Text to Accompany

OPEN FILE REPORT 79-305

1981

FEDERAL COAL RESOURCE OCCURRENCE AND FEDERAL COAL DEVELOPMENT POTENTIAL MAPS OF THE NORTHEAST QUARTER OF THE RED OAK 15-MINUTE QUADRANGLE, LATIMER COUNTY, OKLAHOMA

[Report includes 19 plates]

Prepared for

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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INTRODUCTION

Purpose

This text is to be used in conjunction with the Federal Coal Resource Occurrence (FCRO) and Federal Coal Development Potential (FCDP) Maps of the northeast quarter of the Red Oak 15-minute quadrangle, Latimer County, Oklahoma.

This report was compiled to support the land-planning work of the Bureau of Land Management (BLM). The work was undertaken by Geological Services of Tulsa, Tulsa, Oklahoma, at the request of the United States Geological Survey under contract number 14-08-0001-17989. The resource information gathered for this report is in response to the Federal Coal Leasing Amendments Act of 1976 (Public Law 94-377). Published and unpublished publicly available information was used as the data base for this study. No new drilling or field mapping was done to supplement this study, nor was any confidential or proprietary data used.

The coal data used in this map report were originally compiled on an enlarged version of the Red Oak 15-minute quadrangle base. Subsequently, the Red Oak 7.5-minute topographic quadrangle map base was completed by the U.S. Geological Survey. The more recent base map was used in compositing plates 1, 4, 5, 6, 7, 8, 11, 12, 13, 14, and 15 in the accompanying map set.

Minor discrepancies may exist in the locations of the traces of the coal bed outcrops and other surface data points; however, the enclosed maps are internally consistent. The decision to use a more modern and accurate base should not significantly affect the reserve base or reserve tonnage.

Location

The northeast quarter of the Red Oak 15-minute quadrangle is located in the central portion of the Howe-Wilburton coal mining district in the southern part of the southeastern Oklahoma coal field. All of the quadrangle lies in Latimer County; the county seat is Wilburton, which is 9 miles (14 km) to the west. The city of McAlester is 43 miles (69 km) west of the quadrangle, and the city of Tulsa is approximately 100 miles (160 km) northwest of the quadrangle.

Accessibility

The town of Red Oak is the only settlement of any size in the northeast quarter of the Red Oak 15-minute quadrangle. U.S. Route 270 runs through Red Oak east to Poteau, where it joins U.S. Route 59, and west to McAlester where it joins U.S. Route 69. The junction of U.S. Routes 270 and 271 is about 10 miles (16 km) from the eastern edge of the quadrangle.

Several improved and unimproved roads and jeep trails provide access through the valleys and into many of the mountainous areas in the region.

The Chicago, Rock Island, and Pacific Railroad parallels U.S. Route 270 through the center of the study area.

Physiography

The northest quarter of the Red Oak 15-minute quadrangle is in the Arkoma Basin on the northern edge of the Ouachita Mountains in the Arkansas Valley physiographic province (Hendricks, 1939). The Choctaw Fault, which essentially marks the southern edge of the Basin, cuts across the southern portion of the area.

The topography in the northern half of the study area is that of a fairly broad erosional valley interrupted by three sharply rising mountains. The valley varies in elevation from 500 to 650 feet (168 to 198 m), and the mountains reach a height of about 1300 to 1500 feet (397 to 457 m). The southern part of the quadrangle is dominated by east-west trending ridges and valleys. The ridges range from 800 to 900 feet (243 to 274 meters in altitude, while the valley floors are about 550 to 600 feet (168 to 183 meters) above sea level. A fairly broad valley cuts across the southern third of the quadrangle, ranging in width from about 1.5 miles (2.4 km) in the west to more than 2 miles (3.2 km) in the east.

The coal beds of the area crop out in several places. The Upper and Lower Hartshorne coals are exposed on the north side of a ridge running east-west through the central part of the area, at an elevation of approximately 600-650 feet (183 to 198 m). The Upper and Lower McAlester coals crop out in a band roughly parallel to this about 1 to 1.5 miles (1.6 to 2.4 km) to the north, and also in the valley along the northern edge of the quadrangle. The elevation of both of these outcrops is roughly 600 to 650 feet (183 to 198 m).

The area is drained in the south by the Fourche Maline and its tributaries, and in the north by Brazil Creek and its tributaries.

Climate and Vegetation

The climate in southeastern Oklahoma is for the most part fairly moderate. Winters are short, and extremely cold weather is rare. Summers, however, are generally long and hot. The mean annual temperature is about 62° F (17° C), and ranges from a daily average of about 41° F (5° C in January to to about 82° F (28° C) in July, through it is not unusual to have occasional periods of very hot days (Hendricks, 1939). Annual precipitation in the area averages approximately 41 inches (105 cm), with rains generally abundant in the spring, early summer, fall and winter (Hendricks, 1939).

The area supports a wide variety of vegetation, with oaks, blackjacks, hickories, elms and hackberries being most common. On the higher mountains and ridges pines can also be found. In parts of the valleys that have not been cleared for farming, thick stands of water and willow oaks, hickories, cottonwoods, willows and wild plums may be present (Hendricks, 1939).

Land Status

The Red Oak Known Recoverable Coal Resource Area (KRCRA) is entirely within the NE quarter of the Red Oak 15-minute quadrangle, and consists of approximately 2,880 acres (1,165 ha). In addition to this, the Federal Government also holds title to the coal mineral rights for approximately 16,280 acres (6,588 ha), for a total of 19,540 acres (7,908 ha) or 50% of the northeast quarter of the Red Oak 15-minute quadrangle. As of October 19, 1979, none of this land was leased.

GENERAL GEOLOGY

Previous Work

Much work has been done on the southeastern Oklahoma coal field. The first geologic study of the Howe-Wilburton district, of which the northeast quarter of the Red Oak 15-minute quadrangle is a part, was published by Chance (1890) and included a map showing the outcrops of the most important coal beds in the area. In 1897, Drake published the results of his study on the coal fields of the Indian Territory, which consisted of a map and text of the principal coal beds, general stratigraphy, and structural features.

From 1899 to 1910, Taff and his associates published several reports on the Oklahoma coal lands. These included a number of investigations carried out for the United States Geological Survey on the extent and general character of local stratigraphy, including coal beds. Much of his work was a part of Senate Document 390 (1910), which represented a compilation of material collected for the purpose of determining the value and extent of coal deposits in and under the segregated coal lands of the Choctaw and Chickasaw Nations in Oklahoma.

The Oklahoma Geological Survey published a bulletin by Snider in 1914 on the geology of east-central Oklahoma, emphasizing the geologic structure and oil and gas possibilities of the area. Further studies on the southern Oklahoma coal lands were carried out by Shannon et al (1926), Moose and Searle (1929), and Hendricks (1939). These, along with later works by Knechtel and Oakes in the 1940's added greatly to the body of knowledge on Oklahoma coals, particularly in terms of their quality, chemical composition and extent.

A number of estimates as to original and remaining coal reserves have been published; among them are the figures published in papers by Trumbull (1957) and Friedman (1974). Non-proprietary information of coal test holes drilled in various years in the northeast quarter of the Red Oak 15-minute quadrangle was available from USGS files and incorporated into this report.

Stratigraphy

The Arkoma Basin, once part of the larger Ouachita geosyncline, formed as a result of subsidence beginning in Mississippian time and continuing through Early and Middle Pennsylvanian. Strata in the basin are thought to have been deposited in a deltaic environment with sediment coming primarily from eroding highlands to the northeast, north, and northwest (Brannan, 1968). Evidence that the basin was becoming full is provided by coal seams in the Upper Atoka and Lower Desmoinesian section. Sedimentation continued until Late Pennsylvanian time, when the Arbuckle Orogeny of southern Oklahoma took place (Brannan, 1968). In Early Permian time, Ouachita mountain building to the south of the basin compressed Arkoma Basin strata into a series of long, narrow, east-west anticlinal and synclinal folds (see section on Structure below).

Most of the rock units cropping out in the northeast quarter of the Red Oak 15-minute quadrangle are of Pennsylvanian Age, and include the Atoka Formation, as well as the Hartshorne, McAlester and Savanna Formations of the Lower-Desmoinesian Krebs Group. The Hartshorne and McAlester Formations are coal bearing in this quadrangle. South of the Choctaw fault are non-coal bearing older rocks associated with the Ouachita Province. They lie south of the Oklahoma coal field and will not be discussed in detail here.

The Atoka Formation was named by Taff and Adams in 1900. It is the oldest exposed formation in the quadrangle, and crops out across the central section of it (Hendricks, 1939). The formation consists mostly of black to gray sandy shale interbedded with ridge-forming brown or light gray sandstone units. The sandstone is highly variable in character, both from bed to bed and within a single bed. In most exposures, it is fine-grained, silty, and irregularly bedded; however, locally it may be coarse-grained, clean, and massive to thick-bedded. The Atoka Formation thickens somewhat across the quadrangle, from about 6,500 feet (1,983 m) in the northwest to almost 8,000 feet (24,400 m) at the Choctaw fault in the southeast (Hendricks, 1939).

The Hartshorne Formation, which forms the basal unit of the Desmoinesian Series, crops out in a single band trending east-west across the center of the quadrangle (Hendricks, 1939). It is most probably conformable with the underlying Atoka Formation (McDaniel, 1961, Oakes and Knechtel, 1948), although the sharp and irregular contact between the Hartshorne and Atoka Formations has led some observers to conclude that a minor unconformity separates them, at least locally (Hendricks, 1939, and Branson, 1962). The contact between the Hartshorne Formation and the overlying McAlester Formation is conformable (Hendricks, 1939).

The boundaries of the Hartshorne Formation have been modified several times since the unit was first mapped by H. M. Chance in 1890. Then called the "Tobucksy" sandstone, the formation was renamed the Hartshorne sandstone by Taff in 1899. Early workers defined the formation such that the Upper Hartshorne coal was considered to be part of the overlying McAlester Formation. However, Oakes and Knechtel (1948) recognized a convergence of the Upper and Lower Hartshorne coals in northern LeFlore and eastern Haskell Counties, and redefined the Hartshorne Formation to include both coals. The Hartshorne coal, undivided to the north, splits into Upper and Lower Hartshorne coals along a northeast-southwest trending line. This split line lies to the north of the Red Oak quadrangle, so only the upper and lower splits of the Hartshorne coal are found here. The presently-used definition of the Hartshorne Formation is one proposed by McDaniel (1961), which supports the boundaries suggested by Oakes and Knechtel (1948), but formally divides the formation into upper and lower members where applicable (based on the above mentioned coal "split line").

The Hartshorne Formation is highly variable in character and thickness throughout the Howe-Wilburton district. In general it contains interbedded sandstones and shales which tend to become discontinuous as the upper and lower coals merge. The sands are for the most part fine-grained, white to brown, silty and micaceous, and the shales are gray and sandy. Plant fossils are abundant in the shales. The formation is roughly 400 feet (122 m) thick in this area.

The McAlester Formation averages about 2,250 to 2,500 feet (686 to 763 m) thick in the northeast quarter of the Red Oak 15-minute quadrangle. It crops out in a band running east-west across the area, and lies conformably on the Hartshorne Formation. The McAlester Formation consists primarily of various unnamed shale members, but includes several sandstone members as well. The thickness given below of each individual member has been estimated from well logs in the area.

The lowermost unit of the McAlester Formation is the McCurtain Shale Member. This is a dark gray, clayey shale with numerous siderite concretions and plant material. The McCurtain Shale Member contains a few thin sandstone units, including the McCurtain Sandstone and an associated unnamed local coal, which are found approximately 350 feet (107 m) above the base of the shale.

The most persistent sandstone of the McAlester Formation is the Warner Sandstone Member, a fine-grained, argillaceous unit which forms the first prominent escarpment stratigraphically above the Hartshorne Formation. This member forms the upper boundary of the McCurtain Shale. It is highly variable in thickness (Oakes & Knechtel, 1948), and has a locally persistent coal associated with it. Above the Warner Sandstone is an unnamed shale unit which is dark gray, silty and fissile, and in the northeast Red Oak area has an average thickness of 200 feet (61 m). Siderite concretions are common, and few thin sandstones can be found within it.

The Lequire Sandstone Member of the McAlester Formation is found above this unnamed shale. This unit includes variable sandstone lenses interbedded with siltstones and shales, and can include a thin local coal. Units between the Lequire and Keota Sandstone Members are highly variable in thickness and lateral extent. They include two unnamed shale units and the Cameron and Tamaha Sandstone Members.

The Cameron Sandstone in the northeast Red Oak area is a fairly thick (± 80 ft., 24 m), massive to thin-bedded fine-grained sandstone. The overlying shale includes the economically important Upper and Lower McAlester coals. This unit varies from a green to brown, silty, blocky shale to a green clayey shale which may contain plant remains. The Tamaha Sandstone Member includes a complex of sandstone lenses as opposed to being a single bed (Oakes & Knechtel, 1948) and averages about 20 feet (6 m) thick. The Keota Sandstone Member, separated from the Tamaha by a fairly thick (200 feet, 61 m) unnamed dark gray shale unit, is the uppermost sand unit of the McAlester Formation. It is generally a silty, buff, fine-grained sandstone, ranging from 30 to 70 feet (9 to 21 m) thick. Both the Tamaha and Keota Sandstones tend to be erratic and discontinuous (Russell, 1960). A dark, fissile to blocky shale with siderite concretions marks the top of the McAlester Formation.

The Savanna Formation is the youngest unit exposed in the northeast quarter of the Red Oak 15-minute quadrangle, and is found on the mountains in the northern part of the area (Russell, 1960). In some places the boundary between it and the McAlester Formation appears to be gradational, while in others it is highly irregular. The sandstones of the Savanna Formation form prominent slopes and ridges which tend to rise sharply out of the surrounding terrain. The sandstones are generally brown, dense, fine-grained and micaceous, and the interbedded shales are brown to grayish green.

The Boggy Formation is the upper unit of the Krebs Group in the Desmoinesian Series. It lies conformably on the Savanna Formation, and includes the Secor coal. The formation consists of alternative shale and sandstone units, and its lower boundary is defined as the base of the Bluejacket Sandstone (Russell, 1960). The Boggy Formation is not found in the northeast quarter of the Red Oak 15-minutes quadrangle.

Quaternary deposits of alluvium cover some stream valleys and flood plains in the area.

Structure

The Howe-Wilburton mining district lies within a zone of folded Pennsylvanian rocks characterized by broad, shallow synclines and narrow anticlines (Russell, 1960). The axes of these structures are commonly en echelon, and in general run parallel to the frontal margin of the adjacent Ouachita salient, marked by the Choctaw fault. The principal surface structures in the northeast quarter of the Red Oak 15-minute quadrangle are shown on Plate 1. One of the dominant features in the area is the Brazil anticline, the axis of which extends across the northern quarter of the quadrangle. This is a gently folded anticline whose surface expression is a wide valley in which rocks of the McAlester Formation are exposed, including the economically important Upper and Lower McAlester coals. Beds tip gently around the anticline, with dip measurements ranging from 3° to 6° (Hendricks, 1939 and Russell, 1960). The Red Oak gas field, located just off the northeast corner of the quadrangle, is situated over this structure and produces gas from the Hartshorne sandstone.

South of the Brazil anticline is the Cavanal syncline. This, too, is a relatively shallow structure, with beds dipping from 2° to 11° (Hendricks, 1939). The axis of the syncline extends east-west across the northern portion of the study area. A structurally high point on the Cavanal syncline is present north of Red Oak on Red Oak Mountain (Secs. 22 and 27 of T6N, R21E), and the axis plunges both eastward and westward from here (Hendricks, 1939).

The only major fault in the quadrangle is the Choctaw fault, which as previously mentioned, marks the northern edge of the Ouachita thrust zone.

COAL GEOLOGY

Several major coal beds have been identified and mapped in the northeast quarter of the Red Oak 15-minute quadrangle. They include in ascending order the Lower Hartshorne coal, the Upper Hartshorne coal, the Lower McAlester (Stigler) coal, and the Upper McAlester (Stigler Rider) coal. In addition to these are several other minor local coals which will not be discussed in detail here.

In the NE Red Oak area there is one measurement of a local coal which exceeds the Reserve Base thickness of 1 foot (0.3 m) and is treated as an isolated data point in this report. This was a measurement in data point 62 (see Plate 1 for location and Plate 3 for correlation).

Upper and Lower Hartshorne Coal Beds

The Hartshorne coals occur at or near the top of the Hartshorne Sandstone Formation. The split line for the Hartshorne coal is located north of the Red Oak 15-minute quadrangle, so only the Upper and Lower Hartshorne coals are found here. They both crop out in a band trending east-west across the central portion of the quadrangle, and dip to the north at 30° to 34° (Hendricks, 1939). The structure on these coals is presented on Plate 13, and the thickness of the interburden between them is shown on Plage 14. The interburden ranges from 30 feet (9 m) in the northwest to more than 90 feet (27 m) in the east.

Data on both the Lower Hartshorne, and especially the Upper Hartshorne, is sparse and is limited to the east-central part of the area. The Upper Hartshorne coal here is about 3 feet (0.9 m) thick, and is thought to thin toward the northwest (Plate 11). Sufficient information was not available to isopach this coal in the northeast portion of the study area.

The Lower Hartshorne coal is slightly thicker than its upper counterpart. Its thickest measurement, 4.5 feet (1.4 m), is near the crop line on the eastern border of the quadrangle. The coal is believed to thin somewhat through the central portion of the area in a general northwesterly trend, as shown on Plate 12.

Only a small amount of mining of the Lower Hartshorne coal has taken place in the area, and none of the Upper Hartshorne coal has been mined in the study area (Plate 1).

Upper and Lower McAlester Coal Beds

The Upper and Lower McAlester coals crop out in two places in the northeast quarter of the Red Oak 15-minute quadrangle. First, they are exposed in a narrow band roughly parallel to and 1.5 to 2 miles (2.4 to 3.2 km) north of the Upper and Lower Hartshorne outcrops. The coals dip to the north, where they are again exposed due to erosion on the Brazil anticline.

The structure of the Upper and Lower McAlester coals is shown on Plate 6. Approximately 50 to 70 feet (15 to 21 m) of interburden separates the two seams, as shown on Plate 7. The Upper McAlester is fairly uniform in thickness across the area, averaging between 2 and 3 feet (0.6 and 0.9 m), and thins slightly to the northeast and northwest as shown on the isopach map (Plate 4).

The Lower McAlester coal is only slightly thicker than the Upper McAlester, reaching a maximum measured thickess of 3.3 feet (1.0 m). For the most part this seam averages between 2 and 3 feet (0.6 and 0.9 m). The isopach map for the Lower McAlester is shown on Plate 5.

The Lower McAlester coal has been mined quite extensively along its northern outcrop. The Upper McAlester coal has also been mined, but only in Secs. 16 and 17 of T6N, R21E.

Chemical Analyses of Coal

Chemical analyses were available only for the Upper and Lower Hartshorne coals in this quadrangle, and not for the Upper or Lower McAlester coal. A summary of the analysis available is presented in Table 1. Average analysis is given, along with the range for all samples used to calculate each average value.

Only one partial analysis (made on a moisture-free basis) was available for the Upper Hartshorne coal. The results are as follows: volatile matter (29.8%), fixed carbon (57.0%) and ash (13.2%).

Coal is classified according to Btu/lb, as determined on a moist mineral-matter-free (mmf) basis. The "as received" Btu/lb shown on Table 1 were converted to moist mmf Btu/lb according to the following formula:

$$\text{Moist mmf Btu/lb.} = \frac{\text{As rec'd Btu/lb} - 50\ \text{S}}{[100 - (1.08\ \text{A} + 0.55\ \text{S}]} \times 100$$

where S = sulfur, A = Ash

Based on the average Btu/lb shown on Table 1, the Lower Hartshorne coal is classified as high-volatile A bituminous coal, having an average 14,131 moist mmf Btu/lb.

Isolated Data Points

In instances where single or isolated measurements of coal beds thicker than 1.0 foot (0.3 m) are encountered, the standard criteria for construction of isopach, structure contour, mining ratio, and overburden isopach maps are not available. The lack of data concerning these beds limits the extent to which they can be reasonably projectd in any direction, and usually precludes their correlation with other, better known beds. For this reason, isolated data points have been mapped on separate figures for non-isopached coal beds. These figures are not included in this report, but are kept on file at the BLM Office in Tulsa. However, coal reserves from these isolated data points are included in Tables 2 and 3, and in the Reserve Base tonnages shown on Plate 2.

The only isolated data point in the northeast quarter of the Red Oak 15-minute quadrangle is a measurement of an unnamed local coal.

Table 1. Average chemical analyses for coal in the NE quarter of the Red Oak 15-minute quadrangle, Latimer County, Oklahoma

LOWER HARTSHORNE COAL BED				
ANALYSIS (%)	FORM of ANALYSIS	# OF SAMPLES	AVERAGE	RANGE
PROXIMATE				
Moisture	A	9	4.5	1.5-11.2
Volatile Matter	A	9	34.0	31.0-36.9
	C	20	34.1	26.8-38.5
Fixed Carbon	A	9	55.7	46.6-60.0
	C	20	58.1	49.1-62.6
Ash	A	9	5.1	3.7- 8.9
	C	20	7.8	4.2-21.6
ULTIMATE				
Sulfur	A	9	1.1	0.8-1.8
	C	20	1.2	0.9-2.0
Hydrogen	A	-	-	---
	C	-	-	---
Carbon	A	-	-	---
	C	-	-	---
Nitrogen	A	-	-	---
	C	-	-	---
Oxygen	A	-	-	---
	C	-	-	---
Heating Value				
Calories	A	8	7,496	6,650- 7,839
	C	8	7,870	7,438- 8,133
Btu/Lb	A	8	13,494	11,970-14,110
	C	8	14,179	13,470-14,730

Form of Analysis: A = as received, C - moisture free.

NOTE: To convert Btu/lb. to kj/kg, multiply by 2,326.

Source of data: Shannon et al (1926), Hendricks (1939) and USGS Bore Hole files.

COAL RESOURCES

Data from drill holes, mine measured sections, outcrops, well logs and mine maps were used to construct outcrop, isopach, and structure contour maps of the various coal beds in the northeast quarter of the Red Oak 15-minute quadrangle (see below). The source of each indexed data point shown on Plate 1 is listed in Appendix I at the end of this report.

A system for classifying coal resources has been published by the U.S. Bureau of Mines and the U.S. Geological Survey, and published in U.S. Geological Survey Bulletin 1450-B (1976). Under this system, resources are classified as either Identified or Undiscovered. Identified Resources are specific bodies of coal whose location, rank, quality and quantity are known from geologic evidence supported by specific measurements, while Undiscovered Resources are bodies of coal which are thought to exist, based on broad geologic knowledge and theory.

Identified Resources may be subdivided into three categories of reliability of occurrence, according to their distance from a known point of coal-bed measurement. In order of decreasing reliability, these categories are: measured, indicated and inferred. Measured coal is that which is located within 0.25 mile (0.4 km) from a measurement point, indicated coal extends 0.5 mile (0.8 km) beyound measured coal to a distance of 0.75 mile (1.2 km) from the measurement point, and inferred coal extends 2.25 miles (3.6 km) beyond indicated coal, or a maximum distance of 3 miles (4.8 km) from the measurement point.

Undiscovered Resources may be either hypothetical or speculative. Hypothetical resources are those Undiscovered coal resources that may reasonably be expected to exist in known coal fields under known geologic conditions.

They are located beyond the outer boundary of inferred resources (see above) in areas where the coal-bed continuity is assumed, based on geologic evidence Hypothetical resources are those more than 3 miles (4.8 km) from the nearest measurement point.

Speculative resources are Undiscovered Resources that may occur in favorable areas where no discoveries have yet been made. Speculative resources have not been estimated in this report.

Coal resources for the Upper and Lower McAlester coals, an unnamed local coal, and the Upper and Lower Hartshorne coals were calculated using data obtained from their coal isopach maps (Plates 4, 5, 11 and 12 respectively). The coal-bed acreage (measured by planimeter and calculated using the trapezoidal method [modified from Hollo and Fifadara, 1980]) multiplied by the average thickness of the coal bed, and by a conversion factor of 1,800 short tons of coal per acre-foot (13,238 metric tons per hectare-meter) for bituminous coal yields the coal resources in short tons. Coal resource tonnages were calculated for measured, indicated, inferred and hypothetical categories (as defined below) for unleased Federal coal lands. Coal beds thicker than 1 foot (0.3 m) that lie less than 3,000 feet (914 m) below the ground surface are included. These criteria differ from those stated in U.S. Geological Survey Bulletin 1450-B, which calls for a minimum thickness of 28 inches (70 cm) and a maximum depth of 1,000 feet (305 m) for bituminous coal.

Narrow strips between mines where undisturbed coal is less than 75 meters from the nearest mine are considered to have no reserves and are included within mined-out areas. Mine boundaries are only approximately located (as stated in the legend on Plate 1) and therefore these narrow areas may in reality not even exist. For this reason they are considered to have no reserves, and have not been planimetered.

Reserve Base and Reserve tonnages for the above-mentioned coal beds are shown on Plates 9, 10, 16, and 17, and have been rounded to the nearest 10,000 short tons (9,072 metric tons). In this report, Reserve Base coal is the gross amount of Identified Resources that occurs in beds 1 foot (0.3 m) or more thick and under less than 3,000 feet (914 m) of overburden. Reserves are the recoverable part of the Reserve Base coal. In the southeastern Oklahoma coal field, a recovery factor of 80 percent is applied toward surface-minable Reserve Base coal, and a recovery factor of 50 percent is applied toward subsurface-minable coal. No recovery factor is applicable for in-situ coal gasification methods.

The total tonnage per section for both Reserve Base and hypothetical coal, including both surface and subsurface-minable coal are shown in the northwest corner of the Federal coal lands in each section on Plate 2. All values shown on Plate 2 are rounded to the nearest 10,000 short tons (9,072 metric tons), and total approximately 240.07 million short tons (217.79 million metric tons) for the entire quadrangle, including tonnages in the isolated data points. Reserve Base and hypothetical tonnages from the various development potential categories for surface and subsurface mining and in-situ coal gasification methods are shown in tables 2 and 3.

Geological Services of Tulsa has not made any determination of economic recoverability for any of the coal beds described in this report.

COAL DEVELOPMENT POTENTIAL

Coal development potential areas are drawn to coincide with the boundaries of the smallest legal land subdivisions shown on Plate 2. In sections or parts of sections where no land subdivisions have been surveyed by the BLM, approximate 40-acre (16-hectare) parcels have been used to show to limits of the high, moderate, or low development potentials. A constraint imposed by the BLM specifies that the highest development potential affecting any part of a 40-acre (16-hectare) lot, tract, or parcel be applied to that entire lot, tract, or parcel. For example, if 5 acres (2 hectares) within a parcel meet criteria for a high development potential; 25 acres (10 hectares), a moderate development potential; and 10 acres (4 hectares), a low development potential; then the entire 40 acres (16 hectares) are assigned a high development potential. For purposes of this report, any lot or tract assigned a coal development potential contains coal in beds with a nominal minimum areal extent of 1 acre (0.4 hectare).

Development Potential for Surface Mining Methods

Areas where the coal beds of Reserve Base thickness are overlain by 150 feet (46 m) or less of overburden are considered to have potential for surface mining and are assigned a high, moderate, or low development potential based on the mining ratios (cubic yards of overburden per ton of recoverable coal). The formula used to calculate mining ratios for surface mining of coal is as follows:

$$MR = \frac{t_o\ (cf)}{t_c\ (rf)}$$

where MR = mining ratio

t_o = thickness of overburden in feet

t_c = thickness of coal in feet

rf = recovery factor (80 percent for this quadrangle)

cf = conversion factor for yield MR value in terms of cubic yards of overburden per short tons of recoverable coal:

0.896 for bituminous coal

Note: To convert mining ratio to cubic meters of overburden per metric ton of recoverable coal, multiply MR by 0.8428.

Areas of high, moderate, and low development potential for surface mining methods are defined as areas underlain by coal beds having respective mining ratio values of 0 to 10, 10 to 15, and greater than 15. These mining ratio values for each development potential category are based on economic and technological criteria and were provided by the U.S.Geological Survey.

Areas where the coal data is absent or extremely limited between the 150-foot (46 m) overburden line and the coal outcrop are assigned unknown development potential for surface mining methods. This applies to areas where coal beds 1.0 foot (0.3 m) or more thick are not known but may occur, and to those areas influenced by isolated data points. Limited knowledge pertaining to the areal distribution, thickness, depth and attitude of the coals in these areas prevents accurate evaluation of development potential in the high, moderate, or low categories. The areas influenced by isolated data points in this quadrangle contain no coal available for surface mining.

The coal development potential for surface mining methods is shown on Plate 18. A summary of all tonnage values is presented in Table 2. Of the

Table 2. Coal Reserve Base data for surface mining methods for Federal Coal Lands (in short tons) in the northeast quarter of the Red Oak 15-minute quadrangle, Latimer County, Oklahoma.

Coal Bed	High Development Potential	Moderate Development Potential	Low Development Potential	Unknown Development Potential	TOTAL
Upper McAlester	31,310,000	8,740,000	-	-	40,050,000
Lower McAlester	290,000	150,000	7,180,000	-	7,620,000
Upper Hartshorne	120,000	60,000	2,410,000	-	2,590,000
Lower Hartshorne	130,000	60,000	2,690,000	-	2,880,000
Isolated Data Points	-	-	-	-	-
Total	31,850,000	9,010,000	12,280,000	-	53,140,000

Federal coal land not subject to currently outstanding coal lease, permit, license or preference right lease application having a known development potential for surface mining, 17 percent is rated high, 2 percent is rated moderate, and 12 percent is rated low. The remaining Federal land is (69 percent) classified as having no development potential for surface mining methods.

Development Potential for Subsurface and In-Situ Coal Gasification Methods

Areas considered to have a development potential for conventional subsurface mining methods are those areas where the coal beds of Reserve Base thickness are between 150 and 3,000 feet (46 and 914 m) below the ground surface and have dips of 15° or less. Coal beds lying between 150 and 3,000 feet (46 and 914 m) below the ground surface, dipping greater than 15°, are considered to have a development potential for in-situ coal gasification methods.

Areas of high, moderate, and low development potential for conventional subsurface mining methods are defined as areas underlain by coal beds at depths ranging from 150 to 1,000 feet (46 to 305 m), 1,000 to 2,000 feet (305 to 610 m), and 2,000 to 3,000 feet (610 to 914 m), respectively.

Areas where the coal data is absent or extremely limited between 150 and 3,000 feet (46 to 914 m) below the ground surface are assigned unknown development potentials. This applies to areas where coal beds of Reserve Base thickness are not known, but may occur, and to those areas influenced by isolated data points. The areas influenced by isolated data points in this quadrangle contain approximately 0.22 million short tons (0.20 million metric tons) of coal available for conventional subsurface mining.

Table 3. Coal reserve Base and hypothetical data for subsurface mining and in-situ gasification methods for Federal coal lands (in short tons) in the northeast quarter of the Red Oak 15-minute quadrangle, Latimer County, Oklahoma.

Coal Bed	High Subsurface Development Potential	Moderate Subsurface Development Potential	Low Subsurface Development Potential	Low In-Situ Development Potential	Unknown Development Potential	Hypothetical Coal Tonnage	TOTAL
Upper McAlester	780,000	390,000	5,600,000	-	-	-	6,770,000
Lower McAlester	36,230,000	11,280,000	-	-	-	-	47,510,000
Upper Hartshorne	1,760,000	13,880,000	16,710,000	16,460,000	-	8,810,000	57,620,000
Lower Hartshorne	2,690,000	20,520,000	23,800,000	16,530,000	-	11,270,000	74,810,000
Isolated Data Points	-	-	-	-	220,000	-	220,000
TOTAL	41,460,000	46,070,000	46,110,000	32,990,000	220,000	20,080,000	186,930,000

The coal development potential for conventional subsurface mining and in-situ gasification methods is shown on Plate 19. A summary of all tonnage values is presented in Table 3. Of the Federal land areas having a known development potential for conventional subsurface mining methods, 55 percent is rated high, 15 percent is rated moderate, and none is rated low. Thirteen percent of the remaining Federal land in the quadrangle is classified as having unknown (7%) or no (6%) development potential for either conventional subsurface mining or in-situ gasification methods.

Based on criteria provided by the U.S. Geological Survey coal beds of Reserve Base thickness dipping between 15° and 35°, regardless of tonnage, have a low development potential for in-situ coal gasification methods. Beds dipping from 35° to 90°, with a minimum of 50 million tons of coal in a single unfaulted bed or multiple, closely spaced, approximately parallel beds have a moderate development potential for in-situ gasification methods. Coal lying between the 150-foot (46 m) overburden isopach and the outcrop is not included in total coal tonnages available because it is needed for cover and containment in the in-situ process.

In the northeast quarter of the Red Oak 15-minute quadrangle 24 percent of Federal coal land is classified as having low development potential for in-situ coal gasification. However, 31 percent of this land also has a moderate to high development potential for conventional subsurface mining (Plate 19). No land in the quadrangle has a moderate development potential for in-situ gasification.

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APPENDIX I. SOURCE AND RELIABILITY OF DATA USED ON PLATE 1.

Listed below is a point by point accounting as to the source and reliability of all information shown on Plate 1. Also presented are any notes or comments pertaining to individual data points.

DATA POINT #	LOCATION	INCREASING RELIABILITY →	1	2	3	4	5	REFERENCE	NOTES/COMMENTS
	NW SE	Location					x	Midwest Oil Corp. Rider #1,	Log Depth Datum 18' above
	Section 17	Overburden			x			1960	GL, 1" IE log
1	T 6 N | R 22 E	Coal Thickness	x						
	SE NW	Location			x			USGS files, 1978, Bore Hole	
	Section 17	Overburden		x				#1, KRCRA Map	
2	T 6 N | R 22 E	Coal Thickness			x				
	SE NW	Location			x			USGS files, 1978, Bore Hole	
	Section 17	Overburden		x				#2, KRCRA Map	
3	T 6 N | R 22 E	Coal Thickness			x				
	NW SW	Location			x			USGS files, 1978, Bore Hole	
	Section 17	Overburden		x				#3, KRCRA Map	
4	T 6 N | R 22 E	Coal Thickness			x				
	NE SE	Location			x			USGS files, 1978, Bore Hole	
	Section 18	Overburden		x				#4, KRCRA Map	
5	T 6 N | R 22 E	Coal Thickness			x				
	NE SE	Location			x			USGS files, 1978, Bore Hole	
	Section 18	Overburden		x				#5, KRCRA Map	
6	T 6 N | R 22 E	Coal Thickness			x				
	NW SE	Location			x			USGS files, 1978, Bore Hole	
	Section 18	Overburden		x				#6, KRCRA Map	
7	T 6 N | R 22 E	Coal Thickness			x				
	SE SW	Location					x	BLM Emira Project, 1979,	Final Info. logs available
	Section 18	Overburden					x	Bore Hole #DH-AD-10	
8	T 6 N | R 22 E	Coal Thickness					x		
	NE SW	Location			x			USGS files, 1978, Bore Hole	
	Section 18	Overburden		x				#8, KRCRA Map	
9	T 6 N | R 22 E	Coal Thickness			x				
	NE SW	Location			x			USGS files, 1978, Bore Hole	
	Section 18	Overburden		x				#7, KRCRA Map	
10	T 6 N | R 22 E	Coal Thickness			x				
	NW SE	Location					x	Frankfort Oil Co., Hulsey	Log Depth Datum 17' above
	Section 18	Overburden			x			Unit #1, 1960	GL, 1" IE Log
11	T 6 N | R 22 E	Coal Thickness	x						

DATE POINT #	LOCATION	INCREASING RELIABILITY	1	2	3	4	5	REFERENCE	NOTES/COMMENTS
	NE SW	Location			x			USGS files, 1978, Bore Hole	
	Section 18	Overburden		x				#9, KRCRA Map	
12	T 6 N | R 22 E	Coal Thickness			x				
	NW SW	Location			x			USGS files, 1978, Bore Hole	
	Section 18	Overburden		x				#10, KRCRA Map	
13	T 6 N | R 22 E	Coal Thickness			x				
	NW SW	Location			x			USGS files, 1978, Bore Hole	
	Section 18	Overburden		x				#11, KRCRA Map	
14	T 6 N | R 22 E	Coal Thickness			x				
	NW SW	Location			x			USGS files, 1978, Bore Hole	
	Section 18	Overburden		x				#12, KRCRA Map	
15	T 6 N | R 22 E	Coal Thickness			x				
	NW SW	Location			x			USGS files, 1978, Bore Hole	
	Section 18	Overburden		x				#13, KRCRA Map	
16	T 6 N | R 22 E	Coal Thickness			x				
	NE SE	Location			x			USGS files, 1978, Bore Hole	
	Section 13	Overburden		x				#14, KRCRA Map	
17	T 6 N | R 21 E	Coal Thickness			x				
	NE SE	Location			x			USGS files, 1978, Bore Hole	
	Section 13	Overburden		x				#15, KRCRA Map	
18	T 6 N | R 21 E	Coal Thickness			x				
	NW SE	Location			x			USGS files, 1978, Bore Hole	
	Section 13	Overburden		x				#17, KRCRA Map	
19	T 6 N | R 21 E	Coal Thickness			x				
	NE SE	Location			x			USGS files, 1978, Bore Hole	
	Section 13	Overburden		x				#16, KRCRA Map	
20	T 6 N | R 21 E	Coal Thickness			x				
	SE NW	Location					x	Midwest Oil Corp. Gallagher	Log Datum Depth, 17.55'
	Section 13	Overburden			x			#1, 1967	above G.L., 1" & 2-1/2" IE
21	T 6 N | R 21 E	Coal Thickness	x						log
	SE SW	Location			x			USGS files, 1978, Bore Hole	
	Section 13	Overburden		x				#19, KRCRA Map	
22	T 6 N | R 21 E	Coal Thickness			x				
	SE SW	Location			x			USGS files, 1978, Bore Hole	
	Section 13	Overburden		x				#18, KRCRA Map	
23	T 6 N | R 21 E	Coal Thickness			x				
	S/2 N/2 SW	Location			x			USGS files, 1978, Bore Hole	
	Section 13	Overburden		x				#20, KRCRA Map	
24	T 6 N | R 21 E	Coal Thickness			x				

DATE POINT #	LOCATION	INCREASING RELIABILITY →	1	2	3	4	5	REFERENCE	NOTES/COMMENTS
	SW SW	Location			x			USGS Files, 1978, Bore Hole	
	Section 13	Overburden		x				#21, KRCRA Map	
25	T 6 N | R 21 E	Coal Thickness			x				
	NW SW	Location			x			USGS files, 1978, Bore Hole	
	Section 13	Overburden		x				#22, KRCRA Map	
26	T 6 N | R 21 E	Coal Thickness			x				
	SW NE	Location					x	Frankfort Oil Co.,	T.D. 12059. Log Datum
	Section 14	Overburden			x			Gallagher #1, 1962	Depth 18.35' above G.L.,
27	T 6 N | R 21 E	Coal Thickness	x						2" & 5" Ind. logs
	SW SE	Location			x			USGS files, 1978, Bore Hole	
	Section 14	Overburden		x				#24, KRCRA Map	
28	T 6 N | R 21 E	Coal Thickness			x				
	SW SE	Location			x			USGS files, 1978, Bore Hole	
	Section 14	Overburden		x				#23, KRCRA Map	
29	T 6 N | R 21 E	Coal Thickness			x				
	SW SE	Location			x			USGS files, 1978, Bore Hole	
	Section 14	Overburden		x				#25, KRCRA Map	
30	T 6 N | R 21 E	Coal Thickness			x				
	SE SW	Location			x			USGS files, 1978, Bore Hole	
	Section 14	Overburden		x				#26, KRCRA Map	
31	T 6 N | R 21 E	Coal Thickness			x				
	SE SW	Location			x			USGS files, 1978, Bore Hole	
	Section 14	Overburden		x				#27, KRCRA Map	
32	T 6 N | R 21 E	Coal Thickness			x				
	SW SW	Location			x			USGS files, 1978, Bore Hole	
	Section 14	Overburden		x				#28, KRCRA Map	
33	T 6 N | R 21 E	Coal Thickness			x				
	SW SW	Location			x			USGS files, 1978, Bore Hole	
	Section 14	Overburden		x				#30, KRCRA Map	
34	T 6 N | R 21 E	Coal Thickness			x				
	SW SE	Location			x			USGS files, 1978, Bore Hole	
	Section 15	Overburden		x				#33, KRCRA Map	
35	T 6 N | R 21 E	Coal Thickness			x				
	SW SE	Location			x			USGS files, 1978, Bore Hole	
	Section 15	Overburden		x				#34, KRCRA Map	
36	T 6 N | R 21 E	Coal Thickness			x				
	NW NW	Location		x				USGS files, 1978, Bore Hole	45' High wall, 1.9' is an
	Section 22	Overburden			x			#37, KRCRA Map	average thickness for LM.
37	T 6 N | R 21 E	Coal Thickness			x				

DATA POINT #	LOCATION	INCREASING RELIABILITY	1	2	3	4	5	REFERENCE	NOTES/COMMENTS
	NE SE	Location					x	Midwest Oil Corp., Brewer	Log Datum Depth 17.9 above
	Section 16	Overburden			x			#1, 1962	GL, 1" & 2-1/2" IE Log
38	T 6 N R 21 E	Coal Thickness	x						
	SW SW	Location					x	BLM Emria Project, 1979,	Final info. logs available
	Section 16	Overburden					x	Bore Hole No. DH-AD-8	
39	T 6 N R 21 E	Coal Thickness					x		
	NW NW	Location		x				USGS files, (no date avail-	40' High wall, average coal
	Section 16	Overburden			x			able) strip mine composite.	thickness is 1.8'
40	T 6 N R 21 E	Coal Thickness			x				
	SE SE	Location		x				USGS files, (no date avail-	25' High wall
	Section 17	Overburden			x			able) strip mine composite.	
41	T 6 N R 21 E	Coal Thickness			x				
	NW SE	Location					x	Midwest Oil Corp., Sentry	Log Datum Depth, 22.15'
	Section 17	Overburden			x			Royalty #1, 1962	above GL, 1" & 2-1/2" IE
42	T 6 N R 21 E	Coal Thickness	x						Log.
	NE SE	Location					x	Midwest Oil Corp., White	Log Depth Datum, 21.85
	Section 18	Overburden			x			#1, 1961	above GL, 1" & 2-1/2" IE
43	T 6 N R 21 E	Coal Thickness	x						Log.
	NW NW	Location			x			USGS files, Bore Hole #18,	
	Section 21	Overburden		x				(no date available)	
44	T 6 N R 21 E	Coal Thickness			x				
	NE NW	Location					x	Midwest Oil Corp., Noah #1,	Log Depth Datum, 20' above
	Section 21	Overburden			x			1963	GL, 1" & 2-1/2" IE Log.
45	T 6 N R 21 E	Coal Thickness	x						
	NW NE	Location			x			USGS files, 1978, Bore Hole	
	Section 21	Overburden		x				#38, KRCRA Map	
46	T 6 N R 21 E	Coal Thickness			x				
	SW NE	Location	x					USGS files, 1978, Bore Hole	Point believed to be
	Section 22	Overburden		x				#36, KRCRA Map	originally located 1/4 sec.
47	T 6 N R 21 E	Coal Thickness			x				too far south.
	SW NE	Location			x			USGS files, Bore Hole #19,	
	Section 22	Overburden		x				(no date available)	
48	T 6 N R 21 E	Coal Thickness			x				
	NW NE	Location			x			USGS files, 1978, Bore Hole	
	Section 22	Overburden		x				#35, KRCRA Map	
49	T 6 N R 21 E	Coal Thickness			x				
	NE NE	Location			x			USGS files, 1978, Bore Hole	
	Section 22	Overburden		x				#32	
50	T 6 N R 21 E	Coal Thickness			x				

DATA POINT #	LOCATION	INCREASING RELIABILITY	1	2	3	4	5	REFERENCE	NOTES/COMMENTS
	NE NE	Location			x			USGS files, 1978, Bore Hole	
	Section 22	Overburden		x				#31, KRCRA Map	
51	T 6 N R 21 E	Coal Thickness			x				
	NW NW	Location			x			USGS files, 1978, Bore Hole	
	Section 23	Overburden		x				#29, KRCRA Map	
52	T 6 N R 21 E	Coal Thickness			x				
	NE NE	Location					x	BLM Emria Project, 1979,	Final info. logs available
	Section 23	Overburden					x	Bore Hole #DH-AD-9	
53	T 6 N R 21 E	Coal Thickness					x		
	NE NW	Location					x	Pan American Pet. Corp.,	Log Depth Datum, 19.41'
	Section 19	Overburden			x			Kent Unit #1, 1962	above GL, 2-1/2" Sonic Logs
54	T 6 N R 21 E	Coal Thickness	x						
	NE NW	Location					x	Pan American Pet. Corp.,	Log Depth Datum, 14' above
	Section 20	Overburden			x			Martin Unit #1, 1961	GL, 1" & 2-1/2" IE Log.
55	T 6 N R 22 E	Coal Thickness	x						
	NW SE	Location			x			USGS files, Bore Hole #17,	
	Section 26	Overburden		x				(no date available)	
56	T 6 N R 21 E	Coal Thickness			x				
	SE NE	Location					x	Senate Document 390, 1910,	
	Section 31	Overburden					x	p. 64, Bore Hole #19	
57	T 6 N R 21 E	Coal Thickness					x		
	SE NE	Location			x			USGS files, Bore Hole #16,	
	Section 33	Overburden		x				(no date available)	
58	T 6 N R 21 E	Coal Thickness			x				
	NE SW	Location			x			USGS files, Bore Hole #20,	
	Section 35	Overburden		x				(no date available)	
59	T 6 N R 21 E	Coal Thickness			x				
	S/2 S/2	Location					x	USGS files, 1959, Bore Hole	
	Section 31	Overburden					x	#23	
60	T 6 N R 21 E	Coal Thickness					x		
	SE SE	Location					x	USGS files, 1957, Bore Hole	
	Section 31	Overburden					x	#10	
61	T 6 N R 22 E	Coal Thickness					x		
	SE SW	Location				x		USGS files, 1957, Bore Hole	
	Section 32	Overburden					x	#8	
62	T 6 N R 22 E	Coal Thickness					x		
	SW NE	Location					x	USGS files, 1957, Bore Hole	
	Section 5	Overburden					x	#2	
63	T 5 N R 22 E	Coal Thickness					x		

DATA POINT #	LOCATION	INCREASING RELIABILITY	1	2	3	4	5	REFERENCE	NOTES/COMMENTS
	SE NW	Location			x			USGS files, 1957, Bore Hole	
	Section 5	Overburden					x	#3	
64	T 5 N | R 22 E	Coal Thickness					x		
	SE NW	Location			x			USGS files, 1957, Bore Hole	
	Section 5	Overburden					x	#4	
65	T 5 N | R 22 E	Coal Thickness					x		
	NE NW	Location			x			USGS files, 1957, Bore Hole	
	Section 5	Overburden					x	#5	
66	T 5 N | R 22 E	Coal Thickness					x		
	NE NW	Location				x		USGS files, 1957, Bore Hole	
	Section 5	Overburden					x	#6	
67	T 5 N | R 22 E	Coal Thickness					x		
	SW NW	Location			x			USGS files, 1957, Bore Hole	
	Section 5	Overburden					x	#22	
68	T 5 N | R 22 E	Coal Thickness					x		
	SE NW	Location					x	USGS files, 1958, Bore Hole	
	Section 6	Overburden					x	#27	
69	T 5 N | R 22 E	Coal Thickness					x		
	NW NW	Location					x	USGS files, 1958, Bore Hole	
	Section 6	Overburden					x	#24	
70	T 5 N | R 22 E	Coal Thickness					x		
	NE SE	Location	x					Fieldner, et al, 1922, p.	3 sample average
	Section 1	Overburden	-	-	-	-	-	219-220. Oak Ridge Coal	
71	T 5 N | R 21 E	Coal Thickness				x		Co., JB Hilling #2 Mine	
	NW SE	Location	x					Moose & Searle, 1929, p.	2 sample average. (Roof:
	Section 1	Overburden	-	-	-	-	-	50-51. Oak Ridge Coal Co.,	18" bony coal)
72	T 5 N | R 21 E	Coal Thickness				x		J.B. Hilling #1 Mine	

APPENDIX II TABLES OF OIL AND GAS TEST HOLES

Note: "Top Log Int." refers to the measured depth to the top of the interval logged by the particular sonde. Driller log total depth, referenced to K.B. or D.F., has been abbreviated to T.D. (Note: This may vary from T.D. referenced to G.L.). The measured depth at which coal is reported on the scout card appears in the column titled "Scout Card Coal". The column titled "Harts./Drill./Scout" contains the measured depths drilled to the top of the Hartshorne Sandstone, as reported by the driller logs and the scout cards.

* Logged interval stratigraphically below Hartshorne Coals.

Sec-Tn-Rg	Operator/Farm Location	Driller Logs Coal Reported Thickness & Depth	Scout Card Coal	Harts. Drill. Scout	Top Log Int. Gamma Elec.	Top Log Int. Dens. Sonic	T.D. Year
9-5-21	Pan Am./#1 J. A. Johnson			NR	1386	1386	9686
	1370 FSL 2640 FWL of N/2	NR	NR	NR	1386*		1967
19-5-21	Wheeler/#1 H. T. Jennings			NR	0*		9761
	CSE NW	NR	NR	NR	319*		1959
13-6-21	Midwest/#1 Gallagher			NR	6500		12038
	2825 FSL 1980 FWL	NR	NR	1460	198	7900	1962
14-6-21	Frankfort/#1 W. Gallagher			NR		5580	12077
	SE SW NE	NR	NR	NR	232		1963
15-6-21	Midwest/#1 Booth			NR		6700	12228
	NE NW SE	NR	NR	1493	198		1963
15-6-21	Midwest/#1 Dennis						1724
	CSE NW		NR	NR			
15-6-21	No information, location only:						
	NW NW						
16-6-21	Midwest/#1 Brewer			NR	3700	3600	12333
	NW NE SE	NR	NR	1504	204		1962
17-6-21	H. Zucker/#1 Old Mack			NR			6513
	C of Section	NR	NR	1619	310		1950
17-6-21	Midwest/#1 Sentry royalty			NR	7600	7100	12600
	2265 FSL 3355 FWL	NR	NR	NR	208		1963
18-6-21	Midwest/#1 White			NR		3200	12940
	SW NE SE	NR	NR	1856	206		1961
20-6-21	Mustang/#1-20 Gillespie			NR			8927
	CNW	NR	NR	1893			1973
21-6-21	Midwest/#1 Noah			NR		3850	12495
	SE NE NW	NR	NR	1720	207		1963

Sec-Tn-Rg	Operator/Farm Location	Driller Logs Coal Reported Thickness & Depth	Scout Card Coal	Harts. Drill. Scout	Top Log Int. Gamma Elec.	Dens. Sonic	T.D. Year
22-6-21	Humble/#1 J. C. Oxley			NR		5850	7913
	1450 East, 1540 North of Center	NR	NR	NR	2188		1965
23-6-21	Humble/#1 Erwin			NR		4370	12100
	1320 FSL 1170 FWL of NE/4	NR	NR	NR	2294		1964
24-6-21	Pan Amer./#1 Cecil			NR	2346		11950
	1320 FNL 1180 FEL of NW/4	NR	NR	NR	2346	2346	1965
25-6-21	Pan Amer./#1 Knauer			NR	2510		13311
	660 FSL 1190 FWL of NW/4	NR	NR	NR	2510	2510	1966
26-6-21	Texas O & G/#1 Gallagher			2664			12700
	CNW NW	NR	NR	2664			1979
26-6-21							
27-6-21	Mustang/#1-27 Lyons			2040			12352
	1170 FSL 970 FWL of SW/4	NR	NR	2040			1977
28-6-21	Mustang/#1-28 Smallwood			1987			12946
	CSW	NR	NR	1987			1976
33-6-21	Cleary/#1-33 Cannon			NR		3900	13131
	150 FSL 1320 FWL of NW/4	NR	NR	1725	2176		1972
33-6-21	Sarkey/#1-33 Thrift			NR			12426
	1320 FSL 300 FWL of NE/4	NR	NR	NR			1977
17-6-22	Midwest/#1 Rider			NR			12130
	2141 FSL 2917 FWL	NR	NR	1670	199	3500	1961
18-6-22	Frankfort/#1 Hulsey			NR		3600	12465
	NW NW SE	NR	NR	1590	223		1961
18-6-22	LeFlore/#1 E. Baker						1872
	CNW		NR	NR			1934
19-6-22	Pan Amer./#1 Kent			NR	2523		12160
	4480 FSL 1980 FWL	NR	NR	NR	248	234	1962
20-6-22	Pan Amer. Pet./#1 Martin			NR	7910		12500
	4200 FSL 2440 FWL	NR	NR	2082	234	7910	1961
29-6-22	Dyco/#1 Steele			NR			12786
	CNW	NR	NR	NR			1974
31-6-22	Mustang/Fields (1-31)			2190			13353
	500 FSL 1320 FWL of NW/4	NR	NR	2190			1977