SOIL SURVEY OF

Briscoe County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1967–71. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Cap Rock Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in determining the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Briscoe County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside, and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page number of the capability unit and the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those that have a moderate limitation can be colored yellow, and those that have a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the range sites.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for dwellings and industrial buildings and for recreation areas in the sections "Engineering Uses of the Soils" and "Recreational Development."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain estimates of soil properties and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Briscoe County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

***Cover:* The Caprock Escarpment and the adjoining rough country separate the tableland of the High Plains from the Rolling Plains. The soils are dominantly of the Burson, Quinlan, and Obaro series.**

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SOIL SURVEY OF BRISCOE COUNTY, TEXAS

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE,
IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

BRISCOE COUNTY is in the northwestern part of the Texas Panhandle (fig. 1). It has a total area of 568,960 acres, or 889 square miles. In 1970, the total population of the county was 2,794. Silverton, the county seat, is in the west-central part of the county.

The western part of the county is in the High Plains area. This area is a tableland that has an average elevation of about 3,200 feet. The eastern part of the county is in the Rolling Plains area, which has an average elevation of 2,500 feet. Bordering the High Plains area on the east and north is a rugged caliche escarpment known locally as the Caprock. Below the Caprock is a rough broken area that leads down to the Rolling Plains. The roughest terrain in the county is in the northwestern part and is known locally as the Palo Duro Breaks. The Prairie Dog Town Fork of the Red River cuts across the northern part of Briscoe County.

About 24 percent of the county is cultivated. Cotton, grain sorghum, and winter wheat are the main crops. About one-half of the cultivated area is irrigated. Irrigation water is pumped from deep wells. Many of the soils in the county are subject to soil blowing and erosion.

In 1945 farmers and ranchers in the county organized the Cap Rock Soil and Water Conservation District. Through the district, the U.S. Department of Agriculture, Soil Conservation Service, provides technical assistance to farmers and ranchers and helps them in managing and conserving their soils.

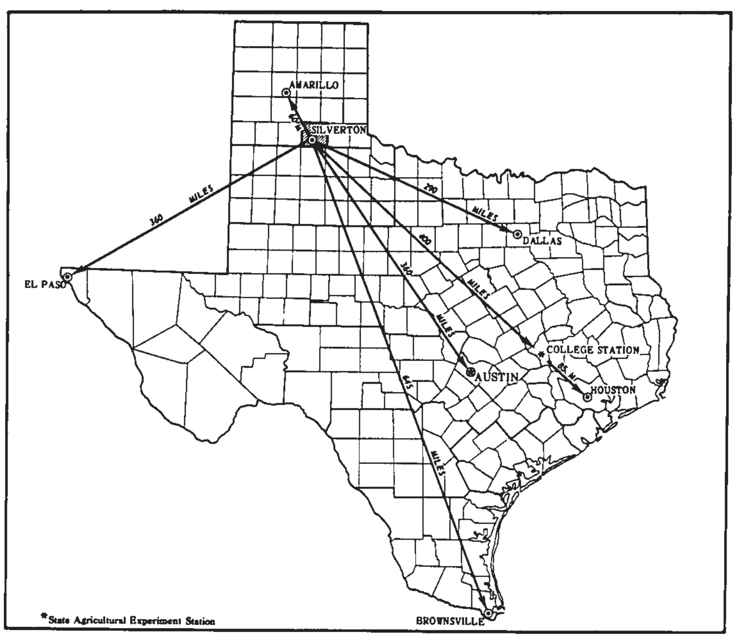

Figure 1.—Location of Briscoe County in Texas.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Briscoe County, where they are located, and how they can be used. The soil scientists went into the county knowing they would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Amarillo and Pullman, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Amarillo fine sandy loam, 0 to 1 percent slopes, is one of several phases within the Amarillo series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Briscoe County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Berda-Polar complex, 3 to 12 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and." Burson and Quinlan soils, steep, is an example.

While a soil survey is in progress, samples of soil are taken as needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to slow permeability or a high water table. They see that streets, road pavements, and foundations for houses crack on a given kind of soil, and they relate this failure to a high shrink-swell potential. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their study and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Briscoe County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is useful as a general guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The seven soil associations in Briscoe County are described in this section.

1. Quinlan-Burson-Obaro association

Very shallow to deep, gently sloping to hilly and steep, moderately permeable and moderately rapidly permeable loams on uplands

This association is in areas below the Caprock Escarpment. It makes up about 44 percent of the county. It is about 24 percent Quinlan soils, 19 percent Burson soils, 10 percent Obaro soils, and 47 percent Enterprise, Lincoln, and Tivoli soils.

Quinlan soils have a surface layer of reddish-yellow, calcareous loam about 6 inches thick. The next layer is reddish-yellow, calcareous silty clay loam about 9 inches thick. The underlying material to a depth of 60 inches is yellowish-red, weakly cemented sandstone.

Burson soils have a surface layer of red, calcareous loam about 6 inches thick. The underlying material to a depth of 40 inches is red, weakly cemented sandstone interbedded with silty and loamy material.

Obaro soils have a surface layer of reddish-brown, calcareous loam about 10 inches thick. The next layer is calcareous loam about 30 inches thick. It is red in the upper 20 inches and light red in the lower 10 inches. The underlying material to a depth of 70 inches is red, weakly cemented sandstone.

Enterprise soils are on foot slopes. Lincoln soils are on bottom lands along streams. Small areas of Tivoli soils are on dunes along creeks and rivers.

Most areas of this association are in range, but a few scattered areas are cultivated. In places where the soils are shallow and steep, the amount of forage available to cattle and horses is moderately low. Some areas along the Caprock are inaccessible to cattle and horses. This association is well suited to habitat for deer, aoudad sheep, quail, turkey, and other wildlife. The development of scenic recreational areas such as camping areas, lakes, playgrounds, and nature trails is feasible.

2. *Pullman association*

Deep, nearly level to gently sloping, very slowly permeable clay loams on smooth uplands

This association is a broad plain that is characterized by depressions, or playas, that dot the landscape and collect most of the runoff water. It makes up about 39 percent of the county. Pullman clay loam makes up about 75 percent of the association. Estacado, Lofton, Olton, and Randall soils make up 25 percent (fig. 2).

Pullman soils have a surface layer of grayish-brown, noncalcareous clay loam about 6 inches thick. The upper part of the subsoil is brown, noncalcareous clay to a depth of 18 inches. Between depths of 18 and 50 inches, the subsoil is calcareous clay that is brown in the upper 22 inches and reddish brown in the lower 10 inches. The lower part of the subsoil to a depth of 80 inches is pink silty clay that is about 50 percent calcium carbonate.

Estacado and Olton soils are on uplands. Lofton soils are on benches around playas, and Randall soils are on the bottom of playas.

This association is used mostly for crops. About 30 percent of the area is irrigated, and about 25 percent is dryfarmed. The rest is used as range.

3. *Amarillo-Olton-Acuff association*

Deep, nearly level to gently sloping, moderately permeable and moderately slowly permeable loams, clay loams, and fine sandy loams on smooth uplands

This association is on smooth plains below the Caprock Escarpment. It makes up about 11 percent of the county. Amarillo soils make up 19 percent of the association, Olton soils 18 percent, Acuff soils 14 percent, and Berda, Mobeetie, and Spur soils make up 49 percent.

The Amarillo soils have a surface layer of light reddish-brown, noncalcareous fine sandy loam about 10 inches thick. The upper part of the subsoil to a depth of 34 inches is noncalcareous sandy clay loam. It is reddish brown in the upper 8 inches and yellowish red in the lower 16 inches. The lower part of the subsoil to a depth of 80 inches is calcareous sandy clay loam. It is yellowish red in the upper 18 inches, reddish yellow in the next 18 inches, and red in the lower 10 inches.

The Olton soils have a surface layer of reddish-brown, noncalcareous clay loam about 6 inches thick. The upper part of the subsoil to a depth of 18 inches is reddish-brown, noncalcareous clay loam. Between depths of 18 and 66 inches, the subsoil is calcareous clay loam. The upper 30 inches is yellowish red, and the lower 18 inches is pink. Below a depth of 66 inches, and extending to a depth of 85 inches, the subsoil is reddish-yellow, calcareous sandy clay loam.

The Acuff soils have a surface layer of reddish-brown, noncalcareous loam about 10 inches thick. The upper part of the subsoil to a depth of 16 inches is reddish-brown, noncalcareous clay loam. The lower part of the subsoil to a depth of 80 inches is calcareous clay loam. It is reddish brown in the upper 12 inches, yellowish

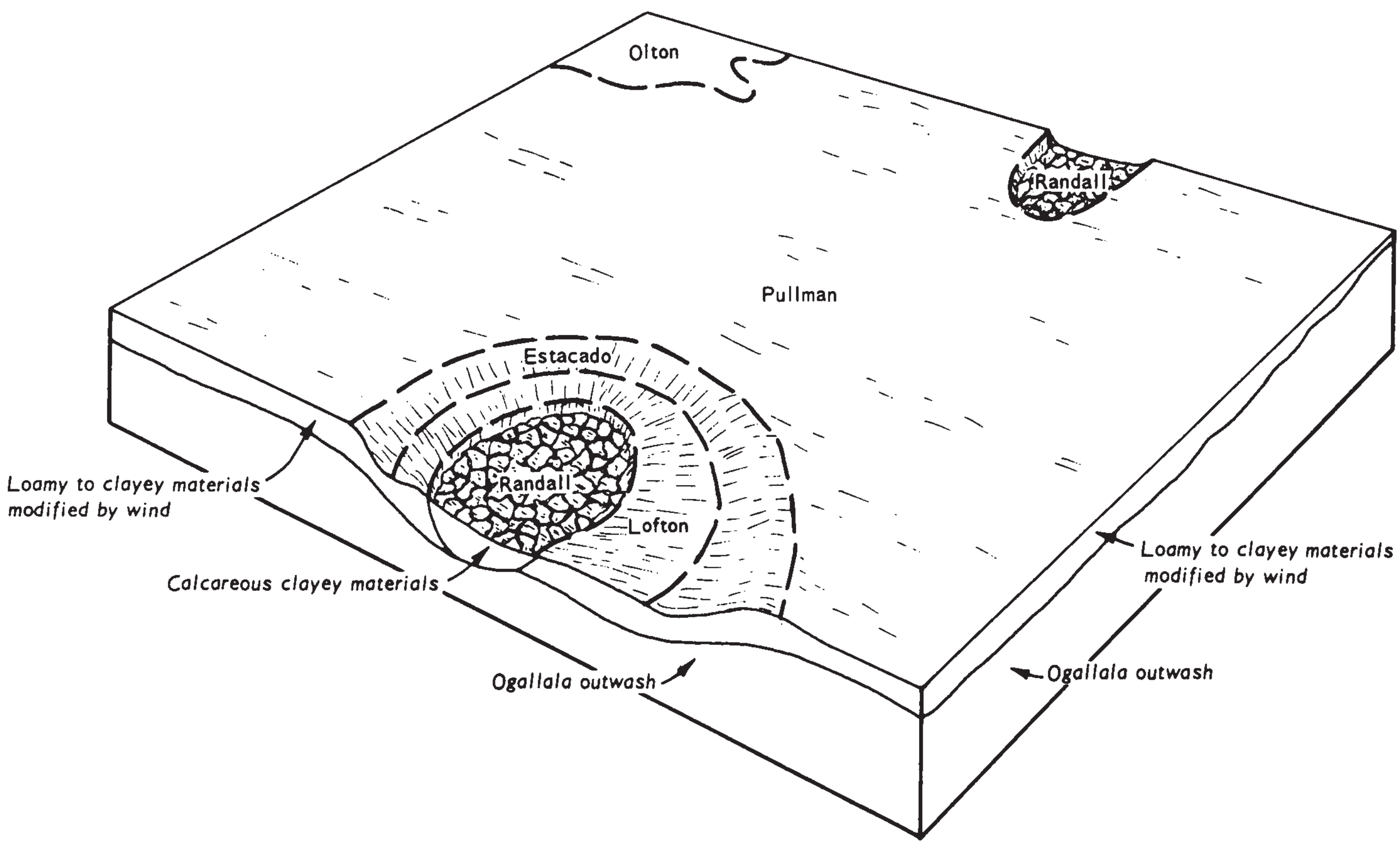

Figure 2.—Typical pattern of soils and parent material in the Pullman association.

red in the next 12 inches, reddish yellow in the next 28 inches, and red in the lower 12 inches.

Berda and Mobeetie soils are on smooth uplands. Spur soils are on bottom lands along creeks.

This association is mostly dryfarmed (fig. 3). A few areas are irrigated. Some small scattered areas are in range.

4. *Olton association*

Deep, nearly level to gently sloping, moderately slowly permeable clay loams on uplands

This association is on a broad plain. It makes up about 2 percent of the county. Olton soils make up 75 percent of the association, and Estacado, Pullman, and Randall soils make up 25 percent.

The Olton soils have a surface layer of reddish-brown, noncalcareous clay loam about 6 inches thick. The upper part of the subsoil to a depth of 18 inches is reddish-brown, noncalcareous clay loam. Between depths of 18 and 66 inches, the subsoil is calcareous clay loam. The upper 30 inches is yellowish red, and the lower 18 inches is pink. Below a depth of 66 inches, and extending to a depth of 85 inches, the subsoil is reddish-yellow, calcareous sandy clay loam.

Estacado and Pullman soils are on uplands. Randall soils are on the bottom of playas.

This association is used mostly for crops. About 50 percent of the area is dryfarmed, 25 percent is irrigated, and 25 percent is used as range. The soils are well suited to crops. The areas used as range are mostly small, scattered plots.

5. *Berda-Enterprise association*

Deep, gently sloping to sloping, moderately permeable and moderately rapidly permeable loams on uplands

This association is in areas below the Caprock Escarpment. It makes up about 2 percent of the county.

Figure 3.—**Cotton on Miles and Berda soils near Quitaque.**

Berda soils make up 55 percent of the association, Enterprise soils 35 percent, and Acuff, Obaro, and Olton soils make up 10 percent.

The Berda soils have a surface layer of brown, calcareous loam 8 inches thick. The next layer is 40 inches of brown, calcareous clay loam that has a few soft masses of calcium carbonate and a few quartz pebbles. Below this to a depth of 65 inches is light yellowish-brown, calcareous sandy clay loam.

The Enterprise soils have a surface layer of reddish-brown, calcareous loam about 5 inches thick. The next layer is reddish-brown, calcareous loam about 23 inches thick. Below this to a depth of 60 inches is yellowish-red, calcareous loam.

Acuff and Olton soils in small areas on ridgetops. Obaro soils are on midslopes and foot slopes.

This association is used only as range. It has potential as habitat for deer, quail, and turkey.

6. *Springer-Miles association*

Deep, nearly level to undulating, moderately permeable and moderately rapidly permeable loamy fine sands on uplands

This association is on uplands in areas below the Caprock Escarpment. It makes up about 1 percent of the county. Springer soils make up 60 percent of the association, Miles soils 30 percent, and Amarillo and Tivoli soils 10 percent.

The Springer soils have a surface layer of reddish-brown, noncalcareous loamy fine sand about 16 inches thick. The subsoil is red, noncalcareous fine sandy loam about 52 inches thick. Below this to a depth of 112 inches is calcareous sandy clay loam. It is reddish brown in the upper 30 inches and red in the lower 14 inches.

The Miles soils have a surface layer of reddish-brown, noncalcareous loamy fine sand about 10 inches thick. The upper part of the subsoil is reddish-brown, noncalcareous sandy clay loam about 22 inches thick. The lower part of the subsoil to a depth of 76 inches is yellowish-red sandy clay loam. It is noncalcareous in the upper 16 inches and calcareous below.

The Amarillo soils are in areas similar and adjacent to those of Miles soils. Tivoli soils are in small, scattered areas on dunes.

About 50 percent of the association is used for dryland farming. A few small areas are irrigated and used for pasture and special crops. The rest is scattered areas of range.

7. *Lincoln-Yahola association*

Deep, nearly level, moderately rapidly permeable and rapidly permeable loamy fine sands and fine sandy loams on bottom lands

This association is in areas along major creeks and rivers. Most areas are subject to flooding. The association makes up about 1 percent of the county. It is about 55 percent Lincoln soils, 35 percent Yahola soils, and 10 percent Clairemont, Spur, and Tivoli soils (fig. 4).

The Lincoln soils have a surface layer of reddish-yellow, calcareous loamy fine sand about 8 inches thick. The underlying material is reddish-yellow, calcareous loamy fine sand to a depth of 60 inches.

The Yahola soils have a surface layer of light reddish-brown, calcareous fine sandy loam about 10 inches thick.

Figure 4.—**Prairie Dog Town Fork of Red River. Lincoln and Yahola soils are dominant in the areas adjacent to the river channel.**

Below this is light reddish-brown, calcareous fine sandy loam to a depth of 40 inches. The next layer is reddish-yellow, calcareous loamy fine sand to a depth of 60 inches.

Clairemont and Spur soils are on bottom lands in areas adjacent to Yahola soils. Tivoli soils are in duned areas adjacent to bottom lands.

This association is used mostly as range. It is suited to habitat for deer, quail, and turkey. Small areas of Yahola soils are cultivated.

Descriptions of the Soils

This section describes the soil series and mapping units in Briscoe County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of each series description is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, the differences are stated in the description of the mapping unit, or they are differences that are apparent in the name of the mapping unit. Soil colors in this section are expressed both in words and in Munsell color notations and are for dry soil unless otherwise stated.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and range site in which the mapping unit has been placed. The page for the description of each capability unit and range site can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Acuff loam, 0 to 1 percent slopes	3,460	0.6
Acuff loam, 1 to 3 percent slopes	5,720	1.0
Amarillo fine sandy loam, 0 to 1 percent slopes	4,030	.7
Amarillo fine sandy loam, 1 to 3 percent slopes	4,910	.9
Amarillo fine sandy loam, 3 to 5 percent slopes	3,300	.6
Berda loam, 0 to 1 percent slopes	2,830	.5
Berda loam, 1 to 3 percent slopes	6,700	1.2
Berda loam, 3 to 5 percent slopes	5,490	1.0
Berda loam, 5 to 8 percent slopes	11,610	2.0
Berda-Polar complex, 3 to 12 percent slopes	3,050	.5
Burson and Quinlan soils, steep	91,010	16.0
Clairemont silty clay loam	750	.1
Drake loam, 1 to 3 percent slopes	720	.1
Drake loam, 3 to 5 percent slopes	650	.1
Enterprise loam, 3 to 8 percent slopes	10,840	2.0
Estacado clay loam, 0 to 1 percent slopes	830	.1
Estacado clay loam, 1 to 3 percent slopes	1,580	.3
Estacado clay loam, 3 to 5 percent slopes	960	.2
Lincoln soils, frequently flooded	5,740	1.0
Lipan clay	2,600	.5
Lofton clay loam	12,890	2.3
Miles loamy fine sand, 0 to 3 percent slopes	2,390	.4
Mobeetie fine sandy loam, 0 to 3 percent slopes	440	.1
Obaro loam, 1 to 3 percent slopes	2,570	0.4
Obaro loam, 3 to 5 percent slopes	7,500	1.3
Obaro and Quinlan soils, rolling	30,140	5.3
Olton clay loam, 0 to 1 percent slopes	10,280	1.8
Olton clay loam, 1 to 3 percent slopes	15,860	2.8
Paloduro loam, 0 to 1 percent slopes	3,390	.6
Paloduro loam, 1 to 3 percent slopes	3,240	.6
Pullman clay loam, 0 to 1 percent slopes	163,000	28.6
Pullman clay loam, 1 to 3 percent slopes	12,420	2.2
Quinlan and Burson soils, hilly	75,390	13.2
Randall clay	16,600	2.9
Roscoe clay	6,250	1.1
Springer loamy fine sand, 3 to 8 percent slopes	3,940	.7
Spur loam	800	.1
Stamford clay, 0 to 1 percent slopes	740	.1
Tivoli fine sand	4,330	.8
Tulia loam, 1 to 3 percent slopes	1,350	.2
Tulia loam, 3 to 5 percent slopes	460	.1
Tulia and Estacado soils, 5 to 8 percent slopes	15,140	2.7
Yahola fine sandy loam	1,790	.3
Yahola fine sandy loam, frequently flooded	1,800	.3
Stream channels and water	9,470	1.7
Total	568,960	100.0

the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*8*).[1]

Acuff Series

The Acuff series consists of deep, nearly level to gently sloping, noncalcareous, loamy soils on uplands. These soils formed in old, loamy, alluvial material that has been reworked by wind.

In a representative profile the surface layer is reddish-brown, neutral loam about 10 inches thick. The upper part of the subsoil to a depth of 16 inches is reddish-brown, noncalcareous clay loam. The lower part of the subsoil to a depth of 80 inches is calcareous clay loam. It is reddish brown in the upper 12 inches, yellowish red in the next 12 inches, reddish yellow in the next 28 inches, and red in the lower 12 inches.

Acuff soils are well drained. Permeability is moderate, and available water capacity is high. Runoff is slow to medium. The hazards of soil blowing and water erosion are slight to moderate.

These soils are used mostly for crops, and they are well suited to this purpose. A few small areas are used as range.

Representative profile of Acuff loam, 1 to 3 percent slopes, 3 miles west on Texas Highway 86 from its intersection with Farm Road 1065 in Quitaque, then 1.6 miles south on a county road and 1.15 miles east of the road:

Ap—0 to 10 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; weak, fine, granular structure; slightly hard, friable; few, hard, caliche pebbles on the surface as much as ½ inch in diameter; neutral; abrupt, smooth boundary.

B21t—10 to 16 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate, fine and medium, subangular blocky structure; hard, friable; few fine pores; few thin clay films; few worm casts; few films of calcium carbonate in lower 2 inches; mildly alkaline; clear, smooth boundary.

B22t—16 to 28 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate, fine, subangular blocky structure; hard, friable; few fine pores; few thin clay films; few worm casts; slight increase in clay; common films and few, fine, soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B23t—28 to 40 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate, fine, subangular blocky structure; hard, friable; few fine pores; few thin clay films; few worm casts; common films and few, fine, soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B24tca—40 to 68 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; moderate, fine, subangular blocky structure; slightly hard, friable; few fine pores; few thin clay films; few worm casts; about 35 percent, by volume, calcium carbonate; many films and fine, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

B25t—68 to 80 inches, red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; weak, fine, subangular blocky structure; hard, friable; few fine roots; few fine pores; few worm casts; few, fine, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 60 inches thick. Depth to free carbonates ranges from 16 to 33 inches. The A horizon is 10 to 14 inches thick. It is brown, dark brown, reddish brown, or reddish gray. The Bt horizon is reddish-brown, reddish-yellow, yellowish-red, or red sandy clay loam or clay loam. The Btca horizon is at a depth of 36 to 60 inches and is 20 to 60 percent, by volume, calcium carbonate.

Acuff loam, 0 to 1 percent slopes (AcA).—This soil is

[1] Italic numbers in parentheses refer to Literature Cited, p. 59.

on smooth uplands below the Caprock Escarpment. Areas are 50 to 200 acres in size and are oval to irregular in shape. Slopes average about 0.3 percent.

The surface layer is reddish-brown, neutral loam about 12 inches thick. The subsoil to a depth of 40 inches is reddish-brown clay loam that is noncalcareous in the upper part and calcareous in the lower part. Between the depths of 40 and 52 inches, it is reddish-yellow clay loam that is about 20 percent carbonates. Below this is reddish-yellow, calcareous clay loam that extends to a depth of 80 inches.

Included with this soil in mapping are small areas of Amarillo, Berda, Olton, and Paloduro soils. Amarillo and Berda soils are on low rises. Olton and Paloduro soils are in positions similar to those of Acuff soils.

This Acuff soil is used mostly for dryland cotton, grain sorghum, and wheat. It is also used for barley, forage sorghum, and oats.

The main concerns in management are conserving moisture and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth and to control soil blowing. Using diversion terraces helps to control water erosion and to conserve moisture. Emergency tillage helps to control soil blowing where crop residue is inadequate. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Capability units IIIe–1, dryland, and IIe–1, irrigated; Clay Loam range site.

Acuff loam, 1 to 3 percent slopes (AcB).—This gently sloping soil is in smooth areas below the Caprock Escarpment. It is on ridges and low rises and in areas along draws. Areas are 10 to 200 acres in size. Slopes average about 2 percent. This soil has the profile described as representative of the Acuff series.

Included with this soil in mapping are small areas of Amarillo, Berda, Olton, and Paloduro soils. These soils make up less than 10 percent of a mapped area. Also included are areas of an Acuff soil that has a surface layer of sandy clay loam and makes up about 30 percent of some mapped areas.

This Acuff soil is well suited to cotton, forage and grain sorghum, and wheat. Most areas are cultivated.

The main concerns in management are conserving moisture and maintaining tilth. Leaving crop residue on the soil surface helps to control soil blowing and to maintain tilth. Using diversion terraces helps to control water erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–2, dryland, and IIIe–1, irrigated; Clay Loam range site.

Amarillo Series

The Amarillo series consists of deep, nearly level to gently sloping, noncalcareous, loamy soils on uplands. These soils formed in old eolian deposits.

In a representative profile the surface layer is light reddish-brown, noncalcareous fine sandy loam about 10 inches thick. The upper part of the subsoil to a depth of 34 inches is noncalcareous sandy clay loam. It is reddish brown in the upper 8 inches and yellowish red in the lower 16 inches. The lower part of the subsoil to a depth of 80 inches is calcareous sandy clay loam. It is yellowish red in the upper 18 inches, reddish yellow in the next 18 inches, and red in the lower 10 inches.

Amarillo soils are well drained. Permeability is moderate, and available water capacity is high. Runoff is slow to medium. The hazard of soil blowing is moderate, and the hazard of water erosion is slight to moderate.

These soils are well suited to crops. About 75 percent of the acreage is dryfarmed. The rest is used as range.

Representative profile of Amarillo fine sandy loam, 1 to 3 percent slopes, 4 miles east on Texas Highway 86 from its intersection with Farm Road 1065 in Quitaque, then 1.2 miles north on a county road, then 0.3 mile east of the road:

Ap—0 to 10 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, fine, granular structure; slightly hard, very friable; few, fine, siliceous pebbles; noncalcareous; moderately alkaline; abrupt, smooth boundary.

B21t—10 to 18 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few, fine, siliceous pebbles; few worm casts; clay films darker than crushed color; noncalcareous; moderately alkaline; clear, smooth boundary.

B22t—18 to 34 inches, yellowish-red (5YR 4/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few, fine, siliceous pebbles; few worm casts; few thin clay films; clay slightly decreases with depth; noncalcareous; moderately alkaline; gradual, smooth boundary.

B23t—34 to 52 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate, medium, subangular blocky structure; hard, friable; few worm casts; few thin clay films; few films and fine soft masses of calcium carbonate increasing with depth; calcareous; moderately alkaline; gradual, smooth boundary.

B24tca—52 to 70 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak, medium, subangular blocky structure; hard, friable; common fine pores; few fine siliceous pebbles; slight increase in clay content from B23t horizon; few thin clay films; few, fine, soft masses of calcium carbonate; about 25 percent calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B25tca—70 to 80 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak, medium, subangular blocky structure; slightly hard, friable; few thin clay films; few soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 60 inches to more than 80 inches thick. Depth to secondary carbonates is 24 to 36 inches. Depth to a horizon that is more than 15 percent calcium carbonate is 45 to 60 inches. The A horizon is 7 to 16 inches thick. It is brown, reddish-brown, or light reddish-brown fine sandy loam. The B2t horizon is reddish brown, light reddish brown, brown, or yellowish red. It is fine sandy loam or sandy clay loam that is dominantly 18 to 30 percent clay. The B2tca horizon is pink, light reddish brown, red, reddish-yellow, or yellowish-red clay loam or sandy clay loam and is 20 to 60 percent calcium carbonate.

Amarillo fine sandy loam, 0 to 1 percent slopes (AmA).—This nearly level soil is on smooth uplands below the Caprock Escarpment. Areas are irregular in shape and average about 100 acres in size, but a few areas are more than 500 acres.

The surface layer is light reddish-brown, noncalcareous fine sandy loam about 9 inches thick. The subsoil to a depth of 84 inches is sandy clay loam. It is reddish brown and noncalcareous in the upper 6 inches; yellowish red and has a few masses of calcium carbonate in the next 33 inches; and reddish yellow and calcareous in the lower 36 inches.

Included with this soil in mapping are small areas of Acuff, Berda, and Paloduro soils that make up about 5 percent of the mapped area. Also included are areas of a soil that is similar to this Amarillo soil but has prominent accumulations of calcium carbonate below a depth of 60 inches. This soil makes up about 25 percent of some mapped areas.

This Amarillo soil is used mostly for cotton, grain sorghum, and wheat. A few areas are in barley, forage sorghum, and oats. The hazard of soil blowing is moderate, and the hazard of water erosion is slight.

The main concerns in management are controlling soil blowing, conserving moisture, and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth, to conserve moisture, and to control soil blowing. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–3, dryland, and IIe–2, irrigated; Sandy Loam range site.

Amarillo fine sandy loam, 1 to 3 percent slopes (AmB).—This gently sloping soil is on uplands below the Caprock Escarpment. Areas average about 200 acres in size but range from 50 to 500 acres. Slopes average about 2 percent. This soil has the profile described as representative of the Amarillo series.

Included with this soil in mapping are small areas of Acuff, Berda, and Paloduro soils that make up about 5 percent of the mapped area. Also included are some areas of a soil near the Caprock Escarpment that is similar to this Amarillo soil but that has free carbonates between the depths of 15 and 34 inches. This soil makes up about 20 percent of some mapped areas.

This Amarillo soil is used mostly for dryland cotton, grain sorghum, and wheat. The hazards of soil blowing and water erosion are moderate.

The main concerns in management are controlling water erosion and soil blowing and conserving moisture. Leaving crop residue on the soil surface helps to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–3, dryland, and IIIe–3, irrigated; Sandy Loam range site.

Amarillo fine sandy loam, 3 to 5 percent slopes (AmC).—This gently sloping soil is on uplands below the Caprock Escarpment. Areas are 10 acres to about 100 acres in size and are oval to irregular in shape. Slopes average about 4 percent.

The surface layer is reddish-brown, noncalcareous fine sandy loam about 8 inches thick. The subsoil is sandy clay loam that extends to a depth of 65 inches. It is noncalcareous and light reddish brown in the upper 28 inches and calcareous and yellowish red in the lower 29 inches.

Included with this soil in mapping are small areas of Acuff, Berda, Obaro, and Paloduro soils that make up about 10 percent of the mapped area. Also included are areas of a soil that is similar to this Amarillo soil but has free carbonates at a depth of 12 to 34 inches. This soil makes up about 25 percent of some mapped areas.

This Amarillo soil is used mostly for dryland cotton, grain sorghum, and wheat. The hazards of soil blowing and water erosion are moderate.

The main concerns in management are controlling water erosion and soil blowing and conserving moisture. Leaving crop residue on the soil surface helps to conserve moisture and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IVe–1, dryland, and IVe–1, irrigated; Sandy Loam range site.

Berda Series

The Berda series consists of deep, nearly level to sloping, loamy, calcareous soils on uplands. These soils formed in loamy calcareous material.

In a representative profile the surface layer is brown, calcareous loam about 8 inches thick. The next layer is 40 inches of brown, calcareous clay loam that has soft masses of calcium carbonate and a few quartzite pebbles. Below this is light yellowish-brown, calcareous sandy clay loam that extends to a depth of 65 inches.

Berda soils are well drained. Permeability is moderate, and available water capacity is high. Runoff is medium to rapid. The hazard of soil blowing is moderate, and the hazard of water erosion is slight to severe.

These soils are suited to use as pasture, range, and wildlife habitat. The soils in less sloping areas are suited to crops. About half of the acreage is used for crops, and the rest is used as range.

Representative profile of Berda loam, 5 to 8 percent slopes, about 15 miles east of the courthouse in Silverton on Texas Highway 256, on the south side of the highway:

A1—0 to 8 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable; common fine roots; few masses of calcium carbonate 1 millimeter to 5 millimeters in diameter; calcareous; moderately alkaline; clear, smooth boundary.

B21—8 to 24 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to moderate, fine, subangular blocky; hard, firm; few fine roots; few worm casts; few soft masses of calcium carbonate 2 to 5 millimeters in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

B22ca—24 to 48 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to moderate, fine, subangular blocky; hard, firm; few fine roots; few fine pores; few worm casts; few, fine, quartzite pebbles; about 5 percent, by volume, soft masses of calcium carbonate 3 to 10 millimeters in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

B23—48 to 65 inches, light yellowish-brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; weak, fine, subangular blocky structure; hard, friable; few worm casts; few soft masses of calcium carbonate 1 millimeter to 3 millimeters in diameter; thin strata of gravelly fine sandy loam.

The A horizon is 6 to 12 inches thick and is brown, grayish brown, and reddish brown. The B horizon extends to a depth of 48 inches or more. It is pale-brown, grayish-brown, light brownish-gray, brown, light-brown, light yellowish-brown, light reddish-brown, and reddish-brown loam, clay loam, or sandy clay loam. It dominantly is 20 to 30 percent clay, but it ranges to as much as 35 percent clay. Filaments, coatings, and pebbles of calcium carbonate make up 2 to 15 percent of the volume of the B horizon. The C horizon is calcareous unweathered material of loam and fine sandy loam texture.

Berda loam, 0 to 1 percent slopes (BeA).—This nearly level soil is on smooth uplands below the Caprock Escarpment. Areas are 10 to 200 acres in size and are irregular in shape.

The surface layer is grayish-brown, calcareous loam about 10 inches thick. The next layer to a depth of 48 inches is light-brown, calcareous clay loam that has a few soft masses of calcium carbonate. Below this is light reddish-brown, calcareous clay loam that extends to a depth of 60 inches.

Included with this soil in mapping are small areas of Acuff, Amarillo, Mobeetie, and Paloduro soils that make up 5 to 15 percent of the mapped area.

This Berda soil is used mostly for dryland cotton, grain sorghum, and wheat. The hazard of soil blowing is moderate, and the hazard of water erosion is slight.

The main concerns in management are controlling soil blowing, conserving moisture, and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth, to conserve moisture, and to control soil blowing. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–1, dryland, and IIe–1, irrigated; Hardland Slopes range site.

Berda loam, 1 to 3 percent slopes (BeB).—This gently sloping soil is on smooth uplands below the Caprock Escarpment. Areas are 10 to 200 acres in size and are somewhat oval to irregular in shape. Slopes average about 2 percent.

The surface layer is brown, calcareous loam about 8 inches thick. The next layer is grayish-brown, calcareous loam that extends to a depth of 56 inches. Below this to a depth of 65 inches is pale-brown, calcareous loam that has many caliche pebbles.

Included with this soil in mapping are small areas of Acuff, Amarillo, Mobeetie, and Paloduro soils that make up 10 to 15 percent of most areas.

This Berda soil is used mostly for dryland cotton, grain sorghum, and wheat. The hazards of soil blowing and water erosion are moderate.

The main concerns in management are controlling soil blowing and water erosion and conserving moisture. Leaving crop residue on the soil surface helps to conserve moisture and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–2, dryland, and IIIe–1, irrigated; Hardland Slopes range site.

Berda loam, 3 to 5 percent slopes (BeC).—This gently sloping soil is on uplands below the Caprock Escarpment. Areas are irregular in shape and are 10 to 300 acres in size. Slopes average about 4 percent.

The surface layer is reddish-brown, calcareous loam about 8 inches thick. The next layer is reddish-brown, calcareous sandy clay loam that extends to a depth of 46 inches. Below this to a depth of 60 inches is reddish-brown, calcareous clay loam.

Included with this soil in mapping are small areas of Enterprise, Mobeetie, and Polar soils and a few areas of sandstone outcrop. Also included are some areas of gullied soils and a few small areas of a Berda loam that has slopes of 5 to 20 percent.

This Berda soil is used mostly as range. Some cultivated areas are in dryland cotton, grain sorghum, and wheat. The hazards of soil blowing and water erosion are moderate.

The main concerns in management are controlling soil blowing and water erosion and conserving moisture. Leaving crop residue on the soil surface helps to conserve moisture and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IVe–2, dryland, and IVe–1, irrigated; Hardland Slopes range site.

Berda loam, 5 to 8 percent slopes (BeD).—This sloping soil is on uplands below the Caprock Escarpment. Most areas are on foot slopes below small escarpments, knolls, and ridges. Areas are mainly long and narrow in shape and are 10 to 300 acres in size. Slopes average about 7 percent. This soil has the profile described as representative of the Berda series.

Included with this soil in mapping are small areas of Enterprise, Mobeetie, and Polar soils and a few areas of sandstone outcrop. Also included are some areas of gullied soils and a few small areas of a Berda loam that has slopes of 8 to 20 percent.

This soil is not suited to cultivation. It is used as range. The hazard of soil blowing is moderate, and the hazard of water erosion is severe. Capability unit VIe–1, dryland; Hardland Slopes range site.

Berda-Polar complex, 3 to 12 percent slopes (BpE).—This complex is made up of gently sloping to strongly sloping soils on uplands below the Caprock Escarpment. It is about 50 percent Berda loam, 45 percent Polar gravelly sandy clay loam, and 5 percent Mobeetie and Tulia soils. Areas of the soils are so intermingled that it is not feasible to separate them at the scale of mapping. The topography consists of hills and ridges that rise above surrounding smooth plains. Areas are irregular in shape and are 10 to 100 acres in size.

The Berda soil is on lower slopes. Slopes are dominantly 3 to 8 percent. The surface layer is brown, calcareous loam about 7 inches thick. The next layer is brown, calcareous sandy clay loam to a depth of 24 inches. Below this is reddish-brown, calcareous sandy clay loam that extends to a depth of 46 inches.

The Polar soil is on hills and ridgetops. Slopes are dominantly 6 to 12 percent. This soil has the profile described as representative of the Polar series.

The soils in this mapping unit are not suited to cultivation, but a few small areas adjoining arable soils are cultivated. Most areas are used as range. The hazard of soil blowing is moderate, and the hazard of water erosion is severe. Capability unit VIe–1, dryland; Hardland Slopes range site.

Burson Series

The Burson series consists of very shallow to shallow, hilly and steep, calcareous, loamy soils on uplands. These soils formed in loamy red-bed material of Triassic or Permian origin.

In a representative profile the surface layer is red, calcareous loam about 6 inches thick. The underlying material to a depth of 40 inches is red, calcareous, weakly cemented, very fine grained sandstone interbedded with silty and loamy material.

Burson soils are well drained to excessively drained. Permeability is moderate, and available water capacity is very low. Runoff is medium to very rapid. The hazard of soil blowing is slight, and the hazard of water erosion is severe.

These soils are not suited to cultivation. Areas are used as range. They have potential for development as wildlife habitat.

Representative profile of Burson loam in an area of Burson and Quinlan soils, steep, 18 miles east of Silverton on Texas Highway 256, then 2.35 miles southeast on Burson Lake road and 200 feet south of the road; 2,100 feet southeast of the southeastern end of Burson Lake dam:

A1—0 to 6 inches, red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; weak, fine, granular structure; slightly hard, very friable; common roots; calcareous; moderately alkaline; clear, smooth boundary.

C—6 to 40 inches, red (2.5YR 5/6) weakly cemented very fine grained sandstone and siltstone interbedded with strata of silty and loamy material; red (2.5YR 4/6) moist; common grayish flecks about 3 to 6 millimeters in diameter; few roots in upper part; calcareous; moderately alkaline.

Depth to sandstone or shale ranges from 3 to 12 inches. The A horizon is red, reddish brown, yellowish red, or reddish gray. It is loam, silt loam, very fine sandy loam, or silty clay loam and is 15 to 35 percent clay. The C horizon is red, reddish brown, yellowish red, or reddish yellow. It is weakly cemented, very fine grained sandstone or siltstone interbedded with strata of weakly to strongly consolidated, soft, loamy or silty material.

Burson and Quinlan soils, steep (BQG).—This mapping unit is made up of soils on the Caprock Escarpment and the adjoining steep and broken land. It is about 30 percent Burson soils, 20 percent Quinlan soils, and 50 percent other soils and shale and sandstone ledges and outcrops. Areas are characterized by scenic escarpments, canyon walls, buttes, mesas, sharp hogbacks, and ridges. Slopes are dominantly 20 to 45 percent. The difference in elevation across areas of this mapping unit is about 800 feet. Soil patterns are not uniform. Some areas are entirely Burson soils, some are Quinlan soils, and some contain both soils. The composition of this mapping unit is more variable than that of others in the county, but this difference does not affect the use and management of the soils.

A Burson soil in this mapping unit has the profile described as representative of the Burson series. Slopes are dominantly 35 to 45 percent.

The Quinlan soil has a surface layer of yellowish-red, calcareous silty clay loam. Below this is yellowish-red, weakly cemented, very fine grained sandstone. Slopes are 20 to 35 percent.

Included with these soils in mapping are small areas of Berda, Mobeetie, and Obaro soils and some shale and sandstone ledges and outcrops. The Berda and Mobeetie soils are in small areas near the lower edge of the Caprock Escarpment. The Obaro soils and the shale and sandstone ledges and outcrops are intermingled with Burson and Quinlan soils.

The soils in this mapping unit are used as range. The hazard of soil blowing is slight, and the hazard of water erosion is severe. Some rough and steep areas are inaccessible to cattle and horses. These soils are suited to habitat for aoudad sheep, deer, quail, and turkey. Capability unit VIIs–1, dryland; Rough Breaks range site.

Clairemont Series

The Clairemont series consists of deep, nearly level, calcareous, loamy soils on bottom lands. These soils formed in alluvial sediment from red-bed material.

In a representative profile the surface layer is reddish-brown, calcareous silty clay loam about 4 inches thick. The underlying material to a depth of 18 inches is yellowish-red, calcareous clay loam. Between depths of 18 and 50 inches, it is yellowish-red silty clay loam. Between depths of 50 and 60 inches, it is yellowish-red, calcareous sandy clay loam.

Clairemont soils are moderately permeable. These soils are flooded occasionally. Available water capacity is very high, and runoff is slow. The hazards of soil blowing and water erosion are slight.

These soils are suited to crops. Most areas are in range and are used for grazing.

Representative profile of Clairemont silty clay loam, 4.25 miles north of Silverton on a county road, then 2 miles east on another county road, 2.75 miles north to the end of a third county road, then about 5.5 miles northeast in range, then 0.8 mile northwest of the point where Dinner Creek enters the Prairie Dog Town Fork of Red River and 200 feet west of the river channel:

Ap—0 to 4 inches, reddish-brown (2.5YR 4/4) silty clay loam, dark reddish brown (2.5YR 3/4) moist; weak, fine, subangular blocky structure; slightly hard, friable; many fine roots; few masses of calcium sulfate and calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

C1—4 to 18 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; massive; slightly hard, friable; common fine roots; threads of soft white calcium sulfate and calcium carbonate along old root channels; few quartz pebbles as much as ¼ inch in diameter; calcareous; moderately alkaline; clear, smooth boundary.

C2—18 to 50 inches, yellowish-red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; massive; slightly hard, friable; few thin strata of silty loam and very fine sandy loam; few white threads of calcium sulfate and calcium carbonate; common fine roots; calcareous; moderately alkaline.

C3—50 to 60 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; massive; friable; few threads of calcium sulfate and calcium carbonate; few quartz pebbles as much as ¼ inch in diameter; calcareous; moderately alkaline.

The A horizon is 4 to 10 inches thick and is light reddish brown, reddish brown, yellowish red, or reddish yellow. The C horizon is silty clay loam or clay loam. The clay content is 18 to 35 percent. Sand coarser than very fine makes up less than 15 percent of the C horizon to a depth of 40 inches. Thin lenses and layers of silty clay, sandy loam, and loamy sand are common.

Clairemont silty clay loam (Cm).—This nearly level soil is on flood plains along major rivers and streams. Areas are 200 to 800 feet wide, are parallel to the streambeds, and are 20 to 100 acres in size. Slopes are 0 to 1 percent.

Included with this soil in mapping are narrow areas of Lincoln and Yahola soils. Also included are some small clayey spots. Included areas make up about 10 percent of the mapped area.

This Clairemont soil is suited to cultivated crops. A few areas are in cotton, grain sorghum, and wheat. The rest is used as range because the areas are surrounded by rough country and are hard to get into with farm machinery. This soil is flooded one or more times in 4 to 10 years.

The main concern in management is maintaining soil tilth. Leaving crop residue on the soil surface helps to maintain tilth and to control soil blowing. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Capability units IIw–2, dryland, and IIw–2, irrigated; Loamy Bottomland range site.

Drake Series

The Drake series consists of deep, gently sloping, calcareous, loamy soils on uplands. These soils formed in loamy, calcareous, eolian material.

In a representative profile the surface layer is grayish-brown, calcareous loam about 8 inches thick. The underlying material is calcareous clay loam that extends to a depth of 60 inches. It is light brownish gray in the upper 12 inches and light gray in the lower 40 inches.

Drake soils are well drained. Permeability is moderate, and available water capacity is medium. Runoff is medium. The hazard of soil blowing is severe, and the hazard of water erosion is slight to moderate.

These soils are suited to cultivation. A few areas are dryfarmed, and the rest is used as range.

Representative profile of Drake loam, 3 to 5 percent slopes, about 5 miles south on Texas Highway 207 from its intersection with Texas Highway 86 in Silverton, then 5 miles west on Farm Road 145, then 500 feet south of the road:

A1—0 to 8 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to weak, fine, granular; hard, friable; many fine roots; few worm casts; calcareous; moderately alkaline; clear, smooth boundary.

C1—8 to 20 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; massive; hard, friable; few fine roots; common worm casts; few films of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C2—20 to 60 inches light-gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; massive; hard, friable; few fine roots; few worm casts; few soft masses of calcium carbonate 1 millimeter to 5 millimeters in diameter; calcareous; moderately alkaline.

The profile is more than 60 inches deep. The A horizon is 4 to 10 inches thick and is gray, grayish brown, or dark grayish brown. The C horizon is gray, light brownish-gray, light-gray, grayish-brown, or brown loam, clay loam, or sandy clay loam. Filaments and coatings of calcium carbonate are few to common.

Drake loam, 1 to 3 percent slopes (DrB).—This gently sloping soil is in crescent-shaped areas on low ridges that curve around the eastern sides of playas above the Caprock Escarpment. Areas are 200 to 500 feet wide and are 15 to 40 acres in size. Slopes average about 2 percent.

The surface layer is grayish-brown, calcareous loam about 8 inches thick. The underlying material is light-gray, calcareous clay loam that extends to a depth of 60 inches.

Included with this soil in mapping are small areas of Estacado and Tulia soils that make up about 5 percent of the mapped area.

This Drake soil is used mostly as range. A few cultivated areas are in grain sorghum and wheat. The hazard of soil blowing is severe, and the hazard of water erosion is slight.

The main concerns in management are controlling soil blowing, conserving moisture, and improving soil productivity. Leaving crop residue on the soil surface helps to improve productivity, to conserve moisture, and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Using fertilizer and some trace elements in irrigated areas helps to improve soil productivity. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IVe–3, dryland, and IIIe–6, irrigated; High Lime range site.

Drake loam, 3 to 5 percent slopes (DrC).—This gently sloping soil is in crescent-shaped areas on low ridges that curve around the eastern sides of playas above the Caprock Escarpment. Areas are 300 to 700 feet wide and are 15 to 60 acres in size. Slopes average about 4 percent. This soil has the profile described as representative of the Drake series.

Included with this soil in mapping are small areas of Estacado and Tulia soils that make up about 5 percent of the mapped area.

This soil is used mostly as range. Some cultivated areas are in grain sorghum and wheat. The hazard of soil blowing is severe, and the hazard of water erosion is moderate.

The main concerns in management are controlling soil blowing and erosion, conserving moisture, and improving soil productivity. Leaving crop residue on the soil surface helps to improve productivity, to conserve moisture, and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Using fertilizer and some trace elements in irrigated areas helps to improve soil productivity. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units VIe–2, dryland, and IVe–1, irrigated; High Lime range site.

Enterprise Series

The Enterprise series consists of deep, gently sloping to sloping, calcareous, loamy soils on uplands. These soils formed in loamy eolian material.

In a representative profile the surface layer is reddish-brown, calcareous loam about 5 inches thick. The next layer is reddish-brown, calcareous loam about 23 inches thick. Below this to a depth of 60 inches is yellowish-red, calcareous loam.

Enterprise soils are well drained. Permeability is moderately rapid, and available water capacity is high. Runoff is medium. These soils receive runoff from sloping soils in higher lying areas. The hazards of soil blowing and water erosion are moderate.

These soils are used as range, but they are suited to cultivation. Most areas have potential for development as wildlife habitat.

Representative profile of Enterprise loam, 3 to 8 percent slopes, about 12 miles north of Silverton, 0.1 mile northeast from the main crossing at Coon Creek to a bend in the road, then 300 feet east, on the north side of the road:

A1—0 to 5 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; moderate, medium, subangular blocky and granular structure; slightly hard, friable; few worm casts; few threads of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B21—5 to 28 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; moderate, medium, subangular blocky structure; hard, friable; few worm casts; few threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B22—28 to 60 inches, yellowish-red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; weak, fine, subangular blocky structure; slightly hard, friable; calcareous; moderately alkaline.

Satinspar gypsum, shale, and sandstone pebbles and fragments are scattered throughout the profile in places. The A horizon is 4 to 14 inches thick and is reddish brown, light reddish brown, or light brown. The B2 horizon is reddish brown or yellowish red. In some profiles a few filaments, films, and pebbles of calcium carbonate are in the lower part of this horizon.

Enterprise loam, 3 to 8 percent slopes (EnD).—This gently sloping to sloping soil is on foot slopes below the Caprock Escarpment. Areas are irregular in shape and are 10 to 200 acres in size. Slopes average about 5 percent.

Included with this soil in mapping are small areas of Berda, Obaro, and Quinlan soils.

This Enterprise soil is used mostly as range. It is suited to cultivation, and a few small areas are cultivated.

The main concerns in management are controlling soil blowing and water erosion and conserving moisture. Leaving crop residue on the soil surface helps to maintain tilth, to conserve moisture, and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IVe–2, dryland, and IVe–1, irrigated; Mixedland range site.

Estacado Series

The Estacado series consists of deep, nearly level to sloping, calcareous, loamy soils on uplands. These soils formed in old, loamy, alluvial material that has been reworked by wind.

In a representative profile the surface layer is brown clay loam about 11 inches thick. The subsoil is calcareous clay loam that extends to a depth of 80 inches. It is brown and has a few concretions of calcium carbonate in the upper 13 inches; is reddish yellow and is about 40 percent calcium carbonate in the next 24 inches; and is yellowish red in the lower 32 inches.

Estacado soils are well drained. Permeability is moderate, and available water capacity is medium. Runoff is slight to medium. The hazard of soil blowing is moderate. The hazard of water erosion is slight to moderate.

These soils are suited to cultivation. About 25 percent of the acreage is dryfarmed, 25 percent is irrigated, and 50 percent is used as range.

Representative profile of Estacado clay loam, 1 to 3 percent slopes, about 5 miles south on Texas Highway 207 from its intersection with Texas Highway 86 in Silverton, then 4 miles west on Farm Road 145, then 300 feet north of the road:

Ap—0 to 11 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, very fine, granular structure; hard, friable; few, fine, caliche pebbles; calcareous; moderately alkaline; abrupt, smooth boundary.

B21t—11 to 24 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate, subangular blocky structure; hard, friable; few fine concretions of calcium carbonate; few worm casts; few thin clay films; calcareous; moderately alkaline; gradual, smooth boundary.

B22tca—24 to 48 inches, reddish-yellow (7.5YR 7/6) clay loam, reddish yellow (7.5YR 6/6) moist; moderate; fine, subangular blocky structure; slightly hard, friable; about 40 percent, by volume, calcium carbonate, mostly well mixed with the soil mass but a few soft masses as much as 1 inch in diameter; few worm casts and fine pores; few thin clay films; calcareous; moderately alkaline; diffuse, smooth boundary.

B23t—48 to 80 inches, yellowish-red (5YR 5/8) clay loam, yellowish red (5YR 4/8) moist; moderate, medium, subangular blocky structure; hard, friable; few fine pores; common clay films; few fine concretions of calcium carbonate; calcareous; moderately alkaline.

The A horizon is 11 to 14 inches thick. It is brown, dark brown, grayish brown, or dark grayish brown. The Bt horizon is 12 to 36 inches thick. It is brown, reddish-brown, yellowish-red, reddish-yellow, or light reddish-brown clay loam or sandy clay loam. Depth to the B2tca horizon is 10 to 30 inches. Filaments, coatings, concretions, and soft masses of calcium carbonate make up 15 to 60 percent of the volume. The lower part of the Bt horizon ranges from 1 to 25 percent calcium carbonate.

Estacado clay loam, 0 to 1 percent slopes (EsA).—This nearly level soil is on smooth uplands in the High Plains part of the county. Areas are oval to irregular in shape and are 5 to 80 acres in size. Slopes average about 0.3 percent.

The surface layer is dark grayish-brown, calcareous clay loam about 12 inches thick. The upper part of the subsoil to a depth of 26 inches is brown, calcareous clay loam. The middle part of the subsoil to a depth of 48 inches is reddish-brown, calcareous silty clay loam. The lower part of the subsoil to a depth of 80 inches is yellowish-red, calcareous clay loam.

Included with this soil in mapping are small areas of Olton, Pullman, and Tulia soils that make up about 10 percent of most mapped areas. A few areas are as much as 20 percent Tulia soils.

This Estacado soil is used mostly for cotton, grain sorghum, and wheat. It is well suited to alfalfa if it is irrigated. A few scattered areas are used as range. The hazard of soil blowing is moderate. The hazard of water erosion is slight.

The main concerns in management are controlling soil blowing and water erosion, conserving moisture, and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth, to conserve moisture, and to control soil blowing. Terracing long slopes helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–1, dryland, and IIe–1, irrigated; Hardland Slopes range site.

Estacado clay loam, 1 to 3 percent slopes (EsB).—This gently sloping soil is on smooth uplands in the High Plains part of the county. Areas are mainly between 20 to 45 acres in size and are around playas and along draws. Slopes average about 2 percent. This soil has the profile described as representative of the Estacado series.

Included with this soil in mapping are small areas of Lofton, Olton, Pullman, and Tulia soils that make up about 6 percent of most mapped areas. A few areas are as much as 20 percent Tulia soils.

This Estacado soil is used mostly for cotton, grain sorghum, and wheat. A few scattered areas are used as range. The hazards of soil blowing and water erosion are moderate.

The main concerns in management are controlling soil blowing and water erosion, conserving moisture, and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth, to conserve moisture, and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–2, dryland, and IIIe–1, irrigated; Hardland Slopes range site.

Estacado clay loam, 3 to 5 percent slopes (EsC).—This gently sloping soil is on uplands in the High Plains part of the county. Areas are along draws and around playas. Most areas are long and have irregular outer boundaries. They average about 30 acres in size but range from 5 to 80 acres. Slopes average about 4 percent.

The surface layer is brown, calcareous clay loam about 12 inches thick. The subsoil to a depth of 35 inches is calcareous clay loam that is reddish brown in the upper part and light reddish brown in the lower part. Between the depths of 35 and 45 inches, it is light reddish-brown clay loam that is about 40 percent carbonates. Below a depth of 45 inches, it is yellowish-red, calcareous clay loam.

Included with this soil in mapping are small areas of Lofton, Olton, Pullman, and Tulia soils that make up about 5 percent of most mapped areas.

This Estacado soil is used mostly as range. A few areas are in grain sorghum and wheat. The hazards of soil blowing and water erosion are moderate.

The main concerns in management are controlling soil blowing and erosion, conserving moisture, and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth, to conserve moisture, and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IVe–2, dryland, and IVe–1, irrigated; Hardland Slopes range site.

Lincoln Series

The Lincoln series consists of deep, nearly level, calcareous, sandy soils on bottom lands. These soils formed in recent sandy alluvium.

In a representative profile the surface layer is reddish-yellow, calcareous loamy fine sand about 8 inches thick. The underlying material is reddish-yellow, calcareous loamy fine sand to a depth of 60 inches.

Lincoln soils are somewhat excessively drained. Permeability is rapid, and available water capacity is low. Runoff is slow. These soils are flooded one or more times in 4 to 10 years. A water table is at a depth of 20 to 60 inches in some areas. The hazard of soil blowing is severe, and the hazard of water erosion is slight.

These soils are not suited to cultivation. Most areas are used as range. They have potential for development as wildlife habitat.

Representative profile of Lincoln loamy fine sand in an area of Lincoln soils, frequently flooded, about 30 miles northeast of Silverton, about 1 mile west on a county road from Texas Highway 70, 50 feet west of the channel of Battle Creek and 25 feet north of the county road:

A1—0 to 8 inches, reddish-yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6) moist; weak, fine, granular structure; soft, very friable; few fine and medium roots; few quartz pebbles as much as

½ inch in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

C—8 to 60 inches, reddish-yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6) moist; single grained; soft, very friable; few fine roots; common thin strata and lenses ¼ inch to 4 inches thick of fine sandy loam, very fine sandy loam, silt loam, silty clay loam, and sand; calcareous; moderately alkaline.

The profile is calcareous loamy fine sand or fine sand to a depth of 60 inches. It is reddish brown, light reddish brown, reddish yellow, or yellowish red. It has thin layers and lenses, 1 inch to 5 inches thick, of silt loam, very fine sandy loam, fine sandy loam, and clay loam throughout. Thick beds of gravel and coarse sand are below a depth of 40 inches in places.

Lincoln soils, frequently flooded (Lf).—This undifferentiated group consists of Lincoln soils and of soils that are similar in behavior to Lincoln soils. These nearly level soils are on bottom lands along rivers and creeks. Extensive areas 300 feet to about ½ mile wide are parallel to the streambeds along Prairie Dog Town Fork of the Red River. Narrower areas are along the tributaries of this stream. Slopes are 0 to 1 percent. Soil patterns are not uniform.

Included with these soils in mapping are areas of narrow, barren, gravelly and sandy stream channels. Also included are small intermingled areas of Clairemont, Tivoli, and Yahola soils that make up less than 8 percent of the mapped area.

These soils are used as range or improved pasture. They are not suited to cultivation. Areas are flooded one or more times in 4 to 10 years. In some areas a high water table is at a depth of 20 to 60 inches. Capability unit Vw–2, dryland; Sandy Bottomland range site.

Lipan Series

The Lipan series consists of deep, nearly level, calcareous, clayey soils in benched areas around playas. These soils formed in calcareous clays.

In a representative profile the surface layer is gray, calcareous clay about 65 inches thick. The underlying material is light-gray, calcareous clay that extends to a depth of 85 inches.

Lipan soils are moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is slow. These soils receive runoff from adjoining sloping soils. The hazards of soil blowing and water erosion are slight.

These soils are suited to cultivation. About half of the acreage is cultivated. The rest is small scattered areas that are used as range.

Representative profile of Lipan clay, about 5 miles south of Silverton on Texas Highway 207, 5 miles west on Farm Road 145, and 50 feet off the road:

A11—0 to 6 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, very fine, blocky structure; very hard, very firm; calcareous; moderately alkaline; clear, smooth boundary.

A12—6 to 30 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; intersecting slickensides that part to parallelepipeds and moderate, medium, blocky structure; very hard, very firm; calcareous; moderately alkaline; gradual, smooth boundary.

AC—30 to 65 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; intersecting slickensides that part to parallelepipeds and moderate, medium, blocky structure; very hard, very firm; few masses of calcium carbonate 1 millimeter to 2 millimeters in diameter; calcareous; moderately alkaline; diffuse, smooth boundary.

Cca—65 to 85 inches, light-gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; massive; very hard, very firm; few, faint, fine, brownish-yellow iron stains; about 20 percent, by volume, calcium carbonate well mixed with the soil mass; calcareous; moderately alkaline.

The A horizon is 13 to 31 inches thick and is gray or light gray. In most profiles slickensides are in the lower part of the A horizon. The AC horizon extends to a depth of 40 to 70 inches. It is gray, light gray, or grayish brown and has few to common masses and soft concretions of calcium carbonate. The C horizon is gray, light gray, or grayish brown. In some profiles it is thinly stratified with loam and sandy clay loam.

Lipan clay (Ln).—This nearly level soil is on benches around playas in the High Plains part of the county. The benches are 3 to 10 feet above the playa floor. Areas are 8 to 100 acres in size. They partly encircle or wholly encircle the playa. Slopes are 0 to 1 percent but are mainly less than 0.5 percent.

Included with this soil in mapping are small areas of Lofton, Randall, and Roscoe soils that make up less than 8 percent of the mapped area.

This Lipan soil is used mainly for crops, but it is also used as range. It is suited to cotton, grain sorghum, and wheat. It is flooded one or more times in 4 to 10 years.

The main concern in management is maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth and to control soil blowing. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIw–1, dryland, and IIw–1, irrigated; Clay Loam range site.

Lofton Series

The Lofton series consists of deep, nearly level, noncalcareous, loamy soils on uplands. These soils are on benches around playas. They formed in clayey calcareous sediment.

In a representative profile the surface layer is dark-gray clay loam about 6 inches thick. The subsoil to a depth of 80 inches is clay that is noncalcareous in the upper part and calcareous in the lower part. It is dark gray in the upper 17 inches; dark grayish brown in the next 15 inches; grayish brown in the next 10 inches; light brownish gray in the next 12 inches; and light brown in the lower 20 inches.

Lofton soils are moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is very slow. The hazards of soil blowing and water erosion are slight.

These soils are well suited to cultivation. Most areas are cultivated. Small scattered areas are in native vegetation.

Representative profile of Lofton clay loam, 2.7 miles west on Texas Highway 86 from its intersection with Texas Highway 207 in Silverton and 0.15 mile north of the highway:

Ap—0 to 6 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak, very fine, subangular blocky structure and moderate, fine, granular structure; hard, friable; many, fine, fibrous roots; mildly alkaline; abrupt, smooth boundary.

B21t—6 to 23 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, medium, blocky structure; very hard, very firm; common fine roots; wedge-shaped peds; distinct clay films; mildly alkaline; clear, smooth boundary.

B22t—23 to 38 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate, medium, blocky structure; very hard, very firm; wedge-shaped peds tilted about 15 degrees from the horizontal; few fine roots, mostly compressed between peds; common distinct clay films; calcareous; moderately alkaline; gradual, smooth boundary.

B23t—38 to 48 inches, grayish-brown (10YR 5/2) clay, dark grayish-brown (10YR 4/2) moist; weak, medium, blocky structure; very hard, very firm; few fine roots; few faint clay films; few, small soft masses and threads of calcium carbonates increasing with depth; calcareous; moderately alkaline; gradual, smooth boundary.

B24tca—48 to 60 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; moderate, fine, blocky structure; very hard, very firm; few fine roots; few thin clay films; few streaks of dark colored material in old cracks in upper part; about 10 percent segregated carbonates as much as ½ inch in diameter; calcareous; moderately alkaline; diffuse, smooth boundary.

B25t—60 to 80 inches, light-brown (7.5YR 6/4) clay, brown (7.5YR 5/4) moist; common, medium, distinct mottles of light brownish gray (10YR 6/2); moderate, fine, blocky structure; very hard, firm; few fine roots; few iron manganese concretions 3 to 5 millimeters in diameter; few iron stains; few soft masses of calcium carbonate; common calcium carbonate films on surface of peds; few thin clay films; calcareous; moderately alkaline.

The A horizon is 6 to 10 inches thick. The A horizon and the upper part of the Bt horizon, to a depth of more than 20 inches, are dark gray, dark grayish brown, or very dark grayish brown. The Bt horizon is clay or silty clay. The lower part of this horizon is grayish brown, gray, dark gray, dark grayish brown, or brown. The B2tca horizon is light brownish gray, gray, or grayish brown.

Figure 5.—**Dryland grain sorghum on undulating Miles and Springer loamy fine sands.**

Lofton clay loam (Lo).—This nearly level soil is on benches around playas in the High Plains part of the county. The benches are 7 to 15 feet above the playa bottoms. Areas are 5 to 200 acres in size. They partly encircle or wholly encircle the playa. Slopes are 0 to 1 percent but are mainly less than 0.5 percent.

Included with this soil in mapping are small areas of Lipan, Pullman, and Roscoe soils that make up less than 5 percent of the mapped area.

This Lofton soil is used mostly for crops. It is well suited to cotton, grain sorghum, and wheat. A few areas are in native vegetation. This soil is seldom flooded.

The main concerns in management are conserving moisture and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–5, dryland, and IIs–1, irrigated; Clay Loam range site.

Miles Series

The Miles series consists of deep, nearly level to gently undulating, noncalcareous, sandy soils on uplands. These soils formed in windblown sandy and loamy material.

In a representative profile the surface layer is reddish-brown, noncalcareous loamy fine sand about 10 inches thick. The subsoil extends to a depth of 84 inches. The upper 22 inches is reddish-brown sandy clay loam. The lower 52 inches is yellowish red and reddish-yellow sandy clay loam. The subsoil is noncalcareous in the upper 38 inches and calcareous below.

Miles soils are well drained. Permeability is moderate, and available water capacity is medium. Runoff is slow. The hazard of soil blowing is moderate, and the hazard of water erosion is slight.

About 60 percent of the acreage is cultivated (fig. 5). Most areas are dryfarmed, but a few areas are irrigated. Scattered areas are used as range.

Representative profile of Miles loamy fine sand, 0 to 3 percent slopes, 4 miles east on Texas Highway 86 from its intersection with Farm Road 1065 in Quitaque, then 2.3 miles south on Farm Road 2733, or 0.5 mile west and 0.35 mile south of the intersection of Farm Roads 599 and 2733, and 100 feet east of road:

Ap—0 to 10 inches, reddish-brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) moist; single grained; soft, very friable; neutral; abrupt, smooth boundary.

B21t—10 to 32 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; distinct common clay films on prism faces; few worm casts; neutral; gradual, smooth boundary.

B22t—32 to 48 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few fine pores; few very fine pockets of clean sand grains; distinct common clay films on prism faces; few worm casts; clay decreases with depth; mildly alkaline; gradual, smooth boundary.

B23t—48 to 76 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate, medium, subangular blocky structure; hard, friable; few fine pores; few thin clay films; few films and fine threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B24tca—76 to 84 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak, fine, subangular blocky structure; hard, friable; few fine pores; about 15 percent, by volume, films, concretions, and soft masses of calcium carbonate; few distinct clay films; calcareous; moderately alkaline.

The A horizon is 7 to 20 inches thick and is light reddish brown, reddish brown, or light brown. The Bt horizon is reddish-brown, reddish-yellow, yellowish-red, or red fine sandy loam or sandy clay loam. It is dominantly 20 to 25 percent clay, but in places it is as much as 35 percent clay. Secondary carbonates are below a depth of 36 inches.

Miles loamy fine sand, 0 to 3 percent slopes (MeB).—This nearly level to gently undulating soil is on uplands below the Caprock Escarpment. Areas are oval to irregular in shape and are 20 to 200 acres in size.

Included with this soil in mapping are small areas of Amarillo and Springer soils that make up 10 percent or less of the mapped area. Also included are a few eroded spots in which the loamy sand surface layer ranges from 4 to 26 inches thick.

This Miles soil is used mostly for crops. Most areas are in dryland cotton and grain sorghum. A few areas are irrigated and are in peanuts or in bermudagrass pasture.

The main concern in management is controlling soil blowing. Leaving crop residue on the soil surface helps to control soil blowing and water erosion. Deep plowing also helps to control soil blowing. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–6, dryland, and IIIe–5, irrigated; Sandy range site.

Mobeetie Series

The Mobeetie series consists of deep, nearly level to gently sloping, calcareous, loamy soils on smooth uplands. These soils formed in loamy calcareous material that has been reworked by wind.

In a representative profile the surface layer is pinkish-gray, calcareous fine sandy loam about 10 inches thick. Below this is about 30 inches of light-brown, calcareous fine sandy loam. The underlying material is light-brown, calcareous fine sandy loam that extends to a depth of 60 inches.

Mobeetie soils are well drained. Permeability is moderately rapid, and available water capacity is medium. Runoff is slow to medium. The hazards of soil blowing and water erosion are moderate.

These soils are suited to cultivation. Most areas are dryfarmed. Small scattered areas are used as range.

Representative profile of Mobeetie fine sandy loam, 0 to 3 percent slopes, 1.75 miles west on Texas Highway 86 from its intersection with Farm Road 1065 in Quitaque, then 0.5 mile south of the highway and 50 feet east of a field boundary:

Ap—0 to 10 inches, pinkish-gray (7.5YR 6/2) fine sandy loam, brown (7.5YR 5/2) moist; weak, fine, granular structure; soft, very friable; few caliche pebbles as much as 2 inches in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

B2—10 to 40 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak, fine, subangular blocky structure parting to weak, fine, granular; slightly hard, very friable; few caliche pebbles as much as 1 inch in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

C—40 to 60 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak, fine, subangular blocky structure; slightly hard, very friable; thin strata of silt loam and loamy fine sand; calcareous; moderately alkaline.

The solum ranges from 30 inches to more than 60 inches in thickness. The A horizon is 6 to 12 inches thick and is brown, light reddish brown, reddish brown, or pinkish gray. The B2 horizon is light-brown, brown, reddish-brown, or light reddish-brown fine sandy loam. It is 10 to 15 percent clay. The C horizon is mostly fine sandy loam, but this horizon commonly contains thin strata of gravel, silt loam, and loamy fine sand.

Mobeetie fine sandy loam, 0 to 3 percent slopes (MoB).—This nearly level to gently sloping soil is on uplands below the Caprock Escarpment. Areas are 10 to 60 acres in size. The surface is slightly moundy or undulating in places. Slopes average about 1 percent.

Included with this soil in mapping are small areas of Amarillo, Berda, and Paloduro soils that make up 5 to 10 percent of most mapped areas.

This Mobeetie soil is used mostly for dryland cotton, grain sorghum, and wheat.

The main concerns in management are controlling soil blowing and water erosion, conserving moisture, and improving soil productivity. Leaving crop residue on the soil surface helps to improve productivity, to conserve moisture, and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–3, dryland, and IIIe–3, irrigated; Mixedland Slopes range site.

Obaro Series

The Obaro series consists of moderately deep to deep, gently sloping and rolling, calcareous loams on uplands. These soils formed in weakly consolidated, calcareous sandstone or siltstone.

In a representative profile the surface layer is reddish-brown, calcareous loam about 10 inches thick. The next layer is calcareous loam about 30 inches thick. It is red in the upper 20 inches and light red in the lower 10 inches. The underlying material to a depth of 70 inches is red, weakly cemented sandstone.

Obaro soils are well drained. Permeability is moderate, and available water capacity is medium. Runoff is medium to rapid. The hazard of soil blowing is slight. The hazard of water erosion is moderate to severe.

These soils are used mostly as range. A few small areas are used for crops.

Representative profile of Obaro loam, 3 to 5 percent slopes, 32 miles northeast of Silverton, 2.35 miles west and 0.8 mile south of the point where Mulberry Creek enters Hall County:

Ap—0 to 10 inches, reddish-brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak, fine, granular structure; slightly hard, very friable; few worm casts; few calcium carbonate concretions 2 to 15 millimeters in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

B2—10 to 30 inches, red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; moderate, fine, subangular blocky structure; hard, friable; common worm casts; about 3 percent, by volume, films, concretions, and soft masses of calcium carbonate 3 to 10 millimeters in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

B3ca—30 to 40 inches, light-red (2.5YR 6/6) loam, red (2.5YR 5/6) moist; weak, fine, subangular blocky structure; friable; few worm casts; about 10 percent, by volume, siltstone fragments; about 8 percent, by volume, films and soft masses of calcium carbonate 1 millimeter to 3 millimeters in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

C—40 to 70 inches, red (2.5YR 5/6) very fine grained weakly cemented sandstone, red (2.5YR 4/6) moist; very hard, firm; few roots in fractures; few light-gray spots 2 to 5 millimeters in diameter; few calcium carbonate films in fractures of upper part; mildly alkaline in lower part.

Depth to sandstone is 20 to 48 inches. The A horizon is 5 to 12 inches thick and is reddish brown or red. The B2 horizon and the B3ca horizon are light reddish-brown, reddish-brown, yellowish-red, reddish-yellow, red, or light-red loam or sandy clay loam. The B2 horizon is less than 15 percent sand coarser than very fine sand. It has few to common calcium carbonate filaments and coatings. The B3ca horizon is 1 to 15 percent calcium carbonate and 2 to 5 percent, by volume, siltstone, sandstone, or shale fragments. The C horizon in most places is red, weakly cemented siltstone or very fine grained sandstone, but it is soft packsand in some places.

Obaro loam, 1 to 3 percent slopes (ObB).—This gently sloping soil is on uplands below the Caprock Escarpment. Most areas are on smooth convex ridges and divides. Areas average about 75 acres in size. Slopes are mostly between 1 and 2 percent.

The surface layer is reddish-brown, calcareous loam about 10 inches thick. The next layer is red, calcareous loam about 20 inches thick. The underlying material is red, weakly cemented siltstone.

Included with this soil in mapping are small areas of Enterprise, Olton, Paloduro, and Quinlan soils. These soils make up about 8 percent of the mapped area.

This Obaro soil is used mostly as range. Some cultivated areas are in cotton, grain sorghum, forage sorghum, and wheat. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

The main concerns in management are controlling erosion and conserving moisture. Leaving crop residue on the soil surface helps to control soil blowing. Using diversion terraces helps to control erosion and conserve moisture. In irrigated areas a well-designed irrigation system helps to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–4, dryland, and IIIe–4, irrigated; Mixedland range site.

Obaro loam, 3 to 5 percent slopes (ObC).—This gently sloping soil is on uplands below the Caprock Escarpment. Areas are 5 to 200 acres in size and are dominantly long and narrow. Most areas are on smooth convex divides and ridges. Slopes average about 4 percent. This soil has the profile described as representative of the Obaro series.

Included with this soil in mapping are small areas of Enterprise, Olton, Paloduro, and Quinlan soils. These soils make up about 8 percent of the mapped area.

This Obaro soil is used mostly as range. A few areas are in wheat, grain sorghum, and forage sorghum. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

The main concerns in management are controlling erosion and conserving moisture. Leaving residue on the soil surface helps to control soil blowing. Using diversion terraces helps to control erosion and conserve moisture. In irrigated areas a well-designed irrigation system helps to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IVe–2, dryland, and IVe–1, irrigated; Mixedland range site.

Obaro and Quinlan soils, rolling (OQE).—This mapping unit is made up of rolling soils on hills and ridges below the Caprock Escarpment. It is about 50 percent Obaro soils, 40 percent Quinlan soils, and 10 percent other soils or sandstone outcrop. Most areas are surrounded by steep and broken land. Slopes range from 5 to 16 percent, but they are mostly 8 to 12 percent. Areas are 100 to 500 acres in size. The composition of this mapping unit is more variable than that of others in the county, and soil patterns are not uniform. Mapping has been controlled well enough, however, for the anticipated use of the soils.

The Obaro soils are in less sloping areas on ridgetops and side slopes. These soils have a surface layer of reddish-brown, calcareous loam about 6 inches thick. The next layer is 22 inches of calcareous loam that is reddish brown in the upper part and red in the lower part. The underlying material is red, very fine grained, weakly cemented sandstone.

The Quinlan soils are in steeper areas on ridgetops, knolls, and side slopes. A Quinlan soil in this mapping unit has the profile described as representative of the Quinlan series.

Included with these soils in mapping are small areas of Burson and Olton soils and some spots of sandstone outcrop.

The soils in this mapping unit are used as range. They are not suited to cultivated crops. Capability unit VIe–3, dryland; Mixedland range site.

Olton Series

The Olton series consists of deep, nearly level to gently sloping, noncalcareous, loamy soils on smooth uplands. These soils formed in old, loamy, alluvial material that has been reworked by wind.

In a representative profile the surface layer is reddish-brown, noncalcareous clay loam about 6 inches thick. The upper part of the subsoil to a depth of 18 inches is reddish-brown, noncalcareous clay loam. Between depths of 18 and 66 inches, the subsoil is calcareous clay loam. The upper 30 inches is yellowish red, and the lower 18 inches is pink. Below a depth of 66 inches, and extending to a depth of 85 inches, the subsoil is reddish-yellow, calcareous sandy clay loam.

Olton soils are well drained. Permeability is moderately slow, and available water capacity is high. Runoff is slow to medium. The hazard of soil blowing is slight, and the hazard of water erosion is slight to moderate.

These soils are well suited to cultivation. About 25 percent of the acreage is dryfarmed, 25 percent is irrigated, and 50 percent is scattered areas of range.

Representative profile of Olton clay loam, 1 to 3 percent slopes, 6 miles west on Texas Highway 86 from its intersection with Texas Highway 207 in Silverton, then 0.4 mile south on a county road and 100 feet east of the road, in a field:

Ap—0 to 6 inches, reddish-brown (5YR 5/3) clay loam, dark reddish brown (5YR 3/3) moist; weak, very fine, granular structure; hard, firm; mildly alkaline; abrupt, smooth boundary.

B21t—6 to 18 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist, moderate, fine, blocky structure; very hard, very firm; thin distinct clay films; mildly alkaline; clear, smooth boundary.

B22t—18 to 48 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate, medium, blocky structure; very hard, firm; thick prominent clay films; few films and fine soft masses of calcium carbonate increasing with depth; calcareous; moderately alkaline; gradual, smooth boundary.

B23tca—48 to 66 inches, pink (5YR 7/4) clay loam, light reddish brown (5YR 6/4) moist; weak, fine, subangular blocky structure; few fine pores; few worm casts; about 60 percent, by volume, calcium carbonate mostly well mixed with the soil mass; few calcium carbonate concretions as much as 1 inch in diameter; carbonates have masked clay films; calcareous; moderately alkaline; diffuse, smooth boundary.

B24t—66 to 85 inches, reddish-yellow (5YR 7/6) sandy clay loam, reddish yellow (5YR 6/6) moist; moderate, medium, subangular blocky structure; hard, friable; few thin clay films; few films; fine concretions, and soft masses of calcium carbonate; few black stains on surface of peds; calcareous; moderately alkaline.

The solum is more than 60 inches thick. Depth to secondary carbonates is 16 to 28 inches. The A horizon is 6 to 11 inches thick and is brown, dark brown, reddish brown, or dark reddish brown. The B21t and B22t horizons are similar to the A horizon in color, but the B22t horizon ranges to yellowish red and reddish yellow. The B21t and B22t horizons are clay loam that is 32 to 40 percent clay. The B23tca horizon is at a depth of 30 to 60 inches. It is 20 to 60 percent soft and cemented masses and concretions of calcium carbonate. It is pink, reddish yellow, or light reddish brown. The B24t horizon is clay loam or sandy clay loam and extends to a depth of more than 80 inches. It is similar to the B23tca horizon in color.

Olton clay loam, 0 to 1 percent slopes (OtA).—This nearly level soil is on smooth uplands in the High Plains part of the county. Areas are 60 to 350 acres in size. The surface is plane to weakly convex. Slopes average less than 0.5 percent.

The surface layer is dark-brown clay loam about 8 inches thick. The subsoil to a depth of 44 inches is reddish-brown clay loam that is noncalcareous in the upper part and calcareous in the lower part. Between depths of 44 and 60 inches, it is yellowish-red, calcareous clay loam. Below a depth of 60, it is light reddish-brown clay loam that is about 20 percent calcium carbonate.

Included with this soil in mapping are small areas of Estacado and Pullman soils that make up less than 8 percent of the mapped area.

This Olton soil is used mainly for cotton, grain sorghum, and wheat, but soybeans are grown in small areas. About 50 percent of the areas are irrigated. The hazards of soil blowing and water erosion are slight.

The main concerns in management are controlling soil blowing and erosion, conserving moisture, and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth, to conserve moisture, and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–1, dryland, and IIe–1, irrigated; Clay Loam range site.

Olton clay loam, 1 to 3 percent slopes (OtB).—This gently sloping soil is on uplands in the High Plains part of the county. Slopes average about 2 percent. Some areas are slightly oval in shape and are 200 to 300 acres in size. Other areas along draws and around playas are long and narrow in shape and are 50 to 100 acres in size. This soil has the profile described as representative of the Olton series.

Included with this soil in mapping are a few small areas of Estacado and Pullman soils that make up less than 15 percent of any mapped area.

This Olton soil is used mostly for cotton, grain sorghum, and wheat. A few areas are irrigated. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

The main concerns in management are controlling erosion, conserving moisture, and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth, to conserve moisture, and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–2, dryland, and IIIe–1, irrigated; Clay Loam range site.

Paloduro Series

The Paloduro series consists of deep, nearly level to gently sloping, calcareous, loamy soils on smooth uplands. These soils formed in old alluvial material that has been reworked by wind.

In a representative profile the surface layer is brown, calcareous loam about 6 inches thick over brown, calcareous clay loam about 10 inches thick. The next layer is reddish brown and calcareous and extends to a depth of 80 inches. It is clay loam in the upper 22 inches, loam in the next 30 inches, and fine sandy loam in the lower 12 inches.

Paloduro soils are well drained. Permeability is moderate, and available water capacity is high. Runoff is medium. The hazard of soil blowing is slight, and the hazard of water erosion is slight to moderate.

These soils are well suited to cultivation. Most areas are dryfarmed, but some scattered areas are in range.

Representative profile of Paloduro loam, 1 to 3 percent slopes, 1 mile east on Texas Highway 86 from its intersection with Farm Road 1065 in Quitaque, then 0.85 mile south on a county road, then 0.3 mile east on a turnrow and 25 feet north, in a cultivated field:

Ap—0 to 6 inches, brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; hard, friable; few caliche and siliceous pebbles 2 to 20 millimeters in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 16 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky structure; hard, friable; few caliche pebbles 2 to 15 millimeters in diameter; few worm casts; calcareous; moderately alkaline; clear, smooth boundary.

B21—16 to 38 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate, fine, subangular blocky structure; hard, friable; few caliche pebbles 2 to 15 millimeters in diameter; common films of calcium carbonate; common worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B22—38 to 68 inches, reddish-brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak, fine, subangular blocky structure; hard, friable; about 10 percent, by volume, caliche pebbles 2 to 15 millimeters in diameter; few siliceous pebbles coated with caliche; common worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B23—68 to 80 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, fine, subangular blocky structure; hard, very friable; few caliche pebbles 2 to 15 millimeters in diameter; few siliceous pebbles 5 to 40 millimeters in diameter coated with caliche; thin strata of loamy sand in the lower part; moderately alkaline.

The solum ranges from 40 inches to more than 80 inches in thickness. The A horizon is 12 to 19 inches thick and is brown, dark brown, grayish brown, or dark grayish brown. The B2 horizon is reddish brown, light reddish brown, or brown. It is loam, clay loam, or sandy clay loam and is 20 to 35 percent clay. Calcium carbonate content ranges from a few filaments and pebbles to about 15 percent, by volume, soft masses and concretions.

Paloduro loam, 0 to 1 percent slopes (PaA).—This nearly level soil is in smooth areas below the Caprock Escarpment. Areas are irregular in shape and are 10 to 300 acres in size. Slopes average about 0.5 percent. Surfaces are mostly plane to convex.

The surface layer is dark-brown, calcareous loam about 18 inches thick. The next layer is about 22 inches of reddish-brown, calcareous loam over reddish-brown clay loam to a depth of 70 inches.

Included with this soil in mapping are areas of Acuff, Amarillo, Berda, and Olton soils 1 acre to 8 acres in size. These soils make up about 12 percent of the mapped area.

This soil is used mostly for cotton, grain sorghum, forage sorghum, and wheat. A few areas are used as range. The hazards of soil blowing and water erosion are slight.

The main concerns in management are conserving moisture and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth, to conserve moisture, and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–1, dryland, and IIe–1, irrigated; Hardland Slopes range site.

Paloduro loam, 1 to 3 percent slopes (PaB).—This gently sloping soil is in areas below the Caprock Escarpment. Areas are irregular in shape and are 5 to 200 acres in size. Slopes average about 2 percent. Most surfaces are simple and convex. This soil has the profile described as representative of the Paloduro series.

Included with this soil in mapping are small areas of Acuff, Amarillo, Berda, and Olton soils.

This Paloduro soil is mostly in cotton, grain sorghum, forage sorghum, and wheat. A few areas are used as range. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

The main concerns in management are controlling erosion and conserving moisture. Leaving crop residue on the soil surface helps to conserve moisture and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–2, dryland, and IIIe–1, irrigated; Hardland Slopes range site.

Polar Series

The Polar series consists of shallow to very shallow, gently sloping to strongly sloping, calcareous, gravelly loamy soils on uplands. These soils formed in ancient gravelly alluvium (fig. 6).

In a representative profile the surface layer is about 14 inches thick. It is brown, calcareous gravelly sandy clay loam in the upper 8 inches and light yellowish-brown, calcareous very gravelly clay loam in the lower 6 inches. The underlying material extends to a depth of 80 inches. It is pale-brown very gravelly loam that is weakly cemented with caliche in the upper 10 inches and layers of gravel, sand, and clay loam in the lower 56 inches.

Polar soils are excessively drained. Permeability is moderately rapid, and available water capacity is very low. Runoff is medium to rapid. The hazard of soil blowing is moderate, and the hazard of water erosion is severe.

These soils are not suited to cultivation. Most areas are used as range.

Polar soils in Briscoe County are mapped only in a complex with Berda soils.

Representative profile of Polar gravelly sandy clay loam in an area of Berda-Polar complex, 3 to 12 percent slopes, 4 miles east on Texas Highway 86 from its intersection with Farm Road 1065 in Quitaque, then 0.25 mile north on a county road, then 0.15 mile east of the road, to the north edge of a gravel pit:

A11—0 to 8 inches, brown (7.5YR 5/2) gravelly sandy clay loam, dark brown (7.5YR 4/2) moist; moderate, fine, subangular blocky structure parting to mod-

Figure 6.—**Profile of a Polar soil showing many rounded and egg-shaped quartzite pebbles.**

erate, fine, granular; slightly hard, friable; common fine roots; about 20 percent quartz pebbles 2 to 50 millimeters in diameter; few worm casts; few caliche fragments as much as ¼ inch in diameter; calcareous; moderately alkaline; clear, smooth boundary.

A12ca—8 to 14 inches, light yellowish-brown (10YR 6/4) very gravelly sandy clay loam; yellowish brown (10YR 5/4) moist; moderate, fine, subangular blocky structure parting to moderate, fine, granular; hard, friable; few fine roots; about 50 percent quartz pebbles 2 to 50 millimeters in diameter that are partly coated with caliche, mostly on the underside; common caliche fragments as much as 1 inch in diameter; calcareous; moderately alkaline; abrupt, wavy boundary.

C1ca—14 to 24 inches, pale-brown (10YR 6/3) very gravelly loam that is weakly cemented with caliche, very pale brown (10YR 7/4) moist; caliche can be broken with fingers when moist; about 15 percent pockets of soil material similar to that in the A12ca horizon; calcareous; moderately alkaline; clear, wavy boundary.

C2—24 to 80 inches, layers of gravel, sand, and clay loam, few inches to about 2 feet thick; trace of gravel to more than 90 percent gravel.

Depth of the solum to a distinct layer of carbonate accumulation ranges from 4 to 14 inches. The A horizon is 35 to 70 percent gravel and averages more than 35 percent quartz gravel. It is brown, light brown, reddish brown, light reddish brown, or light yellowish brown. A gravelly A1 horizon that is 20 to 35 percent gravel over a very gravelly A12ca horizon that is 50 percent or more gravel is in areas where the soil is thicker. The C1ca horizon is 50 to 70 percent gravel that is weakly cemented with calcium carbonate. The C2 horizon is crossbedded with layers of sand, gravel, and clay loam many feet thick.

Pullman Series

The Pullman series consists of deep, nearly level to gently sloping, noncalcareous, loamy soils on smooth uplands. These soils formed in old alluvial sediment that has been reworked by wind.

In a representative profile the surface layer is grayish-brown, noncalcareous clay loam about 6 inches thick. The upper part of the subsoil is brown, noncalcareous clay to a depth of 18 inches. Between depths of 18 and 50 inches, the subsoil is calcareous clay that is brown in the upper 22 inches and reddish brown in the lower 10 inches. The lower part of the subsoil to a depth of 80 inches is pink silty clay that is about 50 percent calcium carbonate. Below this it is reddish-yellow, calcareous silty clay loam.

Pullman soils are well drained. Permeability is very slow, and available water capacity is high. Runoff is slow. The hazard of soil blowing is slight, and the hazard of water erosion is slight to moderate.

These soils are well suited to cultivation. About 30 percent of the acreage is irrigated, 25 percent is dryfarmed, and the rest is scattered areas of range.

Representative profile of Pullman clay loam, 0 to 1 percent slopes, 6.5 miles south on Texas Highway 207 from its intersection with Texas Highway 86 in Silverton, then 2 miles east on a county road, then 150 feet east and 150 feet north of the road:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; hard, friable; neutral; abrupt, smooth boundary.

B21t—6 to 18 inches, brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, medium, blocky structure parting to moderate fine, blocky; very hard, very firm; few fine roots; few fine pores; common prominent clay films; wedge-shaped peds aligned horizontally; mildly alkaline; clear, smooth boundary.

B22t—18 to 24 inches, brown (7.5YR 4/4) clay, dark brown (7.5YR 3/4) moist; moderate, medium and fine, blocky structure; very hard, very firm; few fine roots, mostly flattened between peds; common fine pores; continuous clay films; wedge-shaped peds aligned horizontally; few films of calcium carbonate on surface of peds in the lower part; calcareous; moderately alkaline; gradual, smooth boundary.

B23t—24 to 40 inches, brown (7.5YR 4/4) clay, dark brown (7.5YR 3/4) moist; moderate, medium, blocky structure; very hard, very firm; few fine roots and pores; distinct common clay films; wedge-shaped peds aligned horizontally; few films and soft masses of calcium carbonate 1 millimeter to 3 millimeters in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

B24t—40 to 50 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate, medium, blocky structure; very hard, very firm; few fine roots; common fine pores; common distinct films; peds aligned vertically; few, black, ferromanganese concretions 1 millimeter to 3 millimeters in diameter; few films and concretions of calcium carbonate 2 to 5 millimeters in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

B25tca—50 to 80 inches, pink (5YR 7/4) silty clay, reddish yellow (5YR 7/6) moist; moderate, fine, subangular blocky structure; hard, firm; common fine pores; few faint clay films; few worm casts; about 50 percent, by volume, soft masses of calcium carbonate, mostly well mixed with soil mass; calcareous; moderately alkaline; gradual, wavy boundary.

B26t—80 to 100 inches, reddish-yellow (5YR 6/6) silty clay loam, yellowish red (5YR 5/6) moist; weak, medium, subangular blocky structure parting to moderate, very fine, subangular blocky; hard, firm; common fine pores; few faint clay films; about 20 percent, by volume, calcium carbonate, mostly well mixed with soil mass; calcareous; moderately alkaline.

The solum is 70 inches to more than 100 inches thick. Depth to faint or nonvisible secondary calcium carbonate is 15 to 30 inches. Depth to a prominent layer of caliche is 30 to 60 inches. The A horizon is 4 to 8 inches thick. It is brown, grayish-brown, or dark grayish-brown clay loam. The B2t horizon is clay or silty clay. The B21t and B22t horizons are brown, dark brown, grayish brown, or dark grayish brown and are 40 to 55 percent clay. The B23t and B24 horizons are brown, reddish brown, or yellowish brown. The B2tca horizon is pink, reddish-yellow, or yellowish-brown clay, silty clay, clay loam, or silty clay loam. It is 20 to 70 percent soft bodies and concretions of calcium carbonate. The part of the B2t horizon that is below the B2tca horizon is reddish-brown, yellowish-red, or reddish-yellow clay, clay loam, or silty clay loam.

Pullman clay loam, 0 to 1 percent slopes (PuA).—This nearly level soil is on smooth uplands above the Caprock Escarpment. Areas are 500 to 5,000 acres in size and are irregular in shape. They are marked by playas and small areas of other soils. Slopes average less than 0.5 percent. This soil has the profile described as representative of the Pullman series.

Included with this soil in mapping are small areas of Estacado, Lofton, Olton, Randall, and Tulia soils. These included soils make up less than 5 percent of the mapped area.

This Pullman soil is used mainly for crops. Cotton, grain sorghum, and wheat are the main crops. The hazard of soil blowing and water erosion are slight.

The main concerns in management are maintaining tilth, conserving moisture, and controlling erosion. Leaving crop residue on the soil surface helps to maintain tilth and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses (fig. 7). Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe–5, dryland, and IIs–1, irrigated; Clay Loam range site.

Pullman clay loam, 1 to 3 percent slopes (PuB).—This gently sloping soil is on uplands above the Caprock Escarpment. Areas are along draws or around playas on the High Plains and average about 200 acres in size. Slopes average about 2 percent. Surfaces are plane to convex.

The surface layer is brown, neutral clay loam about 5 inches thick. The upper part of the subsoil to a depth of 22 inches is dark-brown, neutral clay. Between depths of 22 and 42 inches, the subsoil is calcareous clay that is reddish brown in the upper part and yellowish red in the lower part. The lower part of subsoil to a depth of 65 inches is pink clay that is about 40 percent carbonates over reddish-yellow, calcareous clay to a depth of 80 inches.

Included with this soil in mapping are small areas of Estacado, Lofton, Randall, and Roscoe soils that are

Figure 7.—**Furrow irrigation on a Pullman clay loam.**

1 acre to 5 acres in size. These soils make up about 6 percent of the mapped area.

This Pullman soil is used mainly for cotton, grain sorghum, and wheat. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

The main concerns in management are controlling erosion, conserving moisture, and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth, to conserve moisture, and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIe-7, dryland, and IIIe-2, irrigated; Clay Loam range site.

Quinlan Series

The Quinlan series consists of shallow, rolling to steep, calcareous, loamy soils on uplands. These soils formed in calcareous or alkaline, weakly consolidated sandstone.

In a representative profile the surface layer is reddish-yellow, calcareous loam about 6 inches thick. The next layer is reddish-yellow, calcareous silty clay loam about 9 inches thick. The underlying material to a depth of 60 inches is yellowish-red, weakly cemented sandstone.

Quinlan soils are well drained. Permeability is moderately rapid, and available water capacity is low. Runoff is medium to rapid. The hazard of soil blowing is slight, and the hazard of water erosion is severe.

These soils are not suited to cultivation. All areas are used as range. Most areas have potential for development as wildlife habitat.

Representative profile of Quinlan loam in an area of Obaro and Quinlan soils, rolling, 3 miles east on Texas Highway 86 from its intersection with Texas Highway 207 in Silverton, then 7.3 miles north on a county road to the Caprock, then above 4 miles east on a main ranch road to a ranch pond and 550 feet east of the pond and 150 feet east of the ranch road:

A1—0 to 6 inches, reddish-yellow (5YR 6/6) loam, yellowish red (5YR 5/6) moist; weak, very fine, subangular blocky structure and weak, fine, granular structure; slightly hard, very friable; common fine roots; few fine pores; few bluish spots 1 millimeter to 2 millimeters in diameter; calcareous; moderately alkaline; clear, smooth boundary.

B2—6 to 15 inches, reddish-yellow (5YR 6/6) silty clay loam, yellowish red (5YR 5/6) moist; weak, very fine, subangular blocky structure; slightly hard, very friable; common fine roots; few bluish spots 1 millimeter to 3 millimeters in diameter; about 25 percent, by volume, siltstone fragments; calcareous; moderately alkaline; clear, smooth boundary.

C—15 to 60 inches, yellowish-red (5YR 5/6) weakly cemented sandstone; yellowish red (5YR 4/6) moist; few fine roots in fractures; few bluish spots 1 millimeter to 3 millimeters in diameter; films of calcium carbonate between layers of noncalcareous sandstone; few layers of gray very fine grained sandstone as much as ½ inch thick.

The solum ranges from 10 to 20 inches in thickness. The A horizon is 4 to 12 inches thick. This horizon and the B2 horizon are reddish-brown, light reddish-brown, red, light-red, yellowish-red, or reddish-yellow loam, silt loam, silty clay loam, or very fine sandy loam. The lower part of the B2 horizon has small chips and fragments of sandstone or siltstone. The C horizon is weakly cemented, very fine grained sandstone or siltstone that is calcareous in the upper few inches and along cracks and cleavage planes.

Quinlan and Burson soils, hilly (QBG).—This mapping unit is made up of soils in hilly areas below the Caprock Escarpment. It is about 40 percent Quinlan soils, 30 percent Burson soils, and 30 percent Clairemont, Enterprise, and Obaro soils. Areas are mainly 1,000 to 3,000 acres in size and are irregular in shape. Slopes range from 10 to 30 percent. The composition of this mapping unit is more variable than that of others in the county, and soil patterns are not uniform. Mapping has been controlled well enough, however, for the anticipated use of the soils.

The Quinlan soils are on upper slopes and ridgetops. Slopes range from 10 to 20 percent. These soils have a surface layer of yellowish-red, calcareous silt loam about 6 inches thick. The next layer is 10 inches of yellowish-red, calcareous silty clay loam. The underlying material is yellowish-red, very fine grained sandstone.

The Burson soils are in steeper, rougher parts of areas. Slopes range from 20 to 30 percent. These soils have a surface layer of reddish-brown, calcareous loam about 8 inches thick. The underlying material is reddish-brown, very fine grained, calcareous sandstone.

Clairemont soils are in narrow bottoms, and Enterprise soils are on foot slopes, and Obaro soils are on ridgetops.

Included with these soils in mapping are some areas of Quinlan soils that have slopes of 5 to 10 percent and some areas of Burson soils that have slopes of 30 to 45 percent. Also included are small barren exposures of sandstone and shale.

The soils in this mapping unit are used as range. They are suited to habitat for aoudad sheep, deer, turkey, and other wildlife. Capability unit VIe-3, dryland; Quinlan soil, Mixedland range site; Burson soil, Very Shallow range site.

Randall Series

The Randall series consists of deep, nearly level, calcareous, clayey soils in playas. These soils formed in clayey calcareous material (fig. 8).

In a representative profile the surface layer is gray, calcareous clay about 65 inches thick. The underlying material is light-gray, calcareous clay that extends to a depth of 80 inches.

Randall soils are somewhat poorly drained. Most areas are inundated for a few weeks each year. Permeability is very slow, and available water capacity is high. The hazard of soil blowing is severe in barren areas where the surface has been inundated and vegetation has been killed. The soils have large cracks when dry, and they swell and expand when wet.

These soils are used mostly as range. A few small areas are cultivated. The soils have potential for development as wildlife habitat.

Representative profile of Randall clay 5 miles south on Texas Highway 207 from its intersection with

Figure 8.—**Randall clay in a playa bottom. The surface shows microknolls and microhollows formed by shrinking and swelling of the clay.**

Texas Highway 86 in Silverton, then 6 miles east on Farm Road 145, then 1 mile east on a county road, then 1 mile south, 1,850 feet west, and 800 feet south of the road:

A1—0 to 25 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; moderate, fine, blocky structure; very hard, very firm; numerous sedge and weed roots; shiny surface on peds; calcareous; moderately alkaline; gradual, smooth boundary.

AC—25 to 65 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; slickensides parting to parallelepipeds or weak, medium, wedge-shaped peds tilted about 20 degrees from the horizontal; very hard, very firm; few, black, round, shotlike concretions 2 to 5 millimeters in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

C—65 to 80 inches, light-gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; massive; very hard, very firm; few small concretions of calcium carbonate; few, small, black concretions; calcareous; moderately alkaline.

Depth to underlying loamy material is more than 50 inches. In most places iron and manganese concretions are scattered throughout the profile. The surface is wavy because it has microknolls and microdepressions. The microknolls are 3 to 8 inches higher than the microdepressions. The A horizon is 12 to 30 inches thick. It is thicker in microdepressions than on microknolls. It is gray, dark gray, or very dark gray. In places the upper 2 to 4 inches of the A horizon is clay loam. The AC horizon is gray or dark-gray clay or silty clay that is 40 to 60 percent clay. Intersecting slickensides and parallelepipeds are at a depth of 20 to 30 inches. The C horizon is light-gray or grayish-brown clay or silty clay. In some places it is yellowish-red and reddish-brown sandy clay and clay loam below a depth of 65 inches.

Randall clay (Ra).—This nearly level soil is on the bottoms of playas, or depressions, that dot the smooth High Plains above the Caprock Escarpment. The playas are round to oval in shape and range from less than 1 acre to about 100 acres in size. The bottom of the playas is a few inches to about 5 feet below the surrounding soils. Surfaces are slightly concave and have a low, slightly moundy gilgai microrelief.

Included with this soil in mapping are narrow areas of gently sloping Lipan, Lofton, and Roscoe soils around the edges of the playas. These soils make up less than 5 percent of the mapped area.

This Randall soil is used mainly for grazing. A few of the smaller playas are drained and are in grain sorghum or wheat. This soil is flooded one or more times each year, and, in places, flooding lasts for several weeks.

The main concern in management is controlling soil blowing. Managing grazing so that a good plant cover is left on the surface helps to prevent soil blowing. Where plant cover is lacking, emergency chiseling helps to prevent soil blowing. Capability unit VIw–1, dryland; range site is the same as that of the adjacent soil.

Roscoe Series

The Roscoe series consists of deep, nearly level, calcareous, clayey soils on playa benches. These soils formed in clayey calcareous material.

In a representative profile the surface layer is dark-gray, calcareous clay about 26 inches thick. Below this is grayish-brown, calcareous clay that extends to a depth of 56 inches. The underlying material is light-gray, calcareous clay that extends to a depth of 65 inches.

Roscoe soils are moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is very slow. The hazards of soil blowing and water erosion are slight.

These soils are well suited to cultivation. About half of the acreage is cultivated, and the rest is used as range. Most cultivated areas are dryfarmed, but a few areas are irrigated.

Representative profile of Roscoe clay, 5 miles south on Texas Highway 207 from its intersection with Texas Highway 86 in Silverton, then 4 miles west on Farm Road 145, then 1.7 miles south on a county road and 0.3 miles west of the road:

A11—0 to 7 inches, dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, very fine, subangular blocky structure; very hard, very firm; calcareous; moderately alkaline; clear, smooth boundary.

A12—7 to 26 inches, dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, medium, blocky structure parting to moderate, very fine, blocky; very hard, very firm; few small concretions of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

AC—26 to 56 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; slickensides that part to parallelepipeds and moderate, medium, blocky structure; very hard, very firm; few soft masses of calcium carbonate as much as ¼ inch in diameter; few streaks of darker colored soil in old weather cracks about ½ inch wide;

calcareous; moderately alkaline; gradual, smooth boundary.

C—56 to 65 inches, light gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; weak, medium, blocky structure; very hard, very firm; few fine pores; few streaks of darker colored soil in old cracks; few soft masses of calcium carbonate; calcareous; moderately alkaline.

Depth to underlying loamy material is 6 feet or more. The surface is wavy in uncultivated areas because it has microknolls and microdepressions. The microknolls are 3 to 8 inches higher than the microdepressions. The A horizon is 20 to 36 inches thick. It is thicker in microdepressions than on microknolls. It is gray, dark gray, or very dark gray clay. The AC horizon is brown, grayish-brown, or brownish-gray clay. Intersecting slickensides and wedge-shaped parallelepipeds are at a depth of 20 to 30 inches. The C horizon is light gray, light brown, or very pale brown clay that is about 1 to 25 percent, by volume, segregated calcium carbonate.

Roscoe clay (Ro).—This nearly level soil is on benches around playas in the High Plains part of the county. The benches are 7 to 15 feet above the playa bottoms and 5 to 30 feet below the main level of the High Plains. Areas are 5 to 200 acres in size, and they partially or wholly encircle the playas. Slopes are dominantly less than 0.5 percent.

Included with this soil in mapping are small areas of Lipan, Lofton, and Pullman soils and some narrow areas of Roscoe soils that have slopes of 1 to 3 percent. These soils make up less than 10 percent of the mapped area.

This Roscoe soil is used mostly for crops. It is well suited to cotton, grain sorghum, and wheat. About 20 percent of the areas are irrigated.

The main concerns in management are conserving moisture and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth, to conserve moisture, and to control soil blowing. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIIw–1, dryland, and IIw–1, irrigated; Clay Loam range site.

Springer Series

The Springer series consists of deep, undulating, noncalcareous sandy soils on uplands. These soils formed in unconsolidated material of eolian or alluvial origin (fig. 9).

In a representative profile the surface layer is reddish-brown, neutral loamy fine sandy about 16 inches thick. The subsoil is red, noncalcareous fine sandy loam about 52 inches thick. Below this to a depth of 112 inches is calcareous sandy clay loam. It is reddish brown in the upper 30 inches and red in the lower 14 inches.

Springer soils are well drained. Permeability is moderately rapid, and available water capacity is medium. Runoff is slow. The hazard of soil blowing is severe, and the hazard of water erosion is slight.

About 50 percent of the acreage is used for crops. Most areas are dryfarmed, but a few are irrigated. The rest is small scattered areas of range and irrigated pasture.

Representative profile of Springer loamy fine sand,

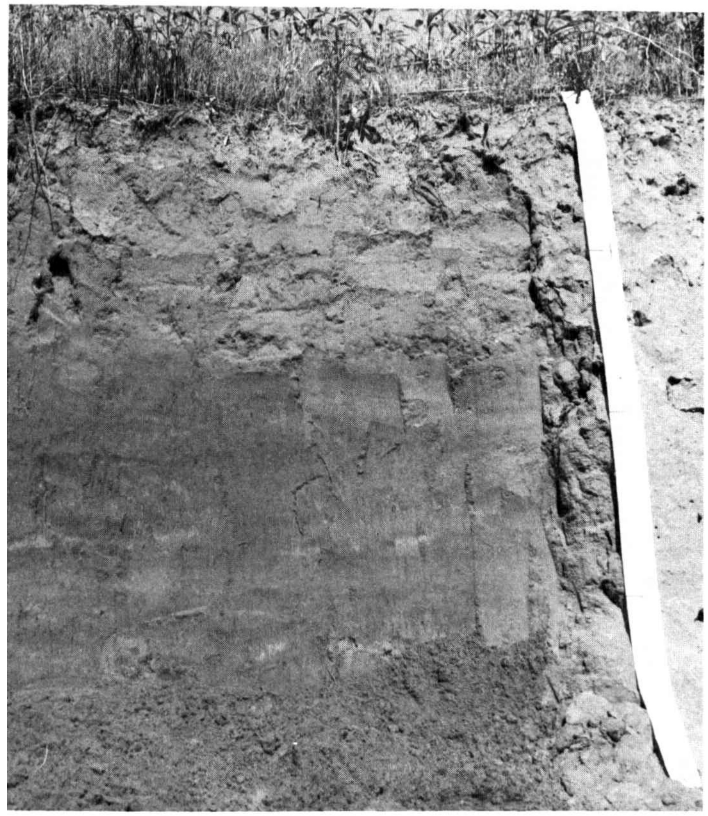

Figure 9.—**Profile of a Springer loamy fine sand showing faintly expressed horizons. The upper 16 inches is loamy sand, and the underlying material is fine sandy loam.**

3 to 8 percent slopes, 4 miles east on Texas Highway 86 from its intersection with Farm Road 1065 in Quitaque, then 2.5 miles south on Farm Road 2733 and 200 feet west of the road:

A1—0 to 16 inches, reddish-brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) moist; single grained; loose; neutral; clear, smooth boundary.

B21t—16 to 26 inches, red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; slightly hard, very friable; few worm casts; mildly alkaline; gradual, smooth boundary.

B22t—26 to 68 inches, red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; few fine pores; few faint clay films; few worm casts; few very fine pockets of clean sand grains; mildly alkaline; gradual, smooth boundary.

B23t—68 to 98 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate, medium, subangular blocky structure; hard, friable; few fine pores; few faint clay films; few very fine pockets of clean sand grains; calcareous; moderately alkaline; gradual, smooth boundary.

B24t—98 to 112 inches, red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) moist; weak, medium, subangular blocky structure; slightly hard, friable; thin patchy clay films; few faint films of carbonate in old pores; calcareous; moderately alkaline.

The solum is more than 60 inches thick. The A horizon is 10 to 20 inches thick. It is light reddish brown, reddish brown, light brown, or brown. The upper part of the B2t horizon is about 12 to 18 percent clay. It is reddish brown, reddish yellow, yellowish red, or red. Below a depth of 40 inches, the Bt horizon is loamy fine sand, fine sandy loam, or sandy clay loam. In some places loamy fine sand that has clean sand grains overlies the lower part of the Bt horizon where the texture is fine sandy loam or sandy clay loam. Free carbonates are below a depth of 40 inches in some places.

Springer loamy fine sand, 3 to 8 percent slopes (SfD).—This undulating soil is on uplands below the Caprock Escarpment. Areas are irregular in shape and are 40 acres to about 500 acres in size. The undulating surface consists of swells and lows. The swells are 1 foot to 4 feet high and 100 to 400 feet across. A few intermingled hummocks that are as much as 20 feet high are in some areas.

Included with this soil in mapping are areas of Miles and Tivoli soils. Also included are areas of a soil that is similar to this Springer soil but has a surface layer of loamy fine sand 20 to 40 inches thick. Included areas make up 10 to 15 percent of the mapped area.

This Springer soil is not suited to cultivation unless it is irrigated.

The main concerns in management are controlling soil blowing and conserving moisture. Leaving crop residue on the soil surface helps to conserve moisture and to control soil blowing. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units VIe–4, dryland, and IVe–2, irrigated; Sandy range site.

Spur Series

The Spur series consists of deep, nearly level, calcareous loamy soils on bottom lands. These soils formed in loamy calcareous alluvium.

In a representative profile the surface layer is brown, calcareous loam about 18 inches thick. The next layer to a depth of 40 inches is brown, calcareous clay loam. The underlying material is light reddish-brown, calcareous sandy clay loam that extends to a depth of 65 inches.

Spur soils are well drained. Permeability is moderate, and available water capacity is high. Runoff is slow. The hazards of soil blowing and water erosion are slight.

These soils are occasionally flooded, but they are well suited to cultivation. Most areas are cultivated. The few small scattered areas are in range.

Representative profile of Spur loam 4 miles east on Texas Highway 86 from its intersection with Farm Road 1065 in Quitaque, then about 0.25 mile south on Farm Road 2733, then 200 feet south and 50 feet west of the Kent Creek bridge on the farm road:

Ap—0 to 8 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; hard, friable; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—8 to 18 inches, brown (7.5YR 4/2) loam, dark brown (7.5 3/2) moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable; few fine pockets of fine sandy loam; few worm casts; calcareous; moderately alkaline; clear, smooth boundary.

B2—18 to 40 inches, brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; moderate, fine, subangular blocky structure; hard, friable; few worm casts; few distinct lenses of loam and sandy loam; few calcium carbonate films; calcareous; moderately alkaline; clear, smooth boundary.

C—40 to 65 inches, light reddish-brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) moist; weak, fine, subangular blocky structure; hard, friable; thin strata of fine sandy loam and loamy fine sand; calcareous; moderately alkaline.

The A horizon is 11 to 19 inches thick and is brown or dark brown. The B horizon is brown or reddish-brown clay loam that is 25 to 35 percent clay. Films and fine concretions of calcium carbonate are common in this horizon. Also common are faint to distinct lenses and thin layers of loam and sandy loam and dark-colored strata. The C horizon is dominantly sandy clay loam or clay loam and thin strata of loamy sand to silty clay. It is brown to light reddish brown.

Spur loam (Sp).—This nearly level soil is on bottom lands along creeks and streams. Areas are long and narrow in shape, are parallel to stream channels, and are 15 to 100 acres in size. Slopes are 0 to 1 percent.

Included with this soil in mapping are small areas of Lincoln and Yahola soils, along the stream channel, and small areas of Berda, Miles, and Paloduro soils, along outer edges of mapped areas.

This Spur soil is used mostly for crops. It is well suited to cotton, grain sorghum, and wheat. This soil receives runoff from adjoining gently sloping to sloping soils. It is flooded one or more times in 4 to 10 years.

The main concern in management is maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth and to control soil blowing. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIw–2, dryland, and IIw–2, irrigated; Valley range site.

Stamford Series

The Stamford series consists of deep, nearly level, calcareous, clayey soils on uplands. These soils formed in clayey calcareous material.

In a representative profile the surface layer is reddish-brown, calcareous clay about 54 inches thick. The underlying material to a depth of 75 inches is calcareous silty clay that is red in the upper part and reddish yellow in the lower part.

Stamford soils are well drained. Permeability is very slow, and available water capacity is high. Runoff is slow. The hazards of soil blowing and water erosion are slight.

These soils are well suited to cultivation. About 75 percent of the acreage is dryfarmed. The rest is in range.

Representative profile of Stamford clay, 0 to 1 percent slopes, 6 miles east on Texas Highway 86 from its intersection with Farm Road 1065 in Quitaque, then 2 miles north on a county road, then 0.4 mile west on another county road, on the south side of the road:

Ap—0 to 5 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; massive parting to weak, very fine, granular structure; very hard, very firm; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—5 to 30 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate, medium, blocky structure parting to moderate, fine, blocky; very hard, very firm; wedge-shaped peds tilted about 20 degrees from the horizontal; few iron-manganese concretions 1 millimeter to 2 millimeters in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

AC—30 to 54 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate, medium, blocky structure; very hard, very firm; wedge-shaped peds tilted about 20 degrees from the horizontal; few iron-manganese concretions 1 millimeter to 2 millemeters in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—54 to 60 inches, red (2.5YR 5/6) silty clay, red (2.5YR 4/6) moist; weak, fine, blocky structure; hard, firm; about 5 percent, by volume, lumps of calcium carbonate as much as ¼ inch in diameter; calcareous; moderately alkaline; clear, smooth boundary.

C2—60 to 75 inches, reddish-yellow (5YR 6/6) silty clay, yellowish red (5YR 5/6) moist; weak, fine, blocky structure; hard, firm; few gypsum crystals; few fragments of red sandy shale; calcareous; moderately alkaline.

The solum is 30 to 60 inches thick. The profile is 45 to 55 percent clay throughout. The A horizon is reddish gray, dark reddish gray, or reddish brown. When dry, cracks extend through this horizon and are 0.4 of an inch, or more, wide at a depth of 20 inches. The AC horizon is red or reddish brown. Chroma of the AC horizon in a given soil is brighter than in the overlying A horizon. The C horizon is red, weak red, or reddish brown. It is 5 to 30 percent filaments and soft masses of calcium carbonate. In some places a very dark gray, lacustrine clay that has seams of soft gypsum is below a depth of 40 inches.

Stamford clay, 0 to 1 percent slopes (StA).—This nearly level soil is in valley fills or on high alluvial plains below the Caprock Escarpment. Areas are irregular in shape and are 25 to 300 acres in size. Slopes are dominantly between 0.5 and 1 percent.

Included with this soil in mapping are small areas of Obaro and Olton soils that make up less than 5 percent of the mapped area.

This Stamford soil is well suited to cotton, grain sorghum, and wheat.

The main concerns in management are conserving moisture and maintaining tilth. Leaving crop residue on the soil surface helps to maintain tilth, to conserve moisture, and to control soil blowing. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIs–1, dryland, and IIs–1, irrigated; Clay Flats range site.

Tivoli Series

The Tivoli series consists of deep, gently sloping to moderately steep, noncalcareous, sandy soils on uplands. These soils formed in sandy eolian material.

In a representative profile the surface layer is brown, neutral fine sand about 16 inches thick. The underlying material to a depth of 70 inches is neutral fine sand that is light brown in the upper part and reddish brown in the lower part.

Tivoli soils are excessively drained. Permeability is rapid, and available water capacity is low. Runoff is very slow. The hazard of soil blowing is severe.

These soils are not suited to cultivation. All areas are used as range.

Representative profile of Tivoli fine sand, 4 miles east on Texas Highway 86 from its intersection with Farm Road 1065 in Quitaque, then 4 miles south on Farm Road 2733, then about 2 miles east of the road, 0.4 mile west and 400 feet north of the southeast corner of Briscoe County.

Ap—0 to 16 inches, brown (7.5YR 5/4) fine sand, brown (7.5YR 4/4) moist; single grained; loose, few roots; neutral; clear, smooth boundary.

C1—16 to 50 inches, light brown (7.5YR 6/4) fine sand; brown (7.5YR 5/4) moist; single grained; loose; few roots; neutral; gradual, smooth boundary.

C2—50 to 70 inches, reddish-brown (5YR 5/4) fine sand, reddish brown (5YR 4/4) moist; single grained; loose; neutral.

The A horizon is light brown, brown, or light reddish-brown fine sand. The C horizon is brown, light brown, reddish-brown, reddish-yellow, or yellowish-red fine sand or loamy fine sand that is many feet thick. It is calcareous below a depth of 40 inches in some places.

Tivoli fine sand (TfF).—This gently sloping to moderately steep soil is in areas along major creeks and rivers. Areas are 20 acres to about 900 acres in size. The surface has hummocks and dunes that rise 3 to 30 feet above surrounding areas. Slopes are 3 percent to about 20 percent on sides of dunes and hummocks.

Included with this soil in mapping are small areas of Miles and Springer soils and a few areas that have blowouts. Also included are areas of a soil that is similar to the Tivoli soil but is calcareous throughout. Included areas are 3 to 10 acres in size and make up less than 10 percent of the mapped area.

This Tivoli soil is not suited to cultivation. It is used only as range. Capability unit VIIe–1, dryland; Deep Sand range site.

Tulia Series

The Tulia series consists of deep, gently sloping to sloping, calcareous, loamy soils on uplands. These soils formed in loamy calcareous material probably of eolian origin.

In a representative profile the surface layer is light brown, calcareous loam about 8 inches thick. The next layer is clay loam that extends to a depth of 42 inches. It is light brown and about 30 percent calcium carbonate in the upper 10 inches and pink and about 55 percent calcium carbonate in the next 24 inches. The lower layer is reddish-yellow, calcareous clay loam that extends to a depth of 80 inches.

Tulia soils are well drained. Permeability is moderate, and available water capacity is medium. Runoff is medium to rapid. The hazard of soil blowing is moderate, and the hazard of water erosion is slight to moderate.

The less sloping soils are suited to cultivation. About 75 percent of the acreage is in use as range, and the rest is cultivated. Most cultivated areas are dryfarmed, but a few are irrigated.

Representative profile of Tulia loam, 1 to 3 percent slopes, 5 miles south on Texas Highway 207 from its intersection with Texas Highway 86 in Silverton, then 4.6 miles east on Farm Road 145 and 50 feet north of road right-of-way.

Ap—0 to 8 inches, light brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; hard, friable; weak crust on surface ¼ inch thick; few caliche pebbles as much as ½ inch in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

B21ca—8 to 18 inches, light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate, fine, subangular blocky structure; hard, firm; few fine roots; few fine pores; few worm casts; estimated 30 percent calcium carbonate; many soft masses of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B22ca—18 to 42 inches, pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) moist; moderate, fine, subangular blocky structure; hard, friable; few fine roots; few fine pores; few worm casts; estimated 55 percent calcium carbonate; many, large, soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B23t—42 to 80 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; moderate, medium, subangular blocky structure; hard, friable; few thin clay films; few fine pores; few iron-manganese films; few, fine, soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 60 inches thick. A prominent layer that is 30 to 60 percent calcium carbonate is immediately below the A horizon. The A horizon is 6 to 11 inches thick. It is brown, dark brown, light brown, grayish brown, dark grayish brown, or dark yellowish brown. The B2ca horizon is pink, pinkish-white, pinkish-gray, light reddish-brown, light brown, or very pale-brown loam or clay loam. Calcium carbonate content in most places is 30 to 40 percent in the B21ca horizon and 50 to 60 percent in the B22ca horizon. The carbonates are soft masses, weakly cemented concretions, and dispersed clays and silts. The B23t horizon is brown, reddish-brown, light reddish-brown, reddish-yellow, or yellowish-red sandy clay loam or clay loam. It is 10 to 30 percent calcium carbonate.

Tulia loam, 1 to 3 percent slopes (TuB).—This gently sloping soil is in areas along draws and around playas in the High Plains part of the county. Areas are irregular in shape and are 4 acres to about 100 acres in size. Slopes average about 2 percent. This soil has the profile described as representative of the Tulia series.

Included with this soil in mapping are small areas of Estacado, Mansker, and Olton soils that make up about 15 percent of the mapped area. Also included are areas of a soil that is similar to this Tulia soil but is less limy because it is 15 to 40 percent calcium carbonate. This soil makes up about 20 percent of some mapped areas.

This Tulia soil is used mostly as range. It is suited to cotton and wheat. Grain sorghum yields are low because the high lime content of the soil causes chlorosis in the plants. The hazard of soil blowing is moderate, and the hazard of water erosion is slight.

The main concerns in management are controlling soil blowing and conserving moisture. Leaving crop residue on the soil surface helps to conserve moisture and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IVe–3, dryland, and IIIe–6, irrigated; Hardland Slopes range site.

Tulia loam, 3 to 5 percent slopes (TuC).—This gently sloping soil is in areas mainly along draws and around playas in the High Plains part of the county. Some areas are between the High Plains and the Caprock Escarpment. Areas are irregular in shape and are about 5 to 110 acres in size. Slopes average about 4 percent.

The surface layer is calcareous loam about 6 inches thick. The next layer is about 36 inches of pink clay loam that is 40 percent calcium carbonate. Below this to a depth of 80 inches is yellowish-red sandy clay loam that is about 55 percent carbonate.

Included with this soil in mapping are small areas of Estacado, Mansker, and Olton soils that make up 10 to 15 percent of the mapped area. Also included are small areas of a soil that is similar to Tulia soil but is less limy because it is 15 to 40 percent calcium carbonate.

This Tulia soil is used mostly as range. It is suited to cotton and wheat. Grain sorghum production is low because the high lime content of the soil causes chlorosis in the plants. The hazards of soil blowing and water erosion are moderate.

The main concerns in management are controlling soil blowing and water erosion and conserving moisture. Leaving crop residue on the soil surface helps to conserve moisture and to control soil blowing. Using diversion terraces helps to control erosion and to conserve moisture. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. Where crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IVe–2, dryland, and IVe–1, irrigated; Hardland Slopes range site.

Tulia and Estacado soils, 5 to 8 percent slopes (TxD).—This mapping unit is made up of sloping soils in areas on the margins of the High Plains. It is 35 to 70 percent Tulia soils and 25 to 60 percent Estacado soils. The soils are in alternating bands on the landscape; however, the Tulia soils are mainly in the more sloping areas. Most areas are between nearly level uplands and the Caprock Escarpment. A few areas are along draws. Areas are long and narrow, are 200 to 2,000 feet wide, and follow the contour of the Caprock along stream channels. Slopes average about 6 percent. The composition of this mapping unit is more variable than that of others in the county, and soil patterns are not uniform.

The Tulia soils have a surface layer of grayish brown, calcareous loam about 6 inches thick. The next layer is about 12 inches of very pale brown, calcareous clay loam over 20 inches of pink clay loam that is about 45 percent calcium carbonate. The subsoil to a depth of 80 inches is brown clay loam that is about 15 percent calcium carbonate.

The Estacado soils have a surface layer of brown, calcareous clay loam 11 inches thick. The subsoil to a depth of 18 inches is brown, calcareous clay loam. Between depths of 18 and 50 inches, it is brown clay loam that is about 25 percent calcium carbonate. Below a depth of 50 inches, it is reddish-yellow, calcareous clay loam.

Included with these soils in mapping are small areas of Olton and Pullman soils on the higher positions of the mapped area and small areas of Paloduro soils on the lower positions.

The soils in this mapping unit are used only as range. They are not suited to cultivation. The hazards of soil blowing and water erosion are moderate. Capability unit VIe–1, dryland; Hardland Slopes range site.

Yahola Series

The Yahola series consists of deep, nearly level, calcareous, loamy soils on bottom lands. These soils formed in loamy calcareous alluvium.

In a representative profile the surface layer is light reddish-brown, calcareous fine sandy loam about 10 inches thick. Below this is light reddish-brown, calcareous fine sandy loam to a depth of 40 inches. The next layer is reddish-yellow, calcareous loamy fine sand to a depth of 60 inches.

Yahola soils are well drained. Permeability is moderately rapid, and available water capacity is medium. Runoff is slow. The hazard of soil blowing is moderate, and the hazard of water erosion is slight.

Some areas of these soils are occasionally flooded, and others are seldom flooded. The soils in seldom-flooded areas are well suited to cultivation. A few areas are cultivated, and the rest are used as range.

Representative profile of Yahola fine sandy loam, frequently flooded, 4 miles west on Texas Highway 86 from its intersection with Farm Road 1065 in Quitaque, then 2 miles south on a county road, 0.75 mile north and 0.4 mile west of ranch headquarters, and 50 feet east of the channel of Cottonwood Creek:

A1—0 to 10 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, very fine, granular structure; slightly hard, very friable; distinctly stratified with recent deposits of silt loam about 1 inch thick; few thin lenses of organic material, few fine and medium roots; calcareous; moderately alkaline; abrupt, smooth boundary.

C1—10 to 40 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) moist; massive; slightly hard, very friable; few fine and medium roots; distinctly stratified with silt loam and loamy fine sand; calcareous; moderately alkaline; abrupt, wavy boundary.

C2—40 to 60 inches, reddish-yellow (7.5YR 7/6) loamy fine sand, reddish yellow (7.5YR 6/6) moist; massive; loose, very friable; few fine and medium roots; about 5 percent fine quartz pebbles; stratified with fine sandy loam; calcareous; moderately alkaline.

Throughout the profile are thin layers, 1 inch to 4 inches thick, of very fine sandy loam, clay loam, loamy fine sand, and clay. The A horizon and the C horizon are brown, light brown, reddish brown, light reddish brown, reddish yellow, or yellowish red. In some places the C horizon is sand, loamy sand, and gravel below a depth of 40 inches.

Yahola fine sandy loam (Ya).—This nearly level soil is on bottom lands along Prairie Dog Town Fork of the Red River and other large streams. Areas are long and narrow and average about 700 feet in width. Slopes are mostly less than 1 percent.

The surface layer is reddish-yellow, calcareous fine sandy loam to a depth of 42 inches. The lower layer is reddish-yellow, calcareous loamy fine sand to a depth of 60 inches.

Included with this soil in mapping are small intermingled areas of Clairemont soils. Also included are narrow areas of Berda and Obaro soils on the outer edges of some mapped areas.

This Yahola soil is used mostly as range because much of it is in rough areas that are hard to reach with farm machinery. It is well suited to cotton, grain sorghum, and wheat. This soil is flooded one or more times in 4 to 10 years. The hazard of soil blowing is moderate, and the hazard of water erosion is slight.

The main concern in management is controlling soil blowing. Leaving crop residue on the soil surface helps to control soil blowing. In irrigated areas a well-designed irrigation system is needed to control erosion and prevent water losses. When crop residue is inadequate, soil blowing can be controlled by emergency tillage and roughening of the surface. Capability units IIw–1, dryland, and IIe–3, irrigated; Loamy Bottomland range site.

Yahola fine sandy loam, frequently flooded (Yf).—This nearly level soil is on bottom lands along Prairie Dog Town Fork of the Red River and other large streams. Areas are long and narrow, range from 200 to 600 feet wide, and are as much as 1 mile or more long. Slopes are 0 to 1 percent. This soil has the profile described as representative of the Yahola series.

Included with this soil in mapping is a stream channel of barren sand and gravel that makes up 10 to 25 percent of most mapped areas. Narrow areas of Berda and Spur soils are included on the outer edges of some mapped areas.

This Yahola soil is used only as range. It is not suited to crops because it is flooded one or more times in 1 to 4 years. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Capability unit Vw–1, dryland; Loamy Bottomland range site.

Use and Management of the Soils

This section briefly describes the capability classification used by the Soil Conservation Service, gives predicted yields of the major crops, and discusses irrigation. It also discusses the use of the soils for range, wildlife habitat, recreational development, and engineering works.

Capability Grouping

Some readers, particularly those who farm on a large scale, may find it practical to use and manage alike some of the different kinds of soil on their farm. These readers can make good use of the capability classification system, a grouping that shows, in a general way, the suitability of soils for most kinds of farming.

The grouping is based on permanent limitations of soils when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations for range or for engineering.

In the capability system, the kinds of soils are grouped at three levels: the class, the subclass, and the unit. The broadest grouping, the capability class, is designed by Roman numerals I to VIII. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops or forage.

The subclass indicates major kinds of limitations within the classes. Within most of the classes there can be as many as four subclasses. The subclasses are indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter "e" shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; "w" means that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); "s" shows that the soil is limited mainly because it is shallow, droughty, or stony; and "c" indicates that the chief limitation is climate that is too cold or too dry.

Class I has no subclasses because the soils of this class have few or no limitations. Class V can contain, at the most, only the subclasses indicated by w, s, and c, because the soils in it are subject to little or no erosion. This class has other limitations, however, that restrict its use largely to pasture or range or to wildlife habitat.

Subclasses are further divided into groups called capability units. These are groups of soils that are so much alike that they are suited to the same crops and pasture plants, they require about the same management, and they have generally similar productivity and other response to management. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IVe-1.

Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In Briscoe County, the soils are grouped according to irrigated and dryland uses. For example, Acuff loam, 0 to 1 percent slopes, is classified IIe-1 where irrigated and IIIe-1 where dryfarmed. The eight classes in the capability system and the subclasses and units in Briscoe County are described in the list that follows.

DRYLAND CAPABILITY UNITS

Class I. Soils have few limitations that restrict their use. (None in Briscoe County)

Class II. Soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

- Subclass IIs. Soils are moderately limited because permeability is very slow.
  - Unit IIs-1. Deep, very slowly permeable, nearly level, calcareous clays on uplands.
- Subclass IIw. Soils are moderately limited by excess water.
  - Unit IIw-1. Deep, moderately rapidly permeable, nearly level, calcareous fine sandy loams on flood plains.
  - Unit IIw-2. Deep, moderately permeable, nearly level, calcareous loams to silty clay loams on bottom lands.

Class III. Soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.

- Subclass IIIe. Soils are subject to severe erosion if they are cultivated and not protected.
  - Unit IIIe-1. Deep, moderately permeable to moderately slowly permeable, nearly level, calcareous to noncalcareous loams to clay loams on uplands.
  - Unit IIIe-2. Deep, moderately permeable to moderately slowly permeable, gently sloping, calcareous to noncalcareous loams to clay loams on uplands.
  - Unit IIIe-3. Deep, moderately permeable to moderately rapidly permeable, nearly level to gently sloping, calcareous to noncalcareous fine sandy loams on uplands.
  - Unit IIIe-4. Moderately deep to deep, moderately permeable, gently sloping, calcareous loams on uplands.
  - Unit IIIe-5. Deep, very slowly permeable, nearly level, noncalcareous clay loams on uplands.
  - Unit IIIe-6. Deep, moderately permeable, nearly level to undulating, noncalcareous loamy fine sands on uplands.
  - Unit IIIe-7. Deep, very slowly permeable, gently sloping, noncalcareous clay loams on uplands.
- Subclass IIIw. Soils are severely limited for cultivation by excess water.
  - Unit IIIw-1. Deep, very slowly permeable, nearly level, calcareous to noncalcareous clays on benches around playas.

Class IV. Soils have very severe limitations that reduce the choice of plants or require very careful management, or both.

- Subclass IVe. Soils are subject to very severe erosion if they are cultivated and not protected.
  - Unit IVe-1. Deep, moderately permeable, gently sloping, noncalcareous fine sandy loams on uplands.
  - Unit IVe-2. Deep to moderately deep, moderately permeable to moderately rapidly permeable, gently sloping to sloping, calcareous clay loams to loams on uplands.
  - Unit IVe-3. Deep, moderately permeable, gently sloping, calcareous loams on uplands.

Class V. Soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife habitat.

- Subclass Vw. Soils are too wet for cultivation; drainage or protection is not feasible.
  - Unit Vw-1. Deep, moderately rapidly permeable, nearly level, calcareous fine sandy loams on bottom lands.

Unit Vw-2. Deep, rapidly permeable, nearly level calcareous loamy fine sand on bottom lands.

Class VI. Soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Subclass VIe. Soils are severely limited, mainly by risk of erosion if protective cover is not maintained.

Unit VIe-1. Deep to very shallow, moderately permeable to moderately rapidly permeable, gently sloping to strongly sloping, calcareous loams and clay loams to gravelly sandy clay loams on uplands.

Unit VIe-2. Deep, moderately permeable, gently sloping, calcareous loams on uplands.

Unit VIe-3. Deep to very shallow, moderately permeable to moderately rapidly permeable, rolling to hilly, calcareous loams on uplands.

Unit VIe-4. Deep, moderately rapidly permeable, undulating noncalcareous loamy fine sands on uplands.

Subclass VIw. Soils too wet for cultivation for permanent vegetation. Inundated for several weeks annually.

Unit VIw-1. Deep, very slowly permeable, nearly level, calcareous clay in playas.

Class VII. Soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to range or wildlife habitat.

Subclass VIIe. Soils are very severely limited, mainly by risk or erosion if protective cover is not maintained.

Unit VIIe-1. Deep, rapidly permeable, gently sloping to moderately steep, noncalcareous fine sands on uplands.

Subclass VIIs. Soils are very severely limited, mainly by limited soil depth.

Unit VIIs-1. Very shallow to shallow, moderately permeable to moderately rapidly permeable, steep, calcareous loam on uplands.

Class VIII. Soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes. (None in Briscoe County)

IRRIGATED CAPABILITY UNITS

Class I. Soils have few limitations that restrict their use. (None in Briscoe County)

Class II. Soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Subclass IIe. Soils are subject to moderate erosion if they are not protected.

Unit IIe–1. Deep, moderately permeable to moderately slowly permeable, calcareous to noncalcareous loams to clay loams on uplands.

Unit IIe–2. Deep, moderately permeable, nearly level, noncalcareous fine sandy loams to loams on uplands.

Unit IIe–3. Deep, moderately rapidly permeable, nearly level, calcareous fine sandy loams on flood plains.

Subclass IIs. Soils have moderate limitations because permeability is very slow.

Unit IIs–1. Deep, very slowly permeable, nearly level, calcareous to noncalcareous clay loams on uplands.

Subclass IIw. Soils are moderately limited by excess water.

Unit IIw–1. Deep, very slowly permeable, nearly level, calcareous to noncalcareous clays on benches around playas.

Unit IIw–2. Deep, moderately permeable, nearly level, calcareous loams to silty loams on bottom lands.

Class III. Soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Subclass IIIe. Soils are subject to severe erosion if they are cultivated and not protected.

Unit IIIe–1. Deep, moderately permeable to moderately slowly permeable, gently sloping, calcareous to noncalcareous loams to clay loams on uplands.

Unit IIIe–2. Deep, very slowly permeable, gently sloping, noncalcareous clay loams on uplands.

Unit IIIe–3. Deep, moderately permeable to moderately rapidly permeable, nearly level to gently sloping, calcareous fine sandy loams on uplands.

Unit IIIe–4. Moderately deep to deep, moderately permeable, gently sloping, calcareous loams on uplands.

Unit IIIe–5. Deep, moderately permeable, nearly level to undulating, noncalcareous loamy fine sands on uplands.

Unit IIIe–6. Deep, moderately permeable, gently sloping, calcareous loams on uplands.

Class IV. Soils have very severe limitations that reduce the choice of plants or require very careful management, or both.

Subclass IVe. Soils are subject to very severe erosion if they are cultivated and not protected.

Unit IVe–1. Deep to moderately deep, moderately permeable, gently sloping, calcareous to noncalcareous clay loams and loams to fine sandy loams on uplands.

Unit IVe–2. Deep, moderately rapidly permeable, undulating, noncalcareous loamy fine sands on uplands.

Predicted Yields

The predicted average yields per acre that can be expected of the principal crops grown in Briscoe County under a high level of management are given in table 2. The predictions are based on estimates made by farmers, soil scientists, county agricultural workers, and others who have knowledge of yields in the county and on information taken from research data.

The yields are given for both dryland and irrigated

TABLE 2.—*Predicted average yields per acre of principal crops under a high level of management*

[Only arable soils are listed. Absence of data indicates that the crop is not suited to the soil specified or is not grown on it]

Soil	Wheat		Grain sorghum		Cotton	
	Dryland	Irrigated	Dryland	Irrigated	Dryland	Irrigated
	Bu	*Bu*	*Bu*	*Bu*	*Lb*	*Lb*
Acuff loam, 0 to 1 percent slopes	20	55	25	120	200	850
Acuff loam, 1 to 3 percent slopes	15	50	20	100	150	800
Amarillo fine sandy loam, 0 to 1 percent slopes	15	60	20	110	200	880
Amarillo fine sandy loam, 1 to 3 percent slopes	15	50	15	100	200	850
Amarillo fine sandy loam, 3 to 5 percent slopes	10	40	15		150	
Berda loam, 0 to 1 percent slopes	15	50	25	90	200	800
Berda loam, 1 to 3 percent slopes	15	45	20	80	150	800
Berda loam, 3 to 5 percent slopes	10		15		150	
Clairemont silty clay loam	25	50	40	120	400	850
Drake loam, 1 to 3 percent slopes	10	45	10	60		800
Drake loam, 3 to 5 percent slopes		30		60		
Enterprise loam, 3 to 8 percent slopes	10		20			
Estacado clay loam, 0 to 1 percent slopes	15	55	20	100	200	850
Estacado clay loam, 1 to 3 percent slopes	15	45	20	80	150	800
Estacado clay loam, 3 to 5 percent slopes	10		15			
Lipan clay	15	50	20	100	200	800
Lofton clay loam	15	55	20	120	200	800
Miles loamy fine sand, 0 to 3 percent slopes			15	80		
Mobeetie fine sandy loam, 0 to 3 percent slopes	15	45	20	100	200	800
Obaro loam, 1 to 3 percent slopes	15	55	25	110	200	800
Obaro loam, 3 to 5 percent slopes	10		20		150	
Olton clay loam, 0 to 1 percent slopes	15	50	20	120	200	850
Olton clay loam, 1 to 3 percent slopes	15	50	15	100	150	800
Paloduro loam, 0 to 1 percent slopes	15	55	20	100	200	850
Paloduro loam, 1 to 3 percent slopes	15	45	15	90	150	800
Pullman clay loam, 0 to 1 percent slopes		55	15	110	150	800
Pullman clay loam, 1 to 3 percent slopes	15	45	15	100	150	800
Roscoe clay	15	50	20	100	200	800
Springer loamy fine sand, 3 to 8 percent slopes			15	60		
Spur loam	20	60	30	130	300	900
Stamford clay, 0 to 1 percent slopes	15		20		200	
Tulia loam, 1 to 3 percent slopes	10	35	15	70	25	700
Tulia loam, 3 to 5 percent slopes	10		15		100	
Yahola fine sandy loam	30	45	45	90	450	800

soils, if the soils are used for both methods of farming. If only one method is practical, yields for only this method of farming are given. Not included in this table are soils that are used only as range or for recreational purposes.

Crops other than those shown in table 2 are grown in the county, but are not included in the table because their acreage is small or reliable data on yields are not available.

The predicted yields given in table 2 can be expected if the following management practices are used on dryland and irrigated soils.

1. Rainfall is effectively used and conserved.
2. Surface or subsurface drainage systems, or both, are installed.
3. Crop residue is managed to maintain soil tilth.
4. Tillage is minimal but timely.
5. Insect, disease, and weed control measures are consistently used.
6. Fertilizer is applied according to soil test and crop needs.
7. Suited crop varieties are used at optimum seeding rates.

The following additional practices are used in irrigated areas.

8. Suitable quality of irrigation water is used.
9. Irrigations are timed to meet the need of the soil and crop.
10. Irrigation systems are properly designed and efficiently used.

Irrigation

The first irrigation wells in Briscoe County were drilled in the mid-1930's. Drilling continued slowly into the early 1950's. The number of wells has increased rapidly since that time when a severe drought emphasized the need for supplemental irrigation. In 1970, approximately 70,000 acres was irrigated. The irrigated areas are largely in the High Plains part of the county. A few irrigated areas are around Quitaque.

The irrigation wells are 100 to 300 feet deep. The water comes from the basal sands and gravels of the Ogallala Formation of the High Plains. The rate of pumping originally was 400 to 900 gallons per minute. However, during the last few years the aquifer has been depleted rapidly, and the output of the wells has declined significantly. Some wells have been depleted to the point that it is no longer economical to pump them for ordinary field crops.

In the High Plains area of the county, irrigation is mainly by the gravity flow method. Most farmers use furrows to direct the water, but a few fields in more sloping areas have been bench leveled. In areas below the Caprock Escarpment around Quitaque, irrigation is mainly by sprinkler system.

Such crops as cotton, forage sorghum, grain sorghum, soybeans, and wheat are dryfarmed but they are also irrigated where water is available. A few irrigated pastures are in permanent bermudagrass.

Range[2]

Ranching and livestock production are important enterprises in Briscoe County. Approximately 73 percent of the county is in native grass. At the time of the survey, 58 ranch units had more than a section in grass, or more than 640 acres, and 12 ranch units had less than a section. The largest single ranch in the county is 105,000 acres in size. The average size of all the ranches in the county is 6,000 acres, and the average size of the smaller ranches is 400 acres. About 70 percent of the ranch units have some cultivated areas that are used for the production of such grazing crops as sorghums or wheat. Most stalk fields are used for grazing in fall and winter.

Livestock operations are mainly cow-calf and stocker cattle enterprises. Approximately 70 percent of the ranches are cow-calf enterprises, and 30 percent are stocker cattle enterprises. Ranchers keep a herd of mother cows from which to raise calves.

Livestock production is mainly beef cattle. A few ranches have a small number of chickens, hogs, horses, and sheep. In 1969, farms and ranches in Briscoe County had 30,207 cattle and calves, 6,015 chickens, 11,111 hogs and pigs, 476 horses, and 445 sheep and lambs.

Briscoe County has several kinds of grassland. The most extensive consists of mid and short grasses on the Clay Loam range site, which is made up of clays, loams, and clay loams. Tall grasses are on bottom lands and in sandy, rocky, and sloping areas. Steep, shallow soils in discontinuous areas produce sparse vegetation.

Range sites and condition classes

Soils differ in their capacity to produce grass and other plants for grazing. Soils that produce about the same kind and amount of forage, if the range is in similar condition, make up a range site.

Range sites are kinds of rangeland that differ in their ability to produce vegetation. The soils of any one range site produce about the same kind and amount of climax vegetation. The climax vegetation is the stabilized plant community; it reproduces itself and does not change so long as the environment remains unchanged. Throughout the prairie and the plains, the climax vegetation consists of the plants that were growing on any given site when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. Hence, invaders come in and grow along with increasers after the climax vegetation has been reduced by grazing. Many are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. Range condition class indicates the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there.

A range is in *excellent* condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in *good* condition if the percentage is 51 to 75; in *fair* condition if the percentage is 26 to 50; and in *poor* condition if the percentage is less than 25.

Range condition is judged according to standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

The potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during their growing season.

A primary objective of good range management is to keep the range in excellent or good condition. If this is done, water is conserved, yields are improved or maintained, and the soils are protected. The major concern in range management is recognition of important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Plant growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy and the long term trend is toward lower production. On the other hand, some range that has been closely grazed for short periods, under the supervision of a careful manager, may have a degraded appearance that temporarily conceals its quality and ability to recover.

Descriptions of the range sites

In the following paragraphs, the 14 range sites in Briscoe County are described and the climax plants and principal invaders on the sites are named. Also given is an estimate of the total annual acre yield of air-dry herbage in favorable and less favorable years for each site where it is in excellent condition. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this survey.

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[2] By JOHN A. WRIGHT, area range conservationist, Soil Conservation Service.

CLAY FLATS RANGE SITE

Stamford clay, 0 to 1 percent slopes, is the only soil in this site. This deep, nearly level, calcareous soil is on uplands. It is well drained. Permeability is very slow. The hazards of soil blowing and water erosion are slight. The surface layer becomes hard and massive after heavy trampling during wet weather.

The climax plant community is mainly short grasses and a few perennial forbs. Its composition, by percentage of total weight, is approximately 45 percent galleta; 15 percent blue grama; 15 percent buffalograss; 10 percent side-oats grama; 5 percent alkali sacaton; 5 percent western wheatgrass and vine-mesquite; and 5 percent perennial forbs.

If the site is continuously heavily grazed, side-oats grama, blue grama, western wheatgrass, and vine-mesquite decrease; alkali sacaton, buffalograss, and annual weeds increase; and mesquite, pricklypear, and cholla invade.

Where this site is in excellent condition, the total annual acre yield of air-dry forage ranges from approximately 1,700 pounds in favorable years to 1,000 pounds in less favorable years. About 95 percent of this forage can be used by livestock and wildlife.

CLAY LOAM RANGE SITE

This range site is made up of deep, nearly level to gently sloping clays, clay loams, and loams on uplands (fig. 10). These soils are well drained to moderately well drained. Permeability is moderate to very slow. The hazard of soil blowing is slight, and the hazard of water erosion is slight to moderate. In many places the intake of moisture is reduced by surface crusting, and downward movement is slowed by compacted layers, or "hoofpans."

The climax plant community is mainly short grasses and a few mid grasses. Its composition, by percentage of total weight, is approximately 50 percent blue grama; 20 percent buffalograss; 5 percent side-oats grama; 5 percent galleta or tobosagrass; 5 percent western wheatgrass; 5 percent vine-mesquite; 5 percent bluestem; and 5 percent perennial forbs.

If this site is continuously heavily grazed by cattle, blue grama, side-oats grama, western wheatgrass, and vine-mesquite decrease or disappear; buffalograss, perennial three-awn, sand dropseed, and annual weeds increase; and mesquite, cholla, pricklypear, and some yucca invade.

Where this site is in excellent condition, the average annual acre yield of air-dry herbage ranges from 2,000 pounds in favorable years to 1,000 pounds in less favorable years. Approximately 95 percent of this forage can be used by livestock and wildlife.

DEEP SAND RANGE SITE

Tivoli fine sand is the only soil in this site. This deep, gently sloping to moderately steep, duned, noncalcareous soil is on uplands. It is excessively drained. Per-

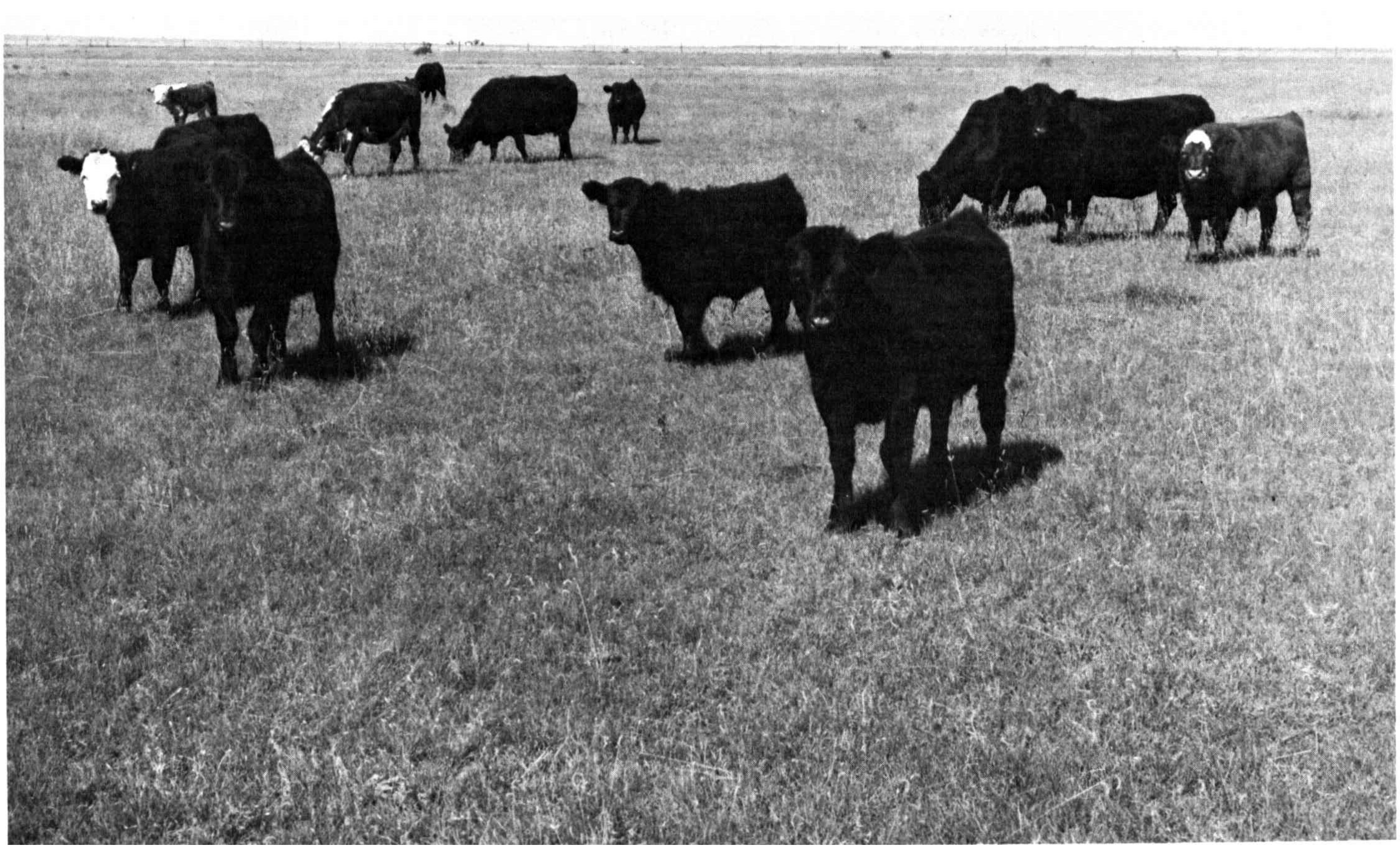

Figure 10.—Clay Loam range site showing a good cover of blue grama and buffalograss on a nearly level Pullman soil.

meability is rapid. The hazard of soil blowing is severe, and the hazard of erosion is slight.

The climax plant community is a mixture of tall and mid grasses and shin oak, sand plum, and skunkbush. Its composition, by percentage of total weight, is approximately 15 percent little bluestem; 10 percent sand bluestem; 10 percent side-oats grama; 10 percent big sandreed; 5 percent switchgrass; 5 percent indiangrass; 5 percent sand dropseed; 5 percent needleandthread; 5 percent hairy grama; 5 percent perennial three-awn; 15 percent woody plants; and 10 percent perennial forbs.

If the site is continuously heavily grazed by cattle, switchgrass, indiangrass, little bluestem, and big sandreed decrease; sand dropseed, perennial three-awn, hairy grama, sand sage, and annual forbs increase; and shin oak and yucca invade.

Where this site is in excellent condition, the total annual acre yield of air-dry herbage ranges from about 3,500 pounds in favorable years to 1,500 pounds in less favorable years. Approximately 90 percent of this forage can be used by livestock and wildlife.

HARDLAND SLOPES RANGE SITE

This range site is made up of very shallow to deep, nearly level to strongly sloping, calcareous loams and clay loams to gravelly sandy clay loams. These soils are well drained to excessively drained. Permeability is moderate to moderately rapid. The hazard of soil blowing is slight to moderate, and the hazard of water erosion is slight to severe.

The climax plant community is a mixture of mid and short grasses and a small amount of yucca and forbs. Its composition, by percentage of total weight, is approximately 35 percent side-oats grama; 25 percent blue grama; 5 percent vine-mesquite; 5 percent little bluestem; 5 percent buffalograss; 5 percent silver bluestem; 5 percent Wright three-awn; 5 percent sand dropseed; 5 percent woody plants; and 5 percent perennial forbs.

If the site is continuously heavily grazed by cattle, side-oats grama, blue grama, vine-mesquite, and little bluestem decrease; buffalograss, silver bluestem, sand dropseed, Wright three-awn, and yucca increase; and mesquite and annual weeds invade.

Where this site is in excellent condition, the total annual acre yield of air-dry herbage ranges from about 2,200 pounds in favorable years to 1,400 pounds in less favorable years. Approximately 95 percent of this forage can be used by livestock and wildlife.

HIGH LIME RANGE SITE

This range site is made up of deep, gently sloping, calcareous loams on uplands. These soils are well drained. Permeability is moderate. The hazard of soil blowing is severe, and the hazard of erosion is slight to moderate.

The climax plant community is mainly mid and short grasses. Its composition, by percentage of total weight, is approximately 30 percent side-oats grama; 20 percent blue grama; 15 percent buffalograss; 5 percent switchgrass; 5 percent little bluestem; 5 percent other perennial grasses; 10 percent woody plants; and 10 percent perennial forbs.

If the site is continuously heavily grazed by cattle, side-oats grama, blue grama, switchgrass, and little bluestem decrease; buffalograss, three-awns, sand dropseed, and annual weeds increase; and mesquite, cholla, and pricklypear invade.

Where this site is in excellent condition, the total annual acre yield of air-dry herbage ranges from about 1,800 pounds in favorable years to 1,100 pounds in less favorable years. Approximately 90 percent of this forage can be used by livestock and wildlife.

LOAMY BOTTOMLAND RANGE SITE

This range site is made up of deep, calcareous silty clay loams to fine sandy loams on bottom lands. These soils are well drained. Permeability is moderate to moderately rapid. The hazard of soil blowing is slight to moderate, and the hazard of water erosion is slight.

The climax plant community is a mixture of tall and mid grasses and cottonwood, hackberry, and willow trees. Its composition, by percentage of total weight, is approximately 15 percent switchgrass; 15 percent indiangrass; 15 percent sand bluestem; 10 percent little bluestem; 10 percent western wheatgrass; 5 percent side-oats grama; 5 percent vine-mesquite; 5 percent alkali sacaton; 5 percent other perennial grasses; 10 percent woody plants; and 5 percent perennial forbs.

If the site is continuously heavily grazed by cattle, indiangrass, switchgrass, sand bluestem, and little bluestem decrease; alkali sacaton, vine-mesquite, side-oats grama, buffalograss, silver bluestem, wild plum, and annual weeds increase; and buffalograss, three-awns, inland saltgrass, salt cedar, and annual forbs invade.

Where this site is in excellent condition, the total annual acre yield of air-dry herbage ranges from about 3,400 pounds in favorable years to 2,200 pounds in less favorable years. Approximately 85 percent of this forage can be used by livestock and wildlife.

MIXEDLAND RANGE SITE

This range site is made up of shallow to deep, gently sloping to sloping and rolling to hilly, calcareous loams on uplands (fig. 11). These soils are well drained. Permeability is moderate to moderately rapid. The hazard of soil blowing is slight, and the hazard of water erosion is moderate to severe.

The climax plant community is a mixture of tall and mid grasses and yucca and redberry juniper. Its composition, by percentage of total weight, is approximately 35 percent side-oats grama; 10 percent little bluestem; 10 percent blue grama; 5 percent vine-mesquite; 5 percent sand bluestem; 5 percent buffalograss; 5 percent silver bluestem; 5 percent sand dropseed; 5 percent feather dalea and black dalea; and 15 percent perennial forbs.

If the site is continuously heavily grazed by cattle, side-oats grama, little bluestem, blue grama, vine-mesquite, and sand bluestem decrease; buffalograss, sand dropseed, silver bluestem, yucca, and redberry juniper increase; and mesquite, condalias, and annual weeds invade.

Where this site is in excellent condition, the total annual acre yield of air-dry herbage ranges from about 2,400 pounds in favorable years to 1,600 pounds in less favorable years. Approximately 95 percent of this forage can be used by livestock and wildlife.

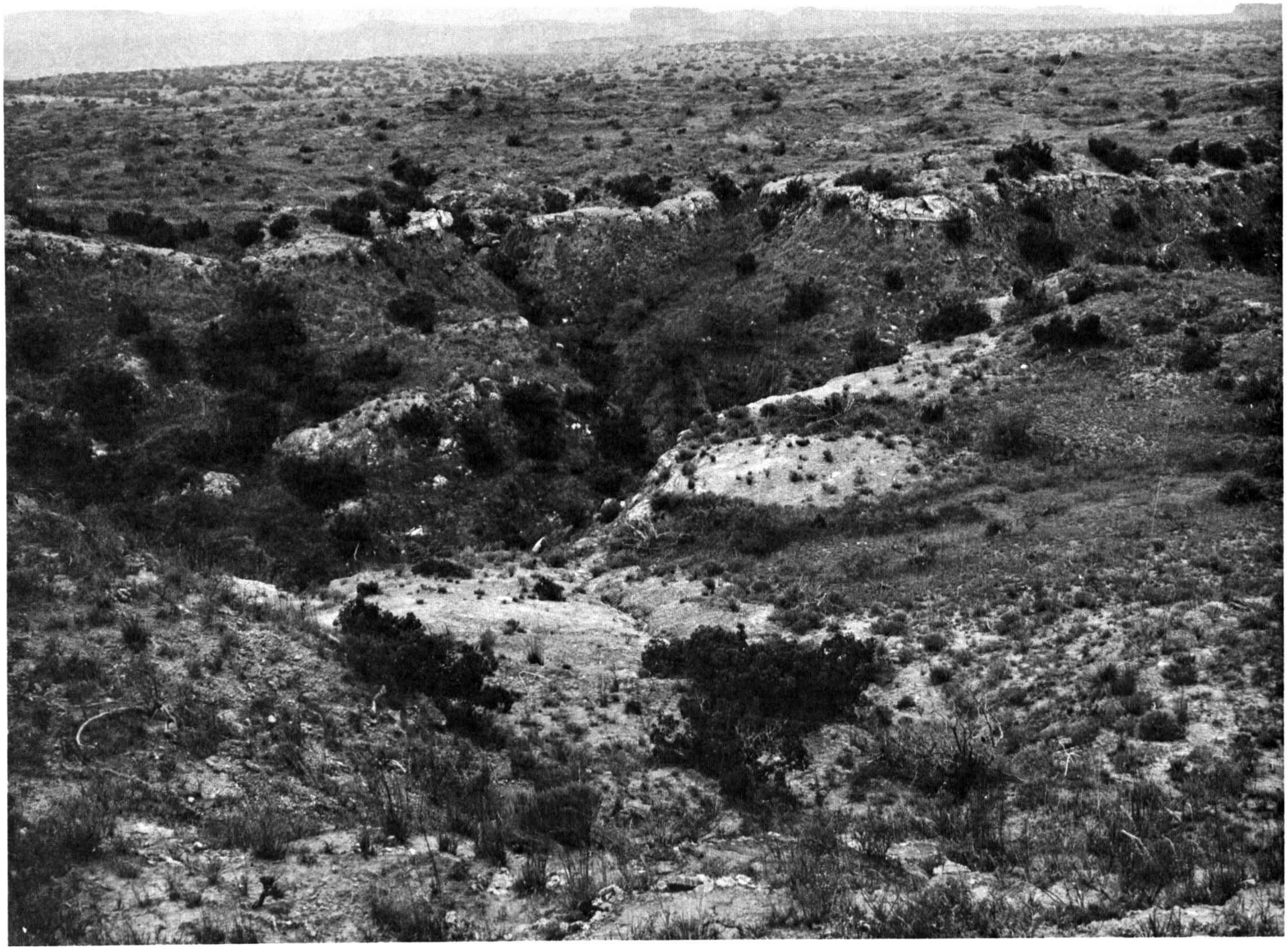

Figure 11.—**Mixedland and Very Shallow range sites in an area north of Quitaque. Obaro, Quinlan, and Burson soils are in these range sites.**

MIXEDLAND SLOPES RANGE SITE

Mobeetie fine sandy loam, 0 to 3 percent slopes, is the only soil in this site. This deep, nearly level to gently sloping, calcareous soil is on smooth uplands. It is well drained. Permeability is moderately rapid. The hazards of soil blowing and water erosion are moderate.

The climax plant community is mainly tall, mid, and short grasses. Its composition, by percentage of total weight, is approximately 30 percent side-oats grama; 20 percent blue grama; 10 percent little bluestem: 10 percent sand bluestem; 5 percent indiangrass; 5 percent buffalograss; 5 percent hairy grama; 5 percent other perennial grasses; 5 percent small soapweed; and 5 percent perennial forbs.

If the site is continuously heavily grazed by cattle, side-oats grama, blue grama, little bluestem, and sand bluestem decrease; buffalograss, hairy grama, three-awns, sand dropseed, and annual weeds increase; and sand sagebrush, shin oak, and pricklypear invade.

Where this site is in excellent condition, the total annual acre yield of air-dry herbage ranges from about 2,200 pounds in favorable years to 1,500 pounds in less favorable years. Approximately 95 percent of this forage can be used by livestock and wildlife.

ROUGH BREAKS RANGE SITE

This site is in areas that are characterized by scenic escarpments, canyon walls, buttes, mesas, sharp hog-backs, and ridges. Only Burson and Quinlan soils, steep, are in the site. These very shallow to shallow, calcareous loams are on uplands. They are well drained to excessively drained. Permeability is moderate to moderately rapid. The hazard of soil blowing is slight, and the hazard of water erosion is severe.

The climax plant community is a mixture of tall, mid, and short grasses, redberry juniper, and mountain-mahogany. Its composition, by percentage of total weight, is approximately 20 percent side-oats grama; 15 percent little bluestem; 10 percent hairy grama; 10 percent indiangrass, switchgrass, sand bluestem, and Canada wildrye; 20 percent other perennial grasses; 20 percent woody plants; and 5 percent perennial forbs.

If the site is continuously heavily grazed by cattle, side-oats grama, little bluestem, indiangrass, sand bluestem, switchgrass, and Canada wildrye decrease; silver bluestem, Wright three-awn, sand dropseed, redberry juniper, and catclaw sensitivebrier increase; and annual weeds invade.

Where this site is in excellent condition, the total annual acre yield of air-dry herbage ranges from about 1,000 pounds in favorable years to 500 pounds in less favorable years. Approximately 95 percent of this forage can be used by livestock and wildlife.

SANDY RANGE SITE

This range site is made up of deep, nearly level to undulating, noncalcareous loamy fine sands on uplands (fig. 12). These soils are well drained. Permeability is moderate to moderately rapid. The hazard of soil blowing is moderate to severe, and the hazard of water erosion is slight.

The climax plant community is a mixture of tall and mid grasses, sand plum, and shin oak. Its composition, by percentage of total weight, is approximately 20 percent side-oats grama; 15 percent sand bluestem; 15 percent little bluestem; 10 percent switchgrass; 10 percent hairy grama; 5 percent indiangrass; 5 percent needleandthread; 5 percent blue grama; 5 percent other perennial grasses; 5 percent woody plants; and 5 percent perennial forbs.

If the site is continuously heavily grazed by cattle, sand bluestem, switchgrass, little bluestem, side-oats grama, and indiangrass decrease; blue grama, hairy grama, sand dropseed, three-awns, sand sagebrush, and shin oak increase; and red lovegrass, gummy lovegrass, tumble lovegrass, and annual weeds invade.

Where this site is in excellent condition, the total annual acre yield of air-dry herbage ranges from about 3,000 pounds in favorable years to 1,500 pounds in less

Figure 12.—An area of undulating Springer soils in Sandy range site.

favorable years. Approximately 95 percent of this forage can be used by livestock and wildlife.

SANDY BOTTOMLAND RANGE SITE

Lincoln soils, frequently flooded, are the only soils in this site. These deep, nearly level, calcareous loamy fine sands are on bottom lands. The soils are somewhat excessively drained. The hazard of soil blowing is severe, and the hazard of water erosion is slight.

The climax plant community is a mixture of tall and mid grasses, cottonwood, hackberry, and willow trees, and forbs. Its composition, by percentage of total weight, is approximately 20 percent switchgrass; 20 percent sand bluestem; 10 percent alkali sacaton; 5 percent little bluestem; 5 percent indiangrass; 5 percent side-oats grama; 5 percent plains bristlegrass; 5 percent tall dropseed; 15 percent woody plants; and 10 percent perennial forbs.

If the site is continuously heavily grazed by cattle, switchgrass, sand bluestem, little bluestem, indiangrass, side-oats grama, Engelmann-daisy, heath aster, and catclaw sensitivebrier decrease; western wheatgrass, sand dropseed, blue grama, vine-mesquite, inland saltgrass, and American licorice increase; and buffalograss, mesquite, sand sagebrush, and some annual weeds invade.

Where this site is in excellent condition, the total annual acre yield of air-dry herbage ranges from about 3,400 pounds in favorable years to 2,200 pounds in less favorable years. Approximately 80 percent of this forage can be used by livestock and wildlife.

SANDY LOAM RANGE SITE

This range site is made up of deep, nearly level to gently sloping, noncalcareous fine sandy loams on uplands. These soils are well drained. Permeability is moderate. The hazard of soil blowing is moderate, and the hazard of water erosion is slight to moderate.

The climax plant community is a mixture of tall, mid, and short grasses, woody shrubs, and forbs. Its composition, by percentage of total weight, is approximately 25 percent blue grama; 15 percent side-oats grama; 10 percent buffalograss; 5 percent little bluestem; 5 percent sand bluestem; 5 percent indiangrass; 5 percent silver bluestem; 20 percent other perennial grasses; 5 percent sand sagebrush; and 5 percent perennial forbs.

If the site is continuously heavily grazed by cattle, side-oats grama, blue grama, little bluestem, sand bluestem, indiangrass, and switchgrass decrease; buffalograss, sand dropseed, silver bluestem, hairy grama, three-awns, sand sagebrush, and annual forbs increase; and mesquite, catclaw sensitivebrier, and some annuals invade.

Where this site is in excellent condition, the total annual acre yield of air-dry herbage ranges from about 2,400 pounds in favorable years to 1,600 pounds in less favorable years. Approximately 95 percent of this forage can be used by livestock and wildlife.

VALLEY RANGE SITE

Spur loam is the only soil in this site. This deep, nearly level, calcareous soil is on bottom lands. It is well drained. Permeability is moderate. The hazards of soil blowing and water erosion are slight.

The climax plant community is mainly mid and short grasses. Its composition, by percentage of total weight, is approximately 20 percent blue grama; 15 percent vine-mesquite; 15 percent buffalograss; 10 percent side-oats grama; 10 percent western wheatgrass; 5 percent alkali sacaton; 5 percent other perennial grasses; 10 percent woody plants; and 10 percent perennial forbs.

If the site is continuously heavily grazed by cattle, side-oats grama, blue grama, vine-mesquite, and western wheatgrass decrease; buffalograss, three awns, and silver bluestem increase; and mesquite, pricklypear, and annual weeds invade.

Where this site is in excellent condition, the total annual acre yield of air-dry herbage ranges from about 2,600 pounds in favorable years to 1,800 pounds in less favorable years. Approximately 90 percent of this forage can be used by livestock and wildlife.

VERY SHALLOW RANGE SITE

This range site is made up of very shallow to shallow, hilly, calcareous loams on uplands. These soils are well drained to excessively drained. Permeability is moderate to moderately rapid. The hazard of soil blowing is slight, and the hazard of water erosion is severe.

The climax plant community is a mixture of tall and mid grasses, mountain-mahogany, skunkbrush sumac, and perennial forbs. Its composition, by percentage of total weight, is approximately 25 percent side-oats grama; 10 percent little bluestem; 10 percent blue grama; 5 percent sand bluestem; 5 percent indiangrass; 5 percent switchgrass; 25 percent other perennial grasses; 10 percent woody plants; and 5 percent perennial forbs.

If the site is continuously heavily grazed by cattle, sand bluestem, switchgrass, indiangrass, and side-oats grama decrease; hairy grama, Wright's three-awn, sand dropseed, silver bluestem, and annual forbs increase; and mesquite, hairy tridens, redberry juniper, and some annuals invade.

Where this site is in excellent condition, the total annual acre yield of air-dry herbage ranges from about 1,500 pounds in favorable years to 500 pounds in less favorable years. Approximately 90 percent of this forage can be used by livestock and wildlife.

Wildlife [3]

Briscoe County has several miles of escarpment where the High Plains and the Rolling Plains meet. This area, along the Caprock Escarpment, provides some of the best wildlife habitat in the Texas Panhandle (fig. 13).

Aoudad sheep, which were introduced into the area in December 1957 and January 1958, have adapted remarkably well and have become an important kind of wildlife in the county.

The Caprock Escarpment and the Rolling Plains areas provide good habitat for many kinds of wildlife.

[3] ALLEN R. VAUGHN, biologist, Soil Conservation Service, assisted in preparing this section.

Figure 13.—**Burson, Obaro, and Quinlan soils in rough area along the margin of the High Plains. These breaks are habitat for deer and aoudad sheep.**

Mule deer, wild turkey, white-tailed deer, bobwhite quail, coyote, bobcat, opossum, raccoon, ringtail cat, hawk, owl, many kinds of small birds, cottontail rabbit, jackrabbit, ground squirrel, and numerous other kinds of rodents inhabit these areas.

The High Plains area of the county is mostly in crops and short-grass range and does not provide good habitat for many kinds of wildlife. Numerous rodents, jackrabbit, dove, and songbirds inhabit this area. The main kind of predator is the coyote, and several kinds of hawks are common. Pheasants inhabit some of the irrigated areas, and many kinds of waterfowl migrate across the county annually. Duck, geese, shore birds, and other wildlife use the scattered playas in this area. The golden eagle and the bald eagle migrate through the county each year, and some eagles nest in Palo Duro Canyon. Other kinds of wildlife that inhabitat Briscoe County are scaled quail, prairie dog, fox, badger, skunk, woodpecker, sparrow, and porcupine.

The seasonal shortage of water limits the kinds of native fish and amphibians that live in the county. Salamander, commonly known as waterdogs, live in many playas. Several kinds of reptile, including rattlesnakes, are common.

The lack of water in streams during the dry season limits the production of fish. Several ponds and a few lakes have been stocked with bass, channel catfish, and various kinds of sunfish (fig. 14).

Soils directly influence the kind and amount of vegetation and the amount of water available. In this way they indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect the growth of wildlife habitat are (1) thickness of soil useful to crops, (2) texture of the surface layer, (3) available water capacity to a depth of 40 inches, (4) wetness, (5) surface stoniness or rockiness, (6) hazard of flooding, (7) slope, and (8) permeability of the soil to air and water.

In table 3, the soils of Briscoe County are rated according to their suitability for producing six elements of wildlife habitat and for three groups, or kinds, of wildlife. The ratings indicate relative suitability for various elements. A rating of *good* indicates that habitats are easily created, improved, or maintained; that the soil has few or no limitations that affect management; and that satisfactory results can be expected when the soil is used for the prescribed purpose. *Fair* indicates that habitat can be created, improved, or maintained in most places, but the soil has moderate limitations that affect management or development, and that moderate intensity of management and fairly frequent attention may be required to insure satisfactory results. *Poor* indicates that habitat can be created, improved, or maintained in most places, but the soil has severe limitations; that management is difficult, expensive, and requires intensive effort; and that results are questionable. *Very poor* indicates that under the prevailing soil conditions, it is impractical

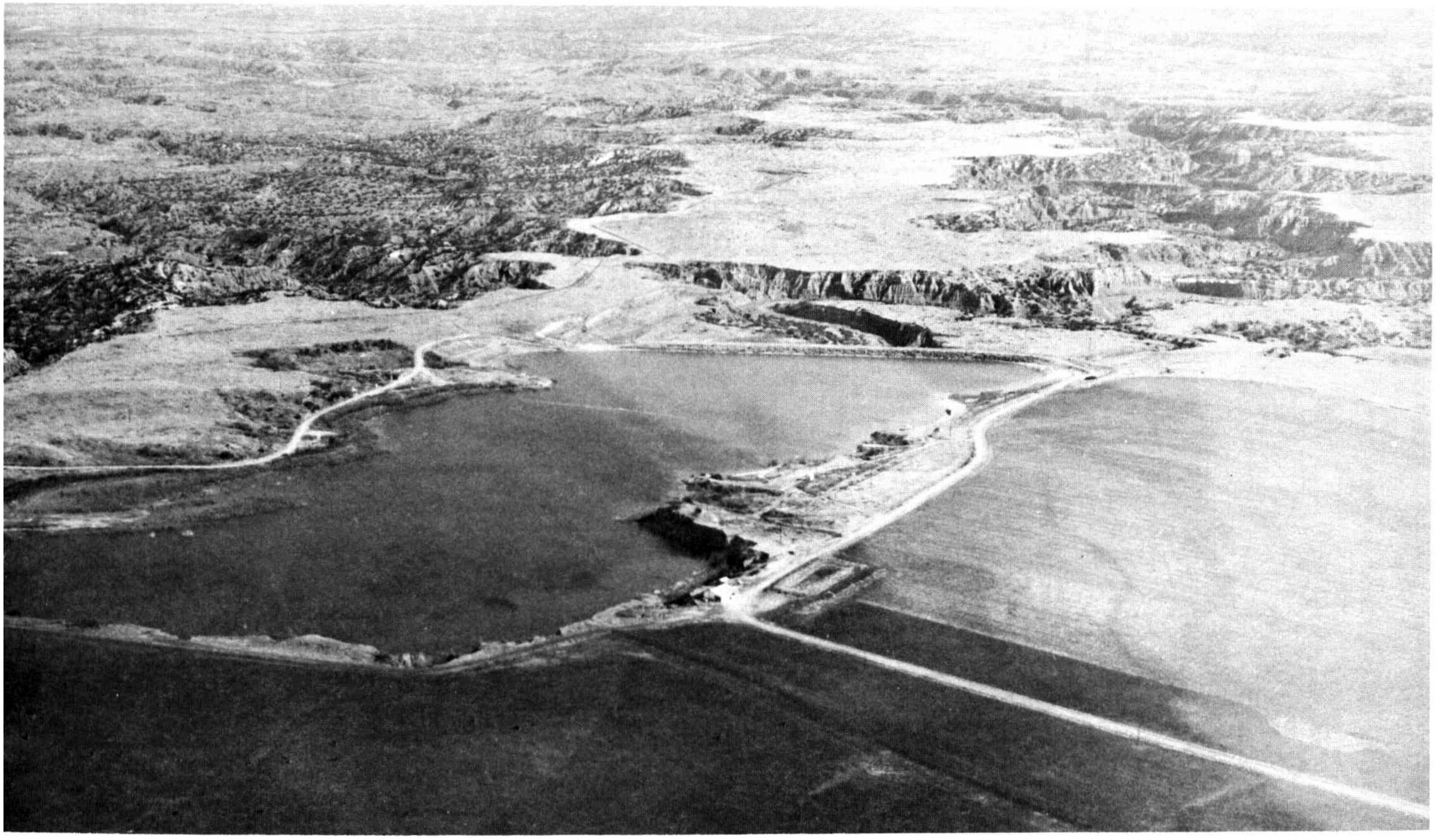

Figure 14.—Theo Lake near Quitaque is well suited to bass, catfish, and sunfish. Acuff, Berda, and Mobeetie soils are in the foreground, and Obaro, Burson, and Quinlan soils are in the background.

to attempt to create, improve, or maintain habitat; that soil conditions are very severe; and that unsatisfactory results are probable.

The ratings take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account climate, present use of soils, or present distribution of wildlife and people. For this reason, onsite inspection is needed in selecting a site for development as a wildlife habitat.

The six elements of wildlife habitat listed in table 3 are briefly defined in the following paragraphs.

Grain and seed crops are crops that produce annual grain, such as corn, sorghum, sunflower, and soybeans.

Grasses and legumes are established by planting. They provide food and cover for wildlife. Grasses include switchgrass, ryegrass, and western wheatgrass; legumes include wild alfalfa, Illinois bundleflower, and sweetclover.

Wild herbaceous upland plants are native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Ragweed, Maximilian sunflower, wildbean, pokeweed, and bristlegrass are examples of these plants. On range typical plants are paspalum, grama, perennial forbs, and legumes.

Shrubs are shrubby plants in subhumid and drier parts of the county that produce twigs, buds, bark, or foliage used as food by wildlife or that provide cover and shade for some kinds of wildlife. Plum, skunkbush sumac, Russian olive, mountain mahogany, shin oak, catclaw acacia, and four-wing saltbrush are typical kinds of plants in this category.

Wetland food and cover plants are annual and perennial herbaceous plants that grow wild on moist and wet sites. They furnish food and cover mostly for wetland wildlife. Typical examples of plants are smartweed, wild millet, spikerush and other rushes, sedges, burreed, tearthumb, and aneilema. Submerged and floating aquatics are not included in this category.

Shallow water developments are impoundments or excavations for controlling water, generally not more than 5 feet deep, to create habitats that are suitable for waterfowl. Some are designed to be drained, planted, and then flooded; others are permeanent impoundments that grow submersed aquatics.

The ratings in table 3 for the three kinds of wildlife are related to ratings made for the elements of wildlife habitat. For example, soils rated very poor for shallow water developments are rated very poor for wetland wildlife. The kinds of wildlife listed in table 3 are briefly described in the following paragraphs.

Open-land wildlife consists of birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, dove, meadowlark, field sparrow, cottontail rabbit, and fox are typical examples of open-land wildlife.

Rangeland wildlife consists of birds and mammals that normally live in areas of natural rangeland. Ante-

TABLE 3.—*Potential of soils for elements of wildlife habitat and kinds of wildlife*

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Shrubs	Wetland food and cover plants	Shallow water developments	Open-land	Rangeland	Wetland
Acuff: AcA, AcB	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
Amarillo: AmA, AmB, AmC.	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
Berda:									
BeA, BeB, BeC	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
BeD, BpE	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor.
For Polar part of BpE, see Polar series.									
Burson: BQG	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Poor	Very poor.
For Quinlan part, see Quinlan series.									
Clairemont: Cm	Good	Good	Fair	Good	Poor	Very poor	Good	Fair	Very poor.
Drake:									
DrB	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
DrC	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
Enterprise: EnD	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Estacado: EsA, EsB, EsC	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
Lincoln: Lf	Very poor	Poor	Good	Good	Poor	Very poor	Poor	Good	Very poor.
Lipan: Ln	Fair	Fair	Fair	Poor	Very poor	Poor	Fair	Poor	Very poor.
Lofton: Lo	Fair	Good	Fair	Fair	Poor	Poor	Fair	Fair	Poor.
Miles: MeB	Poor	Fair	Good	Good	Poor	Very poor	Fair	Good	Very poor.
Mobeetie: MoB	Fair	Good	Fair	Good	Poor	Very poor	Fair	Fair	Very poor.
Obaro:									
ObB, ObC	Fair	Good	Good	Fair	Poor	Very poor	Good	Fair	Very poor.
OQE	Poor	Fair	Good	Fair	Very poor	Very poor	Fair	Fair	Very poor.
For Quinlan part, see Quinlan series.									
Olton: OtA, OtB	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
Paloduro: PaA, PaB	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
Polar	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Poor	Very poor.
Mapped only with Berda soils.									
Pullman: PuA, PuB	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
Quinlan: QBG	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor.
For Burson part, see Burson series.									
Randall: Ra	Poor	Poor	Poor	Very poor	Poor	Fair	Poor	Very poor	Poor.
Roscoe: Ro	Fair	Fair	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
Springer: SfD	Poor	Fair	Good	Good	Poor	Very poor	Fair	Good	Very poor.
Spur: Sp	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Stamford: StA	Good	Good	Poor	Poor	Poor	Very poor	Fair	Poor	Very poor.
Tivoli: TfF	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Poor	Very poor.
Tulia:									
TuB, TuC	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
TxD	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
For Estacado part, see Estacado series.									
Yahola:									
Ya	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Yf	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Fair	Very poor.

lope, buffalo, lark, bunting, coyote, white-tailed deer, mule deer, meadowlark, bobwhite quail, scaled quail, and turkey are typical examples of rangeland wildlife.

Wetland wildlife consists of birds and mammals that normally live in wet areas, marshes, and swamps. Coots, ducks, geese, heron, rail, shore birds, and some rats and mice are typical examples of wetland wildlife.

Recreational Development

Knowledge of soils is necessary for planning, developing, and maintaining areas used for recreation. In table 4 the soils of Briscoe County are rated according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails.

The soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, or intensive maintenance, or a combination of these activities, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have gentle slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used mainly for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry, are free of flooding during the season of use, and do not have slopes or stoniness that greatly increase cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrop, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or on horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have a slope of less than 15 percent, and have few or no rock or stones on the surface.

Engineering Uses of the Soils[4]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among the soil properties most important in engineering are permeability, shear strength, compaction characteristics, compressibility, soil drainage condition, shrink-swell potential, grain-size distribution, plasticity, and reaction. Depth to the water table, depth to bedrock, and slope are also important. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5 and 6, which show, respectively, several estimated soil properties significant in engineering and interpretations for various engineering uses.

This information, along with the soil map and other parts of this survey, can be used to make interpretations in addition to those given in tables 5 and 6, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to a depth greater than those shown in the tables, generally a depth of more than 6 feet. In addition, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have

[4] DAN C. HUCKABEE, Soil Conservation Service, assisted in preparing this section.

TABLE 4.—*Degree of limitation and soil features affecting recreational development*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table. "Percs slowly" and other terms that describe restrictive soil features are defined in the Glossary]

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Acuff: AcA, AcB	Slight	Slight	Slight	Slight.
Amarillo:				
AmA, AmB	Slight	Slight	Slight	Slight.
AmC	Slight	Slight	Moderate: slope	Slight.
*Berda:				
BeA, BeB	Slight	Slight	Slight	Slight.
BeC	Slight	Slight	Moderate: slope	Slight.
BeD, BpE	Slight	Slight	Severe: slope	Slight.
For Polar part of BpE, see Polar series.				
*Burson: BQG	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
For Quinlan part, see Quinlan series.				
Clairemont: Cm	Severe: floods	Moderate: floods	Severe: floods	Slight.
Drake: DrB, DrC	Moderate: dusty	Moderate: dusty	Moderate: dusty; slope.	Moderate: dusty.
Enterprise: EnD	Slight	Slight	Moderate: slope	Slight.
Estacado: EsA, EsB, EsC	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Lincoln: Lf	Severe: floods	Moderate: floods	Severe: floods	Severe: floods.
Lipan: Ln	Severe: percs slowly.	Severe: too clayey.	Severe: percs slowly.	Severe: too clayey.
Lofton: Lo	Severe: percs slowly.	Severe: too clayey.	Severe: percs slowly.	Severe: too clayey.
Miles: MeB	Slight	Slight	Slight	Slight.
Mobeetie: MoB	Slight	Slight	Slight	Slight.
Obaro:				
ObB, ObC	Slight	Slight	Moderate: depth to rock.	Slight.
OQE:				
Obaro part	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Quinlan part	Moderate: slope	Moderate: slope	Severe: depth to rock.	Slight.
Olton: OtA, OtB	Moderate: percs slowly.	Moderate: too clayey.	Moderate: percs slowly.	Moderate: too clayey.
Paloduro: PaA, PaB	Slight	Slight	Slight	Slight.
Polar	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
Pullman: PuA, PuB	Moderate: percs slowly.	Moderate: too clayey.	Moderate: percs slowly.	Moderate: too clayey.
*Quinlan: QBG	Severe: slope	Severe: slope	Severe: depth to rock.	Severe: slope.
For Burson part, see Burson series.				
Randall: Ra	Severe: floods	Severe: too clayey	Severe: floods	Severe: too clayey.
Roscoe: Ro	Severe: percs slowly.	Severe: too clayey	Severe: percs slowly.	Severe: too clayey.
Springer: SfD	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Spur: Sp	Severe: floods	Moderate: floods	Severe: floods	Slight.
Stamford: StA	Severe: percs slowly.	Severe: too clayey	Severe: percs slowly.	Severe: too clayey.
Tivoli: TfF	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Tulia:				
TuB	Slight	Slight	Slight	Slight.
TuC	Slight	Slight	Moderate: slope	Slight.
TxD:				
Tulia part	Slight	Slight	Severe: slope	Slight.
Estacado part	Moderate: too clayey.	Moderate: too clayey.	Severe: slope	Moderate: too clayey.
Yahola: Ya, Yf	Severe: floods	Moderate: floods	Severe: floods	Slight.

different meanings in soil science than in engineering. Many of these terms commonly used in soil science are defined in the Glossary.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified soil classification system (*2*), used by SCS engineers, Department of Defense, and others, and the AASHTO classification system, adopted by the American Association of State Highway and Transportation Officials (*1*).

In the Unified soil classification system, soils are classified according to particle-size distribution, plasticity index, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL–ML. The letters used in class designation mean: G, gravel, S, sand; M, silt; and C, clay. Clean sands are identified by SW or SP; sands that have fines of silt and clay by SM or SC; silt and clay that have a low liquid limit by ML and CL; and silt and clay that have a high liquid limit by MH and CH.

The AASHTO classification system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest.

Table 5 shows the estimated classifications of all soils in the county according to the Unified and AASHTO systems. The AASHTO classifications are without group index numbers.

Estimated properties

Several estimated soil properties significant to engineering are given in table 5. These estimates are made for typical soil profiles by layers sufficiently different to behave in a different way when used for engineering purposes. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. In the following paragraphs the columns in table 5 are explained.

In the column headed "Hydrologic group," the runoff potential from rainfall is given. Four major soil groups are used, and the soils are classified on the basis of intake of water at the end of long-duration storms that occur after prior wetting and opportunity for swelling and without the protective effects of vegetation.

The major soil groups are described in the following paragraphs.

Group A consists of soils that have a high infiltration rate, even when thoroughly wetted. They are chiefly deep, well-drained to excessively drained sand or gravel, or both. These soils have a high rate of water transmission in that water readily passes through them, and they have a low runoff potential.

Group B consists of soils that have a moderate infiltration rate when thoroughly wetted. They are chiefly moderately deep to deep, moderately well drained to well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission and a moderate runoff potential.

Group C consists of soils that have a slow infiltration rate when thoroughly wetted. They are chiefly soils that have a layer that impedes downward movement of water or soils that have moderately fine texture to fine texture. These soils have a slow rate of water transmission and a high runoff potential.

Group D consists of soils that have a very slow infiltration rate when thoroughly wetted. They are chiefly clay soils that have a high swelling potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission and a very high runoff potential.

Depth to bedrock is the distance from the surface of the soil to the upper surface of the rock layer. This column was not included, because the soils in Briscoe County generally are deep to bedrock, except Burson soils, which are 3 to 12 inches deep; Obaro soils, which are 20 to 48 inches deep; Polar soils, which are 4 to 12 inches deep; and Quinlan soils, which are 10 to 20 inches deep.

In the column headed "Depth from surface," the depth is given in inches for the major distinctive layers of the soil profile.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years. This column was not included in Table 5, because a seasonal high water table is not a limitation except in Lincoln soils, which have a water table at a depth of 20 to 60 inches.

Soil texture is described in table 5 in the standard terms used by the U.S. Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and other terms used in USDA textural classification are defined in the Glossary.

The percentages of soil material passing sieves of

TABLE 5.—*Estimates of soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. fully the instructions for referring to other series that appear in the first column of this

Soil series and map symbols	Hydrologic group	Depth from surface	Dominant USDA texture	Classification: Unified	Classification: AASHTO
		In			
Acuff: AcA, AcB	B	0–10	Loam	CL	A–4 or A–6
		10–40	Clay loam	CL	A–6 or A–7–6
		40–80	Clay loam	CL	A–6
Amarillo: AmA, AmB, AmC	B	0–10	Fine sandy loam	SM or SM–SC	A–4
		10–52	Sandy clay loam	SC, CL	A–6, A–4
		52–80	Sandy clay loam	SC or CL	A–6, A–4
*Berda: BeA, BeB, BeC, BeD, BpE. For Polar part of BpE, see Polar series.	B	0–8	Loam	SC or CL	A–4 or A–6
		8–48	Clay loam	SC or CL	A–4 or A–6
		48–65	Sandy clay loam	SC or CL	A–4 or A–6
*Burson: BQG. For Quinlan part, see Quinlan series.	C	0–6	Loam	ML or CL	A–4
		6–40	Weakly cemented sandstone and siltstone.		
Clairemont: Cm	B	0–60	Silty clay loam, clay loam, and sandy clay loam.	CL	A–6, A–4
Drake: DrB, DrC	B	0–60	Loam and clay loam.	CL, CL–ML, SM–SC, SC	A–4 or A–6
Enterprise: EnD	B	0–60	Loam	ML or CL–ML	A–4
Estacado: EsA, EsB, EsC	B	0–24	Clay loam	CL	A–6
		24–48	Clay loam	CL	A–6 or A–7–6
		48–80	Clay loam	CL	A–6 or A–7–6
Lincoln: Lf	A	0–60	Loamy fine sand	SM	A–4
Lipan: Ln	D	0–65	Clay	CH	A–7–6
		65–85	Clay	CL or CH	A–7–6
Lofton: Lo	D	0–6	Clay loam	CL	A–6 or A–7–6
		6–80	Clay	CL or CH	A–7–6
Miles: MeB	B	0–10	Loamy fine sand	SM	A–2–4
		10–84	Sandy clay loam	SC or CL	A–6
Mobeetie: MoB	B	0–60	Fine sandy loam	SM, SM–SC, or CL–ML, ML	A–4
*Obaro: ObB, ObC, OQE. For Quinlan part of OQE, see Quinlan series.	B	0–40	Loam	CL or CL–ML	A–4 or A–6
		40–70	Very fine grained weakly cemented sandstone.	CL–ML	A–4
Olton: OtA, OtB	C	0–6	Clay loam	CL	A–4 or A–6
		6–66	Clay loam	CL	A–6 or A–7–6
		66–85	Sandy clay loam	CL	A–6
Paloduro: PaA, PaB	B	0–80	Loam, clay loam, and fine sandy loam.	SC or CL	A–4 or A–6
Polar. Mapped only with Berda soils.	B	0–8	Gravelly sandy clay loam.	SM, GM or SM–SC, GM–GC	A–1 or A–2–4
		8–24	Very gravelly sandy clay loam and gravelly loam.	GM, GP–GM or GM–GC	A–1 or A–2–4
		24–80	Layers of gravel, sand, and clay loam.		

significant in engineering

The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow care- table. The symbol < means less than. Absence of data indicates that no estimate was made]

Percentage passing sieve—				Liquid limit	Plasticity Index	Perme- ability	Available water capacity	Reaction	Shrink- swell potential	Corrosivity to uncoated steel
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							
				Pct	*Pct*	*In per hr*	*In per in of soil*	*pH*		
100	100	95–100	51–70	25–32	10–15	0.6–2.0	0.14–0.17	6.6–7.3	Low	Moderate.
100	100	95–100	65–75	30–45	15–25	0.6–2.0	0.15–0.18	7.4–8.4	Low	Moderate.
95–100	90–100	90–100	60–75	25–35	15–20	0.6–2.0	0.12–0.15	7.9–8.4	Low	Moderate.
100	100	95–100	36–49	17–25	2–6	2.0–6.0	0.11–0.15	7.9–8.4	Low	Moderate.
100	100	95–100	36–65	25–36	10–20	0.6–2.0	0.15–0.17	7.9–8.4	Low	Moderate.
90–100	90–99	80–95	36–60	20–32	8–15	0.6–2.0	0.11–0.15	7.9–8.4	Low	Moderate.
90–100	85–100	80–95	36–70	20–35	8–20	0.6–2.0	0.14–0.17	7.9–8.4	Low	Moderate.
95–100	95–100	80–95	40–70	20–35	8–20	0.6–2.0	0.14–0.17	7.9–8.4	Low	Moderate.
95–100	95–100	80–95	40–70	20–35	8–20	0.6–2.0	0.14–0.17	7.9–8.4	Low	Moderate.
95–100	90–100	85–100	55–85	20–30	3–10	0.6–2.0	0.10–0.16	7.9–8.4	Low	Low.
100	100	100	85–95	30–40	10–20	0.6–2.0	0.16–0.19	7.9–8.4	Low	Moderate.
100	100	70–90	40–70	20–35	4–15	0.6–2.0	0.10–0.15	7.9–8.4	Low	High.
100	100	95–99	80–90	20–28	1–7	2.0–6.0	0.18–0.20	7.9–8.4	Low	Low.
100	98–100	95–100	51–85	25–40	11–25	0.6–2.0	0.14–0.18	7.9–8.4	Low	Moderate.
95–100	95–100	85–100	55–90	30–42	11–25	0.6–2.0	0.12–0.16	7.9–8.4	Low	Moderate.
95–100	95–100	95–100	60–95	30–45	15–25	0.6–2.0	0.13–0.17	7.9–8.4	Low	Moderate.
100	100	50–90	36–49	----------	[1] NP	0.6–20	0.06–0.09	7.9–8.4	Very low	Very low.
95–100	95–100	95–100	85–95	50–70	35–50	< 0.06	0.15–0.20	7.9–8.4	Very high	High.
95–100	95–100	90–100	80–95	41–60	25–40	< 0.06	0.15–0.20	7.9–8.4	Very high	High.
100	100	98–100	70–90	35–45	15–25	0.2–0.6	0.16–0.20	7.4–7.8	Moderate	High.
100	100	95–100	70–90	45–55	20–30	< 0.06	0.16–0.20	7.4–8.4	High	High.
100	95–100	80–87	15–30	16–22	1–3	2.0–6.0	0.06–0.10	6.6–7.3	Very low	Low.
98–100	98–100	90–97	36–62	25–40	11–20	0.6–2.0	0.13–0.17	6.6–8.4	Low	Moderate.
95–98	90–95	80–95	40–65	18–25	2–7	2.0–6.0	0.10–0.14	7.9–8.4	Very low	Low.
95–98	92–97	90–96	75–85	25–35	7–15	0.6–2.0	0.12–0.16	7.9–8.4	Low	Low.
95–99	90–99	90–98	60–75	20–26	4–6	0.6–2.0	0.04–0.08	7.4–7.8	Very low	Low.
100	95–100	85–100	55–75	20–35	10–20	0.6–2.0	0.15–0.20	7.4–7.8	Low	Moderate.
100	90–100	90–100	70–85	35–50	20–35	0.2–0.6	0.15–0.20	7.4–8.4	Moderate	Moderate.
90–100	90–100	90–100	60–75	25–40	11–20	0.2–0.6	0.10–0.15	7.9–8.4	Moderate	Moderate.
95–100	95–100	80–95	40–60	20–35	8–20	0.6–2.0	0.14–0.17	7.9–8.4	Low	Moderate.
45–75	35–60	30–50	13–25	< 25	NP–7	2.0–6.0	0.04–0.09	7.9–8.4	Very low	Very low.
40–45	30–65	20–45	5–20	< 25	NP–5	2.0–6.0	0.03–0.07	7.9–8.4	Very low	Very low.

TABLE 5.—*Estimates of soil properties*

Soil series and map symbols	Hydro-logic group	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
		In			
Pullman: PuA, PuB	D	0–6	Clay loam	CL	A–7–6, A–6
		6–50	Clay	CL or CH	A–7–6
		50–100	Silty clay and silty clay loam.	CL	A–7–6, A–6
*Quinlan: QBG For Burson part, see Burson series.	C	0–15	Loam and silty clay loam.	CL–ML, CL, SM–SC, SC	A–4 or A–6
		15–60	Weakly cemented sandstone.		
Randall: Ra	D	0–80	Clay	CL or CH	A–7–6
Roscoe: Ro	D	0–56	Clay	CL or CH	A–7–6
		56–65	Clay	CL or CH	A–7–6
Springer: SfD	B	0–16	Loamy fine sand	SM or SP–SM, SM–SC	A–2–4 or A–3
		16–68	Fine sandy loam	SM or SM–SC	A–2–4
		68–98	Sandy clay loam.		
Spur: Sp	B	0–18	Loam	CL	A–4 or A–6 or A–7–6
		18–40	Clay loam	CL	A–4 or A–6
		40–65	Sandy clay loam	CL	A–6 or A–4
Stamford: StA	D	0–54	Clay	CH	A–7–6
		54–75	Silty clay	CL	A–7–6
Tivoli: TfF	A	0–70	Fine sand	SM or SP–SM	A–2–4– or A–3
*Tulia: TuB, TuC, TxD For Estacado part of TxD, see Estacado series.	B	0–8	Loam	SM–SC, SC CL–ML, CL	A–4 or A–6
		8–80	Clay loam	CL, SC	A–4 or A–6
Yahola: Ya, Yf	B	0–40	Fine sandy loam	SM, SM–SC ML, CL–ML	A–2–4 or A–4
		40–60	Loamy fine sand	SM	A–2–4

[1] NP = nonplastic.

four sizes are given as the range of material passing sieves. This information is useful in helping to determine suitability of the soil as a material for construction purposes.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state, and the liquid limit from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 5.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts. These ratings should not be confused with the coefficient of permeability, or *k*-value, used by engineers.

Available water capacity is the ability of a soil to hold water for use by most plants. It commonly is defined as the numerical difference between the amount of water in the soil at field capacity and the amount of water at the time most crop plants wilt. The rate is expressed as inches of water per inch of soil depth.

Reaction is the degree of acidity or alkalinity of a soil expressed as pH. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of the soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the *significant in engineering*—Continued

Percentage passing sieve— No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Liquid limit	Plasticity Index	Perme-ability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel
				Pct	*Pct*	*In per hr*	*In per in of soil*	*pH*		
100	100	95–100	70–90	35–49	15–30	0.2–0.6	0.14–0.18	6.6–7.3	Moderate	High.
100	100	95–100	80–95	45–60	25–35	< 0.06	0.12–0.16	7.4–8.4	High	High.
95–100	90–100	90–100	80–95	35–49	20–30	0.06–0.2	0.12–0.16	7.9–8.4	Moderate	High.
100	95–100	90–100	36–85	20–40	4–15	2.0–6.0	0.10–0.20	7.9–8.4	Low	Low.
100	100	96–100	70–98	41–65	30–45	< 0.06	0.12–0.18	7.9–8.4	High	High.
100	98–100	92–100	76–92	46–65	30–42	< 0.06	0.14–0.16	7.9–8.4	Very high	High.
100	100	94–100	75–95	41–60	30–45	< 0.06	0.10–0.15	7.9–8.4	High	High.
100	95–100	70–85	8–25	< 20	NP–4	6.0–20	0.08–0.10	6.6–7.3	Very low	Low.
100	95–100	80–95	13–35	17–23	2–7	2.0–6.0	0.12–0.14	7.4–7.8	Low	Low.
100	95–100	90–100	60–93	25–45	10–25	0.6–2.0	0.15–0.20	7.9–8.4	Low	Moderate.
100	95–100	95–100	60–90	25–40	10–25	0.6–2.0	0.15–0.20	7.9–8.4	Low	Moderate.
100	95–100	95–100	60–90	25–35	10–20	0.6–2.0	0.11–0.15	7.9–8.4	Low	Moderate.
100	98–100	95–100	80–95	55–75	33–44	< 0.06	0.14–0.17	7.9–8.4	Very high	High.
100	98–100	95–100	80–95	41–49	27–35	< 0.06	0.08–0.14	7.9–8.4	High	High.
100	100	85–95	9–20	----------	NP	6.0–20	0.04–0.06	6.6–7.3	Very low	Very low.
95–100	90–100	85–95	36–70	20–35	5–20	0.6–2.0	0.14–0.18	7.9–8.4	Low	Moderate.
90–100	90–100	80–98	40–80	20–35	8–20	0.6–2.0	0.07–0.12	7.9–8.4	Low	Moderate.
100	100	85–98	30–60	< 26	NP–6	2.0–6.0	0.11–0.16	7.9–8.4	Low	Low.
100	100	90–98	13–30	----------	NP	2.0–6.0	0.07–0.11	7.9–8.4	Very low	Low.

amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to the maintenance of structures built in, on, or of material having this rating.

Corrosivity, as used in table 5, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Installations of uncoated steel that intersect soil boundaries of soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that the probability of soil-induced corrosion damage is low. A rating of *high* means that the probability of damage is high, so that protective measures for steel should be used to avoid or minimize damage. All the soils in Briscoe County rate low in corrosivity to concrete, so this column was not included in the table.

Engineering interpretations

The estimated interpretations in table 6 are based on the engineering properties of soils shown in table 5 and on the experience of engineers and soil scientists with the soils of Briscoe County. In table 6, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for irrigation, terraces and diversions, and waterways. For these particular uses, table 6 lists those soil features not to be overlooked in planning, installing, and maintaining structures.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means that soil properties are generally favorable for the rated use, or in other words, limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome as modified by special planning

TABLE 6.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. fully the instructions for referring to other series that appear in the first column of this table.

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Acuff:					
AcA	Slight	Moderate: seepage.	Moderate: too clayey.	Moderate: low strength.	Moderate: too clayey.
AcB	Slight	Moderate: seepage.	Moderate: too clayey.	Moderate: low strength.	Moderate: too clayey.
Amarillo:					
AmA	Slight	Moderate: seepage.	Slight	Moderate: low strength.	Slight
AmB, AmC	Slight	Moderate: seepage.	Slight	Moderate: low strength.	Slight
*Berda:					
BeA	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Slight
BeB, BeC, BeD, BpE For Polar part of BpE, see Polar series.	Slight	Moderate: slope; seepage.	Moderate: too clayey.	Slight	Slight
*Burson: BQG For Quinlan part, see Quinlan series.	Severe: slope; depth to rock.	Severe: slope; depth to rock.	Severe: slope.	Severe: slope.	Severe: slope; depth to rock.
Clairemont: Cm	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Drake: DrB, DrC	Slight	Severe: seepage.	Slight	Slight	Moderate: too clayey.
Enterprise: EnD	Slight	Severe: seepage.	Slight	Slight	Severe: seepage.
Estacado:					
EsA	Slight	Moderate: seepage.	Moderate: too clayey.	Moderate: low strength.	Moderate: too clayey.
EsB, EsC	Slight	Moderate: seepage.	Moderate: too clayey.	Moderate: low strength.	Moderate: too clayey.
Lincoln: Lf	Severe: floods.	Severe: floods; seepage.	Severe: floods; cut-banks cave.	Severe: floods.	Severe: floods.
Lipan: Ln	Severe: percs slowly.	Severe: floods.	Severe: floods; too clayey.	Severe: floods; shrink-swell.	Severe: floods; too clayey.

interpretations

The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow care-
"Shrink-swell," "piping," and other terms that describe restrictive soil features are defined in the Glossary]

Degree and kind of limitation for—*Cont'd.*			Suitability as a source of—		Soil features affecting—		
Local roads and streets	Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Waterways
Moderate: low strength.	Moderate: seepage.	Moderate: piping; seepage.	Fair: low strength.	Fair: thin layer.	Favorable	Favorable	Favorable.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; seepage.	Fair: low strength.	Fair: thin layer.	Slope	Favorable	Slope.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; seepage.	Fair: low strength.	Fair: thin layer.	Favorable	Favorable	Favorable.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; seepage.	Fair: low strength.	Fair: thin layer.	Slope	Favorable	Slope.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Fair: thin layer.	Favorable	Favorable	Favorable.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Fair: thin layer.	Slope	Favorable	Slope.
Severe: slope.	Severe: depth to rock; seepage.	Severe: thin layer.	Poor: thin layer.	Poor: thin layer.	Slope; rooting depth.	Not needed	Not needed.
Severe: floods.	Moderate: seepage.	Moderate: piping.	Fair: low strength.	Fair: too clayey.	Floods	Floods	Floods.
Moderate: low strength.	Severe: seepage.	Moderate: piping; seepage.	Fair: low strength.	Fair: excess lime.	Slope; excess lime.	Favorable	Slope; excess lime.
Moderate: low strength.	Severe: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Good	Fast intake; slope.	Erodes easily; slope.	Erodes easily; slope.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Fair: too clayey.	Favorable	Favorable	Favorable.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Fair: too clayey.	Slope	Favorable	Slope.
Severe: floods.	Severe: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Poor: too sandy.	Fast intake; floods.	Floods	Floods.
Severe: floods; shrink-swell.	Slight	Moderate: shrink-swell.	Poor: shrink-swell.	Poor: too clayey.	Slow intake	Not needed	Not needed.

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Lofton: Lo	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.
Miles: MeB	Slight	Moderate: seepage.	Slight	Moderate: low strength.	Slight
Mobeetie: MoB	Slight	Severe: seepage.	Slight	Slight	Severe: seepage.
Obaro: ObB, ObC	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
OQE: Obaro part	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock; slope.	Moderate: depth to rock.
Quinlan part	Severe: depth to rock.	Severe: depth to rock; seepage.	Moderate: depth to rock; slope.	Moderate: depth to rock; slope.	Severe: seepage.
Olton: OtA	Moderate: percs slowly.	Slight	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: too clayey.
OtB	Moderate: percs slowly.	Slight	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: too clayey.
Paloduro: PaA	Slight	Moderate: seepage.	Moderate: too clayey.	Moderate: low strength.	Moderate: too clayey.
PaB	Slight	Moderate: seepage.	Moderate: too clayey.	Moderate: low strength.	Moderate: too clayey.
Polar. Mapped only with Berda soils.	Moderate: slope.	Severe: seepage.	Moderate: slope.	Moderate: slope.	Severe: seepage.
Pullman: PuA	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.
PuB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.
*Quinlan: QBG. For Burson part, see Burson series.	Severe: slope; depth to rock.	Severe: slope; depth to rock; seepage.	Severe: slope.	Severe: slope.	Severe: seepage.

interpretations—Continued

Degree and kind of limitation for—*Cont'd.*			Suitability as a source of—		Soil features affecting—		
Local roads and streets	Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Waterways
Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: shrink-swell.	Poor: too clayey.	Slow intake	Favorable	Favorable.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Fair: too sandy.	Favorable	Erodes easily.	Erodes easily.
Moderate: low strength.	Severe: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Good	Fast intake; slope.	Favorable	Erodes easily.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Good	Rooting depth; slope.	Favorable	Erodes easily.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Good	Slope	Slope	Slope.
Moderate: slope.	Severe: depth to rock.	Severe: thin layer.	Poor: thin layer.	Fair: thin layer.	Slope	Not needed	Not needed.
Moderate: low strength.	Moderate: seepage.	Moderate: piping.	Fair: low strength.	Fair: too clayey.	Favorable	Favorable	Favorable.
Moderate: low strength.	Moderate: seepage.	Moderate: piping.	Fair: low strength.	Fair: too clayey.	Slope	Favorable	Favorable.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Fair: too clayey.	Favorable	Favorable	Favorable.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Fair: too clayey.	Slope	Favorable	Favorable.
Moderate: slope.	Severe: seepage.	Moderate: piping; erodes easily.	Good	Poor: small stones.	Slope; rooting depth; fast intake.	Not needed	Not needed.
Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: shrink-swell.	Fair: too clayey.	Slow intake	Favorable	Favorable.
Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: shrink-swell.	Fair: too clayey.	Slow intake; slope.	Favorable	Favorable.
Severe: slope.	Severe: depth to rock.	Severe: thin layer.	Poor: thin layer.	Poor: slope	Slope	Not needed	Not needed.

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Randall: Ra	Severe: floods; percs slowly.	Severe: floods.	Severe: shrink-swell; compressible.	Severe: floods; shrink-swell.	Severe: floods; too clayey.
Roscoe: Ro	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.
Springer: SfD	Slight	Severe: seepage.	Slight	Slight	Severe: seepage.
Spur: Sp	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Stamford: StA	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.
Tivoli: TfF	Severe: slope.	Severe: seepage.	Severe: cutbanks cave.	Slight	Severe: seepage.
Tulia: TuB, TuC	Slight	Moderate: slope; seepage.	Moderate: too clayey.	Slight	Moderate: too clayey.
TxD: Tulia part	Slight	Moderate: slope; seepage.	Moderate: too clayey.	Slight	Moderate: too clayey.
Estacado part	Slight	Moderate: seepage.	Moderate: too clayey.	Moderate: low strength.	Moderate: too clayey.
Yahola: Ya, Yf	Severe: floods.	Severe: floods; seepage.	Severe: floods.	Severe: floods.	Severe: floods.

and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special designs, or intensive maintenance.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

In the following paragraphs the columns in table 6 are explained.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between the depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope affects the difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. The assumptions are made that the embankment is compacted to medium density and that the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic-matter content, and slope; if the floor *interpretations*—Continued

Degree and kind of limitation for—*Cont'd.*			Suitability as a source of—		Soil features affecting—		
Local roads and streets	Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Waterways
Severe: floods; shrink-swell.	Slight	Moderate: shrink-swell; compressible.	Poor: shrink-swell.	Poor: too clayey.	Slow intake; floods.	Not needed	Not needed.
Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: shrink-swell.	Poor: too clayey.	Slow intake	Favorable	Favorable.
Slight	Severe: seepage.	Moderate: piping; erodes easily.	Good	Fair: too sandy.	Fast intake; complex slope.	Not needed	Not needed.
Severe: floods.	Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Fair: too clayey.	Floods	Not needed	Not needed.
Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: shrink-swell.	Poor: too clayey.	Slow intake	Favorable	Favorable.
Severe: slope.	Severe: seepage.	Severe: erodes easily; seepage.	Good	Poor: too sandy.	Slope; fast intake.	Too sandy	Erodes easily.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Moderate: low strength.	Fair: thin layer; excess lime.	Slope; excess lime.	Favorable	Favorable.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Moderate: low strength.	Fair: thin layer; excess lime.	Slope; excess lime.	Slope; erodes easily.	Slope; erodes easily.
Moderate: low strength.	Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Fair: too clayey.	Slope	Slope	Slope.
Severe: floods.	Severe: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Good	Floods; fast intake.	Not needed	Not needed.

needs to be leveled, depth to bedrock is important. The soil properties that affect the embankment are the engineering properties of the embankment material, as interpreted from the Unified soil classification, and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, such as excavations for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding and from a high water table.

Dwellings without basements, as rated in table 6, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rock.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 6 apply only to a depth of about 6 feet; therefore, limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. Even though reliable predictions can be made to a depth of 10 to 15 feet for some soils, every site should be investigated before it is selected.

Local roads and streets, as rated in table 6, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly of asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep. Soil properties that most affect design and construction of roads and streets are load-supporting capacity, stability of the subgrade, and workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material as well as the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect the ease of excavation and the amount of cut and fill needed to reach and even grade.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and their depth to fractured or permeable bedrock or other permeable material.

Dikes, levees, and other embankments require soil material that is resistant to seepage and piping and has favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are unfavorable factors.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of a soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction. A column was not included in the table, however, because limited amounts of sand and gravel are found in Briscoe County. The only deposits of commercial value are in Berda-Polar complex, 3 to 12 percent slopes.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants grown on the soil when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments affect suitability. Damage that will result at the area from which topsoil is taken is also considered in the rating. Excess lime refers to calcium carbonate equivalent of a soil.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Waterways are either natural or shaped channels seeded with grass to carry runoff without causing erosion. The suitability of a soil for grassed waterways is determined by the erosion hazard and the amount of shaping that can be done. This depends upon such features as slope, stoniness, and depth to bedrock. The ease of establishing vegetation in the waterway is also an important soil feature.

Formation and Classification of the Soils

The major factors of soil formation and how they have affected the soils of Briscoe County are discussed in this section. The soil classification system is discused, and the soil series in the county are placed in some categories of the system.

Factors of Soil Formation

Soil is the product of the interaction of five factors of the environment. These factors are (1) parent material, (2) climate, (3) plants and animals, (4) relief, and (5) time.

Each factor has a part in determining the kind of soil that has formed, and each factor affects each of the other factors. The importance of a factor differs from place to place. In some places an intense climate is the most important factor, but in others a highly resistant, rocky parent material is the main factor that determines the character of the soil.

The following paragraphs briefly describe how each of the factors of soil formation has affected the formation of soils in Briscoe County.

Parent material

Parent material has probably influenced the soils in Briscoe County more than any other factor. The soils formed in material from two major geologic formations, the High Plains deposits and the red-bed deposits of Triassic and Permian formations.

The High Plains deposits overlie the red beds. The lower part of the deposits is the Ogallala Formation of Pliocene age. The upper part is a wind-laid mantle of Pleistocene age. The High Plains deposits are in the western part of the county. The Ogallala Formation is exposed in a narrow area along the margins of the High Plains known as the Caprock Escarpment. In this area is Burson and Quinlan soils, steep.

The wind-laid mantle of the High Plains deposits blankets the Ogallala Formation. It consists of layers of clay loam, sandy clay loam, and clay and interbedded strata of soft to hard caliche. The layers are horizons of ancient soils. Soils on uplands are mainly of the Estacado, Olton, Pullman, and Tulia series. The Randall soils are in playas that are scattered throughout the High Plains.

Triassic and Permian formations are exposed in the northern and eastern parts of the county. The topography is uneven and broken. The soils are mainly of the Burson, Obaro, and Quinlan series.

In the southern and eastern parts of the county, the Acuff, Amarillo, Berda, Olton, and Paloduro soils formed in outwash from red beds and a small part of intermixed sediment from the High Plains. In the northeastern part of the county, the Miles and Springer soils formed in eolian sandy material.

Climate

Climate has affected the soils in Briscoe County in several ways. Not enough rainfall has been received to leach, or wash, the carbonates out of the root zone of most soils. Thus, an accumulation of carbonates, or caliche, is at the average depth to which rainfall penetrates. Concentrations of carbonates are in the lower layers of Estacado, Olton, Pullman, and Tulia soils. Most of the carbonates have been leached from Miles and Springer soils, which are sandy and moderately permeable to moderately rapidly permeable.

Clay has moved downward in several soils in Briscoe County. This process is similar to leaching of carbonates but is much slower. Acuff, Amarillo, Olton, and Pullman soils have concentrations of clay in their subsoil.

Strong winds have blown material from playas to form low ridges on their eastern sides. Drake soils formed in this material. Miles, Springer, and Tivoli soils formed in sandy material blown from streambeds.

Plants and animals

Plants, earthworms, insects, micro-organisms, and other living things contribute to the development of soils. The kinds of organisms are determined mainly by the kind of parent material.

In Briscoe County, the climate has limited the vegetation mainly to grasses. Sandy soils support tall grasses, and loamy and clayey soils support mid and short grasses. When leaves and stems of grasses decay, they add organic matter mainly to the surface layer. When roots decompose, they add organic matter to the surface layer and to lower layers. Organic matter supplies food for earthworms and insects and for actinomycetes, bacteria, fungi, and other micro-organisms. The network of pores and channels left by decaying roots hastens the passage of air and water through the soil.

Earthworms are common in loamy soils. They feed on humus and decaying roots. Their castings, passageways, and burrows greatly add to the fertility of the soil and to the movement of air, roots, and water in the soil.

Micro-organisms help to release nutrients from parent material and help to decompose plant residue. They also take nitrogen from the air and store it in the soil.

Rodents tend to keep the soil mixed, which offsets the downward leaching of carbonates and clays. They help to distribute organic matter to the lower layers.

Relief

Relief influences the formation of soils through its effect on drainage and runoff. The rate of soil profile development depends mainly on the amount of moisture that passes downward through the soil. Sloping to steep soils are subject to runoff and soil losses; therefore, they generally have thinner profiles than less sloping soils. Olton and Pullman soils are nearly level to gently sloping and are deep. Very shallow to shallow Burson soils and shallow Quinlan soils are sloping to steep.

Randall soils have been affected by relief. They are in playa bottoms and are somewhat poorly drained. The poor drainage has caused a reduction of iron in these soils and probably accounts for their having clays that differ from those of surrounding well-drained soils.

Time

The length of time that parent material has been in place is reflected in the degree of development of the soil profile. A well developed soil in Briscoe County has had the free carbonates leached out of the upper part of the profile. A concentration of clays has accumulated in the subsoil, and soil horizons are well expressed.

Acuff, Amarillo, Olton, and Pullman soils are well developed. They formed on stable landforms that have not changed much since the original parent material was laid down. These soils have approached an equilibrium with the environment.

Soils that show little evidence of change from the parent material are the calcareous Berda, Mobeetie, Obaro, and Paloduro soils. Carbonates have begun to move into the lower layers, but there is no evidence of clay movement.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and range; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification used was adopted by the National Cooperative Soil Survey in 1965.[5] Because this system is under continual study, readers interested in developments of the current system should search the latest literature available (*7*).

The current system of classification has six categories. Beginning with the broadest, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable (*8*). The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 7, the soil series of Briscoe County are placed in family, subgroup, and order according to the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol). The six orders of the soils of Briscoe County are Alfisols, Aridisols, Entisols, Inceptisols, Mollisols, and Vertisols.

Alfisols have a light-colored surface layer that is low in organic matter, a clay-enriched B horizon, an accumulation of aluminum and iron, and a base saturation of more than 35 percent.

Aridisols have a light-colored surface layer that is low in organic matter, and they do not have adequate moisture to mature a crop without irrigation in most years.

[5] See the unpublished working document "Selected Chapters from the Unedited Text of the Soil Taxonomy," available in the Soil Conservation Service State Office, Temple, Texas.

Entisols have little or no evidence of development of pedogenic horizons.

Inceptisols have a light-colored surface layer that is low in organic matter, but they lack a clay-enriched B horizon.

Mollisols have a dark-colored surface layer that is high in organic matter, and they have a base saturation of more than 50 percent.

Vertisols are clayey soils that have deep, wide cracks during a part of each year in most years.

SUBORDER: Each order is divided into suborders that are based mainly on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or the absence of waterlogging or soil differences that result from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is Ustoll (*Ust*, meaning of dry climate, and *oll* from Mollisol).

GREAT GROUP: Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and those that have thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium) dark-red and dark-brown colors associated with basic rock, and

TABLE 7.—*Classification of soil series*

Series	Family	Subgroup	Order
Acuff	Fine-loamy, mixed, thermic	Aridic Paleustolls	Mollisols.
Amarillo	Fine-loamy, mixed, thermic	Aridic Paleustalfs	Alfisols.
Berda	Fine-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Burson	Loamy, mixed (calcareous), thermic, shallow	Ustic Torriorthents	Entisols.
Clairemont	Fine-silty, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.
Drake	Fine-loamy, mixed (calcareous), thermic	Typic Ustorthents	Entisols.
Enterprise	Coarse-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Estacado	Fine-loamy, mixed, thermic	Calciorthidic Paleustolls	Mollisols.
Lincoln	Sandy, mixed, thermic	Typic Ustifluvents	Entisols.
Lipan	Fine, montmorillonitic, thermic	Entic Pellusterts	Vertisols.
Lofton	Fine, mixed, thermic	Torrertic Argiustolls	Mollisols.
Miles	Fine-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Mobeetie	Coarse-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Obaro	Fine-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Olton	Fine, mixed, thermic	Aridic Paleustolls	Mollisols.
Paloduro	Fine-loamy, mixed, thermic	Aridic Haplustolls	Mollisols.
Polar	Loamy-skeletal, mixed, thermic	Ustollic Calciorthids	Aridisols.
Pullman	Fine, mixed, thermic	Torrertic Paleustolls	Mollisols.
Quinlan	Loamy, mixed, thermic, shallow	Typic Ustochrepts	Inceptisols.
Randall	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Roscoe	Fine, montmorillonitic, thermic	Typic Pellusterts	Vertisols.
Springer	Coarse-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Spur	Fine-loamy, mixed, thermic	Fluventic Haplustolls	Mollisols.
Stamford	Fine, montmorillonitic, thermic	Typic Chromusterts	Vertisols.
Tivoli	Mixed, thermic	Typic Ustipsamments	Entisols.
Tulia	Fine-loamy, carbonatic, thermic	Calciorthidic Paleustalfs	Alfisols.
Yahola	Coarse-loamy, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.

the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haplustolls (*Hapl,* meaning simple horizons, *ust* for dry climate, and *oll,* from Mollisol).

SUBGROUP: Each great group is divided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Aridic Haplustolls.

FAMILY: Soil families are defined within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on that are used as family differentiae as shown in table 7. An example is the fine-loamy, mixed, thermic family of Aridic Haplustolls.

SERIES: The series consists of a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile.

General Nature of the County

This section provides information of general interest about Briscoe County. It briefly discusses the climate, geology, and history, development, and settlement of the county.

Climate [6]

Briscoe County has a cool-temperate, dry steppe climate characterized by mild winters. Rainfall averages 20.77 inches annually. Amounts vary considerably from month to month and from year to year. More than 84 percent of the average total precipitation falls during thunderstorms in the warm season, April through October. May and June are the wettest months, but July and August are wet months when compared to other areas of Texas. Facts about temperature and precipitation are given in table 8.

The prevailing wind at Silverton is southerly throughout the year, which lessens the impact of cold spells in winter. Winds are mainly southwesterly in November through April and southerly in May through October. Silverton receives about 73 percent of the total possible sunshine annually. In winter, the percentage of possible sunshine received is 67 percent; in spring, 70 percent; in summer, 77 percent; and in fall, 75 percent. At noon the relative humidity averages 50 percent in January, 40 percent in April, 44 percent in July, and 45 percent in October.

The average length of the warm season (freeze-free period) is 214 days at Silverton. The average date of the last occurrence of 32° F or below in spring is April 6, and the first occurrence of 32° or below in fall is November 6. During an average year, free water (lake) evaporation exceeds precipitation by 48 inches.

In winter, frequent surges of polar Canadian air bring strong northerly winds and sharp drops in temperature. Cold spells are brief because they are moderated by sunshine and southwesterly winds. Freezes occur almost every night, but days are usually sunny. Winter is dry, and few thunderstorms occur. Precipitation most often falls in the form of light snow. A few exceptionally heavy snows occur.

In spring, the weather frequently changes. Warm and cold spells follow each other in rapid succession throughout March and April, which are the windiest months of the year. Infrequently, strong and persistent southwesterly to northwesterly winds cause duststorms in the area. Thunderstorm activity increases through the spring and reaches a peak in May and June.

Summer is pleasant. Afternoon temperatures are sometimes hot, but most nights are pleasantly cool. Thundershowers and their associated cloud cover limit hot spells to brief periods. A few late spring and early summer thunderstorms may be accompanied by damaging wind and hail.

Fall is also pleasant, and the weather is more varied than in summer. Rainfall decreases progressively from September through November. Mild, sunny days and crisp, cool nights characterize this season.

Geology

Rock of four major geologic systems is exposed in Briscoe County (fig. 15). This rock is of the Permian System of the Paleozoic Era, the Triassic System of the Mesozoic Era, and the Tertiary System and Quarternary System of the Cenozic Era (*3, 4, 5, 6*).

During the Permian Period, some 225 to 280 million years ago, a large area that included nearly all of the Texas Panhandle, the eastern part of New Mexico, and the western part of Oklahoma was covered by a shallow sea. In the Briscoe County area, the sediment that was deposited in this sea is characterized by reddish, very fine grained siltstone and sandstone interstratified with thin layers of gypsum. These red beds make up the Whitehorse Sandstone, Cloud Chief Gypsum, and Quartermaster Formation. Exposures of these rocks are on the Palo Duro Breaks, along Prairie Dog Town Fork of the Red River, and in the lower part of the rough country along the Caprock Escarpment.

During the Triassic Period, some 190 to 225 million years ago, the Permian red beds were uplifted. Streams in uplands adjacent to the Panhandle region eroded the exposed rocks of the Permian System. The Tecovas Formation and the Trujillo Formation of the Dockum Group are made up of material reworked and redeposited by these streams. The group consists of light-brown sandstone and reddish, purplish, and maroon clay (*6*). The Triassic rocks are exposed in the

[6] By ROBERT B. ORTON, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

TABLE 8.—*Temperature*

[Data from Silverton, 1941–70;

Month	Temperature				Precipitation			
					Average total	Probability of receiving—		
	Average daily maximum	Average monthly maximum	Average daily minimum	Average monthly minimum		0 or trace	0.50 inch or more	1 inch or more
	°F	°F	°F	°F	In	Pct	Pct	Pct
January	51.0	73.9	20.4	-0.1	0.73	5	49	27
February	55.6	78.1	24.6	9.6	.53	10	50	25
March	61.1	83.0	30.4	13.0	.72	11	57	33
April	72.8	88.3	42.7	29.8	1.51	1	80	55
May	81.2	95.8	51.3	36.1	3.17	([2])	96	90
June	86.4	98.1	59.6	50.8	3.69	([2])	88	75
July	91.7	98.3	64.8	58.1	2.61	([2])	80	68
August	89.2	99.1	62.3	54.5	2.48	2	80	68
September	80.8	94.0	55.1	42.0	2.28	4	79	60
October	73.9	89.9	43.3	30.4	1.69	5	77	76
November	62.4	80.6	33.1	19.5	.61	18	40	24
December	53.8	73.6	23.8	9.1	.75	10	50	30
Year	71.7		42.6		20.77			

[1] For the period 1962–70.

[2] Less than 1 percent.

upper part of the steep country along the Caprock Escarpment.

During the Pliocene Epoch of the Tertiary Period, some 2 to 12 million years ago, the Ogallala Formation was deposited. Streams, flowing eastward from the rising Rocky Mountain mass, cut valleys and canyons through the formation of the Triassic Period and in some places into the underlying Permian red beds. The climate in this area was subtropical and was more humid than it is now. Early Pliocene streams carried cobbles, gravel, and sand down the mountain slopes and into the valleys cut into Mesozoic and Paleozoic rocks. This valley-filling, alluvial, outwash material makes up the basal strata of the Ogallala Formation. It forms the aquifer for existing underground irrigation water supplies. Finer textured gravelly, sandy, and loamy sediment was then deposited, and valley systems were completely filled. Alluvial aprons spread over the Triassic red beds until the entire pre-Ogallala surface was covered. The build-up continued gradually until a vast plain was formed, which extends several hundred miles east of the Rocky Mountains (*3*).

The Ogallala Formation once covered the entire area, but it was eroded away during the Pleistocene and Holocene Epochs, or Quarternary Period, from all but the western part of the county. The formation ranges from 200 feet to about 600 feet in thickness. It is capped with a thick caliche zone and is exposed along the Caprock Escarpment, where it forms picturesque, whitish to buff-colored cliffs and steep slopes.

The next major geological events were (1) the deposition of the mantle of windblown sediment that blankets the Ogallala Formation on the Southern High Plains, (2) the development and filling of several ages of playa lake basins, and (3) the cutting of stream valleys below the surface of the High Plains. The eolian deposits were mostly laid down during the middle to late part of the Pleistocene Epoch and are informally designated "windblown cover sands" by geologists (*3*). The climate at time was presumed to be dry, windy, and dessicating, and the prevailing wind was from the southwest. During this period, the Pecos River Valley was forming to the west and south. The winds carried medium and fine textured sediment from this river valley and redeposited it over much of the High Plains surface. The grain size became finer to the northeast (*4*). The resultant mantle of loess-like deposit locally exceeds 25 feet in thickness, but it is generally thinner (*3*). This sediment is dominantly fine textured clays, clay loams, loams, and sandy clay loams; thus the term "cover sand" is misleading. The surface is very smooth and nearly level except for the playa depressions, which are scattered over the plains and receive much of the runoff (*4, 6*). Estacado, Olton, Pullman, and Randall are the main soils. At present agents of erosion are slowly wearing away the edges of the High Plains tableland, but the surface above the Caprock Escarpment is very stable.

The Tule Formation in the western part of Briscoe County was deposited during the middle Pleistocene Epoch. It probably comprises both stream and perennial lake deposits laid down about 0.6 million years ago in a large basin, which subsequently has been partly dissected by Tule Creek (*3*). The formation is exposed in the broken and rough country northwest of Silverton. The exposures are strikingly light in color and range from white to light gray.

The surface sediment in the eastern part of the *and precipitation*

elevation 3,280 feet]

Precipitation—*Continued*										
Probability of receiving—*Cont'd.*					Average number of days with precipitation of—			Snow and sleet		
2 inches or more	3 inches or more	4 inches or more	5 inches or more	6 inches or more	0.10 inch or more	0.50 inch or more	1 inch or more	Average total	Maximum	Greatest depth
Pct	*Pct*	*Pct*	*Pct*	*Pct*				*In*	*In*	*In*
7	2	([2])	([2])	([2])	1	1	0	2.4	11.0	10
5	1	([2])	([2])	([2])	2	([3])	0	1.3	0	19
10	4	2	([2])	([2])	3	([3])	([3])	2.1	12.0	0
25	10	5	1	1	3	1	([3])	([4])	([4])	0
70	50	35	25	17	5	2	1	([4])	([4])	0
55	35	22	13	11	7	3	1	0	0	0
40	21	11	7	5	4	2	([3])	0	0	0
40	25	12	8	5	4	1	1	0	0	0
35	22	12	8	4	3	2	1	0	0	0
36	23	13	8	4	3	1	([3])	([4])	.3	0
7	3	2	([2])	([2])	2	1	([3])	.4	3.5	0
10	5	2	1	0	2	([3])	([3])	1.3	0	11
----------	----------	----------	----------	----------	39	14	4	7.5	----------	19

[3] Less than one-half day.

[4] Trace.

county is outwash deposits of Quaternary age. The main soils are Acuff, Amarillo, Miles, Olton, and Springer soils.

The most recent sediment is the alluvial deposits along the rivers and streams in the southeastern part of the county and along the Prairie Dog Town Fork of the Red River. The main soils are Lincoln and Yahola soils.

History, Development, and Settlement

Briscoe County was formed in 1876 from Bexar County and was formally organized in 1892. It was named for Andrew Briscoe, a Republic of Texas soldier. The county was one of the last strongholds for Indian tribes who found the recesses of Tule Canyon excellent grazing grounds for antelope and buffalo. Quitaque was the scene of the last Indian battle in the county.

Settlement of the county was delayed because the topography was rough and Indian raids were a danger. The Quitaque Ranch, which covered parts of Briscoe, Floyd, and Hall counties and had its headquarters just south of Quitaque Creek, was fenced in 1883. The Land Act of 1887 opened the area to settlement by allowing settlers to take up either 3 sections of rangeland or 1 section of farmland. By 1880, Quitaque was a stage stop that had a population of 30. Silverton was established as the county seat in 1892. The first cotton gin was built in 1912.

Farming gradually developed during the early 1900's, and the county became an area of extensive dryland farming and ranching. Wheat, cotton, and grain sorghum were the main crops. When drought struck the Great Plains area during the 1930's, duststorms, lack of rainfall, and low market prices forced many farmers to leave Briscoe County. Rainfall increased during the early years of the 1940's, and irrigation from deep wells was begun about that time. Farmers and ranchers began to prosper again. Irrigation, improved farming practices, and better outlets for farm products have produced a stable farm economy.

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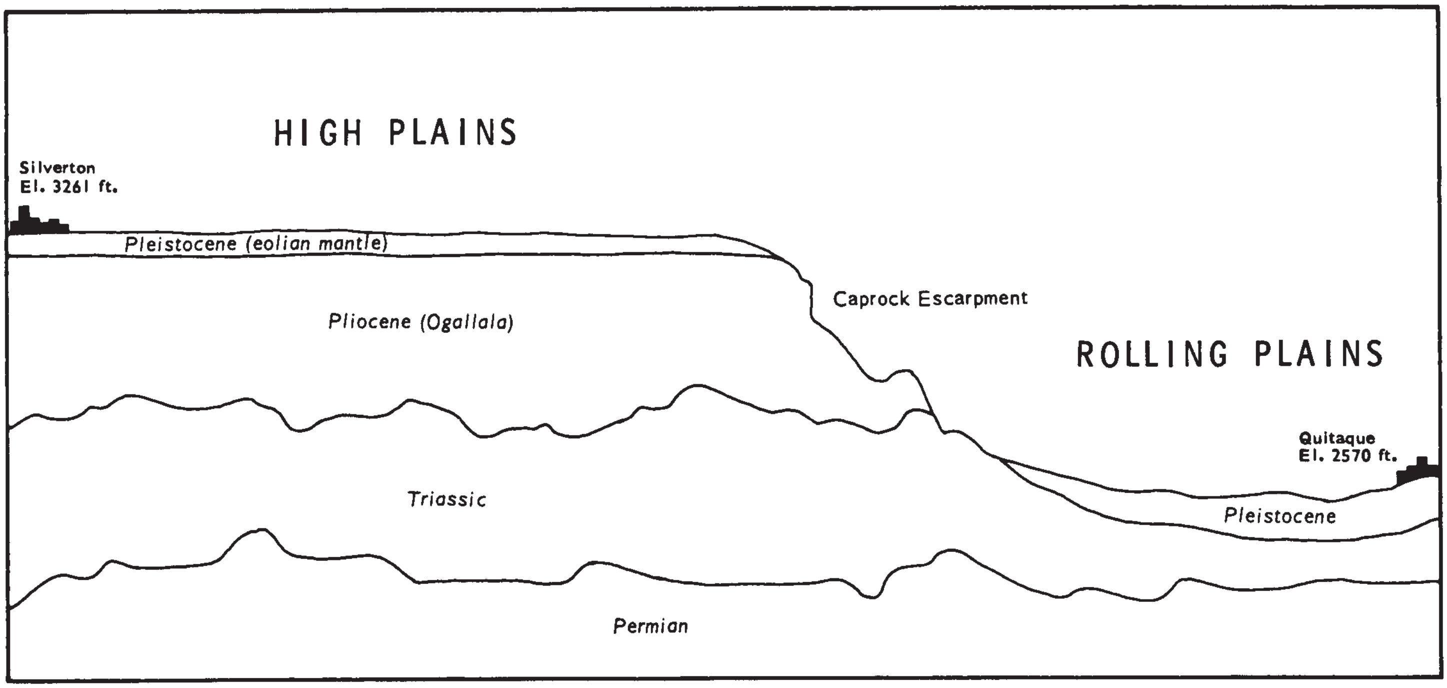

Figure 15.—**Generalized geologic section betwen Silverton and Quitaque.**

Glossary

ABC soil. A soil that has a complete profile, including an A, a B, and a C horizon.

AC soil. A soil that has an A and a C horizon but no B horizon. Commonly such soils are immature, as those developing from alluvium or those on steep, rocky slopes.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Bench terrace. A shelflike embankment of earth that has a level or nearly level top and a steep or nearly vertical downhill face, constructed along the contour of sloping land or across the slope to control runoff and erosion. The downhill face of the bench may be made of rocks or masonry, or it may be planted to vegetation.

Blowout. An excavation produced by wind action in loose soil, usually sand.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the southwestern states. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Chiseling. Tillage of soil with an implement having one or more soil penetrating points that loosen the subsoil and bring *clods* to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizons above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site; it reproduces itself and does not change as long as the environment does not change.

Coarse fragments. Mineral or rock particles more than 2 millimeters in diameter.

Complex slope. Slopes are short and irregular.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Cutbanks cave. Walls of cuts are not stable.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Deferred grazing. The practice of delaying grazing until range plants have reached a definite stage of growth, in order to increase the vigor of the forage and to allow the desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Erosion pavement. A layer of gravel or stones on the ground surface that remains after the fine particles are removed by wind or water. Desert pavements result from exposure to dry winds.

Excess lime. Carbonates restrict plant growth.

Fallow. Cropland left idle in order to restore productivity, mainly through accumulation of water, nutrients, or both. Summer fallow is a common stage before cereal grain in regions of limited rainfall. The soil is tilled for at least one growing season to control weeds, to aid decomposition of plant residues, and to encourage the storage of moisture for the succeeding grain crop.

Fast intake. Water infiltrates rapidly.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity*, or *capillary capacity.*

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.

Gilgai. Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and microknolls, in nearly level areas, or of microvalleys and microridges that run with the slope.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

Gypsum. Calcium sulphate.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size —*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Percs slowly. Water moves through the soil too slowly.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Piping. Water can form tunnels or pipelike cavities in the soil.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Poorly graded. A soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock. Only the upper part of this, modified by organisms and other soil-building forces, is regarded by soil scientists as soil. Most American engineers speak of the whole regolith, even to great depths, as "soil."

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. If two sequa are present in a single soil profile, it is said to have a bisequum.

Shrink-swell. Soil expands significantly when wet and shrinks when dry.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tillage of a soil below normal depth ordinarily to shatter a hardpan or claypan.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Well-graded soil. A soil or soil material consisting of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when in a dark, humid atmosphere.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit read the description then check its mapping unit for recommendations on use and management. For information about a range site read the range site description and the introduction to the range section. For facts about wildlife and recreation turn to the sections beginning on pages 37 and 41, respectively. Absence of data in the column on irrigated capability units means the soil is not suited to irrigation. Other information is given in tables as follows:

Acreage and extent, table 1, page 6.
Predicted yields, table 2, page 31.

Engineering uses of the soils, tables 5 and 6, pages 44 through 53.

Map symbol	Mapping unit	Described on page	Capability unit Dryland Symbol	Capability unit Irrigated Symbol	Range site Name	Range site Page
AcA	Acuff loam, 0 to 1 percent slopes	6	IIIe-1	IIe-1	Clay Loam	33
AcB	Acuff loam, 1 to 3 percent slopes	7	IIIe-2	IIIe-1	Clay Loam	33
AmA	Amarillo fine sandy loam, 0 to 1 percent slopes	7	IIIe-3	IIe-2	Sandy Loam	37
AmB	Amarillo fine sandy loam, 1 to 3 percent slopes	8	IIIe-3	IIIe-3	Sandy Loam	37
AmC	Amarillo fine sandy loam, 3 to 5 percent slopes	8	IVe-1	IVe-1	Sandy Loam	37
BeA	Berda loam, 0 to 1 percent slopes	9	IIIe-1	IIe-1	Hardland Slopes	34
BeB	Berda loam, 1 to 3 percent slopes	9	IIIe-2	IIIe-1	Hardland Slopes	34
BeC	Berda loam, 3 to 5 percent slopes	9	IVe-2	IVe-1	Hardland Slopes	34
BeD	Berda loam, 5 to 8 percent slopes	9	VIe-1	------	Hardland Slopes	34
BpE	Berda-Polar complex, 3 to 12 percent slopes	9	VIe-1	------	Hardland Slopes	34
BQG	Burson and Quinlan soils, steep	10	VIIs-1	------	Rough Breaks	35
Cm	Clairemont silty clay loam	11	IIw-2	IIw-2	Loamy Bottomland	34
DrB	Drake loam, 1 to 3 percent slopes	11	IVe-3	IIIe-6	High Lime	34
DrC	Drake loam, 3 to 5 percent slopes	11	VIe-2	IVe-1	High Lime	34
EnD	Enterprise loam, 3 to 8 percent slopes	12	IVe-2	IVe-1	Mixedland	34
EsA	Estacado clay loam, 0 to 1 percent slopes	13	IIIe-1	IIe-1	Hardland Slopes	34
EsB	Estacado clay loam, 1 to 3 percent slopes	13	IIIe-2	IIIe-1	Hardland Slopes	34
EsC	Estacado clay loam, 3 to 5 percent slopes	13	IVe-2	IVe-1	Hardland Slopes	34
Lf	Lincoln soils, frequently flooded	14	Vw-2	------	Sandy Bottomland	37
Ln	Lipan clay	14	IIIw-1	IIw-1	Clay Loam	33
Lo	Lofton clay loam	15	IIIe-5	IIs-1	Clay Loam	33
MeB	Miles loamy fine sand, 0 to 3 percent slopes	16	IIIe-6	IIIe-5	Sandy	36
MoB	Mobeetie fine sandy loam, 0 to 3 percent slopes	16	IIIe-3	IIIe-3	Mixedland Slopes	35
ObB	Obaro loam, 1 to 3 percent slopes	17	IIIe-4	IIIe-4	Mixedland	34
ObC	Obaro loam, 3 to 5 percent slopes	17	IVe-2	IVe-1	Mixedland	34
OQE	Obaro and Quinlan soils, rolling	17	VIe-3	------	Mixedland	34
OtA	Olton clay loam, 0 to 1 percent slopes	18	IIIe-1	IIe-1	Clay Loam	33
OtB	Olton clay loam, 1 to 3 percent slopes	18	IIIe-2	IIIe-1	Clay Loam	33
PaA	Paloduro loam, 0 to 1 percent slopes	19	IIIe-1	IIe-1	Hardland Slopes	34
PaB	Paloduro loam, 1 to 3 percent slopes	19	IIIe-2	IIIe-1	Hardland Slopes	34
PuA	Pullman clay loam, 0 to 1 percent slopes	21	IIIe-5	IIs-1	Clay Loam	33
PuB	Pullman clay loam, 1 to 3 percent slopes	21	IIIe-7	IIIe-2	Clay Loam	33
QBG	Quinlan and Burson soils, hilly	22	VIe-3	------	---------------	--
	Quinlan soil	--	------	------	Mixedland	34
	Burson soil	--	------	------	Very Shallow	37
Ra	Randall clay	23	VIw-1	------	1/	--
Ro	Roscoe clay	24	IIIw-1	IIw-1	Clay Loam	33
SfD	Springer loamy fine sand, 3 to 8 percent slopes	25	VIe-4	IVe-2	Sandy	36
Sp	Spur loam	25	IIw-2	IIw-2	Valley	37
StA	Stamford clay, 0 to 1 percent slopes	26	IIs-1	IIs-1	Clay Flats	33
TfF	Tivoli fine sand	26	VIIe-1	------	Deep Sand	33
TuB	Tulia loam, 1 to 3 percent slopes	27	IVe-3	IIIe-6	Hardland Slopes	34
TuC	Tulia loam, 3 to 5 percent slopes	27	IVe-2	IVe-1	Hardland Slopes	34
TxD	Tulia and Estacado soils, 5 to 8 percent slopes	27	VIe-1	------	Hardland Slopes	34
Ya	Yahola fine sandy loam	28	IIw-1	IIe-3	Loamy Bottomland	34
Yf	Yahola fine sandy loam, frequently flooded	28	Vw-1	------	Loamy Bottomland	34

1/ Included with the surrounding range site.

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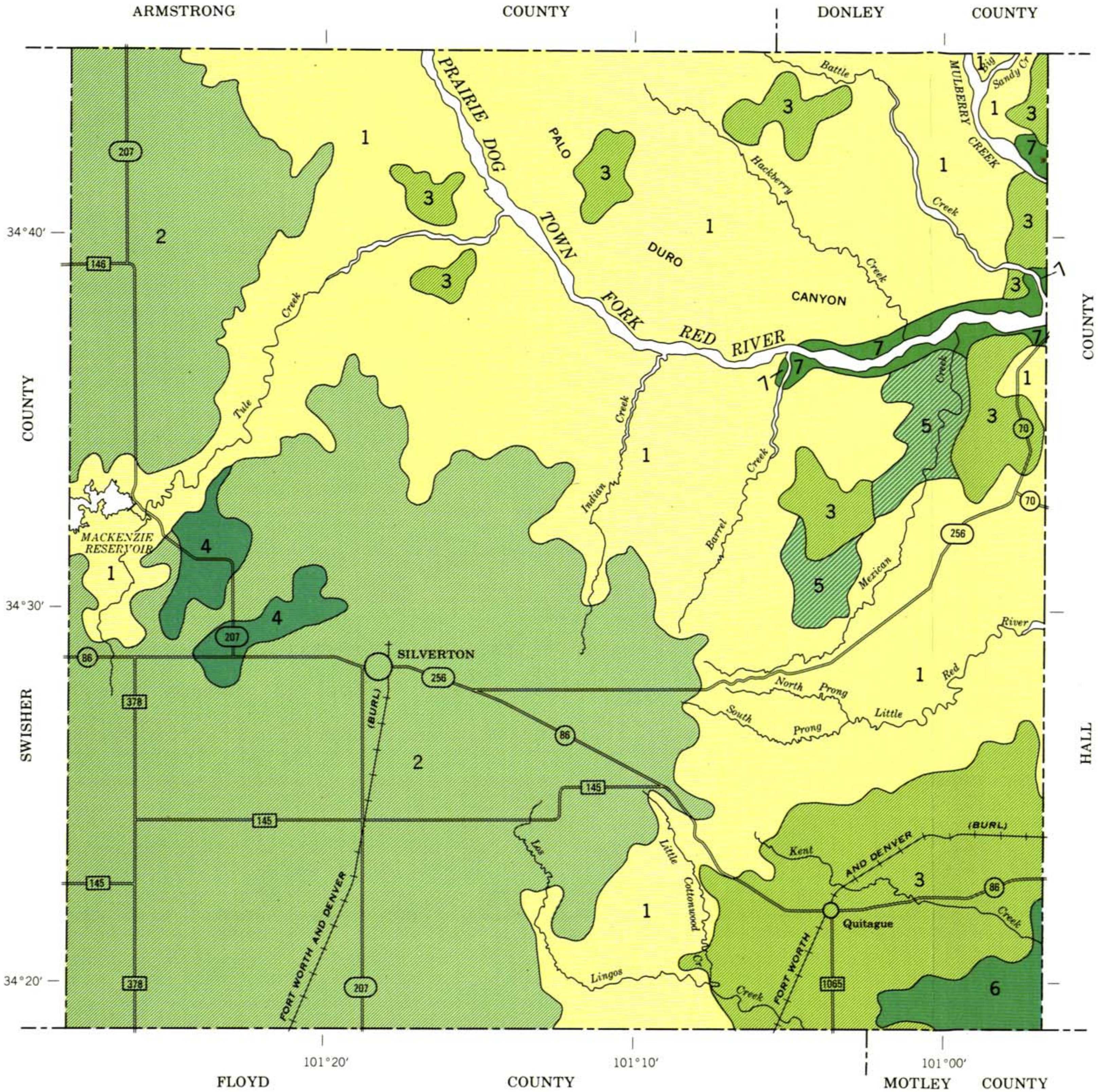

SOIL ASSOCIATIONS

1 Quinlan-Burson-Obaro association: Very shallow to deep, gently sloping to hilly and steep, moderately permeable and moderately rapidly permeable loams on uplands

2 Pullman association: Deep, nearly level to gently sloping, very slowly permeable clay loams on smooth uplands

3 Amarillo-Olton-Acuff association: Deep, nearly level to gently sloping, moderately permeable and moderately slowly permeable loams, clay loams, and fine sandy loams on smooth uplands

4 Olton association: Deep, nearly level to gently sloping, moderately slowly permeable clay loams on uplands

5 Berda-Enterprise association: Deep, gently sloping to sloping, moderately permeable and moderately rapidly permeable loams on uplands

6 Springer-Miles association: Deep, nearly level to undulating, moderately permeable and moderately rapidly permeable loamy fine sands on uplands

7 Lincoln-Yahola association: Deep, nearly level, moderately rapidly permeable and rapidly permeable loamy fine sands and fine sandy loams on bottomlands

Compiled 1976

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U.S. DEPARTMENT OF AGRICULTURE,
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

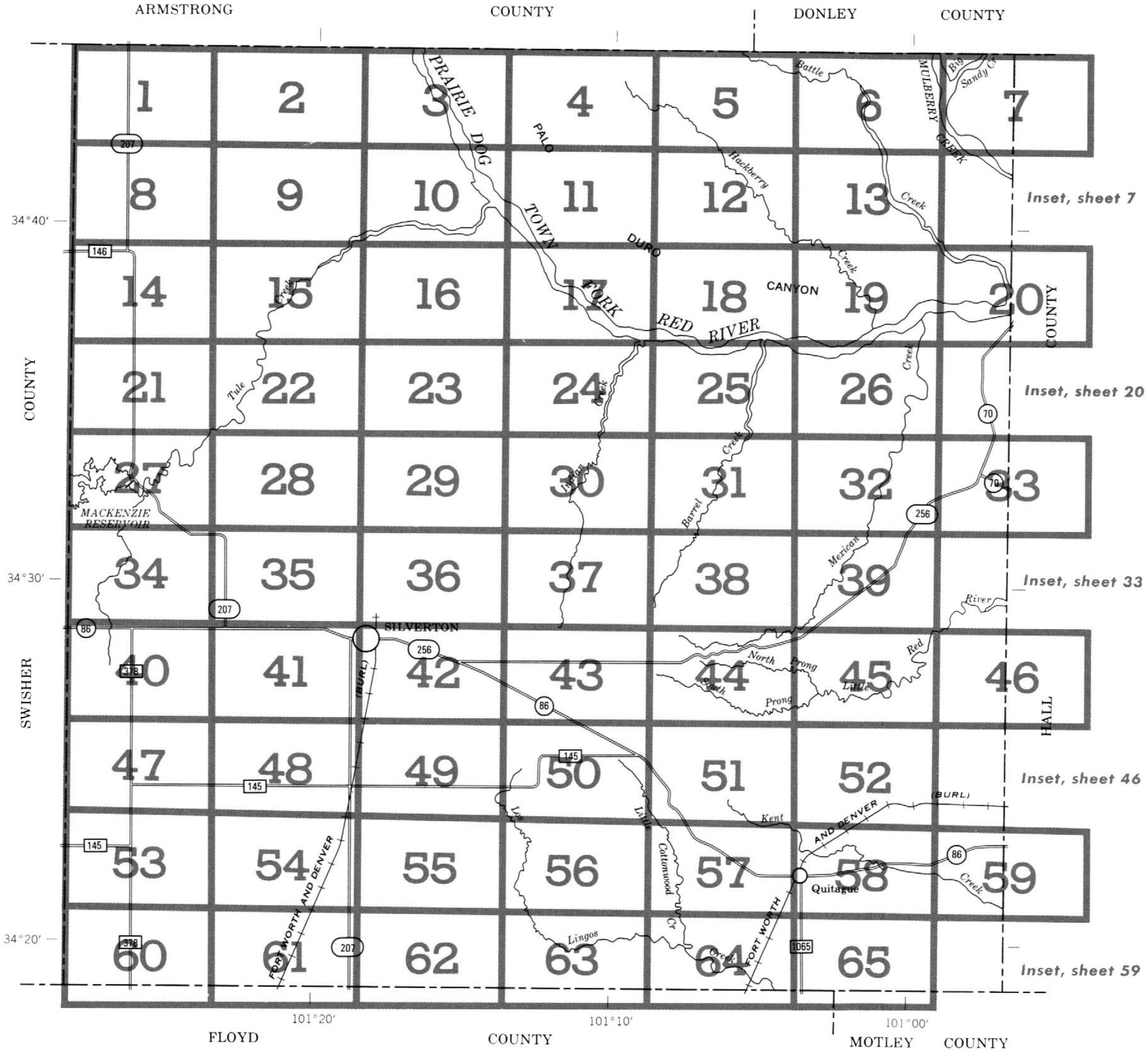
GENERAL SOIL MAP

BRISCOE COUNTY TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



Original text from each individual map sheet read:
This map is compiled on 1974 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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INDEX TO MAP SHEETS

BRISCOE COUNTY TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second letter is a capital if the mapping unit is broadly defined *; otherwise, it is a small letter. The third letter, always a capital, shows the slope. Symbols without slope letters are those of nearly level soils. (W) following the soil name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in some places, but the degree of erosion cannot be estimated reliably.

SYMBOL	NAME
AcA	Acuff loam, 0 to 1 percent slopes
AcB	Acuff loam, 1 to 3 percent slopes
AmA	Amarillo fine sandy loam, 0 to 1 percent slopes (W)
AmB	Amarillo fine sandy loam, 1 to 3 percent slopes (W)
AmC	Amarillo fine sandy loam, 3 to 5 percent slopes (W)
BeA	Berda loam, 0 to 1 percent slopes
BeB	Berda loam, 1 to 3 percent slopes
BeC	Berda loam, 3 to 5 percent slopes
BeD	Berda loam, 5 to 8 percent slopes
BpE	Berda-Polar complex, 3 to 12 percent slopes
BQG	Burson and Quinlan soils, steep
Cm	Clairemont silty clay loam
DrB	Drake loam, 1 to 3 percent slopes
DrC	Drake loam, 3 to 5 percent slopes
EnD	Enterprise loam, 3 to 8 percent slopes
EsA	Estacado clay loam, 0 to 1 percent slopes
EsB	Estacado clay loam, 1 to 3 percent slopes
EsC	Estacado clay loam, 3 to 5 percent slopes
Lf	Lincoln soils, frequently flooded
Ln	Lipan clay
Lo	Lofton clay loam
MeB	Miles loamy fine sand, 0 to 3 percent slopes (W)
MoB	Mobeetie fine sandy loam, 0 to 3 percent slopes
ObB	Obaro loam, 1 to 3 percent slopes
ObC	Obaro loam, 3 to 5 percent slopes
OQE	Obaro and Quinlan soils, rolling
OtA	Olton clay loam, 0 to 1 percent slopes
OtB	Olton clay loam, 1 to 3 percent slopes
PaA	Paloduro loam, 0 to 1 percent slopes
PaB	Paloduro loam, 1 to 3 percent slopes
PuA	Pullman clay loam, 0 to 1 percent slopes
PuB	Pullman clay loam, 1 to 3 percent slopes
QBG	Quinlan and Burson soils, hilly
Ra	Randall clay
Ro	Roscoe clay
SfD	Springer loamy fine sand, 3 to 8 percent slopes (W)
Sp	Spur loam
StA	Stamford clay, 0 to 1 percent slopes
TfF	Tivoli fine sand (W)
TuB	Tulia loam, 1 to 3 percent slopes
TuC	Tulia loam, 3 to 5 percent slopes
TxD	Tulia and Estacado soils, 5 to 8 percent slopes
Ya	Yahola fine sandy loam
Yf	Yahola fine sandy loam, frequently flooded

* The composition of these units is more variable than that of others in the survey area but has been controlled well enough to be interpreted for the expected use of the soils.

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA; FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

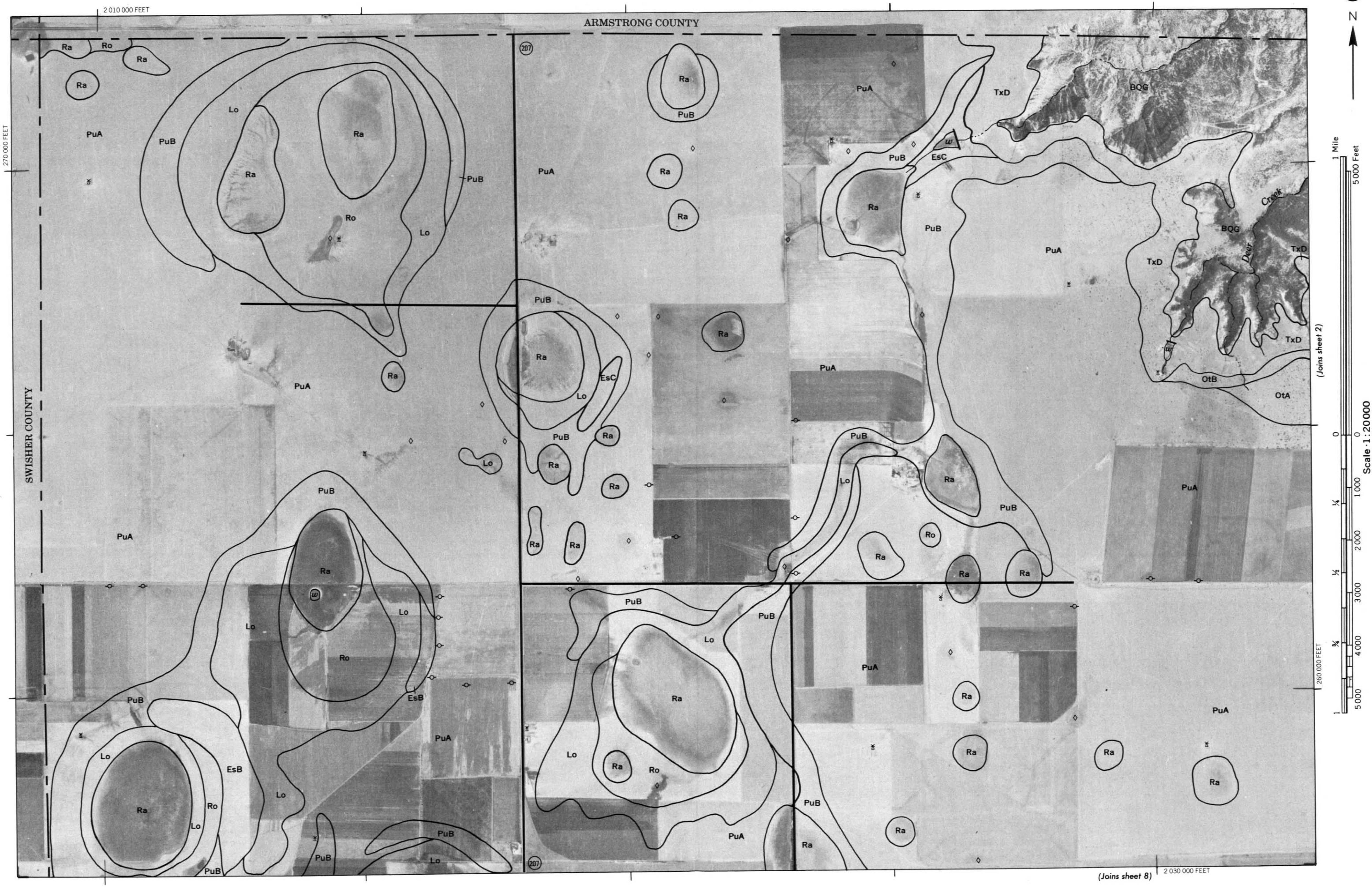
GULLY

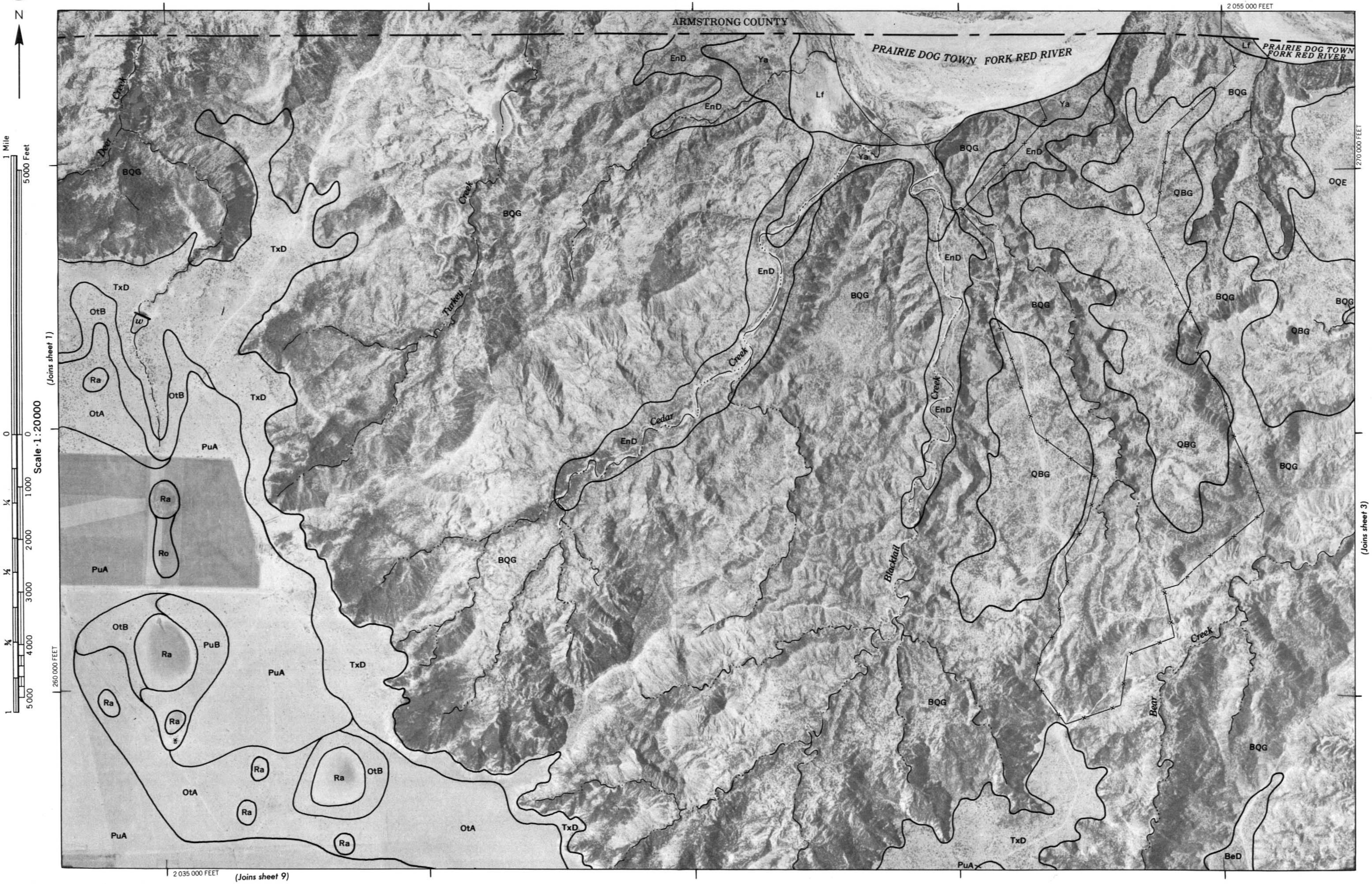
DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Caliche pit

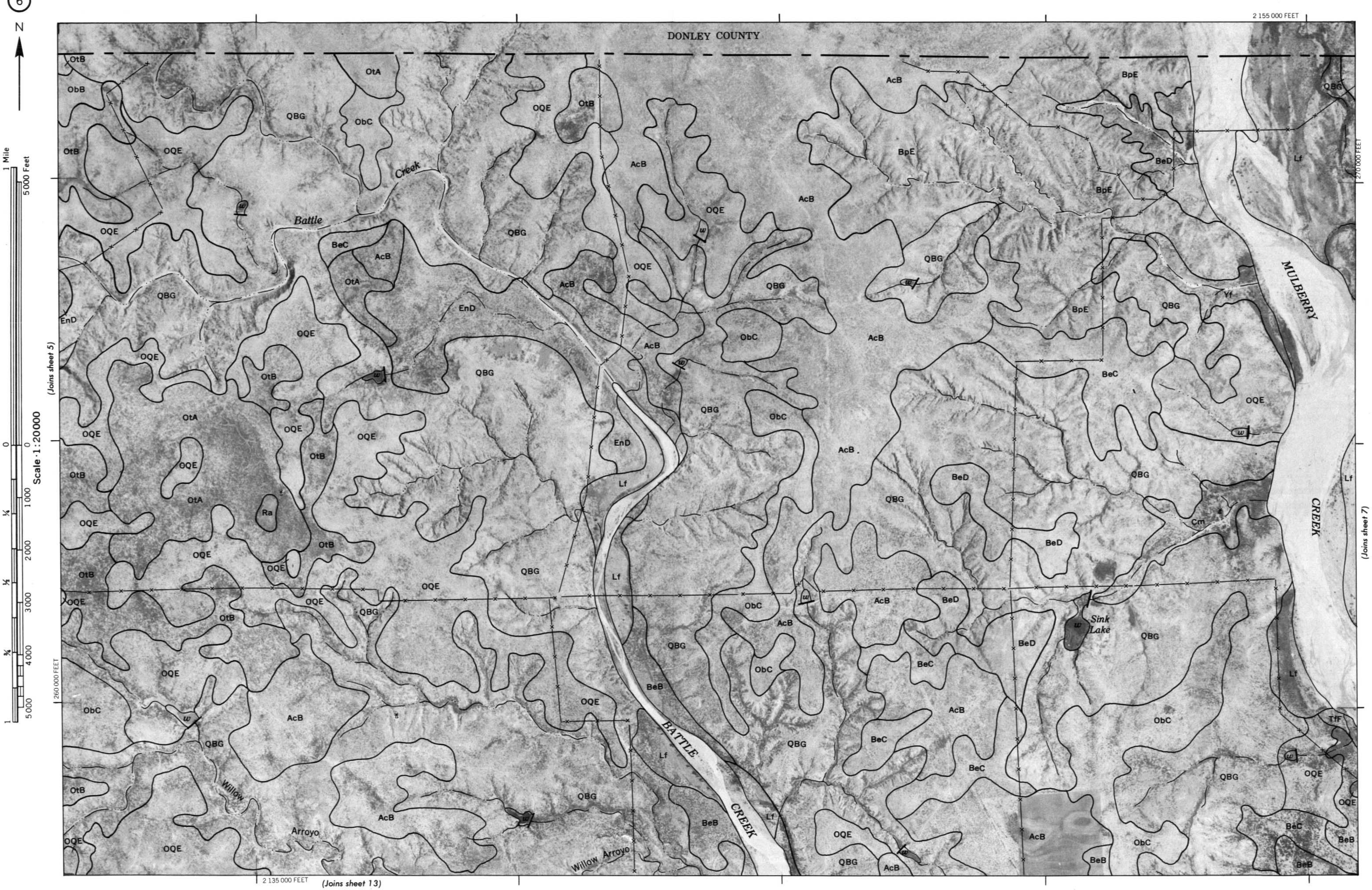

ARMSTRONG COUNTY
SWISHER COUNTY
2 010 000 FEET
270 000 FEET
260 000 FEET
2 030 000 FEET
(Joins sheet 2)
(Joins sheet 8)
N
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
Scale 1:20000
207
Deer
Creek
Ra
Ro
PuA
PuB
Lo
EsC
EsB
TxD
BQG
OtB
OtA
w


N
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 9)
2 055 000 FEET
270 000 FEET
260 000 FEET
2 035 000 FEET
ARMSTRONG COUNTY
PRAIRIE DOG TOWN FORK RED RIVER
PRAIRIE DOG TOWN FORK RED RIVER
Deer Creek
Turkey Creek
Cedar Creek
Creek
Blacktail
Bear Creek
BQG
QBG
OQE
EnD
Ya
Lf
TxD
OtB
OtA
PuA
PuB
Ra
Ro
w
BeD

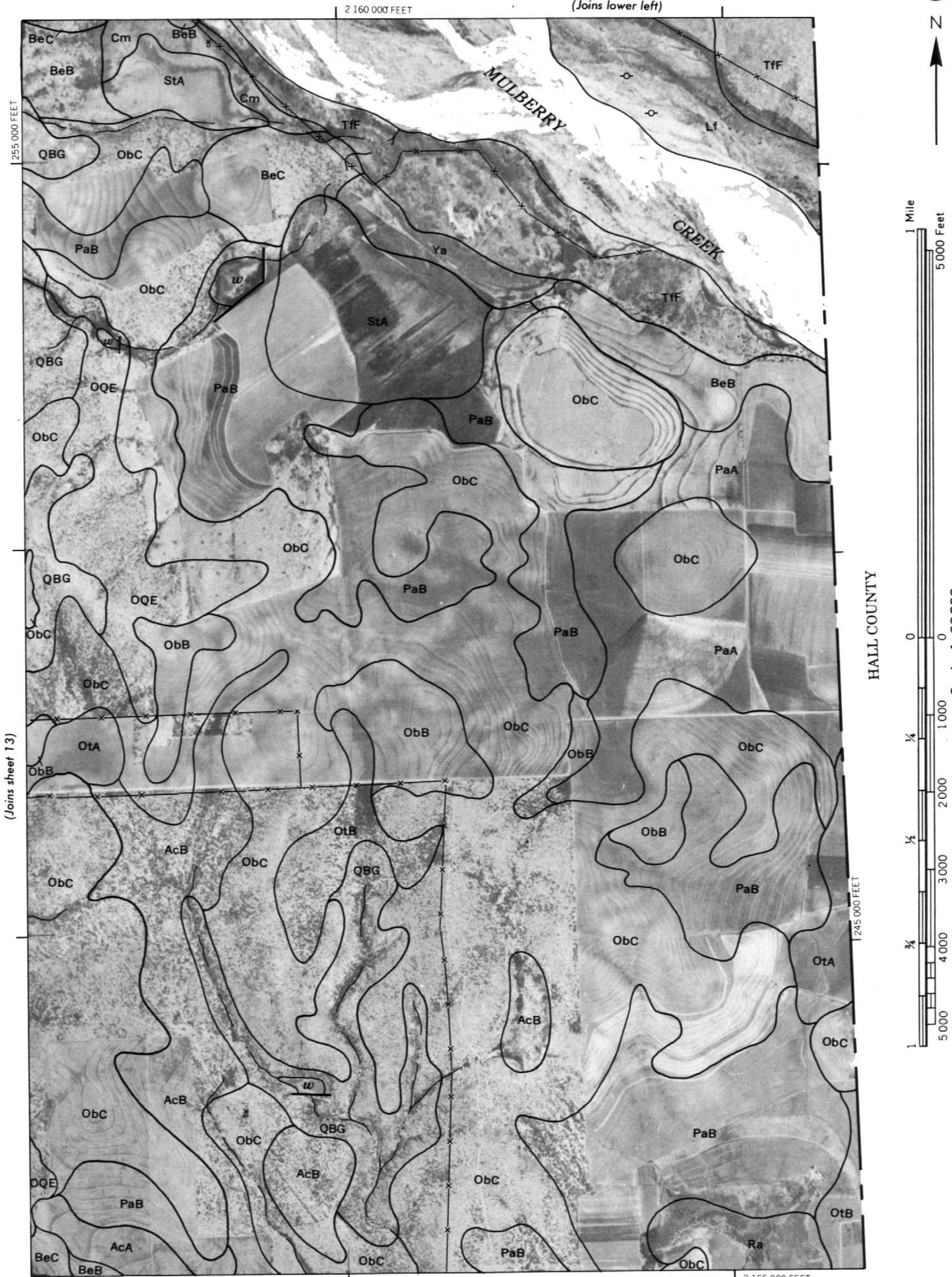
2 060 000 FEET
270 000 FEET
ARMSTRONG COUNTY
PRAIRIE DOG TOWN FORK RED RIVER
PRAIRIE DOG TOWN FORK RED RIVER
Bear Creek
Campbell Creek
Pilgrim Creek
Goodnight Canyon
Jersey Canyon
Big Betty Canyon
Big Betty Reservoir
Robbins Arroyo
OQE
BQG
QBG
EnD
Cm
Lf
Ya
OtB
Ra
w
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 10)
260 000 FEET
2 080 000 FEET
N
1 Mile
5 000 Feet
Scale 1:20000


N
1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1
ARMSTRONG COUNTY
2 105 000 FEET
270 000 FEET
260 000 FEET
2 085 000 FEET
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 11)
Arroyo
Robbins
Creek
Hardscrabble
Hackberry
Creek
Mitchell
Creek
OQE
BQG
EnD
QBG
BpE
BeD
AmC
OtB
BeC
AcB
Yf

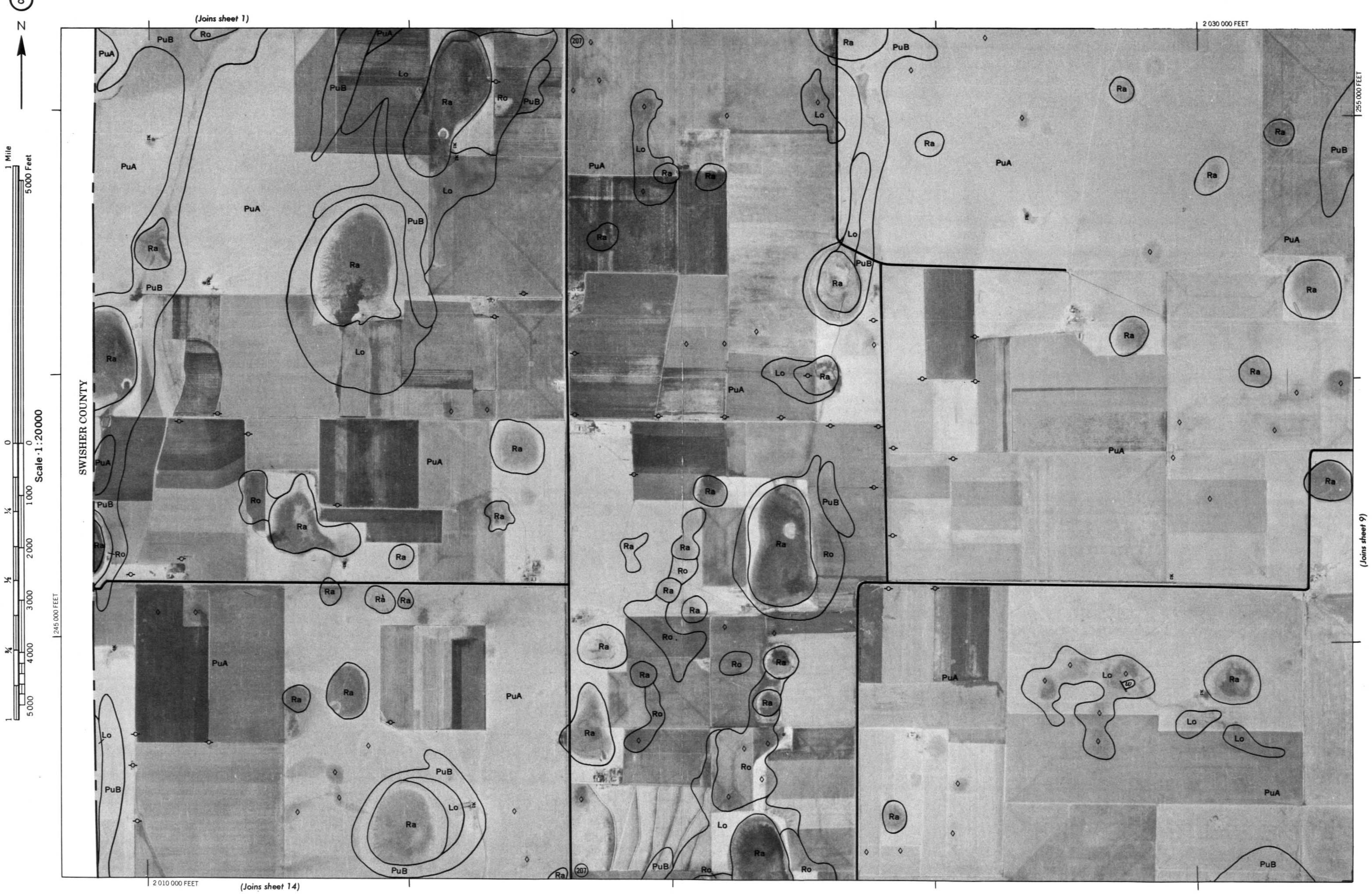

2 110 000 FEET
270 000 FEET
260 000 FEET
2 130 000 FEET
ARMSTRONG COUNTY
DONLEY COUNTY
Battle Creek
Love Arroyo
Hackberry Creek
STINKHOLE
DIVIDE
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 12)
N
Scale 1:20000
1 Mile
5000 Feet
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000
OQE
EnD
QBG
OtA
OtB
ObC
ObB
AmC
AmB
BpE
AcB
AcA
BeD
Yf
w

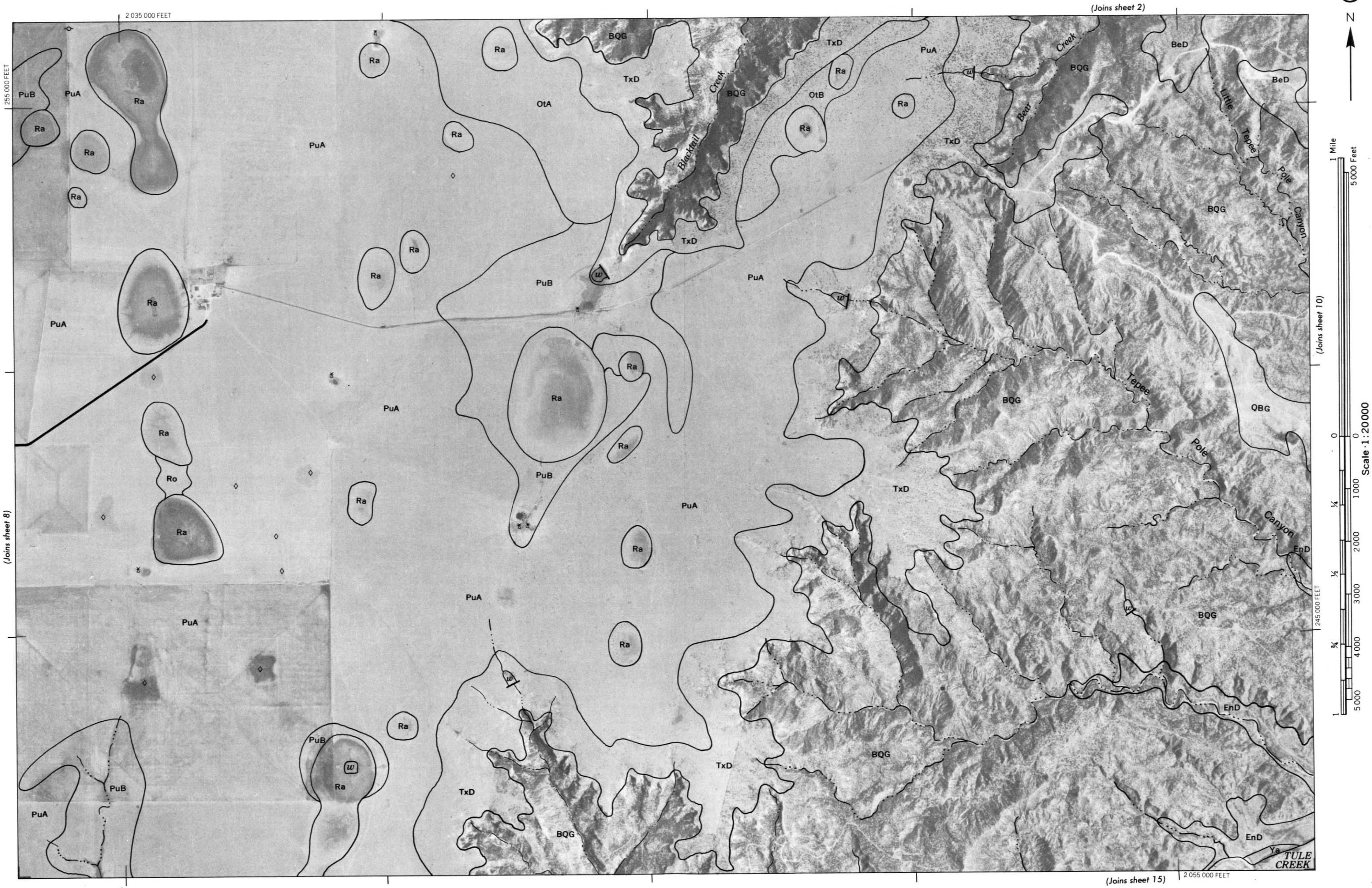

N
DONLEY COUNTY
Battle Creek
BATTLE CREEK
MULBERRY CREEK
Sink Lake
Willow Arroyo
(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 13)
2 155 000 FEET
2 135 000 FEET
270 000 FEET
260 000 FEET
Scale 1:20000
1 Mile
5000 Feet


2 160 000 FEET
DONLEY COUNTY
HALL COUNTY
(Joins sheet 6)
(Joins upper right)
2 165 000 FEET
270 000 FEET
260 000 FEET
BIG SANDY CREEK
MULBERRY CREEK


2 160 000 FEET
(Joins lower left)
255 000 FEET
245 000 FEET
MULBERRY CREEK
HALL COUNTY
(Joins sheet 13)
(Joins sheet 20)
2 165 000 FEET
N
1 Mile
5 000 Feet
Scale 1:20000

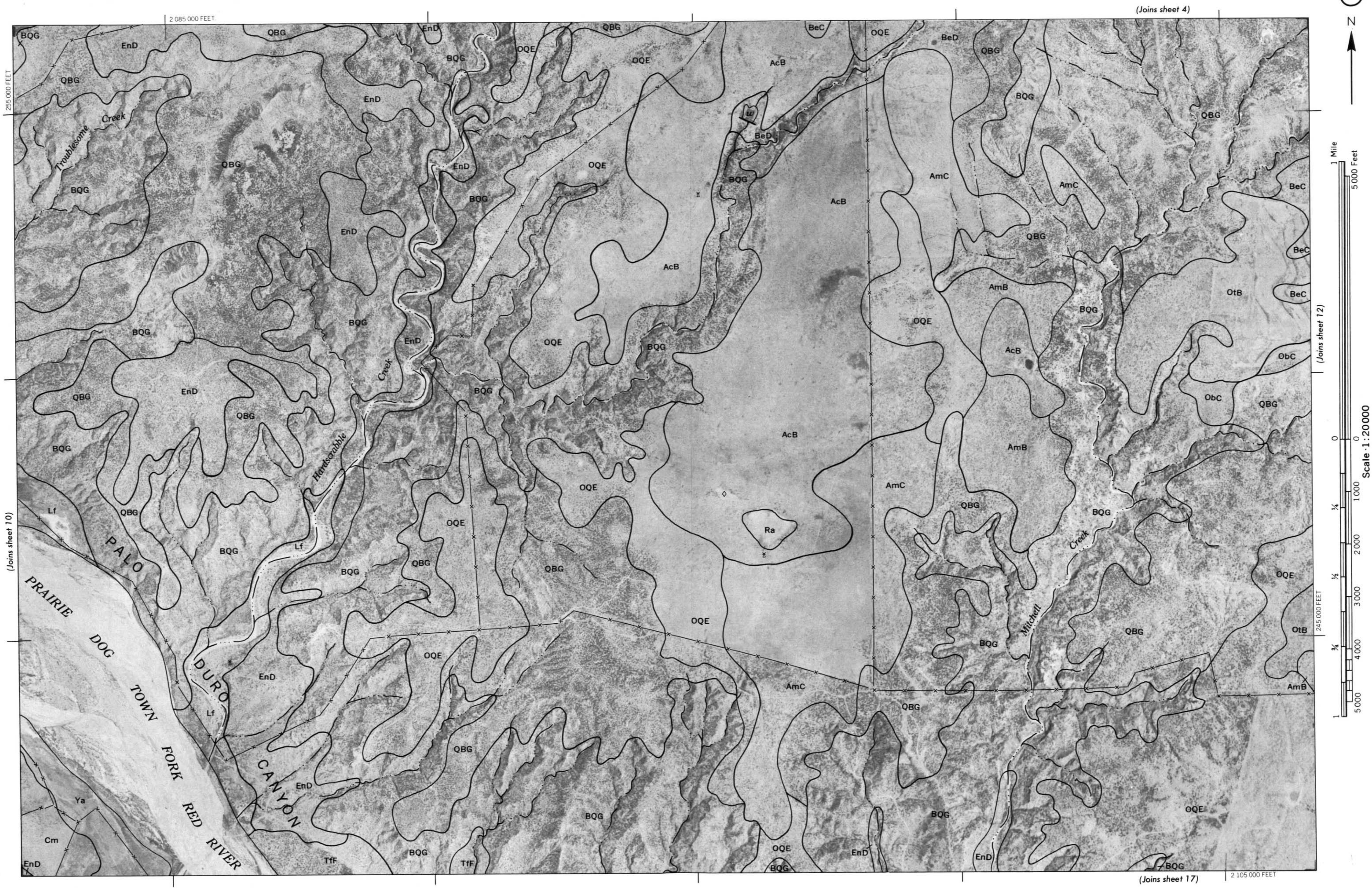
BRISCOE COUNTY, TEXAS — SHEET NUMBER 8





2 035 000 FEET
255 000 FEET
(Joins sheet 2)
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 15)
2 055 000 FEET
245 000 FEET
N
Blackmill Creek
Bear Creek
Little Tepee
Pole Canyon
Tepee Pole Canyon
TULE CREEK
PuB
PuA
Ra
Ro
OtA
OtB
TxD
BQG
BeD
QBG
EnD
Ya
1 Mile
5000 Feet
Scale 1:20000

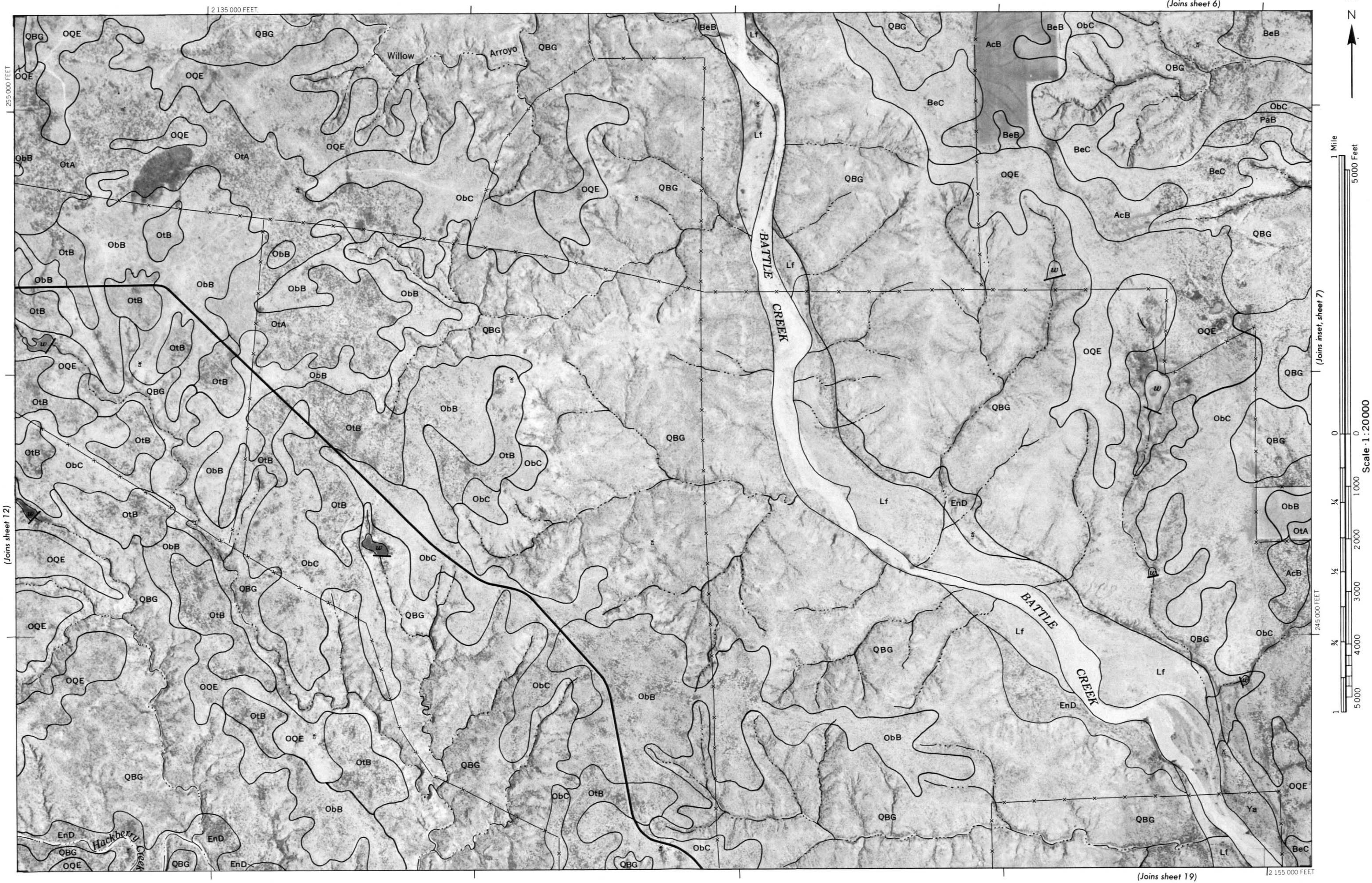
BRISCOE COUNTY, TEXAS — SHEET NUMBER 10

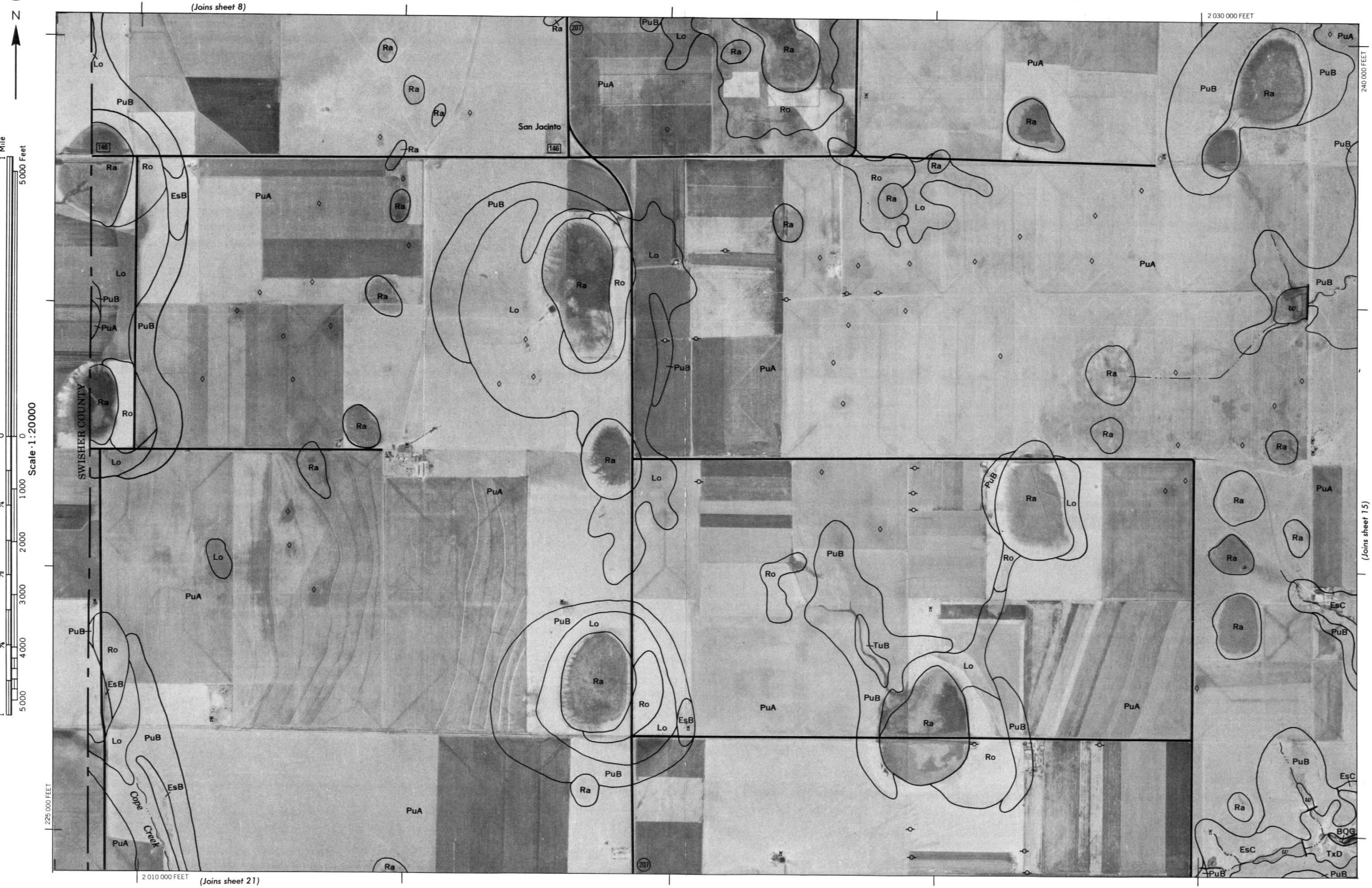


11
N
(Joins sheet 4)
(Joins sheet 10)
(Joins sheet 12)
(Joins sheet 17)
2 085 000 FEET
2 105 000 FEET
255 000 FEET
245 000 FEET
Troublesome Creek
Hardscrabble Creek
Mitchell Creek
PALO DURO CANYON
PRAIRIE DOG TOWN FORK RED RIVER
QBG
BQG
EnD
OQE
AcB
BeC
BeD
AmC
AmB
OtB
ObC
Ra
Lf
Ya
Cm
TfF
1 Mile
5000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000
Scale 1:20000


N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
(Joins sheet 5)
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 18)
2 130 000 FEET
255 000 FEET
245 000 FEET
2 110 000 FEET
STINKHOLE
DIVIDE
Hackberry
Creek
Hackberry
Creek
Rough
Creek
West Fork Rough Creek
QBG
BeD
BpE
OQE
AcB
OtB
OtA
ObB
BQG
BeC
ObC
OQE
QBG
AmB
BeB
EnD
OtB
w

BRISCOE COUNTY, TEXAS — SHEET NUMBER 13

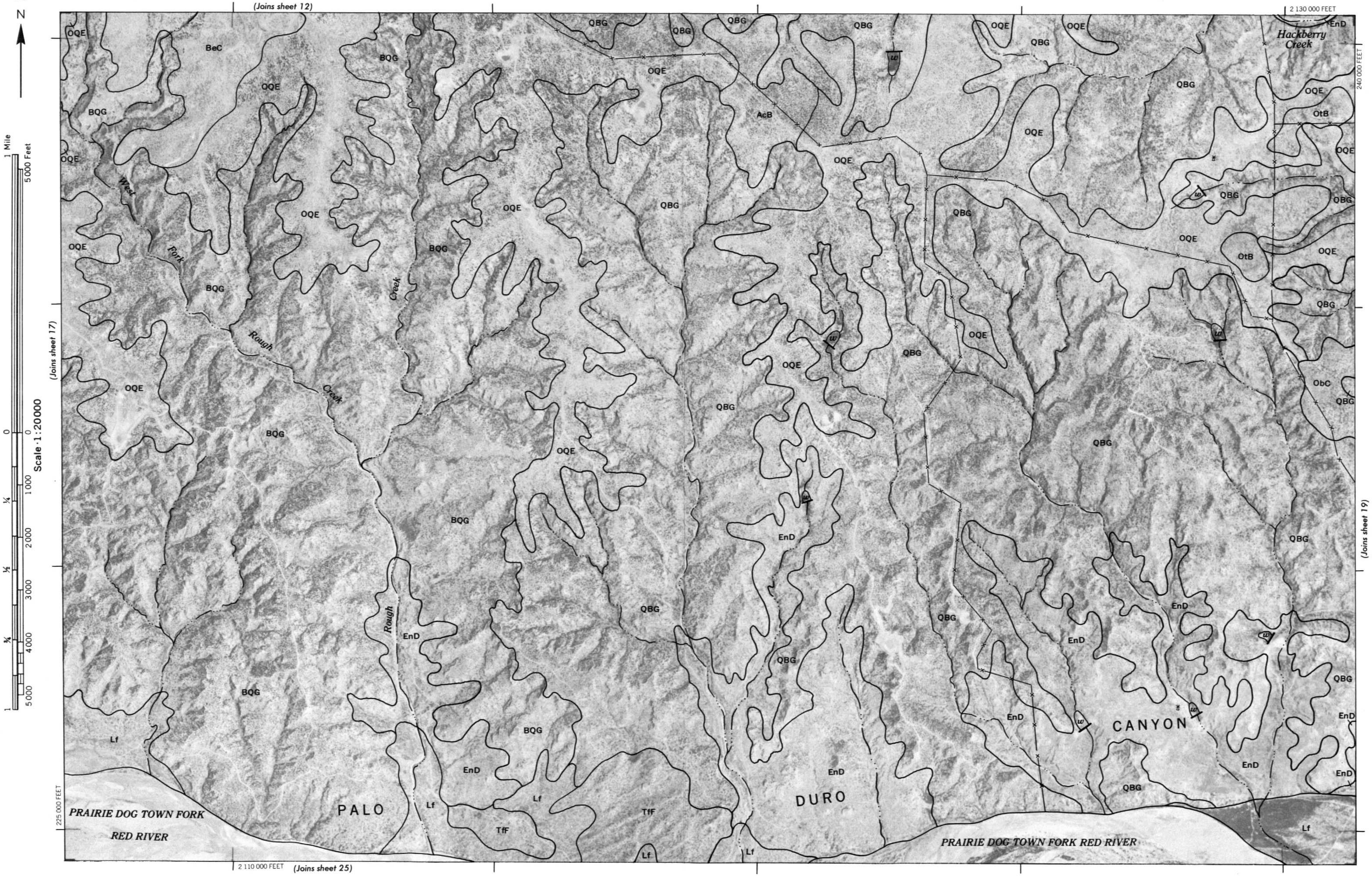


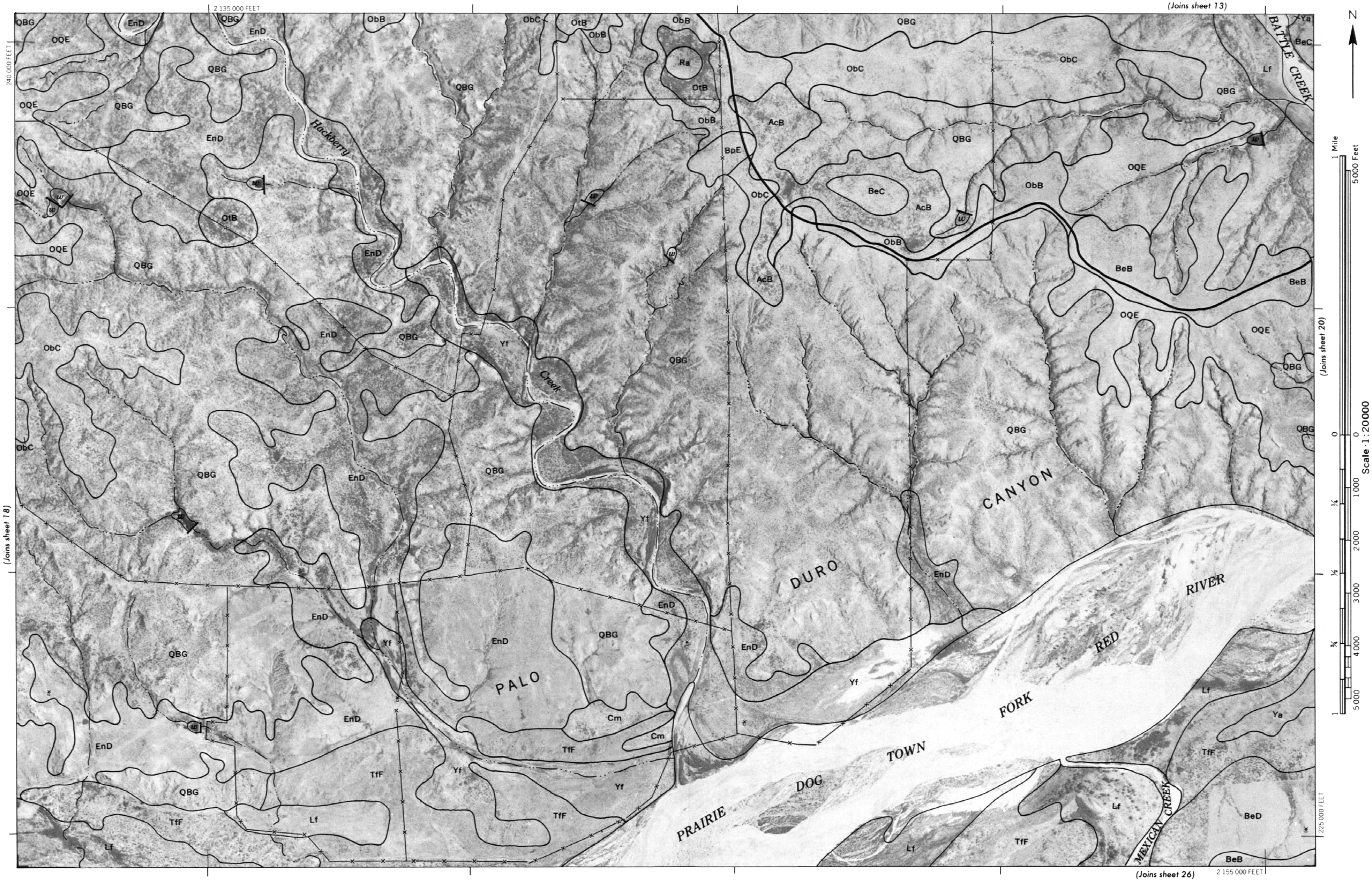

(Joins sheet 8)
(Joins sheet 15)
(Joins sheet 21)
2 030 000 FEET
240 000 FEET
225 000 FEET
2 010 000 FEET
N
1 Mile
5 000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
SWISHER COUNTY
San Jacinto
146
207
Cope Creek
Ra
Lo
Ro
PuA
PuB
EsB
EsC
TuB
TxD
BOG
w

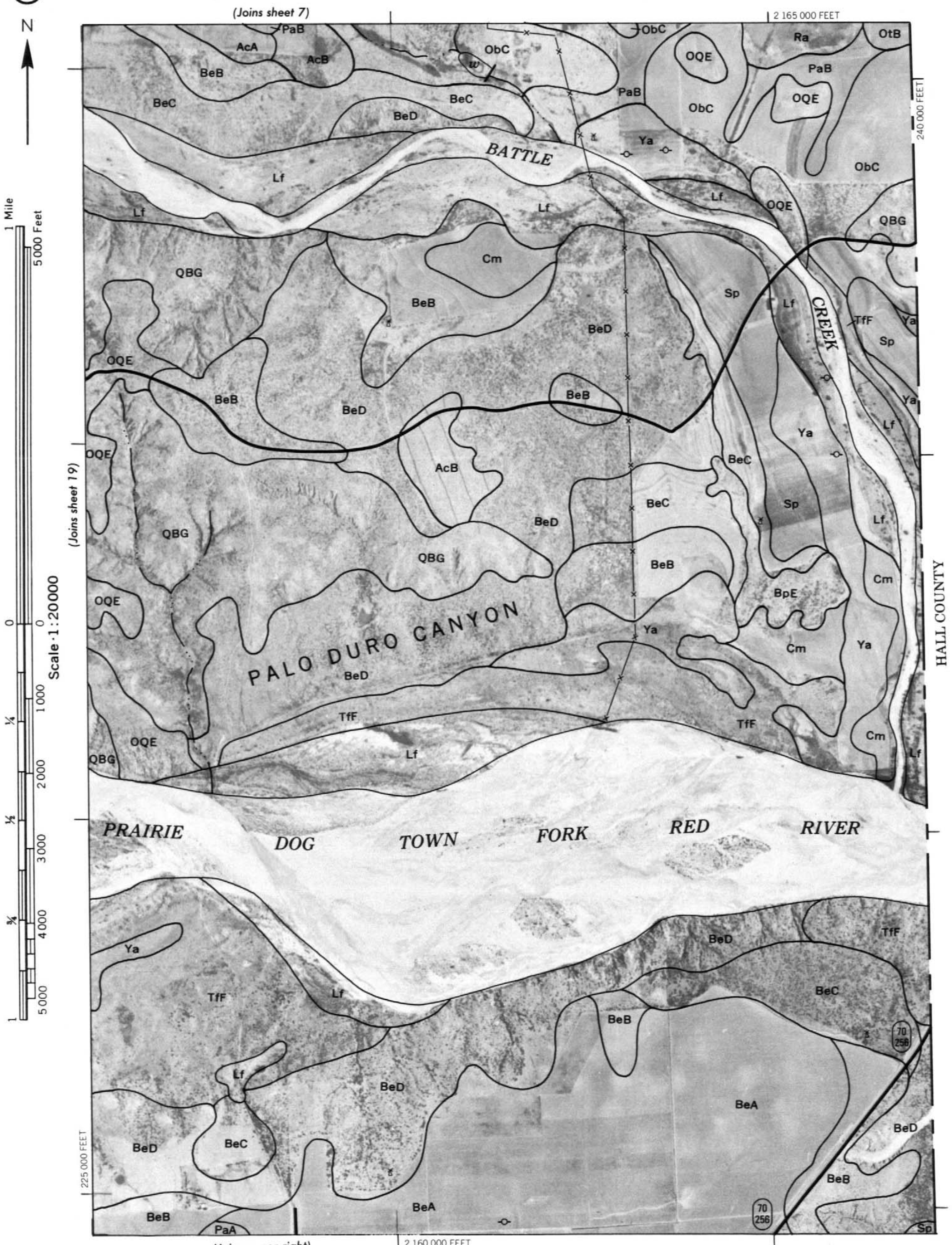

15
N
2 035 000 FEET
240 000 FEET
(Joins sheet 9)
(Joins sheet 16)
(Joins sheet 14)
(Joins sheet 22)
225 000 FEET
2 055 000 FEET
TULE CREEK
TULE CREEK
Lufberg Canyon
McMurtry Canyon
PuA
PuB
EsC
Ra
Ro
TxD
BQG
QBG
EnD
Ya
Lf
BeD
w
1 Mile
5000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000
Scale 1:20000

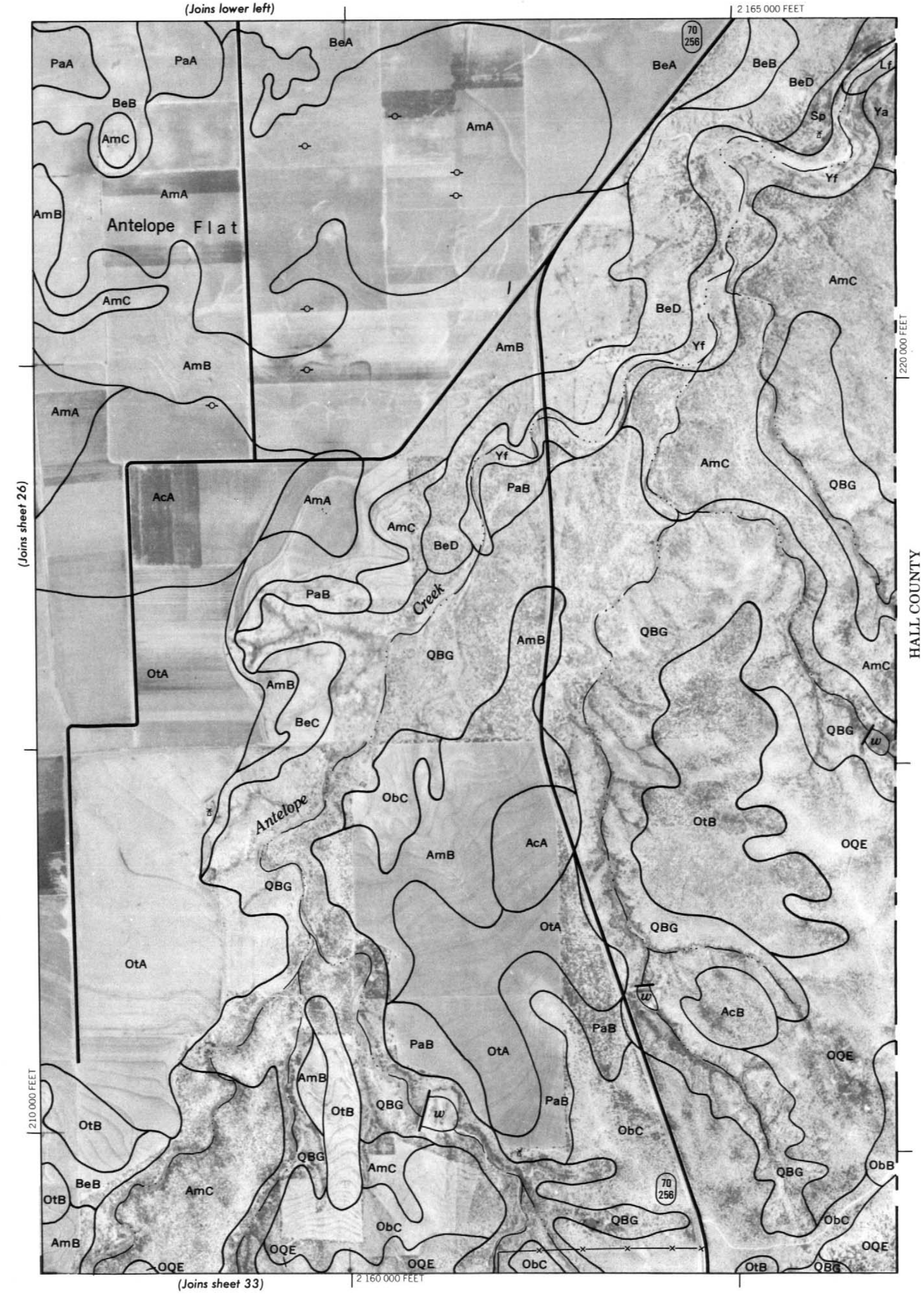

N
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
(Joins sheet 10)
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 23)
2 080 000 FEET
240 000 FEET
225 000 FEET
2 060 000 FEET
Tule Creek
COON
CREEK
BQG
QBG
EnD
OQE
OtB
AmB
Ya
BeD
ObB
w

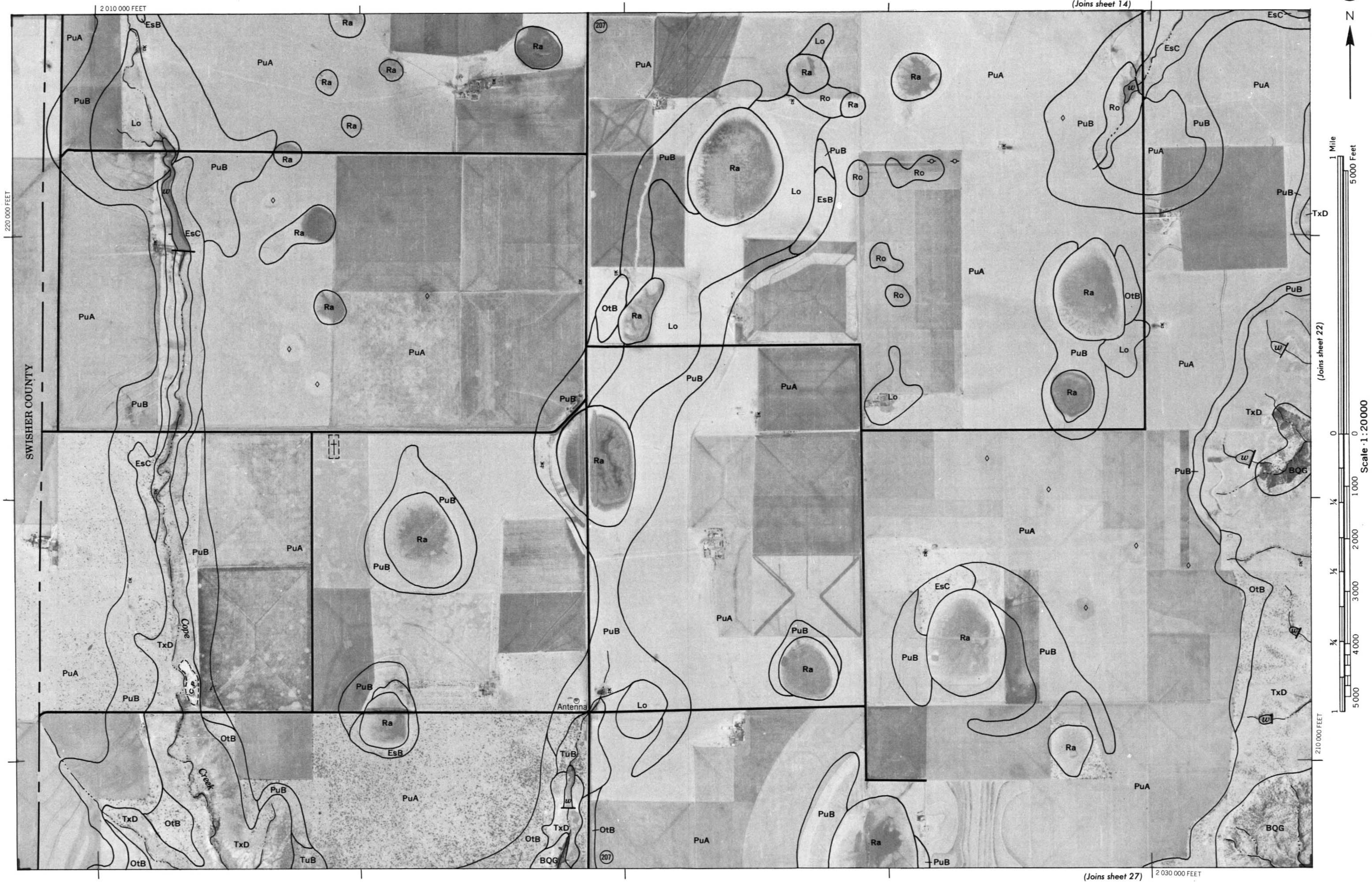

17
N
(Joins sheet 11)
(Joins sheet 18)
(Joins sheet 24)
(Joins sheet 16)
2 085 000 FEET
240 000 FEET
225 000 FEET
2 105 000 FEET
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
Scale 1:20000
COON CREEK
PRAIRIE DOG TOWN FORK RED RIVER
PALO DURO CANYON
Mitchell Creek
Sand Creek
Dinner Creek
West Fork
East Fork
EnD
Cm
Ya
QBG
TfF
BQG
OQE
Lf
ObB


(Joins sheet 12)
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 25)
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
2 130 000 FEET
240 000 FEET
225 000 FEET
2 110 000 FEET
West Fork Rough Creek
Rough Creek
Creek
Hackberry Creek
PALO DURO CANYON
PRAIRIE DOG TOWN FORK RED RIVER
OQE
BeC
BQG
QBG
AcB
OtB
ObC
EnD
Lf
TfF
w

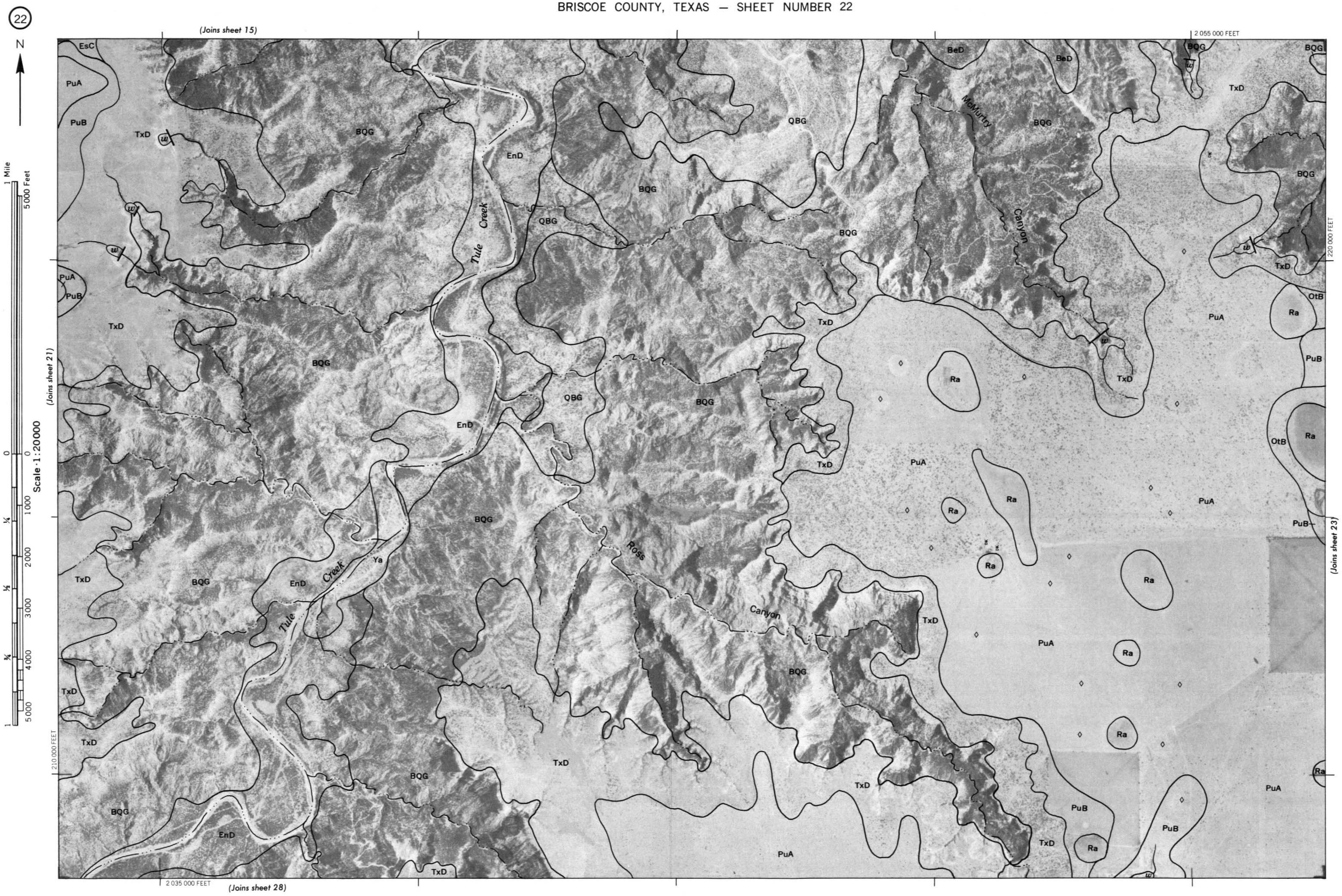

19
N
2 135 000 FEET
240 000 FEET
(Joins sheet 13)
(Joins sheet 18)
(Joins sheet 20)
(Joins sheet 26)
2 155 000 FEET
225 000 FEET
1 Mile
5000 Feet
Scale 1:20000
BATTLE CREEK
Hackberry
Creek
CANYON
DURO
PALO
PRAIRIE
DOG
TOWN
FORK
RED
RIVER
MEXICAN CREEK
QBG
OQE
EnD
ObB
ObC
OtB
Ra
AcB
BpE
BeC
BeB
BeD
Lf
Yf
Ya
Cm
TfF


N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 7)
(Joins sheet 19)
(Joins upper right)
2 165 000 FEET
240 000 FEET
225 000 FEET
2 160 000 FEET
BATTLE
CREEK
PALO DURO CANYON
PRAIRIE DOG TOWN FORK RED RIVER
HALL COUNTY
70
256

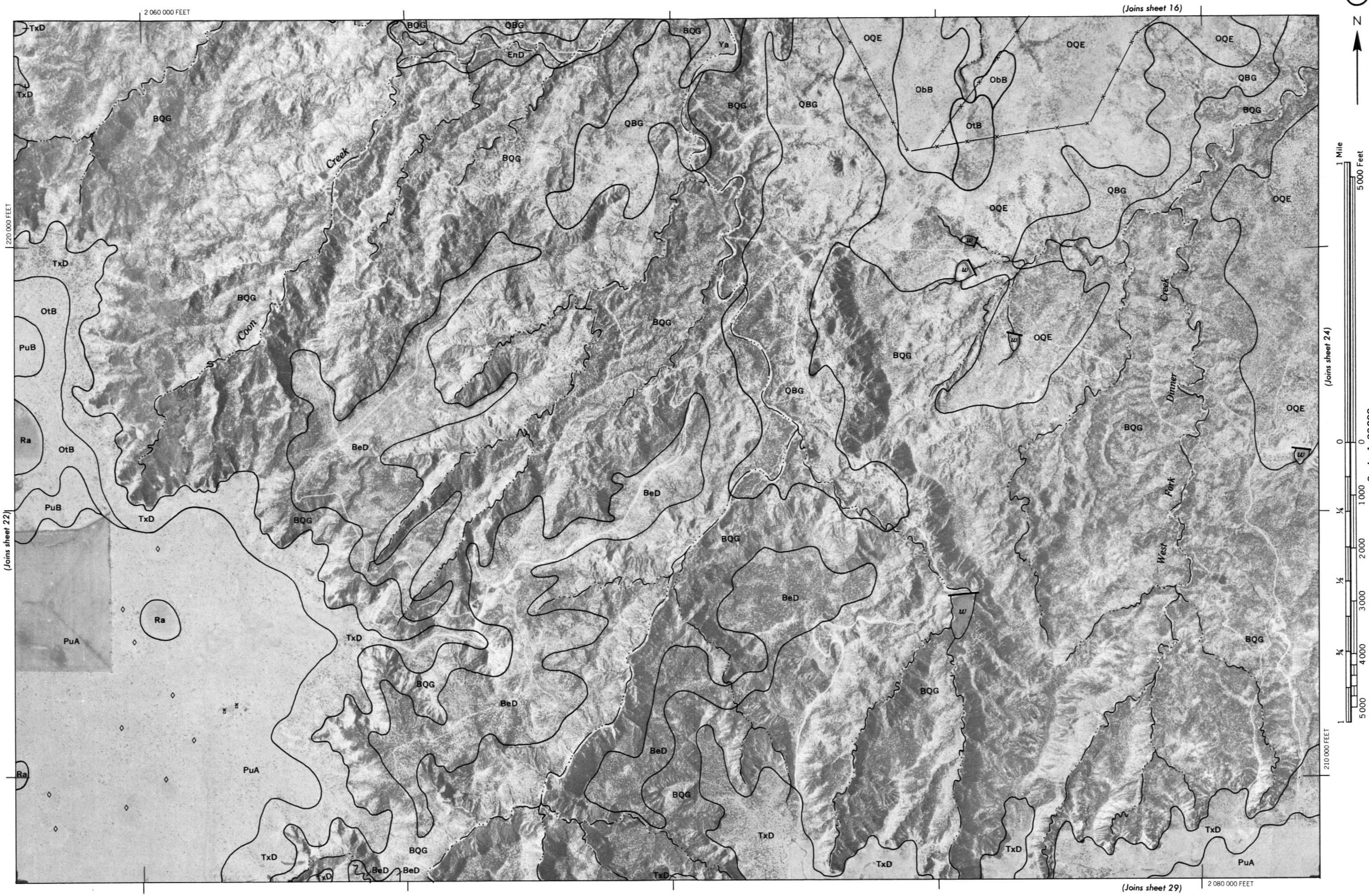

(Joins lower left)
(Joins sheet 26)
(Joins sheet 33)
2 165 000 FEET
220 000 FEET
210 000 FEET
2 160 000 FEET
Antelope Flat
Antelope
Creek
HALL COUNTY
70
256



21
N
(Joins sheet 14)
(Joins sheet 22)
(Joins sheet 27)
SWISHER COUNTY
2 010 000 FEET
2 030 000 FEET
220 000 FEET
210 000 FEET
207
Cope Creek
Antenna
PuA
PuB
Ra
Ro
Lo
EsB
EsC
OtB
TxD
TuB
BQG
1 Mile
5000 Feet
Scale 1:20000


22
N
(Joins sheet 15)
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 28)
2 055 000 FEET
220 000 FEET
210 000 FEET
2 035 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
Tule Creek
McMurtry Canyon
Ross Canyon
EsC
PuA
PuB
TxD
BQG
EnD
QBG
BeD
OtB
Ra
Ya
w

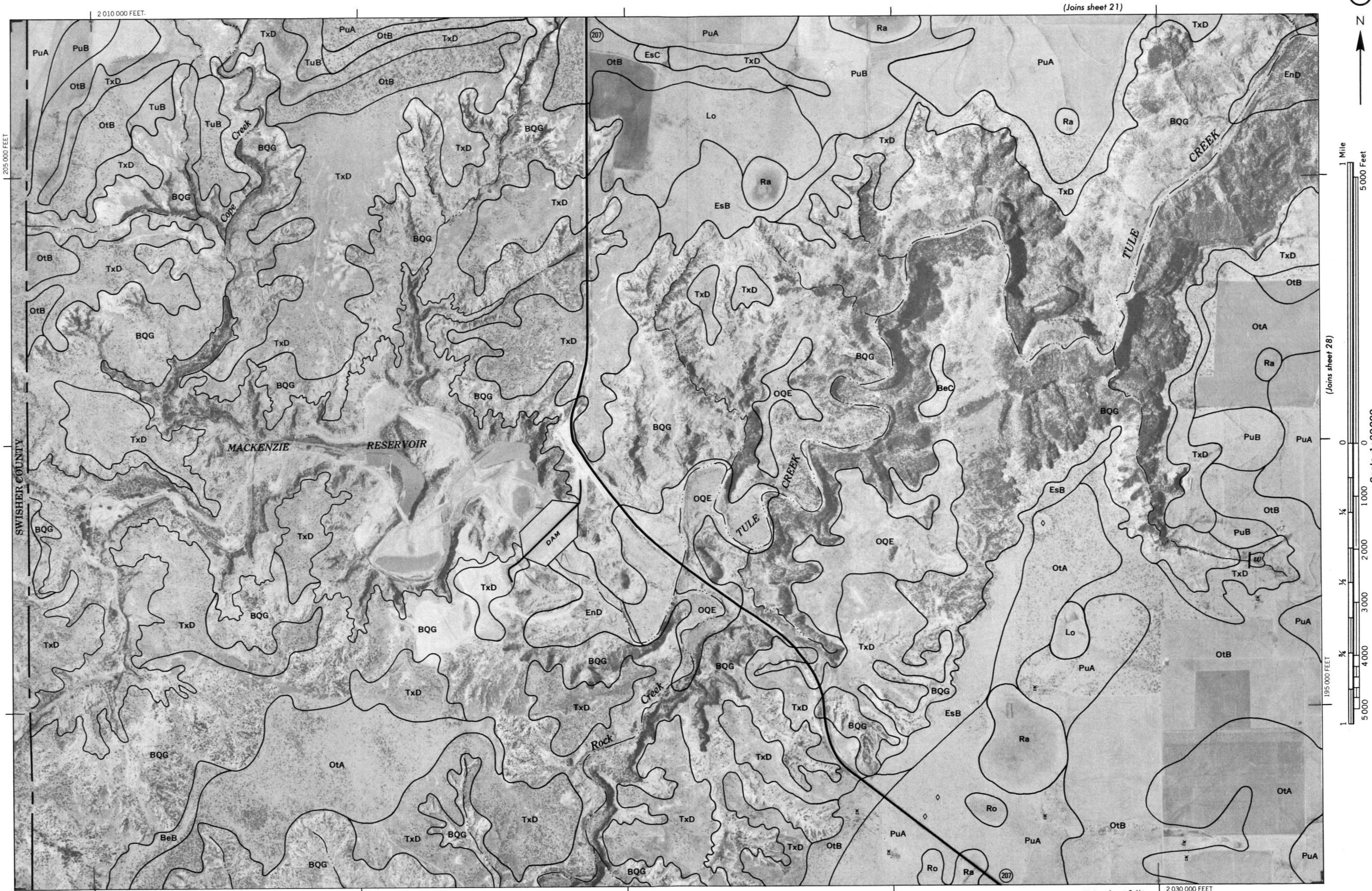
23

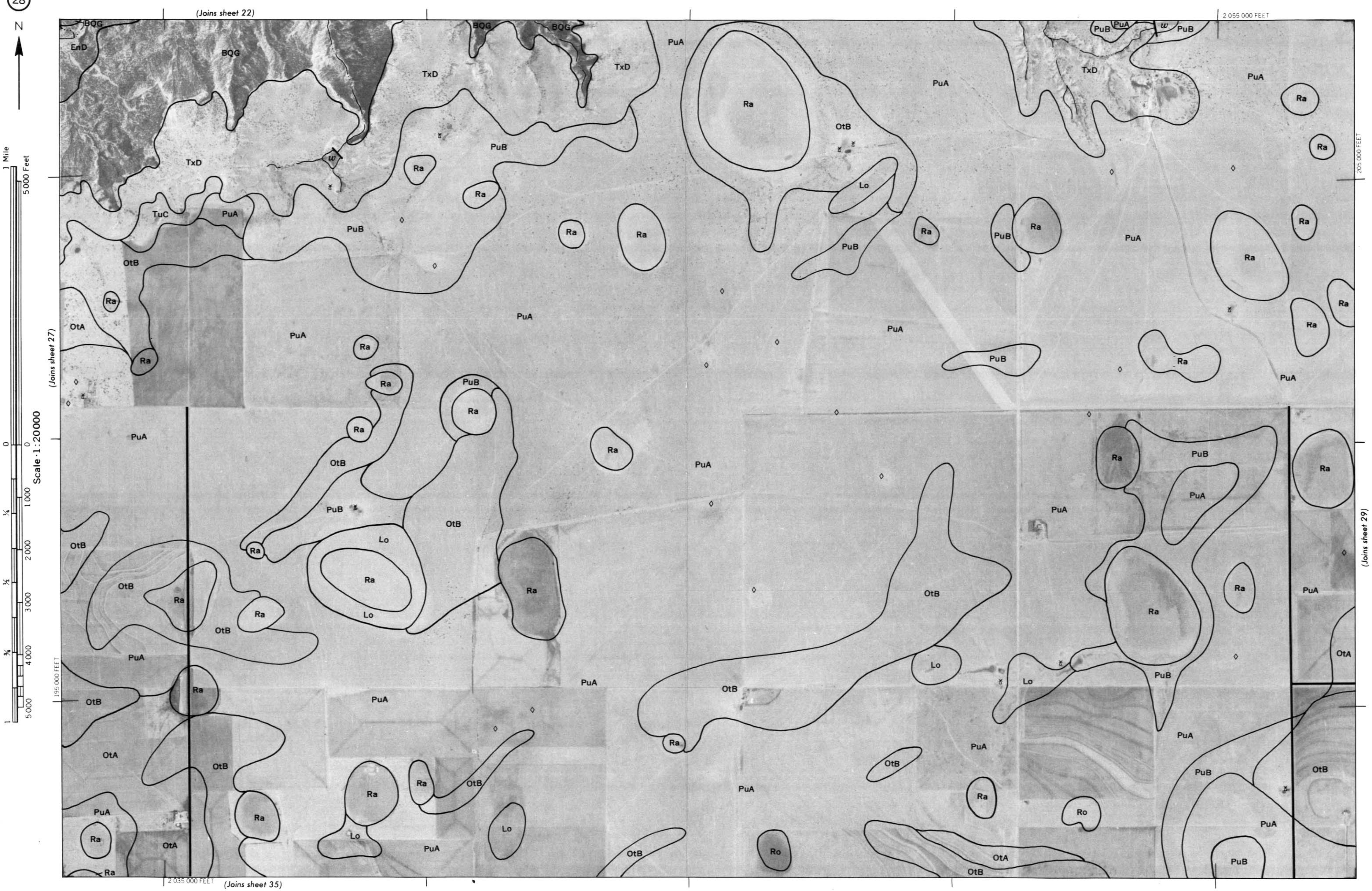

2 060 000 FEET
(Joins sheet 16)
N
220 000 FEET
(Joins sheet 22)
(Joins sheet 24)
210 000 FEET
2 080 000 FEET
(Joins sheet 29)
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000
TxD
BQG
QBG
EnD
Ya
OQE
ObB
OtB
PuB
Ra
PuA
BeD
Creek
Coon
Dinner
West
Fork
w

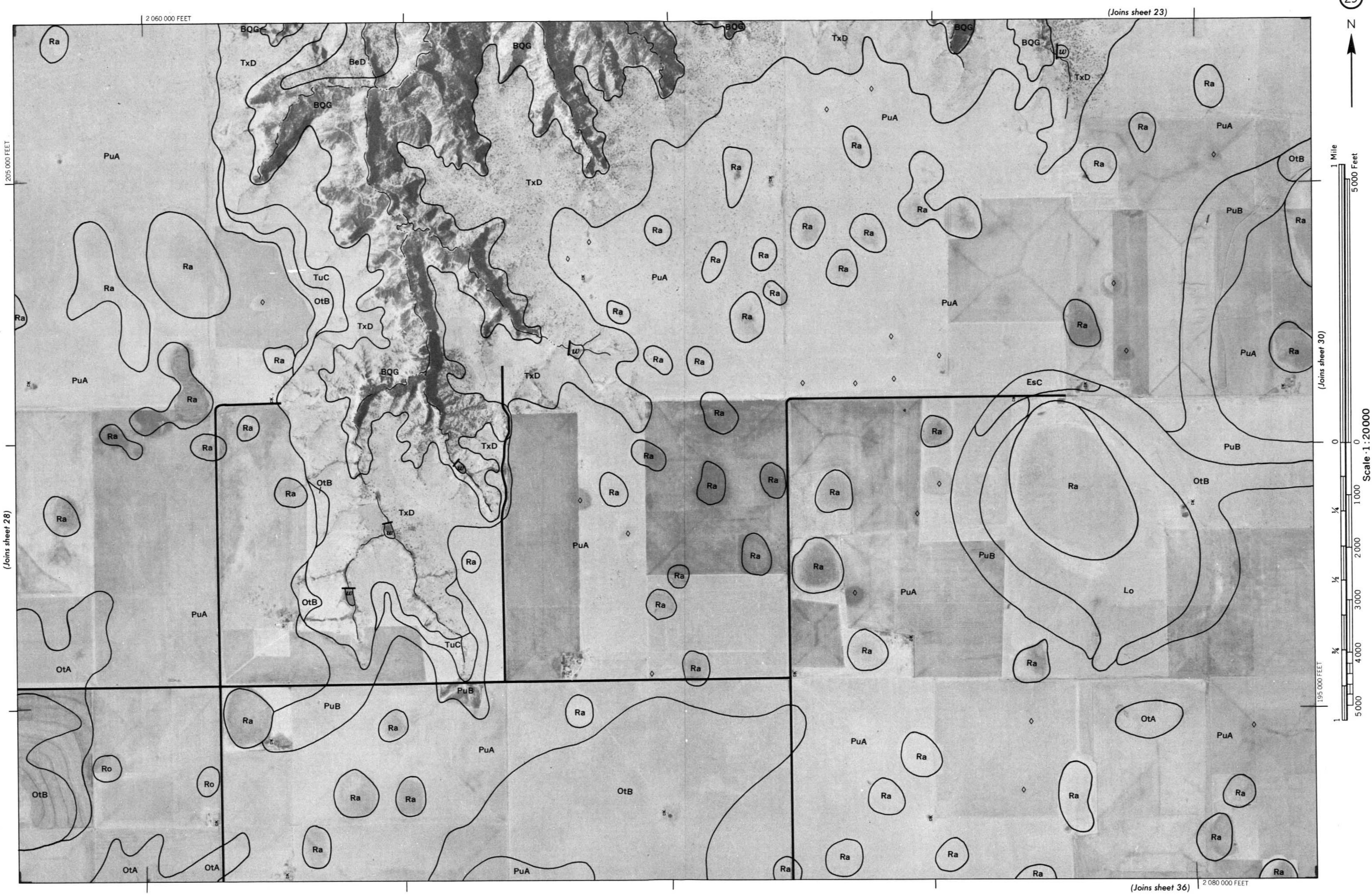

24
N
(Joins sheet 17)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 30)
2 105 000 FEET
220 000 FEET
210 000 FEET
2 085 000 FEET
PRAIRIE DOG TOWN FORK RED RIVER
West Fork Dinner Creek
East Fork Dinner Creek
Comanche Creek
INDIAN CREEK
Johnson Canyon
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
OQE
BQG
QBG
EnD
Lf
OtB
TxD
PuA
w

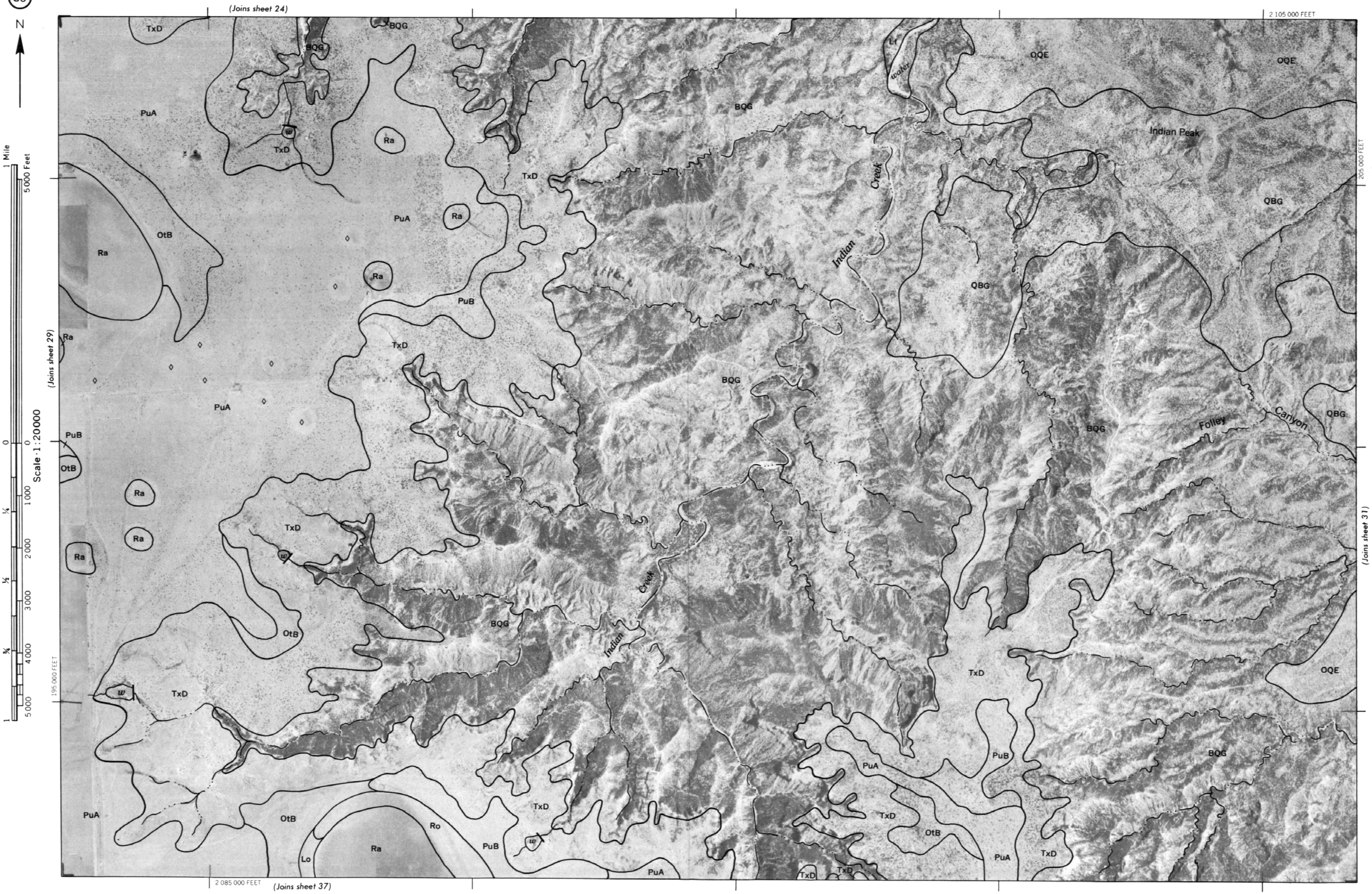

2 110 000 FEET
(Joins sheet 18)
PRAIRIE
DOG
TOWN
FORK
RED
RIVER
220 000 FEET
(Joins sheet 24)
(Joins sheet 26)
(Joins sheet 31)
210 000 FEET
2 130 000 FEET
Johnson
Canyon
Little
Indian
Creek
Cleveland
Draw
BARREL
CREEK
Lost
Canyon
TfF
Lf
Cm
BeB
BeD
EnD
BQG
QBG
OQE
ObC
w
N
1 Mile
5000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000
Scale 1:20000


N
Scale 1:20000
1 Mile
5 000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000
(Joins sheet 19)
(Joins sheet 25)
(Joins inset, sheet 20)
(Joins sheet 32)
2 155 000 FEET
220 000 FEET
210 000 FEET
2 135 000 FEET
PRAIRIE DOG TOWN FORK RED RIVER
Antelope Flat
MEXICAN CREEK
Lost Canyon
Cherokee Creek
Cm
EnD
Lf
TfF
QBG
OQE
BeD
PaB
BeB
AcB
AmA
AmB
AmC
SfD
PaA
BeC
AcA
OtA
OtB
ObC
BpE
Yf
Ya

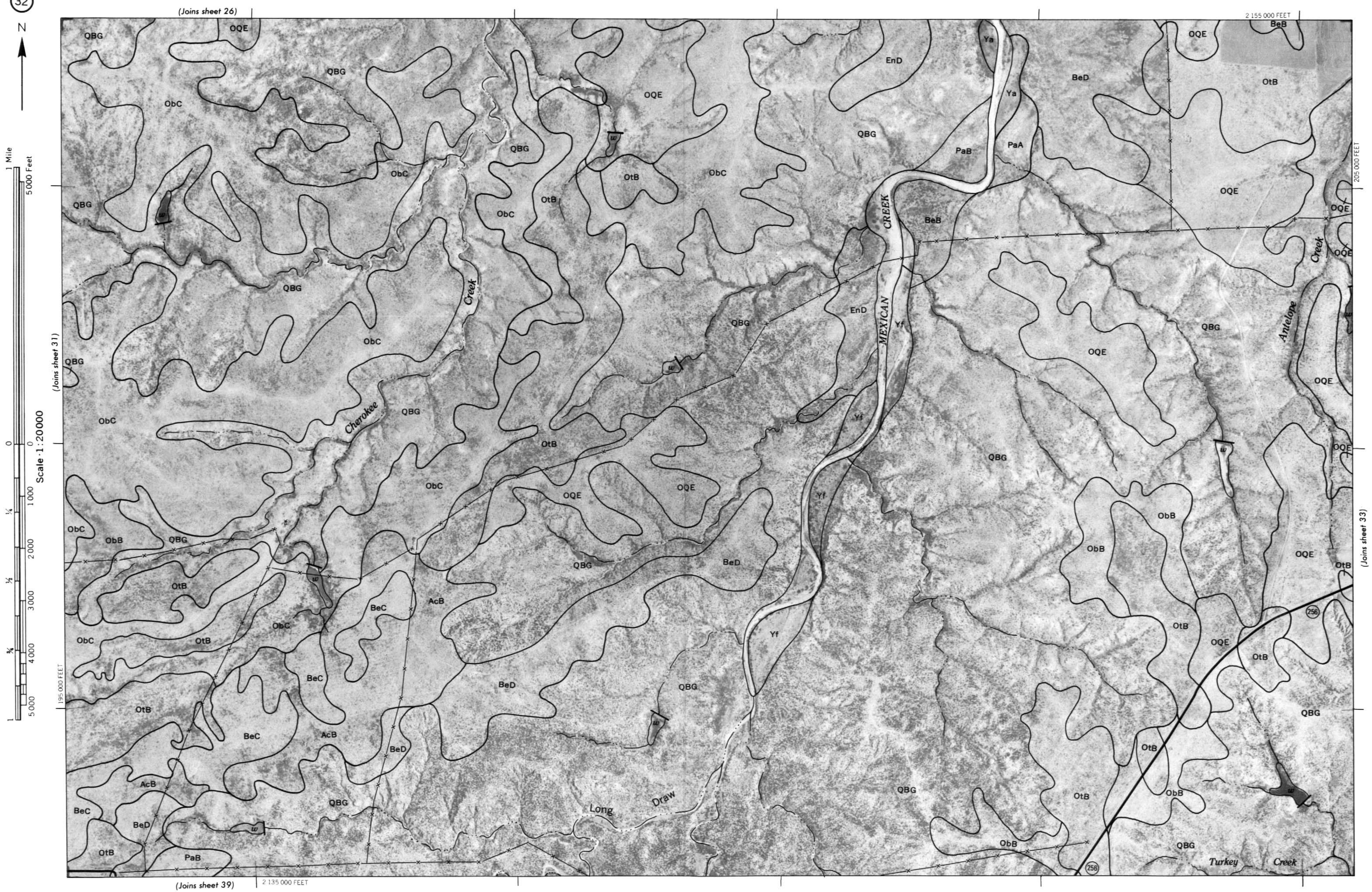

(Joins sheet 21)
2 010 000 FEET
205 000 FEET
N
SWISHER COUNTY
Cope Creek
MACKENZIE RESERVOIR
DAM
TULE CREEK
Rock Creek
207
(Joins sheet 28)
195 000 FEET
2 030 000 FEET
(Joins sheet 34)
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000
PuA
PuB
OtB
OtA
TxD
TuB
BQG
EsC
EsB
Lo
Ra
Ro
EnD
BeC
BeB
OQE
w

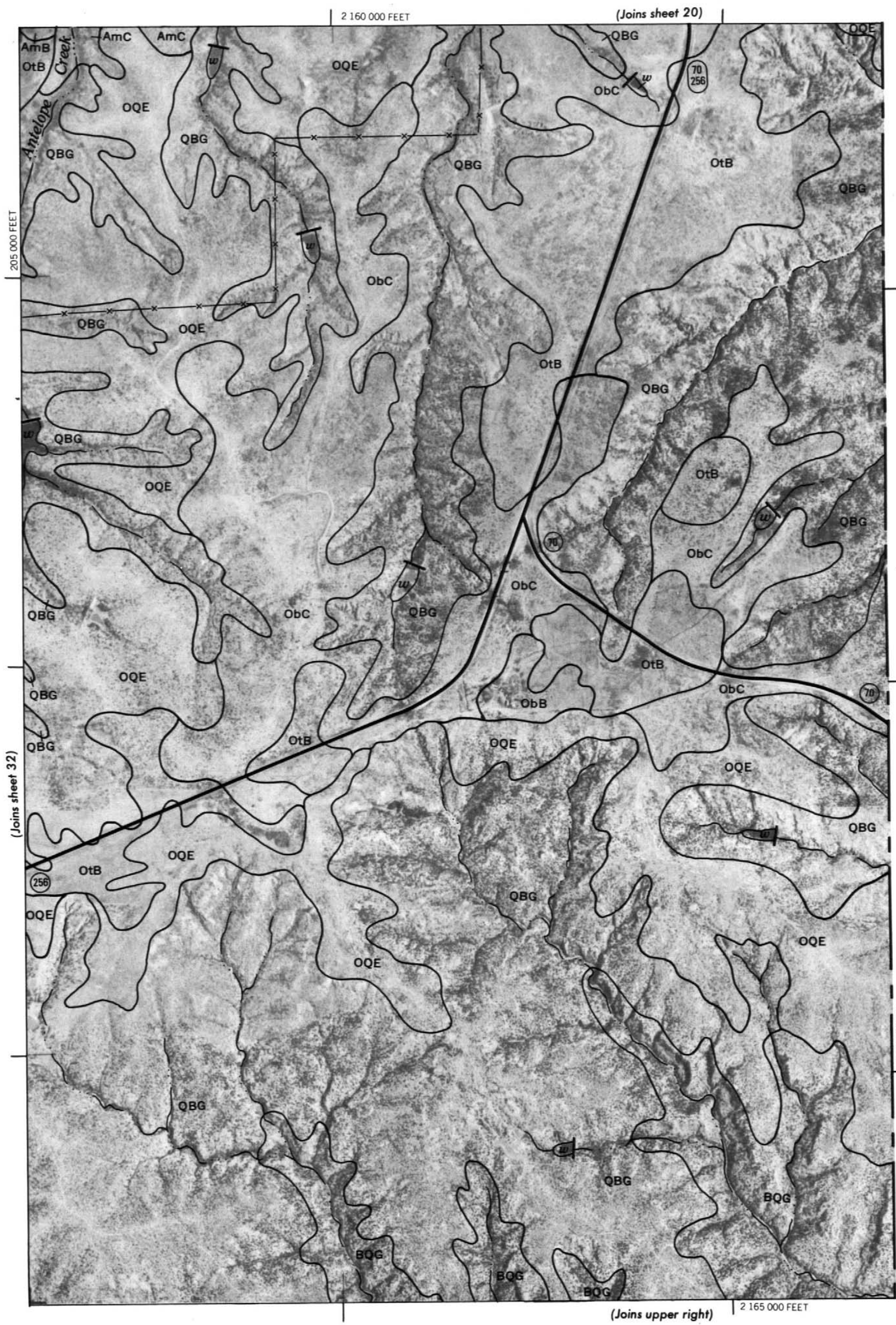

N
(Joins sheet 22)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 35)
2 055 000 FEET
205 000 FEET
195 000 FEET
2 035 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
BQG
EnD
TxD
TuC
PuA
PuB
OtA
OtB
Ra
Ro
Lo
w

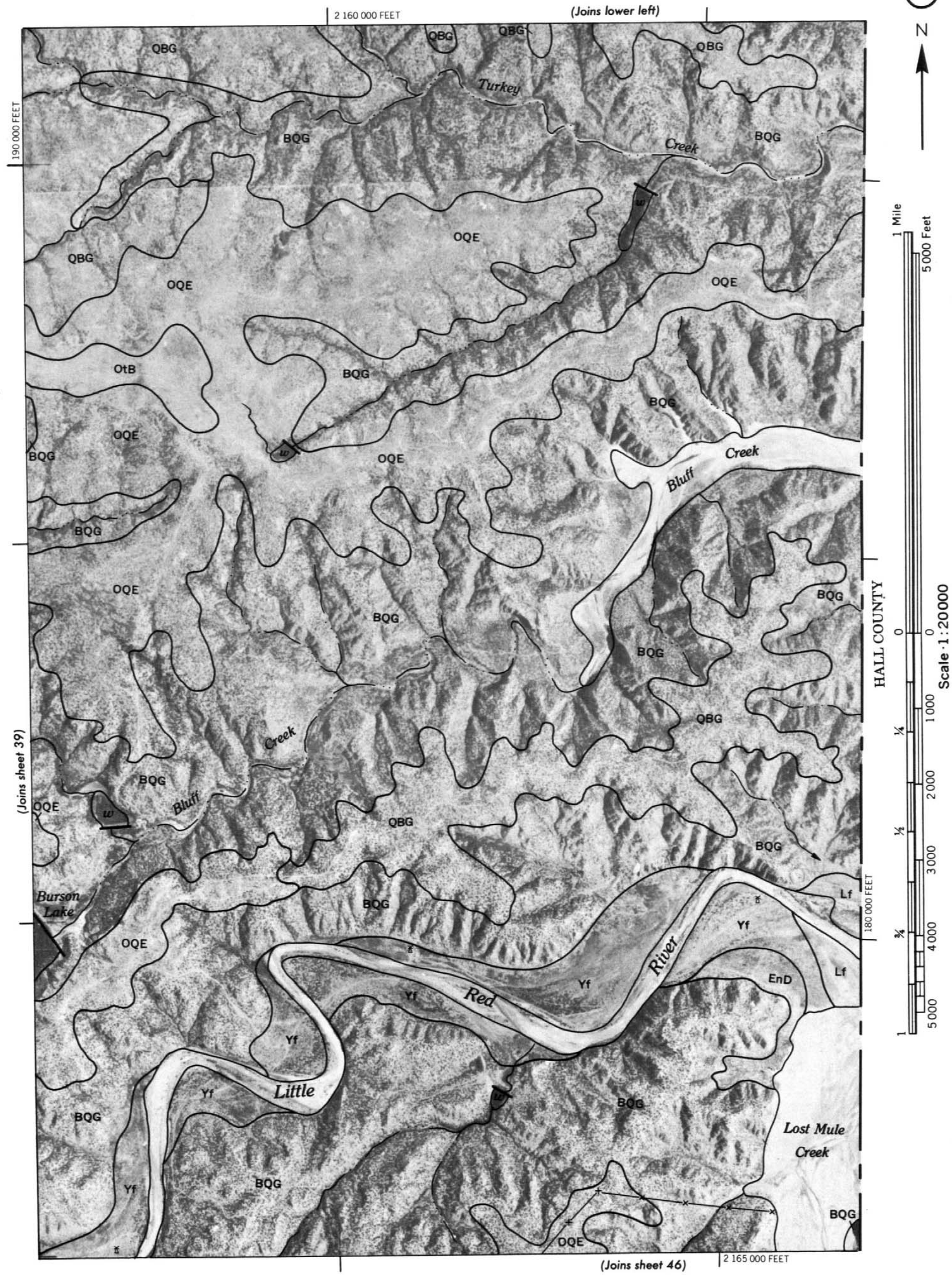

29
N
(Joins sheet 23)
(Joins sheet 28)
(Joins sheet 30)
(Joins sheet 36)
2 060 000 FEET
2 080 000 FEET
205 000 FEET
195 000 FEET
1 Mile
5 000 Feet
Scale 1:20000
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
BQG
TxD
BeD
PuA
PuB
Ra
TuC
OtB
OtA
EsC
Lo
Ro
w

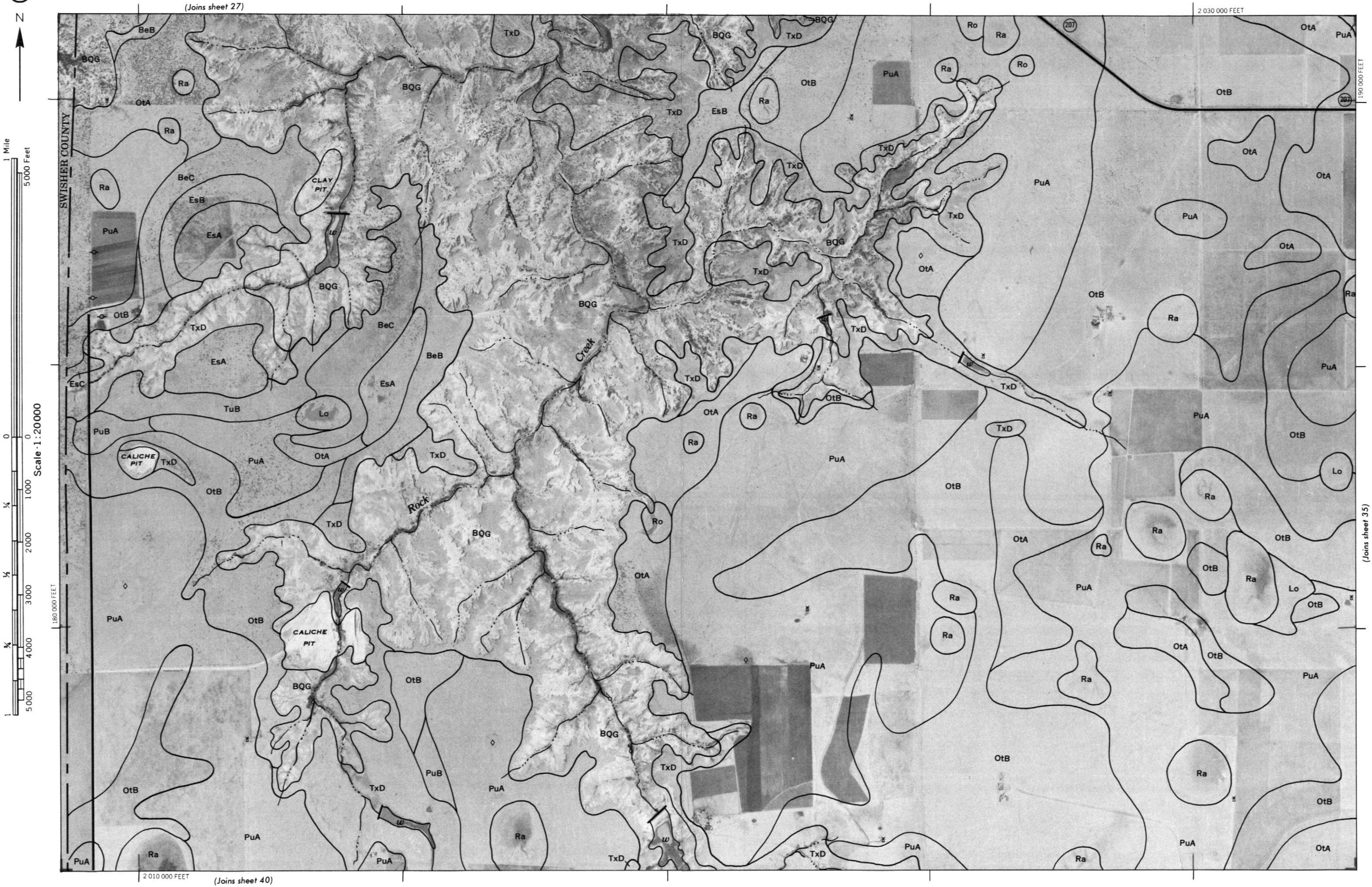

(Joins sheet 24)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 37)
N
1 Mile
5 000 Feet
Scale 1:20000
2 105 000 FEET
205 000 FEET
195 000 FEET
2 085 000 FEET
Indian Peak
Indian Creek
Folley Canyon
water
TxD
BQG
PuA
PuB
OtB
Ra
Ro
Lo
Lf
QBG
OQE
w

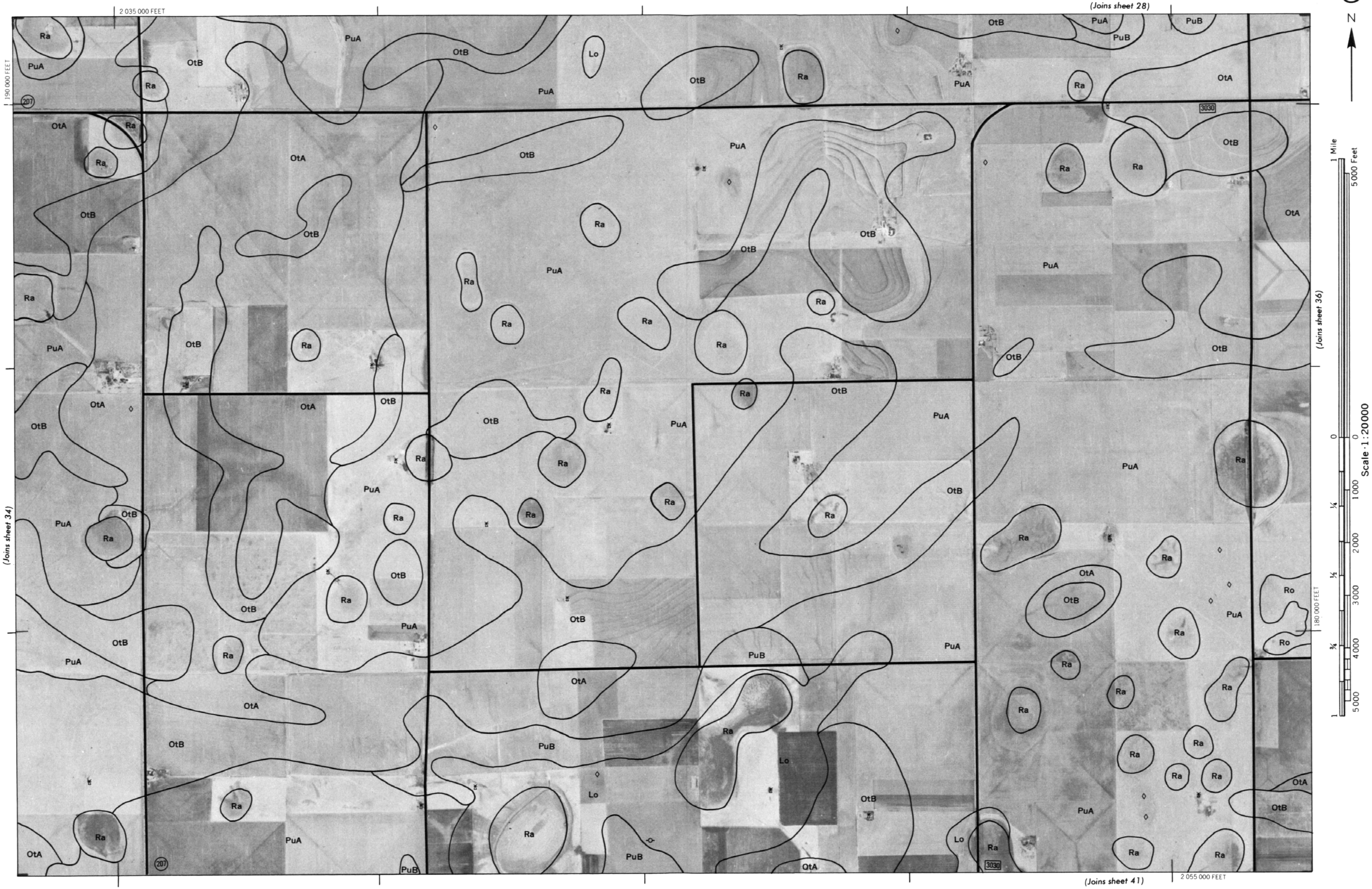

2,110 000 FEET
(Joins sheet 25)
205 000 FEET
(Joins sheet 30)
(Joins sheet 32)
(Joins sheet 38)
2 130 000 FEET
195 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000
Cleveland
Draw
Folley
Canyon
Barrel
Creek
BARREL CREEK
Karnes Flat
Ferrel Spring
Schott Mountain
OQE
QBG
BQG
EnD
Lf
Yf
ObC
ObB
OtB
StA
PaB
BeB
BeD
BeC
AmB
AcB
w

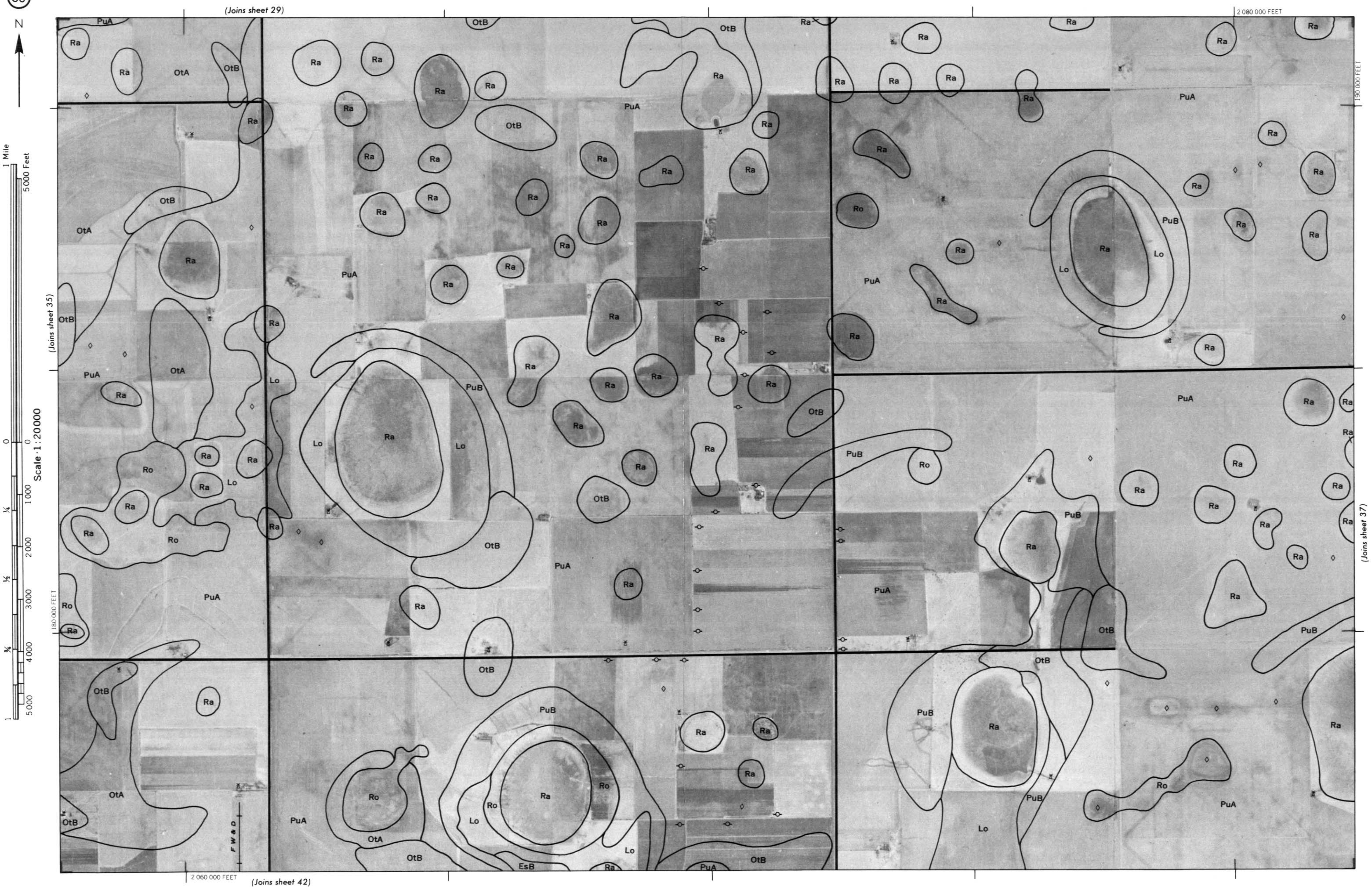

32
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 26)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 39)
2 155 000 FEET
205 000 FEET
195 000 FEET
2 135 000 FEET
Cherokee Creek
MEXICAN CREEK
Antelope Creek
Long Draw
Turkey Creek
256
QBG
OQE
ObC
ObB
OtB
EnD
BeD
BeB
BeC
AcB
PaB
PaA
Ya
Yf
w

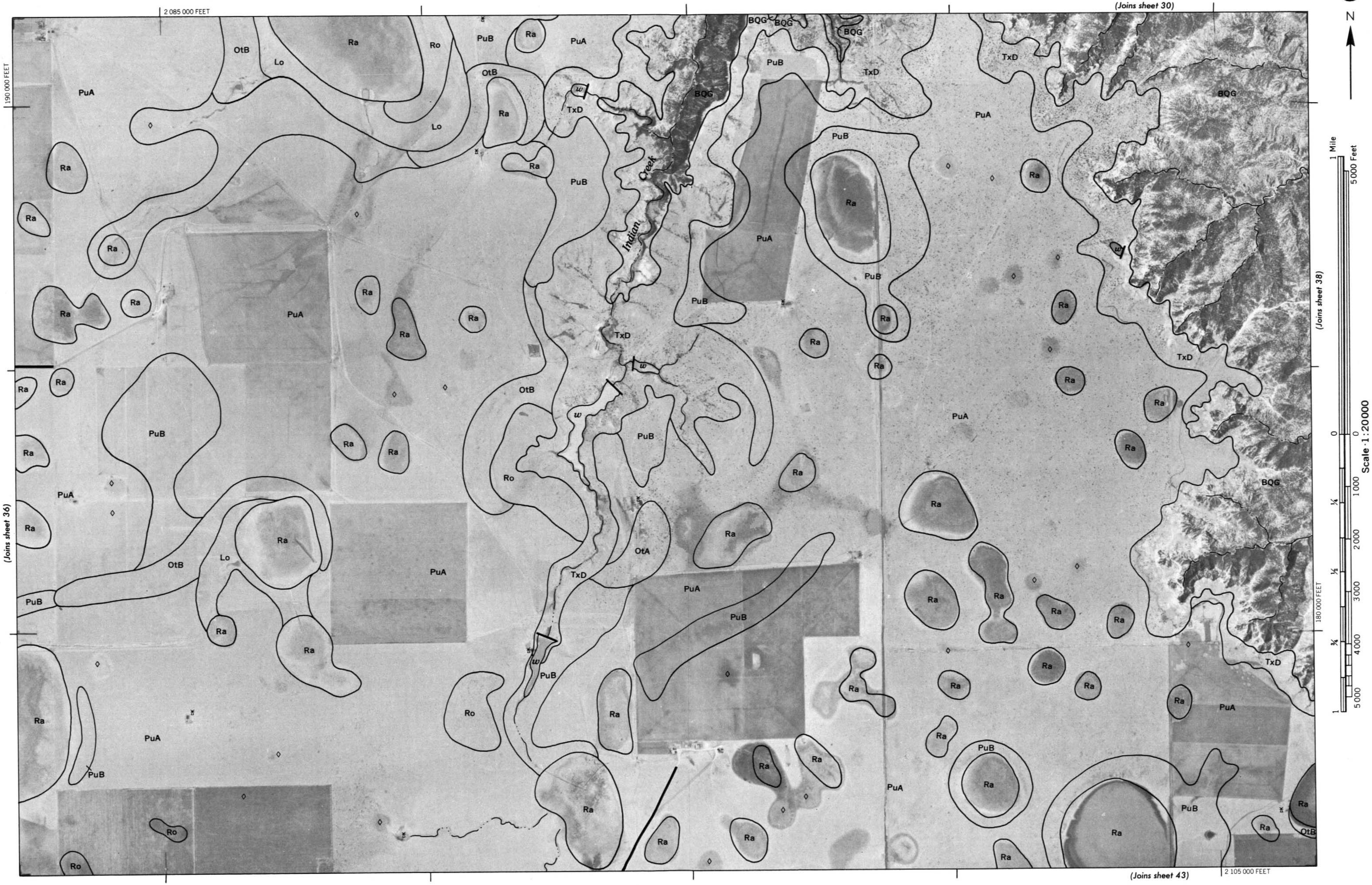

2 160 000 FEET
(Joins sheet 20)
205 000 FEET
195 000 FEET
2 165 000 FEET
(Joins sheet 32)
(Joins upper right)
HALL COUNTY
Antelope
Creek
AmB
AmC
OtB
OQE
QBG
ObC
ObB
BQG
70
256


2 160 000 FEET
(Joins lower left)
190 000 FEET
180 000 FEET
2 165 000 FEET
(Joins sheet 39)
(Joins sheet 46)
HALL COUNTY
Turkey
Creek
Bluff
Creek
Burson
Lake
Little
Red
River
Lost Mule
Creek
QBG
BQG
OQE
OtB
Yf
Lf
EnD
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1


N
(Joins sheet 27)
(Joins sheet 35)
(Joins sheet 40)
SWISHER COUNTY
2 030 000 FEET
190 000 FEET
180 000 FEET
2 010 000 FEET
207
1 Mile
5 000 Feet
Scale 1:20000
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
Rock
Creek
CLAY PIT
CALICHE PIT
CALICHE PIT
BeB
BeC
BQG
EsA
EsB
EsC
Lo
OtA
OtB
PuA
PuB
Ra
Ro
TuB
TxD
w


N
2 035 000 FEET
190 000 FEET
180 000 FEET
2 055 000 FEET
(Joins sheet 28)
(Joins sheet 34)
(Joins sheet 36)
(Joins sheet 41)
207
3030
1 Mile
5000 Feet
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
Scale 1:20000
Ra
PuA
OtB
OtA
Lo
PuB
Ro

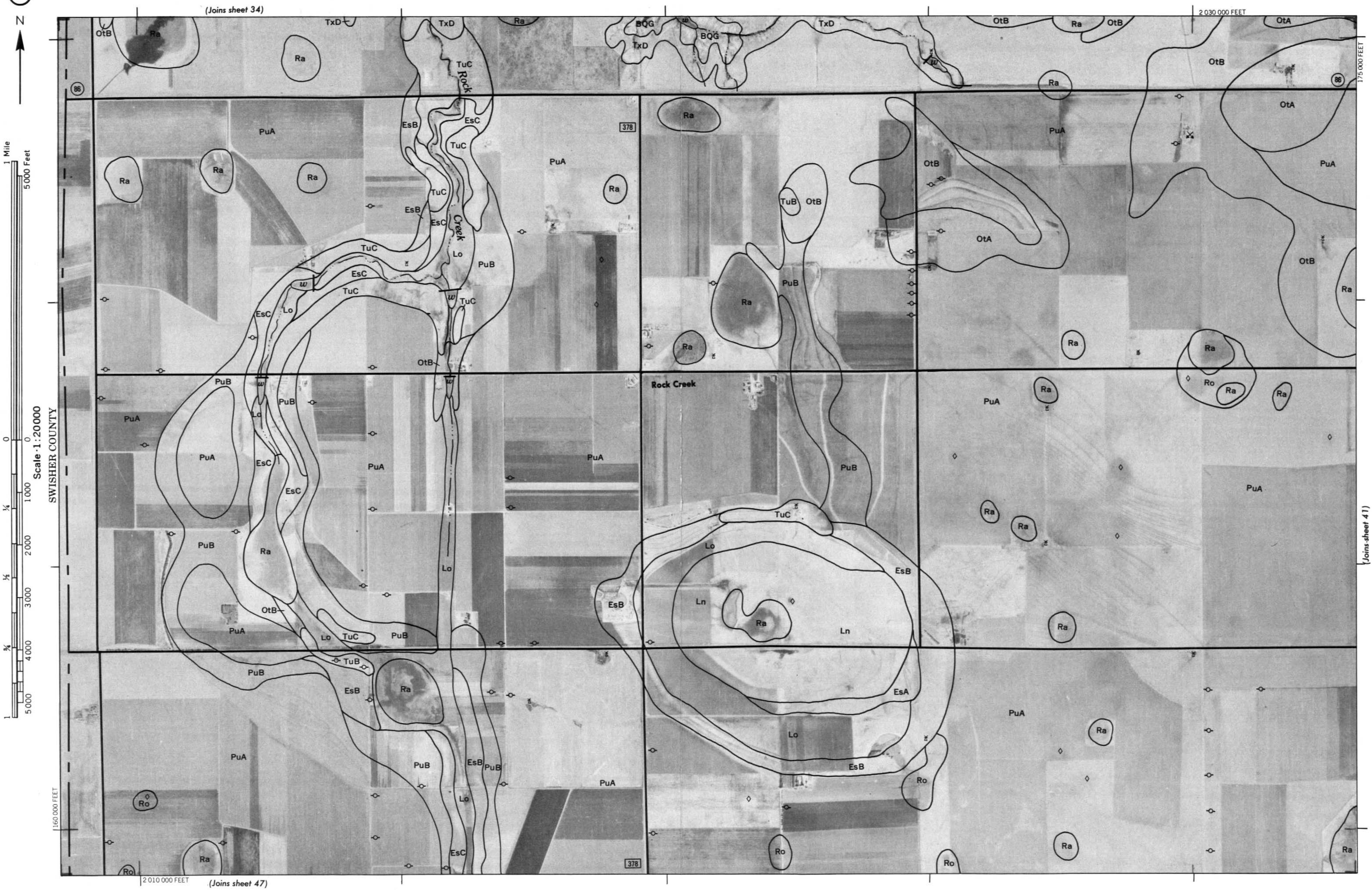

(Joins sheet 29)
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 42)
N
1 Mile
5000 Feet
0
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
2 080 000 FEET
190 000 FEET
180 000 FEET
2 060 000 FEET
F W & D
PuA
PuB
OtA
OtB
Ra
Ro
Lo
EsB

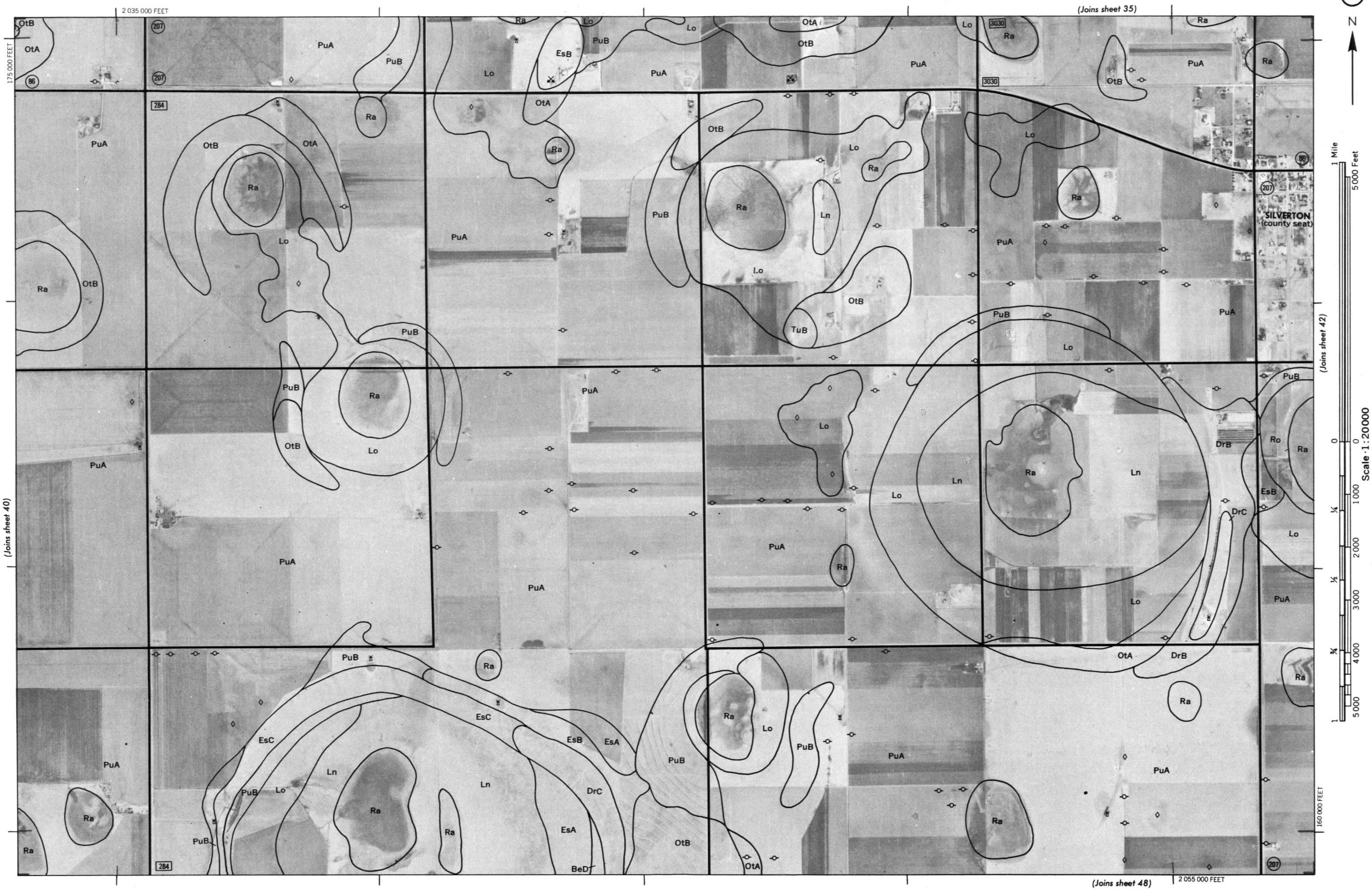

(Joins sheet 30)
(Joins sheet 38)
(Joins sheet 36)
(Joins sheet 43)
2 085 000 FEET
190 000 FEET
180 000 FEET
2 105 000 FEET
N
Indian Creek
BQG
TxD
PuA
PuB
Ra
Ro
OtB
OtA
Lo
w
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
Scale 1:20000

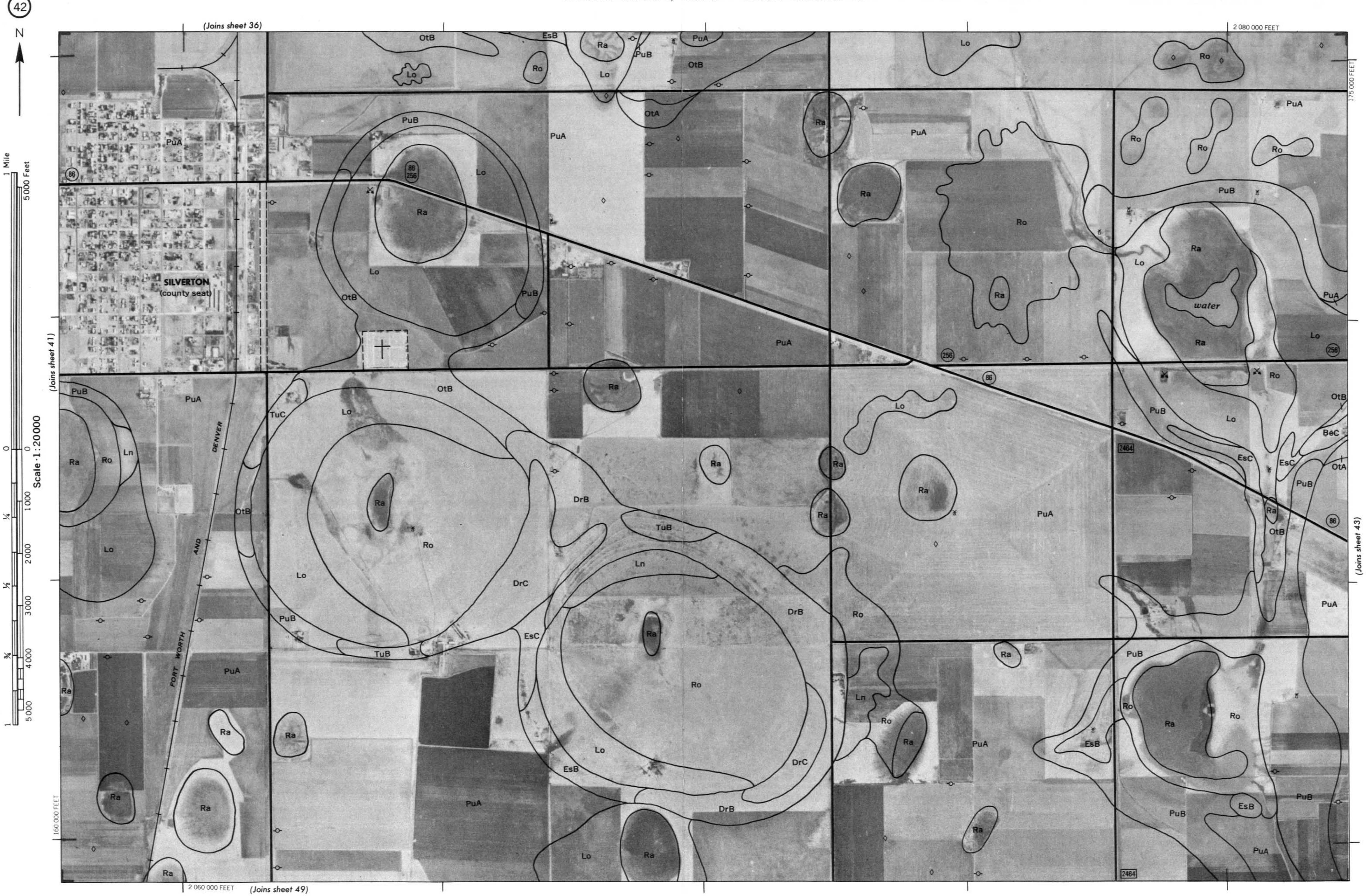

N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
(Joins sheet 31)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 44)
2 130 000 FEET
190 000 FEET
180 000 FEET
2 110 000 FEET
Barrel
Creek
Schott Mountain
Long
Draw
South
Draw
QBG
BQG
OQE
BeC
BeB
BeD
PaB
StA
AmB
BeC
OtB
AcB
AcA
OtA
AmC
EnD
Ra
TxD
OtB
PuA
PuB
TuC
TuB
w

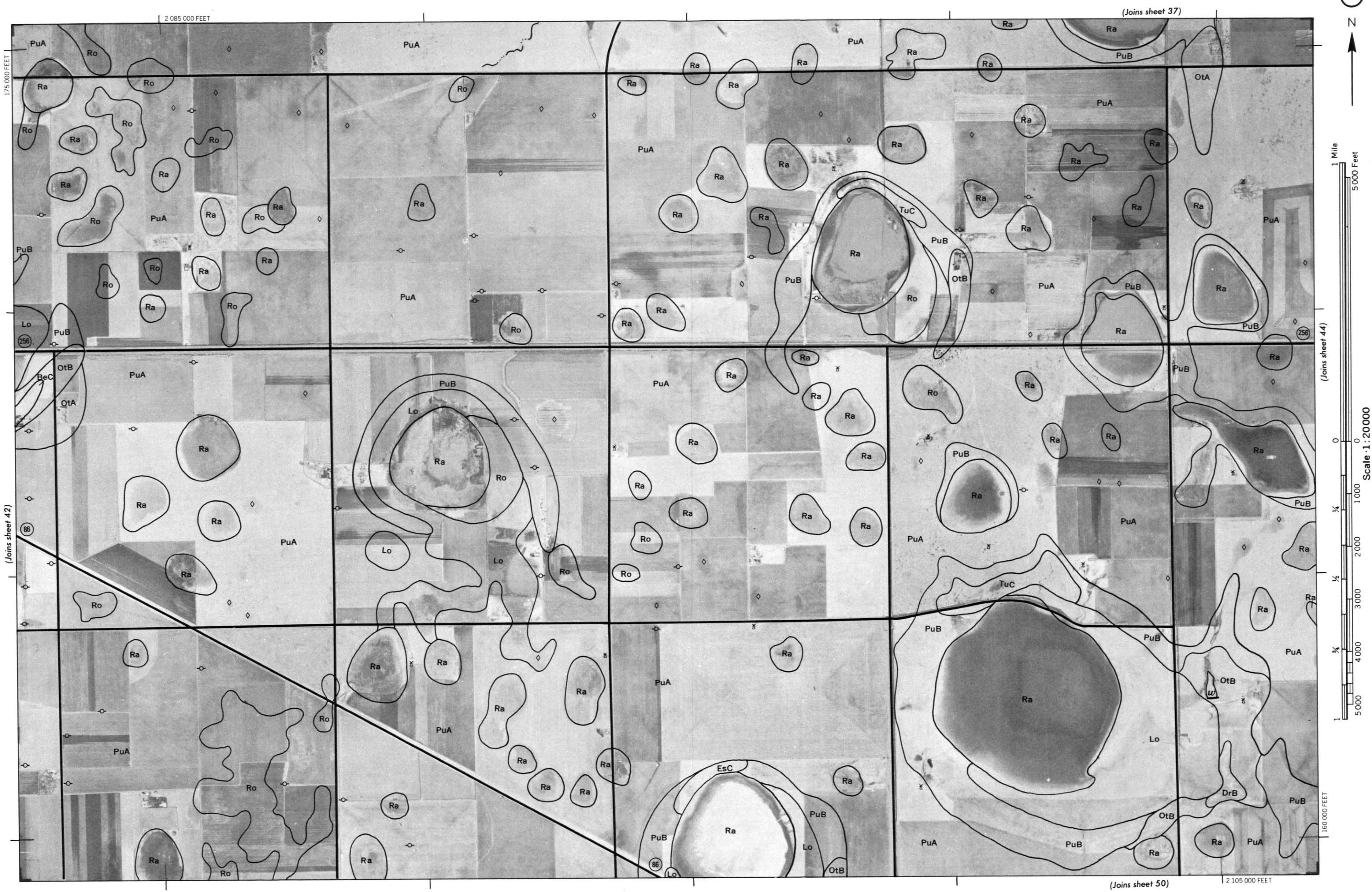

2 135 000 FEET
190 000 FEET
180 000 FEET
2 155 000 FEET
(Joins sheet 32)
(Joins sheet 38)
(Joins inset, sheet 33)
(Joins sheet 45)
N
Scale 1:20000
1 Mile
5000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000
Long Draw
South Draw
Mexican Creek
Bluff Creek
Burson Lake
256
OtB
BeD
PaB
QBG
OQE
BeC
AcB
AcA
OtA
ObB
BQG
AmC
EnD
w

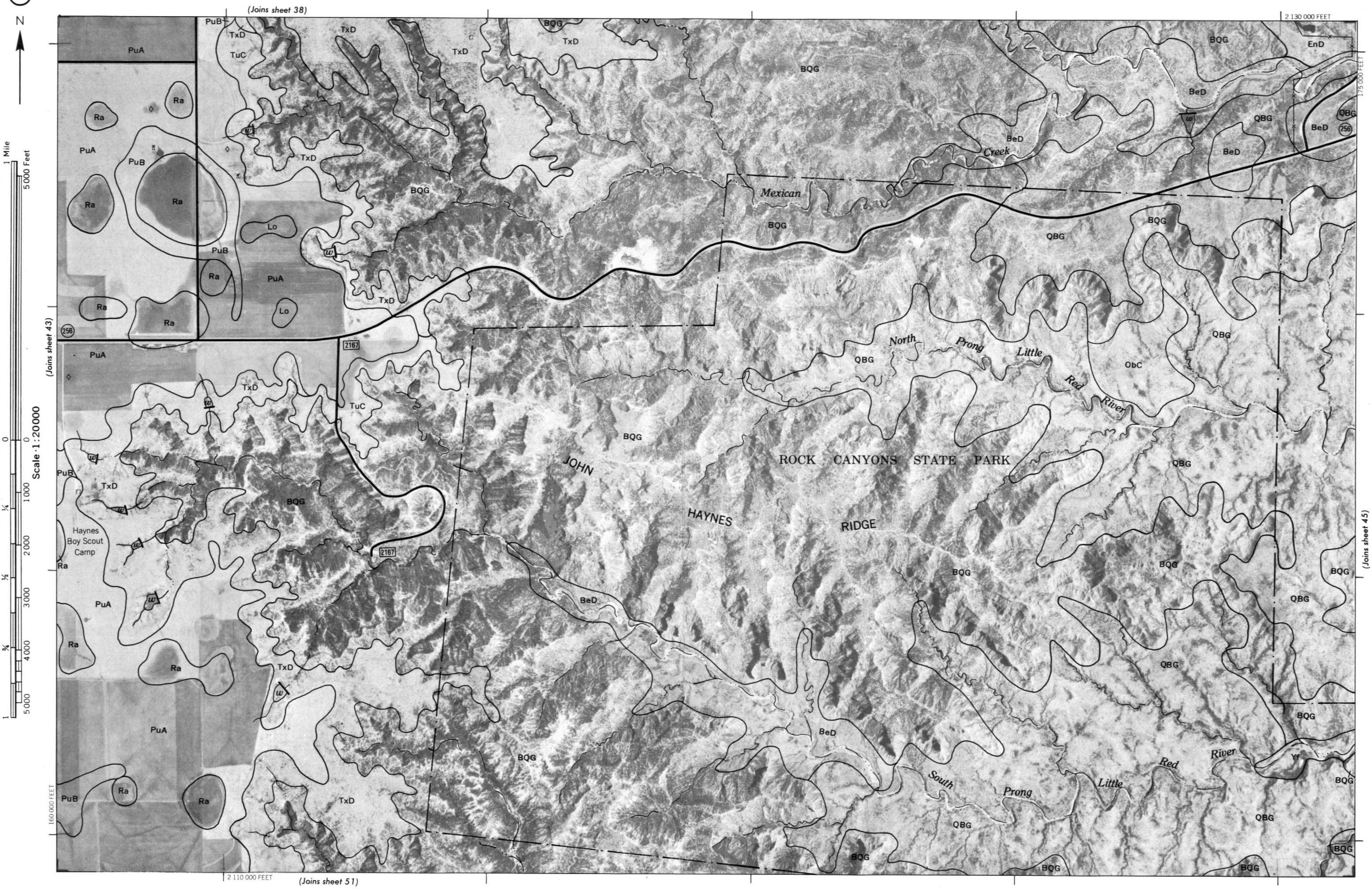
BRISCOE COUNTY, TEXAS — SHEET NUMBER 40




(Joins sheet 35)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 48)
2 035 000 FEET
175 000 FEET
2 055 000 FEET
160 000 FEET
N
SILVERTON
(county seat)
207
86
284
3030
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
½
¼
¾
1
OtA
OtB
PuA
PuB
Ra
Lo
Ln
EsB
EsA
EsC
TuB
DrB
DrC
Ro
BeD

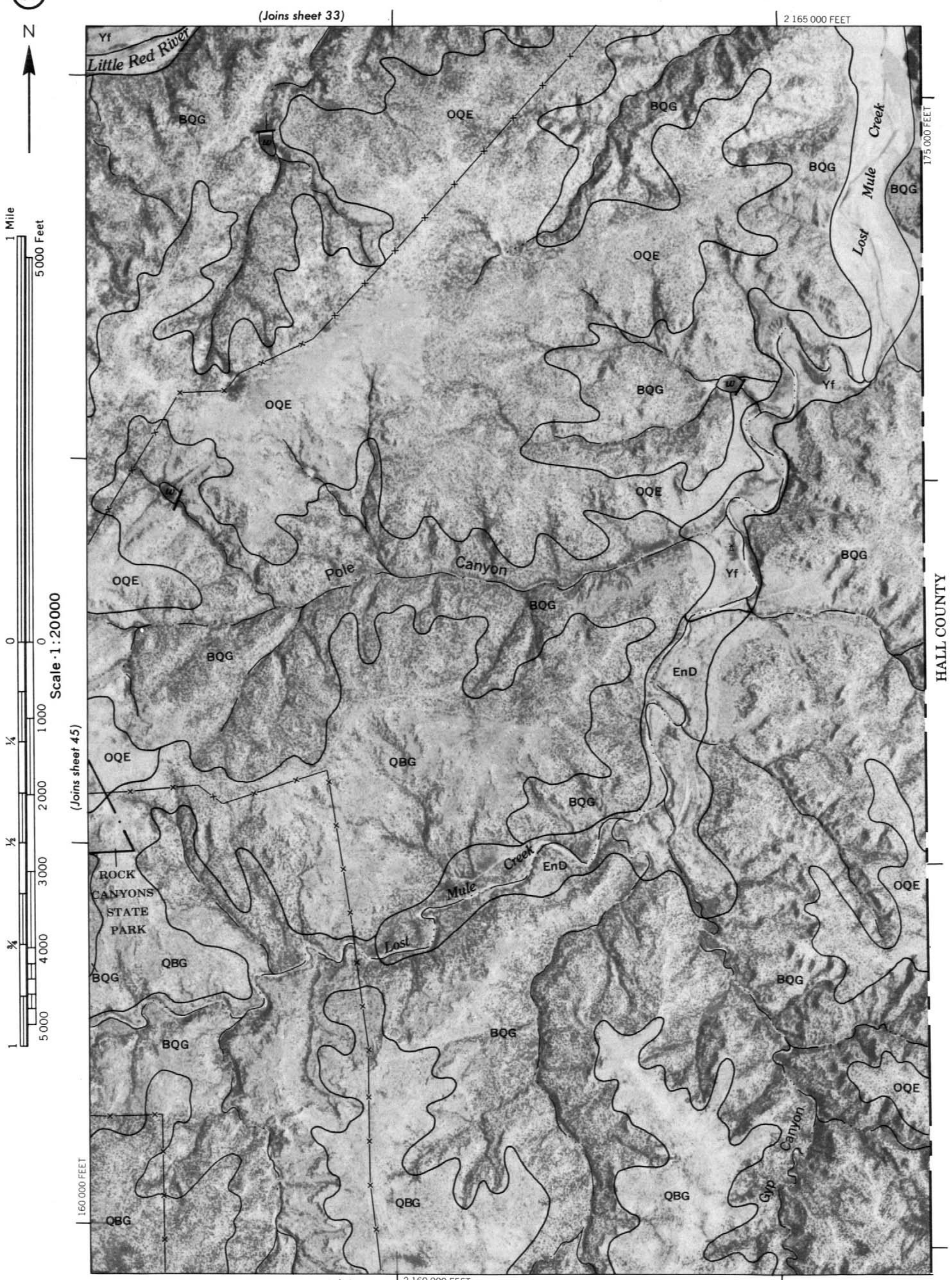

42
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 36)
(Joins sheet 41)
(Joins sheet 43)
(Joins sheet 49)
2 080 000 FEET
175 000 FEET
160 000 FEET
2 060 000 FEET
SILVERTON
(county seat)
FORT WORTH AND DENVER
water
86
256
2464
PuA
PuB
OtB
OtA
EsB
EsC
Ra
Ro
Lo
Ln
TuC
TuB
DrB
DrC
BeC

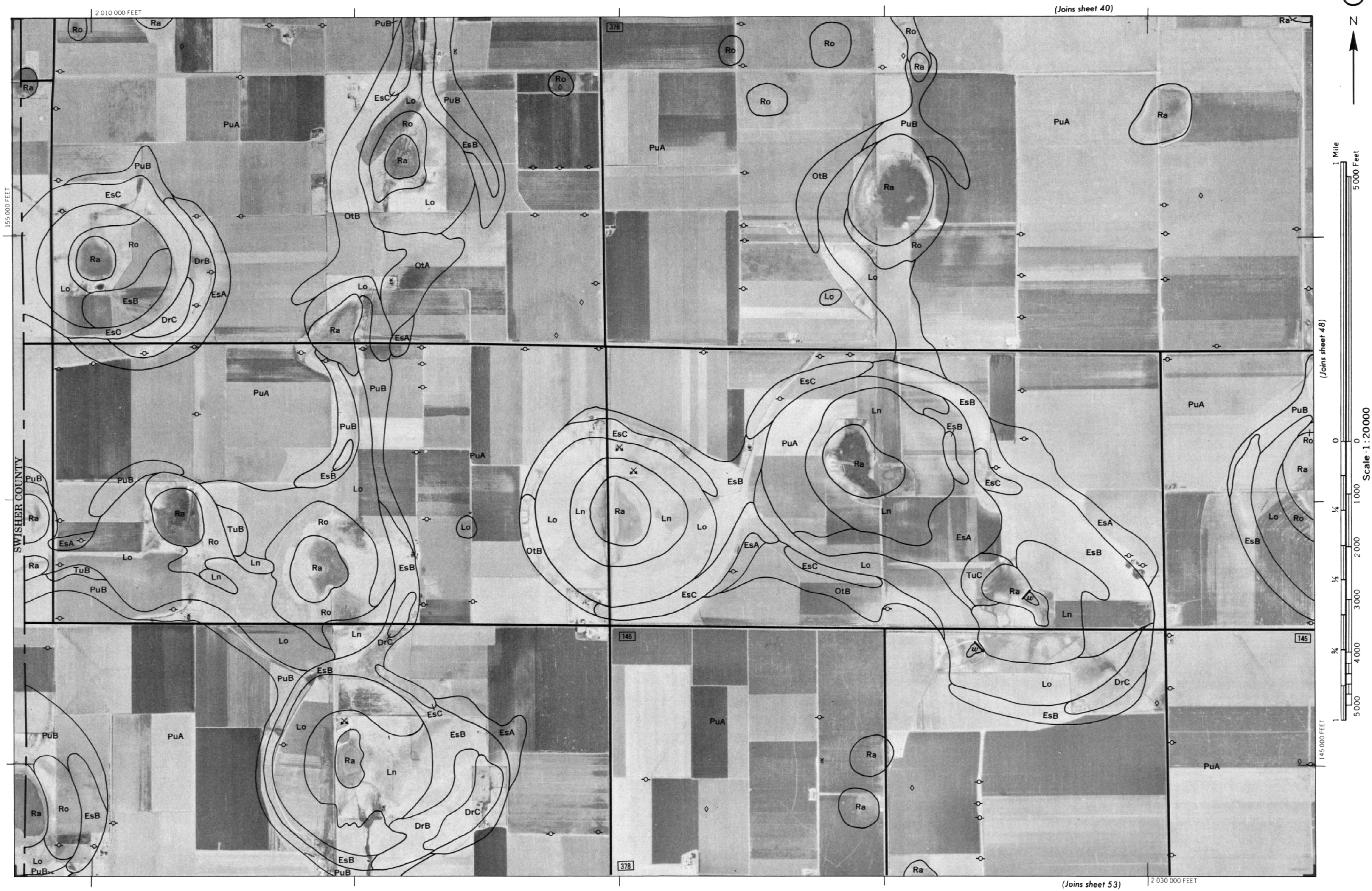

43
N
2 085 000 FEET
175 000 FEET
(Joins sheet 37)
(Joins sheet 44)
(Joins sheet 42)
(Joins sheet 50)
160 000 FEET
2 105 000 FEET
1 Mile
5 000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
256
86
PuA
Ro
Ra
PuB
Lo
OtB
BeC
OtA
TuC
EsC
DrB
w


N
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
(Joins sheet 38)
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 51)
2 130 000 FEET
175 000 FEET
160 000 FEET
2 110 000 FEET
ROCK CANYONS STATE PARK
JOHN HAYNES RIDGE
Haynes Boy Scout Camp
Mexican Creek
North Prong Little Red River
South Prong Little Red River
2167
256
PuA
PuB
Ra
Lo
TxD
TuC
BQG
QBG
BeD
EnD
ObC
Yf

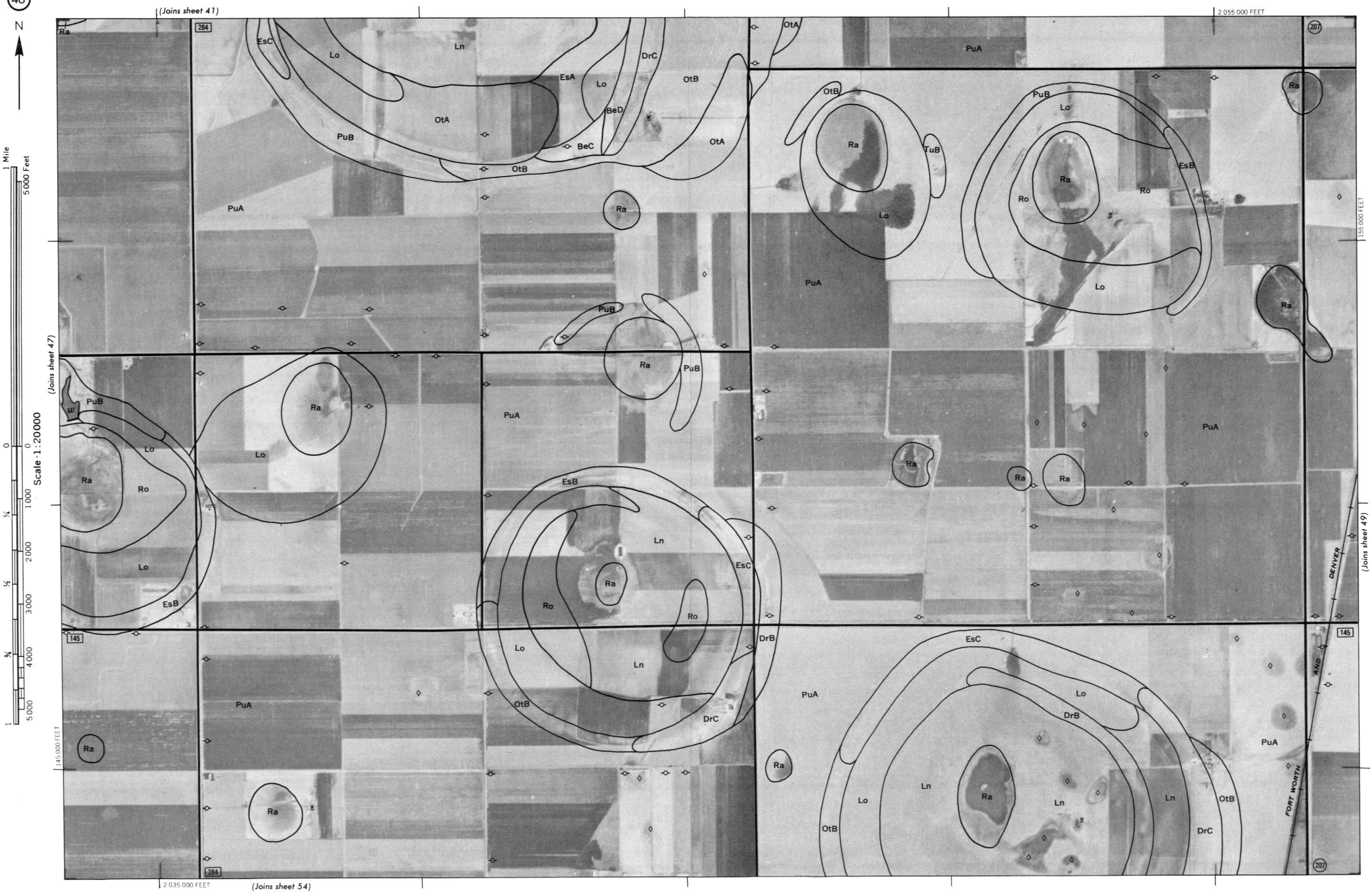

45
2 135 000 FEET
175 000 FEET
(Joins sheet 39)
(Joins sheet 46)
(Joins sheet 44)
(Joins sheet 52)
2 155 000 FEET
160 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000
0
1/4
1/2
3/4
1
0
1000
2000
3000
4000
5000
Mexican Creek
North Prong
Little Red River
Holmes Creek
South Prong
Mule Creek
Lost
ROCK CANYONS STATE PARK
256
EnD
BeD
QBG
AcB
AmB
AmC
BQG
OQE
Yf
AmA
ObB
AcA
OtA
w

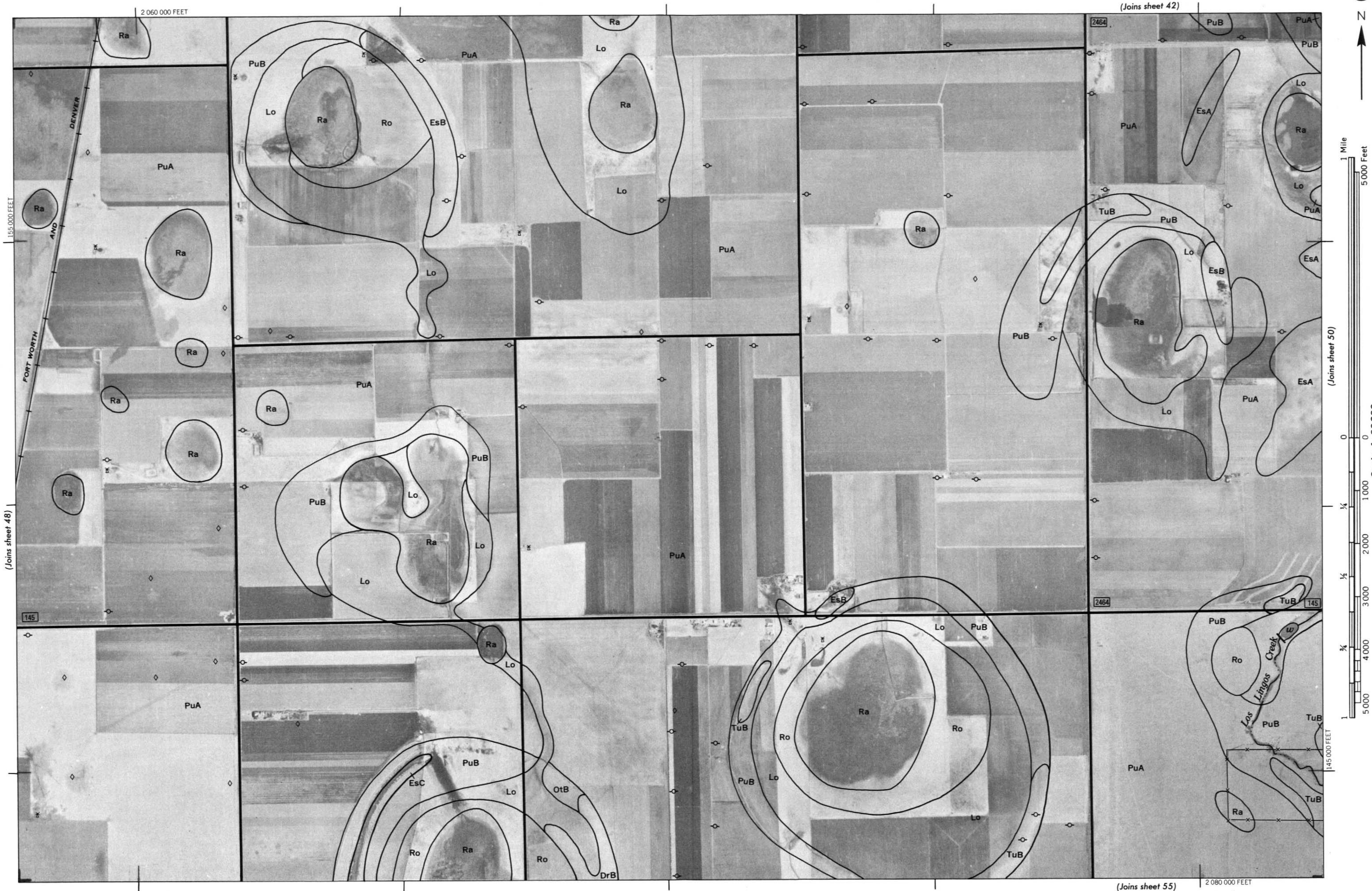
BRISCOE COUNTY, TEXAS — SHEET NUMBER 46

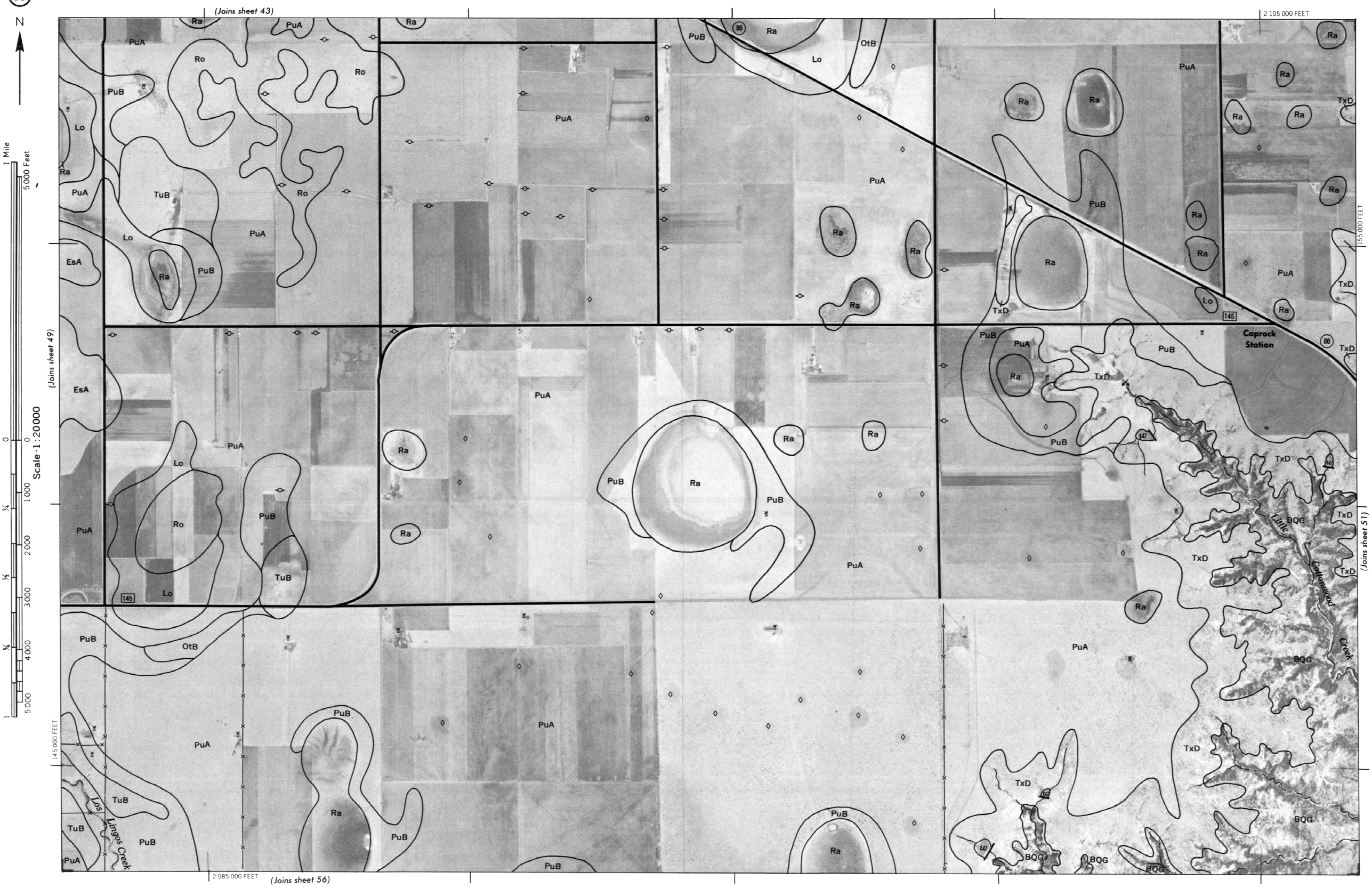



(Joins sheet 40)
(Joins sheet 48)
(Joins sheet 53)
2 010 000 FEET
2 030 000 FEET
155 000 FEET
145 000 FEET
SWISHER COUNTY
N
1 Mile
5000 Feet
Scale 1:20000
378
145
Ro
Ra
PuA
PuB
EsC
EsB
EsA
Lo
Ln
OtB
OtA
DrB
DrC
TuB
TuC

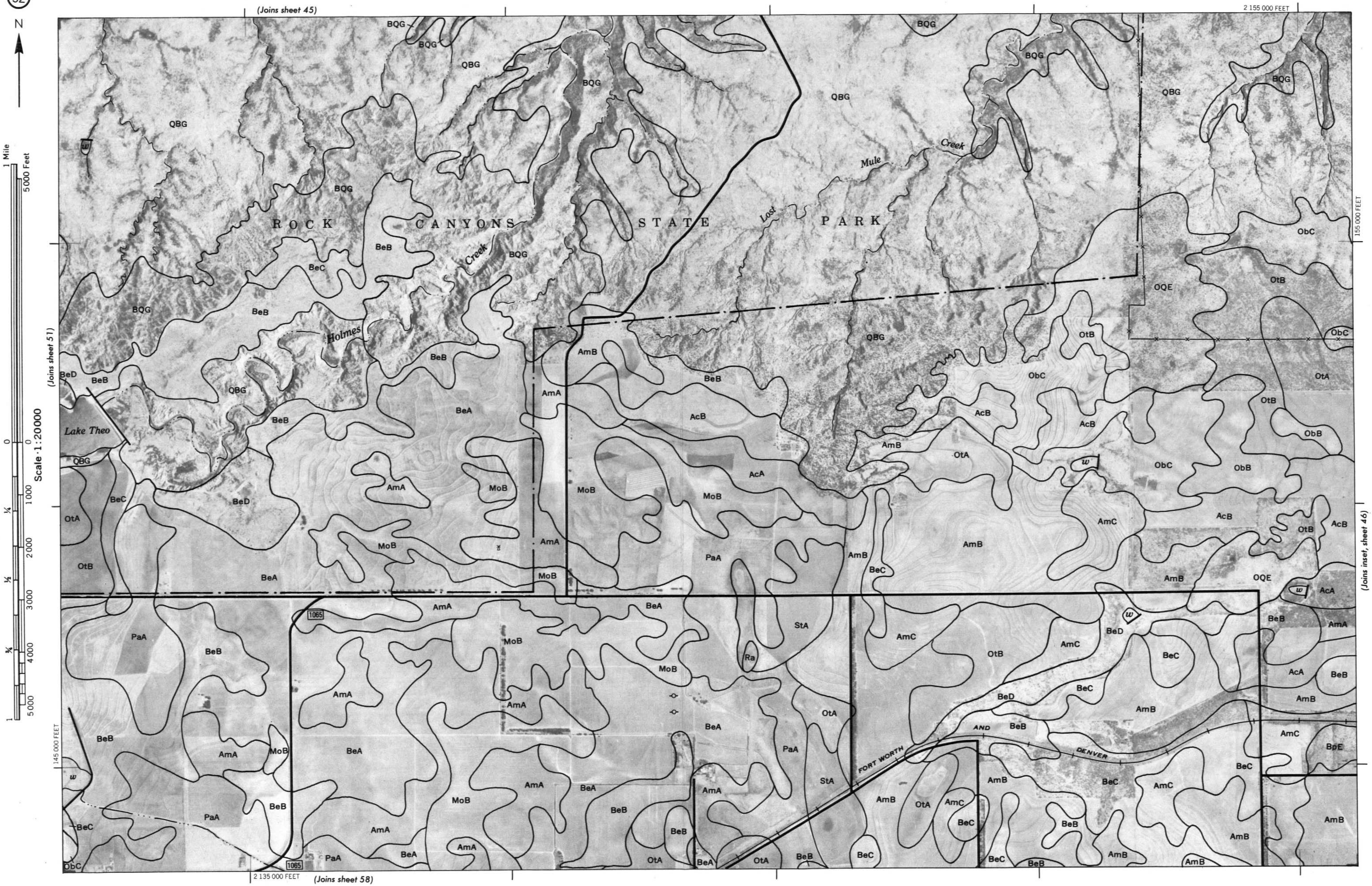
BRISCOE COUNTY, TEXAS — SHEET NUMBER 48

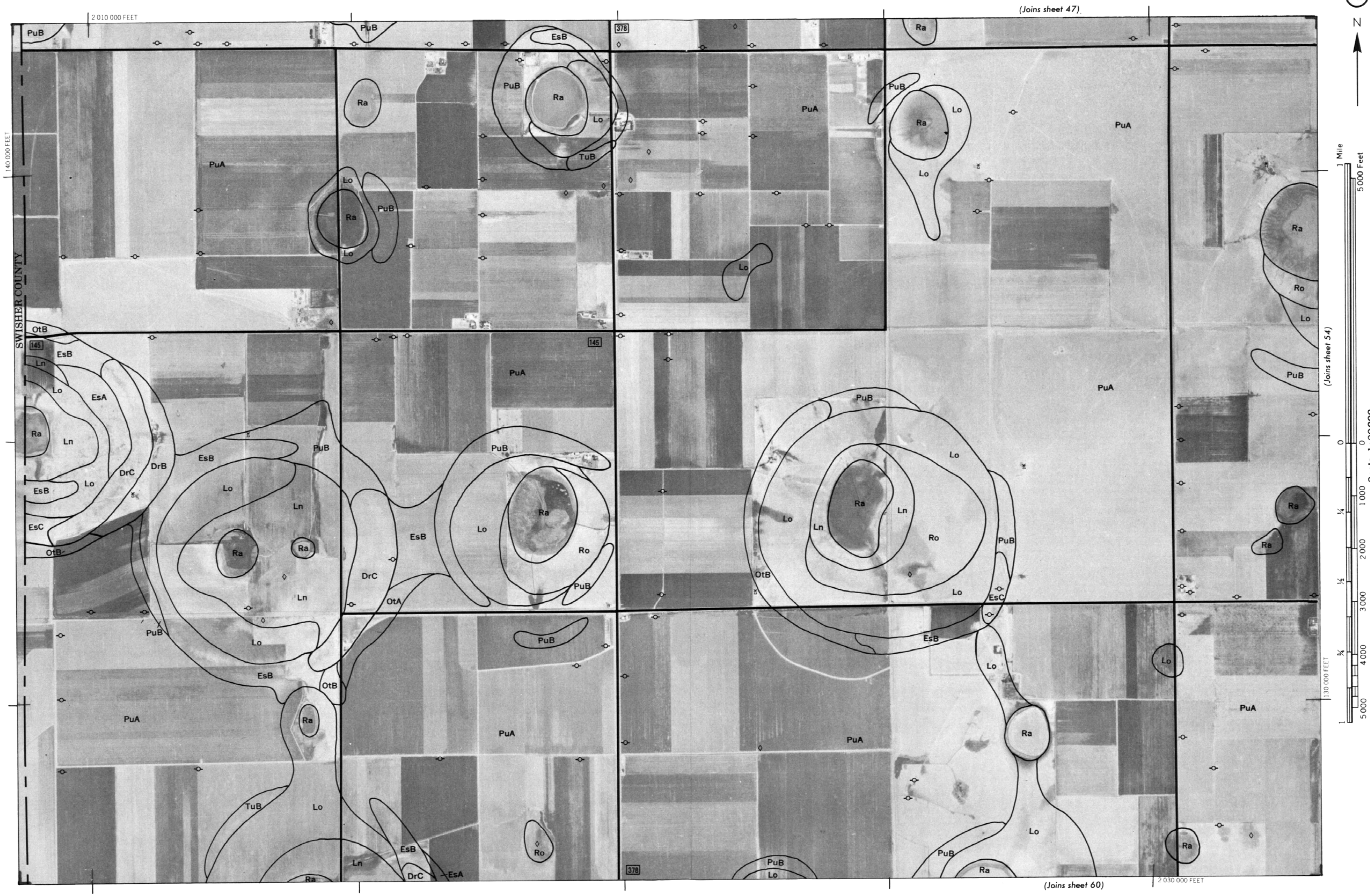



49
N
(Joins sheet 42)
(Joins sheet 48)
(Joins sheet 50)
(Joins sheet 55)
2 060 000 FEET
2 080 000 FEET
155 000 FEET
145 000 FEET
FORT WORTH AND DENVER
Los Lingos Creek
2464
145
PuA
PuB
Ra
Lo
Ro
EsB
EsA
EsC
TuB
OtB
DrB
W
1 Mile
5000 Feet
Scale 1:20000


N
Scale 1:20000
1 Mile
5000 Feet
(Joins sheet 43)
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 56)
2 105 000 FEET
155 000 FEET
145 000 FEET
2 085 000 FEET
Caprock Station
Little Cottonwood Creek
Los Lingos Creek
86
145
Ra
PuA
PuB
Ro
Lo
TuB
EsA
OtB
TxD
BQG
w


2 110 000 FEET
(Joins sheet 44)
Eagles Point
ROCK CANYONS STATE PARK
155 000 FEET
(Joins sheet 50)
(Joins sheet 52)
(Joins sheet 57)
145 000 FEET
2 130 000 FEET
Holmes Creek
Dry Creek
Hawkins Lake
Dry Creek Lake
Lake Theo
Little Cottonwood Creek
Kent Creek
Old Flat Top
Antenna
86
PuA
PuB
Ra
TxD
BQG
QBG
BeC
BeD
BeB
OtB
OtA
ObC
PaA
PaB
OQE
AmC
AmB
AmA
w
N
1 Mile
5000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000
Scale 1:20000


N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
(Joins sheet 45)
(Joins sheet 51)
(Joins inset, sheet 46)
(Joins sheet 58)
2 155 000 FEET
155 000 FEET
145 000 FEET
2 135 000 FEET
ROCK CANYONS STATE PARK
Holmes Creek
Lost Mule Creek
Lake Theo
FORT WORTH AND DENVER
1065
BQG
QBG
BeB
BeC
BeD
BeA
OtA
OtB
AmA
AmB
AmC
MoB
AcB
AcA
ObC
ObB
OQE
PaA
StA
Ra
BpE
w

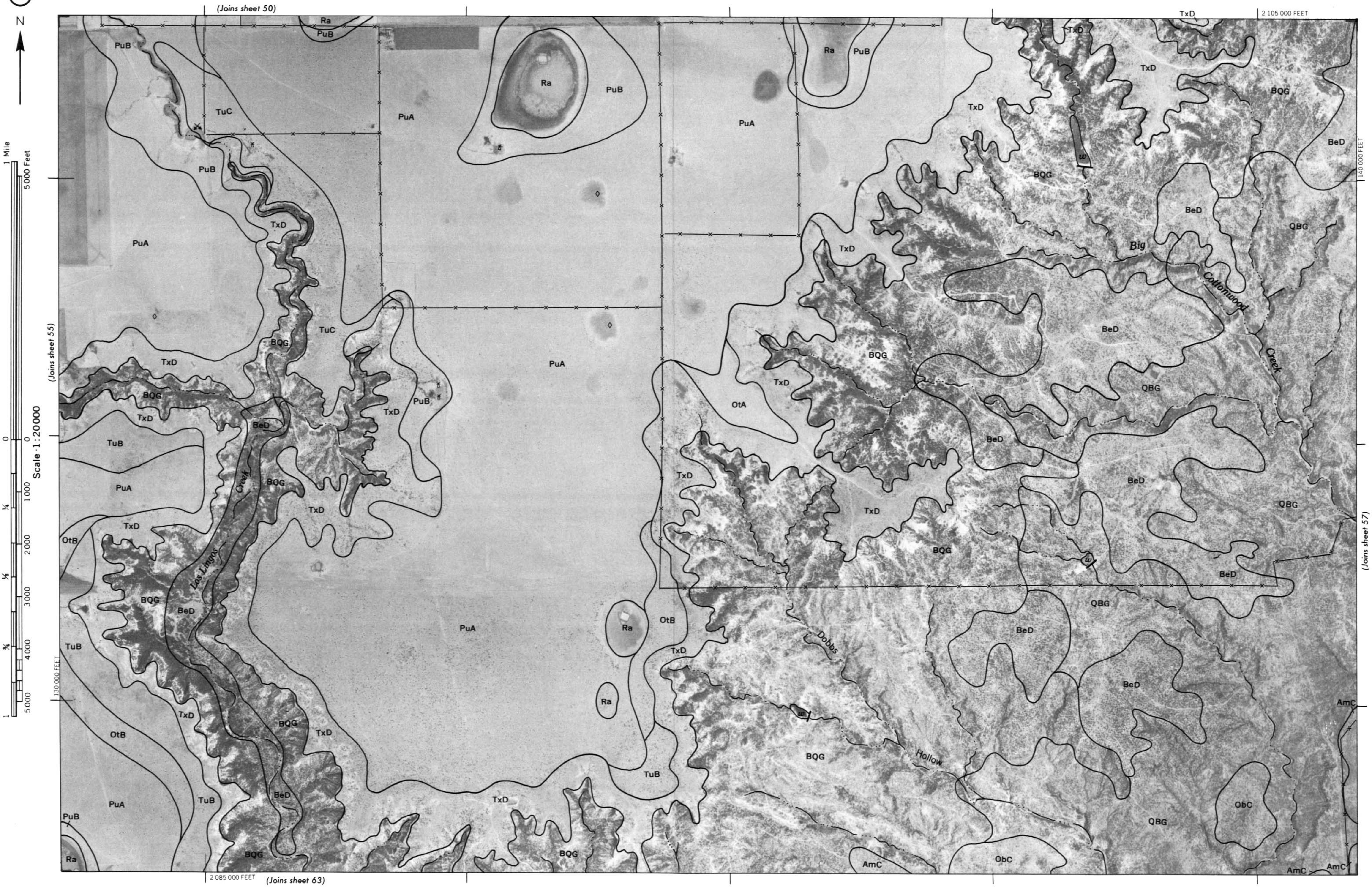


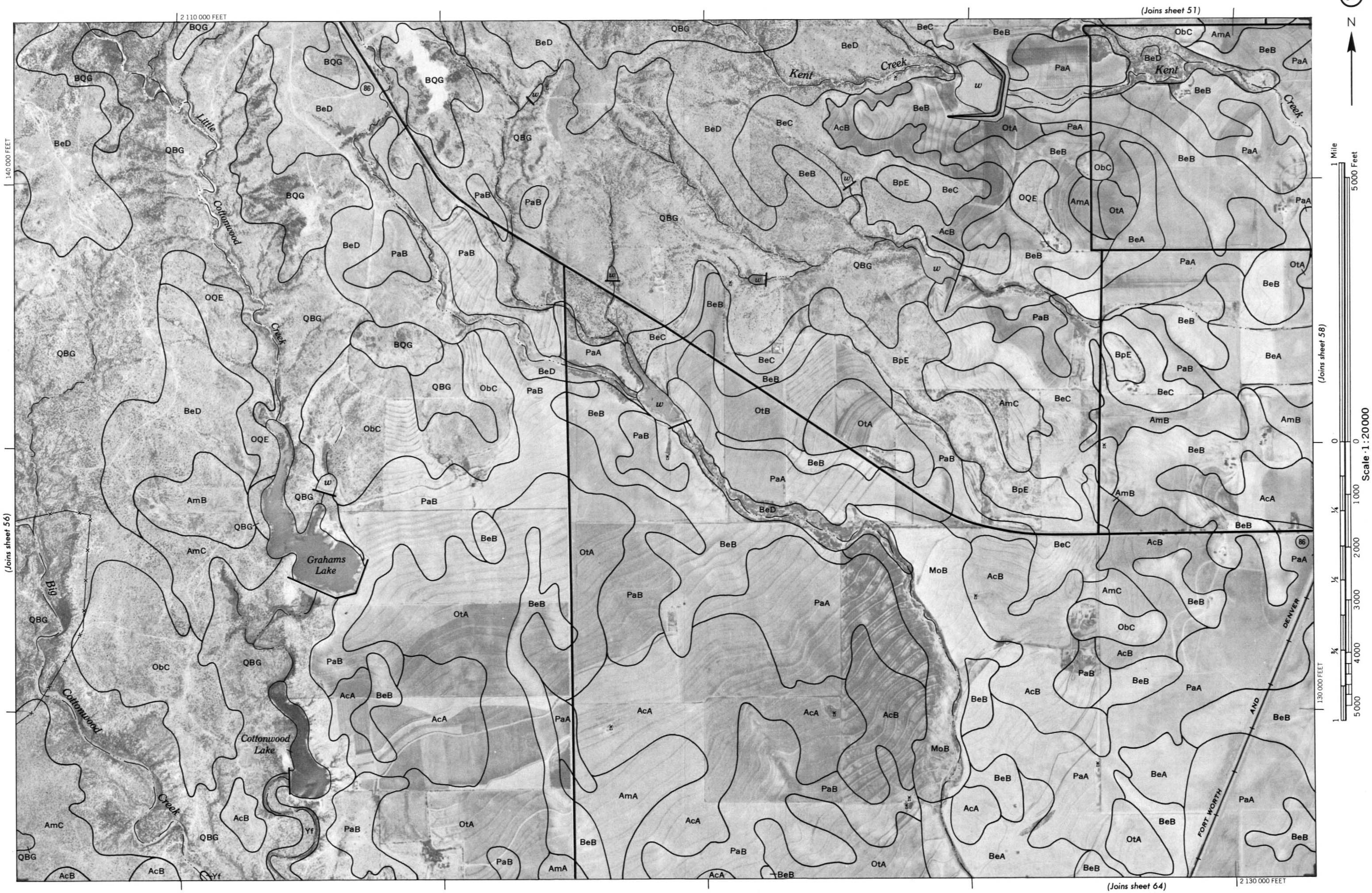
53
(Joins sheet 47)
(Joins sheet 54)
(Joins sheet 60)
2 010 000 FEET
2 030 000 FEET
140 000 FEET
130 000 FEET
SWISHER COUNTY
N
Scale 1:20000
1 Mile
5000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000
378
145
PuA
PuB
Ra
Ro
Lo
Ln
EsA
EsB
EsC
DrB
DrC
OtA
OtB
TuB

54

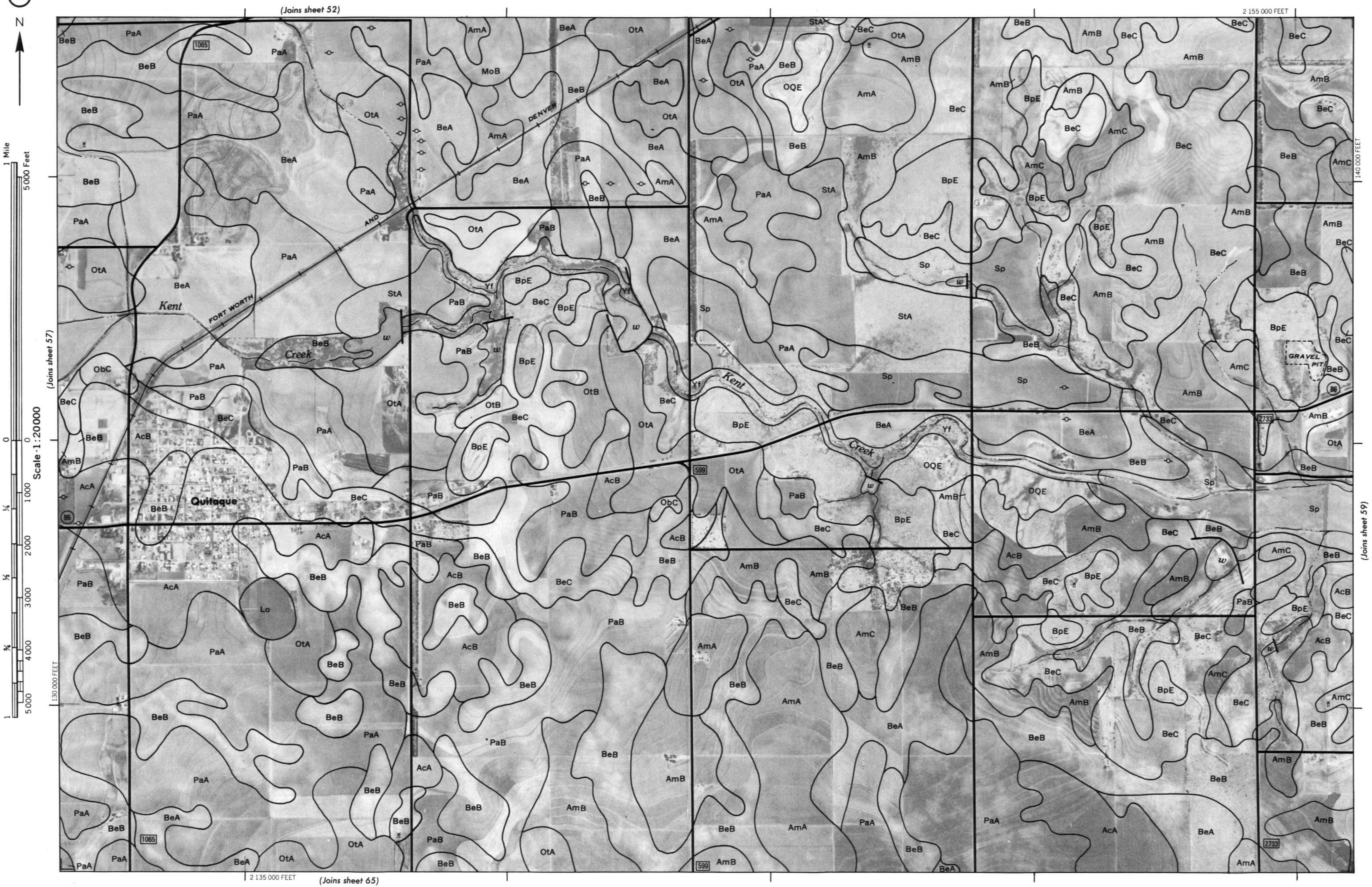
BRISCOE COUNTY, TEXAS — SHEET NUMBER 54


(Joins sheet 49)
(Joins sheet 56)
(Joins sheet 54)
(Joins sheet 62)
2 060 000 FEET
140 000 FEET
130 000 FEET
2 080 000 FEET
N
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
Scale 1:20000
PuB
EsC
Ra
Lo
Ro
DrB
TuB
PuA
PuB
Ra
Lo
PuB
Ra
Ro
OtA
TuB
OtB
PuB
Ra
Ra
TxD
BOG
TuB
w
Ra
Lo
Ra
Ro
EsC
PuA
PuB
Lo
Ra
Ra
Ra
PuA
Ra
Ro
PuB
Lo
Ra
PuA
TuB
OtB
Ra
Ro
EsB
PuA
Lo
PuB
Ra
Ra
Ra
Ra
Lo
PuA
Ra
PuA
PuB
Ra
Ra

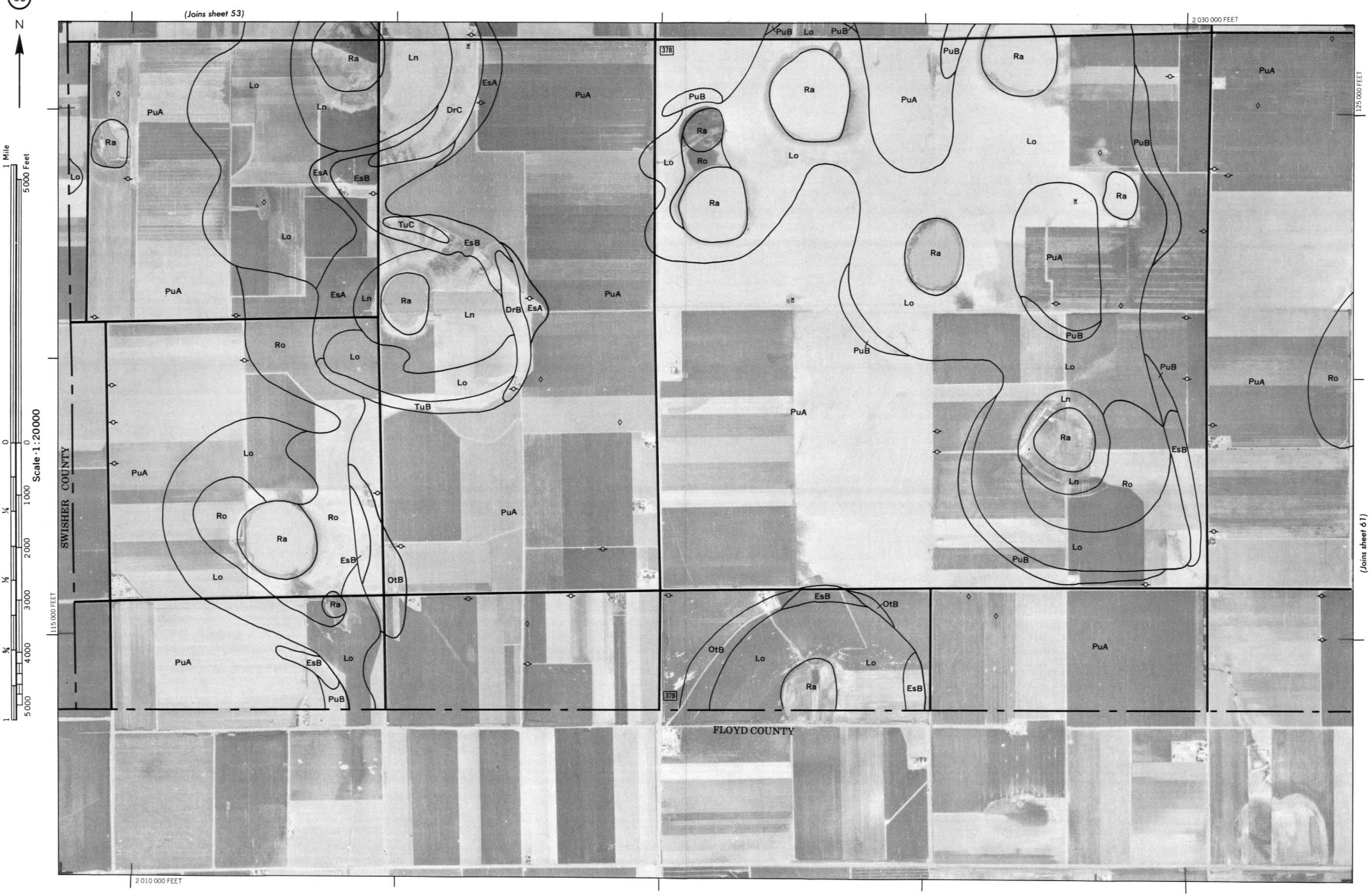

N
(Joins sheet 50)
(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 63)
2 105 000 FEET
140 000 FEET
130 000 FEET
2 085 000 FEET
1 Mile
5000 Feet
Scale 1:20000
Big Cottonwood Creek
Los Lingos Creek
Dobbs Hollow
PuB
PuA
Ra
TuC
TxD
BQG
BeD
QBG
OtA
OtB
TuB
AmC
ObC

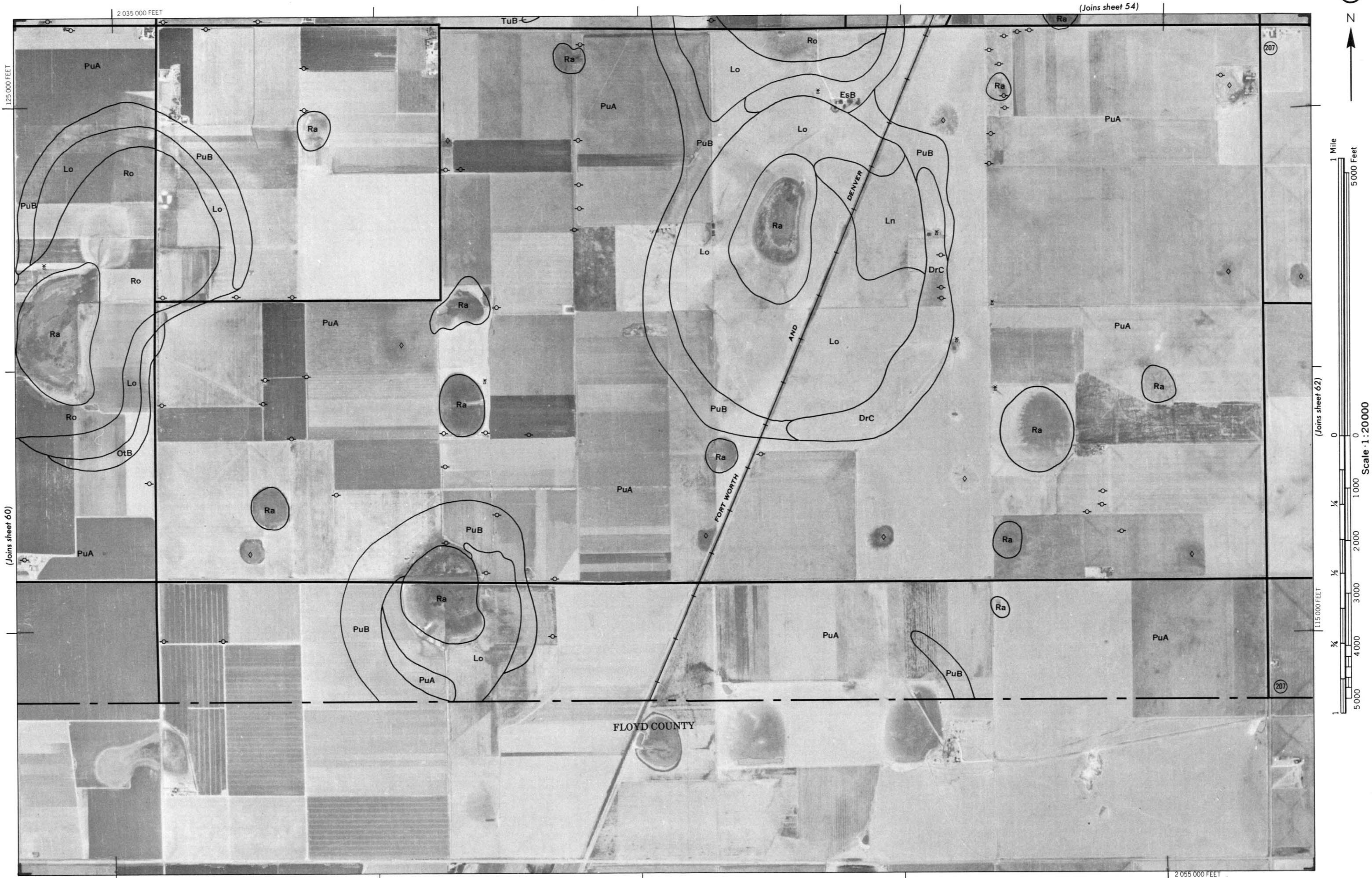


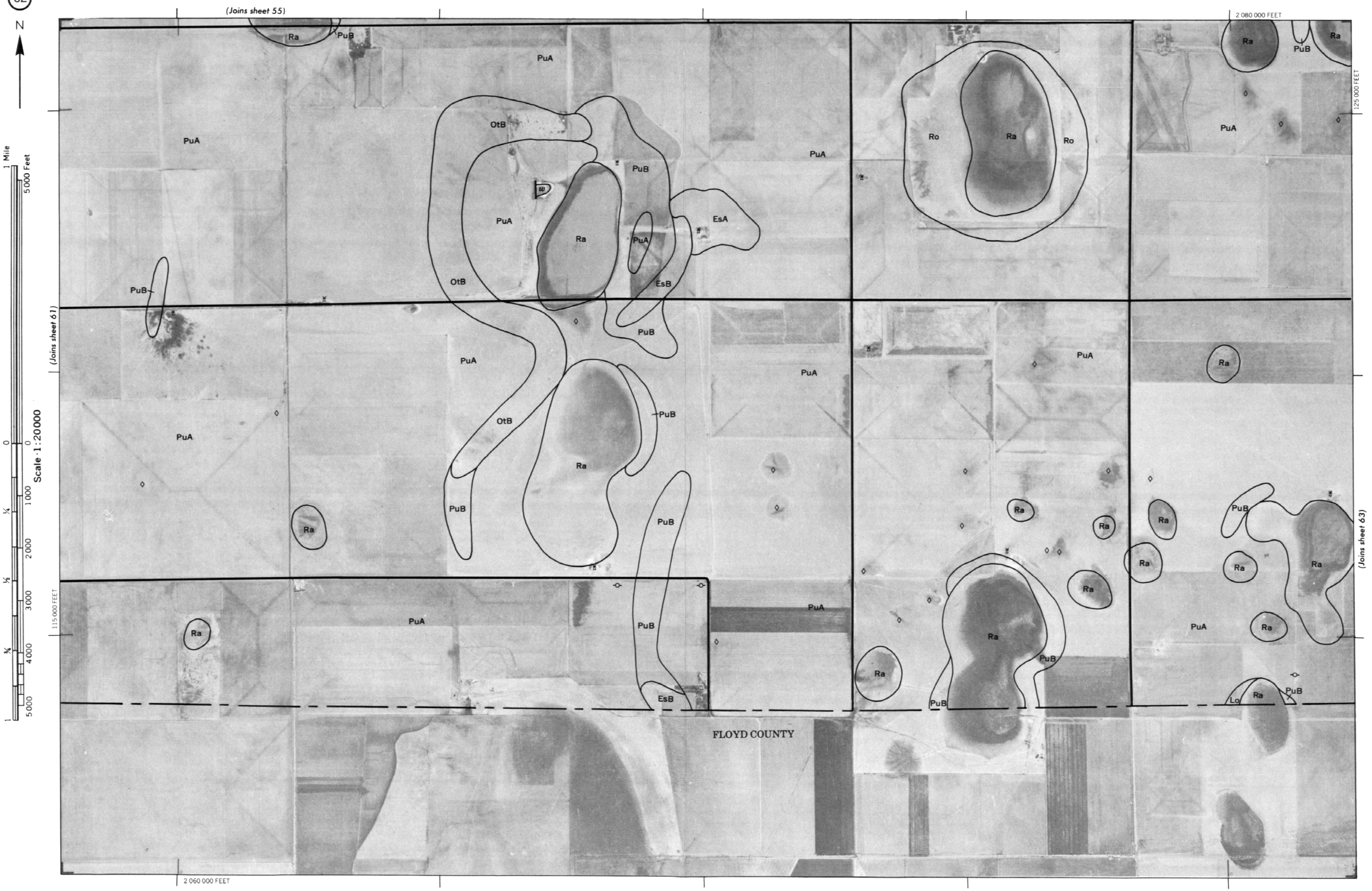
N
2 110 000 FEET
140 000 FEET
130 000 FEET
2 130 000 FEET
(Joins sheet 51)
(Joins sheet 58)
(Joins sheet 64)
(Joins sheet 56)
Kent Creek
Little Cottonwood Creek
Big Cottonwood Creek
Grahams Lake
Cottonwood Lake
86
FORT WORTH AND DENVER
1 Mile
5000 Feet
Scale 1:20000

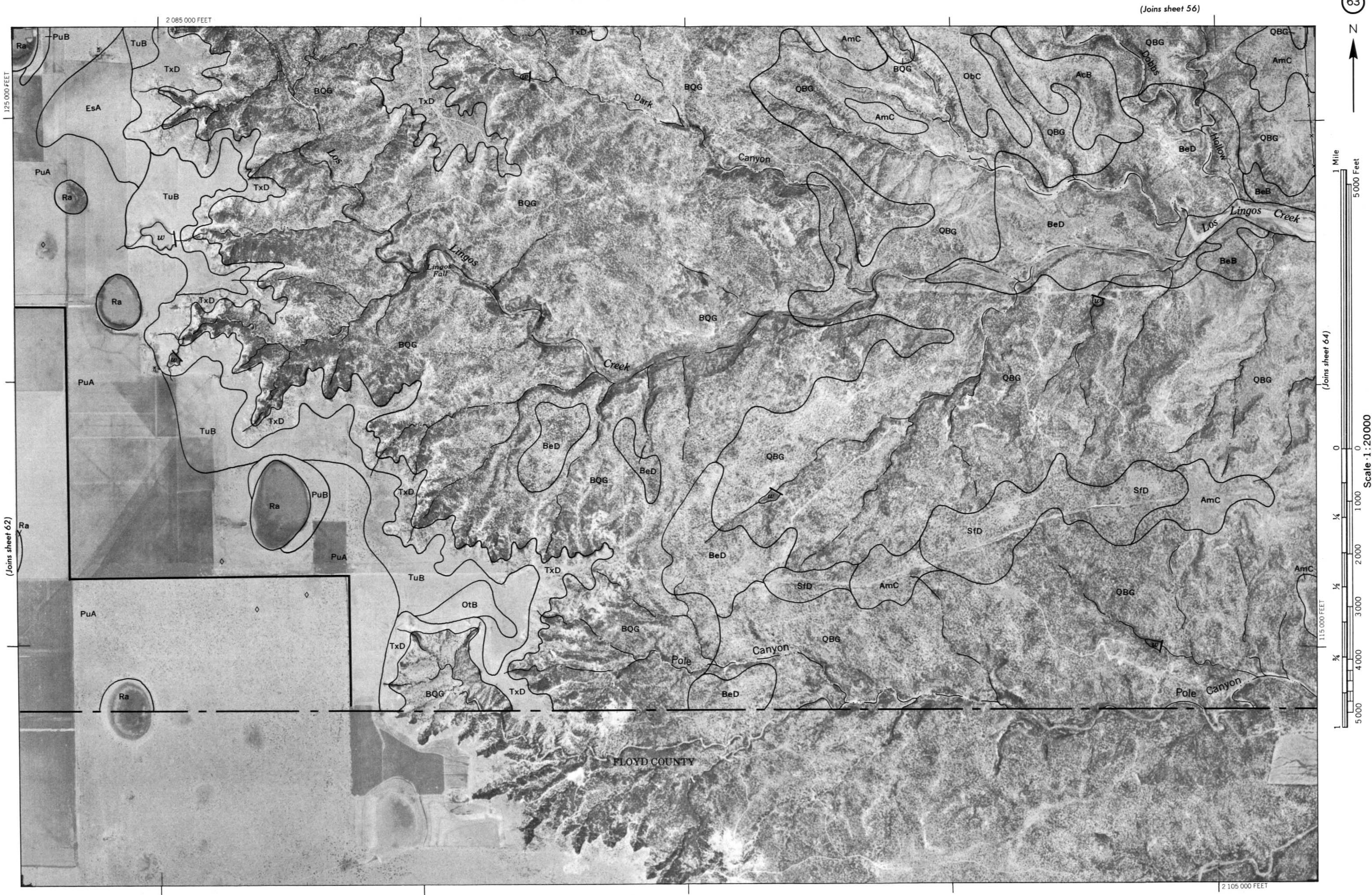

(Joins sheet 52)
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 65)
N
1 Mile
5000 Feet
Scale 1:20000
2 155 000 FEET
140 000 FEET
130 000 FEET
2 135 000 FEET
Quitaque
Kent
Creek
FORT WORTH
AND
DENVER
GRAVEL PIT
1065
86
599
2733


(Joins sheet 46)
(Joins lower left)
(Joins sheet 58)
(Joins sheet 65)
(Joins upper right)
2 160 000 FEET
2 165 000 FEET
140 000 FEET
130 000 FEET
125 000 FEET
115 000 FEET
HALL COUNTY
MOTLEY COUNTY
Kent
Creek
86
N
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000
AcA
AcB
AmA
AmB
AmC
BeB
BeC
BeD
BpE
MeB
OtA
SfD
Sp
TfF
w

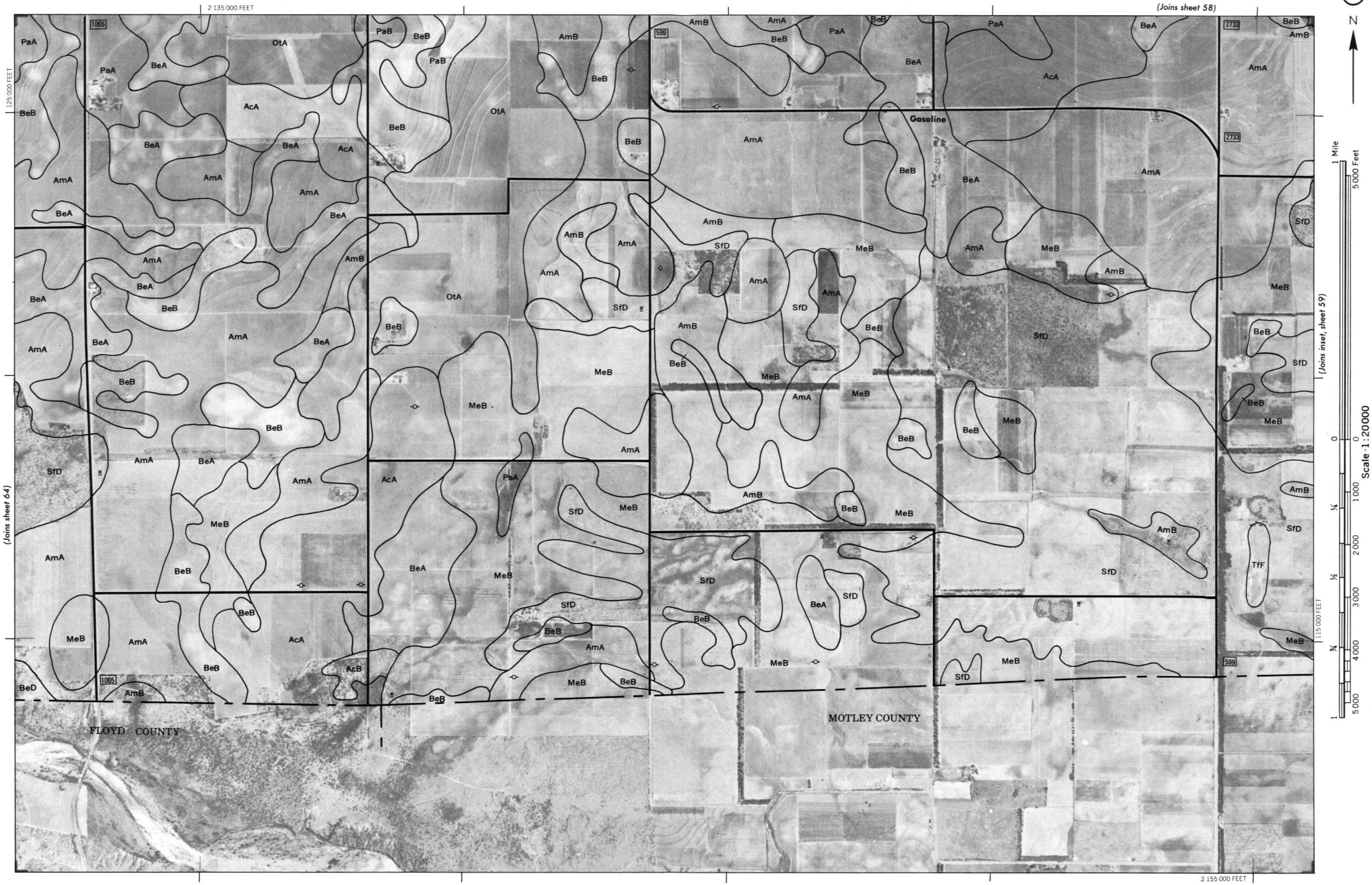

(Joins sheet 53)
(Joins sheet 61)
N
1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000
2 030 000 FEET
125 000 FEET
115 000 FEET
2 010 000 FEET
SWISHER COUNTY
FLOYD COUNTY
378
PuA
PuB
Lo
Ln
Ra
Ro
EsA
EsB
DrC
DrB
TuC
TuB
OtB


2 035 000 FEET
125 000 FEET
(Joins sheet 54)
(Joins sheet 60)
(Joins sheet 62)
115 000 FEET
2 055 000 FEET
TuB
Ro
Lo
EsB
PuA
PuB
Ra
Ro
Lo
PuB
Ln
DrC
DrC
DENVER
AND
FORT WORTH
OtB
207
FLOYD COUNTY
N
1 Mile
5000 Feet
Scale 1:20000
0
1/4
1/2
3/4
1
1000
2000
3000
4000
5000


N
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
(Joins sheet 55)
(Joins sheet 61)
(Joins sheet 63)
2 080 000 FEET
125 000 FEET
115 000 FEET
2 060 000 FEET
FLOYD COUNTY
Ra
PuB
PuA
OtB
Ro
EsA
EsB
Lo


63
N
(Joins sheet 56)
(Joins sheet 62)
(Joins sheet 64)
2 085 000 FEET
2 105 000 FEET
125 000 FEET
115 000 FEET
1 Mile
5 000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000
Ra
PuB
TuB
TxD
EsA
PuA
BQG
Los
Lingos
Lingos Fall
Creek
Dark
Canyon
AmC
QBG
ObC
AcB
Dobbs
Hollow
BeD
BeB
Los Lingos Creek
BeD
SfD
OtB
Pole Canyon
FLOYD COUNTY

BRISCOE COUNTY, TEXAS — SHEET NUMBER 64


2 135 000 FEET
(Joins sheet 58)
125 000 FEET
(Joins sheet 64)
(Joins inset, sheet 59)
115 000 FEET
2 155 000 FEET
N
Gasoline
FLOYD COUNTY
MOTLEY COUNTY
1065
599
2733
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
Scale 1:20000
PaA
PaB
BeA
BeB
BeD
AmA
AmB
AcA
AcB
OtA
MeB
SfD
TfF