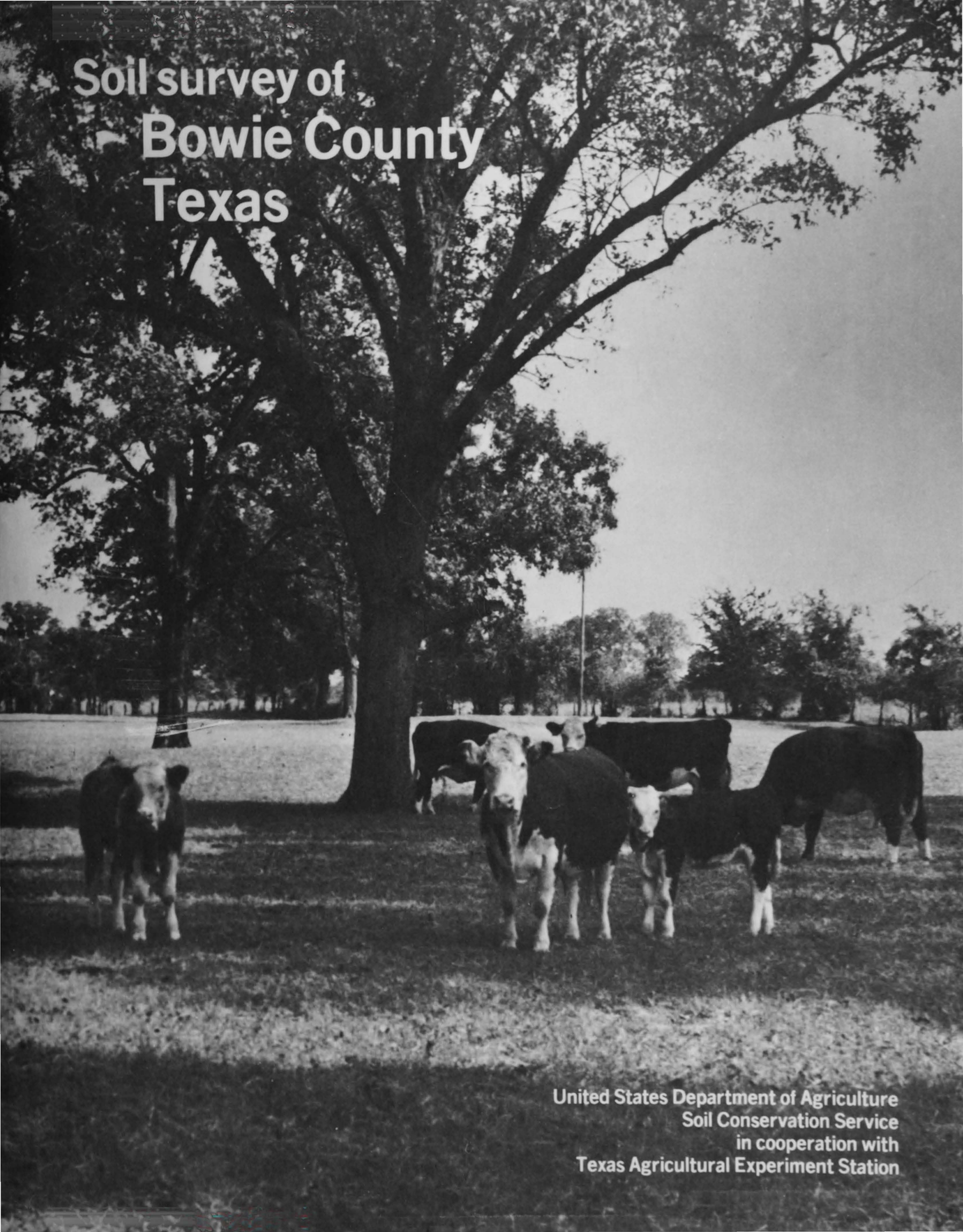
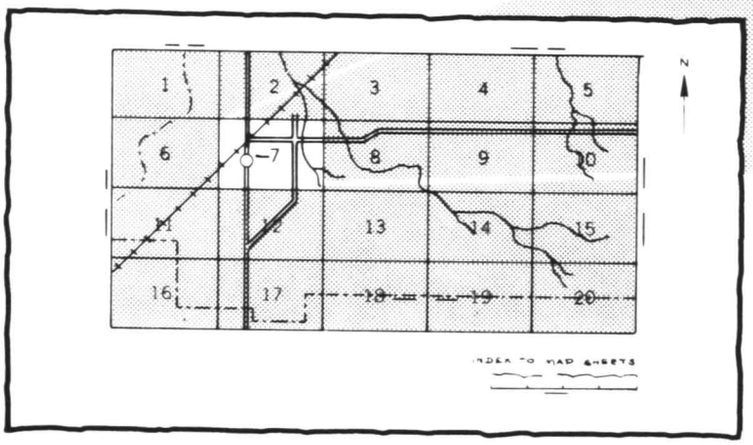
Soil survey of Bowie County Texas

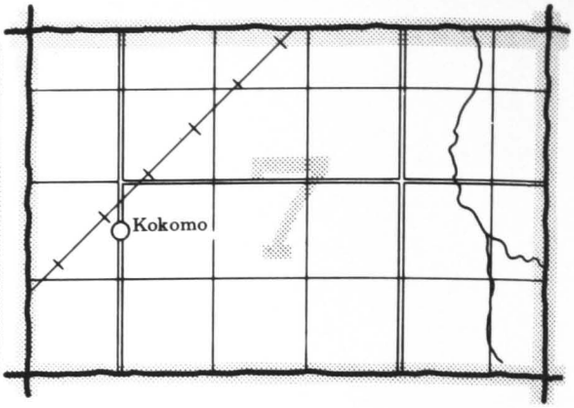


United States Department of Agriculture
Soil Conservation Service
in cooperation with
Texas Agricultural Experiment Station

HOW TO USE

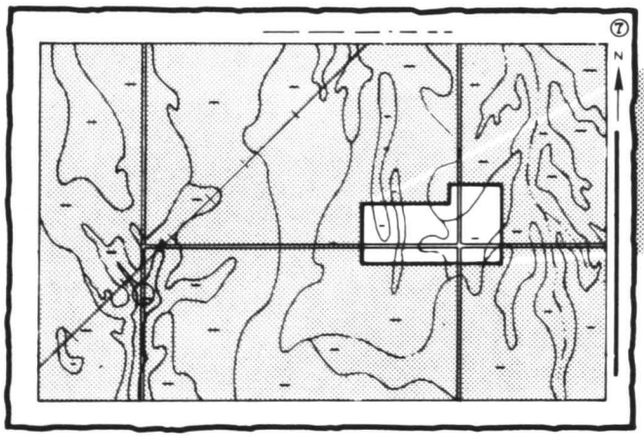
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

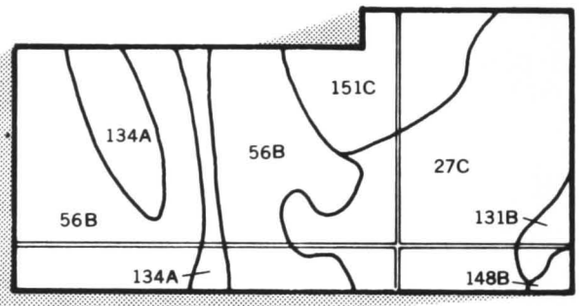




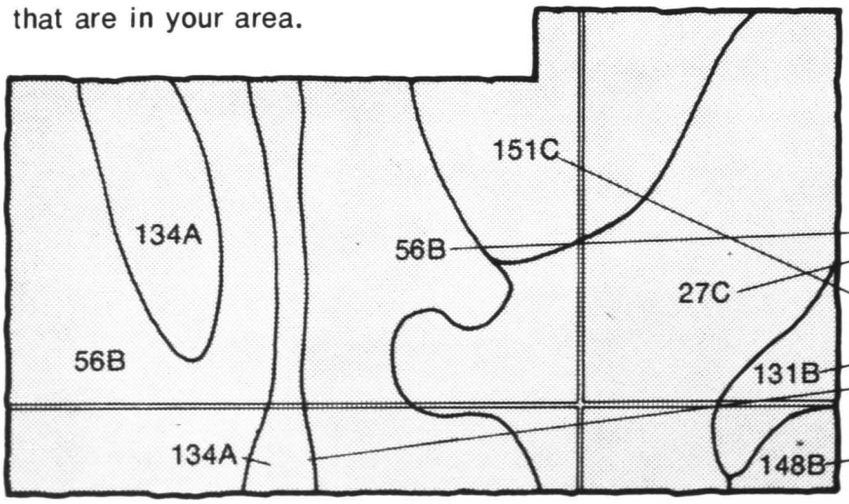
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





4. List the mapping unit symbols that are in your area.



Symbols

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56B
131B
134A
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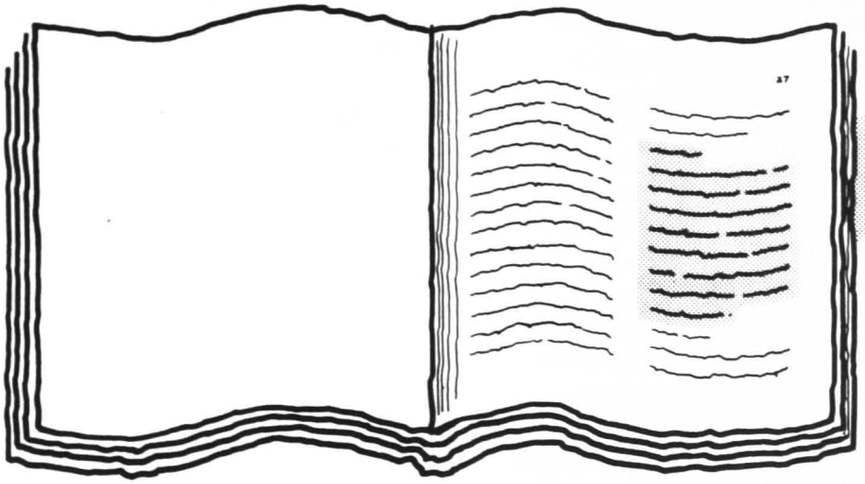
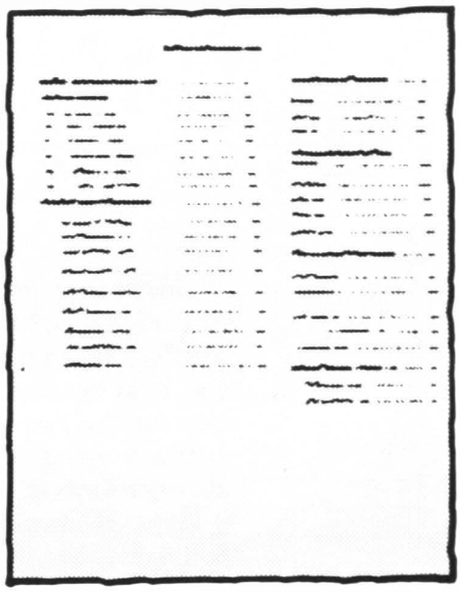
151C

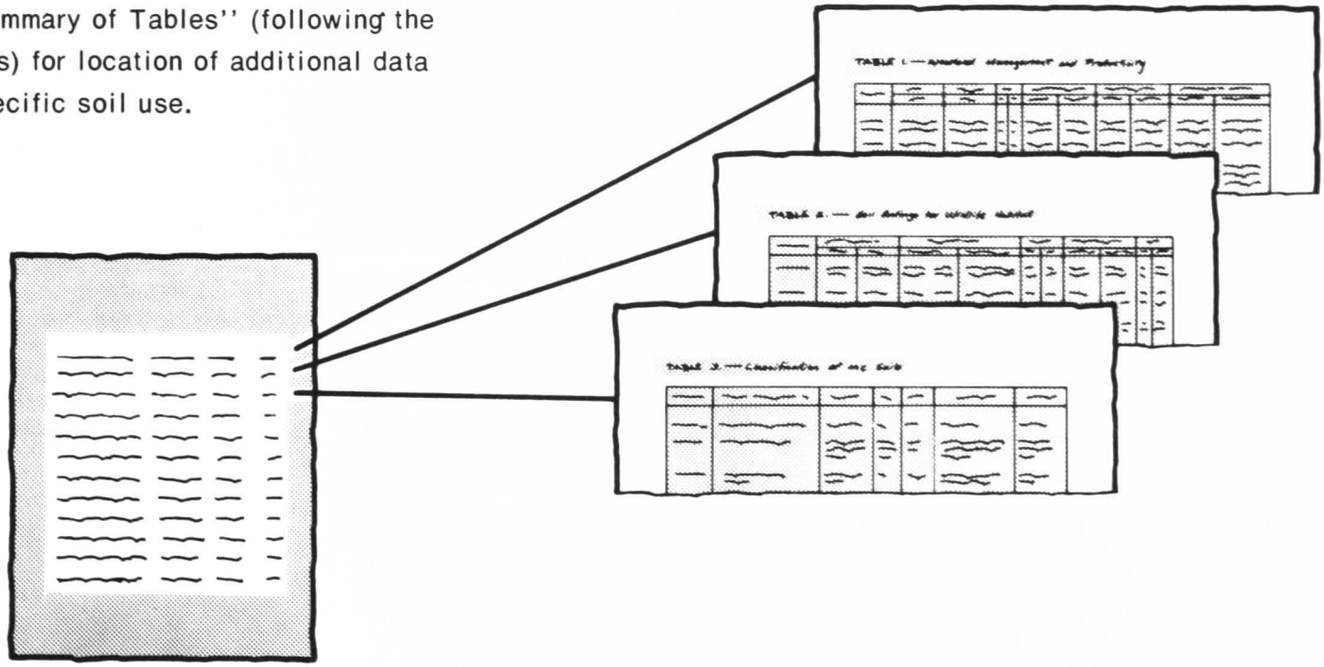
THIS SOIL SURVEY

5. Turn to "Index to Soil Mapping Units" which lists the name of each mapping unit and the page where that mapping unit is described.





6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. 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, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1972-77. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. 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 Bowie County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Cattle grazing improved bermudagrass on Severn very fine sandy loam.

contents

soil series

Issued October 1980

index to map units

summary of tables

foreword

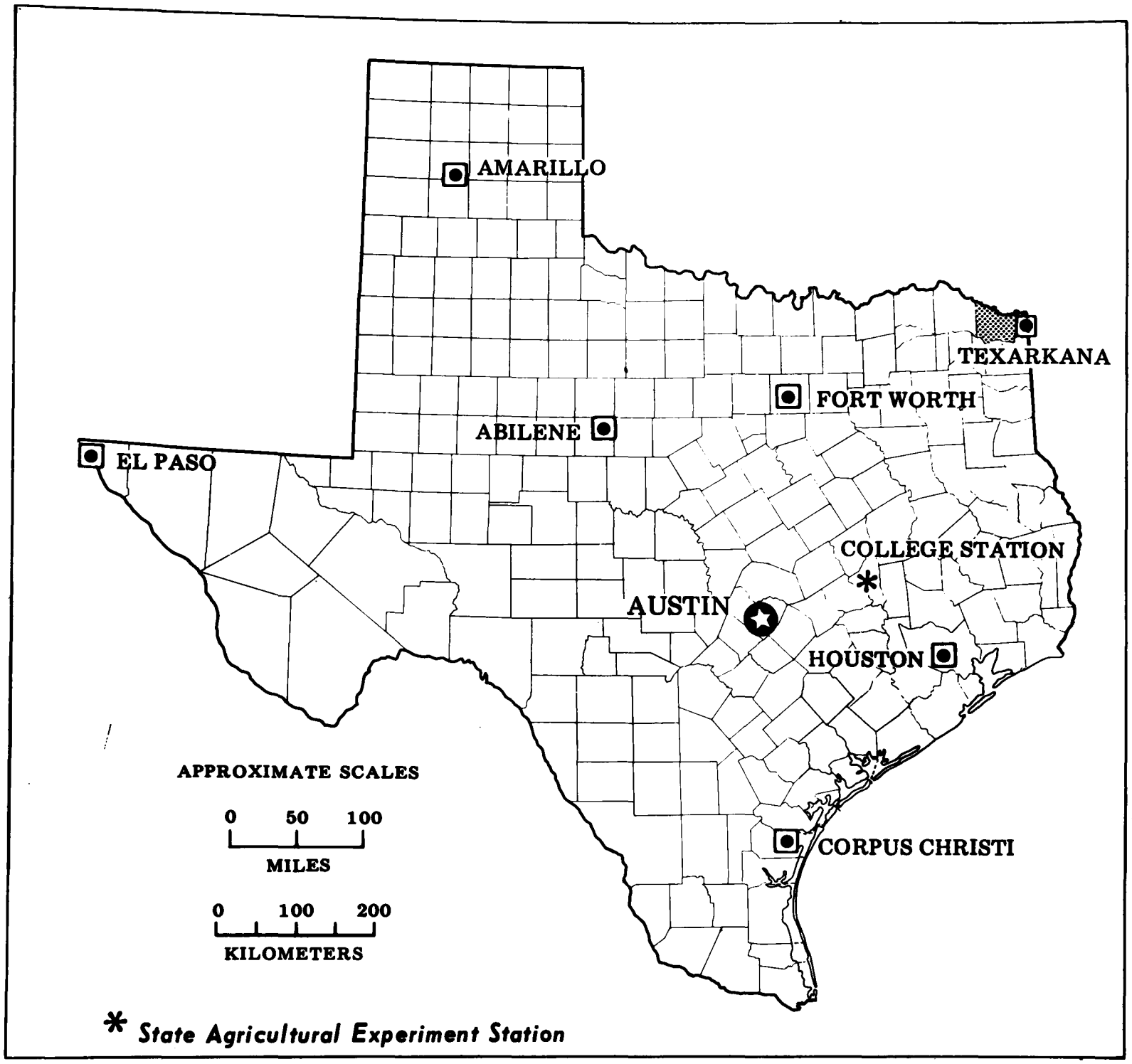
This soil survey contains information that can be used in land-planning programs in Bowie County, Texas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

George C. Marks
State Conservationist
Soil Conservation Service



Location of Bowie County in Texas.

soil survey of
Bowie County, Texas

By Richard W. Fox, soil scientist, Soil Conservation Service

Soils surveyed by Richard W. Fox, Thomas L. Galloway, Lionell Joseph, Kirthell Roberts, and Jesse R. Thomas, Soil Conservation Service.

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

Bowie county is located in the extreme northeastern corner of Texas. It covers a total area of 590,720 acres, or 923 square miles. Elevations range from about 460 feet above sea level in the west-central part of the county to about 200 feet above sea level in the southeastern part of the county.

Most of the soil in the county is nearly level overall, but it has a secondary relief of low mounds. Some steep areas are along and parallel to drainageways. A central ridge runs across the county from east to west. Drainage south of this ridge flows south through Blythe Creek, Ward Creek, Anderson Creek, Big Creek, Elliott Creek, and Day's Creek into Lake Wright Patman and the Sulphur River. Drainage north of this ridge flows north through Beaverdam Creek, Mill Creek, Mud Creek, and Barkman Creek into the Red River.

The county is in the Western Coastal Plain Land Resource Area. This area is commonly known as "the East Texas Timberlands." About 70,000 acres are on bottom land along the Red River.

Livestock, soybeans, and timber are of foremost importance in the county. About 170,000 acres are used for hayland and improved pasture. Crops of soybeans, cotton, wheat, and rice are on about 100,000 acres. About 260,000 acres are used for commercial timber. The remaining part of the county is used mostly for lakes and developments of urban or built-up areas. Red River Arsenal covers about 30,000 acres, which is mostly forested.

The majority of the soils in the county formed under forest land. Along the central ridge there are scattered areas of soils formed under prairie. Soils on bottom land are along the Sulphur River and Red River.

general nature of the county

This section provides general information about Bowie County. It contains a brief discussion of the settlement and population, agriculture, natural resources, and climate of the county.

settlement and population

Bowie County was created in 1840 from a part of Red River County. It was organized in 1841. The county was named for James Bowie, adventurer, indian fighter, rancher, and Alamo hero.

The population of Bowie County in 1970 was 67,813. Texarkana is the major city in the county and has a population of about 35,000. Boston is the county seat and is composed of the courthouse square surrounded by an area named New Boston that has a population of about 4,100.

agriculture

Livestock, crops, and wood products are the main agricultural enterprises in Bowie County. Crop production was once the primary land use, but pasture and hayland have replaced cultivated crops in many areas.

Livestock operations are mainly cow-calf. The livestock are mostly pastured in summer and are fed hay and feed supplements in winter. Cattle graze improved cool-season grasses and legumes from October to July. Stocker cattle operations are increasing in importance. Calves are often sold on a contract basis.

Crop production consists mainly of hay and forage. Soybeans are also a major crop. Crops of lesser acreage

are wheat, cotton, corn, grain sorghum, rice, peanuts, and vegetables. Pecans are another source of agricultural income. Most of the pecan orchards are in bottom land in the northern part of the county.

Major timber companies own large tracts of commercial timber in Bowie County. Smaller landowners also produce both pine and hardwood timber. Younger stands of pine are thinned and sold for pulpwood, posts, and other wood products. Older stands with larger mature trees are sold for sawtimber. Hardwood forests are cut mainly for pulpwood, crossties, and sawtimber.

natural resources

Soil is the most important natural resource in Bowie County. The production of livestock, forage, and crops are sources of livelihood.

Lignite leasing has become increasingly important in the southern part of the county.

Water is an important natural resource. Lake Texarkana, Red River, Sulphur River, and numerous smaller lakes and creeks provide abundant water supplies for the county. The average annual rainfall is 44 inches, so that farm ponds are numerous. Some parts of the county have available underground water. These plentiful supplies of water provide for industrial, recreational, agricultural, and domestic uses.

Fish and wildlife are natural resources in the county. The county and the landowners receive income from fishing permits and hunting leases.

climate

Prepared by the National Climatic Center, Asheville, North Carolina

Bowie county has long, hot summers because moist tropical air from the Gulf of Mexico persistently covers the area. Winters are cool and fairly short, with only a rare cold wave that moderates in 1 or 2 days. Precipitation is fairly heavy throughout the year, and prolonged droughts are rare. Summer precipitation, mainly afternoon thundershowers, is adequate for all crops.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Clarksville, Texas, in the period 1951 to 1975. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 45 degrees F, and the average daily minimum temperature is 34 degrees. The lowest temperature on record, which occurred at Clarksville on February, 2, 1951, is -5 degrees. In summer the average temperature is 80 degrees, and the average daily maximum temperature is 92 degrees. The highest recorded temperature, which occurred at Clarksville on July 24, 1954, is 108 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 44 inches. Of this, 23 inches, or 52 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 17 inches. The heaviest 1-day rainfall during the period of record was 7.45 inches at Clarksville on October 1, 1955. Thunderstorms occur on about 50 days each year, and most occur in spring.

Snowfall is rare. In 75 percent of the winters, there is no measurable snowfall. In 5 percent, the snowfall, usually of short duration, is more than 2 inches. The heaviest 1-day snowfall on record was more than 2 inches.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent.

Severe local storms, including tornadoes, strike occasionally in or near the area. They are short and cause variable and spotty damage. Every few years in summer or autumn, a tropical depression or remnant of a hurricane which has moved inland causes extremely heavy rains for 1 to 3 days.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study 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, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for

engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, pasture and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their suitability for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the suitability of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil suitability ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, pasture, woodland, urban uses,* and *recreation areas*. Cultivated crops and pasture plants are those grown extensively in the survey area. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments. Recreation areas are campsites, picnic areas, playgrounds, and paths and trails.

The land area of the nine soil associations in Bowie County make up about 97 percent of the total acreage in the county. The rest is water.

soil descriptions

dominantly gently sloping soils; on uplands

This group of map units makes up about 58 percent of the county. The major soils are in the Darden, Eylau, McKamie, Rosalie, Ruston, Sawyer, and Woodtell series. These soils have a loamy or sandy surface layer and clayey to sandy lower layers. They are moderately well drained to excessively drained. The soils in this group of units are mainly very slowly permeable, moderately permeable, and rapidly permeable, and all soils are acid.

These soils are used for pasture, woodland, and crops. Improved pastures consist mainly of common bermudagrass, Coastal bermudagrass, and Pensacola bahiagrass. Loblolly and shortleaf pine grow mainly in woodland. The main crops are wheat, soybeans, and oats.

These soils are well suited to most urban and recreational uses. The main limiting factors are wetness and high shrink-swell.

1. Sawyer-Eylau-Woodtell

Moderately well drained, moderately slowly permeable to very slowly permeable loamy soils

This map unit is made up of dominantly nearly level to strongly sloping soils that have slopes of 0 to 12 percent. It covers about 47 percent of the county (fig. 1). Sawyer soils make up about 39 percent of the unit; Eylau soils, about 14 percent; and Woodtell soils, about 12 percent. Other soils make up the remaining 35 percent.

Sawyer soils are moderately well drained and nearly level and gently sloping. They are on upland stream divides. Typically, these soils have a surface layer of dark grayish brown silt loam about 6 inches thick. The subsoil extends to a depth of about 80 inches. It is yellowish brown silty clay loam and clay loam in the upper part and is very strongly acid clay mottled with gray, red, and brown in the lower part.

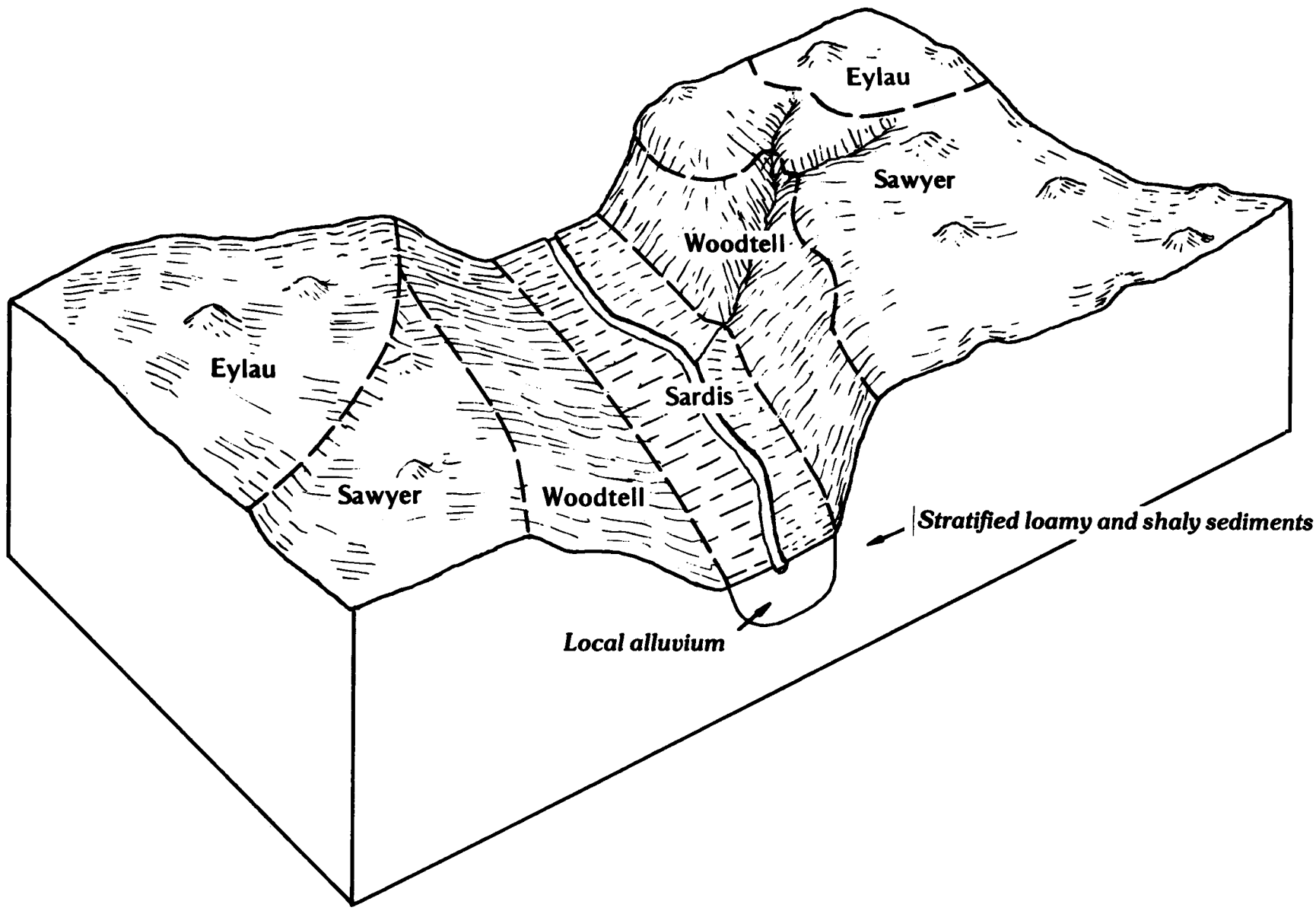


Figure 1.—Typical pattern of soils and underlying material in the Sawyer-Eylau-Woodtell map unit.

Eylau soils are moderately well drained and nearly level and gently sloping. They are on upland stream divides. Typically, these soils have a surface layer of dark grayish brown very fine sandy loam about 12 inches thick. The subsoil, which extends to a depth of about 80 inches, is sandy clay loam that is strong brown in the upper part; brownish yellow in the middle part; and has mottles of red, brown, and gray in the lower part. Typically, this soil is slightly acid in the upper part and grades to very strongly acid in the lower part.

The Woodtell soils are moderately well drained and gently to strongly sloping. They are on upland ridgetops and side slopes above drains. Typically, they have a surface layer of brownish very fine sandy loam about 6 inches thick. The subsoil, which extends to a depth of 53 inches, is red clay in the upper part and gray clay in the lower part. Below this to a depth of 72 inches is stratified shale and sandy clay loam. These soils are strongly acid and very strongly acid.

Other soils in this unit are the deep, poorly drained Adaton and Wrightsville soils and somewhat poorly drained Annona soils on broad flats and in small depressed areas; the deep, well drained Blevins soils on the somewhat higher uplands; the Sardis and Thenas soils on bottom land; and the deep, well drained Ruston and Rosalie soils on ridges and low rises.

The soils in this map unit are used mainly for pasture and woodland, but in some areas they are cultivated.

These soils are moderately well suited to crops. Soybeans, grain sorghum, corn, wheat, and oats are the main crops. Fertilizer needs to be added for higher production.

These soils are well suited to pasture. The main grasses are improved bermudagrass and bahiagrass.

Cool season grasses are wheat, ryegrass, and tall fescue. Clovers increase the production of forage in pastures. The main clovers are crimson clover, white clover, and arrowleaf clover. Fertilizer must be added for high production. Liming is necessary to maintain a favorable soil reaction.

These soils are well suited to woodland. Loblolly and slash pine are the main species.

These soils are poorly suited to most urban development. Very slow permeability, shrinking and swelling, and wetness are the most limiting features. These soils are well suited to most recreational uses; however, some of these uses are limited by very slow permeability and by slope.

2. Ruston-McKamie

Well drained, moderately permeable and very slowly permeable loamy soils

This map unit is made up of dominantly gently sloping to strongly sloping soils that have slopes of 1 to 12 percent. It covers about 9 percent of the county (fig. 2). Ruston soils make up about 40 percent of the unit; McKamie soils, about 30 percent; and other soils make up the remaining 30 percent.

Ruston soils are well drained and gently sloping and sloping. They are on high alluvial terraces. Typically, these soils have a surface layer of strong brown fine sandy loam about 5 inches thick. Below this, to a depth of about 16 inches, is yellowish red, fine sandy loam. The subsoil to a depth of 80 inches or more is red sandy clay loam. This soil is slightly acid in the upper part and grades to very strongly acid in the lower part.

McKamie soils are well drained and gently sloping to strongly sloping. They are on high alluvial terraces. Typically, these soils have a surface layer of brownish loam about 13 inches thick. The subsoil extends to a depth of 58 inches. It is red clay in the upper part and

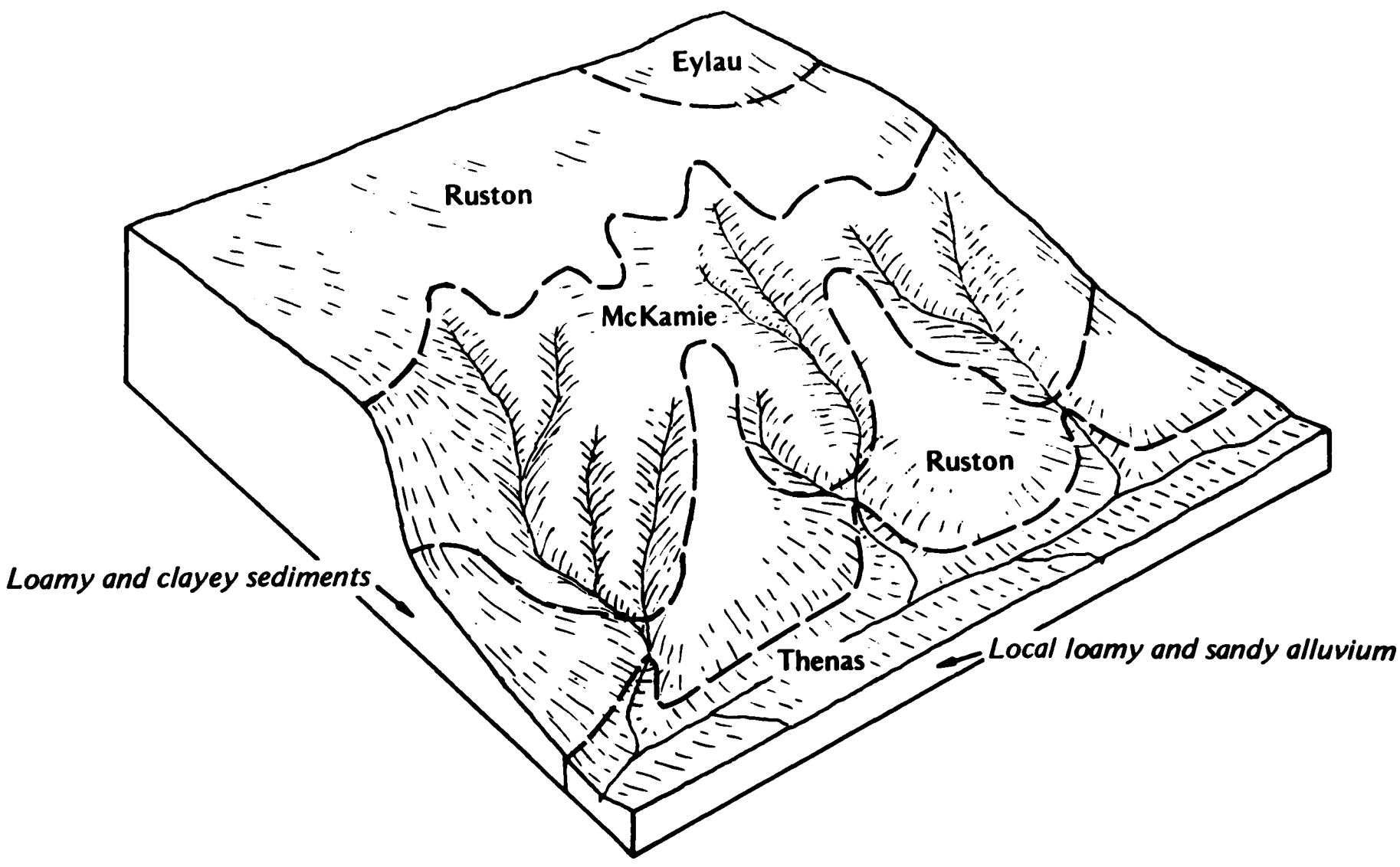


Figure 2.—Typical pattern of soils and underlying material in the Ruston-McKamie map unit.

red sandy clay loam in the lower part. The underlying layer to a depth of 80 inches or more is red fine sandy loam. Typically, this soil is slightly acid in the upper part and very strongly acid in the lower part.

Other soils in this unit are the deep, well drained Vesey soils that are in small, nearly level, and gently sloping areas; the deep, moderately well drained Eylau and Sawyer soils in small, slightly depressed areas; the deep, well drained Smithdale soils on ridge crests and side slopes; and the frequently flooded Thenas soils in small creek bottoms.

The soils in this map unit are used mainly for pasture and woodland. Some areas are used for crops.

These soils are moderately well suited to crops. Slope and the hazard of erosion are the main limitations. Soybeans, wheat, and oats are the main crops.

These soils are well suited to pasture. The main grasses are improved bermudagrass and bahiagrass. Wheat, Elbon rye, and ryegrass make excellent cool season pastures. The main clovers are crimson and arrowleaf clovers.

These soils are moderately well suited to woodland. With good management, moderate yields of loblolly or slash pine are possible.

These soils are mostly well suited to recreational and urban development.

3. Rosalie-Darden

Well drained to excessively drained, moderately permeable and rapidly permeable sandy soils

This map unit is made up of dominantly gently sloping to strongly sloping soils that have slopes of 1 to 12 percent. It covers about 2 percent of the county. Rosalie soils make up about 60 percent of the unit; Darden soils, about 17 percent; and other soils make up the remaining 23 percent.

Rosalie soils are well drained and gently sloping. They are on upland interstream divides. Typically, these soils have a surface layer of brown, slightly acid loamy fine sand about 8 inches thick. Below this, to a depth of 24 inches, is brownish yellow, medium acid loamy fine sand. The subsoil to a depth of 80 inches or more is very strongly acid sandy clay loam. It is strong brown in the upper part and red in the lower part.

Darden soils are excessively drained and gently sloping to strongly sloping. They are on high alluvial terraces. Typically, these soils are brownish loamy fine sand to a depth of 80 inches or more. They are slightly acid to neutral.

Other soils in this unit are deep, well drained Blevins soils; the frequently flooded Thenas soils on stream bottoms; and the moderately well drained, sloping Woodtell soils on uplands.

The soils in this map unit are used mainly as pasture and woodland. Crops in some small areas include watermelons and vegetables.

These soils are moderately well suited to cultivated crops. Droughtiness, low fertility, and complex slopes are the main limitations.

These soils are poorly suited to pasture. The main plants are improved bermudagrass or bahiagrass in combination with crimson or arrowleaf clover.

This unit is moderately well suited to woodland. With good management, moderate yields of loblolly and slash pine are possible.

These soils are well suited to most urban and recreational development.

Dominantly nearly level soils; on uplands

This group of map units make up about 18 percent of the county. The major soils are in the Alusa, Annona, Ashford, and Wrightsville series. These soils have a loamy or clayey surface layer and clayey lower layers. They are somewhat poorly drained or poorly drained and are very slowly permeable and acid.

These soils are used for woodland, pasture, and crops. Improved pastures consist mainly of common bermudagrass, Coastal bermudagrass, Pensacola bahiagrass, and tall fescue. Woodland areas grow mostly water oak, willow oak, red oak, and post oak. Loblolly and shortleaf pine grow in some areas.

The main crops are soybeans, rice, wheat, and oats.

These soils are poorly suited to most urban development. The main limiting factors are very slow permeability, high shrink-swell, and wetness.

4. Wrightsville

Poorly drained, very slowly permeable loamy soils

This map unit is made up of dominantly nearly level soils that have slopes of 0 to 1 percent. It makes up about 8 percent of the county (fig. 3). Wrightsville soils make up about 60 percent of the unit, and other soils make up the remaining 40 percent.

Wrightsville soils are nearly level and are on uplands. Typically, these soils have a surface layer of brown, strongly acid silt loam about 4 inches thick. Below this, to a depth of 16 inches, is light brownish gray, very strongly acid silt loam. The next layer to a depth of 80 inches or more is light brownish gray, very strongly acid clay that has strong brown mottles.

Other soils in this unit are the nearly level, poorly drained, Adaton soils on uplands; the deep, loamy somewhat poorly drained Annona soils; the deep, clayey, poorly drained Ashford soils in small, depressed areas; the deep, loamy, somewhat poorly drained Rodessa soils on mounds; the deep, loamy, moderately well drained Sawyer soils slightly higher on uplands; and the deep, loamy, sloping Woodtell soils along drainageways.

The soils in this map unit are used for crops, pasture, and woodland.

These soils are moderately well suited to cultivated crops. Poor drainage and low fertility are the limiting features. Soybeans is the main crop.

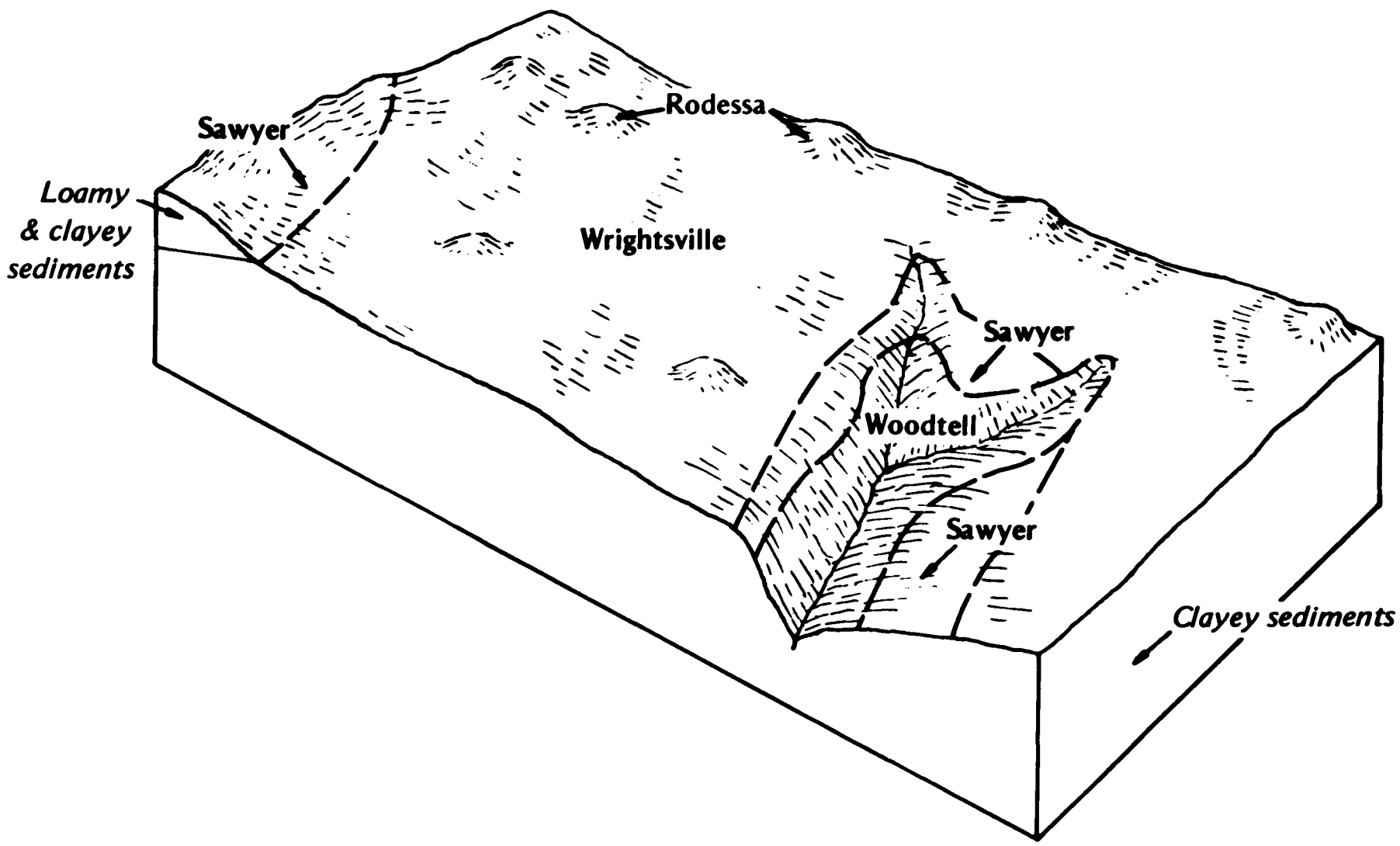


Figure 3.—Typical pattern of soils and underlying material in the Wrightsville map unit.

These soils are moderately well suited to pasture. The grasses are mostly improved bermudagrass and bahiagrass. Cool season grasses are ryegrass and tall fescue. White clover is the main legume.

These soils are moderately well suited to woodland. With proper management, the production of loblolly pine and slash pine is moderate.

These soils are poorly suited to urban and recreational development. Wetness, very slow permeability, and shrinking and swelling are the limiting features.

5. Annona-Alusa

Somewhat poorly drained and poorly drained, very slowly permeable loamy soils

This map unit is made up of dominantly nearly level to gently sloping soils that have slopes of 0 to 3 percent. It covers about 6 percent of the county. Annona soils make up about 60 percent of the unit; Alusa soils, about 25 percent; and other soils make up the remaining 15 percent.

Annona soils are somewhat poorly drained and gently sloping. They are on uplands. Typically, these soils have a surface layer of very dark grayish brown loam about 2 inches thick. Below this, to a depth of 12 inches, is brown loam that is mottled with dark yellowish brown and yellowish brown. The next layer extends to a depth of 80 inches or more. It is clay mottled with red, brown, and gray. Typically, these soils are very strongly acid in the upper part and neutral in the lower part.

Alusa soils are poorly drained and nearly level. They are on uplands. Typically, these soils have a surface layer of dark grayish brown loam about 6 inches thick. The next layer is grayish brown loam about 5 inches thick. The subsoil to a depth of 80 inches or more is clay that is grayish brown in the upper part, gray in the middle part, and light gray in the lower part. These soils are medium acid to very strongly acid.

Other soils in this unit are the deep, poorly drained Amy soils and the somewhat poorly drained Sardis soils on creek bottoms; the deep, moderately well drained Sawyer soils on mounds, ridges, and low rises; and the

deep, poorly drained Wrightsville soils in depressed areas.

The soils in this map unit are used for pasture, crops, and woodland.

These soils are moderately well suited to crops. Wetness is the main limitation. Prolonged wet seasons in the spring and fall often restrict planting and harvesting. These soils are droughty at times during the summer. The main crops are soybeans, oats, and wheat.

These soils are moderately well suited to pasture. Grasses are mostly improved bermudagrass and bahiagrass. Cool season pastures are ryegrass, oats, wheat, Elbon rye, and tall fescue.

These soils are moderately well suited to woodland.

These soils are poorly suited to urban and recreational development. Wetness, very slow permeability, and high shrink-swell are the most limiting features.

6. Ashford

Poorly drained, very slowly permeable clayey soils

This map unit is made up of dominantly nearly level soils in slight depressions. Slopes are 0 to 1 percent. The unit covers about 4 percent of the county (fig. 4). Ashford soils make up about 65 percent of the unit and other minor soils make up the remaining 35 percent.

Ashford soils are nearly level and poorly drained. They are in slight depressions on uplands. Typically, these soils have a surface layer that is light olive gray, slightly acid clay about 4 inches thick. The subsoil to a depth of 80 inches or more is grayish, very strongly acid clay that is mottled with brown and red.

Other soils in this unit are the deep, gently sloping, clayey Bryarly soils; the deep, clayey, frequently flooded Gladewater soils; the deep, loamy, somewhat poorly drained Rodessa soils on mounds; the deep, clayey Woodtell soils along drainageways; and the deep, nearly level, poorly drained Wrightville soils.

The soils of this map unit are used mostly as woodland of low quality hardwoods.

The soils in this map unit are moderately well suited to most cultivated crops; however, they are well suited to rice production. Wetness is the main limitation for most

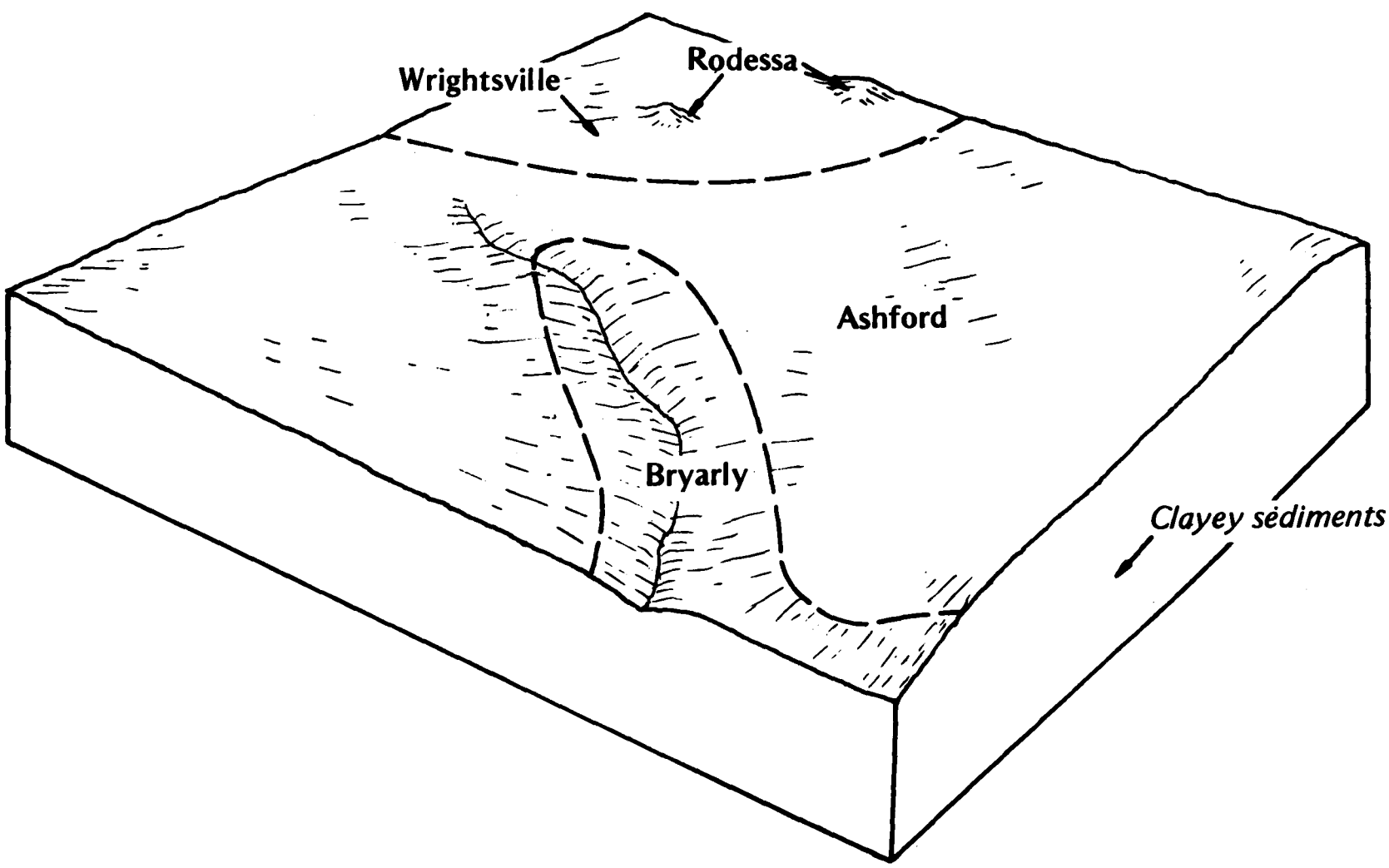


Figure 4.—Typical pattern of soils and underlying material in the Ashford map unit.

crops. Prolonged wet seasons cause planting and harvesting to be delayed and difficult.

These soils are moderately well suited to pasture. Wetness and low fertility are limitations. The main grasses are bahiagrass and tall fescue.

These soils are moderately well suited to woodland; they are best suited to hardwoods. Wetness is the main limiting feature.

These soils are poorly suited to urban and recreational development. Wetness and high shrink-swell are limiting features.

Dominantly nearly level soils; on bottom land

This group of map units makes up about 21 percent of the county. The major soils are in the Billyhaw, Gladewater, Perry, Severn, and Texark series. These soils are nearly level and on flood plains. They are loamy or clayey throughout and are well drained to poorly drained. Some soils are frequently flooded, and some are occasionally flooded. Soils in this group range from acid to alkaline.

These soils are used for crops, pasture, and woodland. Soybeans, grain sorghum, cotton, and wheat are the major crops. Improved pastures are mainly improved bermudagrass or tall fescue.

Good stands of cottonwood, pecan, bois d'arc, elm, and hackberry grow in woodland areas along the Red River. In the Sulphur River bottom, the trees are mainly water oak, willow oak, green ash, elm, and hackberry.

The soils of these units are poorly suited to urban and recreational development. The hazard of flooding, high shrink-swell, and wetness are the most limiting features.

7. Gladewater-Texark

Poorly drained, very slowly permeable clayey soils that are frequently flooded

This map unit is made up of dominantly nearly level soils that have slopes of 0 to 1 percent. It covers about 8 percent of the county. Gladewater soils make up about 40 percent of the unit; Texark soils, about 11 percent; and other soils, about 49 percent.

Gladewater soils are poorly drained and on broad, nearly level bottom land. Typically, these soils have a surface layer that is very dark gray, neutral clay about 5 inches thick. The subsoil, which extends to a depth of about 42 inches, is clay. It is slightly acid and gray in the upper part and medium acid and dark gray in the lower part. The underlying layer, which extends to a depth of 72 inches or more, is gray, strongly acid clay.

Texark soils are nearly level, and poorly drained. They are on broad bottom land. These soils have a surface layer that is very dark gray, neutral clay about 16 inches thick. The next layer to a depth of 80 inches or more is clay. It is dark gray and medium acid in the upper part, gray and very strongly acid in the middle part, and gray and medium acid in the lower part.

Other soils in this unit are the deep, poorly drained Adaton soils and the somewhat poorly drained Sawyer soils on uplands; the deep Amy, Sardis, and Thenas soils on narrow flood plains; and the deep, clayey Bryarly and Woodtell soils on side slopes adjacent to flood plains. Most of these soils are used for woodland and for wildlife habitat.

The soils in this map unit are poorly suited to crops. Frequent flooding is the main hazard.

These soils are moderately well suited to pasture. Tall fescue is one of the best adapted grasses because of its tolerance to wetness.

These soils are well suited to woodland. Wetness and flooding limit this map unit to hardwoods.

These soils are poorly suited to urban and recreational development. Frequent flooding and wetness are the main restrictive features.

8. Billyhaw-Perry

Somewhat poorly drained and poorly drained, very slowly permeable clayey soils that are rarely or occasionally flooded

This map unit is made up of dominantly nearly level soils that have slopes of 0 to 1 percent. A few areas of Billyhaw soils are gently sloping and have slopes of 1 to 5 percent. This map unit makes up about 8 percent of the county. Billyhaw soils make up about 55 percent of the unit; Perry soils, about 15 percent; and other soils, the remaining 30 percent.

Billyhaw soils are somewhat poorly drained and nearly level and gently sloping. They are on broad bottom land. Typically, these soils are clay to a depth of about 57 inches. Below this to a depth of about 80 inches or more is silt loam. In the upper part, the soil profile is dark brown and neutral. It grades to reddish brown and moderately alkaline in the lower part.

Perry soils are poorly drained and nearly level. They are on slightly depressed bottom land. Typically, these soils have a surface layer that is dark gray, medium acid clay about 4 inches thick. The subsoil to a depth of 80 inches or more is clay. It is gray and slightly acid in the upper part of the subsoil, and it is dark reddish brown and moderately alkaline with concretions of calcium carbonate in the lower part.

Other soils in this unit are the deep, loamy Dardanelle and Severn soils on low rises and ridges; the deep, clayey Muldrow and Roebuck soils in somewhat depressed areas close to creeks and bayous; and the deep, nearly level, clayey Redlake soils on broad, bottom land.

Most of the soils in this map unit are used for crops. A few scattered areas are used for woodland and pasture. These soils are moderately well suited to cultivated crops. Soybeans and cotton are the main crops. Wetness is the main limiting feature.

These soils are suited to pasture. Improved bermudagrass and tall fescue mixed with white clover is a common pasture mixture.

These soils are well suited to woodland. Cottonwood and other hardwood trees are well suited.

These soils are poorly suited to urban and recreational development. The main restrictive features are high shrink-swell, clayey texture, and wetness.

9. Severn

Well drained, moderately rapidly permeable loamy soils that are rarely flooded

This map unit is made up of dominantly nearly level soils on bottom land. Slopes are 0 to 1 percent. The unit covers about 5 percent of the county. Severn soils make up about 53 percent of the unit, and other minor soils make up the remaining 47 percent.

Severn soils are well drained and nearly level. They are on bottom land. Typically, these soils have a surface layer of reddish brown, moderately alkaline very fine sandy loam about 8 inches thick. The next layer to a depth of 65 inches or more is yellowish red, moderately alkaline very fine sandy loam stratified with other colors and textures.

Other soils in this unit are the deep, loamy Dardanelle soils on low rises; the deep, sandy Kiomatia soils on undulating bottom land; and the deep, clayey Redlake and Roebuck soils on slightly depressed bottom land.

The soils in this map unit are used almost entirely for crops. These soils are well suited to cultivated crops. The main crops are soybeans, cotton, grain sorghum, wheat, and oats.

These soils are well suited to pasture. Improved bermudagrass is the main grass. White clover is also adapted to this soil. Some areas are in alfalfa meadows that are used for hay.

These soils are well suited to woodland. Cottonwood and other adapted hardwoods grow rapidly.

These soils are moderately well suited to most urban development. The main limitation is the hazard of flooding. These soils are well suited to recreational development.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A number identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Ruston fine sandy loam, 3 to 8 percent slopes, is one of several phases in the Ruston series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Wrightsville-Rodessa complex is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and suitabilities for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

1—Adaton-Muskogee complex. The nearly level soils in this complex are on uplands with mounds. Slopes range from 0 to 2 percent. Areas of this soil complex are broad and irregular in shape. They range from 20 to over 1,000 acres and average about 200 acres.

This complex is about 70 percent Adaton soils, 20 percent Muskogee soils, and 10 percent other soils. The surface is smooth to weakly concave.

This complex is characterized by flats of Adaton silt loam and circular mounds of Muskogee soils in a random pattern. The mounds are 2 to 3 feet high, 40 to 100 feet in diameter, and 100 to 200 feet apart. Areas of these soils are so intermingled that they could not be shown separately at the scale selected for mapping.

Typically, the Adaton soil has a surface layer of brown, slightly acid silt loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. It is very strongly acid, mottled grayish, brownish, and yellowish clay loam in the upper part and very strongly acid brownish and grayish silty clay in the lower part.

The Adaton soils are poorly drained. A water table is at the surface during the winter and spring. Water ponds on the surface for 2 to 3 weeks during the wet season. Runoff is slow, and permeability is slow. Available water capacity is high. The rooting zone is deep, but excess water inhibits the movement of air and plant roots. The erosion hazard is slight.

Typically, the Muskogee soil has a surface layer of brown, slightly acid silt loam that is 6 inches thick. Below this, to a depth of 10 inches, is yellowish brown, strongly acid silt loam. The subsoil extends to a depth of 80 inches or more. It is yellowish brown, very strongly acid silt loam in the upper part, yellowish brown, very strongly acid silty clay loam with light brownish gray mottles in the middle part, and mottled brownish and reddish very strongly acid clay in the lower part.

The Muskogee soils are moderately well drained. Runoff and permeability are slow. Available water

capacity is high. The rooting zone is deep. The erosion hazard is slight.

Included with this complex in mapping are areas of similar soils that are better drained. Also included in the spaces between mounds are areas of Wrightsville soils. The included soils make up about 10 percent of the mapped areas.

Most areas of this complex are used for pasture and woodland.

These soils are moderately well suited to pastures of white clover and fescue. Proper grazing and the addition of fertilizers and lime are needed.

These soils are well suited to hardwood trees such as water oak, willow oak, red oak, and sweetgum. Some woodland areas that are managed properly have good stands of loblolly pine. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

These soils are moderately well suited to crops such as soybeans and corn. Poor drainage and a high water table are the main limiting features. A drainage system is needed, but suitable outlets are often difficult to locate. Crop residue left on or near the soil surface aids water infiltration and maintains organic matter content. The addition of lime and complete fertilizers increases production.

These soils are poorly suited to urban development. Wetness is the main limitation. Low strength is a limitation for local roads and streets. These soils are poorly suited to recreational development because of wetness.

This complex is in capability subclass IIIw; Adaton part is in woodland group 2w and Muskogee part in woodland group 3o.

2—Alusa loam. This nearly level soil is on upland prairies and savannahs. Slopes range from 0 to 1 percent. The soil areas are broad and irregular in shape. They range from 50 to about 1,000 acres and average about 300 acres.

Typically, this soil has a surface layer of dark grayish brown loam about 6 inches thick. Below this is grayish brown loam about 5 inches thick. The subsoil extends to a depth of 80 inches or more. It is clay that is grayish brown in the upper part, gray in the middle part, and light gray in the lower part. This soil is medium acid to very strongly acid.

Alusa loam is poorly drained. A water table is at or near the surface during the winter and spring. Runoff is slow, and permeability is very slow. Available water capacity is high. The rooting zone is deep. The erosion hazard is slight. This soil shrinks and cracks when dry.

Included with this soil in mapping are small areas of Adaton, Annona, and Wrightsville soils. Also included on mounds are small areas of soils that have a thick surface layer. Included soils make up less than 25 percent of any mapped area.

This Alusa soil is used mainly for crops and pasture.

This soil is moderately well suited to pasture. Fescue and white clover can be established and maintained if they are properly fertilized and if rotation grazing is used (fig. 5).

This soil is moderately well suited to woodland. Trees such as loblolly pine, water oak, and sweetgum can be grown. Proper management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, aids in establishing and maintaining the woodland.

This soil is moderately well suited to soybeans, oats, and grain sorghum. Poor drainage and clayey texture are the main limiting features. A drainage system is needed. Crop residue left on the soil surface aids water infiltration and maintains organic matter content. The addition of lime and a complete fertilizer increases crop yields.

This soil is poorly suited to urban and recreational development. Wetness, high shrink-swell, and very slow permeability are the main limiting features. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IIIw; woodland group 3w.

3—Amy silt loam, frequently flooded. This nearly level soil is on flood plains along local streams. Slopes range from 0 to 1 percent. Soil areas are mainly long and narrow and follow the meanders of the creeks. They range from 20 to several hundred acres and average about 200 acres.

Typically, this soil has a surface layer of dark grayish brown, very strongly acid silt loam about 4 inches thick. Below this is light brownish gray, strongly acid loam about 14 inches thick. The subsoil extends to a depth of 65 inches or more. To a depth of about 42 inches it is strongly acid and very strongly acid gray loam that has brownish mottles. In the lower part it is very strongly acid silt loam that is light brownish gray.

This soil is poorly drained. A water table is at or near the soil surface during the wet season. This soil floods two to four times a year for brief periods. Runoff and permeability are slow. Available water capacity is high. The rooting zone is deep. The erosion hazard is slight.

Included with this soil in mapping are small areas of the similar Thenas and Sardis soils. Included soils make up less than 25 percent of any mapped area.

This Amy soil is used mainly for woodland and pasture.

This soil is moderately well suited to pasture. Bahiagrass, fescue, and white clover can be successfully grown if they are properly fertilized and if proper grazing is used.

This soil is well suited to trees such as loblolly pine, green ash, and sweetgum. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

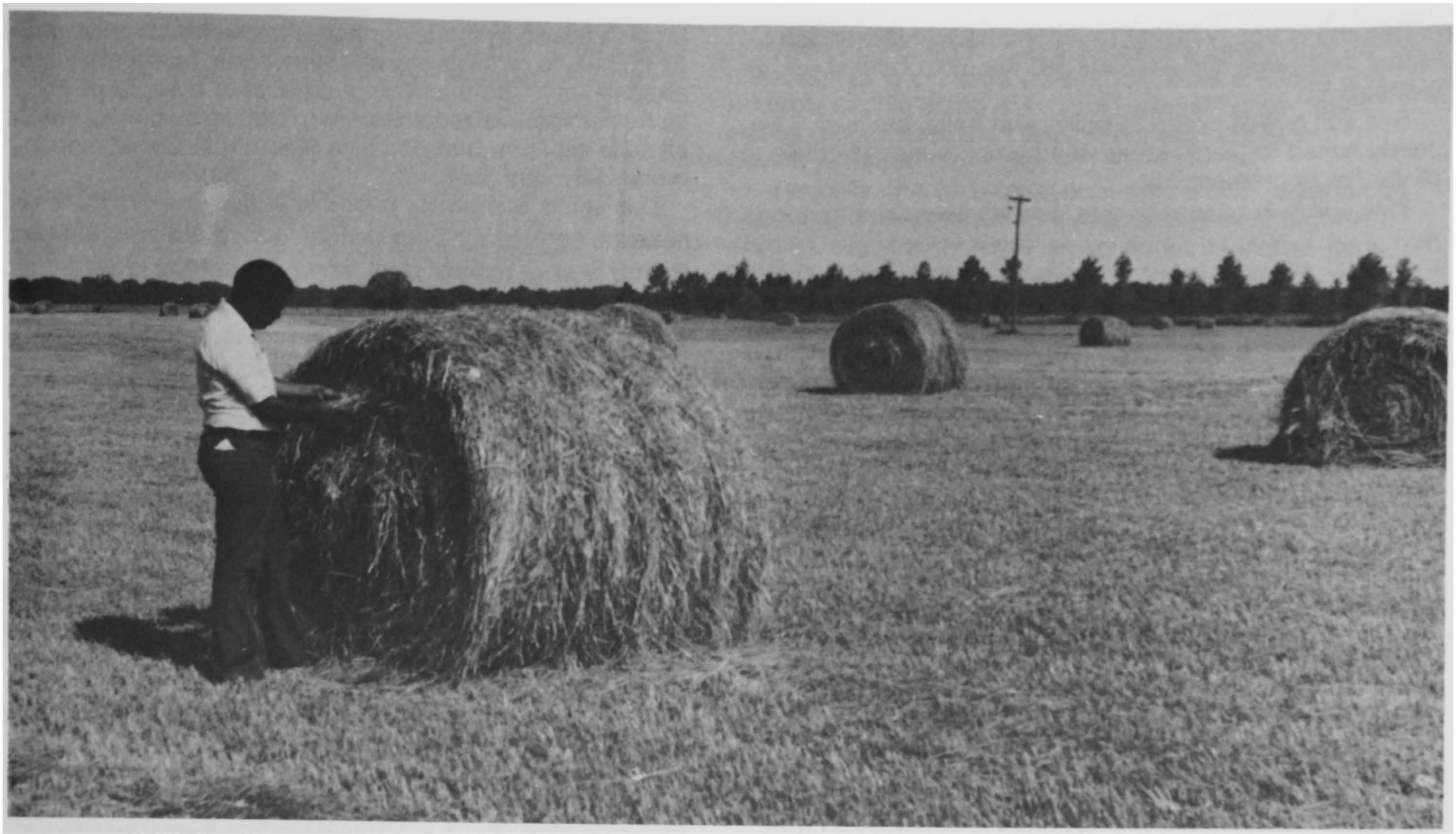


Figure 5.—Large round rolls of Pensacola bahiagrass hay on Alusa loam.

This soil is poorly suited to crops. Frequent flooding and poor drainage are the main limiting features.

This soil is poorly suited to most urban and recreational development. Frequent flooding and wetness are the main limiting features.

This soil is in capability subclass Vw; woodland group 2w.

4—Annona loam, 1 to 3 percent slopes. This gently sloping soil is on uplands. Slopes average about 2 percent. Soil areas are broad and irregular in shape. They range from 20 to 500 acres in size and average about 200 acres.

Typically, this soil has a surface layer of very dark grayish brown loam about 2 inches thick. Below this is brown loam about 10 inches thick. The subsoil extends to a depth of 80 inches or more. It is clay that is mottled in shades of red, brown, and gray in the upper part and is grayish brown in the lower part. This soil is slightly acid to very strongly acid.

This Annona soil is somewhat poorly drained. Runoff is slow, and permeability is very slow. Available water capacity is high. The rooting zone is deep, but the clayey subsoil restricts the movement of roots, water, and air. The erosion hazard is moderate.

Included with this soil in mapping are small areas of Adaton, Alusa, and Sawyer soils. Also included on mounds are a few areas of soils that have a thick surface layer. Included soils make up less than 15 percent of any mapped area.

This Annona soil is used mostly for pasture and woodland.

This soil is moderately well suited to pasture. Proper fertilizing, the addition of lime, and proper grazing are necessary to produce moderate yields of improved grasses. Improved bermudagrass, bahiagrass, and fescue are adapted to this soil as well as white and arrowleaf clovers.

This soil is moderately well suited to crops such as soybeans, grain sorghum, and corn. The hazard of erosion and low fertility are the main limiting features. Crop residue and cover crops left on the soil surface help maintain soil tilth and organic matter content. Erosion control is needed. The addition of lime and a complete fertilizer increases yields.

The soil is moderately well suited to trees such as loblolly pine, red oak, and sweetgum. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber yields.

This soil is poorly suited to most urban development. High shrink-swell and wetness are the main limiting features.

This soil is well suited to paths and trails, but it is poorly suited to picnic areas and campgrounds because of very slow premeability.

This soil is in capability subclass IIIe; woodland group 4c.

5—Ashford clay. This nearly level soil is in broad, flat areas of uplands. Soil areas are irregular in shape. They range from 50 to over 1,000 acres and average about 300 acres.

Typically, the surface layer is light olive gray, slightly acid clay about 4 inches thick. The subsoil extends to a depth of 80 inches or more. It is gray, very strongly acid clay that is mottled with reds and brown in the upper part and is olive gray, strongly acid clay in the lower part.

This soil is poorly drained. A high water table is at or near the surface during the cool season. Runoff and permeability are very slow. Available water capacity is high. The rooting zone is deep, but the movement of roots, water, and air is restricted by the clayey texture. The erosion hazard is slight.

Included with this soil in mapping are small areas of Wrightsville and Bryarly soils. These included soils make up about 10 percent of any mapped area.

This Ashford soil is used mainly for hardwood forest and wildlife habitat, but a small percent is used for crops and pasture.

This soil is moderately well suited to pasture and to plants such as fescue and bahiagrass. Proper fertilization and proper grazing increase yields.

This soil is moderately well suited to hardwood trees such as southern red oak and water oak. Proper woodland management, such as control of undesirable hardwood, selective harvesting, and fire protection, is needed to increase timber yields.

This soil is moderately well suited to crops. Soybeans is one of the main crops. Poor drainage, very slow permeability, and clay texture are the main limiting features. The addition of lime and a complete fertilizer is needed for good yields. Cover crops and plant residue left on the surface of the soil help to maintain organic matter content and soil tilth. A drainage system is needed for best yields.

This soil is poorly suited to urban and recreational development. Wetness and high shrink-swell are the main limitations. Low strength is a limitation for local roads and streets.

This soil is in capability subclass IIIw; woodland group 3w.

6—Billyhaw clay, 0 to 1 percent slopes. This nearly level soil is on flood plains. Soil areas are irregular in shape. They range from 100 to over 1,000 acres and average about 600 acres.

Typically, the surface layer is neutral clay about 25 inches thick. It is dark brown in the upper part and dark reddish brown in the lower part. Below this, to a depth of 57 inches, is reddish brown, calcareous, moderately alkaline clay. The underlying material to a depth of 75 inches or more is reddish brown, calcareous, moderately alkaline silt loam that contains few thin strata of reddish brown silty clay loam.

This soil is somewhat poorly drained. A water table is near the surface for brief periods during the cool season. Runoff is slow to very slow, and permeability is very slow. Available water capacity is high. The rooting zone is deep, but the movement of water, air, and plant roots is restricted by the clayey texture throughout. The erosion hazard is slight. This soil shrinks and cracks when dry (fig. 6).

Included with this soil in mapping are small areas of

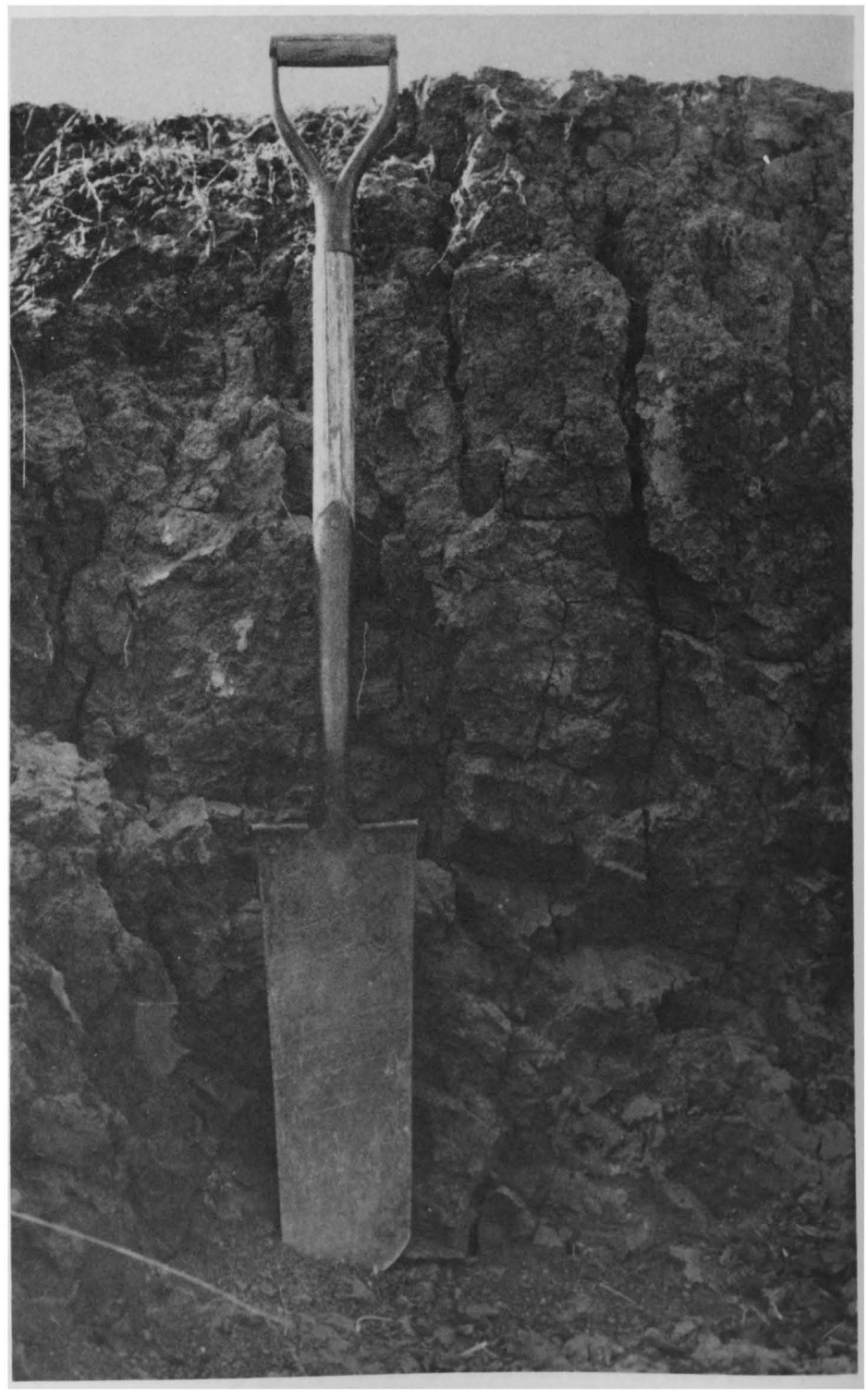


Figure 6.—Profile of Billyhaw clay, 0 to 1 percent slopes. Note large cracks extending deep into the profile.

Redlake, Perry, and Muldrow soils. These included soils make up less than 15 percent of the mapped acreage.

Most of this Billyhaw soil is used for crops. Some areas are in improved pastures.

This soil is well suited to pasture. Tall fescue, bermudagrass, and white clover produce high yields if they are properly fertilized and properly grazed.

This soil is well suited to trees such as eastern cottonwood, green ash, water oak, and willow oak. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is moderately well suited to crops such as soybeans and cotton (fig. 7). Wetness is the main limiting feature. A drainage system is needed to take away excess water. Crop residue left on the soil surface aids water infiltration and maintains organic matter content. Selective fertilization increases crop yields.

This soil is poorly suited to recreational and urban development. Wetness and high shrink-swell are main limitations. Low strength is an additional limitation for local roads and streets.

This soil is in capability subclass IIw; woodland group 2w.

7—Billyhaw clay, 1 to 5 percent slopes. This gently sloping soil is on flood plains. Soil areas are long and narrow and lie along drains and around oxbow lakes. They range from 50 to several hundred acres and average about 150 acres.

Typically, the surface layer is dark brown, neutral clay about 13 inches thick. The next layer is dark reddish brown, moderately alkaline clay about 31 inches thick that is calcareous and has a few concretions of calcium carbonate in the lower part. Below this to a depth of 72 inches or more is reddish brown, moderately alkaline clay.

This soil is somewhat poorly drained. It rarely floods. Runoff is medium, and permeability is very slow. Available water capacity is high. The rooting zone is deep, but the movement of water, air, and plant roots is restricted by the clayey texture. The erosion hazard is moderate.

Included with this soil in mapping are small areas of Billyhaw clay, 0 to 1 percent slopes, which make up less than 10 percent of any mapped area.

This Billyhaw soil is used mainly for crops and pasture.

This soil is moderately well suited to pasture. Tall fescue, bermudagrass, and white clover produce

Figure 7.—Soybeans growing on Billyhaw clay, 0 to 1 percent slopes.

moderate yields if they are properly fertilized and if properly grazed.

This soil is well suited to trees such as eastern cottonwood, green ash, water oak, and willow oak. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is moderately well suited to crops such as soybeans and cotton. Close growing crops and crop residue left on the soil surface reduce the erosion hazard, aid water infiltration, and maintain organic matter content. Selective fertilization increases crop yields.

This soil is poorly suited to urban development. Wetness and high shrink-swell are main limitations. Low strength is also a main limiting feature for local roads and streets.

This soil is poorly suited to recreational development. Wetness, very slow permeability, and clayey texture are the main limiting features.

This soil is in capabilty subclass IIIe; woodland group 2w.

8—Blevins silt loam, 1 to 3 percent slopes. This gently sloping soil is on uplands. Soil areas are irregular in shape. They range from 50 to several hundred acres and average about 80 acres.

Typically, this soil has a surface layer of yellowish brown, slightly acid silt loam about 8 inches thick. Below this is light yellowish brown, medium acid silt loam. The subsoil extends to a depth of 80 inches or more. It is very strongly acid clay loam that is yellowish brown with some yellowish mottles in the upper part and grayish mottles in the lower part.

This soil is well drained. Runoff is medium, and permeability is moderate. Available water capacity is high. The rooting zone is deep. The erosion hazard is slight.

Included with this soil in mapping are small areas of Rosalie and Sawyer soils, which make up less than 20 percent of the mapped acreage.

This Blevins soil is used mainly for pasture and crops.

This soil is moderately well suited to pasture plants such as bermudagrass, bahiagrass, tall fescue, crimson clover, and arrowleaf clover. Low fertility is the main limiting feature. Proper grazing and the addition of lime and fertilizer increase forage yields.

This soil is well suited to trees such as loblolly pine, sweetgum, and southern red oak. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is moderately well suited to crops such as soybeans, corn, and grain sorghum. Soil fertility and the hazard of erosion are the limiting features. Terraces decrease soil washing. Crop residue left on the soil surface helps to maintain the organic matter content. Lime and complete fertilizers increase crop yields.

This soil is well suited to recreational development.

This soil is in capability subclass IIe; woodland group 2o.

9—Bryarly clay loam, 1 to 5 percent slopes. This gently sloping soil is on uplands. Soil areas are broad and irregular in shape. They average about 300 acres.

Typically the surface layer is very dark grayish brown, medium acid clay loam about 3 inches thick. The subsoil extends to a depth of 80 inches or more. It is red, very strongly acid clay that has grayish mottles in the upper 12 inches; light brownish gray, very strongly acid clay that has reddish and brownish mottles in the next 42 inches; and brownish yellow, very strongly acid clay that has grayish mottles in the lower part.

This soil is moderately well drained. Runoff is medium, and permeability is very slow. Available water capacity is high. The rooting zone is deep, but the movement of water, air, and plant roots is restricted because of the clayey subsoil. The erosion hazard is moderate.

Included with this soil in mapping are small areas of Annona, Wrightsville, Ashford, and Woodtell soils. The included soils make up as much as 10 percent of any mapped area.

This Bryarly soil is used mainly for woodland and small acreages are used for pasture and crops.

This soil is poorly suited to pasture. Bermudagrass, fescue, and arrowleaf clover are the main pasture plants. Proper grazing and the addition of lime and fertilizers increase yields.

This soil is poorly suited to woodland. Loblolly pine, slash pine, southern red oak, and sweetgum are the main species on this soil. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is poorly suited to crops. Soybeans, grain sorghum, and oats are the main crops. Low fertility, the clayey subsoil, and the hazard of erosion are the main limiting features. Intensive management is needed. Plant residue left on the soil surface helps to maintain organic matter content and improves the movement of water, roots, and air through the soil. Erosion control, such as terracing and contour farming, reduces soil washing. Complete fertilizers and liming increase crop production.

This soil is poorly suited to urban development. High shrink-swell and clay loam texture are the main limitations. Low strength is also a main limiting feature for local roads and streets.

This soil is poorly suited to recreational developments such as camp areas and playgrounds. The very slow permeability is the main limiting feature. This soil is well suited to picnic areas and paths and trails.

This soil is in capability subclass IVe; woodland group 5c.

10—Dardanelle loam, 0 to 1 percent slopes. This nearly level soil is on flood plains. Soil areas are irregular in shape. They are mostly between 50 and 200 acres and average about 150 acres.

Typically, this soil has a surface layer of very dark grayish brown, slightly acid loam about 8 inches thick. The subsoil extends to a depth of 70 inches or more. It is dark brown, neutral clay loam in the upper 18 inches; dark reddish brown, neutral loam that has dark reddish brown mottles in the middle 22 inches; and reddish brown, neutral loam in the lower part.

This soil is well drained. It floods rarely for brief periods. Runoff is slow, and permeability is moderate. Available water capacity is high. The root zone is deep and easily penetrated by roots, water, and air. The erosion hazard is slight.

Included with this soil in mapping are small areas of Severn, Billyhaw, and Redlake soils. These included soils make up less than 15 percent of any mapped area.

This Dardanelle soil is used for crops and pasture.

This soil is well suited to pasture plants such as bermudagrass, tall fescue, and arrowleaf clover. Fertilizers high in nitrogen increase production.

This soil is well suited to trees such as cottonwood, black walnut, pecan, and sweetgum. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is well suited to soybeans, cotton, and corn. Crop residue left on the soil surface helps to maintain organic matter content. Fertilizers can increase production.

This soil is moderately well suited to urban development. Shrinking and swelling is a limitation for small commercial buildings. Low strength is a limitation for roads and streets.

This soil is well suited to recreational development.

This soil is in capability class I; woodland group 1o.

11—Darden loamy fine sand, 1 to 8 percent slopes. This sandy soil is on upland knolls and divides between streams. Soil areas are irregular in shape. They range from 20 to 120 acres and average about 40 acres.

Typically, this soil has a surface layer of brown, slightly acid loamy fine sand about 8 inches thick. The next layer is dark yellowish brown, medium acid loamy fine sand about 6 inches thick. The next 39 inches is brown, strongly acid loamy fine sand. The next layer to a depth of 80 inches or more is strong brown, neutral loamy fine sand.

This soil is excessively drained. Runoff is very slow, and permeability is rapid. Available water capacity is low. The rooting zone is deep, and the erosion hazard is slight.

Included with this soil in mapping are small areas of Rosalie and Vesey soils. The included soils make up less than 20 percent of any mapped area.

This Darden soil is used for pasture, woodland, and crops.

This soil is moderately well suited to pasture plants such as bermudagrass, bahiagrass, crimson clover, and arrowleaf clover. Proper grazing and frequent applications of complete fertilizer increase yields.

This soil is moderately well suited to trees such as loblolly and slash pine. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is moderately well suited to crops such as soybeans and watermelons. Low fertility and droughtiness are the main limiting features. Plant residues left on the soil surface help to maintain organic matter content and conserve moisture. Lime and frequent applications of fertilizers can increase yields.

This soil is well suited to most urban development. Caving of cutbanks is a problem in excavation.

This soil is moderately well suited to recreational development. The sandy texture is the main limiting feature.

This soil is in capability subclass IIIs; woodland group 3s.

12—Darden loamy fine sand, 8 to 12 percent slopes. This strongly sloping sandy soil is along streams. Soil areas are long and narrow. They range from 10 to 100 acres and average about 20 acres.

Typically, this soil has a surface layer of dark yellowish brown, strongly acid loamy fine sand about 5 inches thick. Below this to a depth of 25 inches is yellowish brown, very strongly acid loamy fine sand. The next layer to a depth of 80 inches or more is strong brown, very strongly acid loamy fine sand.

This soil is excessively drained. Runoff is very slow, and the permeability is rapid. Available water capacity is low. The rooting zone is deep. The erosion hazard is slight.

Included with this soil in mapping are small areas of Rosalie loamy fine sand. Also included are areas of soils that are similar to the Darden soils that have a sandy clay loam layer below a depth of 60 inches. The included soils make up less than 20 percent of any mapped area.

This Darden soil is used for pasture and woodland.

It is poorly suited to pasture. The main pasture plants are bermudagrass, bahiagrass, crimson clover, and arrowleaf clover. Proper grazing and frequent applications of a complete fertilizer can increase production.

This soil is moderately well suited to trees such as loblolly and slash pine. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

Droughtiness and low fertility are the main limiting features for crops. Soybeans and watermelons are the main crops.

Crop residue left on or near the surface of the soil helps to maintain organic matter content. Additions of lime and frequent additions of a complete fertilizer can increase production.

This soil is moderately well suited to most urban and recreational development. Sandy texture and slope are the limiting features.

This soil is in capability subclass IVe; woodland group 3s.

13—Eylau very fine sandy loam, 0 to 3 percent slopes. This nearly level to gently sloping soil is on broad interstream divides on uplands. Soil areas are irregular in shape. They range from 20 to several hundred acres and average about 75 acres.

Typically, the surface layer is dark grayish brown, slightly acid very fine sandy loam about 6 inches thick. Below this is brown, medium acid very fine sandy loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. It is very strongly acid sandy clay loam that is strong brown in the upper part, brownish yellow in the middle part, and mottled with red, brown, and gray in the lower part.

This soil is moderately well drained. Runoff is slow, and permeability is moderately slow. Available water capacity is high. The rooting zone is deep. The erosion hazard is slight to moderate.

Included with this soil in mapping are small areas of Blevins and Sawyer soils. These included soils make up less than 20 percent of any mapped area.

This Eylau soil is used for crops, pasture, and woodland.

This soil is well suited to pasture plants such as bermudagrass, bahiagrass, crimson clover, and arrowleaf clover. Proper grazing and the addition of fertilizers increase production.

This soil is moderately well suited to trees such as loblolly and slash pine. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is moderately well suited to crops. The main crops are soybeans, grain sorghum, and corn. The hazard of erosion and low fertility are the main limiting features. Terraces and contour tillage help control erosion. Crop residue left on the soil surface helps to maintain organic matter content. Additions of lime and complete fertilizer can increase production.

This soil is moderately well suited to urban and recreational development. Wetness and very slow permeability are the main limiting features. Low strength is also a main limitation for local roads and streets.

This soil is in capability subclass IIe; woodland group 3o.

14—Eylau-Urban land complex, 0 to 3 percent slopes. This complex is on uplands. Soil areas are irregular in shape. They range from 20 to 200 acres and average about 50 acres.

This complex consists of about 60 percent Eylau soils, 30 percent Urban land, and 10 percent other soils. Areas of these soils and Urban land are so intermingled that they could not be shown separately at the scale selected for mapping.

Typically, the Eylau soil has a surface layer of dark grayish brown, slightly acid very fine sandy loam about 6 inches thick. Below this is brown, medium acid very fine sandy loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. It is very strongly acid sandy clay loam that is strong brown in the upper part, it is brownish yellow in the middle part, and it is mottled with red, brown, and gray in the lower part.

Eylau soils are moderately well drained. Runoff is slow, and permeability is moderately slow. Available water capacity is high. The rooting zone is deep. The erosion hazard is slight to moderate.

Urban land consists of areas of structures and disturbed areas in which the soil has been so altered or obscured that classification is not practical. The main works and structures that cover the areas are office buildings, warehouses, railroad yards, schools, churches, dwellings, garages, sidewalks, driveways, streets, and paved parking lots. Also included are areas that have been disturbed by cutting, filling, or grading.

Included with this complex in mapping are areas of Saffel, Sawyer, and Sacul soils. Included soils make up less than 15 percent of any mapped area.

The soils in this map unit are moderately well suited to most urban development. Wetness is the main limitation and low strength is also a limiting feature for local roads and streets. Information about the use of these soils for urban development is contained in the sections on engineering and recreation.

This complex is not placed in a capability subclass or woodland group.

15—Ferris clay, 5 to 12 percent slopes. This sloping and strongly sloping soil is on convex upland ridges and slopes along drainageways. Soil areas are long and narrow. They average about 100 acres.

Typically, this soil has a surface layer of dark grayish brown, mildly alkaline clay about 3 inches thick. Below this, to a depth of about 58 inches, is moderately alkaline clay that is light olive brown in the upper part and mottled grayish and brownish in the lower part. Below this, to a depth of 70 inches or more is mottled grayish and brownish, moderately alkaline stratified clay and shale.

The soil is well drained. Runoff is rapid, and permeability is very slow. Available water capacity is high. The rooting zone is deep, but the movement of roots, water, and air is restricted because of the clayey texture throughout. The erosion hazard is severe.

Included with this soil in mapping are small areas of Morse and McKamie soils. Also included are small eroded areas in which shale is exposed. The included soils and eroded areas make up less than 20 percent of any mapped area.

This Ferris soil is used for pasture.

This soil is poorly suited to pasture. The main plants are bermudagrass and black medic. Proper grazing and selective fertilization increase production. Cultivation of this soil is not recommended because of the severe erosion hazard.

This soil is poorly suited to most urban development. High shrink-swell and clayey texture are the main limiting features. Low strength is also a main limitation for local roads and streets. This soil is moderately well suited to recreational development. Clayey texture, very slow permeability, and slope are the main limitations.

This soil is in capability subclass VIe; woodland group not assigned.

16—Gladewater clay, frequently flooded. This nearly level soil is on flood plains. Slopes are less than 1 percent. Soil areas are long. They are mostly 300 to 1,000 acres and average about 800 acres.

Typically, the surface layer is very dark gray, neutral clay about 5 inches thick. The subsoil, which extends to a depth of about 42 inches, is clay that is slightly acid and gray in the upper part and medium acid and dark gray in the lower part. The underlying material to a depth of 72 inches or more is gray, strongly acid clay.

This soil is poorly drained. It floods two to four times a year for long periods of 7 days to a month. Runoff is very slow, and permeability is very slow. Available water capacity is high. The rooting zone is deep, but the movement of water, roots, and air is restricted because of the clayey texture. The erosion hazard is slight.

Included with this soil in mapping are small areas of Texark soils, which make up less than 10 percent of the mapped acreage.

This Gladewater soil is mostly in woodland. A few areas are used for pasture.

This soil is moderately well suited to pasture. Fescue and bermudagrass are adapted grasses. Proper grazing and selective fertilization increase production. This soil is well suited to hardwood trees such as water oak and sweetgum. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

Cultivation of this soil is not recommended because of the flood hazard.

This soil is poorly suited to urban and recreational development because of frequent flooding, shrinking and swelling, and clayey texture. Low strength is a limitation for local roads and streets.

This soil is in capability subclass Vw; woodland group 2w.

17—Kiomatia loamy fine sand, frequently flooded. This nearly level and gently sloping sandy soil is on flood plains. Slopes range from 1 to 3 percent and average about 2 percent. The areas are long and narrow and generally parallel the stream channels. They range from 50 to several hundred acres and average about 75 acres.

Typically, the surface layer is reddish brown, moderately alkaline loamy fine sand about 3 inches thick. The lower layer extends to a depth of about 72 inches or more. It is brown, moderately alkaline loamy fine sand that contains thin strata of fine sandy loam.

This soil is well drained. It floods at least once a year for a period of 2 days to 7 days. Runoff is slow, and permeability is rapid. Available water capacity is low. The root zone is deep and easily penetrated by roots, water, and air. The erosion hazard is slight.

Included with this soil in mapping are small areas of a soil that is similar to the Kiomatia soils in use and management but has clayey strata below a depth of 3 feet. Also included are small areas of riverwash, small creek channels, and oxbows. A few small areas of Severn soils are included. Included soils make up less than 25 percent of the mapped acreage.

This Kiomatia soil is idle or used as pasture.

This soil is moderately well suited to pasture. Bermudagrass is the main pasture plant. Proper grazing and frequent applications of a complete fertilizer increase production.

This soil is well suited to trees such as eastern cottonwood, black walnut, and sweetgum. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production. This soil is very poorly suited to crops because of the flood hazard.

This soil is poorly suited to urban and recreational development. Frequent flooding, seepage, and wetness are the main limiting features.

This soil is in capability subclass Vw; woodland group 2w.

18—McKamie loam, 1 to 5 percent slopes. This gently sloping soil is on ridges and slopes of old terraces along streams. Slopes average about 3 percent. Soil areas are long and narrow. They range from 20 to 100 acres and average about 65 acres.

Typically, this soil has a loam surface layer about 13 inches thick. It is dark grayish brown in the upper part and brown in the lower part. The subsoil extends to a depth of 58 inches. It is red clay in the upper part and red sandy clay loam in the lower part. Below this to a depth of 80 inches or more is red fine sandy loam. This soil is slightly acid in the upper part and very strongly acid in the lower part.

This soil is well drained. Runoff is medium, and permeability is very slow. Available water capacity is high. The root zone is deep; however, the clayey subsoil slows the movement of roots, water, and air.

Included with this soil in mapping are small areas of Woodtell, Vesey, and Ruston soils. Included soils make up less than 20 percent of the mapped acreage.

This McKamie soil is mostly in woodland. A few scattered areas are used for pasture.

This soil is poorly suited to pasture. Bermudagrass, bahiagrass, crimson clover, and arrowleaf clover are common pasture plants. Proper grazing and the addition of a complete fertilizer increase production.

This soil is moderately well suited to trees such as loblolly pine and slash pine. Proper woodland management, such as selective cutting, removal of

undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is moderately well suited to crops such as soybeans and small grains. Erosion hazard, low fertility, and very slow permeability are the main limiting features. Terraces and contour tillage help control erosion. Crop residue left on the soil surface aids water intake and helps to maintain organic matter content. The addition of lime and a complete fertilizer increases production.

This soil is poorly suited to urban development. High shrink-swell is the main limiting feature. Low strength is also a main limitation for local roads and streets.

This soil is well suited to recreational development such as picnic areas and paths and trails. It is moderately well suited to camp areas and playgrounds. Slope and very slow permeability are the main limiting features.

This soil is in capability subclass IVe; woodland group 3c.

19—McKamie loam, 5 to 12 percent slopes. This sloping and strongly sloping soil is along stream terraces. Slopes average about 10 percent. Areas are long and narrow. They range from 30 to 200 acres and average about 100 acres.

Typically, the surface layer is brown, strongly acid loam about 4 inches thick. The subsoil extends to a depth of about 54 inches. It is red clay, to a depth of 44 inches, and is red, sandy clay loam in the lower part. The underlying material to a depth of about 74 inches or more is yellowish red sandy clay loam. This soil is medium acid to very strongly acid.

This soil is well drained. Runoff is rapid, and permeability is very slow. Available water capacity is high. The root zone is deep; however, the clayey subsoil slows the movement of roots, water, and air. The erosion hazard is severe.

Included with this soil in mapping are small areas of less sloping McKamie soils and small areas of Woodtell, Ruston, and Morse soils. The included soils make up less than 20 percent of the mapped acreage.

Most of this McKamie soil is in woodland. A few areas are used for improved pasture.

This soil is poorly suited to pasture. The main pasture plants are bahiagrass, crimson clover, and arrowleaf clover. Proper grazing and the addition of fertilizers increase production.

This soil is moderately well suited to trees such as loblolly and slash pine. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

Cultivation of this soil is not recommended because of the severe erosion hazard.

This soil is poorly suited to urban development. The main limitation is high shrink-swell, and low strength is also a limitation for local roads and streets.

This soil is well suited to recreational development such as paths and trails. It is moderately well suited to camp areas and picnic areas. Slope and very slow permeability are limitations. This soil is very poorly suited to playgrounds because of slope.

This soil is in capability subclass VIe; woodland group 3c.

20—Morse clay, 3 to 8 percent slopes, eroded. This gently sloping and sloping soil is on high terraces along streams. Slopes average about 6 percent. Soil areas are long and narrow and lay parallel to streams. They range from 50 to 400 acres and average about 200 acres. Erosion forms U-shaped gullies that are 4 to 12 feet across, 2 to 5 feet deep, and 150 to 300 feet apart. Some of them cannot be crossed with common farm machinery.

Typically, this soil is clay to a depth of 80 inches or more. It is dark reddish brown in the upper part, dark red in the middle part, and red in the lower part. This soil is moderately alkaline throughout.

This soil is well drained. Runoff is rapid, and permeability is very slow. Available water capacity is high. The rooting zone is deep; however, the clayey texture slows the movement of roots, water, and air. The erosion hazard is severe.

Included with this soil in mapping are small areas of McKamie and Woodtell soils which make up less than 20 percent of the mapped acreage.

This Morse soil is used mainly for pasture.

This soil is poorly suited to pasture plants. Bermudagrass is the main grass. Proper grazing and selective fertilization increase production. This soil is poorly suited to crops. Cultivation is not recommended because of the severe erosion hazard.

This soil is poorly suited to urban development. The main limitation is high shrink-swell, and low strength is also a limitation for local roads and streets.

This soil is poorly suited to recreational development. Clayey texture and very slow permeability are the main limiting features.

This soil is in capability subclass VIe; woodland group 5t.

21—Muldrow clay loam. This nearly level soil is on low terraces along streams. Soil areas are irregular in shape and are long and narrow. They range from 50 to 500 acres and average about 250 acres.

Typically, this soil has a surface layer of very dark grayish brown, medium acid clay loam about 14 inches thick. The subsoil extends to a depth of 79 inches or more. It is black, neutral clay in the upper 23 inches. The lower part is very dark gray, neutral and mildly alkaline clay that has dark yellowish brown mottles and reddish brown mottles.

This soil is somewhat poorly drained. A water table is within 2 feet of the surface during the cool season. Runoff is slow, and permeability is very slow. Available water capacity is high. The rooting zone is deep, but excess water inhibits the movement of roots and air. The erosion hazard is none to slight.

Included with this soil in mapping are small areas of Billyhaw and Perry soils. Also included are a few areas of soils similar to Muldrow soils that have a thicker surface layer of clay loam than the Muldrow soils and are on low mounds. The included soils make up less than 20 percent of mapped areas.

This Muldrow soil is used for crops and pasture.

This soil is well suited to pasture plants such as bermudagrass, fescue, and white clover. Proper grazing and fertilization increase production.

This soil is well suited to hardwood trees such as green ash, eastern cottonwood, and sweetgum. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is moderately well suited to crops. The main crops are soybeans, grain sorghum, and corn. Wetness is the main limiting feature. A drainage system is needed to control wetness. Crop residue left on the soil surface aids infiltration and maintains the organic matter content. Selective fertilization increases yields.

This soil is poorly suited to urban development. The high shrink-swell is a main limiting feature. Low strength is also a main limitation for local roads and streets.

This soil is moderately well suited to recreational development such as picnic areas and paths and trails. The clayey texture and wetness are the main limitations. This soil is poorly suited to camp areas and playgrounds because of the very slow permeability.

This soil is in capability subclass IIw; woodland group 2w.

22—Perry clay, occasionally flooded. This nearly level soil is on flood plains. Slopes are less than 1 percent. Soil areas are long and narrow. They range from 50 to several hundred acres and average about 200 acres.

Typically, this soil has a surface layer of dark gray, medium acid clay about 4 inches thick. The subsoil is also clay, and it extends to a depth of 80 inches or more. To a depth of 45 inches it is gray and is slightly acid in the upper part, neutral in the middle part and moderately alkaline in the lower part. Below 45 inches it is calcareous, has many calcium carbonate concretions, and is dark reddish gray in the upper part and dark reddish brown in the lower part.

Perry clay is poorly drained. It floods occasionally—less than once every 2 years. A water table is within 2 feet of the soil surface during the winter and spring. Runoff and permeability are very slow. Available water capacity is high. The rooting zone is deep, but excess water and heavy clay inhibit the movement of roots, water, and air. The erosion hazard is none to slight.

Included with this soil in mapping are small areas of Billyhaw soils which make up less than 10 percent of any mapped area.

This Perry soil is mostly used for improved pasture.

This soil is moderately well suited to pasture. Fescue and bermudagrass are the main grasses. Proper grazing and fertilization increase production.

This soil is well suited to trees such as eastern cottonwood and sweetgum. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is moderately well suited to crops such as soybeans and cotton. Wetness is the main limiting feature. A drainage system is needed to reduce the wetness. Crop residue left on the surface of the soil increases infiltration and maintains the organic matter content. Selective fertilization increases production.

This soil is poorly suited to urban development. Wetness and high shrink-swell are the main limitations.

This soil is poorly suited to recreational development because of wetness, very slow permeability, and clayey texture.

This soil is in capability subclass IVw; woodland group 2w.

23—Redlake clay. This nearly level soil is on flood plains. Soil areas are irregular in shape. They range from 60 to 500 acres and average about 300 acres.

Typically, this soil has a surface layer of dark reddish brown, moderately alkaline clay about 5 inches thick. The subsoil, which extends to a depth of 56 inches, is moderately alkaline clay. It is dark red in the upper part and red in the lower part. The underlying material to a depth of about 72 inches or more is red, moderately alkaline silt loam that is weakly stratified with other textures and colors.

This soil is moderately well drained. It is rarely flooded. Runoff is slow, and permeability is very slow. Available water capacity is high. The rooting zone is deep; however, the clayey subsoil slows the movement of air, water, and roots. The erosion hazard is slight.

Included with this soil in mapping are small areas of Billyhaw and Severn soils. Included soils make up less than 10 percent of the mapped acreage.

Most of this Redlake soil is cultivated.

This soil is moderately well suited to pasture plants such as bermudagrass, tall fescue, white clover, and arrowleaf clover. Proper grazing and fertilization increase production.

This soil is moderately well suited to trees such as cottonwood, pecan, and green ash. Proper woodland management, such as selective cutting, removal of undesirable trees, and protection from fire, increases timber production.

This soil is well suited to crops such as soybeans, grain sorghum, and small grains. Crop residue left on the soil surface increases infiltration and helps to maintain organic matter content. Selective fertilization increases production.

This soil is poorly suited to urban and recreational development. Shrinking and swelling and the high clay

content are the main limitations, and low strength is a main limitation for local roads and streets.

This soil is in capability subclass IIIw; woodland group 3w.

24—Roebuck clay, frequently flooded. This nearly level soil is in depressed areas on flood plains. Slopes are less than 1 percent. Soil areas are long and narrow and follow the meanders of sloughs. They range from 15 to 50 acres and average about 40 acres.

Typically, this soil has a surface layer of dark reddish brown, moderately alkaline clay about 9 inches thick. The subsoil, to a depth of about 40 inches, is dark reddish brown, moderately alkaline clay. The underlying layer to a depth of about 65 inches or more is reddish brown, moderately alkaline clay.

This soil is somewhat poorly drained. It floods at least once a year for a period of 7 days to more than 1 month. Water stands on the surface during the cool season. Runoff and permeability are very slow. Available water capacity is high. The rooting zone is deep, but excess water and clay inhibit the movement of roots, water, and air. The erosion hazard is none to slight.

Included with this soil in mapping are small areas of the similar Billyhaw, Perry, and Redlake soils. Included soils make up less than 25 percent of the mapped acreage.

All of this Roebuck soil is in native stands of elm, ash, hackberry, pecan, bois d'arc, willow, and white oak.

This soil is poorly suited to pasture unless a drainage system is installed. Proper grazing and selective fertilization increase production. The main grasses are bermudagrass and fescue.

This soil is moderately well suited to trees such as eastern cottonwood, green ash, and pecan. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and control of fire, increases timber production.

This soil is poorly suited to crops unless the flooding is controlled and a drainage system is installed. Soybeans, grain sorghum, and small grains are adapted crops. Frequent flooding, wetness, and very slow permeability are the main limiting features. Crop residue left on the soil surface increases the infiltration rate and helps to maintain the organic matter content. Selective fertilization increases production.

This soil is poorly suited to urban and recreational development. The main limitations are frequent flooding, wetness, high shrink-swell, and high clay content. Low strength is also a limitation for local roads and streets.

This soil is in capability subclass Vw; woodland group 3w.

25—Rosalie loamy fine sand, 2 to 5 percent slopes. This gently sloping soil is on upland interstream divides. Slopes average about 3 percent. Soil areas are irregular in shape. They range from 20 to 100 acres and average about 60 acres.

Typically, this soil has a surface layer of brown, slightly acid loamy fine sand about 8 inches thick. Below this is yellowish brown, medium acid loamy fine sand about 16 inches thick. The subsoil to a depth of 80 inches or more is very strongly acid sandy clay loam that is strong brown in the upper part and red in the lower part.

This soil is well drained. Runoff is slow, and permeability is moderate. Available water capacity is medium. The rooting zone is deep, and roots, water, and air move easily through the soil. The erosion hazard is slight.

Included with this soil in mapping are small spots of Blevin silt loam and small areas of Darden loamy fine sand. Included soils make up less than 20 percent of the mapped acreage.

All of this Rosalie soil is used for pasture and woodland except for a few small fields that are used for gardens and truck farms.

This soil is moderately well suited to pasture. The main pasture plants are bermudagrass, bahiagrass, and arrowleaf clover. However, proper grazing and the application of lime and fertilizers increase production.

This soil is moderately well suited to trees such as loblolly pine and slash pine (fig. 8). Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and control of fire, increases timber production.

This soil is moderately well suited to crops. The main crops are soybeans and cotton. Droughtiness and low fertility are the main limiting features. Crop residue left on the surface of the soil helps to maintain the organic matter content. The application of fertilizers and lime increases production.

This soil is well suited to most urban and recreational development.

This soil is in capability subclass IIIs; woodland group 3s.

26—Ruston loamy fine sand, 2 to 5 percent slopes. This soil is on upland terraces. Soil areas are generally long and narrow. They range from 20 to several hundred acres and average about 75 acres.

Typically, the surface layer is brown, strongly acid loamy fine sand about 14 inches thick. The subsoil extends to a depth of 80 inches or more. It is yellowish red, strongly acid fine sandy loam, to a depth of 28 inches, and is red, strongly acid sandy clay loam that is coarsely mottled with yellowish brown in the lower part. The lower layer contains lenses and coatings of light colored uncoated fine sand.

This Ruston soil is well drained. Runoff is medium, and permeability is moderate. Available water capacity is medium. The rooting zone is deep, and roots, water, and air move easily through the soil. The erosion hazard is slight.

Included with this soil in mapping are small spots of Ruston fine sandy loam and small areas of Rosalie soils. Included soils make up less than 20 percent of the mapped acreage.

Figure 8.—Fast growing loblolly pine plantation on Rosalie loamy fine sand, 2 to 5 percent slopes.

This Ruston soil is used mainly for pasture and woodland. A few small areas are used for vegetables and other crops.

This soil is well suited to pasture plants such as bermudagrass, bahiagrass, crimson clover, and arrowleaf clover. Proper grazing and the addition of lime and fertilizers increase production.

This soil is moderately well suited to trees such as loblolly and slash pine. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is moderately well suited to crops. Soybeans, grain sorghum, and small grains are the main crops. Droughtiness and low fertility are the main limiting features. Crop residue left on the soil surface helps to maintain the organic matter content. Lime and fertilizers increase production.

This soil is well suited to most urban development. Low strength is a limiting feature for roads and streets.

This soil is well suited to most recreational development. Slope is a limitation for playgrounds.

This soil is in capability subclass IIIe; woodland group 3o.

27—Ruston fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on crests and side slopes of upland terraces. Soil areas are irregular in shape. They range from 15 to 300 acres and average about 70 acres.

Typically, the surface layer is slightly acid, brown fine sandy loam about 18 inches thick. The subsoil extends to a depth of 80 inches or more. It is yellowish red sandy clay loam that is medium acid in the upper part, strongly acid in the middle part, and very strongly acid in the lower part.

This soil is well drained. Runoff is medium, and permeability is moderate. The available water capacity is medium. The rooting zone is deep; and roots, water, and air move readily through the soil. The erosion hazard is moderate.

Included with this soil in mapping are small areas of Vesey fine sandy loam, Ruston loamy fine sand, and a soil similar to the Ruston soils that has a thicker surface layer and is on low mounds. The included soils make up less than 20 percent of the mapped acreage.

This Ruston soil is used for woodland, pasture, and crops.

This soil is well suited to pasture plants such as bermudagrass, bahiagrass, crimson clover, and arrowleaf clover. Proper grazing and the addition of lime and fertilizers increase production.

This soil is moderately well suited to trees such as loblolly and slash pine. Woodland management, such as selective cutting, removal of undesirable trees, and protection from fire, increases timber production.

This soil is moderately well suited to crops. Soybeans, grain sorghum, and small grains are the main crops. The erosion hazard and low fertility are the main limiting features. Terraces and diversions help to control soil washing. Crop residue left on the soil surface improves infiltration and helps to maintain organic matter content. Lime and fertilizers increase production.

This soil is well suited to most urban and recreational development. However, low strength is a limitation for roads and streets.

This soil is in capability subclass IIe; woodland group 3o.

28—Ruston fine sandy loam, 3 to 8 percent slopes. This gently sloping and sloping soil is on convex upland terraces. Slopes average about 5 percent. Soil areas are irregular in shape. They are mainly less than 100 acres and average about 30 acres.

Typically, this soil has a surface layer of brown, slightly acid fine sandy loam about 5 inches thick. Below this, to a depth of about 16 inches, is a layer of yellowish brown, medium acid fine sandy loam. The subsoil to a depth of 80 inches or more is red sandy clay loam. It is strongly acid in the upper part and very strongly acid in the lower part.

This soil is well drained. Runoff is medium, and permeability is moderate. Available water capacity is medium. The rooting zone is deep; and roots, water, and air move easily through the soil. The erosion hazard is moderate.

Included with this soil in mapping are small areas of Woodtell, McKamie, and Eylau soils. Included soils make up as much as 15 percent of any mapped area.

This Ruston soil is mainly used for woodland and pasture. A few areas are used for cotton and soybeans.

This soil is well suited to pasture plants such as bermudagrass, bahiagrass, crimson clover, arrowleaf clover, and vetch. Proper grazing and the addition of lime and fertilizers increase production.

This soil is moderately well suited to trees such as loblolly and slash pine. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is moderately well suited to crops such as soybeans, grain sorghum, and small grains. The erosion hazard and low fertility are the main limiting features. Terraces and diversions reduce soil washing. Crop residue left on the soil surface increases infiltration and helps to maintain organic matter content. Lime and fertilizers increase production.

This soil is well suited to most urban and recreational development. However, low strength is a limitation for roads and streets.

This soil is in capability subclass IIIe; woodland group 3o.

29—Ruston-Urban land complex, 1 to 5 percent slopes. This complex is on crests and side slopes of upland terraces. Slopes are convex and average about 2 percent. Soil areas are irregular in shape. They range from 20 to 200 acres and average about 60 acres.

This complex is about 45 percent Ruston soils, 40 percent Urban land, and 15 percent other soils. Areas of these soils and Urban land are so intermingled that they could not be shown separately at the scale selected for mapping.

Typically, the Ruston soil has a fine sandy loam surface layer about 18 inches thick. It is brown in the upper part and dark yellowish brown with yellowish brown mottles in the lower part. The subsoil to a depth of 80 inches or more is sandy clay loam. It is yellowish red in the upper part, reddish brown in the middle part, and yellowish red in the lower part. This soil is typically slightly acid in the upper part and grades to very strongly acid in the lower part.

The Ruston soils are well drained. Runoff is medium, and permeability is moderate. The rooting zone is deep; and roots, water, and air move easily through the soil. Available water capacity is medium. The erosion hazard is moderate.

Urban land consists of disturbed areas in which the soil has been so altered or obscured that classification is not practical. The main works and structures that cover the areas are office buildings, railroad yards, warehouses, churches, schools, dwellings, and streets. Also included are areas that have been disturbed by cutting, filling, or grading.

Included with this complex in mapping are small areas of Blevins soils. They make up less than 15 percent of any mapped area.

The soils in this map unit are well suited to most urban development. Corrosivity to concrete and low strength for roads and streets are the main limiting features. These soils are well suited to recreation uses; however, slope limits the use of some areas for playgrounds. Information about the use of these soils for urban development is contained in the sections on engineering and recreation.

This complex is not assigned to a capability subclass or woodland group.

30—Sacul fine sandy loam, 3 to 8 percent slopes. This gently sloping and sloping soil is on uplands along creeks, stream branches, drains, and rivers. Soil areas are long and narrow. They range from 20 to over 200 acres and average about 35 acres.

Typically, this soil has a surface layer of dark brown, slightly acid fine sandy loam about 2 inches thick. Below this, to a depth of 10 inches, is yellowish brown, medium acid fine sandy loam. The subsoil extends to a depth of 65 inches or more. It is mottled red, pinkish gray, light brownish gray, and yellowish red, very strongly acid clay in the upper part and red, very strongly acid clay loam in the lower part.

Included with this soil in mapping, are small areas of a soil that is similar to the Sacul soil but has red silty clay loam in the upper part of the subsoil that does not have grayish colored mottles. Small areas of McKamie and Ruston soils are also included. The included soils make up less than 15 percent of the mapped acreage of this soil.

This Sacul soil is moderately well drained. Runoff is rapid, and permeability is slow. The available water

capacity is high. The rooting zone is deep. The erosion hazard is severe.

This soil is used for pasture and woodland.

It is moderately well suited to pasture plants such as bahiagrass, bermudagrass, crimson clover, and arrowleaf clover. Proper grazing and the addition of lime and fertilizers increase production.

This soil is moderately well suited to trees such as loblolly pine, slash pine, and shortleaf pine. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is poorly suited to crops. Intensive erosion control measures, management of crop residue, and fertilization are needed to successfully farm this soil.

This soil is poorly suited to urban development. The main limitations are shrinking and swelling and a high clay content, and low strength also limits local roads and streets.

This soil is well suited to recreational developments such as picnic areas and paths and trails. It is moderately well suited to camp areas and playgrounds. Slope and slow permeability are limitations.

This soil is in capability subclass IVe; woodland group 3c.

31—Sacul fine sandy loam, 8 to 12 percent slopes. This strongly sloping soil is on uplands along streams. Soil areas are long and narrow. They range from 25 to 300 acres and average about 40 acres.

Typically, this soil has a surface layer of very dark grayish brown, slightly acid fine sandy loam about 2 inches thick that has a few brown mottles. The subsoil extends to a depth of 65 inches or more. To a depth of about 49 inches, it is very strongly acid clay that is yellowish red in the upper part, red in the middle part, and gray in the lower part. Below this, the lower part of the subsoil is gray, very strongly acid sandy clay loam.

Included with this soil in mapping are small areas of the gently sloping Sacul soils and small areas of the gravelly Woodtell soils. The included soils make up less than 25 percent of any mapped area.

This Sacul soil is moderately well drained. Runoff is rapid, and permeability is slow. The available water capacity is high. The rooting zone is deep. The erosion hazard is severe.

This soil is used for woodland and pasture.

It has a medium potential for pasture plants such as bahiagrass, bermudagrass, crimson clover, and arrowleaf clover. Proper grazing and the addition of lime and fertilizers increase yields.

This soil is moderately well suited to trees such as loblolly pine, slash pine, and shortleaf pine. Woodland management, such as selective cutting, removal of undesirable trees, and protection from fire, increases timber production.

This soil is poorly suited to cultivation because of slope and the erosion hazard.

This soil is poorly suited to urban development. The main limitations are high shrink-swell and high clay content, and low strength is also a limitation for local roads and streets. This soil is moderately well suited to recreational development. Slope and slow permeability are limitations.

This soil is in capability subclass VIe; woodland group 3c.

32—Sacul-Urban land complex, 3 to 8 percent slopes. This sloping soil is on ridgetops and side slopes along streams. Soil areas are long and narrow. They range from 10 to 100 acres and average about 25 acres.

This complex is about 55 percent Sacul soils, 30 percent Urban land, and about 15 percent other soils.

Areas of these soils and Urban land are so intermingled that they could not be shown separately at the scale selected for mapping.

Typically, this Sacul soil has a dark yellowish brown, slightly acid fine sandy loam surface layer about 2 inches thick. The next layer, to a depth of 10 inches, is strong brown, medium acid fine sandy loam. The subsoil extends to a depth of 65 inches or more. It is mottled red, pinkish gray, and yellowish red, very strongly acid clay, to a depth of 55 inches, and is red, very strongly acid clay loam in the lower part.

Urban land consists of areas that are covered mostly by commercial buildings, parking lots, houses, and streets. The main characteristic of Sacul soils that affects construction is the high shrink-swell of the clayey subsoil. These soils are also moderately to highly erosive. Low strength is a limitation for local roads and streets. Information about the use of these soils for urban development is contained in the sections on engineering and recreation.

This complex is not assigned to a capability subclass or woodland group.

33—Saffell gravelly sandy loam, 3 to 8 percent slopes. This gently sloping and sloping soil is on high terraces. Soil areas are irregular in shape. They range up to about 100 acres and average about 20 acres.

Typically, this soil has a surface layer of brown, slightly acid, gravelly sandy loam about 6 inches thick.

Below this, to a depth of 14 inches, is yellowish red, medium acid, gravelly sandy loam. The subsoil extends to a depth of 80 inches or more. It is red, very strongly acid gravelly sandy clay loam.

This soil is well drained. Runoff is medium, and permeability is moderate. Available water capacity is low. The rooting zone is deep, and roots, water, and air move easily through the soil. The erosion hazard is moderate.

Included with this soil in mapping are small areas of Ruston, Smithdale, Woodtell, and Eylau soils that are too small to be mapped separately. These included soils make up less than 15 percent of any mapped area.

Most of this Saffell soil is in woodland.

This soil is poorly suited to pasture. However, proper grazing and the addition of lime and fertilizers increase

production. Bahiagrass, bermudagrass, crimson clover, and arrowleaf clover are the main plants.

These soils are moderately well suited to loblolly pine, shortleaf pine, and eastern redcedar. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases yields.

This soil is poorly suited to crops. Droughtiness, the erosion hazard, the high gravel content, and low fertility are the main limiting features. However, the addition of lime and fertilizers will increase production. Terraces and diversions help control soil washing. Crop residue left on the soil surface helps to maintain organic matter content.

This soil is well suited to most urban development. Small stones or gravel are limitations for shallow excavations. In some areas, slope is a limitation for small commercial buildings.

This soil is well suited to recreational development except for playgrounds, which are limited by slope and small stones or gravel.

This soil is in capability subclass IIIe; woodland group 4f.

34—Saffell-Urban land complex, 3 to 8 percent slopes. This deep, gently sloping and sloping complex is on forested convex upland terraces. Slopes average about 5 percent. Areas are long and narrow. They average about 75 acres. This complex is about 45 percent Saffell soils, about 35 percent Urban land, and about 20 percent other soils. Areas of these soils and Urban land are so intermingled that they could not be shown separately at the scale selected for mapping.

Typically, the Saffell soil has a slightly acid gravelly sandy loam surface layer about 14 inches thick. It is brown in the upper part and yellowish red in the lower part. The subsoil to a depth of 80 inches or more is red, very strongly acid gravelly sandy clay loam.

Cuts for leveling purposes have removed the gravelly sandy loam surface layer and exposed the more clayey subsoil in some places. The Saffell soils are well drained and moderately permeable. The available water capacity is low. The erosion hazard is moderate.

Urban land is occupied mostly by commercial establishments and their paved parking lots. In places there are single-unit dwellings, streets, driveways, sidewalks, and patios.

Information on the use of these areas for urban development is contained in the sections on engineering and recreation.

This complex is not assigned to a capability subclass or woodland group.

35—Sardis silt loam, frequently flooded. This nearly level soil is on flood plains along the major creeks and drainageways. Slopes are less than 1 percent. Soil areas are long and narrow and parallel to streams. They range from 50 to several hundred acres and average about 200 acres.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of 62 inches or more. In the upper 41 inches, it is silt loam that is yellowish brown in the upper part and brown in the lower part. The lower part of the subsoil is pale brown fine sandy loam. Typically, this soil is neutral in the upper part and grades to very strongly acid in the lower part.

This soil is somewhat poorly drained. It floods briefly two to four times a year. A water table is 1 to 3 feet below the surface during winter and spring. Runoff is slow, and permeability is moderate. The available water capacity is high. The rooting zone is deep, and roots, water, and air move easily through the soil. The erosion hazard is slight.

Included with this soil in mapping are small areas of Amy and Thenas soils. The included soils make up less than 30 percent of any mapped area.

This Sardis soil is used mainly for woodland and pasture.

This soil is moderately well suited to pasture. The main forage plants are bermudagrass, fescue, bahiagrass, crimson clover, and arrowleaf clover. Frequent flooding and wetness limit yields to some extent. Proper grazing and the addition of lime and fertilizers increase yields.

This soil is well suited to trees such as loblolly pine, yellow-poplar, water oak, and sweetgum. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is not recommended for cultivation because of frequent flooding.

This soil is poorly suited to urban and recreational development because of the hazard of flooding.

This soil is in capability subclass Vw; woodland group 1w.

36—Sawyer silt loam, 0 to 3 percent slopes. This nearly level and gently sloping soil is on uplands. Areas are broad and irregular in shape. They range from 20 to 500 acres and average about 100 acres.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. It is yellowish brown silty clay loam in the upper 9 inches, yellowish brown clay loam that has grayish and reddish mottles in the next 11 inches, and mottled gray, red, and strong brown clay in the lower part. Typically, this soil is slightly acid in the upper part and grades to very strongly acid in the lower part.

This soil is moderately well drained. Runoff and permeability are slow. Available water capacity is high. The rooting zone is deep, but the clayey texture in the lower part slows the movement of roots, water, and air. The erosion hazard is moderate.

Included with this soil in mapping are a few areas of Adaton and Eylau soils. Some areas have small mounds. Included soils make up 10 to 20 percent of the area.

These Sawyer soils are used mostly for pasture. A few areas are used for woodland and crops.

This soil is well suited to pasture plants such as bermudagrass, dallisgrass, bahiagrass, ryegrass, arrowleaf clover, and crimson clover. Proper grazing and the addition of lime and fertilizers increase production.

This soil is well suited to trees such as loblolly and slash pine. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and control of fire, increases timber production (fig. 9).

This soil is moderately well suited to crops. The main crops are soybeans, grain sorghum, corn, and small grains. Low fertility and the erosion hazard are the main limiting features. Terraces and diversions decrease the amount of soil washing. Crop residue left on the soil surface increases infiltration and maintains organic matter content. Lime and fertilizers increase yields.

This soil is poorly suited to most urban development. High shrink-swell and high clay content are the main limiting features. Low strength is also a limitation for roads and streets.

This soil is well suited to recreational developments

Figure 9.—Mixed pine and hardwood forest on Sawyer silt loam, 0 to 3 percent slopes.

such as picnic areas and paths and trails. It is moderately well suited to camp areas and playgrounds. Slow permeability and slope are limitations.

This soil is in capability subclass IIe; woodland group 2w.

37—Sawyer-Urban land complex, 0 to 3 percent slopes. This nearly level and gently sloping soil is on upland interstream divides. Slopes average about 2 percent. Most areas are broad and irregular in shape. They range from 20 to several hundred acres and average about 50 acres.

This complex is about 60 percent Sawyer soils, 30 percent Urban land, and 10 percent other soils. Areas of these soils and Urban land are so intermingled that they could not be shown separately at the scale selected for mapping.

Typically, the Sawyer soil has a surface layer of dark grayish brown silt loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. It is yellowish brown silty clay loam that has grayish and reddish mottles in the upper 26 inches. Below this is gray, red, and strong brown, very strongly acid clay. The upper layers of most of the soil have been altered by cutting and filling.

Sawyer soils are moderately well drained. Runoff is slow, and permeability is slow. Available water capacity is high. The rooting zone is deep, but the clayey texture in the lower part slows the movement of water, air, and plant roots. The erosion hazard is moderate.

Structures on Urban land are mostly commercial buildings, streets, parking lots, and residences.

Included with this complex in mapping are small areas of Eylau and Ruston soils. The included soils make up about 10 percent of each mapped area.

The main soil characteristics that affect construction are high shrink-swell and wetness. Low strength limits use for streets and roads. Information about the use of these soils for urban development is contained in the sections on engineering and recreation.

This complex is not assigned to a capability subclass or woodland group.

38—Severn very fine sandy loam. This nearly level soil is on flood plains that rarely flood. Soil areas are long and narrow and parallel the river. They range from 100 to over 1,000 acres and average about 300 acres.

Typically, this soil has a surface layer of reddish brown very fine sandy loam about 8 inches thick. The next layer, to a depth of about 42 inches, is yellowish red very fine sandy loam. Below this to a depth of 65 inches or more is reddish brown, moderately alkaline silty clay loam stratified with other textures. Typically, this soil is moderately alkaline throughout.

This soil is well drained. It is rarely flooded. Runoff is slow, and permeability is moderately rapid. Available water capacity is high. The rooting zone is deep, and roots, water, and air move easily through the soil. The erosion hazard is slight.

Included with this soil in mapping are small areas of Severn silty clay loam and Kiomatia soils. Also included are areas of a soil that has a thin clayey horizon on the surface and stratified sandy horizons below. These soils make up less than about 20 percent of the mapped acreage.

Most of this Severn soil is used for crops.

This soil is well suited to pasture. Bermudagrass, white clover, and alfalfa are common pasture and hay plants. Proper grazing and fertilization increase production.

This soil is well suited to trees such as eastern cottonwood, black walnut, pecan, and sweetgum. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is well suited to soybeans, grain sorghum, cotton, and corn. Crop residue left on the soil surface helps to maintain organic matter content. Fertilizers increase yields.

This soil is moderately well suited to urban development. Limitations are flooding and low strength. Low strength is particularly a limitation for roads and streets.

This soil is well suited to recreational development.

This soil is in capability class I; woodland group 2o.

39—Severn silty clay loam. This nearly level soil is on flood plains that rarely flood. Areas are circular or long and narrow. They range from 10 to 100 acres and average about 50 acres.

Typically, the surface layer is dark reddish brown silty clay loam about 8 inches thick. The underlying material extends to a depth of 72 inches or more. It is silt loam that is reddish brown in the upper part, yellowish red in the middle part, and reddish brown in the lower part. This soil is typically calcareous throughout.

This soil is well drained. Runoff is slow, and permeability is moderately rapid. Available water capacity is high. The rooting zone is deep, and roots, water, and air move easily through the soil. The erosion hazard is slight.

Included with this soil in mapping are small areas of Billyhaw clay, Severn very fine sandy loam, and Redlake clay. Included soils make up less than 20 percent of any mapped area.

Most of this Severn soil is used for crops. Minor acreages are in pasture and woodland.

This soil is well suited to pasture. Bermudagrass, white clover, and alfalfa, are the main pasture plants. Proper grazing and the addition of fertilizers increase production.

This soil is well suited to trees such as eastern

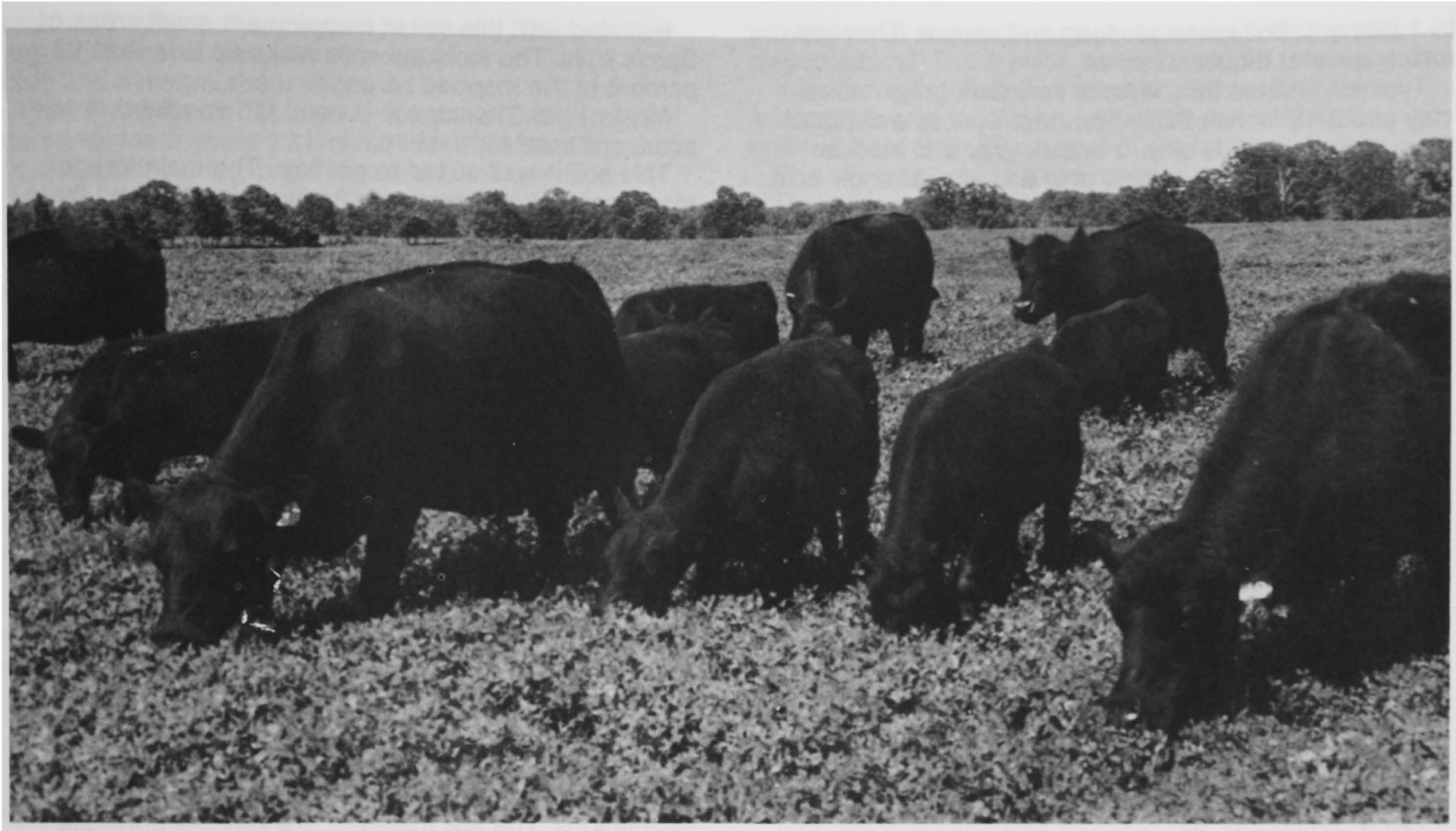


Figure 10.—Calves and their dams graze an excellent stand of arrowleaf clover on Blevins silt loam, 1 to 3 percent slopes.

cottonwood, pecan, black walnut, and sweetgum. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is well suited to crops such as soybeans, corn, cotton, small grain, and grain sorghum. Crop residue left on the soil surface increases infiltration and helps to maintain organic matter content. Proper fertilization increases yields.

This soil is moderately well suited to most urban development. Limitations are the flood hazard and low strength, which particularly limit roads and streets.

This soil is well suited to most recreational development.

This soil is in capability class I; woodland group 2o.

40—Smithdale fine sandy loam, 8 to 12 percent slopes. This strongly sloping soil is on ridges and side slopes of high terraces. Slopes average about 10 percent. Areas are irregular in shape. They range from 15 to 100 acres and average about 50 acres.

Typically, the surface layer of this soil is slightly acid, fine sandy loam about 15 inches thick. The upper part is brown, and the lower part is yellowish red. The subsoil extends to a depth of 80 inches or more. It is red sandy clay loam that has streaks of lighter colored uncoated silt and sand in the lower part.

This soil is well drained. Runoff is rapid, and permeability is moderate. Available water capacity is high. The rooting zone is deep, and roots, water, and air move readily through the soil. The erosion hazard is severe.

Included with this soil in mapping are small areas of Ruston and McKamie soils. The included soils make up less than 30 percent of the mapped acreage.

Most of this Smithdale soil is used for pasture and woodland.

This soil is well suited to pasture. Bermudagrass, bahiagrass, crimson clover, and arrowleaf clover are common pasture plants. Proper grazing helps to control soil washing. Lime and fertilizers increase production.

This soil is moderately well suited to trees such as loblolly and slash pine. Woodland management, such as selective cutting, control of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is poorly suited to crops. The slope and hazard of erosion are limitations for crop production.

This soil is moderately well suited to most urban and recreational development. Slope is the main limitation.

This soil is in capability subclass VIe; woodland group 3o.

41—Texark clay, frequently flooded. This nearly level soil is on broad flood plains. Slopes range from 0

to 1 percent. Soil areas are long and narrow. They are mainly several thousand acres.

Typically, the surface layer is very dark gray, neutral clay about 16 inches thick. The next layer to a depth of 80 inches or more is clay. It is dark gray and medium acid to a depth of 35 inches, gray and very strongly acid to 62 inches, and gray and medium acid in the lower part.

This soil is poorly drained. It floods two to four times each year for long periods of generally over 7 days duration. A water table is near the surface during the winter and spring. Runoff and permeability are very slow. Available water capacity is high. The rooting zone is deep, but the movement of water, air, and roots is restricted. The erosion hazard is slight.

Included with this soil in mapping are small areas of Gladewater and Sardis soils. These make up less than 10 percent of any mapped area.

This Texark soil is mainly used for woodland. A few acres are used for pasture.

This soil is moderately well suited to pastures of fescue. Flooding is too frequent and of too long a duration for most plants. Proper grazing and fertilization increase production.

This soil is moderately well suited to such trees as eastern cottonwood, green ash, and water oak. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

Cultivation of this soil is impractical because of the flooding hazard.

This soil is poorly suited to urban and recreational development. The main limitations are the flooding hazard, high shrink-swell, and high clay content.

This soil is in capability subclass Vw; woodland group 3w.

42—Thenas fine sandy loam, frequently flooded. This nearly level soil is on flood plains. Slopes are less than 1 percent. Soil areas are long and narrow and border streams. They range from 10 to 130 acres and average about 100 acres.

Typically, this soil has a surface layer of dark brown fine sandy loam about 6 inches thick. The subsoil extends to a depth of 55 inches. To about 34 inches it is fine sandy loam that is dark brown in the upper part and dark yellowish brown in the lower part. Below 34 inches it is yellowish brown loamy fine sand. The underlying layer is light yellowish brown loamy fine sand stratified with loamy and sandy layers. This soil is strongly acid to neutral.

This soil is moderately well drained. A water table is 2 to 3 feet below the surface during the winter and spring. This soil floods briefly two to four times a year. Runoff is slow, and permeability is moderate. Available water capacity is medium. The rooting zone is deep, and roots, water, and air move easily through the soil. The erosion hazard is slight.

Included with this soil in mapping are small areas of Sardis soils. The included soils make up less than 20 percent of the mapped acreage.

Most of this Thenas soil is used for woodland. A few acres are used for pasture.

This soil is well suited to pasture. The main forage plants are bermudagrass, dallisgrass, fescue, and white clover. Proper grazing and the addition of lime and fertilizers increase yields.

This soil is well suited to trees such as loblolly pine, slash pine, southern red oak, and eastern cottonwood. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is not suited to crops. The flooding hazard is the main limitation.

This soil is poorly suited to urban and recreational development. The main limitation is the flooding hazard.

This soil is in capability subclass Vw; woodland group 1w.

43—Udorthents, loamy and clayey. This map unit consists of gently sloping to moderately steep soils on uplands. Slopes range from 1 to 20 percent. Areas are square, rectangular, or oblong. They range from 5 to 500 acres and average about 40 acres.

No original soil profile remains. The soil horizons have been broken up, removed, or mixed by gravel mining and excavations. The soil materials are variable from one mapped area to another. One of the more common soil profiles is made up of mottled gray and red, very strongly acid sandy clay loam to a depth of about 80 inches. Clods, streaks, and pockets of clay loam, fine sandy loam, and silty clay loam are throughout the profile. Small siliceous pebbles litter the surface in most places.

Udorthents are well drained to somewhat poorly drained. Runoff is medium to very rapid. Permeability is moderate to very slow, and available water capacity is low to medium. The root zone is deep, but a clay layer may inhibit the movement of water, air, and roots in some areas. The erosion hazard is severe.

Included in mapping are small areas of Annona, Sawyer, Saffel, Eylau, and Ruston soils. Included soils make up less than 10 percent of any mapped area.

Udorthents are poorly suited to crops, pasture, and woodland. These soils can be reclaimed for these uses by smoothing, erosion control, and increasing the level of fertility.

These soils are poorly suited to urban development because the topography is made up of pits and hummocky areas. Wetness and shrinking and swelling in some places are other limitations.

These soils are poorly suited to recreation uses mainly because of slope and wetness.

This map unit is not placed in a capability subclass or woodland group.

44—Vesey fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on weakly convex high

terraces. Slopes average about 2 percent. Soil areas are irregular in shape. They range from about 15 to 100 acres and average about 35 acres.

Typically, this soil has a surface layer of brown, neutral fine sandy loam about 12 inches thick. The next layer, to a depth of 30 inches, is strong brown, fine sandy loam. The subsoil to a depth of about 80 inches or more is yellowish red, slightly acid sandy clay loam that has a few streaks and pockets of uncoated sand in the lower part.

This soil is well drained. Runoff is slow, and permeability is moderate. Available water capacity is medium. The rooting zone is deep; and roots, water, and air move easily through the soil. The erosion hazard is slight.

Included with this soil in mapping are small areas of a soil like the Vesey soil that has a sandy surface layer, and small spots of Ruston soils. The included soils make up less than 15 percent of the mapped acreage.

Most of this Vesey soil is used for crops or pasture.

This soil is moderately well suited to pasture plants such as bermudagrass, bahiagrass, crimson clover, and arrowleaf clover. Proper grazing and the addition of fertilizers increase production.

This soil is moderately well suited to loblolly pine, slash pine, and sweetgum. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is well suited to crops. The main crops are soybeans, grain sorghum, and small grains. Low fertility and the erosion hazard are the main limiting features. Terraces and diversions help to control soil washing. Crop residue left on the soil surface helps to maintain organic matter content. Fertilizers increase production.

This soil is moderately well suited to urban development. Shrinking and swelling is the main limitation.

This soil is well suited to recreational development.

This soil is in capability subclass IIe; woodland group 3o.

45—Woodtell very fine sandy loam, 3 to 5 percent slopes. This gently sloping soil is on ridges and hills. Soil areas are round or oblong. They range from 5 to 30 acres and average about 15 acres.

Typically, the surface layer is brownish very fine sandy loam about 6 inches thick. The subsoil, which extends to a depth of about 46 inches, is clay that is reddish in the upper part and grayish in the lower part. It has reddish and brownish mottles. The underlying layer to a depth of 60 inches or more is pale brown stratified shale and sandy clay loam. This soil is very strongly acid throughout.

This soil is moderately well drained. Runoff is medium, and the permeability is very slow. The available water capacity is medium. The root zone is deep; but the movement of water, air, and roots is restricted by the clayey subsoil. The erosion hazard is moderate to severe.

Included with this soil in mapping are small areas of Adaton, Sawyer, and Eylau soils. The included soils make up less than 20 percent of each mapped area.

This Woodtell soil is used for pasture and woodland.

This soil is moderately well suited to pasture. Common forage plants are bermudagrass, bahiagrass, crimson clover, and arrowleaf clover. Proper grazing and the addition of lime and fertilizers increase yields.

This soil is moderately well suited to loblolly and slash pine. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber yields.

This soil is poorly suited to crops. The erosion hazard, droughtiness, and low fertility are the main limiting features; however, with intensive management, these soils can be used for crops. Crop residue left on the soil surface increases infiltration and helps to maintain the organic matter content. Lime and heavy applications of complete fertilizers increase yields.

This soil is poorly suited to urban development. The main limitations are the high shrink-swell, wetness, high clay content, and low strength. Low strength is mainly a limitation for local roads and streets.

This soil is well suited to paths and trails. It is moderately well suited to picnic areas. Seasonal wetness is a limitation.

This soil is in capability subclass IVe; woodland group 4c.

46—Woodtell very fine sandy loam, 5 to 12 percent slopes. This sloping and strongly sloping soil is on forested upland slopes along drainageways. Slopes average about 8 percent. Soil areas are long and narrow. They range from 10 to 200 acres and average about 50 acres.

Typically, the surface layer is brownish very fine sandy loam about 6 inches thick. The subsoil, which extends to a depth of about 53 inches, is clay that is red in the upper part and grayish in the lower part. It is mottled in shades of red, brown, and gray throughout. The underlying material to a depth of about 72 inches or more is partially weathered, stratified, light brownish gray shale and sandy clay loam. This soil is typically strongly acid in the upper part and very strongly acid in the lower part.

This soil is moderately well drained. Runoff is rapid, and permeability is very slow. Available water capacity is medium. The rooting zone is deep, but the clayey subsoil slows the movement of roots, water, and air. The erosion hazard is severe.

Included with this soil in mapping are small areas of soils that are similar to the Woodtell soil that have a clayey B horizon that extends below a depth of 60 inches. Also included are small areas of Annona soils and McKamie soils and a few small, gravelly spots. The included soils make up less than 15 percent of the mapped acreage.

This Woodtell soil is used for pasture and woodland.

This soil is moderately well suited to pasture. The main forage crops are bermudagrass, bahiagrass, crimson clover, and arrowleaf clover. Proper grazing and the addition of lime and fertilizers can increase yields.

This soil is moderately well suited to trees such as loblolly pine and shortleaf pine. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is not recommended for cultivation because of slope and the hazard of erosion.

This soil is poorly suited to urban development. The main limitations are the high shrink-swell, high clay content, and low strength. Low strength is a limitation for local roads and streets.

This soil is well suited to recreational development such as paths and trails. It is moderately well suited to picnic areas. Limitations for camp areas and playgrounds are very slow permeability and slope.

This soil is in capability subclass VIe; woodland group 4c.

47—Woodtell gravelly sandy loam, 3 to 8 percent slopes. This gently sloping soil is on narrow convex ridges. Slopes average about 5 percent. Soil areas are oblong. They range from 5 to about 25 acres and average about 15 acres.

Typically, this soil has a surface layer of brownish gravelly sandy loam about 12 inches thick. The subsoil extends to a depth of 44 inches. It is red clay in the upper part and red clay loam in the lower part. Gray mottles are throughout. The underlying material to a depth of 70 inches or more is red sandy clay loam. This soil is typically strongly acid in the upper part and very strongly acid in the lower part.

This soil is moderately well drained. Runoff is medium, and permeability is very slow. Available water capacity is medium. The rooting zone is deep, but the clayey subsoil slows the movement of roots, water, and air. The erosion hazard is moderate.

Included with this soil in mapping are small areas of soils like the Woodtell soil that has loamy subsoil and small areas of the gravelly Saffell soils. The included soils make up less than 15 percent of the mapped acreage.

This Woodtell soil is used for pasture and woodland. The surface layer has been removed from much of this soil for gravel.

This soil is moderately well suited to pasture. Bermudagrass, bahiagrass, crimson clover, and arrowleaf clover are the main forage plants. Proper grazing, the addition of lime, and heavy applications of fertilizers can increase yields.

This soil is moderately well suited to loblolly and slash pine. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber yields.

This soil is poorly suited to crops. Crops can grow successfully, however, with intensive management that includes erosion control, proper management of crop residue, and recommended applications of lime and fertilzers. The main crops are corn and soybeans.

This soil is poorly suited to urban development. The main limitation is the high shrink-swell, and low strength is a limitation for roads and streets.

This soil is well suited to recreational development such as paths and trails. Very slow permeability and slope are limitations for camp areas, picnic areas, and playgrounds.

This soil is in capability subclass IVe; woodland group 4c.

48—Wrightsville-Rodessa complex. This nearly level complex is on broad, upland terraces. Slopes average less than 1 percent. Soil areas are irregular in shape. They range from 10 to over 1,000 acres and average about 300 acres.

This complex is characterized by broad flats of Wrightsville silt loam and circular mounds of Rodessa loam in a random pattern. The mounds of Rodessa soil are so small and the soil pattern is so intricate that the soils could not be shown separately at the scale selected for mapping. The mounds are 2 to 3 feet high, 60 to 120 feet in diameter, and 100 to 200 feet apart.

This complex is about 75 percent Wrightsville soils, 15 percent Rodessa soils, and 10 percent other soils.

Typically, the Wrightsville soil has a surface layer of brown, strongly acid silt loam about 4 inches thick. The next layer, which extends to a depth of 16 inches, is light brownish gray, very strongly acid silt loam. The subsoil to a depth of 80 inches or more is light brownish gray, very strongly acid clay that has strong brown mottles and vertical streaks of uncoated sand and silt.

Wrightsville soils are poorly drained. A water table is at or near the soil surface during the winter and spring. Water stands on the surface for 2 or 3 weeks during the cool season. Runoff is slow, and permeability is very slow. The available water capacity is high. The rooting zone is deep, but the excess water and clayey subsoil restrict the movement of air and plant roots. The erosion hazard is slight.

Typically, the Rodessa soil has a surface layer of brownish loam about 14 inches thick. The subsoil extends to a depth of 70 inches or more. It is yellowish brown loam to a depth of 26 inches. Below this to a depth of about 42 inches, it is clay loam that is yellowish brown in the upper part and pale brown in the lower part. It has common tongues and streaks of uncoated sand and silt and has reddish, brownish, and grayish mottles. The lower part of the subsoil is mottled gray and red clay.

Rodessa soils are somewhat poorly drained. A water table is 2 to 3 feet below the surface during the cool season. Runoff is slow, and permeability is very slow. Available water capacity is high. The rooting zone is deep. The erosion hazard is slight.

Included with this complex in mapping are small spots of Adaton, Ashford, and Sawyer soils. Included soils make up less than 10 percent of the mapped acreage.

Most areas of Wrightsville-Rodessa complex are used for woodland and wildlife habitat. A few areas are used for rice and soybeans and for pasture.

These soils are moderately well suited to pasture plants such as bahiagrass, dallisgrass, and tall fescue. Crimson clover and arrowleaf clover will grow on the Rodessa part of the complex. A drainage system will remove excess water and provide a better environment for pasture plants. Proper grazing and complete fertilizers can increase forage yields.

These soils are moderately well suited to loblolly pine, water oak, willow oak, and sweetgum. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber yields.

The soils in this complex, are moderately well suited to crops such as soybeans and rice (fig. 11). Wetness, very slow permeability, low fertility, and droughtiness are the main limiting features. A drainage system is needed to remove excess water. Crop residue left on the soil surface improves infiltration and helps to maintain organic matter content. The addition of lime and a complete fertilizer can increase yields.

These soils are poorly suited to urban development. The main limitations are wetness, low strength, and high shrink-swell characteristics. Low strength limits use for roads and streets.

These soil are poorly suited to most recreational developments because of very slow permeability. However, they are well suited to paths and trails.

This complex is in capability subclass IIIw; woodland group 3w.

Figure 11.—Combining rice on Wrightsville-Rodessa complex.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops, pasture, and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the suitabilities and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where wetness or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 215,640 acres in the survey area was used for crops and pasture in 1967 according to the Conservation Needs Inventory (*4*). Of this total, 53,144 acres was used for cropland and 162,499 acres was used for hay and pasture. Since this inventory, cropland acreage has increased to an estimated 100,000 acres. Acreage used for hay and pasture has increased to an estimated 170,000 acres.

The soils in Bowie County have good potential for increased production of food. About 295,000 acres of potentially good cropland is currently used as pasture or woodland. About 260,000 acres of woodland is potentially good pasture. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production techonology to all cropland in the survey area. This soil survey can help facilitate the application of such technology.

The acreage in crops and pasture has gradually decreased as more and more land is used for urban development. In 1967 there were about 26,000 acres of urban and built-up land in the survey area, and this figure has been growing. The use of this soil survey to help make land use decisions that will influence the future role of farming in the survey area is discussed in the section "General soil map units."

Soil erosion is the major concern on most of the cropland in Bowie County. If slope is more than 1 percent, erosion is a hazard. Annona, Blevins, Eylau, Ruston, Sawyer, and Vesey soils, for example, have slopes of more than 1 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Alusa and Annona soils. Second, soil erosion on farmland results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for

extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land, also provide nitrogen, and improve tilth for the following crop.

Slopes are so short and irregular that contour tillage or terracing is not practical in most areas of the sloping Blevins, Eylau, and Sawyer soils. On these soils, a cropping system that provides substantial vegetative cover is required to control erosion unless minimum tillage is practiced. Minimizing tillage and leaving crop residue on the surface help increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most soils in the survey area, but they are more difficult to use successfully on the eroded soils and on the soils that have a clayey surface layer.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are not practical on deep, well drained soils that have irregular or complex slopes. They are most practical on deep, well drained, clayey and loamy soils that have long, smooth, simple slopes of more than 1 percent.

Information for the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil drainage is the major management need on about one-third of the acreage used for crops and pasture in the survey area. Some soils are so wet that the production of crops is hindered. These are the somewhat poorly drained and poorly drained Adaton, Alusa, Annona, Ashford, Billyhaw, Muldrow, and Wrightsville soils.

Many soils on uplands are slightly acid to strongly acid in their natural state. If they have never been limed, applications of ground limestone are required to raise the pH level sufficiently for good growth of alfalfa and other crops that grow only on nearly neutral soils. Available phosphorus and potash levels are naturally low in most of these soils. On all soils additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Most of the soils used for crops in the survey area have a surface layer of fine sandy loam or silt loam that is light in color and low in content of organic matter. Generally the structure of such soils is weak, and intense rainfall causes the formation of a crust on the surface. The crust is hard when dry and nearly impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material can help improve soil structure and reduce crust formation.

Special crops grown commercially in the survey area are cucumbers, watermelons, tomatoes, and other vegetables. There are some pecan orchards on the Billyhaw and Severn soils along the Red River. In numerous small areas, berries, peas, okra, melons, sweet corn, peppers, and sweet potatoes are grown.

Pasture is important in Bowie County because the raising of livestock is the main farm enterprise. For the past several years the trend has been to convert land from woodland to pasture and some woodland and pasture to cropland. Land used for pasture and hay generally is planted to introduced grasses and legumes that respond to good management.

Among the important plants are improved bermudagrass, tall fescue, bahiagrass, ryegrass, Elbon rye, crimson clover, white clover, and arrowleaf clover.

Good management for pasture includes fertilization, maintenance of a favorable soil reaction, timely and rotation grazing, weed and brush management, and an adequate water supply. Good management for hay includes fertilization, maintenance of favorable soil reaction, and harvesting of forage at the correct stage of growth.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for pasture, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated 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* shows 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*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

About 260,000 acres, or 44 percent, of Bowie County is forested. The dominant species of trees used for commercial purposes vary greatly, depending on the soils. Most upland soils are covered with loblolly and shortleaf pine and numerous understory shrubs, vines, grasses, and legumes. Many old fields have been planted in loblolly and slash pine. These trees grow mainly on loamy soils. On the wetter soils in the flatwoods, for example on Wrightsville soils, water oak, willow oak, sweetgum, and pine are dominant. On the wetter soils in the Sulphur River flood plain, for example on Texark soils, green ash, hackberry, and water oak are dominant.

Forest products are a major source of income in Bowie County. Lumber, pulpwood, poles, piling, plywood, and fiberboard are manufactured from products grown in the county . Production could be much higher, however, if all woodland were properly managed.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or

special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

woodland understory vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

Table 9 shows, for each soil suitable for woodland use, the potential for producing understory vegetation. The total production of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4 1/2 feet. It is expressed in pounds per acre of air-dry vegetation in favorable, normal, and unfavorable years. In a favorable year, soil moisture is above average during the optimum part of the growing season; in a normal year, soil moisture is average; and in an unfavorable year, it is below average.

Table 9 also lists the common names of the characteristic vegetation on each soil and the percentage composition, by air-dry weight, of each kind of plant. The table shows the kind and percentage of understory plants expected under a canopy density that is most nearly typical of woodland in which the production of wood crops is highest.

recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to

flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

wildlife habitat

Gary Valentine, biologist, Soil Conservation Service, and Bobby Alexander, wildlife biologist, Texas Parks and Wildlife Department, assisted in preparing this section.

Squirrel, white-tailed deer, and waterfowl are the most utilized wildlife resources in Bowie County. Bottom land along the Sulphur River and in the upper reaches of Lake Wright Patman is excellent habitat for gray squirrels. Willow oak flatwoods in the southwestern part of the county are good squirrel habitat.

Whitetails inhabit the entire county, except for northeast Bowie County in the Red River bottom and the vicinity of McKinney Bayou. Deer populations are locally heavy (one deer per 15 acres) where soybeans are produced adjacent to good cover. In remaining deer habitat areas, populations range from moderate (one deer per 30 acres) to light (one deer per 50 acres).

Within the past 10 years the Texas Parks and Wildlife Department has stocked pen-reared turkeys of eastern stock at two locations—the Red River Army Depot and along the Red River in the northwestern part of Bowie County. These stockings continue to be evaluated and represent the only probable populations of wild turkey in Bowie County.

In the past, an abundance of good quail habitat has been found in this county. Reforestation of old fields and conversion of native pastures to improved pastures have reduced the amount of good quail habitat. Presently, huntable populations of quail are found locally, especially where soybean fields remain fallow for a year or two.

Hunting of migratory game is enjoyed by county residents. Excellent dove hunting is found early in the season in harvested grain sorghum fields along the Red River. Waterfowl, particularly mallard, wood duck, and teal, are harvested along the Red River and its oxbows within the Sulphur River bottom, in the upper end of Lake Wright Patman, and in the wetlands around McKinney Bayou.

Endangered and threatened species are important natural resources of Bowie County. Bald eagles remain around Lake Wright Patman over winter. A few alligators inhabit the Sulphur River bottom. Although no colonies of red-cockaded woodpeckers are known, habitat for this endangered species exists in Bowie County. The river otter, rare in Northeast Texas, has been sighted recently in the county.

Lake Wright Patman and the Red River with its associated oxbow lakes provide good fishing for warmwater species such as black bass, crappie, channel catfish, and flathead catfish. The Bowie County Soil and Water Conservation District has an aggressive program for assisting landowners in stocking farm ponds, mainly with channel catfish and fathead minnows.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and

features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, woolly croton, and ragweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine and cedar.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial,

and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 13 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less

than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill, topsoil, sand, and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate

shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 14 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 16.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and

the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, and large stones affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, and slope affect the construction of grassed waterways. Low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent.

Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

soil and water features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv*, meaning river, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Udifluvents (*Ud*, meaning humid, plus *fluvents*, the suborder of the Entisols that are stratified and have irregular organic matter content).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Udifluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is sandy, mixed, thermic Typic Udifluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*5*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Adaton series

The soils of the Adaton series are deep, poorly drained, and loamy. They formed in loamy sediments on uplands. Slopes range from 0 to 2 percent.

A typical pedon of Adaton silt loam in an area of Adaton-Muskogee complex, in pasture; from the intersection of U.S. Highway 259 and Farm Road 561, 200 feet south on U.S. Highway 259, 2 miles west on county road, 0.3 mile south on county road, and 50 feet east:

Ap—0 to 6 inches; brown (10YR 5/3) silt loam; few fine faint yellowish brown mottles; weak medium granular

structure; hard, friable; many roots; slightly acid; gradual smooth boundary.

B21tg—6 to 18 inches; light brownish gray (10YR 6/2) clay loam; many coarse distinct brownish yellow (10YR 6/6) and few fine faint yellowish red mottles; moderate medium subangular blocky structure; hard, friable; few fine roots; few patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B22tg—18 to 29 inches; mottled grayish brown (10YR 5/2) and brownish yellow (10YR 6/6) clay loam; moderate medium subangular blocky structure; hard, friable; few patchy clay films on faces of peds; common streaks and pockets of light gray (10YR 7/2) uncoated silt; very strongly acid; gradual smooth boundary.

B23tg—29 to 36 inches; grayish brown (10YR 5/2) clay loam; many coarse prominent brownish yellow and few fine faint red mottles; weak medium subangular blocky structure; hard, friable; few patchy clay films on faces of peds; many streaks and pockets of light gray (10YR 7/2) uncoated silt; very strongly acid; gradual smooth boundary.

B24tg—36 to 60 inches; mottled grayish brown (10YR 5/2), red (2.5YR 4/6), and brownish yellow (10YR 6/6) silty clay; weak medium subangular blocky structure; extremely hard, very firm; few patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B25tg—60 to 80 inches; light brownish gray (10YR 6/2) silty clay; few fine faint brownish yellow mottles; weak coarse subangular blocky structure; extremely hard, firm; few patchy clay films on faces of peds; very strongly acid.

The solum ranges from 60 to more than 80 inches in thickness. Reaction throughout the solum is strongly acid or very strongly acid except in the upper horizons that have been limed.

The A1 or Ap horizon is 4 to 8 inches thick. It is very dark grayish brown, brown, or dark grayish brown. A thin A2 horizon is present in some pedons. The Bt horizon is light brownish gray, grayish brown, or gray with mottles of brownish yellow, yellowish brown, brown, strong brown, and red. The B21t and B22t horizons range from clay loam to silty clay loam. The lower part of the Bt horizon is clay loam, silty clay loam, or silty clay.

Alusa series

The soils of the Alusa series are deep, poorly drained, and loamy. They formed in loamy and clayey sediments on uplands. Slopes range from 0 to 1 percent.

A typical pedon of Alusa loam, in pasture; from the intersection of Texas Highway 8 and Farm Road 1840 in Boston, 0.6 mile west on Farm Road 1840, 0.5 mile north on county road, 0.25 mile west on county road, and 50 feet north:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loam; weak medium and fine granular structure; hard, friable; many fine roots; few fine black concretions; medium acid; clear smooth boundary.

A2—6 to 11 inches; grayish brown (10YR 5/2) loam; few fine faint strong brown and reddish brown mottles; moderate medium and fine subangular blocky structure; hard, friable; many fine roots; many black concretions; strongly acid; abrupt smooth boundary.

B21tg—11 to 20 inches; grayish brown (10YR 5/2) clay; many fine prominent red mottles; weak coarse and medium subangular blocky structure; extremely hard, very firm; continuous clay films; thin coatings of silt on ped surfaces; strongly acid; gradual smooth boundary.

B22tg—20 to 38 inches; gray (10YR 5/1) clay; many fine prominent red and common fine faint strong brown mottles; weak coarse subangular blocky structure; extremely hard, very firm; many clay films on faces of peds; strongly acid; gradual smooth boundary.

B23tg—38 to 48 inches; gray (10YR 5/1) clay; many fine prominent red mottles; weak coarse subangular blocky structure; extremely hard, very firm; many clay films on faces of peds; medium acid; gradual smooth boundary.

B24tg—48 to 58 inches; gray (10YR 5/1) clay; common fine faint strong brown mottles; weak coarse subangular blocky structure; extremely hard, very firm; many clay films on faces of peds; many black specks and concretions; few brown concretions; medium acid; gradual smooth boundary.

B25tg—58 to 80 inches; light gray (10YR 6/1) clay; many fine prominent strong brown mottles; weak coarse subangular blocky structure; extremely hard, very firm; many clay films on faces of peds; few brown concretions; many black concretions and black masses; slightly acid.

The solum ranges from 60 to more than 80 inches in thickness.

The A1 horizon is 4 to 10 inches thick. It is very dark grayish brown, dark grayish brown, grayish brown, or gray. The A1 horizon is medium acid or strongly acid except where the soil has been limed. The A2 horizon is 2 to 7 inches thick. It is light brownish gray or grayish brown. Reaction is medium acid or strongly acid. The A2 horizon has few to common mottles in shades of brown. Thickness of the A horizon is less than 12 inches. The Btg horizon is light brownish gray, gray, light gray, dark gray, or grayish brown with common to many coarse mottles of brown, red, and gray. Texture is clay, silty clay, or silty clay loam. Reaction ranges from very strongly acid to neutral.

Amy series

The soils of the Amy series are deep, poorly drained, and loamy. They formed in alluvium on flood plains of local streams. Slopes range from 0 to 1 percent.

A typical pedon of Amy silt loam, frequently flooded, in woodland; from the intersection of State Line Road and Days Creek channel, 0.5 mile south on State Line Road, and 50 feet west:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam; weak medium subangular blocky structure; hard, friable; many fine roots; very strongly acid; clear smooth boundary.

A2—4 to 18 inches; light brownish gray (10YR 6/2) loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, friable; few fine roots; strongly acid; diffuse wavy boundary.

B21tg—18 to 28 inches; gray (10YR 5/1) loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, friable; few tongues and coatings of light brownish gray (10YR 6/2) silt loam; strongly acid; diffuse wavy boundary.

B22tg—28 to 42 inches; gray (10YR 5/1) loam; few fine distinct dark yellowish brown and common fine distinct yellowish brown mottles; weak medium subangular blocky structure; extremely hard, friable; few tongues, interfingers, and coatings of light brownish gray (10YR 6/2) silt; very strongly acid; gradual smooth boundary.

B23tg—42 to 65 inches; light brownish gray (10YR 6/2) silt loam; few fine distinct yellowish red and common fine distinct brownish yellow mottles; weak medium subangular blocky structure; extremely hard, friable; few small siliceous pebbles; very strongly acid.

The solum ranges from 40 to more than 65 inches in thickness. In unlimed soil the solum is strongly acid or very strongly acid.

The A1 horizon is 3 to 6 inches thick and is grayish brown or dark grayish brown. The A2 horizon is 8 to 15 inches thick and is light brownish gray or light gray. It has few to many mottles in shades of brown and yellow. Interfingers of the A2 horizon make up 5 to 10 percent of the Bt horizon. The thickness of the a horizon is 12 to 20 inches. The color of the B2tg horizon is gray, light brownish gray, or light gray. Texture is silty clay loam, loam, or silt loam. Mottles in shades of brown, gray, red, and yellow are common to many. A few siliceous pebbles are in most pedons in the lower part of the B2tg horizon.

These soils are taxadjuncts to the Amy series because they are less clayey than is typical for the Amy series. Use, behavior, and management are similar to those of the Amy soils.

Annona series

The soils of the Annona series are deep, somewhat poorly drained, and loamy. They formed in loamy and clayey sediments on uplands. Slopes range from 1 to 3 percent.

A typical pedon of Annona loam, 1 to 3 percent slopes, in pasture; from the intersection of Texas Highway 98 and Farm Road 1840 west of Boston, 3.7 miles west on Farm Road 1840, and 300 feet north:

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) loam; few fine distinct pale brown mottles; moderate fine granular structure; slightly hard, very friable; many fine roots; slightly acid; gradual smooth boundary.

A2—2 to 12 inches; brown (10YR 5/3) loam; common fine distinct dark grayish brown and few fine faint dark yellowish brown mottles; weak fine subangular blocky structure; slightly hard, very friable; few fine roots; slightly acid; abrupt smooth boundary.

B21t—12 to 18 inches; red (2.5YR 4/6) clay; many medium distinct yellowish brown (10YR 5/4) and few fine distinct light brownish gray mottles; moderate medium subangular blocky structure; extremely hard, very firm; many clay films; common pressure faces; very strongly acid; gradual smooth boundary.

B22t—18 to 35 inches; mottled red (2.5YR 4/6), gray (10YR 6/1), and yellowish brown (10YR 5/4) clay; moderate fine subangular blocky structure; very hard, very firm; few patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B23t—35 to 45 inches; light brownish gray (10YR 6/2) clay; common fine distinct gray and many coarse prominent red (2.5YR 4/6) mottles; weak medium blocky structure; very hard, very firm; many slickensides; medium acid; gradual smooth boundary.

B24t—45 to 80 inches; grayish brown (10YR 5/2) clay; many coarse faint brown (10YR 5/3) and few fine prominent yellowish brown mottles; extremely hard, very firm; neutral.

The solum ranges from 60 to more than 80 inches in thickness.

The A1 horizon is very dark grayish brown, dark yellowish brown, brown, or yellowish brown. The A2 horizon is brown, pale brown, light yellowish brown, gray, or light gray. The thickness of the A horizon is 6 to 14 inches. Reaction ranges from strongly acid to slightly acid. The B21t horizon is red, dark red, reddish yellow, or yellowish red. It has few to many mottles of light brownish gray, gray, dark yellowish brown, or yellowish brown. The B21t horizon is clay or clay loam, and clay content ranges from 35 to 60 percent. The reaction is very strongly acid or strongly acid. The B22t horizon is mottled gray, red, yellowish red, and yellowish brown. It is clay with a reaction of strongly acid or very strongly acid. The lower part of the B2t horizon is light brownish gray and grayish brown mottled with red, gray, yellowish red, yellowish brown, light olive brown, brown, and olive

yellow. It is clay, and reaction ranges from medium acid to moderately alkaline. Calcium carbonate concretions are in the lower part of the Bt horizon in some pedons.

Ashford series

The soils of the Ashford series are deep, poorly drained, and clayey. They formed in clayey sediments on uplands. Slopes range from 0 to 1 percent.

A typical pedon of Ashford clay, in woodland; from the intersection of U.S. Highway 67 and Farm Road 990 in Bassett, 1.5 miles west on U.S. Highway 67, and 300 feet north:

A1—0 to 4 inches; light olive gray (5Y 6/2) clay; many medium distinct red (2.5YR 5/8) mottles; moderate medium subangular blocky structure; extremely hard, very firm, sticky and plastic; many fine roots; slightly acid; gradual smooth boundary.

B21tg—4 to 14 inches; gray (5Y 5/1) clay; many coarse distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few fine pores; peds have shiny faces; very strongly acid; gradual smooth boundary.

B22tg—14 to 28 inches; gray (5Y 5/1) clay; many common distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, very firm, sticky and plastic; peds have shiny faces; few small slickensides; very strongly acid; gradual smooth boundary.

B23tg—28 to 48 inches; gray (5Y 5/1) clay; many common distinct yellowish red (5YR 5/6) and red (2.5YR 5/8) mottles; weak medium subangular blocky structure; extremely hard, very firm, sticky and plastic; very strongly acid; gradual smooth boundary.

B24tg—48 to 80 inches; olive gray (5Y 5/2) clay; few fine distinct yellowish red mottles; weak medium subangular blocky structure; extremely hard, very firm, sticky and plastic; strongly acid.

The solum ranges from 60 to more than 80 inches in thickness. During dry seasons, cracks 1/2 to 1 inch in width extend from the surface to a depth of 20 to 30 inches.

Some pedons have small amounts of white neutral salts in the lower horizons and a few black concretions throughout the solum.

The A horizon is 3 to 9 inches thick. It is dark grayish brown, grayish brown, dark gray, light olive gray, or olive gray. Reaction ranges from slightly acid to strongly acid. The B2tg horizon is gray, dark gray, or olive gray. Few to many yellowish brown, yellowish red, or red mottles are in most pedons. A few small slickensides are at a depth of 10 to 36 inches. In the upper part of the B2tg horizon reaction ranges from very strongly acid to medium acid, and in the lower part of the B2tg horizon reaction ranges from very strongly acid to mildly alkaline. The clay content of the upper 20 inches of the B2t horizon is 60 to 75 percent.

Billyhaw series

The soils of the Billyhaw series are deep, somewhat poorly drained, and clayey. They formed in clayey alluvial sediments on flood plains. Slopes range from 0 to 5 percent. Areas are characterized by cycles of microknolls and microdepressions that are 10 to 24 feet apart. In undisturbed areas, the microknolls are 3 to 6 inches higher than the microdepressions.

A typical pedon of Billyhaw clay, 0 to 1 percent slopes, in pasture; from the intersection of Texas Highway 8 and Interstate Highway 30 in New Boston, 6.2 miles north on Texas Highway 8 to county road, 1.4 miles west on county road, and 0.9 mile along fence:

A11—0 to 7 inches; dark brown (7.5YR 3/2) clay; moderate fine subangular blocky and granular structure; extremely hard, very firm, sticky and plastic; many fine roots; neutral; clear smooth boundary.

A12—7 to 25 inches; dark reddish brown (5YR 3/2) clay; moderate fine subangular blocky and granular structure; extremely hard, very firm, sticky and plastic; common fine roots; few fine pores; neutral; gradual wavy boundary.

AC1—25 to 39 inches; reddish brown (5YR 4/4) clay; moderate fine blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few fine pores; few large intersecting slickensides; few small black spots; few fine concretions of calcium carbonate; few pockets and old cracks partially filled with silt; calcareous; moderately alkaline; gradual wavy boundary.

AC2—39 to 57 inches; reddish brown (5YR 4/4) clay; moderate fine blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few fine pores; few large intersecting slickensides; few fine pitted concretions of calcium carbonate; few small black spots on faces of peds; few pockets of silt loam; calcareous; moderately alkaline; clear smooth boundary.

IIC—57 to 75 inches; reddish brown (5YR 5/4) silt loam; massive; slightly hard, very friable, slightly sticky and slightly plastic; few thin strata of reddish brown (5YR 4/4) silty clay loam; calcareous; moderately alkaline.

The solum ranges from 40 inches to more than 60 inches in thickness. Calcareous layers are more than 20 inches deep. During dry seasons cracks as much as 2 inches in width extend from the surface to a depth of more than 20 inches. Clay content ranges from 60 to 80 percent throughout the 10- to 40-inch control section. The thickness of the A horizon ranges from 13 inches on microknolls to 29 inches in microdepressions.

The A1 horizon is dark reddish brown, dark brown, very dark brown, or very dark grayish brown. Reaction ranges from slightly acid to mildly alkaline. The AC horizon is dark brown, reddish brown, yellowish red, or red. Mottles of reddish brown and dark brown range from none to common. Concretions of calcium carbonate range from 0 to 10 percent. In some pedons the AC horizon contains soft masses of secondary carbonates. Intersecting slickensides are below a depth of 16 inches. Reaction ranges from neutral to moderately alkaline. The C horizon is reddish brown, red, dark red, or yellowish red. Reaction is mildly alkaline or moderately alkaline. Concretions of calcium carbonate range from 0 to 10 percent. Texture is silt loam, silty clay loam, sandy clay loam, or clay.

Blevins series

The soils of the Blevins series are deep, well drained, and loamy. They formed in loamy sediments on uplands. Slopes range from 1 to 3 percent.

A typical pedon of Blevins silt loam, 1 to 3 percent slopes, in woodland; from the intersection of Texas Highway 8 and Interstate Highway 30 in New Boston, 0.25 mile north on Texas Highway 8, 2.25 miles east on county road, 1 mile north on county road, and 50 feet west of road:

A1—0 to 8 inches; yellowish brown (10YR 5/4) silt loam; moderate fine granular structure; slightly hard, friable; many fine roots; slightly acid; gradual smooth boundary.

A2—8 to 15 inches; light yellowish brown (10YR 6/4) silt loam; moderate medium and fine subangular blocky structure; slightly hard, friable; few fine roots; medium acid; gradual smooth boundary.

B21t—15 to 38 inches; yellowish brown (10YR 5/6) clay loam; few fine faint reddish yellow mottles; moderate medium subangular blocky structure; hard, friable; few fine roots; many patchy clay films on faces of peds; few worm casts; very strongly acid; gradual smooth boundary.

B22t—38 to 61 inches; yellowish brown (10YR 5/6) clay loam; many fine faint red, reddish yellow, and light gray mottles; moderate medium subangular blocky structure; hard, friable; few patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B23t&A'2—61 to 80 inches; yellowish brown (10YR 5/6) clay loam; few fine faint red mottles; weak medium subangular blocky structure; hard, friable; 20 percent by volume coatings, streaks, and pockets of light gray (10YR 7/2) uncoated sand and silt; very strongly acid.

The solum ranges from 60 to more than 80 inches in thickness. Reaction of the soil ranges from slightly acid to strongly acid in the A horizon, and it is very strongly acid in the Bt horizon.

The A1 horizon is 6 to 8 inches thick. It is yellowish brown, brown, dark grayish brown, or dark brown. The A2 horizon is 5 to 10 inches thick. It is light yellowish brown, pale brown, or brown. It is silt loam or fine sandy loam. The B21t and B22t horizons are yellowish brown or brownish yellow. They have few to common reddish, yellowish, and brownish mottles. The B23t&A'2 horizon is yellowish brown or brownish yellow. Some pedons are mottled with shades of red, gray, brown, or yellow. Texture is sandy clay loam or clay loam.

Bryarly series

The soils of the Bryarly series are deep, moderately well drained, and loamy. They formed in clayey sediments on uplands. Slopes range from 1 to 5 percent.

A typical pedon of Bryarly clay loam, 1 to 5 percent slopes, in woodland; from the intersection of Farm Road 990 and U.S. Highway 67 in Bassett, 2.5 miles east on U.S. 67, south on county road 1 mile, east on county road 0.4 mile, and 200 feet north of road:

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) clay loam; moderate medium subangular blocky structure; hard, firm; many fine roots; medium acid; clear smooth boundary.

B21t—3 to 15 inches; red (2.5YR 4/6) clay; many coarse prominent light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; extremely hard, very firm; few fine roots; common pressure faces; few patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B22t—15 to 24 inches; mottled light brownish gray (10YR 6/2) and red (2.5YR 4/6) clay; moderate medium subangular blocky structure; extremely hard, very firm; few patchy clay films on faces of peds; few slickensides; very strongly acid; gradual smooth boundary.

B23t—24 to 42 inches; light brownish gray (10YR 6/2) clay; many coarse prominent red (2.5YR 4/6) mottles; weak medium subangular blocky structure; extremely hard, very firm; few patchy clay films on faces of peds; few slickensides; very strongly acid; gradual smooth boundary.

B24t—42 to 57 inches; light brownish gray (10YR 6/2) clay; many coarse distinct yellowish brown (10YR 5/8) mottles; moderate subangular blocky structure; extremely hard, very firm; common pressure faces; very strongly acid; gradual smooth boundary.

B25t—57 to 80 inches; brownish yellow (10YR 6/6) clay; few fine distinct brownish gray mottles; weak medium blocky structure; extremely hard, very firm; very strongly acid.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon is 2 to 6 inches thick. It is very dark grayish brown, dark grayish brown, dark yellowish brown,

or dark brown. Reaction ranges from very strongly acid to slightly acid. The B21t horizon is red, yellowish red, or reddish brown. It is mottled in shades of gray, yellowish brown, grayish brown, light brownish gray, brown, or dark grayish brown. Reaction is strongly acid or very strongly acid. The B22t horizon is gray or light brownish gray mottled with shades of red, very dark grayish brown, dark grayish brown, or yellowish brown. Reaction ranges from very strongly acid through neutral. The lower part of the B2t horizon is gray, light olive brown, brownish yellow, yellowish brown, or light brownish gray. It is mottled with shades of red, gray, olive, and brown. Texture is clay or shaly clay. Reaction ranges from very strongly acid to moderately alkaline.

These soils are considered taxadjuncts to the Bryarly series, because in most pedons, they do not have carbonates and they are more acid in the lower part of the B2t horizon than is typical for the Bryarly series. Use, behavior, and management are very similar to those of the Bryarly soils.

Dardanelle series

The soils of the Dardanelle series are deep, well drained, and loamy. They formed in loamy alluvial sediments on flood plains. Slopes range from 0 to 1 percent.

A typical pedon of Dardanelle loam, 0 to 1 percent slopes, in cropland; from the intersection of Farm Road 1398 and Interstate Highway 30 in Hooks, 5.4 miles north on Farm Road 1398 and county road, 0.7 mile west on field road, and 50 feet south of road:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam; weak fine subangular blocky and granular structure; hard, friable; slightly acid; clear smooth boundary.

B21t—8 to 26 inches; dark brown (7.5YR 3/2) clay loam; few fine faint reddish brown (5YR 4/3) mottles; moderate fine granular and subangular blocky structure; hard, friable; few fine pores; neutral; gradual smooth boundary.

B22t—26 to 48 inches; dark reddish brown (5YR 3/4) loam; moderate medium and fine subangular blocky structure; hard, friable; few fine pores; many thick dark reddish brown (5YR 3/2) clay films on faces of peds; neutral; gradual smooth boundary.

B23t—48 to 70 inches; reddish brown (5YR 4/4) loam; weak coarse subangular blocky structure; hard, friable; few fine pores; few clay films on faces of peds; neutral.

The solum ranges from 50 to 70 inches in thickness. The thickness of the mollic epipedon ranges from 20 to 40 inches.

The A horizon is very dark brown, very dark grayish brown, dark brown, or dark reddish brown. Reaction ranges from neutral to medium acid. The B21t horizon is dark reddish brown, dark brown, or very dark grayish brown. It is clay loam or silty clay loam. Reaction is slightly acid or neutral. The B22t and B23t horizons are dark reddish brown, reddish brown, brown, or yellowish red. Texture is loam, clay loam, or silty clay loam. Reaction is slightly acid or neutral.

Darden series

The soils of the Darden series are deep, excessively drained, and sandy. They formed in sandy sediments on uplands. Slopes range from 1 to 12 percent.

A typical pedon of Darden loamy fine sand, 1 to 8 percent slopes, in cropland; from the intersection of Farm Road 1326 and Farm Road 114, 3.9 miles north of Oak Grove, 1.2 miles north and west on county road, and 400 feet west:

Ap—0 to 8 inches; brown (7.5YR 4/4) loamy fine sand; weak fine granular structure; soft, very friable; many fine roots; slightly acid; clear smooth boundary.

A12—8 to 14 inches; dark yellowish brown (10YR 4/6) loamy fine sand; weak fine subangular blocky structure; soft, very friable; common fine roots; medium acid; gradual smooth boundary.

C1—14 to 42 inches; brown (7.5YR 5/4) loamy fine sand; single grained; loose; few fine roots; strongly acid; gradual smooth boundary.

C2—42 to 53 inches; strong brown (7.5YR 5/6) loamy fine sand; single grained; loose; few fine roots; strongly acid; gradual smooth boundary.

C3—53 to 80 inches; strong brown (7.5YR 5/6) loamy fine sand; single grained; loose; neutral.

The thickness of sandy horizons exceeds 80 inches. The 10- to 40-inch control section contains 10 to 25 percent silt plus clay. Reaction ranges from very strongly acid to slightly acid in the A horizon and upper C horizon and very strongly acid to neutral in the lower C horizon. A few small rounded pebbles are in some pedons.

The A horizon is 6 to 24 inches thick. It is brown, dark yellowish brown, yellowish brown, or brownish yellow. The C horizon is brown, strong brown, reddish yellow, yellowish brown, or brownish yellow. The texture is mostly loamy fine sand, but some pedons have thin strata of fine sand, loamy sand, or sand. Mottles range from none to few in shades of brown or yellow. Thin discontinuous lamellae, below a depth of 40 inches, range from none to few. Pockets or strata of clean sand with chromas of 1 or 2 are at a depth below 40 inches in some pedons.

Eylau series

The soils of the Eylau series are deep, moderately well drained, and loamy. They formed in loamy sediments on uplands. Slopes range from 0 to 3 percent.

A typical pedon of Eylau very fine sandy loam, 0 to 3 percent slopes in woodland; from the intersection of

Interstate Highway 30 and the Kansas City Southern Railroad in Texarkana, 0.3 mile south of Interstate 30, and 50 feet west of railroad track:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) very fine sandy loam; weak fine granular structure; slightly hard, very friable; many fine roots; slightly acid; gradual smooth boundary.

A2—6 to 12 inches; brown (7.5YR 5/4) very fine sandy loam; weak medium and coarse subangular blocky structure parting to weak fine granular; slightly hard, very friable; many fine roots; medium acid; gradual smooth boundary.

B21t—12 to 22 inches; strong brown (7.5YR 5/6) sandy clay loam; moderate medium and fine subangular blocky structure; hard, friable; common fine roots; common fine pores; few patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B22t—22 to 28 inches; strong brown (7.5YR 5/6) sandy clay loam; few fine distinct yellowish red mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; extremely hard, firm; common fine roots; common fine pores; thin continuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

B23t—28 to 36 inches; strong brown (7.5YR 5/6) sandy clay loam; many medium distinct yellowish red (5YR 4/6) and few fine faint light brownish gray mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; extremely hard, firm; about 20 percent by volume is brittle mainly in the yellowish red portion; few fine roots; common fine pores; many clay films on faces of peds; very strongly acid; gradual smooth boundary.

B24t—36 to 55 inches; brownish yellow (10YR 6/6) sandy clay loam; few fine faint light brownish gray and few medium distinct yellowish red (5YR 4/6) mottles; moderate coarse prismatic structure parting to moderate medium and fine subangular blocky; hard, friable; about 45 percent by volume is brittle mainly in the brownish yellow and yellowish red portion; common medium vesicular pores; many clay films on faces of peds; very strongly acid; gradual wavy boundary.

B25t&A'2—55 to 63 inches; mottled strong brown (7.5YR 5/6) and red (2.5YR 4/6) sandy clay loam (B2t); moderate coarse prismatic structure parting to weak medium subangular blocky; friable; many clay films on faces of peds; tongues and interfingers of light brownish gray (10YR 6/2) fine sand (A'2) 0.5 inch to 3 inches wide make up about 15 percent of the horizon; very strongly acid; diffuse wavy boundary.

B26t&A'2—63 to 80 inches; mottled red (2.5YR 4/6) and strong brown (7.5YR 5/6) sandy clay loam (B2t); weak coarse prismatic structure; hard, friable; tongues and interfingers of light brownish gray (10YR 6/2) fine sandy loam (A'2) make up about 25 percent of the horizon and range from 1 inch to 5 inches wide; very strongly acid.

The solum thickness exceeds 80 inches. Reaction ranges from strongly acid to slightly acid in the A horizon and is very strongly acid or strongly acid in the Bt horizon.

The A1 horizon is 3 to 9 inches thick. It is dark grayish brown, yellowish brown, brown, or light yellowish brown. The A2 horizon is 4 to 14 inches thick. It is pale brown, brown, light yellowish brown, brownish yellow, yellowish brown, light brown, reddish yellow, or strong brown. The B2t horizon is strong brown, reddish yellow, yellowish brown, or brownish yellow. Light brownish gray or gray mottles are within 30 inches of the surface. Yellowish red and red mottles range from none to common. Some or all of these subhorizons are 40 to 60 percent brittle. The texture of the Bt horizon is clay loam, sandy clay loam, or silty clay loam. The Bt part of the B2t&A'2 horizon is mottled with red, yellowish red, strong brown, gray, and light brownish gray. The A'2 part occurs as tongues and interfingers and is light brownish gray or light gray. The A'2 part is typically fine sand but ranges to very fine sand, silt, or fine sandy loam. These tongues and interfingers make up 5 to 30 percent of the horizon.

Ferris series

The soils of the Ferris series are deep, well drained, and clayey. The formed in clayey sediments on uplands. Slopes range from 5 to 12 percent.

A typical pedon of Ferris clay, 5 to 12 percent slopes in pasture; from the intersection of Farm Road 1326 and Farm Road 114 north of Oak Grove, 1 mile south on Farm Road 1326, 1.3 miles west on county road, and 300 feet north of road:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) clay; weak fine subangular blocky structure; very hard, firm; few worm casts; mildly alkaline; gradual smooth boundary.

AC1—3 to 26 inches; light olive brown (2.5Y 5/4) clay; moderate fine subangular blocky structure; very hard, firm; few black specks and concretions; calcareous; moderately alkaline; gradual smooth boundary.

AC2—26 to 47 inches; mottled olive gray (5Y 5/2) and light olive brown (2.5Y 5/6) clay; weak medium subangular blocky structure; very hard, firm; few fine threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

AC3ca—47 to 58 inches; mottled light olive brown (2.5Y 5/4) and grayish brown (2.5Y 5/2) clay; weak medium and fine subangular blocky structure; very hard, firm; many pockets and a few fine threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—58 to 70 inches; stratified yellowish brown (10YR 5/8), brown (10YR 5/3), and light gray (2.5Y 7/2) clay and shale; weak medium and fine platy structure; very hard, firm; calcareous; moderately alkaline.

The solum ranges in thickness from 30 to 60 inches.

The A horizon is 2 to 7 inches thick. It is grayish brown, light brownish gray, dark grayish brown, brown, light yellowish brown, light olive brown, olive gray, or olive. The A horizon is mildly alkaline or moderately alkaline. In some pedons it is calcareous. The AC1 and AC2 horizons are light olive brown, yellowish brown, light yellowish brown, light brownish gray, light olive gray, pale olive, light gray, or olive gray with or without mottles of gray, brown, and contrasting shades of olive and yellow. Gray, light brownish gray, and grayish brown mottles are few to many and are inherited from the gray color of the shaly parent material. The AC3ca horizon is 5 to 35 percent calcium carbonate. Gypsum is in the lower part of the horizon of some pedons. The C horizon ranges from shaly clay to calcareous clay mixed with shale.

These soils are taxadjuncts to the Ferris series because they are in a udic moisture regime, which is not typical for the soils in the Ferris series. Use, management, and behavior are very similar to those of the Ferris soils.

Gladewater series

The soils of the Gladewater series are deep, poorly drained, and clayey. They formed in clayey alluvial sediments on flood plains. Slopes are less than 1 percent.

A typical pedon of Gladewater clay, frequently flooded, in woodland; from the intersection of U.S. Highway 259 and the Sulphur River channel, 500 feet east and 1,000 feet north on power line right-of-way:

A1—0 to 5 inches; very dark gray (10YR 3/1) clay; moderate fine granular structure; extremely hard, very firm, very plastic; many fine roots; neutral; clear smooth boundary.

B21g—5 to 18 inches; gray (10YR 5/1) clay; common fine distinct dark yellowish brown mottles; moderate fine subangular blocky structure; extremely hard, very firm, very plastic; few fine roots; few cracks filled with very dark gray clay; slightly acid; gradual smooth boundary.

B22g—18 to 42 inches; dark gray (10YR 4/1) clay; few fine distinct yellowish brown mottles; weak coarse subangular blocky structure; extremely hard, very firm, very plastic; few fine roots; medium acid; gradual smooth boundary.

Cg—42 to 72 inches; gray (10YR 5/1) clay; few fine distinct strong brown mottles; massive; extremely hard, very firm, very plastic; few fine roots; strongly acid.

The solum ranges from 30 to 50 inches in thickness. This soil is clayey throughout.

The A horizon is 4 to 8 inches thick. It is black, very dark gray, or very dark grayish brown. It ranges in reaction from medium acid to neutral. The B2g horizon is dark gray or gray. The reaction ranges from slightly acid to very strongly acid. The Cg horizon is very dark gray, dark gray, or gray. It is clay stratified with silty clay or clay loam. Reaction ranges from strongly acid to neutral.

Kiomatia series

The soils of the Kiomatia series are deep, well drained, and sandy. They formed in sandy alluvial sediments on flood plains. Slopes range from 0 to 3 percent.

A typical pedon of Kiomatia loamy fine sand, frequently flooded, in woodland; from the intersection of U.S. Highway 259 and the Red River, 300 feet south and 2,000 feet east:

A1—0 to 3 inches; reddish brown (5YR 4/4) loamy fine sand; weak fine granular structure; very friable; few fine roots; calcareous; moderately alkaline; gradual smooth boundary.

C—3 to 72 inches; brown (7.5YR 5/4) loamy fine sand; single grained; loose; thin strata and lenses of fine sandy loam; calcareous; moderately alkaline.

The soil ranges from neutral to moderately alkaline. It is calcareous or noncalcareous.

The A horizon is 2 to 8 inches thick. It is brown, strong brown, or reddish brown. The C horizon is brown, strong brown, or reddish brown. It is loamy fine sand, fine sand, or loamy very fine sand with lenses of fine sandy loam.

McKamie series

The soils of the McKamie series are deep, well drained, and loamy. They formed in stratified loamy and clayey sediments on uplands. Slopes range from 1 to 12 percent.

Typical pedon of McKamie loam, 1 to 5 percent slopes, in pasture; from the intersection of Texas Highway 8 and Interstate Highway 30 in New Boston, 6.2 miles north on Texas Highway 8 to county road, west on county road 1.5 miles, and 300 feet south of road:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) loam; weak fine granular structure; slightly hard, very friable; many fine roots; slightly acid; clear smooth boundary.

A2—3 to 13 inches; brown (7.5YR 5/4) loam; weak fine granular structure; slightly hard, very friable; few fine roots; slightly acid; clear smooth boundary.

B21t—13 to 17 inches; red (2.5YR 4/8) clay; weak fine subangular blocky structure; hard, friable; many patchy clay films on faces of peds; few fine roots; medium acid; gradual smooth boundary.

B22t—17 to 36 inches; red (2.5YR 4/6) clay; moderate fine subangular blocky structure; extremely hard, friable; nearly continuous clay films on faces of peds; strongly acid; gradual smooth boundary.

B3—36 to 58 inches; red (2.5YR 4/8) sandy clay loam; few faint light red mottles; moderate fine subangular blocky structure; hard, friable; few patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

C—58 to 80 inches; red (2.5YR 4/8) fine sandy loam; weak fine subangular blocky structure; hard, friable; very strongly acid.

The solum ranges in thickness from 45 to 60 inches.

The A horizon is 5 to 15 inches thick. It is dark grayish brown or brown. Reaction ranges from slightly acid to strongly acid. The B2t horizon is red, dark reddish brown, reddish brown, or yellowish red. It is dominantly clay in the upper 20 inches, but thin horizons of clay loam or silty clay loam are in some pedons. The B2t horizon ranges from medium acid to very strongly acid. The B3 horizon is fine sandy loam, silty clay loam, sandy clay loam, clay loam, or very fine sandy loam. Reaction ranges from neutral to very strongly acid. The C horizon is fine sandy loam, very fine sandy loam, silt loam, or silty clay loam. Some horizons are stratified with thin layers. The C horizon ranges from very strongly acid to moderately alkaline.

Morse series

The soils of the Morse series are deep, well drained, and clayey. They formed in clayey sediments on uplands. Slopes range from 3 to 8 percent.

A typical pedon of Morse clay, 3 to 8 percent slopes, eroded, in pasture; from the intersection of Farm Road 114 and the west Bowie County line, 1,400 feet east on Farm Road 114, north on county road 1.1 miles, and 100 feet east of road:

A11—0 to 6 inches; dark reddish brown (5YR 3/4) clay; weak subangular blocky and granular structure; extremely hard, very firm; many fine roots; calcareous; moderately alkaline; gradual smooth boundary.

A12—6 to 16 inches; dark reddish brown (5YR 3/4) clay; weak subangular blocky structure; extremely hard, very firm; few fine roots; few concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

AC—16 to 58 inches; dark red (2.5YR 3/6) clay; weak subangular blocky structure; extremely hard, very firm; common concretions of calcium carbonate; many large intersecting slickensides; calcareous; moderately alkaline; gradual smooth boundary.

C—58 to 80 inches; red (2.5YR 4/6) clay; massive; extremely hard, very firm; few concretions of calcium carbonate; many large intersecting slickensides; calcareous; moderately alkaline.

The thickness of the solum ranges from 50 to 80 inches. Intersecting slickensides range from common to many. Gilgai relief is slight to none.

The A horizon is 12 to 18 inches thick. It is dark reddish brown or dark brown. Reaction ranges from neutral to moderately alkaline. The AC horizon is red or dark red. It is clay or silty clay. It contains concretions of calcium carbonate in amounts ranging from 1 to 10 percent by volume and is mildly alkaline or moderately alkaline. The C horizon is red, yellowish red, or reddish brown. It is clay or silty clay and is mildly alkaline or moderately alkaline.

Some pedons have a sandy IIC horizon below a depth of 60 inches.

These soils are taxadjuncts to the Morse series because they are more clayey in the lower horizons than is typical for the Morse series. Use, management, and behavior are similar to those of the Morse soils.

Muldrow series

The soils of the Muldrow series are deep, somewhat poorly drained, and clayey. They formed in clayey alluvial sediments on flood plains. Slopes range from 0 to 1 percent.

A typical pedon of Muldrow clay loam, in pasture; from the intersection of Farm Road 1326 and Farm Road 114 north of Oak Grove, 2.5 miles west on Farm Road 114, north on county road 2.3 miles, .25 mile east of road:

A1—0 to 14 inches; very dark grayish brown (10YR 3/2) clay loam; moderate fine granular and subangular blocky structure; hard, firm; many fine roots; few worm channels filled with very dark gray clay loam; medium acid; gradual smooth boundary.

B21tg—14 to 37 inches; black (10YR 2/1) clay; moderate fine subangular blocky structure; very hard, firm; few fine roots; few worm channels filled with dark reddish brown material; neutral; gradual smooth boundary.

B22tg—37 to 62 inches; very dark gray (10YR 3/1) clay; few fine distinct dark yellowish brown mottles; moderate fine subangular blocky structure; very hard, very firm; few fine roots; few small slickensides; neutral; gradual smooth boundary.

B3g—62 to 79 inches; very dark gray (5YR 3/1) clay; common fine faint reddish brown mottles; moderate fine subangular blocky structure; extremely hard, very firm; mildly alkaline.

The thickness of the solum exceeds 60 inches. Dark colors extend to a depth of more than 40 inches.

The A horizon is 11 to 18 inches thick. It is dark brown, very dark grayish brown, very dark gray, very dark brown, or black. Reaction is medium acid or strongly acid. The B2tg and B3g horizons are very dark gray, very dark grayish brown, very dark brown, or black. Dark yellowish brown and reddish brown mottles are few to

common. The B2tg and B3g horizons are clay or clay loam. They have a clay content of 35 to 50 percent. The B2t horizon is slightly acid or neutral. The B3 horizon is neutral to moderately alkaline.

Muskogee series

The soils of the Muskogee series are deep, moderately well drained, and loamy. They formed in silty sediments on uplands. This soil has slopes of 0 to 2 percent and is on mounds in the Adaton-Muskogee complex.

A typical pedon of Muskogee silt loam in the Adaton-Muskogee complex, in pasture; from the intersection of U.S. Highway 259 and Farm Road 561 south of De Kalb, 200 feet south on U.S. Highway 259, 2 miles west on county road, 0.3 mile south on county road, and 100 feet east:

A1—0 to 6 inches; brown (10YR 4/3) silt loam; moderate medium granular structure; hard, friable; many fine roots; slightly acid; clear smooth boundary.

A2—6 to 10 inches; yellowish brown (10YR 5/4) silt loam; moderate medium granular structure; hard, friable; many fine roots; strongly acid; clear smooth boundary.

B1—10 to 15 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; hard, friable; few fine roots; very strongly acid; gradual smooth boundary.

B21t—15 to 25 inches; yellowish brown (10YR 5/6) silty clay loam; few fine faint light brownish gray mottles; moderate medium and fine subangular blocky structure; hard, friable; many patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B22t—25 to 50 inches; mottled light brownish gray (10YR 6/2), red (2.5YR 4/6), and yellowish red (5YR 5/6) clay; weak medium subangular blocky structure; extremely hard, very firm; many patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B23t—50 to 80 inches; light brownish gray (10YR 6/2) clay; many coarse prominent red (2.5YR 4/6) mottles; weak medium subangular blocky structure; extremely hard, very firm; few patchy clay films on faces of peds; about 10 percent uncoated silt on surfaces of peds; strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches. Reaction ranges from medium acid to very strongly acid. The base saturation 50 inches below the top of the Bt horizon is 35 to 55 percent.

The A1 horizon is 4 to 7 inches thick. It is dark grayish brown, brown, or grayish brown. The A2 horizon is 3 to 8 inches thick. It is grayish brown, yellowish brown, light yellowish brown, or brown. The A2 horizon is silt loam or very fine sandy loam. The B1 horizon is 3 to 12 inches thick. It is yellowish brown, brownish yellow, or light yellowish brown. The B1 horizon is silt loam or very fine sandy loam. The upper part of the Bt horizon is yellowish brown or strong brown. It is silt loam or silty clay loam. The lower part of the Bt horizon is light gray or light brownish gray with mottles in shades of red and brown. It is clay or silty clay.

Perry series

The soils of the Perry series are deep, poorly drained, and clayey. They formed in clayey alluvial sediments on flood plains. Slopes are less than 1 percent.

A typical pedon of Perry clay, occasionally flooded, in pasture; from the intersection of State Line Road and Interstate Highway 30 at Texarkana, 2.25 miles north on State Line Road, and 50 feet east:

A1—0 to 4 inches; dark gray (10YR 4/1) clay; weak medium subangular blocky structure; extremely hard, very firm; few fine roots; medium acid; gradual smooth boundary.

B21g—4 to 18 inches; gray (10YR 5/1) clay; common fine faint strong brown mottles; weak medium subangular blocky structure; extremely hard, very firm; few fine roots; slightly acid; gradual smooth boundary.

B22g—18 to 34 inches; gray (10YR 5/1) clay; few medium faint strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, very firm; neutral; gradual smooth boundary.

B23g—34 to 45 inches; gray (10YR 5/1) clay; common fine distinct light olive brown mottles; weak medium subangular blocky structure; extremely hard, very firm; few concretions of calcium carbonate; moderately alkaline; gradual smooth boundary.

IIB31—45 to 55 inches; dark reddish gray (5YR 4/2) clay; few fine faint dark reddish brown mottles; weak medium subangular blocky structure; extremely hard, very firm; many concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

IIB32—55 to 80 inches; dark reddish brown (5YR 3/4) clay; common fine faint dark reddish gray mottles; weak medium subangular blocky structure; extremely hard, very firm; many concretions of calcium carbonate; calcareous; moderately alkaline.

The thickness of the solum ranges from 30 to 60 inches.

The A horizon is 4 to 8 inches thick. It is gray, grayish brown, dark gray, dark grayish brown, or very dark gray. Reaction ranges from very strongly acid to medium acid. The B2g horizon is gray or dark gray with few to many mottles in shades of brown or red. Reaction ranges from strongly acid to neutral. The IIB horizon is dark reddish gray, dark reddish brown, or reddish brown. Reaction

ranges from neutral to moderately alkaline. The IIB horizon is calcareous or noncalcareous and has few to many calcium carbonate concretions.

These soils are taxadjuncts to the Perry series because they are deeper to the IIB horizon than is typical for the Perry series. Use, management, and behavior are similar to those of the Perry soils.

Redlake series

The soils of the Redlake series are deep, moderately well drained, and clayey. They formed in clayey alluvium on flood plains. Slopes are less than 1 percent.

A typical pedon of Redlake clay, in cropland; from the intersection of Interstate Highway 30 and Farm Road 992 in New Boston, 13.5 miles north on Farm Road 992, 3 miles north and west on private road, and 50 feet east:

A1—0 to 5 inches; dark reddish brown (2.5YR 3/4) clay; weak coarse granular and subangular blocky structure; extremely hard, very firm; common fine roots; few worm casts; calcareous; moderately alkaline; clear smooth boundary.

B21—5 to 35 inches; dark red (2.5YR 3/6) clay; weak coarse subangular blocky structure; extremely hard, very firm; few fine roots; few worm casts; calcareous; moderately alkaline; clear smooth boundary.

B22—35 to 56 inches; red (2.5YR 4/6) clay; weak coarse subangular blocky structure; extremely hard, very firm; calcareous; moderately alkaline; abrupt smooth boundary.

IIC—56 to 72 inches; red (2.5YR 5/6) silt loam; massive; slightly hard, friable; few thin strata of silty clay loam; calcareous; moderately alkaline.

The thickness of the solum ranges from 30 to 60 inches. All horizons are mildly alkaline or moderately alkaline. Some pedons are noncalcareous in the upper 10 inches, but all are calcareous below a depth of 10 inches. These soils crack when dry.

The A horizon is 5 to 10 inches thick. It is dark reddish brown or dusky red. The B horizon is red, dark red, or dark reddish brown. Texture is clay or silty clay. The IIC horizon is silt loam, clay loam, or silty clay loam and is stratified in some pedons.

Rodessa series

The soils of the Rodessa series are deep, somewhat poorly drained, and loamy. They formed in clayey sediments on uplands. They are on mounds in the Wrightsville-Rodessa complex. Slopes range from 0 to 1 percent.

A typical pedon of Rodessa loam in the Wrightsville-Rodessa complex, in woodland; from the intersection of Farm Road 561 and U.S. Highway 259 south of De Kalb, 0.1 mile south on U.S. Highway 259, 1.8 miles west on county road, 1.5 miles south, and 25 feet west:

A11—0 to 8 inches; brown (10YR 4/3) loam; moderate medium granular structure; slightly hard, very friable; many fine roots; slightly acid; clear smooth boundary.

A12—8 to 14 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; slightly hard, very friable; few fine roots; medium acid; gradual smooth boundary.

B1—14 to 26 inches; yellowish brown (10YR 5/6) loam; moderate fine subangular blocky structure; hard, very friable; many worm casts; many patchy clay films on faces of peds; few black concretions; strongly acid; gradual smooth boundary.

B21t&A'2—26 to 34 inches; yellowish brown (10YR 5/8) clay loam; few fine distinct red mottles; moderate fine subangular blocky structure; hard, firm; white (10YR 8/2) uncoated silt and sand on surfaces of peds and in streaks and tongues make up 25 percent of the horizon; very strongly acid; gradual smooth boundary.

B22t&A'2—34 to 42 inches; pale brown (10YR 6/3) clay loam; many coarse distinct strong brown (7.5YR 5/6), many coarse prominent red (2.5YR 4/6), and few medium faint light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; hard, firm; white (10YR 8/2) tongues and streaks of uncoated silt and sand make up about 15 percent of the horizon; very strongly acid; gradual smooth boundary.

B23t—42 to 70 inches; gray (10YR 5/1) clay; few coarse faint strong brown (7.5YR 5/6) and many coarse distinct red (2.5YR 4/6) mottles; weak medium subangular blocky structure; very hard, very firm; few streaks of uncoated sand and silt; very strongly acid.

The thickness of the solum ranges from 60 to more than 100 inches.

The A horizon is 16 to 22 inches thick. It is brown, dark yellowish brown, yellowish brown, light yellowish brown, or pale brown. The A horizon is loam or fine sandy loam. Reaction ranges from slightly acid to very strongly acid. The B1 horizon is 6 to 12 inches thick. It is light yellowish brown, yellowish brown, or very pale brown. It is loam or fine sandy loam. Reaction ranges from medium acid to very strongly acid. The B2t&A'2 horizons are clay loam or loam. The B2t part is yellowish brown, pale brown, strong brown, or light brownish gray. The A'2 part is white or light gray and makes up 10 to 60 percent of the horizon. Reaction of the B2t&A'2 horizon is strongly acid or very strongly acid. The lower part of the B2t horizon is gray, dark gray, or light brownish gray. This horizon is clay or silty clay. Reaction ranges from medium acid to very strongly acid.

Roebuck series

The soils of the Roebuck series are deep, somewhat poorly drained, and clayey. They formed in clayey alluvium on flood plains. Slopes are less than 1 percent.

A typical pedon of Roebuck clay, frequently flooded, in woodland; from the intersection of Texas Highway 8 and Interstate Highway 30 in New Boston, 6.5 miles north on Texas Highway 8, 0.6 mile west on county road, 0.6 mile north on pasture road, 0.7 mile west along pasture road to fence line, and 600 feet south on fence line:

A1—0 to 9 inches; dark reddish brown (5YR 3/2) clay; moderate fine granular structure; very hard, very firm; many fine roots; calcareous; moderately alkaline; clear smooth boundary.

B21—9 to 16 inches; dark reddish brown (5YR 3/3) clay; moderate fine subangular blocky structure; very hard, very firm; few fine roots; calcareous; moderately alkaline; clear smooth boundary.

B22—16 to 40 inches; dark reddish brown (5YR 3/4) clay; weak fine subangular blocky structure; very hard, very firm; calcareous; moderately alkaline; clear smooth boundary.

C—40 to 65 inches; reddish brown (5YR 4/4) clay; weak fine subangular blocky structure; very hard, very firm; few black specks; common thin strata of silt loam; calcareous; moderately alkaline.

The thickness of the solum ranges from 30 to 60 inches. All horizons are moderately alkaline.

The A horizon is 6 to 18 inches thick. It is very dark brown, very dark grayish brown, very dusky red, dusky red, dark reddish brown, or dark brown. The B horizon is dusky red, dark reddish brown, dark red, weak red, reddish brown, or red. It is clay, clay loam, silty clay loam, or silty clay that is more than 35 percent clay. The C horizon is clay or clay stratified with coarser textured materials.

These soils are taxadjuncts to the Roebuck series because they are calcareous throughout, which is not typical of the Roebuck series. However, use, behavior, and management are similar to those of the Roebuck soils.

Rosalie series

The soils of the Rosalie series are deep, well drained, and sandy. They formed in loamy and sandy sediments on uplands. Slopes range from 2 to 5 percent.

A typical pedon of Rosalie loamy fine sand, 2 to 5 percent slopes, in pasture; from the intersection of Farm Road 561 and Farm Road 990 north of Bassett, 0.5 mile west on Farm Road 561, and 50 feet north of road:

A1—0 to 8 inches; brown (10YR 4/3) loamy fine sand; weak fine granular structure; slightly hard, very friable; many fine roots; few siliceous pebbles; slightly acid; gradual smooth boundary.

A2—8 to 24 inches; yellowish brown (10YR 5/4) loamy fine sand; weak fine subangular blocky structure; slightly hard, very friable; few fine roots; few siliceous pebbles; medium acid; gradual smooth boundary.

B21t&A2—24 to 36 inches; strong brown (7.5YR 5/6) sandy clay loam; few fine faint red mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; many patchy clay films on faces of peds; about 10 percent brownish yellow (10YR 6/6) loamy fine sand on ped surfaces and in vertical streaks; few siliceous pebbles; very strongly acid; gradual smooth boundary.

B22t&A2—36 to 55 inches; strong brown (7.5YR 5/6) sandy clay loam; few fine faint red mottles; weak fine and medium subangular blocky structure; hard, friable; few patchy clay films on faces of peds; about 20 percent of volume vertical streaks and ped coatings of light gray (10YR 7/2) loamy fine sand; very strongly acid; gradual smooth boundary.

B23t—55 to 80 inches; red (2.5YR 4/6) sandy clay loam; weak medium and fine subangular blocky structure; hard, friable; common streaks and pockets of light gray (10YR 7/2) uncoated sand; very strongly acid.

The thickness of the solum is 60 to 90 inches.

The A1 horizon is 6 to 11 inches thick. It is brown, dark grayish brown, or yellowish brown. It contains few to common coarse fragments. Reaction ranges from slightly acid to very strongly acid. The A2 horizon is 8 to 16 inches thick. It is light yellowish brown or yellowish brown. The thickness of the A horizon ranges from 22 to 36 inches. Reaction ranges from medium acid to very strongly acid. The B21t&A2 horizon is yellowish brown, brownish yellow, brown, or strong brown. It is sandy clay loam or clay loam. In most pedons the A2 horizon makes up 5 to 20 percent of volume. The A2 material is made up of grayish sand or silt streaks and coatings. This B21t&A2 horizon is extremely acid or very strongly acid. The lower part of the Bt horizon is mottled in shades of red, yellow, brown, and gray. It is sandy clay loam or clay loam. The Bt horizon contains common streaks and pockets of uncoated sand grains that are extremely acid or very strongly acid.

Ruston series

The soils of the Ruston series are deep, well drained, and loamy. They formed in loamy sediments on uplands. Slopes range from 1 to 8 percent.

A typical pedon of Ruston fine sandy loam, 3 to 8 percent slopes, in woodland; from the intersection of Myrtle Springs Road with Farm Road 989 north of Nash, 0.7 mile west on Myrtle Springs Road, and 50 feet north of road:

A1—0 to 5 inches; brown (10YR 4/3) fine sandy loam; weak fine granular structure; slightly hard, very friable; many fine roots; slightly acid; gradual smooth boundary.

A2—5 to 16 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine granular structure; slightly

hard, very friable; many fine roots; medium acid; clear irregular boundary.

B21t—16 to 25 inches; red (2.5YR 4/6) sandy clay loam; weak fine subangular blocky structure; hard, friable; few patchy clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t&A'2—25 to 55 inches; red (2.5YR 4/6) sandy clay loam; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; few thick clay films; about 30 percent of volume streaks of uncoated sand that range from 1/4 inch to 2 inches wide; strongly acid; gradual smooth boundary.

B23t&A'2—55 to 80 inches; red (2.5YR 4/8) sandy clay loam; weak subangular blocky structure; very hard, friable; few thick clay films; about 25 percent of volume streaks of uncoated sand that range from 1 inch to 4 inches wide; very strongly acid.

The thickness of the solum is more than 60 inches.

The A1 horizon is 3 to 6 inches thick. It is brown, yellowish brown, dark grayish brown, or dark brown. It is fine sandy loam or loamy fine sand. Reaction ranges from slightly acid to strongly acid. The A2 horizon is 4 to 15 inches thick. It is pale brown, yellowish brown, light yellowish brown, or light brownish gray. It is fine sandy loam or loamy fine sand. Reaction ranges from strongly acid to slightly acid. Thickness of the A horizon is 10 to 18 inches. The B2 horizon is reddish brown, reddish yellow, yellowish red, or red. It is sandy clay loam, fine sandy loam, or clay loam. The B2 horizon ranges from medium acid to very strongly acid. Streaks and pockets of uncoated sand within the lower part of the Bt horizon are 1/4 inch to 4 inches thick and make up from 5 to 30 percent of the horizon.

Sacul series

The soils of the Sacul series are deep, moderately well drained, and clayey. They formed in clayey and shaly sediments on uplands. Slopes range from 3 to 12 percent.

A typical pedon of Sacul fine sandy loam, 3 to 8 percent slopes, in woodland; from the intersection of U.S. Highway 59 and Farm Road 989 in Texarkana, 0.6 mile southwest on U.S. Highway 59, south on county road 0.7 mile, and 100 feet east of road in pine plantation:

A1—0 to 2 inches; dark brown (10YR 4/3) fine sandy loam; weak fine granular structure; slightly hard, friable; few fine roots; slightly acid; clear smooth boundary.

A2—2 to 10 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine granular structure; hard, friable; few fine roots; medium acid; clear smooth boundary.

B21t—10 to 22 inches; red (2.5YR 4/8) clay; weak medium subangular blocky structure; extremely hard, very firm; many patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B22t—22 to 34 inches; yellowish red (5YR 5/6) clay; many coarse distinct red (2.5YR 4/8) and pinkish gray (7.5YR 6/2) mottles; weak medium subangular blocky structure; extremely hard, very firm; many patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B23t—34 to 45 inches; dark red (2.5YR 3/6) clay; many coarse distinct light brownish gray (10YR 6/2) and few fine faint yellowish red mottles; weak medium subangular blocky structure; extremely hard, very firm; many patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B24t—45 to 55 inches; light brownish gray (10YR 6/2) clay; many coarse distinct dark red (2.5YR 3/6) and few fine faint yellowish red mottles; weak medium subangular blocky structure; extremely hard, very firm; few patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B3—55 to 65 inches; red (2.5YR 4/8) clay loam; many coarse distinct dark red (2.5YR 3/6) and light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; extremely hard, very firm; very strongly acid.

The thickness of the solum ranges from 40 to more than 70 inches. Reaction is strongly acid or very strongly acid throughout, except where limed.

The A1 horizon is 1 to 3 inches thick. It is very dark grayish brown, or dark brown. The A2 horizon is 4 to 10 inches thick. It is yellowish brown, brown, pale brown, or light yellowish brown. It is fine sandy loam or loam. The B21t horizon is 10 to 14 inches thick. It is red or yellowish red. The B21t horizon is clay or silty clay. The B22t horizon is 10 to 15 inches thick. It is red or yellowish red with mottles in shades of gray. The B23t, B24t, and B3 horizons are mottled in shades of red, yellow, and gray. Any of these colors are dominant in some places.

Saffell series

The soils of the Saffell series are deep, well drained, and gravelly. They formed in gravelly and loamy deposits on uplands. Slopes range from 3 to 8 percent.

A typical pedon of Saffell gravelly sandy loam, 3 to 8 percent slopes, in woodland; from the intersection of Farm Road 1397 and Interstate Highway 30 in Texarkana, 300 feet south, and 300 feet west of the intersection:

A1—0 to 6 inches; brown (7.5YR 4/4) gravelly sandy loam; weak fine subangular blocky structure; hard, very friable; many fine roots; about 20 percent by volume of siliceous pebbles up to 2 inches in diameter; slightly acid; gradual smooth boundary.

A2—6 to 14 inches; yellowish red (5YR 5/6) gravelly sandy loam; weak fine subangular blocky structure;

hard, very friable; many fine roots; about 40 percent by volume of siliceous pebbles up to 3 inches in diameter; medium acid; gradual smooth boundary.

B21t—14 to 45 inches; red (2.5YR 4/6) very gravelly sandy clay loam; weak medium and fine subangular blocky structure; hard, very friable; few fine roots; few patchy clay films on faces of peds; about 50 percent by volume of siliceous pebbles up to 3 inches in diameter; very strongly acid; gradual smooth boundary.

B22t—45 to 80 inches; red (2.5YR 4/6) gravelly sandy clay loam; weak medium and fine subangular blocky structure; hard, very friable; few fine roots; few patchy clay films on faces of peds; about 20 percent by volume of siliceous pebbles up to 3 inches in diameter; very strongly acid.

The thickness of the solum exceeds 60 inches. Reaction is strongly acid or very strongly acid except in surface layers that have been limed.

The A1 horizon is 3 to 6 inches thick. It is brown or dark grayish brown. Pebbles make up 10 to 30 percent of the horizon. The A2 horizon is 2 to 8 inches thick. It is brown, yellowish red, or reddish yellow. Pebbles make up 30 to 50 percent of the horizon. The B2t horizon is red or yellowish red. Pebbles make up 35 to 65 percent of the upper part of the horizon and 20 to 65 percent of the lower part.

These soils are taxadjuncts to the Saffell series. They have a thicker solum than is defined as the range for the Saffell soils, and they do not have a decrease in clay content of more than 20 percent from their maximum within a depth of 60 inches. However, management, use, and behavior are similar to those of the Saffell series.

Sardis series

The soils of the Sardis series are deep, somewhat poorly drained, and loamy. They formed in loamy alluvial sediments high in silt on flood plains. Slopes are less than 1 percent.

A typical pedon of Sardis silt loam, frequently flooded, in pasture; from the intersection of U.S. Highway 82 and U.S. Highway 259 west of De Kalb, 1.75 miles south on U.S. Highway 259, and 50 feet west of road:

A1—0 to 9 inches; brown (10YR 4/3) silt loam; weak fine granular structure; slightly hard, very friable; many fine roots; neutral; gradual smooth boundary.

B21—9 to 16 inches; yellowish brown (10YR 5/4) silt loam; few fine faint grayish brown mottles; moderate medium subangular blocky structure; slightly hard, very friable; few fine roots; strongly acid; gradual smooth boundary.

B22—16 to 50 inches; brown (10YR 5/3) silt loam; few fine distinct yellowish brown and common medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; slightly hard, very friable; very strongly acid; gradual smooth boundary.

B3—50 to 62 inches; pale brown (10YR 6/3) fine sandy loam; many medium distinct yellowish brown (10YR 5/6) and few fine faint light brownish gray mottles; weak medium subangular blocky structure; slightly hard, very friable; very strongly acid; clear smooth boundary.

The solum thickness ranges from 40 to 70 inches. The 10- to 40-inch control section ranges from 20 to 35 percent clay and is less than 15 percent coarser than very fine sand.

The A horizon is 6 to 10 inches thick. It is brown or dark grayish brown. Reaction ranges from neutral to medium acid. The B2 horizon is brown, dark brown, or yellowish brown with few to many mottles in shades of gray and brown. It is silt loam, silty clay loam, or loam. Reaction ranges from medium acid to very strongly acid. The B3 horizon is light brownish gray, pale brown, or gray. It is silty clay loam, silt loam, fine sandy loam, or clay loam. Reaction ranges from medium acid to very strongly acid.

Sawyer series

The soils of the Sawyer series are deep, moderately well drained, and loamy. They formed in loamy and clayey sediments on uplands. Slopes range from 0 to 3 percent.

A typical pedon of Sawyer silt loam, 0 to 3 percent slopes, in pasture; from the intersection of Texas Highway 98 and U.S. Highway 82 west of New Boston, 1 mile west on U.S. Highway 82, south on county road 0.9 mile, and 50 feet east of road:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; hard, friable; many fine roots; slightly acid; gradual smooth boundary.

B21t—6 to 15 inches; yellowish brown (10YR 5/6) silty clay loam; few fine faint light brownish gray mottles; weak coarse subangular blocky structure parting to moderate medium and fine subangular blocky; hard, friable; few fine roots; few patchy clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—15 to 26 inches; yellowish brown (10YR 5/6) clay loam; many prominent coarse red (2.5YR 4/6) and many fine faint light brownish gray mottles; moderate medium subangular blocky structure; hard, friable; few patchy clay films on faces of peds; 5 percent by volume light gray (10YR 7/2) uncoated sand and silt; very strongly acid; gradual smooth boundary.

B23t&A2—26 to 38 inches; mottled yellowish brown (10YR 5/6) and red (2.5YR 4/6) clay; moderate medium and fine subangular blocky structure; hard, firm; few patchy clay films on faces of peds; 20

percent by volume light gray (10YR 7/2) uncoated sand and silt between peds; very strongly acid; gradual smooth boundary.

B24t—38 to 61 inches; gray (10YR 5/1) clay; few coarse distinct strong brown (7.5YR 5/8) and many coarse prominent red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm; continuous clay films on faces of peds; about 5 percent by volume uncoated sand and silt on faces of peds; very strongly acid; gradual smooth boundary.

B25t—61 to 80 inches; mottled gray (10YR 5/1) and red (2.5YR 4/6) clay; few fine distinct strong brown mottles; weak medium subangular blocky structure; extremely hard, very firm; continuous clay films on faces of peds; about 10 percent by volume uncoated sand and silt in streaks and pockets; very strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches.

The A horizon is 4 to 10 inches thick. It is dark grayish brown, brown, pale brown, or grayish brown. Reaction is slightly acid or medium acid. In some pedons there is an A2 horizon that is brown, grayish brown, or pale brown and is 3 to 5 inches thick. In some pedons there is a B1 horizon that is thin yellowish brown. The B21t horizon is yellowish brown or strong brown. In some pedons this horizon has a few grayish mottles. It is silt loam, silty clay loam, or clay loam. Reaction is strongly acid or very strongly acid. The B22t horizon is yellowish brown with common or many grayish brown, light brownish gray, light gray, or gray mottles and few or common yellowish red or red mottles. This horizon is silt loam, silty clay loam, or clay loam. Reaction is strongly acid or very strongly acid. The depth to the clayey Bt horizon is 24 to 40 inches. The lower part of the Bt horizon is mottled gray, red, and brown. Each of these colors is dominant in places. Texture is clay or silty clay. Pockets, streaks, and tongues of lighter colored clean sand and silt make up 5 to 25 percent of the lower part of the Bt horizon.

Severn series

The soils of the Severn series are deep, well drained, and loamy. They formed in loamy alluvium high in silt on flood plains. Slopes range from 0 to 1 percent.

A typical pedon of Severn very fine sandy loam, in cropland; 200 feet west of the south end of the Red River bridge on U.S. Highway 259:

Ap—0 to 8 inches; reddish brown (5YR 4/4) very fine sandy loam; weak subangular blocky and granular structure; slightly hard, friable; many fine roots; few worm casts; calcareous; moderately alkaline; gradual smooth boundary.

C1—8 to 42 inches; yellowish red (5YR 4/6) very fine sandy loam; massive; slightly hard, friable; few fine strata of loam and loamy fine sand; calcareous; moderately alkaline; abrupt smooth boundary.

C2—42 to 65 inches; reddish brown (5YR 4/4) silty clay loam; massive; slightly hard, firm; few fine strata of loam and loamy fine sand; calcareous; moderately alkaline.

The A horizon is 6 to 15 inches thick. It is dark brown, dark reddish brown, or reddish brown. The A horizon is very fine sandy loam or silty clay loam. Reaction is moderately alkaline or mildly alkaline. Some pedons are noncalcareous in the upper 10 inches. The C horizon is yellowish red, reddish brown, or light reddish brown. It is very fine sandy loam, silty clay loam, or silt loam. The C horizon contains thin strata of coarser and finer textured materials.

Smithdale series

The soils of the Smithdale series are deep, well drained, and loamy. They formed in loamy sediments on uplands. Slopes range from 8 to 12 percent.

A typical pedon of Smithdale fine sandy loam, 8 to 12 percent slopes, in pasture; from the intersection of Farm Road 2735 and U.S. Highway 82 in De Kalb, 8.25 miles north on Farm Road 2735, 1.2 miles east on county road, 0.25 mile south on county road; and 150 feet east of road:

A1—0 to 6 inches; dark brown (7.5YR 4/4) fine sandy loam; weak fine granular structure; slightly hard, very friable; few fine roots; slightly acid; clear smooth boundary.

A2—6 to 15 inches; yellowish red (5YR 5/6) fine sandy loam; weak fine subangular blocky structure; slightly hard, very friable; few fine roots; medium acid; gradual smooth boundary.

B21t—15 to 25 inches; red (2.5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; hard, friable; few fine roots; many pores and horizontal channels 1/8 inch in diameter; many patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B22t—25 to 42 inches; red (2.5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; hard, friable; many patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B23t—42 to 80 inches; red (2.5YR 4/6) sandy clay loam; moderate coarse prismatic structure parting to moderate medium and fine subangular blocky; hard, friable; many patchy clay films on faces of peds; tongues of uncoated sand about 1 inch wide make up 15 to 20 percent; very strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches. Reaction in all horizons is strongly acid or very strongly acid in unlimed soil.

The A1 horizon is 4 to 10 inches thick. It is brown, dark brown, dark grayish brown, or dark yellowish brown.

The A2 horizon is 5 to 9 inches thick. It is yellowish red, strong brown, or light brown. The A2 horizon is fine sandy loam or loam. Thickness of the A horizon is less than 18 inches. The upper part of the B2t horizon is yellowish red or red. Texture is sandy clay loam or clay loam. The lower part of the B2t horizon is yellowish red or red. It is sandy clay loam or loam that is 10 to 20 percent light gray, uncoated sand and silt.

Texark series

The soils of the Texark series are deep, poorly drained, and clayey. They formed in clayey alluvium on flood plains. Slopes are less than 1 percent.

In undisturbed areas, gilgai microrelief consists of microknolls and microdepressions 10 to 24 feet apart. The microknolls are 3 to 10 inches higher than the microdepressions.

A typical pedon of Texark clay, frequently flooded, in woodland; from the intersection of Farm Road 561 and U.S. Highway 259 near Dalby Springs, 350 feet south on U.S. Highway 259, 3.4 miles south and west on county road to metal gate, 0.5 mile south on pasture road, 0.6 mile west into Sulphur River bottom, and 200 feet south of road:

A1—0 to 16 inches; very dark gray (10YR 3/1) clay; moderate fine granular structure; extremely hard, very firm, sticky and plastic; many fine roots; neutral; gradual wavy boundary.

AC1g—16 to 35 inches; dark gray (10YR 4/1) clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few intersecting slickensides; few mica flakes; few cracks filled with very dark gray clay; medium acid; gradual wavy boundary.

AC2g—35 to 62 inches; gray (10YR 5/1) clay; many medium faint grayish brown (10YR 5/2) and common fine distinct dark yellowish brown mottles; weak medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few intersecting slickensides; few mica flakes; few streaks of very dark gray; very strongly acid; gradual boundary.

AC3g—62 to 80 inches; gray (10YR 5/1) clay; many medium faint grayish brown (10YR 5/2) and common fine distinct dark yellowish brown mottles; weak medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few mica flakes; medium acid.

When the soil is dry, cracks 1/4 inch to 2 inches wide extend from the surface into the ACg horizon. Clay content of the 10- to 40-inch control section ranges from 60 to 80 percent.

The A1 horizon is very dark gray or black. It ranges from 10 inches thick on microknolls to 28 inches in microdepressions. In more than half of each pedon the A1 horizon is between 12 and 20 inches thick. Reaction ranges from slightly acid to mildly alkaline. Texture is clay or silty clay. The ACg horizon is dark gray or gray. Cracks extending into this horizon are commonly filled with black or very dark gray soil from the surface layer. There are few to common yellowish brown, dark yellowish brown, brown, grayish brown, and strong brown mottles. Slickensides begin at depths of 15 to 25 inches. Reaction ranges from very strongly acid to neutral.

Thenas series

The soils of the Thenas series are deep, moderately well drained, and loamy. They formed in sandy alluvium on flood plains. Slopes are less than 1 percent.

A typical pedon of Thenas fine sandy loam, frequently flooded, in pasture; from the intersection of Farm Road 2516 and Farm Road 989 south of Texarkana, 1.5 miles south and 1.5 miles west on Farm Road 2516, and 200 feet south of road on east side of Spring Creek:

A1—0 to 6 inches; dark brown (10YR 4/3) fine sandy loam; weak fine granular and subangular blocky structure; slightly hard, very friable; many fine roots; slightly acid; abrupt smooth boundary.

B21—6 to 18 inches; dark brown (10YR 4/3) fine sandy loam; few fine faint dark grayish brown mottles; weak medium subangular blocky structure; slightly hard, very friable; many fine roots; slightly acid; abrupt smooth boundary.

B22—18 to 34 inches; dark yellowish brown (10YR 4/4) fine sandy loam; few fine faint dark grayish brown mottles; weak medium subangular blocky structure; slightly hard, very friable; few fine roots; medium acid; abrupt smooth boundary.

B3—34 to 55 inches; yellowish brown (10YR 5/4) loamy fine sand; weak fine granular structure; loose; few thin streaks and strata of varying colors and textures; slightly acid; abrupt smooth boundary.

C—55 to 70 inches; light yellowish brown (10YR 6/4) loamy fine sand; single grained; loose; few thin streaks and strata of fine sandy loam and fine sand; neutral.

The thickness of the solum ranges from 30 to 80 inches. The average clay content of the 10- to 40-inch control section is 12 to 18 percent.

The A horizon is 5 to 15 inches thick. It is dark brown, dark grayish brown, or pale brown. Reaction is medium or slightly acid. The B2 horizon is dark yellowish brown, yellowish brown, dark brown, or brown. Mottles with chroma of 2 or less are within 20 inches of the surface. Reaction ranges from strongly acid to neutral. The C horizon is yellowish brown, light yellowish brown, brown, or dark brown. It has thin strata in shades of brown and gray and varying textures. The C horizon is fine sandy loam, loamy fine sand, fine sand, or sandy clay loam. Reaction ranges from strongly acid to neutral.

Vesey series

The soils of the Vesey series are deep, well drained, and loamy. They formed in loamy sediments on uplands. Slopes range from 1 to 3 percent.

A typical pedon of Vesey fine sandy loam, 1 to 3 percent slopes, in cropland; from the intersection of Farm Road 2735 and U.S. Highway 259 in the Springhill Community, 0.5 mile east on Farm Road 2735, and 50 feet south of road:

A1—0 to 12 inches; brown (7.5YR 4/4) fine sandy loam; weak fine granular structure; slightly hard, very friable; many fine roots and pores; few worm casts; neutral; gradual smooth boundary.

A2—12 to 30 inches; strong brown (7.5YR 5/6) fine sandy loam; moderate medium subangular blocky structure parting to weak fine granular and subangular blocky; hard, very friable; few fine roots; many fine pores; few worm casts; neutral; gradual smooth boundary.

B21t—30 to 50 inches; yellowish red (5YR 4/6) sandy clay loam; moderate medium and fine subangular blocky structure; very hard, friable; few patchy clay films on faces of peds; few fine pores; few pockets of uncoated sand grains; slightly acid; gradual smooth boundary.

B22t—50 to 80 inches; yellowish red (5YR 5/6) sandy clay loam; moderate medium and fine subangular blocky structure; very hard, friable; few patchy clay films on faces of peds; about 5 percent pockets of uncoated sand grains; slightly acid.

The thickness of the solum ranges from 60 to more than 80 inches. Reaction of the A horizon ranges from neutral to medium acid, and reaction of the B horizon ranges from slightly acid to strongly acid.

The A1 horizon is 6 to 12 inches thick. It is dark brown, brown, or yellowish brown. The A2 horizon is 10 to 24 inches thick. It is strong brown, brown, reddish yellow, or yellowish brown. The thickness of the A horizon is 20 to 35 inches. The Bt horizon is yellowish red, red, or dark red. It is sandy clay loam or clay loam. Pockets, streaks, and tongues of uncoated sand make up 5 to 10 percent of the lower part of the Bt horizon. The lower part of the Bt horizon has a few iron concretions in some pedons.

Woodtell series

The soils of the Woodtell series are deep, moderately well drained, and loamy. They formed in clayey and shaly sediments on uplands. Slopes range from 3 to 12 percent.

A typical pedon of Woodtell very fine sandy loam, 5 to 12 percent slopes, in pasture; from the intersection of Farm Road 561 and Texas Highway 98 south and east of De Kalb, 1.1 miles west on Farm Road 561, 1.1 miles north on county road, and 50 feet east of road:

A1—0 to 2 inches; dark grayish brown (10YR 4/2) very fine sandy loam; weak fine granular and subangular blocky structure; hard, friable; many fine and medium roots and decaying organic materials in root channels; strongly acid; clear smooth boundary.

A2—2 to 6 inches; strong brown (7.5YR 5/6) fine sandy loam; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; hard, friable; few fine roots; strongly acid; clear smooth boundary.

B21t—6 to 17 inches; red (2.5YR 4/6) clay; common fine and medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; extremely hard, very firm; continuous clay films on faces of peds; few fine roots; very strongly acid; gradual smooth boundary.

B22t—17 to 33 inches; light gray (10YR 7/2) clay; few fine faint yellowish brown and few fine prominent red mottles; moderate medium subangular blocky structure; extremely hard, very firm; many clay films on faces of peds; very strongly acid; gradual smooth boundary.

B23t—33 to 46 inches; gray (10YR 6/1) clay; many coarse distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; few clay films on faces of peds; few fine pockets of light gray uncoated silt; extremely hard, very firm; very strongly acid; gradual smooth boundary.

B24t—46 to 53 inches; light brownish gray (10YR 6/2) clay; many coarse distinct, yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, very firm; very strongly acid; gradual smooth boundary.

C—53 to 72 inches; light brownish gray (10YR 6/2) stratified shale, sandy clay loam, and clay; few medium distinct yellowish brown (10YR 5/6) mottles; weak fine platy structure; hard, friable; very strongly acid.

The thickness of the solum ranges from 45 to 60 inches. The A horizon and the upper part of the B2t horizon contain coarse fragments and pebbles in some pedons.

The A horizon is 4 to 9 inches thick. The A1 horizon is dark grayish brown, dark brown, brown, or dark yellowish brown. The A2 horizon is strong brown or yellowish brown. Reaction ranges from slightly acid to strongly acid. The upper part of the B2t horizon is red or yellowish red with mottles in shades of brown and gray. The lower part of the B2t horizon is gray, light brownish gray, or yellowish brown with mottles of yellowish brown or red. Reaction ranges from very strongly acid to medium acid. The C horizon is mottled in shades of gray, brown, or yellow. It is stratified shale, clay, shaly clay, sandy clay loam, or loam. Reaction ranges from very strongly acid to slightly acid.

Wrightsville series

The soils of the Wrightsville series are deep, poorly drained, and loamy. They formed in clayey sediments on uplands. Slopes range from 0 to 1 percent.

A typical pedon of Wrightsville silt loam in the Wrightsville-Rodessa complex, in woodland; from the intersection of Farm Road 561 and U.S. Highway 259 south of De Kalb, 0.1 mile south on U.S. Highway 259, 1.8 miles west on county road, 1.5 miles south, 50 feet west of road:

A1—0 to 4 inches; brown (10YR 5/3) silt loam; weak fine granular structure; hard, friable; many fine roots and bits of organic material; strongly acid; clear smooth boundary.

A2g—4 to 16 inches; light brownish gray (10YR 6/2) silt loam; common fine faint strong brown mottles; weak medium subangular blocky structure; extremely hard, friable; few fine roots; very strongly acid; gradual irregular boundary.

B21tg&A'2g—16 to 28 inches; light brownish gray (2.5Y 6/2) clay loam; few fine faint strong brown mottles; weak medium subangular blocky structure; extremely hard, very firm; about 20 percent of volume tongues of light brownish gray (10YR 6/2) uncoated sand and silt; very strongly acid; gradual smooth boundary.

B22tg—28 to 55 inches; light brownish gray (2.5Y 6/2) clay; few fine faint strong brown mottles; weak medium subangular blocky structure; extremely hard, very firm; streaks and coatings on peds of light brownish gray (10YR 6/2) silt loam; very strongly acid; gradual smooth boundary.

B23tg—55 to 66 inches; light brownish gray (2.5Y 6/2) clay; many medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, very firm; continuous clay films on faces of peds; few slickensides; few black specks and streaks; streaks and coatings on peds of light brownish gray (10YR 6/2) silt loam; very strongly acid; gradual smooth boundary.

B24tg—66 to 80 inches; light brownish gray (2.5Y 6/2) clay; few fine faint strong brown mottles; weak subangular blocky structure; extremely hard, very firm; continuous clay films on faces of peds; few slickensides and pressure faces; streaks of light brownish gray (10YR 6/2) silt loam; strongly acid.

The thickness of the solum ranges from 65 to 80 inches. Reaction is strongly acid or very strongly acid except in places where the soil has been limed.

The A1 horizon is 2 to 5 inches thick. It is grayish brown, brown, or dark grayish brown. In some pedons this horizon has a few faint yellowish brown or strong brown mottles. The A2 horizon is 9 to 18 inches thick. It is light brownish gray or light gray. The A2 horizon is silt loam or silty clay loam. Tongues of this horizon extend deep into the B2tg horizon. The B2tg horizon is gray or light brownish gray. Mottles of strong brown and yellowish brown range from few to many. The B2tg horizon is clay or silty clay with tongues and streaks of lighter colored uncoated silt, silt loam, or very fine sandy loam. In a few pedons, there are black streaks, specks, and concretions in the B2tg horizon.

formation of the soils

In this section the factors of soil formation are discussed and related to the soils in the survey area. In addition, the processes of soil formation are described.

factors of soil formation

Soil is formed by the action of soil-forming processes on material deposited or accumulated by geological forces. The characteristics of a soil at any given point depend on (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and has existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief or lay of the land, and (5) the length of time the forces of soil development have acted on the soil material.

All five of these factors are important in the genesis of each soil; some have had more influence than others on a given soil. The factors are discussed in the following paragraphs.

parent material

The parent materials of most of the soils on uplands in the county are unconsolidated loamy and clayey sediments deposited by water. The Annona and Alusa soils are examples of soils that formed in these deposits.

Along the Red River, the parent materials are loamy and clayey deposits transported from the watersheds to the west. On the active flood plain, the soils are stratified, indicating deposits from different floods during recent times. Most of these deposits are sandy. The Kiomatia and Severn soils formed in these deposits, but the Ruston and McKamie soils formed in loamy and clayey terrace deposits.

Clayey sediments cover the flood plain of the Sulphur River. Texark and Gladewater soils formed in these deposits.

Smaller streams in the survey area mostly have loamy sediments on their flood plains. Amy, Sardis, and Thenas soils formed in these deposits.

climate

The climate of Bowie County is warm and humid. The climate that existed during the time when the soils formed influenced their formation.

When the soils were forming, temperature, high humidity, and rainfall caused deep penetration of water through the soils and into the underlying layers. Moisture and warm temperature favored root growth, activity of micro-organisms, and the weathering of soil minerals. As a result, many deep soils formed in the county. With the passage of time, however, much of the calcium and other bases were removed from many of the soils by leaching. This resulted in the formation of acid soils in most places and in the formation of some soils that are low in the essential plant nutrients.

plant and animal life

Plants, micro-organisms, earthworms, insects, animals, and even man have contributed to the development of soils. Gains or losses of organic matter, nitrogen, and plant nutrients and changes in soil structure and porosity are some of the changes caused by living organisms.

Plants played a major role in soil development in Bowie County. Roots of grasses, shrubs, and trees decayed and left pores and holes that serve as passageways for water.

Earthworms, insects, rodents, and other animals worked and mixed the soils. Worms hastened the decay of organic matter, and worm casts improved the soil structure to aid the movement of water and growth of roots. Fungi, bacteria, and other micro-organisms helped to decay organic matter and improve fertility.

The activities of man also have affected soil development by tillage and other use of soils such as construction and excavation activities.

relief

Relief influences soil formation through its effect on drainage, erosion, plant cover, and infiltration. Most of Bowie County has low relief and is not severely dissected by streams. As a result, runoff is not rapid, and the soils are moistened to depths of several feet each year. Large areas of nearly level soils are common. The Alusa, Ashford, and Wrightsville soils, which show characteristics of poor drainage, formed in these areas. Steep soils along streams generally have a thinner surface layer than others. Woodtell, Sacul, and Morse soils are examples. In cleared areas, these soils are generally more eroded than the nearly level and gently sloping soils.

Some of the effects of relief, for example shallow soil formation on steep slopes, are not pronounced in Bowie County. Because the abundant rainfall and long warm

periods minimize the effect of slope, most of the soils are deep.

A form of microrelief known as 'pimple mounds' is common in the county. The Adaton-Muskogee complex has this kind of topography. The intermound areas are connected and form tenuous drainageways that leave small slightly depressed spots.

time

A great length of time is required for the formation of soils with distinct horizons. The differences in length of time that parent materials have been in place are generally reflected in the degree of development of the soil profile.

The soils in Bowie County range from young to old. The young soils have little profile development but the older soils have well-expressed horizons. Kiomatia and Severn soils are examples of young soils. These soils formed in recently deposited sediments on flood plains. They are stratified and have only faint horizonation and a high content of carbonates. The Sawyer and Ruston soils formed in older sediments. They have well expressed soil horizons, are deep, and are leached of most bases.

geology

The geologic strata in which the soils of Bowie County developed consist mostly of clay, sandy clay, siltstone, and sand deposited during Upper Cretaceous, Eocene, Pleistocene, and Recent periods (*3*).

Exposures of the Midway and Wilcox Groups predominate in the county. Exceptions are areas of alluvium of Recent age and terrace deposits of Pleistocene age along the Red River and Sulphur River and their tributaries. Outcrops of the Marlbrook Marl Formation and Navarro Group (Cretaceous System) are in the northwest part of the county.

Soils that formed from the Midway and Wilcox Groups are mainly the Annona, Alusa, Eylau, Sawyer, and Woodtell soils. Soils on the Pleistocene terraces are mainly the McKamie, Rodessa, Ruston, and Wrightsville soils. Soils that formed in Recent alluvial deposits are mainly the Billyhaw, Gladewater, Kiomatia, Sardis, Severn, and Texark soils. Ferris soils were derived from the Marlbrook Marl Formation and the Navarro Group.

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glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (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 moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

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 oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds 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; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, 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 classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

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 nearly level plains 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 so that it flows in only one direction.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are 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.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded 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 of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and 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 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of 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 plant and animal activities are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. 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 grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

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 water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

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."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such 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 ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-75 at Clarksville, Texas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	°F	In	In	In	Days	In
January----	54.0	31.6	42.8	79	9	39	2.70	1.22	3.90	5	0.2
February---	58.2	34.9	46.5	79	14	71	3.21	1.50	4.60	6	0.1
March------	65.2	41.3	53.3	85	21	202	3.70	1.48	5.49	6	0.0
April------	74.9	51.7	63.4	88	32	402	5.37	2.22	7.91	7	0.0
May--------	81.7	60.0	70.9	93	43	648	4.89	2.44	6.88	7	0.0
June-------	88.7	67.2	78.0	98	54	840	3.45	1.16	5.27	5	0.0
July-------	93.1	70.5	81.8	103	60	986	3.25	1.31	4.80	5	0.0
August-----	93.1	69.4	81.3	103	57	970	2.37	.62	3.76	4	0.0
September--	86.8	63.1	74.9	100	45	747	3.97	1.11	6.27	5	0.0
October----	78.3	52.0	65.1	93	33	468	4.05	.95	6.48	4	0.0
November---	65.4	41.1	53.3	84	20	148	3.92	1.33	5.99	5	0.1
December---	56.6	34.0	45.3	78	14	53	3.44	1.51	5.01	6	0.0
Yearly:											
Average--	74.7	51.4	63.1	---	---	---	---	---	---	---	---
Extreme--	---	---	---	106	6	---	---	---	---	---	---
Total----	---	---	---	---	---	5,574	44.32	35.42	52.72	65	0.4

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-75 at Clarksville, Texas]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 19	March 28	April 9
2 years in 10 later than--	March 11	March 22	April 4
5 years in 10 later than--	February 22	March 11	March 25
First freezing temperature in fall:			
1 year in 10 earlier than--	November 7	October 29	October 25
2 years in 10 earlier than--	November 16	November 5	October 30
5 years in 10 earlier than--	December 3	November 19	November 8

TABLE 3.--GROWING SEASON

[Recorded 1951-75 at Clarksville, Texas]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	250	224	209
8 years in 10	261	234	216
5 years in 10	282	253	228
2 years in 10	304	272	240
1 year in 10	315	282	247

TABLE 4.--SUITABILITIES AND LIMITATIONS OF MAP UNITS FOR SPECIFIED USES

Map Unit	Percent of Area*	Cultivated farm crops	Pasture	Woodland	Urban uses	Recreation areas
1. Sawyer-Eylau-Woodtell	47	Moderately well: erodes easily.	Well	Well	Poor: shrink-swell, wetness.	Well.
2. Ruston-McKamie	9	Moderately well: slope, erodes easily.	Well	Moderately well: too clayey.	Well	Well.
3. Rosalie-Darden	2	Poor: droughty, low fertility.	Moderately well: droughty, low fertility.	Moderately well: droughty.	Well	Well.
4. Wrightsville	8	Moderately well: wetness, low fertility.	Moderately well: wetness.	Moderately well: wetness.	Poor: wetness.	Poor: wetness.
5. Annona-Alusa	6	Moderately well: wetness, droughty.	Moderately well: droughty.	Moderately well: droughty.	Poor: high shrink-swell, wetness.	Poor: wetness.
6. Ashford	4	Moderately well: wetness.	Moderately well: wetness.	Moderately well: wetness.	Poor: shrink-swell.	Poor: wetness.
7. Gladewater-Texark	8	Poor: floods.	Moderately well: wetness.	Well	Poor: floods, shrink-swell.	Poor: floods.
8. Billyhaw-Perry	8	Moderately well: wetness.	Well	Well	Poor: shrink-swell, wetness.	Poor: wetness.
9. Severn	5	Well	Well	Well	Moderately well: floods.	Well.

* 3 percent of the county is in water area.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Adaton-Muskogee complex	41,000	6.9
2	Alusa loam	10,000	1.7
3	Amy silt loam, frequently flooded	4,200	0.7
4	Annona loam, 1 to 3 percent slopes	36,000	6.1
5	Ashford clay	15,000	2.5
6	Billyhaw clay, 0 to 1 percent slopes	25,000	4.2
7	Billyhaw clay, 1 to 5 percent slopes	900	0.2
8	Blevins silt loam, 1 to 3 percent slopes	30,400	5.1
9	Bryarly clay loam, 1 to 5 percent slopes	3,100	0.5
10	Dardanelle loam, 0 to 1 percent slopes	4,300	0.7
11	Darden loamy fine sand, 1 to 8 percent slopes	1,200	0.2
12	Darden loamy fine sand, 8 to 12 percent slopes	800	0.1
13	Eylau very fine sandy loam, 0 to 3 percent slopes	37,000	6.3
14	Eylau-Urban land complex, 0 to 3 percent slopes	3,900	0.7
15	Ferris clay, 5 to 12 percent slopes	350	0.1
16	Gladewater clay, frequently flooded	18,800	3.2
17	Kiomatia loamy fine sand, frequently flooded	2,000	0.3
18	McKamie loam, 1 to 5 percent slopes	6,000	1.0
19	McKamie loam, 5 to 12 percent slopes	10,000	1.7
20	Morse clay, 3 to 8 percent slopes, eroded	900	0.2
21	Muldrow clay loam	1,100	0.2
22	Perry clay, occasionally flooded	6,500	1.1
23	Redlake clay	2,900	0.5
24	Roebuck clay, frequently flooded	4,500	0.8
25	Rosalie loamy fine sand, 2 to 5 percent slopes	8,500	1.4
26	Ruston loamy fine sand, 2 to 5 percent slopes	4,000	0.7
27	Ruston fine sandy loam, 1 to 3 percent slopes	4,000	0.7
28	Ruston fine sandy loam, 3 to 8 percent slopes	14,050	2.4
29	Ruston-Urban land complex, 1 to 5 percent slopes	104	*
30	Sacul fine sandy loam, 3 to 8 percent slopes	1,300	0.2
31	Sacul fine sandy loam, 8 to 12 percent slopes	1,700	0.3
32	Sacul-Urban land complex, 3 to 8 percent slopes	1,600	0.3
33	Saffell gravelly sandy loam, 3 to 8 percent slopes	2,500	0.4
34	Saffell-Urban land complex, 3 to 8 percent slopes	200	*
35	Sardis silt loam, frequently flooded	18,000	3.0
36	Sawyer silt loam, 0 to 3 percent slopes	114,300	19.3
37	Sawyer-Urban land complex, 0 to 3 percent slopes	2,000	0.3
38	Severn very fine sandy loam	13,500	2.3
39	Severn silty clay loam	2,450	0.4
40	Smithdale fine sandy loam, 8 to 12 percent slopes	1,800	0.3
41	Texark clay, frequently flooded	5,050	0.9
42	Thenas fine sandy loam, frequently flooded	17,000	2.9
43	Udorthents, loamy and clayey	3,300	0.6
44	Vesey fine sandy loam, 1 to 3 percent slopes	1,600	0.3
45	Woodtell very fine sandy loam, 3 to 5 percent slopes	3,500	0.6
46	Woodtell very fine sandy loam, 5 to 12 percent slopes	36,000	6.1
47	Woodtell gravelly sandy loam, 3 to 8 percent slopes	3,000	0.5
48	Wrightsville-Rodessa complex	44,936	7.6
	Water	20,480	3.5
	Total	590,720	100.0

* Less than 0.1 percent.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Cotton lint	Soybeans	Wheat	Corn	Improved bermuda-grass	Bahiagrass	Tall fescue
	Lb	Bu	Bu	Bu	AUM*	AUM*	AUM*
1 Adaton-Muskogee	---	25	---	---	8.0	7.5	8.5
2 Alusa	---	25	---	---	7.0	6.0	5.5
3 Amy	---	---	---	---	---	7.5	4.0
4 Annona	---	30	45	45	7.0	6.0	---
5 Ashford	---	20	---	---	---	7.0	7.0
6 Billyhaw	500	35	35	---	8.0	---	9.0
7 Billyhaw	400	30	30	---	8.0	---	8.0
8 Blevins	450	25	---	55	8.0	7.5	---
9 Bryarly	---	---	---	---	6.0	5.0	---
10 Dardanelle	850	45	---	90	12.0	---	---
11 Darden	---	20	---	---	7.5	6.5	---
12 Darden	---	---	---	---	6.0	5.0	---
13 Eylau	350	25	---	60	12.0	9.5	---
14 Eylau-Urban land	---	---	---	---	---	---	---
15 Ferris	---	---	---	---	4.5	---	---
16 Gladewater	---	---	---	---	7.0	6.0	6.0
17. Kiomatia							
18 McKamie	---	21	---	---	6.5	5.5	---
19 McKamie	---	---	---	---	5.5	5.0	---
20 Morse	---	---	---	---	4.0	---	---
21 Muldrow	525	35	---	---	10.0	---	8.0

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Cotton lint	Soybeans	Wheat	Corn	Improved bermuda-grass	Bahiagrass	Tall fescue
	Lb	Bu	Bu	Bu	AUM*	AUM*	AUM*
22---------- Perry	---	30	---	---	8.0	---	7.5
23---------- Redlake	550	40	35	---	8.0	---	7.0
24---------- Roebuck	---	---	---	---	---	---	---
25---------- Rosalie	250	20	---	45	6.5	---	---
26---------- Ruston	---	25	---	65	12.0	9.5	---
27---------- Ruston	---	30	---	70	12.0	9.5	---
28---------- Ruston	---	25	---	65	12.0	9.5	---
29---------- Ruston-Urban land	---	---	---	---	---	---	---
30---------- Sacul	---	---	---	---	---	7.5	---
31---------- Sacul	---	---	---	---	---	6.5	---
32---------- Sacul-Urban land	---	---	---	---	---	---	---
33---------- Saffell	---	---	30	---	5.0	5.0	---
34---------- Saffell-Urban land	---	---	---	---	---	---	---
35---------- Sardis	---	---	---	---	8.0	---	---
36---------- Sawyer	550	25	---	50	10.0	---	7.0
37---------- Sawyer-Urban land	---	---	---	---	---	---	---
38, 39---------- Severn	700	40	---	---	9.5	---	---
40---------- Smithdale	400	30	---	50	9.0	---	---
41---------- Texark	---	---	---	---	---	---	7.0
42---------- Thenas	---	---	---	---	12.0	8.5	---
43.** Udorthents							
44---------- Vesey	350	35	---	65	8.0	7.0	---
45---------- Woodtell	200	15	---	35	7.0	6.0	---

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Cotton lint	Soybeans	Wheat	Corn	Improved bermuda-grass	Bahiagrass	Tall fescue
	Lb	Bu	Bu	Bu	AUM*	AUM*	AUM*
46---------- Woodtell	---	---	---	---	6.0	5.5	---
47---------- Woodtell	200	15	---	35	7.0	6.0	---
48---------- Wrightsville-Rodessa	---	26	---	---	---	7.5	---

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	15,950	---	---	---
II	221,513	195,413	26,100	---
III	180,395	57,615	105,430	17,350
IV	45,040	20,540	24,500	---
V	51,555	---	51,555	---
VI	48,950	48,950	---	---
VII	---	---	---	---
VIII	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
1:*								
Adaton	2w	Slight	Severe	Severe	Moderate	Water oak	80	Shumard oak, loblolly pine, sweetgum.
						Loblolly pine	80	
						Sweetgum	80	
Muskogee	3o	Slight	Slight	Slight	Slight	Shortleaf pine	70	Loblolly pine, shortleaf pine, eastern redcedar, Shumard oak, water oak, sweetgum.
						Sweetgum	80	
						Loblolly pine	---	
						Water oak	---	
						Southern red oak	---	
2 Alusa	3w	Slight	Severe	Severe	Severe	Loblolly pine	80	Loblolly pine.
						Water oak	---	
						Sweetgum	---	
3 Amy	2w	Slight	Severe	Severe	Moderate	Loblolly pine	90	Loblolly pine, sweetgum, eastern cottonwood, green ash, American sycamore, Nuttall oak.
						Sweetgum	90	
						Water oak	90	
4 Annona	4c	Slight	Moderate	Slight	Slight	Loblolly pine	74	Loblolly pine, slash pine.
						Shortleaf pine	65	
						Southern red oak	65	
5 Ashford	3w	Slight	Severe	Severe	Severe	Southern red oak	70	Water oak, loblolly pine.
						Water oak	---	
						Willow oak	---	
						Post oak	---	
6, 7 Billyhaw	2w	Slight	Severe	Moderate	Moderate	Green ash	85	Green ash, eastern cottonwood, water oak.
						Eastern cottonwood	100	
						Cherrybark oak	90	
						Water oak	90	
						Willow oak	90	
8 Blevins	2o	Slight	Slight	Slight	Slight	Loblolly pine	80	Loblolly pine, sweetgum.
						Shortleaf pine	70	
						Sweetgum	80	
						Southern red oak	---	
						White oak	---	
9 Bryarly	5c	Slight	Moderate	Slight	Moderate	Loblolly pine	60	Loblolly pine, slash pine.
						Shortleaf pine	50	
						Southern red oak	50	
						Sweetgum	50	
10 Dardanelle	1o	Slight	Slight	Slight	Slight	Green ash	75	Eastern cottonwood, sweetgum, American sycamore, black walnut.
						Eastern cottonwood	105	
						Cherrybark oak	100	
						Sweetgum	100	
						American sycamore	---	
11, 12 Darden	3s	Slight	Moderate	Severe	Slight	Loblolly pine	80	Loblolly pine, slash pine.
						Shortleaf pine	70	
13 Eylau	3o	Slight	Slight	Slight	Slight	Loblolly pine	73	Loblolly pine, slash pine.
						Shortleaf pine	71	
						Southern red oak	---	
						Slash pine	77	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
16 Gladewater	2w	Slight	Severe	Moderate	Severe	Water oak	90	Water oak, sweetgum.
						Willow oak	90	
						Green ash	---	
17 Kiomatia	2w	Slight	Moderate	Moderate	Moderate	Eastern cottonwood	100	Eastern cottonwood, sweetgum, black walnut, American sycamore.
						Sweetgum	95	
18, 19 McKamie	3c	Slight	Moderate	Moderate	Moderate	Loblolly pine	80	Loblolly pine.
						Shortleaf pine	70	
20 Morse	5t	Moderate	Severe	Severe	Moderate	Loblolly pine	65	Eastern redcedar.
						Eastern redcedar	60	
21 Muldrow	2w	Slight	Moderate	Moderate	Slight	Green ash	90	Green ash, American sycamore, eastern cottonwood, sweetgum.
						Pecan	80	
						Willow oak	---	
						Water oak	---	
						Common hackberry	---	
22 Perry	2w	Slight	Severe	Moderate	Moderate	Cherrybark oak	---	Eastern cottonwood, sweetgum.
						Eastern cottonwood	90	
						Green ash	72	
						Sweetgum	92	
						Water oak	---	
						Pecan	---	
						Water hickory	---	
23 Redlake	3w	Slight	Severe	Moderate	Moderate	Eastern cottonwood	90	Eastern cottonwood, pecan, American sycamore, green ash.
						Pecan	---	
						Black walnut	---	
						Green ash	---	
24 Roebuck	3w	Slight	Moderate	Moderate	Moderate	Eastern cottonwood	90	Eastern cottonwood, green ash, pecan, bur oak.
						Green ash	---	
						Pecan	---	
25 Rosalie	3s	Slight	Moderate	Severe	Moderate	Loblolly pine	80	Loblolly pine, shortleaf pine.
						Shortleaf pine	70	
26, 27, 28 Ruston	3o	Slight	Slight	Slight	Slight	Loblolly pine	84	Loblolly pine.
						Shortleaf pine	75	
30, 31 Sacul	3c	Moderate	Slight	Slight	Moderate	Loblolly pine	80	Loblolly pine, shortleaf pine.
						Shortleaf pine	70	
33 Saffell	4f	Slight	Slight	Moderate	Moderate	Loblolly pine	70	Loblolly pine, shortleaf pine, eastern redcedar.
						Shortleaf pine	60	
						Eastern redcedar	---	
35 Sardis	1w	Slight	Moderate	Moderate	Severe	Loblolly pine	95	Loblolly pine, yellow-poplar, sweetgum.
						Sweetgum	100	
						Water oak	90	
36 Sawyer	2w	Slight	Moderate	Slight	Slight	Loblolly pine	90	Loblolly pine, slash pine, longleaf pine.
						Slash pine	90	
						Longleaf pine	80	
38, 39 Severn	2o	Slight	Slight	Slight	Moderate	Eastern cottonwood	100	Eastern cottonwood, American sycamore, pecan, black walnut, sweetgum.
						Pecan	76	
						Common hackberry	76	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
40---------- Smithdale	3o	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------	80 69	Loblolly pine.
41---------- Texark	3w	Slight	Severe	Moderate	Severe	Green ash---------- Water oak---------- Common hackberry---- Sweetgum----------	82 --- --- ---	Water oak, eastern cottonwood.
42---------- Thenas	1w	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Sweetgum---------- Blackgum---------- Southern red oak---- White oak----------	110 100 --- --- ---	Loblolly pine, American sycamore, slash pine, southern red oak, eastern cottonwood, sweetgum, pecan, black walnut.
44---------- Vesey	3o	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Southern red oak---- Sweetgum----------	80 70 70 70	Loblolly pine, shortleaf pine, slash pine, sweetgum.
45, 46, 47--------- Woodtell	4c	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------	70 60	Slash pine, loblolly pine.
48:*								
Wrightsville------	3w	Slight	Severe	Moderate	Severe	Loblolly pine------- Sweetgum---------- Water oak----------	80 80 80	Loblolly pine, sweetgum, water oak, willow oak.
Rodessa----------	3w	Slight	Moderate	Slight	Moderate	Loblolly pine------- Shortleaf pine------ Water oak---------- Southern red oak----	80 70 80 70	Loblolly pine, shortleaf pine, slash pine, water oak, sweetgum.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION

[Only the soils suitable for production of commercial trees are listed]

Map symbol and soil name	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
1:*				
Adaton	Favorable	---	Longleaf uniola	35
	Normal	2,000	Pinehill bluestem	20
	Unfavorable	---	Plumegrass	10
Muskogee	Favorable	3,000	Beaked panicum	12
	Normal	2,500	Lespedeza	10
	Unfavorable	1,500	Virginia wildrye	8
			Panicum	5
			Sedge	5
2 Alusa	Favorable	1,300	Panicum	15
	Normal	1,000	Sedge	15
	Unfavorable	600	Broadleaf uniola	10
			Little bluestem	5
3 Amy	Favorable	2,000	Switchgrass	20
	Normal	1,800	Bluestem	15
	Unfavorable	1,000	Velvet panicum	10
			Beaked panicum	10
			Longleaf uniola	10
			Panicum	5
			Spike uniola	5
			Sedge	5
			Flatsedge	5
4 Annona	Favorable	2,500	Little bluestem	15
	Normal	2,000	Brownseed paspalum	15
	Unfavorable	1,000	Panicum	15
			Indiangrass	10
			Longleaf uniola	10
			Purpletop	5
5 Ashford	Favorable	2,500	Sedge	15
	Normal	1,500	Broomsedge bluestem	15
	Unfavorable	750	Beaked panicum	5
			Longleaf uniola	5
			Little bluestem	5
			Panicum	5
			Paspalum	5
			Tickclover	5
			Ticklegrass	5
			Hawthorn	5
6, 7 Billyhaw	Favorable	4,000	Virginia wildrye	15
	Normal	3,000	Sedge	15
	Unfavorable	2,000	Beaked panicum	10
			Switchgrass	10
			Longleaf uniola	10
			Eastern gamagrass	5
			Rustyseed paspalum	5
			Little bluestem	5
			Hawthorn	5
			Osageorange	5
8 Blevins	Favorable	2,000	Little bluestem	20
	Normal	1,500	Indiangrass	10
	Unfavorable	800	Big bluestem	5
			Switchgrass	5
			Plumegrass	5
			Panicum	5
			Sedge	5

See footnote at end of table.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION--Continued

Map symbol and soil name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
		Lb/acre		Pct
9 Bryarly	Favorable	3,500	Little bluestem	15
	Normal	2,500	Indiangrass	10
	Unfavorable	1,500	Longleaf uniola	10
			Purpletop	10
			Brownseed paspalum	10
			Panicum	10
10 Dardanelle	Favorable	4,500	Big bluestem	20
	Normal	3,000	Little bluestem	15
	Unfavorable	2,000	Canada wildrye	15
			Indiangrass	15
			Switchgrass	15
			Panicum	15
			Eastern gamagrass	5
11, 12 Darden	Favorable	3,000	Broomsedge bluestem	20
	Normal	2,000	Pinehill bluestem	15
	Unfavorable	1,200	Little bluestem	10
			Purpletop	10
			Panicum	10
			Indiangrass	5
			Arrowfeather threeawn	5
			Bluejack oak	5
			Blackjack oak	5
			Post oak	5
13 Eylau	Favorable	3,500	Pinehill bluestem	15
	Normal	3,000	Beaked panicum	15
	Unfavorable	2,000	Panicum	15
			Longleaf uniola	10
			Brownseed paspalum	10
			Indiangrass	5
			Purpletop	5
14:*				
Eylau	Favorable	3,500	Pinehill bluestem	15
	Normal	3,000	Beaked panicum	15
	Unfavorable	2,000	Panicum	15
			Longleaf uniola	10
			Brownseed paspalum	10
			Indiangrass	5
			Purpletop	5
Urban land.				
16 Gladewater	Favorable	5,000	Sedge	15
	Normal	3,500	Beaked panicum	10
	Unfavorable	1,800	Giant cane	10
			Paspalum	10
			Panicum	10
			Virginia wildrye	5
			Purpletop	5
17 Kiomatia	Favorable	5,000	Beaked panicum	20
	Normal	4,000	Giant cane	20
	Unfavorable	2,500	Sedge	10
			Virginia wildrye	10
			Purpletop	10
			Longleaf uniola	5
18, 19 McKamie	Favorable	---	Pinehill bluestem	60
	Normal	1,800	Panicum	10
	Unfavorable	---	Longleaf uniola	10
			Threeawn	10

See footnote at end of table.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION--Continued

Map symbol and soil name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
		Lb/acre		Pct
20 Morse	Favorable	2,500	Little bluestem	25
	Normal	1,800	Big bluestem	20
	Unfavorable	900	Virginia wildrye	20
			Indiangrass	15
			Switchgrass	15
			Eastern gamagrass	5
21 Muldrow	Favorable	2,600	Beaked panicum	15
	Normal	2,000	Sedge	15
	Unfavorable	1,600	Switchgrass	10
			Canada wildrye	10
			Eastern gamagrass	5
			Broadleaf uniola	5
			Greenbrier	5
22 Perry	Favorable	3,000	Sedge	15
	Normal	2,100	Switchgrass	10
	Unfavorable	1,500	Big bluestem	10
			Scribner panicum	10
23 Redlake	Favorable	6,000	Giant cane	15
	Normal	4,000	Canada wildrye	10
	Unfavorable	2,000	Sedge	10
			Switchgrass	10
			Indiangrass	10
			Broadleaf uniola	5
			Eastern gamagrass	5
24 Roebuck	Favorable	3,000	Sedge	15
	Normal	2,100	Switchgrass	10
	Unfavorable	1,500	Big bluestem	10
			Scribner panicum	10
25 Rosalie	Favorable	2,500	Pinehill bluestem	30
	Normal	1,600	Longleaf uniola	25
	Unfavorable	1,000	Panicum	10
			Paspalum	10
			Indiangrass	5
			Purpletop	5
26, 27, 28 Ruston	Favorable	---	Longleaf uniola	50
	Normal	1,200	Pinehill bluestem	15
	Unfavorable	---	Beaked panicum	10
			Panicum	10
29:*				
Ruston	Favorable	---	Longleaf uniola	50
	Normal	1,200	Pinehill bluestem	15
	Unfavorable	---	Beaked panicum	10
			Panicum	10
Urban land.				
30, 31 Sacul	Favorable	3,000	Bluestem	25
	Normal	2,200	Beaked panicum	15
	Unfavorable	1,500	Uniola	10
			Plumegrass	8
			Panicum	7
			Sedge	5
32:*				
Sacul	Favorable	3,000	Bluestem	25
	Normal	2,200	Beaked panicum	15
	Unfavorable	1,500	Uniola	10
			Plumegrass	8
			Panicum	7
			Sedge	5
Urban land.				

See footnote at end of table.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION--Continued

Map symbol and soil name	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
33---------- Saffell	Favorable	1,500	Bluestem----------	20
	Normal	1,000	Uniola----------	15
	Unfavorable	500	Virginia wildrye----------	10
			Beaked panicum----------	10
			Indiangrass----------	5
			Panicum----------	5
			Sedge----------	5
34:*				
Saffell----------	Favorable	1,500	Bluestem----------	20
	Normal	1,000	Uniola----------	15
	Unfavorable	500	Virginia wildrye----------	10
			Beaked panicum----------	10
			Indiangrass----------	5
			Panicum----------	5
			Sedge----------	5
Urban land.				
35---------- Sardis	Favorable	3,000	Switchgrass----------	20
	Normal	2,500	Plumegrass----------	20
	Unfavorable	1,800	Beaked panicum----------	15
			Velvet panicum----------	10
			Eastern gamagrass----------	5
			Panicum----------	5
			Sedge----------	5
36---------- Sawyer	Favorable	3,000	Uniola----------	38
	Normal	2,200	Little bluestem----------	20
	Unfavorable	1,000	Big bluestem----------	7
			Beaked panicum----------	5
			Plumegrass----------	5
			Panicum----------	5
			Sedge----------	5
			Farkleberry----------	5
37:*				
Sawyer----------	Favorable	3,000	Uniola----------	38
	Normal	2,200	Little bluestem----------	20
	Unfavorable	1,000	Big bluestem----------	7
			Beaked panicum----------	5
			Plumegrass----------	5
			Panicum----------	5
			Sedge----------	5
			Farkleberry----------	5
Urban land.				
38, 39---------- Severn	Favorable	4,500	Little bluestem----------	15
	Normal	3,000	Big bluestem----------	10
	Unfavorable	2,000	Canada wildrye----------	10
			Panicum----------	10
			Indiangrass----------	5
			Switchgrass----------	5
			Sedge----------	5
			Scribner panicum----------	5
40---------- Smithdale	Favorable	---	Longleaf uniola----------	30
	Normal	1,200	Pinehill bluestem----------	17
	Unfavorable	---	Beaked panicum----------	12
			Panicum----------	12
41---------- Texark	Favorable	4,000	Sedge----------	20
	Normal	2,500	Virginia wildrye----------	15
	Unfavorable	1,200	Paspalum----------	10
			Panicum----------	10
			Beaked panicum----------	5
			Purpletop----------	5
			Switchcane----------	5
			Hawthorn----------	5

See footnote at end of table.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION--Continued

Map symbol and soil name	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
42---------- Thenas	Favorable	3,000	Beaked panicum----------	15
	Normal	2,500	Virginia wildrye----------	10
	Unfavorable	1,500	Longleaf uniola----------	10
			Sedge----------	10
44---------- Vesey	Favorable	3,000	Longleaf uniola----------	20
	Normal	2,000	Beaked panicum----------	10
	Unfavorable	1,000	Purpletop----------	10
			Paspalum----------	10
			Panicum----------	10
			Little bluestem----------	5
			Greenbrier----------	5
45, 46, 47--------- Woodtell	Favorable	2,500	Pinehill bluestem----------	20
	Normal	2,000	Panicum----------	10
	Unfavorable	1,500	Sedge----------	10
			Brownseed paspalum----------	10
			Indiangrass----------	5
			Longleaf uniola----------	5
			Purpletop----------	5
			Carolina jointtail----------	5
			Knotroot bristlegrass----------	5
			Splitbeard bluestem----------	5
48:* Wrightsville------	Favorable	3,000	Plumegrass----------	15
	Normal	2,000	Switchgrass----------	10
	Unfavorable	1,250	Beaked panicum----------	10
			Uniola----------	10
			Paspalum----------	5
			Panicum----------	5
			Velvet panicum----------	5
			Sedge----------	5
			Blueberry----------	5
Rodessa----------	Favorable	3,000	Longleaf uniola----------	15
	Normal	2,000	Beaked panicum----------	10
	Unfavorable	1,500	Purpletop----------	10
			Greenbrier----------	10
			Panicum----------	10
			Paspalum----------	10
			Little bluestem----------	5
			Sedge----------	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails
1:*				
Adaton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Muskogee	Moderate: percs slowly, wetness.	Slight	Moderate: percs slowly.	Slight.
2 Alusa	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.
3 Amy	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
4 Annona	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight.
5 Ashford	Severe: wetness, percs slowly, too clayey.	Severe: wetness, too clayey.	Severe: wetness, percs slowly, too clayey.	Severe: wetness, too clayey.
6, 7 Billyhaw	Severe: floods, wetness, percs slowly.	Severe: too clayey.	Severe: too clayey, wetness, percs slowly.	Severe: too clayey.
8 Blevins	Slight	Slight	Moderate: slope.	Slight.
9 Bryarly	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
10 Dardanelle	Slight	Slight	Slight	Slight.
11 Darden	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
12 Darden	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.
13 Eylau	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, percs slowly.	Slight.
14:*				
Eylau	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, percs slowly.	Slight.
Urban land.				
15 Ferris	Moderate: too clayey, percs slowly, slope.	Moderate: too clayey, slope, percs slowly.	Severe: slope.	Moderate: too clayey.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails
16 Gladewater	Severe: floods, wetness, percs slowly.	Severe: too clayey, wetness.	Severe: floods, too clayey, wetness.	Severe: too clayey, wetness.
17 Kiomatia	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
18 McKamie	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
19 McKamie	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight.
20 Morse	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
21 Muldrow	Severe: percs slowly, floods.	Moderate: wetness, too clayey, floods.	Severe: percs slowly.	Moderate: too clayey, wetness.
22 Perry	Severe: floods, wetness, too clayey.	Severe: floods, wetness, too clayey.	Severe: floods, wetness, too clayey.	Severe: floods, wetness, too clayey.
23 Redlake	Severe: floods, percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
24 Roebuck	Severe: floods, percs slowly.	Severe: too clayey.	Severe: floods, too clayey, percs slowly.	Severe: too clayey.
25 Rosalie	Slight	Slight	Moderate: slope.	Slight.
26, 27, 28 Ruston	Slight	Slight	Moderate: slope.	Slight.
29:*				
Ruston	Slight	Slight	Moderate: slope.	Slight.
Urban land.				
30 Sacul	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
31 Sacul	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
32:*				
Sacul	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Urban land.				

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails
33 Saffell	Severe: small stones.	Moderate: small stones.	Severe: small stones, slope.	Moderate: small stones.
34:*				
Saffell	Severe: small stones.	Moderate: small stones.	Severe: small stones, slope.	Moderate: small stones.
Urban land.				
35 Sardis	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: floods, wetness.	Moderate: floods, wetness.
36 Sawyer	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
37:*				
Sawyer	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Urban land.				
38, 39 Severn	Severe: floods.	Slight	Slight	Slight.
40 Smithdale	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
41 Texark	Severe: floods, wetness, percs slowly.	Severe: too clayey, wetness.	Severe: floods, too clayey, wetness.	Severe: too clayey, wetness.
42 Thenas	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
43.* Udorthents				
44 Vesey	Slight	Slight	Slight	Slight.
45 Woodtell	Severe: slope, percs slowly.	Moderate: wetness.	Severe: percs slowly.	Slight.
46 Woodtell	Severe: slope, percs slowly.	Moderate: slope.	Severe: slope, percs slowly.	Slight.
47 Woodtell	Severe: slope, percs slowly.	Moderate: wetness.	Severe: percs slowly.	Slight.
48:*				
Wrightsville	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.
Rodessa	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1:*										
Adaton	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Muskogee.										
2 Alusa	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
3 Amy	Poor	Fair	Fair	Good	Fair	Good	Poor	Fair	Good	Fair.
4 Annona	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
5 Ashford	Fair	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
6, 7 Billyhaw	Fair	Fair	Fair	Good	---	Poor	Fair	Fair	Good	Poor.
8 Blevins	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
9 Bryarly	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
10 Dardanelle	Good	Good	Good	Good	---	Poor	Fair	Good	Good	Poor.
11, 12 Darden	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
13. Eylau	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
14:* Eylau.	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Urban land.										
15 Ferris	Poor	Fair	Fair	---	---	Very poor.	Very poor.	Fair	---	Very poor.
16 Gladewater	Poor	Fair	Fair	Fair	---	Poor	Good	Fair	Fair	Fair.
17 Kiomatia	Poor	Fair	Fair	Fair	---	Poor	Very poor.	Fair	Fair	Very poor.
18, 19 McKamie	Fair	Good	Good	---	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
20 Morse	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
21 Muldrow	Fair	Good	Fair	Good	Good	Fair	Good	Fair	Good	Fair.
22 Perry	Poor	Fair	Fair	Fair	---	Fair	Fair	Fair	Fair	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
23 Redlake	Fair	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
24 Roebuck	Poor	Fair	Poor	Good	Good	Poor	Fair	Poor	Fair	Poor.
25 Rosalie	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
26, 27 Ruston	Good	Good	Good	---	Good	Poor	Very poor.	Good	Good	Very poor.
28 Ruston	Fair	Good	Good	---	Good	Very poor.	Very poor.	Good	Good	Very poor.
29:*										
Ruston	Good	Good	Good	---	Good	Poor	Very poor.	Good	Good	Very poor.
Urban land.										
30, 31 Sacul	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
32:*										
Sacul	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Urban land.										
33 Saffell	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
34:*										
Saffell	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Urban land.										
35 Sardis	Poor	Fair	Fair	Good	---	Fair	Fair	Fair	Good	Fair.
36 Sawyer	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
37:*										
Sawyer	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Urban land.										
38, 39 Severn	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
40 Smithdale	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
41 Texark	Poor	Fair	Fair	Good	---	Good	Fair	Fair	Good	Fair.
42 Thenas	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
43.* Udorthents										

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
44 Vesey	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
45 Woodtell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Poor.
46, 47 Woodtell	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
48:*										
Wrightsville	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Rodessa	Fair	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1:*					
Adaton	Severe: wetness, too clayey.	Severe: wetness.	Severe: wetness.	Severe: wetness, corrosive.	Severe: wetness, low strength.
Muskogee	Severe: too clayey, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.
2 Alusa	Severe: wetness, too clayey.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, low strength, shrink-swell.
3 Amy	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, low strength.
4 Annona	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell.
5 Ashford	Severe: too clayey, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, low strength.
6, 7 Billyhaw	Severe: too clayey, wetness.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.	Severe: low strength, wetness, shrink-swell.
8 Blevins	Slight	Slight	Slight	Slight	Moderate: low strength.
9 Bryarly	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
10 Dardanelle	Slight	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength.
11 Darden	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
12 Darden	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
13 Eylau	Moderate: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: low strength, wetness.
14:*					
Eylau	Moderate: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: low strength, wetness.
Urban land.					
15 Ferris	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
16---------- Gladewater	Severe: too clayey, wetness, floods.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, wetness, low strength.
17---------- Kiomatia	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
18---------- McKamie	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
19---------- McKamie	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
20---------- Morse	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
21---------- Muldrow	Severe: wetness, too clayey.	Severe: floods, shrink-swell.	Severe: wetness, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.
22---------- Perry	Severe: wetness, too clayey, floods.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: wetness, shrink-swell, floods.
23---------- Redlake	Severe: floods, too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.
24---------- Roebuck	Severe: floods, too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell, low strength.
25---------- Rosalie	Slight----------	Slight----------	Moderate: wetness.	Slight----------	Slight.
26, 27---------- Ruston	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: low strength.
28---------- Ruston	Slight----------	Slight----------	Slight----------	Moderate: slope.	Moderate: low strength.
29:*					
Ruston----------	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: low strength.
Urban land.					
30---------- Sacul	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell	Severe: low strength, shrink-swell.
31---------- Sacul	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
32:*					
Sacul	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Urban land.					
33 Saffell	Severe: small stones.	Slight	Slight	Moderate: slope.	Slight.
34:*					
Saffell	Severe: small stones.	Slight	Slight	Moderate: slope.	Slight.
Urban land.					
35 Sardis	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, low strength.
36 Sawyer	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.
37:*					
Sawyer	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.
Urban land.					
38, 39 Severn	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
40 Smithdale	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
41 Texark	Severe: floods, too clayey, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, wetness.
42 Thenas	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
43.* Udorthents					
44 Vesey	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.
45 Woodtell	Severe: wetness, too clayey.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
46 Woodtell	Severe: wetness, too clayey.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
47---------- Woodtell	Severe: wetness, too clayey.	Severe: shrink-swell.	Severe: shrink-swell. wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
48:*					
Wrightsville-----	Severe: wetness, too clayey.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, low strength, shrink-swell.
Rodessa----------	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1:*					
Adaton	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
Muskogee	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Fair: thin layer, too clayey.
2 Alusa	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey, hard to pack.
3 Amy	Severe: floods, percs slowly, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
4 Annona	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey.
5 Ashford	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
6 Billyhaw	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
7 Billyhaw	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
8 Blevins	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight	Good.
9 Bryarly	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
10 Dardanelle	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Good.
11 Darden	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
12 Darden	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.
13 Eylau	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: too clayey.
14:*					
Eylau	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: too clayey.
Urban land.					

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
15---------- Ferris	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
16---------- Gladewater	Severe: percs slowly, floods, wetness.	Slight----------	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
17---------- Kiomatia	Severe: floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Fair: too sandy.
18---------- McKamie	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
19---------- McKamie	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
20---------- Morse	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Severe: too clayey.	Poor: too clayey.
21---------- Muldrow	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
22---------- Perry	Severe: percs slowly, wetness, floods.	Severe: floods.	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Poor: wetness, too clayey.
23---------- Redlake	Severe: percs slowly, floods.	Severe: floods.	Severe: floods, too clayey.	Severe: floods.	Poor: hard to pack, too clayey.
24---------- Roebuck	Severe: percs slowly, floods.	Severe: floods.	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey.
25---------- Rosalie	Moderate: wetness.	Moderate: wetness, seepage.	Moderate: too sandy.	Slight----------	Good.
26, 27, 28---------- Ruston	Slight----------	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
29:*					
Ruston----------	Slight----------	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
Urban land.					
30---------- Sacul	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
31---------- Sacul	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
32:*					
Sacul----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
Urban land.					

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
33 Saffell	Slight	Moderate: slope, seepage.	Slight	Slight	Poor: small stones.
34:*					
Saffell	Slight	Moderate: slope, seepage.	Slight	Slight	Poor: small stones.
Urban land.					
35 Sardis	Severe: floods, wetness.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
36 Sawyer	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Fair: too clayey, thin layer.
37:*					
Sawyer	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Fair: too clayey, thin layer.
Urban land.					
38, 39 Severn	Moderate: floods.	Severe: seepage, floods.	Severe: seepage.	Severe: seepage.	Good.
40 Smithdale	Moderate: slope.	Severe: seepage, slope.	Slight	Moderate: slope.	Fair: slope.
41 Texark	Severe: percs slowly, floods, wetness.	Slight	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
42 Thenas	Severe: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: wetness.
43.* Udorthents					
44 Vesey	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
45 Woodtell	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer.
46 Woodtell	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer.
47 Woodtell	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer.
48:*					
Wrightsville	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
48:* Rodessa	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1:*				
Adaton	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, too clayey.
Muskogee	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
2 Alusa	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
3 Amy	Poor: wetness, low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
4 Annona	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
5 Ashford	Poor: low strength, wetness, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
6, 7 Billyhaw	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
8 Blevins	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
9 Bryarly	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
10 Dardanelle	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
11 Darden	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
12 Darden	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy, slope.
13 Eylau	Fair: wetness, low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
14:*				
Eylau	Fair: wetness, low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Urban land.				
15 Ferris	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
16 Gladewater	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
17 Kiomatia	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
18, 19 McKamie	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
20 Morse	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, excess lime.
21 Muldrow	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
22 Perry	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, too clayey.
23 Redlake	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
24 Roebuck	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
25 Rosalie	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
26 Ruston	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
27, 28 Ruston	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
29:*				
Ruston	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Urban land.				
30, 31 Sacul	Severe: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, too clayey.
32:*				
Sacul	Severe: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, too clayey.
Urban land.				
33 Saffell	Good	Poor: excess fines.	Fair: excess fines.	Poor: small stones.
34:*				
Saffell	Good	Poor: excess fines.	Fair: excess fines.	Poor: small stones.
Urban land.				

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
35 Sardis	Fair: wetness, low strength.	Poor: excess fines.	Poor: excess fines.	Good.
36 Sawyer	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
37:*				
Sawyer	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Urban land.				
38, 39 Severn	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
40 Smithdale	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
41 Texark	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
42 Thenas	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
43.* Udorthents				
44 Vesey	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
45, 46, 47 Woodtell	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
48:*				
Wrightsville	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Rodessa	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1:*						
Adaton	Slight	Moderate: piping, unstable fill.	Percs slowly, wetness.	Percs slowly, wetness.	Percs slowly, wetness.	Percs slowly, wetness.
Muskogee	Slight	Moderate: hard to pack, wetness.	Percs slowly, slope.	Erodes easily, slope, slow intake.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
2 Alusa	Slight	Moderate: compressible, unstable fill.	Percs slowly, wetness.	Slow intake, wetness.	Percs slowly, wetness.	Percs slowly, wetness.
3 Amy	Slight	Severe: wetness.	Floods, percs slowly, wetness.	Wetness, percs slowly, floods.	Not needed	Percs slowly, wetness, erodes easily.
4 Annona	Slight	Moderate: hard to pack, wetness.	Percs slowly	Slow intake, wetness, erodes easily.	Percs slowly, wetness, erodes easily.	Percs slowly, erodes easily.
5 Ashford	Slight	Severe: wetness.	Percs slowly	Wetness, slow intake, percs slowly.	Not needed	Wetness, percs slowly, erodes easily.
6, 7 Billyhaw	Slight	Moderate: hard to pack, wetness.	Percs slowly	Wetness, percs slowly, slow intake.	Not needed	Percs slowly, wetness, erodes easily.
8 Blevins	Moderate: seepage.	Moderate: compressible, piping.	Not needed	Erodes easily, slope.	Erodes easily, slope.	Erodes easily, slope.
9 Bryarly	Slight	Moderate: hard to pack.	Percs slowly	Slow intake, erodes easily.	Percs slowly, erodes easily.	Erodes easily, percs slowly.
10 Dardanelle	Moderate: seepage.	Moderate: seepage.	Not needed	Favorable	Not needed	Favorable.
11, 12 Darden	Severe: seepage.	Severe: seepage, piping.	Not needed	Fast intake, droughty, slope.	Too sandy, slope.	Droughty, slope.
13 Eylau	Moderate: seepage.	Moderate: wetness.	Favorable	Wetness	Wetness	Favorable.
14:*						
Eylau	Moderate: seepage.	Moderate: wetness.	Favorable	Wetness	Wetness	Favorable.
Urban land.						
15 Ferris	Slight	Severe: hard to pack.	Not needed	Percs slowly, slow intake, slope.	Percs slowly, slope.	Percs slowly, slope.
16 Gladewater	Slight	Severe: wetness, hard to pack.	Floods, percs slowly.	Slow intake, wetness, percs slowly.	Percs slowly, wetness.	Percs slowly, wetness.
17 Kiomatia	Severe: seepage.	Moderate: seepage.	Floods	Droughty, floods, fast intake.	Favorable	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
18 McKamie	Slight	Moderate: shrink-swell, compressible.	Not needed	Slope, erodes easily, slow intake.	Erodes easily, percs slowly.	Favorable.
19 McKamie	Slight	Moderate: shrink-swell, compressible.	Not needed	Slope, erodes easily, slow intake.	Slope, erodes easily, percs slowly.	Slope.
20 Morse	Slight	Moderate: shrink-swell, compressible.	Not needed	Slow intake, percs slowly, erodes easily.	Erodes easily, percs slowly, slope.	Slope.
21 Muldrow	Slight	Severe: compressible, shrink-swell.	Percs slowly, floods.	Percs slowly, floods, wetness.	Percs slowly, wetness.	Percs slowly, wetness.
22 Perry	Slight	Moderate: shrink-swell, compressible.	Floods, percs slowly.	Floods, slow intake, wetness.	Not needed	Wetness.
23 Redlake	Slight	Moderate: unstable fill, compressible.	Floods, percs slowly.	Slow intake, floods.	Percs slowly	Percs slowly.
24 Roebuck	Slight	Moderate: hard to pack.	Not needed	Slow intake, floods, percs slowly.	Not needed	Percs slowly.
25 Rosalie	Moderate: seepage.	Slight	Not needed	Fast intake	Favorable	Favorable.
26, 27 Ruston	Moderate: seepage.	Slight	Not needed	Slope	Favorable	Favorable.
28 Ruston	Moderate: seepage.	Slight	Not needed	Slope	Favorable	Slope.
29:*						
Ruston	Moderate: seepage.	Slight	Not needed	Slope	Favorable	Favorable.
Urban land.						
30, 31 Sacul	Slight	Moderate: compressible.	Not needed	Erodes easily, slow intake, slope.	Slope, erodes easily, percs slowly.	Erodes easily, percs slowly, slope.
32:*						
Sacul	Slight	Moderate: compressible.	Not needed	Erodes easily, slow intake, slope.	Slope, erodes easily, percs slowly.	Erodes easily, percs slowly, slope.
Urban land.						
33 Saffell	Moderate: seepage.	Moderate: seepage, piping, thin layer.	Not needed	Droughty, fast intake, slope.	Erodes easily, slope, small stones.	Droughty, erodes easily, slope.
34:*						
Saffell	Moderate: seepage.	Moderate: seepage, piping, thin layer.	Not needed	Droughty, fast intake, slope.	Erodes easily, slope, small stones.	Droughty, erodes easily, slope.
Urban land.						

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
35 Sardis	Moderate: seepage.	Moderate: piping, wetness.	Floods	Floods, wetness, erodes easily.	Wetness	Wetness.
36 Sawyer	Slight	Moderate: compressible.	Not needed	Slow intake, slope.	Favorable	Favorable.
37:*						
Sawyer	Slight	Moderate: compressible.	Not needed	Slow intake, slope.	Favorable	Favorable.
Urban land.						
38, 39 Severn	Severe: seepage.	Severe: piping.	Not needed	Fast intake	Not needed	Favorable.
40 Smithdale	Severe: seepage.	Moderate: piping, unstable fill.	Not needed, slope.	Fast intake, seepage, complex slope.	Slope, erodes easily.	Slope, erodes easily.
41 Texark	Slight	Severe: wetness.	Floods, percs slowly.	Slow intake, wetness, percs slowly.	Not needed	Wetness, percs slowly.
42 Thenas	Moderate: seepage.	Slight	Floods, wetness.	Wetness, floods.	Not needed	Favorable.
43.* Udorthents						
44 Vesey	Severe: seepage.	Moderate: seepage, piping.	Not needed	Favorable	Favorable	Favorable.
45, 46, 47 Woodtell	Slight	Moderate: unstable fill, compressible, hard to pack.	Percs slowly, slope.	Slow intake, slope.	Slope, erodes easily, wetness.	Percs slowly, slope, erodes easily.
48:*						
Wrightsville	Slight	Severe: unstable fill, compressible.	Favorable, wetness, percs slowly.	Favorable, wetness, slow intake.	Not needed	Not needed.
Rodessa	Slight	Moderate: hard to pack, wetness.	Percs slowly	Percs slowly, wetness.	Not needed	Erodes easily, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
1:*											
Adaton	0-6	Silt loam	ML, CL, CL-ML	A-4	0	100	98-100	90-100	84-100	<30	NP-10
	6-80	Silt loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	98-100	95-100	84-100	30-52	11-34
Muskogee	0-6	Silt loam	ML, CL, CL-ML	A-4	0	100	100	95-100	85-100	18-30	1-10
	6-10	Silty clay loam, silt loam.	CL, CH	A-6, A-7-6	0	100	100	95-100	90-100	35-55	15-30
	10-80	Silty clay, clay	CH	A-7-6	0	100	100	95-100	90-100	55-70	30-40
2 Alusa	0-11	Loam	ML, CL, CL-ML	A-4	0	98-100	98-100	94-100	65-97	<31	NP-10
	11-48	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	98-100	98-100	94-100	80-98	46-70	25-44
	48-80	Clay	CH	A-7	0	80-100	80-100	75-95	70-95	56-70	33-44
3 Amy	0-18	Silt loam, loam.	ML, CL-ML	A-4	0	100	95-100	90-100	70-95	<30	NP-5
	18-65	Silt loam, silty clay loam.	CL	A-4, A-6	0	100	95-100	95-100	85-95	25-40	8-20
4 Annona	0-12	Loam	SM, ML, SM-SC, CL-ML	A-4	0	95-100	95-100	75-95	45-70	<30	NP-7
	12-45	Clay, clay loam	CH	A-7	0	95-100	95-100	90-100	75-95	51-70	30-45
	45-80	Clay, clay loam	CH, CL	A-7	0	95-100	95-100	90-100	75-95	41-65	25-45
5 Ashford	0-4	Clay	CH	A-7-6	0	100	95-100	95-100	90-100	51-75	33-49
	4-48	Clay	CH	A-7-6	0	95-100	95-100	95-100	90-100	65-85	45-55
	48-80	Clay	CH	A-7-6	0	95-100	95-100	95-100	90-100	55-85	35-55
6 Billyhaw	0-25	Clay	CH	A-7-6	0	98-100	98-100	95-100	95-100	55-80	35-55
	25-57	Clay	CH	A-7-6	0	98-100	95-100	95-100	95-100	60-85	35-55
	57-75	Stratified silt loam to clay.	ML, CL, CH, MH	A-4, A-6, A-7-6	0	95-100	95-100	95-100	60-100	30-60	8-30
7 Billyhaw	0-13	Clay	CH	A-7-6	0	98-100	98-100	95-100	95-100	55-80	35-55
	13-44	Clay	CH	A-7-6	0	98-100	95-100	95-100	95-100	60-85	35-55
	44-72	Clay	ML, CL, CH, MH	A-4, A-6, A-7-6	0	95-100	95-100	95-100	60-100	30-60	8-30
8 Blevins	0-15	Silt loam	ML, CL-ML	A-4	0	100	95-100	85-95	60-85	<25	NP-7
	15-80	Clay loam	CL	A-6, A-4	0	100	95-100	90-100	85-95	25-35	8-15
9 Bryarly	0-3	Clay loam	CL	A-6, A-7	0	100	95-100	90-100	55-80	35-48	18-30
	3-80	Clay	CH	A-7	0	100	95-100	90-100	75-95	60-76	35-48
10 Dardanelle	0-8	Loam	ML, CL, CL-ML	A-4, A-6	0	100	100	100	85-100	16-30	3-11
	8-26	Silt loam, silty clay loam, clay loam.	CL-ML, CL	A-4, A-6	0	100	100	100	80-100	23-38	6-15
	26-70	Silt loam, very fine sandy loam, loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	100	80-100	16-38	3-15
11 Darden	0-14	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	90-100	5-35	---	NP
	14-80	Loamy fine sand	SM, SP-SM	A-2	0	100	100	90-100	11-35	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
12---------- Darden	0-25	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	90-100	5-35	---	NP
	25-80	Loamy fine sand	SM, SP-SM	A-2	0	100	100	90-100	11-35	---	NP
13---------- Eylau	0-12	Very fine sandy loam.	SM, SM-SC, CL-ML, ML	A-4	0	100	100	75-100	40-65	<25	NP-6
	12-36	Sandy clay loam, clay loam, silty clay loam.	CL	A-4, A-6	0	100	100	85-100	51-80	25-40	8-20
	36-55	Sandy clay loam, clay loam, silty clay loam.	CL	A-4, A-6	0	100	100	85-100	51-70	25-40	8-20
	55-80	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6, A-7	0	100	100	85-100	45-65	25-45	8-25
14:* Eylau----------	0-12	Very fine sandy loam.	SM, SM-SC, CL-ML, ML	A-4	0	100	100	75-100	40-65	<25	NP-6
	12-36	Sandy clay loam, clay loam, silty clay loam.	CL	A-4, A-6	0	100	100	85-100	51-80	25-40	8-20
	36-55	Sandy clay loam, clay loam, silty clay loam.	CL	A-4, A-6	0	100	100	85-100	51-70	25-40	8-20
	55-80	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6, A-7	0	100	100	85-100	45-65	25-45	8-25
Urban land.											
15---------- Ferris	0-70	Clay----------	CH	A-7-6	0	95-100	95-100	75-100	75-98	51-70	35-50
16---------- Gladewater	0-5	Clay----------	CH, CL	A-7	0	100	100	90-100	80-95	48-75	25-50
	5-72	Clay, silty clay	CH	A-7	0	100	100	95-100	90-100	51-75	30-50
17---------- Kiomatia	0-3	Loamy fine sand	SM, SM-SC	A-4, A-2-4	0	100	95-100	80-100	30-45	<26	NP-7
	3-72	Stratified fine sand to loam.	SM, SM-SC	A-2-4	0	100	95-100	80-90	13-30	<22	NP-5
18---------- McKamie	0-13	Loam----------	SM, ML, CL-ML, SM-SC	A-4	0	100	100	90-100	40-80	<30	NP-7
	13-36	Clay, silty clay	CH, CL	A-7-6	0	100	100	95-100	80-100	45-70	22-40
	36-80	Silty clay loam, silt loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	50-95	20-40	5-22
19---------- McKamie	0-4	Loam----------	SM, ML, CL-ML, SM-SC	A-4	0	100	100	90-100	40-80	<30	NP-7
	4-44	Clay, silty clay	CH, CL	A-7-6	0	100	100	95-100	80-100	45-70	22-40
	44-74	Silty clay loam, very fine sandy loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	50-95	20-40	5-22
20---------- Morse	0-6	Clay----------	CH	A-7-6	0	90-100	85-100	85-100	80-100	50-75	25-45
	6-80	Clay----------	CH	A-7-6	0	90-100	85-95	85-95	80-95	55-75	30-45

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
21---------- Muldrow	0-14	Clay loam-------	CL	A-6, A-7-6	0	100	100	96-100	80-98	33-43	12-20
	14-79	Silty clay loam, silty clay, clay.	CL, CH, ML, MH	A-6, A-7	0	100	100	96-100	80-98	37-70	15-40
22---------- Perry	0-4	Clay----------	CH, CL	A-7-6	0	100	100	100	95-100	45-75	22-45
	4-45	Clay----------	CH	A-7-6	0	100	100	100	95-100	60-80	33-50
	45-80	Clay----------	CH, CL	A-7-6	0	90-100	85-100	75-100	70-100	45-80	22-50
23---------- Redlake	0-56	Clay----------	CL, CH	A-7	0	100	100	98-100	90-100	41-70	18-38
	56-72	Clay loam, silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	96-100	80-90	37-55	16-30
24---------- Roebuck	0-65	Clay----------	CL, CH	A-6, A-7	0	100	100	96-100	90-99	37-70	15-40
25---------- Rosalie	0-24	Loamy fine sand	SP-SM, SM	A-2-4	0-5	95-100	85-95	75-85	10-20	<25	NP-3
	24-80	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	98-100	95-100	80-90	36-55	20-40	8-20
26---------- Ruston	0-14	Loamy fine sand	SM, ML	A-4, A-2-4	0	85-100	78-100	65-100	30-75	<20	NP-3
	14-80	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	85-100	78-100	70-100	36-75	30-40	11-18
27---------- Ruston	0-18	Fine sandy loam	SM, ML	A-4, A-2-4	0	85-100	78-100	65-100	30-75	<20	NP-3
	18-80	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	85-100	78-100	70-100	36-75	30-40	11-18
28---------- Ruston	0-16	Fine sandy loam	SM, ML	A-4, A-2-4	0	85-100	78-100	65-100	30-75	<20	NP-3
	16-80	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	85-100	78-100	70-100	36-75	30-40	11-18
29:*											
Ruston----------	0-18	Fine sandy loam	SM, ML	A-4, A-2-4	0	85-100	78-100	65-100	30-75	<20	NP-3
	18-80	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	85-100	78-100	70-100	36-75	30-40	11-18
Urban land.											
30---------- Sacul	0-10	Fine sandy loam	SM, ML	A-4	0	95-100	90-100	80-100	40-65	<20	NP-3
	10-45	Clay, silty clay	CH, MH, CL	A-7	0	95-100	90-100	85-95	80-90	45-70	20-40
	45-65	Silty clay loam, silt loam, clay loam.	CL, CH, ML, SC	A-6, A-7, A-4	0	95-100	90-100	85-100	40-90	25-55	8-32
31---------- Sacul	0-2	Fine sandy loam	SM, ML	A-4	0	95-100	90-100	80-100	40-65	<20	NP-3
	2-49	Clay, silty clay	CH, MH, CL	A-7	0	95-100	90-100	85-95	80-90	45-70	20-40
	49-65	Silty clay loam, silt loam, clay loam, sandy clay loam.	CL, CH, ML, SC	A-6, A-7, A-4	0	95-100	90-100	85-100	40-90	25-55	8-32

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
32:*											
Saeul	0-10	Fine sandy loam	SM, ML	A-4	0	95-100	90-100	80-100	40-65	<20	NP-3
	10-55	Clay, silty clay	CH, MH, CL	A-7	0	95-100	90-100	85-95	80-90	45-70	20-40
	55-65	Silty clay loam, silt loam, clay loam.	CL, CH, ML, SC	A-6, A-7, A-4	0	95-100	90-100	85-100	40-90	25-55	8-32
Urban land.											
33 Saffell	0-14	Gravelly sandy loam.	SM	A-1, A-2, A-4	0-5	70-80	50-75	40-65	20-40	<20	NP-3
	14-80	Gravelly sandy loam, very gravelly sandy loam, gravelly loamy sand.	GM, GC, SM, SC	A-1, A-2, A-3	0-5	25-80	10-70	5-60	5-35	<35	NP-15
34:*											
Saffell	0-14	Gravelly sandy loam.	SM	A-1, A-2, A-4	0-5	70-80	50-75	40-65	20-40	<20	NP-3
	14-80	Gravelly sandy loam, very gravelly sandy loam, gravelly loamy sand.	GM, GC, SM, SC	A-1, A-2, A-3	0-5	25-80	10-70	5-60	5-35	<35	NP-15
Urban land.											
35 Sardis	0-9	Silt loam	ML, CL-ML, CL	A-4	0	100	100	80-100	75-95	<30	NP-10
	9-50	Silt loam, silty clay loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	100	85-100	80-100	25-40	5-20
	50-62	Loam, silt loam, sandy loam.	ML, SM, CL, SC	A-4, A-2	0	100	95-100	60-95	35-75	<30	NP-10
36 Sawyer	0-6	Silt loam	ML, CL-ML	A-4	0	100	95-100	85-95	60-90	<25	NP-7
	6-26	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	100	95-100	85-95	70-90	30-40	10-20
	26-80	Silty clay, clay	CH, CL, MH	A-7	0	100	95-100	90-100	80-90	45-60	20-35
37:*											
Sawyer	0-6	Silt loam	ML, CL-ML	A-4	0	100	95-100	85-95	60-90	<25	NP-7
	6-32	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	100	95-100	85-95	70-90	30-40	10-20
	32-80	Silty clay, clay	CH, CL, MH	A-7	0	100	95-100	90-100	80-90	45-60	20-35
Urban land.											
38 Severn	0-8	Very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	94-100	65-97	22-31	3-12
	8-65	Stratified silt loam to loamy very fine sand.	ML, CL-ML	A-4	0	100	100	94-100	65-97	<28	NP-7

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
39---------- Severn	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-98	32-42	12-20
	8-72	Stratified silt loam to loamy very fine sand.	ML, CL-ML	A-4	0	100	100	94-100	65-97	<28	NP-7
40---------- Smithdale	0-15	Fine sandy loam	SM, SM-SC	A-4	0	100	85-100	60-80	36-49	<20	NP-5
	15-80	Clay loam, sandy clay loam, loam.	SM-SC, SC, CL, CL-ML	A-6, A-4	0	100	85-100	80-95	45-75	23-38	7-15
41---------- Texark	0-16	Clay----------	CH	A-7-6	0	100	100	95-100	90-100	56-75	33-49
	16-62	Clay----------	CH	A-7-6	0	100	100	95-100	90-100	76-96	49-65
	62-80	Clay----------	CH	A-7-6	0	100	100	95-100	90-100	76-96	49-65
42---------- Thenas	0-6	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	100	95-100	80-100	36-55	20-28	3-7
	6-34	Fine sandy loam, loam.	SM, ML, SM-SC, CL-ML	A-4	0	100	95-100	80-100	51-65	20-28	3-7
	34-70	Stratified sandy clay loam to loamy sand.	SM-SC, SC, CL-ML, CL	A-4, A-6, A-2	0	100	95-100	60-90	25-60	20-35	4-15
43.* Udorthents											
44---------- Vesey	0-30	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2-4, A-4	0	90-100	90-100	75-95	35-60	<25	NP-7
	30-80	Sandy clay loam, clay loam.	SM-SC, CL-ML, CL, SC	A-4, A-6	0	95-100	90-100	80-95	45-70	20-35	5-15
45---------- Woodtell	0-6	Very fine sandy loam.	SM, SM-SC, CL-ML, ML	A-2-4, A-4	0	90-100	85-100	75-95	30-60	<25	NP-7
	6-44	Clay, silty clay	CH, CL	A-7-6	0	100	90-100	80-100	60-98	51-75	28-50
	44-60	Variable--------	---	---	---	---	---	---	---	---	---
46---------- Woodtell	0-6	Very fine sandy loam.	SM, SM-SC, CL-ML, ML	A-2-4, A-4	0	90-100	85-100	75-95	30-60	<25	NP-7
	6-53	Clay, silty clay	CH, CL	A-7-6	0	100	90-100	80-100	60-98	51-75	28-50
	53-72	Variable--------	---	---	---	---	---	---	---	---	---
47---------- Woodtell	0-12	Fine sandy loam Gravelly sandy loam.	SM, SM-SC, CL-ML, ML	A-2-4, A-4	0	90-100	85-100	75-95	30-60	<25	NP-7
	12-32	Clay, silty clay	CH, CL	A-7-6	0	100	90-100	80-100	60-98	51-75	28-50
	32-70	Clay loam, clay, sandy clay loam.	CL, CH, SC	A-6, A-7-6	0	100	80-100	75-90	36-98	35-65	15-45

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
48:*											
Wrightsville------	0-16	Silt loam-------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	75-100	<31	NP-10
	16-55	Silty clay, clay, silty clay loam.	CH, CL, MH	A-7	0	100	100	95-100	90-100	41-65	22-40
	55-80	Silty clay loam, silty clay, clay.	CL, CH, MH	A-7, A-6	0	100	95-100	95-100	90-100	35-65	16-40
Rodessa----------	0-26	Loam----------	ML, CL-ML, CL	A-4	0	100	100	80-95	55-75	15-25	3-8
	26-70	Clay, clay loam.	CH, CL	A-7-6	0	100	100	90-100	75-95	45-65	25-40

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
						K	T
	In	In/hr	In/in	pH			
1:*							
Adaton----------	0-6	0.6-2.0	0.20-0.22	4.5-5.5	Low----------	0.43	---
	6-80	0.06-0.2	0.18-0.22	4.5-5.5	Moderate-------	0.37	
Muskogee--------	0-6	0.6-2.0	0.16-0.24	4.5-6.0	Low----------	0.43	5
	6-10	0.2-0.6	0.16-0.24	4.5-6.0	Moderate-------	0.37	
	10-80	0.06-0.2	0.14-0.18	5.1-7.8	High----------	0.32	
2---------- Alusa	0-11	0.6-2.0	0.15-0.24	5.1-6.0	Low----------	0.49	5
	11-48	<0.06	0.12-0.22	4.5-7.3	High----------	0.43	
	48-80	<0.06	0.12-0.18	7.4-8.4	High----------	0.37	
3---------- Amy	0-18	0.6-2.0	0.13-0.24	4.5-5.5	Low----------	0.43	5
	18-65	0.06-0.2	0.16-0.24	4.5-5.5	Low----------	0.43	
4---------- Annona	0-12	0.6-2.0	0.13-0.18	4.5-6.5	Low----------	0.43	5
	12-45	<0.06	0.12-0.18	4.5-6.0	High----------	0.32	
	45-80	<0.06	0.12-0.18	5.6-8.4	High----------	0.28	
5---------- Ashford	0-4	0.06-0.2	0.14-0.18	5.1-6.5	High----------	0.37	5
	4-48	<0.06	0.12-0.18	4.5-6.0	High----------	0.37	
	48-80	<0.06	0.12-0.18	5.1-7.8	High----------	0.37	
6---------- Billyhaw	0-25	<0.06	0.14-0.19	6.1-7.8	High----------	0.37	5
	25-57	<0.06	0.14-0.19	6.6-8.4	High----------	0.37	
	57-75	0.06-0.6	0.14-0.20	7.4-8.4	Moderate-------	0.37	
7---------- Billyhaw	0-13	<0.06	0.14-0.19	6.1-7.8	High----------	0.37	5
	13-44	<0.06	0.14-0.19	6.6-8.4	High----------	0.37	
	44-72	0.06-0.6	0.14-0.20	7.4-8.4	Moderate-------	0.37	
8---------- Blevins	0-15	0.6-2.0	0.11-0.24	4.5-5.5	Low----------	0.37	4
	15-80	0.6-2.0	0.15-0.24	4.5-5.5	Low----------	0.37	
9---------- Bryarly	0-3	0.6-2.0	0.14-0.18	4.5-6.5	Moderate-------	0.43	5
	3-80	<0.06	0.12-0.18	4.5-7.3	High----------	0.32	
10---------- Dardanelle	0-8	0.6-2.0	0.13-0.24	5.6-7.3	Low----------	0.37	5
	8-26	0.6-2.0	0.15-0.24	5.1-7.3	Moderate-------	0.32	
	26-70	0.6-2.0	0.13-0.24	5.6-8.4	Low----------	0.32	
11---------- Darden	0-14	6.0-20	0.05-0.09	4.5-7.3	Low----------	0.15	5
	14-80	6.0-20	0.05-0.09	4.5-7.3	Low----------	0.15	
12---------- Darden	0-25	6.0-20	0.05-0.09	4.5-7.3	Low----------	0.15	5
	25-80	6.0-20	0.05-0.09	4.5-7.3	Low----------	0.15	
13---------- Eylau	0-12	2.0-6.0	0.12-0.16	5.1-6.5	Low----------	0.28	5
	12-36	0.6-2.0	0.14-0.20	4.5-5.5	Low----------	0.37	
	36-55	0.2-0.6	0.10-0.14	4.5-5.5	Low----------	0.37	
	55-80	0.6-2.0	0.10-0.14	4.5-5.5	Low----------	0.37	
14:*							
Eylau----------	0-12	2.0-6.0	0.12-0.16	5.1-6.5	Low----------	0.28	5
	12-36	0.6-2.0	0.14-0.20	4.5-5.5	Low----------	0.37	
	36-55	0.2-0.6	0.10-0.14	4.5-5.5	Low----------	0.37	
	55-80	0.6-2.0	0.10-0.14	4.5-5.5	Low----------	0.37	
Urban land.							
15---------- Ferris	0-70	<0.06	0.15-0.18	7.9-8.4	Very high------	0.32	4

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Map symbol and soil name	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T
	In	In/hr	In/in	pH			
16---------- Gladewater	0-5	0.06-0.2	0.15-0.20	5.6-7.3	High----------	0.32	5
	5-72	<0.06	0.15-0.18	4.5-7.3	High----------	0.32	
17---------- Kiomatia	0-3	0.6-2.0	0.10-0.15	6.1-8.4	Low----------	0.17	5
	3-72	6.0-20	0.05-0.10	6.1-8.4	Low----------	0.17	
18---------- McKamie	0-13	0.6-2.0	0.14-0.22	5.1-6.5	Low----------	0.43	3
	13-36	<0.06	0.18-0.20	4.5-6.0	High----------	0.32	
	36-80	0.2-2.0	0.14-0.22	4.5-8.4	Moderate-------	0.37	
19---------- McKamie	0-4	0.6-2.0	0.14-0.22	5.1-6.5	Low----------	0.43	3
	4-44	<0.06	0.18-0.20	4.5-6.0	High----------	0.32	
	44-74	0.2-2.0	0.14-0.22	4.5-8.4	Moderate-------	0.37	
20---------- Morse	0-6	<0.06	0.15-0.18	7.4-8.4	Very high------	0.37	4
	6-80	<0.06	0.15-0.18	6.6-8.4	Very high------	0.37	
21---------- Muldrow	0-14	0.2-0.6	0.15-0.22	5.1-6.0	Moderate-------	0.43	5
	14-79	<0.06	0.12-0.22	6.1-8.4	High----------	0.43	
22---------- Perry	0-4	<0.06	0.17-0.20	4.5-6.0	Very high------	0.24	5
	4-45	<0.06	0.17-0.20	5.1-7.3	Very high------	0.28	
	45-80	<0.06	0.17-0.20	6.1-8.4	Very high------	0.28	
23---------- Redlake	0-56	<0.06	0.12-0.18	7.4-8.4	High----------	0.37	5
	56-72	0.06-0.2	0.15-0.20	7.4-8.4	Moderate-------	0.43	
24---------- Roebuck	0-65	<0.06	0.12-0.20	6.1-8.4	High----------	0.37	5
25---------- Rosalie	0-24	6.0-20	0.05-0.10	5.1-6.0	Low----------	0.17	5
	24-80	0.6-2.0	0.10-0.15	3.6-5.5	Low----------	0.24	
26---------- Ruston	0-14	0.6-2.0	0.09-0.16	5.1-6.5	Low----------	0.32	5
	14-80	0.6-2.0	0.12-0.17	4.5-6.0	Low----------	0.28	
27---------- Ruston	0-18	0.6-2.0	0.09-0.16	5.1-6.5	Low----------	0.32	5
	18-80	0.6-2.0	0.12-0.17	4.5-6.0	Low----------	0.28	
28---------- Ruston	0-16	0.6-2.0	0.09-0.16	5.1-6.5	Low----------	0.32	5
	16-80	0.6-2.0	0.12-0.17	4.5-6.0	Low----------	0.28	
	41-47	0.6-2.0	0.12-0.15	4.5-6.0	Low----------	0.32	
	47-80	0.6-2.0	0.12-0.17	4.5-6.0	Low----------	0.28	
29:*							
Ruston----------	0-18	0.6-2.0	0.09-0.16	5.1-6.5	Low----------	0.32	5
	18-80	0.6-2.0	0.12-0.17	4.5-6.0	Low----------	0.28	
Urban land.							
30---------- Sacul	0-10	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.32	3
	10-45	0.06-0.2	0.12-0.18	4.5-5.5	High----------	0.32	
	45-65	0.2-0.6	0.16-0.24	4.5-5.5	Moderate-------	0.37	
31---------- Sacul	0-2	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.32	3
	2-49	0.06-0.2	0.12-0.18	4.5-5.5	High----------	0.32	
	49-65	0.2-0.6	0.16-0.24	4.5-5.5	Moderate-------	0.37	
32:*							
Sacul----------	0-10	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.32	3
	10-55	0.06-0.2	0.12-0.18	4.5-5.5	High----------	0.32	
	55-65	0.2-0.6	0.16-0.24	4.5-5.5	Moderate-------	0.37	
Urban land.							
33---------- Saffell	0-14	2.0-6.0	0.05-0.10	4.5-5.5	Low----------	0.20	4
	14-45	0.6-2.0	0.06-0.12	4.5-5.5	Low----------	0.28	
	45-80	0.6-6.0	0.04-0.11	4.5-5.5	Low----------	0.17	

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Map symbol and soil name	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T
	In	In/hr	In/in	pH			
34:*							
Saffell	0-14	2.0-6.0	0.05-0.10	4.5-5.5	Low	0.20	4
	14-45	0.6-2.0	0.06-0.12	4.5-5.5	Low	0.28	
	45-80	0.6-6.0	0.04-0.11	4.5-5.5	Low	0.17	
Urban land.							
35 Sardis	0-9	0.6-2.0	0.15-0.24	4.5-6.0	Low	0.37	5
	9-50	0.6-2.0	0.15-0.24	4.5-6.0	Low	0.37	
	50-62	0.6-2.0	0.10-0.24	4.5-6.0	Low	0.37	
36 Sawyer	0-6	0.6-2.0	0.15-0.24	4.5-5.5	Low	0.43	3
	6-26	0.2-0.6	0.15-0.24	4.5-5.5	Moderate	0.37	
	26-80	0.06-0.2	0.12-0.18	4.5-5.5	High	0.32	
37:*							
Sawyer	0-6	0.6-2.0	0.15-0.24	4.5-5.5	Low	0.43	3
	6-32	0.2-0.6	0.15-0.24	4.5-5.5	Moderate	0.37	
	32-80	0.06-0.2	0.12-0.18	4.5-5.5	High	0.32	
Urban land.							
38 Severn	0-8	2.0-6.0	0.13-0.20	7.4-8.4	Low	0.32	5
	8-65	2.0-6.0	0.11-0.20	7.9-8.4	Low	0.32	
39 Severn	0-8	2.0-6.0	0.15-0.19	7.9-8.4	Moderate	0.32	5
	8-72	2.0-6.0	0.11-0.20	7.9-8.4	Low	0.32	
40 Smithdale	0-15	2.0-6.0	0.14-0.16	4.5-5.5	Low	0.28	5
	15-80	0.6-2.0	0.15-0.17	4.5-5.5	Low	0.24	
41 Texark	0-16	<0.06	0.15-0.18	6.1-7.8	High	0.32	5
	16-62	<0.06	0.12-0.18	4.5-7.3	High	0.32	
	62-80	<0.06	0.12-0.18	4.5-8.4	High	0.32	
42 Thenas	0-6	2.0-6.0	0.12-0.17	5.1-7.3	Low	0.24	5
	6-34	0.6-2.0	0.11-0.15	5.1-7.3	Low	0.24	
	34-70	0.6-2.0	0.10-0.20	5.1-7.3	Low	0.20	
43.* Udorthents							
44 Vesey	0-30	6.0-20	0.07-0.15	5.6-7.3	Low	0.32	5
	30-80	0.6-2.0	0.12-0.20	5.1-6.5	Moderate	0.32	
45 Woodtell	0-6	0.6-2.0	0.10-0.15	4.5-6.5	Low	0.43	4
	6-44	<0.06	0.12-0.18	3.6-5.5	High	0.32	
	44-60	---	---	---	---	----	
46 Woodtell	0-6	0.6-2.0	0.10-0.15	4.5-6.5	Low	0.43	4
	6-53	<0.06	0.12-0.18	3.6-5.5	High	0.32	
	53-72	---	---	---	---	----	
47 Woodtell	0-12	0.6-2.0	0.10-0.15	4.5-6.5	Low	0.43	4
	12-32	<0.06	0.12-0.18	3.6-5.5	High	0.32	
	32-44	0.06-0.2	0.12-0.20	4.5-6.0	High	----	
	44-70	---	---	---	---	----	
48:*							
Wrightsville	0-16	0.2-0.6	0.16-0.24	3.6-5.5	Low	0.49	5
	16-55	<0.06	0.14-0.22	3.6-5.5	High	0.37	
	55-80	<0.06	0.14-0.22	3.6-8.4	High	0.43	
Rodessa	0-26	0.6-2.0	0.11-0.20	4.5-6.5	Low	0.43	5
	26-70	<0.06	0.12-0.18	4.5-6.0	High	0.32	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the text explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Map symbol and soil name	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Conrete
					Ft				
1:*									
Adaton	D	None	---	---	0-0.5	Apparent	Jan-Apr	High	High.
Muskogee	C	None	---	---	1.0-2.0	Perched	Jan-Apr	High	Moderate.
2 Alusa	D	None	---	---	0-1.0	Perched	Nov-Apr	High	Moderate.
3 Amy	D	Frequent	Brief	Dec-May	0-1.0	Perched	Dec-Apr	High	Moderate.
4 Annona	D	None	---	---	2.0-4.0	Apparent	Dec-Feb	High	Moderate.
5 Ashford	D	None	---	---	0-1.0	Perched	Dec-Apr	High	High.
6, 7 Billyhaw	D	Rare	---	---	1.0-2.0	Apparent	Jan-Apr	High	Low.
8 Blevins	B	None	---	---	>6.0	---	---	Moderate	Moderate.
9 Bryarly	D	None	---	---	>6.0	---	---	High	Moderate.
10 Dardanelle	B	Rare	Brief	Dec-Mar	>6.0	---	---	Moderate	Moderate.
11, 12 Darden	A	None	---	---	>6.0	---	---	Low	High.
13 Eylau	C	None	---	---	2.0-3.0	Perched	Feb-May	Moderate	High.
14:*									
Eylau	C	None	---	---	2.0-3.0	Perched	Feb-May	Moderate	High.
Urban land.									
15 Ferris	D	None	---	---	>6.0	---	---	High	Low.
16 Gladewater	D	Frequent	Long	Nov-May	0-3.5	Apparent	Nov-May	High	Moderate.
17 Kiomatia	A	Frequent	Brief	Feb-Jun	3.0-5.0	Apparent	Jan-Jul	Low	Low.
18, 19 McKamie	D	None	---	---	>6.0	---	---	High	Moderate.
20 Morse	D	None	---	---	>6.0	---	---	High	Low.
21 Muldrow	D	Rare	---	---	0-2.0	Apparent	Sep-Mar	High	Moderate.
22 Perry	D	Occasional	Brief	Dec-Jun	0-2.0	Apparent	Dec-Apr	High	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Concrete
					Ft				
23---------- Redlake	D	Rare--------	---	Jan-May	>6.0	---	---	High-----	Low.
24---------- Roebuck	D	Frequent----	Long to very long.	Jan-Jul	>6.0	---	---	High-----	Low.
25---------- Rosalie	B	None--------	---	---	3.0-5.0	Perched	Dec-Feb	Low------	High.
26, 27, 28-------- Ruston	B	None--------	---	---	>6.0	---	---	Moderate	Moderate.
29:*									
Ruston----------	B	None--------	---	---	>6.0	---	---	Moderate	Moderate.
Urban land.									
30, 31---------- Sacul	C	None--------	---	---	>6.0	---	---	High-----	Moderate.
32:*									
Sacul----------	C	None--------	---	---	>6.0	---	---	High-----	Moderate.
Urban land.									
33---------- Saffell	B	None--------	---	---	>6.0	---	---	Low------	Moderate.
34:*									
Saffell----------	B	None--------	---	---	>6.0	---	---	Low------	Moderate.
Urban land.									
35---------- Sardis	C	Frequent----	Brief-----	Dec-May	1.0-3.0	Apparent	Jan-May	High-----	Moderate.
36---------- Sawyer	C	None--------	---	---	2.0-3.0	Perched	Dec-Apr	High-----	High.
37:*									
Sawyer----------	C	None--------	---	---	2.0-3.0	Perched	Dec-Apr	High-----	High.
Urban land.									
38, 39---------- Severn	B	Rare--------	---	---	>6.0	---	---	Low------	Low.
40---------- Smithdale	B	None--------	---	---	>6.0	---	---	Low------	Moderate.
41---------- Texark	D	Frequent----	Long------	Dec-Jun	0-2.5	Apparent	Dec-May	High-----	Low.
42---------- Thenas	C	Frequent----	Brief-----	Oct-May	2.0-3.0	Apparent	Nov-May	High-----	Moderate.
43.* Udorthents									
44---------- Vesey	B	None--------	---	---	>6.0	---	---	Moderate	Moderate.
45, 46, 47-------- Woodtell	D	None--------	---	---	1.5-4.0	Apparent	Dec-Feb	High-----	High.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Concrete
					Ft				
48:*									
Wrightsville-----	D	None--------	---	---	0.6-1.5	Perched	Dec-Apr	High-----	High.
Rodessa----------	D	None--------	---	---	2.0-3.0	Apparent	Dec-May	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Adaton	Fine-silty, mixed, thermic Typic Ochraqualfs
Alusa	Fine, montmorillonitic, thermic Typic Albaqualfs
*Amy	Fine-silty, siliceous, thermic Typic Ochraquults
Annona	Fine, montmorillonitic, thermic Vertic Paleudalfs
Ashford	Very-fine, montmorillonitic, thermic Vertic Ochraqualfs
Billyhaw	Very-fine, montmorillonitic, thermic Typic Chromuderts
Blevins	Fine-silty, siliceous, thermic Typic Paleudults
*Bryarly	Fine, montmorillonitic, thermic Vertic Paleudalfs
Dardanelle	Fine-silty, mixed, thermic Typic Argiudolls
Darden	Thermic, coated Typic Quartzipsamments
Eylau	Fine-loamy, siliceous, thermic Fragiaquic Paleudults
*Ferris	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Gladewater	Fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts
Kiomatia	Sandy, mixed, thermic Typic Udifluvents
McKamie	Fine, mixed, thermic Vertic Hapludalfs
*Morse	Fine, mixed, thermic Entic Chromuderts
Muldrow	Fine, mixed, thermic Typic Argiaquolls
Muskogee	Fine-silty, mixed, thermic Aquic Paleudalfs
*Perry	Very-fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts
Redlake	Fine, mixed, thermic Vertic Eutrochrepts
Rodessa	Fine, mixed, thermic Aquic Glossudalfs
*Roebuck	Fine, montmorillonitic, thermic Vertic Hapludolls
Rosalie	Loamy, siliceous, thermic Arenic Paleudults
Ruston	Fine-loamy, siliceous, thermic Typic Paleudults
Sacul	Clayey, mixed, thermic Aquic Hapludults
*Saffell	Loamy-skeletal, siliceous, thermic Typic Hapludults
Sardis	Fine-silty, siliceous, thermic Fluvaquentic Dystrochrepts
Sawyer	Fine-silty, siliceous, thermic Aquic Paleudults
Severn	Coarse-silty, mixed (calcareous), thermic Typic Udifluvents
Smithdale	Fine-loamy, siliceous, thermic Typic Paleudults
Texark	Very-fine, montmorillonitic, thermic Typic Pelluderts
Thenas	Coarse-loamy, mixed, thermic Fluvaquentic Eutrochrepts
Vesey	Fine-loamy, mixed, thermic Glossic Paleudalfs
Woodtell	Fine, montmorillonitic, thermic Vertic Hapludalfs
Wrightsville	Fine, mixed, thermic Typic Glossaqualfs

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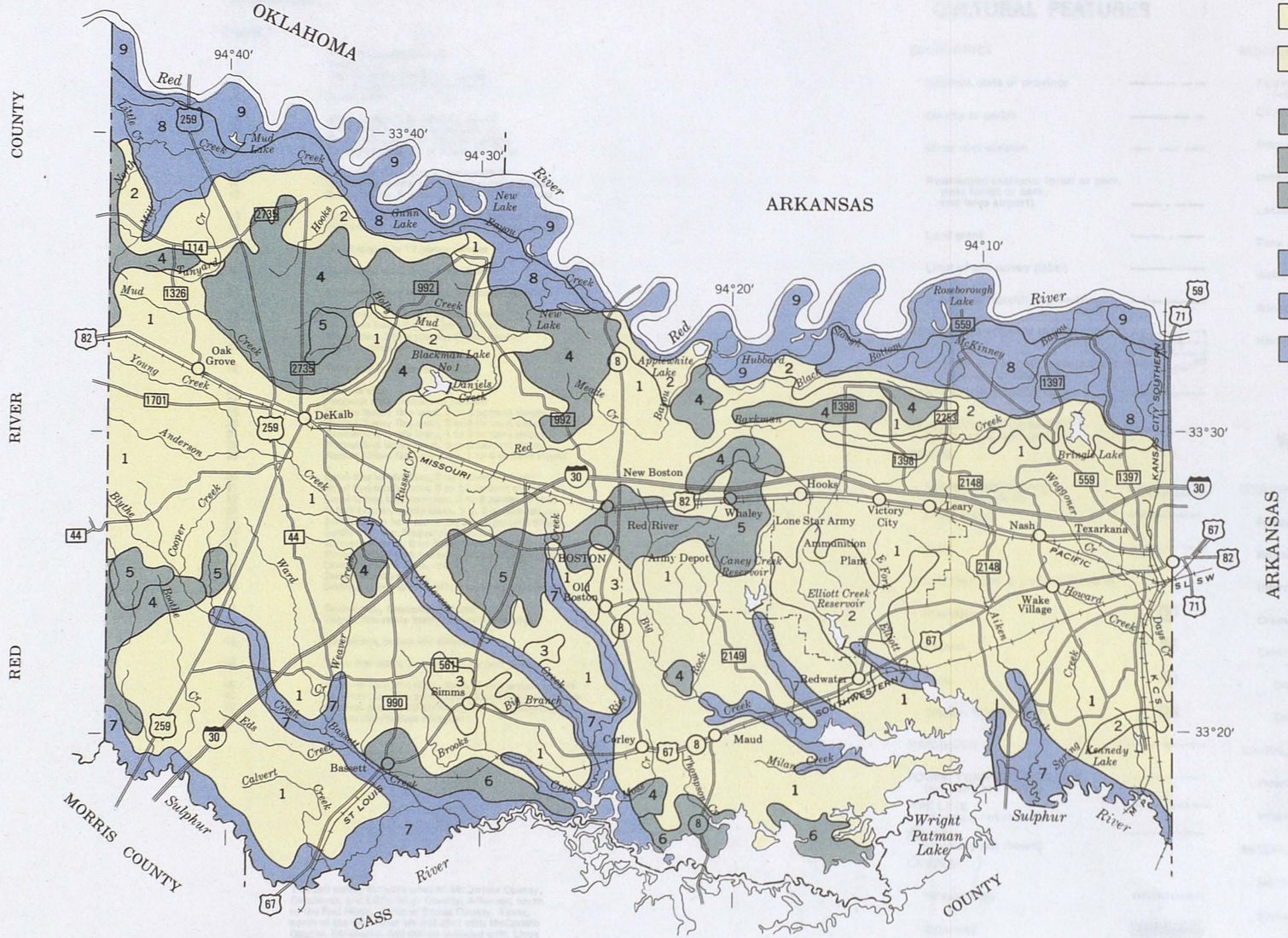


LEGEND

DOMINANTLY GENTLY SLOPING SOILS; ON UPLANDS

1 — Sawyer-Eylau-Woodtell: Moderately well drained, moderately slowly permeable to very slowly permeable loamy soils

2 — Ruston-McKamie: Well drained, moderately permeable to very slowly permeable loamy soils

3 — Rosalie-Darden: Well drained to excessively drained, moderately permeable to rapidly permeable sandy soils

DOMINANTLY NEARLY LEVEL SOILS; ON UPLANDS

4 — Wrightsville: Poorly drained, very slowly permeable loamy soils

5 — Annona-Alusa: Somewhat poorly drained and poorly drained, very slowly permeable loamy soils

6 — Ashford: Poorly drained, very slowly permeable clayey soils

DOMINANTLY NEARLY LEVEL SOILS; ON BOTTOM LAND

7 — Gladewater-Texark: Poorly drained, very slowly permeable clayey soils that are frequently flooded

8 — Billyhaw-Perry: Somewhat poorly drained and poorly drained, very slowly permeable clayey soils that are rarely or occasionally flooded

9 — Severn: Well drained, moderately rapidly permeable loamy soils that are rarely flooded

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.

Compiled 1979

This soil survey includes areas of McCurtain County, Oklahoma, and Little River County, Arkansas, south of the Red River. Areas of Bowie County, Texas, north of the Red River are included with McCurtain County, Oklahoma and will be included with Little River County, Arkansas

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENTAL STATION

GENERAL SOIL MAP

BOWIE COUNTY, TEXAS

N

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km

SOIL LEGEND

The publication map symbols are numeric and the map unit names are in alphabetical order.

SYMBOL	NAME
1	Adaton-Muskogee complex
2	Alusa loam
3	Amy silt loam, frequently flooded
4	Annona loam, 1 to 3 percent slopes
5	Ashford clay
6	Billyhaw clay, 0 to 1 percent slopes
7	Billyhaw clay, 1 to 5 percent slopes
8	Blevins silt loam, 1 to 3 percent slopes
9	Bryarly clay loam, 1 to 5 percent slopes
10	Dardanelle loam, 0 to 1 percent slopes
11	Darden loamy fine sand, 1 to 8 percent slopes
12	Darden loamy fine sand, 8 to 12 percent slopes
13	Eylau very fine sandy loam, 0 to 3 percent slopes
14	Eylau-Urban land complex, 0 to 3 percent slopes
15	Ferris clay, 5 to 12 percent slopes
16	Gladewater clay, frequently flooded
17	Kiomatia loamy fine sand, frequently flooded
18	McKamie loam, 1 to 5 percent slopes
19	McKamie loam, 5 to 12 percent slopes
20	Morse clay, 3 to 8 percent slopes, eroded
21	Muldrow clay loam
22	Perry clay, occasionally flooded
23	Redlake clay
24	Roebuck clay, frequently flooded
25	Rosalie loamy fine sand, 2 to 5 percent slopes
26	Ruston loamy fine sand, 2 to 5 percent slopes
27	Ruston fine sandy loam, 1 to 3 percent slopes
28	Ruston fine sandy loam, 3 to 8 percent slopes
29	Ruston-Urban land complex, 1 to 5 percent slopes
30	Sacul fine sandy loam, 3 to 8 percent slopes
31	Sacul fine sandy loam, 8 to 12 percent slopes
32	Sacul-Urban land complex, 3 to 8 percent slopes
33	Saffell gravelly sandy loam, 3 to 8 percent slopes
34	Saffell-Urban land complex, 3 to 8 percent slopes
35	Sardis silt loam, frequently flooded
36	Sawyer silt loam, 0 to 3 percent slopes
37	Sawyer-Urban land complex, 0 to 3 percent slopes
38	Severn very fine sandy loam
39	Severn silty clay loam
40	Smithdale fine sandy loam, 8 to 12 percent slopes
41	Texark clay, frequently flooded
42	Thenas fine sandy loam, frequently flooded
43	Udorthents, loamy and clayey
44	Vesey fine sandy loam, 1 to 3 percent slopes
45	Woodtell very fine sandy loam, 3 to 5 percent slopes
46	Woodtell very fine sandy loam, 5 to 12 percent slopes
47	Woodtell gravelly sandy loam, 3 to 8 percent slopes
48	Wrightsville-Rodessa complex

This soil survey includes areas of McCurtain County, Oklahoma, and Little River County, Arkansas, south of the Red River. Areas of Bowie County, Texas, north of the Red River are included with McCurtain County, Oklahoma, and will be included with Little River County, Arkansas.

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) — Hedley Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 175
- State — 28
- County, farm or ranch — 1283

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

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 — CnB, WaC2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

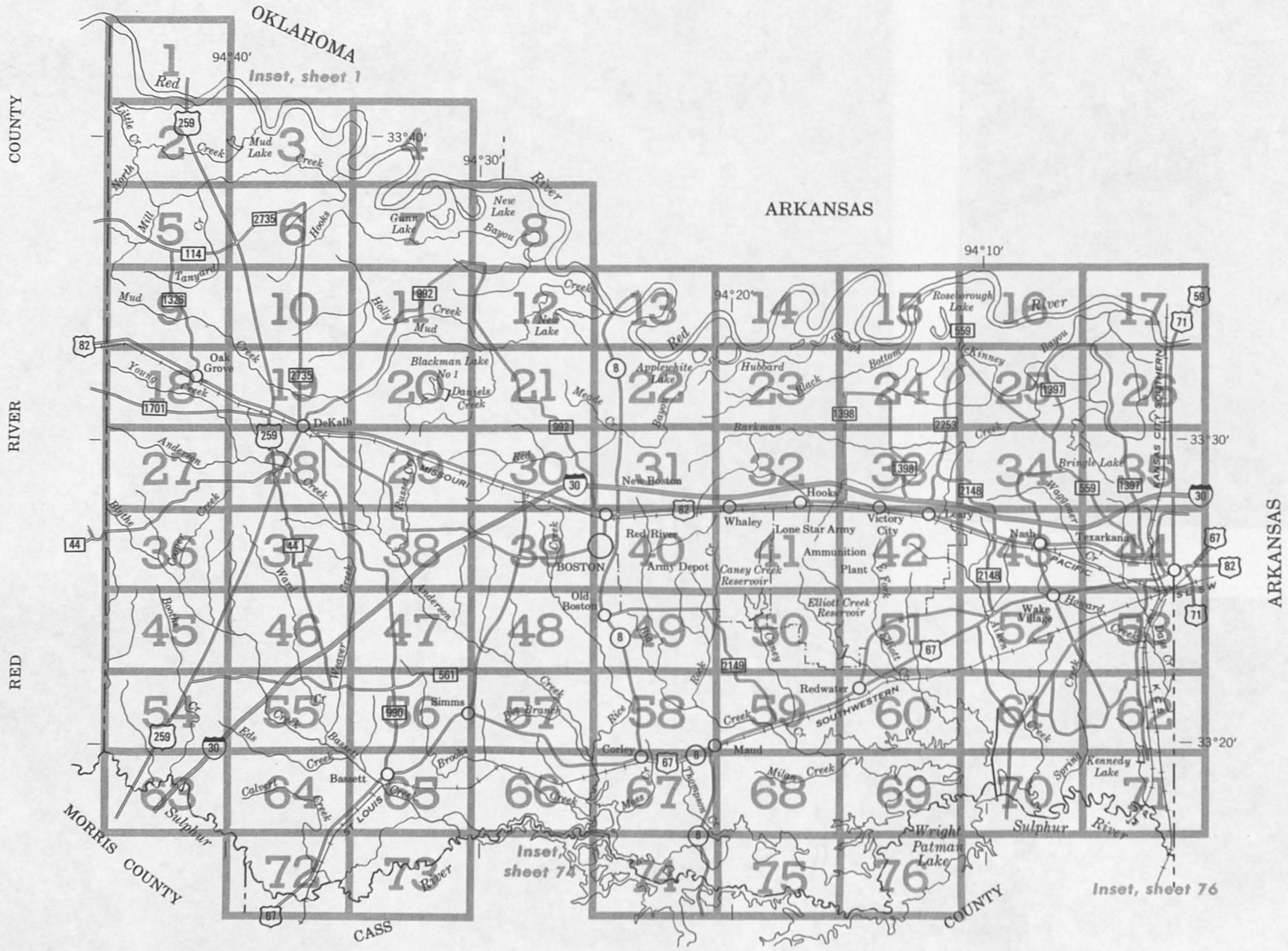
GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

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



N

INDEX TO MAP SHEETS

BOWIE COUNTY, TEXAS

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km

BOWIE COUNTY, TEXAS NO. 1

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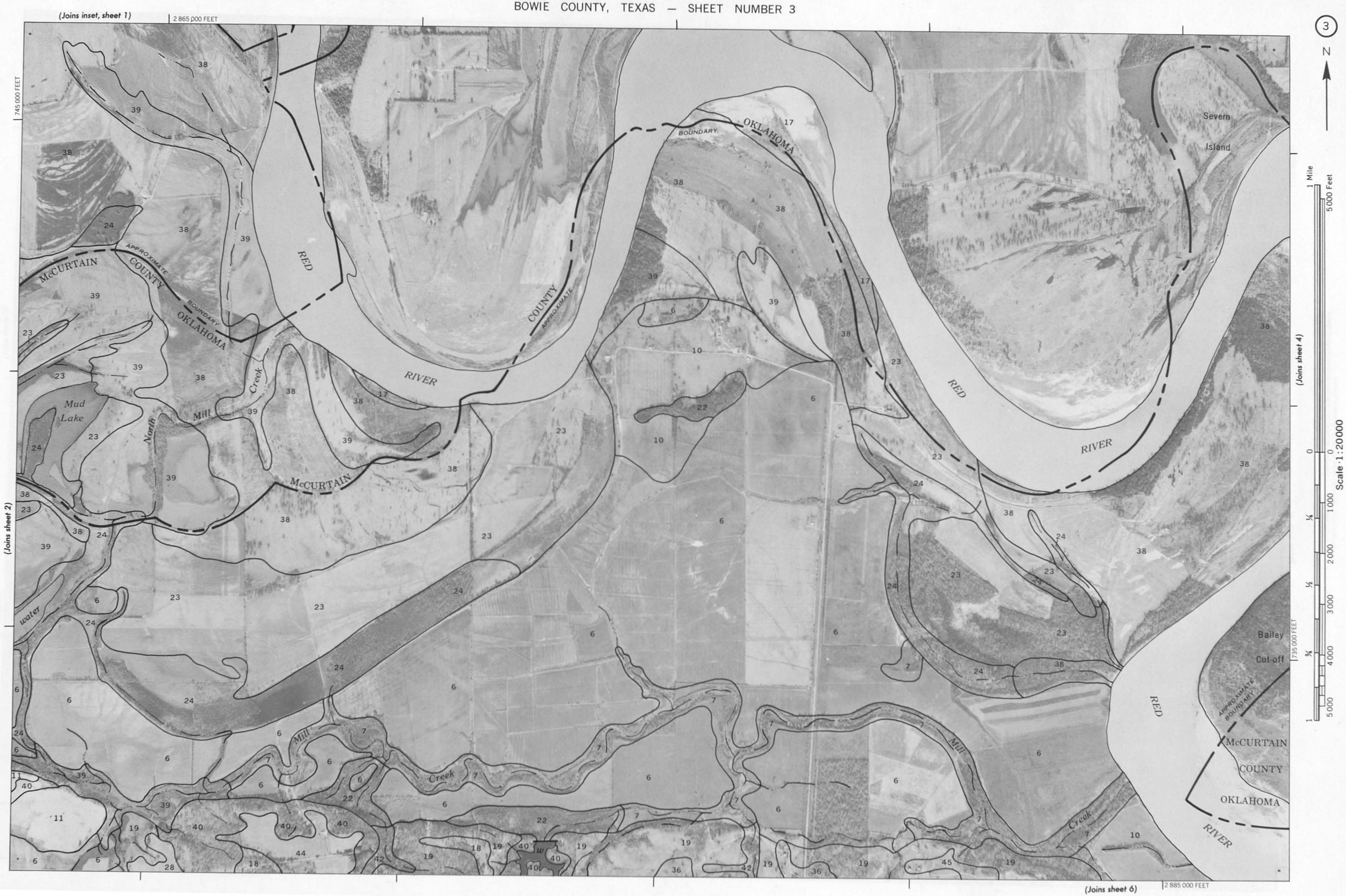

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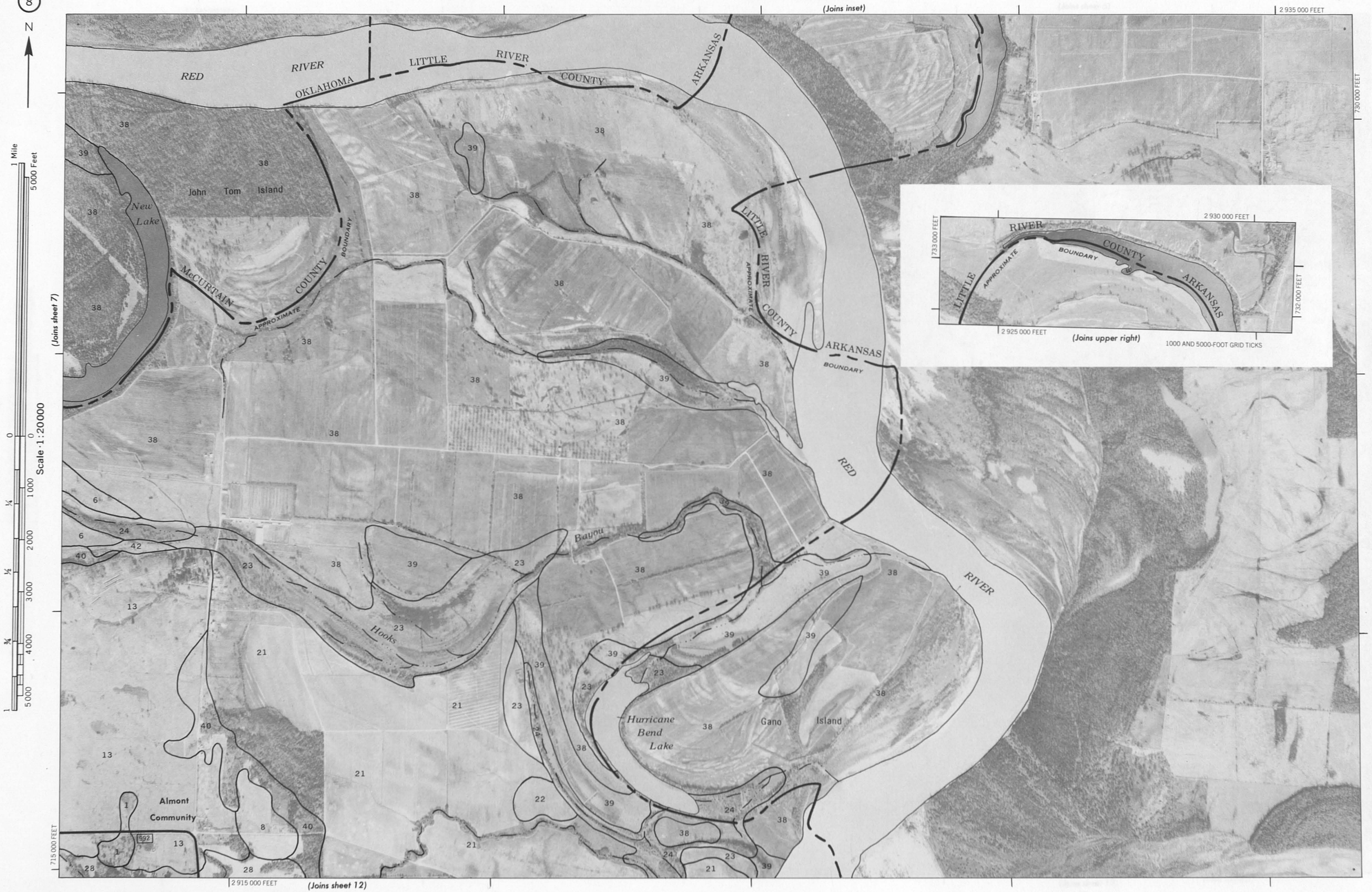
BOWIE COUNTY, TEXAS — SHEET NUMBER 8



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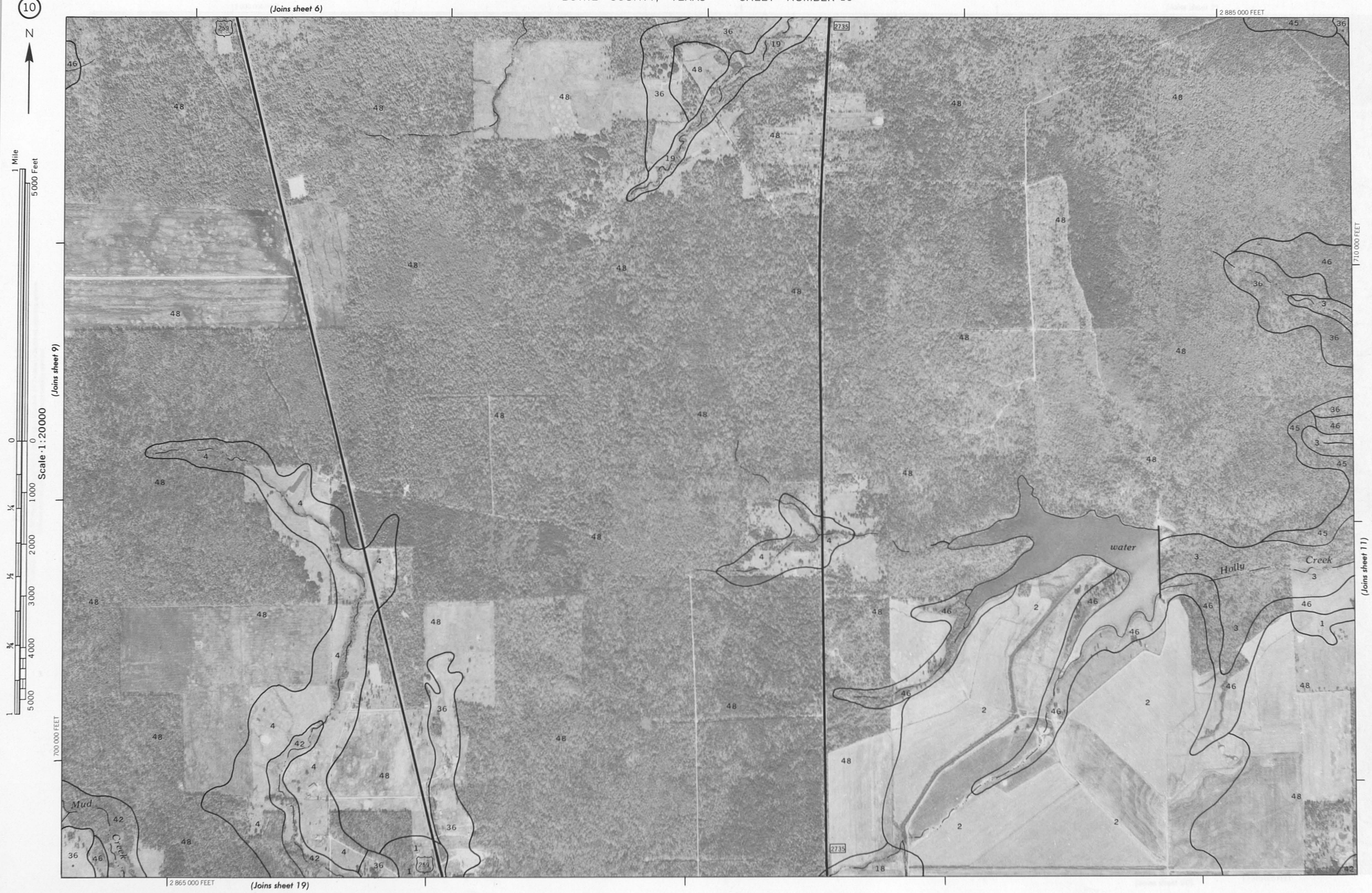

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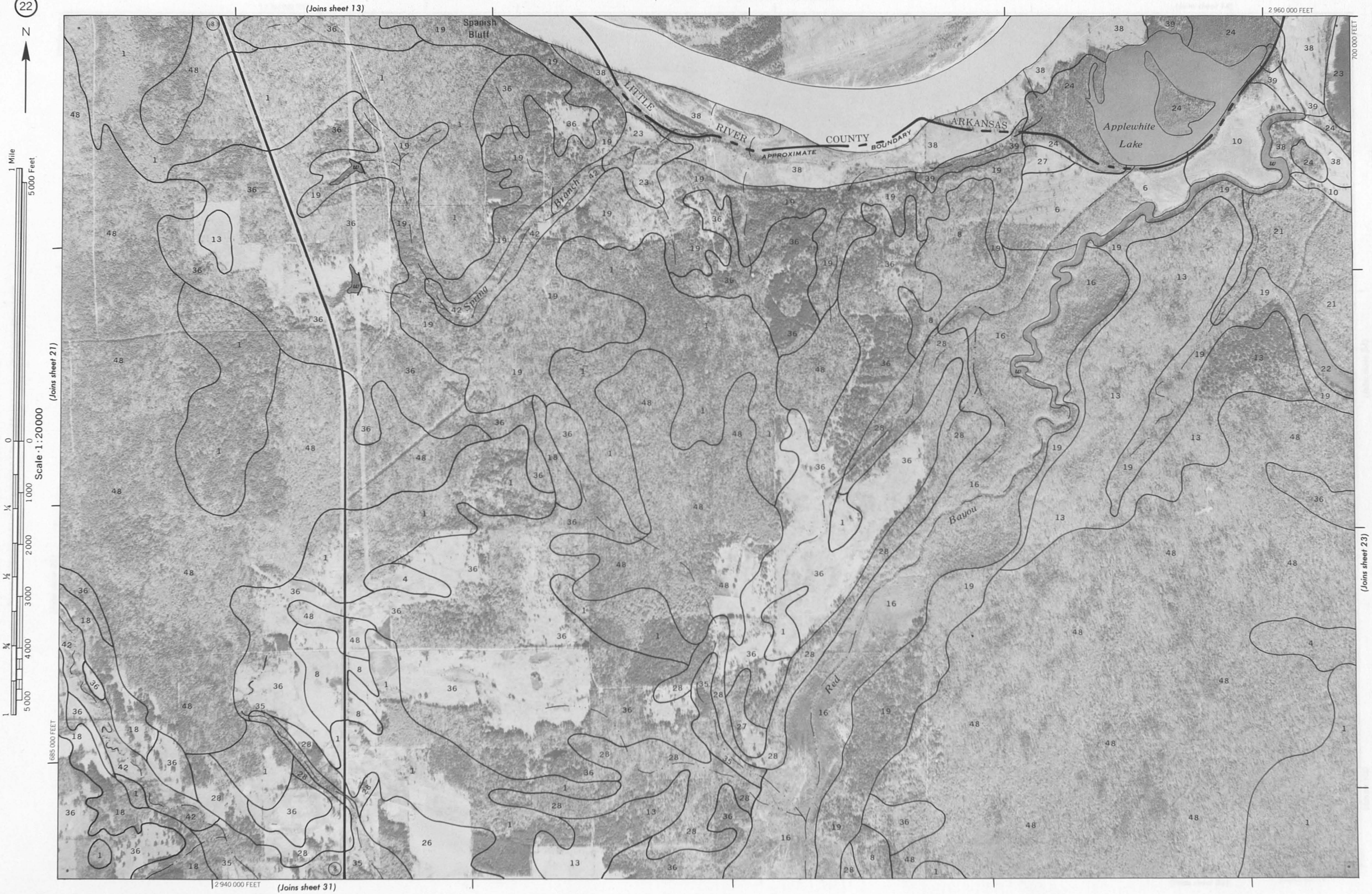
BOWIE COUNTY, TEXAS — SHEET NUMBER 22



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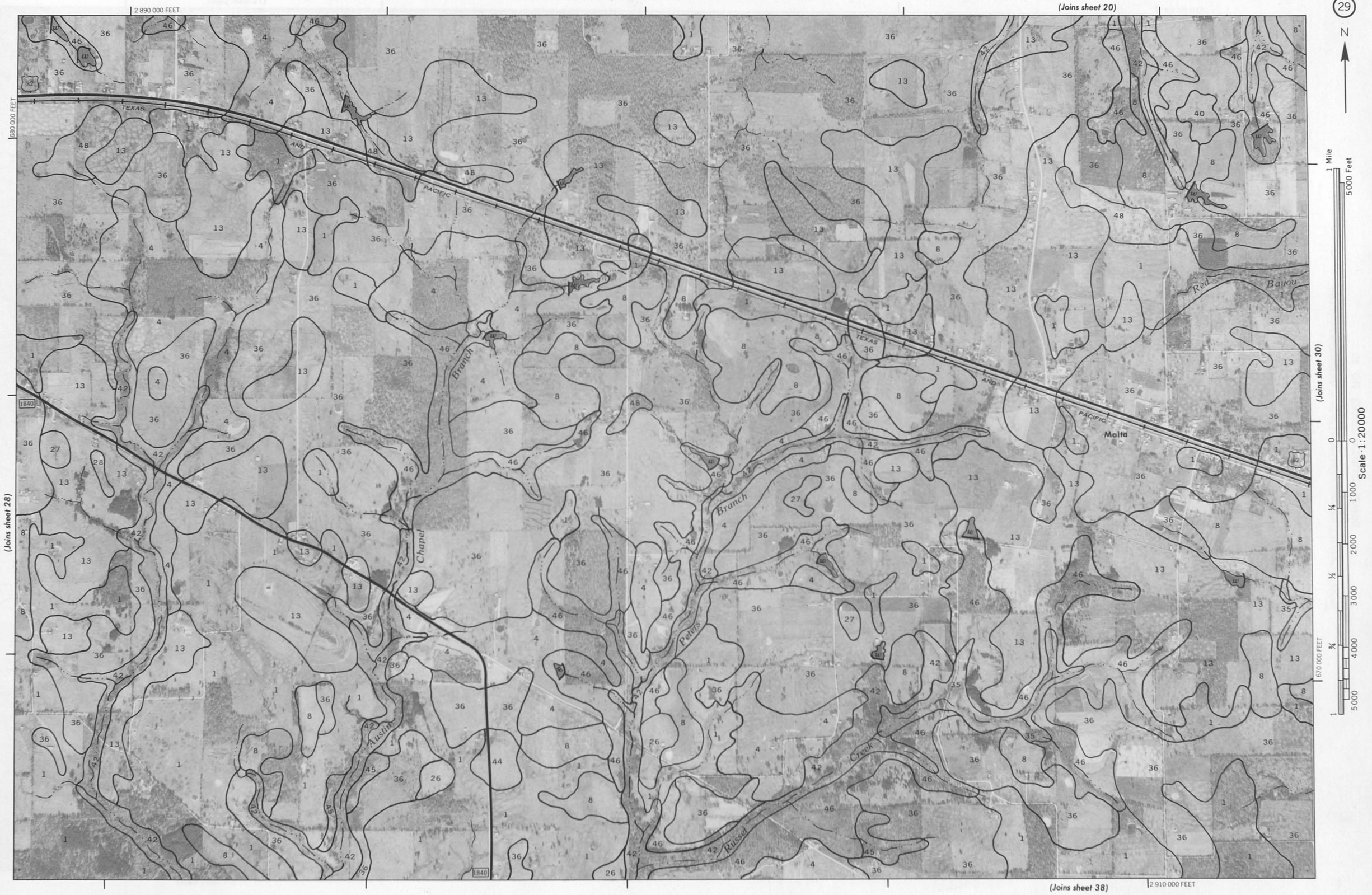

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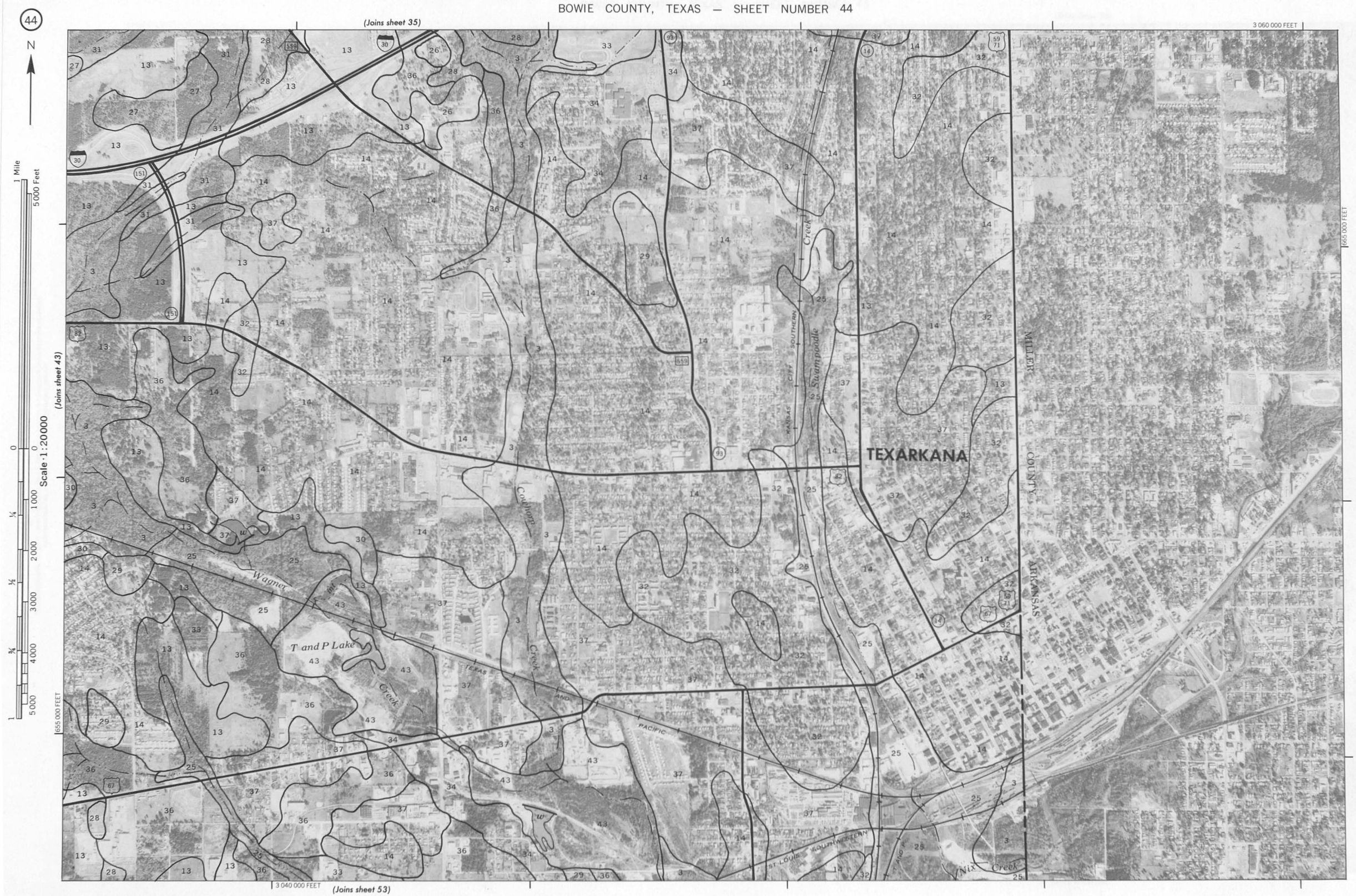

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52

N

(Joins sheet 43)

1 Mile
5000 Feet
Scale 1:20000

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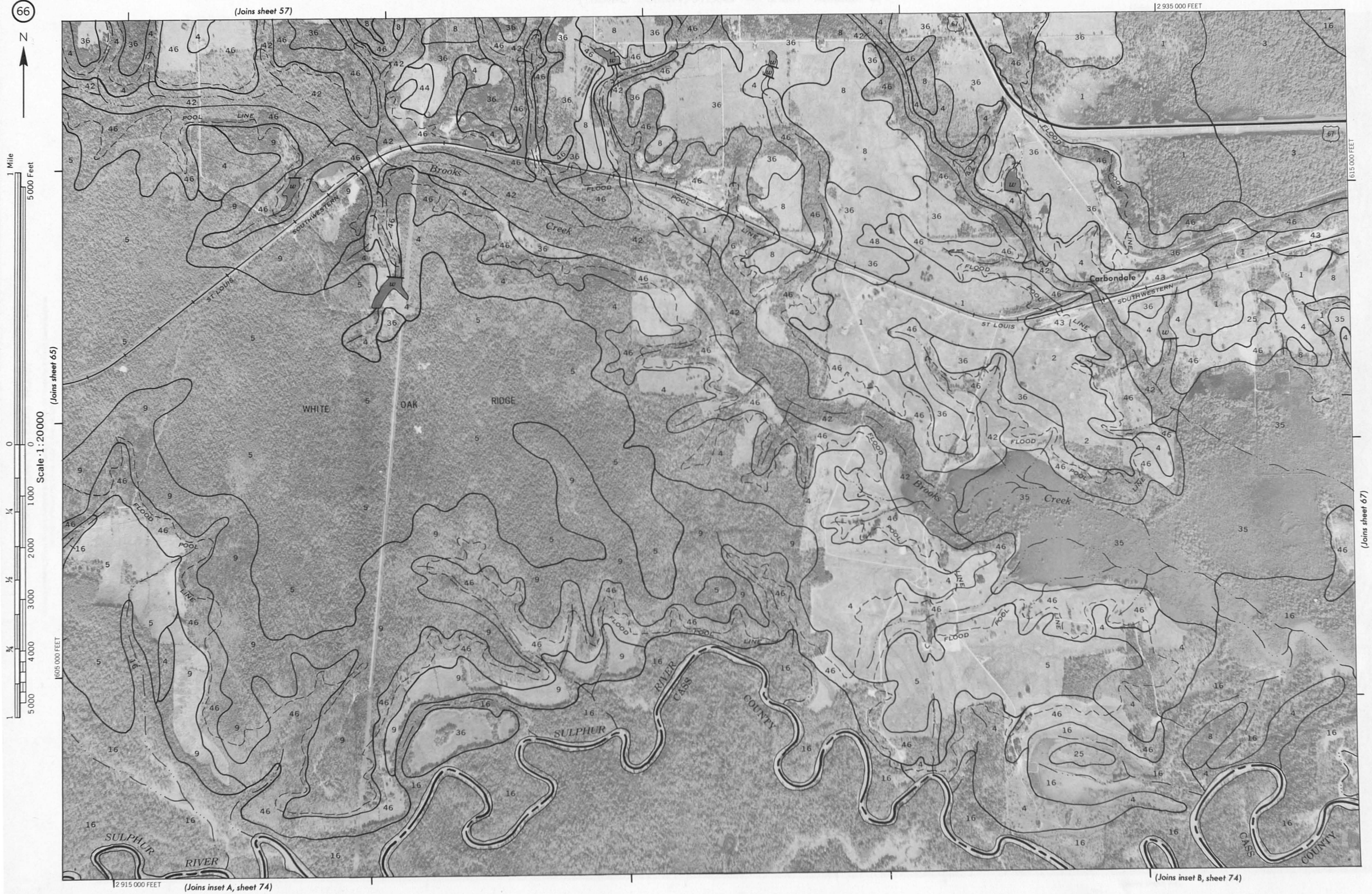

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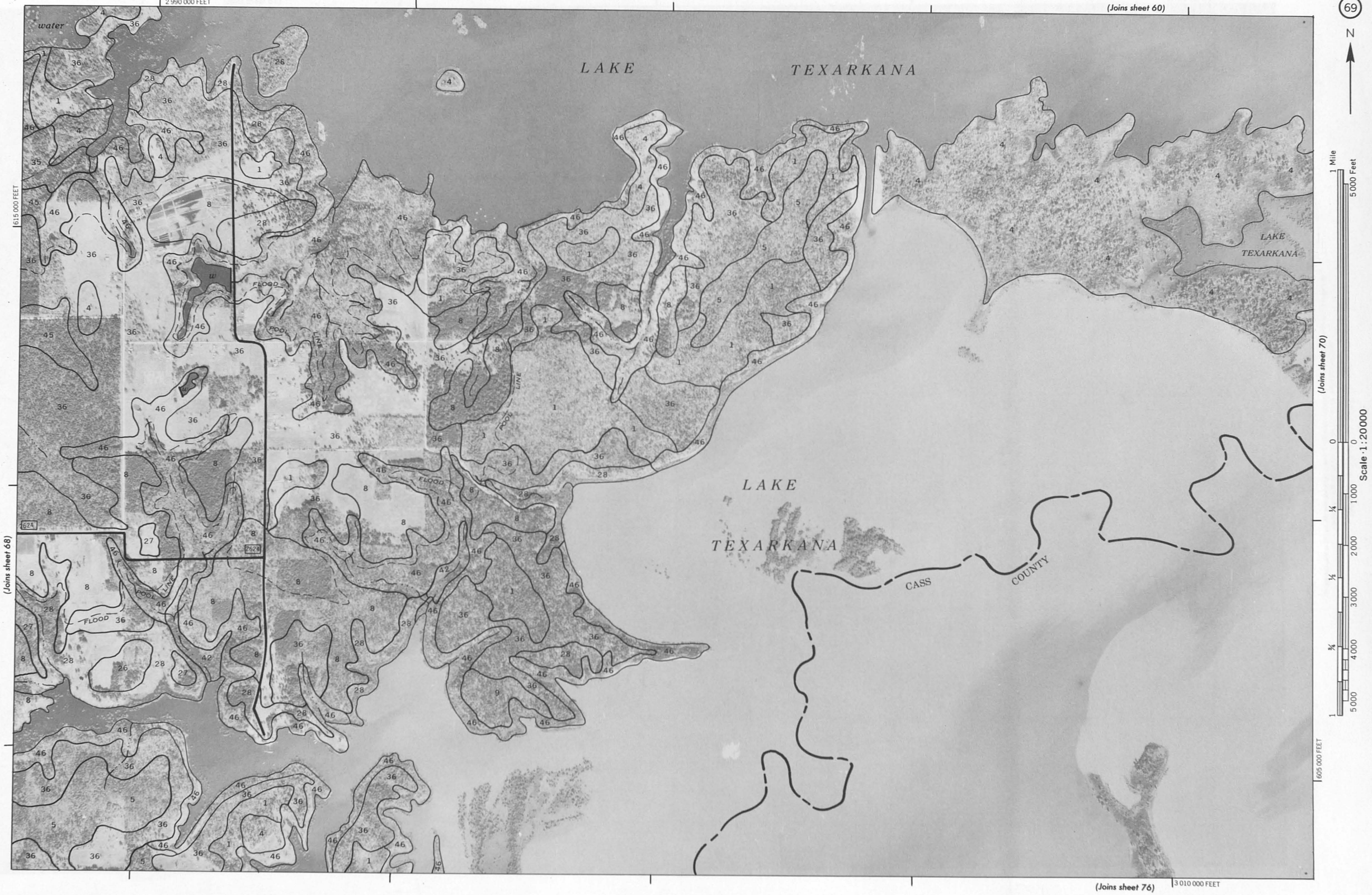

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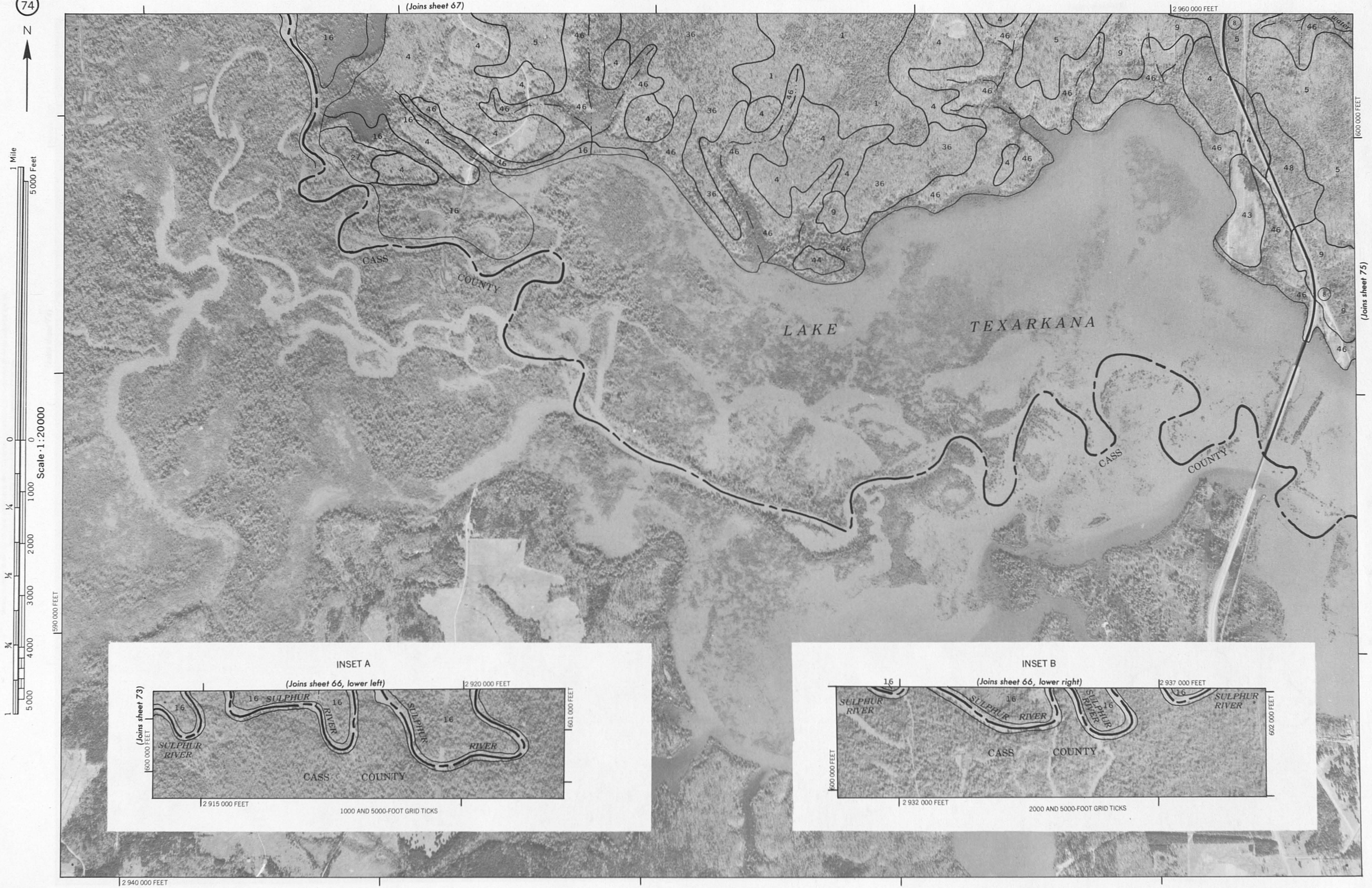

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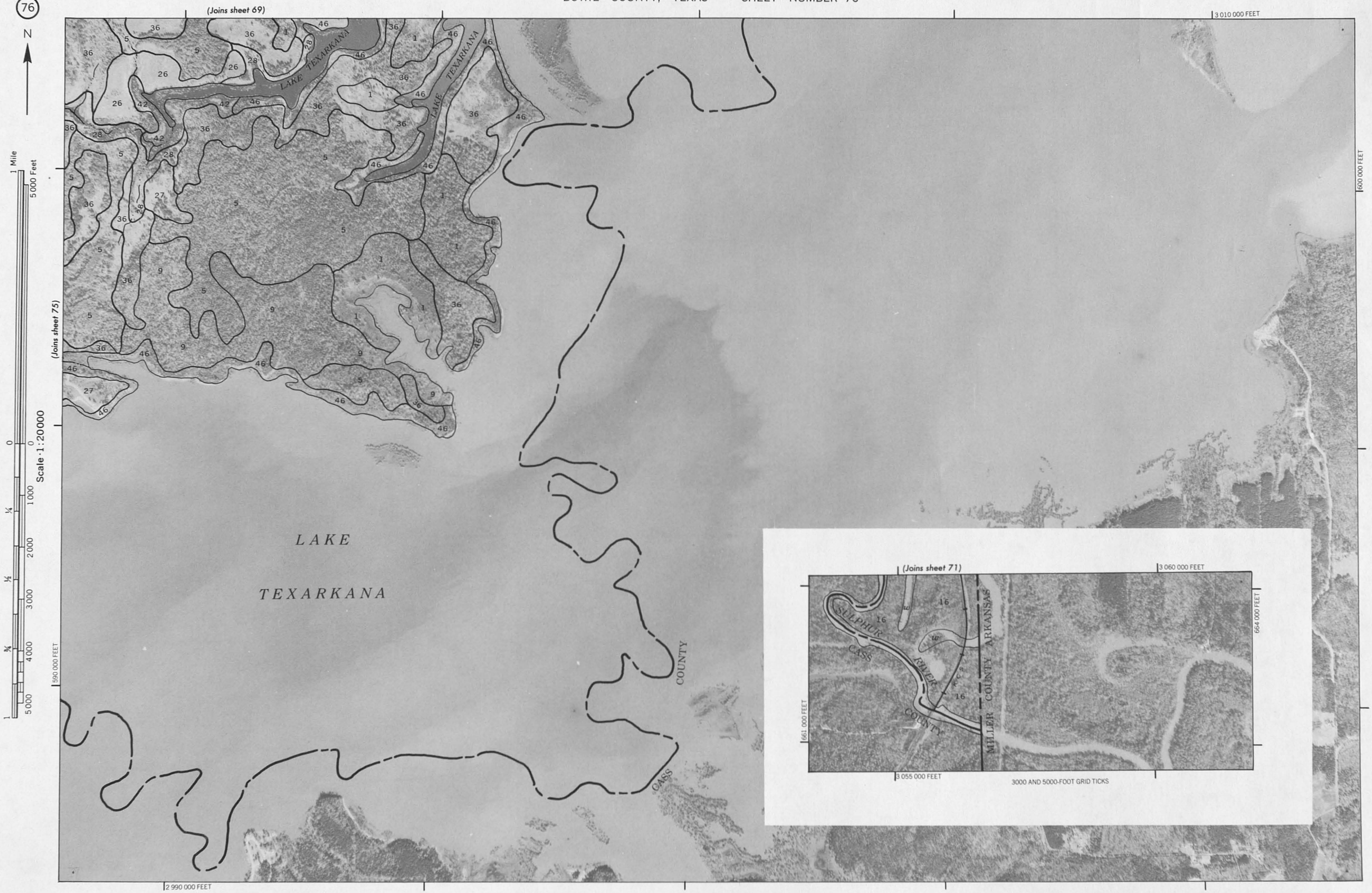

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