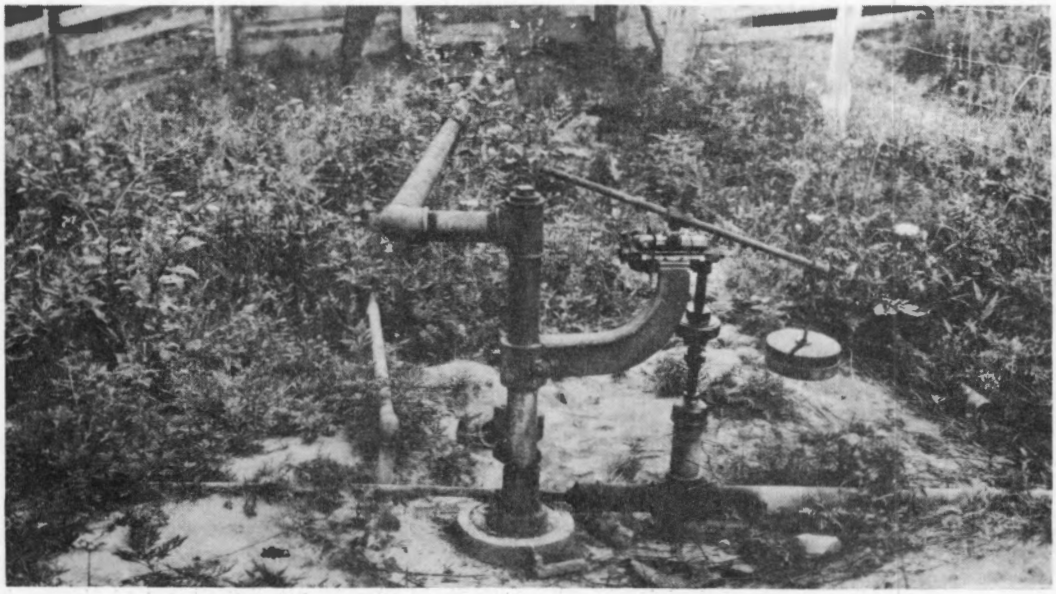
In 1863 ownership of the Federal Creek lands passed from the local operators to larger companies which had been formed to exploit the newly found oil field. One of the early organizations was the Ohio Petroleum Company. Figure 14 shows a map which accompanied a prospectus prepared to promote the sale of stock in the company. Hundreds of Cow Run oil wells were drilled on these farms in the years from 1861 to 1938 and ownership of the mineral rights changed six times. The operating companies have been: Ohio Petroleum Company, 1861 to 1871; The Mansfield Petroleum Company, 1871 to 1890; The Midland Petroleum Company, 1890 to 1900; The Squires Brothers, 1900 to 1911; and Smith and Dunn from 1911 to 1938. In their efforts to get all the oil, wells were sometimes drilled without regard to spacing or to the location of older wells. Figure 15 illustrates an instance in which two wells, less than 10 feet apart, produced from the same sand. In 1911, when Smith and Dunn acquired the Joy farm, production had declined until it was hardly economical to operate the wells. They introduced a revolutionary new program of repressuring the oil reservoir by forcing compressed air into some of the wells. The surrounding wells responded and in some cases began flowing as much as 50 barrels of oil per day. Operations continued in this manner until 1938 when the economic limit was again reached and the wells were abandoned.



Courtesy of O. C. Dunn, Jr.

Fig. 15. Two wells producing from the Cow Run on the Dale (Joy) farm in Section 2, Homer Township. Although less than ten feet apart they produced independently. The wells are equipped with the Dunn compressed air lifting unit.

Very little is known of this and other early production as records were either poorly kept or lost. The oil was Pennsylvania grade and was produced from the Cow Run sand. The outline of the sand body was soon defined by producing wells or by dry holes where the sand was not present. The sand, which was found about 100 feet below the level of Federal Creek, contained enough gas to cause most of the early wells to flow their oil but by 1870 it was exhausted. They were then pumped by hand with two men raising 40 to 50 barrels in a 12-hour day.



Courtesy of O. C. Dunn, Jr.

Fig. 16. Close up of Cow Run well head on Dale (Joy) farm equipped with apparatus perfected by the late O. C. Dunn for automatically flowing wells by compressed air. Use of this method never became widespread because of difficulty in keeping the mechanism in adjustment.

In the May 12, 1865, issue of the Morgan County Herald the following article appears:

> "The Ohio and Pennsylvania Company on Federal Creek after going in one well to a depth of 540 feet struck a vein of gas and salt water which has been blowing with such a force as to prevent the workmen from tubing it. Some oil is thrown out and they anticipate a good yield of oil. This is the greatest depth oil has been obtained in the Creek."

The company was in search of oil and gas was regarded as a nuisance except as fuel to fire the boilers. The producing formation was probably the Lower Freeport sandstone and salt water evidently drowned out the gas. No further production from this formation has been found in the immediate area.

The First Berea sand in Homer Township has been only meagerly productive. In Sections 25 and 31 some wells are known to have produced oil but no other information was found concerning them. A few other unsuccessful tests have reached this sand but the greater part of the township remains unexplored.

In Sections 1 and 2, in approximately the same productive area as the overlying Cow Run sand, gas has been found in the Second Berea sand. Seventeen gas wells and two dry holes have been drilled in these two sections which mark the western boundary of the Second Berea gas field (Plate III). The first producing well was completed in 1931 by the Bowman Oil and Gas Company on J. J. Joy farm in Section 1. The Second Berea, which was found 40 feet below the First Berea, was penetrated from 1,632 to 1,645 feet and produced 120,000 cubic feet of gas per day after shot. This well is still producing. The initial open flows were relatively small, few exceeding 100,000 cubic feet per day after shot, but they produced for many years. The pay is a very fine-grained sand which has responded very well to the hydraulic fracture method of increasing natural production. As a result of this success, current activity in Sections 1 and 2 will probably extend the limits of the gas producing area.

No Clinton or Medina sand test wells have been drilled in Homer Township.

MALTA TOWNSHIP

Newspaper accounts concerning oil and gas wells completed in Malta Township may be found as early as 1861. From the time of the early settlers oil seeps near Oil Spring Run and Gillespie Run were known so it was along their banks that the first test wells were drilled. Although a number of the seeps are still active, very little other evidence of this early production now exists.

Several Cow Run and Peeker sand oil pools were developed in the western part of the township prior to 1900 but the wells were relatively small. The Joetown pool, discovered in 1910, later proved to be a continuation of the Oil Spring Run productive area. Between 1910 and 1920 compressed air was introduced into the oil sands of these pools in an effort to increase recovery. Production records of these operations are not available so the degree of success is not known. Occasional wells continue to test edge areas of these old pools but they seldom exceed one barrel per day.

Shortly after the Civil War gas was struck near Malta at a depth of 40 feet. It was unused until 1888 when the S. R. Dresser Gas Company was formed to furnish gas to the residents of McConnelsville and Malta. The company later became known as the Malta-McConnelsville Gas Company and their first gas well was completed in 1891 to a total depth of 562 feet on the George W. Riley farm in Section 16 of Malta Township. The producing sand, found from 482 to 517 feet, was probably the Clarion sandstone. In the same year the company, encouraged by shows of gas in a well on the McConnelsville fair grounds, completed several successful wells in the Second Berea sand. By 1929, when they became a part of the Ohio Fuel Gas Company, the Malta and McConnelsville Gas Company had drilled a total of 104 gas wells and 22 dry holes. Seventy-five of the successful wells were in the Second Berea sand and 29 were in shallow sands. Nine of the dry holes were Second Berea and 13 were shallow. The territory developed is about four miles wide and reaches from Bristol Township southwestward to the Malta-Penn Township line. The producing sands in the shallow wells are the Clarion and the Lower Freeport sandstones which are referred to in the area as Second Cow Run. The wells vary from 400 to 600 feet in depth. The Second Berea sand occurs 10 to 30 feet below the First Berea and 1,350 to 1,550 feet below the surface. Production, after a 40 to 80 quart shot of nitroglycerine, usually ranged from 10,000 to 200,000 cubic feet of gas per day and the rock pressure about 500 p. s. i. Many wells drilled by the original company are still producing.

Clinton or Medina sand test wells in Malta Township have met with limited success. In the northwestern part of the township (Section 32) the Industrial Gas Corporation - Gillespie No. 1 well, completed in April of 1943, found the Clinton sand from 4,412 to 4,460 feet with 527,000 cubic feet of gas per day after shot and with a somewhat below normal rock pressure of 750 p. s. i. Although the production was not large considering the cost of the hole, eight other wells were drilled near by. Two produced for a short time and the rest were dry. In Section 23 S a Clinton gas well was completed on the Richard Cashman farm in 1948 by the Mid-East Oil Company. The sand was penetrated from 4,696 to 4,720 feet and produced 1,750,000 cubic feet of gas per day after shot. After one year the well was producing 120,000 cubic feet of gas per day but was plugged because of litigation. It has not been offset.

Thirteen wells have tested the Medina sand in Malta Township but none was successful. However, one well in the southeast quarter of Section 16 is reported to have produced 25 barrels of oil per day after shot. It apparently did not hold up as it was plugged several months after completion.

MANCHESTER TOWNSHIP

Only three wells have been drilled in this township. The first, completed in 1920, was drilled in Section 5 to a depth of 526 feet without finding oil or gas in quantity. The second, the

Wittmer and Morrow - Dye No. 1, Section 30, was completed in 1949 with a show of gas in the Medina sand from 5,175 to 5,200 feet. It was abandoned as a dry hole at total depth of 5,205 feet in "red rock." Another Medina sand test, the Mid-Atlantic Oil and Gas Company - Rex No. 1, drilled in 1952, reached a total depth of 5,153 feet without finding production.

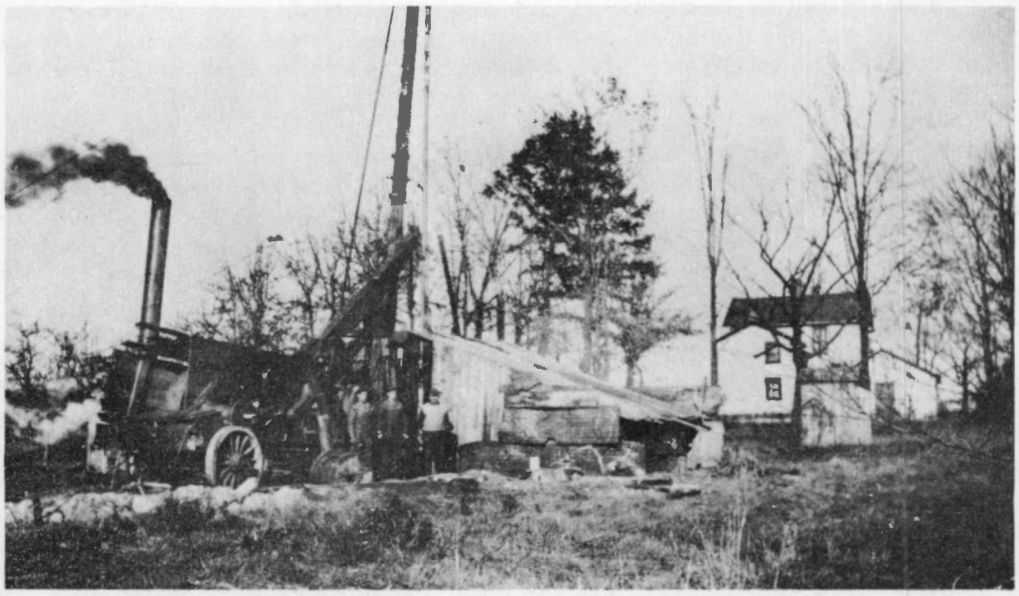
Manchester Township lies near the axis of the Parkersburg-Lorain syncline. To date very little oil or gas production has been discovered near the axis or along the western flank of this structure. For this reason the outlook for future production from Manchester Township is not encouraging.

MARION TOWNSHIP

Very little of this township remains to be tested for oil and gas in the shallow sands. An estimated 1,600 holes have found production in 14 different pay sands. The only Clinton sand test drilled in the township was unsuccessful.

The Chesterhill pool produces oil from the Cow Run sand in an irregular strip about one mile wide in the southern portion of the township. Although the wells were not large, the pool produced for many years. Development began in 1861 near the village of Joy in Homer Township but it was not until 1892 that it was successfully extended eastward into Section 33 of Marion Township. Bownocker (12) gives the following account of the discovery of oil near Chesterhill.

> "In the spring of 1899 a well was drilled on the land of E. J. Lambert, two miles south of Chesterhill. When put to pumping it started at 60 barrels, but the production decreased so rapidly that the well was abandoned the following December. Within a year 40 wells were drilled in this field, one-half of which were failures. In December 1900, the Southwest Petroleum Company and A. J. Lovell bought the pool for $37,000, the production being 37 barrels per day. The first well was drilled on the Crayton farm between two dry holes 400 feet apart, and a 30-barrel producer secured. With this encouragement other wells were drilled in quick succession and the pool was soon connected with the production lying to the northwest and to the northeast."



Courtesy of O. C. Dunn, Jr.

Fig. 17. Well drilling in the Chesterhill pool, Marion Township, about 1900.

Between 1910 and 1920 much of the productive acreage in the vicinity of Chesterhill was purchased by the Henne and Dunn Company. The wells were repressured with compressed air and many responded by producing as much as 30 barrels of oil per day. Today the pool is mostly abandoned, although occasionaly one-barrel wells are still being drilled by the local operators.

The producing formation at Chesterhill is the Cow Run sand which lies approximately 80 feet below the Ames limestone and ranges in texture from a conglomerate to a siltstone. It averages 30 feet in thickness with a pay zone of as much as 10 feet.

In the northwest corner of Marion Township a small Cow Run oil pool was discovered in 1899. The sand was found at 310 feet and was less than five feet thick. Daily production of the individual wells was small but 63 known producers were drilled. Some of the wells are reported to have produced from the Peeker sand which lies between the Cow Run and the Ames limestone. Records were so poorly kept that positive identification of the sand is not ascertained in this report.

Oil has been found in Marion Township in commercial quantities only in the Peeker and Cow Run sands (Conemaugh). The deeper sands have produced only gas. Beginning about 1920 an unknown number of wells were drilled to sands of Allegheny age. They were prolific but short lived producers of gas. Pay sands in the Allegheny are the Lower Freeport and the Clarion sandstones and are known to the driller as either the Macksburg 500-foot or Second Cow Run. These sands, found from 300 to 450 feet below the Ames limestone, have the appearance of sugar when brought from the bore hole. They are pure granular quartz sandstones that may have excellent porosity and permeability but usually "lens out" to a shale within relatively short distances. Some of these wells have produced over 1,000,000 cubic feet of gas per day natural when completed. They are known to blow down within a few hours or last as long as five to ten years.

The Macksburg 700-foot, the Salt, the Brill, and Maxton are local drillers' terms for gas-bearing sandstones in the Pottsville formation. They are very similar in character to the overlying Allegheny strata but they have been better producers of oil and gas. The productive area of these sands is in the eastern half of the township where the development has largely been in the hands of local operators. Well depths vary from 800 to 1,000 feet and rock pressures range up to 400 p. s. i. Average initial production is comparatively high as many wells were in excess of 500,000 cubic feet of gas per day after shot. Salt water sometimes becomes a problem, but usually when production is no longer economical the wells are deepened 500 to 600 feet to the Second Berea sand.

Although the Big Injun sand generally has not been productive in Morgan County a few wells in Section 3 of Marion Township, on the J. A. Daugherty farm, are reported to have produced gas. They were drilled in 1900 by the Home Gas Company to supply gas for about 50 homes in the village of Malta. The sand was found at approximately 1,000 feet below the surface and reported 60 feet thick. Production figures and date of abandonment are not known.

Marion Township lies in the main trend of the Second Berea gas field. Development began shortly after 1920, in the southern part of the township. Drilling progressed rapidly until 1940 when nearly 300 gas wells and 17 dry holes had been completed. The peak year was in 1928 when 50 wells were drilled. After shot the wells produced up to 300,000 cubic feet of gas per day, the average being about 100,000 cubic feet. The original reservoir pressure was 550 p. s. i. and the sand occurred from 1,500 feet below the surface in the northern part of the township to about 1,700 feet in the south. Although the initial production from these wells is comparatively low their normal life span has proved to be 20 years or more.

The Second Berea is a very fine-grained sand with low porosity and permeability. It is described by the driller as being "tight." The formation is free of salt water and makes only enough oil in Marion Township to necessitate periodic removal to avoid gas flow interference. The Second Berea occurs approximately 30 feet below the First Berea and averages 25 feet in thickness. The location of the pay zone varies considerably as some wells find gas in the top, some in the bottom, and others throughout the entire sand section.

Recent successful hydraulic fracturing of marginal wells in the Second Berea gas field has spread into Marion Township as the sand characteristics here should also be well suited to this process. The prospects of finding additional Second Berea gas around the edges of the old field appear good if this new procedure continues to prove successful. There are a few untested areas in this township where additional gas may be found in Pennsylvanian sands. To date these strata have failed to respond to hydraulic fracturing because rock pressures are often under 200 p. s. i. and the sands are usually soft and porous.

The possibility for production from the Clinton or Medina sand is not known in this township. The only deep well drilled, the Texas Utilities Company - C. W. Newton No. 5, Section 23, was completed as a dry hole in the Clinton in 1941. The sand was found "broken" between 4,468 and 4,493 feet. The total depth of 4,532 feet was not deep enough to reach the Medina sand horizon.

MEIGSVILLE TOWNSHIP

Although the search for oil and gas in Meigsville Township began in the early 1860's no commercial production has been found. Many Cow Run sand tests, mainly in the valleys of Meigs Creek and Fourmile Creek, found only small shows of oil or dry holes. Of the four First Berea or deeper test wells known to have been drilled in the township, three recorded shows of oil. One, located in southwest quarter of Section 18, reported a good show of gas in the Second Berea. Another, the Clyde Foraker-Claude Murray No. 1, in Section 1, was an unsuccessful Oriskany sand test. The sand occurred between 3,475 and 3,505 feet but produced only salt water. The remaining two wells tested the Medina sand. One was located in the northwest quarter of Section 22, and the other in the southeast quarter of Section 12, but both were dry. The latter, the John Morrow - L. F. Murrey No. 1, was drilled in 1948 to a total depth of 5,231 feet. A complete string of rock samples were saved from this well and given to the Ohio Geological Survey for study. They have been of valuable assistance in studies of the subsurface geology in this area (See Appendix I).

MORGAN TOWNSHIP

The first well in Morgan Township was drilled in the spring of 1861 when the "oil fever" first reached Morgan County. No commercial production was found. Further development did not occur until almost 30 years later when the discovery well in the Second Berea gas pool was completed north of McConnelsville. Bownocker (12) describes this well as follows:

> "In the spring of 1889 a well was drilled on the east bank of the river about one-half mile northeast of the city. The Berea sand was found at a depth of 1,195 feet, but the amount of gas liberated was so small that the well was abandoned. About the same time a well was drilled three-fourths of a mile north of the city. It supplied enough gas for one residence.
>
> "These wells were failures, but the people were not satisfied. Some believed that gas would be found if only the drill were forced deep enough, and accordingly it was decided to attempt to reach the Clinton or Lancaster gas rock. However, no company was found that was willing to back so expensive and hazardous an enterprise, but the city, through its council, provided $5,000 to explore the territory further. The well was located on the McConnelsville fair grounds, and work was begun September 3, 1894. The Berea was reached at a depth of 1,279 feet on October 24. It gave nothing more encouraging than a show of oil and gas, and many of the most intelligent citizens urged that the well be abandoned, and that the funds, of which a large part still remained, be used for drilling other wells near the city. The State Geologist was appealed to, and strongly advised that the well be abandoned, stating that even should the Clinton be reached and gas found, the expense of drilling such deep wells would

be so great that the gas would be too costly to be used as a fuel. However, those in charge insisted on drilling deeper, and on November 8th work was resumed. Progress was very slow, and on March 14th, 1895, when at a depth of 3,186 feet, the tools became fast and the well was abandoned."

The good show of gas found in the fair grounds well led to a successful test by the S. R. Dresser Gas Company on the C. B. Bozman farm, in Section 12, just east of McConnelsville. This well in turn led to further development in the immediate vicinity so that both Malta and McConnelsville were assured of an ample supply. Of the 30 known Second Berea test wells in Morgan Township, 28 were drilled by the S. R. Dresser Gas Company, or as it was later known, The Malta and McConnelsville Gas Company. The development of the Second Berea sand gas pool in Morgan Township was contemporaneous with its development in Malta Township, which has been previously discussed. The geology of the sand is also similar. The potential productive life of these gas wells is attested to by a well on the B. F. Reed farm, northwest quarter of Section 6, which was completed in 1899 and was still delivering gas into the line in the summer of 1954.

The only well to reach the Clinton or Medina sands in Morgan Township was the Stephens Petroleum Company - Edwin Roberts No. 1 in Section 27. It was completed in 1945 as a dry hole through the Medina sand.

PENN TOWNSHIP

Development of production in Penn Township has been very similar to that in Marion Township which borders it on the south. Besides the numerous Cow Run and Peeker oil pools within its limits, the Second Berea gas field extends in a northeast-southwest direction across it in a strip approximately three miles wide. Many shallow sand gas wells also produced in this area and were subsequently deepened when their production declined. An estimated 1,300 wells have been drilled in the township.

The principal oil pool is located in Sections 11, 12, and Fraction 2, to southeast of Pennsville. Production is from the Cow Run sand at about 400 feet below the surface. The maximum thickness of this channel deposit south of Pennsville is 40 feet with the average 25 feet. The pay zone is about 15 feet thick and the oil is Pennsylvania grade. Little is known of the discovery or early development of the pool except that drilling began shortly after 1910. The wells started at approximately 20 to 30 barrels of oil per day but declined in a few years to a point where it became necessary to use compressed air on nearly all the leases. By using this method of secondary recovery, production in many cases increased to the original daily output. The wells were operated in this manner until about 1935 when decreased production made it necessary to abandon them. The Henne and Dunn Oil Company of Marietta owned most of the acreage in this pool during repressuring. Several smaller Cow Run pools occur in various parts of the township but little or nothing is known regarding their development.

In the vicinity of Pennsville, in Sections 2 and 35, oil is found in a sand known as the Peeker to the driller. The following is a portion of the driller's log of the Ohio Fuel Gas Company - Charles Harkins No. 1 well, in Section 2, completed August 20, 1932, as a Second Berea gas well:

Lime	290-295	AMES
Sand	295-315	PEEKER (SALTZBURG)
Slate and Lime	315-330	
Slate	330-380	
Sand	380-400	COW RUN
Red Rock	400-425	
Lime	425-440	BRUSH CREEK?
Slate	440-560	
Sand	560-573	MAHONING
Coal	573-576	NO. 7

This log shows the position of the Peeker sand in this area. Here, as in so many of the other shallow oil pools, no records are available which show sand conditions or production. From interviews with drillers the author has learned that the Peeker sand is usually finer grained and harder than the Cow Run. In this area it is reported that the crude oil produced by the Peeker is slightly inferior to that of the Cow Run. Development of the pool probably occurred between 1910 and 1920. It has also been partially repressured.

The Allegheny sands have been found productive principally in Sections 1, 16, and 17. The Macksburg 500-foot, which is the Clarion sandstone, is reported to have produced small amounts of oil and gas in Section 1. The wells were from 550 to 650 feet deep but no other information concerning them is known. Wells in Sections 16 and 17 produced gas from the Clarion and Homewood sandstones. They were drilled on the James, Harris, and Gladden farms between 1920 and 1925, and had initial open flows as high as 1,000,000 cubic feet of gas per day, but salt water soon ruined them. Local operators refer to these two pays as the James and the Harris gas sands.

The Pottsville sands have not been as productive in Penn Township as in Marion Township. Many wells have produced gas from the Massillon sand in the southern part of the township. Initial open flows were as high as 1,500,000 cubic feet of gas per day with the average being near 800,000 cubic feet. The original rock pressure was about 100 p. s. i. and the depth of the wells from 700 to 900 feet. Many of these wells were later deepened to the Second Berea sand.

The first well in the Second Berea gas field in Penn Township was completed in 1922 by the Malta and McConnelsville Gas Company as they moved southward from Malta Township. However, the Company drilled very few wells in this area, and the major portion of the development was done by local independents. The geology and production history of this portion of the field is similar to that in Malta and Marion Townships.

In studying future prospects for Second Berea production in Penn Township, careful consideration should be given to all of Section 4, the eastern portion of Section 5, the western half of Section 34, and the southeast quarter of Section 33. These are untested areas between the main producing trend and a gas well located in Section 5. (See Plate III).

The only deep test drilled in Penn Township was completed in 1948 by the National Gas and Oil Corporation on J. C. O. Tompkins farm in Section 36 and recorded a $2\frac{1}{2}$ barrel show of oil in the Medina sand from 4,925 to 4,933 feet. It was drilled to a total depth of 4,944 feet and abandoned.

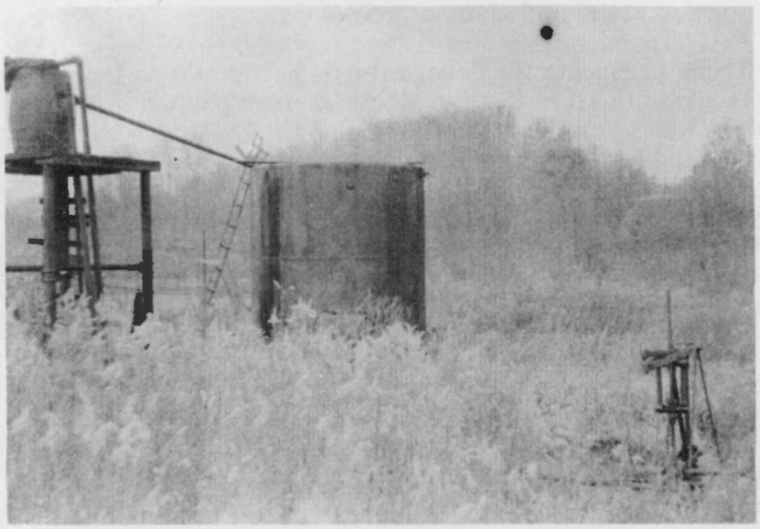
UNION TOWNSHIP

Oil production in Union Township is centered in Sections 1, 2, 3, 11, and 12, in the valleys of Wolf Creek and Buck Run in the northeast corner of the township. (See Plate V). It was regarded as very favorable territory when drilling for oil first began in Morgan County in 1860. At that time it was thought that oil occurred only in valleys so exploration was centered along the banks of the smaller streams. The great spring floods probably prevented extensive drilling along the Muskingum River.

The first well in Union Township was completed in the fall of 1860 on the Ritchey farm in the southeast quarter of Section 12, on the east bank of Wolf Creek. The pay sand was struck at 37 feet, just below the Ames limestone, and probably would correlate with the Saltzburg or Peeker sandstone. About a year later oil was discovered one mile west on the banks of Buck Run. The identity of the producing sand here is not certain but it is thought to have been Cow Run. Following the Civil War hundreds of wells were drilled along both streams as the entire Wolf Creek - Buck Run area was found productive. The oil was hauled by wagon to McConnelsville and sold to the McConnelsville Carbon Oil Company, who refined and marketed it for lubricating purposes. The refinery, as a result of declining oil prices, went into bankruptcy about 1872. When they lost the market for their oil many of the operators on Buck Run and Wolf

Creek were forced to shut down. In 1893, a pipeline laid from Corning to Macksburg passed near Buck Run and provided a new outlet for the oil. Exploratory work resumed, wells were cleaned out, and the pool was returned to production. Early well locations had been confined to stream bottoms but as these wells were exhausted the adjoining hills became dotted with rigs as equally good producers were found. By 1912 production had again declined to a minimum and the new Smith-Dunn air-repressuring process was being instituted. Production increased and new wells were drilled, many of which pumped until 1940. Drilling has continued through the years so that today a few leases still have pumping wells. Production figures are not known but the early wells are believed to have averaged about five barrels per day, with the largest being about 100 barrels per day. One well in this pool has become famous for its long production record. It was completed in the summer of 1861 and named the Greathouse No. 1 after its driller. By 1865 it had produced over 13,000 barrels of oil. This is exceptional production when one considers that it was pumped by hand. Greathouse No. 1 was pumped regularly until 1894 when tools became fast in the hole during a clean out job. After all attempts failed to remove the tools a new hole was put down a few feet from the old one and production resumed. This well, located in Section 11, was still producing in the summer of 1953. (See Fig. 18).

Although two pay sands appear to be present in the Buck Run pool there is no record of any one well producing from both sands. Presence of the two separate reservoirs becomes evident when the intervals between them and the Ames limestone are considered. One of the sands is found directly beneath the Ames and is probably the Peeker. Its pay section is variable in both thickness and position within an average 20 feet of sand. Where the sand is absent oil is often found in the Cow Run about 80 feet below. The Ames is fairly persistent in this area and freshwater usually occurs both directly above and below it. Some salt water is found



1953

Fig. 18. The Greathouse well——oldest producer in Morgan County. Original well was drilled in 1861 and produced until 1894 when swabbing tools were lost in the hole. The present well was then drilled a few feet from the old one. It is approximately 300 feet deep and still produces a small amount of oil.

in the Cow Run. Since very little gas was produced with the oil at Buck Run, it was necessary to drill wells to the No. 7 (Upper Freeport) coal to obtain sufficient gas for pumping and other operating purposes.

The First Berea sand oil production in Union Township is considered part of the Corning pool of Monroe Township, Perry County. Drilling extended into Union Township in 1895 and

at least 65 First Berea wells were drilled in the western portion of Sections 6 and 7. Most of the wells have been plugged because of salt water encroachment from the southwest.

The first well to reach the Clinton sand in Morgan County was drilled in Union Township in 1908. It was the O. C. Edda Company - T. J. Chappalear No. 1 completed as a dry hole at a total depth of 3,947 feet. The Clinton was penetrated from 3,925 to 3,944 feet. Two additional deep tests in the township also found the Clinton dry. One, drilled in Section 22, was carried to the Medina but failed to find production.

WINDSOR TOWNSHIP

To date, production in Windsor Township is limited to the southwestern portion where three shallow sand oil pools have been found. In area the largest of these produces from a narrow zone of Peeker sand, which is sometimes less than a hundred yards wide, which extends from Fraction 6 southeast to the Washington County line. The sand, averaging 22 feet thick, lies approximately 375 feet beneath the surface and just below the Ames limestone. The first wells were drilled about 1898. Initial productions were from 20 to 40 barrels per day, but within a short time they settled to about 2 barrels. By 1920 almost 50 percent of the pool was abandoned. Drilling has continued sporadically through the years as small producers may still be found in the area. South of the Dale pool (see Plate V), as this narrow Peeker sand productive strip has been named, lies a group of 75 to 100 wells of which little is known except that they produce from the Peeker or the Cow Run sands.

The discovery of a third pool in Windsor Township was announced in the May 16, 1900, issue of the McConnelsville Herald by the following article:

> "Oil excitement five miles southeast of Windsor and about two and a half miles from Roxbury is intense. Four wells have been drilled in on the Yarnell place and they can be included in about eight acres of ground. No. 4 is reported as a 2,000 barrel well. It has been increasing since it was struck. Such wells in shallow sands have never been struck before. The wells are only about 350 feet deep."

This activity occurred in Lots 1 and 2 of Windsor Township just north of the Washington County line. The news item is not an exaggeration as the oil wells in this pool were the largest ever reported in the county. The First Cow Run sand lies immediately above the Cambridge limestone in the area of this pool. Large quantities of gas were associated with the oil.

There have been several attempts to find other producing areas in Windsor Township but all have failed. Four widely scattered Big Injun sand tests resulted in dry holes. Ten First Berea sand wells have been drilled but only salt water and shows of oil and gas were the rewards. No Clinton or Medina wells have been attempted.

YORK TOWNSHIP

Production in York Township has been derived from the First Berea, the Clinton, and the Medina sands. For convenience the township is divided into three pools (see Fig. 17): the York Township First Berea sand pool which produces oil and gas in the central area; the Deavertown pool which produces oil and gas from the Clinton and Medina sands in the western portion; and the Brush Creek Clinton sand gas pool in the eastern part of the township.

The First Berea pool was discovered in 1923 when the Pure Oil Company completed the Ira Barringer well No. 1 in Section 32 with 30 barrels of oil per day after shot. The Berea sand was found from 1,328 to 1,352 feet. Development of the pool was extremely rapid as nearly 200 wells were completed during the next three years. By 1926 the limits of the oil area had been

defined but gas continued to be discovered to the west. Very little new drilling occurred in the area from 1930 to 1941. In the latter year a successful gas well on the Dallas Stoneburner farm in Section 30 renewed activity and during the next three years the productive area was extended westward and southward to the village of Deavertown.

First Berea sand gas wells in York Township, despite comparatively low initial volumes, have produced about 15 to 20 years. Although initial open flows ranged as high as 1,000,000 cubic feet per day the average was about 200,000 cubic feet. The original reservoir pressure was 350 to 400 p. s. i. Of the more than 250 First Berea wells drilled in York Township only 13 were dry.

Many of the oil wells in the York Township pool have produced from 25 to 30 years. Average initial production after shot was 35 barrels. Most of the acreage was owned by large companies who agreed to drill the wells on a spacing pattern of approximately eight acres per well. This respect for distances between wells and lease lines was at times maintained under severe difficulties due to heavy timber, underbrush, and rugged topography. The major operating companies were The Pure Oil Company, the Sun Oil Company, The National Gas and Oil Corporation, and the Preston Oil Company. The Pure Oil Company later acquired nearly all the oil producing leases and in 1938 drilled two wells as inputs for an experimental gas pressure maintenance project. It met with only limited success and was abandoned due to the high cost of purchased gas. In 1948 an experimental water flood was placed in operation. A detailed report of this project together with the geology of the field is included in Chapter 4. Most of the oil pool is still in production although it has been in stripper stage for many years.

The productive area of the Clinton and Medina sands in western York Township is the southeast extension of the Crooksville pool in adjoining Perry County. The first well in York Township was The Ohio Fuel Gas Company - R. S. Cosgrove No. 1 in Section 24. It was drilled to the Medina sand but, after finding only a small show of gas, was plugged back to the Clinton and completed as a small oil and gas well. The Clinton sand was found from 3,868 to 3,920 feet and the Medina from 3,954 to 3,957 feet. Further development was slow, 11 wells being drilled during the next 14 years. In 1944 two fairly productive gas wells were found in Sections 30 and 34 W. During the next seven years the territory in the vicinity of these wells received 63 successful tests and eight dry holes. Twenty of the successful tests were Medina gas wells and six were dry holes. The remainder were completed in the Clinton sand at approximately 3,800 feet below the surface and with an average thickness of 25 feet. The original reservoir pressure of the gas wells was 900 p. s. i. and the average initial production was 800,000 cubic feet of gas after shot. Four Clinton oil wells in Sections 35 W and 36 W averaged 90 barrels after shot. The top of the Medina sand in this pool is found at approximately 110 feet below the top of the

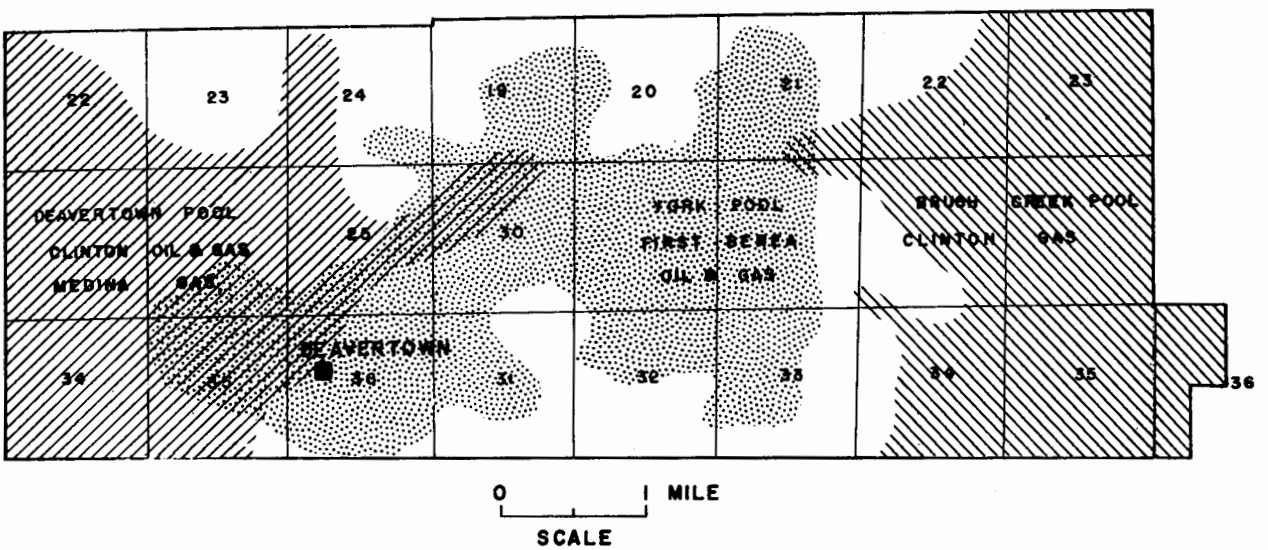
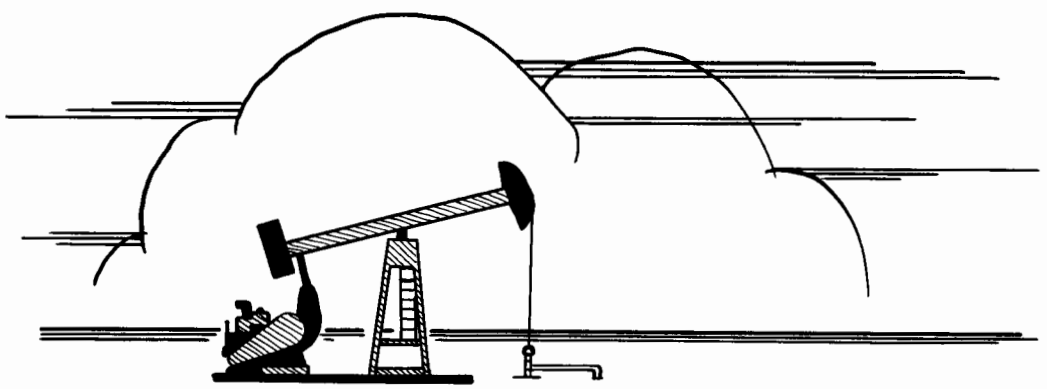


Fig. 19. Map of York Township showing oil and gas producing areas.

Clinton and varies from 5 to 8 feet thick. The average initial production from wells in this sand is 200,000 cubic feet of gas after shot. Medina production has been found principally in Sections 25, 26W, 34W, 35W, and 36W. The wells were drilled during the past seven years and are still producing.

In July 1941 The Pure Oil Company and The Ohio Fuel Gas Company completed two successful Clinton sand wells in eastern York Township and thereby extended the Brush Creek gas pool of Muskingum County southward into Morgan County. The Pure Oil Company - Clara Fouts No. 1 well in Section 22E. was the largest with an open flow of 10,000,000 cubic feet of gas per day natural although it "blew down" and was plugged in less than a year. The Ohio Fuel Gas Company - Charles Snyder No. 1 in Section 23E. produced 530,000 cubic feet after shot. In this area the Clinton sand lies at an average depth of 4,200 feet below the surface. Average initial production of wells in this pool was over 1,000,000 cubic feet of gas per day and the original reservoir pressure was 1,100 p. s. i. Sixty-two wells were drilled from 1941 to 1951, 40 of which were successful. In most instances when the Clinton sand did not produce they were continued on to the Medina, although it has failed to produce in this township.



CHAPTER 4

SECONDARY RECOVERY

REPRESSURING WITH AIR

As production from the shallow sand oil pools in the Appalachian area started declining, the operators began experimenting with various methods of obtaining additional oil from their wells. It was discovered, more by accident than intent, that introducing gas under pressure into an oil producing formation considerably increased the daily output. Often times gas was not available, or the market price made it uneconomical for use, so compressed air was substituted. This method was first demonstrated in Marion Township, Morgan County, by the late I. L. Dunn of Marietta, Ohio. The experiment was conducted in 1911 near Chesterhill on the Wood farm which was then under lease to the Cumberland Oil Company. Oil was being recovered from the Cow Run sand at approximately 400 feet below the surface. Efforts to stabilize production by applying a vacuum to the wells on this property had been going on for five years but the annual production had declined from 17,000 to 8,700 barrels. In the initial repressuring operation 150,000 cubic feet of air was injected into the pay sand of one of the wells at a pressure of 40 p. s. i. Within a week production increases in offset wells were so encouraging that the operation was greatly expanded. Old wells were cleaned out and converted to air inputs and where necessary new wells were drilled. Four years after repressuring was begun on this farm the annual production reached over 16,000 barrels of oil.

The success of this experiment and its rapid acceptance by producers revitalized shallow sand oil operations in Morgan County. The "Smith-Dunn or Marietta Compressed-Air Process," as it was named by J. O. Lewis (13), was put into operation on nearly every lease in the shallow sand producing area. Most of the supposedly exhausted areas were redrilled and others, which had been abandoned due to low initial production or other economic reasons, were redeveloped. By 1930 the great majority of these projects had passed their economic limit and were abandoned. A few small installations have operated at various times until as recently as 1950. Several favorable areas which appear to have not been subjected to repressuring are the Dale pool in southwestern Windsor Township, the Pennsville pool in the area northeast of the village of Pennsville, and the extreme northwestern portion of the Buck Run pool which lies in the north half of Section 3, Union Township (see Plate V). There were over a hundred wells in each of these pools.

WATER FLOODING

The only known attempt to increase oil production by water flooding in Morgan County was undertaken by The Pure Oil Company in York Township during 1948. We thank this company for allowing us to include the following report on this project by their Production Engineer, Mr. James B. Hunter.

> "It is the purpose of this report to briefly summarize procedure and results of a pilot water flood which was executed to determine the possibilities and economics of water flooding the Berea sand in York Township, Morgan County, Ohio.
>
> "The York-Morgan pool is located in York Township, Morgan County, Ohio. The oil-producing portion of this pool is located partly in Sections

20, 21, 28, 29, 32, and 33, T-10N, R-13W. Its areal extent is about 3 square miles extending about $2\frac{1}{4}$ miles in a north-south, and about $1\frac{1}{4}$ miles in a east-west direction. The terrain in this area is very rough and broken with about 200 feet of relief. It is subject to numerous slips and slides which cause considerable trouble by tilting or shearing of casing heads of producing wells.

"Oil in this area is produced from the First Berea sandstone which is found at a mean depth of about 1,265 feet. Its mean thickness is 22 feet with an average pay section of approximately 8.8 feet (average pay in area of pilot flood).

"This field was developed between the years of 1920 and 1925. Initial well productions ranged from 5 to 50 barrels per day. The overall primary production to date has been in the neighborhood of 1,000 barrels per acre, or 125 barrels per acre-foot. (These statistical figures were derived by spot check and could vary in either direction.)

"Spacing in this field has been about 8 acres per well. Core analysis of sand from R. E. Hughes well No. 10 and Charles Swytser well No. 22 indicates a porosity of 19 percent, permeability of 69 millidarcys, and a residual oil content of about 300 barrels per acre-foot as of 1938.

"In 1948 a pilot water flood was initiated in the southeast part of this pool to determine the characteristics and economics involved. Two adjacent six-spot patterns were developed by converting existing wells, R. E. Hughes well Nos. 2, 3, and 10, and Charles Swytser well Nos. 8, 10, 12, 16, and 22 to water input wells, which left Hughes No. 1 and Swytser No. 11 as pattern producers. (See Fig. 20.) The area has previously been subjected to repressuring with gas.

"The first consideration in development of any water flood is source water. In this flood, water was obtained from a fresh water well at valley level. This particular well was 30 feet in depth. In order to have a uniform flow of water through the water plant on the upstream side of the high-pressure pump, water from the well was raised with a Pomona deep well pump. This water was found to be fairly stable, if not exposed to atmosphere. Water was treated with certain additives which were introduced by means of a common garden hose down the annulus of the water well.

"The water plant itself consisted of 100-barrel stock tank to receive water from the well, a small centrifugal pump to move water through the plant, Pur-O-Cel FAC-9 (diatomaceous earth) filter, 20-barrel finished water tank, and a HP 3" x 6" Worthington KIS duplex pump powered by a W-25 Allis-Chalmers engine: the above equipment was hooked-up in series as set forth respectively. All tanks were equipped with gas seals and immersed over-flows for exclusion of air. The high-pressure pump had 800 p.s.i. rating which was based on requirement of 0.5 p.s.i. per foot of depth: pressure parting of the sand in the area was tested and found to occur at 650 p.s.i. plus.

"The original casing program when this field was developed was to set a long string of casing in the bottom of a slate formation about 225 feet above top of Berea sand, and leave the rest of the hole open. In completing old wells for water input wells, the production string of tubing was pulled and the wells cleaned out to bottom. A 2-inch injection string was run with a burlap packer which was set in the top of the First Berea. The packer was then covered with flint rock and sand for a seal,

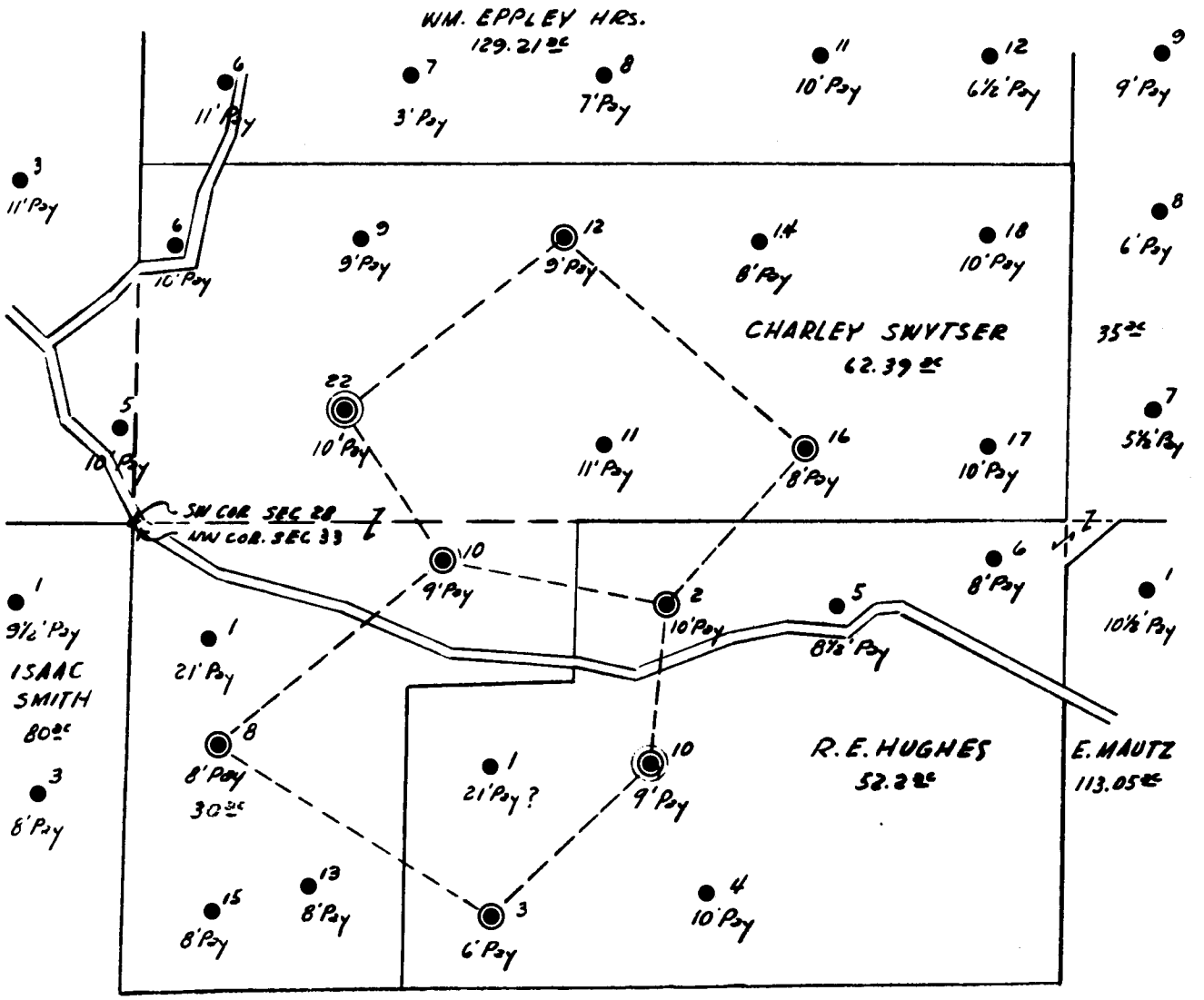


Fig. 20. Map showing location and outline of pilot water flood of Berea sand in York Township, Morgan County.

after which cement was run on same. When the tubing had been cemented, the shot hole was filled with washed pea gravel through the tubing to prevent caving.

"In the case of the R. E. Hughes well No. 10 and the Charles Swytser well No. 22, it was necessary to shoot these two wells as they had been drilled in 1938 for gas input wells and were not previously shot. Neither of these two wells was ever produced. After shooting these two wells they were completed in the same manner as the others.

"In August 1948, all of the above mentioned wells which had been selected for input wells were converted and were on injection. With the exception of Hughes No. 10 and Swytser No. 22, all input wells had a build-up of tubing-head pressure after the first or second day on injection. Input rates at the beginning were 50 barrels per day per well, or 5 barrels per day per foot of pay sand.

"After a couple of month's operation it became apparent that the desired volumes could not be injected. Tubing-head pressures built up to maximum limit of 650 p. s. i., at which pressure only 3 barrels per day per foot of pay was being injected: exceptions again being the Hughes No. 10 and the Swytser No. 22 which were still taking water with no appreciable tubing-head pressure. These were the two wells which were shot just prior to water injection, having never been produced.

The first thought was that the sand face in the old wells was partially plugged. An attempt was made to correct this condition by circulation of live steam, and next a paraffin solvent. The efficiency of both operations was retarded by the presence of pea gravel in shot holes and having to work through 2-inch tubing which was cemented in. Neither of the above jobs was successful.

"By the early part of 1949 the injection rate at full-line-pressure was only 275 barrels per day for both patterns, or 27. 5 barrels per day per well. Based on an estimate of 1, 362, 000 barrels required to completely flood both of these patterns, it would have required about 13½ years to complete this pilot flood. Operating costs for this length of time would more than consume anticipated returns of recovered oil. The cost to rework the once converted injection wells was considered prohibitive, and the project was abandoned early in 1949.

"The ability of the Hughes No. 10 and the Swytser No. 22 to take water very definitely proves that the Berea sand in this field will take water: these wells had no build-up of tubing pressure when the project was abandoned. It is a possibility that if the old producers used for water injection wells had been given a light shot prior to cleaning-out, they would have taken water as did the above two newer wells which were drilled for gas input wells originally.

"Recovery of oil by water flooding is still unknown in this field as this pilot flood did not proceed far enough to effect the production of the pattern or the first line offset producers."

HORIZONTAL WELLS

There have been several attempts to recover oil from the shallow First Cow Run sand in Morgan County by boring horizontal holes either into the outcrop or into the sand face that has

Courtesy of O. C. Dunn, Jr.

Fig. 21. Drilling the first horizontal well in Morgan County. This was the second well of its kind in the world.

Courtesy of O. C. Dunn, Jr.

Fig. 22. Oil flowing from the horizontal well after being shot along its entire length of 802 feet.

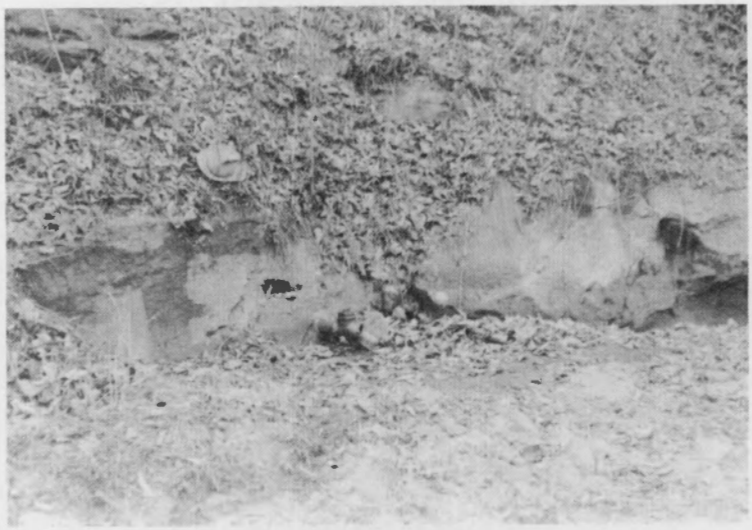


Fig. 23. The horizontal well as it appears today. Oil and water are still running from the pipe cemented in the sandstone. The black area on the face of the Cow Run sandstone is oil seeping from the formation.

been exposed by excavation. Although the engineering achievements involved in these projects were notable the companies failed in each case because of high operating costs and small production. In the future, should crude oil become scarce and prices rise sufficiently these methods of recovery may again be employed on the oil sands which lie near the surface.

The first horizontal hole in Morgan County was drilled near the village of Malta in Section 32 of Malta Township by the Ohio Levelwell Company under the direction of Leo Ranney (14, 15). This well, completed in 1937, was drilled 802 feet into the outcrop of the First Cow Run sand along Havener Run on the Dion Birney farm (see Figs. 21 and 22). The sand here is 28 feet thick with two pay streaks which are separated by a hard, fine-grained impermeable zone. The upper pay lies three feet from the top of the sand and is four feet in thickness while the lower pay includes all of the bottom 14 feet of the sand. The pool was discovered in the 1860's and had been subjected to both vacuum and pressure. It had not been operated since 1930. A core of the sand was taken from a well drilled about 700 feet from the outcrop and 40 feet from the horizontal well. Parke Dickey's (16) report of the project states:

> "The sand showed a porosity for the upper pay of about 16 percent and an oil saturation of 16 percent. The lower pay showed a porosity up to 20 percent and oil saturation of 17.5 percent. The permeability of both pays was high and quite uniform, ranging from 150 to 750 millidarcys. The oil content was quite low, and was estimated as 4,200 barrels per acre for the 18¼ feet of pay sand (Leo Ranney, personal communication).
>
> "The horizontal well was started in the upper pay and drilled almost level for 802 feet. Later a branch hole was drilled from 630 to 953 feet. The branch was believed to have descended 8 or 9 feet, and to have finished in the lower pay.
>
> "The well was drilled with a conventional diamond drilling machine with a rotatable hydraulic having a 2-foot feed, powered by a 25 hp. gasoline engine. The hole was 2-5/8 inches in diameter. At times the drill advanced at the rate of one foot per minute, and in one 7-hour shift 106 feet of hole was made. The average rate of drilling on the first hole was 40 feet per shift.
>
> "Three times during the drilling, gas and oil spouted from the hole, which doubtless penetrated pockets in the sand that had formerly been sealed off so that escape of their contents to the outcrop or to the old wells had been prevented.
>
> "The hole was shot with 1,150 pounds of 80 percent high velocity gelatine in sticks 2 inches in diameter. Great lengths of dynamite cannot be fired from a single point, since the compression wave travels faster than the ignition wave and the compressed explosive will not fire. Accordingly a fuse of TNT (Cordeau-Brickford) was laid along-side the dynamite, with blasting caps attached at short intervals.
>
> "After shooting, the well blew for about 20 minutes and then flowed by heads for about an hour. It is estimated that several hundred barrels flowed out, but this oil, which was confined behind a dam, was lost during a washout of the creek. The hole was found to be open clear back, and was cleaned out by washing. Large quantities of sand were removed.
>
> "The well has 3 feet of casing cemented to the rock, and is tubed to 940 feet, the last 10 feet of pipe being perforated. When producing, vacuum applied to this pipe removes the oil collected in the far end of the hole, and is then applied to the casing which removes the oil from the first branch of the hole. The well is said to have produced 9½ barrels in 7 hours after standing two weeks before shooting."

In the summer of 1953 the authors visited the location of this well and found the three-inch pipe still protruding from the outcrop (see Fig. 23). Operations have long been abandoned but a stream of water and oil one-half inch in diameter is still issuing from the pipe. It was estimated eight parts water to one part oil.

In 1939, after Ranney and The Ohio Levelwell Company had experimented with the horizontal well bored into the outcrop, they decided to dig a pit through the First Cow Run to expose fresh surfaces of the sand. This pit, located about 500 yards upstream from the horizontal well, was 30 feet deep and 30 feet in diameter with concrete walls one foot thick. The plan called for horizontal holes to be drilled radially from the pit into the sand (see Fig. 24). After three holes had been drilled and were producing a few barrels of oil per day the company was dissolved because of financial difficulties. Work was never resumed and today the pit stands half filled with water.

The second attempt to drill a horizontal well into the outcrop of the First Cow Run sand was made in 1938 by the Fear and Branbury Company with Leo Ranney as consultant. This well was located on the Sarah Drake farm in Section 16 about one-half mile from the nearest production. The hole, 3-3/64 inches in diameter, was bored for a distance of 981 feet where it was stopped because the sand "lensed out" into shale. Although initial production is not known, oil was taken from this well for several years. When the sand surrounding the bore hole had given up its free oil, production declined rapidly as there was insufficient reservoir energy to cause the oil to move to the open hole.

The last attempt at horizontal drilling in Morgan County was made in 1945 by the Blakson Oil Company of Charleston, West Virginia. They sank a shaft on the Lelia Anderson farm in Section 2 of Union Township in the middle of the old Buck Run pool, and cores of the First Cow Run were taken adjacent to the location of the shaft. The sand averaged 20 feet in thickness with the lower 10 feet constituting the pay zone. The rectangular shaft, six by eight feet at the top and widening into a 20-foot-square room at the bottom, was sunk to a depth of 113 feet through the sand. Workmen were lowered into the shaft by means of a hoisting cage. The Company planned to drill 24 horizontal holes radially from the bottom of the shaft into the First Cow Run sand. The first two holes were successfully completed and had a combined production of 12 to 14 barrels of oil per day after being shot along their entire length. The expense of operation at this point became too great for the rewards and the Blakson Oil Company was forced to abandon the project. The well was operated for a few years by local men but is now shut down.

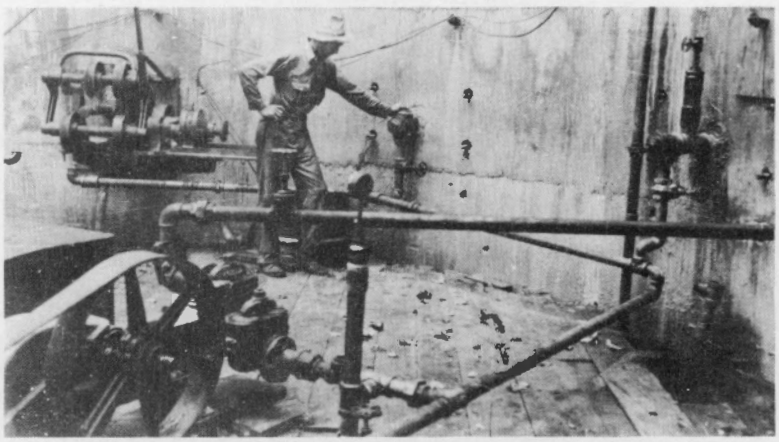


Fig. 24. Bottom of the pit from which horizontal wells were bored radially into the Cow Run sand. Workman has his hand on one of the wells.

APPENDIX I

SAMPLE ANALYSIS OF TWO WELLS IN MORGAN COUNTY

Analyses of samples from two wells in Morgan County were made by George G. Shearrow of the Survey staff and the findings presented here. A nearly complete "string" of cuttings were saved and processed from the Murrey well but cuttings from the Barnes well were not saved until the Silurian rocks were penetrated. The latter was drilled into the Cambrian and is the deepest hole in Morgan County to date.

Due to the limited data available, the interpretations made in these analyses are considered as preliminary. The drillers' logs are presented for comparison.

J. E. MORROW - L. F. MURREY # 1

SECTION 12, MEIGSVILLE TOWNSHIP, MORGAN COUNTY

ELEVATION: 865 FEET

DRILLERS' LOG		SAMPLE ANALYSIS	
		Pennsylvanian	
1 - 72	Clay	0 - 73	No samples
72 - 111	Big Lime	73 - 110	Limestone, light brown to gray, dense
111 - 122	Shale	110 - 115	Shale, medium green, slightly calcareous
		115 - 122	Shale, dark gray
122 - 125	Coal	122 - 125	Coal
125 - 128	Lime	125 - 140	Limestone, light brown, dense
128 - 132	Shale	140 - 160	Limestone, light brown to gray, dense
132 - 145	Lime	160 - 180	Shale, grayish green
145 - 245	Shells	180 - 185	Shale, gray, minor amounts of coal
		185 - 220	Shale, gray
		220 - 225	Shale, dark gray, traces of coal
		225 - 245	Limestone, buff to light brown, dense
245 - 340	Red shale	245 - 340	Shale, reddish brown, calcareous
340 - 385	Gray shale	340 - 385	Shale, green and brown, calcareous
385 - 400	Red shale	385 - 400	Shale, reddish brown and green, calcareous
400 - 402	Cambridge lime	400 - 402	Limestone, buff, dense
402 - 540	Shale	402 - 410	Shale, reddish brown and green, calcareous
		410 - 450	Siltstone, greenish gray
		450 - 470	Limestone, gray, brown, green, dense, traces of pyrite
		470 - 505	Shale, medium green
		505 - 525	Shale, dark gray
		525 - 540	Shale, reddish brown
540 - 570	Sand	540 - 570	Sandstone, white, fine- to medium-grained
570 - 580	Shale	570 - 580	Shale, reddish brown and gray
580 - 630	Sand	580 - 590	Sandstone, white, fine- to medium-grained, aggregate
		590 - 595	Shale, dark gray
		595 - 600	Sandstone, light gray, very fine- to fine-grained, aggregate
		600 - 625	Sandstone, white, fine- to medium-grained, subangular, aggregate

DRILLERS' LOG			SAMPLE ANALYSIS		
			625 - 626	Coal, traces
630 - 770		Blue shale	626 - 650	Shale, gray
			650 - 655	Limestone, light brown, dense, cherty
			655 - 656	Coal, traces
			656 - 705	Sandstone, white, fine-grained, subangular, aggregate
			705 - 755	Shale, medium gray
			755 - 765	Siltstone, light gray
			765 - 775	Shale, medium gray
			775 - 785	Siltstone, light gray
770 - 800		White sand	785 - 800	Sandstone, white, fine-grained, aggregate
800 - 810		White shale	800 - 805	Shale, gray
			805 - 810	Sandstone, white, fine-grained, aggregate
810 - 815		White sand	810 - 849	Shale, dark gray and brown
815 - 855		Brown shale	849 - 850	Coal, traces
855 - 860		White sand	850 - 860	Siltstone, dark gray
860 - 910		Blue shale	860 - 870	Shale, dark gray, traces of coal
			870 - 905	Shale, dark gray
			905 - 910	Shale, dark gray, traces of coal
910 - 1,080		White sand	910 - 920	Sandstone, white, very fine-grained, aggregate
			920 - 925	Shale, gray
			925 - 945	Shale, medium gray, minor amounts of light gray siltstone
			945 - 960	Sandstone, white, very fine- to fine-grained, aggregate
			960 - 1,005	Sandstone, white, fine-grained, aggregate
			1,005 - 1,025	Sandstone, white, very fine-grained, aggregate
			1,025 - 1,055	Siltstone, gray, fragments of limestone, traces of siderite and limonite
				Mississippian
				Logan and Cuyahoga Formations
			1,055 - 1,075	Siltstone, calcareous, light blue-gray
			1,075 - 1,095	Siltstone, light blue-gray, minor amounts of light gray shale
1,080 - 1,155		Green shale	1,095 - 1,105	Shale, dark gray
			1,105 - 1,115	Siltstone, gray
			1,115 - 1,125	Siltstone and shale, gray
			1,125 - 1,150	Shale, gray, minor amounts of gray siltstone
1,155 - 1,190		Big Injun sand, water	1,150 - 1,170	Sandstone, conglomeratic, with fine- to coarse-grained subangular sand
			1,170 - 1,175	Siltstone, gray and brown
			1,175 - 1,190	Sandstone, conglomeratic, fine- to coarse-grained subangular sand
1,190 - 1,280		White sand & shale	1,190 - 1,195	Sandstone, very fine-grained, aggregate
			1,195 - 1,230	Shale and siltstone, medium gray
1,280 - 1,300		White sand	1,230 - 1,290	Siltstone, medium gray, minor amounts of gray shale
1,300 - 1,590		Blue shale	1,290 - 1,350	Shale, medium gray, minor amounts of gray siltstone
			1,350 - 1,470	Siltstone, medium gray, minor amounts of gray shale
			1,470 - 1,500	Shale, medium gray
			1,500 - 1,520	Shale, medium gray, minor amounts of siltstone
			1,520 - 1,580	Shale, medium gray, minor amounts of brown shale

DRILLERS' LOG		SAMPLE ANALYSIS	
			Sunbury Formation
		1,580 - 1,600	Shale, dark gray
1,590 - 1,615	Brown shale	1,600 - 1,615	Shale, black
			Berea Formation
1,615 - 1,660	Berea sand, show of gas & oil; HFW	1,615 - 1,620	Sandstone, very fine-grained, aggregate
		1,620 - 1,650	Sandstone, very fine-grained, subangular
1,660 - 1,706	Shale	1,650 - 1,700	Siltstone, medium gray
			Bedford Formation
		1,700 - 1,705	Siltstone, medium gray, minor amounts of red shale
1,706 - 2,750	Shale	1,705 - 1,740	Shale, medium gray, minor amounts of brown shale
			Devonian
			Ohio Formation
		1,740 - 1,940	Shale, medium to dark gray
		1,940 - 1,955	Siltstone, med gray, minor amounts of dark gray shale
		1,955 - 1,970	Shale, medium to dark gray
		1,970 - 2,010	Shale, medium gray, minor amounts of gray siltstone
		2,010 - 2,235	Shale, medium to dark gray
		2,235 - 2,315	Shale, light to medium gray
		2,315 - 2,330	Shale, light to medium gray, traces of siltstone
		2,330 - 2,370	Shale, light to medium gray
		2,370 - 2,385	Shale, light to medium gray, traces of siltstone
		2,385 - 2,490	Shale, light to medium gray
		2,490 - 2,505	Shale, light to med. gray, traces of light gray siltstone
		2,505 - 2,595	Shale, light to medium gray
		2,595 - 2,660	Shale, lt. to med. gray, minor amounts of gray siltstone
		2,660 - 2,780	Shale, medium to dark gray
2,750 - 2,900	Shale	2,780 - 2,960	Shale, black
2,900 - 3,190	Shale	2,960 - 2,970	Shale, dark gray to black
		2,970 - 3,190	Shale, black
			Olentangy Formation
3,430 - 3,620	Blue shale	3,190 - 3,620	Shale, light to medium gray, very slightly calcareous
			Columbus Formation
3,620 - 4,824	Niagara lime	3,620 - 3,630	Limestone, brown, dense, 10% chert
		3,630 - 3,660	Limestone, brown to buff, dense, 60-75% chert
		3,660 - 3,720	Limestone, buff, dense, 50 to 75% chert, traces of very fine sand
			Oriskany Formation
3,710 - 3,730	Oriskany, gas; 60,000 blew down	3,720 - 3,728	Sandstone, fine-grained, subangular, 15% limestone

DRILLERS' LOG		SAMPLE ANALYSIS	
		3,728 - 3,735	Sandstone, very fine- to fine-grained, subangular, 10% limestone
		3,735 - 3,745	Limestone, buff to white, dense, 40% very fine-grained subangular sandstone
			Lower Helderberg Group
		3,745 - 3,855	Limestone, buff to gray, dense, 20 to 60% chert
			Silurian
			Cayuga Group
3,900 -	Water	3,855 - 3,940	Limestone, buff, dense to finely crystalline, 10% chert
		3,940 - 4,050	Dolomite, brown to buff, dense, 40 to 50% anhydrite, traces of brown and gray shale
		4,050 - 4,195	Dolomite, buff, dense to finely crystalline, 30 to 40% brn. and gry shale, minor amounts of anhydrite
		4,195 - 4,390	Dolomite, buff to brown, dense, 20 to 30% brown and gray shale, minor amounts of anhydrite
		4,390 - 4,450	Dolomite, brown and green, dense, 40 to 60% gray, brown, and green shale, traces of anhydrite
		4,450 - 4,545	Dolomite, buff to brown, dense, 40 to 50% gray and brown shale, traces of anhydrite
			Lockport Formation
		4,545 - 4,600	Dolomite, brown and gray, finely crystalline, 20% gray and brown shale, traces of gypsum
		4,600 - 4,670	Dolomite, brown, dense to finely crystalline, 15 to 20% brown shale, traces of gypsum
		4,670 - 4,690	Limestone, brown, finely crystalline, 30% gray shale, traces of gypsum
		4,690 - 4,695	Limestone, brown, finely crystalline, 25% gypsum
		4,695 - 4,720	Limestone, brown, finely crystalline, 10% brown shale
		4,720 - 4,735	Limestone, brown, dense to finely crystalline, 20% brown shale
		4,735 - 4,750	Limestone, brown, dense to finely crystalline, 35% brown shale
			Clinton Formation
		4,750 - 4,765	Shale, gray brown, 15% brown crystalline dolomite
		4,765 - 4,775	Shale, gray-brown, 15% very fine-grained aggregate sandstone, 10% brown, crystalline dolomite
		4,775 - 4,805	Dolomite, brown to buff, finely crystalline, 30% very fine-grained, aggregate sst., 15% gray shale
		4,805 - 4,815	Shale, gray, 15% very fine-grained aggregate sandstone, 10% brown, crystalline dolomite
4,824 - 5,003	Gray shale	4,815 - 4,830	Shale, gray, 10% gray and brown dense dolomite
		4,830 - 4,850	Shale, gray, 15% gray siltstone, 5% gray and brown dense dolomite

DRILLERS' LOG		SAMPLE ANALYSIS	
		4,850 - 4,885	Shale, gray, red, and brown
		4,885 - 4,905	No sample
		4,905 - 4,930	Shale, gray, red and brown
		4,930 - 4,965	Shale, green, minor amounts of red, traces of glauconite
		4,965 - 5,005	Shale, calcareous, green, red, and gray
5,003 - 5,036	Shale	5,005 - 5,035	Shale, gray and red
			Medina Group
5,036 - 5,050	Shell	5,035 - 5,050	Dolomite, buff, coarsely crystalline, 15% chert, 30% gray and green shale
5,050 - 5,068	Shale	5,050 - 5,068	Shale, gray-green
5,068 - 5,084	Stray Sand	5,068 - 5,084	Sandstone, very fine-grained, aggregate
5,084 - 5,102	Gray shale	5,084 - 5,100	Shale, gray-green
5,102 - 5,135	Clinton Sand	5,100 - 5,108	Sandstone, very fine- to fine-grained, aggregate
		5,108 - 5,124	Sandstone, very fine- to fine-grained, subangular
		5,124 - 5,140	Sandstone, very fine-grained, aggregate, minor amts. of gray-green shale
		5,140 - 5,148	Sandstone, very fine- to fine-grained, subangular
5,135 - 5,207	Shale and shells	5,148 - 5,175	Shale, gray, interbedded gray siltstone
		5,175 - 5,185	Shale, gray
		5,185 - 5,205	Shale, gray, interbedded gray siltstones
5,207 - 5,225	Medina sand	5,205 - 5,211	Sandstone, very fine- to fine-grained, aggregate
		5,211 - 5,215	Sandstone, very fine- to fine-grained, subangular
5,227 - 5,231	Shale	5,215 - 5,231	No sample
5,231	Total Depth	5,231	Total Depth

NATIONAL GAS & OIL CORP. - MAYNARD BARNES # 1

SECTION 12, DEERFIELD TOWNSHIP, MORGAN COUNTY

ELEVATION: 928 FEET

DRILLERS' LOG		SAMPLE ANALYSIS	
		0 - 4,242	No samples
			Silurian
			Medina Group
4,239 - 4,250	Big shell	4,242 - 4,250	Dolomite, shaly, 40% gray shale
		4,250 - 4,255	Shale, gray
4,258 - 4,263	Second shell	4,255 - 4,265	Shale, gray, 20% brown, dense dolomite, minor amounts of red hematite
4,263 - 4,276	Red rock	4,265 - 4,270	Shale, gray, 20% brown, dense dolomite
		4,270 - 4,274	Shale, gray, 20% brown, dense dolomite, 10% very fine-grained sandstone

DRILLERS' LOG		SAMPLE ANALYSIS	
4,276 - 4,337	Clinton sand show gas; 20,000	4,274 - 4,278	Sandstone, very fine-grained, aggregate
		4,278 - 4,295	Shale, gray, 35% very fine-grained, aggregate sandstone
		4,295 - 4,309	Sandstone, very fine-grained, aggregate, minor amounts of gray shale
		4,309 - 4,325	Sandstone, very fine- to fine-grained, subangular
4,337 - 4,394	Dark shale	4,325 - 4,345	Shale, gray, 20% very fine-grained, aggregate sandstone
		4,345 - 4,395	Shale, gray, traces of very fine-grained, aggregate sandstone
4,394 - 4,401	Medina sand, dry	4,395 - 4,400	Sandstone, very fine-grained, subangular
4,401 - 4,411	Gray shale	4,400 - 4,411	Shale, gray, 35% very fine-grained, aggregate sandstone
			Ordovician
			Cincinnatian Series
4,411 - 4,696	Red shale	4,411 - 4,556	Shale, red
		4,556 - 4,566	No sample
		4,566 - 4,665	Shale, red
		4,665 - 4,695	Shale, brown
4,696 - 5,510	Gray shale	4,695 - 4,720	Shale, gray, traces of very fine-grained aggregate sandstone
		4,720 - 4,750	Shale, gray, 10% very fine-grained aggregate sandstone
		4,750 - 4,765	Shale, gray, traces of very fine-grained aggregate sandstone
		4,765 - 4,790	Shale, gray, 10% very fine-grained aggregate sandstone
		4,790 - 4,875	Shale, gray, traces of very fine-grained aggregate sandstone
		4,875 - 4,895	Shale, gray, 20% fossiliferous limestone, traces of very fine-grained aggregate sandstone
		4,895 - 4,905	Shale, gray, traces of very fine-grained aggregate sandstone
		4,905 - 4,920	Shale, gray, 35% fossiliferous limestone, traces of very fine-grained aggregate sandstone
		4,920 - 4,930	Shale, gray
		4,930 - 4,945	Shale, gray, 20% fossiliferous limestone
		4,945 - 5,005	Shale, gray, 30% fossiliferous limestone
		5,005 - 5,085	Shale, gray, 35% dense limestone, traces of very fine-grained aggregate sandstone
		5,085 - 5,100	Shale, gray, 25% dense limestone, traces of very fine-grained aggregate sandstone
		5,100 - 5,135	Shale, gray, 40% dense limestone
		5,135 - 5,160	Shale, gray, 15% dense limestone
		5,160 - 5,180	Shale, gray, 35% dense limestone
		5,180 - 5,200	Shale, gray, 10% dense limestone
		5,200 - 5,240	Shale, gray, 25% dense limestone
		5,240 - 5,260	Shale, gray
		5,260 - 5,275	Shale, gray, calcareous
		5,275 - 5,305	Shale, gray
		5,305 - 5,320	Shale, gray, calcareous
		5,320 - 5,350	Shale, gray
		5,350 - 5,395	Shale, gray, calcareous
		5,395 - 5,405	Shale, gray

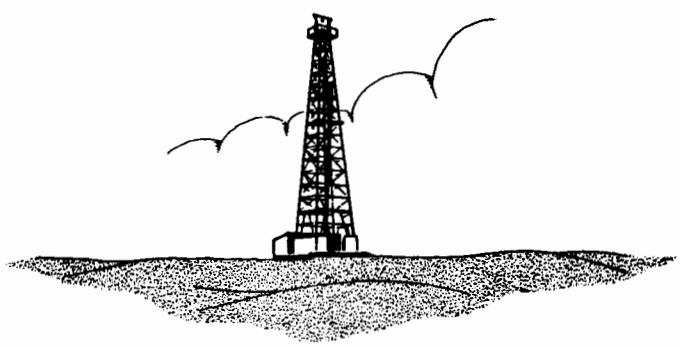
DRILLERS' LOG		SAMPLE ANALYSIS	
		5,405 - 5,455	Shale, gray, calcareous
		5,455 - 5,470	Shale, gray
		5,470 - 5,495	Shale, gray, calcareous
		5,495 - 5,510	Shale, gray
5,510 - 5,562	Brown shale	5,510 - 5,580	Shale, gray, calcareous
5,562 - 5,592	Black shale	5,580 - 5,592	Shale, gray
5,592 - 5,720	Dark brown shale	5,592 - 5,635	Shale, black
		5,635 - 5,681	Shale, black, calcareous
		5,681 - 5,690	Shale, brown, 45% dense fossiliferous limestone
		5,690 - 5,705	Shale, brown, 35% dense fossiliferous limestone
		5,705 - 5,719	Shale, brown, 45% dense fossiliferous limestone
			Trenton Formation
5,720 - 6,437	Trenton limestone, dry	5,719 - 5,735	Limestone, light brown, dense, fossiliferous, 30% gray and brown shale, traces of chert
		5,735 - 5,765	Limestone, light brown and gray, dense, 35% brown and gray shale, traces of chert
		5,765 - 5,780	Limestone, light brown, dense, 35% brown and gray shale, traces of chert
		5,780 - 5,790	No sample
		5,790 - 5,815	Limestone, light brown
			Black River Formation
		5,815 - 5,835	Limestone, light brown, lithographic, 10% gray and brown shale
		5,835 - 5,845	Limestone, light brown, lithographic, 25% gray and brown shale, traces of chert and bentinitic shale
		5,845 - 5,885	Limestone, light brown, lithographic, 5% gray and brown shale, traces of chert
		5,885 - 5,925	Limestone, brown, lithographic, 25% gray and brown shale
		5,925 - 6,095	Limestone, light brown, lithographic, 5% brown shale
		6,095 - 6,160	Limestone, light brown, lithographic, 25% brown shale
		6,160 - 6,165	Limestone, light brown, lithographic, 35% gray and brown bentinitic shale
		6,165 - 6,200	Limestone, light brown, dense to crystalline, 10% gray and brown shale, traces of dolomitic chert
		6,200 - 6,290	Limestone, light brown, lithographic, 15% brown shale
		6,290 - 6,315	Limestone, brown, lithographic, 25% brown shale and chert
		6,315 - 6,355	Limestone, brown, lithographic, 35% brown shale and chert
		6,355 - 6,390	Limestone, light brown, lithographic, 5% brown shale
		6,390 - 6,400	Limestone, light brown, dense, 35% brown shale and chert
		6,400 - 6,415	Limestone, light brown, lithographic, 25% brown shale and chert
		6,415 - 6,425	Limestone, light gray and brown, lithographic, 40% brown shale and chert

DRILLERS' LOG		SAMPLE ANALYSIS	
6,437 - 6,493	Green shale	6,425 - 6,450	Limestone, light gray and brown, lithographic, 25% brown shale and chert
		6,450 - 6,460	Shale, gray and green, 35% lithographic limestone (Glenwood Horizon)
		6,460 - 6,475	Dolomite, green, crystalline, 35% green shale and gray chert
		6,475 - 6,493	Shale, green, 25% green and brown crystalline dolomite
			Cambrian
			St. Peter Formation
6,493 - 6,610	Dolomite	6,493 - 6,501	Sandstone, fine- to medium-grained, rounded and frosted
			Oneota Formation ?
		6,501 - 6,505	Dolomite, gray and brown, crystalline, 45% very fine-grained sandstone, traces of glauconite
		6,505 - 6,510	Dolomite, gray and brown, crystalline, 15% very fine-grained subangular sandstone, traces of glauconite
		6,510 - 6,515	Dolomite, gray and brown, crystalline, 40% very fine-grained subangular sandstone
		6,515 - 6,520	Dolomite, brown, crystalline, 20% very fine-grained subangular sandstone
		6,520 - 6,535	Dolomite, brown, crystalline, 25% brown chert and gray shale, traces of pyrite
		6,535 - 6,540	Dolomite, brown, crystalline, 20% gray shale
		6,540 - 6,550	Dolomite, white, brown, and gray, crystalline, 20% very fine-grained subangular sandstone, traces of gray shale
		6,550 - 6,560	Dolomite, white and gray, crystalline, 15% gray shale, traces of pyrite
		6,560 - 6,575	Dolomite, white and gray, crystalline, 20% white dolomitic chert and gray shale
		6,575 - 6,590	Dolomite, white and brown, crystalline, 15% gypsum sand and gray shale
		6,590 - 6,610	Dolomite, white and brown, crystalline, 10% gypsum sand and white dolomitic chert, traces of gray shale
6,610 - 6,631	Sandy dolomite	6,610 - 6,620	Dolomite, brown, crystalline, 45% gypsum sand and gray, brown, and red shale
		6,620 - 6,625	Dolomite, brown, crystalline, 25% very fine- to fine-grained quartz sand and 40% gypsum sand
		6,625 - 6,630	Dolomite, brown, crystalline, 35% chert sand and shale
6,631 - 6,644	St. Peter water	6,630 - 6,644	Sandstone, fine-grained, subangular to rounded and frosted, 10% brown crystalline dolomite
6,644	Total Depth	6,644	Total Depth

APPENDIX II

WELL DATA TABLES

The following tables are records of wells with known surface elevations that penetrate the First Berea sand and deeper formations in Morgan County. The section, farm name, total depth, depths of producing horizons, and initial production are listed. The wells are numbered in order by townships and coincide with the map numbers on Plate IV.



WELL DATA

M = Thousand cubic feet
Bbl = Barrels, 42-gallon standard
S. g. = Show of gas
S. o. = Show of oil

Elevations given in tenths and hundredths determined by spirit level, others by altimeter.

Plate No.	Sec. No.	Operator	Farm Name and Well No.	Date Comp	Total Depth	Depth of Sand Below Surface				Surface Elevation	Depth of Top of Sand Below Sea Level				Initial Production	Producing Sand	Remarks
						1st Berea	2nd Berea	Clinton	Medina		1st Berea	2nd Berea	Clinton	Medina			
						BLOOM TOWNSHIP											
1	2	B. G. Bartley	Ross Robinson No. 2	1947	4,456	1,325 1,353	1,368 1,390	4,412 4,443		879	446	489	3,533		25 Bbls	Clinton	
2	2	H. K. Porter, Inc.	Marietta White No. 1	1944	4,735	1,482 1,502	1,525 1,550	4,583 4,641	4,715 4,735	1,030	452	495	3,553	3,785	3 Bbls	Clinton	Medina dry
3	3	Stephens Petroleum Co.	A. E. Baker No. 1	1947	4,603	1,472 1,504	1,522 1,550	4,541 4,585		999	471	521	3,540		20 Bbls	Clinton	
4	3	Stephens Petroelum Co.	Ross N. Robinson No. 1	1946	4,417	1,335 1,353	1,375 1,390	4,387 4,416		840	495	535	3,547		6,000 M	Clinton	
5	4	Stephens Petroelum Co.	Van Horn, Rex & Barr No. 1	1946	4,443	1,400 1,417	1,400 1,450	4,409 4,442		964	436		3,445		4,800 M	Clinton	
6	4	Industrial Gas Corp.	Hiran F. Barr No. 1	1943	4,535	1,443 1,454	1,480 1,500	4,471 4,518		997	431	477	3,471		143 M	Clinton	S. g. in Ohio Shale
7	4	Industrial Gas Corp.	Chas. Reeder No. 2	1943	4,507	1,364 1,380	1,410 1,430	4,398 4,442	4,490 4,500	930	434	480	3,468	3,560	Dry		
8	5	Stephens Petroleum Co.	C. H. Van Horn No. 1	1945	4,410	1,390 1,405	1,440 1,444	4,389 4,410		959	431	481	3,430		12,500 M	Clinton	
9	5	Ohio Fuel Gas Co.	R. F. Williams et al No. 1	1944	4,146	1,130 1,145	no sand	4,100 4,130		724.5	405		3,375		525 M	Clinton	S. g. in 1st Berea
10	5	Ohio Fuel Gas Co.	R. F. Williams et al No. 3	1945	4,099	1,113 1,123	1,158 1,165	4,077 4,087		680.5	432	477	3,396		830 M	Clinton	
11	8	H. K. Porter, Inc.	C. H. Van Horn No. 1	1945	4,394	1,352 1,377	1,400 1,422	4,376 4,394		921	431	479	3,455		1,324 M	Clinton	
12	8	Ohio Fuel Gas Co.	C. E. Maatz No. 1	1945	4,421	1,328 1,345	no sand	4,307 4,344	4,409 4,421	910.7	417		3,396	3,498	Dry		
13	8	H. K. Porter, Inc.	Lyle Carpenter No. 1	1944	4,390	1,375 1,388	1,422 1,435	4,357 4,384		945	430	477	3,412		800 M	Clinton	
14	8	Stephens Petroleum Co.	E. W. Pool No. 1	1946	4,232	1,141 1,158	1,190 1,210	4,116 4,160	4,216 4,222	744	397	446	3,372	3,472	Dry		
15	9	Industrial Gas Corp.	Gifford-Stewart No. 1	1944	4,515	1,457 1,473	1,503 1,521	4,475 4,500		1,016	441	487	3,459		800 M	Clinton	
16	9	Industrial Gas Corp.	Robinson-Huffman No. 1	1944	4,489	1,369 1,386	1,410 1,430	4,383 4,407	4,480 4,487	917	452	483	3,466	3,563	930 M	Clinton	Medina dry
17	9	Industrial Gas Corp.	Huffman-Stewart No. 1	1944	4,520	1,375 1,398	1,413 1,438	4,393 4,441		929	446	484	3,464		Dry		
18	9	E. Kent Kane	J. C. Sewart No. 1	1948	4,483	1,344 1,361	1,394 1,419	4,350 4,402	4,467 4,474	900	444	494	3,450	3,467	50 M	Clinton	Medina dry
19	10	Palm Oil Corp.	C. Richardson No. 1	1944	4,522	1,348 1,360	1,390 1,400	4,388 4,426		897	451	493	3,491		150 M	Clinton	
20	10	H. K. Porter, Inc.	C. Richardson No. 1	1944	4,562	1,313 1,336	1,364 1,378	4,403 4,423	4,527 4,539	844	408	449	3,498	3,822	Dry		
21	10	Industrial Gas Corp.	E. E. Stewart No. 2	1944	4,525	1,390 1,405	1,435 1,455	4,473 4,500		966	455	499	3,537		184 M	Clinton	
22	10	McKenzie & Silhol	E. E. Stewart No. 3	1945	4,395	1,305 1,320	1,345 1,360	4,345 4,384		861	500	540	3,540		150 M	Clinton	
23	10	Davis & Hazlett	H. Richardson No. 2	1943	4,355	1,250 1,263	1,290 1,326	4,321 4,354		840	410	450	3,481		4,500 M	Clinton	
24	10	H. K. Porter, Inc.	D. Richardson No. 1	1944	4,576	1,425 1,448	no sand	4,536 4,575		959	466		3,577		Dry		
25	11	Palm Oil Corp.	W. Richardson No. 1	1944	4,727	1,480 1,530	no sand	4,600 4,635	4,714 4,716	982	498		3,618		Dry		
26	15	H. K. Porter, Inc.	T. L. Lyons No. 1	1945	4,470	1,265 1,283	1,304 1,332	4,340 4,371	4,440 4,447	832	413	452	3,488	3,588	Dry		
27	15	Palm Oil Corp.	Greer & Lyons No. 1	1944	4,439	1,325 1,348	no sand	4,377 4,437		858	467		3,519		567 M	Clinton	
28	16	Ohio Fuel Gas Co.	W. L. McElheny et al No. 1	1944	4,598	1,450 1,470	1,503 1,523	4,472 4,502	4,572 4,582	1,003.7	446	499	3,468	3,568	Dry		
29	16	H. K. Porter, Inc.	S. A. Greer No. 1	1944	4,620	1,468 1,486	1,520 1,500	4,520 4,550	4,620	1,004	464	516	3,516		52 M	Clinton	S. o. top Big Lime
30	21	Industrial Gas Corp.	Frank Strahler No. 1	1944	4,413	1,190 1,208	1,240 1,255	4,200 4,245	4,310	724	466	516	3,476		Dry		
31	24W	Ohio Fuel Gas Co.	Milton Fouts No. 1	1943	4,198	1,185 1,200	no sand	4,144 4,198		787.26	398		3,357		15,151 M	Clinton	
32	24	Preston Oil Co.	Milton Fouts No. 2	1944	4,257	1,185 1,200	no sand	4,168 4,181	4,248 4,253	788.7	396		3,379	3,479	Dry		S. o. in Medina
33	24	Ohio Fuel Gas Co.	C. E. Mercer No. 1	1941	4,239	1,195 1,208	1,245 1,255	4,139 4,169	4,231 4,239	809	386	436	3,330	3,422	200M	Clinton	Water in Medina
34	25	Ohio Fuel Gas Co.	Taylor & Jackson II No. 1	1945	4,054	1,055 1,080	1,118 1,125	4,038 4,051		669.9	385	448	3,368		560 M	Clinton	
35	25	Industrial Gas Corp.	Clovis Mercer No. 1	1945	4,336	1,355 1,378	1,405 1,425	4,304 4,334		935	420	470	3,369		2,000 M	Clinton	
36	25	Industrial Gas Corp.	Clovis Mercer No. 2	1945	4,174	1,151 1,174	1,200 1,220	4,088 4,120		754	397	446	3,334		Dry		
37	26	Logan Gas Co.	Jeff Huffman No. 1	1928	4,665	1,470 1,490	1,516 1,533	4,595 4,621		973	497	526	3,622		Dry		
38	36	Ohio Fuel Gas Co.	S. R. Birton No. 1	1944	4,436	1,437 1,457	1,484 1,494	4,396 4,434		1,032.1	405	452	3,364		393 M	Clinton	
39	3	National Gas & Oil Corp.	C. J. Ross No. 1	1948	4,550	1,344 1,360	1,385 1,410	4,400 4,451	4,516 4,525	882	462	503	3,558		Dry		S. g. in 2nd Berea
40	11	Clyde Foraker	Maynard Williams No. 1	1935	1,410	1,333 1,358	1,381 1,394			786	547	595			Dry		S. g. in 2nd Berea
41	14	Logan Gas Co.	Clarence Lyons No. 1	1927	1,556	1,488 1,505	1,536 1,551			986	502	550			Dry		Water in 1st Berea
42	21	Producers Natural Gas Co.	J. C. Cooper No. 1	1927	1,434	1,355 1,382	1,413 1,420			898	457	515			67 M	2nd Berea	
						BRISTOL TOWNSHIP											
1	6	Industrial Gas Corp.	Aurice Richards No. 1	1943	4,846	1,548 1,617	no sand	4,715 4,765	4,832 4,836	990	558		3,725	3,842	Dry		
2	13	Wittmer Oil & Gas Corp.	Ivan E. Morris No. 1	1948	4,969	1,456 1,492	no sand	4,855 4,894	4,951 4,962	767	689		4,088	4,184	452 M	Clinton	Medina dry
3	24	Wittmer Oil & Gas Corp.	W. D. Wortman No. 1	1948	4,901	1,450 1,490	no sand	4,840 4,879		781	669		4,059		1,047 M	Clinton	S. g. in Oriskany
4	14	Pamaco Gas & Oil Co.	T. V. Ray No. 1	1952	5,129			5,010 5,055		978			4,032		Dry		
5	23	Speary Oil & Gas Co.	Hardesty Heirs No. 1	1940	1,505	1,400 1,437	no sand			750	650				Dry		Water in Berea
6	24	Noble Drilling Co.	F. A. Davis No. 1	1951	1,532	1,495 1,530				818	677				Dry		Water in Berea
7	29	Malta & McConnelsville Gas Co.	Sam E. Bone No. 1	1909	1,379	1,300 1,319	1,333 1,363			713.4	587	620			Dry		
8	30	Ohio Fuel Gas Co.	Samuel E. Bone No. 1	1951	1,428	1,357 1,375	1,396 1,420			799.2	558	597			Dry		S. g. in 2nd Berea
9	31	Malta & McConnelsville Gas Co.	B. F. Reed No. 1 ?	1900	1,584	1,498 1,516	1,536 1,562			919	579	617			Gas	2nd Berea	
10	31	Malta & McConnelsville Gas Co.	B. F. Reed No. 1 ?	1901	1,666	1,580 1,597	1,616 1,640			1,015.5	582	601			Gas	2nd Berea	
11	31	Malta & McConnelsville Gas Co.	B. F. Reed No. 1 ?	1901	1,564	1,482 1,497	1,519 1,542			911	571	608			Gas	2nd Berea	
12	30	Malta & McConnelsville Gas Co.	H. C. Ingram No. 1	1902	1,902	1,486 1,502	1,526 1,547			920.1	566	599			Gas	2nd Berea	
13	32	Malta & McConnelsville Gas Co.	W. F. Fox No. 1	1909	1,554	1,495 1,508	no sand			899.7	595				Dry		S. o. & g. in 2nd Berea

CENTER TOWNSHIP

1	9	Robt. Lewis	C. E. Combs No. 1	1936	3,719	1,524	1,582	no sand					738.13	786				Dry		S. g. in 1st Berea
2	12	Robt. Lewis	James Danford No. 3	1936	1,540	1,532	1,540						706	826				Dry		S. o. & wtr., 1st Berea
3	12	Barnesville Development	Jas. Danford No. 1	1936	1,548	1,534	1,548						710	824				Dry		S. o. & wtr., 1st Berea
4	13	Dengle Firm	Laura Orum No. 1	1950	1,631	1,601	1,610						770	831				Oil	1st Berea	
5	13	Dengle Firm	Laura Orum No. 2	1950	1,584	1,552	1,571						724	828				Oil	1st Berea	
6	23	White Oil Co.	Clint Taylor No. 1	1947	1,549	1,540	1,549						667	879				Oil	1st Berea	
7	23	White Oil Co.	W. C. & Lydia Fisher No. 3	1940	1,580	1,573	1,580						710	863				8 Bbls	1st Berea	
8	23	White Oil Co.	L. V. Fisher No. 4	1947	1,613	1,604	1,613						745	859				Oil	1st Berea	
9	23	White Oil Co.	L. V. Fisher No. 5	1948	1,622	1,608	1,622						739	869				Oil	1st Berea	
10	23	White Oil Co.	L. V. Fisher No. 6	1951	1,644	1,627	1,644						753	874				Oil	1st Berea	
11	24	White Oil Co.	Herman Hilton No. 1	1944	1,658	1,637	1,658						734	903				Dry		S. o. & g. in 1st Berea
12	24	Dengle Firm	D. & L. Wagner No. 1	1949	1,773	1,675	1,690						828	847				Dry		
13	24	Dengle Firm	Denver Wagner No. 4	1950	1,637	1,632	1,637						777	855				1 Bbl.	1st Berea	
14	24	Wm. Patten, et. al.	L. C. Taylor No. 1	1949	1,608	1,602	1,608						729	873				Gas	1st Berea	
15	24	Ohio Fuel Gas Co.	W. W. Gordon No. 1	1906	1,637	1,625	1,637						731	894				Dry		S. o. & g. in 1st Berea
16	30	Deist, et. al.	L. R. Deist No. 1	1950	1,482	1,464	1,482						648	816				Dry		Wtr. in 1st Berea
17	27	Not known	Caldwell Country Club	19—	1,616	1,605	1,616						733	872				Oil	1st Berea	
18	26	Not known	Elmer Fitch No. 1	19—		1,528	1,536						655	873				Dry		S. o. & g. in 1st Berea
19	30	B. H. Putnam	L. R. Deist No. 1	1951	3,758	1,587	1,630						782	805				Dry		

DEERFIELD TOWNSHIP

1	2	Industrial Gas Corp.	T. Southard-P. Clawson No. 1	1944	4,365	1,345	1,362	no sand		4,247	4,295	4,356	4,365	982	363		3,265	3,374	Dry		S. o. & wtr. in Medina
2	3	Ohio Fuel Gas Co.	Delmar Woodward No. 1	1943	4,082	1,137	1,152	1,190	1,205	4,049	4,079			789.5	347	400	3,259		263M	Clinton	S. o. in 1st Berea
3	3	Ohio Fuel Gas Co.	Alice Piper No. 1	1944	4,317	1,378	1,396	1,428	1,443	4,272	4,301			1,035.7	342	392	3,236		Dry		S. g. in Clinton
4	4	Industrial Gas Corp.	Perley & Emma Weaver No. 1	1942	4,275	1,321	1,336	1,375	1,388	4,160	4,194			1,020	301	355	3,140	3,255	Dry		
5	5	Industrial Gas Corp.	Anna Steiner No. 2	1944	4,151	1,257	1,273	1,310	1,322	4,039	4,064	4,130	4,136	1,005	252	305	3,034	3,125	Dry		S. o. & g. in Clinton
6	10	Ohio Fuel Gas Co.	R. O. Massey No. 1	1945	4,442	1,372	1,397	no sand		4,311	4,365	4,428	4,438	1,036.3	336		3,275	3,275	Dry		
7	11	Industrial Gas Corp.	Gertie Edgell No. 1	1945	4,283	1,330	1,350	no sand		4,245	4,283			918	412		3,327		Dry		S. g. in Clinton
8	11	Industrial Gas Corp.	Florence Martin No. 1	1945	4,336	1,358	1,377	no sand		4,268	4,314			988	370		3,280		333M	Clinton	
9	11	Ackerman Development Co.	J. C. Benanti No. 2	1948	4,194	1,195	1,207	1,248	1,260	4,157	4,194			838	357	410	3,319		466M	Clinton	
10	11	J. E. Morrow	C. C. Jadwin No. 1 (2)	1948	4,331	1,280	1,305	1,350	1,360	4,233	4,265	4,321	4,328	906	374	444	3,327	3,415	Dry		S. g. in Clinton
11	11	Moore & Co.	Florence Martin No. 2	1946	4,338	1,387	1,397	1,437	1,442	4,314	4,338			1,004	383	433	3,310		2,457M		
12	12	National Gas & Oil Corp.	Maynard Barnes No. 1	1947	6,644	1,310	1,329	1,354	1,369	4,276	4,337	4,394	4,401	925	385	429	3,351	3,416	Dry		S. g. in Clinton
13	12	Ackerman Development Co.	Sherman Lett No. 1	1948	4,406	1,340	1,360	no sand		4,302	4,335	4,406		1,008	332		3,294		Dry		
14	12	Ackerman Development Co.	J. C. Benanti No. 1	1948	4,173	1,198	1,205	1,240	1,252	4,134	4,160			811	387	429	3,323		3,855M	Clinton	
15	12	Industrial Gas Corp.	J. H. C. Smith No. 2	1946	4,366	1,334	1,356	1,390	1,406	4,288	4,322			1,027	307	363	3,261		Dry		
16	14	H. R. Helvenston	Charles Wiseman No. 2	1947	4,397	1,357	1,372	1,420	1,422	4,296	4,324	4,390	4,397	958	399	462	3,338	3,412	150M	Clinton	Medina dry
17	15	Ohio Fuel Gas Co.	Albert E. Hivnor No. 1	1943	4,316	1,313	1,330	no sand		4,160	4,228	4,298	4,308	968.2	345		3,192	3,330	Dry		S. g. in Clinton
18	16	National Gas & Oil Corp.	Cyrus Banks No. 2	1948	4,200	1,325	1,337	1,372	1,385	4,140	4,193			1,020	305	352	3,120		Dry		S. g. in Clinton
19	17	Portage Producing Co.	Howard White No. 2	1937	4,188	1,240	1,280	no sand		4,068	4,093			915	325		3,153		Dry		
20	19	J. E. Morrow	Bruse & Ethel Ford No. 1	1947	4,194	1,320	1,324	no sand		4,107	4,132	4,186	4,191	998	322		3,109		Dry		S. g. in Clinton
21	20	E. D. Jennings	Wm. Bankes Heirs No. 1	1947	4,120	1,196	1,212	1,256	1,261	4,000	4,020	4,091	4,098	952	244	304	3,048	3,139	Dry		S. g. in Clinton
22	20	National Gas & Oil Corp.	Ralph Kinnan No. 1	1947	4,137	1,318	1,336	1,380	1,385	4,106	4,137			1,014	304	376	3,092		855 M	Clinton	
23	20	National Gas & Oil Corp.	Ralph Kinnan No. 2	1948	4,188	1,346	1,360	no sand		4,123	4,178			1,008	338		3,115		50M	Clinton	
24	20	National Gas & Oil Corp.	Lindemore - Banks No. 1	1947	4,255	1,325	1,350	1,380	1,405	4,135	4,188	4,248	4,255	1,016	309	364	3,119	3,232	Dry		S. g. in Clinton
25	21	Walter Linkhorn	Elmer Patterson No. 1	1947	4,256	1,322	1,338	1,380	1,388	4,161	4,184	4,251	4,256	977	345	403	3,184	3,274	Dry		
26	22	Ohio Fuel Gas Co.	Donald M. Finley No. 2	1946	4,318	1,300	1,317	1,370	1,374	4,200	4,227	4,311	4,318	914.4	414	456	3,286		Dry		S. g. Clin. ; S. o. Medina
27	22	Ohio Fuel Gas Co.	E. E. Price No. 1	1947	4,320	1,335	1,360	1,396	1,403	4,200	4,240	4,300	4,308	971.5	363	425	3,229	3,329	Dry		
28	27	Ohio Fuel Gas Co.	Geo. E. Carr et al No. 1	1946	4,278	1,318	1,333	1,368	1,374	4,241	4,258			922.5	395	445	3,318		1,420M	Clinton	
29	27	Ohio Fuel Gas Co.	A. M. Bankes No. 1	1946	4,289	1,293	1,308	1,345	1,355	4,188	4,192	4,281	4,287	902.5	390	442	3,285	3,378	Dry		
30	34	Ohio Fuel Gas Co.	Fred Roberts No. 1	1952	4,330	1,349	1,366	1,418	1,423	4,209	4,241	4,309	4,310	958.7	390	459	3,250	3,350	Dry		Water in Medina
31	3	Not known	W. H. & V. Maive No. 1		1,198	1,148	1,160	no sand						807.3	341				Dry		
32	5	Dailey Oil Co.	Geo. Steiner No. 1	1926	1,382	1,314	1,330	1,368	1,375					1,012	302	356			Dry		
33	6	Pemberton Bros.	Lester Edgel No. 2	1944	1,250	1,231	1,248							980	251				Dry		S. g. in 1st Berea
34	6	Industrial Gas Corp.	U. G. Custer No. 1	1944	1,267	1,245	1,262							974	271				Dry		S. o. in 1st Berea
35	8	Ohio Fuel Gas Co.	H. W. & H. P. Gordon No. 1	1921	1,357	1,333	1,350							1,022.5	310				Oil & gas	1st Berea	
36	8	Almendinger Oil Co.	C. E. & Mary Nelson No. 1	1947	1,362	1,338	1,354							1,039	299				40M		
37	9	Ohio Fuel Gas Co.	Harry E. Maxwell No. 1	1923	1,378	1,359	1,375							1,038	321				95M	1st Berea	
38	9	Ohio Fuel Gas Co.	C. H. Aler No. 1	1920	1,317	1,300	1,315							988.1	312				1117M	1st Berea	
39	9	Ohio Fuel Gas Co.	Chas. Porter No. 1	1923	1,427	1,405	1,421							1,090	315				150M	1st Berea	
40	9	Wildwood Oil & Gas Co.	C. E. Nelson No. 4	1937	1,367	1,336	1,356							1,010	326				100M	1st Berea	
41	15	Pure Oil Co.	O. & C. Ford No. 1	1918	1,272	1,243	1,270							904	339				Dry	1st Berea	
42	16	J. D. Pearce	C. H. Aler No. 1	1929	1,337	1,320	1,337							965	355				50M		
43	16	Peeper Run Oil & Gas	W. Masterson No. 2	1936	1,340	1,329	1,340							1,020	319				Dry	1st Berea	S. g. in 1st Berea
44	16	Ohio Fuel Gas Co.	Lydia Whitaker No. 1	1027	1,418	1,341	1,358	1,397	1,411					1,016	325	381			Dry		S. o. in 1st Berea
45	17	Ohio Fuel Gas Co.	Howard White No. 2	1931	1,305	1,285	1,302							983	302				41M		
46	20	Portersville Oil Co.	R. Bankes No. 2	1948	1,384	1,344	1,362	no sand						1,021					Gas & oil	1st Berea	
47	20	Altier Bros.	N. L. Altier No. 1	1949	1,349	1,330	1,349							1,010					Oil	1st Berea	
48	21	Almendinger & Bankes	C. M. Banks No. 2	1949	1,271	1,201	1,219	no sand						865					Dry	1st Berea	S. o. in 1st Berea

Plate No.	Sec. No.	Operator	Farm Name and Well No.	Date Comp.	Total Depth	Depth of Sand Below Surface								Surface Elevation					Initial Production	Producing Sand	Remarks
						1st Berea		2nd Berea		Clinton		Medina			1st Berea	2nd Berea	Clinton	Medina			
49	21	Spohn & Barringer	Harold Finley No. 1	1905	1,288	1,268	1,288							906					3 Bbls.	1st Berea	
50	21	Pure Oil Co.	P. W. Patterson No. 1	1924	1,233	1,213	1,231							859					Dry		S. o. in 1st Berea
51	22	Ohio Fuel Gas Co.	John Harker No. 1	1945	1,932	1,310	1,320							924.2					210M	Ohio Shale	1st Berea dry
52	22	Sawyer & Sands	Clarence Finley No. 1		1,260	1,245	1,260							892.6					1½ Bbls.	1st Berea	
53	30	Ralston & Maynard	Ralston & Maynard No. 7		1,209	1,183	1,205							904					3 Bbls.	1st Berea	
54	31	Amber Oil Co.	John McCarty No. 16	1952	1,329	1,309	1,329							1,000					Dry		Water in 1st Berea
						HOMER TOWNSHIP															
1	1	Bowman Oil & Gas	J. J. Joy No. 1	1931	1,648	1,568	1,595	1,632	1,645					999.6	568	632			120M	2nd Berea	Water in 1st Berea
2	1	D. T. Orndoff	O. M. Lowell No. 1	1934	1,336	1,240	1,265	1,310	1,322					679.6	560	630			20M	2nd Berea	
3	1	D. T. Orndoff	O. M. Lowell No. 2	1934	1,445	1,354	1,383	1,422	1,433					797.7	556	624			100M	2nd Berea	
4	1	D. T. Orndoff	Hopkins & Smith No. 2	1934	1,442	1,350	1,375	1,410	1,430					788		562	622		90M		
5	1	C. S. Parks	Edward North No. 1	1936	1,423	1,350	1,377	1,414	1,423					782.5	567	631			100M	2nd Berea	
6	2	D. T. Orndoff	Katherine R. Dale No. 1	1938	1,423	1,338	1,359	1,406	1,419					789.4	549	617			70M	2nd Berea	
7	2	D. T. Orndoff	Otto Boileau No. 1	1932	1,322	1,240	1,261	1,297	1,322					674	566	623			90M	2nd Berea	
8	Fr. 3	D. T. Orndoff	Glass Heirs No. 1	1942	1,360	1,270	1,280	1,354	1,360					790	480	564			70M	2nd Berea	
9	Fr. 3	Pure Oil Co.	J. L. Glass No. 1	1926	1,288	1,195	1,246	1,258	1,279					698.7	496	559			Dry		
10	Fr. 5	Cameron Oil & Gas	C. B. Smith No. 1	1929	1,296	1,178	1,195	1,261	1,273					710					Dry		
11	8	D. T. Orndoff	Trixie L. Thomas No. 1	1941	1,280	1,202	1,221	1,263	1,270					780	422				Dry		
12	23	Glouster Oil & Gas	C. A. Gardner No. 2	1920	1,340	1,299	1,340							879	420				Dry		
13	25	New Straitsville Oil & Gas	Riley Morris No. 1	1933	1,075	1,030	1,050							750	480				Dry		S. o., wtr. in 1st Berea
						MALTA TOWNSHIP															
1	5	Walter Linkhorn	Edna Walpole No. 1	1947	4,548	1,430	1,445	1,485	1,495	4,431	4,470	4,543	4,548	1,000	430	485	3,431	3,543	Dry		S. o. in Medina
2	9	National Gas & Oil Corp.	Mary Smith No. 1	1947	4,632	1,473	1,485	1,523	1,533	4,529	4,552	4,624	4,632	937	536	586	3,592	3,687	Dry		Water in Medina
3	9	E. D. Jennings	Frank Northrup No. 1	1946	4,362	1,202	1,220	1,255	1,265	4,256	4,298	4,353	4,361	703	499	552	3,553	3,650	Dry		S. g. in Clinton
4	15	D. O. Lynn	Luther Tippie No. 1	1947	4,659	1,460	1,478	1,508	1,528	4,525	4,585	4,654	4,659	943	517	565	3,582	3,711	Dry		S. o. in Clinton
5	15	Mid-East Oil Co.	Harry Willis No. 1	1948	4,702	1,487	1,505	1,527	1,548	4,564	4,607	4,667	4,678	936	551	591	3,628	3,731	Dry		S. g. in Medina
6	15	Mid-East Oil Co.	C. E. Perkins No. 1	1948	4,766	1,533	1,553	1,578	1,699	4,645	4,685	4,750	4,762	981	552	597	3,664	3,769	Dry		S. o. in 1st Berea
7	23	Mid-East Oil Co.	Ameen J. Maghes No. 1	1948	4,721	1,535	1,555	1,575	1,595	4,696	4,720			955	580	620	3,741		1250M	Clinton	
8	22	Modern Motors	M. B. Strahl No. 1	1948	5,035	1,615	1,633	1,664	1,675	4,676	4,736	4,794	4,801	1,070	545	594	3,606	3,724	Dry		
9	24	Brendel Oil & Gas	A. C. & E. L. Warren No. 1	1943	4,564	1,500	1,514	no sand		4,449	4,495	4,550	4,557	1,031	469		3,418	3,519	Dry		S. o., wtr. in Medina
10	29N	Industrial Gas Corp.	Nicholl - Dutton No. 1	1944	4,353	1,324	1,343	1,373	1,393	4,315	4,333			896	428	477	3,419		1000M	Clinton	
11	29N	Industrial Gas Corp.	Nicholl - Anderson No. 1	1944	4,406	1,326	1,340	1,385	1,390	4,306	4,338	4,400	4,403	903	423	482	3,403	3,497	Dry		Water in Medina
12	32	Industrial Gas Corp.	M. D. Pickerel No. 1	1943	4,407	1,335	1,354	1,388	1,410	4,347	4,382			991	352	405	3,364		559M	Clinton	S. o. in 1st Berea
13	32	Brendel Oil & Gas	Dion S. Birney No. 1	1943	4,523	1,410	1,439	not logged		4,416	4,458	4,515	4,522	946	464		3,472	3,569	Dry		Water in Medina
14	32	W. T. Porter	W. T. Porter No. 1	1943	4,241	1,130	1,147	1,180	1,194	4,136	4,173	4,234	4,241	721	409	459	3,415	3,513	Dry		S. g. & o. in Clinton
15	14	Ohio Fuel Gas Co.	J. C. Gregg Heirs No. 3	1917										856.9					Gas	2nd Berea	
16	14	Ohio Fuel Gas Co.	Shirley Gregg No. 1	1911	1,385	1,302	1,321	1,341	1,365					730	572	611			Gas	2nd Berea	
17	14	Ohio Fuel Gas Co.	Ohio Fuel Gas Co. No. 1	1917	1,314	1,229	1,247	1,277	1,297					663.3	566	614			213M	2nd Berea	
18	14	Ohio Fuel Gas Co.	J. F. Heintzelman No. 2	1914	1,555									852.0					Gas	2nd Berea	
19	23	Ohio Fuel Gas Co.	J. A. Biedenbach No. 2	1913	1,500	1,418	1,430	1,460	1,480					847	571	613			110M	2nd Berea	
20	23	Ohio Fuel Gas Co.	J. A. Biedenbach No. 3	1915	1,499	1,418	1,431	1,456	1,480					836.7	581	619			Gas	2nd Berea	
21	23	Ohio Fuel Gas Co.	Geo. Roberts No. 2	1927	1,566	1,500	1,531							1,043	457				Gas	2nd Berea	
22	26	Ohio Fuel Gas Co.	W. H. Coler No. 1	1930	1,592	1,520	1,540	1,564	1,588					923.6	594	640			Gas	2nd Berea	
23	26	Ohio Fuel Gas Co.	W. P. Chappelear No. 1	1929	1,582	1,511	1,531	1,558	1,579					921.1	590	637			Gas	2nd Berea	
24	26	Ohio Fuel Gas Co.	W. P. Chappelear No. 2	1930	1,598	1,525	1,545	1,560	1,596					939.1	586	621			67M	2nd Berea	
25	26	Ohio Fuel Gas Co.	C. H. Pierce No. 1		1,623	1,548	1,568	1,593	1,618					963.7	584	630			280M	2nd Berea	
26	26	Ohio Fuel Gas Co.	Jas. M. Davis No. 1		1,630	1,557	1,577	1,602	1,627					985.5	571	616			600M	2nd Berea	
27	26	Ohio Fuel Gas Co.	A. J. Monroe No. 3	1921	1,609	1,526	1,543	1,567	1,590					939.4	587	628			421M	2nd Berea	
28	27	Ohio Fuel Gas Co.	William J. Best No. 1	1929	1,599	1,525	1,545	1,571	1,593					954.6	565	616			110M	2nd Berea	
29	27	Ohio Fuel Gas Co.	C. H. Pierce No. 2		1,570	1,498	1,518	1,547	1,567					919.8	578	627			24M	2nd Berea	
30	32	Ohio Fuel Gas Co.	Milton A. Pickerell	1930	1,193	1,140	1,163							702	491				Gas	2nd Berea	
31	26	Ohio Fuel Gas Co.	C. F. Clendenon No. 1	1922	1,614	1,529	1,546	1,568	1,593					932.3	597	636			Dry		
32	25	Ohio Fuel Gas Co.	J. M. Scott No. 1	1922	1,673	1,583	1,603	1,621	1,650					975.0	608	645			7M	2nd Berea	
33	24S	Ohio Fuel Gas Co.	J. W. Taylor No. 2	1916	1,488	1,415			1,488					874	541				100M	2nd Berea	
						MANCHESTER TOWNSHIP															
1	30	J. Morrow & Wittmer	Marg. Dye No. 1	1948	5,205	1,584	1,622	no sand		5,071	5,093	5,175	5,200	873	711		4,198	4,302	Dry		
2	9	Mid-Atlantic Oil & Gas Co.	E. G. Rex No. 1	1952	5,153	1,493	1,536	no sand		4,990	5,070			805	688		4,185		Dry		

MARION TOWNSHIP

1	23	Texas Gas Utilities	C. W. Newton No. 5	1941	4,532	1,390	1,415	1,436	1,464	4,468	4,493		801	484	535	3,867	Dry	
2	Fr 1	Bern Oil & Gas	Merle Carroll No. 1	1945	1,655	1,568	1,606	1,635	1,851				825	763			Dry	
3	Fr 5	Ohio Fuel Gas Co.	Hugh Ellis No. 1		1,490	1,416	1,436	1,459	1,482				731.57	684	727		Dry	
4	Fr17	Ohio Fuel Gas Co.	Harley J. Thomas No. 2	1929	1,639	1,553	1,583	1,610	1,635				948	605	662		106M	2nd Berea
5	Fr18	Cumberland Oil Co.	H. S. Hopkins No. 2 B	1927	1,582	1,511	1,527	1,558	1,582				1,000	511	558		Gas	2nd Berea Water in 1st Berea
6	Fr25	Ohio Fuel Gas Co.	Theodore J. Newburn No. 1	1927	1,637			1,604	1,633				918.6		687		190M	2nd Berea
7	Fr23	Ohio Fuel Gas Co.	Theodore J. Newburn No. 4	1929	1,700	1,622	1,647	1,671	1,691				997.2	625	674		184M	2nd Berea
8	Fr23	Ohio Fuel Gas Co.	C. O. Thomas No. 1	1929	1,642	1,568	1,588	1,613	1,637				944.1	624	669		67M	2nd Berea
9	Fr23	Ohio Fuel Gas Co.	Chas. G. Hopkins No. 4	1928	1,597	1,525	1,541	1,586	1,592				903.0	622	663		840M	2nd Berea
10	Fr24	C. P. Bowman	Charles Hopkins No. 2	1937	1,556	1,486	1,506	1,535	1,554				926	560	609		80M	2nd Berea
11	Fr24	Bern Oil & Gas	Edna Morris No. 2	1949	1,800	1,608	1,625	1,665	1,885				974	634	691		38M	2nd Berea
12	Fr25	McBride, et al	Kenneth L. Storlin No. 1	1928	1,456			1,426	1,451				737.7		688		250M	2nd Berea
13	Fr33	Bowman Oil & Gas	J. H. Woolman No. 1	1927	1,541	1,467	1,484	1,512	1,537				847	620	665		Gas	2nd Berea
14	Fr33	Bowman Oil & Gas	A. L. Schwab No. 1	1930	1,667	1,595	1,613	1,646	1,665				997	598	649		Gas	2nd Berea Water in 1st Berea
15	Fr34	Ohio Fuel Gas Co.	N. M. Wood No. 4	1937	1,655	1,578	1,599	1,629	1,650				996.74	581	632		200M	2nd Berea
16	Fr34	Ohio Fuel Gas Co.	Frank Hart No. 1	1929	1,667	1,590	1,612	1,640	1,664				985.6	604	654		143M	2nd Berea
17	Fr35	Ohio Fuel Gas Co.	George M. Woolman	1926	1,638	1,567	1,585	1,615	1,636				976.6	600	638		151M	2nd Berea
18	Fr34	Ohio Fuel Gas Co.	Frank Hart No. 2	1929	1,681			1,653	1,667				962		691		18M	2nd Berea
19	2	Burns Oil Co.	E. M. McGuiness No. 1	1935	1,747	1,672			1,732				893	779			431M	Salt Sand
20	16	Ohio Fuel Gas Co.	Elma Edgerton No. 1	1929	1,541	1,470	1,488	1,510	1,537				785.2	685	725		Dry	
21	16	Ohio Fuel Gas Co.	T. J. Newburn No. 3	1927	1,654			1,617	1,644				921.8		694		Dry	
22	16	Ohio Fuel Gas Co.	E. N. Williams No. 2		1,577	1,506	1,524	1,547	1,574				858.62	647	688		100M	2nd Berea
23	17	Texas Gas Utilities	Chas. Dunn No. 4	1929	1,441			1,411	1,436				731.6		679		250M	2nd Berea
24	17	Texas Gas Utilities	Chas. Dunn No. 2	1927	1,445			1,403	1,435				728.6		674		Dry	S. o. in Salt Sand
25	17	Ohio Fuel Gas Co.	Hiram Thomas No. 1	1932	1,508	1,434	1,450	1,472	1,502				788.02	646	684		20M	2nd Berea Water in 1st Berea
26	17	Ohio Fuel Gas Co.	Emmett Adrian No. 5		1,520	1,445	1,470						826	619			Gas	2nd Berea
27	18	Kemrow Co.	Leslie Ellis No. 4	1928	1,473	1,404	1,422	1,469	1,473				759	645	710		300M	2nd Berea
28	18	Ohio Fuel Gas Co.	J. Barkhurst No. 2		1,453	1,386	1,408	1,431	1,453				757	629	674		95M	2nd Berea
29	18	Lang & Campbell	W. M. Hilaman No. 1	1928	1,631	1,561	1,582	1,600	1,630				914	647	686		Dry	S. o. & g. in 2nd Ber
30	18	Ohio Fuel Gas Co.	Lovell et al No. 3	1928	1,452	1,379	1,399	1,437	1,447				742.5	637	695		250M	2nd Berea
31	23	Ohio Fuel Gas Co.	H. D. Huffman No. 2	1926	1,628	1,562		1,599	1,626				943	619	656		130M	2nd Berea
32	23	Ohio Fuel Gas Co.	H. D. Huffman No. 3	1928	1,548	1,473	1,493	1,517	1,545				854.9	618	662		153M	2nd Berea
33	23	Kemrow Co.	E. Mosier No. 1	1928	1,535	1,458	1,477	1,500	1,530				854.2	604	646		231M	2nd Berea
34	23	Ohio Fuel Gas Co.	T. J. Newburn No. 1	1927	1,586			1,550	1,579				872.1		678		223M	2nd Berea
35	23	Ohio Fuel Gas Co.	T. M. Frisby No. 1	1929	1,636	1,556	1,580	1,606	1,632				939.8	616	666		932M	2nd Berea
36	24	Ohio Fuel Gas Co.	C. D. Dougan No. 1	1928	1,583	1,505	1,525	1,550	1,578				918.2	587	632		213M	2nd Berea
37	24	Ohio Fuel Gas Co.	C. D. Dougan No. 2	19—	1,474	1,400	1,422	1,447	1,470				827	573	620		140M	2nd Berea
38	24	Ohio Fuel Gas Co.	Daniel Barkhurst No. 1	1927	1,531			1,504	1,527				848.4		656		184M	2nd Berea
39	24	Ohio Fuel Gas Co.	C. J. Humphrey No. 1	1927	1,579	1,505	1,524	1,544	1,573				889	616	655		310M	2nd Berea
40	24	Ohio Fuel Gas Co.	C. J. Humphrey No. 2	1928	1,530			1,497	1,526				851.9		611		184M	2nd Berea
41	24	Ohio Fuel Gas Co.	F. D. Fitch No. 1	1927	1,626	1,551	1,578	1,592	1,620				944.8	606	647		184M	2nd Berea
42	24	Ohio Fuel Gas Co.	F. D. Fitch No. 2	1929	1,562	1,492	1,512	1,539	1,560				894.3	598	645		151M	2nd Berea
43	24	Ohio Fuel Gas Co.	Frank S. Miller No. 2	1928	1,565	1,484	1,509	1,534	1,561				912	576	626		591M	2nd Berea
44	24	Ohio Fuel Gas Co.	Gus Carr No. 1	1928	1,516	1,439	1,464	1,489	1,513				842.8	596	622		143M	2nd Berea
45	24	Ohio Fuel Gas Co.	Russell Janes No. 1	1929	1,600	1,528	1,548	1,573	1,596				942.8	585	630		116M	2nd Berea
46	24	Bowman Oil & Gas	Geo. H. Carr No. 3	1929	1,612	1,545	1,562	1,590	1,609				951.9	593	638		260M	2nd Berea
47	25	Chas. Fox et al	L. E. Glass No. 2	1927	1,612			1,607	1,631				819.6		788		370M	2nd Berea
48	25	Ohio Fuel Gas Co.	Letitia Glass No. 1	1927	1,635	1,550	1,572	1,600	1,625				912.5	637	888		350M	2nd Berea
49	25	Bowman Oil & Gas	G. E. Huffman No. 2	1927	1,541	1,465	1,487	1,517	1,537				851	614	666		460M	2nd Berea
50	25	Bowman Oil & Gas	G. E. Huffman No. 3	1927	1,617	1,542	1,562	1,591	1,613				910.4	632	681		360M	2nd Berea
51	25	Morgan Oil & Gas	Charlie Fox No. 4	1929	1,627	1,540	1,560	1,600	1,620				921.3	619	679		150M	2nd Berea
52	25	Morgan Oil & Gas	Charlie Fox No. 5	1929	1,531			1,500	1,531				836.1		664		200M	2nd Berea
53	25	J. H. McBride	Marion Mills No. 1	1929	1,556			1,536	1,556				653.6		683		300M	2nd Berea
54	26	Bowman Oil & Gas	Mary R. Mills No. 1	1928	1,827	1,550	1,572	1,610	1,625				945.9				220M	2nd Berea
55	26	Bowman Oil & Gas	S. & C. Spurrier No. 1	1928	1,636	1,560	1,580	1,612	1,632				936.2	624	666		300M	2nd Berea Water in 1st Berea
56	26	Bowman Oil & Gas	S. & C. Spurrier No. 3	1929	1,627	1,552	1,574	1,603	1,625				924.5	627	678		150M	2nd Berea Water in 1st Berea
57	26	Bowman Oil & Gas	C. E. Huffman No. 6	1928	1,663	1,589	1,609	1,637	1,658				987	622	870		180M	2nd Berea Water in 1st Berea
58	26	Bowman Oil & Gas	Anna M. Porter No. 1	1928	1,615	1,541	1,560	1,597	1,612				933	608	664		40M	2nd Berea Water in 1st Berea
59	26	Morgan Oil & Gas	Thomas Ball No. 2	1928	1,564			1,542	1,564				864.7		677		700M	2nd Berea
60	29	Bern Oil & Gas	Huffman & Hummel No. 2	1942	1,535	1,408	1,428	1,466	1,485				846	562	620		60M	2nd Berea
61	29	Bern Oil & Gas	Huffman & Hummel No. 3	1943	1,714	1,582	1,599	1,632	1,654				1,005	577			60M	2nd Berea
62	29	Ohio Fuel Gas Co.	Simeon Remy No. 1	1928	1,488	1,413	1,438	1,461	1,484				853.6	559	607		30M	2nd Berea
63	29	Kemrow Co.	W. A. Huffman No. 2	1928	1,532	1,452	1,474	1,500	1,525				864	578	636		84M	2nd Berea
64	29	Texas Gas Utilities	James Huffman No. 5	1929	1,643	1,575	1,595	1,620	1,640				972.3	603	648		213M	2nd Berea
65	30	Ohio Fuel Gas Co.	A. M. Hummel No. 1		1,642	1,566	1,588	1,615	1,637				1,001	565	614		240M	2nd Berea
66	30	Ohio Fuel Gas Co.	A. M. Hummel No. 2	1927	1,505	1,433	1,448	1,477	1,501				866.8	566	610		790M	2nd Berea
67	30	Ohio Fuel Gas Co.	C. D. Dougan No. 3	19—	1,630	1,557	1,579	1,604	1,627				988.2	569	618		46M	2nd Berea
68	30	Penn Contracting Co.	F. A. Dawson No. 1	1936	1,569	1,505	1,525	1,547	1,569				960.89	544	601		120M	2nd Berea
69	30	Ohio Fuel Gas Co.	F. J. Strode No. 1	1929	1,620	1,544	1,566	1,594	1,614				989.8	554	604		184M	2nd Berea
70	30	Ohio Fuel Gas Co.	F. J. Strode No. 2	1929	1,571	1,485	1,516	1,549	1,566				941.3	544	608		304M	2nd Berea

Plate No.	Sec. No.	Operator	Farm Name and Well No.	Date Comp.	Total Depth	Depth of Sand Below Surface								Surface Elevation	Depth of Top of Sand Below Sea Level				Initial Production	Producing Sand	Remarks
						1st Berea		2nd Berea		Clinton		Medina			1st Berea	2nd Berea	Clinton	Medina			
71	30	Texas Gas Utilities	Lewis Huffman No. 1	1927	1,445	1,403	1,435							998.1	405				Dry	2nd Berea	
72	30	Texas Gas Utilities	Lewis Huffman No. 3	1927	1,579	1,496	1,521	1,542	1,570					965.13	531	567			30M	2nd Berea	
73	30	Texas Gas Utilities	Lewis Huffman No. 4	1929	1,609	1,537	1,560	1,587	1,607					992.2	545	595			480M	2nd Berea	
74	30	Texas Gas Utilities	Lewis Huffman No. 5	1931	1,469	1,390	1,410	1,435	1,465					850.4	540	585			20M	2nd Berea	
75	31	Bowman Oil & Gas	O. M. Lovell No. 1-A	1926	1,541	1,470	1,494	1,524	1,541					871.8	598	652			40M	2nd Berea	Water in 1st Berea
76	31	Bowman Oil & Gas	O. M. Lovell No. 3-A	1931	1,527	1,450	1,472	1,507	1,522					858.1	592	649			90M	2nd Berea	Water in 1st Berea
77	31	Bowman Oil & Gas	G. E. Huffman No. 1	1926	1,562	1,483	1,505	1,539	1,561					885.1	598	654			330M	2nd Berea	Water in 1st Berea
78	31	Ohio Fuel Gas Co.	J. T. Joy No. 1	1926	1,520	1,446	1,467	1,497	1,516					838	608	678			400M	2nd Berea	Water in 1st Berea
79	31	Ohio Fuel Gas Co.	J. T. Joy No. 2	1926	1,411	1,320	1,343	1,383	1,400					726.3	594	657			431 M	2nd Berea	Gas in Salt Sand
80	31	Ohio Fuel Gas Co.	J. T. Joy No. 4	1927	1,332			1,304	1,321					656.6		647			84M	2nd Berea	
81	31	Ohio Fuel Gas Co.	J. T. Joy No. 5	1927	1,437			1,409	1,430					748.3		661			275M	2nd Berea	
82	31	Ohio Fuel Gas Co.	J. T. Joy No. 6	1928	1,427	1,340	1,364	1,399	1,422					730.9	609	668			116M	2nd Berea	
83	31	Bowman Oil & Gas	O. M. Lovell No. 1-B	1926	1,358	1,277	1,305	1,341	1,355					693.1	584	648			200M	2nd Berea	Water in 1st Berea
84	31	Bowman Oil & Gas	O. M. Lovell No. 2-B	1926	1,505	1,427	1,453	1,487	1,503					849.7	577	637			140M	2nd Berea	Water in 1st Berea
85	31	Bowman Oil & Gas	O. M. Lovell No. 1-C	1926	1,318	1,238	1,264	1,299	1,313					657.6	580	631			130M	2nd Berea	Water in 1st Berea
86	31	Bowman Oil & Gas	O. M. Lovell No. 2-C	1934	1,320	1,236	1,262	1,297	1,310					668	578	629			60M	2nd Berea	
87	32	Ohio Fuel Gas Co.	A. A. Boileau No. 1	1931	1,563	1,478	1,500	1,530	1,553					902.6	575	627			200M	2nd Berea	Gas in Salt Sand
88	32	Ohio Fuel Gas Co.	A. A. Boileau No. 2	1931	1,558	1,475	1,502	1,540	1,550					904.9	570	635			Dry		Gas in Salt Sand
89	32	Ohio Fuel Gas Co.	H. S. Hallowell No. 1	1931	1,585	1,507	1,530	1,564	1,577					927.3	580	637			200M	2nd Berea	Water in 1st Berea
90	32	Ohio Fuel Gas Co.	A. A. Boileau No. 3	1943	1,369	1,290	1,312	1,348	1,364					722.8	567	625			50M	2nd Berea	
91	32	Bowman Oil & Gas	Ason McGrew No. 1	1926	1,581	1,497	1,519	1,559	1,571					898	599	661			180M	2nd Berea	Water in 1st Berea
92	32	Bowman Oil & Gas	C. M. Huffman No. 2	1930	1,623	1,545	1,570	1,606	1,619					957.7	587	648			280M	2nd Berea	Water in 1st Berea
93	32	Bowman Oil & Gas	C. M. Huffman No. 3	1931	1,414	1,349	1,361	1,396	1,410					753.3	596	643			200M	2nd Berea	Water in 1st Berea
94	32	Bowman Oil & Gas	C. M. Huffman No. 4	1937	1,363	1,289	1,307	1,345	1,358					706.4	583	639			50M	2nd Berea	Water in 1st Berea
95	32	Bowman Oil & Gas	Alex Mingus No. 1	1929	1,646	1,573	1,592	1,626	1,644					976.9	596	649			300M	2nd Berea	Water in 1st Berea
96	32	Bowman Oil & Gas	Alex Mingus No. 2	1931	1,600	1,527	1,546	1,583	1,596					933.8	593	649			280M	2nd Berea	Water in 1st Berea
97	33	Ohio Fuel Gas Co.	O. L. Chappelear No. 1	1935	1,590	1,513	1,534	1,565	1,582					925.9	587	636			130M	2nd Berea	Water in 1st Berea
98	33	Ohio Fuel Gas Co.	N. M. Wood, et. al. No. 7	1943	1,641	1,565	1,587	1,620	1,635					995.2	570	625			30M	2nd Berea	Water in 1st Berea
99	33	Ohio Fuel Gas Co.	N. M. Wood No. 8	1943	1,639	1,566	1,586	1,617	1,635					1,001.6	564	615			100M	2nd Berea	Water in 1st Berea
100	33	E. N. Williams	Dale Woodyard No. 1	1942	1,553	1,483	1,503	1,539	1,553					933	550	606			Dry		S. g. in 1st &2nd Berea
101	34	Ohio Fuel Gas Co.	N. M. Wood No. 2-A	1942	1,660	1,570	1,590	1,634	1,655					1,014.6	555	619			100M	2nd Berea	Gas in Salt Sand
102	34	Ohio Fuel Gas Co.	N. M. Wood No. 3	1936	1,620	1,538	1,563	1,590	1,612					961.4	577	629			160M	2nd Berea	Water in 1st Berea
103	34	Ohio Fuel Gas Co.	N. M. Wood No. 5	1947	1,659	1,579	1,599	1,631	1,649					1,019.6	569	611			70M	2nd Berea	Gas in Macksburg Sd.
104	34	Ohio Fuel Gas Co.	N. M. Wood No. 6	1947	1,651	1,570	1,589	1,616	1,634					1,003.6	566	612			40M	2nd Berea	Gas in Salt Sand
105	34	Ohio Fuel Gas Co.	M. A. & E. Hart No. 1	1943	1,550	1,465	1,485	1,525	1,546					929.5	535	595			157M	2nd Berea	
106	34	Ohio Fuel Gas Co.	Hiram Hart No. 2	1946	1,592	1,514	1,537	1,564	1,582					949.2	565	615			Gas	2nd Berea	Gas in Salt Sand
107	34	Ohio Fuel Gas Co.	Hiram Hart No. 3	1936	1,629	1,546	1,567	1,599	1,621					982.6	563	616			60M	2nd Berea	S. o. in 1st Berea
108	34	Ohio Fuel Gas Co.	Lucy T. Hart No. 5	1943	1,659	1,583	1,597	1,627	1,649					1,021.65	561	605			190M	2nd Berea	Water in 1st Berea
109	35	Ohio Fuel Gas Co.	Hiram Hart No. 1	1930	1,630	1,550	1,570	1,605	1,626					991.7	558	613			60M	2nd Berea	
110	35	Ohio Fuel Gas Col	C. H. Mendenhall No. 1	1944	1,587	1,505	1,525	1,566	1,583					980.2	525	591			10M	2nd Berea	Water in 1st Berea
111	35	Ohio Fuel Gas Co.	F. J. Strode No. 1	1930	1,554	1,473	1,497	1,529	1,551					923.6	549	606			942M	2nd Berea	Water in 1st Berea
112	35	Ohio Fuel Gas Co.	C. H. Mendenhall No. 2	1954	1,550	1,475	1,499	1,532	1,549					946	529	586			41M	2nd Berea	
113	36	Texas Gas Utilities	L. R. Boyd No. 1	1929	1,5—	1,495	1,516	1,546	1,572					951.2	544	595			Dry		
114	36	Ohio Fuel Gas Co.	G. K. Strode No. 1	1930	1,576	1,500	1,525	1,555	1,574					955	545	600			68 M	2nd Berea	
115	36	Kemrow Co.	James Boyd No. 1	1929	1,578	1,500	1,523	1,558	1,573					959.4	541	599			105 M	2nd Berea	
						MEIGSVILLE TOWNSHIP															
1	12	John Morrow	L. F. Murrey No. 1	1948	5,231	1,615	1,660	no sand		5,102	5,135	5,207	5,225	865	750		4,237	4,342	Dry		
2	22	Clyde Foraker	Chas. W. Dearth No. 1	1939	5,097	1,615	1,675	no sand		4,948	4,972	5,060	5,097	905	610		4,043	4,155	Dry		
3	9	Ohio Oil Co.	Marg. Curran No. 1	1928	1,481	1,398	1,435	no sand						732.5	665				Dry		S. g., wtr., 1st Berea
4	1	Clyde Foraker	Claude Murray No. 1	1942	3,564	1,410	1,480	no sand						692	718				Dry		Oriskany test
						MORGAN TOWNSHIP															
1	27	Stephens Petroleum	Edwin Roberts No. 1	1945	4,582	1,385	1,405	1,427	1,444	4,453	4,496	4,547	4,553	850	535	577	3,603	3,697	Dry		
2	1	Ohio Fuel Gas Co.	Walter E. Barkhurst No. 1	1926	1,584	1,495	1,510	1,532	1,558					943.2	552	589			280M	2nd Berea	
3	1	Ohio Fuel Gas Co.	E. R. Barkhurst No. 2	1945	1,637	1,566	1,581	1,600	1,624					1,021.6	544	578			100M	2nd Berea	
4	1	Ohio Fuel Gas Co.	B. F. Reed No. 2	1918	1,573	1,488	1,505	1,523	1,553					930.8	557	592			40M	2nd Berea	
5	1	Ohio Fuel Gas Co.	B. F. Reed No. 3	1946	1,546	1,476	1,491	1,535	1,546					928.5	547	606			64M	2nd Berea	S. o. in 1st Berea
6	1	Ohio Fuel Gas Co.	Mary McGovern No. 1	1899	1,591	1,505	1,520	1,540	1,569					937	568				Gas	2nd Berea	
7	6	Ohio Fuel Gas Co.	B. F. Reed No. 1-A	1899	1,472	1,395	1,410	1,431	1,452					820	575				Gas	2nd Berea	
8	11	Ohio Fuel Gas Co.	John & Fred Dover No. 1	1918	1,564	1,482	1,495	1,519	1,541					930.6	534	590			Gas	2nd Berea	
9	12	Ohio Fuel Gas Co.	John & Fred Dover No. 1-A											712.5					Gas	2nd Berea	
10	12	Ohio Fuel Gas Co.	C. M. Simpson No. 1	1899	1,519	1,427	1,542	1,470	1,488					849.4	578	621			Gas	2nd Berea	
11	12	Ohio Fuel Gas Co.	John Greer No. 1	1897	1,528	1,452	1,465	1,488	1,508					886.6	565	603			Gas	2nd Berea	
12	13	Ohio Fuel Gas Co.	L. M. Stanton No. 1	1899	1,306	1,231	1,444	1,267	1,284					655.9	575	611			Gas	2nd Berea	
13	36	Ohio Fuel Gas Co.	E. E. & Etta Harris	1900	1,481	1,392	1,410	1,434	1,459					840.5	552	594			Gas	2nd Berea	
14	36	Ohio Fuel Gas Co.	Benj. Reed No. 2	1907	1,533	1,447	1,458	1,479	1,505					932.6	515	547			Dry		
15	13	Ohio Fuel Gas Co.	McConnelsville Fair Grounds	1895	3,186	1,279	1,296	1,330	1,345					725	554	605			Dry		

PENN TOWNSHIP

1	38	National Gas & Oil Corp.	J. C. O. Tompkins No. 1	1948	4,944	1,620	1,647	1,660	1,694	4,823	4,857	4,925	4,933	983	637	677	3,840	3,942	Dry		S. g. in Clinton, S. o. Med.
2	2	Ohio Fuel Gas Co.	Chas. Harris No. 1	1932	1,665	1,588	1,613	1,637	1,659					976.7	611	660			21M	2nd Berea	Water in 1st Berea
3	2	Ohio Fuel Gas Co.	C. J. Kennard No. 1	1929	1,424	1,353	1,371	1,400	1,420					763.7	589	636			29M	2nd Berea	
4	2	Ohio Fuel Gas Co.	J. F. Dougan No. 1	1929	1,668	1,595	1,815	1,635	1,660					(?)780.93	814	854			83M	2nd Berea	
5	2	Ohio Fuel Gas Co.	Grant Coulson No. 1	1929	1,639	1,588	1,588	1,608	1,635					946.9	621	661			95M	2nd Berea	
6	2	Ohio Fuel Gas Co.	Wm. Penrose No. 1	1928	1,710	1,640	1,660	1,680	1,706					1,022.9	617	657			Gas	2nd Berea	
7	3	Ohio Fuel Gas Co.	John Snearly No. 1	1926	1,559	1,486	1,501	1,532	1,554					897.9	603	634			65M	2nd Berea	S. g. in Salt Sand
8	3	Ohio Fuel Gas Co.	John Snearly No. 2	1929	1,541	1,479	1,496	1,523	1,539					890.7	588	631			62M	2nd Berea	S. g. in No. 7 coal
9	3	Ohio Fuel Gas Co.	C. J. Kennard No. 1	1927	1,888	1,819	1,634	1,863	1,685					1,009.8	609	653			53M	2nd Berea	S. g. in Salt Sand
10	3	Ohio Fuel Gas Co.	C. B. McInturf No. 1	1930	1,672	1,594	1,618	1,646	1,664					1,024.0	570	622			95M	2nd Berea	S. o. in 1st Berea
11	3	Ohio Fuel Gas Co.	Shirley Janes No. 1	1928	1,577	1,505	1,525	1,550	1,573					931.4	574	619			16M	2nd Berea	
12	3	Ohio Fuel Gas Co.	R. A. Kennard No. 1	1926	1,566	1,495	1,514	1,537	1,559					893.6	589	631			151M	2nd Berea	
13	3	Ohio Fuel Gas Co.	R. A. Kennard No. 3	1931	1,423	1,350	1,365	1,390	1,416					757.5	592	632			24M	2nd Berea	Gas in 3alt Sand
14	3	Ohio Fuel Gas Co.	G. F. Kennard No. 4	1927	1,515	1,448	1,465	1,488	1,512					851.7	594	636			106M	2nd Berea	
15	8	Marion Drilling Co.	Parker Sands No. 3	1931	1,403	1,328	1,348	1,378	1,398					778	550	600			Gas	2nd Berea	
16	9	Penn Contracting Co.	John McInturf No. 1	1941	1,396	1,324	1,344	1,369	1,386					771	553	598			50M	2nd Berea	
17	10	Penn Ohio Gas Co.	John Greathouse No. 3	1929	1,610	1,488	1,502	1,530	1,555					863	625	667			32M	2nd Berea	Gas in Maxton
18	10	Parks, et. al.	John Greathouse No. 4	1935	1,562	1,500	1,514	1,535	1,562					902.5	597	632			210M	2nd Berea	S. g. in 2nd Cow Run
19	10	C. A. Anderson	Mabelle Matson No. 1	1945	1,603	1,504	1,524	1,551	1,569					903	601	648			50M	2nd Berea	
20	10	J. M. Williams	Walter Anderson No. 15	1931	1,437			1,413	1,437					790		623			100M	2nd Berea	
21	11	Westerman Bros.	J. C. & Hattie Williams No. 1	1928	1,500			1,480	1,500					840.8		631			450M	2nd Berea	
22	14	Ohio Fuel Gas Co.	J. P. Hilaman No. 4	1928	1,535			1,526	1,535					839.09		687			100M	2nd Berea	
23	14	Penn Oil & Gas Co.	C. A. Mendenhal No. 3		1,632			1,812	1,632					953.7		658			250M	2nd Berea	
24	14	Ohio Fuel Gas Co.	F. E. Williams No. 1	1929	1,605	1,535	1,555	1,575	1,595					908.0	627	667			20M	2nd Berea	
25	14	Ohio Fuel Gas Co.	F. E. Williams No. 2	1931	1,501	1,423	1,449	1,469	1,491					798.8	624	670			30M	2nd Berea	Water in 1st Berea
26	15	Ohio Fuel Gas Co.	Orin & Oral Wolf No. 2		1,475			1,455	1,475					793.4		662			30M	2nd Berea	Gas in Salt Sand
27	15	Bowman Oil & Gas	Russel Janes No. 1	1927	1,570	1,502	1,517	1,545	1,568					899.5	603	646			90M	2nd Berea	
28	15	Ohio Fuel Gas Co.	F. A. Mendenhall No. 1	1928	1,448	1,378	1,391	1,417	1,442					783.6	594	633			94M	2nd Berea	
29	15	Bowman Oil & Gas	O. W. Abel No. 2	1929	1,441	1,388	1,386	1,418	1,437					787.5	601	651			Gas	2nd Berea	
30	15	Bowman Oil & Gas	Henry Abel No. 1	1927	1,422	1,348	1,370	1,394	1,417					741.3	607	653			91M	2nd Berea	
31	16	Ohio Fuel Gas Co.	A. W. Embree No. 1-A	1929	1,610	1,536	1,556	1,589	1,606					976.7	559	612			21M	2nd Berea	
32	16	Ohio Fuel Gas Co.	A. W. Embree No. 2	1930	1,538	1,485	1,487	1,513	1,532					892.4	573	621			238M	2nd Berea	Oil in 1st Cow Run
33	16	Ohio Fuel Gas Co.	A. W. Embree No. 3	1930	1,536	1,462	1,482	1,511	1,531					894.8	567	616			24M	2nd Berea	Water in 1st Berea
34	16	Ohio Fuel Gas Co.	A. W. Embree No. 4	1931	1,655	1,584	1,604	1,631	1,651					1,012.6	573	618			83M	2nd Berea	Gas in 2nd Cow Run
35	16	Ohio Fuel Gas Co.	A. W. Embree No. 5	1930	1,658	1,580	1,605	1,630	1,650					1,009.6	570	620			95M	2nd Berea	Water in 1st Berea
36	16	State Line Oil & Gas	Embree Trust No. 2	1933	1,509	1,434	1,454	1,484	1,502					866.1	568	618			30M	2nd Berea	Water in 1st Berea
37	16	Kemrow Co.	H. J. Abel No. 1	1930	1,624	1,525	1,559	1,595	1,620					994.8	530	600			100M	2nd Berea	Gas in 2nd Cow Run
38	18	Ohio Fuel Gas Co.	E. A. Gladden No. 1	1930	1,423	1,351	1,373	1,398	1,415					798.5	552	599			24M	2nd Berea	
39	18	Ohio Fuel Gas Co.	Jas. W. Harris No. 1	1934	1,417	1,337	1,359	1,386	1,409					784.4	553	602			20M	2nd Berea	Gas in Salt Sand
40	16	Ohio Fuel Gas Co.	W. B. Miller No. 1	1929	1,552	1,477	1,498	1,527	1,548					921.7	555	605			723M	2nd Berea	
41	16	Ohio Fuel Gas Co.	W. B. Miller No. 2	1930	1,650	1,575	1,595	1,625	1,645					1,019.1	556	607			90M	2nd Berea	Gas in 2nd Cow Run
42	16	Ohio Fuel Gas Co.	W. B. Miller No. 3	1930	1,612	1,531	1,555	1,585	1,607					981.6	549	603			304M	2nd Berea	
43	16	Ohio Fuel Gas Co.	H. R. Greathouse No. 1	1930	1,569	1,492	1,514	1,542	1,564					912.8	579	629			67M	2nd Berea	Water in 1st Berea
44	17	Ohio Fuel Gas Co.	H. & J. Miller No. 1	1929	1,882	1,581	1,603	1,832	1,854					1,027.7	553	604			38M	2nd Berea	
45	34	J. M. Williams	F. E. & B. H. Williams No. 1	1946	1,555	1,483	1,498	1,527	1,549					866	617	661			80M	2nd Berea	Water in 1st Berea
46	35	Calhoun & Williams	Leonard & Vesta Smith No. 1	1951	1,665	1,570	1,580	1,608	1,630					940	630	668			330M	2nd Berea	
47	35	Ohio Fuel Gas Co.	Stanley Newson No. 1	1924	1,523	1,437	1,457	1,478	1,503					828.4	609	650			120M	2nd Berea	
48	35	Ohio Fuel Gas Co.	Stanley Newson No. 2	1925	1,539	1,456	1,472	1,494	1,517					837.8	618	656			90M	2nd Berea	
49	35	Ohio Fuel Gas Co.	W. B. Newton No. 1	1922	1,615	1,529	1,541	1,570	1,596					915.5	613	654			90M	2nd Berea	Oil in Wolf Creek Sd.
50	35	Ohio Fuel Gas Co.	W. E. Gifford No. 2	1925	1,555	1,470	1,488	1,510	1,534					846	624	664			100M	2nd Berea	
51	11	Penn Oil & Gas Co.	Dennis Benjamin No. 2	1929	1,892			1,659	1,679					999		660			Gas	2nd Berea	
52	36	Southern Oil Co.	A. L. Gifford No. 1-A	1930	1,598	1,530	1,550	1,571	1,594					898	632	673			Dry		

UNION TOWNSHIP

1	22	Ohio Fuel Gas Co.	H. E. Grimes et al No. 1	1949	4,522	1,500	1,515	no sand		4,390	4,438	4,500	4,510	1,065.5	434		3,324	3,434	Dry		
2	18	Wittmer Oil & Gas Corp.	Perry Van Horn No. 1	1943	4,122	1,226	1,244	no sand		4,019	4,036			830	396		3,189		Dry		
3	29	O. C. Edda Co.	T. J. Chappalear	1908	3,947	1,150	1,170	no sand		3,925	3,944			770	380		3,155		Dry		
4	1	Penn Contracting Co.	Mary Smith No. 1	1940	1,297	1,284	1,297	no sand						817	467				40M	1st Berea	
5	6	Ralston & Maynard	W. P. Smith No. 9	1912	1,310	1,290	1,310	no sand						1,014	276				Oil	1st Berea	
6	6	Ralston & Maynard	W. P. Smith No. 4	1912	1,270	1,250	1,270	no sand						952	298				Oil		
7	6	Thistle Oil Co.	John Weiner No. 2	1910	1,115	1,095	1,115	no sand						808	287				Oil		
8	7	Thistle Oil Co.	J. L. Weiner No. 1	1897	1,155	1,135	1,155	no sand						802	333				Oil		
9	7	Thistle Oil Co.	J. L. Weiner No. 5	1914	1,230	1,200	1,220	no sand						835	365				Oil		
10	12	Thistle Oil Co.	Harry Carter No. 1	1941	1,410	1,315	1,326	1,375	1,380					833	482	542			Dry		
11	15	Penn Contracting Co.	Lucy Fitch No. 1	1935	1,402	1,327	1,340	1,383	1,392					910	417	473			Dry		S. o. in 1st Berea
12	19	Penn Contracting Co.	G. E. Van Horn No. 1	1938	2,270	1,103	1,124	1,175	1,186					758	345	417			Dry		S. g. in 1st Berea
13	26	Ohio Fuel Gas Co.	Jesse L. Best No. 1	1926	1,415	1,330	1,350	1,388	1,395					836.9	493	551			Dry		S. g. in 2nd Berea

Plate No.	Sec. No.	Operator	Farm Name and Well No.	Date Comp	Total Depth	Depth of Sand Below Surface: 1st Berea		2nd Berea		Clinton		Medina		Surface Elevation	Depth of Top of Sand Below Sea Level: 1st Berea	2nd Berea	Clinton	Medina	Initial Production	Producing Sand	Remarks
										WINDSOR TOWNSHIP											
1	88	Parks et al	N. L. Ervin No. 3	1935	1,478	1,427	1,478							630	797				Dry		
2	94	Not known	T. B. Lane		1,570	1,542	1,560							745.9	796				Dry		S. o. in 1st Berea
3	1136	E. S. Kepple et al	C. M. Newsom No. 1	1938	1,725	1,642	1,672	no sand						904	738				Dry		Water in 1st Berea
4	1056	E. S. Kepple	J. & L. Van Fossen No. 1		1,584	1,578	1,584							875.2	703				Dry		
5	1056	Stoney Springs Oil & Gas	J. & L. Van Fossen No. 2	1935	1,588	1,573	1,588							868	705				Dry		
6	87	Choquill et al	M. L. Ervin No. 2	1935	1,410	1,367	1,410							636	731				Dry		Water in 1st Berea
7	88	Parks et al	M. L. Ervin No. 1	1919	1,390	1,376	1,390							640	736				Dry		Water in 1st Berea
										YORK TOWNSHIP											
1	19	H. K. Porter, Inc.	Raymond Stoneburner No. 1	1944	4,123	1,280	1,300	no sand		4,055	4,081			1,060	220	220	2,995		200M	Clinton	
2	19	L. C. Moore, Inc.	J. R. Floyd No. 2	1948	4,117	1,260	1,280	no sand		4,004	4,027	4,102	4,107	994	266	266	3,110		Dry		
3	20	Gas Producing Co. of Ohio	Charles Bailey No. 2	1937	4,161	1,270	1,290	1,320	1,330	4,054	4,084	4,151	4,161	1,023	247	297	3,031	3,128	Dry		
4	20	McKenzie & Silhol	J. A. Floyd No. 6	1946	4,434	1,295	1,315	no sand		4,077	4,127			1,080	215		2,997		Dry		S. g. in Clinton
5	20	Pure Oil Co.	W. F. Williams No. 9	1935	4,205	1,271	1,297	no sand		4,105	4,141	4,200	4,205	1,020	251		3,085	3,180	Dry		Water in Medina
6	20	Gas Producing Co. of Ohio	Clara Tidball No. 1	1937	4,074	1,212	1,232	1,232	1,252	4,030	4,074			954	258	278	3,076		960M	Clinton	
7	20	Gas Producing Co. of Ohio	Eliz. Floyd No. 4	1936	4,152	1,325	1,345	no sand		4,114	4,145			1,078	247		3,036		780M	Clinton	
8	20	Gas Producing Co. of Ohio	Eliz. Floyd No. 5	1937	4,140	1,312	1,332	1,350	1,365	4,080	4,120			1,079	233	271	3,001		Dry		
9	21	Clint Littleton et al	Hiram Walker No. 1	1942	4,258	1,312	1,338	no sand		4,174	4,209			990	322		3,184		Dry		
10	21	Industrial Gas Corp.	Ralph Eppley No. 6	1942	4,264	1,367	1,380	1,412	1,428	4,204	4,251			1,049	318	363	3,155		Dry		
11	21	Not known	Amos Souders No. 15	1942	4,282	1,370	1,390	1,400	1,410	4,182	4,216	4,277	4,282	1,100	270	300	3,082	3,177	Dry		S. o. in 2nd Berea
12	22E	Clint Littleton et al	Matheney Hetrs et al No. 2	1942	4,266	1,393	1,403	no sand		4,198	4,243			1,032	361		3,166		240M	Clinton	
13	22E	Clint Littleton et al	Matheney Heirs et al No. 3	1942	4,250	1,354	1,363	no sand		4,191	4,224			1,040	314		3,151		170M	Clinton	
14	22E	Ohio Fuel Gas Co.	Harry B. Snyder No. 1	1941	4,091	1,176	1,196	1,224	1,239	4,053	4,090			824.3	352	400	3,129		2,080M	Clinton	
15	22E	Pure Oil Co.	Clara Fouts No. 1	1941	4,212	1,290	1,312	no sand		4,156	4,177			957.2	333		3,199		10,000M	Clinton	
16	22E	Brush Creek Gas Co.	Manley & K. McLaughlin No. 2	1941	4,275	1,348	1,370	1,395	1,410	4,222	4,265			1,008	340	387	3,214		Dry		
17	22E	National Gas & Oil Corp.	Manley & K. McLaughlin No. 3	1950	4,205	1,275	1,295	1,330	1,340	4,152	4,204			944	331	386	3,208		885M	Clinton	
18	22E	Industrial Gas Corp.	Christian E. Bayley No. 1	1941	4,257	1,338	1,367	1,397	1,412	4,210	4,255			1,014	324	383	3,146		2,339M	Clinton	S. o. in 1st Berea
19	22W	Gas Producing Co. of Ohio	Andrew Kamorom No. 1	1940	3,823	1,130	1,150	1,185	1,198	3,763	3,798			947	183	238	2,816		3 Bbls.	Clinton	S. o. in 2nd Berea
20	22W	Gas Producing Co. of Ohio	Fred Rambo No. 1	1938	3,846	1,159	1,179	no sand		3,796	3,829			989.3			2,807		680M	Clinton	
21	22W	National Gas & Oil Corp.	Elmer Guinsler et al No. 2	1951	3,824	1,082	1,100	no sand		3,695	3,750	3,815	3,821	882	200		2,813	2,933	400M	Clinton	Medina dry
22	22W	Gas Producing Co. of Ohio	Arthur Printz No. 1	1940	3,915	1,175	1,195	1,230	1,242	3,805	3,838	3,897	3,907	982	193	248	2,823	2,915	Dry		S. o. & g. in Clinton
23	22W	National Gas & Oil Corp.	B. F. Tharp No. 1		3,600	1,000	1,025	no sand		3,544	3,600			838.3	162		2,706		80B	Clinton	
24	22W	National Gas & Oil Corp.	B. F. Tharp No. 2		3,630	1,005	1,025	no sand		3,615	3,630			806.8	198		2,808		20B	Clinton	
25	23E	Ohio Fuel Gas Co.	Roy E. Divers No. 1	1941	4,355	1,335	1,355	no sand		4,251	4,276	4,339	4,346	997	338		3,254	3,342	Dry		
26	23E	Ohio Fuel Gas Co.	Frank Ribble No. 1	1941	4,254	1,330	1,338	no sand		4,218	4,254			982	347		3,235		10,990M	Clinton	
27	23E	Ohio Fuel Gas Co.	Chas. Snyder No. 1	1941	4,284	1,305	1,322	no sand		4,232	4,262			960	345		3,272		530M	Clinton	
28	23E	Ohio Fuel Gas Co.	Chas. Snyder No. 2	1941	4,306	1,322	1,342	no sand		4,241	4,272			980.6	342		3,260		33M	Clinton	
29	23E	Ohio Fuel Gas Co.	W. W. Cunningham No. 1	1942	4,293	1,360	1,370	no sand		4,264	4,292			989	371		3,275		1,710M	Clinton	
30	23E	Ohio Fuel Gas Co.	Harvey B. Snyder No. 2	1942	4,277	1,334	1,354	1,386	1,396	4,237	4,273			986.7	348	400	3,251		455M	Clinton	
31	23E	Ohio Fuel Gas Co.	Anna C. Nutter No. 1	1944	4,325	1,340	1,350	no sand		4,278	4,308			973.9	367		3,305		Dry		S. o. & g. in Clinton
32	23W	Ohio Fuel Gas Co.	F. C. Everhart No. 1	1949	3,959	1,168	1,184	1,223	1,235	3,851	3,878	3,925	3,935	975.4	193	248	2,876	2,950	Dry		
33	23W	Ohio Fuel Gas Co.	G. W. Dearinger No. 1	1948	3,975	1,160	1,175	no sand		3,856	3,883	3,967	3,972	980.0	180		2,876	2,987	220M	Clinton	Medina dry
34	24	Ohio Fuel Gas Co.	R. S. Cosgrave No. 1	1930	4,122	1,198	1,214	no sand		3,868	3,920	3,934	3,957	1,010.66	187		2,857	2,923	4 B; 168M	Medina	
35	24	W. L. Swingle	Vaughn Stoneburner No. 1	1946	4,092	1,245	1,265	1,292	1,298	3,985	4,032	4,085	4,092	1,006	239		2,979	3,079	Dry		S. g. in Clin. ; wtr. Med.
36	25	Foraker Drilling Co.	W. C. Spring No. 1	1949	3,987	1,175	1,190	no sand		3,881	3,914	3,980	3,985	965.2	210		2,916	2,999	1,332M	Medina	Clinton dry
37	25	Ohio Fuel Gas Co.	T. A. Pletcher No. 1	1947	3,987	1,180	1,195	no sand		3,861	3,898	3,981	3,987	948.9	231		2,912	3,032	500M	Medina	S. o. in Clinton
38	25	National Gas & Oil Corp.	R. B. Pickens No. 1	1951	4,021	1,207	1,224	1,247	1,263	3,900	3,957	4,010	4,016	1,016	191	231	2,884	2,994	130M	Medina	Clinton dry
39	26E	Pure Oil Co.	C. C. Williams No. 2	1942	4,319	1,358	1,365	1,405	1,430	4,286	4,315			990	368	415	3,296		1,979M	Clinton	
40	26E	Ohio Fuel Gas Co.	Mildred M. Dovenbarger No. 1	1943	4,359	1,351	1,368	1,415	1,422	4,291	4,317			975.4	376	440	3,316		Dry		S. g. in Clinton
41	26E	Industrial Gas Corp.	Verna Divers No. 1	1942	4,342	1,394	1,410	1,450	1,465	4,327	4,342			1,034	360	416	3,293		6,180M	Clinton	
42	26E	Industrial Gas Corp.	Verna Divers No. 2	1942	4,289	1,348	1,358	1,400	1,410	4,259	4,289			990	358	410	3,269		1,776M	Clinton	
43	26E	Industrial Gas Corp.	Verna Divers No. 3	1943	4,274	1,338	1,353	no sand		4,226	4,269			1,087	251		3,139		431M	Clinton	
44	26E	National Gas & Oil Corp.	Verna Divers No. 4	1948	4,269	1,260	1,278	1,311	1,323	4,121	4,195	4,262	4,269	919	339	392	3,202	3,343	Dry		S. g. in Clinton
45	26E	Ohio Fuel Gas Co.	R. F. Williams No. 1	1942	4,261	1,327	1,347	1,370	1,390	4,232	4,261			966.7	360	403	3,265		11,700 M	Clinton	
46	26E	Ohio Fuel Gas Co.	Bertha E. Mercer No. 1	1943	4,316	1,315	1,335	no sand		4,257	4,293			945.88	369		3,311		Dry		
47	26W	Zanesville Tool	Dell W. Rambo No. 1	1947	3,981	1,175	1,192	no sand		3,860	3,814	3,976	3,981	980	195		2,880	2,996	190M	Medina	S. o. in Clinton
48	26W	Zanesville Tool	Dell W. Rambo No. 2	1947	3,974	1,169	1,188	no sand		3,861	3,899			968	201		2,893		500M	Medina	Clinton dry
49	26W	Ohio Fuel Gas Co.	D. L. Jadwin No. 2	1947	3,932	1,160	1,176	no sand		3,824	3,855	3,928	3,932	972.1	188		2,852	3,856	710M	Medina	
50	26W	Ohio Fuel Gas Co.	C. C. Darr No. 1	1948	4,005	1,200	1,214	no sand		3,880	3,922	3,998	4,005	987.6	212		2,892	3,010	50M	Medina	S. o. & g. in Clinton
51	26W	Ohio Fuel Gas Co.	George Komaromy No. 1	1948	3,902	1,107	1,127	no sand		3,800	3,820	3,896	3,902	912.4	195		2,888	2,984	470M	Medina	Clinton dry
52	26W	Ohio Fuel Gas Co.	Margaret Deaver et al No. 1	1947	3,920	1,120	1,135	no sand		3,789	3,828	3,908	3,918	921.0	199		2,868	2,987	360M	Medina	Clinton dry
53	26W	Ohio Fuel Gas Co.	New York Coal Co. No. 1	1948	3,948	1,158	1,175	no sand		3,783	3,847	3,931	3,937	976.4	182		2,807	2,955	190M	Clinton	Medina dry
54	27E	Industrial Gas Corp.	C. A. Eppley No. 1	1942	4,281	1,336	1,346	1,385	1,397	4,230	4,281			1,002	334	383	3,228		261M	Clinton	
55	27E	Industrial Gas Corp.	C. A. Eppley No. 2	1942	4,361	1,372	1,392	1,425	1,435	4,248	4,289	4,355	4,361	1,034	338	391	3,214	3,321	Dry		S.o. & g. in 1st Berea

56	27E	Industrial Gas Corp.	Theodore Eppley No. 1	1941	4,168	1,254	1,266	1,291	1,303	4,103	4,141			927	327	364	3,176		380M	Clinton	
57	27E	Industrial Gas Corp.	Boyd Divers No. 2	1942	4,258			1,382	1,400	4,186	4,218			1,010		372	3,176		400M	Clinton	
58	27E	Ohio Fuel Gas Co.	Jesse G. Eppley No. 1	1942	4,231	1,338	1,358	1,387	1,400	4,201	4,230			1,025.1	313	362	3,176		3,450M	Clinton	
59	27E	Ohio Fuel Gas Co.	Hiram Walker No. 1	1942	4,281	1,325	1,345	no	sand	4,220	4,235			998	327		3,222		Dry		
60	27E	Industrial Gas Corp.	Sidney Garrett No. 1	1942	4,281	1,361	1,381	1,415	1,425	4,223	4,261			1,003	358				569M	Clinton	
61	27W	Ohio Fuel Gas Co.	Myrtle E. Hull No. 1	1945	3,755	1,072	1,088	no	sand	3,711	3,742			898.6	173		2,812		800M	Clinton	
62	27W	Ohio Fuel Gas Co.	Myrtle E. Hull No. 2	1945	3,863	1,141	1,156	no	sand	3,815	3,831			959.6	181		2,855		Dry		S.o. & g. in Clinton
63	27W	Foraker Drilling Co.	Gilbert Crabtree No. 1	1948	3,896	1,104	1,125	no	sand	3,750	3,792	No Medina		921	183		2,829		Dry		S.o. in Clinton
64	27W	F. R. Beasley	James May No. 1	1948	3,669	929	948	no	sand	3,528	3,595	No Medina		768			2,760		120M	Clinton	
65	28	Pure Oil Co.	J. G. Eppley No. 3	1942	4,204	1,307	1,335	no	sand	4,148	4,200			990	317		3,158		Dry		S.o. & g. in Clinton
66	28	Pure Oil Co.	J. G. Eppley No. 4	1942	4,222	1,314	1,344	no	sand	4,165	4,199			991	323		3,174		Dry		
67	30	H. K. Porter, Inc.	Harry D. Pletcher No. 1	1944	4,003	1,258	1,273	no	sand	4,031	4,053			1,020	238		3,011		4,750M	Clinton	S. g. in 1st Berea
68	30	W. L. Swingle	Dallas Stoneburner No. 1	1946	4,045	1,265	1,285	no	sand	4,000	4,050			1,010	255		2,990		1,600M	Clinton	S. g. in 1st Berea
69	30	H. K. Porter, Inc.	Dallas Stoneburner,et ux No.1	1944	4,120	1,250	1,270	no	sand	4,031	4,042			1,009	241		3,022		Dry		S. g. in 1st Berea
70	30	H. K. Porter, Inc.	Theron Stoneburner No. 1	1945	4,000	1,161	1,180	no	sand	3,918	3,923			900					Dry		S. g. in 1st Be. & Nwbg.
71	31	H. K. Porter, Inc.	Caroline L. Weaver No. 4	1945	4,019	not logged		no	sand	3,923	3,960			925			2,998		Dry		
72	32	Industrial Gas Corp.	Smith-Swyster No. 1	1945	4,104	1,180	1,200	1,232	1,245	4,015	4,027	4,100	4,104	865	315	367	3,150	3,235	Dry		
73	33	Jean. Glass Co.	Mary L. & John F. Dever No1	1946	4,330	1,336	1,352	no	sand	4,208	4,243	4,318	4,330	1,012	324		3,196	3,306	Dry		
74	33	Pure Oil Co.	Hughes-Swyster No. 1	1943	4,142	1,190	1,212	1,241	1,257	4,042	4,080	4,127	4,142	893	297	348	3,149	3,234	Dry		
75	34E	Pure Oil Co.	A. L. Stainbrook No. 1	1943	4,114	1,170	1,180	no	sand	4,060	4,112			808			3,252		337M	Clinton	
76	34E	Ohio Fuel Gas Co.	Harlan E. Bush No. 1	1943	4,092	1,141	1,155	no	sand	4,016	4,063			795.5	346		3,221		130M	Clinton	
77	34E	Industrial Gas Corp.	Eppley-Bush-Fye No. 1	1943	4,353	1,404	1,416	1,448	1,156	4,298	4,345			1,037	367	411	3,261		1,770M	Clinton	
78	34E	Industrial Gas Corp.	Theodore Eppley No. 2	1942	4,094	1,170	1,192	1,228	1,244	4,055	4,089			838	332	390	3,217		Dry		S.o. Berea; s.g. Clin.
79	34E	Ohio Fuel Gas Co.	S. J. Hivnor No. 1	1944	4,263	1,338	1,355	no	sand	4,221	4,255			1,004.4	334		3,217		1,330M	Clinton	
80	34W	C. M. Foraker, et. al.	New York Coal Co. No. 1	1944	3,826	1,143	1,158	no	sand	3,790	3,826			965	178		2,825		1,810M	Clinton	
81	34W	Foraker & Sons	New York Coal Co. No. 2	1945	3,699	950	965	no	sand	3,572	3,613	3,696	3,699	787	163		2,785	2,909	91M	Clinton	
82	34W	Foraker Drilling Co.	Ada L. Thompson No. 1	1948	3,894	1,017	1,034	no	sand	3,681	3,725	3,784	3,789	811	206		2,876	2,973	300M	Medina	S. g. in 1st Berea
83	34W	Ohio Fuel Gas Co.	Hull Rambs No. 1	1946	3,849	1,137	1,155	no	sand	3,808	3,828			965.3	172		2,843		123M	Clinton	S. g. in 1st Berea
84	34W	Ohio Fuel Gas Co.	M. E. Hull, et.al. No. 1	1946	3,729	not logged		no	sand	3,697	3,725			867.6			2,830		1,330M	Clinton	
85	34W	Firitz Oil & Gas Co.	Mary Deaver, et.al. No. 1	1951	3,689	936	950	no	sand	3,569	3,604	3,680	3,686	780	156		2,789	2,900	Dry		S. g. in Medina
86	35E	Ohio Fuel Gas Co.	Harlan E. Burt No. 1	1942	4,309	1,279	1,300	no	sand	4,194	4,224	4,295	4,305	903.0	376		3,291	3,392	Dry		
87	35E	Ohio Fuel Gas Co.	Harlon E. Bush No. 1	1944	4,315	1,352	1,372	1,408	1,423	4,255	4,290			994.2	358	414	3,261		Dry		S. g. in 2nd Berea
88	35E	Sturm & Brummage	C. E. Rinebarger No. 1	1944	4,333	1,370	1,390	1,425	1,435	4,306	4,331			985.5	384	439	3,320		4,560M	Clinton	
89	35E	Ohio Fuel Gas Co.	W. H. Garrett No. 1	1943	4,271	1,315	1,331	1,370	1,380	4,235	4,265			938.9	376	430	3,295		2,280M	Clinton	
90	35E	Industrial Gas Corp.	Ch. Fye No. 1	1943	4,253	1,329	1,341	1,381	1,400	4,217	4,250			964	365	417	3,253		3,297M	Clinton	
91	35W	Zanesville Tool	F. E. Foraker, et.al. No. 1	1943	3,941	1,137	1,157	1,181	1,201	3,819	3,882	3,936	3,940	936	201	245	2,883	3,000	83M	Medina	Clinton dry
92	35W	Ohio Fuel Gas Co.	C. L. Weaver No. 2	1946	3,792	1,100	1,118	no	sand	3,756	3,791			916.3	184		2,840		3,950M	Clinton	
93	35W	Oxford Oil Co	Caroline Weaver No. 5	1949	3,951	1,143	1,161	no	sand	3,830	3,865	3,937	3,946	953	190		2,877	2,984	300M	Clinton	Medina dry
94	35W	Ohio Fuel Gas Co.	L. H. Gregg No. 2	1946	3,844	1,136	1,151	no	sand	3,795	3,833			952	184		2,843		1,120M	Clinton	
95	35W	Ohio Fuel Gas Co.	Edith M. Hull No. 3	1949	3,946	1,154	1,166	no	sand	3,802	3,855	3,925	3,930	961.9	192		2,840	2,963	22B; 230M	Clinton	Medina dry
96	36E	Ohio Fuel Gas Co.	C. E. Rinebarger No. 2	1944	4,371	1,390	1,410	1,442	1,457	4,324	4,369			990.7	399	451	3,333		1,000 M	Clinton	
97	36E	Ohio Fuel Gas Co.	C. E. Rinebarger No. 3	1945	4,448	1,427	1,445	1,483	1,498	4,365	4,408			1,035.8	391	447	3,329		Dry		
98	36	Foraker Drilling Co.	Harry Gibbs & Knapp No. 2	1950	3,980	1,157	1,172	no	sand	3,862	3,924	3,975	3,979	950			2,912		1,200M	Medina	Clinton dry
99	22E	York Gas Co.	Frank Matheny No. 1	1941	4,183	1,350	1,362	no	sand	4,202	4,256			1,025	325		3,177		500M	Medina	
100	26W	Ohio Fuel Gas Co.	Dora Jadwin No. 1	1947	3,981	1,195	1,212	no	sand	3,861	3,898	3,975	3,981	1,006.6	189		2,855	2,969	710M	Medina	Clinton dry
101	36W	Sidwell Bros.	John Sipos No. 1	1949	3,945	1,173	1,187	no	sand	3,897	3,939			969	209		2,928		143Bbls.	Clinton	
102	19	National Gas & Oil Corp.	J. R. Floyd No. 1	1926	1,342	1,316	1,340							1,097	219				300M	Berea	
103	19	Morgan Gas Co.	Dallas Stoneburner No. 4	1943	1,202	1,175	1,199							950	225				37M	Berea	
104	19	Pure Oil Co.	Hughes - Floyd No. 1	1925	1,341	1,316	1,334							1,083.0	233				663M	Berea	
105	19	Industrial Gas Co.	B. L. Stoneburner No. 1	1922	1,320	1,299	1,320							1,077	222				1,080M	Berea	
106	19	National Gas & Oil Corp.	Ruth Stoneburner No. 2	1925	1,315	1,291	1,315							1,058	233				800M	Berea	
107	20	Pure Oil Co.	Clarence Fye No. 1	1925	1,367	1,340	1,354							1,080.8	259				9B; 150M	Berea	
108	20	Pure Oil Co.	Clarence Fye No. 3	1925	1,414	1,387	1,414							1,119	268				26Bbls.	Berea	
109	20	National Gas & Oil Corp.	Eliz. J. Floyd No. 3	1924	1,348	1,318	1,343							1,110	208				100M	Berea	
110	20	Pure Oil Co.	Jacob Fisher No. 1	1929	1,346	1,317	1,341							1,074	243				28M	Berea	
111	20	Hope Construction & Refining Co.	C. H. Bailey No. 1	1926	1,410	1,379	1,406							1,156	223				430M	Berea	
112	21	Pure Oil Co.	W. F. Williams No. 2	1926	1,360	1,331	1,354							1,054	277				4 Bbls.	Berea	
113	21	Pure Oil Co.	W. F. Williams No. 5	1926	1,193	1,170	1,186							878.8	291				5 Bbls.	Berea	
114	21	Pure Oil Co.	W. F. Williams No. 8	1926	1,380	1,358	1,374							1,064.3	294				5 Bbls.	Berea	
115	21	Preston Oil Co.	Matilda Eppley No. 1	1926	1,377	1,339	1,363							1,036	303				8 Bbls.	Berea	
116	21	Preston Oil Co.	Matilda Eppley No. 3	1926	1,418	1,382	1,406							1,080.4	302				8 Bbls.	Berea	
117	21	Pure Oil Co.	Milton Nicewanger No. 4		1,390	1,372	1,390							1,098	274				Oil	Berea	
118	21	Pure Oil Co.	Milton Nicewanger No. 10		1,311	1,277	1,311							985.4	292				16 Bbls.	1st Berea	
119	21	Sun Oil Co.	Amos Souders No. 8	1925	1,390	1,349	1,372							1,070	279				30 Bbls.	1st Berea	
120	24	W. L. Swingle	Robert Nutter No. 1	1943	1,192	1,170	1,190							966	204				73 M	1st Berea	
121	24	Ohio Fuel Gas Co.	David E. Allen No. 1	1951	1,268	1,249	1,261							1,049.9	199				Dry		S. g. in 1st Berea
122	24	W. L. Swingle	Sylvester Pletcher No. 1	1943	1,180	1,158	1,177							963	185				95 M	1st Berea	
123	25	Morgan Gas	Chas. Bush No. 1	1942	1,181	1,159	1,180							941	218				200 M	1st Berea	
124	25	Ohio Fuel Gas Co.	Thos. Pletcher No. 1	1943	1,191	1,168	1,145							940	228				Dry		S. g. in 1st Berea
125	25	Morgan Gas	Birdie Barringer No. 1	1944	1,170	1,147	1,167							938	209				38M	1st Berea	

Plate No.	Sec. No.	Operator	Farm Name and Well No.	Date Comp.	Total Depth	Depth of Sand Below Surface				Surface Elevation	Depth of Top of Sand Below Sea Level				Initial Production	Producing Sand	Remarks
						1st Berea	2nd Berea	Clinton	Medina		1st Berea	2nd Berea	Clinton	Medina			
126	26W	Ohio Fuel Gas Co.	Caroline Weaver	1942	1,169	1,144 1,164				955	189				74M	1st Berea	
127	27W	Ohio Fuel Gas Co.	Mary A. Koonts No. 1	1929	1,055	1,033 1,053				674	159				Dry		
128	27W	Clyde Foraker	C. M. Foraker, et. al. No. 1	1933	1,015	1,000 1,015				652.6	174				250M	1st Berea	
129	28	Pure Oil Co.	C. E. Swytser No. 14	1925	1,268	1,226 1,248				940	288				30 Bbls.	1st Berea	
130	28	Pure Oil Co.	C. E. Swytser No. 17	1926	1,265	1,221 1,247				928	292				15 Bbls.	1st Berea	
131	28	Pure Oil Co.	C. E. Swytser No. 22	1938	1,284	1,258 1,264				939	319				Oil	1st Berea	Core test
132	28	Pure Oil Co.	Wilbert Bush No. 5	1926	1,347	1,313 1,345				1,023	290				10 Bbls.	1st Berea	
133	28	Pure Oil Co.	Wilbert Bush No. 6	1926	1,381	1,356 1,378				1,057	301				12 Bbls.	1st Berea	
134	28	Pure Oil Co.	Wilbert Bush No. 7	1930	1,350	1,319 1,333				1,032	287				17 Bbls.	1st Berea	
135	28	Pure Oil Co.	Wilbert Bush No. 8	1930	1,400	1,366 1,398				1,065	303				5 Bbls.	1st Berea	
136	28	Pure Oil Co.	Wm. Eppley Hrs. No. 1	1924	1,392	1,363 1,366				1,094	269				75 Bbls.	1st Berea	
137	28	Pure Oil Co.	Wm. Eppley Hrs. No. 7	1925	1,380	1,350 1,377				1,074.9	275				29 Bbls.	1st Berea	
136	29	Pure Oil Co.	C. S. Christman No. 4	1924	1,349	1,324 1,345				1,063	261				36 Bbls.	1st Berea	
139	29	Pure Oil Co.	B. A. Barringer No. 2	1925	1,295	1,268 1,294				974.6	293				1,000 M	1st Berea	
140	29	Pure Oil Co.	B. A. Barringer No. 3	1925	1,225	1,196 1,219				934.6	261				Oil	1st Berea	
141	29	Pure Oil Co.	Ira Barringer No. 5	1924	1,341	1,314 1,341				1,046.5	267				40 Bbls.	1st Berea	
142	29	Pure Oil Co.	Ira Barringer No. 6	1924	1,190	1,166 1,190				920	246				50 Bbls.	1st Berea	
143	29	Pure Oil Co.	Jos. Longstreth No. 1	1925	1,263	1,241 1,263				1,000	241				1,750M	1st Berea	
144	29	Pure Oil Co.	Geo. Fye No. 1	1924	1,387	1,364 1,387				1,095	266				Oil	1st Berea	
145	29	Pure Oil Co.	Geo. Fye No. 7	1925	1,229	1,204 1,228				948	256				17 Bbls.	1st Berea	
146	29	Pure Oil Co.	Geo. Fye No. 8	1926	1,253	1,232 1,253				985	267				5B: 368M	1st Berea	
147	29	Pure Oil Co.	Ernest Bell No. 3	1925	1,330	1,305 1,326				1,055	250				13 Bbls.	1st Berea	
148	29	Pure Oil Co.	Wm. Eppley Heirs No. 3	1924	1,356	1,330 1,352				1,061	269				Oil	1st Berea	
149	30	Morgan Gas	D. Stoneburner No. 2	1942	1,189	1,165 1,187				940	225				510M	1st Berea	
150	30	Waverly Oil	David Mast Hrs. No. 1	1925	1,242					980					Dry		S.g. in 1st Berea
151	30	Morgan Gas	B. Barringer et al No. 1	1942	1,228	1,204 1,224				974	230				40M	1st Berea	
152	30	Industrial Gas Corp.	B. A. Barringer No. 1	1944	1,176	1,156 1,174				915	241				16M	1st Berea	
153	31	National Gas & Oil Corp.	C. Weaver No. 5	1945	1,176	1,157 1,169				930	227				150M	1st Berea	S.g. in Squaw
154	31	National Gas & Oil Corp.	C. Weaver No. 6	1948	1,249	1,232 1,243				1,016	216				65M	1st Berea	
155	32	Pure Oil Co.	Isaac Smith No. 4	1925	1,272	1,249 1,272				961	268				31 Bbls.	1st Berea	
156	32	Pure Oil Co.	Isaac Smith No. 8	1926	1,322	1,304 1,325				1,015	289				5 Bbls.	1st Berea	
157	32	Pure Oil Co.	C. S. Christman No. 1	19—	1,357	1,323 1,344				1,048	275				35 Bbls.	1st Berea	
158	32	Pure Oil Co.	Charles Knapp No. 1	19—	1,371	1,353 1,371				1,098	255				25 Bbls.	1st Berea	
159	32	Pure Oil Co.	Ira Barringer No. 1	1923	1,369	1,328 1,352				1,064	264				30 Bbls.	1st Berea	
160	33	Pure Oil Co.	R. E. Hughes No. 1	1925	1,190	1,164 1,185				863	301				13 Bbls.	1st Berea	
161	33	Pure Oil Co.	R. E. Hughes No. 6	1926	1,230	1,197 1,220				869	308				10 Bbls.	1st Berea	
162	33	Pure Oil Co.	W. Kirkwood No. 1	192-	1,416	1,395 1,418				1,090	305				15 Bbls.	1st Berea	
163	33	Pure Oil Co.	Mary Bell No. 2	1926	1,335	1,320 1,335				1,091	229				8 Bbls.	1st Berea	
164	33	Pure Oil Co.	C. E. Swytser No. 7	1925	1,228	1,191 1,216				894	297				41 Bbls.	1st Berea	
165	35W	Ohio Fuel Gas Co.	Robert Tysinger No. 1	1943	1,106	1,086 1,105				684.2	202				100M	1st Berea	
166	35W	Industrial Gas Corp.	Glenn C. Pletcher No. 1	1943	1,155	1,135 1,153				950	185				93 M	1st Berea	
167	36W	Ohio Fuel Gas Co.	Harry S. Spring, et al No. 1	1943	1,073	1,054 1,072				831.0	223				160M	1st Berea	
168	36W	Ohio Fuel Gas Co.	H. M. Fell No. 1	1942	1,079	1,053 1,073				833	220				160M	1st Berea	
169	36W	Ohio Fuel Gas Co.	Wm. M. Longstreth No. 1	1925	1,155	1,121 1,140				897.9	223				110M	1st Berea	
170	36W	Ohio Fuel Gas Co.	Wm. M. Longstreth No. 2	1942	1,155	1,130 1,151				913.3	217				130M	1st Berea	
171	36W	Morgan Gas	Carl Weaver No. 2	1942	1,120	1,096 1,118				876	220				238M	1st Berea	
172	36W	Ohio Fuel Gas Co.	Chas. A. Knapp No. 1	1942	1,171	1,152 1,171				955.15	197				824M	1st Berea	
173	36W	Ohio Fuel Gas Co.	Belle Spring et al No. 1	1944	1,148	1,127 1,147				916.3	209				73M	1st Berea	
174	36W	Ohio Fuel Gas Co.	W. H. Knapp	1942	1,103	1,079 1,099				851.85	227				104M	1st Berea	

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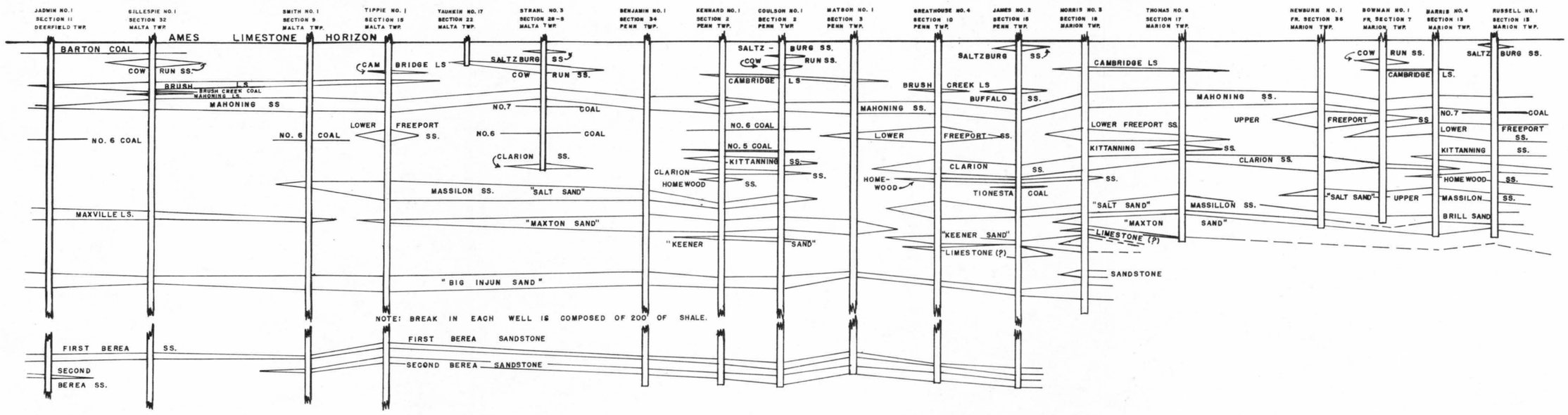
PLATE I

SECTION A — A'



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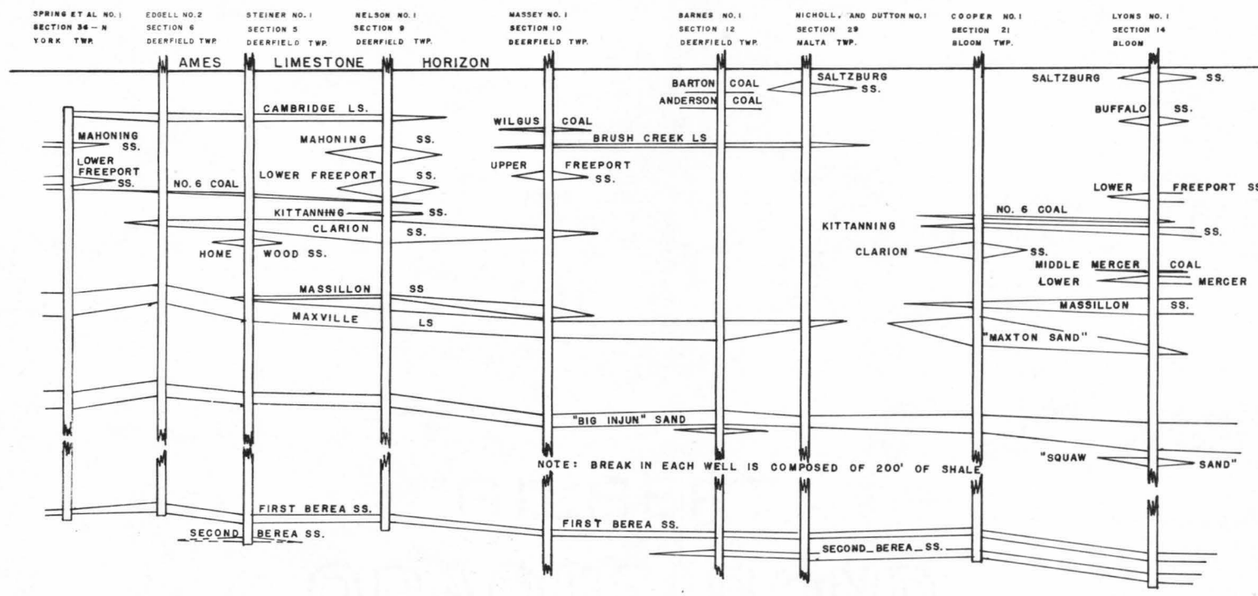
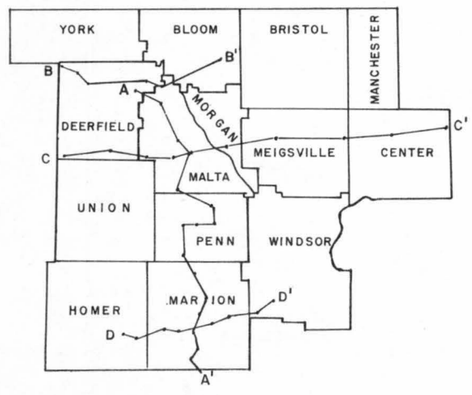
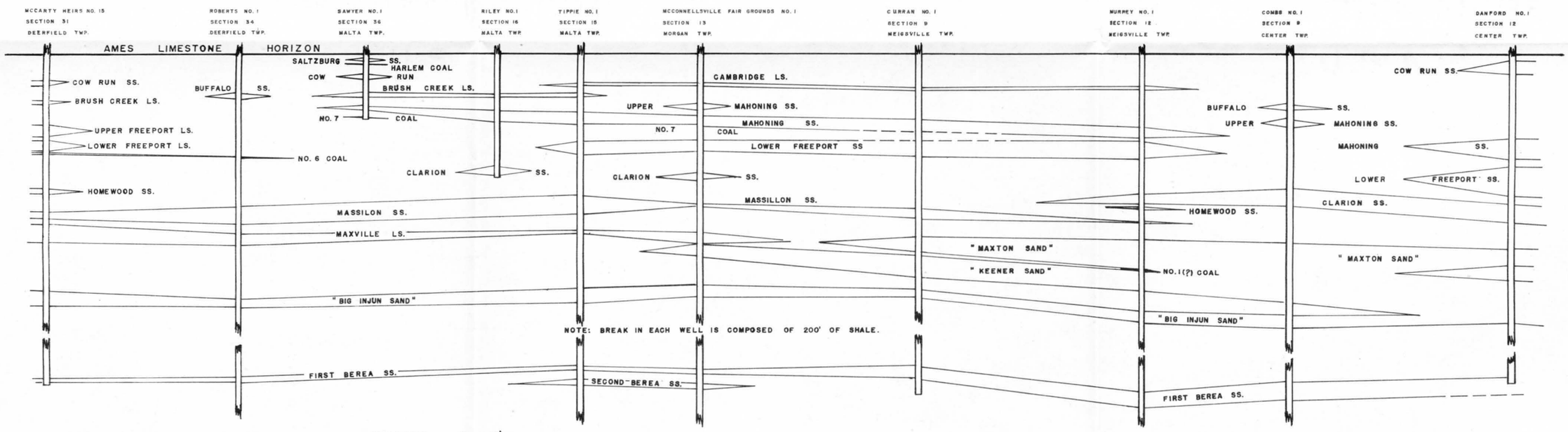




INDEX MAP OF MORGAN COUNTY SHOWING LOCATIONS OF CROSS SECTIONS

SECTION C — C'



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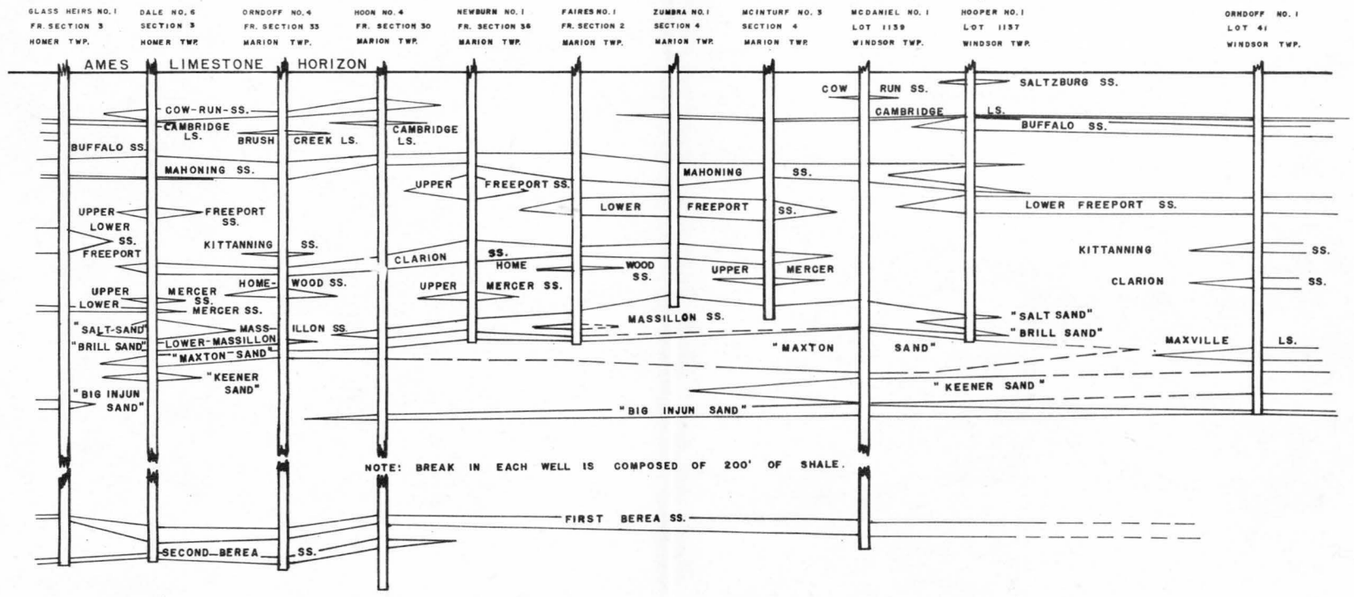


LEGEND

(AMES 0 — LIMESTONE)

-300

-600

VERTICAL SCALE IN FEET

0 1 2

HORIZONTAL SCALE IN MILES

DATUM PLANE — AMES LIMESTONE

DATA FROM DRILLERS LOGS

PLATE I

REPORT OF INVESTIGATIONS NO. 22

DRAFTING BY RODERICK S. WILLIAMS

COLUMBUS

1954

SUBSURFACE CROSS SECTIONS SHOWING KEY HORIZONS BETWEEN THE AMES LIMESTONE AND THE SECOND BEREA SANDSTONE IN MORGAN COUNTY

BY BYRON D. MAGBEE

STATE OF OHIO

FRANK J. LAUSHE, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

A.W. MARION, DIRECTOR

DIVISION OF GEOLOGICAL SURVEY

JOHN H. MELVIN, CHIEF

PLATE II

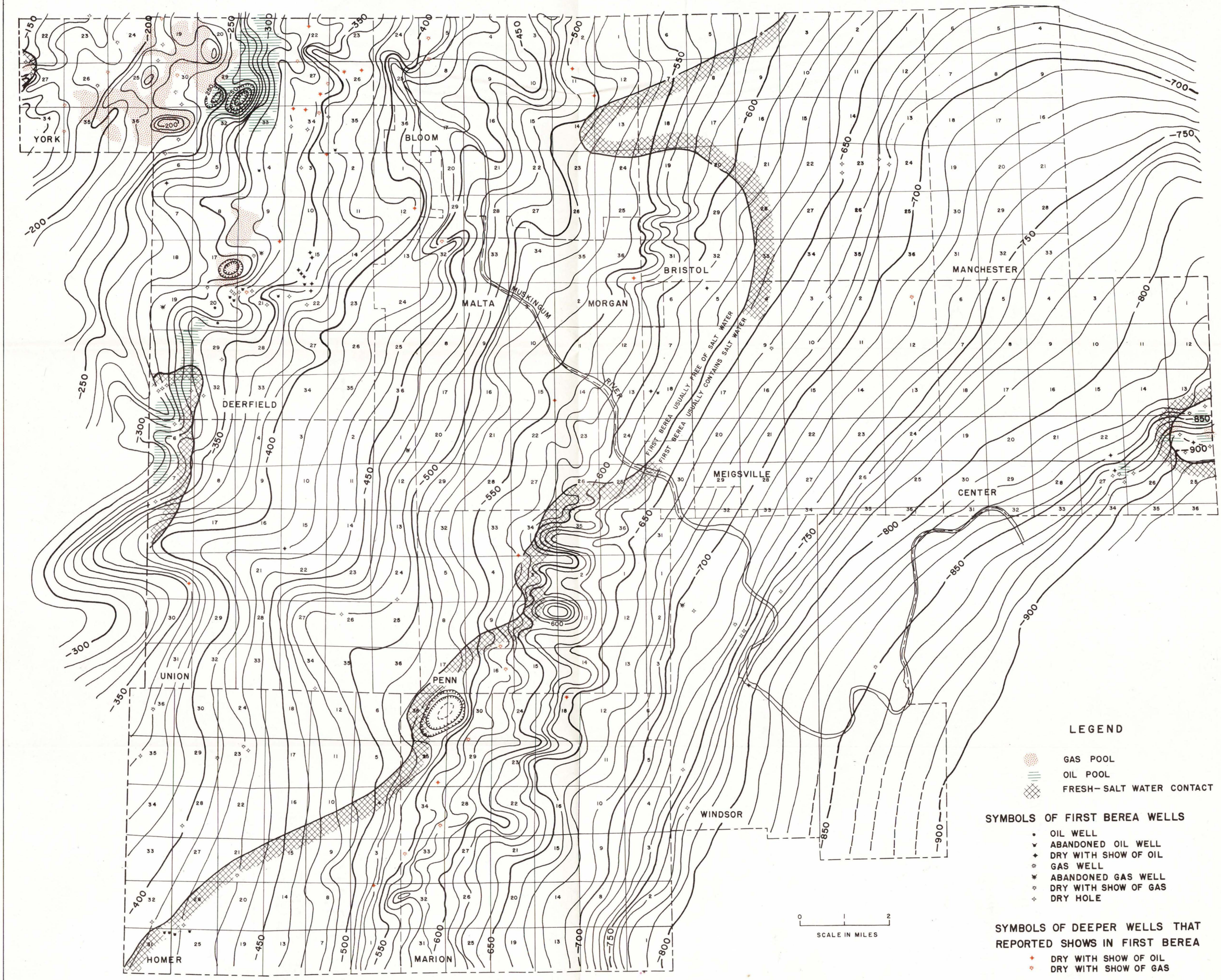


PLATE II

REPORT OF INVESTIGATIONS NO. 22

DRAFTING BY RODERICK S. WILLIAMS

COLUMBUS

1954

STRUCTURE CONTOURS ON TOP OF THE FIRST BEREA SAND AND PRODUCING AREAS IN MORGAN COUNTY

BY BYRON D. MAGBEE

DATUM = SEA LEVEL CONTOUR INTERVAL = 10 FEET

STATE OF OHIO

FRANK J. LAUSCHE, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

A. W. MARION, DIRECTOR

DIVISION OF GEOLOGICAL SURVEY

JOHN H. MELVIN, CHIEF

YORK
BLOOM
MORGAN
BRISTOL
MANCHESTER
DEERFIELD
MALTA
MEIGSVILLE
CENTER
UNION
PENN
WINDSOR
HOMER
MARION
MUSKINGUM RIVER

LEGEND

WELLS DRILLED TO THE SECOND BEREA SAND

- AREA OF SECOND BEREA GAS PRODUCTION
- ABANDONED GAS WELL
- DRY WITH SHOW OF GAS
- DRY HOLE
- NS NO SECOND BEREA SAND RECORDED

WELLS DRILLED TO CLINTON OR MEDINA SANDS THAT RECORDED SECOND BEREA INFORMATION

- SHOW OF GAS IN SECOND BEREA
- SHOW OF OIL IN SECOND BEREA
- DRY IN SECOND BEREA
- NS NO SECOND BEREA SAND RECORDED

THE MAJORITY OF CLINTON AND MEDINA WELLS IN YORK TOWNSHIP AND IN NORTHERN BLOOM TOWNSHIP RECORDED SECOND BEREA SAND. ONLY THOSE REPORTING OIL OR GAS SHOWS IN THE SECOND BEREA ARE INDICATED.

0 1 2
SCALE IN MILES

PLATE III

PLATE III

REPORT OF INVESTIGATIONS NO. 22

DRAFTING BY RODERICK S. WILLIAMS

COLUMBUS

1954

THICKNESS AND PRODUCING AREAS OF THE SECOND BEREA SAND IN MORGAN COUNTY

BY BYRON D. MAGBEE

CONTOUR INTERVAL— 5 FEET

STATE OF OHIO

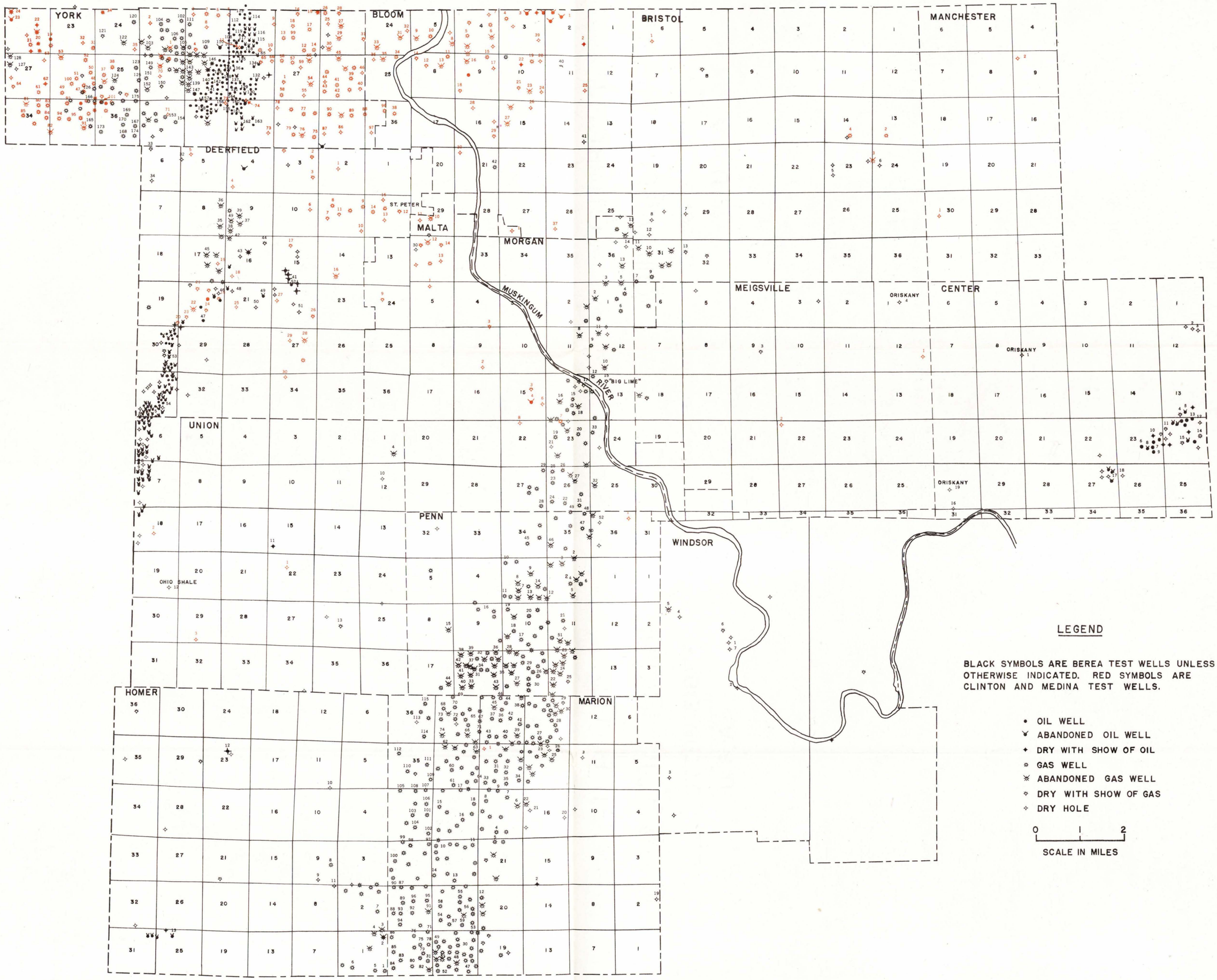
FRANK J. LAUSCHE, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

A. W. MARION, DIRECTOR

DIVISION OF GEOLOGICAL SURVEY

JOHN H. MELVIN, CHIEF



LEGEND

BLACK SYMBOLS ARE BEREA TEST WELLS UNLESS OTHERWISE INDICATED. RED SYMBOLS ARE CLINTON AND MEDINA TEST WELLS.

- OIL WELL
- ABANDONED OIL WELL
- DRY WITH SHOW OF OIL
- GAS WELL
- ABANDONED GAS WELL
- DRY WITH SHOW OF GAS
- DRY HOLE

0 1 2

SCALE IN MILES

PLATE IV

REPORT OF INVESTIGATIONS NO. 22

DRAFTING BY RODERICK S. WILLIAMS

COLUMBUS

1954

INDEX MAP SHOWING BEREA AND DEEPER WELLS IN MORGAN COUNTY

WELLS WITH KNOWN SURFACE ELEVATION NUMBERED-SEE APPENDIX

BY BYRON D. MAGBEE

STATE OF OHIO

FRANK J. LAUSCHE, GOVERNOR

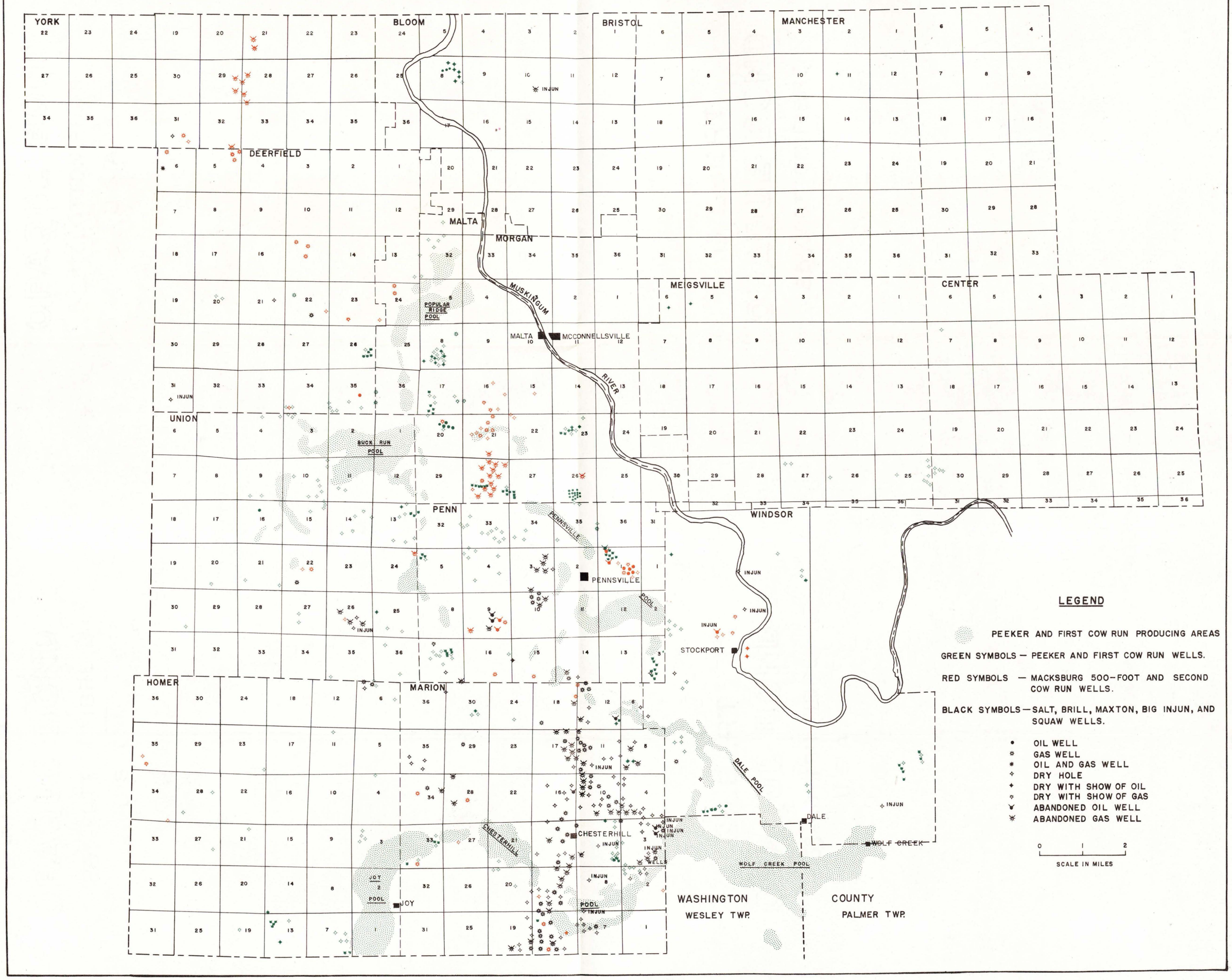
DEPARTMENT OF NATURAL RESOURCES

A. W. MARION, DIRECTOR

DIVISION OF GEOLOGICAL SURVEY

JOHN H. MELVIN, CHIEF

PLATE IV



LEGEND

PEEKER AND FIRST COW RUN PRODUCING AREAS

GREEN SYMBOLS — PEEKER AND FIRST COW RUN WELLS.

RED SYMBOLS — MACKSBURG 500-FOOT AND SECOND COW RUN WELLS.

BLACK SYMBOLS — SALT, BRILL, MAXTON, BIG INJUN, AND SQUAW WELLS.

- OIL WELL
- GAS WELL
- OIL AND GAS WELL
- DRY HOLE
- DRY WITH SHOW OF OIL
- DRY WITH SHOW OF GAS
- ABANDONED OIL WELL
- ABANDONED GAS WELL

0 1 2

SCALE IN MILES

PLATE V

REPORT OF INVESTIGATIONS NO. 22

DRAFTING BY RODERICK S. WILLIAMS

COLUMBUS

1954

LOCATION OF SHALLOW SAND WELLS AND PRODUCING AREAS IN MORGAN COUNTY

BY BYRON D. MAGBEE

STATE OF OHIO

FRANK J. LAUSCHE, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

A.W. MARION, DIRECTOR

DIVISION OF GEOLOGICAL SURVEY

JOHN H. MELVIN, CHIEF

PLATE V