United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Texas Agricultural
Experiment Station
and Texas State
Soil and Water
Conservation Board

Soil Survey of Camp, Franklin, Morris, and Titus Counties, Texas

How To Use This Soil Survey

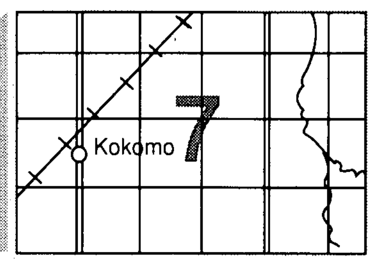
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

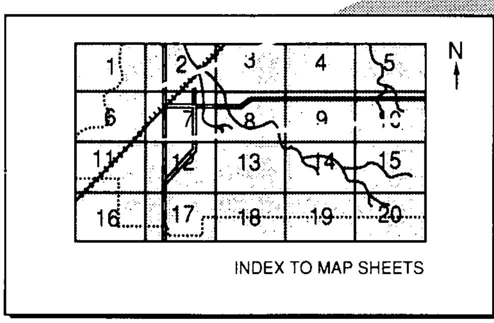
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



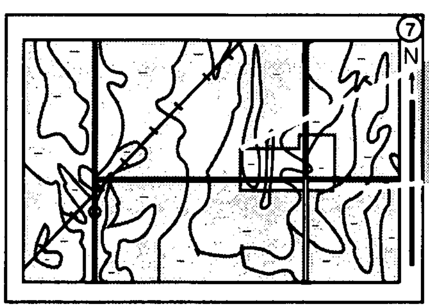
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

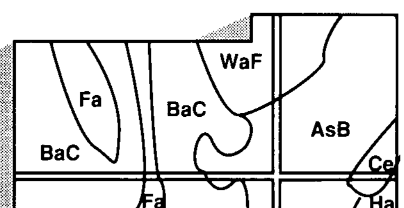


INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

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.

Major fieldwork for this soil survey was completed in 1984. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This soil survey was made cooperatively by the Soil Conservation Service, the Texas Agricultural Experiment Station, and the Texas State Soil and Water Conservation Board. It is part of the technical assistance furnished to the Sulphur-Cypress 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.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: More than half of the acreage in Camp, Franklin, Morris, and Titus Counties is used for pasture or hay. The soil in this area is Bowie fine sandy loam, 2 to 5 percent slopes.

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Soil Series

Issued February 1990

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Summary of Tables

Foreword

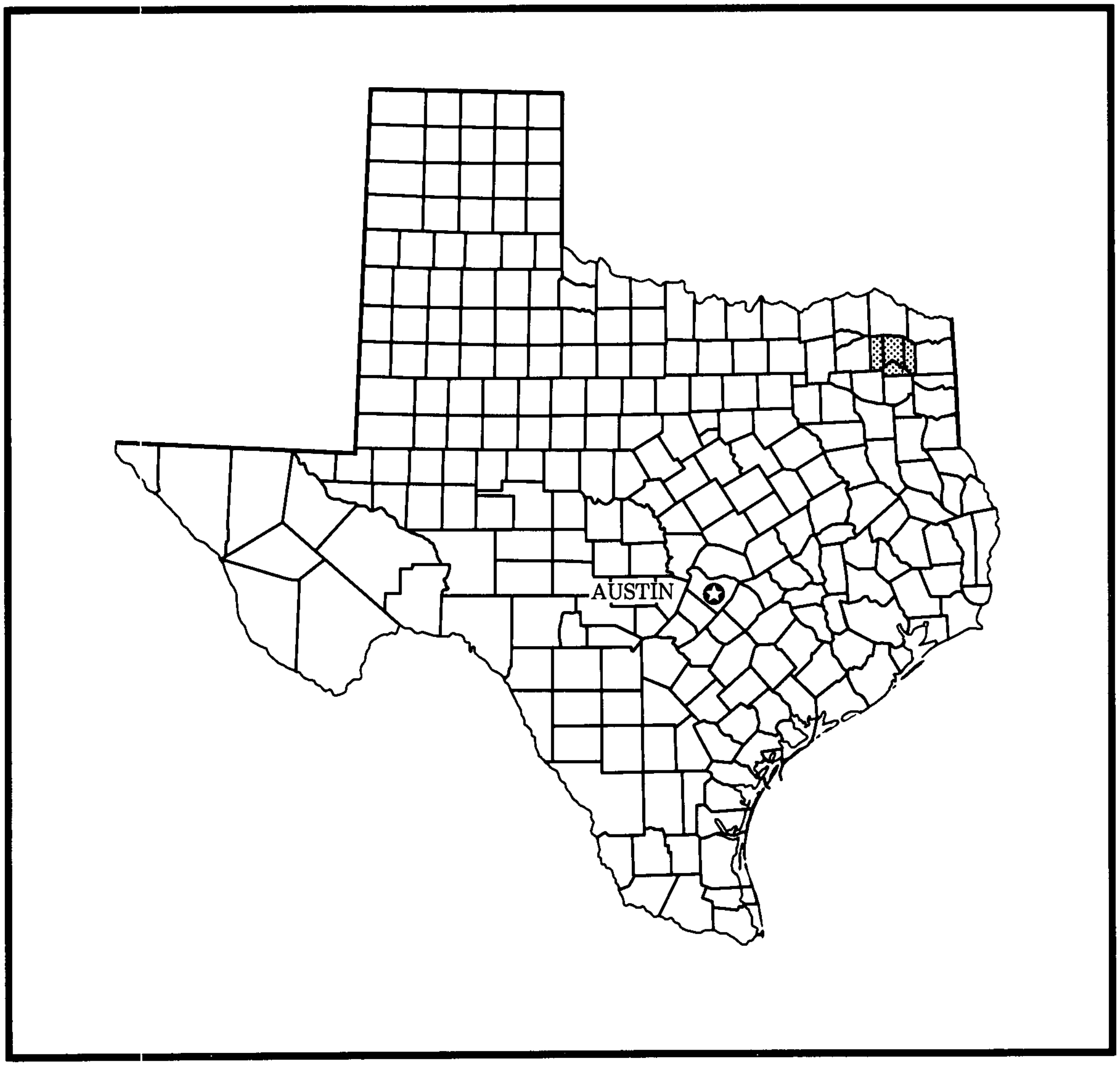
This soil survey contains information that can be used in land-planning programs in Camp, Franklin, Morris, and Titus Counties. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the 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 shallow to bedrock. 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.

Coy A. Garrett
State Conservationist
Soil Conservation Service



Location of Camp, Franklin, Morris, and Titus Counties in Texas.

Soil Survey of Camp, Franklin, Morris, and Titus Counties, Texas

By Kirthell Roberts, Soil Conservation Service

Soils surveyed by James A. Douglass, II, Richard W. Fox,
and Kirthell Roberts, Soil Conservation Service;
and Thomas L. Galloway and Jesse R. Thomas, Jr. (deceased)

United States Department of Agriculture, Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station
and Texas State Soil and Water Conservation Board

CAMP, FRANKLIN, MORRIS, and TITUS COUNTIES are in northeastern Texas. Pittsburg is the county seat of Camp County, Mt. Vernon is the county seat of Franklin County, Daingerfield is the county seat of Morris County, and Mt. Pleasant is the county seat of Titus County. The total area of the four counties is 1,161 square miles, or 757,326 acres. Elevation ranges from about 230 feet above sea level in southeastern Camp County to about 615 feet above sea level in central Morris County.

The topography of the survey area is nearly level to hilly. The drainage pattern is well defined, and many streams dissect the area. The northern parts of Franklin, Morris, and Titus Counties drain into the Sulphur River mainly from White Oak Creek and its tributaries. Most of Camp County and the southern parts of Franklin, Morris, and Titus Counties drain into Lake O' the Pines from Big Cypress Creek and its many tributaries.

Livestock, timber, poultry, and dairy farming are the major agricultural enterprises in the survey area. About 55 percent of the survey area is used as pasture and hayland *(16)*. About 33 percent of the area is used as woodland, and about 4 percent is used for crops of peanuts, sweet potatoes, grain sorghum, wheat, and vegetables. The rest is water areas and urban and built-up land.

The survey area is in the East Texas Timberland Resource Area. The soils in the southern part of the area formed under pine forest vegetation. Those in the central part formed under hardwood forest "post oak savannah" vegetation. The soils in the northern part formed under prairie. The soils are dominantly loamy or sandy, and in unprotected sloping areas, they are subject to water erosion. The soils on flood plains are loamy or clayey. The loamy soils are mostly along creeks, such as Big Cypress and White Oak. The clayey soils are along the Sulphur River.

General Nature of the Survey Area

The settlement and population, agriculture, natural resources, and climate of the survey area are described in this section.

Settlement and Population

Camp County was organized in 1874 from part of Upshur County. It was named in honor of J.L. Camp, former Texas legislator. Franklin and Morris Counties were organized in 1875 from part of Titus County. Franklin County was named in honor of B.C. Franklin, first judge appointed by the Republic of Texas. Morris County was named in honor of William Wright Morris, also a former Texas legislator. Titus County, the oldest county in the survey area, was organized in 1846 from parts of Bowie and Red River Counties. It was named in honor of A.J. Titus, an early settler of the area.

According to the 1980 census, Titus County had a population of 21,442. Mt. Pleasant, the county seat and major city, had a population of 11,003. The population of Morris County was 14,629. Daingerfield, the county seat and major city, had a population of 3,030. Camp County had a population of 9,275. Pittsburg, the county seat and major city, had a population of 4,245. The population of Franklin County was 6,893. Mt. Vernon, the county seat and major city, had a population of 2,025.

Agriculture

Livestock production is the major farming enterprise in the survey area. Pasture and hayland are the largest land use, followed by woodland and cropland. Beef cattle production is mainly cow-calf operations; however, stocker calf operations are increasing. The livestock are mostly pastured in summer and fed hay and supplements in winter. Cool-season grasses are planted for winter grazing in some areas. Most warm-season pastures are coastal bermudagrass, common bermudagrass, and bahiagrass. The pastures also provide hay for winter feeding. Many pastures are overseeded with cool-season legumes of clovers and vetch to improve the soil and provide additional forage.

More than 120 dairy farms are in the survey area, mainly in Camp and Franklin Counties *(11)*. The dairies generally have more than 100 milk cows in each milking herd. Many acres of pasture for grazing and hay are required for dairy production. In addition, some dairymen plant corn or grain sorghum for silage.

The survey area is the center of the northeast Texas poultry and egg producing area (fig. 1). More than 350 poultry and egg producing operations are in the area. The operations consist of broiler, breeder, replacement layers, and egg houses, as well as several poultry and egg processing plants. Annual production exceeds 12 million broilers, fryers, and laying hens. Egg production in the area each year is about 37 million dozen commercial and hatching eggs. Camp County leads the survey area in poultry products. The poultry industry provides many jobs and significant income for people in the area.

Small farmsteads in the survey area produce commercial and truck crops. Peanuts, sweet potatoes, grain sorghum, and wheat are the main commercial crops. Processing plants for peanuts and sweet potatoes are in Morris County. The major truck crops are peas, corn, and watermelons; however, cucumbers and tomatoes are also grown. Most of the crops are not irrigated.

The timber industry also aids the local economy. Commercial timber production is mainly in the southern or "pine belt" part of the survey area. Camp County and the southernmost parts of Franklin, Morris, and Titus Counties produce pine and hardwood timber for pulpwood, sawlogs, posts, and poles. The woodland in the northern part is mainly hardwoods. The timber from this area is used for crossties and specialty products, such as tool handles and brooms. Pine plantations have been planted in idle fields to increase future timber yields.

Natural Resources

The most important resource in Camp, Franklin, Morris, and Titus Counties is the soil. The production of food and fiber are sources of livelihood for many people.

Titus and Franklin Counties are the center of the lignite coal mining area of northeast Texas. Each day many tons of coal are mined from open pits. The coal is converted into energy for the production of electricity at a nearby hydroelectric plant (fig. 2). This industry provides many jobs in mining, reclamation, transportation, and generating plant operations.

Iron ore mining has been of major importance in the survey area for many years. Iron ore from the ironstone-enriched hills of the southeast part of Morris County is used for steel production in the Lone Star area of the county. Gravel for construction is also mined from gravelly iron ore hills. The mining of iron ore and gravel greatly impacts the local economy in jobs and income for the area.

Oil and gas are also produced in the survey area. About 6 small oil fields are in the area. The largest is the Talco Oil Field in northern Franklin and Titus Counties. The New Hope and Trix-Liz Oil Fields are also in these counties. In Camp County, the Pittsburg, Newsome, and Piston Mill Oil Fields have produced oil and gas for over 30 years. Even though these fields are small, they are still sources of income for many landowners. Oil and gas exploration, drilling, and servicing provide many jobs in each county.

Water for fish and wildlife is plentiful in the survey area. Lake Bob Sandlin, Lake Cypress Springs, Lake O' the Pines, Lake Monticello, Lake Welch, Sulphur River, Big Cypress and White Oak Creeks, and numerous small lakes, ponds, and creeks provide abundant water for agriculture, industry, recreation, and domestic uses. The fish and wildlife provide income and recreation for the landowners.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Camp, Franklin, Morris, and Titus Counties have 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 thunderstorms, is adequate for all crops.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Mt. Pleasant in the period 1950 to 1981. 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.

Figure 1.—Poultry houses, bermudagrass meadows, and pine-hardwood timber are common in the survey area. The soil is Freestone fine sandy loam, 1 to 3 percent slopes.

In winter the average temperature is 44 degrees F, and the average daily minimum temperature is 32 degrees. The lowest temperature on record, which occurred at Mt. Pleasant on February 2, 1951, is 12 degrees below zero. In summer the average temperature is 81 degrees, and the average daily maximum temperature is 93 degrees. The highest recorded temperature, which occurred at Mt. Pleasant on August 31, 1954, is 109 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 45.68 inches. Of this, 24 inches, or 53 percent, usually falls in April through September. The growing season for most crops falls within this period. 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 5.4 inches at Mt. Pleasant on September 22, 1957. Thunderstorms occur on about 44 days each year, and most occur in summer.

The average seasonal snowfall is 2 inches. The greatest snow depth at any one time during the period of record was 5 inches. On an average of 1 day, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible in summer and 55 percent in winter.

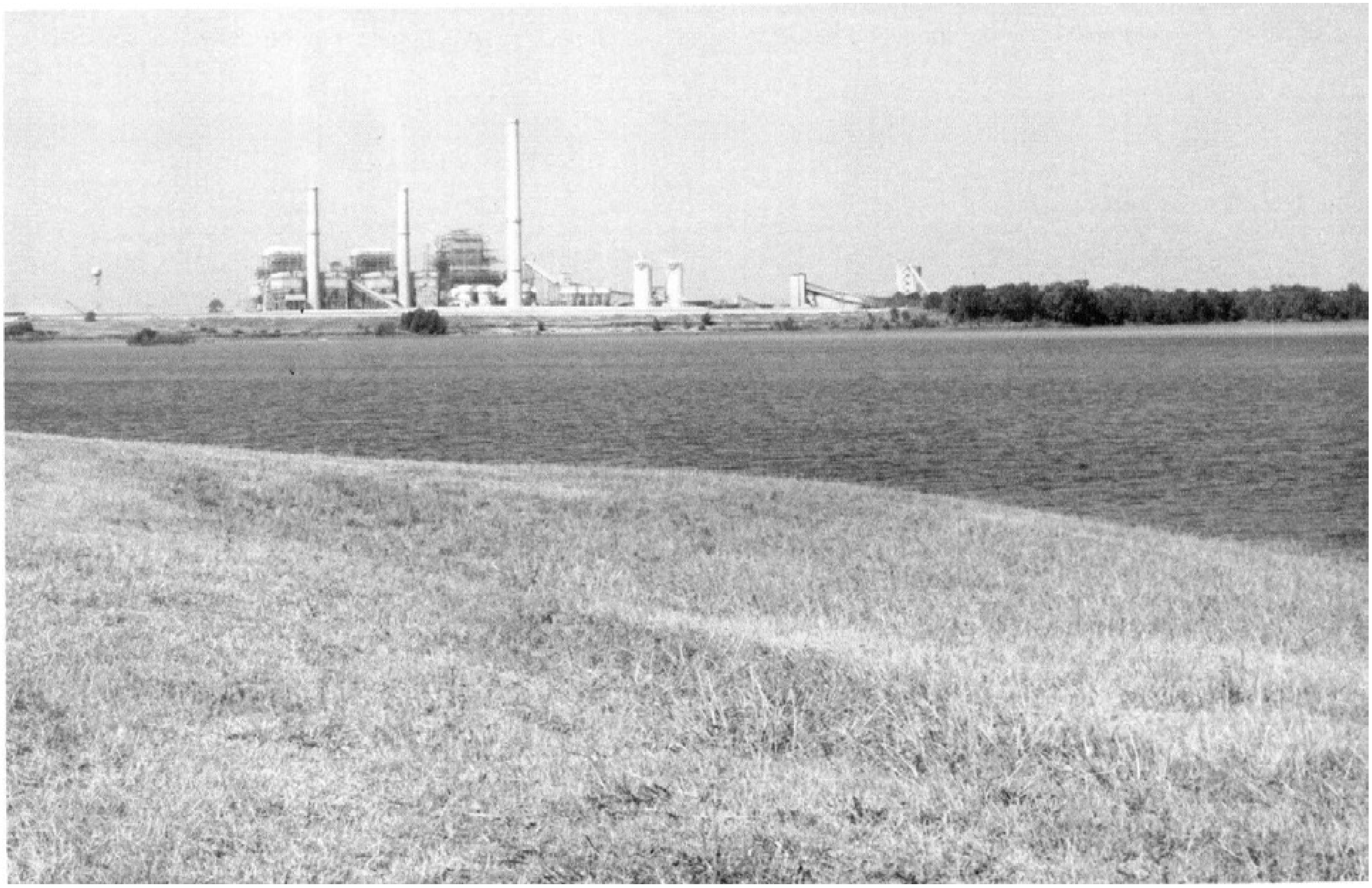


Figure 2.—The cooling lake at this lignite-burning hydroelectric plant is used for fishing and other recreation. The soil is Woodtell fine sandy loam, 2 to 5 percent slopes.

The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in spring.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material from which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area are generally collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. In the detailed soil map units, these latter soils are called inclusions or included soils. In the general soil map units, they are called soils of minor extent.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed, and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

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 a 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.

Twelve general soil map units are in this survey area. These units make up 97 percent of the total acreage. The rest is water.

Sandy and Loamy Soils; on Savannahs

The map units of this group make up about 37 percent of the survey area. The major soils are in the Derly, Freestone, Pickton, Raino, Talco, Wolfpen, and Woodtell series. These soils are nearly level to moderately steep. Permeability is moderate to very slow.

Native vegetation is mainly mixed hardwoods and grasses with a few scattered pine. Most of the soils are used as pasture or woodland. Improved bermudagrass, common bermudagrass, and bahiagrass are the dominant pasture plants. Woodland is mainly oak, elm, gum, hickory, and a few scattered pine. In some areas, these soils are used for peanuts, sweet potatoes, grain sorghum, and corn.

These soils are suited to most urban and recreational uses; however, slope, shrinking and swelling, and wetness are limiting features.

1. Woodtell-Freestone

Gently sloping to moderately steep, moderately well drained, loamy soils

This map unit is made up of Woodtell soils on ridgetops and side slopes adjacent to streams and Freestone soils on stream divides, foot slopes, and at the head of drainageways (fig. 3). The Woodtell soils are gently sloping to moderately steep and are very slowly permeable. The Freestone soils are gently sloping and slowly permeable. Slopes are 1 to 20 percent.

This map unit makes up about 24 percent of the survey area. It is about 52 percent Woodtell soils, 29 percent Freestone soils, and 19 percent soils of minor extent.

Typically, the Woodtell soils have a dark brown fine sandy loam surface layer about 3 inches thick. The subsurface layer is dark yellowish brown fine sandy loam to a depth of 6 inches. The subsoil to a depth of 55 inches is clay that grades to clay loam in the lower part. It is red to a depth of 26 inches yellowish brown to a depth of 38 inches, and light gray and light brownish gray below that. The substratum is stratified light gray shale and strong brown sandy clay loam. These soils are medium acid in the upper part, very strongly acid in the middle part, and strongly acid in the lower part.

Typically, the Freestone soils have a dark brown fine sandy loam surface layer about 5 inches thick. The subsurface layer is yellowish brown loam to a depth of 11 inches. The subsoil to a depth of 27 inches is yellowish brown loam and clay loam that has mottles in shades of gray and red. To a depth of 73 inches, the subsoil is mottled grayish brown, red, and yellowish brown clay that grades to light brownish gray in the lower part. The subsoil has streaks and pockets of light brownish gray clean sand and silt. The substratum to a depth of 85 inches is stratified light brownish gray shale and yellowish brown sandy clay loam. It has strong brown mottles. These soils are medium acid or slightly acid in the upper part, very strongly acid in the middle part, and medium acid in the lower part.

Of minor extent in this map unit are Bernaldo, Bowie, Estes, Grayrock, Nahatche, Raino, and Wolfpen soils. The Bernaldo, Bowie, Estes, Grayrock, Nahatche, and Raino soils are loamy, and the Wolfpen soils are sandy. The Bernaldo and Bowie soils are on gentle side slopes, and the Estes and Nahatche soils are on flood plains of streams. The Grayrock soils are reclaimed mine spoil material. The Raino soils are on mounds, and the Wolfpen soils are on convex ridgetops and side slopes.

The soils of this map unit are used mainly as pasture and woodland, but in some areas they are used for cultivated crops. Erosion is a severe hazard in much of the map unit area.

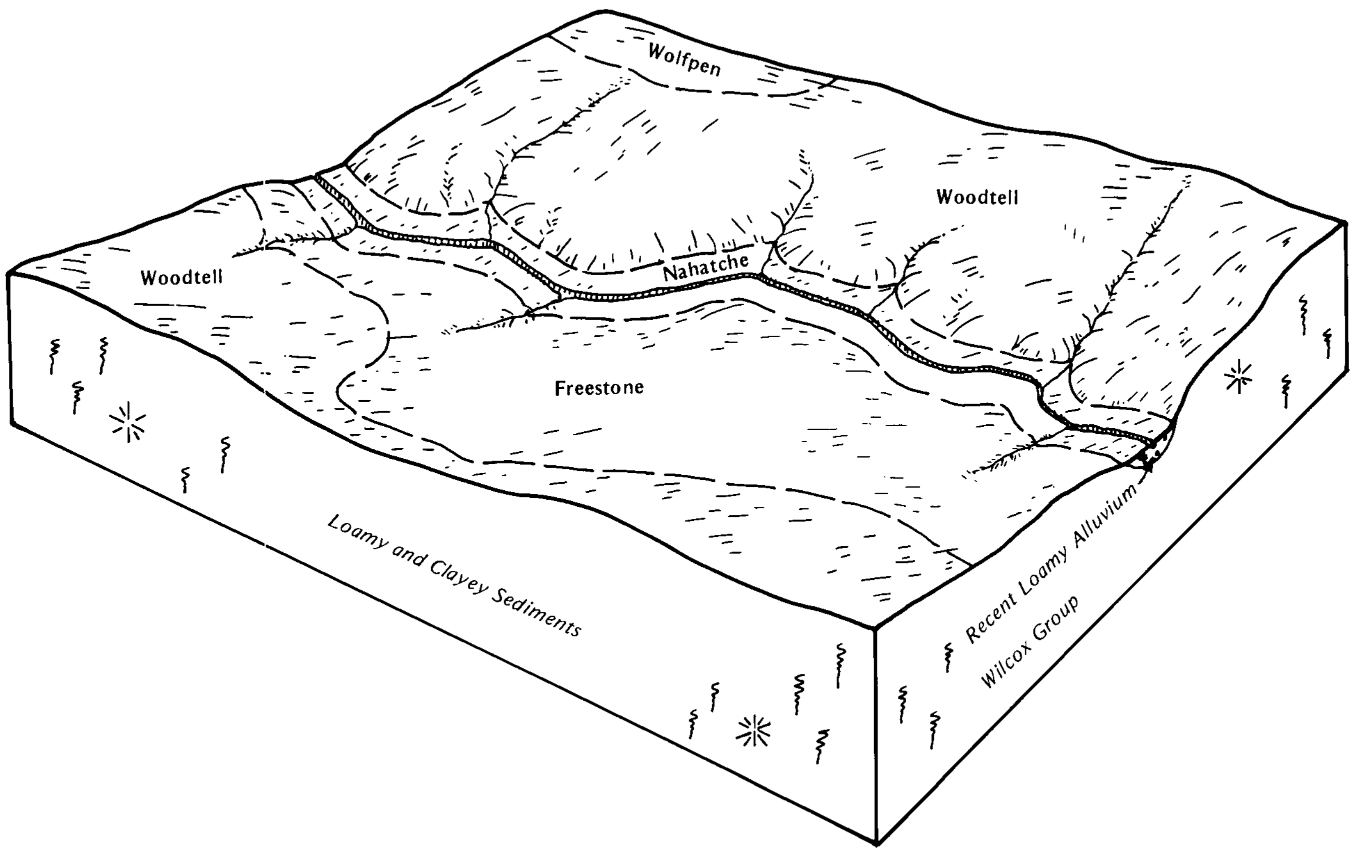


Figure 3.—Pattern of soils and underlying material in the Woodtell-Freestone map unit.

Coastal bermudagrass, common bermudagrass, and bahiagrass are the major pasture plants. Legumes, such as crimson clover, arrowleaf clover, and vetch, are used to increase forage. Cool-season wheat, ryegrass, and oats are planted for additional grazing. Fertilizer and lime are needed for high yields.

Mixed hardwoods are dominant in woodland areas of these soils. A few scattered areas have shortleaf pine, and some idle fields have been planted to loblolly pine or slash pine. Slope and seasonal wetness are the main limiting features for woodland use.

The main crops are peanuts, sweet potatoes, corn, and vegetable crops. Fertilizer and lime are essential for high yields. Contour farming, terraces, and cover crops help control erosion.

These soils are suited to most urban uses; however, very slow permeability, shrinking and swelling, and slope are limitations for sanitary facilities, dwellings, and streets.

2. Derly-Raino-Talco

Nearly level, poorly drained to moderately well drained, loamy soils

This map unit is made up of Derly and Talco soils in low, wet depressions and Raino soils on low, oval mounds (fig. 4). Derly soils are poorly drained, and Raino soils are moderately well drained. These soils are very slowly permeable. Talco soils are somewhat poorly drained and slowly permeable. Slopes are 0 to 1 percent.

This map unit makes up about 9 percent of the survey area. It is about 34 percent Derly soils, 19 percent Raino soils, 11 percent Talco soils, and 36 percent soils of minor extent.

Typically, the Derly soils have a brown silt loam surface layer 7 inches thick. The subsurface layer is light brownish gray silt loam to a depth of 14 inches. The subsoil to a depth of 26 inches is light brownish gray silty clay loam. To a depth of 80 inches, it is grayish brown and light brownish gray clay. Tongues of light gray clean

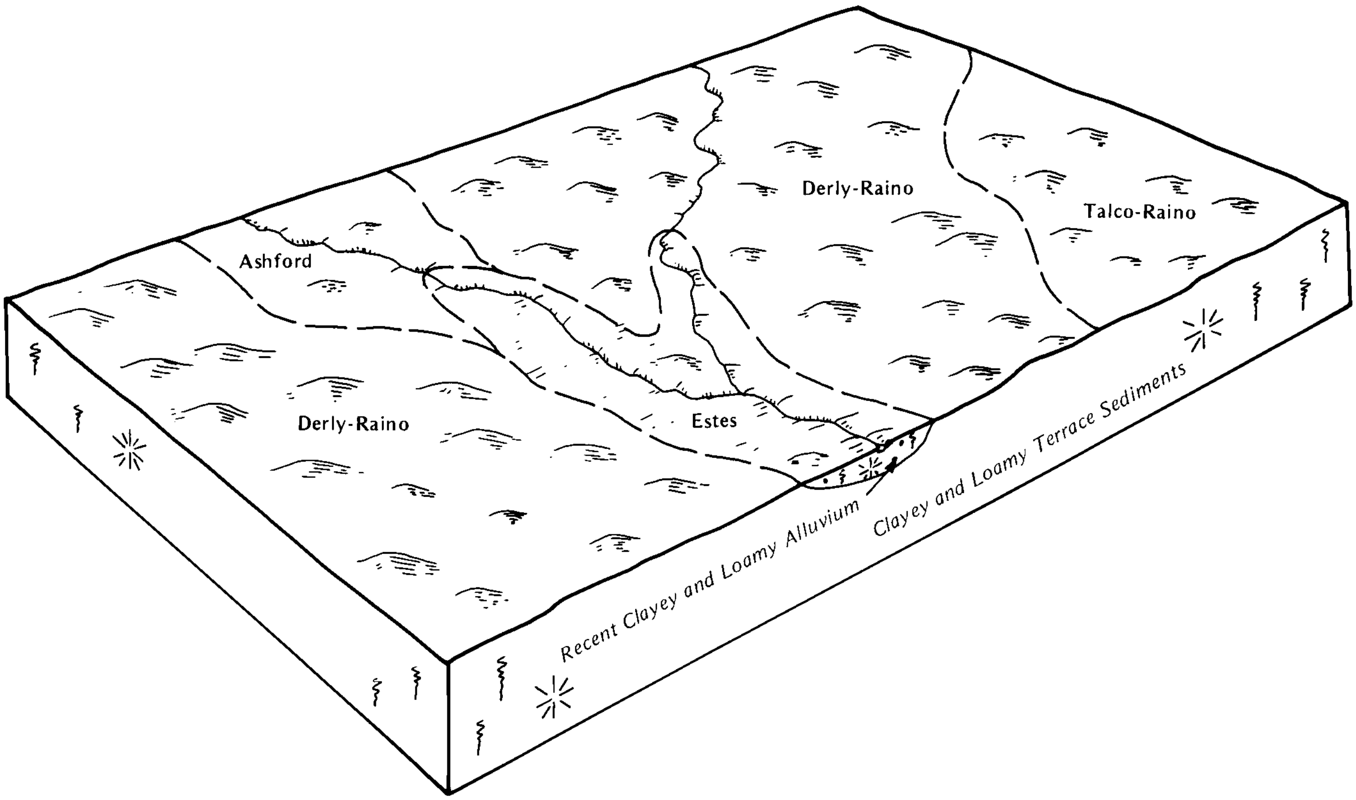


Figure 4.—Pattern of soils and underlying material in the Derly-Raino-Talco map unit.

sand and silt are throughout the subsoil. These soils are strongly acid in the upper part and very strongly acid grading to neutral in the lower part.

Typically, the Raino soils have a dark yellowish brown loam surface layer about 6 inches thick. The next layer to a depth of 21 inches is yellowish brown loam. The subsoil extends to a depth of at least 78 inches. To a depth of 35 inches, it is yellowish brown loam that has light brownish gray mottles. To a depth of 45 inches, the subsoil is mottled gray, strong brown, and yellowish red clay. Pockets of clean sand and silt are between depths of 21 and 45 inches. The subsoil is mottled yellowish red, gray, and strong brown clay to a depth of 65 inches, and mottled light brownish gray, brownish yellow, strong brown, and yellowish red clay loam below that. These soils are medium acid in the upper part and strongly acid or very strongly acid in the lower part.

Typically, the Talco soils have a grayish brown silt loam surface layer 3 inches thick. The subsurface layer is mottled pale brown, light brownish gray, and yellowish brown silt loam to a depth of 8 inches. The subsoil extends to a depth of at least 80 inches. To a depth of 13 inches, it is brownish yellow silt loam that has mottles in shades of gray. To a depth of 35 inches, the subsoil is light brownish gray silt loam that has mottles in shades of yellow and brown. It has 5 to 20 percent, by volume, streaks and pockets of clean sand and silt between depths of 8 and 35 inches. The subsoil is gray silty clay and grayish brown and light brownish gray clay loam below that. These soils are neutral in the upper part and strongly acid or very strongly acid in the lower part.

Of minor extent in this map unit are Ashford, Besner, Crockett, Freestone, Woodtell, Estes, and Nahatche soils. The Ashford soils are clayey and are on low, wet terraces. The Besner, Crockett, Freestone, and Woodtell soils are on higher, more convex landscapes than the major soils, and the Estes and Nahatche soils are on flood plains of streams. These soils are loamy.

The soils of this map unit are mainly used as woodland. In a few small areas, they are used as pasture or cropland.

Willow oak, water oak, post oak, red oak, sweetgum, and elm are the major trees in woodland areas. Because of wetness, management of these soils for production and harvesting of timber is difficult.

Pastures are commonly bahiagrass, common bermudagrass, and tall fescuegrass. Overseeding pastures with white clover or singletary peas increases forage production. Some areas are planted to cool-season wheat, ryegrass, and oats for added grazing. Fertilizer, lime, and surface drainage increase yields.

Wetness limits the use of these soils for cultivated crops; however, small areas are planted to wheat and grain sorghum. Drainage, fertilizer, and lime increase yields.

The soils of this map unit are poorly suited to most urban uses. Wetness, very slow permeability, and shrinking and swelling are the main limiting features for septic tank absorption fields, sewage lagoons, streets, and dwellings.

3. Wolfpen-Pickton

Gently sloping to moderately steep, well drained, sandy soils

This map unit is made up of Wolfpen soils on stream divides and convex ridges and Pickton soils on high ridgetops and side slopes above streams (fig. 5). Wolfpen soils are gently sloping, and Pickton soils are gently sloping to moderately steep. These soils are moderately permeable. Slopes are 2 to 15 percent.

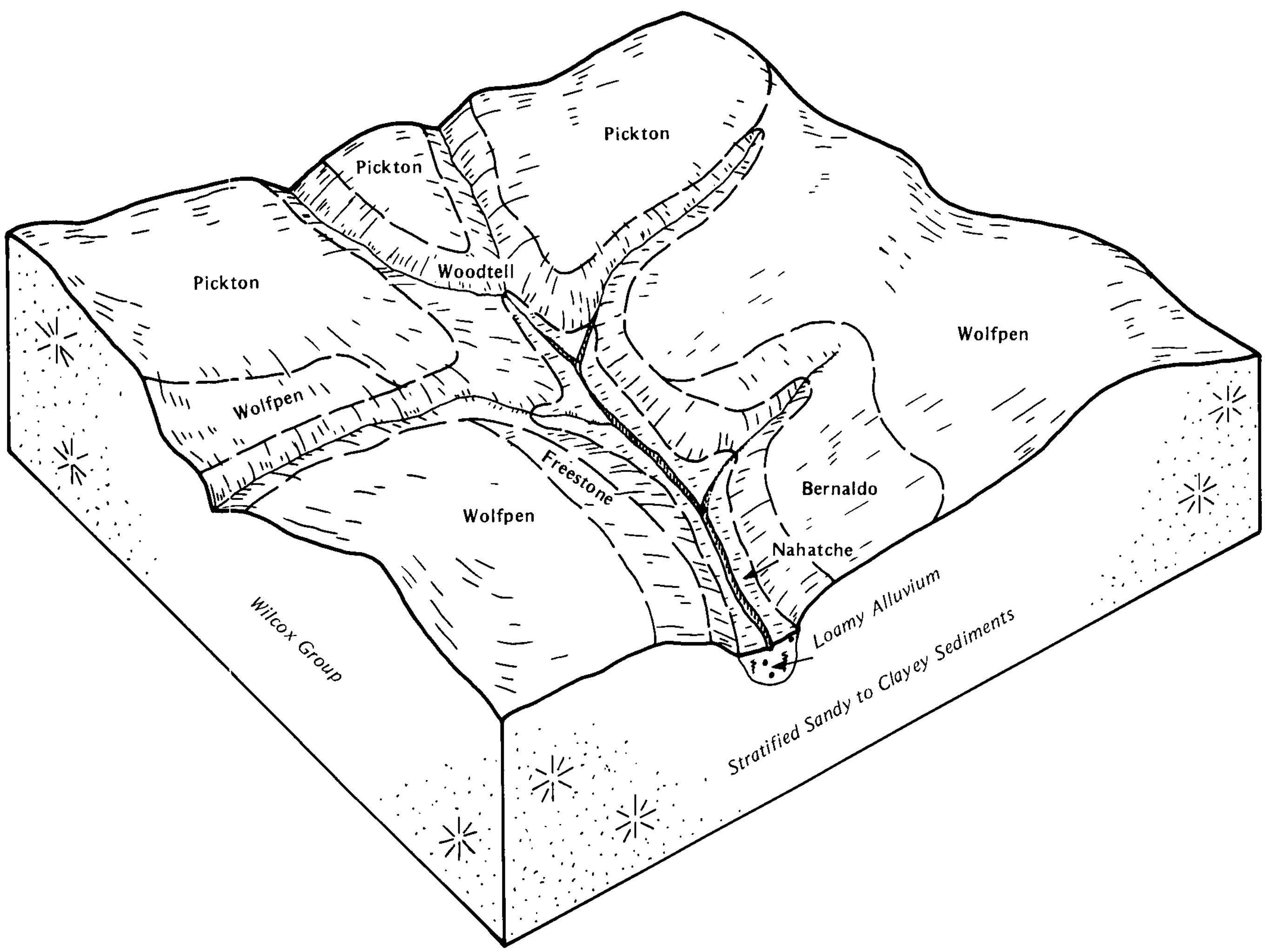


Figure 5.—Pattern of soils in the Wolfpen-Pickton map unit.

This map unit makes up about 4 percent of the survey area. It is about 38 percent Wolfpen soils, 27 percent Pickton soils, and 35 percent soils of minor extent.

Typically, the Wolfpen soils have a dark brown loamy fine sand surface layer about 11 inches thick. The next layer to a depth of 25 inches is yellowish brown fine sand. The subsoil is sandy clay loam to a depth of at least 80 inches. To a depth of 56 inches, it is yellowish brown with mottles in shades of red, gray, and brown. Below that, it is mottled in shades of red, gray, and brown. These soils are slightly acid in the upper part, medium acid in the middle part, and very strongly acid in the lower part.

Typically, the Pickton soils have a dark brown fine sand surface layer about 11 inches thick. The subsurface layer to a depth of 48 inches is yellowish brown over light yellowish brown fine sand. The subsoil to a depth of at least 80 inches is sandy clay loam. The upper part is strong brown with mottles in shades of red, and the lower part is yellowish red with mottles in shades of gray and brown. These soils are slightly acid in the upper part and grade to very strongly acid in the lower part.

Of minor extent in this map unit are Bernaldo, Duffern, Freestone, Nahatche, and Woodtell soils. The Bernaldo, Freestone, and Woodtell soils are loamy and are on side slopes and ridgetops. The Duffern soils are sandy and are on plane stream divides and convex side slopes. The Nahatche soils are loamy and are on flood plains.

The soils of this map unit are mainly used as pasture. In some areas, they are used as woodland or cropland.

Pasture grasses, such as coastal bermudagrass, common bermudagrass, bahiagrass, and lovegrass, are dominant warm-season varieties. Legumes, such as crimson clover, arrowleaf clover, and hairy vetch, are often overseeded to pastures for increased forage and fertility. Ryegrass and wheat provide winter grazing. Droughtiness is a limitation for pasture forage production. Fertilizer and lime increase yields.

Mixed hardwoods and scattered pine make up most woodland areas. Pine trees are sparse except where fields have been planted to loblolly or slash pines. Droughtiness limits the growth of trees and decreases the survival rate of seedlings.

The main crops are peanuts, sweet potatoes, and watermelons. Seasonal droughtiness is the main limitation for cultivated crops. Fertilizer and lime are needed for high yields. Cover and residue crops reduce erosion and help to maintain organic matter.

The soils in this map unit are suited to most urban uses; however, wetness and seepage are problems for sanitary facilities.

Sandy and Loamy Soils; in Timberland

The map units of this group make up about 33 percent of the survey area. The major soils are in the Bowie, Cuthbert, Darco, Kirvin, Kullit, Lilbert, Redsprings, and Sacul series (fig. 6). These soils are gently sloping to steep and moderately permeable to slowly permeable.

Native vegetation is mainly pine and hardwoods. Most of the soils are used as woodland or pasture. Loblolly pine and shortleaf pine are dominant trees in most woodland areas. Bermudagrass and bahiagrass are the common pasture plants. In some areas, these soils are used for sweet potatoes, truck crops, or orchards.

These soils are suited to most urban and recreational uses; however, slope is a limiting feature.

4. Bowie-Cuthbert-Kirvin

Gently sloping to steep, moderately well drained and well drained, loamy soils

This map unit is made up of Bowie soils on stream divides and in concave areas along small drainageways, Cuthbert soils on side slopes adjacent to streams or on flood plains, and Kirvin soils on low, oval hills or convex ridgetops in higher positions than the Bowie soils. Bowie soils are gently sloping and moderately well drained. Cuthbert and Kirvin soils are well drained. Cuthbert soils are moderately sloping to steep, and Kirvin soils are gently sloping and moderately sloping. The soils of this map unit are moderately slowly permeable. This map unit has a well-defined drainage pattern among low hills and ridges. Slopes are 2 to 25 percent.

This map unit makes up about 21 percent of the survey area. It is about 37 percent Bowie soils, 28 percent Cuthbert soils, 17 percent Kirvin soils, and 18 percent soils of minor extent.

Typically, the Bowie soils have a dark brown fine sandy loam surface layer about 4 inches thick. The subsurface layer is yellowish brown fine sandy loam to a depth of 11 inches. The subsoil to a depth of at least 75 inches is sandy clay loam. It is yellowish brown and brownish yellow with red mottles to a depth of 38 inches and brownish yellow with red mottles to a depth of 58 inches. Below that, it is mottled light gray, brownish yellow, and yellowish red. Streaks of clean sand and 5 to 10 percent nodular plinthite are below a depth of 38 inches. These soils are strongly acid or medium acid in the upper part and very strongly acid or strongly acid in the lower part.

Typically, the Cuthbert soils have a dark brown fine sandy loam surface layer about 4 inches thick. The subsurface layer is brown fine sandy loam to a depth of about 9 inches. The subsoil to a depth of 22 inches is yellowish red clay. The next layer to a depth of 32 inches is yellowish red and strong brown clay loam that has a few shale fragments. The substratum to a depth of 60 inches is light gray and dark grayish brown shale and yellowish brown and light gray sandstone. Thin strata of interbedded ironstone is throughout this layer. These soils are medium acid or strongly acid in the upper part and very strongly acid in the lower part.

Typically, the Kirvin soils have a dark brown very fine sandy loam surface layer about 5 inches thick. The subsurface layer is brown very fine sandy loam to a

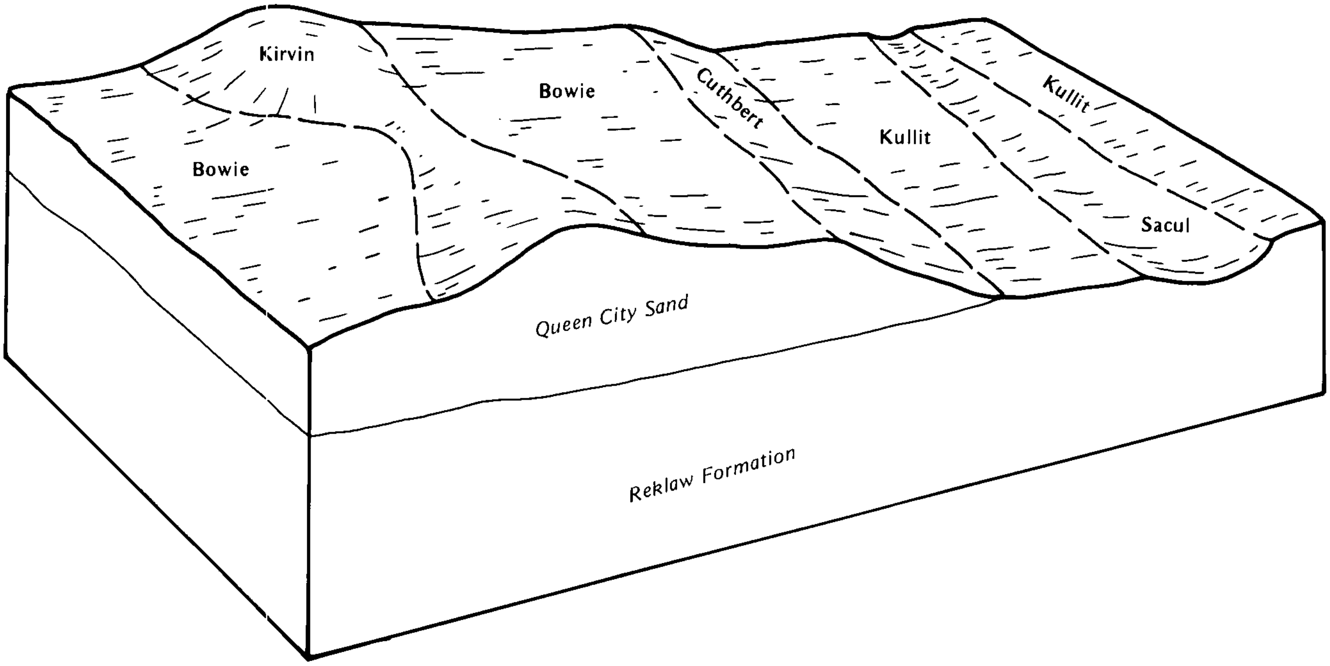


Figure 6.—Pattern of soils and underlying material in the Bowie-Cuthbert-Kirvin and Kullit-Sacul map units.

depth of about 14 inches. The subsoil to a depth of 42 inches is clay. It is red with strong brown mottles to a depth of 34 inches. Below that, it is mottled red and reddish yellow clay and light brownish gray shale fragments. The substratum to a depth of 72 inches is stratified lenses of light gray shale; light brown, red, and strong brown loam; and red sandy clay loam. These soils are neutral in the upper part and very strongly acid in the lower part.

Of minor extent in this map unit are Bernaldo, Besner, Elrose, Estes, Nahatche, Kullit, Sacul, Lilbert, and Tenaha soils. The Bernaldo, Besner, Elrose, Kullit, and Sacul soils are loamy, and they are on slightly concave foot slopes and side slopes. The Estes and Nahatche soils are loamy and are on flood plains of small streams. The Lilbert and Tenaha soils are sandy and are on convex hills and side slopes along streams.

Most of the soils of this map unit are used as pasture or woodland. In a few areas, they are used for crops. Erosion is a severe hazard in most areas of these soils.

The main pasture plants are coastal bermudagrass, common bermudagrass, and bahiagrass. To increase forage, many pastures are overseeded with legumes, such as arrowleaf clover, crimson clover, or hairy vetch. Ryegrass and wheat are planted in some areas for winter grazing. Lime and fertilizer are essential for high yields.

These soils produce native woodland of pine and mixed hardwoods. Loblolly pine and shortleaf pine are the main commercial trees. Because of slope, management of these soils for woodland production in some areas is difficult.

Sweet potatoes, peanuts, grain sorghum, and truck crops are in some areas of this map unit. Fertilizer and lime help increase yields of these crops. Peach, plum, and pear orchards are in some areas. Slope is the main limitation for cropland. Terraces, contour farming, and cover crops reduce erosion and improve yields.

These soils are suited to most urban uses. Moderately slow permeability and slope are limitations that affect sanitary facilities and local roads and streets.

5. Lilbert-Darco

Gently sloping, well drained, sandy soils

This map unit is made up of Lilbert and Darco soils on stream divides and low convex ridges. Lilbert soils are moderately slowly permeable, and Darco soils are moderately permeable. Slopes are 2 to 5 percent.

This map unit makes up about 5 percent of the survey area. It is about 50 percent Lilbert soils, 14 percent Darco soils, and 36 percent soils of minor extent.

Typically, the Lilbert soils have a brown loamy fine sand surface layer about 9 inches thick. The subsurface layer is light yellowish brown loamy fine sand to a depth of 26 inches. The subsoil to a depth of at least 80 inches is yellowish brown sandy clay loam. It has red, yellowish red, and light brownish gray mottles. Plinthite ranges from 4 to 7 percent, by volume, in the lower part. These soils are medium acid or strongly acid in the upper part and very strongly acid in the lower part.

Typically, the Darco soils have a surface layer of very dark grayish brown loamy fine sand about 7 inches thick. The subsurface layer to a depth of 58 inches is loamy fine sand. It is light yellowish brown in the upper part and pale brown in the lower part. The subsoil to a depth of 80 inches is yellowish red sandy clay loam. These soils are slightly acid in the upper part and very strongly acid in the lower part.

Of minor extent in this map unit are Briley, Bowie, Cuthbert, Duffern, Nahatche, and Tenaha soils. The Briley, Duffern, and Tenaha soils are sandy. These soils are intermingled with the Lilbert and Darco soils. The Bowie and Cuthbert soils are loamy and are on side slopes and ridgetops. The Nahatche soils are loamy and are on flood plains of small streams.

The soils of this map unit are used mainly as pasture or woodland. In a few small areas, they are used for crops.

Warm-season grasses, such as coastal bermudagrass, common bermudagrass, and lovegrass, are in most pastures. Some pastures are overseeded with legumes, such as vetch, arrowleaf clover, and crimson clover. Wheat, oats, and ryegrass are seeded to provide winter grazing. Droughtiness is a limitation for forage production. Fertilizer and lime are essential for high yields.

Pine and mixed hardwoods are the native woodland on these soils, and the principal commercial trees are loblolly and shortleaf pines. Slash pine is planted in some small acres. Droughtiness is the main limitation for woodland production.

The main crops are peanuts, watermelons, sweet potatoes, and vegetables. Peach, plum, and pear orchards are adapted to some areas of these soils. Fertilizer and lime are needed for high yields. Droughtiness is the main limitation for cultivated crops. Cover crops and contour farming help to control erosion.

The soils of this map unit are suited to most urban uses; however, seepage and the sandy surface texture are limitations for sanitary facilities and recreation areas. Low strength is a limitation for roads and streets.

6. Kullit-Sacul

Gently sloping to moderately steep, moderately well drained, loamy soils

This map unit is made up of Kullit soils on stream divides and foot slopes and at the head of drainageways and Sacul soils on low hills and side slopes along streams. Kullit soils are gently sloping and moderately slowly permeable. Sacul soils are gently sloping to moderately steep and slowly permeable. Slopes are 1 to 15 percent.

This map unit makes up about 4 percent of the survey area. It is 52 percent Kullit soils, 24 percent Sacul soils, and 24 percent soils of minor extent.

Typically, the Kullit soils have a brown very fine sandy loam surface layer about 7 inches thick. The subsurface layer to a depth of 14 inches is light yellowish brown very fine sandy loam. The subsoil extends to a depth of at least 73 inches. To a depth of 33 inches, it is yellowish brown clay loam that has mottles in shades of red, brown, and gray. Below that, the subsoil is clay that is mottled dark red, gray, and yellowish brown in the upper part and gray with mottles in shades of brown and red in the lower part. These soils are slightly acid in the upper part and strongly acid or very strongly acid in the lower part.

Typically, the Sacul soils have a very dark grayish brown fine sandy loam surface layer about 4 inches thick. The subsoil extends to a depth of 42 inches. To a depth of 22 inches, it is dark red clay that has light brownish gray mottles, and to a depth of 33 inches, it is mottled dark red, light brownish gray, and reddish yellow clay. Below that, the subsoil is mottled dark red, reddish yellow, and light brownish gray clay loam, silt loam, and shale. The substratum to a depth of 60 inches is stratified red, grayish brown, and yellowish red sandy loam and shale. These soils are strongly acid in the upper part and strongly acid or very strongly acid in the lower part.

Of minor extent in this map unit are Bowie, Cuthbert, Kirvin, and Nahatche soils. The Bowie, Cuthbert, and Kirvin soils are loamy and are on higher upland ridges and side slopes than the Sacul soils. The Nahatche soils are loamy and are on flood plains.

Most of the soils of this map unit are used as pasture or woodland. In a few areas, they are used for cultivated crops. Seasonal wetness is the main limitation, and erosion is a hazard.

The major pasture plants are coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding pastures with arrowleaf clover, crimson clover, vetch, or other legumes is common. Some areas are seeded to cool-season ryegrass, oats, and wheat for winter grazing. Fertilizer and lime increase yields.

Woodland is mainly pine and mixed hardwoods. Loblolly and shortleaf pines are the principal commercial trees. Hickory, oak, elm, and gum are also common forest types. Proper woodland management practices can increase yields. Because of slope and seasonal wetness, management of these soils for woodland production is difficult.

In a few areas, these soils are used for sweet potatoes, peanuts, grain sorghum, and corn. Fertilizer and lime are essential for good yields. Slope is the major limitation, and terraces and contour farming help to control erosion.

These soils are suited to most urban uses; however, slope, shrinking and swelling, and low strength affect roads, streets, and dwellings.

7. Cuthbert-Redsprings

Strongly sloping to steep, well drained, loamy soils

This map unit is made up of Cuthbert and Redsprings soils on hills, known locally as "mountains," which are the highest points in the survey area (fig. 7). These soils are moderately slowly permeable. Slopes are 8 to 40 percent.

This map unit makes up about 3 percent of the survey area. It is 30 percent Cuthbert soils, 20 percent Redsprings soils, and 50 percent soils of minor extent.

Typically, the Cuthbert soils have a dark brown gravelly fine sandy loam surface layer about 9 inches thick. It has about 30 percent ironstone pebbles and fragments. The subsoil extends to a depth of about 36 inches. It is red clay in the upper part and red clay loam with grayish shale fragments in the lower part. The substratum to a depth of 60 inches is stratified red sandy clay loam, yellowish brown sandstone, and gray shale. These soils are strongly acid in the upper part and very strongly acid in the lower part.

Typically, the Redsprings soils have a gravelly fine sandy loam surface layer about 10 inches thick. It is dark reddish brown in the upper part and yellowish red in the lower part. The subsoil to a depth of 44 inches is red clay that has remnants of reddish yellow weathered glauconite. The substratum to a depth of 60 inches is reddish yellow weathered glauconite. These soils are neutral in the upper part and grade to very strongly acid in the lower part.

Of minor extent in this map unit are Elrose, Kirvin, Nahatche, and Tenaha soils. The Elrose, Kirvin, and Nahatche soils are loamy. The Elrose soils are on foot slopes, the Kirvin soils are on narrow ridges, and the Nahatche soils are on flood plains. The Tenaha soils are sandy and are on convex upper hillsides and side slopes. Also included are areas of soils that have been mined for iron ore.

Most of the soils of this map unit are used as woodland or habitat for wildlife. A few areas have been cleared for use as pasture or for iron ore production. Erosion is a hazard.

The soils of this map unit produce a mixed native woodland. Pine, oak, elm, and hickory are common, but loblolly and shortleaf pines are the main commercial trees. Because of stoniness and slope, these soils produce low quality timber. The woodland provides a natural refuge for deer and other wildlife. Some areas are inaccessible to vehicles.

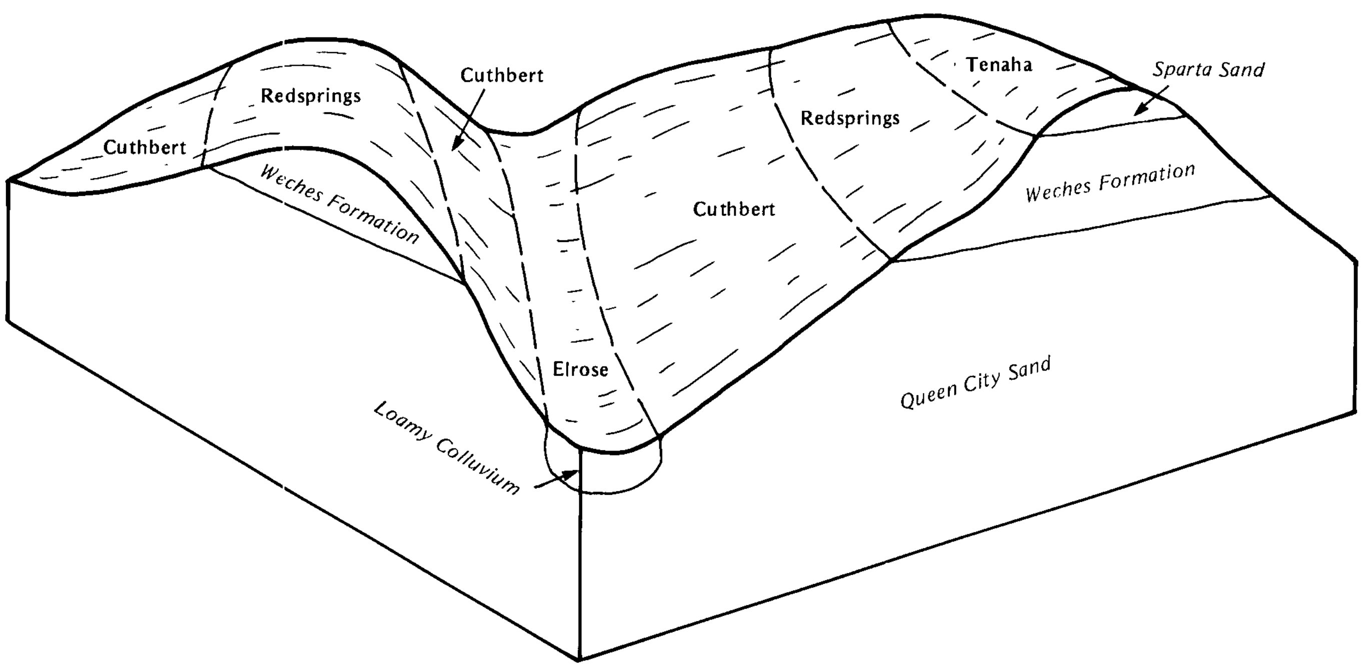


Figure 7.—Pattern of soils and underlying material in the Cuthbert-Redsprings map unit.

These soils are not suited to use as pasture or for crops because of slope and ironstone fragments or gravel.

These soils are poorly suited to urban uses, but they provide scenic homesites. Slope, shrinking and swelling, and ironstone fragments are the major limitations.

Loamy and Clayey Soils; on Flood Plains

The map units of this group make up about 21 percent of the survey area. The major soils are in the Estes, Gladewater, Iuka, Kaufman, and Nahatche series. These soils are nearly level and moderately permeable to very slowly permeable. They are subject to frequent flooding.

Native vegetation is mainly mixed hardwoods. Most of the soils in this group are used as woodland. Some areas of these soils are cleared and planted to fescuegrass, bermudagrass, or bahiagrass pastures. These soils are not used as cropland or urban land because of flooding.

8. Nahatche-Iuka

Nearly level, somewhat poorly drained and moderately well drained, loamy soils

This map unit is made up of soils on flood plains of major creeks including Hart Creek, Ripley Creek, and Lilly Creek. Nahatche soils are somewhat poorly drained, and Iuka soils are moderately well drained. These soils are moderately permeable. Slopes are 0 to 1 percent.

This map unit makes up about 11 percent of the survey area. It is about 55 percent Nahatche soils, 13 percent Iuka soils, and 32 percent soils of minor extent.

Typically, the Nahatche soils have a dark brown silty clay loam surface layer about 6 inches thick. The underlying material to a depth of 28 inches is grayish brown silt loam and light brownish gray loam that have mottles in shades of brown. To a depth of 44 inches, the underlying material is grayish brown clay loam that has mottles in shades of brown and gray. The next layer, to a depth of 68 inches, is dark gray clay loam that has mottles in shades of brown and has streaks of loam. The underlying material to a depth of 80 inches is mottled grayish brown, dark gray, reddish yellow, and brownish yellow loam. These soils are slightly acid to strongly acid in the upper part and neutral or mildly alkaline in the lower part.

Typically, the Iuka soils have a dark brown and brown fine sandy loam surface layer about 12 inches thick. The underlying material to a depth of 73 inches is fine sandy loam. The upper part is yellowish brown with strong brown and light brownish gray mottles. The lower part is mottled and stratified in shades of yellow, brown, and gray. These soils are slightly acid in the upper part and strongly acid or very strongly acid in the lower part.

Of minor extent in this map unit are Besner, Bienville, Bowie, Cuthbert, Estes, Freestone, Hopco, Talco, and Woodtell soils. Except for the Bienville soils, these soils are loamy. The Besner and Talco soils are on moundy terraces along streams, and the Bienville soils are sandy and are on low terrace ridges. The Bowie, Cuthbert, Freestone, and Woodtell soils are on side slopes adjacent to flood plains. The Estes and Hopco soils are on flood plains in positions similar to those of the Nahatche and Iuka soils.

The soils of this map unit are used mainly as woodland or pasture. In a few isolated areas, they are used for cultivated crops.

The major trees on these soils are hardwoods; however, loblolly pine and shortleaf pine are well adapted to the Iuka soils. Wetness and flooding are the main concerns in management.

The main pasture plants are bahiagrass and common bermudagrass on the Nahatche soils and coastal bermudagrass on the Iuka soils. Cool-season tall fescuegrass overseeded with white clover is adapted to both soils.

These soils are not suited to cultivation because of frequent flooding; however, a few small areas of the Iuka soils that flood less frequently are planted to vegetable crops.

These soils are not suited to urban uses because of flooding and wetness.

9. Estes

Nearly level, somewhat poorly drained, loamy soils

This map unit is made up of Estes soils on flood plains of major streams including Big Cypress Creek, Boggy Creek, and White Oak Creek. These soils are very slowly permeable. Slopes are 0 to 1 percent.

This map unit covers about 6 percent of the survey area. It is about 61 percent Estes soils and 39 percent soils of minor extent.

Typically, the Estes soils have a dark grayish brown clay loam surface layer about 8 inches thick. The subsoil extends to a depth of at least 80 inches. To a depth of 63 inches, it is grayish brown clay that has mottles in shades of brown and gray. Below that, it is light brownish gray clay loam. These soils are medium acid in the surface layer and extremely acid or very strongly acid below that.

Of minor extent in this map unit are Besner, Bienville, Bowie, Cuthbert, Freestone, Gladewater, Nahatche, Raino, Talco, and Woodtell soils. Except for the Bienville and Gladewater soils, these soils are loamy. The Bienville soils are sandy, and the Gladewater soils are clayey. The Besner, Raino, and Talco soils are on moundy terraces along flood plains. The Bienville soils are on low terrace ridges. The Bowie, Cuthbert, Freestone, and Woodtell soils are on side slopes adjacent to flood plains. The Gladewater and Nahatche soils are on flood plains with the Estes soils.

The soils of this map unit are mainly used as woodland. In a few areas, they are used as pasture.

The dominant trees on these soils are hardwoods, mainly water oak, willow oak, ash, and sweetgum. Because of flooding and wetness, managing these soils for pine timber production is difficult.

Common bermudagrass and bahiagrass are the main warm-season pasture plants adapted to these soils. Tall fescuegrass and white clover provide additional cool-season grazing and forage. Flooding and wetness limit the use of these soils as pasture. Fertilizer and lime increase yields.

These soils are not suited to cultivated crops or urban uses because of frequent flooding and wetness.

10. Kaufman-Gladewater

Nearly level, somewhat poorly drained and poorly drained, clayey soils

This map unit is made up of Kaufman and Gladewater soils on flood plains of the Sulphur River. Kaufman soils are somewhat poorly drained, and Gladewater soils are poorly drained. These soils are very slowly permeable. Slopes are 0 to 1 percent.

This map unit makes up about 4 percent of the survey area. It is about 54 percent Kaufman soils, 22 percent Gladewater soils, and 24 percent soils of minor extent.

Typically, the Kaufman soils have a black clay surface layer about 12 inches thick. The subsoil to a depth of 72 inches is very dark gray clay that has mottles in shades of brown. These soils are mildly alkaline in the upper part, slightly acid in the middle part, and neutral in the lower part.

Typically, the Gladewater soils have a very dark grayish brown clay surface layer about 6 inches thick. The subsoil to a depth of 63 inches is clay. It is grayish brown in the upper part dark grayish brown in the middle part, and grayish brown in the lower part. These soils are neutral in the upper part, slightly acid or medium acid in the middle part, and neutral in the lower part.

Of minor extent in this map unit are Hopco, Nahatche, Texark, and Varro soils. The Hopco, Nahatche, and Varro soils are loamy. They are slightly higher on the flood plain than the Kaufman and Gladewater soils. The Texark soils are clayey and are intermingled on flood plains with areas of the Gladewater soils.

The soils of this map unit are mainly used as woodland. A very small acreage has been cleared and planted to improved pasture.

These soils are adapted to hardwood trees, such as cottonwood, green ash, willow oak, water oak, and hackberry. Because of flooding and wetness, management of these soils for timber production and harvesting is difficult.

Fescuegrass, bermudagrass, and bahiagrass are adapted to these soils; however, frequent flooding limits the establishment of good stands of grass.

These soils are not suited to cultivated crops or urban uses because of frequent flooding and wetness.

Loamy and Clayey Soils; on Prairies

The map units of this group make up about 6 percent of the survey area. The major soils are in the Crockett, Ellis, and Normangee series. These soils are nearly level to strongly sloping and very slowly permeable.

Native vegetation is mid and tall grasses with scattered post oak, bois-d'arc, and hackberry along breaks and streams. Most of the soils in this group are used as pasture or for crops. In some areas, they are used as improved pasture or remain as native pasture. Wheat and grain sorghum are the main crops.

The soils of this group are poorly suited to most urban and recreational uses.

11. Crockett

Nearly level to gently sloping, moderately well drained, loamy soils

This map unit is made up of Crockett soils on slightly convex stream divides and eroded side slopes. These soils are very slowly permeable. Slopes are 0 to 5 percent.

This map unit makes up about 4 percent of the survey area. It is about 79 percent Crockett soils and 21 percent soils of minor extent (fig. 8).

Typically, the Crockett soils have a dark brown silt loam surface layer about 8 inches thick. The subsoil to a depth of 60 inches is clay. The upper part of the subsoil is dark brown and olive brown with mottles in shades of red and brown, and the lower part is light olive brown and mottled gray, light olive brown, and light yellowish brown. The substratum to a depth of 80 inches is mottled light yellowish brown and grayish brown shaly silty clay that has a few concretions of calcium carbonate. These soils are medium acid in the upper part and grade to mildly alkaline in the lower part.

Of minor extent in this map unit are Nahatche, Normangee, Wilson, and Woodtell soils. These soils are loamy. The Nahatche soils are on flood plains of dissecting streams. The Normangee soils are on convex ridges and side slopes along streams. The Wilson soils are on low, depressional flats. The Woodtell soils are in low, moundy areas.

The soils of this map unit are used mainly as improved or native pasture. In some areas, they are used as cropland. Erosion is a hazard.

Bluestems, threeawns, and tridens are the main native grasses. The native pastures are commonly of low quality. Bermudagrass or bahiagrass overseeded with arrowleaf clover is common in improved pastures. Controlled grazing improves native pastures, and fertilizer increases yields on improved pastures.

Wheat and grain sorghum are the common crops on these soils. The hazard of erosion and the very slow permeability are limitations. Terraces, contour farming, and cover crops reduce erosion. Fertilizer increases yields.

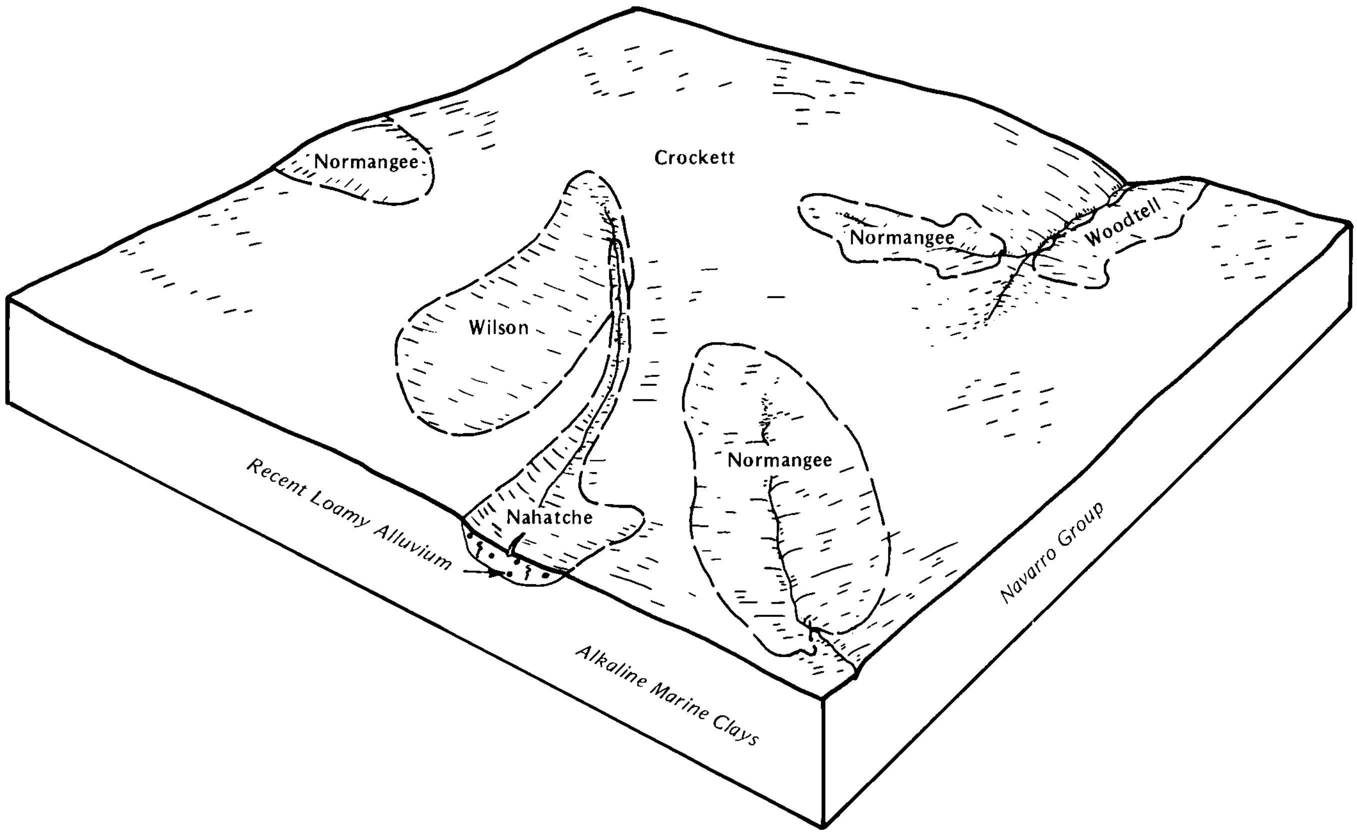


Figure 8.—Pattern of soils in the Crockett map unit.

These soils are poorly suited to most urban and recreational uses because of the very slow permeability, shrinking and swelling, and low strength.

12. Normangee-Crockett-Ellis

Gently sloping to strongly sloping, moderately well drained and well drained, loamy and clayey soils

This map unit is made up of Normangee, Crockett, and Ellis soils. Normangee soils are on eroded ridges and gentle side slopes, and Crockett and Ellis soils are on eroded side slopes along drainageways. These soils are very slowly permeable. Normangee and Crockett soils are moderately well drained, and Ellis soils are well drained. Normangee soils are gently sloping and moderately sloping, Crockett soils are gently sloping, and Ellis soils are moderately sloping and strongly sloping. Slopes are 2 to 12 percent.

This map unit makes up about 2 percent of the survey area. It is about 37 percent Normangee soils, 22 percent Crockett soils, 10 percent Ellis soils, and 31 percent soils of minor extent.

Typically, the Normangee soils have a dark brown gravelly clay loam surface layer about 3 inches thick. The subsoil to a depth of 49 inches is clay. It is dark brown with mottles in shades of red and brown to a depth of 11 inches; mottled brown, yellowish brown, and light brownish gray to a depth of 23 inches; light yellowish brown with mottles in shades of gray and brown to a depth of 41 inches; and light brown with mottles in shades of gray and brown below that. The substratum to a depth of 62 inches is light brownish gray, gray, and yellowish brown stratified shale and clay. These soils are slightly acid in the upper part and neutral in the lower part.

Typically, the Crockett soils have a brown silt loam surface layer 3 inches thick. The subsoil to a depth of 44 inches is clay. It is dark yellowish brown with mottles in shades of red and brown to a depth of 8 inches, and below that, it is light olive brown, gray, and yellowish brown. The substratum is gray and light olive brown shaly clay and has a few concretions and soft masses of calcium carbonate. These soils are slightly acid in the upper part, neutral in the middle part, and mildly alkaline in the lower part.

Typically, the Ellis soils have a very dark grayish brown clay surface layer about 3 inches thick. The subsoil to a depth of about 38 inches is clay. It is dark grayish brown in the upper part and grades to olive in the lower part. A few mottles in shades of brown and olive are in the lower part of the subsoil. The substratum is olive shaly clay that has light olive brown mottles and a few concretions of calcium carbonate. These soils are slightly acid in the upper part and grade to moderately alkaline in the lower part.

Of minor extent in this map unit are Bazette, Nahatche, and Woodtell soils. The Bazette and Woodtell soils are loamy and are in positions similar to those of the Crockett soils, or they are intermingled with areas of the Normangee and Ellis soils. The Nahatche soils are loamy and are on flood plains.

The soils of this map unit are mainly used as native or improved pasture. Erosion is a severe hazard.

Low quality native grasses are common on these soils; however, some areas of these soils have been planted to improved bermudagrass and bahiagrass to improve the quality and quantity of forage production. Controlled grazing and fertilizer can increase yields.

These soils are poorly suited to use as cropland because of slope and the hazard of erosion. They are also poorly suited to most urban and recreational uses because of shrinking and swelling, slope, and the very slow permeability.

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 symbol 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, salinity, wetness, 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, Woodtell fine sandy loam, 2 to 5 percent slopes, is one of several phases in the Woodtell series.

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

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. Besner-Talco complex, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Cuthbert and Redsprings soils, 15 to 40 percent slopes, is an undifferentiated group in this survey area.

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.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Oil-waste land is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 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 potentials for many uses. The Glossary defines many of the terms used in describing the soils.

AsA—Ashford clay, 0 to 1 percent slopes. This soil is nearly level and poorly drained. It is in low-lying areas on stream terraces. The surface is plane to slightly concave. The areas are oblong to irregular in shape. They range from 50 to 1,000 acres, but average about 500 acres.

Typically, this soil has a very dark grayish brown clay surface layer 3 inches thick. The subsoil to a depth of 80 inches is light brownish gray clay that has mottles in shades of brown. This soil is slightly acid in the surface layer and very strongly acid or strongly acid in the subsoil.

Permeability is very slow, and the available water capacity is high. Runoff is very slow. The root zone is deep; however, because of the clayey texture, root penetration is somewhat restricted. This soil is difficult to work because of the clayey texture and because the soil remains wet for long periods after rains. Water ponds in places for brief periods during the winter and spring.

Included with this soil in mapping are small areas of Freestone soils. Freestone soils are in slightly higher positions than those of the Ashford soil, and the upper part of the subsoil is yellowish brown loam. The included soils make up less than 10 percent of the map unit.

The Ashford soil is used mainly as pasture. In some areas, it is used as woodland. A small acreage is used for small grains.

Common pasture plants on this soil are bahiagrass, fescuegrass, and common bermudagrass. Fescuegrass and white clover in combination provide excellent winter grazing. Wetness, the clayey texture, and very slow permeability are limiting features for use of this soil as pasture. Fertilizer, lime, and drainage improve yields.

Willow oak and post oak are the main commercial timber on this soil. Wetness and the clayey texture are concerns in managing this soil for commercial timber production. Selective harvesting, removal of undesirable plants, and protection from fire increases production.

Wetness and the clayey texture limit the use of this soil as cropland; however, some areas are planted to wheat and grain sorghum. Drainage and fertilizers increase yields.

This soil is limited for urban uses because of wetness, shrinking and swelling, low strength, and corrosiveness. Proper planning and design can reduce the effects of these limitations.

The Ashford soil is in capability subclass IVw. The woodland ordination symbol is 4W.

BaD—Bazette silty clay loam, 5 to 15 percent slopes. This soil is strongly sloping to moderately steep and well drained. It is on side slopes above drainageways. The areas are long and narrow. They range from 20 to 150 acres, but average about 50 acres.

Typically, this soil has a dark grayish brown silty clay loam surface layer about 6 inches thick. The subsoil to a depth of 28 inches is light olive brown clay. To a depth of 37 inches, it is mottled olive yellow and light olive brown clay that has fragments of gray shale. The substratum to a depth of 60 inches is stratified olive gray, gray, and brownish yellow shaly clay and shale. The soil is slightly acid or medium acid in the upper part and mildly alkaline in the lower part.

Permeability is slow, and the available water capacity is moderate. Runoff is rapid. Erosion is a severe hazard in unprotected areas of this soil.

Included with this soil in mapping are small areas of Ellis, Normangee, and Woodtell soils. Ellis soils have a clay surface layer, and Normangee soils have a gravelly surface layer. Woodtell soils have reddish subsoil. The included soils make up less than 20 percent of the map unit.

Most areas of Bazette soil are native pasture. Some areas are improved pasture.

Native pastures include threeawns, tridens, bluestems, and low panicums. These pastures are mainly of low quality, and shrubs and trees are commonly encroaching. Controlled grazing can increase the quality and quantity of native grasses.

The improved pastures on this soil are bahiagrass, common bermudagrass, or lovegrass. Legumes, such as crimson clover and arrowleaf clover, are well adapted, provide extra cool-season grazing, and add nitrogen to the soil. Fertilizer and controlled grazing increase yields.

This soil is not suited to the commercial production of timber. The climax vegetation is native grasses and forbs; however, a few areas are under a fairly dense cover of mixed hardwood trees, such as post oak, hackberry, hickory, and bois-d'arc.

The Bazette soil is not suited to crop production because of slope and the severe hazard of erosion.

This soil is poorly suited to most urban uses because of slow permeability, slope, and the clayey texture. Good design and careful installation can reduce the effects of these limitations.

The Bazette soil is in capability subclass VIe. It does not have a woodland ordination symbol.

BbB—Bernaldo fine sandy loam, 1 to 3 percent slopes. This soil is gently sloping and well drained. It is on interstream divides. The surface is plane to slightly convex. The areas range from 15 to 250 acres, but average about 80 acres.

Typically, this soil has a dark yellowish brown fine sandy loam surface layer about 6 inches thick. The subsurface layer to a depth of 17 inches is yellowish brown fine sandy loam. The subsoil to a depth of 48 inches is yellowish brown sandy clay loam that has mottles in shades of yellow and red. To a depth of 80 inches, the subsoil is mottled yellowish brown, red, light brownish gray, and brownish yellow sandy clay loam. It has light gray clean sand and silt coatings on the surface of peds. The soil is slightly acid in the upper part and grades to very strongly acid in the lower part.

Permeability is moderate, and the available water capacity is high. Runoff is slow. The root zone is deep. A fluctuating high water table is below a depth of 48 inches in the winter.

Included with this soil in mapping are small areas of Wolfpen, Freestone, and Woodtell soils. Wolfpen soils have a sandy surface layer more than 20 inches thick and are slightly higher on the landscape than the Bernaldo soil. Freestone soils are in low concave spots, and the lower part of the subsoil is clayey. Woodtell soils are on convex spots, and the upper part of the subsoil is red clay. The included soils make up less than 15 percent of the map unit.

The Bernaldo soil is used mainly as pasture or woodland. In a few small areas, it is used as cropland.

The common pasture plants are coastal and common bermudagrass. Cool-season legumes, such as crimson clover, vetch, and arrowleaf clover, produce winter forage and add nitrogen. Fertilizer, lime, and controlled grazing improve yields.

Woodland areas of this soil consist of hardwood and pine trees. Commercial trees used for timber production are loblolly pine, shortleaf pine, and sweetgum. Selective cutting, removal of undesirable trees, and protection from wildfires increase yields. This soil has no major limitations for timber production.

This soil is well suited to use as cropland. Corn, peas, sweet potatoes, grain sorghum, and peanuts are the common crops (fig. 9). Lime and fertilizer increase yields. Residue management is needed to maintain organic matter and improve tilth. Terraces, contour farming, and conservation tillage help to control soil erosion.

This soil is suited to most urban uses; however, it has some limitations that can be reduced by proper design and installation. Seasonal wetness is a limiting feature for septic tank absorption fields, and low strength is a limiting feature for local roads and streets. Corrosiveness is a problem for untreated steel and concrete.

The Bernaldo soil is in capability subclass IIe. The woodland ordination symbol is 10A.

BcB—Bernaldo-Urban land complex, 1 to 3 percent slopes. This complex is made up of Bernaldo soil and Urban land on interstream divides. The Bernaldo soil is gently sloping and well drained. The areas are oblong and range from 10 to 100 acres.

This complex is 40 to 75 percent Bernaldo soil, 15 to 25 percent Urban land, and about 5 to 15 percent other soils. Areas of the Bernaldo soil and Urban land are too intricately mixed to be mapped separately at the scale used for the maps in the back of this publication.

Typically, the Bernaldo soil has a dark yellowish brown fine sandy loam surface layer about 6 inches thick. The subsurface layer to a depth of 17 inches is yellowish brown fine sandy loam. The subsoil to a depth of 48 inches is yellowish brown sandy clay loam. It has mottles in shades of yellow and red and tongues of gray silt in the lower part. To a depth of 80 inches, the subsoil is mottled yellowish brown, red, light brownish gray, and

Figure 9.—Grain sorghum grows well on Bernaldo fine sandy loam, 1 to 3 percent slopes. A poultry house and pine-hardwood timber are in the background.

brownish yellow sandy clay loam. It has light gray clean sand and silt coatings on the surface of peds. The soil is slightly acid in the upper part and grades to very strongly acid in the lower part.

Permeability is moderate, and the available water capacity is high. Runoff is slow. The root zone is deep. A fluctuating high water table is below a depth of 48 inches in winter.

Urban land consists of areas covered by dwellings, commercial buildings, schools, churches, driveways, streets, parking lots, and railroad yards, and areas that have been disturbed by cutting, filling, or grading. The soil has been altered to such an extent that further classification is not possible.

Included with this complex in mapping are small areas of Freestone and Woodtell soils. Freestone soils are in low, wet spots, and the lower part of the subsoil is clay. Woodtell soils are in convex spots, and the upper part of the subsoil is red clay.

The Bernaldo soil is suited to most urban uses; however, wetness is a limiting feature for septic tank filter fields and sanitary landfills. Expanding field lines and lining landfills with an impervious material, such as clay, can overcome this problem. Low strength is a limitation for local roads and streets. Reinforcing base material helps to overcome this limitation. This soil will corrode steel pipe and concrete. Coating pipe and treating concrete permits these materials to last longer.

This complex is not in a capability class, and it does not have a woodland ordination symbol.

BdB—Besner-Talco complex, 0 to 2 percent slopes. These soils are nearly level and gently sloping, and they are well drained. They are on terraces adjacent to large streams. The Besner soil is on ridges and mounds 1 to 4 feet higher than the adjacent Talco soil on flats. The surface is slightly convex to plane. The areas are long and narrow. They range from 10 to 80 acres, but average about 30 acres.

This complex is about 65 percent Besner soil, 20 percent Talco soil, and 15 percent other soils. The Talco soil is not in a few areas of this complex. Areas of the Besner and Talco soils are too intricately mixed to be mapped separately at the scale used for the maps in the back of this publication.

Typically, the Besner soil has a dark brown fine sandy loam surface layer about 3 inches thick. The subsurface layer to a depth of 9 inches is yellowish brown fine sandy loam. The next layer to a depth of 31 inches is yellowish brown fine sandy loam that has yellowish red and dark yellowish brown mottles. It has streaks and pockets of light gray clean sand and silt. The subsoil to a depth of 86 inches is loam. The upper part is yellowish brown and strong brown with yellowish red and grayish brown mottles, and the lower part is mottled in shades of brown and gray. This soil is very strongly acid in the upper part and grades to slightly acid in the lower part.

Permeability is moderate, and the available water capacity is high. Runoff is slow. The root zone is deep. A high water table is at a depth of 4 to 6 feet for brief periods in winter.

Typically, the Talco soil has a brown loam surface layer about 3 inches thick. The subsurface layer to a depth of 15 inches is pale brown, brown, and light brownish gray loam. The subsoil to a depth of 64 inches is grayish brown and light brownish gray clay loam that has mottles in shades of brown and red. It has streaks and tongues of light gray clean sand and silt. The lower part of the subsoil is light brownish gray loam that has mottles in shades of brown and yellow. The soil is medium acid in the upper part and neutral in the lower part.

Permeability is slow, and the available water capacity is high. Runoff is very slow. The root zone is deep. Water ponds on the Talco soil for very brief to brief periods during the winter and spring.

Included with this complex in mapping are small areas of Derly, Freestone, and Nahatche soils. Derly soils have a clayey subsoil and are poorly drained. Freestone soils are in higher positions than those of the soils in this complex. The lower part of the subsoil is clayey. Nahatche soils are somewhat poorly drained and are on associated flood plains.

The Besner and Talco soils are used mainly as pasture. In some areas, they are used as woodland, and in a few small areas, they are used as cropland.

These soils are suited to coastal bermudagrass, common bermudagrass, and bahiagrass. Overseeding with arrowleaf clover or white clover adds nitrogen and provides winter forage. Lime, fertilizer, and controlled grazing improve yields.

Most woodland areas of the Besner soil consist of red oak, loblolly pine, and sweetgum, and the low, wet areas of the Talco soil consist of water oak and willow oak. Loblolly pine is the principal tree suitable for commercial timber production on the Besner soil. Wetness limits the Talco soil for pine production because the low, wet spots make harvesting difficult.

Because of the variable occurrence of the Talco soil, most areas of this soil are not used for crops. Corn, peas, and some truck crops are on the Besner soil. Lime, fertilizer, and drainage, where feasible, improve yields. Terraces, contour farming, and conservation tillage reduce soil erosion.

These soils are suited to some urban uses; however, wetness and seepage are limiting features for septic tank absorption fields and building sites. Low strength of road base material is a limiting feature for roads and streets. Proper design and installation are essential to overcome these limitations.

This complex is in capability subclass IIe. The woodland ordination symbol for the Besner soil is 11A. It is 5W for the Talco soil.

BeB—Bienville loamy fine sand, 0 to 3 percent slopes. This soil is deep, nearly level and gently sloping, and somewhat excessively drained. It is on alluvial stream terraces of major creeks. The areas are oblong and are on low ridges adjacent to flood plains. They range from 15 to 100 acres, but average about 40 acres.

Typically, the Bienville soil has a dark brown loamy fine sand surface layer about 9 inches thick. The subsurface layer to a depth of 21 inches is strong brown loamy fine sand. The subsoil to a depth of at least 80 inches is loamy fine sand. To a depth of 56 inches, it is strong brown with light yellowish brown mottles and yellowish red lamellae. Below that, it is light yellowish brown with strong brown mottles and yellowish red lamellae. The soil is slightly acid in the upper part and medium acid in the lower part.

Permeability is moderately rapid, and the available water capacity is low. Runoff is slow. The root zone is deep. A high water table is within 4 to 6 feet of the surface during winter and spring.

Included with this soil in mapping are small areas of luka, Nahatche, and Talco soils. luka and Nahatche soils have a loamy surface layer and are on associated flood plains. Talco soils are loamy throughout and are in low, wet areas. The included soils make up less than 20 percent of the map unit.

The Bienville soil is used mainly as woodland; however, in many areas, it is used as pasture. In a few areas, it is used for truck crops.

Most woodland areas of this soil consist of mixed hardwood and pine. Loblolly pine is the principal commercial tree. Some cropland has been planted to slash and loblolly pines for timber production. Droughtiness is a minor limitation for woodland production. During the dry season, seedling mortality rates increase because of the low available water capacity.

The Bienville soil is suited to warm-season grasses, such as coastal bermudagrass, bahiagrass, and lovegrass. Lime and fertilizer are essential for good yields.

Truck crops, such as peas, peanuts, corn, and watermelons, are the main crops on this soil. Lime and fertilizer can increase yields. Residue management improves soil tilth and reduces erosion.

This soil is suited to most urban uses; however, it has some limitations that can be overcome by good design and careful installation. A seasonal high water table is a limiting feature for septic tank absorption fields. Permeability and seepage are also limitations to the use of this soil as sites for sewage lagoons. Corrosiveness is a limiting feature for concrete.

The Bienville soil is in capability subclass IIs. The woodland ordination symbol is 10S.

BoC—Bowie fine sandy loam, 2 to 5 percent slopes. This soil is gently sloping and moderately well drained. It is on upland interstream divides. The surface is plane to weakly convex. The areas range from 20 to 200 acres, but average about 50 acres.

Typically, the Bowie soil has a dark brown fine sandy loam surface layer about 4 inches thick. The subsurface layer is yellowish brown fine sandy loam to a depth of 11 inches. The subsoil to a depth of 38 inches is yellowish brown and brownish yellow sandy clay loam that has red mottles. To a depth of 75 inches, it is brownish yellow and mottled brownish yellow, light gray, and yellowish red sandy clay loam that has streaks of clean sand and 5 to 10 percent nodular plinthite. The soil is strongly acid or medium acid in the upper part and very strongly acid in the lower part.

Permeability is moderately slow, and the available water capacity is high. Runoff is medium. The root zone is deep, but roots are restricted in some areas by masses of hardened plinthite in the lower horizons. Erosion is a moderate hazard.

Included with this soil in mapping are small areas of Kullit, Lilbert, and Kirvin soils. Kullit soils are in concave positions, and the lower part of the subsoil is clayey. Lilbert soils have a sandy surface layer 20 to 40 inches thick. Kirvin soils have a red clay subsoil and are in higher positions than those of the Bowie soil. The included soils make up less than 20 percent of the map unit.

The Bowie soil is used mainly as pasture or woodland. In some small areas, it is used as cropland and for orchards.

The common pasture plants on this soil are bahiagrass, common bermudagrass, and coastal bermudagrass. Cool-season legumes, such as crimson clover, vetch, and arrowleaf clover, produce winter forage and add soil nutrients. Fertilizer, lime, and controlled grazing increase yields.

This soil is well adapted to the production of timber and has no major limitations. Woodland areas consist of hardwood and pine. Loblolly and shortleaf pines are used for commercial timber production. Selective cuttings, removal of undesirable trees, and protection from wildfires increase yields.

Sweet potatoes, peanuts, corn, and peas are the main crops on the Bowie soil (fig. 10). Erosion is a hazard, but terraces, conservation tillage, and contour farming can help to control it. Fertilizer and lime increase yields. Residue left on the surface maintains organic matter and improves the soil tilth.

This soil is well adapted to the production of orchard fruits, such as peaches, plums, and pears. Fertilizer and lime increase yields. Erosion is a hazard, but it can be controlled by using terraces and diversions.

This soil is suited to most urban uses; however, it has some limitations that can be resolved by good designs and careful installation. Slow permeability is a limiting feature for septic tank absorption fields, and low strength

Figure 10.—Most of the acreage of Bowie fine sandy loam, 2 to 5 percent slopes, is pasture or woodland, but crops, such as sweet potatoes, are grown.

is a limiting feature for roads and streets. Corrosiveness can be overcome by treating steel and concrete.

The Bowie soil is in capability subclass IIIe. The woodland ordination symbol is 9A.

BuC—Bowie-Urban land complex, 2 to 5 percent slopes. This complex is made up of Bowie soil and Urban land on upland interstream divides. The Bowie soil is gently sloping and moderately well drained. The areas are oblong and range from 40 to 100 acres.

This complex is 50 to 75 percent Bowie soil, 15 to 25 percent Urban land, and about 10 to 25 percent other soils. Areas of the Bowie soil and Urban land are too intricately mixed to be mapped separately at the scale used for the maps in the back of this publication.

Typically, the Bowie soil has a dark brown fine sandy loam surface layer about 4 inches thick. The subsurface layer is yellowish brown fine sandy loam to a depth of 11 inches. The subsoil to a depth of 38 inches is yellowish brown and brownish yellow sandy clay loam that has red mottles. To a depth of 75 inches, it is brownish yellow and mottled brownish yellow, light gray, and yellowish red sandy clay loam that has streaks of uncoated sand and 5 to 10 percent nodular plinthite. The soil is strongly acid or medium acid in the upper part and very strongly acid in the lower part.

Permeability is moderately slow, and the available water capacity is high. Runoff is medium. Erosion is a moderate hazard.

Urban land consists of areas covered by dwellings, commercial buildings, schools, churches, driveways, streets, parking lots, and railroad yards. It also includes areas that have been disturbed by cutting, filling, or grading. The soil has been altered to such an extent that further classification is not possible.

Included with this complex in mapping are small areas of Elrose, Kirvin, Kullit, and Lilbert soils. Elrose soils have a redder subsoil than that of the Bowie soil. Kirvin soils have a clayey subsoil, and Kullit soils are slowly permeable. Lilbert soils have a sandy surface layer.

This complex is suited to most urban uses. The Bowie soil is corrosive to steel and concrete, however, and treatment is needed to reduce underground pipe corrosion. Base material for streets and roads require reinforcement. Septic tank absorption fields should be well designed to overcome the moderately slow permeability.

This complex is not in a capability class, and it does not have a woodland ordination symbol.

ByC—Briley loamy fine sand, 2 to 5 percent slopes. This soil is gently sloping and well drained. It is on oval ridges and stream divides. The surface is plane to slightly convex. The areas are oblong to irregular in shape. They range from 10 to 50 acres, but average about 20 acres.

Typically, the Briley soil has a dark grayish brown loamy fine sand surface layer about 8 inches thick. The subsurface layer to a depth of 29 inches is brown loamy fine sand. The next layer to a depth of 35 inches is yellowish red fine sandy loam. The subsoil to a depth of 65 inches is red sandy clay loam that has mottles in shades of yellow, red, and brown. To a depth of 76 inches, it is red fine sandy loam. The subsoil has a few ironstone pebbles and pockets of clean sand throughout. The soil is medium acid throughout.

Included with this soil in mapping are small areas of Bowie, Lilbert, and Kirvin soils. Bowie soils have a loamy surface layer and yellowish subsoil. These soils are in concave positions. Lilbert soils have a yellowish subsoil and are in positions similar to those of the Briley soil. Kirvin soils have a red clay subsoil and are in convex positions. The included soils make up less than 15 percent of the map unit.

Permeability is moderate, and the available water capacity is moderate. Runoff is slow. The root zone is deep and easily penetrated by plant roots.

The Briley soil is used mainly as pasture. In some areas, it is used as woodland, and some small tracts are used as cropland.

This soil is well suited to grasses, such as bahiagrass, common bermudagrass, coastal bermudagrass, and lovegrass. Arrowleaf clover and crimson clover are adapted and are overseeded in winter pastures. Lime and split applications of fertilizer during the growing season increase yields.

Woodland areas of this soil are mainly mixed hardwoods and pine. Loblolly pine is used for commercial timber production. Droughtiness is the main limiting feature for timber production. Thinning and prescribed burning increase yields.

This soil is suited to corn, peanuts, sweet potatoes, and watermelons; however, droughtiness is a limitation for crop production. Lime and split applications of fertilizer increase yields. Residue management and conservation tillage maintain organic matter and reduce erosion.

This soil is suited to most urban uses; however, it is corrosive for steel and concrete structures. In addition, seepage is a limiting feature for sanitary landfills. These limitations can be somewhat overcome by coating pipe, by treating concrete, and by adding clay liners in landfills.

The Briley soil is in capability subclass IIIe. The woodland ordination symbol is 9S.

CrA—Crockett silt loam, 0 to 1 percent slopes. This soil is nearly level and moderately well drained. It is on broad, irregularly shaped stream divides. The surface is plane to weakly concave. The areas range from 30 to several hundred acres, but average about 200 acres.

Typically, the Crockett soil has a silt loam surface layer about 13 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The subsoil to a depth of 54 inches is clay. The upper part is brown with strong brown and reddish yellow mottles, and the lower part is olive brown with strong brown mottles. The substratum to a depth of 80 inches is stratified light yellowish brown, light olive brown, and light brownish gray shaly silty clay. The soil is medium acid in the upper part and slightly acid in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is slow. The root zone is deep, but roots are restricted by the dense subsoil. This soil is easily tilled but is subject to surface crusting after rains.

Included with this soil in mapping are small areas of Derly, Wilson, and Raino soils. Derly and Wilson soils have a gray subsoil and are in slight depressions. Raino soils have a thick, loamy surface layer and are on mounds. The included soils make up less than 15 percent of the map unit.

The Crockett soil is used mostly as pasture of native grasses, bermudagrass, or bahiagrass. In a few areas, it is used for cultivated crops.

Pastures are mainly coastal bermudagrass, common bermudagrass, and bahiagrass. Arrowleaf clover is overseeded in many pastures for additional forage production. Very slow permeability is the main limiting feature of this soil for use as pasture. Fertilizer and controlled grazing increase yields.

This soil is not suited to woodland production. The climax vegetation is native grasses and forbs.

Winter wheat is planted on this soil for grain production and for cool-season grazing. Corn and grain sorghums can be grown. Very slow permeability and droughtiness are the main limiting features of this soil for use as cropland. Fertilizer increases yields. Residue left on or near the surface helps to maintain organic matter and improves soil tilth.

This soil is poorly suited to most urban uses. Very slow permeability, corrosiveness, high shrink-swell potential, and low strength are limiting features. Low strength and shrinking and swelling can be partly overcome by strengthening or replacing the base material. Corrosiveness to steel can be partly overcome by coating pipe and by providing cathodic protection.

The Crockett soil is in capability subclass IIIs. It does not have a woodland ordination symbol.

CrB—Crockett silt loam, 1 to 3 percent slopes. This soil is gently sloping and moderately well drained. It is on broad, irregularly shaped stream divides. The surface is plane to slightly convex. The areas range from 50 to several hundred acres, but average about 300 acres.

Typically, the Crockett soil has a dark brown silt loam surface layer about 8 inches thick. The subsoil to a depth of 60 inches is clay. The upper part is dark brown and olive brown with mottles in shades of red and brown. The lower part is light olive brown and mottled gray, light olive brown, and light yellowish brown. The substratum to a depth of 80 inches is mottled light yellowish brown and grayish brown shaly silty clay that has a few concretions and soft masses of calcium carbonate. The soil is medium acid to a depth of 18 inches, neutral to a depth of 60 inches, and mildly alkaline below that.

Permeability is very slow, and the available water capacity is high. Runoff is slow. The root zone is deep, but roots are restricted by the dense clayey subsoil. This soil is easily tilled, but it is subject to surface crusting after rains. Erosion is a moderate hazard.

Included with this soil are small areas of Woodtell and Raino soils. Woodtell soils have a red subsoil and are slightly higher on the landscape than the Crockett soil. Raino soils are on mounds and have a thick, loamy surface layer. Small areas of Crockett soils that are eroded are on the more convex and sloping landscapes. The included soils make up less than 10 percent of the map unit.

The Crockett soil is used mostly as improved or native pasture. In a few areas, it is used for cultivated crops, mostly small grains.

Pastures are mainly coastal bermudagrass, common bermudagrass, and bahiagrass. Arrowleaf clover is overseeded in some pastures for additional grazing and forage production. Very slow permeability is the main limiting feature of this soil for use as pasture. Fertilizer and controlled grazing increase yields.

This soil is not suited to use as woodland. The climax vegetation is native grasses and forbs.

Winter wheat is planted on this soil for grain production and for cool-season grazing (fig. 11). Corn and grain sorghum are also grown. Erosion is a hazard, and very slow permeability is the main limiting feature of this soil for use as cropland. Fertilizer increases yields, and terraces, contour farming, and cover crops help to control erosion. Residue left on or near the surface helps to maintain organic matter and improves soil tilth.

This soil is poorly suited to most urban uses because of very slow permeability, corrosiveness, the clayey texture, and high shrink-swell potential. Low strength is a limitation for local roads and streets. Low strength and shrinking and swelling can be partly overcome by strengthening or replacing the base material. Corrosiveness to steel can be partly overcome by coating steel pipe and by providing cathodic protection.

This Crockett soil is in capability subclass IIIe. It does not have a woodland ordination symbol.

CrC3—Crockett silt loam, 2 to 5 percent slopes, severely eroded. This soil is gently sloping and moderately well drained. It is on irregularly shaped slopes surrounding small drainageways. The surface is mainly plane or convex. The areas range from 50 to 200 acres, but average about 80 acres.

About half of the areas of this soil have gullies about 100 to 300 feet apart. They also have spots of sheet erosion. The gullies are U-shaped and are about 4 to 50 feet wide, 30 to 400 feet long, and 1 to 5 feet deep. Some gullies cannot be crossed by farm machinery. Other areas have only an occasional gully; however, sheet erosion has removed over 50 percent of the surface layer.

Typically, the Crockett soil has a brown silt loam surface layer about 3 inches thick. The subsoil to a depth of 44 inches is clay. To a depth of 8 inches, it is dark yellowish brown with mottles in shades of red and brown. Below that, it is light olive brown, gray, and yellowish brown. The substratum is gray and light olive brown shaly clay that has a few concretions and soft masses of calcium carbonate. The soil is slightly acid in the upper part, neutral in the middle part, and mildly alkaline in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is rapid. The root zone is deep, but roots are restricted by the dense clayey subsoil. Erosion is a severe hazard.

Included with this soil are small areas of Woodtell, Bazette, and Normangee soils. Woodtell soils have a red subsoil and are on convex spots on the landscape. Bazette soils have a clay loam surface layer, and Normangee soils have a gravelly surface layer. The included soils make up less than 10 percent of the map unit.

The Crockett soil is mainly used as native pasture; however, in some small areas, it is used as improved pasture.

The main pasture plants are coastal bermudagrass, common bermudagrass, and bahiagrass. Arrowleaf clover is overseeded in many pastures for additional forage production. Very slow permeability is the main limiting feature of this soil for use as pasture. Fertilizer and controlled grazing increase yields.

This soil is not suited to woodland production. The climax vegetation is native grasses and forbs.

Corn, grain sorghum, and small grains are the main crops on this soil. Winter wheat can be planted for grain production and cool-season grazing. Erosion is a hazard, and droughtiness and very slow permeability are limiting features. Fertilizer increases yields. Terraces, contour farming, and cover crops help to control erosion. Residue left on or near the soil surface helps to maintain organic matter and improves soil tilth.

Figure 11.—Winter wheat is grown on Crockett silt loam, 1 to 3 percent slopes, for grain production and for cool-season grazing.

This soil has several limitations for urban uses. Very slow permeability, the clayey texture, corrosiveness to steel, high shrink-swell potential, and low strength are the main limiting features. Low strength and high shrink-swell potential can be partly overcome by strengthening or replacing the base material. Very slow permeability limits the use for septic tank absorption fields. Corrosiveness to steel can be partly overcome by coating pipe and by providing cathodic protection.

The Crockett soil is in capability subclass IVe. It does not have a woodland ordination symbol.

CsE—Cuthbert fine sandy loam, 8 to 25 percent slopes. This soil is strongly sloping to steep and well drained. It is on hilly uplands on side slopes above drainageways. The surface is plane to concave. The areas are long and narrow. They range from 10 to 300 acres, but average 80 acres.

Typically, the Cuthbert soil has a dark brown fine sandy loam surface layer about 4 inches thick. The subsurface layer to a depth of about 9 inches is brown fine sandy loam. The subsoil to a depth of 22 inches is yellowish red clay. The next layer to a depth of 32 inches is yellowish red and strong brown clay loam that has a few shale fragments. The substratum to a depth of 60 inches is light gray and dark grayish brown shale and yellowish brown and light gray sandstone. It has thin strata of interbedded ironstone. The soil is medium acid or strongly acid in the upper part and very strongly acid in the lower part.

Permeability is moderately slow, and the available water capacity is moderate. Runoff is rapid. The root zone is moderately deep. Erosion is a severe hazard unless the soil is protected by plant cover.

Included with this soil in mapping are small areas of Kirvin, Sacul, and Tenaha soils. Kirvin soils have a thicker sola and are in higher positions than those of the Cuthbert soil. Sacul and Tenaha soils are in positions similar to those of the Cuthbert soil. Sacul soils have gray mottles in the upper part of the subsoil. Tenaha soils have a sandy surface layer more than 20 inches thick. Also included are areas of Cuthbert soils that are gravelly and cobbly. These soils have 15 to 50 percent, by volume, ironstone fragments less than 3 inches across. The included soils make up less than 15 percent of the map unit.

The Cuthbert soil is mainly used as woodland of mixed hardwoods and pine. Some areas have been cleared and are used as pasture.

In native woodland areas of this soil, the main trees are shortleaf pine, red oak, sweetgum, loblolly pine, and post oak. The principal commercial tree is loblolly pine. Steepness of slope and the clayey subsoil are concerns in management.

Pasture plants on this soil include common bermudagrass or bahiagrass overseeded with crimson or arrowleaf clovers. Steepness of slope and the hazard of erosion are concerns. Lime, fertilizer, and controlled grazing increase yields.

This soil is not suited to cultivation because of steepness of slope and the hazard of erosion.

This soil has some major limitations for urban uses. It is highly corrosive to steel and concrete. Corrosiveness can be somewhat overcome by treating the soil, by coating the pipe, and by providing cathodic protection. Low strength and steepness of slope are limitations for streets and roads. In addition, slope and shrinking and swelling of the soil are limitations for building sites; however, the scenic views make very desirable homesites. Most limitations can be partly overcome by good design and careful installation.

The Cuthbert soil is in capability subclass VIe. The woodland ordination symbol is 8C.

CuF—Cuthbert and Redsprings soils, 15 to 40 percent slopes. This undifferentiated map unit is made up of Cuthbert and Redsprings soils on moderately steep and steep uplands. These soils are well drained. They are on hills, known locally as "mountains," and are the highest part of the landscape. The areas are generally oval and can include one hill or several hills joined together. The areas range from 100 to 1,000 acres, but average about 300 acres.

In most areas, this map unit consists of 40 to 60 percent Cuthbert soil, 30 to 50 percent Redsprings soil, and about 10 percent other soils. The Cuthbert and Redsprings soils are not uniform and do not occur in a regular pattern. The Redsprings soil is not in some areas, and in others, it is less than 30 percent of the map unit. Ironstone pebbles and large stones cover the surface in some small areas of this map unit.

Typically, the Cuthbert soil has a dark brown gravelly fine sandy loam surface layer about 9 inches thick. It has about 30 percent ironstone pebbles and fragments. The subsoil extends to a depth of about 35 inches. It is red clay in the upper part. The lower part is red sandy clay loam that has shale fragments in shades of gray. The substratum to a depth of 60 inches is stratified red sandy clay loam, yellowish brown sandstone, and gray shale. The soil is strongly acid in the upper part and very strongly acid in the lower part.

Permeability is moderately slow, and the available water capacity is moderate. Runoff is rapid. The root zone is deep. This soil is subject to erosion.

Typically, the Redsprings soil has a gravelly fine sandy loam surface layer about 10 inches thick. It is dark reddish brown in the upper part and yellowish red in the lower part. The subsoil to a depth of 44 inches is red clay that has remnants of reddish yellow weathered glauconite. The substratum to a depth of 60 inches is reddish yellow weathered glauconite. The soil is neutral in the upper part and grades to very strongly acid in the lower part.

Permeability is moderately slow, and the available water capacity is moderate. Runoff is medium to rapid. The root zone is deep. This soil is subject to erosion.

Included with these soils in mapping are small areas of the Tenaha, Elrose, Kirvin, and Sacul soils. Tenaha soils have a sandy surface layer more than 20 inches thick. Elrose soils have a loamy subsoil more than 60 inches thick. Kirvin and Sacul soils have a thicker subsoil than that of the Redsprings soil. In addition, Sacul soils have gray mottles in the upper part of the subsoil.

The Cuthbert and Redsprings soils are used mainly as woodland or habitat for wildlife. They are also a source of iron ore for steel production.

Loblolly and shortleaf pines are the major commercial trees; however, because of the small size of the trees, the timber produced is used mainly for pulpwood in paper production, rather than for lumber. Because of slope, most areas are rather inaccessible to vehicles and domestic livestock, but they are a natural refuge for deer and other wildlife.

These soils are not suited to use as cropland or pasture because of steepness of slope. Erosion is a hazard. Coarse fragments of ironstone limit agricultural practices.

These soils are frequently used as a source for iron ore to produce steel or for use as road base material. Erosion is a hazard.

These soils are limited for urban uses because of slope; however, because of the scenic views, areas of these soils are desirable for homesites.

The Cuthbert and Redsprings soils are in capability subclass VIIe. The ordination symbol for Cuthbert soil is 6R, and it is 7R for the Redsprings soil.

DaC—Darco loamy fine sand, 2 to 5 percent slopes. This soil is gently sloping and well drained. It is on broad interstream divides and oblong ridges. The surface is plane to slightly convex. The areas range from 30 to 300 acres, but average about 80 acres.

Typically, the Darco soil has a very dark grayish brown loamy fine sand surface layer about 7 inches thick. The subsurface layer to a depth of 58 inches is loamy fine sand. It is light yellowish brown in the upper part and pale brown in the lower part. The subsoil to a depth of 80 inches is yellowish red sandy clay loam. The soil is slightly acid in the upper part and very strongly acid in the lower part.

Permeability is moderate, and the available water capacity is low. Runoff is slow. The root zone is deep.

Included with this soil in mapping are small areas of Duffern, Lilbert, and Tenaha soils. Duffern soils are sandy to a depth of at least 80 inches. Lilbert and Tenaha soils have a sandy surface layer 20 to 40 inches thick. In addition, Tenaha soils are on side slopes above drainageways. The included soils make up less than 20 percent of the map unit.

The Darco soil is used mainly as pasture or woodland. In some small areas, this soil is used as cropland.

Grasses, such as coastal bermudagrass and lovegrass, are commonly used as warm-season pasture. Lime and split applications of complete fertilizers during the growing season increase yields. Droughtiness and the hazard of erosion are the main limiting features for pasture production.

Woodland areas of this soil are mainly mixed hardwoods and pines. Slash and loblolly pines are used for commercial timber production. Droughtiness is the main limitation for the production of commercial timber because it limits the growth of trees and decreases the survival rate of seedlings. Proper thinning and prescribed burning help to develop good stands of timber.

This soil is suited to crops, such as watermelons, sweet potatoes, and peanuts. Droughtiness, however, is a limitation. Lime and split applications of fertilizers increase yields. Residue management, cover crops, and conservation tillage help to maintain organic matter in the surface layer.

This soil is suited to most urban uses; however, seepage is a limiting feature for sewage lagoons and sanitary landfills. This limitation can be overcome by using clay liners, good design, and careful installation.

The Darco soil is in capability subclass IIIs. The woodland ordination symbol is 9S.

DrA—Derly-Raino complex, 0 to 1 percent slopes. This complex is made up of Derly and Raino soils on nearly level to depressional and moundy stream terraces. The Derly soil is poorly drained, and the Raino soil is moderately well drained. The areas are plane to weakly concave, and mounds dot the landscape. The areas range from 30 to more than 1,000 acres, but average about 500 acres.

This complex is made up of about 70 percent Derly soil, 20 percent Raino soil, and 10 percent other soils. Raino soil is on ovate mounds that protrude at random from intermound areas of Derly soil. The mounds are scarce in some areas and abundant in other areas. In typical areas, the mounds are 2 to 4 feet high, 20 to 80 feet across, and 50 to 200 feet apart. The Derly and Raino soils are too intricately mixed to be mapped separately at the scale used for maps in the back of this publication.

Typically, the Derly soil has a brown silt loam surface layer 7 inches thick. The subsurface layer is light brownish gray silt loam to a depth of 14 inches. The subsoil to a depth of 26 inches is light brownish gray silty clay loam. To a depth of 80 inches, it is clay that is grayish brown in the upper part and light brownish gray in the lower part. Tongues of light gray clean sand and silt are throughout the subsoil. The soil is strongly acid in the upper part, very strongly acid in the middle part, and grades to neutral in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is slow. The root zone is deep. In wet seasons, a high water table is within 18 inches of the surface. Water ponds for a few days in places.

Typically, the Raino soil has a dark yellowish brown loam surface layer 6 inches thick. The next layer is yellowish brown loam to a depth of 21 inches. The subsoil to a depth of 35 inches is yellowish brown loam. It has light brownish gray mottles and has pockets of clean sand and silt. To a depth of 45 inches, the subsoil is mottled gray, strong brown, and yellowish red clay that has pockets of clean sand and silt, and to a depth of 65 inches, it is mottled yellowish red, gray, and strong brown clay. The subsoil to a depth of 78 inches is mottled light brownish gray, brownish yellow, strong brown, and yellowish red clay loam. The soil is medium acid in the upper part and very strongly acid in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is slow. The root zone is deep. During the wet season, a high water table is about 2 to 4 feet below the surface.

Included with this complex in mapping are small areas of Freestone, Woodtell, and Talco soils. Freestone soils are in slightly higher positions than those of the Derly and Raino soils. The upper part of the subsoil is loamy, and the lower part is clayey. Woodtell soils have a red subsoil and are on steeper slopes. Talco soils are not dominantly gray in the upper part of the subsoil and are better drained.

The Derly and Raino soils are mainly used as woodland. A few small areas have been cleared and are used as improved pasture or as cropland.

Woodland areas of these soils consist of willow oak, water oak, post oak, red oak, sweetgum, and elm. Wetness is the main limitation for timber production and harvesting. The Derly soil is best suited to wetness-tolerant trees, such as willow oak, water oak, and sweetgum. Loblolly pine, shortleaf pine, post oak, red oak, and elm grow well on the Raino soil.

The common improved pasture plants include bahiagrass, common bermudagrass, and tall fescuegrass. Some pastures are overseeded with white clover and singletary peas. Poor drainage and very slow permeability are limiting features. Fertilizer, lime, and surface drainage increase yields.

The soils in this complex are difficult to work. When the Raino soil is ready for cultivation, the Derly soil is still too wet to cultivate. Excess water and very slow permeability are limiting features for use as cropland; however, wheat is grown on these soils. A drainage system and fertilizer can increase yields.

These soils are poorly suited to most urban uses. Wetness and very slow permeability prevent satisfactory operation of septic tanks. Wetness and the clayey texture are limitations for sanitary landfills, and these limitations are costly to overcome. Shrinking and swelling, low strength, and wetness are problems for buildings and roads and streets. Proper design and careful installation of structures help to overcome or modify these limitations. Coating pipe and treating concrete reduce corrosiveness.

The Derly and Raino soils are in capability subclass IIIw. The woodland ordination symbol for the Derly soil is 4W. It is 9W for the Raino soil.

DuC—Duffern fine sand, 2 to 5 percent slopes. This soil is gently sloping and excessively drained. It is on broad interstream divides. The surface is plane to weakly convex. The areas range from 50 to 500 acres, but average about 100 acres.

Typically, the Duffern soil is fine sand to a depth of at least 95 inches. The surface layer is 8 inches thick. It is dark brown. The subsurface layer extends to a depth of 46 inches. It is yellowish brown and light yellowish brown. The subsoil is brownish yellow in the upper part and light gray in the lower part. Thin lamellae of yellowish brown and yellowish red loamy material are few or common in the subsoil. The soil is medium acid to neutral.

Permeability is rapid, and the available water capacity is very low. Runoff is very slow. The root zone is deep.

Included with this soil in mapping are small areas of Lilbert, Wolfpen, Darco, and Pickton soils. Lilbert and Wolfpen soils have a sandy surface layer less than 40 inches thick. Darco and Pickton soils have a sandy surface layer less than 72 inches thick. These soils are slightly higher on the landscape than the Duffern soil and have a loamy subsoil. The included soils make up less than 25 percent of the map unit.

The Duffern soil is used mainly as woodland or pasture. In a few isolated areas, it is used for cultivated crops.

Woodland areas of this soil are mixed stands of hardwoods and pine. Loblolly pine is the principal commercial tree. A few areas have been planted to slash pine and drought-resistant loblolly pine. The major limitations for woodland production are droughtiness and texture. The deep, sandy soil makes harvesting difficult, and droughtiness decreases the survival rate of seedlings.

This soil is suited to warm-season pasture plants, such as coastal bermudagrass and lovegrass; however, frequent applications of fertilizer and lime are required for good production. Very low available water capacity is the main limiting feature of this soil for use as pasture.

The Duffern soil is used in a few areas for cultivated crops, such as watermelons, peanuts, and vegetables. Fertilizer and lime are essential for good yields. Slope and droughtiness are the main limitations, and erosion is a hazard. Conservation tillage, cover crops, and contour farming reduce erosion and help to maintain fertility.

This soil is used as a source for roadfill and building material (fig. 12). Unprotected areas of this soil are subject to erosion.

This soil is suited to most urban uses; however, the poor filtering capacity of this soil limits its use for septic tank absorption fields and sewage lagoons. Seepage is also a limitation for these uses. Corrosiveness is a limitation for concrete. These limitations can be overcome by careful planning and installation.

The Duffern soil is in capability subclass IVs. The woodland ordination symbol is 7S.

DuE—Duffern fine sand, 8 to 15 percent slopes. This soil is on strongly sloping to moderately steep side slopes above drainageways. It is excessively drained. The surface is plane to concave. The areas range from 20 to 200 acres, but average about 80 acres.

Typically, the Duffern soil has a brown fine sand surface layer about 7 inches thick. The next layer to a depth of 63 inches is yellowish brown fine sand. The underlying layer to a depth of 84 inches is strong brown fine sand. The soil is slightly acid in the upper part and medium acid in the lower part.

Permeability is rapid, and the available water capacity is very low. Runoff is very slow. The root zone is deep. Erosion is a moderate hazard.

Included with this soil in mapping are small areas of Tenaha, Darco, and Pickton soils. Tenaha soils have a sandy surface layer less than 40 inches thick and a loamy subsoil. Darco and Pickton soils have a sandy surface layer less than 72 inches thick and a loamy subsoil. Also included are areas of Duffern fine sand that have slopes of less than 8 percent. The included soils make up less than 15 percent of the map unit.

This Duffern soil is mainly used as woodland. In other areas, it is used as pasture.

Woodland areas of this soil consist of sandjack oak, blackjack oak, shortleaf pine, post oak, and red oak. Commercial trees are mainly shortleaf pine. Droughtiness and slope are limiting features for timber production.

Pasture plants include coastal bermudagrass and weeping lovegrass. Droughtiness is a limiting feature for pasture establishment. Lime, proper fertilization, and controlled grazing improve yields.

This soil is not suited to cultivation because of slope and the hazard of erosion.

This soil is suited to many urban uses; however, slope, the sandy texture, and seepage are limitations for septic

Figure 12.—Sand is mined from Duffern fine sand, 2 to 5 percent slopes, for use in construction.

tank absorption fields, sewage lagoons, and sanitary landfills. Slope is also a limitation for local roads and streets. Corrosiveness for concrete is moderate. Good design and careful installation can modify or overcome these limitations.

The Duffern soil is in capability subclass VIe. The woodland ordination symbol is 7S.

EID3—Ellis clay, 5 to 12 percent slopes, severely eroded. This soil is strongly sloping and well drained. It is on side slopes along drainageways. The surface is plane to weakly convex. The areas range from 30 to 100 acres, but average about 50 acres.

Most areas of this soil have gullies 100 to 500 feet apart. A few rills are between the gullies. The gullies are U-shaped and are about 2 to 30 feet wide, 30 to 200 feet long, and 1 foot to 5 feet deep. A few gullies cannot be crossed with farm machinery. Other areas have many rills and only a few gullies.

Typically, the Ellis soil is very dark grayish brown clay about 3 inches thick. The subsoil to a depth of about 38 inches is clay. It is dark grayish brown in the upper part and grades to olive in the lower part. The subsoil has a few mottles in shades of brown and olive. The substratum is olive shaly clay that has light olive brown mottles and a few concretions and soft masses of calcium carbonate. The soil is slightly acid in the upper part and grades to moderately alkaline in the lower part.

Permeability is very slow, and the available water capacity is moderate. Runoff is rapid. The root zone is deep; however, roots are restricted by the clayey texture. Erosion is a severe hazard if the soil does not have a plant cover.

Included with this soil in mapping are small areas of Normangee, Bazette, Crockett, and Woodtell soils. These soils have a loamy surface layer and are in positions similar to those of the Ellis soil. In addition, Normangee soils have 15 percent or more siliceous pebbles in the surface layer. The included soils make up less than about 20 percent of the map unit.

The Ellis soil is used as native or improved pasture. Some areas of this soil are idle, and shrubs and trees are encroaching.

This soil is suited to pasture plants, such as common bermudagrass and bahiagrass. Fertilizer improves yields.

This soil is not suited to production of commercial trees. The climax vegetation is native grasses and forbs.

The Ellis soil is not suited to cultivated crops because of slope and the hazard of erosion.

This soil is poorly suited to most urban uses. The slope and shrinking and swelling are major limitations for buildings and sanitary facilities. Low strength limits the use of this soil for local roads and streets. Proper design and installation can reduce these limitations.

The Ellis soil is in capability subclass VIe. It does not have a woodland ordination symbol.

ErC—Elrose gravelly fine sandy loam, 3 to 8 percent slopes. This soil is gently sloping to strongly sloping and well drained. It is on narrow foot slopes above drainageways and colluvial toe slopes. The areas are slightly convex, and they range from 20 to 80 acres, but average 40 acres.

Typically, the Elrose soil has a reddish brown gravelly fine sandy loam surface layer about 7 inches thick. The subsoil extends to a depth of at least 80 inches. It is red sandy clay loam to a depth of 22 inches and dark red sandy clay loam to a depth of 71 inches. Below that, it is red fine sandy loam. The subsoil has strong brown mottles below a depth of 22 inches and remnants of glauconite and fragments of ironstone below a depth of 34 inches. The soil is slightly acid in the surface layer and very strongly acid in the subsoil.

Permeability is moderate, and the available water capacity is moderate. Runoff is medium. The root zone is deep. Erosion is a moderate hazard.

Included with this soil in mapping are small areas of Bowie, Kirvin, and Redsprings soils. Bowie soils have a yellowish subsoil and are on concave, gentle slopes. Kirvin and Redsprings soils have a clayey subsoil and are in convex positions on the landscape. Redsprings soils are also in more sloping areas than those of the Elrose soil. The included soils make up less than 10 percent of the map unit.

The Elrose soil is mainly used as woodland or pasture. In other areas, it is used as cropland or for gardens and orchards.

Most woodland areas of this soil consist of mixed hardwoods and pine. Loblolly pine is the principal commercial tree. Some idle cropland fields have been planted to slash pine for timber production. The gravel reduces the available water capacity and limits timber production; however, proper woodland management can increase timber yields.

Warm-season pasture plants commonly planted on this soil are common bermudagrass and coastal bermudagrass. Overseeding with arrowleaf clover, crimson clover, or vetch is a frequent pasture management practice. Cool-season grasses, such as winter oats or ryegrass, are also planted. Clover provides forage during the winter and adds nitrogen to the soil. Lime and fertilizer are essential for good yields.

This soil is suited to garden and truck crops, such as corn, beans, peas, sweet potatoes, and tomatoes. A few small areas of cropland are planted to wheat and ryegrass for grain production. This soil is also suited to orchard fruit production, such as peaches, plums, and pears. Lime and fertilizer can increase yields. Residue management, contour farming, and terraces reduce erosion.

This soil is suited to most urban uses; however, seepage is a limitation for sewage lagoons and trench landfills. Clay liners help control seepage. Corrosiveness is a limitation for uncoated steel and concrete. Coating steel pipe and providing cathodic protection help to control corrosion. Good design and careful installation can help overcome or modify these limitations.

The Elrose soil is in capability subclass IIIe. The woodland ordination symbol is 7F.

Es—Estes clay loam, frequently flooded. This soil is nearly level and somewhat poorly drained. It is on flood plains of large streams. Slopes are 0 to 1 percent. The areas are from 500 feet to over 1 mile wide and range from 300 to 2,000 acres.

Typically, the Estes soil has a dark grayish brown clay loam surface layer about 8 inches thick. The subsoil extends to a depth of at least 80 inches. To a depth of 63 inches, it is grayish brown clay that has mottles in shades of brown and gray. Below that, the subsoil is light brownish gray clay loam. The soil is medium acid in the surface layer and extremely acid or very strongly acid in the subsoil.

Permeability is very slow, and the available water capacity is high. Runoff is slow. The root zone is deep. A high water table is at or near the surface during the wet season. This soil is subject to flooding at least once each year for brief to long periods during the winter and spring. Water also stands or ponds in places for a few days to a few weeks (fig. 13).

Included with this soil in mapping are small areas of Nahatche, Besner, and Bienville soils. The Nahatche soils are loamy throughout and make up 5 to 10 percent of the map unit. Besner and Bienville soils are in slightly higher positions than those of the Estes soil and have a loamy and sandy surface layer. The included soils make up less than 10 percent of the map unit.

Most areas of the Estes soil are in hardwood timber. A few areas have been cleared and planted to improved pasture.

Water oak and willow oak are the dominant trees in woodland areas. Sweetgum and ash are also common. Pine production and timber harvesting are restricted by wetness and flooding.

Some areas of this soil are planted to adapted warm-season grasses, such as common bermudagrass or bahiagrass. Tall fescuegrass and white clover are good cool-season forage combinations for grazing. Flooding and wetness limit production on this soil; however, fertilizer and lime can increase yields.

This soil is not suited to crops or to urban uses because of frequent flooding. Ponding is also a limitation for urban uses.

The Estes soil is in capability subclass Vw. The woodland ordination symbol is 7W.

Figure 13.—Water ponds on Estes clay loam, frequently flooded, for a few days to a few weeks after rainfall.

FrB—Freestone fine sandy loam, 1 to 3 percent slopes. This soil is on gently sloping stream divides, on foot slopes, and at the head of drainageways. It is moderately well drained. The surface is concave or plane. The areas are irregularly shaped and range from 15 to 500 acres, but average about 100 acres.

Typically, the Freestone soil has a dark brown fine sandy loam surface layer about 5 inches thick. The subsurface layer to a depth of 11 inches is yellowish brown loam. The subsoil to a depth of 27 inches is yellowish brown with mottles in shades of gray and red. It is loam in the upper part and clay loam in the lower part. To a depth of 73 inches, it is mottled grayish brown, red, and yellowish brown clay that grades to light brownish gray clay in the lower part. The subsoil has streaks and pockets of light brownish gray clean sand and silt. The substratum to a depth of 85 inches is stratified light brownish gray shale and yellowish brown sandy clay loam that has mottles in shades of brown. The soil is medium acid or slightly acid in the upper part, very strongly acid in the middle part, and medium acid in the lower part.

Permeability is slow, and the available water capacity is high. Runoff is medium. The root zone is deep. A perched high water table is 1.5 to 3 feet below the surface during winter and spring. Erosion is a moderate hazard.

Included with this soil in mapping are small areas of Raino, Woodtell, and Talco soils. Raino soils have a thick, loamy surface layer and are on moundy landscapes. Woodtell soils are on convex ridgetops, and the upper part of the subsoil is red clay. Talco soils are somewhat poorly drained and are in low, wet areas. The included soils make up less than 15 percent of the map unit.

The Freestone soil is used mainly as improved pasture. In a few areas, it is used as woodland or cropland.

This soil is well suited to coastal bermudagrass, common bermudagrass, bahiagrass, and legumes, such as crimson clover, arrowleaf clover, and vetch. Wheat, oats, ryegrass, and other cool-season grasses are planted for winter grazing in some areas of this soil. Fertilizer and lime are needed for high yields.

The Freestone soil produces hardwoods and pines. Sweetgum, oak, elm, and hickory are the major hardwoods. Loblolly and shortleaf pines are the major commercial trees. Seasonal wetness is a limiting feature for timber harvesting. Proper woodland practices can increase yields.

This soil is suited to cultivated crops, such as corn, sorghum, peanuts, small grains, and vegetables (fig. 14). Fertilizer and lime are essential for high yields. Contour farming, terraces, and cover crops reduce erosion. Crop residue maintained on the surface improves soil tilth.

This soil is suited to most urban uses; however, wetness, the clayey texture of the subsoil, and shrinking and swelling are limiting features for sanitary facilities and dwellings. Low strength reduces the carrying capacity of roads and streets. This soil is corrosive to uncoated underground steel and concrete. If this soil is used for roads and streets, the base material needs to be strengthened. Proper foundation design is required to overcome the moderate to high shrink-swell potential in the lower part of the subsoil.

The Freestone soil is in capability subclass IIe. The woodland ordination symbol is 9W.

FuB—Freestone-Urban land complex, 1 to 3 percent slopes. This complex consists of Freestone soil and Urban land on broad divides, wide foot slopes, and at the heads of streams. The Freestone soil is moderately well drained. The areas are oblong and range from 20 to 80 acres.

This complex is 55 to 75 percent Freestone soil, 15 to 35 percent Urban land, and 10 percent or less other soils. Areas of the Freestone soil and Urban land are too intricately mixed to be mapped separately at the scale used for the maps in the back of this publication.

Typically, the Freestone soil has a dark brown fine sandy loam surface layer about 5 inches thick. The subsurface layer to a depth of 11 inches is yellowish brown loam. The subsoil to a depth of 27 inches is yellowish brown with mottles in shades of gray and red. It is loam in the upper part and clay loam in the lower part. To a depth of 73 inches, it is mottled grayish brown, red, and yellowish brown clay that grades to light brownish gray in the lower part. The subsoil has streaks and pockets of light brownish gray clean sand and silt. The substratum to a depth of 85 inches is stratified light brownish gray shale and yellowish brown sandy clay loam that has mottles in shades of brown. The soil is medium acid or slightly acid in the upper part, very strongly acid in the middle part, and medium acid in the lower part.

Permeability is slow, and the available water capacity is high. Runoff is medium. The root zone is deep. A perched high water table is 1.5 to 3 feet below the surface during winter and spring. Erosion is a moderate hazard.

Urban land consists of areas covered by dwellings, commercial buildings, schools, churches, driveways, streets, parking lots, and railroad yards. It also includes areas that have been disturbed by cutting, filling, or grading. The soil has been altered to such an extent that further classification is not possible.

Included with this complex in mapping are small areas of Raino, Woodtell, and Talco soils. Raino soils have a thick, loamy surface layer and are on moundy landscapes. Woodtell soils are on convex ridgetops, and the upper part of the subsoil is red clay. Talco soils are somewhat poorly drained and are in low, wet areas.

This soil is suited to most urban uses; however, wetness, the clayey texture of the subsoil, and shrinking and swelling are limiting features for sanitary facilities and dwellings. Low strength reduces the carrying capacity of roads and streets. This soil is corrosive to uncoated underground steel and concrete. If this soil is used for roads and streets, the base material needs to be strengthened. Proper foundation design is required to overcome the moderate to high shrink-swell potential in the lower part of the subsoil.

This complex is not in a capability class, and it does not have a woodland ordination symbol.

Gw—Gladewater clay, frequently flooded. This soil is nearly level and poorly drained. It is on large flood plains. Slopes are 0 to 1 percent. The areas are plane and are from 1,000 feet to 2 miles wide. They are extensive and range up to 2,000 acres, but they average about 800 acres.

Figure 14.—Freestone fine sandy loam, 1 to 3 percent slopes, is suited to crops, such as corn, but most of the acreage is pasture.

Typically, the Gladewater soil has a very dark grayish brown clay surface layer about 6 inches thick. The subsoil to a depth of 63 inches is clay. It is grayish brown in the upper part, dark grayish brown in the middle part, and grayish brown in the lower part. The subsoil has light olive brown and strong brown mottles. The soil is neutral in the upper part, medium acid or slightly acid in the middle part, and neutral in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is very slow. The root zone is deep, but the clayey texture restricts movement of water, roots, and air. This soil is subject to flooding 2 to 4 times a year for periods of 7 to 30 days. A high water table is at a depth of less than 3.5 feet during winter and spring.

Included with this soil in mapping are small areas of closely similar Kaufman, Texark, and Nahatche soils, which are on flood plains. Kaufman and Texark soils have a thicker, darker color surface layer than that of the Gladewater soil. Nahatche soils are loamy throughout. The included soils make up less than 15 percent of the map unit.

Areas of the Gladewater soil are mainly in hardwood forest. A few small areas have been cleared and planted to improved pasture.

The most common trees on this soil are green ash, hackberry, elm, willow oak, and water oak. Because of frequent flooding, managing this soil for commercial timber production is difficult; however, wetness-tolerant trees grow well and provide ideal wildlife refuge. Wetness and flooding also restrict harvesting operations.

This soil is suited to pasture plants, such as common bermudagrass and bahiagrass. Fescuegrass and white clover are excellent combinations for cool-season grazing. Fertilizer, lime, and proper grazing increase yields.

This soil is not suited to cultivated crops or urban uses because of wetness and frequent flooding.

The Gladewater soil is in capability subclass Vw. The woodland ordination symbol is 5W.

GyB—Grayrock silty clay loam, 2 to 5 percent slopes. This soil is gently sloping and well drained. It consists of reclaimed mine spoil material. The areas are broad stream divides with a convex surface. Except in new mining areas, the areas of this soil are typically several hundred acres in size.

Typically, the Grayrock soil has a dark grayish brown silty clay loam surface layer 7 inches thick. The underlying material to a depth of 80 inches is dark grayish brown, olive brown, and olive gray silty clay loam that has fragments of shale and lignite throughout. The soil is neutral in the upper part, medium acid in the middle part, and mildly alkaline in the lower part.

Permeability is slow, and it is expected to decrease as the soil settles. The available water capacity is moderate. Runoff is medium. The root zone is deep, and roots move readily through the soil. Erosion is a moderate hazard.

Included with this soil in mapping are small areas of Freestone, Woodtell, and Wolfpen soils. These soils are on the edge of mined areas. They have a yellow or red loamy or clayey subsoil. The included soils make up less than 10 percent of the map unit.

Most areas of the Grayrock soil have been established to bermudagrass and are used as pasture or hayland. The other areas are in various stages of reclamation.

After reclamation, this soil is suited to pasture plants, such as bermudagrass, bahiagrass, and arrowleaf clover. Fertilizer and controlled grazing are necessary to establish stands and maintain yields.

Various trees and wildlife plantings are in the trial stage, and a few crops are being planted to determine their adaptability. Fertilizer and additional organic matter are important to the productivity of all plantings. Terraces, contour farming, and residue management improve soil tilth and help to control erosion.

This soil is suited to most urban uses; however, it has some limiting features. The slow permeability is a limiting feature for septic tank absorption fields. This limitation can be overcome somewhat by increasing the size of the absorption field. Because of the clayey texture, digging or covering sanitary landfills is difficult and equipment use is restricted during wet weather. Unstable fill is a restriction for dwellings and small commercial buildings. This soil will settle for several years, which can cause building and road foundations to fracture. The base can be strengthened or replaced, but uneven settling will probably occur for several years. This soil is corrosive to steel, but this problem can be partly overcome by coating pipes and by providing cathodic protection.

The Grayrock soil is in capability subclass IVe. It does not have a woodland ordination symbol.

GyD—Grayrock silty clay loam, 5 to 12 percent slopes. This soil is strongly sloping and well drained. It consists of shaped areas along manmade drainageways in reclaimed mine spoil material. The areas are long and narrow and typically are several hundred acres.

Typically, the Grayrock soil has a dark grayish brown silty clay loam surface layer 6 inches thick. The underlying material to a depth of 80 inches is dark grayish brown silty clay loam that has fragments of shale and lignite throughout. The soil is mildly alkaline throughout.

Permeability is slow, and it is expected to decrease as the soil settles. The available water capacity is moderate. Runoff is rapid. The root zone is deep and roots move readily through the soil. The hazard of erosion is moderate to severe because of slope and the erosiveness of the soil material.

Included with this soil in mapping are small areas of Freestone, Woodtell, and Wolfpen soils. These soils are on the edge of mined areas. They have a yellow or red loamy or clayey subsoil. The included soils make up less than 10 percent of the map unit.

Most areas of the Grayrock soil have been established to bermudagrass and are used as pasture or hayland. The other areas are in various stages of reclamation.

Various trees and wildlife plantings are in the trial stage, and a few crops are being planted to determine their adaptability to this soil. Fertilizer and additional organic matter are important to the productivity of all plantings. Terraces, contour farming, and residue management improve soil tilth and help to control erosion.

The Grayrock soil is not suited to cultivation because of steepness of slope, the low organic matter content, and the hazard of erosion.

This soil is suited to most urban uses; however, it has some limiting features. The slow permeability is a limiting feature for septic tank absorption fields. This limitation can be overcome somewhat by increasing the size of the absorption field. Because of the clayey texture, digging or covering sanitary landfills is difficult and equipment use is restricted during wet weather. Unstable fill is a restriction for dwellings and small commercial buildings. This soil will settle for several years, which can cause building and road foundations to fracture. The base can be strengthened or replaced, but uneven settling will probably occur for several years. This soil is corrosive to steel, but this problem can be partly overcome by coating pipes and by providing cathodic protection.

The Grayrock soil is in capability subclass VIe. It does not have a woodland ordination symbol.

Ho—Hopco silty clay loam, occasionally flooded. This soil is nearly level and somewhat poorly drained. It is on flood plains 500 feet to 1 mile wide along major streams and creeks. The surface is plane, and slopes are 0 to 1 percent. The areas range from 40 to several hundred acres, but average about 200 acres.

Typically, the Hopco soil has a very dark grayish brown silty clay loam surface layer about 10 inches thick. The next layer to a depth of 51 inches is very dark grayish brown and very dark gray silty clay that has mottles in shades of brown. The lower layer to a depth of 80 inches is olive brown silty clay loam that has mottles in shades of brown. The soil is neutral throughout.

Permeability is moderately slow, and the available water capacity is high. Runoff is slow. The root zone is deep, and roots move readily through the soil. This soil is easily worked but is wet during winter and spring. A seasonal high water table is at a depth of 2 to 4 feet during the wet season.

Included with this soil in mapping are small areas of the similar Nahatche and Gladewater soils. Nahatche soils have a lighter color surface layer than that of the Hopco soil. Gladewater soils are clayey. They are in slightly lower positions than those of the Hopco soil and are poorly drained. The included soils make up about 10 percent of the map unit.

The Hopco soil is mainly used as pasture or cropland. A few small isolated areas are native pasture or woodland.

This soil is suited to warm-season pasture plants, such as common bermudagrass and bahiagrass. Fescuegrass, white clover, and arrowleaf clover are well adapted for cool-season grazing. Fertilizer and controlled grazing increase yields. This soil rarely requires lime.

The Hopco soil is adapted to trees, such as willow oak, water oak, sweetgum, green ash, and cottonwood. Wetness and flooding are concerns in managing this soil for commercial timber production.

If this soil is protected from flooding, it is suited to crops, such as cotton, corn, grain sorghum, and small grains. Wetness is the main limiting feature. Fertilizer and weed control increase yields. Residue left on or near the soil surface helps to maintain organic matter and improves soil tilth.

This soil is not suited to urban uses because of wetness and the hazard of flooding.

The Hopco soil is in capability subclass IIw. The woodland ordination symbol is 6W.

Iu—Iuka fine sandy loam, frequently flooded. This soil is nearly level and moderately well drained. It is on flood plains of smaller streams and creeks. The areas are long and commonly 200 to 500 feet wide. They range from 50 to 200 acres, but average about 80 acres.

Typically, the Iuka soil has a dark brown fine sandy loam surface layer about 5 inches thick. The next layer to a depth of 12 inches is brown fine sandy loam. The underlying material to a depth of 73 inches is fine sandy loam. The upper part is yellowish brown with strong brown and light brownish gray mottles, and the lower part is mottled and stratified in shades of yellow, brown, and gray. The soil is slightly acid in the upper part and grades to very strongly acid in the lower part.

Permeability is moderate, and the available water capacity is moderate. Runoff is slow. The root zone is deep. This soil is subject to flooding 2 to 4 times during most years for an average duration of about 2 days. Flooding is generally in winter and spring. A high water table is generally 1 foot to 3 feet below the surface during these months.

Included with this soil in mapping are small areas of Nahatche, Bienville, Besner, and Cuthbert soils. Nahatche soils are dominantly gray. They are in low spots and are wetter than the Iuka soil. Bienville soils are sandy to a depth of more than 60 inches and are in slightly higher positions than those of the Iuka soil. Besner soils are on moundy terraces adjacent to flood plains. Cuthbert soils have a clayey subsoil and are on sloping uplands. Also included are small areas of Iuka soils that are occasionally flooded. The included soils make up less than 20 percent of the map unit.

The Iuka soil is used mainly as pasture; however, small tracts are woodland.

Common bermudagrass, coastal bermudagrass, and bahiagrass are the main pasture plants. This seasonally wet soil is also suited to cool-season forage, such as tall fescuegrass overseeded with white clover. Lime and fertilizer are essential for good yields.

The Iuka soil is well suited to use as woodland. Woodland areas consist of mixed hardwoods and pine, mainly loblolly pine, sweetgum, water oak, and willow oak. The main commercial trees for woodland production are loblolly pine, water oak, and sweetgum. Adapted trees produce well on this soil; however, wetness and flooding affect seedling survival and timber harvesting.

This soil is not suited to cultivation because of frequent flooding. However, a few small isolated areas that are occasionally flooded are used to produce truck crops of peas, beans, corn, and tomatoes.

This soil is not suited to most urban uses because of frequent flooding and wetness.

The Iuka soil is in capability subclass Vw. The woodland ordination symbol is 12W.

Ka—Kaufman clay, frequently flooded. This soil is nearly level and somewhat poorly drained. It is on flood plains of the Sulphur River. The surface is plane, and slopes are 0 to 1 percent. The areas range from 1,000 to several thousand acres, but average about 3,000 acres.

Typically, the Kaufman soil has a black clay surface layer about 12 inches thick. The subsoil to a depth of 72 inches is very dark gray clay that has dark brown mottles. The soil is mildly alkaline in the upper part, slightly acid in the middle part, and neutral in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is slow. The root zone is deep, but the dense clay restricts root growth. This soil is subject to flooding 2 to 4 times in most years for periods of more than 7 days. Flooding generally occurs during winter and spring. A high water table is at a depth of less than 3.5 feet from fall to spring.

Included with this soil in mapping are small areas of Gladewater and Varro soils. Gladewater soils are poorly drained and are in lower positions than those of the Kaufman soil. Varro soils are loamy and are calcareous throughout. The included soils make up less than 10 percent of the map unit.

The Kaufman soil is used mainly as woodland. In a few areas, it is used as improved or native pasture.

This soil is well adapted to trees, such as cottonwood, green ash, willow oak, water oak, pecan, and sweetgum. Pine production and timber harvesting are restricted by flooding and wetness.

This soil is suited to fescuegrass, bermudagrass, and bahiagrass; however, frequent overflows limit the establishment of good stands and the clayey texture makes seedbed preparation difficult. Fertilizer and controlled grazing increase yields.

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

This soil is not suited to urban uses because of high shrink-swell potential, the clayey texture, severe wetness, and frequent flooding.

The Kaufman soil is in capability subclass Vw. The woodland ordination symbol is 4W.

KfC—Kirvin very fine sandy loam, 3 to 8 percent slopes. This soil is gently sloping to strongly sloping and well drained. It is on oval ridges. The areas are oblong to irregular in shape, and the surface is convex. The areas range from 15 to 80 acres, but average about 30 acres.

Typically, the Kirvin soil has a dark brown very fine sandy loam surface layer about 5 inches thick. The subsurface layer to a depth of 14 inches is brown very fine sandy loam. The subsoil to a depth of 34 inches is red clay. To a depth of 42 inches, it is mottled red and reddish yellow clay that has grayish shale fragments. The substratum to a depth of 72 inches is stratified lenses of light gray shale, light brown or strong brown loam, and red sandy clay loam or loam. The soil is neutral in the upper part and very strongly acid in the lower part.

Permeability is moderately slow, and the available water capacity is moderate. Runoff is medium to rapid. The root zone is deep. Erosion is a moderate hazard if the soil is not protected by plant cover.

Included with this soil in mapping are small areas of Bowie, Sacul, and Cuthbert soils. Bowie soils have a loamy subsoil in shades of brown and are in lower positions than those of the Kirvin soil. Sacul soils are on concave slopes, and the upper part of the subsoil has mottles in shades of gray. Cuthbert soils are on steep side slopes and are 20 to 40 inches to stratified material. Also included are areas of Kirvin soils that have 15 to 35 percent ironstone pebbles in the surface layer. The included soils make up less than 15 percent of the map unit.

The Kirvin soil is used mainly as pasture. In some areas, it is used as woodland or cropland.

This soil is suited to pasture plants, such as common bermudagrass, coastal bermudagrass, and bahiagrass. Legumes, such as crimson and arrowleaf clovers, are commonly overseeded on pastures for additional forage production. Lime and split applications of fertilizer increase yields.

Woodland areas of this soil consist of mixed hardwoods and pines, such as red oak, elm, hickory, sweetgum, shortleaf pine, and loblolly pine. Loblolly pine is used for commercial timber production. Prescribed burning and proper thinning improve the stand and increase production. This soil has no significant limitations for timber production.

The Kirvin soil is suited to corn, peanuts, sweet potatoes, and truck crops. Fertilizer and lime increase yields. Terraces, contour farming, and conservation tillage reduce erosion and improve yields.

This soil is suited to most urban uses; however, it has some limiting features. Low strength is a limiting feature for local roads and streets. Permeability, the clayey texture, and shrinking and swelling are limiting features for sanitary facilities and dwellings. Corrosiveness is a limiting feature for uncoated pipe and untreated concrete. These limitations can be overcome by replacing base material, properly designing septic tank absorption fields and dwelling foundations, and treating pipe and concrete.

The Kirvin soil is in capability subclass IVe. The woodland ordination symbol is 8A.

KgC—Kirvin gravelly fine sandy loam, 3 to 8 percent slopes. This soil is gently sloping to strongly sloping and well drained. It is on oval ridges. The areas are oblong to irregular in shape, and the surface is convex. The areas range from 15 to 130 acres, but average about 50 acres.

Typically, the Kirvin soil has a brown gravelly fine sandy loam surface layer about 9 inches thick. The subsoil to a depth of 40 inches is red clay. It has mottles in shades of red, yellow, and gray in the lower part. To a depth of 45 inches, it is mottled red, yellowish red, and gray clay and shale. The substratum to a depth of 63 inches is stratified gray shale, red clay, and yellowish red sandstone. The soil is medium acid in the upper part and very strongly acid in the lower part.

Permeability is moderately slow, and the available water capacity is moderate. Runoff is medium to rapid. The root zone is deep. Erosion is a moderate hazard if the soil is not protected by plant cover.

Included with this soil in mapping are small areas of Bowie, Elrose, and Cuthbert soils. Bowie soils are in lower positions than those of the Kirvin soil and have a loamy subsoil in shades of yellow. Elrose soils have a loamy subsoil and are on foot slopes. Cuthbert soils are less than 40 inches thick over stratified material and are on steep side slopes. Also included are areas of Kirvin soils that are not gravelly. The included soils make up less than 15 percent of the map unit.

The Kirvin soil is used mainly as woodland. In some areas, it is used as pasture or cropland.

Native woodland consists of red oak, blackjack oak, post oak, loblolly pine, and shortleaf pine. Loblolly pine is used for commercial timber production. The gravel reduces the available water capacity and limits timber production. Selective cutting, proper thinning, and prescribed burning improve the stand and increase yields.

The Kirvin soil is suited to warm-season pasture plants, such as common bermudagrass, coastal bermudagrass, and bahiagrass. Crimson and arrowleaf clovers are overseeded on grass pastures for cool-season grazing. These legumes provide ample winter forage and add soil nutrients. Lime and split applications of fertilizer improve yields.

This soil is only marginally suited to cultivation because of steepness of slope and the accumulation of ironstone gravel on the surface. In addition, erosion is a hazard. Lime and split applications of fertilizers increase yields. Terraces and contour farming reduce erosion.

This soil is suited to most urban uses; however, it has some limiting features that can be overcome by good design and careful installation. Moderately slow permeability is a limiting feature for septic tank absorption fields. Low strength and high shrink-swell potential are limiting features for local roads and streets. Corrosiveness can be a problem unless pipes are coated and concrete is treated.

The Kirvin soil is in capability subclass IVe. The woodland ordination symbol is 8F.

KrC—Kirvin-Urban land complex, 2 to 8 percent slopes. This complex is made up of Kirvin soil and Urban land on uplands. The Kirvin soil is gently sloping to strongly sloping and well drained. The areas are oblong to irregular in shape, and the surface is convex. The areas range from 15 to 80 acres, but average about 30 acres.

This map unit is 50 to 75 percent Kirvin soil, 15 to 35 percent Urban land, and 15 percent or less other soils. Areas of the Kirvin soil and Urban land are too intricately mixed to be separated at the scale used for the maps in the back of this publication.

Typically, the Kirvin soil has a dark brown very fine sandy loam surface layer about 5 inches thick. The subsurface layer to a depth of 14 inches is brown very fine sandy loam. The subsoil to a depth of 42 inches is red clay. It has mottles in shades of yellow and shale fragments in shades of gray in the lower part. The substratum to a depth of 72 inches is stratified light gray shale, light brown or strong brown loam, and red sandy clay loam or loam. The soil is neutral in the upper part and very strongly acid in the lower part. In some areas, the surface layer is gravelly fine sandy loam.

Permeability is moderately slow, and the available water capacity is moderate. Runoff is medium to rapid. Erosion is a moderate hazard.

Urban land consists of areas covered by dwellings, commercial buildings, schools, churches, driveways, streets, parking lots, and railroad yards. It also includes areas of soils that have been disturbed by cutting, filling, or grading. The soils have been altered to such an extent that further classification is not possible.

Included with this complex in mapping are small areas of Bowie, Cuthbert, and Elrose soils. Bowie soils have a loamy subsoil in shades of yellow and are in lower positions than those of the Kirvin soil. Cuthbert soils are less than 40 inches thick to stratified material and are on steep side slopes. Elrose soils have a loamy subsoil and are on foot slopes.

The soil in this complex is suited to most urban uses; however, low strength is a limitation for streets and roads and shrinking and swelling of the soil is a limitation for buildings. The Kirvin soil is corrosive to uncoated underground steel and concrete. Proper design and careful installation help to overcome these limitations.

This complex is not in a capability class, and it does not have a woodland ordination symbol.

KsC—Kirvin soils, graded, 2 to 8 percent slopes. These soils are deep, gently sloping to strongly sloping, and well drained. They are on oval, gravelly knolls and ridges. The gravelly surface layer of these soils has been removed for construction material (fig. 15). The surface is convex. The areas generally follow the surface contour. They range from 10 to 150 acres, but average about 40 acres.

Typically, the Kirvin soil to a depth of 3 inches is red clay loam that has about 10 percent ironstone pebbles. To a depth of 39 inches, it is red clay that has fragments of shale and sandstone in shades of gray and yellow. The underlying material to a depth of 70 inches is stratified sandy clay loam, fractured sandstone, and shale in shades of red, yellow, and gray. The soil is strongly acid in the upper part and very strongly acid in the lower part.

Figure 15.—Ironstone gravel mined from the surface of Kirvin soils, graded, 2 to 8 percent slopes, is stored for use in construction.

Permeability is moderately slow, and the available water capacity is moderate. Runoff is medium to rapid. Erosion is a severe hazard.

Included with these soils in mapping are small areas of Cuthbert and Redsprings soils from which the surface layer has been partly or completely removed. These soils are in more sloping and hilly positions than those of the Kirvin soils. Also included are small areas of Kirvin soils from which the surface layer has not been removed. These included soils make up less than 20 percent of the map unit.

Most areas of the Kirvin soils are idle. In some areas, the soils are used as improved pasture, and in a few areas, pine plantations have been established.

These soils are suited to pasture production. If these soils are heavily limed, fertilized, mulched, and seeded, stands of bahiagrass, bermudagrass, crimson clover, and arrowleaf clover can be established. Controlled grazing and continued applications of fertilizer and lime can increase yields.

These soils are not suited to cultivation because erosion is a hazard and the topsoil has been removed.

These soils are suited to use as woodland; however, seedling mortality, erosion, and slow growth are concerns. The timber is mostly of low quality. Planting improved pine species, harvesting selectively, and protecting woodland from wildfires increase yields.

These soils are moderately suited to most urban uses. Low strength, high shrink-swell potential, and corrosiveness are the main limiting features. Low strength and high shrink-swell potential can be minimized by strengthening or replacing the base material. Corrosiveness can be reduced by coating pipes and treating concrete.

The Kirvin soils are in capability subclass VIe. The woodland ordination symbol is 3C.

KtB—Kullit very fine sandy loam, 1 to 3 percent slopes. This soil is on gently sloping stream divides, on foot slopes, and at the head of streams. It is moderately well drained. The surface is plane to slightly concave. The areas are irregularly shaped, and they range from 20 to 300 acres, but average about 50 acres.

Typically, the Kullit soil has a brown very fine sandy loam surface layer about 7 inches thick. The subsurface layer to a depth of 14 inches is light yellowish brown very fine sandy loam. The subsoil to a depth of 33 inches is yellowish brown clay loam that has mottles in shades of red, brown, and gray. To a depth of 73 inches, the subsoil is clay. It is mottled red, gray, and yellowish brown in the upper part, and the lower part is gray with mottles in shades of brown and red. The soil is slightly acid in the upper part and strongly acid to very strongly acid in the lower part.

Permeability is moderately slow, and the available water capacity is moderate. Runoff is medium. The root zone is deep. A high water table is within 2 to 3 feet of the surface during winter and spring. Erosion is a moderate hazard if the soil is not protected by plant cover.

Included with this soil in mapping are small areas of Bowie, Sacul, and Talco soils. Bowie soils have a loamy subsoil in shades of brown and are in slightly higher positions than those of the Kullit soil. Sacul soils have a red clayey subsoil and are also in higher positions. Talco soils are in depressional, moundy areas and are somewhat poorly drained. The included soils make up less than 15 percent of the map unit.

The Kullit soil is used mostly as improved pasture. A small acreage is woodland or cropland.

This soil is suited to warm-season pasture plants, such as common bermudagrass, coastal bermudagrass, and bahiagrass. Legumes, such as arrowleaf clover, crimson clover, and vetch, are commonly overseeded on pastures. Ryegrass, wheat, and oats are used for winter forage. Lime and split applications of fertilizer improve yields.

Woodland areas of this soil consist of loblolly pine, shortleaf pine, post oak, elm, hickory, and sweetgum. Commercial trees used for timber production are loblolly pine and sweetgum. Selective cutting, proper thinning, and prescribed burning reduce wildfires, improve the stand, and increase yields.

The Kullit soil is well suited to corn, peanuts, peas, beans, and other truck crops (fig. 16); however, erosion is a hazard. Lime and fertilizer are essential for good yields. Terraces, contour farming, and conservation tillage reduce erosion.

This soil is only moderately suited to pear, apple, and pecan orchards. Wetness caused by the seasonal high water table is a limitation.

This soil is suited to most urban uses. Wetness, however, is a problem for septic tank absorption fields, and low strength is a limiting feature for local roads and streets. Shrinking and swelling of the soil is a limiting feature for buildings, and corrosiveness is a problem for uncoated pipe and untreated concrete. These problems can be overcome with good design and careful installation.

The Kullit soil is in capability subclass IIe. The woodland ordination symbol is 9W.

KuB—Kullit-Urban land complex, 1 to 3 percent slopes. This complex consists of areas of Kullit soil and Urban land on broad ridges, foot slopes, and at the head of streams. The Kullit soil is gently sloping and moderately well drained. The areas are irregularly shaped and range from 20 to 150 acres.

This complex is 60 to 75 percent Kullit soil, 10 to 25 percent Urban land, and 15 percent or less other soils. Areas of the Kullit soil and Urban land are too intricately mixed to be mapped separately at the scale used for the maps in the back of this publication.

Typically, the Kullit soil has a brown very fine sandy loam surface layer about 7 inches thick. The subsurface layer to a depth of 14 inches is light yellowish brown very fine sandy loam. The subsoil to a depth of 33 inches is yellowish brown clay loam that has mottles in shades of red, gray, and brown. To a depth of 73 inches, it is clay. It is mottled red, gray, and yellowish brown in the upper part, and the lower part is gray with mottles in shades of brown and red. The soil is slightly acid in the upper part and very strongly acid in the lower part.

Permeability is moderately slow, and the available water capacity is moderate. Runoff is slow to medium. The root zone is deep. A high water table is within 2 to 3 feet of the surface during winter and spring. Erosion is a moderate hazard.

Urban land consists of areas covered by dwellings, commercial buildings, schools, churches, driveways, streets, parking lots, and railroad yards. It also includes areas of soils that have been disturbed by cutting, filling, or grading. The soils have been altered to such an extent that further classification is not possible.

Included in mapping are small areas of Bowie and Kirvin soils. Bowie soils have a loamy subsoil and are in slightly higher positions than those of the Kullit soil. Kirvin soils have a red clay subsoil and are on higher ridges.

The soil in this map unit is suited to most urban uses; however, good design and careful installation are needed. Wetness is a limitation for septic tank absorption fields. Expanding the filter lines can help to overcome this problem. Low strength is a limiting feature for local roads and streets, but reinforcing the base material can solve this problem. Shrinking and swelling limits the use of this soil as sites for buildings; however, applications of lime help to control the shrink-swell potential of this soil. Corrosiveness is high for steel pipe and concrete, but coating pipes and treating concrete can reduce the rate of corrosion.

This complex is not in a capability class, and it does not have a woodland ordination symbol.

LbC—Lilbert loamy fine sand, 2 to 5 percent slopes. This soil is gently sloping and well drained. It is on stream divides and ridges on uplands. The surface is plane to weakly convex. The areas are irregularly shaped. They range from 20 to 100 acres, but average about 40 acres.

Typically, the Lilbert soil has a brown loamy fine sand surface layer about 9 inches thick. The subsurface layer to a depth of 26 inches is light yellowish brown loamy

Figure 16.—Kullit very fine sandy loam, 1 to 3 percent slopes, is well suited to cultivated crops, such as purple hull peas.

fine sand. The subsoil to a depth of 80 inches is yellowish brown sandy clay loam that has red, yellowish red, and light brownish gray mottles. Plinthite ranges from 4 to 7 percent, by volume, in the lower part of the subsoil. The soil is medium acid or strongly acid in the upper part and very strongly acid in the lower part.

Permeability is moderately slow, and the available water capacity is moderate. Runoff is slow. The root zone is deep, but roots are restricted in the lower layers.

Included with this soil in mapping are small areas of Bowie soils and the closely similar Briley and Darco soils. Bowie soils have a loamy surface layer and are lower on the landscape than the Lilbert soil. They make up less than 10 percent of any mapped area. Briley soils have a red subsoil and are in higher positions than those of the Lilbert soil. Darco soils have a sandy surface layer more than 40 inches thick and are in lower positions. The similar soils make up less than 20 percent of mapped areas. The Bowie, Briley, and Darco soils make up less than 20 percent of the map unit.

The Lilbert soil is used mainly as pasture or woodland. In other areas, it is used as cropland or for orchards.

The main warm-season pasture plants are coastal bermudagrass, common bermudagrass, and bahiagrass. Oats, wheat, and ryegrass are well adapted to provide cool-season grazing forage. Pastures are frequently overseeded with legumes, such as crimson clover, arrowleaf clover, and vetch, to provide winter forage. Lime, split applications of fertilizers, and controlled grazing increase yields.

Native trees on this soil are loblolly pine, shortleaf pine, elm, and post oak. Commercial trees for timber production are slash and loblolly pines. Many idle cropland fields have been planted to slash pine plantations. In other areas, Virginia pines are planted for Christmas tree production. Droughtiness is the main concern in managing this soil for woodland use.

Common crops include sweet potatoes, peanuts, watermelons, and truck crops. Cover crops and high residue crops reduce erosion and increase organic matter. Lime, contour farming, conservation tillage, and split applications of fertilizers increase yields.

The Lilbert soils are suited to peach, plum, and pear orchards. Although this soil has moderate moisture and fertilizer storage, fertilizers need to be added for good yields. Droughtiness is the main limitation for producing orchard fruit.

This soil is suited to most urban uses; however, good design and careful installation are needed. The moderately slow permeability is a limitation for septic tank absorption fields and sewage lagoons. Expanding filter fields and lining sewage lagoons help to correct the problem. Seepage is a limitation for area sanitary landfills. Corrosiveness for steel and concrete is moderate to high. Coating pipe and treating concrete can overcome these problems.

The Lilbert soil is in capability subclass IIIs. The woodland ordination symbol is 9S.

Na—Nahatche loam-silty clay loam, frequently flooded. This soil is nearly level and somewhat poorly drained. It is on flood plains of major streams. Slopes are 0 to 1 percent. The areas are long and about 500 feet to 1 mile wide. They are extensive, ranging up to several thousand acres, but averaging about 500 acres.

Typically, the Nahatche soil has a dark brown silty clay loam surface layer about 6 inches thick. The texture of the surface layer is variable and can be loam, silt loam, clay loam, and silty clay loam. The underlying material to a depth of 28 inches is grayish brown silt loam and light brownish gray loam that have mottles in shades of brown. To a depth of 44 inches, it is grayish brown clay loam that has mottles in shades of brown and gray. The next layer to a depth of 68 inches is dark gray clay loam that has mottles in shades of brown and has streaks of loam. To a depth of 80 inches, the underlying material is mottled grayish brown, dark gray, reddish yellow, and brownish yellow loam. The soil is slightly acid to strongly acid in the upper part and neutral or mildly alkaline in the lower part.

Permeability is moderate, and the available water capacity is high. Runoff is slow. The root zone is deep. A high water table is at the surface or less than 1.5 feet below the surface during the wet season. This soil is subject to flooding 2 to 4 times a year for durations of 2 to more than 7 days during winter and spring.

Included with this soil in mapping are small areas of Hopco, Iuka, and Bienville soils. Hopco soils have a deep, dark color surface layer and are in slightly higher positions than those of the Nahatche soil. Iuka soils have a coarser textured subsoil and are also in slightly higher positions. Bienville soils are sandy throughout and are on low terrace ridges. The included soils make up less than 20 percent of the map unit.

The Nahatche soil is used mainly as woodland. However, many areas have been cleared and are improved pasture.

This soil is suited to common bermudagrass, bahiagrass, and fescuegrass. Legumes, such as arrowleaf clover and white clover, are overseeded on grass pastures for additional grazing forage. Some small areas are planted to wheat, oats, or ryegrass for winter grazing. Fertilizer, lime, and controlled grazing increase yields.

The Nahatche soil is mainly suited to hardwood trees, such as water oak, willow oak, and sweetgum. Because of flooding and wetness, managing this soil for pine timber production and harvesting the timber are difficult. The hardwood forest on this soil provides excellent wildlife habitat.

This soil is not suited to use as cropland or to urban use because of frequent flooding and wetness. The limitations for urban use are extremely difficult to overcome.

The Nahatche soil is in capability subclass Vw. The woodland ordination symbol is 7W.

NoD2—Normangee gravelly clay loam, 3 to 8 percent slopes, eroded. This soil is gently sloping to strongly sloping and moderately well drained. It is on eroded side slopes along drainageways and ridges of upland prairies. The surface is convex. The areas range from 40 to 200 acres, but average about 70 acres. Erosion has removed the surface layer so that the clayey subsoil is exposed in about 20 percent of the acreage. In about 70 percent of the acreage, the surface layer is less than 5 inches thick. Some small areas have a few active gullies, but the gullies can be crossed by farm equipment.

Typically, the Normangee soil has a dark brown gravelly clay loam surface layer about 3 inches thick. The subsoil to a depth of 49 inches is clay. To a depth of 11 inches, it is dark brown with mottles in shades of red and brown. To a depth of 23 inches, the subsoil is mottled brown, yellowish brown, and light brownish gray. Below that, it is light yellowish brown and light brown with mottles in shades of gray and brown. The substratum to a depth of 62 inches is light brownish gray, gray, and yellowish brown stratified shale and clay. The soil is slightly acid in the upper part and neutral in the lower part.

Permeability is very slow, and the available water capacity is moderate. Runoff is rapid. The root zone is deep, but the dense subsoil restricts root growth. Erosion is a severe hazard if the soil is not protected by plant cover.

Included with this soil in mapping are small areas of Woodtell, Ellis, and Crockett soils. These soils are not gravelly and are in positions similar to those of the Normangee soil. Woodtell and Crockett soils have a coarser textured surface layer. In addition, Woodtell soils have a red subsoil. Ellis soils are clayey throughout. The included soils make up less than 10 percent of the map unit.

The Normangee soil is used mainly as pasture. Most areas are improved pasture; however, some areas remain in native pasture.

This soil is well suited to pasture plants, such as common bermudagrass and bahiagrass. Arrowleaf clover, crimson clover, and vetch are overseeded on pastures to increase forage production and soil nitrogen. Fertilizer and controlled grazing increase yields and reduce erosion.

This soil is not suited to woodland production. Tall grasses are the climax vegetation on this soil.

This soil is not suited to use as cropland. Slope and the hazard of erosion prevent successful cultivation.

This soil is poorly suited to most urban uses. Septic tank absorption fields are limited because of the very slow permeability. This limitation can be partly overcome by increasing the size of the absorption field. The high clay content makes sanitary landfills expensive to operate. High shrink-swell potential and low strength are problems for dwellings, buildings, and roads and streets. The effects of shrinking and swelling can be lessened by adding sandy fill material under the structures. Strength can be increased by replacing or reinforcing the base material.

The Normangee soil is in capability subclass VIe. It does not have a woodland ordination symbol.

Ow—Oil-waste land. This map unit consists of small areas of various soils that have been affected by oil field activity. Oil-waste land areas are well drained to poorly drained. Slopes are variable, ranging from 0 to 8 percent. Areas of these soils on flood plains are nearly level and those on uplands are gently sloping to strongly sloping.

The soils of this map unit have been altered and damaged by heavy machinery and by the addition of chemicals, oil derivatives, and by-products. Salt brine, drilling mud, and sludge have been spilled on the soils during the oil production process.

Permeability is moderately rapid to very slow, and the available water capacity is low to high. Erosion is a hazard in gently sloping to strongly sloping areas damaged by oil spills or salt.

Small areas of undisturbed soils are included in mapping. A few areas damaged during the early 1930's have returned to native vegetation of hardwood, grass, and pine. The undisturbed soils make up less than 15 percent of the map unit.

The productivity of soils in the Oil-waste land areas is virtually destroyed and very little vegetation remains. Generally, the reclamation of these areas for the production of vegetation and for urbanization is possible but costly.

Oil-waste land is not in a capability class, and it does not have a woodland ordination symbol.

PkC—Pickton fine sand, 2 to 5 percent slopes. This soil is gently sloping and well drained. It is on oblong ridges and wide interstream divides on uplands. The surface is plane to slightly convex. The areas range from 20 to 300 acres, but average about 50 acres.

Typically, the Pickton soil has a dark brown fine sand surface layer about 11 inches thick. The subsurface layer to a depth of 48 inches is yellowish brown over light yellowish brown fine sand. The subsoil to a depth of 80 inches is sandy clay loam. The upper part is strong brown with mottles in shades of red, and the lower part is yellowish red with mottles in shades of gray and brown. The soil is medium acid or slightly acid in the upper part and very strongly acid in the lower part.

Permeability is moderate, and the available water capacity is low. Runoff is very slow. The root zone is deep and easily penetrated by plant roots. A high water table is at a depth of 4 to 6 feet during winter.

Included with this soil in mapping are small areas of the similar Wolfpen and Duffern soils. Wolfpen soils have a sandy surface layer 20 to 40 inches thick and are lower on the landscape than the Pickton soil. Duffern soils are sandy to a depth of 80 inches and are in slightly lower positions. The included soils make up less than 20 percent of the map unit.

The Pickton soil is used mainly as pasture, but a large acreage is woodland. In some small areas, this soil is used as cropland or for orchards.

This soil is well suited to coastal bermudagrass and weeping lovegrass. Frequent applications of lime and fertilizer are essential for good yields. Droughtiness is the main limitation to the use of this soil as pasture.

Native woodland areas consist of sandjack oak, blackjack oak, red oak, and shortleaf pine. Loblolly pine is suitable for commercial timber production. Droughtiness limits the growth of trees and decreases the survival rate of seedlings. Selective cutting, proper thinning, and prescribed burnings reduce the threat of wildfires and improve the timber stand.

The Pickton soil is suited to sweet potatoes, peanuts, watermelons, and peas; however, droughtiness is a limitation. Frequent applications of lime and fertilizer are essential for good yields. Crop residue left on or near the surface reduces erosion and adds organic matter to the soil.

This soil is suited to use for peach, plum, and pear orchards. Low available water capacity, however, is a limiting feature for fruit production. Planting trees on the contour helps to control erosion.

This soil is suited to most urban uses; however, wetness and seepage are limiting features for septic tank absorption fields and trench sanitary landfills. Corrosiveness is a limiting feature for concrete and steel; however, coating pipe and treating concrete can overcome or reduce this problem.

The Pickton soil is in capability subclass IIIs. The woodland ordination symbol is 8S.

PkE—Pickton fine sand, 8 to 15 percent slopes. This soil is strongly sloping to moderately steep and well drained. It is on side slopes above drainageways on uplands. The surface is slightly convex. The areas are long and narrow. They range from 20 to 100 acres, but average about 40 acres.

Typically, the Pickton soil has a brown fine sand surface layer about 11 inches thick. The subsurface layer to a depth of 48 inches is yellowish brown and light yellowish brown fine sand. The subsoil to a depth of 56 inches is strong brown sandy clay loam that has mottles in shades of brown, gray, and red. To a depth of 80 inches, it is mottled brown, gray, and red sandy clay loam. The soil is slightly acid in the upper part and very strongly acid in the lower part.

Permeability is moderate, and the available water capacity is low. Runoff is very slow. The root zone is deep and easily penetrated by plant roots. A high water table is at a depth of 4 to 6 feet during the winter, and water often seeps at the foot of slopes. Erosion is a moderate hazard.

Included with this soil in mapping are small areas of Woodtell and Duffern soils. Woodtell soils have a loamy surface layer and a clayey subsoil. These soils are in higher positions than those of the Pickton soil. Duffern soils are sandy throughout and are in slightly lower positions. The included soils make up less than 10 percent of the map unit.

The Pickton soil is used predominantly as woodland, but some areas have been cleared and planted to improved pasture.

Native woodland consists of sandjack oak, blackjack oak, red oak, hickory, and shortleaf pine. Loblolly pine is used for commercial timber production. Slope and droughtiness are the main limitations for woodland use. Slope limits harvesting equipment operations, and droughtiness decreases seedling survival rate. Selective cutting, proper thinning, and prescribed burning enhance the timber stand and reduce the threat of wildfires.

The main pasture plants on this soil are coastal bermudagrass and lovegrass. Light applications of fertilizer and lime at frequent intervals increase yields. Low available water capacity limits pasture production.

This soil is not suited to use as cropland because of slope and the hazard of erosion.

This soil is suited to most urban uses; however, slope, seepage, and the sandy texture limit some uses. Seepage and slope are limitations for septic tank absorption fields and sanitary landfills. Slope is also a limiting feature for local roads and streets. Corrosiveness is a limitation for uncoated pipe and concrete, but this can be overcome by treating concrete and coating pipe. Careful installation and good design can reduce many of these limitations for urban use.

The Pickton soil is in capability subclass VIe. The woodland ordination symbol is 8S.

PuC—Pickton-Urban land complex, 2 to 5 percent slopes. This complex is made up of Pickton soil and Urban land on oblong ridges and interstream divides. The Pickton soil is gently sloping and well drained. The areas are irregular in shape and range from 10 to 70 acres.

This complex is 55 to 75 percent Pickton soil, 15 to 30 percent Urban land, and 10 to 15 percent other soils. Areas of the Pickton soil and Urban land are too intricately mixed to be mapped separately at the scale used for the maps in the back of this publication.

Typically, the Pickton soil has a brown fine sand surface layer about 11 inches thick. The subsurface layer to a depth of 48 inches is yellowish brown over light yellowish brown fine sand. The subsoil to a depth of 80 inches is sandy clay loam. The upper part is strong brown with yellowish red mottles, and the lower part is yellowish red with mottles in shades of gray and brown. The soil is slightly acid in the upper part and very strongly acid in the lower part.

Permeability is moderate, and the available water capacity is low. Runoff is very slow. The root zone is deep and easily penetrated by plant roots. A high water table is 4 to 6 feet below the surface during the winter.

Urban land consists of areas covered by dwellings, commercial buildings, schools, churches, driveways, streets, parking lots, and railroad yards. Also included are areas of soils that have been disturbed by cutting, filling, or grading. The soils have been altered to such an extent that further classification is not possible.

Included with this complex in mapping are small areas of Wolfpen, Bernaldo, and Freestone soils. Wolfpen soils have a sandy surface layer less than 40 inches thick and are lower on the landscape than the Pickton soil. Bernaldo soils have a loamy surface layer and are also lower on the landscape. Freestone soils are in slightly concave spots. They have a loamy surface layer, and the lower part of the subsoil is clayey.

The Pickton soil is suited to most urban uses; however, good design and careful installation are needed. Seepage is a limiting feature for septic tank absorption fields and trench sanitary landfills. Corrosiveness is a problem for steel pipe and concrete, but coating pipe and treating concrete can solve this problem.

This complex is not in a capability class, and it does not have a woodland ordination symbol.

SaC—Sacul fine sandy loam, 2 to 5 percent slopes. This soil is gently sloping and moderately well drained. It is on low ridges and side slopes along streams. The areas are plane to weakly convex and irregular in shape. They range from 15 to 80 acres, but average about 30 acres.

Typically, the Sacul soil has a brown fine sandy loam surface layer about 4 inches thick. The subsurface layer is yellowish brown fine sandy loam to a depth of 8 inches. The subsoil to a depth of 48 inches is clay underlain by sandy clay loam. It is dark red with light brownish gray mottles in the upper part and light brownish gray with dark red mottles in the lower part. The substratum to a depth of 60 inches is stratified gray, red, and yellowish brown shale and sandy loam. The soil is strongly acid in the upper part and very strongly acid in the lower part.

Permeability is slow, and the available water capacity is high. Runoff is medium to rapid. A high water table is 2 to 4 feet below the surface during winter and spring. The root zone is deep. Erosion is a moderate hazard.

Included with this soil in mapping are small areas of Kullit and Bowie soils. These soils have a loamy subsoil in shades of yellow, and they are on gentle, concave slopes. The included soils make up less than 10 percent of the map unit.

The Sacul soil is used mainly as woodland or pasture. In some small areas, it is used for cultivated crops.

This soil is suited to pasture plants, such as bahiagrass, coastal bermudagrass, and common bermudagrass. Legumes, such as arrowleaf clover and crimson clover, are overseeded on many pastures. Ryegrass, wheat, and oats are planted in the fall for winter forage and grazing. Fertilizer, lime, weed control, and controlled grazing increase yields.

Woodland areas commonly consist of red oak, post oak, sweetgum, hickory, shortleaf pine, and loblolly pine. Shortleaf pine and loblolly pine are the principal trees of commercial value. The clayey subsoil is the main limiting feature for timber production. Selective thinning and harvesting improve stands and increase yields.

This soil has limitations for use as cropland, but corn, grain sorghum, and garden crops are common. Erosion is a hazard, and wetness is a limiting feature. Fertilizer and lime increase yields. Terraces, cover crops, and contour farming help to control erosion. Residue left on or near the soil surface helps to maintain organic matter and improves soil tilth.

This soil is suited to most urban uses; however, slow permeability, shrinking and swelling, and corrosiveness are limiting features. Low strength is a limitation for local roads and streets, but strengthening or replacing the base material can help to overcome this limitation. Shrinking and swelling can be combatted by reinforcing foundations and by using sandy fill beneath buildings, roads, and streets. Corrosion can be reduced by coating pipes and treating concrete.

The Sacul soil is in capability subclass IVe. The woodland ordination symbol is 9C.

SaD—Sacul fine sandy loam, 5 to 15 percent slopes. This soil is strongly sloping to moderately steep and is moderately well drained. It is on long, narrow side slopes along streams. The surface is mainly weakly convex. The areas are irregular in shape. They range from 30 to 150 acres, but average about 50 acres.

Typically, the Sacul soil has a very dark grayish brown fine sandy loam surface layer about 4 inches thick. The subsoil to a depth of 22 inches is dark red clay that has light brownish gray mottles. To a depth of 33 inches, it is mottled dark red, light brownish gray, and reddish yellow clay, and to a depth of 42 inches, it is mottled red, reddish yellow, and light brownish gray clay loam, silt loam, and shale. The substratum to a depth of 60 inches is stratified red, grayish brown, and yellowish red sandy loam and shale. The soil is strongly acid in the upper part and very strongly acid in the lower part.

Permeability is slow, and the available water capacity is high. Runoff is rapid. A high water table is 2 to 4 feet below the surface during winter and spring. Erosion is a severe hazard.

Included with this soil in mapping are small areas of Cuthbert and Tenaha soils. Cuthbert soils are well drained and do not have gray mottles. Tenaha soils have a sandy surface layer 20 to 40 inches thick. These soils are in positions similar to those of the Sacul soil but are slightly better drained. The included soils make up less than 15 percent of the map unit.

The Sacul soil is used mainly as woodland. Other areas have been cleared and planted to pasture.

Common bermudagrass, coastal bermudagrass, and bahiagrass are the major pasture plants. Crimson clover, arrowleaf clover, and vetch are the main legumes overseeded on these pastures. Erosion is a hazard, and droughtiness is a limiting feature. Fertilizer, lime, weed control, and controlled grazing increase yields.

The forest type common to this soil is mixed hardwoods and pines. The main commercial trees are loblolly pine and shortleaf pine. The clayey subsoil and the slope are the main limiting features. Selective harvesting, removal of undesirable trees, and protection from wildfires increase yields.

This soil is not suited to use as cropland because of steepness of slope and the hazard of erosion.

This soil is poorly suited to most urban uses because of the clayey texture, slope, low strength, shrinking and swelling, and corrosiveness. Shrinking and swelling can be compensated by reinforcing foundations and adding sandy fill material beneath foundations. Replacing or strengthening the base material can offset the effects of low strength on roads and streets. Corrosion can be reduced by coating pipe and treating concrete.

The Sacul soil is in capability subclass VIe. The woodland ordination symbol is 9C.

TaA—Talco-Raino complex, 0 to 1 percent slopes. The Talco and Raino soils are on nearly level to slightly depressional, moundy stream terraces. The Talco soil is somewhat poorly drained, and the Raino soil is moderately well drained. The areas are plane to weakly concave. They range from 20 to 1,000 acres, but average about 200 acres.

This complex is made up of about 60 percent Talco soil, 25 percent Raino soil, and about 15 percent other soils. Raino soil is on ovate mounds that protrude at random from intermound areas of Talco soil. The mounds are 1 foot to 3 feet high, 50 to 100 feet in diameter, and 50 to 250 feet apart. The Talco and Raino soils are too intricately mixed to be separated at the scale used for the maps in the back of this publication.

Typically, the Talco soil has a grayish brown silt loam surface layer 3 inches thick. The next layer to a depth of 8 inches is mottled pale brown, light brownish gray, and yellowish brown silt loam. The subsoil to a depth of 35 inches is silt loam that has 5 to 20 percent, by volume, streaks and pockets of clean sand and silt. The upper part is brownish yellow with mottles in shades of gray, and the lower part is light brownish gray with mottles in shades of yellow and brown. The subsoil to a depth of 80 inches is gray silty clay and grayish brown and light brownish gray clay loam. The soil is neutral in the surface layer and strongly acid or very strongly acid below that.

Permeability is slow, and the available water capacity is high. Runoff is slow. The root zone is deep. Water ponds for several weeks during the cool season.

Typically, the Raino soil has a brown loam surface layer 6 inches thick. The subsurface layer to a depth of 21 inches is yellowish brown loam that has mottles in shades of gray and brown. The subsoil to a depth of 32 inches is yellowish brown loam that has about 20 percent, by volume, tongues of gray clean sand and silt. To a depth of 75 inches, it is clay. The upper part is mottled in shades of red, gray, and brown, and the lower part is grayish brown with mottles in shades of red and brown. The soil is medium acid in the upper part and very strongly acid in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is slow. The root zone is deep. A high water table is 2 to 4 feet below the surface during the cool season.

Included with this complex in mapping are small areas of Freestone, Derly, and Woodtell soils. Freestone soils are less gray in the upper part of the subsoil than the Talco and Raino soils and are in slightly higher positions. Derly soils have a clayey subsoil, are poorly drained, and are in slightly lower positions. Woodtell soils have a red clay subsoil and are in sloping positions.

The Talco and Raino soils are used mainly as woodland. Other areas have been cleared and are used as improved pasture or cropland.

Woodland areas of this complex consist of water oak, willow oak, and red oak on the Talco soil and loblolly pine, shortleaf pine, and water oak on the Raino soil. The main commercial tree on these soils is loblolly pine; however, hardwood trees are also well adapted. Wetness is a limitation for commercial timber production and makes harvesting difficult.

These soils are suited to improved pastures, such as common bermudagrass, Dallisgrass, bahiagrass, and fescuegrass. In many areas, pastures are overseeded with white clover or singletary peas for cool-season forage. Wetness and slow permeability are limitations to the use of these soils as pasture. Fertilizer, lime, and surface drainage, where practical, increase yields.

These soils have severe limitations for use as cropland because of wetness; however, small areas are planted to winter wheat or grain sorghum. A drainage system, fertilizer, and lime increase yields.

These soils are poorly suited to most urban uses because of wetness, slow permeability, low strength, and corrosiveness. Wetness and slow permeability are limitations for septic tank absorption fields and sanitary landfills. Low strength and wetness cause problems for buildings and local roads and streets. Corrosiveness is a limiting feature for uncoated steel and concrete. Coating pipe and treating concrete reduce corrosion problems. These limitations can be overcome or modified with proper design and careful installation.

This complex is in capability subclass IIIw. The woodland ordination symbol for the Talco soil is 5W. It is 9W for the Raino soil.

TeE—Tenaha loamy fine sand, 8 to 20 percent slopes. This soil is strongly sloping to moderately steep and well drained. It is on long, narrow slopes along drainageways high on the landscape. The surface is convex. The areas range from 30 to 150 acres, but average about 60 acres.

Typically, the Tenaha soil has a dark brown loamy fine sand surface layer about 12 inches thick. The subsurface layer is light yellowish brown loamy fine sand to a depth of 26 inches. The surface and subsurface layers have a few iron-enriched pebbles. The subsoil to a depth of 45 inches is mottled red, yellowish red, and strong brown sandy clay loam. The substratum to a depth of 75 inches, is stratified reddish yellow, pinkish gray, red, and yellowish red sandstone, shale, sandy clay loam, and fine sandy loam. The soil is medium acid in the upper part and very strongly acid in the lower part.

Permeability is moderate, and the available water capacity is moderate. Runoff is slow. The root zone is deep, and roots move easily through the soil. Erosion is a moderate hazard.

Included with this soil in mapping are small areas of Cuthbert, Sacul, and Lilbert soils. Cuthbert soils have a loamy surface layer and are in positions similar to those of the Tenaha soil. Sacul soils have a clayey subsoil and are on lower slopes. Lilbert soils are on ridges, and the subsoil is yellowish and is deeper than that of the Tenaha soil. The included soils make up about 20 percent of the map unit.

The Tenaha soil is used mainly as woodland. In a few areas, it is used as improved pasture.

This soil is suited to loblolly pine and shortleaf pine. Various hardwood trees are also well adapted, but pines are the principal commercial trees. Slope and high rate of seedling mortality are the main concerns in managing this soil for timber production. Selective cutting, removal of undesirable trees, and protection from wildfires increase yields.

This soil is suited to pasture plants, such as coastal bermudagrass, common bermudagrass, and bahiagrass. Lovegrass is planted in some areas. Overseeding these pastures with crimson clover, arrowleaf clover, or vetch provides additional forage. Light applications of fertilizer and lime at frequent intervals can increase forage yields. Seasonal droughtiness and slope limit the use of this soil for pasture production.

This soil is not suited to use as cropland because of slope and droughtiness during the growing season.

This soil is suited to most urban uses, but it has some limitations that can be modified or overcome with proper design and careful installation. Slope is a limitation for dwellings, buildings, and local roads and streets. Cutting and filling must be considered to prepare sites for these uses. Seepage and the hazard of cutbanks caving are limiting features for sanitary facilities. Clay liners can reduce seepage.

The Tenaha soil is in capability subclass VIe. The woodland ordination symbol is 8S.

Tx—Texark clay, frequently flooded. This soil is nearly level and poorly drained. It is on flood plains along the Sulphur River. The flood plains are 2 to 4 miles wide. The surface is plane, and slopes are 0 to 1 percent. The areas are extensive and range to several hundred acres.

Typically, the Texark soil has a very dark gray clay surface layer about 17 inches thick. The subsoil to a depth of 60 inches is dark gray clay that has mottles in shades of brown and yellow. The soil is mildly alkaline in the upper part, strongly acid in the middle part, and very strongly acid in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is very slow. The root zone is deep, but the dense clay restricts root penetration. This soil is subject to flooding 2 to 4 times in most years for periods of more than 7 days. Flooding generally occurs during the winter and spring. A high water table is at a depth of less than 2.5 feet from fall to spring.

Included with this soil in mapping are small areas of Nahatche and Woodtell soils. Nahatche soils are brownish and loamy throughout. They are in slightly higher spots than the Texark soil. Woodtell soils have a red clay subsoil and are on higher slopes adjacent to flood plains. The included soils make up less than 10 percent of the map unit.

The Texark soil is used mainly as woodland. A few areas have been cleared and are improved pasture.

This soil is suited to water oak, willow oak, eastern cottonwood, and green ash. Wetness and flooding are the main limiting features for commercial timber production and harvesting.

The Texark soil is suited to pasture plants, such as common bermudagrass, bahiagrass, and tall fescuegrass; however, the frequent flooding makes establishment difficult. Controlled grazing and fertilizer increase yields.

This soil is not suited to use as cropland because frequent flooding prevents crop production and erodes recently tilled land.

This soil is not suited to urban uses. Frequent flooding, high shrink-swell potential, and wetness are limitations that are very difficult to overcome.

The Texark soil is in capability subclass Vw. The woodland ordination symbol is 4W.

Ud—Udorthents, loamy and clayey. This soil is nearly level to strongly sloping and well drained or moderately well drained. It is on uplands. Slopes range from 0 to 12 percent. The areas are square, rectangular, or oblong. They range from 15 to about 800 acres, but average about 100 acres.

The soil material has been stripped from these areas to a depth of 2 to 20 feet. In most areas, none of the original soil remains. The present soil is variable from one area to another. The soil commonly consists of stratified clay and shale in shades of red, gray, and brown to a depth of 50 inches. The soil ranges from very strongly acid to slightly acid, and it varies from sandy clay loam to clay and shaly clay. In some areas, the soil has random layers of two or more of these textures.

Permeability is moderate to very slow, and the available water capacity is low. Runoff is slow to rapid. The root zone is deep. Erosion is a severe hazard.

Included with this soil in mapping are areas of Freestone, Bowie, Kirvin, and Woodtell soils. The included soils make up less than 10 percent of the map unit.

Most areas of Udorthents are spillways of lakes or borrow areas for construction. Deep excavations, ponding, and droughtiness limit revegetation in these areas.

This soil generally has low fertility and poor physical condition because of the excavation. Reclamation is necessary to establish crops, pasture plants, or timber. Adding topsoil, smoothing the surface, using erosion control practices, and increasing fertility aid in reclaiming areas of this soil.

This soil is not suited to urban uses before it is reclaimed because of the pits, dumps, and moundy topography. In addition, slow permeability, the clayey texture, moderate to high shrink-swell potential, and low strength for roads and streets are limitations.

Udorthents are not in a capability class, and they do not have a woodland ordination symbol.

Ug—Udorthents, gravelly. This soil is gently sloping to moderately steep and is well drained. It is on hilly uplands. Slopes range from 3 to 20 percent. The areas are varied in shape and commonly consist of graded areas, pits, and dumps. The areas range from 50 to more than 700 acres, but average about 200 acres.

The areas have been surface mined for iron ore to a depth of 5 to 30 feet, and no original soil profile remains. In some areas, ironstone and sandstone are exposed. Typically, this soil has a reddish gravelly clay surface layer 10 inches thick. The underlying material is fragmented ironstone, weakly cemented glauconitic sandstone, and shale. Some areas are variable and have sandstone, shale, and ironstone at the surface. The soil is gravelly and is sandy clay loam, clay loam, clay, or sandy clay. It is very strongly acid or strongly acid throughout.

Permeability is moderately slow or slow, and the available water capacity is low. Runoff is medium to rapid. The root zone is very shallow to shallow. Erosion is a severe hazard.

Included with this soil in mapping are areas of Kirvin, Cuthbert, and Redsprings soils. These soils are common in the hilly areas of southeast Morris County. The included soils make up less than 15 percent of the map unit.

Udorthents are mainly abandoned iron ore mining areas and are idle. Stoniness, deep excavations, slope, and droughtiness limit revegetation in these areas.

This soil is commonly shallow, stony, and is often ironstone-cemented at the surface. Fertility is low, and physical conditions are poor. Pasture or woodland uses are not feasible without reclamation. Some areas are returning naturally to stands of shortleaf pine. Timber in these areas is generally of low quality. Filling pits, smoothing the surface, and increasing fertility are necessary to reclaim these areas.

This soil is not suited to urban uses because of soil depth, stoniness, slope, and slow permeability.

Udorthents are not in a capability class, and they do not have a woodland ordination symbol.

Va—Varro clay loam, frequently flooded. This soil is nearly level and well drained. It is on natural levees of flood plains of major streams. The surface is plane. The areas are extensive and range from several hundred acres to more than 1,000 acres.

Typically, the Varro soil has a dark grayish brown clay loam surface layer about 8 inches thick. The underlying material to a depth of 60 inches is dark grayish brown, grayish brown, and stratified light yellowish brown and very dark gray clay loam, silty clay loam, and loam. The soil is moderately alkaline and calcareous throughout.

Permeability is moderate, and the available water capacity is high. Runoff is slow. The root zone is deep. This soil is subject to flooding once or twice each year for periods of up to 4 days. Flooding generally occurs during winter and spring. A high water table is at a depth of 5 to 6 feet for short periods during winter and spring.

Included with this soil in mapping are small areas of Kaufman and Gladewater soils. These soils are clayey, noncalcareous, and are in low, wet spots on the flood plains. The included soils make up about 10 percent of the map unit.

Most areas of Varro soil are improved and native pasture. Many areas are also in hardwood forest.

This soil is suited to pasture plants, such as fescuegrass, bermudagrass, and bahiagrass; however, frequent flooding limits production and the establishment of pasture. Some pastures are overseeded with white clover for additional forage. Fertilizer increases yields. A few pasture areas are in native grasses and are mainly of low quality. Beaked panicum, broadleaf uniola, wildrye, and carpetgrass are the most common plants. Controlled grazing improves stands and increases yields.

The Varro soil is well suited to eastern cottonwood, willow oak, and water oak. Because of flooding and wetness, however, managing this soil for commercial timber production and harvesting the timber are difficult. Selective cutting, removal of undesirable trees, and fire prevention increase yields.

This soil is not suited to cultivated crops or urban uses because of frequent flooding. Wetness is also a limitation for urban uses.

The Varro soil is in capability subclass Vw. The woodland ordination symbol is 4W.

WcA—Wilson silt loam, 0 to 1 percent slopes. This soil is nearly level and somewhat poorly drained. It is on low foot slopes, at heads of streams, and in slight depressions on terraces and stream divides. The surface is weakly concave to plane. The areas range from 40 to 200 acres, but average about 70 acres.

Typically, the Wilson soil has a dark grayish brown silt loam surface layer about 9 inches thick. The subsoil to a depth of 28 inches is very dark gray silty clay loam and clay. To a depth of 50 inches, it is dark grayish brown clay that has mottles in shades of brown. The subsoil to a depth of 65 inches is light olive gray clay that has a few calcium carbonate masses and a few black specks and concretions. The soil is medium acid in the upper part, mildly alkaline in the middle part, and neutral in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is slow. The root zone is deep, but the dense subsoil restricts root growth. A high water table is within 1 foot of the soil surface during the winter and spring.

Included with this soil in mapping are a few small areas of Crockett soils. Crockett soils are slightly higher on the landscape than the Wilson soil, and the subsoil is in shades of brown. The included soils make up about 10 percent of the map unit.

The Wilson soil is used mainly as improved or native pasture. In a few areas, it is used for cultivated crops, mainly small grains.

This soil is well suited to warm-season pasture plants, such as bermudagrass and bahiagrass. Ryegrass, oats, and wheat are commonly planted for cool-season grazing. Many pastures are overseeded with white clover or arrowleaf clover for additional winter forage. Fertilizer, lime, and controlled grazing increase yields.

The Wilson soil is not suited to use as woodland. The climax vegetation is native grasses and forbs; however, a few areas have scattered elm, hackberry, and post oak.

This soil is cultivated to crops, such as grain sorghum, corn, and wheat. Very slow permeability and wetness, however, are limiting features for this use. Fertilizer increases yields, and residue left on or near the surface helps to maintain organic matter and improves soil tilth.

This soil is poorly suited to most urban uses. Wetness, shrinking and swelling, and the clayey texture limit the use of this soil as sites for sanitary landfills and buildings. These limiting features are very difficult to overcome, but buildings can be placed on fill material, which increases drainage of the sites. The effects of shrinking and swelling of the soil can be reduced by treating soil material with lime and by reinforcing foundations. Corrosiveness is a limiting feature for concrete structures and steel pipe, but it can be partly overcome by treating concrete and by coating pipe to provide cathodic protection.

The Wilson soil is in capability subclass IIIw. It does not have a woodland ordination symbol.

WdC—Wolfpen loamy fine sand, 2 to 5 percent slopes. This soil is gently sloping and well drained. It is on ridges and interstream divides high on the landscape. The surface is plane to convex. The areas range from 20 to about 100 acres, but average about 40 acres.

Typically, the Wolfpen soil has a dark brown loamy fine sand surface layer about 11 inches thick. The next layer to a depth of 25 inches is yellowish brown loamy fine sand. The subsoil to a depth of 56 inches is yellowish brown sandy clay loam that has mottles in shades of red, gray, and brown. To a depth of 80 inches, it is mottled red, light brownish gray, and strong brown sandy clay loam. The soil is slightly acid in the upper part, medium acid in the middle part, and very strongly acid in the lower part.

Permeability is moderate, and the available water capacity is moderate. Runoff is slow. The root zone is deep, and roots move easily through the soil. A high water table is at a depth of 4 to 6 feet during the winter and spring.

Included with this soil in mapping are small areas of Bernaldo, Freestone, and Pickton soils. The Bernaldo and Freestone soils have a loamy surface layer and are lower on the landscape than the Wolfpen soil. These soils make up 10 to 15 percent of some mapped areas. The Pickton soils are similar to the Wolfpen soil except they have a thicker surface layer and are higher on the landscape. The included soils make up less than 10 percent of the map unit.

The Wolfpen soil is used mainly as improved pasture or woodland. In some small areas, it is used for crops or orchards.

This soil is suited to warm-season pasture plants, such as coastal bermudagrass, common bermudagrass, bahiagrass, and lovegrass. Cool-season grasses, such as oats, ryegrass, and wheat, are often planted to provide winter grazing. Overseeding the pasture with arrowleaf clover, crimson clover, or hairy vetch increases forage and soil nitrogen. Proper use of fertilizer and lime is needed for high yields.

The major forest type on this soil is mixed hardwood and pine. Red oak, post oak, elm, sweetgum, and hickory are well adapted to this soil. Loblolly pine and shortleaf pine are the main commercial trees. Virginia pine is planted in some areas for Christmas tree production. Because of seasonal droughtiness and a moderate rate of seedling mortality, managing this soil for timber production is difficult. Selective cutting, removal of undesirable trees, and protection from wildfires increase yields.

The main crops on this soil are peanuts, sweet potatoes, watermelons, and corn. In some areas, this soil is used for truck crops, such as peas, beans, and cucumbers. Cover crops and high residue crops reduce erosion and help to maintain organic matter. Fertilizer and lime are needed for high yields.

This soil is suited to peach, plum, and pear orchards; however, droughtiness is a limiting feature. Fertilizer is needed for good fruit production.

This soil is suited to most urban uses. Seepage is a problem for sanitary facilities, but it can be reduced by using clay liners in sewage lagoons. Corrosion of steel and concrete structures can be reduced by coating steel and treating concrete.

The Wolfpen soil is in capability subclass IIIs. The woodland ordination symbol is 10S.

WeC—Wolfpen-Urban land complex, 2 to 5 percent slopes. This complex is made up of Wolfpen soil and Urban land on ridges and interstream divides high on the landscape. The Wolfpen soil is gently sloping and well drained. The areas are oblong and range from 15 to 200 acres.

This complex is 50 to 75 percent Wolfpen soil, 15 to 35 percent Urban land, and 15 percent or less other soils. Areas of the Wolfpen soil and Urban land are too intricately mixed to be mapped separately at the scale used for the maps in the back of this publication.

Typically, the Wolfpen soil has a dark brown loamy fine sand surface layer about 11 inches thick. The next layer to a depth of 25 inches is yellowish brown loamy fine sand. The subsoil to a depth of 56 inches is yellowish brown sandy clay loam that has mottles in shades of red, gray, and brown. To a depth of 80 inches, it is mottled red, light brownish gray, and strong brown sandy clay loam. The soil is slightly acid in the upper part, medium acid in the middle part, and very strongly acid in the lower part.

Permeability is moderate, and the available water capacity is moderate. Runoff is slow. The root zone is deep. A high water table is at a depth of 4 to 6 feet during the winter and spring.

Urban land consists of areas covered by dwellings, commercial buildings, schools, churches, driveways, streets, parking lots, and railroad yards. It also includes areas of soils that have been disturbed by cutting, filling, or grading. The soils have been altered to such an extent that further classification is not possible.

Included with this complex in mapping are small areas of Pickton, Bernaldo, and Freestone soils. Pickton soils have a sandy surface layer more than 40 inches thick and are in higher positions than those of the Wolfpen soil. Bernaldo and Freestone soils have a loamy surface layer and are in lower positions.

The Wolfpen soil is suited to most urban uses. Seepage is a problem for sanitary facilities, but it can be reduced by using clay liners in sewage lagoons. Corrosiveness of steel pipe and concrete can be reduced by coating the pipe and treating the concrete.

This complex is not in a capability class, and it does not have a woodland ordination symbol.

WoC—Woodtell fine sandy loam, 2 to 5 percent slopes. This soil is gently sloping and moderately well drained. It is on low ridgetops and side slopes along upland streams. The areas are plane to slightly convex. They range from 15 to 80 acres, but average about 30 acres.

Typically, the Woodtell soil has a dark yellowish brown fine sandy loam surface layer about 5 inches thick. The subsoil to a depth of 27 inches is red clay that has mottles in shades of brown. To a depth of 48 inches, it is mottled light brownish gray and light olive brown clay underlain by clay loam. The substratum to a depth of 75 inches is light brownish gray and yellowish brown clay loam and shale that has mottles in shades of gray. The soil is strongly acid in the upper part, medium acid in the middle part, and neutral in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is medium. The root zone is deep, but roots are restricted by the dense clay. Erosion is a moderate hazard.

Included with this soil in mapping are small areas of Bernaldo and Freestone soils. Bernaldo and Freestone soils have a yellowish loamy subsoil and are slightly lower on the landscape than the Woodtell soil. The included soils make up no more than 10 percent of the map unit.

The Woodtell soil is used mostly as pasture or woodland. In a few areas, it is used for cultivated crops.

This soil is suited to bahiagrass, bermudagrass, arrowleaf clover, and crimson clover. Very slow permeability is the main limiting feature. Fertilizer, lime, weed control, and controlled grazing increase yields and improve the quality of the forage.

The major forest type on the Woodtell soil is mixed hardwood and pine. Loblolly pine is the principal commercial tree. Because of the clayey subsoil and very slow permeability, managing this soil for timber production is difficult. Selective harvesting, removal of undesirable trees, and protection from wildfires increase yields.

A very small acreage of this soil is used for cultivated crops, such as corn, wheat, and grain sorghum. Erosion is a hazard, and the very slow permeability is a limiting feature. Fertilizer and lime increase yields. Terraces, cover crops, and contour farming reduce erosion. Residue left on or near the soil surface helps to maintain organic matter and soil tilth.

This soil is poorly suited to most urban uses. Very slow permeability prevents satisfactory functioning of septic tank absorption fields. This can be only partly corrected by increasing the size of the absorption area. High clay content makes the operation of sanitary landfills expensive and difficult. Because of low strength and shrinking and swelling, this soil cannot satisfactorily support buildings, dwellings, or roads and streets. Sand fill and soil stabilization treatment can reduce shrinking and swelling. Strengthening or replacing the base material helps to overcome the low strength limitation.

The Woodtell soil is in capability subclass IVe. The woodland ordination symbol is 8C.

WoE—Woodtell fine sandy loam, 5 to 20 percent slopes. This soil is strongly sloping to moderately steep and is moderately well drained. It is on long, narrow side slopes along small streams. The surface is convex. The areas range from 20 acres to several hundred acres, but average about 100 acres.

Typically, the Woodtell soil has a dark brown fine sandy loam surface layer about 3 inches thick. The subsurface layer to a depth of 6 inches is dark yellowish brown fine sandy loam. The subsoil to a depth of 55 inches is clay that grades into clay loam in the lower part. It is red to a depth of 26 inches, yellowish brown to a depth of 38 inches, and light gray and light brownish gray below that. The substratum is stratified light gray shale and strong brown sandy clay loam. The soil is medium acid in the upper part, very strongly acid in the middle part, and strongly acid in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is rapid. The root zone is deep, but roots are restricted by the dense clay. Erosion is a severe hazard.

Included with this soil in mapping are small areas of the similar Bazette, Crockett, and Normangee soils. Bazette soils have a yellowish subsoil. Crockett soils have an eroded surface layer and are less red and less sloping than the Woodtell soil. Normangee soils have an eroded gravelly clay loam surface layer. The included soils make up no more than 15 percent of the map unit.

Woodtell soil is used mainly as woodland. Some areas have been cleared and established to improved pasture.

The native forest on this soil is commonly red oak, post oak, hickory, and shortleaf pine. Loblolly pine is planted in some areas for additional timber production and is the main commercial tree. Slope and the clayey subsoil are the main limiting features for timber production. Proper thinning and harvesting increase yields.

The Woodtell soil is suited to warm-season pasture plants, such as coastal bermudagrass, common bermudagrass, and bahiagrass. Some pastures are overseeded with arrowleaf clover or planted to cool-season wheat, ryegrass, or oats for additional forage production. Fertilizer and lime are essential for high yields.

This soil is not suited to use as cropland. Slope, very slow permeability, and the hazard of erosion make cultivation impractical.

This soil is poorly suited to most urban uses. Very slow permeability prevents satisfactory functioning of septic tank absorption fields and can only be partly overcome by increasing the size of the absorption area. High clay content makes the operation of sanitary landfills expensive and difficult. Shrinking and swelling causes soil strength to be too low to support buildings, dwellings, or roads and streets. This limitation can be reduced by adding sandy fill beneath buildings, roads, and streets, or by replacing or strengthening the base material. Corrosion can be reduced by coating steel pipe and treating concrete.

The Woodtell soil is in capability subclass VIe. The woodland ordination symbol is 8C.

WrB—Woodtell-Raino complex, 1 to 3 percent slopes. The soils of this complex are moderately well drained and are on gently sloping, moundy uplands. The surface is plane to weakly convex. The areas range from 20 to several hundred acres, but average about 80 acres.

This complex is made up of about 50 percent Woodtell soil, 30 percent Raino soil, and 20 percent other soils. Raino soil is on ovate mounds that protrude at random from intermound areas of Woodtell soil. Mounds are 2 to 4 feet high, 30 to 70 feet in diameter, and 40 to 200 feet apart. These soils are too intricately mixed to be mapped separately at the scale used for the maps in the back of this publication.

Typically, the Woodtell soil has a very dark grayish brown loam surface layer about 6 inches thick. The subsurface layer is yellowish brown loam to a depth of 12 inches. The subsoil to a depth of 49 inches is clay. It is red in the upper part and grades to light olive brown in the lower part. Mottles in shades of brown are throughout the subsoil. The substratum to a depth of 60 inches is grayish brown stratified clay, shaly clay, and sandy clay loam that has mottles in shades of brown. This soil is medium acid in the upper part and very strongly acid in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is medium. The root zone is deep, but roots are restricted by the dense clay.

Typically, the Raino soil has a dark yellowish brown loam surface layer about 5 inches thick. The subsurface layer to a depth of 23 inches is strong brown loam. The subsoil extends to a depth of 69 inches. To a depth of 32 inches, it is strong brown clay loam that has mottles in shades of red and brown. Below that, the subsoil is mottled red, yellowish brown, light brownish gray, and strong brown clay. The substratum to a depth of 80 inches is light gray clay and shaly clay that has mottles in shades of brown and has black concretions. The soil is medium acid in the upper part, very strongly acid in the middle part, and neutral in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is slow. The root zone is deep. A high water table is 2 to 4 feet below the surface during the winter.

Included with this complex in mapping are small areas of Freestone, Talco, and Derly soils. Freestone soils have a yellowish subsoil and are slightly higher on the landscape than the Woodtell and Raino soils. Talco soils have a grayish loamy subsoil and are in lower positions. Derly soils have a grayish clayey subsoil and are in depressions.

The Woodtell and Raino soils are mainly used as pasture. In some areas, they are used as woodland, and small acreages are cropland.

These soils are well suited to warm-season pasture plants, such as bermudagrass, bahiagrass, and Dallisgrass. Legumes, such as arrowleaf clover, crimson clover, and vetch, are overseeded on some pastures. Many areas of these soils are planted to cool-season ryegrass, wheat, or oats for winter grazing. Fertilizer, lime, and controlled grazing increase yields.

Woodland areas of these soils consist of red oak, post oak, willow oak, hickory, and sweetgum, as well as shortleaf and loblolly pines. Commercial trees are mainly pines; however, oaks have some commercial value. The clayey subsoil is the main limiting feature. Selective cutting, removal of undesirable trees, and protection from wildfires increase yields.

The Woodtell and Raino soils are suited to crops, such as small grains, grain sorghum, and corn. Wetness and moundiness are the main limiting features, and erosion is a hazard. Terracing and contour farming help to control erosion in some areas. Residue left on or near the surface helps to maintain organic matter and improves soil tilth.

These soils are poorly suited to most urban uses because of wetness, the clayey texture, high shrink-swell potential, and corrosiveness. Sandy or loamy fill beneath structures helps to overcome wetness, the clayey texture, and shrinking and swelling. Replacing the base material and reinforcing foundations also help to overcome shrinking and swelling and the clayey texture. Coating pipe and treating concrete help to overcome the corrosive nature of the soil.

This complex is in capability subclass IIIe. The woodland ordination symbol for Woodtell soil is 7C. It is 9W for Raino soil.

WuC—Woodtell-Urban land complex, 2 to 8 percent slopes. This complex is made up of Woodtell soil and Urban land on low ridgetops and side slopes along upland streams. The Woodtell soil is gently sloping to strongly sloping and moderately well drained. The areas are oblong and range from 20 to 100 acres.

This complex is 50 to 75 percent Woodtell soil, 15 to 35 percent Urban land, and 15 percent or less other soils. Areas of the Woodtell soil and Urban land are too intricately mixed to be mapped separately at the scale used for the maps in the back of this publication.

Typically, the Woodtell soil has a dark yellowish brown fine sandy loam surface layer about 5 inches thick. The subsoil to a depth of 27 inches is red clay that has mottles in shades of brown. To a depth of 48 inches, it is mottled light brownish gray and light olive brown clay underlain by clay loam. The substratum to a depth of 75 inches is yellowish brown and light olive brown clay loam and shale. The soil is strongly acid in the upper part, medium acid in the middle part, and neutral in the lower part.

Permeability is very slow, and the available water capacity is high. Runoff is medium. The root zone is deep, but roots are restricted by the dense clay. Erosion is a moderate hazard.

Urban land consists of areas covered by dwellings, commercial buildings, schools, churches, driveways, streets, parking lots, and railroad yards. It also includes areas of soils that have been disturbed by cutting, filling, or grading. The soils have been altered to such an extent that further classification is not possible.

Included with this complex in mapping are small areas of Freestone and Bernaldo soils. These soils have a yellowish loamy subsoil and are slightly lower on the landscape than the Woodtell soils.

The Woodtell soil is poorly suited to most urban uses. Very slow permeability prevents satisfactory functioning of septic tank absorption fields. This can only be partly corrected by increasing the size of the absorption area. High clay content makes the operation of sanitary landfills expensive and difficult. Shrinking and swelling is a limitation for buildings, dwellings, and roads and streets. Sand fill and soil stabilization treatment can reduce this limitation. Strengthening or replacing the base material helps to overcome the low strength limitation.

This complex is not in a capability class, and it does not have a woodland ordination symbol.

Prime Farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in Camp, Franklin, Morris, and Titus Counties are listed.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources. Farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water control structures. Public land is land not available for farming in national forests, national parks, military reservations, and state parks.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject to frequent flooding during the growing season. The slope ranges mainly from 0 to 5 percent.

Nearly 26 percent, or about 190,000 acres, of the survey area is prime farmland. It is scattered throughout the counties, but general soil map units 1, 2, 4, and 6 have the largest areas of prime farmland. Map units 3, 5, 8, 9, and 10 have substantial areas and map units 7, 11, and 12 have only small, scattered areas of prime farmland. Many acres of prime farmland are used for crops, such as sweet potatoes, peanuts, grain sorghum, watermelons, corn, and peas.

The following map units, or soils, make up prime farmland in Camp, Franklin, Morris, and Titus Counties. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Soils that have limitations, such as a high water table or flooding, may qualify as prime farmland if these limitations are overcome by such measures as drainage or flood control. In the following list, the measures needed to overcome the limitations of a map unit, if any, are shown in parentheses after the map unit name. Onsite evaluation is necessary to determine if the limitations have been overcome by the corrective measures.

BbB Bernaldo fine sandy loam, 1 to 3 percent slopes
BdB Besner-Talco complex, 0 to 2 percent slopes (Talco soil is prime farmland only if drained)
BoC Bowie fine sandy loam, 2 to 5 percent slopes
FrB Freestone fine sandy loam, 1 to 3 percent slopes
Ho Hopco silty clay loam, occasionally flooded
KtB Kullit very fine sandy loam, 1 to 3 percent slopes
TaA Talco-Raino complex, 0 to 1 percent slopes (Talco soil is prime farmland only if drained)

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 for predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland 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 potentials 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 that is in harmony with nature.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, 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

Henry C. Bogusch, Jr., agronomist, Soil Conservation Service, helped prepare this section.

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.

Cropland

Cropland makes up about 4 percent of the survey area. In the past, a large acreage was used for cotton, but insects, diseases, and other factors caused a decrease in cotton production. That land is now used as woodland, pasture, or for other crops, such as grain sorghum, watermelons, wheat, peanuts, sweet potatoes, peaches, and truck crops.

Planners of management systems for individual fields or farms should consider information given for each soil in the section "Detailed Soil Map Units." Specific information is available from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Components of management systems can be separated into cultural and mechanical practices. Cultural management practices to control erosion, maintain soil tilth, maintain soil productivity, and obtain indicated yields depend on the kind of soil and the crop variety. Management includes proper planting rates and dates; appropriate and timely tillage; control of weeds, insects, and diseases; and harvesting to ensure the smallest possible loss. Applicable conservation practices are crop rotations, proper application of fertilizer, conservation tillage, crop residue management, animal waste management, growing green manure crops, and contour farming. Mechanical management practices, such as drainage and terraces, are needed in conjunction with the cultural practices.

Pasture and Hayland

Pasture and hayland are important in the survey area and make up about 55 percent of the area. The important warm-season forages are common bermudagrass, coastal bermudagrass, and Pensacola bahiagrass. Tall fescue is a cool-season grass adapted to most soils that have a good plant, soil, and moisture relationship. Weeping lovegrass is a warm-season grass that is suitable as cool-season forage. Lovegrass is adapted to the deep, sandy soils in the survey area. Legumes, such as crimson clover, white clover, and vetch, are overseeded in permanent pastures for cool-season grazing.

Most improved pastures are on old cropland. Introduced grasses and legumes are used to obtain higher production of forage crops. Information on improved varieties of each species, soil adaptation, timeliness and quality of seedbed preparation, and seeding methods are available from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Controlled grazing, weed and brush control, and fertilizer are needed to maximize production of improved pastures. Fertilizer is needed on all soils in the survey area. Most of the soils also need lime to lower acidity and to improve plant conditions. Many soils on bottom lands need surface drainage to obtain high production.

Surface Mine Reclamation

Current Texas regulations require all mined soils be reclaimed according to a prepared and approved reclamation plan, which includes vegetation of the area. The applicant is responsible for the success of the vegetation following its establishment for a designated period of time. National and state regulations need to be considered in the planning, site selection and design, and application of any reclamation procedures.

The objectives of reclamation are to restore the soil to a condition capable of supporting its intended use, to prevent permanent damage, and to control erosion and sedimentation. More soil amendments, plant material seed and sprigs, and subsequent management are generally needed to accomplish these objectives.

Successful reclamation of strip-mined soils depends on an understanding of the chemical, physical, and biological properties of soils. Soil properties can be altered if the soil is disturbed. This can have an adverse effect on alternative land use and productivity. High levels of acidity and low organic matter content are major conditions that also need to be considered.

Lignite and iron ore are mined in the survey area. Because of differences in mining techniques and in soils, different reclamation methods are required.

Lignite deposits underlie many of the soils in the survey area. Strip mining the lignite deposits results in large acreages of disturbed lands. Surface mining for lignite is accomplished by clearing existing vegetation, removing all overburden using large draglines, mining the lignite, and replacing the overburden (fig. 17).

The reclamation process involves soil reconstruction and revegetation. After mining the lignite and replacing the overburden, the spoil is graded to its planned contour and revegetated to the planned postmine land use (fig. 18). Following reconstruction, the land can be used as cropland, pasture, rangeland, habitat for wildlife, woodland, or for recreational activities, orchards, or residential or industrial development. The selected postmine land use determines the plant materials and the reclamation procedures.

The method of reconstruction is important to the success of reclamation efforts. Replacement of stockpiled topsoil helps retain vegetative material and seeds native to the area and organic matter and microbiological activity normally in the surface layer. The random mixing of all overburden material can alter many of the soil properties, resulting in increased erosion potential, decreased organic matter, and crusting of soils. Testing chemical properties of the soil is needed because unoxidized geologic material from the lower depths probably has acid-forming pyrites.

Revegetation of mined lands requires a good seedbed, adequate amounts of fertilizer, and selection of plants that control erosion and provide for the land's intended use. Plants commonly used for cover and forage include coastal, common, and Tifton 44 bermudagrass; Selection 75 kleingrass; and Pensacola bahiagrass. Other important species include Lehmann lovegrass, Alamo switchgrass, and Lometa indiangrass. Legumes, such as Yuchii arrowleaf clover, crimson clover, Okinawa sericea lespedeza, and hairy vetch, increase forage capabilities and provide needed nitrogen for other species. Other forbs and legumes, such as bushsunflower, singletary pea, Engelmann daisy, and Aztec Maximilian sunflower, provide diversity and increase wildlife habitat.

About 5,000 acres of iron ore mined land is in the survey area. Iron ore deposits occur from the soil surface to a depth of 5 to 50 feet. There generally is no overburden to remove. Surface mining for iron ore is accomplished by clearing existing vegetation and excavating ore.

The reclamation process involves smoothing the sidewalls and mined areas to its planned contour. Topsoil is added from adjacent soil areas or it is hauled in from offsite. Land is then revegetated to the planned postmine land use. The land can then be used as pasture, hayland, rangeland, habitat for wildlife, woodland, or for recreational, residential, or industrial development. The selected postmine land use determines the plant materials and the reclamation procedures.

The revegetation of iron ore mined land reclamation has had best results when weeping lovegrass, T-587 old world bluestem, and Alamo switchgrass were planted.

Orchard Production

Gary Bomar, extension agent (Camp County), Agricultural Extension Service, helped prepare this section.

Camp County is one of the primary peach production areas in Texas. Currently, 200 acres is in commercial peach production (fig. 19). On the average, 1 acre

Figure 17.—Lignite coal mining is a major industry in the survey area. The soil in this mining area is Woodtell fine sandy loam, 2 to 5 percent slopes.

supports 100 trees, and each tree produces 3 bushels of peaches per year. The average annual yield of peaches in the county is 60,000 bushels.

A rigid management program for the orchards in the survey area includes pruning, thinning, and spraying the trees. The trees are sprayed several times throughout the year.

About 95 percent of all fruit produced is sold through local peach sheds on the major highways or through "you pick" operations. Only 5 percent of the peaches and plums is shipped to supermarkets; however, marketing outlets are increasing as production increases.

Peaches and plums are best adapted to loamy soils that are well drained or moderately well drained. Bowie, Bernaldo, Elrose, and Kirvin soils are well suited to peach and plum production. In addition to good drainage, these soils are deep and have medium to high moisture- and fertility-holding capacity. Sandy soils that have a loamy subsoil, such as Lilbert, Briley, Darco, Wolfpen, and Pickton soils, are moderately suited to peach and plum production. Droughtiness is the most limiting feature. Proper slopes for orchards range from 0 to about 5 percent. The hazard of erosion and droughtiness are increased on steeper slopes, limiting production.

The acreage used for orchards increases each year, especially in Camp County. Good soils and sites and proper management increase production and prolong the average life of orchards.

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 5. 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.

Figure 18.—This lignite coal mined area has been reclaimed and planted to coastal bermudagrass. The reclaimed soil is Grayrock silty clay loam, 2 to 5 percent slopes.

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 5 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 for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for use as cropland. 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 criteria used in grouping the soils do not include major, and generally expensive, landforming that would change slope, depth, or other characteristics of the soils, nor do they include 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 rangeland, 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 few 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 they 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 a 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;

Figure 19.—Peach orchards are common in Camp County. This orchard is on Lilbert loamy fine sand, 2 to 5 percent slopes.

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.

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

Woodland Management and Productivity

John M. Patterson, forester Soil Conservation Service, helped prepare this section.

About a third of the survey area is commercial woodland. Private landowners manage about 95 percent of this woodland, and the rest is in public ownership. The commercial woodland consists of several cover types *(8)*. The loblolly-shortleaf pine type covers 20 percent of the area; the oak-pine type, 32 percent; the oak-hickory type, 33 percent; and the oak-gum type, 13 percent.

Urbanization, surface mining, and conversion to other uses, such as pasture, has resulted in a 20 percent reduction in woodland acres over the past 15 years. Income from timber sales is 5 to 10 percent of the total annual agricultural income for the survey area. Most of the timber sold is used in the manufacture of lumber and pulp products; the rest is used in the manufacture of poles, posts, crossties, and various other specialty products (fig. 20).

The woodland in the northern part of the survey area consists primarily of hardwoods. Several small hardwood sawmills produce mainly crossties and dimensional hardwood lumber. Most pines are in the southern part of

Figure 20.—Virginia pine grown on Darco loamy fine sand, 2 to 5 percent slopes, are sold as Christmas trees.

the survey area. There are no large sawmills; however, numerous pulpwood marketing yards ship pulpwood to various mills outside the area.

Control of undesirable species is the major management problem. Improper harvesting methods and inadequate regeneration of existing timber stands are the major limitations to increased production.

Soils vary in their ability to produce trees. Depth, fertility, texture, and the available water capacity influence tree growth. Soil permeability, drainage, and position on the landscape are also important.

This soil survey can be used by woodland managers planning ways to increase the productivity of forest land. Some soils respond better to fertilization than others, and some are more susceptible to landslides and erosion after roads are built and timber is harvested. Some soils require special efforts to reforest. In the section "Detailed Soil Map Units," each map unit in the survey area suitable for producing timber presents information about productivity, limitations for harvesting timber, and management concerns for producing timber. Table 6 summarizes this forestry information and rates the soils for a number of factors to be considered in management. *Slight, moderate*, and *severe* are used to indicate the degree of the major soil limitations to be considered in forest management.

The first tree listed for each soil under the column "Common trees" is the indicator species for that soil. An indicator species is a tree that is common in the area and that is generally the most productive on a given soil.

Table 6 lists the *ordination symbol* for each soil. The first part of the ordination symbol, a number, indicates the potential productivity of a soil for the indicator species, based on the site index. The larger the number, the greater the potential productivity.

The second part of the ordination symbol, a letter, indicates the major kind of soil limitation for use and management. The letter *R* indicates a soil that has a significant limitation because of steepness of slope. The letter *W* indicates a soil in which excessive water, either seasonal or year-round, causes a significant limitation. The letter *D* indicates a soil that has a limitation because of restricted rooting depth, such as a shallow soil that is underlain by hard rock, hardpan, or other layers that restrict roots. The letter *C* indicates a soil that has a limitation because of the kind or amount of clay in the upper part of the soil. The letter *S* indicates a dry, sandy soil. The letter *F* indicates a soil that has a large amount of coarse fragments in the soil profile. The letter *A* indicates a soil that has no significant restrictions or limitations for forest use and management. If a soil has more than one limitation, the priority is as follows: R, W, D, C, S, and F.

Ratings of the *erosion hazard* indicate the probability that damage may occur if site preparation activities or harvesting operations expose the soil. The risk is *slight* if no particular preventive measures are needed under ordinary conditions; *moderate* if erosion control measures are needed for particular silvicultural activities; and *severe* if special precautions are needed to control erosion for most silvicultural activities. Ratings of *moderate* or *severe* indicate the need for construction of higher standard roads, additional maintenance of roads, additional care in planning of harvesting and reforestation operations, or use of specialized equipment.

Ratings of *equipment limitation* indicate limits on the use of forest management equipment, year-round or seasonal, because of such soil characteristics as slope, wetness, stoniness, or susceptibility of the surface layer to compaction. As slope gradient and length increase, it becomes more difficult to use wheeled equipment. On the steeper slopes, tracked equipment must be used. On the steepest slopes, even tracked equipment cannot operate; more sophisticated systems are needed. The rating is *slight* if equipment use is restricted by soil wetness for less than 2 months and if special equipment is not needed. The rating is *moderate* if slopes are steep enough that wheeled equipment cannot be operated safely across the slope, if soil wetness restricts equipment use from 2 to 4 months per year, if stoniness or sandy texture restricts ground-based equipment, or if special equipment is needed to avoid or reduce soil compaction. The rating is *severe* if slopes are steep enough that tracked equipment cannot be operated safely across the slope, if soil wetness restricts equipment use for more than 4 months per year, if stoniness or sandy texture restricts ground-based equipment, or if special equipment is needed to avoid or reduce soil compaction. Ratings of *moderate* or *severe* indicate a need to choose the most suitable equipment and to carefully plan the timing of harvesting and other management operations.

Ratings of *seedling mortality* refer to the probability of death of naturally occurring or properly planted seedlings of good stock in periods of normal rainfall as influenced by kinds of soil or topographic features. *Seedling mortality* is caused primarily by too much water or too little water. The factors used in rating a soil for seedling mortality are texture of the surface layer, depth and duration of the water table, rock fragments in the surface layer, and rooting depth. Mortality generally is greatest on soils that have a sandy or clayey surface layer. The risk is *slight* if, after site preparation, expected mortality is less than 25 percent; *moderate* if expected mortality is between 25 and 50 percent; and *severe* if expected mortality exceeds 50 percent. Ratings of *moderate* or *severe* indicate that it may be necessary to increase the planting rates per acre, to use containerized or larger than usual planting stock, or to make special site preparations, such as bedding, furrowing, installing surface drainage, or providing artificial shade for seedings. Replanting is often necessary if the risk is *moderate* or *severe*.

Ratings of *plant competition* indicate the likelihood of the growth or invasion of undesirable plants. *Plant competition* becomes more severe on the more productive soils, on poorly drained soils, and on soils having a restricted root zone that holds moisture. The risk is *slight* if competition from undesirable plants reduces adequate natural or artificial reforestation but does not necessitate intensive site preparation and maintenance. The risk is *moderate* if competition from undesirable plants reduces natural or artificial reforestation to the extent that intensive site preparation and maintenance are needed. The risk is *severe* if competition from undesirable plants prevents adequate natural or artificial reforestation unless the site is intensively prepared and maintained. A *moderate* or *severe* rating indicates the need for site preparation to ensure the development of an adequately stocked stand. Managers must plan site preparation measures to ensure reforestation without delays.

The potential productivity of *common trees* on a soil is expressed as a *site index*. Common trees are listed in the order of their observed general occurrence. Generally, only two or three tree species dominate.

The soils that are commonly used to produce timber have the yield predicted in cubic feet and board feet. The yield is predicted at the point where mean annual increment culminates.

The *site index* is determined by taking height measurements and determining the age of selected dominant and codominant trees within stands of a given species. This index is the average height, in feet, that the trees attain in a specified number of years. For cottonwood, this is 30 years; for all others, it is 50 years. This index applies to fully stocked, even-aged, unmanaged stands. Site index values shown in table 6 are based on published site index tables *(3, 4, 5, 7, 10, 12)*.

The *productivity class* represents an expected volume produced by the most important trees, expressed in board feet (Doyle Rule) per acre per year. The annual yield figures apply to fully stocked, natural stands. The stands do not have a history of any intermediate cutting management. Therefore, applying sound forestry management practices, such as thinning, significantly increases the listed yields.

Trees to plant are those that are used for reforestation or, if suitable conditions exist, natural regeneration. They are suited to the soils and will produce a commercial wood crop. Desired product, topographic position (such as a low, wet area), and personal preference are three factors of many that can influence the choice of trees to use for reforestation.

Woodland Understory Vegetation

Johnny Patterson, forester, Soil Conservation Service, helped prepare this section.

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.

Livestock farming is the major agricultural enterprise in the survey area. According to the 1978 Census of Agriculture, over 50,000 cattle are in the area, mainly in cow-calf operations. Most forage needs are supplied by improved pastures; however, some forest lands are also grazed.

Forage production increases following clearcutting of an area. Annual herbage yields average about 1,500 pounds (air dry) per acre; on choice sites, the yields can exceed 3,000 pounds. Grasses make up at least 80 percent of the vegetation on grazed forest land that is periodically burned. Sedges, forbs, and shrubs make up the rest.

The density of the overstory canopy determines the amount of light that reaches the understory plants. The canopy cover is the major factor affecting the production of vegetation within reach of livestock and deer. Good silvicultural practices, such as thinning timber stands, removing cull trees, and controlling burning, along with livestock management, are necessary to maintain moderate to good understory plants for grazing. Without the proper management practices, the canopy cover increases drastically because of the growth of shrubs and hardwoods in the midstory. A site that has at least a 75 percent canopy cover may not have sufficient carrying capacity for profitable livestock operations or for use by deer. Livestock and deer compete for many of the same browse plants. Because of the increased value of hunting leases over the past few years, many landowners have removed livestock from the forest land.

In addition to proper woodland management, the use of proper woodland grazing, deferred grazing, planned grazing systems, and prescribed burning can help to achieve high levels of forage production consistent with good forest management.

Proper woodland grazing at an intensity that maintains or improves the quantity and quality of desirable plants increases vigor and reproduction of key forage plants, conserves soil and water, improves the condition of the plants, increases forage production, maintains natural beauty, and reduces the hazard of wildfires. The grazing intensity is generally no more than one-half, by weight, of the annual growth of key forage plants in preferred grazing areas.

Deferred grazing consists of postponing grazing or resting the site from grazing for a prescribed period. The rest period promotes the growth of natural vegetation by increasing the vigor of forage and permitting desirable plants to seed. It also provides feed reserves for fall and winter grazing, improves the appearance of lands that have adequate cover, improves hydrologic conditions, and reduces soil loss.

Planned grazing systems increase production of desirable forage plants and trees. Generally, two or more grazing units are rested from grazing key forage plants in a planned sequence throughout the year or during the growing season.

Prescribed burning or the use of controlled fire can help to control undesirable vegetation; remove old, unpalatable, rough growth; increase production through removal of part of the duff; and reduce the hazard of wildfires.

The quantity and quality of understory vegetation also vary with the kind of soil, the age and kind of trees in the canopy, and the depth and condition of the litter.

Table 7 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 4.5 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 7 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

Ed Schwille, biologist, Soil Conservation Service, helped prepare this section.

About 90 percent of the survey area has medium to high potential for recreational development because of the suitable soils, climate, water, and vegetation, especially coniferous and hardwood trees.

Lake O' the Pines, Cypress Springs, Bob Sandlin, Monticello, and Welch Lakes; some private club lakes; and several other smaller lakes provide fishing and other water-related activities. Extended and overnight camping and picnic areas are available. Daingerfield State Park in Morris County offers a combination of recreational activities (fig. 21). Many areas along the Sulphur River, Big Cypress Creek, and White Oak Creek are suited to recreational uses. Canoeing is available on Big Cypress Creek. Many private water areas ranging from 3 to 200 acres are in the survey area.

Limited accessibility reduces the potential for development of some scenic areas. White-tailed deer, squirrel, bobwhite quail, and waterfowl inhabit the survey area and provide many hunting opportunities. Numerous residential developments also provide recreational opportunities. Several state historical markers and sites are in the survey area.

In table 8, the soils of the survey area are rated according to the 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 recreational 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 8, 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 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

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 gentle 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, 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

Figure 21.—Daingerfield State Park is well designed for recreation. The soil is Cuthbert fine sandy loam, 8 to 25 percent.

surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding 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.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Ed M. Schwille, biologist, Soil Conservation Service, and Joe Campo and John D. Wallace, wildlife biologists, Texas Park and Wildlife Department, helped prepare this section.

Interest in management of wildlife habitat has increased as the demand for hunting opportunities and outdoor recreation increased. Special consideration is given to the improvement of wildlife habitat, especially for game species.

Many fox squirrels, gray squirrels, white-tailed deer, furbearers, and waterfowl are in the survey area. Other major wildlife species are bobwhite quail, mourning dove, raccoon, opossum, striped skunk, cottontail rabbit, swamp rabbit, bobcat, wild hogs, coyote, armadillo, beaver, nutria, numerous songbirds, shore birds, and raptors.

Soils on the flood plains along the Sulphur River and Big Cypress, Boggy, Brushy, Hart, Lilly, Prairie, Ripley, Swanano, Tankersley, and White Oak Creeks provide excellent hardwood bottom land habitat for gray squirrels. Fox squirrels are in the upland pine-hardwood habitat type. Retention of hardwoods helps to maintain desirable squirrel habitat. The expected population density is one squirrel per acre. Habitat for white-tailed deer is mainly in riparian areas, and deer populations are scattered throughout the survey area. In Camp County, the deer density along Big Cypress Creek and associated open fields is about 30 deer per 1,000 acres. The estimated deer density in agricultural areas of Morris County is 30 to 35 deer per 1,000 acres. The northern parts of Titus and Franklin Counties support an estimated 20 deer per 1,000 acres.

An abundance of good quail habitat was in the survey area; however, the conversion of abandoned crop fields to improved pastures or woodland and the loss of "pea patches" reduced the amount of good quail habitat. This condition, however, may be changing. Generally, any method that stimulates the growth of seed-bearing grasses and legumes and maintains escape cover nearby enhances habitat for quail. Many quail are around agricultural areas in the central part of Morris County.

Furbearers, such as raccoon, nutria, coyote, bobcat, and fox, are trapped each year in the survey area. Beaver and nutria have become a nuisance in various creeks and on lakes. Several acres of trees, improved pasture, and crops have been inundated because of beaver activity.

The pocket gopher is also a pest throughout the survey area. It burrows in crop fields, improved pastures, and most importantly, at homesites. Because of the decrease of natural predators, the gopher populations must be controlled.

Hunting of migratory game is common throughout the survey area. Doves are hunted early in the season, especially on harvested grain fields. Weedy sunflower patches and cropland where the residue is left on the surface are habitat for mourning dove. During fall and winter migration, mallard, pintail, gadwall, teal, canvasback, and other ducks use existing water areas. Wood ducks are in sloughs, beaver ponds, and backwater areas of lakes throughout the year. Flooding of hardwoods from October to February in "green tree" reservoirs provide excellent waterfowl habitat. Geese are occasionally in the survey area. Waterfowl are also in the Sulphur River bottom lands, and around the lakes and numerous small livestock ponds in the area. Small wetland areas or marshes provide feeding places for waterfowl.

Numerous reptiles and amphibians inhabit the area. Poisonous species in the survey area include rattlesnake, copperhead, cottonmouth, and coral snake.

Threatened and endangered species in the survey area include the bald eagle, which winters around the large lakes, and alligators along the Sulphur River, creeks, lakes, and in other isolated areas. Good habitat for the red-cockaded woodpecker is available. Some individual woodpeckers have been spotted but no colonies are known to exist. The red wolf is rare; however, it could possibly be in the survey area. River otter are also rare but do inhabit the area.

The numerous lakes, ponds, and creeks in the survey area provide good to excellent fishing. Major warm-water species are largemouth black bass, channel catfish, crappie, flathead catfish, various sunfish, bullhead catfish, buffalo, carp, and gar. Walleye have been introduced into Lake Cypress Springs. Channel catfish and fathead minnows have been stocked in many of the small livestock ponds. Two native species, the chain pickerel and bowfin, are nuisance fish. Commercial catfish operations have been established near Mt. Vernon in Franklin County.

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 9, 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, soybeans, grain sorghum, rye, millet, peas, 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, switchgrass, bahiagrass, clover, winterpeas, and singletary peas.

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, wildrye, goldenrod, beggarweed, wheatgrass, and grama.

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 water oak, willow oak, red oak, post oak, green ash, pecan, sweetgum, walnut, hawthorn, dogwood, hickory, yaupon, honeysuckle, and blackberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are plum, Russian olive, autumn olive, and crabapple.

Coniferous plants furnish browse and seeds. 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, baldcypress, and juniper.

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, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, sesbania, common reedgrass, 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 depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, green tree reservoirs, 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, mourning dove, meadowlark, raptors, numerous songbirds, pocket gophers, cottontail, fox, and coyote.

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, numerous songbirds, woodcock, owls, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

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, alligator, muskrat, mink, nutria, and beaver.

Many areas within the survey area can be improved for use as wildlife habitat by increasing the food and water supply for wildlife. Areas best suited to improvement are the pine-hardwood forests, native pastures, and bottom lands.

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, and 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 must 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, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, 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, corrosiveness, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to: evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and 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 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. 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 the depth to bedrock, a cemented pan, or 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. Depth to a high water table, depth to bedrock or to a cemented pan, 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. Depth to bedrock or to a cemented pan, depth to 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, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, depth to a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 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 11 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 that 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, depth to a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

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 filter the effluent effectively. 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 11 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, depth to a high water table, depth to bedrock or to a cemented pan, 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, bedrock, and cemented pans 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 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, depth to a 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 bedrock, a cemented pan, or 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 12 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 and topsoil. They are rated as a probable or improbable source of 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 foot 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 natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

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 releases a variety of plant-available nutrients as it decomposes.

Water Management

Table 13 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 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 the restrictive features that affect each soil for 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 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 bedrock, to a cemented pan, or 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.

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, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or 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, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, 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. These results are reported in table 20.

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 14 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 the content of particles coarser than sand is as much as 15 percent, 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. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 20.

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 ovendry 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.

Physical and Chemical Properties

Table 15 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.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They influence the soil's adsorption of cations, moisture retention, shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of movement of water through the soil 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 in each major soil layer is stated in inches of water per inch of soil. 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. Losses are expressed in tons per acre per year. These 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 0.02 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 by wind or water that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 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 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 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 covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (there is a near 0 to 5 percent chance of flooding in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (there is a 5 to 50 percent chance of flooding in any year). *Frequent* means that flooding occurs often under normal weather conditions (there is more than a 50 percent chance of flooding in any year). *Common* is used when classification as occasional or frequent does not affect interpretations. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. November-May, for example, means that flooding can occur during the period November through May. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding 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, which are characteristic of soils that are not subject to flooding.

Also considered are 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 16 are the depth to the seasonal high water table; the kind of water table, that is, *perched* or *apparent;* and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 16.

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. 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.

The two numbers in the "High water table-Depth" column indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that the water table exists for less than a month.

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 severely corrosive 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 the amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in table 17, the results of chemical analysis in table 18, and the mineralogy results in table 19. The data are for soils sampled at carefully selected sites. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the National Soil Survey Laboratory, Lincoln, Nebraska, and the Texas A&M University Soil Characterization Laboratory, College Station, Texas.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods *(15)*.

Sand—(0.05-2.0 mm fraction) weight percentages of materials less than 2 mm (3A1).
Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all materials less than 2 mm (3A1).
Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1).
Water retained—pressure extraction, percentage of oven-dry weight of less than 2 mm material; 1/3 or 1/10 (3/10) bar (4B1), 15 bars (4B2).
Moist bulk density—of less than 2 mm material, saran-coated clods (4A1).
Linear extensibility—change in clod dimension based on less than 2 mm material (4D).
Organic carbon—dichromate, ferric sulfate titration (6A1a).
Extractable acidity—potassium chloride-triethanolamine (6H3a).
Cation-exchange capacity—ammonium acetate, pH 7.0 (5A1a).
Cation-exchange capacity—sum of cations (5A3a).
Base saturation—sum of cations, TEA, pH 8.2 (5C3).
Reaction (pH)—1:1 water dilution (8C1a).
Reaction (pH)—calcium chloride (8C1e).
Aluminum—potassium chloride extraction (6G).
Electrical conductivity—saturation extract (8A1a).
Sodium-adsorption ratio (5E).

Engineering Index Test Data

Table 20 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by State Department of Highways and Public Transportation, Austin, Texas.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM); Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(14)*. 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 on laboratory measurements. Table 21 shows the classification of the soils in the survey area. 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 Ultisol.

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 Udult (*Ud*, meaning moist, plus *ult*, from Ultisol).

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 Hapludults (*Hapl*, meaning minimal horizonation, plus *udults*, the suborder of the Ultisols that has an aquic moisture regime).

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 Hapludults.

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 clayey, mixed, thermic Typic Hapludults, such as the Kirvin series.

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. There can be some variation in the texture of the surface layer or of the substratum 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. The soil is compared with similar soils and with nearby soils of other 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 (13)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (15)*. 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."

Ashford Series

The Ashford series consists of deep, poorly drained soils on stream terraces. These soils are very slowly permeable. They formed in clayey alluvial sediment. Slopes are 0 to 1 percent. The soils of the Ashford series are very-fine, montmorillonitic, thermic Vertic Ochraqualfs.

Typical pedon of Ashford clay, 0 to 1 percent slopes; from Mt. Pleasant, 17 miles east on Interstate Highway 30 to U.S. Highway 259, 0.7 mile east and south on access road to gate, 1,100 feet southwest on private road, 300 feet east of road.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) clay; moderate coarse subangular blocky structure parting to weak medium subangular blocky; extremely hard, very firm; many fine roots; slightly acid; clear smooth boundary.
Btg1—3 to 13 inches; light brownish gray (10YR 6/2) clay; many medium distinct yellowish brown (10YR 5/8) mottles; moderate coarse subangular blocky structure parting to weak fine subangular blocky; extremely hard, very firm; many fine roots; shiny faces on few peds; very strongly acid; gradual smooth boundary.
Btg2—13 to 35 inches; light brownish gray (2.5Y 6/2) clay; common medium distinct strong brown (7.5YR 5/8) mottles; weak fine subangular blocky structure; extremely hard, very firm; many fine roots; few patchy clay films on faces of peds; shiny faces on peds; few slickensides; few crayfish krotovinas lined with clay; very strongly acid; gradual smooth boundary.
Btg3—35 to 51 inches; light brownish gray (2.5Y 6/2) clay; few fine faint light yellowish brown mottles; weak fine subangular blocky structure; extremely hard, very firm; common fine roots; few patchy clay films on faces of peds; shiny faces on peds; few slickensides; very strongly acid; gradual smooth boundary.
Btg4—51 to 80 inches; light brownish gray (2.5Y 6/2) clay; few fine faint gray mottles; weak medium subangular blocky structure; extremely hard, very firm; common fine roots; few patchy clay films; strongly acid.

The solum is more than 80 inches thick. Texture is clay, and the clay content of the control section ranges from 60 to 75 percent. Few to common slickensides occur during the wetting and drying cycle. If the soil is dry, cracks 0.5 inch to 1.5 inches wide extend from the surface to a depth of more than 20 inches.

The A horizon is very dark grayish brown, dark grayish brown, or grayish brown. In some pedons, this horizon has few to common yellowish brown or strong brown mottles. Reaction is strongly acid to slightly acid. The A horizon is 2 to 8 inches thick.

The Btg horizon is gray, light gray, light brownish gray, or grayish brown. Mottles of yellowish brown, light yellowish brown, strong brown, or red range from few to many. Reaction is very strongly acid or strongly acid.

Bazette Series

The Bazette series consists of deep, well drained soils on uplands. These soils are slowly permeable. They formed in alkaline, shaly and clayey sediments. Slopes range from 5 to 15 percent. The soils of the Bazette series are fine, montmorillonitic, thermic Udic Haplustalfs.

Typical pedon of Bazette silty clay loam, 5 to 15 percent slopes; from Mt. Vernon, 3.3 miles east on U.S. Highway 67, 7 miles north on Farm Road 1896 to a county road, 3.1 miles west on the county road, 50 feet south of road, in woods.

A—0 to 6 inches; dark grayish brown (2.5Y 4/2) silty clay loam; moderate medium granular structure; hard, firm; common fine roots; few fine pebbles; slightly acid; clear smooth boundary.
Bt1—6 to 19 inches; light olive brown (2.5Y 5/4) clay; moderate medium angular blocky structure to very fine angular blocky; hard, firm; few fine roots; clay films on faces of peds; few fine pebbles; medium acid; gradual wavy boundary.
Bt2—19 to 28 inches; light olive brown (2.5Y 5/4) clay; common medium distinct olive yellow (2.5Y 6/6) mottles; moderate medium angular blocky structure and moderate fine angular blocky structure; very hard, very firm; few fine roots; clay films on faces of peds; few fine pebbles; slightly acid; gradual smooth boundary.
BC—28 to 37 inches; mottled olive yellow (2.5Y 6/6) and light olive brown (2.5Y 5/4) clay; common gray (5Y 5/1) shale fragments in lower part; weak medium blocky structure; very hard, very firm; few fine roots; mildly alkaline; gradual wavy boundary.
C—37 to 60 inches; stratified olive gray (5Y 5/2), gray (10YR 6/1), and brownish yellow (10YR 6/6) shaly clay and fragments of shale; massive; common fine and medium roots; very hard, very firm; few concretions and soft masses of calcium carbonate; mildly alkaline.

The solum is 20 to 40 inches thick. Some pedons have a few concretions and soft masses of calcium carbonate below a depth of 28 inches.

The A horizon is dark grayish brown or very dark grayish brown. Reaction ranges from medium acid to slightly acid. The A horizon is 3 to 9 inches thick.

The Bt horizon is light olive brown, olive brown, or yellowish brown. Mottles in shades of brown or yellow range from few to common. Texture is silty clay or clay. The clay content ranges from 40 to 55 percent. Reaction ranges from medium acid to slightly acid. The Bt horizon is 10 to 25 inches thick.

The BC horizon is olive yellow, light olive brown, or light yellowish brown, or it is mottled in shades of brown and yellow. Texture is silty clay or clay. Shale fragments in shades of gray are common in most pedons. Reaction ranges from medium acid to moderately alkaline. Some pedons are calcareous. This horizon is 6 to 12 inches thick. Some pedons do not have a BC horizon.

The C horizon is stratified clay or silty clay in shades of gray, brown, and yellow. It is interbedded with shale. Reaction is neutral to moderately alkaline. Some pedons are calcareous.

Bernaldo Series

The Bernaldo series consists of deep, well drained soils on uplands. These soils are moderately permeable. They formed in loamy sediment. Slopes range from 1 to 3 percent. The soils of the Bernaldo series are fine-loamy, siliceous, thermic Glossic Paleudalfs.

Typical pedon of Bernaldo fine sandy loam, 1 to 3 percent slopes; from Interstate Highway 30 in Mt. Vernon, 4.8 miles south on Farm Road 115, 2.6 miles east on Farm Road 3122, 1 mile south on Farm Road 2723 to private road, 0.6 mile west on the private road to plantation, 250 feet south, in woods.

A—0 to 6 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine granular structure; loose, friable; many medium and fine roots; few fine ironstone pebbles; slightly acid; gradual wavy boundary.

E—6 to 17 inches; yellowish brown (10YR 5/4) fine sandy loam; few fine and medium distinct yellowish brown (10YR 5/8) mottles; weak fine granular structure; loose, friable; many medium and fine roots; few fine ironstone pebbles; slightly acid; clear wavy boundary.

Bt1—17 to 30 inches; yellowish brown (10YR 5/6) sandy clay loam; few fine faint brownish yellow mottles; weak fine subangular blocky structure; hard, firm; many medium and fine roots; few fine ironstone pebbles; medium acid; gradual wavy boundary.

Bt2—30 to 38 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium prominent red (2.5YR 5/8) mottles, common fine prominent reddish yellow (7.5YR 6/8) mottles, few fine distinct light brownish gray (10YR 6/2) mottles, and few fine faint brownish yellow mottles; weak fine subangular blocky structure; hard, firm; common medium and fine roots; strongly acid; gradual wavy boundary.

Bt/E1—38 to 48 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium prominent red (2.5YR 4/8) mottles, common medium faint brownish yellow (10YR 6/8) mottles, and few medium distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm; common fine roots; 8 to 10 percent, by volume, coatings of light gray clean sand and silt on surface of peds; very strongly acid; gradual wavy boundary.

Bt/E2—48 to 66 inches; mottled yellowish brown (10YR 5/6), light brownish gray (10YR 6/2), red (2.5YR 4/8), and brownish yellow (10YR 6/8) sandy clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very firm; few fine roots; 10 to 15 percent, by volume, coatings of light gray clean sand and silt on surface of peds; very strongly acid; gradual wavy boundary.

Bt/E3—66 to 80 inches; mottled red (2.5YR 4/8), yellowish brown (10YR 5/6), and light brownish gray (10YR 6/2) sandy clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very firm; few fine roots; 10 percent, by volume, coatings of light gray clean sand and silt on surface of peds; very strongly acid.

The solum is more than 80 inches thick. Depth to saturated horizons range from 48 to 72 inches during the cool season. The clay content ranges from 18 to 30 percent in the control section. Base saturation at a depth of 50 inches below the top of the Bt horizon ranges from 35 to 60 percent.

The A horizon is brown, dark brown, or dark yellowish brown. Reaction ranges from strongly acid to slightly acid. The A horizon is 2 to 6 inches thick.

The E horizon is pale brown or yellowish brown. Reaction ranges from strongly acid to slightly acid. The E horizon is 6 to 18 inches thick. The combined thickness of the A and E horizons is less than 20 inches.

The Bt horizon is strong brown, yellowish brown, or brownish yellow. It has mottles in shades of red, brown, or yellow. Gray mottles range from none to common below a depth of 30 inches. Texture is sandy clay loam or loam. Reaction ranges from strongly acid to slightly acid. The Bt horizon is 15 to 40 inches thick.

The Bt/E horizon is similar in color to the Bt horizon. The E part of this horizon is coatings on the surface of peds and vertical streaks and pockets of clean sand and silt. This part ranges from 10 to 30 percent, by volume, and is light gray or light brownish gray. Texture of the Bt part of the horizon is generally loam or sandy clay loam; in some pedons, it is clay loam. Reaction ranges from very strongly acid to medium acid.

Besner Series

The Besner series consists of deep, well drained soils on stream terraces. These soils are moderately permeable. They formed in loamy alluvial deposits along major streams. Slopes range from 0 to 2 percent. The soils of the Besner series are coarse-loamy, siliceous, thermic Glossic Paleudalfs.

Typical pedon of Besner fine sandy loam, in an area of Besner-Talco complex, 0 to 2 percent slopes; from Mt. Vernon, 3.3 miles east on U.S. Highway 67 to Farm Road 1896, 1 mile east on U.S. Highway 67, 0.1 mile north of highway, in hay meadow.

Ap—0 to 3 inches; dark brown (10YR 4/3) fine sandy loam; few fine distinct brownish yellow (10YR 6/8) mottles; weak fine granular structure; loose, friable; many coarse, medium, and fine roots; very strongly acid; gradual smooth boundary.

E—3 to 9 inches; yellowish brown (10YR 5/4) fine sandy loam; many fine faint dark yellowish brown mottles and few fine faint pale brown mottles; weak fine granular structure; loose, friable; many coarse, medium, and fine roots; few black splotches; very strongly acid; gradual wavy boundary.

BE1—9 to 17 inches; yellowish brown (10YR 5/6) fine sandy loam; weak fine granular structure; loose, friable; many coarse, medium, and fine roots; few lenses of light brownish gray (10YR 6/2) clean sand and silt grains; medium acid; gradual wavy boundary.

BE2—17 to 31 inches; yellowish brown (10YR 5/6) fine sandy loam; common fine distinct dark yellowish brown (10YR 4/4) and few fine prominent yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; loose, friable; common fine roots; few fine pores; 2 to 5 percent, by volume, pale brown (10YR 6/3) streaks of clean sand and silt grains (E); slightly acid; gradual wavy boundary.

Bt/E1—31 to 38 inches; yellowish brown (10YR 5/8) loam; few medium distinct yellowish red (5YR 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable; common medium and fine roots; few patchy clay films; about 5 percent, by volume, coatings of light brownish gray (10YR 6/2) clean sand and silt grains (E); strongly acid; gradual wavy boundary.

Bt/E2—38 to 46 inches; strong brown (7.5YR 5/6) loam; common medium distinct grayish brown (10YR 5/2) mottles, few medium distinct yellowish red (5YR 5/6) mottles, and few fine faint yellowish brown mottles; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, firm; common medium and fine roots; few fine pores; few patchy clay films; about 7 percent, by volume, streaks and coatings of light brownish gray (10YR 6/2) clean sand and silt grains (E); very strongly acid; gradual wavy boundary.

Bt1—46 to 66 inches; strong brown (7.5YR 5/8) sandy clay loam; common coarse distinct grayish brown (10YR 5/2) mottles; weak fine prismatic structure parting to weak fine subangular blocky; slightly hard, firm; few fine roots; few patchy clay films; few streaks and pockets of clean sand and silt grains; very strongly acid; gradual wavy boundary.

Bt2—66 to 86 inches; mottled dark yellowish brown (10YR 4/6), strong brown (7.5YR 5/8), grayish brown (10YR 5/2), and pale brown (10YR 6/3) loam; weak fine subangular blocky structure; slightly hard, friable; few fine roots; few streaks and pockets of clean sand and silt grains; slightly acid.

The solum is more than 60 inches thick. The clay content of the control section (upper 20 inches of the Bt/E horizon) ranges from 14 to 18 percent. Base saturation at a depth of 50 inches below the top of the Bt horizon ranges from 35 to 75 percent.

The A horizon is brown or dark brown. Reaction ranges from very strongly acid to slightly acid. The A horizon is 1 inch to 4 inches thick.

The E and BE horizons are dark yellowish brown, yellowish brown, or light yellowish brown. Reaction ranges from very strongly acid to slightly acid. Combined thickness of the E and BE horizons is 18 to 40 inches.

The Bt and Bt/E horizons are yellowish brown, strong brown, or brownish yellow. They have mottles in shades of red, brown, and yellow. The E part of the Bt/E horizon is vertical streaks and coatings of clean sand and silt that range from 5 to 15 percent, by volume. Texture of the Bt part of the horizon is loam or sandy clay loam. Reaction ranges from very strongly acid to slightly acid.

Bienville Series

The Bienville series consists of deep, somewhat excessively drained soils on stream terraces. These soils are moderately rapidly permeable. They formed in sandy alluvium along major streams. Slopes range from 0 to 3 percent. The soils of the Bienville series are sandy, siliceous, thermic Psammentic Paleudalfs.

Typical pedon of Bienville loamy fine sand, 0 to 3 percent slopes; from Daingerfield, 5.6 miles west on Texas Highway 11, 4.2 miles southeast on Farm Road 144, 20 feet north of road, in roadbank.

A—0 to 9 inches; dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; loose; many medium and fine roots; slightly acid; clear wavy boundary.

E—9 to 21 inches; strong brown (7.5YR 5/6) loamy fine sand; single grained; loose; many medium and fine roots; slightly acid; gradual wavy boundary.

E/Bt1—21 to 39 inches; strong brown (7.5YR 5/6) loamy fine sand; common medium faint light yellowish brown (10YR 6/4) mottles; few yellowish red (5YR 4/6) lamellae 0.15 to 0.25 inch thick and 2 to 6 inches apart below a depth of 30 inches; single grained; loose; common fine roots; medium acid; gradual wavy boundary.

E/Bt2—39 to 56 inches; strong brown (7.5YR 5/6) loamy fine sand; many medium faint light yellowish brown (10YR 6/4) mottles; common yellowish red (5YR 4/6) lamellae 0.25 to 0.5 inch thick and 1 inch to 4 inches apart; weak medium blocky structure; loose; medium acid; clear wavy boundary.

E/Bt3—56 to 80 inches; light yellowish brown (10YR 6/4) loamy fine sand; common medium distinct strong brown (7.5YR 5/6) mottles; yellowish red (5YR 4/6) lamellae 0.5 inch to 1.2 inches thick and 0.5 inch to 4 inches apart; weak medium blocky structure; loose; medium acid; clear irregular boundary.

The solum is 60 to more than 80 inches thick. Combined thickness of lamellae ranges from 6 to 8 inches. Depth to lamellae ranges from 30 to 60 inches but is commonly less than 40 inches (fig. 22).

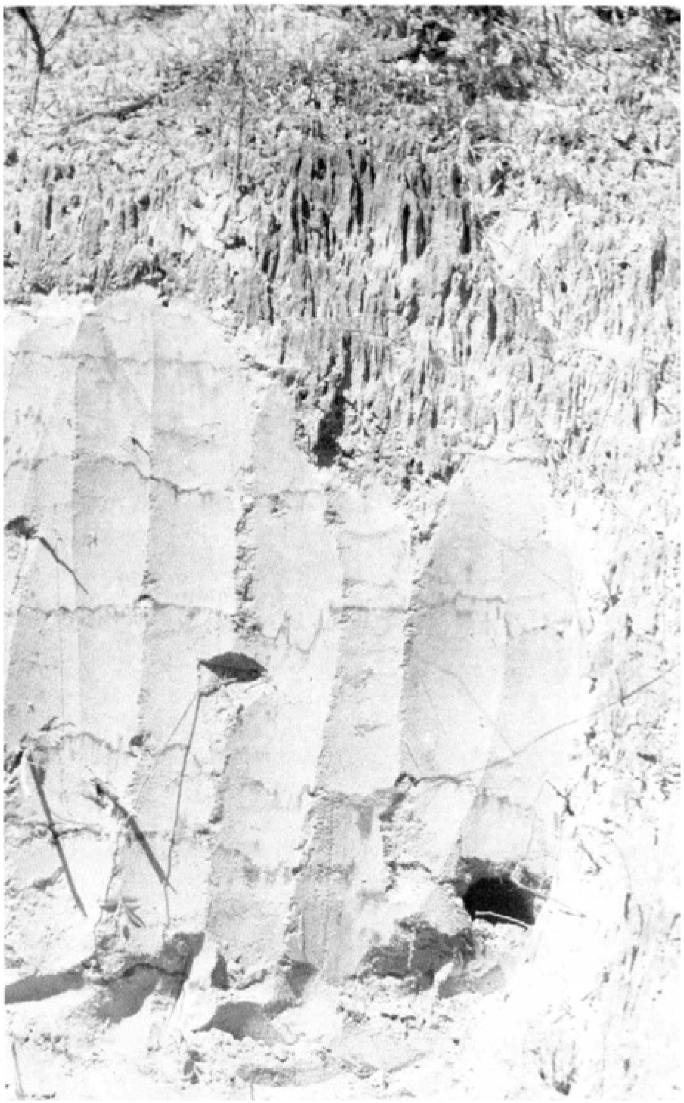


Figure 22.—Bienville loamy fine sand, 0 to 3 percent slopes, has thin bands of darker color, more loamy material called lamellae.

The A horizon is brown, dark brown, or dark yellowish brown. Reaction ranges from medium acid to slightly acid. The A horizon is 4 to 12 inches thick.

The E or EB horizon is strong brown, dark brown, brown, light yellowish brown, or yellowish brown. Reaction ranges from strongly acid to slightly acid. The E or EB horizon is 10 to 30 inches thick.

The E/Bt horizon is strong brown, yellowish brown, or light yellowish brown. Lamellae in shades of brown or red range from 0.1 inch to 1.5 inches thick. Texture of the E/Bt horizon is loamy fine sand. Reaction ranges from strongly acid to medium acid.

Bowie Series

The Bowie series consists of deep, moderately well drained soils on uplands. These soils are moderately slowly permeable. They formed in acidic, loamy sediment. Slopes range from 2 to 5 percent. The soils of the Bowie series are fine-loamy, siliceous, thermic Plinthic Paleudults.

Typical pedon of Bowie fine sandy loam, 2 to 5 percent slopes; from Pittsburg, 2.2 miles south on U.S. Highway 271 to county road, 200 feet west of the intersection, and 100 feet south of the county road.

A—0 to 4 inches; dark brown (10YR 4/3) fine sandy loam; weak fine granular structure; slightly hard, very friable; many fine roots; few fine pores; strongly acid; clear smooth boundary.

E—4 to 11 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; medium acid; gradual smooth boundary.

Bt1—11 to 24 inches; yellowish brown (10YR 5/8) sandy clay loam; few fine distinct red (2.5YR 5/8) mottles; moderate fine subangular blocky structure; hard, friable; few fine roots; few fine tubular pores; few clay films on surfaces of peds; strongly acid; gradual smooth boundary.

Bt2—24 to 38 inches; brownish yellow (10YR 6/6) sandy clay loam; many medium distinct red (2.5YR 5/8) mottles; moderate fine subangular blocky structure; hard, friable; few fine roots; few fine tubular pores; few clay films on surfaces of peds; few ironstone pebbles up to 0.25 inch in diameter; very strongly acid; gradual smooth boundary.

Btv/E1—38 to 49 inches; brownish yellow (10YR 6/6) sandy clay loam; many medium distinct red (2.5YR 5/6) mottles; moderate fine subangular blocky structure; common clay films on surfaces of peds; 4 to 6 percent nodular plinthite; few ironstone pebbles up to 0.25 inch in diameter; 2 to 3 percent vertical streaks of light gray (10YR 7/2) clean sand; very strongly acid; gradual smooth boundary.

Btv/E2—49 to 58 inches; brownish yellow (10YR 6/6) sandy clay loam; many medium distinct red (2.5YR 4/6) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; hard, firm; few fine roots; few clay films on surfaces of peds; 5 to 7 percent plinthite; 3 to 5 percent vertical streaks of light gray (10YR 7/2) clean sand around peds; few ironstone pebbles up to 0.25 inch in diameter; very strongly acid; gradual smooth boundary.

Btv/E3—58 to 75 inches; mottled brownish yellow (10YR 6/6), light gray (10YR 7/2), and yellowish red (5YR 4/6) sandy clay loam; moderate coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few fine roots in gray areas; few clay films on surfaces of peds; 5 to 7 percent nodular plinthite; few coatings and lenses of light gray (10YR 7/2) clean sand; few black and dark yellowish brown concretions up to 0.25 inch in diameter; very strongly acid.

The solum is more than 80 inches thick. Plinthite ranges from 5 to 10 percent, by volume, in some parts of the Bt horizon. Depth to horizons that have over 5 percent plinthite ranges from 30 to 50 inches (fig. 23). The clay content of the control section ranges from 18 to 35 percent.

The A horizon is brown, dark brown, yellowish brown, or light yellowish brown. Reaction ranges from strongly acid to slightly acid. The A horizon is 3 to 8 inches thick.

The E horizon is pale brown, light yellowish brown, yellowish brown, brown, or reddish yellow. Reaction ranges from strongly acid to slightly acid. The E horizon is 4 to 12 inches thick.

The Bt horizon is yellowish brown, brownish yellow, strong brown, or reddish yellow. Few or common mottles in shades of red are in most pedons. Plinthite is less than 4 percent, by volume, and streaks or pockets of clean sand are less than 5 percent. Texture is sandy clay loam or fine sandy loam. Reaction is very strongly acid or strongly acid.

The Btv/E horizon has matrix colors similar to those of the Bt horizon, or it is mottled in shades of brown, red, gray, and yellow. Streaks or pockets of clean sand range from 5 to 15 percent, by volume. Plinthite, mainly in nodular form, makes up 5 to about 15 percent, by volume. Texture is sandy clay loam or clay loam. Reaction is very strongly acid or strongly acid.

Figure 23.—Bowie fine sandy loam, 2 to 5 percent slopes, has plinthite at a depth of about 38 inches that restricts movement of air, water, and plant roots.

Briley Series

The Briley series consists of deep, well drained soils on uplands. These soils are moderately permeable. They formed in acidic, loamy sediment. Slopes range from 2 to 5 percent. The soils of the Briley series are loamy, siliceous, thermic Arenic Paleudults.

Typical pedon of Briley loamy fine sand, 2 to 5 percent slopes; from Daingerfield, 3.7 miles south on U.S. Highway 259, 2 miles west on Farm Road 144 to county road, 0.2 mile north on county road to roadcut on east side.

A—0 to 8 inches; dark grayish brown (10YR 4/2) loamy fine sand; weak fine granular structure; loose; many coarse, medium, and fine roots; medium acid; clear smooth boundary.

E—8 to 29 inches; brown (7.5YR 5/4) loamy fine sand; weak fine granular structure; loose; many coarse, medium, and fine roots; medium acid; gradual wavy boundary.

BE—29 to 35 inches; yellowish red (5YR 5/6) fine sandy loam; weak fine subangular blocky structure; loose, friable; many medium and fine roots; medium acid; gradual wavy boundary.

Bt1—35 to 48 inches; red (2.5YR 4/8) sandy clay loam; many medium distinct yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; slightly hard, friable; 2 to 3 percent, by volume, fine pebbles; yellowish red (5YR 5/6) sandy material in root channels and on vertical faces of peds; medium acid; gradual wavy boundary.

Bt2—48 to 65 inches; red (2.5YR 4/8) sandy clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; hard, firm; 4 to 5 percent, by volume, fine pebbles; common streaks of clean sand on ped faces; medium acid; gradual wavy boundary.

Bt3—65 to 76 inches; red (2.5YR 4/8) fine sandy loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; hard, firm; pockets of light gray (10YR 7/2) clean sand in lower part; medium acid.

The solum is more than 60 inches thick. Base saturation at a depth of 50 inches below the top of the Bt horizon is less than 35 percent. The clay content of the control section ranges from 18 to 28 percent.

The A horizon is light brown, brown, dark brown, or grayish brown. Reaction ranges from strongly acid to slightly acid. The A horizon is 4 to 12 inches thick.

The E horizon is reddish yellow, light yellowish brown, brown, or strong brown. Reaction is medium or slightly acid. The E horizon is 8 to 35 inches thick.

The BE horizon is in shades of red or brown. It is less than 7 inches thick. Some pedons do not have a BE horizon.

The upper part of the Bt horizon is yellowish red, reddish brown, or red. Texture is fine sandy loam or sandy clay loam. In some pedons, this part of the Bt horizon has ironstone pebbles. The lower part of the Bt horizon has colors and textures similar to those of the upper part of the Bt horizon. The lower part also has mottles in shades of red, yellow, or brown, and in addition, the texture can be loam. Reaction of the Bt horizon is strongly acid or medium acid.

Crockett Series

The Crockett series consists of deep, moderately well drained soils on uplands. These soils are very slowly permeable. They formed in alkaline, clayey and shaly sediments. Slopes range from 0 to 5 percent. The soils of the Crockett series are fine, montmorillonitic, thermic Udertic Paleustalfs.

Typical pedon of Crockett silt loam, 1 to 3 percent slopes; from Talco, about 2 miles west on Farm Road 71 to cattle guard on south side of road, 100 feet south of road.

A—0 to 8 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; very hard, very friable; common fine roots; medium acid; abrupt wavy boundary.

Bt1—8 to 18 inches; dark brown (10YR 4/3) clay; few fine distinct reddish brown (5YR 4/4) mottles; moderate fine subangular blocky structure; extremely hard, firm; few fine roots; few fine pores; patchy clay films on faces of peds; few black spots; few fine siliceous pebbles; medium acid; gradual wavy boundary.

Bt2—18 to 30 inches; olive brown (2.5Y 4/4) clay; common fine faint dark yellowish brown mottles and few fine distinct yellowish brown (10YR 5/6) and yellowish red (5YR 5/6) mottles; moderate fine subangular blocky structure; extremely hard, very firm; few fine roots; patchy clay films on faces of peds; few siliceous pebbles up to 0.5 inch in diameter; neutral; gradual wavy boundary.

Bt3—30 to 38 inches; light olive brown (2.5Y 5/4) clay; few fine faint olive brown and gray mottles and few fine distinct yellowish brown (10YR 5/6) and yellowish red (5YR 5/6) mottles; extremely hard, very firm; patchy clay films on faces of peds; neutral; gradual smooth boundary.

BC—38 to 60 inches; mottled gray (10YR 5/1), light olive brown (2.5Y 5/4), and light yellowish brown (2.5Y 6/4) clay; moderate fine subangular blocky structure; extremely hard, very firm; few small partly weathered shale fragments; neutral; gradual smooth boundary.

C—60 to 80 inches; mottled light yellowish brown (2.5Y 6/4) and grayish brown (2.5Y 5/2) shaly silty clay; weak fine platy structure; extremely hard, very friable; few fine concretions and soft masses of calcium carbonate; mildly alkaline.

The solum is 40 to about 70 inches thick. Concretions and soft masses of calcium carbonate range from none to common between depths of 30 and 60 inches. If the soil is dry, cracks 0.25 inch to 2 inches wide extend from the top of the argillic horizon to a depth of more than 20 inches. The control section is clayey. The clay content is 40 to 50 percent. COLE ranges from 0.07 to 0.1.

The A horizon is less than 10 inches thick in most pedons, but ranges up to 15 inches thick in subsoil troughs. The A horizon is dark grayish brown, grayish brown, dark brown, brown, or dark yellowish brown. Reaction ranges from medium acid to neutral. In some pedons, the A horizon has 5 to 10 percent chert pebbles.

The Bt1 horizon is dark grayish brown, dark brown, dark yellowish brown, brown, or reddish brown with mottles in shades of brown or red; or it has a mottled matrix of these colors. Texture is typically clay. Reaction ranges from medium acid to neutral. The Bt1 horizon is 6 to 12 inches thick.

The Bt2, Bt3, and BC horizons are olive brown or light olive brown with brown, grayish brown, gray, strong brown, or brownish yellow mottles. The BC horizon can be mottled in shades of gray or brown without a dominant color. Texture of the Bt2, Bt3, and BC horizons is clay loam, sandy clay, or clay. Reaction ranges from slightly acid to mildly alkaline in the Bt2 and Bt3 horizons and from neutral to moderately alkaline in the BC horizon.

The C horizon is mottled in shades of gray, brown, or yellow. Texture is shaly silty clay or clay loam. Reaction ranges from slightly acid to moderately alkaline.

Cuthbert Series

The Cuthbert series consists of deep, well drained soils on uplands. These soils are moderately slowly permeable. They formed in acidic, loamy and shaly sediments. Slopes range from 8 to 40 percent. The soils of the Cuthbert series are clayey, mixed, thermic Typic Hapludults.

Typical pedon of Cuthbert fine sandy loam, 8 to 25 percent slopes; from Farm Road 993 in Pittsburg, 3.8 miles south on U.S. Highway 271, 0.25 mile east on a county road, 0.25 mile south on a county road, 0.65 mile east on a county road, 10 feet north of road, in roadcut.

A—0 to 4 inches; dark brown (10YR 4/3) fine sandy loam; weak very fine granular structure; slightly hard, very friable; many roots; 7 to 10 percent, by volume, rounded ironstone gravels up to 2 inches in diameter; medium acid; gradual smooth boundary.

E—4 to 9 inches; brown (7.5YR 5/4) fine sandy loam; weak fine granular structure; slightly hard, very friable; many roots; 7 to 10 percent, by volume, rounded ironstone gravel up to 1 inch in diameter; strongly acid; gradual smooth boundary.

Bt1—9 to 15 inches; yellowish red (5YR 4/6) clay; moderate fine subangular blocky structure; very hard, firm; common fine roots; thick continuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt2—15 to 22 inches; yellowish red (5YR 5/6) clay; moderate fine subangular blocky structure; very hard, firm; common fine roots; thick continuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

B/C—22 to 32 inches; stratified strong brown (7.5YR 5/6) and yellowish red (5YR 5/6) clay loam; weak fine subangular blocky structure; very hard, firm; few fine roots; patchy clay films on faces of peds; few light brownish gray (10YR 6/2) shale fragments; very strongly acid; gradual wavy boundary.

C—32 to 60 inches; stratified light gray (10YR 7/2) and dark grayish brown (10YR 4/2) shale, yellowish brown (10YR 5/8) and light gray (10YR 7/2) sandstone; few thin strata of interbedded ironstone; very hard, very firm; yellowish red clay coatings along fractures; very strongly acid.

The solum is 20 to 40 inches thick (fig. 24). The clay content of the control section ranges from 35 to 55 percent.

The A horizon is brown, very dark grayish brown, dark brown, or dark grayish brown. Ironstone fragments range from 5 to 35 percent, by volume. Texture is fine sandy loam or gravelly fine sandy loam. Reaction is slightly acid to strongly acid. The A horizon is 3 to 8 inches thick.

The E horizon is brown, light yellowish brown, or very pale brown. Texture is fine sandy loam or gravelly fine sandy loam. Reaction ranges from strongly acid to slightly acid. Ironstone fragments range from 5 to 35 percent, by volume. The E horizon is 2 to 8 inches thick.

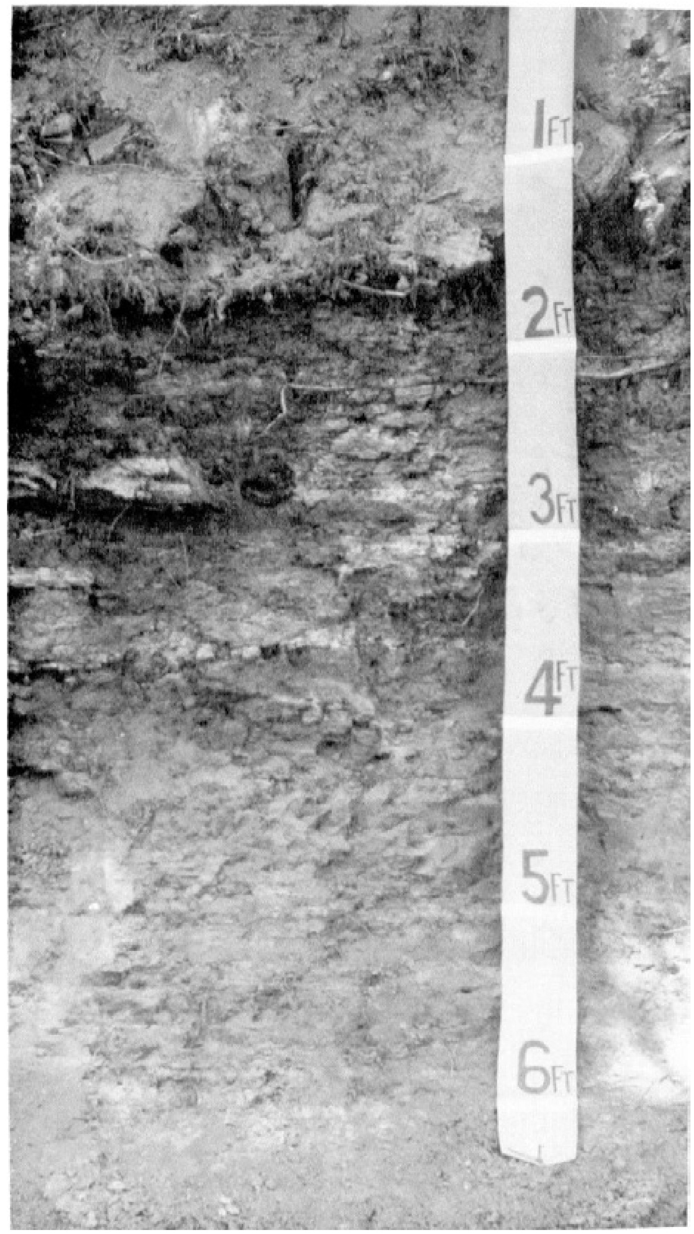


Figure 24.—Cuthbert fine sandy loam, 8 to 25 percent slopes, has strata of sandstone and shale below a depth of 32 inches.

The Bt horizon is red or yellowish red with few or common yellowish brown mottles. Texture is clay in the upper part of the horizon and clay, sandy clay, or sandy clay loam in the lower part. In most pedons, grayish shale fragments are in the lower part of this horizon. Reaction is very strongly acid or strongly acid.

The B/C horizon is stratified in shades of red, brown, or yellow. Texture is clay loam, sandy clay loam, or clay. The degree of weathering is variable; some pedons have shale, sandstone, or ironstone. Reaction is extremely acid or very strongly acid. Some pedons do not have a B/C horizon.

The C horizon is stratified sandstone, shale, sandy loam, sandy clay loam, or ironstone. Reaction is extremely acid to strongly acid.

Darco Series

The Darco series consists of deep, well drained soils on uplands. These soils are moderately permeable. They formed in acidic, sandy and loamy sediments. Slopes range from 2 to 5 percent. The soils of the Darco series are loamy, siliceous, thermic Grossarenic Paleudults.

Typical pedon of Darco loamy fine sand, 2 to 5 percent slopes; from Interstate Highway 30 in Mt. Vernon, 8.7 miles south on Farm Road 115, 1 mile south and west on Farm Road 3357, 100 feet south, in woods.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) loamy fine sand; weak fine granular structure; loose; common fine and medium roots; slightly acid; clear wavy boundary.

E1—7 to 32 inches; light yellowish brown (10YR 6/4) loamy fine sand; weak fine granular structure; loose; common medium and fine roots; few yellowish brown (10YR 5/4) lamellae; slightly acid; gradual wavy boundary.

E2—32 to 58 inches; pale brown (10YR 6/3) loamy fine sand; fine distinct common yellowish brown (10YR 5/4) mottles; weak fine granular structure; loose; common medium and fine roots; slightly acid; gradual wavy boundary.

Bt1—58 to 74 inches; yellowish red (5YR 5/8) sandy clay loam; many coarse distinct red (2.5YR 4/6) mottles; weak fine subangular blocky structure; slightly hard, friable; common fine roots; continuous clay bridging on peds; few thin streaks of light gray (10YR 7/2) clean sand and silt; few clay films; very strongly acid; gradual wavy boundary.

Bt2—74 to 80 inches; yellowish red (5YR 5/8) sandy clay loam; common coarse distinct red (2.5YR 4/6) mottles; weak fine subangular blocky structure; hard, friable; few fine roots; continuous clay bridging on peds; few thin streaks of light gray (10YR 7/2) clean sand and silt; few clay films; very strongly acid.

The solum is more than 80 inches thick. At a depth of 72 inches, the base saturation ranges from 15 to 35 percent.

The A horizon is very dark grayish brown or dark brown. Reaction ranges from strongly acid to slightly acid.

The E horizon is light yellowish brown, yellowish brown, or pale brown loamy fine sand. Reaction ranges from strongly acid to slightly acid. Combined thickness of the A and E horizons is 40 to 72 inches.

The Bt horizon is red, yellowish red, or strong brown. Texture is fine sandy loam, loam, or sandy clay loam. The average clay content of the control section is 15 to 35 percent. Reaction ranges from extremely acid to slightly acid.

Derly Series

The Derly series consists of deep, poorly drained soils on terraces that are 10 to 100 feet above present streams. These soils are very slowly permeable. They formed in clayey sediment. Slopes are 0 to 1 percent. The soils of the Derly series are fine, montmorillonitic, thermic Typic Glossaqualfs.

Typical pedon of Derly silt loam, in an area of Derly-Raino complex, 0 to 1 percent slopes; from Talco, 8.5 miles west on Farm Road 71, 3.8 miles south on Texas Highway 37, 50 feet east on Lake Chapel Church County Road, 100 feet north of road, in woods.

A—0 to 7 inches; brown (10YR 5/3) silt loam; many medium distinct dark yellowish brown (10YR 4/6) mottles, few fine distinct yellowish brown (10YR 5/6) mottles, and few fine faint light brownish gray mottles; weak fine subangular blocky structure; slightly hard, friable; common fine roots; strongly acid; gradual wavy boundary.

E—7 to 14 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct yellowish brown (10YR 5/6) mottles and few fine distinct dark yellowish brown (10YR 4/6) mottles; weak fine subangular blocky structure; slightly hard, friable; few fine roots; strongly acid; gradual wavy boundary.

Btg/E1—14 to 26 inches; light brownish gray (10YR 6/2) silty clay loam (Btg); common medium distinct yellowish brown (10YR 5/6) mottles and few fine distinct brown mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; 30 percent, by volume, tongues of light gray (10YR 7/2) silt and clean sand (E); very hard, firm; very strongly acid; gradual wavy boundary.

Btg/E2—26 to 37 inches; grayish brown (10YR 5/2) clay; few fine distinct light yellowish brown (10YR 6/4) mottles and few fine faint brownish yellow mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, very firm; few small slickensides; 15 percent, by volume, tongues of light gray (10YR 7/2) clean sand and silt (E); few patchy clay films on faces of peds; very strongly acid; gradual wavy boundary.

Btg/E3—37 to 49 inches; grayish brown (10YR 5/2) clay; common fine faint brownish yellow mottles and few fine distinct dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, very firm; few small slickensides; 10 percent, by volume, tongues of light gray (10YR 7/2) clean sand and silt; few white crystals; strongly acid; gradual wavy boundary.

Btg1—49 to 66 inches; grayish brown (2.5Y 5/2) clay; many fine faint brownish yellow mottles and few fine distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; very hard, very firm; few clay films on faces of peds; few small slickensides; few white crystals; slightly acid; gradual wavy boundary.

Btg2—66 to 80 inches; light brownish gray (2.5Y 6/2) clay; many fine distinct strong brown (7.5YR 5/6) mottles, few fine prominent yellowish red (5YR 4/6) mottles, and few fine distinct olive yellow (2.5Y 6/6) mottles; moderate fine subangular blocky structure; very hard, very firm; common clay films on faces of peds; few white crystals; neutral.

The solum is more than 80 inches thick. Depth to a layer that has 5 percent tongues is less than 20 inches. The average clay content of the control section ranges from 35 to 50 percent.

The A horizon is brown, dark brown, or dark grayish brown. It is mottled in shades of brown and gray. Reaction is strongly acid or medium acid. The A horizon is 3 to 7 inches thick.

The E horizon is grayish brown or light brownish gray. It has yellowish brown, strong brown, and dark yellowish brown mottles. Reaction is very strongly acid to medium acid. The E horizon is 4 to 8 inches thick.

The Btg/E horizon is grayish brown or light brownish gray with mottles in shades of gray, yellow, and brown. Tongues and interfingering of E material make up 10 to 30 percent of this horizon. In some pedons, this horizon has pressure faces or small slickensides. Texture is clay loam, silty clay loam, or clay. Reaction is very strongly acid or strongly acid.

The Btg horizon is dark grayish brown, grayish brown, or light brownish gray with yellowish brown, brownish yellow, or strong brown mottles. In some pedons, this horizon has streaks of light gray clean sand or silt. Slickensides or pressure faces are few or common. Texture is clay or silty clay. Reaction ranges from medium acid to neutral.

Duffern Series

The Duffern series consists of deep, excessively drained soils on uplands. These soils are rapidly permeable. They formed in sandy sediment. Slopes range from 2 to 15 percent. The soils of the Duffern series are thermic, coated Typic Quartzipsamments.

Typical pedon of Duffern fine sand, 2 to 5 percent slopes; from Pittsburg, 2.2 miles southwest on Farm Road 556, 4.6 miles west on Farm Road 1519, 0.5 mile south on Ferndale Lake Road, 200 feet west of road, in woods.

Ap—0 to 8 inches; dark brown (10YR 4/3) fine sand; weak fine granular structure; loose; common medium and fine roots; medium acid; clear smooth boundary.

E1—8 to 26 inches; yellowish brown (10YR 5/4) fine sand; single grained; loose; few medium and fine roots; slightly acid; gradual wavy boundary.

E2—26 to 46 inches; light yellowish brown (10YR 6/4) fine sand; single grained; loose; few fine roots; uncoated sand grains; slightly acid; gradual wavy boundary.

Bw1—46 to 63 inches; brownish yellow (10YR 6/6) fine sand; single grained; loose; few yellowish brown (10YR 5/6) sandy loam lamellae about 0.5 inch thick and 2 to 5 inches apart; few streaks of uncoated sand; slightly acid; gradual wavy boundary.

Bw2—63 to 79 inches; brownish yellow (10YR 6/6) fine sand; single grained; loose; few yellowish brown (10YR 5/6) sandy loam lamellae about 0.5 inch thick and 2 to 5 inches apart; few streaks of uncoated sand; slightly acid; gradual wavy boundary.

E/B—79 to 95 inches; light gray (10YR 7/2) fine sand; single grained; loose; common yellowish red (5YR 5/6) sandy loam lamellae about 0.75 inch thick and 2 to 3 inches apart; sand grains coated and bridged in lamellae; slightly acid.

The solum is more than 80 inches thick. Depth to lamellae ranges from 40 to 70 inches. Reaction is medium acid or slightly acid throughout.

The A horizon is dark yellowish brown, yellowish brown, or brown. It is 4 to 12 inches thick.

The E horizon is yellowish brown, pale brown, light yellowish brown, light gray, or very pale brown sand or fine sand.

The Bw horizon is strong brown, yellowish brown, or brownish yellow sand or fine sand. It has lamellae of yellowish red, strong brown, or yellowish brown loamy fine sand or sandy loam. Streaks and pockets of light gray uncoated sand are in some pedons.

The E/B horizon is similar in color to the E or Bw horizon. Texture is sand or fine sand and has reddish or brownish lamellae of loamy fine sand or sandy loam. Some pedons do not have an E/B horizon.

Ellis Series

The Ellis series consists of deep, well drained soils on uplands. These soils are very slowly permeable. They formed in alkaline, shaly clay. Slopes range from 5 to 12 percent. The soils of the Ellis series are fine, montmorillonitic, thermic Vertic Ustochrepts.

Typical pedon of Ellis clay, 5 to 12 percent slopes, severely eroded; from Mt. Vernon, 10.7 miles north on Texas Highway 37, 4.2 miles east on Farm Road 71, 0.8 mile north of road, on pipeline right-of-way.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) clay; moderate fine subangular blocky structure; very hard, very firm; many fine roots; slightly acid; gradual smooth boundary.

Bw1—3 to 15 inches; dark grayish brown (2.5Y 4/2) clay; moderate fine subangular blocky structure; extremely hard, very firm; few fine roots; slightly acid; gradual smooth boundary.

Bw2—15 to 32 inches; olive (5Y 4/3) clay; few fine faint light yellowish brown and olive mottles; moderate medium blocky structure parting to moderate fine subangular blocky; extremely hard, very firm; few fine roots; few pressure faces; neutral; gradual smooth boundary.

BC—32 to 38 inches; olive (5Y 5/3) clay; few medium distinct yellowish brown (10YR 5/8) mottles; moderate fine blocky and platy structure; extremely hard, very firm; few fine roots; few fine concretions and soft masses of calcium carbonate; common medium shale fragments; moderately alkaline; gradual smooth boundary.

C—38 to 70 inches; olive (5Y 5/3) shaly clay; common fine faint light olive brown mottles; moderate medium platy structure; extremely hard, very firm; few fine roots; few fine concretions and soft masses of calcium carbonate; moderately alkaline.

The solum is 20 to 40 inches thick. Texture is clay throughout. The clay content ranges from 40 to 60 percent.

The A horizon is very dark grayish brown, dark grayish brown, olive brown, dark brown, or brown. Reaction is slightly acid or neutral. The A horizon is 2 to 6 inches thick.

The Bw horizon is dark grayish brown, grayish brown, brown, olive brown, and olive. It has mottles in these colors and in strong brown, yellowish brown, and light yellowish brown. Reaction is slightly acid to moderately alkaline. Calcium carbonate concretions are in some pedons.

The BC horizon is grayish brown, light olive brown, light brownish gray, olive, or yellowish brown; or it is mottled in shades of brown, gray, and olive. Texture is clay or shaly clay. Reaction is neutral to moderately alkaline. Concretions and soft masses of calcium carbonate are in most pedons.

The C horizon is stratified shale and clay or shaly clay that is gray to olive. Mottles are in shades of yellow, gray, or brown. Reaction is neutral to moderately alkaline. Concretions and soft masses of calcium carbonate make up to 3 percent of this horizon.

Elrose Series

The Elrose series consists of deep, well drained soils on uplands. These soils are moderately permeable. They formed in loamy glauconitic marine sediment. Slopes range from 3 to 8 percent. The soils of the Elrose series are fine-loamy, siliceous, thermic Typic Paleudalfs.

Typical pedon of Elrose gravelly fine sandy loam, 3 to 8 percent slopes; from U.S. Highway 259 in Lone Star, 2.3 miles southeast on Farm Road 729 to transmission line right-of-way, 200 feet northwest on right-of-way, 20 feet north, in woods.

Ap—0 to 7 inches; reddish brown (5YR 4/4) gravelly fine sandy loam; weak fine granular structure; loose, friable; many coarse to fine roots; 17 percent, by volume, ironstone pebbles; slightly acid; gradual wavy boundary.

Bt1—7 to 22 inches; red (2.5YR 4/6) sandy clay loam; moderate fine subangular blocky structure; slightly hard, firm; many coarse to fine roots; 4 percent, by volume, ironstone pebbles; very strongly acid; gradual wavy boundary.

Bt2—22 to 34 inches; dark red (2.5YR 3/6) sandy clay loam; common fine distinct strong brown mottles; weak fine subangular blocky structure; slightly hard, friable; common medium and fine roots; patchy clay films; very strongly acid; gradual wavy boundary.

Bt3—34 to 51 inches; dark red (2.5YR 3/6) sandy clay loam; common medium and fine strong brown (7.5YR 5/6) glauconite remnants; weak fine subangular blocky structure; slightly hard, friable; few fine roots; patchy clay films; few pinkish gray (7.5YR 6/2) shale fragments in lower part; very strongly acid; gradual wavy boundary.

Bt4—51 to 71 inches; red (2.5YR 4/6) sandy clay loam; common medium strong brown (7.5YR 5/6) glauconite remnants; few fine prominent light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; hard, firm; few fine roots; few patchy clay films; few pinkish gray (7.5YR 6/2) shale fragments; few thin ironstone layers; very strongly acid; gradual wavy boundary.

BC—71 to 82 inches; red (2.5YR 5/8) fine sandy loam; many medium brownish yellow (10YR 6/8) glauconite remnants; common fine light brownish gray (10YR 6/2) shale fragments; weak fine subangular blocky structure; hard, friable; few ironstone fragments; very strongly acid.

The solum is 60 to more than 80 inches thick. Ironstone pebbles range from 15 to 25 percent, by volume, in the surface layer of most pedons. The base saturation at a depth of 50 inches below the top of the Bt horizon ranges from 35 to 50 percent. The clay content ranges from 25 to 35 percent in the control section.

The A horizon is dark reddish brown, reddish brown, or yellowish red. Reaction ranges from strongly acid to slightly acid. The A horizon is 4 to 12 inches thick.

The Bt horizon is dark red or red clay loam or sandy clay loam. Fragments of weathered glauconite less than 1 inch across range from 0 to 10 percent, by volume. Reaction ranges from very strongly acid to medium acid.

The BC horizon is dark red or red. Texture is sandy clay loam or fine sandy loam. Fragments of weathered glauconite less than 1 inch across range up to 20 percent, by volume. Reaction ranges from very strongly acid to medium acid.

The C horizon is unconsolidated glauconite and sandstone in shades of red or brown. Ironstone fragments up to 3 inches across range from none to 20 percent, by volume. Reaction ranges from very strongly acid to slightly acid. Some pedons do not have a C horizon.

Estes Series

The Estes series consists of deep, somewhat poorly drained soils on flood plains. These soils are very slowly permeable. They formed in acidic, clayey and loamy alluvial sediments. Slopes are 0 to 1 percent. The soils of the Estes series are fine, montmorillonitic, acid, thermic Aeric Haplaquepts.

Typical pedon of Estes clay loam, frequently flooded; from Texas Highway 49 in Mt. Pleasant, 4.7 miles south on U.S. Highway 271, 200 feet east of highway, on flood plain of Big Cypress Creek.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) clay loam; few fine distinct dark yellowish brown (10YR 4/6) mottles; weak fine subangular blocky structure; slightly hard, firm; many fine roots; medium acid; gradual wavy boundary.

Bg1—8 to 19 inches; grayish brown (10YR 5/2) clay; many medium distinct dark brown (10YR 4/3) mottles and few fine faint gray mottles; weak fine subangular blocky structure; hard, very firm; many fine and medium roots; many black specks; very strongly acid; gradual wavy boundary.

Bg2—19 to 49 inches; grayish brown (10YR 5/2) clay; few medium distinct yellowish brown (10YR 5/6) mottles and few fine distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; very hard, very firm; few fine roots; few black specks; about 2 percent white crystals in some root channels; extremely acid; gradual wavy boundary.

Bg3—49 to 63 inches; grayish brown (10YR 5/2) clay; common medium distinct yellowish brown (10YR 5/6) mottles and few fine distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; very hard, very firm; few fine roots; few isolated pressure faces; about 3 percent white crystals; very strongly acid; gradual wavy boundary.

BCg—63 to 80 inches; light brownish gray (10YR 6/2) clay loam; common coarse distinct yellowish brown (10YR 5/6) mottles and common medium faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; very hard, very firm; few black specks; about 5 percent white crystals; very strongly acid.

The solum is more than 80 inches thick. The clay content of the control section ranges from 35 to 53 percent.

The A horizon is very dark grayish brown, dark grayish brown, grayish brown, dark brown, brown, or dark yellowish brown. It has few to many mottles in shades of gray and brown. Reaction is very strongly acid to medium acid. The A horizon is 3 to 9 inches thick.

The upper part of the Bg horizon is grayish brown or dark grayish brown. The lower part is grayish brown, light brownish gray, or dark grayish brown. Mottles in shades of gray and brown are throughout the Bg horizon. Texture is clay loam, silty clay loam, silty clay, or clay. Reaction of the Bg horizon ranges from extremely acid to strongly acid. In some pedons, pressure faces or small slickensides are in the lower part of the horizon. Concretions of black or brown and crystals of white salts range from few to common in some pedons.

The BCg horizon is light brownish gray, gray, or light gray. It has few to many mottles in shades of brown, yellow, and red. Texture is clay loam or silty clay loam. Reaction is very strongly acid or strongly acid.

Freestone Series

The Freestone series consists of deep, moderately well drained soils on uplands. These soils are slowly permeable. They formed in loamy and clayey sediments. Slopes range from 1 to 3 percent. The soils of the Freestone series are fine-loamy, siliceous, thermic Glossaquic Paleudalfs.

Typical pedon of Freestone fine sandy loam, 1 to 3 percent slopes; from U.S. Highway 271 bypass in northwest Mt. Pleasant, 1.2 miles northwest on Old Paris Road, 200 feet south of road, in pasture.

Ap—0 to 5 inches; dark brown (10YR 3/3) fine sandy loam; weak fine subangular blocky structure; loose, friable; many fine and common medium roots; medium acid; clear wavy boundary.

E—5 to 11 inches; yellowish brown (10YR 5/4) loam; weak fine and medium subangular blocky structure;

loose, friable; common fine roots; slightly acid; clear wavy boundary.

Bt—11 to 19 inches; yellowish brown (10YR 5/6) loam; few fine prominent yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; slightly hard, friable; common fine roots; many fine pores; thin patchy clay films on surfaces of peds; few fine black concretions; slightly acid; gradual wavy boundary.

Bt/E1—19 to 27 inches; yellowish brown (10YR 5/6) clay loam; common fine prominent dark red (2.5YR 3/6) mottles and few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; slightly hard, friable; few fine roots; many fine pores; thin patchy clay films on surfaces of peds; 5 to 8 percent, by volume, streaks of light brownish gray (10YR 6/2) uncoated sand on surfaces of peds and in root channels; medium acid; gradual wavy boundary.

Bt/E2—27 to 39 inches; mottled grayish brown (10YR 5/2), red (2.5YR 4/8), and yellowish brown (10YR 5/6) clay; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm; few fine roots; few intersecting slickensides; 5 to 8 percent, by volume, streaks of light brownish gray (10YR 6/2) clean sand; very strongly acid; gradual wavy boundary.

2Bt1—39 to 50 inches; mottled red (2.5YR 4/8) and light brownish gray (10YR 6/2) clay; weak medium prismatic structure parting to moderate medium subangular blocky; extremely hard, very firm; few fine roots; few patchy clay films on surfaces of peds; few streaks of clean sand on surfaces of some prisms; very strongly acid; gradual wavy boundary.

2Bt2—50 to 63 inches; light brownish gray (10YR 6/2) clay; common fine prominent red (2.5YR 4/8) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; extremely hard, very firm; few fine roots; few patchy clay films on surfaces of peds; very strongly acid; gradual wavy boundary.

2BC—63 to 73 inches; light brownish gray (10YR 6/2) clay; common medium prominent yellowish red (5YR 5/8) mottles and common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium platy structure; extremely hard, very firm; few fine roots; thick clay films on surfaces of peds; many fine mica flakes; few barite crystals between major bedding planes; very strongly acid; gradual wavy boundary.

2C—73 to 85 inches; stratified light brownish gray (10YR 6/2) shale and yellowish brown (10YR 5/6) sandy clay loam; common medium distinct strong brown (7.5YR 5/6) mottles in shale; weak fine and coarse platy structure; very hard, firm; very strongly acid.

The solum is 60 to more than 80 inches thick. Base saturation ranges from 37 to 72 percent at a depth of 50 inches below the top of the Bt horizon. Mottles that have chroma of 2 or less are within a depth of 18 to 30 inches of the soil surface. The clay content of the control section ranges from 20 to 35 percent.

The A horizon is dark brown, dark grayish brown, dark yellowish brown, or brown. Reaction is strongly acid to slightly acid. The A horizon is 3 to 8 inches thick.

The E horizon is brown, yellowish brown, light yellowish brown, or pale brown. Texture is fine sandy loam or loam. Reaction is strongly acid to slightly acid. The E horizon is 4 to 12 inches thick.

The Bt horizon is yellowish brown, brownish yellow, or strong brown. It has none to few mottles in shades of red and gray. Texture is sandy clay loam or loam. Streaks and pockets of clean sand and silt range from 0 to less than 5 percent, by volume. Reaction ranges from very strongly acid to slightly acid. The Bt horizon is 6 to 18 inches thick.

The Bt/E horizon is mottled in shades of red, gray, and brown. Some pedons have matrix and mottles in shades of these colors. Streaks and pockets of clean sand and silt range from 5 to 15 percent, by volume. Texture is loam, sandy clay loam, clay loam, or clay. Reaction ranges from very strongly acid to medium acid.

The 2Bt1 and 2Bt2 horizons are in shades of gray or brown with mottles in shades of red, or the matrix is mottled with these colors. Streaks and pockets of clean sand and silt range from none to less than 5 percent. Texture is clay or clay loam. The clay content typically is more than 35 percent. Reaction ranges from very strongly acid to slightly acid.

The 2BC and 2C horizons are in shades of gray, or they are stratified and mottled in shades of gray, brown, yellow, or red. Texture is shaly, clayey, or loamy material, and some pedons are interbedded. Reaction ranges from very strongly acid to neutral.

Gladewater Series

The Gladewater series consists of deep, poorly drained soils on flood plains. These soils are very slowly permeable. They formed in clayey alluvial sediment. Slopes are 0 to 1 percent. The soils of the Gladewater series are fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts.

Typical pedon of Gladewater clay, frequently flooded; from Mt. Vernon, 10.7 miles north on Texas Highway 37, 4.6 miles east on Farm Road 71, 0.7 mile north on private road to gate, 50 feet west of gate, on flood plain of Sulphur River.

A—0 to 6 inches; very dark grayish brown (2.5Y 3/2) clay; moderate medium and fine blocky structure; very hard, very firm; many fine and medium roots; neutral; clear smooth boundary.

Bg1—6 to 21 inches; grayish brown (2.5Y 5/2) clay; few fine faint light olive brown and light brownish gray mottles; moderate medium and fine blocky structure; very hard, very firm; few fine roots; few black concretions; neutral; gradual wavy boundary.

Bg2—21 to 35 inches; dark grayish brown (10YR 4/2) clay; common medium distinct strong brown (7.5YR 5/6) mottles and few fine faint light olive brown mottles; moderate medium blocky structure; very hard, very firm; few fine roots and thin lenses of silt; few black concretions; few pressure faces and small slickensides; slightly acid; gradual wavy boundary.

Bg3—35 to 49 inches; dark grayish brown (10YR 4/2) clay; common fine faint brown mottles and few fine faint strong brown mottles; moderate medium blocky structure; extremely hard, very firm; few black concretions; few small slickensides; medium acid; gradual wavy boundary.

Cg—49 to 63 inches; grayish brown (2.5Y 5/2) clay; common fine distinct light olive brown (2.5Y 5/6) mottles; massive; extremely hard, very firm; few black concretions; few white powdery masses; neutral.

The solum is 35 to 50 inches thick. The clay content of the 10- to 40-inch control section ranges from 40 to 60 percent. If the soil is dry, cracks 0.5 inch to 2 inches wide extend from the surface to a depth of more than 20 inches. COLE ranges from 0.09 to 0.13.

The A horizon is very dark gray, very dark grayish brown, dark gray, or dark brown. Reaction ranges from medium acid to neutral. The A horizon is 4 to 9 inches thick.

The Bg horizon is dark gray, dark grayish brown, gray, grayish brown, or light gray. Mottles of strong brown, brown, yellowish brown and light olive brown range from few to many. Texture is clay or silty clay. Reaction ranges from very strongly acid to neutral, but it is strongly acid to slightly acid in some subhorizons above a depth of 40 inches.

The Cg horizon is grayish brown, dark grayish brown, or gray. In some pedons, this horizon has mottles in shades of brown. Texture is clay or silty clay, or it is strata of these materials and clay loam and silty clay loam. Reaction ranges from strongly acid to mildly alkaline.

Grayrock Series

The Grayrock series consists of deep, well drained soils on uplands. These soils are slowly permeable. They are forming in alkaline lignite mine spoil material. Slopes range from 2 to 12 percent. The soils of the Grayrock series are fine-silty, mixed, nonacid, thermic Typic Udorthents.

Typical pedon of Grayrock silty clay loam, 2 to 5 percent slopes; from Interstate Highway 30 overpass in Mt. Pleasant, about 7 miles west on Farm Road 1734 to entrance of TUGCO general plant, about 0.7 mile southwest on a haul road, 100 feet southeast, 36 feet northeast of tree test plot.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine granular and very fine subangular blocky structure; hard, very friable; few medium and common fine and very fine roots; about 2 percent, by volume, lignite and shale fragments 0.25 to 0.5 inch in diameter; few mica flakes; neutral; clear wavy boundary.

C1—7 to 28 inches; dark grayish brown (10YR 4/2) silty clay loam, grayish brown (10YR 5/2) dry; massive; hard, friable; few medium and many fine roots; about 6 percent, by volume, lignite fragments and 12 percent shale fragments, 0.5 inch to 6 inches across; less than 1 percent, by volume, reddish clayey spots; neutral; clear wavy boundary.

C2—28 to 37 inches; olive brown (2.5Y 4/4) silty clay loam; massive; hard, friable; few medium and many fine roots; about 25 percent, by volume, lignite fragments and less than 2 percent, by volume, shale fragments 0.5 inch to 10 inches across; few mica flakes; medium acid; clear wavy boundary.

C3—37 to 80 inches; olive gray (5Y 4/2) silty clay loam; massive; hard, friable; few medium and many fine roots; about 12 percent, by volume, lignite fragments and 4 percent, by volume, shale fragments 0.5 inch to 10 inches across; few mica flakes; mildly alkaline.

The soil material is more than 80 inches thick. Mining operations have mixed the spoil material from a depth of 30 to about 150 feet. Ironstone and sandstone fragments up to 15 inches across range from 0 to 3 percent, by volume. Lignite fragments commonly less than 3 inches across and shale fragments up to 15 inches across make up 2 to 25 percent, by volume. Most fragments break down when rubbed while wet, and they slake in water. The clay content of the control section ranges from 20 to 35 percent. Reaction ranges from medium acid to mildly alkaline, but is commonly neutral.

The A horizon is dark grayish brown, grayish brown, brown, or dark yellowish brown. A few splotches in shades of red and brown are in some pedons. The A horizon is 4 to 10 inches thick.

The C horizon is very dark gray, dark gray, dark grayish brown, grayish brown, brown, olive brown, or olive gray. Splotches in shades of brown, gray, red, and yellow range from none to common. Texture is silty clay loam, clay loam, or loam.

Hopco Series

The Hopco series consists of deep, somewhat poorly drained soils on flood plains. These soils are moderately slowly permeable. They formed in recent loamy alluvium.

Slopes are 0 to 1 percent. The soils of the Hopco series are fine-silty, mixed, thermic Cumulic Haplaquolls.

Typical pedon of Hopco silty clay loam, occasionally flooded; from Mt. Vernon, 4.1 miles north on Texas Highway 37, 1.3 miles east-northeast on county road, 0.3 mile north on ranch road to cropland, on flood plain.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; few fine distinct dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky structure; hard, friable; many fine roots; neutral; gradual wavy boundary.

A1—10 to 29 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; common medium distinct dark yellowish brown (10YR 3/6) mottles and few fine faint dark grayish brown mottles; moderate medium subangular blocky structure; hard, firm; common fine roots; neutral; gradual wavy boundary.

A2—29 to 51 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; common coarse distinct dark yellowish brown (10YR 3/4) mottles and few medium faint dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; hard, firm; common fine roots; neutral; gradual irregular boundary.

Bw—51 to 80 inches; olive brown (2.5Y 4/4) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles, common medium distinct grayish brown (10YR 5/2) mottles, and few medium distinct dark yellowish brown (10YR 3/4) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; few black concretions; neutral.

The solum is more than 80 inches thick. The control section has clay content of 27 to 42 percent and has less than 15 percent fine sand or coarser. Reaction is neutral to moderately alkaline throughout.

The A horizon is very dark grayish brown or very dark gray. In some pedons, mottles of brown, dark grayish brown, or very dark gray range from none to common in the lower part of this horizon.

The Bw horizon is dark grayish brown, olive brown, or light olive brown. Mottles of these colors and yellowish brown, dark yellowish brown, grayish brown, or dark grayish brown are few or common. Texture is clay loam, silty clay loam, or clay. A few concretions of calcium carbonate are in some pedons.

The Hopco soils in this survey area are taxadjuncts to the Hopco series because they are more clayey in the control section than is typical for the Hopco series. Use, behavior, and management, however, are similar to those of the Hopco series.

Iuka Series

The Iuka series consists of deep, moderately well drained soils on flood plains. These soils are moderately permeable. They formed in stratified loamy and sandy alluvial sediments. Slopes are 0 to 1 percent. The soils of the Iuka series are coarse-loamy, siliceous, acid thermic Aquic Udifluvents.

Typical pedon of Iuka fine sandy loam, frequently flooded; from Pittsburg, 7.1 miles southwest on Farm Road 556 to junction with Farm Road 2454, 0.7 mile southwest on Farm Road 556 to county road, 0.9 mile north on county road to gate on west side, 500 feet west, in pasture.

A1—0 to 5 inches; dark brown (10YR 4/3) fine sandy loam; weak fine granular structure; slightly hard, friable; slightly acid; gradual wavy boundary.

A2—5 to 12 inches; brown (10YR 5/3) fine sandy loam; common coarse distinct strong brown (7.5YR 4/6) mottles; weak medium granular structure; slightly hard, friable; strongly acid; clear smooth boundary.

C1—12 to 20 inches; yellowish brown (10YR 5/4) fine sandy loam; common medium distinct strong brown (7.5YR 4/6) mottles and few fine distinct light brownish gray (10YR 6/2) mottles; very weak fine subangular blocky structure; slightly hard, friable; 1 to 2 percent, by volume, iron manganese concretions; thin lenses of light brownish gray (10YR 6/2) loamy fine sand; strongly acid; gradual wavy boundary.

C2—20 to 31 inches; yellowish brown (10YR 5/8) fine sandy loam; many fine distinct strong brown (7.5YR 5/8) mottles and common medium distinct light brownish gray (10YR 6/2) mottles; massive; slightly hard, friable; 2 to 3 percent, by volume, iron manganese concretions; thin lenses of light brownish gray (10YR 6/2) loamy fine sand, 5 to 10 mm thick; very strongly acid; gradual wavy boundary.

C3—31 to 42 inches; yellowish brown (10YR 5/6) fine sandy loam; many medium distinct strong brown (7.5YR 5/8) mottles and common medium distinct light brownish gray (10YR 6/2) mottles; massive; slightly hard, friable; 3 percent, by volume, iron manganese concretions; thin lenses of light brownish gray (10YR 6/2) loamy fine sand, 10 to 15 mm thick; very strongly acid; gradual wavy boundary.

C4—42 to 61 inches; stratified brownish yellow (10YR 6/6), light gray (10YR 7/2), and strong brown (7.5YR 4/6) fine sandy loam; massive; slightly hard, friable; 4 percent, by volume, iron manganese concretions; stratified layer of light gray (10YR 7/2) sand, 20 to 30 mm thick; strongly acid; gradual wavy boundary.

Cg—61 to 73 inches; stratified light brownish gray (10YR 6/2) and strong brown (7.5YR 4/6) fine sandy loam; few medium distinct brownish yellow (10YR 6/6) mottles; massive; slightly hard, friable; 5 percent, by volume, iron manganese concretions; stratified with lenses of light gray (10YR 7/2) sand; few fine bodies of loamy material; very strongly acid.

The clay content between 10 and 40 inches averages 10 to 18 percent. Reaction is very strongly acid or strongly acid except where lime has been added.

The A horizon is dark grayish brown, dark brown, brown, or dark yellowish brown. In some pedons, this horizon has mottles in shades of brown or gray and has thin bedding planes of coarser textures. The A horizon is 5 to 15 inches thick.

The C horizon is brown, strong brown, yellowish brown, or pale brown; or it is mottled in shades of gray, brown, and red. In most pedons, this horizon is mottled with chroma of 2 or less within the upper 20 inches. Mottles in shades of gray, brown, or red range from few to common. Texture is basically fine sandy loam that has strata of loam, sandy clay loam, and loamy fine sand.

The Cg horizon is similar in texture and reaction to the C horizon, but is dominated by grayish colors. Some pedons do not have a Cg horizon.

Buried horizons occur in some pedons below a depth of 20 inches. Thin gravelly or sandy strata are in some pedons below a depth of 40 inches.

Kaufman Series

The Kaufman series consists of deep, somewhat poorly drained soils on flood plains. These soils are very slowly permeable. They formed in alkaline, clayey alluvium. Slopes are 0 to 1 percent. The soils of the Kaufman series are very-fine, montmorillonitic, thermic Typic Pelluderts.

Typical pedon of Kaufman clay, frequently flooded; from Mt. Pleasant, 17 miles east on Interstate Highway 30, 0.5 mile north on U.S. Highway 259, 650 feet west to highline, on flood plain of Sulphur River.

A1—0 to 6 inches; black (10YR 2/1) clay; moderate fine and medium subangular blocky structure; extremely hard, very firm; many fine roots; mildly alkaline; gradual smooth boundary.

A2—6 to 12 inches; black (10YR 2/1) clay; moderate coarse subangular blocky structure parting to weak medium subangular blocky; extremely hard, very firm; many fine roots; few very fine pores; mildly alkaline; gradual smooth boundary.

Bg1—12 to 34 inches; very dark gray (10YR 3/1) clay; few fine faint dark brown mottles; strong coarse blocky structure parting to weak fine blocky; common fine roots; few slickensides up to 14 inches across; few fine pores; mildly alkaline; gradual wavy boundary.

Bg2—34 to 48 inches; very dark gray (10YR 3/1) clay; few fine faint dark brown mottles; strong coarse blocky structure parting to weak fine blocky; extremely hard, very firm; common fine roots; common slickensides 18 to 26 inches across; few fine pores; slightly acid; gradual wavy boundary.

Bg3—48 to 72 inches; very dark gray (10YR 3/1) clay; few fine faint dark brown mottles; moderate coarse blocky structure parting to weak medium blocky; extremely hard, very firm; few fine roots; many slickensides 14 to 18 inches across; few fine pores; neutral.

The solum is 60 to more than 80 inches thick. Texture is clay throughout, and the content of clay in the control section ranges from 60 to more than 80 percent. Slickensides form during the wetting and drying cycle and occur below a depth of 12 inches (fig. 25). Cracks 0.5 inch to 2.5 inches wide extend from the surface to a depth of more than 30 inches during dry periods. Reaction is slightly acid to moderately alkaline throughout. Some pedons are calcareous below a depth of 30 inches.

The A horizon is black or very dark gray. In some pedons, the lower part of this horizon has mottles in shades of brown or yellow.

The Bg horizon is very dark gray or dark gray. Mottles in shades of brown, yellow, or olive range from none to common.

Kirvin Series

The Kirvin series consists of deep, well drained soils on uplands. These soils are moderately slowly permeable. They formed in acidic, stratified shale and loamy sediment. Slope ranges from 2 to 8 percent. The soils of the Kirvin series are clayey, mixed, thermic Typic Hapludults.

Typical pedon of Kirvin very fine sandy loam, 3 to 8 percent slopes; 7.5 miles southwest of Pittsburg on Farm Road 556 to Matinburg Church, 0.5 mile north on county road to gate, 50 feet west, in pasture.

A—0 to 5 inches; dark brown (10YR 4/3) very fine sandy loam; moderate fine granular structure; slightly hard, very friable; common fine roots; few ironstone pebbles; neutral; gradual smooth boundary.

E—5 to 14 inches; brown (7.5YR 5/4) very fine sandy loam; moderate fine subangular blocky structure; slightly hard, friable; few fine roots; few ironstone pebbles; neutral; gradual smooth boundary.

Bt1—14 to 27 inches; red (2.5YR 4/6) clay; few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; very hard, firm; common clay films; very strongly acid; gradual smooth boundary.

Bt2—27 to 34 inches; red (2.5YR 4/6) clay; few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; very hard, firm; few light brownish gray (10YR 6/2) shale fragments;

Figure 25.—Polished shiny surfaces called slickensides are common in soils that have high shrink-swell potential. Slickensides are formed as masses of expanding soil slide past one another. The soil is Kaufman clay, frequently flooded.

common clay films; very strongly acid; gradual smooth boundary.

BC—34 to 42 inches; mottled red (2.5YR 4/6) and reddish yellow (7.5YR 6/8) clay, and light brownish gray (10YR 6/2) shale fragments; moderate fine subangular blocky and weak fine platy structure; hard, firm; patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

C1—42 to 54 inches; stratified light gray (10YR 7/2) shale, light brown (7.5YR 6/4) loam, and red (2.5YR 4/6) sandy clay loam; weak fine platy structure; hard, friable; very strongly acid; gradual smooth boundary.

C2—54 to 72 inches; stratified light gray (10YR 7/2) shale and red (2.5YR 4/6) and strong brown (7.5YR 5/6) loam; weak platy structure; hard, friable; very strongly acid.

The solum is 40 to 60 inches thick. The clay content is 36 to 59 percent in the upper 20 inches of the Bt horizon. Content of ironstone pebbles ranges from 1 to 35 percent, by volume, in the surface horizon and 1 to 10 percent in the subsoil.

The A horizon is brown, dark brown, or dark yellowish brown. Texture is very fine sandy loam or gravelly fine sandy loam. Reaction ranges from strongly acid to neutral. The A horizon is 3 to 8 inches thick.

The E horizon is strong brown, brown, or dark brown. Texture is very fine sandy loam or gravelly fine sandy loam. Reaction ranges from strongly acid to neutral. The E horizon is 2 to 12 inches thick.

The Bt horizon is red or dark red. Mottles in shades of brown, red, yellow, and gray and thin, platy, shale fragments in shades of gray are few or common. Texture is mostly clay, but in some pedons, it is clay loam. Reaction is very strongly acid or strongly acid.

The BC horizon is mottled in shades of red, yellow, gray, or brown. Texture is clay, clay loam, or sandy clay loam. Interbedded layers of these textures with fragments of shale or sandstone are in some pedons. Reaction is extremely acid or very strongly acid.

The C horizon is stratified light gray, light brown, strong brown, red, yellowish red, or reddish yellow. Texture ranges from stratified fine sandy loam to clay loam and sandy clay loam that has interbedded layers of shale, sandstone, or ironstone. Reaction is extremely acid or very strongly acid.

Kullit Series

The Kullit series consists of deep, moderately well drained soils on uplands. These soils are moderately slowly permeable. They formed in acidic, loamy and clayey sediments. Slopes range from 1 to 3 percent. The soils of the Kullit series are fine-loamy, siliceous, thermic Aquic Paleudults.

Typical pedon of Kullit very fine sandy loam, 1 to 3 percent slopes; 7.5 miles southwest of Pittsburg on Farm Road 556 to Matinburg Church, 0.4 mile north on county road, 50 feet east of road, in pasture.

Ap—0 to 7 inches; brown (10YR 5/3) very fine sandy loam; few fine faint dark yellowish brown mottles; weak fine granular structure; loose, very friable; many medium and fine roots; slightly acid; gradual smooth boundary.

E—7 to 14 inches; light yellowish brown (10YR 6/4) very fine sandy loam; few fine faint yellowish brown mottles; weak fine subangular blocky structure; slightly hard, very friable; common medium and fine roots; few fine pores; few worm casts; slightly acid; gradual wavy boundary.

Bt1—14 to 20 inches; yellowish brown (10YR 5/6) clay loam; common fine prominent red (2.5YR 4/6) mottles and few fine faint pale brown mottles; moderate fine subangular blocky structure; hard, friable; few fine roots; few fine pores; patchy clay films on faces of peds; vertical faces of peds coated with loamy material; strongly acid; gradual wavy boundary.

Bt2—20 to 33 inches; yellowish brown (10YR 5/6) clay loam; many medium prominent red (2.5YR 4/6) mottles and common medium distinct light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; very hard, very firm; few fine pores; many continuous clay films on faces of peds; 5 to 10 percent, by volume, clean sand pockets and streaks; strongly acid; gradual smooth boundary.

Bt3—33 to 48 inches; mottled dark red (2.5YR 3/6) and gray (10YR 6/1) clay; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; hard, firm; few fine roots; many continuous clay films on faces of peds; 5 to 10 percent, by volume, clean sand pockets and streaks; very strongly acid; gradual smooth boundary.

Btg1—48 to 63 inches; gray (10YR 6/1) clay; many coarse prominent dark red (2.5YR 3/6) mottles and common fine distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; very hard, very firm; few fine pores; many continuous clay films on faces of peds; very strongly acid; gradual wavy boundary.

Btg2—63 to 73 inches; gray (10YR 6/1) clay; many medium distinct yellowish brown (10YR 5/8) mottles and few medium prominent dark red (2.5YR 3/6) mottles; weak fine subangular blocky structure; very hard, firm; patchy clay films on faces of peds; many fine mica flakes; very strongly acid.

The solum is more than 60 inches thick. Depth to horizons that have more than 35 percent clay ranges from 30 to 54 inches. Base saturation at a depth of 50 inches below the top of the argillic horizon ranges from 15 to 35 percent.

The A horizon is brown, dark brown, or grayish brown. Reaction is strongly acid to slightly acid except where lime has been added. The A horizon is 3 to 9 inches thick.

The E horizon is pale brown, yellowish brown, light yellowish brown, or brownish yellow. Texture is very fine sandy loam. Reaction is the same as that of the A horizon. The E horizon is 3 to 10 inches thick.

The Bt horizon is yellowish brown, strong brown, reddish yellow, or yellowish red. It has few or common mottles in shades of red, brown, and gray. In some pedons, this horizon is coarsely mottled in shades of red, gray, and brown. Reaction is very strongly acid or strongly acid. Texture is clay loam or sandy clay loam in the upper part of the horizon and ranges to clay in the lower part. The clay content of the control section ranges from 20 to 35 percent.

The Btg horizon has colors in shades of red, gray, and brown, or typically, it is mottled in these colors. Texture is clay or sandy clay. Reaction is very strongly acid or strongly acid.

Lilbert Series

The Lilbert series consists of deep, well drained soils on uplands. These soils are moderately slowly permeable. They formed in acidic, loamy and sandy sediments. Slopes range from 2 to 5 percent. Soils of the Lilbert series are loamy, siliceous, thermic Arenic Plinthic Paleudults.

Typical pedon of Lilbert loamy fine sand, 2 to 5 percent slopes; from the junction of Farm Road 3384 and U.S. Highway 271 about 0.8 mile south of Pittsburg, 3 miles south on U.S. Highway 271, 100 feet east, in pine plantation.

A—0 to 9 inches; brown (10YR 5/3) loamy fine sand; single grained; loose; few medium and fine roots; medium acid; gradual wavy boundary.

E—9 to 26 inches; light yellowish brown (10YR 6/4) loamy fine sand; single grained; loose; few medium and fine roots; strongly acid; gradual wavy boundary.

Bt—26 to 37 inches; yellowish brown (10YR 5/6) sandy clay loam; few medium prominent red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; hard, friable; few fine roots; few patchy clay films on faces of peds; few rounded nodules and ironstone pebbles; very strongly acid; gradual wavy boundary.

Btv1—37 to 54 inches; yellowish brown (10YR 5/6) sandy clay loam; common fine prominent yellowish red (5YR 4/6) mottles and few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; hard, friable; few fine roots; few patchy clay films on faces of peds; 5 percent, by volume, slightly brittle plinthite; few ironstone pebbles; very strongly acid; gradual wavy boundary.

Btv2—54 to 69 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium prominent red (2.5YR 4/6) mottles and few fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; 7 percent, by volume, brittle plinthite; few ironstone pebbles; very strongly acid; gradual wavy boundary.

Btv3—69 to 80 inches; yellowish brown (10YR 5/6) sandy clay loam; few fine prominent yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; hard, friable; few fine roots; 4 percent, by volume, brittle plinthite; few ironstone nodules; very strongly acid.

The solum is 60 to more than 80 inches thick. Depth to a horizon that has more than 5 percent plinthite ranges from 30 to 60 inches. Base saturation at a depth of 50 inches below the top of the Bt horizon ranges from 10 to 35 percent. The clay content of the control section ranges from 24 to 35 percent.

The A horizon is dark brown or brown. Reaction ranges from strongly acid to slightly acid. The A horizon is 3 to 15 inches thick.

The E horizon is yellowish brown, light yellowish brown, brown, or pale brown. Reaction ranges from very strongly acid to medium acid. The E horizon is 15 to 25 inches thick.

The Bt horizon is strong brown, brownish yellow, or yellowish brown and has few to many red, yellowish red, grayish brown, and light brownish gray mottles. Texture is sandy clay loam, loam, or clay loam. Reaction ranges from very strongly acid to medium acid.

The Btv horizon has the same colors as those of the Bt horizon, or it is mottled in these colors. Plinthite makes up 5 to 15 percent of the horizon. Texture is dominantly sandy clay loam, but ranges from loam to clay loam. Reaction ranges from very strongly acid to medium acid.

Nahatche Series

The Nahatche series consists of deep, somewhat poorly drained soils on flood plains. These soils are moderately permeable. They formed in loamy alluvial sediment of local streams. Slopes are 0 to 1 percent. Soils of the Nahatche series are fine-loamy, siliceous, nonacid, thermic Aeric Fluvaquents.

Typical pedon of Nahatche loam-silty clay loam, frequently flooded; from Mt. Pleasant, 3.3 miles east on Texas Highway 49, 1.7 miles south on Farm Road 2348, 2.5 miles west on county road across creek to gate, 700 feet north of road, on flood plain of Hart Creek.

Ap—0 to 6 inches; dark brown (10YR 4/3) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; hard, friable; many fine and common medium roots; many fine pores; few brown concretions; common worm casts; slightly acid; clear smooth boundary.

Cg1—6 to 11 inches; grayish brown (10YR 5/2) silt loam; many medium distinct brown (10YR 5/3) and dark yellowish brown (10YR 4/6) mottles and few medium distinct strong brown (7.5YR 5/8) mottles; moderate fine subangular blocky structure; hard, friable; many fine and common medium roots; common fine pores; few brown concretions; medium acid; clear smooth boundary.

Cg2—11 to 28 inches; light brownish gray (10YR 6/2) loam; common medium distinct strong brown (7.5YR 5/8) mottles and few fine distinct dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky structure; slightly hard, friable; common fine roots; many fine pores; common fine brown concretions; few thin lenses of light gray (10YR 7/2) sandy material; strongly acid; gradual wavy boundary.

Cg3—28 to 44 inches; grayish brown (10YR 5/2) clay loam; common medium distinct yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) mottles and common medium faint dark gray (10YR 4/1) mottles; weak medium subangular blocky structure;

slightly hard, friable; common medium and fine roots; few medium and fine pores; few shiny ped faces; vertical streaks of loam in crayfish krotovinas; few black concretions; strongly acid; gradual irregular boundary.

Abg—44 to 68 inches; dark gray (10YR 4/1) clay loam; many coarse faint grayish brown (10YR 5/2) mottles and few medium distinct yellowish brown (10YR 5/8) mottles; weak medium and coarse blocky structure; very hard, firm; few fine roots; few isolated pressure faces; vertical streaks of loam in crayfish krotovinas; common black concretions; common white crystals; neutral; gradual wavy boundary.

2Cg—68 to 80 inches; mottled grayish brown (10YR 5/2), dark gray (10YR 4/1), reddish yellow (7.5YR 6/8), and brownish yellow (10YR 6/6) loam; massive; slightly hard, friable; few white crystals; few brown concretions; mildly alkaline.

The clay content between depths of 10 and 40 inches averages 18 to 30 percent. Reaction ranges from medium acid to mildly alkaline, but in some pedons, it is strongly acid in some subhorizons.

The A horizon is brown, dark brown, dark grayish brown, or grayish brown. Mottles in shades of brown and gray range from none to many. Texture is loam, silt loam, clay loam, or silty clay loam. The A horizon is 4 to 10 inches thick.

The Cg horizon is dark grayish brown or grayish brown in the upper part and light brownish gray, gray, grayish brown, dark gray, or dark grayish brown in the lower part. Mottles in shades of brown and yellow occur throughout and range from few to many. Texture is loam, silt loam, sandy clay loam, clay loam, or silty clay loam. In most pedons, thin strata of coarser textures are common.

Buried soils are below a depth of 40 inches. Some pedons do not have buried soils.

Normangee Series

The Normangee series consists of deep, moderately well drained soils on uplands. These soils are very slowly permeable. They formed in alkaline, clayey and shaly sediments. Slopes range from 3 to 8 percent. Soils of the Normangee series are fine, montmorillonitic, thermic Vertic Haplustalfs.

Typical pedon of Normangee gravelly clay loam, 3 to 8 percent slopes, eroded; 3 miles west of Talco on Farm Road 71, 100 feet north of road, along bank of eroded ditch.

Ap—0 to 3 inches; dark brown (10YR 4/3) gravelly clay loam; moderate fine subangular blocky structure; very hard, firm; many fine roots; 17 to 20 percent, by volume, quartz pebbles 0.5 inch to 2 inches in diameter; slightly acid; clear smooth boundary.

Bt1—3 to 11 inches; dark brown (10YR 4/3) clay; common fine prominent reddish brown (5YR 4/4) mottles and common fine faint grayish brown mottles; moderate to strong medium blocky structure; extremely hard, extremely firm; continuous clay films on faces of peds; few pressure faces; slightly acid; clear wavy boundary.

Bt2—11 to 23 inches; mottled brown (10YR 5/3), yellowish brown (10YR 5/6), and light brownish gray (2.5Y 6/2) clay; moderate coarse blocky structure; extremely hard, extremely firm; continuous clay films on faces of peds; few pressure faces; neutral; gradual wavy boundary.

Bt3—23 to 41 inches; light yellowish brown (2.5Y 6/4) clay; common coarse faint light brownish gray (2.5Y 6/2) mottles and common medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse blocky structure; extremely hard, extremely firm; continuous clay films on faces of peds; few pressure faces; neutral; gradual wavy boundary.

BC—41 to 49 inches; light brownish gray (2.5Y 6/2) clay; many fine distinct gray (10YR 5/1) mottles, common medium distinct yellowish brown (10YR 5/6) mottles, and light yellowish brown (2.5Y 6/4) mottles; weak coarse platy structure; extremely hard, extremely firm; neutral; gradual wavy boundary.

C—49 to 62 inches; stratified light brownish gray (2.5Y 6/2) and gray (N 5/0) shale and yellowish brown (10YR 5/8) clay; massive; extremely hard, extremely firm; neutral.

The solum is 40 to 60 inches thick. Siliceous pebbles up to 3 inches across make up 15 to 25 percent of the surface layer. The clay content of the control section ranges from 40 to 50 percent. During dry periods, cracks up to 0.5 inch wide extend from the surface to a depth of more than 20 inches.

The A horizon is dark grayish brown or dark brown. Reaction ranges from medium acid to neutral. The A horizon is 2 to 6 inches thick.

The Bt1 horizon is dark brown or dark yellowish brown. Mottles in shades of red and brown range from few to common. Texture is clay or clay loam. Reaction ranges from medium acid to neutral.

The Bt2 and Bt3 horizons are brown, dark brown, yellowish brown, dark grayish brown, grayish brown, light olive brown, light yellowish brown, or light brownish gray; or they can be mottled in these colors. Mottles in shades of red, brown, or yellow are common in most pedons. Texture is generally clay, but in some pedons, it can be clay loam. Reaction ranges from slightly acid to moderately alkaline.

The C horizon is stratified clay, shaly clay, and shale. It has colors in shades of gray, olive, yellow, and brown. Reaction ranges from neutral to moderately alkaline.

Pickton Series

The Pickton series consists of deep, well drained soils on uplands. These soils are moderately permeable. They formed in thick beds of sandy and loamy sediments. Slopes range from 2 to 15 percent. Soils of the Pickton series are loamy, siliceous, thermic Grossarenic Paleudalfs.

Typical pedon of Pickton fine sand, 2 to 5 percent slopes; from Interstate Highway 30 in Mt. Pleasant, 3.5 miles north on Farm Road 2152, 0.3 mile east on county road, 0.1 mile east on private road to lake, across lake, in pasture.

A—0 to 11 inches; dark brown (10YR 4/3) fine sand; weak fine subangular blocky structure; loose; many medium and fine roots; slightly acid; gradual wavy boundary.

E1—11 to 31 inches; yellowish brown (10YR 5/4) fine sand; common fine faint pale brown mottles; single grained; loose; common medium and fine roots; medium acid; gradual wavy boundary.

E2—31 to 48 inches; light yellowish brown (10YR 6/4) fine sand; common medium faint very pale brown (10YR 7/3) mottles; single grained; loose; common medium and fine roots; slightly acid; clear smooth boundary.

Bt1—48 to 59 inches; strong brown (7.5YR 5/6) sandy clay loam; many coarse distinct yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure; slightly hard, friable; few medium pale brown (10YR 6/3) coatings on faces of peds; thin patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—59 to 80 inches; yellowish red (5YR 5/8) sandy clay loam; many medium prominent light brownish gray (10YR 6/2) mottles and common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; slightly hard, friable; few fine and very fine pores; many medium light yellowish brown (10YR 6/4) streaks of clean sand 1 inch to 2 inches wide and 6 to 8 inches long on vertical faces of peds; thin patchy clay films on faces of peds; few brittle bodies; very strongly acid.

The solum is more than 80 inches thick. At a depth of 72 inches, the base saturation ranges from 35 to 55 percent. The clay content of the control section ranges from 18 to 30 percent.

The A horizon is brown, dark brown, yellowish brown, or dark yellowish brown. Reaction is medium acid or slightly acid. The A horizon is 6 to 11 inches thick.

The E horizon is brown, yellowish brown, light yellowish brown, or very pale brown. Texture is fine sand or loamy fine sand. Reaction is medium acid or slightly acid. The E horizon is 34 to 62 inches thick.

The Bt horizon is strong brown or yellowish brown in the upper part and strong brown, yellowish brown, or yellowish red in the lower part. Mottles of red, gray, or brown range from few to many. In some pedons, this horizon has dominant gray colors and streaks or pockets of clean sand grains in the lower part. Texture is sandy clay loam or clay loam in the upper part of the horizon and sandy clay loam or fine sandy loam in the lower part. Reaction is very strongly acid to slightly acid.

Raino Series

The Raino series consists of deep, moderately well drained soils on uplands. These soils are very slowly permeable. They formed in loamy and clayey sediments. Slopes of the mounds on which this soil occurs range from 0 to 3 percent. Soils of the Raino series are fine-loamy over clayey, siliceous, thermic Aquic Glossudalfs.

Typical pedon of Raino loam, in an area of Derly-Raino complex, 0 to 1 percent slopes; from Talco, 8.5 miles west on Farm Road 71, 3.8 miles south on Texas Highway 37, 50 feet east on Lake Chapel Church County Road, 50 feet north of county road, in woods.

A—0 to 6 inches; dark yellowish brown (10YR 4/4) loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; loose, friable; many coarse, medium, and fine roots; medium acid; gradual wavy boundary.

BE—6 to 21 inches; yellowish brown (10YR 5/6) loam; few fine distinct light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; many coarse, medium, and fine roots; strongly acid; gradual wavy boundary.

Bt/E1—21 to 35 inches; yellowish brown (10YR 5/6) loam; few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to weak fine subangular blocky; 15 percent, by volume, tongues of light gray (10YR 7/2) clean sand and silt (E); slightly hard, firm; common medium and fine roots; very strongly acid; clear smooth boundary.

Bt/E2—35 to 45 inches; mottled gray (10YR 5/1), strong brown (7.5YR 5/6), and yellowish red (5YR 5/8) clay; weak medium prismatic structure parting to weak fine subangular blocky; 15 percent, by volume, light gray (10YR 7/2) clean sand and silt (E) in upper 2 inches of horizon; very hard, very firm; few medium and fine roots; common continuous clay films on faces of peds; few slickensides; very strongly acid; gradual wavy boundary.

Bt1—45 to 65 inches; mottled yellowish red (5YR 4/6), gray (10YR 5/1), and strong brown (7.5YR 5/6) clay; weak fine subangular blocky structure; very hard, very firm; few fine roots; common continuous clay films on faces of peds; few slickensides; very strongly acid; gradual wavy boundary.

Btg—65 to 78 inches; mottled light brownish gray (10YR 6/2), brownish yellow (10YR 6/6), strong brown

(7.5YR 5/6), and yellowish red (5YR 5/8) clay loam; weak fine subangular blocky structure; very hard, very firm; few fine roots; few patchy clay films on faces of peds; very strongly acid.

The solum is more than 80 inches thick. The clay content of the control section ranges from 18 to 30 percent in the upper part and from 40 to 60 percent in the lower part within 40 inches of the soil surface.

The A horizon is brown, dark brown, yellowish brown, dark yellowish brown, or dark grayish brown. In some pedons, it has a few mottles in shades of yellow and brown. Reaction is medium acid or slightly acid. The A horizon is 4 to 10 inches thick.

The BE or E horizon is brown, strong brown, yellowish brown, pale brown, or light yellowish brown. Mottles in shades of gray and brown range from none to many. Texture is commonly loam, but in some pedons, it is very fine sandy loam. Reaction ranges from very strongly acid to medium acid. The BE or E horizon is 12 to 24 inches thick.

The upper part of the Bt/E horizon is strong brown, brown, yellowish brown, brownish yellow, or light yellowish brown. Yellowish red, red, gray, grayish brown, and light brownish gray mottles range from few to many. Tongues of E material are gray and light gray and range from 10 to 35 percent, by volume. Texture of the upper part of the Bt/E horizon is loam, clay loam, or sandy clay loam. Reaction is very strongly acid or strongly acid.

The lower part of the Bt/E horizon and the Bt and Btg horizons are gray, grayish brown, light brownish gray, brownish yellow, yellowish red, red, yellowish brown, or strong brown; or they are mottled in combinations of these colors. Tongues of E material are light gray and range from 5 to 25 percent, by volume, in the lower part of the Bt/E horizon. Texture of these horizons is commonly clay. Reaction is very strongly acid or strongly acid.

Some pedons have a BCg horizon that is light gray or gray. Mottles in shades of brown, red, or gray range from none to many. Texture is clay loam, sandy clay loam, or clay, and sometimes shaly clay. Reaction ranges from very strongly acid to slightly acid; however, some pedons are neutral below a depth of 60 inches.

Redsprings Series

The Redsprings series consists of deep, well drained soils on hilly uplands. These soils are moderately slowly permeable. They formed in acidic, glauconitic marine sediment. Slopes range from 15 to 40 percent. Soils of the Redsprings series are fine, kaolinitic, thermic Ultic Hapludalfs.

Typical pedon of Redsprings gravelly fine sandy loam, in an area of Cuthbert and Redsprings soils, 15 to 40 percent slopes; from U.S. Highway 259 in Lone Star, 1.5 miles southeast on Farm Road 729, 1 mile north on county road, 0.9 mile east on county road to pipeline right-of-way, 0.5 mile northwest on right-of-way, 20 feet east, in woods.

A1—0 to 4 inches; dark reddish brown (5YR 3/4) gravelly fine sandy loam; weak fine granular structure; slightly hard, friable; many medium and fine roots; 31 percent, by volume, ironstone pebbles up to 1 inch in diameter; few ironstone fragments 3 to 5 inches in diameter; neutral; clear smooth boundary.

A2—4 to 10 inches; yellowish red (5YR 4/6) gravelly fine sandy loam; weak fine granular structure; slightly hard, friable; many fine roots; 25 percent, by volume, ironstone pebbles up to 1 inch in diameter; few ironstone fragments 3 to 5 inches in diameter; slightly acid; gradual wavy boundary.

Bt1—10 to 20 inches; red (2.5YR 4/8) clay; moderate medium and fine subangular blocky structure; hard, firm; many fine roots; continuous clay films on faces of peds; few fine remnants of reddish yellow (7.5YR 6/8) weathered glauconite; 5 percent, by volume, ironstone pebbles and fragments; medium acid; gradual wavy boundary.

Bt2—20 to 32 inches; red (2.5YR 4/8) clay; moderate medium and fine subangular blocky structure; hard, firm; common fine roots; continuous clay films on faces of peds; common fine remnants of weathered glauconite; strongly acid; gradual wavy boundary.

BC—32 to 44 inches; red (2.5YR 4/8) clay; moderate medium subangular blocky structure; very hard, very firm; many thick clay flows in root channels; 25 percent, by volume, remnants of weathered glauconite; about 2 percent, by volume, pinkish gray (7.5YR 7/2) shale fragments; about 8 percent, by volume, ironstone fragments and strata 0.5 inch to 1.5 inches thick; very strongly acid; clear wavy boundary.

C—44 to 60 inches; reddish yellow (7.5YR 6/8) weathered glauconite; common fine pinkish gray (7.5YR 7/2) shale fragments; massive; very hard, very firm; few thick clay flows in fractures of ironstone; very strongly acid.

The solum is 40 to 60 inches thick. Ironstone fragments occur throughout the solum and range from few to 35 percent, by volume. The base saturation at a depth of 50 inches below the top of the Bt horizon ranges from 35 to 60 percent.

The A horizon is dark reddish brown or reddish brown. Reaction ranges from medium acid to neutral. The A horizon is 4 to 10 inches thick.

The Bt horizon is dark red or red clay loam, clay, or the gravelly counterparts. Remnants of weathered glauconite range from 2 to 20 percent, by volume. Reaction ranges from strongly acid to slightly acid.

The BC horizon is dark red or red clay loam or clay. Remnants of weathered glauconite range from 10 to 30 percent, by volume. Thin strata of grayish shale range from 5 to 15 percent, by volume. Reaction is very strongly acid to medium acid.

The C horizon is weathered glauconite in shades of yellow or brown. Interbedded layers of weakly consolidated ironstone, grayish shale, and reddish clay loam occur in some pedons. Reaction is very strongly acid or strongly acid.

Sacul Series

The Sacul series consists of deep, moderately well drained soils on uplands. These soils are slowly permeable. They formed in acidic, loamy, clayey, and shaly sediments. Slopes range from 2 to 15 percent. The soils of the Sacul series are clayey, mixed, thermic Aquic Hapludults.

Typical pedon of Sacul fine sandy loam, 5 to 15 percent slopes; from Daingerfield, 3.5 miles northeast on Farm Road 1400 to the end of pavement, 1.75 miles east to County Line Church, 0.25 mile north on county road, 100 feet east of road.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak very fine granular structure; slightly hard, very friable; many roots; about 2 percent, by volume, ironstone pebbles; strongly acid; clear smooth boundary.

Bt1—4 to 12 inches; dark red (2.5YR 3/6) clay; moderate fine subangular blocky structure; very hard, firm; few roots; continuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt2—12 to 22 inches; dark red (2.5YR 3/6) clay; common fine distinct light brownish gray mottles; moderate fine subangular blocky structure; very hard, firm; continuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt3—22 to 33 inches; mottled dark red (2.5YR 3/6), light brownish gray (10YR 6/2), and reddish yellow (5YR 6/8) clay; moderate fine subangular blocky structure; very hard, firm; continuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

BC—33 to 42 inches; dark red (2.5YR 3/6) and reddish yellow (5YR 6/8) clay loam, few thin layers of light brownish gray (10YR 6/2) silt loam and shale; weak medium platy structure parting to weak fine subangular blocky; very hard, firm; very strongly acid; gradual smooth boundary.

C—42 to 60 inches; stratified red (2.5YR 4/8) and yellowish red (5YR 5/8) sandy loam and grayish brown (10YR 5/2) shale; massive; very hard, firm; very strongly acid.

The solum is 40 to 60 inches thick. Base saturation at 50 inches below the top of the argillic horizon is commonly less than 25 percent. Ironstone fragments less than 2 inches in diameter range from 1 to 8 percent. Reaction is very strongly acid or strongly acid except where lime has been added.

The A horizon is dark brown, brown, very dark grayish brown, or dark grayish brown. It is 1 inch to 4 inches thick.

Some pedons have an E horizon that is brown or yellowish brown. It is fine sandy loam or loam. The E horizon is up to 10 inches thick.

The upper part of the Bt horizon is dark red, red, or yellowish red. In some pedons, it has mottles in shades of brown and gray. The lower part of the Bt horizon and the BC horizon have colors similar to those of the upper part of the Bt horizon and have few to many mottles. In some pedons, the lower part of the Bt horizon is mottled or has a gray matrix. Texture is clay or silty clay in the upper part of the Bt horizon and sandy clay loam, clay loam, or silt loam in the lower part and in the BC horizon.

The C horizon is stratified in shades of red, yellow, and gray. Texture is sandy loam, sandy clay loam, or clay loam interbedded with shale or weakly cemented sandstone.

Talco Series

The Talco series consists of deep, somewhat poorly drained soils on stream terraces. These soils are slowly permeable. They formed in silty sediment of old alluvium. Slopes are 0 to 1 percent. Soils of the Talco series are fine-silty, siliceous, thermic Aeric Glossaqualfs.

Typical pedon of Talco silt loam, in an area of Talco-Raino complex, 0 to 1 percent slopes; from Talco, 9.3 miles east on Farm Road 71 to Wilkinson, 2.4 miles east on Farm Road 71 to gate, 100 feet north of road, in pasture.

A—0 to 3 inches; grayish brown (10YR 5/2) silt loam; weak very fine and fine subangular blocky structure; loose, friable; many medium and fine roots; neutral; clear smooth boundary.

E/B—3 to 8 inches; mottled pale brown (10YR 6/3) and light brownish gray (10YR 6/2) (E) and yellowish brown (10YR 5/4) (B) silt loam; weak fine and medium subangular blocky structure; slightly hard, friable; many medium and fine roots; neutral; clear smooth boundary.

Bt/E—8 to 13 inches; brownish yellow (10YR 6/6) silt loam; many coarse distinct light brownish gray (10YR 6/2) mottles; moderate fine to medium subangular blocky structure; slightly hard, friable; common medium and fine roots; many thin clay films on faces of peds; 5 to 10 percent, by volume, light gray (10YR 7/2) streaks of clean sand and silt (E) up to 0.5 inch wide and 0.5 to 1 inch long; very strongly acid; gradual smooth boundary.

Btg/E1—13 to 22 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct brownish yellow (10YR 6/8) and yellowish brown (10YR 5/8) mottles; weak fine and medium subangular blocky structure; hard, friable; few medium and fine roots; many clay films on faces of peds; 10 to 15 percent, by volume, light gray (10YR 7/2) streaks of clean sand and silt (E) up to 0.5 inch wide and 0.75 inch to 1.5 inches long and few pockets less than 0.5 inch across; very strongly acid; gradual smooth boundary.

Btg/E2—22 to 35 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles and many fine distinct light yellowish brown (10YR 6/4) and brownish yellow (10YR 6/6) mottles; weak fine and medium subangular blocky structure; hard, firm; few medium and fine roots; thin clay films on faces of peds; 15 to 20 percent, by volume, light gray (10YR 7/2) streaks of clean sand and silt (E) up to 0.5 inch wide and 1 inch to 2.5 inches across and few pockets less than 0.5 inch across; very strongly acid; clear smooth boundary.

Btg1—35 to 49 inches; gray (10YR 5/1) silty clay; common fine distinct brown (10YR 5/3) mottles and few fine distinct brownish yellow (10YR 6/6) mottles; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, very firm; few medium and fine roots; thin clay films on faces of peds; some faces of dark peds stained with iron-oxide; few dark concretions; common vertical streaks of gray (10YR 4/1); few coarse pockets of pale brown (10YR 6/3) silty clay loam; few thin streaks of light gray (10YR 7/2) clean sand and silt on faces of peds; very strongly acid; gradual irregular boundary.

Btg2—49 to 66 inches; grayish brown (10YR 5/2) clay loam; few medium prominent red (2.5YR 4/8) mottles and common fine distinct brownish yellow (10YR 6/6) mottles; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, firm; few medium and fine roots; few thin clay films on faces of peds; faces of some peds stained with iron-oxide; few dark concretions; few pale brown (10YR 6/3) silty clay loam pockets; very strongly acid; gradual wavy boundary.

Btg3—66 to 80 inches; light brownish gray (10YR 6/2) clay loam; many medium distinct brownish yellow (10YR 6/6) mottles; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, firm; few medium and fine roots; thin clay films on faces of peds; few dark concretions; very strongly acid.

The solum is more than 60 inches thick. Depth to a layer that has more than 5 percent interfingering is more than 12 inches. The clay content of the control section ranges from 20 to 30 percent.

The A horizon is grayish brown, dark grayish brown, or brown. Mottles in shades of gray or brown range from none to many. Texture is loam or silt loam. Reaction ranges from medium acid to neutral. The A horizon is 3 to 10 inches thick.

The E or E/B horizon is light brownish gray, grayish brown, brown, or pale brown; or it is mottled in these colors and in brownish yellow, yellowish brown, or strong brown. Texture is silt loam or loam. Reaction is very strongly acid or strongly acid. The E or E/B horizon is 4 to 10 inches thick.

The Bt/E and Btg/E horizons are brown, yellowish brown, light yellowish brown, brownish yellow, gray, light brownish gray, or grayish brown. Mottles in shades of brown, yellow, gray, or red range from few to many. Streaks and pockets of light brownish gray or light gray E material ranges from 5 to 30 percent, by volume. Texture is silt loam, silty clay loam, or clay loam. Reaction is very strongly acid or strongly acid.

The Btg horizon is gray, light gray, grayish brown, or light brownish gray. Mottles in shades of red, brown, or yellow range from few to many. Texture is silty clay loam, silty clay, clay loam, or clay, and the clay content ranges from 27 to 50 percent (fig. 26). Reaction is very strongly acid or strongly acid.

Some pedons have a BCg horizon that is grayish brown, light brownish gray, gray, or light gray. Mottles in shades of red, brown, or yellow range from few to many. Texture is silt loam, silty clay loam, or loam. Reaction is very strongly acid or strongly acid.

The Talco soil in the Besner-Talco complex, 0 to 2 percent slopes, is a taxadjunct to the Talco series because the reaction of the lower part of the argillic horizon is more alkaline than the series allows. Use, behavior, and management, however, are similar to those of the Talco series.

Tenaha Series

The Tenaha series consists of deep, well drained soils on uplands. These soils are moderately permeable. They formed in acidic, loamy sediment. Slopes range from 8 to 20 percent. Soils of the Tenaha series are loamy, siliceous, thermic Arenic Hapludults.

Typical pedon of Tenaha loamy fine sand, 8 to 20 percent slopes; from Daingerfield, 3.7 miles south on U.S. Highway 259 to Jenkins, 1.8 miles west on Farm Road 144, 0.5 mile south on county road, 20 feet west, in woods.

A—0 to 12 inches; dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; loose; many medium and fine roots; few rounded ironstone pebbles; medium acid; clear smooth boundary.

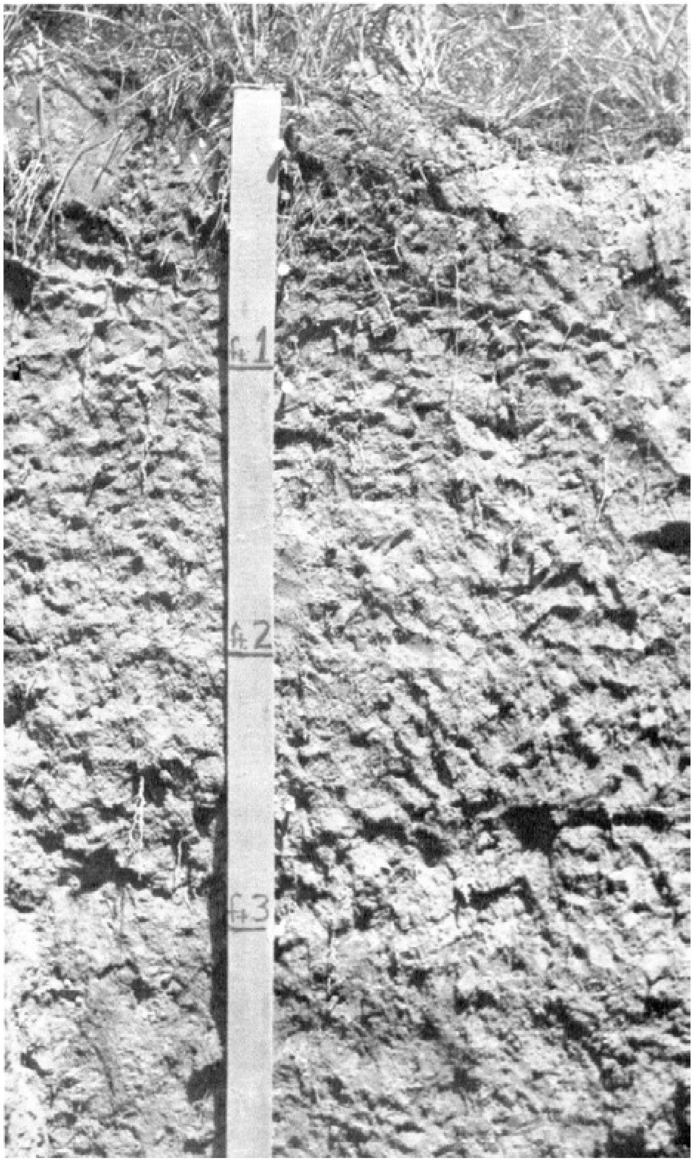


Figure 26.—The subsoil of Talco silt loam, in an area of Talco-Raino complex, 0 to 1 percent slopes, becomes clayey at a depth of about 35 inches.

E—12 to 26 inches; light yellowish brown (10YR 6/4) loamy fine sand; single grained; loose; many medium and fine roots; few rounded ironstone pebbles; medium acid; clear wavy boundary.

Bt1—26 to 33 inches; mottled red (2.5YR 4/8), yellowish red (5YR 5/8), and strong brown (7.5YR 5/6) sandy clay loam; moderate medium subangular blocky structure; slightly hard, friable; many medium and common fine roots; patchy clay films on faces of peds; vertical streaks of light yellowish brown (10YR 6/4) sand coatings in root channels; very strongly acid; clear wavy boundary.

Bt2—33 to 45 inches; mottled red (2.5YR 4/8), yellowish red (5YR 5/8), and strong brown (7.5YR 5/6) sandy clay loam; weak medium subangular blocky structure; slightly hard, friable; many medium and common fine roots; few pockets of light brownish gray (10YR 6/2) weathered shale; patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

CB—45 to 57 inches; stratified reddish yellow (7.5YR 6/8) sandstone, pinkish gray (7.5YR 7/2) shale, red (2.5YR 5/8) sandy clay loam, and yellowish red (5YR 5/8) fine sandy loam; weak coarse platy structure parting to weak fine blocky; hard, firm; few fine roots; few thin patchy clay films on faces of peds; few thin layers of ironstone; very strongly acid; gradual wavy boundary.

C—57 to 75 inches; stratified reddish yellow (7.5YR 6/8) sandstone, yellowish red (5YR 5/8) fine sandy loam, and pinkish gray (7.5YR 7/2) shale; massive; very hard, very firm; thin layers of ironstone; very strongly acid.

The solum is 40 to 60 inches thick. Ironstone pebbles range from a few to about 15 percent, by volume. The clay content of the control section ranges from 22 to 35 percent.

The A horizon is dark brown or brown. Reaction is strongly acid or medium acid.

The E horizon is pale brown, light yellowish brown, yellowish brown, or brown. Reaction is strongly acid or medium acid. Combined thickness of the A and E horizons is 20 to 40 inches.

The Bt horizon is yellowish red, strong brown, or yellowish brown; or it is mottled in these colors and in red. Texture is commonly sandy clay loam, but in some pedons, it is clay loam or loam. Spots or pockets of grayish weathered shale are in some pedons. Reaction is very strongly acid or strongly acid.

The BC or CB horizon is commonly mottled or stratified in shades of red, yellow, and brown. Texture is sandy clay loam, fine sandy loam, or loam. Strata of weathered shale or sandstone range from none to 15 percent. Reaction is very strongly acid or strongly acid.

The C horizon is commonly stratified sandstone, shale, sandy clay loam, and fine sandy loam. The sandstone and soil material are mainly in shades of red, brown, and yellow; and the shale is in shades of gray. Some pedons have layers of ironstone less than 4 inches thick. Reaction is very strongly acid or strongly acid.

Texark Series

The Texark series consists of deep, poorly drained soils on flood plains. These soils are very slowly permeable. They formed in clayey alluvium. Slopes are 0 to 1 percent. Soils of the Texark series are very-fine, montmorillonitic, thermic Typic Pelluderts.

Typical pedon of Texark clay, frequently flooded; from Mt. Pleasant, 17 miles east to the junction of Interstate Highway 30 and U.S. Highway 259, 0.7 mile east on access road to gate, 2 miles southeast on ranch road, 1.4 miles east and north on ranch road across slough bridge, 0.25 mile north on cleared line, on Sulphur River flood plain.

A—0 to 17 inches; very dark gray (10YR 3/1) clay; moderate fine granular structure; extremely hard, very firm; many medium and fine roots; mildly alkaline; gradual smooth boundary.

Bg1—17 to 28 inches; dark gray (10YR 4/1) clay; few coarse distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, very firm; few medium and fine roots; common grooved slickensides; mildly alkaline; gradual smooth boundary.

Bg2—28 to 32 inches; dark gray (10YR 4/1) clay; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, very firm; many grooved slickensides; strongly acid; gradual smooth boundary.

Bg3—32 to 60 inches; dark gray (10YR 4/1) clay; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, very firm; many grooved slickensides; very strongly acid.

The solum is 50 to more than 80 inches thick. Texture is clay throughout, and the content of clay in the control section ranges from 60 to more than 80 percent. During the wetting and drying cycle, slickensides form below a depth of 16 inches. During the dry period, cracks ranging from 0.25 inch to 2 inches wide extend to a depth of more than 30 inches.

The A horizon is black or very dark gray. Reaction is neutral or mildly alkaline. The A horizon is 12 to 20 inches thick.

The Bg horizon is dark gray, gray, dark grayish brown, grayish brown, or light brownish gray. Strong brown, dark yellowish brown, or yellowish brown mottles are few or common. Reaction ranges from very strongly acid to neutral.

Varro Series

The Varro series consists of loamy, well drained soils on flood plains. These soils are moderately permeable. They formed in calcareous alluvial sediments. Slopes are 0 to 1 percent. The soils of the Varro series are fine-loamy, mixed (calcareous), thermic Typic Udifluvents.

Typical pedon of Varro clay loam, frequently flooded; from Mt. Vernon, 10.7 miles north on Texas Highway 37, 2.7 miles west on Farm Road 71, 2.9 miles north on county road, 0.3 mile west on county road, 0.4 mile north on private road, in hay meadow.

A—0 to 8 inches; dark grayish brown (10YR 4/2) clay loam; moderate medium subangular blocky and granular structure; hard, friable; many fine roots; calcareous, moderately alkaline; gradual smooth boundary.

C1—8 to 18 inches; dark grayish brown (10YR 4/2) clay loam; moderate fine platy and subangular blocky structure; hard, friable; few fine roots; few thin strata of pale brown (10YR 6/3) silty clay loam; calcareous, moderately alkaline; clear smooth boundary.

C2—18 to 26 inches; grayish brown (10YR 5/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; strong fine platy structure; hard, friable; few fine roots; many fine strata of dark grayish brown (10YR 4/2) silty clay loam; calcareous, moderately alkaline; clear smooth boundary.

C3—26 to 60 inches; strongly stratified light yellowish brown (10YR 6/4) loam, very dark gray (10YR 3/1) silty clay loam, and pale brown (10YR 6/3) silt loam; strong medium platy structure; hard, friable; few fine roots; calcareous, moderately alkaline.

The alluvial sediment is more than 80 inches thick. The clay content of the control section ranges from 20 to 30 percent. The texture is stratified silty clay loam, clay loam, silt loam, and loam. Bedding planes 0.5 inch to 2 inches thick are typical below the A horizon (fig. 27). This soil is calcareous and moderately alkaline throughout.

The A horizon is dark grayish brown or grayish brown. It is 4 to 12 inches thick.

The C horizon is dark grayish brown, grayish brown, brown, pale brown, or light yellowish brown; or it is mottled or stratified in these colors and has thin strata of black or very dark gray. Colors that have chroma of 2 are derived from parent material.

Wilson Series

The Wilson series consists of deep, somewhat poorly drained soils on remnants of stream terraces. These soils are very slowly permeable. They formed in alkaline, clayey sediment. Slopes are 0 to 1 percent. The soils of the Wilson series are fine, montmorillonitic, thermic Vertic Ochraqualfs.

Typical pedon of Wilson silt loam, 0 to 1 percent slopes; from Mt. Vernon, 0.2 mile west on U.S. Highway 67, 1 mile west on county road, 3.25 miles north on county road to gate on west side of road, 100 feet west of road, in pasture.

A—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure, massive when

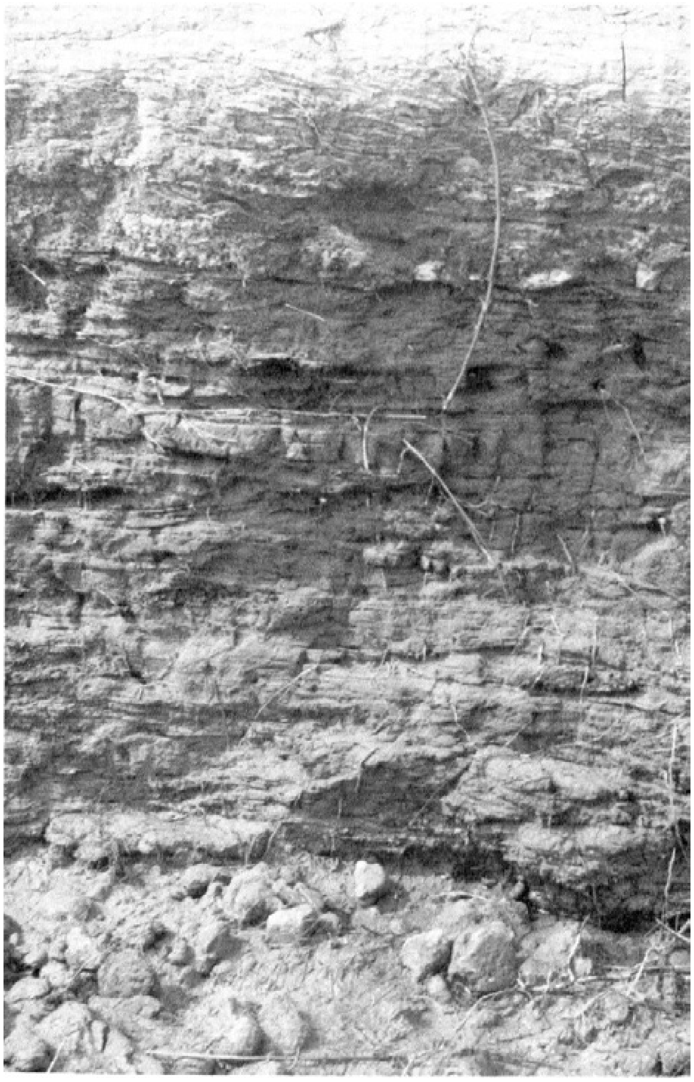


Figure 27.—Varro clay loam, frequently flooded, formed in alluvial sediment. This soil has bedding planes throughout.

dry; hard, friable; many fine roots; medium acid; abrupt wavy boundary.

Btg1—9 to 14 inches; very dark gray (10YR 3/1) silty clay loam; moderate fine subangular blocky structure; hard, friable; common fine roots; few patchy clay films on faces of peds; medium acid; gradual wavy boundary.

Btg2—14 to 28 inches; very dark gray (10YR 3/1) clay; moderate fine blocky structure; extremely hard, very firm; few fine roots; common patchy clay films on faces of peds; few cracks filled with loamy material from the Btg1 horizon; mildly alkaline; gradual wavy boundary.

Btg3—28 to 50 inches; dark grayish brown (10YR 4/2) clay; many medium faint brown (10YR 5/3) mottles; moderate medium blocky structure; extremely hard, very firm; few fine roots; continuous clay films on faces of peds; few pressure faces; neutral; gradual smooth boundary.

BCg—50 to 65 inches; light olive gray (5Y 6/2) clay; weak medium blocky structure; extremely hard, very firm; few very fine concretions and soft masses of calcium carbonate; few ironstone pebbles; few black concretions and specks; neutral.

The solum is 60 to more than 80 inches thick. During the dry period, cracks 0.5 to 1 inch wide extend below the top of the Bt horizon to a depth of more than 20 inches. The clay content of the control section ranges from 35 to 42 percent.

The A horizon is very dark grayish brown, dark grayish brown, or grayish brown. Reaction ranges from medium acid to neutral. The A horizon is 3 to 10 inches thick in more than half the pedon, but it ranges to 15 inches thick in subsoil troughs.

The Btg1 horizon is very dark gray or dark gray. Texture is clay loam, silty clay loam, silty clay, or clay. Reaction ranges from medium acid to neutral.

The Btg2 and Btg3 horizons are very dark gray, dark grayish brown, gray, grayish brown, or light brownish gray. In some pedons, these horizons have few or common mottles in shades of olive, brown, or yellow. Texture is commonly silty clay or clay, but in some pedons, it is silty clay loam or clay loam. Reaction is neutral or mildly alkaline.

The BCg horizon has colors in shades of gray or brown. Mottles or strata in shades of gray, brown, yellow, red, or olive range from few to many. Texture is clay or shaly clay. Strata or fragments of shale make up less than 20 percent of the matrix. Reaction is neutral or mildly alkaline. Concretions and masses of calcium carbonate are in some pedons.

Wolfpen Series

The Wolfpen series consists of deep, well drained soils on uplands (fig. 28). These soils are moderately permeable. They formed in sandy and loamy sediments. Slopes range from 2 to 5 percent. The soils of the Wolfpen series are loamy, siliceous, thermic Arenic Paleudalfs.

Typical pedon of Wolfpen loamy fine sand, 2 to 5 percent slopes; from the junction of U.S. Highway 67 and U.S. Highway 271 (Business) in Mt. Pleasant, 0.2 mile west on U.S. Highway 67, 200 feet north, in vacant lot.

A—0 to 11 inches; dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; loose; many medium and fine roots; slightly acid; gradual wavy boundary.

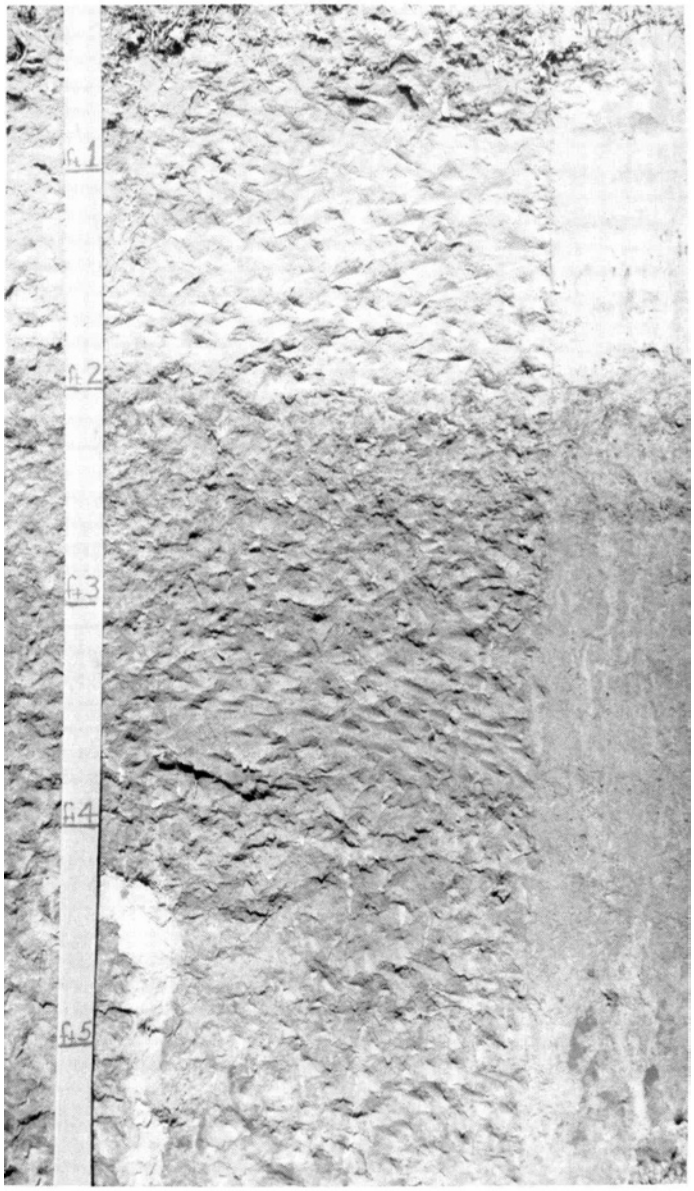


Figure 28.—The sandy clay loam subsoil of Wolfpen loamy fine sand, 2 to 5 percent slopes, begins at a depth of about 2 feet. Streaks of clean sand and silt are below a depth of 4 feet.

BE—11 to 25 inches; yellowish brown (10YR 5/4) loamy fine sand; few fine distinct dark yellowish brown (10YR 4/6) mottles; single grained; loose; common medium and fine roots; strongly acid; gradual wavy boundary.

Bt1—25 to 38 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium prominent red (2.5YR 4/8) mottles, common fine distinct strong brown (7.5YR 5/6) mottles, and few fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; slightly hard, friable; common medium and fine roots; many fine pores; few patchy clay films on faces of peds; slightly brittle; medium acid; gradual wavy boundary.

Bt2—38 to 56 inches; yellowish brown (10YR 5/8) sandy clay loam; common coarse prominent red (2.5YR 4/8) mottles and common medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable; few medium and fine roots; many fine pores; few patchy clay films on faces of peds; slightly brittle; medium acid; gradual wavy boundary.

Bt/E—56 to 80 inches; mottled red (2.5YR 4/8), light brownish gray (10YR 6/2), and strong brown (7.5YR 5/6) sandy clay loam; weak medium subangular blocky structure; slightly hard, friable; few fine roots; few patchy clay films on faces of peds; slightly brittle; common light brownish gray (10YR 6/2) vertical streaks of clean sand (E), 0.5 inch to 1.5 inches wide and 3 to 6 inches long; very strongly acid.

The solum is more than 80 inches thick. The clay content of the control section ranges from 20 to 30 percent. Ironstone pebbles make up less than 5 percent, by volume, of some pedons. Reaction ranges from very strongly acid to slightly acid.

The A horizon is brown, dark brown, dark yellowish brown, or yellowish brown.

The BE horizon is yellowish brown or light yellowish brown. Some pedons have an E horizon that is brown or pale brown. Combined thickness of the A and BE horizons is 20 to 40 inches.

The Bt horizon is strong brown, yellowish brown, or brownish yellow. Mottles in shades of red, brown, yellow, or gray range from none to common; however, mottles that have chroma of 2 or less are at a depth of more than 30 inches. The Bt/E horizon is mottled in colors similar to those of the Bt horizon. Texture of the Bt and Bt/E horizons is mainly sandy clay loam, but in some pedons, it is clay loam. Streaks or pockets of clean sand and silt range from none to 10 percent, by volume, but are commonly about 2 to 8 percent.

Woodtell Series

The Woodtell series consists of deep, moderately well drained soils on uplands. These soils are very slowly permeable. They formed in thick, clayey marine sediment. Slopes range from 1 to 20 percent. The soils of the Woodtell series are fine, montmorillonitic, thermic Vertic Hapludalfs.

Typical pedon of Woodtell fine sandy loam, 5 to 20 percent slopes; from Mt. Pleasant, 17 miles east on

Interstate Highway 30, 0.25 mile north on U.S. Highway 259, 250 feet east of highway, in a pasture.

A—0 to 3 inches; dark brown (10YR 4/3) fine sandy loam; few fine faint dark yellowish brown mottles; weak fine granular structure; slightly hard, very friable; many fine roots; medium acid; clear smooth boundary.

E—3 to 6 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine granular structure; slightly hard, very friable; many fine roots; medium acid; clear smooth boundary.

Bt1—6 to 14 inches; red (2.5YR 4/6) clay; common fine faint reddish yellow mottles; moderate fine subangular blocky structure; very hard, very firm; few fine roots; few patchy clay films on faces of peds; loamy material in few cracks and krotovinas; very strongly acid; gradual smooth boundary.

Bt2—14 to 26 inches; red (2.5YR 4/6) clay; common coarse distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; very hard, very firm; continuous clay films on faces of peds; common slickensides 1 inch to 4 inches across; very strongly acid; gradual smooth boundary.

Bt3—26 to 38 inches; yellowish brown (10YR 5/6) clay; many medium distinct light brownish gray (2.5Y 6/2) mottles and few fine distinct red (2.5YR 4/6) mottles; weak medium subangular blocky structure; very hard, very firm; continuous clay films on faces of peds; common slickensides 6 to 8 inches across; very strongly acid; gradual smooth boundary.

Bt4—38 to 48 inches; light gray (10YR 7/2) clay loam; many coarse distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very hard, very firm; few clay films on faces of peds; very strongly acid; gradual smooth boundary.

BC—48 to 55 inches; light brownish gray (2.5Y 6/2) clay loam; few coarse distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; hard, firm; strongly acid; gradual smooth boundary.

C—55 to 72 inches; stratified light gray (2.5Y 7/2) shale and strong brown (7.5YR 5/6) sandy clay loam; massive; slightly hard, friable; strongly acid.

The solum is 40 to 60 inches thick. The clay content of the control section ranges from 40 to 60 percent.

The A horizon is brown, dark brown, dark grayish brown, very dark grayish brown, or dark yellowish brown. Texture is fine sandy loam or loam. Reaction ranges from strongly acid to slightly acid. The A horizon is 3 to 6 inches thick.

The E horizon is dark yellowish brown, brown, yellowish brown, or light yellowish brown. Texture is fine sandy loam or loam. Reaction ranges from strongly acid to slightly acid. The E horizon is 1 inch to 6 inches thick.

The Bt1 and Bt2 horizons are red or yellowish red. Mottles in shades of brown, yellow, or gray range from few to many. Texture is clay or silty clay. Reaction is very strongly acid or strongly acid.

The Bt3 and Bt4 horizons are mottled in shades of gray, red, and brown; or they have a dominant matrix color in a shade of these colors and have few to many mottles. Texture is clay loam, sandy clay loam, or clay. Reaction ranges from very strongly acid to medium acid.

The BC or C horizon is in shades of gray or brown, or it is mottled in shades of gray, brown, red, or olive. Texture is sandy clay loam, clay loam, clay, or shaly clay with layers of shale or sandstone and shale. Reaction ranges from very strongly acid to neutral.

Formation of the Soils

In this section, the factors of soil formation are described as they relate to the soils in the survey area.

Factors of Soil Formation

Soil is the product of soil-forming processes acting on geologic material. The characteristics of a soil at any given point are determined by the physical and mineral composition of the parent material; the climate under which the parent material accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material. All of the factors are important in the formation of any soil, but the influence of each varies from place to place.

Geology and Parent Material

Homer Logan, geologist, Soil Conservation Service, helped prepare this section.

Camp, Franklin, Morris, and Titus Counties are in the West Gulf Coastal Plain physiographic province *(9)*. Wide lowlands along the Sulphur River and White Oak Creek extend across the northern part of the survey area. Gently rolling topography dominates the central part, while gently rolling to hilly features typify the southern part of the area. The only relatively flat areas are the alluvial lands along the major streams.

The geologic formations in the survey area range in age from Cretaceous to Recent and crop out in northeasterly trending belts. The rocks dip southeast toward the axis of the East Texas basin, which extends northeasterly and lies just south of the area. A prominent structural feature, the Talco fault zone, is about 3 miles wide and extends across the northernmost parts of Franklin, Titus, and Morris Counties. Vertical displacements as large as 360 feet are recorded *(6)*.

The oldest geologic material on the surface is Cretaceous rocks of the Navarro Group. This group is in the extreme northwestern corner of Franklin County *(17)*. The material of this group is clay, silt, and some marl about 750 feet thick. The clayey material weathers to soils that have high shrink-swell potential, such as the Crockett, Ellis, Normangee, and Woodtell soils in the Woodtell-Freestone and Normangee-Crockett-Ellis general soil map units.

Lower Tertiary material of the Midway Group occurs immediately southeast of the Navarro Group. The Midway Group is Paleocene in age. The material is about 760 feet thick and consists mainly of calcareous clays with small amounts of fine sand or silt in the upper part. The clayey material weathers to soils that have high shrink-swell potential, such as the Crockett, Ellis, Normangee, and Woodtell soils. Freestone soils formed from the less clayey material. The soils formed from the Midway Group are common in the Crockett, Normangee-Crockett-Ellis, and Woodtell-Freestone general soil map units.

Southeast of the Midway Group, the Wilcox Group of Eocene age is the dominant surface exposure. This group is in the central part of the survey area. It is about 770 feet thick and consists of fine to medium crossbedded sand, shale, clay, and lignite. Minor amounts of glauconite, siderite, and pyrite are also in this group. The more sandy areas weather to soils common to the Wolfpen-Pickton general soil map unit, and the more clayey areas formed soils common to the Woodtell-Freestone general soil map unit.

The rest of the geologic material on the surface of the survey area, except for Pleistocene and Recent material, is Eocene in age. The formations are described in sequence from oldest to youngest.

The Carrizo Sand, a fine to medium sand with a small amount of silt and clay, forms a sinuous, narrow band across the survey area. It separates the Wilcox Group from the Reklaw Formation, which consists of sand and shale with ironstone concretions. Soils of the Lilbert-Darco general soil map unit are on the Carrizo Sand, and soils of the Bowie-Cuthbert-Kirvin and Kullit-Sacul general soil map units are on the Reklaw Formation. The Queen City Formation is adjacent to the Reklaw Formation, and it consists of fine to medium sand, shale, silt, and impure lignite. The Queen City Formation covers the southern part of Morris and Camp Counties. The soils of the Bowie-Cuthbert-Kirvin and Kullit-Sacul general soil map units are in this area.

The Weches Formation is mainly clay and glauconite with some sand, known as "greensand marl." This formation is about 30 feet thick and forms prominent scarps, ridges, and isolated hills. Limonitic and sideritic iron ore are mined from areas of this formation. The main soils are in the Cuthbert-Redsprings general soil map unit. The Weches Formation outlines the Sparta

Sand, which consists of sand, sandy shale, and clay about 50 feet thick. Soils of the Cuthbert-Redsprings general soil map unit are on this formation; however, the main soil in the Sparta Sand is the Tenaha soil. The Weches Formation and Sparta Sand occupy only a small part of the surface in southern and southeastern Morris County.

The Pleistocene age material is terrace deposits mainly 6 to 30 feet thick over older geologic sediment. These deposits are commonly mounded. They are mainly in the Derly-Raino-Talco general soil map unit.

The youngest material is recent alluvial sediment deposited by modern streams. The soils of the Nahatche-luka general soil map unit are mainly along the smaller local streams, where the sediment is a mixture of loamy materials. The soils of the Estes general soil map unit formed along the larger streams in the survey area. Soils of the Kaufman-Gladewater general soil map unit formed along the Sulphur River, where the sediment is mainly from Cretaceous age clays and marls.

The principal sources of fresh ground water in the survey area are the Wilcox Group, the Carrizo Sand, the Reklaw Formation, and the Queen City Sand. These geologic units probably are hydraulically interconnected. They are known collectively as the "Cypress Aquifer" from Big Cypress Creek, which is the common boundary of the four counties. This aquifer ranges in thickness from zero in the northwestern part of the survey area to about 1,200 feet in the southeastern part of Morris County. Sand makes up about half the volume of the aquifer; the rest is mainly shale, clay, and silt, with numerous beds of lignite. The rocks generally have some iron-bearing minerals.

Climate

Camp, Franklin, Morris, and Titus Counties have a warm, moist, humid, subtropical climate that is characterized by heavy rains. Summers are hot and humid. Winters are mild but well defined. Seasonal changes are gradual.

The climate greatly influenced the development of soils in the survey area. The high humidity and rainfall caused most loamy soils on uplands to be strongly weathered, leached, and acidic. These soils are deep. Because the climate has always been relatively uniform throughout the survey area, most differences among the soils cannot be attributed to the effects of the climate.

Plant and Animal Life

Plants, burrowing animals, earthworms, micro-organisms, and humans have directly influenced the formation of soils. The soils of the prairies formed under tall grasses. Because of the stain of organic matter, the surface layer is mostly dark in color. Crockett, Wilson, Ellis, and Normangee soils developed on the prairie.

Soils that form under trees accumulate organic matter mainly in the upper few inches. The organic matter is quickly destroyed, however, if the soils are cultivated. Cultivated areas of Kullit very fine sandy loam, 1 to 3 percent slopes, is an example.

Earthworms, crayfish, and burrowing rodents help mix the material within the soil. Earthworms are numerous. They enhance the movement of air, water, and plant nutrients in the soils. Crayfish are mostly in soils that have clayey layers and slow runoff, such as the Derly and Wilson soils. The crayfish bring soil material from the lower layers to the surface. Burrowing animals, such as gophers, help mix and aerate loamy soils, such as the Bowie and Freestone soils.

Relief

Relief affects the formation of soils by influencing drainage, infiltration, and plant cover. It also strongly influences how much water percolates through the soil. Soils on nearly level terraces, such as the Derly and Talco soils, have poor drainage. The Cuthbert soils, which are strongly sloping to steep, have a thinner solum than the nearby Bowie soils, which are gently sloping, because on steeper slopes water runs off faster, less moisture infiltrates into the soil, and the plant cover is thinner.

Although most soils in the survey area are gently sloping to steep, shallow soil development as a result of relief is not pronounced. The abundant rainfall and long warm periods have overcome most effects of relief, and most of the soils are deeply developed.

Time

The length of time that climate, living organisms, and relief act upon the parent material affects the kind of soil that forms. The effects of time are modified by the other factors of soil formation. In general, however, soils that do not have definite horizons are young, or immature. Soils that have well-defined horizons are old, or mature. The soils in the survey area range from young to old. luka, Nahatche, and Estes soils are on flood plains and show faint horizons, if any. Woodtell, Kirvin, and Bernaldo soils on uplands are mature soils that have distinct horizons that show little resemblance to the original parent material.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

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.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

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, i.e., 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 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

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). The volume of soft soil decreases excessively 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.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

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.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

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.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazingland for a prescribed period.

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.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

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, such as fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay are in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The movement of water into the soil is rapid.

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.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

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.

Forb. Any herbaceous plant that is 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.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

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.

Green-manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

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.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or 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 Arabic numeral 2 precedes the letter C.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

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.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

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 plants that are the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material. This contrasts 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.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Large stones (in tables). Rock fragments that are 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

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.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

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.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

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 affects the specified use.

Permeability. The quality of the soil that enables water to move through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 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.)

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the 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.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of the 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.

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.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). There is a 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.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

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.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

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.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

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 millimeters 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, E, 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.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind and water erosion.

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).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

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 organic matter content 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 on the contour or at a slight angle to the contour across sloping soils. The terrace intercepts surface runoff, so that water soaks into the soil or flows slowly to a prepared outlet.

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 is 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.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

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.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data recorded in the period 1950-81 at Mt. Pleasant, 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	Units	In	In	In		In
January----	54.1	30.0	42.1	80	9	46	3.04	1.50	4.36	5	0.9
February---	58.5	33.0	45.8	83	13	73	3.35	1.49	4.92	6	0.6
March------	66.4	40.3	53.4	86	21	184	3.85	1.87	5.55	6	0.1
April------	76.0	50.6	63.3	89	31	399	5.07	2.09	7.58	6	0.0
May--------	82.9	59.1	71.0	95	41	651	4.97	2.47	7.13	6	0.0
June-------	90.4	66.7	78.6	100	52	858	3.79	1.28	5.84	5	0.0
July-------	94.6	69.9	82.3	103	59	1,001	3.34	1.23	5.09	5	0.0
August-----	94.4	68.3	81.4	104	57	973	2.65	0.89	4.08	4	0.0
September--	88.0	62.0	75.0	100	43	750	4.52	1.22	7.16	5	0.0
October----	79.2	49.5	64.4	95	31	446	3.74	1.00	5.92	4	0.0
November---	66.3	38.7	52.5	85	19	147	3.92	1.52	5.93	5	0.0
December---	57.7	32.0	44.9	81	13	36	3.44	1.30	5.21	5	0.2
Yearly:											
Average--	75.7	50.0	62.9	---	---	---	---	---	---	---	---
Extreme--	---	---	---	105	7	---	---	---	---	---	---
Total----	---	---	---	---	---	5,564	45.68	36.96	53.73	62	1.8

* 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

[Data recorded in the period 1950-81 at Mt. Pleasant, 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 20	March 28	April 11
2 years in 10 later than--	March 13	March 24	April 6
5 years in 10 later than--	March 1	March 14	March 28
First freezing temperature in fall:			
1 year in 10 earlier than--	November 2	October 27	October 17
2 years in 10 earlier than--	November 12	November 3	October 23
5 years in 10 earlier than--	November 30	November 17	November 2

TABLE 3.--GROWING SEASON

[Data recorded in the period 1950-81 at Mt. Pleasant, 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	241	223	198
8 years in 10	252	231	205
5 years in 10	274	247	219
2 years in 10	295	262	232
1 year in 10	306	271	239

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Camp County	Franklin County	Morris County	Titus County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Acres	Acres	Pct
AsA	Ashford clay, 0 to 1 percent slopes	0	83	710	1,239	2,032	0.3
BaD	Bazette silty clay loam, 5 to 15 percent slopes	0	639	0	0	639	0.1
BbB	Bernaldo fine sandy loam, 1 to 3 percent slopes	0	7,467	1,209	6,998	15,674	2.1
BcB	Bernaldo-Urban land complex, 1 to 3 percent slopes	0	315	0	194	509	0.1
BdB	Besner-Talco complex, 0 to 2 percent slopes	530	707	413	857	2,507	0.3
BeB	Bienville loamy fine sand, 0 to 3 percent slopes	380	172	275	67	894	0.1
BoC	Bowie fine sandy loam, 2 to 5 percent slopes	36,849	5,266	21,353	10,719	74,187	9.8
BuC	Bowie-Urban land complex, 2 to 5 percent slopes	546	0	1,132	468	2,146	0.3
ByC	Briley loamy fine sand, 2 to 5 percent slopes	437	612	1,636	510	3,195	0.4
CrA	Crockett silt loam, 0 to 1 percent slopes	0	4,979	0	535	5,514	0.7
CrB	Crockett silt loam, 1 to 3 percent slopes	0	10,926	0	3,563	14,489	1.9
CrC3	Crockett silt loam, 2 to 5 percent slopes, severely eroded	0	7,300	0	249	7,549	1.0
CsE	Cuthbert fine sandy loam, 8 to 25 percent slopes	25,818	5,832	17,331	5,189	54,170	7.1
CuF	Cuthbert and Redsprings soils, 15 to 40 percent slopes	648	0	8,951	0	9,599	1.3
DaC	Darco loamy fine sand, 2 to 5 percent slopes	1,596	3,331	869	14	5,810	0.8
DrA	Derly-Raino complex, 0 to 1 percent slopes	562	11,008	4,877	16,921	33,368	4.4
DuC	Duffern fine sand, 2 to 5 percent slopes	510	2,303	0	175	2,988	0.4
DuE	Duffern fine sand, 8 to 15 percent slopes	0	1,154	0	0	1,154	0.2
ElD3	Ellis clay, 5 to 12 percent slopes, severely eroded	0	925	210	36	1,171	0.2
ErC	Elrose gravelly fine sandy loam, 3 to 8 percent slopes	0	0	1,697	0	1,697	0.2
Es	Estes clay loam, frequently flooded	7,960	23	7,061	25,140	40,184	5.3
FrB	Freestone fine sandy loam, 1 to 3 percent slopes	0	20,990	5,636	35,333	61,959	8.2
FuB	Freestone-Urban land complex, 1 to 3 percent slopes	0	222	0	1,456	1,678	0.2
Gw	Gladewater clay, frequently flooded	0	1,158	5,863	1,157	8,178	1.1
GyB	Grayrock silty clay loam, 2 to 5 percent slopes	0	0	0	2,892	2,892	0.4
GyD	Grayrock silty clay loam, 5 to 12 percent slopes	0	0	0	1,792	1,792	0.2
Ho	Hopco silty clay loam, occasionally flooded	0	4,595	0	356	4,951	0.7
Iu	Iuka fine sandy loam, frequently flooded	2,990	3,986	3,007	103	10,086	1.3
Ka	Kaufman clay, frequently flooded	0	2,137	3,745	11,866	17,748	2.3
KfC	Kirvin very fine sandy loam, 3 to 8 percent slopes	3,310	1,087	6,195	3,295	13,887	1.8
KgC	Kirvin gravelly fine sandy loam, 3 to 8 percent slopes	4,238	1,582	5,006	3,256	14,082	1.9
KrC	Kirvin-Urban land complex, 2 to 8 percent slopes	139	0	1,085	65	1,289	0.2
KsC	Kirvin soils, graded, 2 to 8 percent slopes	400	427	468	347	1,642	0.2
KtB	Kullit very fine sandy loam, 1 to 3 percent slopes	7,890	824	5,668	3,597	17,979	2.4
KuB	Kullit-Urban land complex, 1 to 3 percent slopes	455	0	187	0	642	0.1
LbC	Lilbert loamy fine sand, 2 to 5 percent slopes	9,400	4,320	9,411	864	23,995	3.2
Na	Nahatche loam-silty clay loam, frequently flooded	11,106	23,307	11,633	23,250	69,296	9.1
NoD2	Normangee gravelly clay loam, 3 to 8 percent slopes, eroded	0	3,276	0	2,136	5,412	0.7
Ow	Oil-waste land	0	61	0	428	489	0.1
PkC	Pickton fine sand, 2 to 5 percent slopes	0	3,414	236	3,707	7,357	1.0
PkE	Pickton fine sand, 8 to 15 percent slopes	0	553	0	231	784	0.1
PuC	Pickton-Urban land complex, 2 to 5 percent slopes	0	0	0	189	189	*
SaC	Sacul fine sandy loam, 2 to 5 percent slopes	613	164	940	93	1,810	0.2
SaD	Sacul fine sandy loam, 5 to 15 percent slopes	4,375	416	2,690	1,068	8,549	1.1
TaA	Talco-Raino complex, 0 to 1 percent slopes	3,688	1,754	2,763	3,899	12,104	1.6
TeE	Tenaha loamy fine sand, 8 to 20 percent slopes	1,632	1,797	4,695	592	8,716	1.1
Tx	Texark clay, frequently flooded	0	0	3,122	0	3,122	0.4
Ud	Udorthents, loamy and clayey	0	190	2,710	1,180	4,080	0.5
Ug	Udorthents, gravelly	0	0	3,052	0	3,052	0.4
Va	Varro clay loam, frequently flooded	0	2,921	0	0	2,921	0.4
WcA	Wilson silt loam, 0 to 1 percent slopes	0	1,513	0	76	1,589	0.2
WdC	Wolfpen loamy fine sand, 2 to 5 percent slopes	0	5,270	519	8,824	14,613	1.9
WeC	Wolfpen-Urban land complex, 2 to 5 percent slopes	0	109	0	1,178	1,287	0.2

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Camp County	Franklin County	Morris County	Titus County	Total-- Area	Extent
		Acres	Acres	Acres	Acres	Acres	Pct
WoC	Woodtell fine sandy loam, 2 to 5 percent slopes	0	10,000	2,674	15,096	27,770	3.7
WoE	Woodtell fine sandy loam, 5 to 20 percent slopes	540	18,885	12,619	48,626	80,670	10.6
WrB	Woodtell-Raino complex, 1 to 3 percent slopes	0	5,893	2,084	13,862	21,839	2.9
WuC	Woodtell-Urban land complex, 2 to 8 percent slopes	0	169	0	216	385	0.1
	Water	3,634	4,457	2,752	8,173	19,016	2.5
	Total	130,246	188,519	166,484	272,077	757,326	100.0

* Less than 0.1 percent.

TABLE 5.--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	Wheat	Peanuts	Watermelons	Sweet potatoes	Improved bermuda-grass	Common bermuda-grass	Bahiagrass
	Bu	Lbs	Tons	Bu	AUM*	AUM*	AUM*
AsA------------- Ashford	30	---	---	---	7.0	6.0	7.0
BaD------------- Bazette	---	---	---	---	5.0	4.0	5.0
BbB------------- Bernaldo	---	2,200	9	400	12.0	8.0	9.0
BcB:							
Bernaldo--------	---	---	---	---	---	---	---
Urban land.							
BdB------------- Besner-Talco	---	---	---	---	10.0	7.0	7.5
BeB------------- Bienville	---	1,500	9	300	11.0	5.5	6.5
BoC------------- Bowie	---	2,400	10	450	12.0	7.0	8.0
BuC:							
Bowie-----------	---	---	---	---	---	---	---
Urban land.							
ByC------------- Briley	---	2,000	10	350	9.0	4.0	4.0
CrA------------- Crockett	25	---	---	---	7.5	6.0	6.0
CrB------------- Crockett	25	---	---	---	7.5	6.0	6.0
CrC3------------ Crockett	20	---	---	---	5.5	4.5	4.5
CsE------------- Cuthbert	---	---	---	---	7.0	5.0	5.0
CuF------------- Cuthbert and Redsprings	---	---	---	---	---	---	---
DaC------------- Darco	---	1,200	9	250	7.0	---	---
DrA------------- Derly-Raino	30	---	---	---	7.0	6.0	7.0
DuC------------- Duffern	---	1,000	7	---	5.0	---	---

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Wheat	Peanuts	Watermelons	Sweet potatoes	Improved bermuda-grass	Common bermuda-grass	Bahiagrass
	Bu	Lbs	Tons	Bu	AUM*	AUM*	AUM*
DuE----------- Duffern	---	---	---	---	5.0	---	---
ElD3----------- Ellis	---	---	---	---	3.5	---	---
ErC----------- Elrose	---	2,400	8	450	10.0	7.0	7.0
Es------------- Estes	---	---	---	---	7.0	6.0	7.0
FrB----------- Freestone	35	1,500	---	350	10.0	8.0	8.0
FuB: Freestone------	---	---	---	---	---	---	---
Urban land.							
Gw------------- Gladewater	---	---	---	---	7.0	6.0	7.0
GyB----------- Grayrock	---	---	---	---	9.0	---	---
GyD----------- Grayrock	---	---	---	---	8.0	---	---
Ho------------- Hopco	45	---	---	---	10.0	8.0	9.0
Iu------------- Iuka	---	---	---	---	9.0	7.0	8.0
Ka------------- Kaufman	---	---	---	---	8.5	---	---
KfC----------- Kirvin	---	600	---	300	9.0	8.0	8.0
KgC----------- Kirvin	---	500	---	250	8.0	7.0	7.0
KrC: Kirvin---------	---	---	---	---	---	---	---
Urban land.							
KsC----------- Kirvin	---	---	---	---	6.0	5.0	5.0
KtB----------- Kullit	---	1,000	---	350	12.0	8.0	9.0
KuB: Kullit---------	---	---	---	---	---	---	---
Urban land.							

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Wheat	Peanuts	Watermelons	Sweet potatoes	Improved bermuda-grass	Common bermuda-grass	Bahiagrass
	Bu	Lbs	Tons	Bu	AUM*	AUM*	AUM*
LbC------------- Lilbert	---	2,000	10	350	9.0	4.0	4.0
Na-------------- Nahatche	---	---	---	---	9.0	5.0	8.0
NoD2------------ Normangee	---	---	---	---	5.0	---	---
Ow. Oil-waste land							
PkC------------- Pickton	---	1,300	9	250	6.5	---	---
PkE------------- Pickton	---	---	---	---	6.5	---	---
PuC: Pickton--------	---	---	---	---	---	---	---
Urban land.							
SaC------------- Sacul	---	500	---	200	7.5	6.5	7.5
SaD------------- Sacul	---	---	---	---	6.0	5.5	6.5
TaA------------- Talco-Raino	30	---	---	---	7.0	6.0	7.0
TeE------------- Tenaha	---	---	---	---	7.0	---	---
Tx-------------- Texark	---	---	---	---	7.0	6.0	7.0
Ud, Ug. Udorthents							
Va-------------- Varro	---	---	---	---	8.0	7.0	8.0
WcA------------- Wilson	30	---	---	---	6.0	5.0	5.0
WdC------------- Wolfpen	---	2,000	10	350	9.0	5.0	6.0
WeC: Wolfpen--------	---	---	---	---	---	---	---
Urban land.							
WoC------------- Woodtell	35	---		---	7.5	6.5	6.5
WoE------------- Woodtell	---	---	---	---	6.0	5.5	5.5

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Wheat	Peanuts	Watermelons	Sweet potatoes	Improved bermuda-grass	Common bermuda-grass	Bahiagrass
	Bu	Lbs	Tons	Bu	AUM*	AUM*	AUM*
WrB------------- Woodtell-Raino	35	---	---	---	8.0	6.5	7.5
WuC:							
Woodtell--------	---	---	---	---	---	---	---
Urban land.							

* 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.

TABLE 6.--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	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Productivity class*	Trees to plant
AsA: Ashford	4W	Slight	Severe	Severe	Severe	Water oak	70	52	Water oak, willow oak.
						Willow oak	---	---	
						Post oak	---	---	
BbB: Bernaldo	10A	Slight	Slight	Slight	Slight	Loblolly pine	93	369	Loblolly pine, shortleaf pine, sweetgum.
						Shortleaf pine	84	326	
						Sweetgum	---	---	
						Southern red oak	---	---	
BdB:									
Besner	11A	Slight	Slight	Slight	Slight	Loblolly pine	99	447	Loblolly pine, slash pine, sweetgum.
						Shortleaf pine	81	285	
						Sweetgum	---	---	
						Southern red oak	---	---	
Talco	5W	Slight	Severe	Moderate	Moderate	Willow oak	81	126	Willow oak, southern red oak.
						Southern red oak	62	59	
						Water oak	---	---	
BeB: Bienville	10S	Slight	Severe	Moderate	Slight	Loblolly pine	97	421	Loblolly pine.
						Shortleaf pine	87	368	
BoC: Bowie	9A	Slight	Slight	Slight	Slight	Loblolly pine	87	300	Loblolly pine, shortleaf pine.
						Shortleaf pine	81	285	
ByC: Briley	9S	Slight	Slight	Moderate	Moderate	Loblolly pine	86	290	Loblolly pine.
						Shortleaf pine	75	222	
CsE: Cuthbert	8C	Moderate	Moderate	Moderate	Slight	Loblolly pine	84	270	Loblolly pine.
						Shortleaf pine	75	222	
CuF:									
Cuthbert	6R	Severe	Severe	Moderate	Slight	Loblolly pine	62	74	Loblolly pine.
						Shortleaf pine	52	43	
Redsprings	7R	Severe	Severe	Moderate	Slight	Loblolly pine	73	160	Loblolly pine.
						Shortleaf pine	61	96	
DaC: Darco	9S	Slight	Moderate	Severe	Moderate	Loblolly pine	86	290	Loblolly pine, shortleaf pine.
						Shortleaf pine	70	173	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Productivity class*	Trees to plant
DrA:									
Derly	4W	Slight	Severe	Moderate	Severe	Water oak	70	52	Water oak, sweetgum, willow oak.
						Willow oak	67	---	
Raino	9W	Slight	Moderate	Slight	Moderate	Loblolly pine	88	310	Loblolly pine, shortleaf pine.
						Shortleaf pine	80	271	
						Water oak	90	207	
DuC, DuE: Duffern	7S	Slight	Moderate	Severe	Slight	Loblolly pine	77	200	Loblolly pine.
						Shortleaf pine	66	139	
ErC: Elrose	7F	Slight	Slight	Moderate	Slight	Loblolly pine	76	190	Loblolly pine.
						Shortleaf pine	70	173	
						Southern red oak	---	---	
Es: Estes	7W	Slight	Severe	Moderate	Moderate	Water oak	97	276	Water oak, sweetgum.
						Willow oak	88	189	
						Sweetgum	93	236	
						Green ash	---	---	
FrB: Freestone	9W	Slight	Moderate	Slight	Moderate	Loblolly pine	86	290	Loblolly pine, shortleaf pine.
						Shortleaf pine	78	251	
						Sweetgum	---	---	
Gw: Gladewater	5W	Slight	Severe	Moderate	Severe	Water oak	76	91	Water oak, willow oak.
						Willow oak	76	65	
Ho: Hopco	6W	Slight	Moderate	Slight	Moderate	Water oak	90	207	Water oak, green ash, yellow-poplar.
						Willow oak	---	---	
Iu: Iuka	12W	Slight	Moderate	Moderate	Moderate	Loblolly pine	107	551	Loblolly pine, water oak, sweetgum.
						Sweetgum	100	305	
						Water oak	100	305	
Ka: Kaufman	4W	Slight	Moderate	Severe	Severe	Water oak	70	52	Water oak, green ash.
						Green ash	69	---	
KfC: Kirvin	8A	Slight	Slight	Slight	Slight	Loblolly pine	81	240	Loblolly pine.
						Shortleaf pine	72	193	
KgC: Kirvin	8F	Moderate	Moderate	Slight	Slight	Loblolly pine	80	230	Loblolly pine.
						Shortleaf pine	70	173	
KsC: Kirvin	3C	Moderate	Moderate	Moderate	Slight	Shortleaf pine	41	86	Loblolly pine.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Productivity class*	
KtB--- Kullit	9W	Slight	Moderate	Slight	Moderate	Loblolly pine---	90	330	Loblolly pine, sweetgum.
						Shortleaf pine---	73	230	
						Sweetgum---	---	---	
LbC--- Lilbert	9S	Slight	Slight	Moderate	Moderate	Loblolly pine---	90	330	Loblolly pine, slash pine.
						Shortleaf pine---	81	285	
Na--- Nahatche	7W	Slight	Severe	Moderate	Slight	Water oak---	100	305	Water oak, loblolly pine.
						Willow oak---	100	305	
						Loblolly pine---	113	662	
PkC--- Pickton	8S	Slight	Slight	Moderate	Moderate	Loblolly pine---	80	230	Loblolly pine.
						Shortleaf pine---	70	173	
PkE--- Pickton	8S	Moderate	Slight	Moderate	Moderate	Loblolly pine---	80	230	Loblolly pine.
						Shortleaf pine---	70	173	
SaC--- Sacul	9C	Slight	Slight	Slight	Moderate	Loblolly pine---	87	300	Loblolly pine, shortleaf pine.
						Shortleaf pine---	74	212	
SaD--- Sacul	9C	Moderate	Slight	Slight	Moderate	Loblolly pine---	80	230	Loblolly pine, shortleaf pine.
						Shortleaf pine---	70	173	
TaA:									
Talco---	5W	Slight	Severe	Moderate	Moderate	Willow oak---	81	126	Loblolly pine, southern red oak, willow oak.
						Southern red oak---	69	76	
						Loblolly pine---	92	356	
						Water oak---	---	---	
Raino---	9W	Slight	Moderate	Slight	Moderate	Loblolly pine---	88	310	Loblolly pine, shortleaf pine.
						Shortleaf pine---	80	271	
						Water oak---	90	207	
TeE--- Tenaha	8S	Moderate	Slight	Severe	Slight	Loblolly pine---	84	270	Slash pine, loblolly pine.
						Shortleaf pine---	71	183	
Tx--- Texark	4W	Slight	Severe	Moderate	Severe	Green ash---	82	---	Water oak, green ash.
						Water oak---	---	---	
						Hackberry---	---	---	
						Sweetgum---	---	---	
Va--- Varro	4W	Slight	Severe	Moderate	Severe	Water oak---	70	52	Water oak.
						Willow oak---	---	---	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Productivity class*	
WdC---------------- Wolfpen	10S	Slight	Slight	Moderate	Moderate	Loblolly pine------- Shortleaf pine------	96 74	408 212	Loblolly pine, shortleaf pine.
WoC, WoE----------- Woodtell	8C	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------	79 72	220 193	Loblolly pine.
WrB:									
Woodtell----------	7C	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------	77 67	200 147	Slash pine, loblolly pine.
Raino-------------	9W	Slight	Moderate	Slight	Moderate	Loblolly pine------- Shortleaf pine------ Water oak-----------	88 80 90	310 271 207	Loblolly pine, shortleaf pine.

* Productivity class is the yield in board feet (Doyle Rule) per acre per year over a 50 year period for fully stocked natural stands.

TABLE 7.--WOODLAND UNDERSTORY PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support native vegetation suitable for grazing are listed]

Map symbol and soil name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
		Lb/acre		Pct
AsA: 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
BaD*: Bazette	Favorable	5,500	Little bluestem	35
	Normal	4,500	Indiangrass	10
	Unfavorable	2,000	Big bluestem	10
			Switchgrass	10
			Panicum	5
			Sideoats grama	10
BbB: Bernaldo	Favorable	3,300	Pinehill bluestem	55
	Normal	2,500	Slender bluestem	5
	Unfavorable	1,500	Longleaf uniola	5
			Splitbeard bluestem	5
			Southern bayberry	5
			Carolina jessamine	5
			Yaupon	5
			American beautyberry	5
BdB:				
Besner	Favorable	3,300	Pinehill bluestem	55
	Normal	2,500	Slender bluestem	5
	Unfavorable	1,500	Longleaf uniola	5
			Splitbeard bluestem	5
			Southern bayberry	5
			Carolina jessamine	5
			Greenbrier	5
			Yaupon	5
			American beautyberry	5
Talco	Favorable	5,500	Sedge	15
	Normal	4,500	Rush	10
	Unfavorable	3,000	Beaked panicum	10
			Longleaf uniola	10
			American beautyberry	8
			Hawthorn	8
			Greenbrier	7
			Blackberry	7
			Panicum	5
			Paspalum	5
			Virginia wildrye	5
			Southern bayberry	5
			Honeysuckle	5
BeB: Bienville	Favorable	1,650	Pinehill bluestem	20
	Normal	1,300	Little bluestem	20
	Unfavorable	1,000	Panicum	20
			Longleaf uniola	10
			Threeawn	10

See footnote at end of table.

TABLE 7.--WOODLAND UNDERSTORY PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
		Lb/acre		Pct
BoC----------------- Bowie	Favorable	3,500	Pinehill bluestem	50
	Normal	3,000	Pineywoods dropseed	10
	Unfavorable	2,000	Longleaf uniola	10
			Big bluestem	10
			Indiangrass	5
ByC----------------- Briley	Favorable	1,500	Pinehill bluestem	50
	Normal	1,200	Longleaf uniola	10
	Unfavorable	900	Fineleaf bluestem	10
			Pineywoods dropseed	10
CrA, CrB*---------- Crockett	Favorable	6,000	Little bluestem	10
	Normal	5,000	Indiangrass	10
	Unfavorable	3,000	Big bluestem	5
			Virginia wildrye	10
			Florida paspalum	10
			Sideoats grama	10
			Texas wintergrass	10
			Paspalum	10
CrC3*-------------- Crockett	Favorable	4,500	Little bluestem	10
	Normal	3,500	Indiangrass	10
	Unfavorable	2,000	Big bluestem	5
			Virginia wildrye	10
			Florida paspalum	10
			Sideoats grama	10
			Texas wintergrass	10
			Paspalum	10
CsE----------------- Cuthbert	Favorable	2,200	Pinehill bluestem	50
	Normal	1,700	Longleaf uniola	10
	Unfavorable	1,200	Fineleaf bluestem	10
			Big bluestem	5
			Pineywoods dropseed	5
CuF:				
Cuthbert----------	Favorable	2,200	Pinehill bluestem	50
	Normal	1,700	Longleaf uniola	10
	Unfavorable	1,200	Fineleaf bluestem	10
			Big bluestem	5
			Pineywoods dropseed	5
Redsprings--------	Favorable	2,300	Pinehill bluestem	50
	Normal	1,800	Fineleaf bluestem	10
	Unfavorable	1,200	Longleaf uniola	10
			Big bluestem	10
			Pineywoods dropseed	5
			Indiangrass	5
			Cutover muhly	5
DaC----------------- Darco	Favorable	1,650	Pinehill bluestem	50
	Normal	1,350	Longleaf uniola	10
	Unfavorable	1,000	Indiangrass	5
			Fineleaf bluestem	5
			Splitbeard bluestem	5
			Pineywoods dropseed	5
			Purple lovegrass	5
			Fringeleaf paspalum	5

See footnote at end of table.

TABLE 7.--WOODLAND UNDERSTORY PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
DrA:				
Derly	Favorable	6,500	Florida paspalum	15
	Normal	4,500	Virginia wildrye	15
	Unfavorable	3,000	Little bluestem	10
			Beaked panicum	10
			Giant cane	10
			Panicum	10
			Redtop panicum	10
			Carolina jointtail	5
Raino	Favorable	2,000	Little bluestem	25
	Normal	1,600	Pinehill bluestem	25
	Unfavorable	1,250	Beaked panicum	10
			Longleaf uniola	10
			Spreading panicum	5
			Brownseed paspalum	5
			Cutover muhly	5
DuC, DuE: Duffern	Favorable	1,500	Pinehill bluestem	30
	Normal	1,200	Longleaf uniola	10
	Unfavorable	1,000	Arrowfeather threeawn	10
			Indiangrass	5
			Fineleaf bluestem	5
			Purple lovegrass	5
			Grape	5
			Bluejack oak	5
			Sassafras	5
			Tickclover	5
ElD3*: Ellis	Favorable	4,500	Little bluestem	30
	Normal	3,500	Indiangrass	15
	Unfavorable	2,000	Vine-mesquite	10
			Texas wintergrass	10
			Meadow dropseed	10
			Florida paspalum	5
			Sideoats grama	5
ErC: Elrose	Favorable	2,500	Longleaf uniola	10
	Normal	1,500	Pineywoods dropseed	10
	Unfavorable	1,000	Big bluestem	10
			Pinehill bluestem	10
Es: Estes	Favorable	1,900	Longleaf uniola	15
	Normal	1,700	Pinehill bluestem	15
	Unfavorable	1,500	Sedge	10
			Beaked panicum	10
			Panicum	5
			Greenbrier	5
			Alabama supplejack	5
FrB: Freestone	Favorable	2,500	Little bluestem	15
	Normal	1,750	Beaked panicum	15
	Unfavorable	1,000	Longleaf uniola	15
			Purpletop	10
			Panicum	10

See footnote at end of table.

TABLE 7.--WOODLAND UNDERSTORY PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
		Lb/acre		Pct
Gw: Gladewater	Favorable	3,500	Sedge	20
	Normal	2,000	Paspalum	15
	Unfavorable	1,500	Virginia wildrye	10
			Panicum	10
			Beaked panicum	5
			Purpletop	5
			Pinehill bluestem	5
Ho: Hopco	Favorable	6,000	Longleaf uniola	15
	Normal	3,500	Virginia wildrye	10
	Unfavorable	2,000	Beaked panicum	10
			Little bluestem	10
			Sedge	10
			Florida paspalum	5
			Indiangrass	5
			Eastern gamagrass	5
			Giant cane	5
Iu: Iuka	Favorable	1,800	Pinehill bluestem	50
	Normal	1,500	Beaked panicum	10
	Unfavorable	1,200	Spreading panicum	10
			Brownseed paspalum	10
			Longleaf uniola	10
Ka: Kaufman	Favorable	6,000	Virginia wildrye	20
	Normal	3,500	Sedge	20
	Unfavorable	1,500	Longleaf uniola	10
			Rustyseed paspalum	10
			Beaked panicum	5
			Switchgrass	5
			Eastern gamagrass	5
			Panicum	5
			Hawthorn	5
			Yaupon	5
KfC: Kirvin	Favorable	2,000	Pinehill bluestem	50
	Normal	1,300	Longleaf uniola	10
	Unfavorable	1,000	Pineywoods dropseed	5
			American beautyberry	5
			Purpletop	5
			Indiangrass	5
			Brownseed paspalum	5
KgC: Kirvin	Favorable	2,400	Pinehill bluestem	50
	Normal	1,900	Longleaf uniola	10
	Unfavorable	1,500	American beautyberry	5
			Indiangrass	5
			Brownseed paspalum	5
			Fineleaf bluestem	5
KsC: Kirvin	Favorable	2,300	Pinehill bluestem	50
	Normal	1,800	Fineleaf bluestem	10
	Unfavorable	1,200	Longleaf uniola	10
			Big bluestem	10
			Splitbeard bluestem	5

See footnote at end of table.

TABLE 7.--WOODLAND UNDERSTORY PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
KtB: Kullit	Favorable	2,500	Beaked panicum	10
	Normal	2,000	Sedge	10
	Unfavorable	1,600	Switchgrass	10
			Canada wildrye	10
			Greenbrier	10
			Broadleaf uniola	5
LbC: Lilbert	Favorable	1,500	Pinehill bluestem	50
	Normal	1,200	Fineleaf bluestem	10
	Unfavorable	900	Longleaf uniola	10
			Pineywoods dropseed	10
			Indiangrass	5
Na: Nahatche	Favorable	3,000	Hairy wildrye	20
	Normal	2,000	Spreading panicum	15
	Unfavorable	1,500	Rustyseed paspalum	15
			Panicum	10
			Bentawn plumegrass	5
			Switchcane	5
NoD2: Normangee	Favorable	5,500	Big bluestem	10
	Normal	4,000	Little bluestem	45
	Unfavorable	3,000	Switchgrass	10
			Indiangrass	15
			Florida paspalum	5
			Sideoats grama	5
PkC, PkE: Pickton	Favorable	3,000	Little bluestem	20
	Normal	2,500	Panicum	15
	Unfavorable	2,000	Purpletop	10
			Big bluestem	10
			Indiangrass	5
			Longleaf uniola	5
			Beaked panicum	5
SaC, SaD: Sacul	Favorable	3,000	Bluestem	25
	Normal	2,200	Beaked panicum	15
	Unfavorable	1,500	Uniola	10
			Plumegrass	8
			Panicum	7
			Sedge	5
TaA:				
Talco	Favorable	5,500	Sedge	15
	Normal	4,500	Rush	10
	Unfavorable	3,000	Beaked panicum	10
			Longleaf uniola	10
			American beautyberry	8
			Hawthorn	8
			Greenbrier	7
			Blackberry	7
			Panicum	5
			Paspalum	5
			Virginia wildrye	5
			Southern bayberry	5
			Honeysuckle	5

See footnote at end of table.

TABLE 7.--WOODLAND UNDERSTORY PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
TaA:				
Raino	Favorable	2,000	Little bluestem	25
	Normal	1,600	Pinehill bluestem	25
	Unfavorable	1,250	Beaked panicum	10
			Longleaf uniola	10
			Spreading panicum	5
			Brownseed paspalum	5
			Cutover muhly	5
TeE: Tenaha	Favorable	2,500	Pinehill bluestem	50
	Normal	2,000	Fineleaf bluestem	10
	Unfavorable	1,250	Longleaf uniola	10
			Indiangrass	5
			Slender bluestem	5
			Pineywoods dropseed	5
			Dogwood	5
			Yaupon	5
Tx: 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
Va: Varro	Favorable	5,500	Sedge	10
	Normal	3,500	Beaked panicum	10
	Unfavorable	2,000	Virginia wildrye	10
			Longleaf uniola	10
			Indiangrass	10
			Scribner panicum	10
			Blackseed needlegrass	10
			Giant cane	5
			Purpletop	5
			Eastern gamagrass	5
			Fringeleaf paspalum	5
			Common carpetgrass	5
WcA: Wilson	Favorable	6,000	Little bluestem	45
	Normal	4,500	Indiangrass	10
	Unfavorable	3,000	Big bluestem	10
			Virginia wildrye	5
			Vine mesquite	5
			Florida paspalum	5
			Sideoats grama	5
			Texas wintergrass	5
			Silver bluestem	5
WdC: Wolfpen	Favorable	3,500	Little bluestem	20
	Normal	2,500	Purpletop	15
	Unfavorable	2,000	Panicum	15
			Longleaf uniola	10
			Beaked panicum	10
			Indiangrass	5

See footnote at end of table.

TABLE 7.--WOODLAND UNDERSTORY PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
WoC: 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
WoE: 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
WrB:				
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
Raino	Favorable	2,000	Little bluestem	25
	Normal	1,600	Pinehill bluestem	25
	Unfavorable	1,250	Beaked panicum	10
			Longleaf uniola	10
			Spreading panicum	5
			Brownseed paspalum	5
			Cutover muhly	5

* This soil is not suited to the production of commercial timber.

TABLE 8.--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	Golf fairways
AsA------------------- Ashford	Severe: ponding, percs slowly, too clayey.	Severe: ponding, too clayey, percs slowly.	Severe: percs slowly, too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
BaD------------------- Bazette	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
BbB------------------- Bernaldo	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
BcB:					
Bernaldo-------------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Urban land.					
BdB:					
Besner---------------	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
Talco----------------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
BeB------------------- Bienville	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
BoC------------------- Bowie	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
BuC:					
Bowie----------------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Urban land.					
ByC------------------- Briley	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
CrA------------------- Crockett	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Severe: erodes easily.	Slight.
CrB, CrC3------------- Crockett	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
CsE------------------- Cuthbert	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Moderate: droughty.
CuF:					
Cuthbert-------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe----------	Moderate: small stones, droughty.
Redsprings-----------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: erodes easily.	Severe: slope.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
DaC------------------- Darco	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Moderate: droughty.
DrA:					
Derly-----------------	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
Raino-----------------	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight----------	Slight.
DuC------------------- Duffern	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
DuE------------------- Duffern	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
ElD3------------------ Ellis	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
ErC------------------- Elrose	Moderate: small stones.	Moderate: small stones.	Moderate: small stones, slope.	Slight----------	Moderate: small stones.
Es-------------------- Estes	Severe: flooding, ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
FrB------------------- Freestone	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly, slope.	Moderate: wetness.	Moderate: wetness.
FuB:					
Freestone-------------	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly, slope.	Moderate: wetness.	Moderate: wetness.
Urban land.					
Gw-------------------- Gladewater	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.	Severe: wetness, flooding, too clayey.
GyB------------------- Grayrock	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
GyD------------------- Grayrock	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Ho-------------------- Hopco	Severe: flooding.	Moderate: wetness, percs slowly.	Moderate: wetness, flooding, percs slowly.	Slight----------	Moderate: flooding.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Iu: Iuka	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
Ka: Kaufman	Severe: flooding, percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, flooding, percs slowly.	Severe: too clayey.	Severe: flooding, too clayey.
KfC: Kirvin	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope.	Slight	Slight.
KgC: Kirvin	Severe: small stones.	Severe: small stones.	Severe: small stones.	Slight	Severe: small stones.
KrC: Kirvin	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope.	Slight	Slight.
Urban land.					
KsC: Kirvin	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
KtB: Kullit	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
KuB: Kullit	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
Urban land.					
LbC: Lilbert	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Moderate: droughty.
Na: Nahatche	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
NoD2: Normangee	Moderate: small stones, percs slowly.	Moderate: small stones, percs slowly.	Severe: small stones.	Slight	Moderate: small stones.
Ow. Oil-waste land					
PkC: Pickton	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
PkE: Pickton	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope.
PuC: Pickton	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
Urban land.					

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
SaC: Sacul	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
SaD: Sacul	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
TaA:					
Talco	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Raino	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
TeE: Tenaha	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
Tx: Texark	Severe: flooding, wetness, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: flooding, too clayey, wetness.	Severe: too clayey, wetness.	Severe: flooding, wetness, too clayey.
Ud, Ug. Udorthents					
Va: Varro	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
WcA: Wilson	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
WdC: Wolfpen	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty, too sandy.
WeC:					
Wolfpen	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty, too sandy.
Urban land.					
WoC: Woodtell	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
WoE: Woodtell	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
WrB:					
Woodtell	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
Raino	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
WuC:					
Woodtell	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
Urban land.					

TABLE 9.--WILDLIFE HABITAT

[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
AsA: Ashford	Fair	Fair	Good	Fair	---	Good	Good	Fair	Fair	Good.
BaD: Bazette	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
BbB: Bernaldo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BcB:										
Bernaldo	---	---	---	---	---	---	---	---	---	---
Urban land.										
BdB:										
Besner	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Talco	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BeB: Bienville	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
BoC: Bowie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
BuC:										
Bowie	---	---	---	---	---	---	---	---	---	---
Urban land.										
ByC: Briley	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
CrA, CrB, CrC3: Crockett	Fair	Good	Good	---	---	Poor	Poor	Good	---	Poor.
CsE: Cuthbert	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CuF:										
Cuthbert	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Redsprings	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
DaC: Darco	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
DrA:										
Derly	Fair	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
Raino	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
DuC, DuE: Duffern	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
ElD3---------------- Ellis	Poor	Fair	Fair	---	---	Very poor.	Very poor.	Fair	---	Very poor.
ErC---------------- Elrose	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Es----------------- Estes	Very poor.	Poor	Fair	Good	---	Fair	Fair	Poor	Fair	Fair.
FrB---------------- Freestone	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
FuB: Freestone---------	---	---	---	---	---	---	---	---	---	---
Urban land.										
Gw----------------- Gladewater	Poor	Fair	Fair	Fair	---	Poor	Good	Fair	Fair	Fair.
GyB---------------- Grayrock	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
GyD---------------- Grayrock	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ho----------------- Hopco	Fair	Fair	Good	Good	---	Fair	Fair	Fair	Good	Fair.
Iu----------------- Iuka	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
Ka----------------- Kaufman	Poor	Poor	Fair	Good	---	Poor	Good	Poor	Good	Fair.
KfC---------------- Kirvin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
KgC---------------- Kirvin	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
KrC: Kirvin------------	---	---	---	---	---	---	---	---	---	---
Urban land.										
KsC---------------- Kirvin	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
KtB---------------- Kullit	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
KuB: Kullit------------	---	---	---	---	---	---	---	---	---	---
Urban land.										
LbC---------------- Lilbert	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Na----------------- Nahatche	Fair	Fair	Fair	Good	Fair	Poor	Fair	Fair	Good	Poor.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
NoD2---------------- Normangee	Fair	Fair	Fair	---	---	Poor	Poor	Fair	---	Poor.
Ow. Oil-waste land										
PkC, PkE----------- Pickton	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
PuC:										
Pickton-----------	---	---	---	---	---	---	---	---	---	---
Urban land.										
SaC---------------- Sacul	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SaD---------------- Sacul	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
TaA:										
Talco-------------	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Raino-------------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
TeE---------------- Tenaha	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Tx----------------- Texark	Poor	Fair	Fair	Good	---	Good	Fair	Fair	Good	Fair.
Ud, Ug. Udorthents										
Va----------------- Varro	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
WcA---------------- Wilson	Fair	Fair	Good	---	---	Fair	Fair	Fair	---	Fair.
WdC---------------- Wolfpen	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
WeC:										
Wolfpen-----------	---	---	---	---	---	---	---	---	---	---
Urban land.										
WoC---------------- Woodtell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Poor.
WoE---------------- Woodtell	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WrB:										
Woodtell----------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Poor.
Raino-------------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

TABLE 9.--WILDLIFE HABITAT--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
WuC:										
Woodtell	---	---	---	---	---	---	---	---	---	---
Urban land.										

TABLE 10.--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. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AsA: Ashford	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell, low strength.	Severe: ponding, too clayey.
BaD: Bazette	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
BbB: Bernaldo	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
BcB:						
Bernaldo	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Urban land.						
BdB:						
Besner	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Slight	Slight.
Talco	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
BeB: Bienville	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty.
BoC: Bowie	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: low strength.	Slight.
BuC:						
Bowie	Slight	Slight	Slight	Slight	Slight	Slight.
Urban land.						
ByC: Briley	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
CrA, CrB, CrC3: Crockett	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
CsE: Cuthbert	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Moderate: droughty.
CuF:						
Cuthbert	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Moderate: small stones, droughty.
Redsprings	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
DaC: Darco	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
DrA:						
Derly	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
Raino	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: low strength, wetness, shrink-swell.	Slight.
DuC: Duffern	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
DuE: Duffern	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
ElD3: Ellis	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: too clayey.
ErC: Elrose	Slight	Slight	Slight	Moderate: slope.	Slight	Moderate: small stones.
Es: Estes	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding.
FrB: Freestone	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
FuB:						
Freestone	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
Urban land.						
Gw: Gladewater	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, flooding, too clayey.
GyB: Grayrock	Slight	Severe: unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Severe: low strength, unstable fill.	Slight.
GyD: Grayrock	Moderate: slope.	Severe: unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Severe: low strength, unstable fill.	Moderate: slope.
Ho: Hopco	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Iu: Iuka	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ka---------------- Kaufman	Severe: cutbanks cave, wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: flooding, too clayey.
KfC--------------- Kirvin	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
KgC--------------- Kirvin	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Severe: small stones.
KrC:						
Kirvin-----------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Urban land.						
KsC--------------- Kirvin	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
KtB--------------- Kullit	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Slight.
KuB:						
Kullit-----------	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Slight.
Urban land.						
LbC--------------- Lilbert	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
Na---------------- Nahatche	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
NoD2-------------- Normangee	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: small stones.
Ow. Oil-waste land						
PkC--------------- Pickton	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty.
PkE--------------- Pickton	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
PuC:						
Pickton----------	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty.
Urban land.						

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
SaC: Sacul	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
SaD: Sacul	Moderate: too clayey, slope, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
TaA:						
Talco	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
Raino	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: low strength, wetness, shrink-swell.	Slight.
TeE: Tenaha	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Tx: Texark	Severe: cutbanks cave, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, low strength, wetness.	Severe: flooding, wetness, too clayey.
Ud, Ug. Udorthents						
Va: Varro	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
WcA: Wilson	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
WdC: Wolfpen	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty, too sandy.
WeC:						
Wolfpen	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty, too sandy.
Urban land.						
WoC: Woodtell	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
WoE: Woodtell	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
WrB:						
Woodtell	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
WrB:						
Raino	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: low strength, wetness, shrink-swell.	Slight.
WuC:						
Woodtell	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
Urban land.						

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AsA: Ashford	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
BaD: Bazette	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
BbB: Bernaldo	Moderate: wetness.	Moderate: seepage, slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
BcB:					
Bernaldo	Moderate: wetness.	Moderate: seepage, slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
Urban land.					
BdB:					
Besner	Moderate: wetness.	Severe: seepage.	Severe: wetness.	Severe: seepage.	Good.
Talco	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding, thin layer.
BeB: Bienville	Moderate: wetness.	Severe: seepage.	Severe: seepage, wetness.	Severe: seepage.	Fair: too sandy.
BoC: Bowie	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
BuC:					
Bowie	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Urban land.					
ByC: Briley	Slight	Moderate: seepage, slope.	Slight	Severe: seepage.	Good.
CrA: Crockett	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
CrB, CrC3: Crockett	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
CsE: Cuthbert	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, slope.

TABLE 11.--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
CuF:					
Cuthbert	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, slope.
Redsprings	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
DaC Darco	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: too sandy.
DrA:					
Derly	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Raino	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
DuC Duffern	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
DuE Duffern	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
ElD3 Ellis	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
ErC Elrose	Slight	Moderate: seepage, slope.	Severe: seepage.	Slight	Fair: too clayey.
Es Estes	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
FrB Freestone	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
FuB:					
Freestone	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
Urban land.					
Gw Gladewater	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
GyB Grayrock	Moderate: percs slowly.	Severe: unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Poor: hard to pack.

TABLE 11.--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
GyD: Grayrock	Moderate: percs slowly, slope.	Severe: slope, unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Poor: hard to pack.
Ho: Hopco	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack.
Iu: Iuka	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
Ka: Kaufman	Severe: flooding, wetness, percs slowly.	Slight	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack.
KfC, KgC: Kirvin	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
KrC:					
Kirvin	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Urban land.					
KsC: Kirvin	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
KtB: Kullit	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness, thin layer.
KuB:					
Kullit	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness, thin layer.
Urban land.					
LbC: Lilbert	Moderate: percs slowly.	Severe: seepage.	Slight	Severe: seepage.	Good.
Na: Nahatche	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
NoD2: Normangee	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Ow. Oil-waste land					
PkC: Pickton	Severe: poor filter.	Severe: seepage.	Severe: wetness, too sandy.	Severe: seepage.	Poor: too sandy.

TABLE 11.--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
PkE------------------ Pickton	Severe: poor filter.	Severe: seepage, slope.	Severe: wetness, too sandy.	Severe: seepage.	Poor: too sandy.
PuC:					
Pickton------------	Severe: poor filter.	Severe: seepage.	Severe: wetness, too sandy.	Severe: seepage.	Poor: too sandy.
Urban land.					
SaC------------------ Sacul	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
SaD------------------ Sacul	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: too clayey.	Moderate: slope, wetness.	Poor: too clayey, hard to pack.
TaA:					
Talco--------------	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding, thin layer.
Raino--------------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
TeE------------------ Tenaha	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Moderate: slope.	Severe: seepage.	Fair: too sandy, slope.
Tx------------------- Texark	Severe: percs slowly, flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, too clayey, wetness.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Ud, Ug. Udorthents					
Va------------------- Varro	Severe: flooding.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Fair: too clayey.
WcA------------------ Wilson	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
WdC------------------ Wolfpen	Severe: poor filter.	Severe: seepage.	Severe: wetness.	Severe: seepage.	Fair: too clayey.
WeC:					
Wolfpen------------	Severe: poor filter.	Severe: seepage.	Severe: wetness.	Severe: seepage.	Fair: too clayey.
Urban land.					
WoC------------------ Woodtell	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.

TABLE 11.--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
WoE----------------- Woodtell	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
WrB:					
Woodtell-----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
Raino--------------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
WuC:					
Woodtell-----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
Urban land.					

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
AsA: Ashford	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
BaD: Bazette	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BbB: Bernaldo	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
BcB:				
Bernaldo	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				
BdB:				
Besner	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Talco	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
BeB: Bienville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
BoC: Bowie	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
BuC:				
Bowie	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Urban land.				
ByC: Briley	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
CrA, CrB, CrC3: Crockett	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CsE: Cuthbert	Fair: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
CuF:				
Cuthbert	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
CuF:				
Redsprings	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
DaC Darco	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
DrA:				
Derly	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Raino	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
DuC, DuE Duffern	Good	Probable	Improbable: too sandy.	Poor: too sandy.
ElD3 Ellis	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
ErC Elrose	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Es Estes	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
FrB Freestone	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
FuB:				
Freestone	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Urban land.				
Gw Gladewater	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
GyB Grayrock	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
GyD Grayrock	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Ho Hopco	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
Iu: Iuka	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ka: Kaufman	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
KfC, KgC: Kirvin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
KrC:				
Kirvin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Urban land.				
KsC: Kirvin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
KtB: Kullit	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
KuB:				
Kullit	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Urban land.				
LbC: Lilbert	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Na: Nahatche	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
NoD2: Normangee	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Ow. Oil-waste land				
PkC, PkE: Pickton	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
PuC:				
Pickton	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Urban land.				
SaC, SaD: Sacul	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
TaA:				
Talco	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Raino	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
TeE: Tenaha	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, slope.
Tx: Texark	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Ud, Ug. Udorthents				
Va: Varro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
WcA: Wilson	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
WdC: Wolfpen	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
WeC: Wolfpen	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Urban land.				
WoC: Woodtell	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
WoE: Woodtell	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
WrB: Woodtell	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Raino	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
WuC: Woodtell	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Urban land.				

TABLE 13.--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. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
AsA: Ashford	Slight	Severe: ponding, hard to pack.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
BaD: Bazette	Slight	Moderate: hard to pack.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
BbB: Bernaldo	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable.
BcB:					
Bernaldo	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable.
Urban land.					
BdB:					
Besner	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
Talco	Moderate: seepage.	Severe: piping, ponding.	Ponding, percs slowly.	Ponding, erodes easily.	Wetness, percs slowly, erodes easily.
BeB: Bienville	Severe: seepage.	Severe: piping, seepage.	Deep to water	Favorable	Droughty.
BoC: Bowie	Moderate: seepage, slope.	Moderate: piping, wetness.	Deep to water	Favorable	Rooting depth.
BuC:					
Bowie	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable.
Urban land.					
ByC: Briley	Moderate: seepage.	Moderate: piping.	Deep to water	Soil blowing	Droughty.
CrA, CrB, CrC3: Crockett	Slight	Severe: hard to pack.	Deep to water	Erodes easily, percs slowly.	Erodes easily, percs slowly.
CsE: Cuthbert	Slight	Moderate: piping.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, droughty.
CuF:					
Cuthbert	Slight	Moderate: piping.	Deep to water	Slope	Slope, droughty.
Redsprings	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope, erodes easily.	Slope, erodes easily.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
DaC: Darco	Severe: seepage.	Severe: seepage, piping.	Deep to water	Too sandy, soil blowing.	Droughty.
DrA:					
Derly	Slight	Severe: hard to pack, wetness.	Percs slowly	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Raino	Slight	Severe: hard to pack.	Percs slowly	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
DuC: Duffern	Severe: seepage.	Severe: seepage, piping.	Deep to water	Too sandy, soil blowing.	Droughty.
DuE: Duffern	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
ElD3: Ellis	Slight	Severe: hard to pack.	Deep to water	Slope, percs slowly.	Slope, percs slowly.
ErC: Elrose	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Favorable.
Es: Estes	Slight	Severe: ponding.	Ponding, percs slowly, flooding.	Ponding, percs slowly.	Wetness, percs slowly.
FrB: Freestone	Slight	Severe: hard to pack.	Percs slowly	Wetness, percs slowly.	Percs slowly.
FuB:					
Freestone	Slight	Severe: hard to pack.	Percs slowly	Wetness, percs slowly.	Percs slowly.
Urban land.					
Gw: Gladewater	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
GyB: Grayrock	Moderate: seepage.	Moderate: piping, hard to pack.	Deep to water	Erodes easily	Erodes easily.
GyD: Grayrock	Moderate: seepage.	Moderate: piping, hard to pack.	Deep to water	Erodes easily, slope.	Erodes easily, slope.
Ho: Hopco	Slight	Moderate: wetness, hard to pack.	Flooding	Erodes easily, wetness.	Erodes easily.
Iu: Iuka	Moderate: seepage.	Severe: piping, wetness.	Flooding	Wetness	Wetness.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Ka: Kaufman	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, percs slowly.	Percs slowly.
KfC: Kirvin	Slight	Severe: hard to pack.	Deep to water	Erodes easily	Erodes easily.
KgC: Kirvin	Slight	Severe: hard to pack.	Deep to water	Favorable	Favorable.
KrC:					
Kirvin	Slight	Severe: hard to pack.	Deep to water	Erodes easily	Erodes easily.
Urban land.					
KsC: Kirvin	Slight	Severe: hard to pack.	Deep to water	Favorable	Favorable.
KtB: Kullit	Moderate: seepage.	Moderate: piping, wetness, thin layer.	Favorable	Erodes easily, wetness.	Erodes easily.
KuB:					
Kullit	Moderate: seepage.	Moderate: piping, wetness, thin layer.	Favorable	Wetness	Favorable.
Urban land.					
LbC: Lilbert	Moderate: seepage.	Moderate: piping.	Deep to water	Soil blowing	Droughty.
Na: Nahatche	Moderate: seepage.	Severe: wetness.	Flooding	Wetness	Wetness.
NoD2: Normangee	Slight	Severe: hard to pack.	Deep to water	Percs slowly	Percs slowly.
Ow. Oil-waste land					
PkC: Pickton	Severe: seepage.	Severe: seepage, piping.	Deep to water	Too sandy, soil blowing.	Droughty.
PkE: Pickton	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
PuC:					
Pickton	Severe: seepage.	Severe: seepage, piping.	Deep to water	Too sandy	Droughty.
Urban land.					
SaC: Sacul	Slight	Severe: hard to pack.	Deep to water	Percs slowly, wetness.	Percs slowly.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
SaD: Sacul	Slight	Severe: hard to pack.	Deep to water	Slope, percs slowly, wetness.	Slope, percs slowly.
TaA:					
Talco	Moderate: seepage.	Severe: piping, ponding.	Ponding, percs slowly.	Ponding, erodes easily.	Wetness, percs slowly, erodes easily.
Raino	Slight	Severe: hard to pack.	Percs slowly	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
TeE: Tenaha	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, soil blowing.	Droughty, slope.
Tx: Texark	Slight	Severe: wetness, hard to pack.	Flooding, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Ud, Ug. Udorthents					
Va: Varro	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable.
WcA: Wilson	Slight	Severe: hard to pack, wetness.	Percs slowly	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
WdC: Wolfpen	Severe: seepage.	Severe: thin layer.	Deep to water	Favorable	Droughty.
WeC:					
Wolfpen	Severe: seepage.	Severe: thin layer.	Deep to water	Favorable	Droughty.
Urban land.					
WoC: Woodtell	Slight	Severe: hard to pack.	Deep to water	Erodes easily	Erodes easily, percs slowly.
WoE: Woodtell	Slight	Severe: hard to pack.	Deep to water	Slope, erodes easily.	Slope, erodes easily, percs slowly.
WrB:					
Woodtell	Slight	Severe: hard to pack.	Deep to water	Erodes easily	Erodes easily, percs slowly.
Raino	Slight	Severe: hard to pack.	Percs slowly	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
WuC:					
Woodtell	Slight	Severe: hard to pack.	Deep to water	Slope, erodes easily.	Slope, erodes easily, percs slowly.
Urban land.					

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated. Some soils may have Unified classifications and USDA textures in addition to those shown. In general, the dominant classifications and textures are shown]

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AsA----------- Ashford	0-3	Clay-----------	CH	A-7-6	0	100	95-100	95-100	90-100	51-75	33-49
	3-51	Clay-----------	CH	A-7-6	0	95-100	95-100	95-100	90-100	55-85	34-55
	51-80	Clay-----------	CH	A-7-6	0	95-100	95-100	95-100	90-100	55-85	35-55
BaD----------- Bazette	0-6	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-90	30-49	11-24
	6-28	Silty clay, clay	CL, CH	A-7	0	95-100	95-100	90-100	80-95	48-66	27-40
	28-60	Shaly clay, clay, silty clay.	CL, CH	A-7	0	95-100	95-100	90-100	70-95	41-60	20-35
BbB----------- Bernaldo	0-17	Fine sandy loam	SM, ML	A-4	0	100	95-100	90-100	40-60	<25	NP-4
	17-48	Loam, sandy clay loam.	CL	A-6	0	100	100	90-100	51-75	26-40	12-24
	48-80	Loam, sandy clay loam, clay loam.	CL, SC, ML, SM	A-4, A-6, A-2-4, A-2-6	0	100	95-100	90-100	28-65	20-40	3-22
BcB:											
Bernaldo--------	0-17	Fine sandy loam	SM, ML	A-4	0	100	95-100	90-100	40-60	<25	NP-4
	17-48	Loam, sandy clay loam.	CL	A-6	0	100	100	90-100	51-75	26-40	12-24
	48-80	Loam, sandy clay loam, clay loam.	CL, SC, ML, SM	A-4, A-6, A-2-4, A-2-6	0	100	95-100	90-100	28-65	20-40	3-22
Urban land.											
BdB:											
Besner----------	0-31	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	95-100	90-100	45-70	<25	NP-7
	31-46	Loam-----------	CL-ML, ML, SM-SC, SM	A-4	0	100	95-100	80-100	40-75	<25	NP-7
	46-86	Loam, sandy clay loam.	SC, CL	A-6, A-4	0	100	95-100	80-100	36-75	18-35	8-20
Talco-----------	0-15	Loam-----------	ML, CL-ML	A-4	0	98-100	95-100	90-100	80-100	<25	NP-7
	15-64	Silt loam, silty clay loam, clay loam.	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	80-100	20-39	5-21
	64-73	Clay loam, silt loam, loam.	CL, CL-ML	A-4, A-6, A-7	0	95-100	95-100	90-100	80-100	25-45	6-23
BeB----------- Bienville	0-21	Loamy fine sand	SM	A-2-4, A-4	0	100	100	90-100	15-50	<25	NP-3
	21-80	Loamy fine sand	SM	A-2-4, A-4	0	100	100	90-100	30-50	<25	NP-3
BoC----------- Bowie	0-11	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2-4, A-4	0	97-100	94-100	90-100	30-55	<25	NP-6
	11-38	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	90-100	87-100	80-100	40-72	20-40	8-25
	38-75	Sandy clay loam, clay loam.	SC, CL	A-4, A-6, A-2-6	0	80-100	70-100	65-100	35-77	20-40	8-25

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BuC:											
Bowie-----------	0-11	Fine sandy loam	SM, SM-SC, ML	A-2-4, A-4	0	98-100	98-100	95-100	30-55	<25	NP-6
	11-38	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	90-100	90-100	85-100	40-72	20-40	8-25
	38-75	Sandy clay loam, clay loam.	SC, CL	A-4, A-6, A-7	0	80-100	70-100	65-100	49-77	20-40	8-25
Urban land.											
ByC-------------- Briley	0-8	Loamy fine sand	SM	A-2-4, A-4	0	95-100	95-100	80-100	17-45	<25	NP-4
	8-29	Loamy fine sand	SM	A-2-4, A-4	0	97-100	95-100	80-100	17-45	<25	NP-4
	29-80	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6	0	95-100	95-100	85-100	36-65	22-39	8-22
CrA-------------- Crockett	0-13	Silt loam--------	SM-SC, ML, CL, ML-CL	A-4, A-6	0-2	98-100	94-100	89-100	60-96	15-35	3-15
	13-54	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	89-100	85-100	85-100	65-98	40-59	23-42
	54-80	Stratified clay loam to shaly silty clay.	CL, CH	A-6, A-7	0-5	90-100	85-100	75-100	53-90	30-60	15-40
CrB-------------- Crockett	0-8	Silt loam--------	SM-SC, ML CL, ML-CL	A-4, A-6	0-2	98-100	94-100	89-100	60-96	15-35	3-15
	8-18	Clay-------------	CH, CL	A-7, A-6	0	89-100	85-100	85-100	65-98	40-59	23-42
	18-38	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	89-100	85-100	85-100	65-98	40-59	23-42
	38-60	Clay loam, sandy clay, clay.	CL, CH	A-6, A-7	0-5	90-100	85-100	75-100	53-90	30-60	15-40
	60-80	Stratified clay loam to shaly silty clay.	CH, CL	A-7	0-5	90-100	90-100	90-100	72-99	45-71	27-52
CrC3------------- Crockett	0-3	Silt loam--------	SM-SC, ML, CL, ML-CL	A-4, A-6	0-2	98-100	94-100	89-100	60-96	15-35	3-15
	3-8	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	89-100	85-100	85-100	65-98	40-59	23-42
	8-35	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	89-100	85-100	85-100	65-98	40-59	23-42
	35-44	Clay loam, sandy clay, clay.	CL, CH	A-6, A-7	0-5	90-100	85-100	75-100	53-90	30-60	15-40
	44-54	Stratified clay loam to shaly clay.	CH, CL	A-7	0-5	90-100	90-100	90-100	72-99	45-71	27-52
CsE-------------- Cuthbert	0-9	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0-1	85-100	78-100	75-98	20-55	<32	NP-7
	9-22	Sandy clay loam, sandy clay, clay.	SC, CL, CH	A-6, A-7-6	0-1	95-100	88-100	80-100	45-98	37-64	19-40
	22-32	Sandy clay loam, clay, clay loam, sandy clay.	SC, CL	A-6, A-7, A-2-6, A-2-7	0-1	89-100	85-100	80-100	28-84	29-45	11-26
	32-60	Stratified fine sandy loam to very shaly clay.	SC, CL, ML	A-6, A-7, A-2-6, A-2-7	0-3	89-100	85-100	80-100	28-84	29-45	7-26

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CuF:											
Cuthbert	0-9	Gravelly fine sandy loam.	SM, GM	A-1-B, A-2-4, A-4	0-5	60-88	50-80	35-75	20-49	<22	NP-7
	9-22	Sandy clay loam, sandy clay, clay.	SC, CL, CH	A-6, A-7-6	0-1	95-100	88-100	80-100	45-98	37-64	19-40
	22-36	Sandy clay loam, clay, shaly clay, clay loam.	SC, CL	A-6, A-7, A-2-6, A-2-7	0-1	89-100	85-100	80-100	28-84	29-45	11-26
	36-60	Stratified fine sandy loam to very shaly clay.	SC, CL, ML	A-6, A-7, A-2-6, A-2-7	0-3	89-100	85-100	80-100	28-84	29-45	7-26
Redsprings	0-10	Gravelly fine sandy loam.	SC, CL-ML, CL, SM-SC	A-2-4, A-4, A-2-7, A-2-6	0-5	80-95	65-80	60-80	25-55	20-42	4-20
	10-32	Gravelly clay, gravelly clay loam, clay loam, clay.	CL, CH	A-7-6	0-2	70-100	70-98	65-90	51-75	41-60	18-35
	32-44	Clay loam, clay	CL, CH	A-6, A-7-6	0-7	95-100	90-100	75-100	51-90	32-56	16-30
	44-60	Stratified sandy clay loam to very shaly clay.	SC, CL, CH	A-4, A-6, A-7-6	0-7	90-100	75-100	50-90	36-80	25-57	9-31
DaC: Darco	0-7	Loamy fine sand	SM	A-2-4	0-2	95-100	95-100	75-100	15-30	<27	NP-3
	7-58	Loamy fine sand, fine sand.	SM	A-2-4	0-2	95-100	95-100	75-100	15-30	<20	NP-3
	58-80	Sandy clay loam, fine sandy loam, loam.	SC, CL	A-6, A-7-6, A-2-4	0	95-100	95-100	80-100	23-55	25-45	9-28
DrA:											
Derly	0-14	Silt loam	ML, CL, CL-ML	A-4	0	100	100	85-100	55-90	<30	NP-10
	14-37	Clay loam, silty clay loam, clay.	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-60	20-36
	37-49	Clay, clay loam, silty clay loam.	CH	A-7	0	100	100	90-100	75-95	51-70	31-44
	49-80	Clay, silty clay	CH	A-7	0	100	100	90-100	75-95	56-70	33-44
Raino	0-21	Loam	ML, CL, CL-ML	A-4	0	95-100	95-100	80-100	51-80	<30	NP-10
	21-35	Loam, sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-6, A-4	0	95-100	95-100	80-100	40-72	20-40	5-20
	35-65	Clay, clay loam	CH, CL	A-7	0	95-100	95-100	80-100	40-72	20-40	5-20
	65-78	Sandy clay loam, clay loam, clay.	CH, CL	A-7	0	95-100	95-100	80-100	55-90	46-74	24-45
DuC: Duffern	0-8	Fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	80-100	5-15	<25	NP-4
	8-46	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	80-100	5-15	<25	NP-4
	46-95	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	80-100	5-20	<25	NP-4

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
DuE-------------- Duffern	0-7	Fine sand--------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	80-100	5-15	<25	NP-4
	7-39	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	80-100	5-15	<25	NP-4
	39-84	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	80-100	5-20	<25	NP-4
E1D3------------- Ellis	0-3	Clay-------------	CH	A-7-6	0-5	95-100	95-100	95-100	75-95	51-75	30-50
	3-38	Clay-------------	CH	A-7-6	0-5	95-100	95-100	95-100	75-95	51-75	30-50
	38-70	Shaly clay, very shaly clay, clay.	CH	A-7-6	0-5	95-100	95-100	90-100	75-95	51-75	30-50
ErC-------------- Elrose	0-7	Gravelly fine sandy loam.	SM, SM-SC	A-2-4, A-4	0-3	75-90	55-78	55-75	20-35	<25	NP-7
	7-71	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	90-100	85-97	80-95	36-65	20-38	8-20
	71-82	Fine sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2-4, A-4	0	90-100	80-90	60-85	25-48	<25	NP-10
Es--------------- Estes	0-8	Clay loam--------	CL	A-7-6, A-6	0	100	100	95-100	70-96	30-49	15-30
	8-63	Silty clay, clay, clay loam, silty clay loam.	CL, CH	A-7-6	0	100	100	95-100	75-100	41-60	25-40
	63-80	Silty clay loam, clay loam.	CL	A-7-6, A-6	0	100	100	95-100	65-95	30-46	15-30
FrB-------------- Freestone	0-11	Fine sandy loam	SM, SM-SC, CL-ML, ML	A-4	0	95-100	95-100	90-100	36-62	<26	NP-7
	11-27	Sandy clay loam, loam, clay loam.	CL, CL-ML	A-6, A-7, A-4	0	95-100	95-100	90-100	55-85	24-46	7-23
	27-73	Clay, clay loam	CL, CH	A-7	0	95-100	95-100	90-100	65-95	42-70	21-44
	73-85	Weathered bedrock	---	---	---	---	---	---	---	---	---
FuB:											
Freestone-------	0-11	Fine sandy loam	SM, SM-SC, CL-ML, ML	A-4	0	95-100	95-100	90-100	36-62	<26	NP-7
	11-27	Sandy clay loam, loam, clay loam.	CL, CL-ML	A-6, A-7, A-4	0	95-100	95-100	90-100	55-85	24-46	7-23
	27-73	Clay, clay loam	CL, CH	A-7	0	95-100	95-100	90-100	65-95	42-70	21-44
	73-85	Weathered bedrock	---	---	---	---	---	---	---	---	---
Urban land.											
Gw--------------- Gladewater	0-6	Clay-------------	CH, CL	A-7	0	100	100	90-100	80-95	48-75	25-50
	6-63	Clay, silty clay	CH	A-7	0	100	100	95-100	90-100	51-75	30-50
GyB, GyD--------- Grayrock	0-7	Silty clay loam	CL, CH	A-6, A-7	0-2	95-100	95-100	85-100	85-100	35-55	11-30
	7-80	Stratified loam to shaly silty clay loam.	CL, CH	A-6, A-7	0-2	95-100	95-100	85-100	85-100	35-55	11-30
Ho--------------- Hopco	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	80-99	35-45	15-22
	10-51	Silty clay loam, clay loam, clay, silty clay.	MH, ML	A-6, A-7	0	100	100	95-100	80-99	40-53	14-23
	51-80	Clay loam, silty clay loam, clay.	CL, ML, MH, CH	A-6, A-7-6	0	100	100	90-100	75-99	37-55	13-25

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Iu---------------- Iuka	0-12	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2	0	95-100	90-100	70-100	30-60	<20	NP-7
	12-42	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	95-100	85-100	65-100	36-75	<30	NP-7
	42-73	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2, A-4	0	95-100	90-100	70-100	25-60	<30	NP-7
Ka---------------- Kaufman	0-6	Clay-------------	CH	A-7	0	100	100	90-100	80-100	56-96	33-62
	6-12	Clay-------------	CH	A-7	0	100	100	95-100	90-100	65-102	45-71
	12-72	Clay-------------	CH	A-7	0	100	100	95-100	90-100	65-102	45-71
KfC-------------- Kirvin	0-14	Very fine sandy loam.	SM, ML, CL, SC	A-4	0-2	85-100	78-98	70-95	36-70	<30	NP-8
	14-42	Clay loam, clay	CL, CH	A-7	0-1	95-100	90-100	85-100	53-95	42-67	24-43
	42-72	Stratified sandy clay loam to very shaly clay.	SC, CL, CH	A-4, A-6, A-7	0-1	95-100	90-100	50-90	36-80	25-52	9-32
KgC-------------- Kirvin	0-9	Gravelly fine sandy loam.	SM, GM, SC, GM-GC	A-2-4, A-4	0-5	55-92	47-80	40-75	25-49	<30	NP-8
	9-40	Clay loam, clay	CL, CH	A-7	0-1	95-100	90-100	85-100	53-95	42-67	24-43
	40-45	Sandy clay loam, clay loam, clay.	CL, CH	A-6, A-7	0-1	95-100	90-100	75-100	51-90	32-59	16-32
	45-63	Stratified sandy clay loam to very shaly clay.	SC, CL, CH	A-4, A-6, A-7	0-1	95-100	90-100	50-90	36-80	25-52	9-32
KrC:											
Kirvin----------	0-14	Very fine sandy loam.	SM, ML, CL, SC	A-4	0-2	85-100	78-98	70-95	36-70	<30	NP-8
	14-42	Clay loam, clay	CL, CH	A-7	0-1	95-100	95-100	85-100	75-95	42-67	25-43
	42-72	Stratified sandy clay loam to very shaly clay.	SC, CL, CH	A-4, A-6, A-7	0-1	95-100	90-100	50-90	36-80	25-52	9-32
Urban land.											
KsC-------------- Kirvin	0-3	Clay loam--------	CL, CH	A-6, A-7	0-1	95-100	90-100	85-99	51-80	32-52	16-32
	3-39	Clay loam, clay	CL, CH	A-6, A-7	0-1	95-100	90-100	85-99	51-90	32-52	16-32
	39-70	Stratified sandy clay loam to very shaly clay.	SC, CL, CH	A-4, A-6, A-7	0-1	95-100	90-100	50-90	36-80	25-52	9-32
KtB-------------- Kullit	0-14	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	94-100	51-80	<28	NP-7
	14-33	Sandy clay loam, clay loam.	CL	A-4, A-6	0	100	98-100	90-100	55-85	25-40	8-21
	33-73	Sandy clay, clay	CL, CH	A-7-6	0	100	98-100	85-100	55-95	44-71	20-42
KuB:											
Kullit----------	0-14	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	94-100	51-80	<28	NP-7
	14-33	Sandy clay loam, clay loam.	CL	A-4, A-6	0	100	98-100	90-100	55-85	25-40	8-21
	33-73	Sandy clay, clay	CL, CH	A-7-6	0	100	98-100	85-100	55-95	44-71	20-42
Urban land.											

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
LbC------------ Lilbert	0-9	Loamy fine sand	SM	A-2-4, A-4	0	95-100	95-100	80-100	17-40	<20	NP-3
	9-26	Loamy fine sand	SM	A-2-4, A-4	0	95-100	95-100	80-100	17-40	<20	NP-3
	26-54	Sandy clay loam, loam, clay loam.	SC, CL	A-6, A-4	0	95-100	95-100	85-100	36-55	23-39	8-22
	54-80	Sandy clay loam, loam, clay loam.	SC, CL	A-6, A-4, A-2-4, A-2-6	0	90-100	90-100	85-100	30-55	22-39	8-20
Na------------- Nahatche	0-6	Loam, silty clay loam, silt loam, clay loam.	CL	A-6, A-7, A-4	0	100	100	90-100	54-92	25-47	8-25
	6-11	Loam, clay loam, silt loam, silty clay loam.	CL	A-6, A-4	0	100	100	85-100	60-90	25-40	8-20
	11-80	Stratified loam to silty clay loam.	CL	A-6, A-7	0	100	100	90-100	60-90	30-45	11-25
NoD2----------- Normangee	0-3	Gravelly clay loam.	CL, SC, GC	A-6, A-7	0-2	65-80	60-75	50-75	40-65	30-48	11-25
	3-49	Clay-----------	CL, CH	A-7	0	98-100	98-100	90-100	70-96	44-80	22-58
	49-62	Stratified shaly clay.	CL, CH	A-7	0	95-100	90-100	90-100	70-90	41-60	20-35
Ow. Oil-waste land											
PkC, PkE--------- Pickton	0-11	Fine sand--------	SM, SM-SC	A-2-4	0	100	95-100	85-100	13-30	<28	NP-7
	11-48	Loamy fine sand, fine sand.	SM, SM-SC	A-2-4	0	100	95-100	85-100	15-30	<28	NP-7
	48-80	Sandy clay loam, clay loam, fine sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-6, A-2-4	0	100	95-100	85-100	25-75	23-35	5-14
PuC: Pickton---------	0-11	Fine sand--------	SM, SM-SC	A-2-4	0	100	95-100	85-100	13-30	<28	NP-7
	11-48	Loamy fine sand, fine sand.	SM, SM-SC	A-2-4	0	100	95-100	85-100	15-30	<28	NP-7
	48-80	Sandy clay loam, clay loam, fine sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-6, A-2-4	0	100	95-100	85-100	25-75	23-35	5-14
Urban land.											
SaC------------ Sacul	0-8	Fine sandy loam, loam.	SM, ML	A-4	0	92-100	90-100	80-100	40-65	<20	NP-3
	8-42	Clay, silty clay	CH, CL	A-7	0	92-100	90-100	85-95	80-90	45-70	20-40
	42-60	Sandy clay loam, silt loam, clay loam.	CL, CH, SC	A-6, A-7, A-4	0	95-100	90-100	85-100	40-90	25-55	8-32
SaD------------ Sacul	0-4	Fine sandy loam	SM, ML	A-4	0	92-100	90-100	80-100	40-65	<20	NP-3
	4-33	Clay, silty clay	CH, CL	A-7	0	92-100	90-100	85-95	80-90	45-70	20-40
	33-60	Sandy clay loam, silt loam, clay loam.	CL, CH, SC	A-6, A-7, A-4	0	95-100	90-100	85-100	40-90	25-55	8-32

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
TaA:											
Talco	0-8	Silt loam	ML, CL-ML	A-4	0	98-100	95-100	90-100	80-100	<25	NP-7
	8-35	Silt loam, silty clay loam, clay loam.	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	80-100	20-39	5-21
	35-66	Silty clay, clay, clay loam, silty clay loam.	CH, CL	A-7	0	95-100	95-100	95-100	85-100	41-55	21-33
	66-80	Silty clay loam, silt loam, loam.	CL, CL-ML	A-4, A-6, A-7	0	95-100	95-100	90-100	80-100	25-45	6-23
Raino	0-21	Loam	ML, CL, CL-ML	A-4	0	95-100	95-100	80-100	51-80	<30	NP-10
	21-32	Loam, fine sandy loam, very fine sandy loam.	ML, CL, CL-ML	A-4	0	95-100	95-100	80-100	51-80	<30	NP-10
	32-65	Clay	CL, SC, SM-SC, CL-ML	A-6, A-4	0	95-100	95-100	80-100	40-72	20-40	5-20
	65-75	Clay, sandy clay, clay loam.	CH, CL	A-7	0	95-100	95-100	80-100	55-90	46-74	24-45
TeE: Tenaha	0-12	Loamy fine sand	SM	A-2-4, A-4	0	95-100	95-100	70-95	15-40	<25	NP-3
	12-26	Loamy fine sand	SM	A-2-4, A-4	0	95-100	95-100	70-95	15-40	<25	NP-3
	26-45	Sandy clay loam, clay loam, loam.	SC, CL	A-6, A-4, A-7-6	0	95-100	95-100	80-100	36-66	25-46	8-26
	45-75	Stratified fine sandy loam to very shaly clay.	SC, CL	A-6, A-7, A-2-6, A-2-7	0-3	89-100	85-100	80-100	28-60	25-45	11-26
Tx: Texark	0-17	Clay	CH	A-7-6, A-7-5	0	100	100	95-100	90-100	56-102	33-64
	17-60	Clay	CH	A-7-6, A-7-5	0	100	100	95-100	90-100	60-96	40-62
Ud, Uq. Udorthents											
Va: Varro	0-8	Clay loam	CL	A-6, A-7-6	0	100	100	85-100	65-85	30-45	10-25
	8-60	Clay loam, loam, silty clay loam, silt loam.	CL	A-6, A-7-6	0	100	100	90-100	70-90	30-45	12-25
WcA: Wilson	0-9	Silt loam	CL	A-6	0	95-100	85-100	80-100	60-96	26-38	11-20
	9-50	Silty clay, clay, clay loam, silty clay loam.	CL, CH	A-7-6	0	90-100	80-100	80-100	65-96	43-56	26-37
	50-65	Clay, shaly clay	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-96	38-65	24-48
WdC: Wolfpen	0-11	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-35	<25	NP-7
	11-25	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-35	<25	NP-7
	25-56	Sandy clay loam, clay loam.	SC, CL	A-6, A-4, A-2	0	95-100	95-100	85-100	26-55	25-40	8-20
	56-80	Sandy clay loam, clay loam.	SC, CL	A-4, A-6, A-2, A-7	0	95-100	95-100	85-100	25-55	25-45	8-27

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WeC:											
Wolfpen---------	0-11	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-35	<25	NP-7
	11-25	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-35	<25	NP-7
	25-56	Sandy clay loam, clay loam.	SC, CL	A-6, A-4, A-2	0	95-100	95-100	85-100	26-55	25-40	8-20
	56-80	Sandy clay loam, clay loam.	SC, CL	A-6, A-4, A-2	0	95-100	95-100	85-100	25-55	25-45	8-27
Urban land.											
WoC-------------- Woodtell	0-5	Fine sandy loam	CL, SM-SC, CL-ML, ML	A-4, A-6	0-2	95-100	90-100	75-100	40-75	20-33	3-13
	5-27	Clay, silty clay	CH	A-7-6	0	100	90-100	80-100	60-98	40-75	25-46
	27-48	Clay loam, clay, sandy clay loam.	CL, CH	A-6, A-7-6	0	100	80-100	75-100	51-98	35-65	15-45
	48-75	Stratified sandy clay loam to shaly clay.	CL, CH, SC	A-6, A-7-6	0	85-100	80-100	60-100	36-95	32-76	13-45
WoE-------------- Woodtell	0-6	Fine sandy loam	CL, SM-SC, CL-ML, ML	A-4, A-6	0-2	95-100	90-100	75-100	40-75	20-33	3-13
	6-26	Clay, silty clay	CH	A-7-6	0	100	90-100	80-100	60-98	40-75	25-46
	26-55	Clay loam, clay, sandy clay loam.	CL, CH	A-6, A-7-6	0	100	80-100	75-100	51-98	35-65	15-45
	55-72	Stratified sandy clay loam to shaly clay.	CL, CH, SC	A-6, A-7-6	0	85-100	80-100	60-100	36-95	32-76	13-45
WrB:											
Woodtell--------	0-12	Loam------------	CL, SM-SC, CL-ML, ML	A-4, A-6	0-2	95-100	90-100	75-100	40-75	20-33	3-13
	12-49	Clay, silty clay	CH	A-7-6	0	100	90-100	80-100	60-98	40-75	25-46
	49-60	Stratified sandy clay loam to shaly clay.	CL, CH, SC	A-6, A-7-6	0	85-100	80-100	60-100	36-95	32-76	13-45
Raino-----------	0-23	Loam------------	ML, CL, CL-ML	A-4	0	95-100	95-100	80-100	51-80	<30	NP-10
	23-32	Loam, fine sandy loam, very fine sandy loam.	CL, SC, SM-SC, CL-ML	A-6, A-4	0	95-100	95-100	80-100	40-72	20-40	5-20
	32-69	Clay------------	CH, CL	A-7	0	95-100	95-100	80-100	55-90	46-74	24-45
	69-80	Sandy clay loam, clay loam, clay, shaly clay.	CL, CH	A-7	0	95-100	80-100	80-100	55-90	41-60	18-35
WuC:											
Woodtell--------	0-5	Fine sandy loam	CL, SM-SC, CL-ML, ML	A-4, A-6	0-2	95-100	90-100	75-100	40-75	20-33	3-13
	5-27	Clay, silty clay	CH	A-7-6	0	100	90-100	80-100	60-98	40-75	25-46
	27-48	Clay loam, clay, sandy clay loam.	CL, CH	A-6, A-7-6	0	100	80-90	75-100	51-98	35-65	15-45
	48-75	Stratified sandy clay loam to shaly clay.	CL, CH, SC	A-6, A-7-6	0	85-100	80-100	60-100	36-95	32-76	13-45
Urban land.											

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH				Pct
AsA Ashford	0-3	40-50	1.35-1.55	0.06-0.2	0.14-0.18	5.1-6.5	High	0.32	5	.5-2
	3-51	60-75	1.40-1.60	<0.06	0.12-0.18	4.5-5.5	High	0.32		
	51-80	60-75	1.40-1.70	<0.06	0.12-0.18	5.1-5.5	High	0.32		
BaD Bazette	0-6	27-35	1.40-1.60	0.06-2.0	0.15-0.20	5.6-6.5	Low	0.37	3	1-3
	6-28	40-55	1.50-1.65	0.06-0.2	0.14-0.18	5.6-6.5	High	0.37		
	28-60	40-55	1.50-1.65	0.06-0.2	0.14-0.18	6.6-8.4	High	0.37		
BbB Bernaldo	0-17	5-15	1.30-1.50	2.0-6.0	0.11-0.15	5.1-6.5	Low	0.28	5	<1
	17-48	18-30	1.40-1.65	0.6-2.0	0.15-0.20	4.5-6.5	Moderate	0.32		
	48-80	10-30	1.50-1.70	0.6-2.0	0.15-0.20	4.5-6.0	Low	0.32		
BcB:										
Bernaldo	0-17	5-15	1.40-1.60	2.0-6.0	0.11-0.15	5.1-6.5	Low	0.28	5	<1
	17-48	18-30	1.50-1.70	0.6-2.0	0.15-0.20	4.5-6.5	Moderate	0.32		
	48-80	10-30	1.50-1.70	0.6-2.0	0.15-0.20	4.5-6.0	Low	0.32		
Urban land.										
BdB:										
Besner	0-31	5-15	1.20-1.40	2.0-6.0	0.11-0.15	4.5-6.5	Low	0.24	5	<1
	31-46	14-18	1.30-1.50	0.6-2.0	0.15-0.20	4.5-6.5	Low	0.32		
	46-86	15-30	1.30-1.50	0.6-2.0	0.15-0.20	4.5-6.5	Low	0.32		
Talco	0-15	7-20	1.35-1.60	0.6-2.0	0.14-0.22	5.6-7.3	Low	0.37	5	.5-3
	15-64	15-30	1.35-1.60	0.6-2.0	0.14-0.22	5.1-6.5	Low	0.32		
	64-73	15-35	1.40-1.65	0.2-0.6	0.14-0.22	6.1-7.3	Moderate	0.37		
BeB Bienville	0-21	5-10	1.35-1.60	2.0-6.0	0.08-0.11	5.1-6.5	Low	0.20	5	.5-2
	21-80	8-13	1.35-1.80	2.0-6.0	0.08-0.13	5.1-6.0	Low	0.20		
BoC Bowie	0-11	5-15	1.40-1.62	2.0-6.0	0.10-0.15	4.5-6.5	Low	0.32	5	<1
	11-38	18-35	1.60-1.75	0.6-2.0	0.11-0.18	4.5-5.5	Low	0.32		
	38-75	20-35	1.70-1.80	0.2-0.6	0.11-0.18	4.5-5.5	Low	0.32		
BuC:										
Bowie	0-11	5-15	1.40-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low	0.32	5	<1
	11-38	18-35	1.60-1.75	0.6-2.0	0.13-0.18	4.5-5.5	Low	0.32		
	38-75	20-35	1.70-1.80	0.2-0.6	0.13-0.18	4.5-5.5	Low	0.32		
Urban land.										
ByC Briley	0-8	5-12	1.50-1.65	6.0-20	0.07-0.11	5.1-6.5	Low	0.20	5	<2
	8-29	5-12	1.50-1.65	6.0-20	0.07-0.11	5.1-6.5	Low	0.20		
	29-80	15-35	1.55-1.69	0.6-2.0	0.13-0.17	5.1-6.0	Low	0.24		
CrA Crockett	0-13	5-20	1.50-1.60	0.6-2.0	0.11-0.20	5.6-7.3	Low	0.43	5	.5-2
	13-54	40-50	1.35-1.60	<0.06	0.14-0.18	5.6-7.3	High	0.32		
	54-80	35-50	1.50-1.70	<0.06	0.12-0.20	6.1-8.4	Moderate	0.32		
CrB Crockett	0-8	5-20	1.50-1.60	0.6-2.0	0.11-0.20	5.6-7.3	Low	0.43	5	.5-2
	8-18	40-50	1.35-1.60	<0.06	0.14-0.18	5.6-7.3	High	0.32		
	18-38	35-50	1.40-1.65	<0.06	0.15-0.18	6.1-6.5	High	0.32		
	38-60	35-50	1.50-1.70	<0.06	0.12-0.20	6.6-8.4	Moderate	0.32		
	60-80	30-50	1.50-1.70	<0.06	0.11-0.15	6.1-8.4	High	0.32		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
CrC3	0-3	5-20	1.50-1.60	0.6-2.0	0.11-0.20	5.6-7.3	Low	0.43	5	.5-2
Crockett	3-8	40-50	1.35-1.60	<0.06	0.14-0.18	5.6-7.3	High	0.32		
	8-35	35-50	1.40-1.65	<0.06	0.15-0.18	6.1-8.4	High	0.32		
	35-44	35-50	1.50-1.70	<0.06	0.12-0.20	6.1-8.4	Moderate	0.32		
	44-54	30-50	1.50-1.70	<0.06	0.11-0.15	6.1-8.4	High	0.32		
CsE	0-9	2-15	1.20-1.40	2.0-6.0	0.11-0.15	5.1-6.5	Low	0.37	3	<2
Cuthbert	9-22	35-55	1.24-1.45	0.2-0.6	0.10-0.15	4.5-5.5	Moderate	0.32		
	22-32	20-50	1.35-1.60	0.2-0.6	0.09-0.15	3.6-5.5	Moderate	0.32		
	32-60	18-45	1.40-1.65	0.06-0.6	0.08-0.15	3.6-5.5	Moderate	0.32		
CuF:										
Cuthbert	0-9	2-15	1.20-1.40	2.0-6.0	0.10-0.14	5.1-6.5	Low	0.20	3	<2
	9-22	35-55	1.24-1.45	0.2-0.6	0.10-0.15	4.5-5.5	Moderate	0.32		
	22-36	20-50	1.35-1.60	0.2-0.6	0.09-0.15	3.6-5.5	Moderate	0.32		
	36-60	20-45	1.40-1.65	0.06-0.6	0.08-0.15	3.6-5.5	Moderate	0.32		
Redsprings	0-10	2-15	1.25-1.45	0.6-2.0	0.10-0.14	5.6-7.3	Low	0.37	4	<2
	10-32	35-60	1.30-1.45	0.2-0.6	0.12-0.18	5.1-6.5	Moderate	0.32		
	32-44	27-55	1.30-1.50	0.2-0.6	0.12-0.17	4.5-6.0	Moderate	0.32		
	44-60	20-45	1.40-1.60	0.06-0.2	0.10-0.17	4.5-5.5	Moderate	0.32		
DaC	0-7	3-12	1.50-1.65	6.0-20	0.07-0.11	5.1-6.5	Low	0.17	5	<1
Darco	7-58	3-12	1.50-1.65	6.0-20	0.07-0.11	5.1-6.5	Low	0.17		
	58-80	15-35	1.55-1.75	0.6-2.0	0.12-0.17	3.6-6.5	Low	0.24		
DrA:										
Derly	0-14	8-20	1.40-1.60	0.6-2.0	0.13-0.24	4.5-6.0	Low	0.37	5	.5-2
	14-37	30-45	1.40-1.55	0.06-0.2	0.15-0.22	4.5-5.5	Moderate	0.37		
	37-49	35-60	1.45-1.60	<0.06	0.12-0.18	4.5-5.5	Very high	0.32		
	49-80	40-60	1.44-1.65	<0.06	0.12-0.18	5.6-7.3	Very high	0.32		
Raino	0-21	5-18	1.30-1.40	0.6-2.0	0.11-0.20	4.5-6.5	Low	0.43	5	<2
	21-35	5-18	1.35-1.55	0.6-2.0	0.11-0.20	4.5-6.5	Low	0.43		
	35-65	18-30	1.45-1.65	0.6-2.0	0.15-0.20	4.5-5.5	Moderate	0.43		
	65-78	35-60	1.45-1.65	<0.06	0.12-0.18	4.5-5.5	High	0.32		
DuC	0-8	2-8	1.35-1.50	6.0-20.0	0.05-0.09	5.6-6.5	Low	0.15	5	<1
Duffern	8-46	2-8	1.40-1.55	6.0-20.0	0.02-0.09	5.6-6.5	Low	0.15		
	46-95	5-10	1.45-1.60	6.0-20.0	0.05-0.09	5.6-6.5	Low	0.15		
DuE	0-7	2-8	1.35-1.50	6.0-20.0	0.05-0.09	5.6-6.5	Low	0.15	5	<1
Duffern	7-39	2-8	1.40-1.55	6.0-20.0	0.02-0.09	5.6-6.5	Low	0.15		
	39-84	5-10	1.45-1.60	6.0-20.0	0.05-0.09	5.6-6.5	Low	0.15		
ElD3	0-3	40-50	1.35-1.55	<0.06	0.12-0.18	6.1-7.3	High	0.32	3	1-3
Ellis	3-38	40-60	1.35-1.55	<0.06	0.12-0.18	6.1-8.4	High	0.32		
	38-70	40-60	1.40-1.65	<0.06	0.10-0.15	6.6-8.4	High	0.32		
ErC	0-7	5-12	1.25-1.40	2.0-6.0	0.07-0.12	5.1-6.5	Low	0.24	5	.5-2
Elrose	7-71	20-35	1.30-1.55	0.6-2.0	0.13-0.18	4.5-6.0	Low	0.32		
	71-82	5-25	1.35-1.65	2.0-6.0	0.10-0.16	4.5-6.0	Low	0.24		
Es	0-8	28-40	1.30-1.50	0.06-0.2	0.17-0.21	4.5-6.0	Moderate	0.32	5	2-5
Estes	8-63	35-55	1.50-1.65	<0.06	0.13-0.17	3.6-5.5	High	0.32		
	63-80	25-40	1.45-1.65	0.06-0.2	0.15-0.20	4.5-5.5	Moderate	0.32		
FrB	0-11	5-15	1.35-1.56	2.0-6.0	0.11-0.15	5.1-6.5	Low	0.32	5	.5-2
Freestone	11-27	20-35	1.35-1.55	0.2-0.6	0.12-0.17	4.5-6.5	Moderate	0.32		
	27-73	35-50	1.29-1.60	0.06-0.2	0.12-0.18	4.5-6.5	High	0.32		
	73-85	---	---	---	---	---	---	---		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH				Pct
FuB:										
Freestone-------	0-11	5-15	1.35-1.56	2.0-6.0	0.11-0.15	5.1-6.5	Low----------	0.32	5	.5-2
	11-27	20-35	1.35-1.55	0.2-0.6	0.12-0.17	4.5-6.5	Moderate-----	0.32		
	27-73	35-50	1.29-1.60	0.06-0.2	0.12-0.18	4.5-6.5	High---------	0.32		
	73-85	---	---	---	---	---	-------------	----		
Urban land.										
Gw--------------- Gladewater	0-6	40-60	1.35-1.55	0.06-0.2	0.15-0.20	5.6-7.3	High---------	0.32	5	1-3
	6-63	40-60	1.40-1.60	<0.06	0.15-0.18	4.5-7.8	High---------	0.32		
GyB, GyD--------- Grayrock	0-7	27-35	1.30-1.50	0.06-0.2	0.14-0.19	5.6-7.8	Moderate-----	0.37	5	1-3
	7-80	20-35	1.35-1.55	0.06-0.2	0.10-0.18	5.6-7.8	Moderate-----	0.37		
Ho--------------- Hopco	0-10	20-35	1.35-1.50	0.2-0.6	0.16-0.22	6.6-8.4	Moderate-----	0.37	5	1-4
	10-51	27-42	1.35-1.50	0.2-0.6	0.16-0.22	6.6-8.4	Moderate-----	0.37		
	51-80	27-42	1.35-1.55	0.2-0.6	0.15-0.20	6.6-8.4	Moderate-----	0.37		
Iu--------------- Iuka	0-12	6-15	1.20-1.50	2.0-6.0	0.10-0.15	5.1-6.5	Low----------	0.24	5	.5-2
	12-42	10-18	1.30-1.60	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.28		
	42-73	5-15	1.30-1.60	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.20		
Ka--------------- Kaufman	0-6	50-86	1.40-1.50	<0.06	0.15-0.20	6.1-8.4	Very high----	0.32	5	1-4
	6-12	60-86	1.40-1.50	<0.06	0.15-0.18	6.1-8.4	Very high----	0.32		
	12-72	60-86	1.40-1.60	<0.06	0.15-0.18	6.1-8.4	Very high----	0.32		
KfC-------------- Kirvin	0-14	5-15	1.20-1.40	2.0-6.0	0.11-0.16	5.1-7.3	Low----------	0.37	4	<2
	14-42	35-60	1.24-1.45	0.2-0.6	0.10-0.15	3.6-5.5	Moderate-----	0.32		
	42-72	20-45	1.40-1.65	0.06-0.2	0.08-0.16	3.6-5.0	Moderate-----	0.32		
KgC-------------- Kirvin	0-9	5-15	1.20-1.40	2.0-6.0	0.08-0.12	5.1-7.3	Low----------	0.20	4	<2
	9-40	35-60	1.24-1.45	0.2-0.6	0.10-0.15	3.6-5.5	Moderate-----	0.32		
	40-45	25-50	1.35-1.60	0.2-0.6	0.10-0.16	3.6-5.0	Moderate-----	0.32		
	45-63	20-45	1.40-1.65	0.06-0.2	0.08-0.16	3.6-5.0	Moderate-----	0.32		
KrC:										
Kirvin-----------	0-14	5-15	1.20-1.40	2.0-6.0	0.11-0.16	5.1-7.3	Low----------	0.37	4	<2
	14-42	35-60	1.24-1.45	0.2-0.6	0.10-0.15	3.6-5.5	Moderate-----	0.32		
	42-72	20-45	1.40-1.65	0.06-0.2	0.08-0.16	3.6-5.0	Moderate-----	0.32		
Urban land.										
KsC-------------- Kirvin	0-3	20-40	1.20-1.40	0.2-0.6	0.12-0.17	5.1-7.3	Moderate-----	0.32	4	<1
	3-39	35-50	1.30-1.50	0.2-0.6	0.12-0.17	3.6-5.0	Moderate-----	0.32		
	39-70	20-45	1.40-1.60	0.06-0.2	0.10-0.17	3.6-5.0	Moderate-----	0.32		
KtB-------------- Kullit	0-14	10-18	1.30-1.60	0.6-2.0	0.13-0.20	5.1-6.5	Low----------	0.37	5	<1
	14-33	20-35	1.35-1.60	0.6-2.0	0.11-0.15	4.5-5.5	Low----------	0.28		
	33-73	35-50	1.35-1.65	0.2-0.6	0.11-0.15	4.5-5.5	Moderate-----	0.28		
KuB:										
Kullit-----------	0-14	10-18	1.30-1.60	0.6-2.0	0.13-0.20	5.1-6.5	Low----------	0.37	5	<1
	14-33	20-35	1.35-1.60	0.6-2.0	0.11-0.15	4.5-5.5	Low----------	0.28		
	33-73	35-50	1.35-1.65	0.2-0.6	0.11-0.15	4.5-5.5	Moderate-----	0.28		
Urban land.										
LbC-------------- Lilbert	0-9	3-12	1.50-1.60	6.0-20	0.07-0.12	5.1-6.5	Low----------	0.20	5	<2
	9-26	3-12	1.50-1.65	6.0-20	0.07-0.11	4.5-6.0	Low----------	0.20		
	26-54	24-35	1.55-1.69	0.6-2.0	0.13-0.17	4.5-6.0	Low----------	0.24		
	54-80	20-35	1.60-1.75	0.2-0.6	0.10-0.15	4.5-6.0	Low----------	0.24		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH				Pct
Na------------ Nahatche	0-6	18-35	1.10-1.30	0.6-2.0	0.15-0.20	5.6-7.8	Moderate-----	0.28	5	1-3
	6-11	18-35	1.20-1.50	0.6-2.0	0.10-0.15	5.1-7.8	Moderate-----	0.28		
	11-80	18-35	1.30-1.60	0.6-2.0	0.10-0.15	5.1-7.8	Moderate-----	0.28		
NoD2---------- Normangee	0-3	27-35	1.50-1.60	0.06-0.2	0.10-0.14	5.6-7.3	Low----------	0.28	4	.5-2
	3-49	38-50	1.55-1.65	<0.06	0.12-0.18	5.6-8.4	High---------	0.32		
	49-62	40-50	1.60-1.70	<0.06	0.12-0.18	6.1-8.4	High---------	0.32		
Ow. Oil-waste land										
PkC, PkE--------- Pickton	0-11	3-8	1.30-1.60	6.0-20	0.07-0.10	5.6-6.5	Low----------	0.15	5	.5-2
	11-48	3-12	1.30-1.60	6.0-20	0.07-0.11	5.6-6.5	Low----------	0.17		
	48-80	18-30	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24		
PuC:										
Pickton---------	0-11	3-8	1.30-1.60	6.0-20	0.07-0.10	5.6-6.5	Low----------	0.15	5	.5-2
	11-48	3-12	1.30-1.60	6.0-20	0.07-0.11	5.6-6.5	Low----------	0.17		
	48-80	18-30	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24		
Urban land.										
SaC------------- Sacul	0-8	5-15	1.30-1.50	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.32	5	1-3
	8-42	40-60	1.20-1.35	0.06-0.2	0.12-0.18	4.5-5.5	High---------	0.32		
	42-60	20-40	1.25-1.45	0.2-0.6	0.16-0.24	4.5-5.5	Moderate-----	0.37		
SaD------------- Sacul	0-4	5-15	1.30-1.50	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.32	5	1-3
	4-33	40-60	1.20-1.35	0.06-0.2	0.12-0.18	4.5-5.5	High---------	0.32		
	33-60	20-40	1.25-1.45	0.2-0.6	0.16-0.24	4.5-5.5	Moderate-----	0.37		
TaA:										
Talco-----------	0-8	7-20	1.35-1.60	0.6-2.0	0.14-0.22	4.5-7.3	Low----------	0.37	5	.5-3
	8-35	20-30	1.35-1.60	0.6-2.0	0.14-0.22	4.5-5.5	Low----------	0.32		
	35-66	27-50	1.20-1.50	0.06-0.2	0.16-0.24	4.5-5.5	High---------	0.32		
	66-80	15-35	1.40-1.65	0.2-0.6	0.14-0.22	4.5-5.5	Moderate-----	0.37		
Raino-----------	0-21	5-18	1.30-1.40	0.6-2.0	0.11-0.20	4.5-6.5	Low----------	0.43	5	<2
	21-32	5-18	1.35-1.55	0.6-2.0	0.11-0.20	4.5-6.5	Low----------	0.43		
	32-65	18-30	1.45-1.65	0.6-2.0	0.15-0.20	4.5-5.5	Moderate-----	0.43		
	65-75	40-60	1.45-1.65	<0.06	0.12-0.18	4.5-6.5	High---------	0.32		
TeE------------- Tenaha	0-12	3-15	1.50-1.65	6.0-20	0.07-0.11	5.1-6.0	Low----------	0.17	3	<1
	12-26	3-15	1.50-1.65	6.0-20	0.07-0.11	5.1-6.0	Low----------	0.24		
	26-45	22-35	1.50-1.65	0.6-2.0	0.12-0.17	4.5-5.5	Low----------	0.24		
	45-75	10-30	1.60-1.75	0.2-0.6	0.08-0.14	4.5-5.5	Low----------	0.24		
Tx-------------- Texark	0-17	45-75	1.30-1.40	<0.06	0.15-0.18	6.6-7.8	High---------	0.32	5	1-4
	17-60	60-80	1.35-1.45	<0.06	0.12-0.18	4.5-7.3	High---------	0.32		
Ud, Ug. Udorthents										
Va-------------- Varro	0-8	27-35	1.20-1.40	0.6-2.0	0.15-0.20	7.4-8.4	Moderate-----	0.28	5	<2
	8-60	18-35	1.25-1.50	0.6-2.0	0.15-0.20	7.4-8.4	Moderate-----	0.28		
WcA------------- Wilson	0-9	18-27	1.40-1.65	0.2-0.6	0.15-0.20	5.6-7.3	Low----------	0.43	5	.5-2
	9-50	35-50	1.50-1.70	<0.06	0.14-0.20	5.6-7.8	High---------	0.37		
	50-65	40-60	1.50-1.70	<0.06	0.12-0.15	6.6-7.8	High---------	0.37		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH				Pct
WdC--------------	0-11	3-12	1.30-1.60	6.0-20.0	0.07-0.11	4.5-6.5	Low----------	0.17	5	.5-2
Wolfpen	11-25	3-12	1.30-1.65	6.0-20.0	0.07-0.11	4.5-6.5	Low----------	0.17		
	25-56	20-30	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24		
	56-80	20-35	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24		
WeC:										
Wolfpen---------	0-11	3-12	1.30-1.60	6.0-20.0	0.07-0.11	4.5-6.5	Low----------	0.17	5	.5-2
	11-25	3-12	1.30-1.65	6.0-20.0	0.07-0.11	4.5-6.5	Low----------	0.17		
	25-56	20-30	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24		
	56-80	20-35	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24		
Urban land.										
WoC--------------	0-5	5-20	1.20-1.40	0.6-2.0	0.10-0.15	4.5-6.5	Low----------	0.43	4	<1
Woodtell	5-27	40-60	1.30-1.50	<0.06	0.12-0.18	4.5-5.5	High---------	0.32		
	27-48	30-50	1.30-1.50	0.06-0.2	0.12-0.20	4.5-6.0	High---------	0.32		
	48-75	20-50	1.35-1.65	0.06-0.2	0.10-0.15	4.5-7.3	High---------	0.32		
WoE--------------	0-6	5-20	1.20-1.40	0.6-2.0	0.10-0.15	4.5-6.5	Low----------	0.43	4	<1
Woodtell	6-26	40-60	1.30-1.50	<0.06	0.12-0.18	4.5-5.5	High---------	0.32		
	26-55	30-50	1.30-1.50	0.06-0.2	0.12-0.20	4.5-6.0	High---------	0.32		
	55-72	20-50	1.35-1.65	0.06-0.2	0.10-0.15	4.5-7.3	High---------	0.32		
WrB:										
Woodtell--------	0-12	5-20	1.20-1.40	0.6-2.0	0.10-0.15	4.5-6.5	Low----------	0.43	4	<1
	12-49	40-60	1.30-1.50	<0.06	0.12-0.18	4.5-5.5	High---------	0.32		
	49-60	20-50	1.35-1.65	0.06-0.2	0.10-0.15	4.5-7.3	High---------	0.32		
Raino-----------	0-23	5-18	1.30-1.40	0.6-2.0	0.11-0.20	4.5-6.5	Low----------	0.43	5	<2
	23-32	18-30	1.45-1.65	0.6-2.0	0.15-0.20	4.5-5.5	Moderate-----	0.43		
	32-69	40-60	1.45-1.65	<0.06	0.12-0.18	4.5-5.5	High---------	0.32		
	69-80	25-50	1.50-1.70	0.06-0.2	0.12-0.18	4.5-7.3	High---------	0.32		
WuC:										
Woodtell--------	0-5	5-20	1.20-1.40	0.6-2.0	0.10-0.15	4.5-6.5	Low----------	0.43	4	<1
	5-27	40-60	1.30-1.50	<0.06	0.12-0.18	4.5-5.5	High---------	0.32		
	27-48	30-50	1.30-1.50	0.06-0.2	0.12-0.20	4.5-6.0	High---------	0.32		
	48-75	20-50	1.35-1.65	0.06-0.2	0.10-0.15	4.5-7.3	High---------	0.32		
Urban land.										

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Map symbol and soil name	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Concrete
					Ft				
AsA---------------- Ashford	D	None---------	---	---	+0.-1.0	Perched	Dec-Apr	High------	High.
BaD---------------- Bazette	C	None---------	---	---	>6.0	---	---	High------	Low.
BbB---------------- Bernaldo	B	None---------	---	---	4.0-6.0	Apparent	Nov-Feb	Moderate	Moderate.
BcB: Bernaldo----------	B	None---------	---	---	4.0-6.0	Apparent	Nov-Feb	Moderate	Moderate.
Urban land.									
BdB: Besner------------	B	None---------	---	---	4.0-6.0	Apparent	Jan-Feb	Low-------	Moderate.
Talco-------------	D	None---------	---	---	+1-2.5	Perched	Dec-May	High------	Moderate.
BeB---------------- Bienville	A	None---------	---	---	4.0-6.0	Apparent	Dec-Apr	Low-------	Moderate.
BoC---------------- Bowie	B	None---------	---	---	3.5-5.0	Apparent	Jan-Apr	Moderate	High.
BuC: Bowie-------------	B	None---------	---	---	>6.0	---	---	Moderate	High.
Urban land.									
ByC---------------- Briley	B	None---------	---	---	>6.0	---	---	Moderate	High.
CrA, CrB, CrC3----- Crockett	D	None---------	---	---	>6.0	---	---	High------	Low.
CsE---------------- Cuthbert	C	None---------	---	---	>6.0	---	---	High------	High.
CuF: Cuthbert----------	C	None---------	---	---	>6.0	---	---	High------	High.
Redsprings--------	B	None---------	---	---	>6.0	---	---	High------	High.
DaC---------------- Darco	A	None---------	---	---	>6.0	---	---	Low-------	Moderate.
DrA: Derly-------------	D	None---------	---	---	0-1.5	Perched	Oct-May	High------	High.
Raino-------------	D	None---------	---	---	2.0-3.5	Perched	Dec-May	High------	Moderate.
DuC, DuE----------- Duffern	A	None---------	---	---	>6.0	---	---	Low-------	Moderate.
ElD3--------------- Ellis	D	None---------	---	---	>6.0	---	---	High------	Low.

TABLE 16.--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				
ErC--------------- Elrose	B	None---------	---	---	>6.0	---	---	Moderate	Moderate.
Es---------------- Estes	D	Frequent----	Brief to long.	Nov-May	+.5-2.0	Perched	Nov-May	High-----	High.
FrB--------------- Freestone	C	None---------	---	---	1.5-3.0	Perched	Dec-May	High-----	Moderate.
FuB:									
Freestone--------	C	None---------	---	---	1.5-3.0	Perched	Dec-May	High-----	Moderate.
Urban land.									
Gw---------------- Gladewater	D	Frequent----	Brief to long.	Nov-May	0-3.5	Apparent	Nov-May	High-----	Moderate.
GyB, GyD---------- Grayrock	C	None---------	---	---	>6.0	---	---	Moderate	Moderate.
Ho---------------- Hopco	C	Occasional	Brief-----	Dec-May	2.0-4.0	Apparent	Dec-May	High-----	Low.
Iu---------------- Iuka	C	Frequent----	Very brief to brief.	Dec-Apr	1.0-3.0	Apparent	Dec-Apr	Moderate	High.
Ka---------------- Kaufman	D	Frequent----	Long------	Dec-May	1.5-4.0	Apparent	Nov-May	High-----	Low.
KfC, KgC---------- Kirvin	C	None---------	---	---	>6.0	---	---	High-----	High.
KrC:									
Kirvin-----------	C	None---------	---	---	>6.0	---	---	High-----	High.
Urban land.									
KsC--------------- Kirvin	D	None---------	---	---	>6.0	---	---	High-----	High.
KtB--------------- Kullit	B	None---------	---	---	2.0-3.0	Apparent	Dec-May	High-----	High.
KuB:									
Kullit-----------	B	None---------	---	---	2.0-3.0	Apparent	Dec-May	High-----	High.
Urban land.									
LbC--------------- Lilbert	B	None---------	---	---	>6.0	---	---	Moderate	High.
Na---------------- Nahatche	C	Frequent----	Brief to long.	Nov-May	0.5-1.5	Apparent	Nov-May	High-----	Moderate.
NoD2-------------- Normangee	D	None---------	---	---	>6.0	---	---	High-----	Low.
Ow. Oil-waste land									
PkC, PkE---------- Pickton	A	None---------	---	---	4.0-6.0	Apparent	Jan-Mar	Moderate	High.

TABLE 16.--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				
PuC:									
Pickton----------	A	None--------	---	---	4.0-6.0	Apparent	Jan-Mar	Moderate	High.
Urban land.									
SaC, SaD---------- Sacul	C	None--------	---	---	2.0-4.0	Apparent	Dec-Apr	High-----	Moderate.
TaA:									
Talco------------	D	None--------	---	---	+1-2.5	Perched	Dec-May	High-----	Moderate.
Raino------------	D	None--------	---	---	2.0-3.5	Perched	Dec-May	High-----	Moderate.
TeE--------------- Tenaha	B	None--------	---	---	>6.0	---	---	Moderate	Moderate.
Tx---------------- Texark	D	Frequent----	Long------	Dec-Jun	0-2.5	Apparent	Dec-May	High-----	Low.
Ud, Ug. Udorthents									
Va---------------- Varro	B	Frequent----	Very brief to brief.	Jan-May	5.0-6.0	Apparent	Jan-Jun	Moderate	Low.
WcA--------------- Wilson	D	None--------	---	---	0.5-1.5	Perched	Nov-Mar	High-----	High.
WdC--------------- Wolfpen	A	None--------	---	---	4.0-6.0	Apparent	Dec-May	Moderate	High.
WeC:									
Wolfpen----------	A	None--------	---	---	4.0-6.0	Apparent	Dec-May	Moderate	High.
Urban land.									
WoC--------------- Woodtell	D	None--------	---	---	>6.0	---	---	High-----	High.
WoE--------------- Woodtell	D	None--------	---	---	>6.0	---	---	High-----	High.
WrB:									
Woodtell---------	D	None--------	---	---	>6.0	---	---	High-----	High.
Raino------------	D	None--------	---	---	2.0-3.5	Perched	Dec-May	High-----	Moderate.
WuC:									
Woodtell---------	D	None--------	---	---	>6.0	---	---	High-----	High.
Urban land.									

TABLE 17.--PHYSICAL ANALYSIS OF SELECTED SOILS

[A dash indicates material was not detected]

Soil name and sample number	Depth	Horizon	Particle-size distribution (percent less than 2 mm): Sand: Very coarse (2-1)	Coarse (1-0.5)	Medium (0.5-0.25)	Fine (0.25-0.10)	Very fine (0.10-0.05)	Total (2-0.05)	Silt (0.05-0.002)	Clay (<0.002)	COLE	Bulk density (1/3 bar)	Water content: 1/3 bar	15 bar
	In		mm	mm	mm	mm	mm	mm	mm	mm		G/cc	Pct (wt)	
Estes: 1/ 2/														
S81TX-449-1	8-19	Bg1	0.2	1.6	2.5	5.3	4.7	14.3	38.7	47.0	---	---	---	17.5
	19-49	Bg2	0.2	1.2	2.3	5.1	4.4	13.2	34.8	52.0	---	---	---	18.8
Freestone: 1/ 3/														
S82TX-449-1	0-5	Ap	0.2	0.4	0.9	27.6	21.4	50.5	43.2	6.3	0.02	1.56	---	20.3
	5-11	E	0.3	0.4	0.9	25.8	20.1	47.5	42.2	10.3	0.02	1.54	---	15.1
	11-19	Bt	0.1	0.3	0.6	21.4	18.0	40.4	37.4	22.2	0.03	1.49	---	20.7
	19-27	Bt/E1	0.4	0.2	0.6	20.7	17.4	39.3	34.0	26.7	0.03	1.52	---	21.2
	27-39	Bt/E2	0.5	0.3	0.4	11.2	8.4	20.8	21.7	57.5	0.12	1.29	---	36.9
	39-50	2Bt1	0.1	0.1	0.4	13.4	8.3	22.3	25.9	51.8	0.11	1.34	---	33.9
	50-63	2Bt2	0.1	0.1	0.8	21.8	9.7	32.5	25.0	42.5	0.06	1.42	---	28.6
	63-73	2BC	0.0	0.1	0.2	5.3	4.5	10.1	37.4	52.5	0.11	1.30	---	36.9
	73-85	2C	0.1	0.1	1.3	43.8	12.0	57.3	16.7	26.0	0.03	1.44	---	26.0
Grayrock: 1/ 2/														
S80TX-449-1	0-7	Ap	0.2	0.2	0.3	0.7	5.5	6.9	59.2	33.9	0.04	1.32	26.3	14.5
	7-15	C1 4/	0.2	0.1	0.4	0.7	4.1	5.5	60.0	34.5	0.05	1.37	28.6	16.0
	15-28	C1 4/	0.1	0.2	0.3	0.6	3.4	4.6	62.1	33.3	0.04	1.40	24.4	15.7
	28-37	C2	0.5	1.9	2.7	2.9	7.4	15.4	63.1	21.5	---	1.50	---	18.4
	37-60	C3 4/	0.1	0.1	0.1	0.4	5.0	5.7	60.8	33.5	0.04	1.54	23.1	15.8
	60-80	C3 4/	0.1	0.2	0.2	0.4	4.8	5.7	63.9	30.4	---	1.50	---	15.8
Talco: 1/ 3/														
S82TX-449-3	0-3	A	0.1	0.1	0.1	8.1	20.9	29.3	60.1	10.6	---	---	---	---
	3-8	E/B	0.1	0.1	0.1	8.1	20.0	28.4	57.9	13.7	0.02	1.58	18.0	---
	8-13	Bt/E	0.3	0.1	0.1	7.1	17.7	25.3	54.7	20.0	0.03	1.56	20.0	---
	13-22	Btg/E1	0.2	0.1	0.1	6.6	16.8	23.8	54.1	22.1	0.03	1.39	24.8	---
	22-35	Btg/E2	0.2	0.1	0.1	6.6	17.4	24.4	54.1	21.5	0.04	1.38	30.0	---
	35-49	Btg1	0.3	0.1	0.1	5.5	12.8	18.4	40.0	41.6	0.10	1.24	40.8	---
	49-66	Btg2	0.1	0.1	0.1	5.3	14.8	20.4	41.3	38.3	0.09	1.42	31.2	---
	66-80	Btg3	0.0	0.1	0.1	7.6	21.2	29.0	41.1	29.9	0.07	1.52	26.5	---
Woodtell: 3/ 5/ 6/														
S82TX-449-2	0-2	A	0.2	0.3	0.5	14.2	21.8	37.0	54.9	8.1	---	---	---	---
	2-6	E	2.1	0.7	0.5	19.4	28.4	51.1	40.6	8.3	0.01	1.55	---	15.5
	6-11	Bt1	0.1	0.1	0.2	6.3	11.7	18.4	25.6	56.0	0.08	1.26	---	33.4
	11-17	Bt2	0.2	0.1	0.1	5.8	10.9	17.1	25.9	57.0	0.09	1.28	---	32.7
	17-22	Bt3	0.0	0.0	0.1	4.5	10.6	15.2	31.5	53.3	0.08	1.32	---	31.2
	22-30	Bt4	0.0	0.1	0.1	5.7	13.0	18.9	34.3	46.8	0.07	1.37	---	28.1
	30-41	Bt5	0.1	0.1	0.2	6.4	13.5	20.3	35.2	44.5	0.09	1.32	---	32.5
	41-47	BC	0.1	0.1	0.2	8.2	13.3	21.9	37.0	41.1	0.07	1.36	---	30.4
	47-53	CB	0.0	0.1	0.2	5.8	15.3	21.4	39.4	39.2	0.07	1.37	---	29.7
	53-64	C1	0.2	0.3	0.3	6.1	25.0	31.9	36.3	31.8	0.06	1.34	---	28.1
	64-80	C2	0.0	0.0	0.1	10.4	15.1	25.6	37.6	36.8	0.06	1.39	---	27.6

TABLE 17.--PHYSICAL ANALYSIS OF SELECTED SOILS--Continued

1/ See the section "Soil Series and Their Morphology" for pedon location. This is the typical pedon for the soil series in this survey area.

2/ Analysis by the National Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska.

3/ Analysis by the Texas A&M University Soil Characterization Laboratory, College Station, Texas.

4/ The horizon was divided for sampling purposes.

5/ Pedon location of Woodtell soil: from Loop 271 in Mt. Pleasant, 5.6 miles west on Old Paris Road, 50 feet north, in woodland.

6/ This pedon is a taxadjunct to the series because the COLE is slightly less than required for a Vertic subgroup.

TABLE 18.--CHEMICAL ANAYLSIS OF SELECTED SOILS

[A dash indicates material was not detected. T indicates trace]

Soil name and sample number	Depth	Horizon	Extractable bases					Extractable acidity	Cation-exchange capacity	Base saturation (sum)	Organic carbon	pH		ESP	SAR	Electrical conductivity	Aluminum
			Ca	Mg	Na	K	Sum					H_2O (1:1)	$CaCl_2$ 0.1m (1:2)				
	In		-----Milliequivalents/100 grams of soil----							Pct	Pct			Pct	Pct	Mmhos/cm	meq/100g
Estes: 1/ 2/ S81TX-449-1																	
	8-19	Bg1	---	---	---	---	---	---	---	---	0.59	4.5	4.3	---	4	2.4	---
	19-49	Bg2	---	---	---	---	---	---	---	---	0.48	4.3	4.2	---	5	3.4	---
Freestone: 1/ 3/ S82TX-449-1																	
	0-5	Ap	4.9	0.7	0.0	0.3	5.9	---	6.3	94	2.37	6.0	---	0	---	---	---
	5-11	E	3.1	0.4	0.0	0.2	3.7	---	4.5	82	0.30	6.2	---	0	---	---	---
	11-19	Bt	5.2	1.5	0.1	0.3	7.1	---	8.4	84	0.29	6.2	---	1	---	---	---
	19-27	Bt/E1	3.8	3.0	0.2	0.2	7.2	---	9.1	79	0.23	5.7	---	2	---	---	---
	27-39	Bt/E2	4.7	8.7	0.6	0.4	14.4	---	24.9	58	0.24	4.7	---	3	---	---	5.6
	39-50	2Bt1	5.3	9.9	0.7	0.4	16.3	---	24.4	67	0.17	4.7	---	3	---	---	4.1
	50-63	2Bt2	5.0	9.5	0.8	0.3	15.6	---	20.3	77	0.16	4.9	---	4	---	---	2.6
	63-73	2BC	8.5	15.1	1.4	0.4	25.4	---	28.2	90	0.15	4.8	---	5	---	---	1.8
	73-85	2C	4.3	7.5	0.8	0.2	12.8	---	14.2	91	0.11	4.8	---	6	---	---	0.6
Grayrock: 1/ 2/ S80TX-449-1																	
	0-7	Ap	16.2	7.9	0.1	0.5	24.7	6.0	30.7	80	2.25	6.6	6.5	T	T	1.9	---
	7-15	C1 4/	17.0	7.9	0.3	0.4	25.6	7.3	32.9	78	4.16	6.2	6.1	1	1	2.1	---
	15-28	C1 4/	18.3	9.2	0.8	0.5	28.8	4.6	33.4	86	2.48	7.1	6.8	2	2	2.7	---
	28-37	C2	29.9	10.4	1.2	0.3	41.8	12.9	54.7	76	5.89	5.7	5.6	2	2	3.4	---
	37-60	C3 4/	16.9	8.4	0.9	0.3	26.7	3.5	30.2	88	1.97	7.4	7.2	3	2	2.8	---
	60-80	C3 4/	16.7	8.8	1.0	0.5	27.0	3.2	30.2	89	1.53	7.4	7.3	3	2	3.5	---
Talco: 1/ 3/ S82TX-449-3																	
	0-3	A	7.3	0.6	0.1	0.2	8.2	---	7.7	---	1.35	6.6	---	1	---	---	---
	3-8	E/B	2.7	0.6	0.1	0.1	3.5	---	6.8	---	0.50	5.2	---	---	---	---	0.6
	8-13	Bt/E	2.1	1.1	0.1	0.1	3.5	---	8.9	39	0.26	4.9	---	1	---	---	3.1
	13-22	Btg/E1	1.1	1.2	0.1	0.1	2.5	---	10.0	26	0.21	4.8	---	1	---	---	4.0
	22-35	Btg/E2	0.9	1.0	0.2	0.1	2.2	---	9.9	23	0.18	4.9	---	2	---	---	4.0
	35-49	Btg1	2.3	3.3	1.4	0.2	7.2	---	22.0	33	0.24	4.9	---	6	---	---	9.4
	49-66	Btg2	3.2	3.9	1.8	0.3	9.2	---	19.8	47	0.20	4.8	---	9	---	---	7.9
	66-80	Btg3	3.9	4.5	1.9	0.2	10.5	---	18.9	55	0.11	4.7	---	10	---	---	6.0
Woodtell: 3/ 5/ S82TX-449-2																	
	0-2	A	17.5	2.9	0.1	0.5	21.0	---	29.0	73	10.45	5.0	---	0	---	---	0.1
	2-6	E	0.5	0.4	0.1	0.1	1.1	---	5.2	21	0.73	4.2	---	2	---	---	2.2
	6-11	Bt1	1.3	7.0	0.2	0.4	8.9	---	27.3	33	0.64	4.5	---	1	---	---	14.8
	11-17	Bt2	1.1	7.2	0.2	0.4	8.9	---	28.4	31	0.50	4.6	---	1	---	---	17.1
	17-22	Bt3	0.9	7.0	0.3	0.4	8.6	---	29.7	29	0.30	4.7	---	1	---	---	17.9
	22-30	Bt4	0.7	7.3	0.5	0.4	9.0	---	27.4	33	0.26	4.8	---	2	---	---	16.3
	30-41	Bt5	1.3	8.7	0.7	0.4	11.1	---	26.9	41	0.20	4.7	---	3	---	---	14.7
	41-47	BC	1.7	9.8	1.0	0.3	12.8	---	27.7	46	0.18	4.8	---	3	---	---	13.1
	47-53	CB	2.4	11.3	1.2	0.4	15.3	---	27.8	55	0.16	4.8	---	4	---	---	10.3
	53-64	C1	3.8	11.5	1.5	0.3	17.0	---	24.1	71	0.17	4.5	---	6	---	---	5.0
	64-80	C2	6.7	12.2	2.8	0.4	22.2	---	23.9	93	0.14	4.6	---	12	---	---	1.0

TABLE 18.--CHEMICAL ANAYLSIS OF SELECTED SOILS--Continued

1/ See the section "Soil Series and Their Morphology" for pedon location. This is the typical pedon for the soil series in this survey area.

2/ Analysis by the National Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska.

3/ Analysis by the Texas A&M University Soil Characterization Laboratory, College Station, Texas.

4/ The horizon was divided for sampling purposes.

5/ Pedon location of Woodtell soil: from Loop 271 in Mt. Pleasant, 5.6 miles west on Old Paris Road, 50 feet north, in woodland.

TABLE 19.--CLAY MINERALOGY OF SELECTED SOILS

[A dash indicates material was not detected. T indicates trace]

Soil name and sample number	Depth	Horizon	Clay minerals			
			Montmorillonite	Mica	Kaolinite	Quartz
	In		Pct	Pct	Pct	Pct
Derly: 1/						
S83TX-159-2 2/	18-26	Btg/E1	30-50	---	30-50	---
S83TX-449-1 3/	13-21	Btg/E1	>50	---	30-50	---
S83TX-449-2 4/	12-22	Bg/E	>50	---	30-50	---
Estes: 1/ 5/						
S81TX-449-1	8-19	Bg1	10-30	0-10	10-30	---
	19-49	Bg2	30-50	0-10	10-30	---
Freestone: 5/ 6/						
S82TX-449-1	0-5	Ap	T	0-10	10-50	10-50
	19-27	Bt/E1	<10	0-10	10-50	10-50
	73-85	2C	>50	0-10	10-50	10-50
Grayrock: 1/ 5/						
S80TX-449-1	0-7	Ap	>50	10-30	30-50	---
	7-15	C1	30-50	0-10	30-50	---
	28-37	C2	>50	10-30	30-50	---
	37-60	C3	>50	10-30	30-50	---
Talco: 5/ 6/						
S82TX-449-3	0-3	A	T	0-10	10-50	10-50
	13-22	Btg/E1	<10	0-10	10-50	10-50
	66-80	Btg3	>50	0-10	10-50	10-50
Woodtell: 6/ 7/						
S82TX-449-2	0-2	A	T	0-10	10-50	10-50
	17-22	Bt3	>50	0-10	10-50	10-50
	64-80	C2	>50	0-10	10-50	10-50

1/ Analysis by the National Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska.

2/ Pedon location of Derly soil: from U.S. Highway 67 in Mt. Vernon, 6.7 miles north on Texas Highway 37, 2.3 miles east and northeast on a county road, 50 feet east of the road, in woodland.

3/ Pedon location of Derly soil: from Interstate 30 in Mt. Pleasant, 12 miles north on Farm Road 1402 to Wilkinson, 2 miles east on Farm Road 71, 100 feet north, in woodland.

4/ Pedon location of Derly soil: from Farm Road 1402 in Wilkinson, 0.1 mile east on Farm Road 71, 0.3 mile northeast on a county road, 100 feet south of a church.

5/ See the section "Soil Series and Their Morphology" for pedon location. This is the typical pedon for the soil series in the survey area.

6/ Analysis by the Texas A&M University Soil Characterization Laboratory, College Station, Texas.

7/ Pedon location of Woodtell soil: from Loop 271 in Mt. Pleasant, 5.6 miles west on Old Paris Road, 50 feet north, in woodland.

TABLE 20.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available]

Soil name, sample number, horizon, and depth (in inches)	Classification		Grain-size distribution 1/									Liquid limit 2/	Plasticity index 2/	Particle density	Shrinkage		
			Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
												Pct		G/cc	Pct	Pct	Pct
Ashford clay 3/ (S78TX-343-001)																	
A --- 0-3	A-7-6(40)	CH	100	100	100	100	100	96	96	60	52	60	36	2.58	12.0	19.6	1.90
Btg1 --- 3-13	A-7-6(39)	CH	100	100	100	100	100	97	93	67	59	57	34	2.71	12.0	19.0	1.97
Btg4 --- 51-80	A-7-6(58)	CH	100	100	100	100	100	97	95	75	67	75	52	2.70	10.0	24.6	2.08
Bazette silty clay loam: 3/ (S82TX-159-004)																	
A --- 0-6	A-7-6(22)	CL	100	98	96	95	94	83	42	38	34	49	24	2.62	21.0	12.2	1.70
Bt1 --- 6-19	A-7-6(36)	CH	100	97	96	96	95	91	75	65	54	61	32	2.67	18.0	17.8	1.84
Cuthbert fine sandy loam: 3/ (S83TX-063-004)																	
E --- 4-9	A-4(0)	SM-SC	100	99	92	83	79	37	17	8	7	23	4	2.65	18.0	2.9	1.73
Bt1 --- 9-15	A-6(13)	CL	100	100	99	98	98	68	55	38	35	40	19	2.73	19.0	10.0	1.77
B/C --- 22-32	A-7-6(21)	CL	100	100	100	99	98	81	69	39	33	45	22	2.69	20.0	11.0	1.72
Derly silt loam: 3/ (S82TX-159-001)																	
E --- 7-14	A-4(8)	CL	100	100	100	100	100	80	---	---	---	26	9	2.69	18.0	4.3	1.80
Btg/E1 --- 14-26	A-6(16)	CL	100	100	100	100	100	85	---	---	---	35	20	2.67	15.0	9.3	1.90
Btg/E2 --- 26-37	A-6(16)	CL	100	100	100	100	100	85	---	---	---	35	20	2.65	16.0	9.3	1.85
Elrose gravelly fine sandy loam: 3/ (S82TX-343-001)																	
Ap --- 0-7	A-2-4(0)	SM	99	98	87	72	62	29	25	3	3	23	2	2.65	21.0	1.8	1.65
Bt1 --- 7-22	A-6(10)	CL	100	100	99	97	95	64	55	36	34	37	19	2.73	18.0	9.7	1.83
Freestone fine sandy loam: 3/ (S82TX-449-003)																	
E --- 5-11	A-4(0)	CL-ML	100	100	100	100	98	61	48	12	10	19	4	2.65	17.0	1.4	1.84
Bt/E1 --- 19-27	A-6(9)	CL	100	100	100	99	99	67	58	25	20	32	17	2.67	17.0	7.8	1.85
2Bt1 --- 39-50	A-7-6(38)	CH	100	100	100	100	100	79	76	59	49	67	43	2.69	14.0	21.0	1.95

See footnotes at end of table.

TABLE 20.--ENGINEERING INDEX TEST DATA--Continued

Soil name, sample number, horizon, and depth (in inches)	Classification		Grain-size distribution 1/									Liquid limit 2/	Plasticity index 2/	Particle density	Shrinkage		
			Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
												Pct		G/cc	Pct	Pct	Pct
Grayrock silty clay loam: 3/																	
(S82TX-449-006)																	
Ap --- 0-7	A-7-6(32)	CH	100	100	100	100	100	98	88	46	32	54	29	2.67	23.0	12.8	1.67
C1 --- 7-28	A-7-6(32)	CH	100	100	100	99	99	97	89	46	35	54	29	2.68	24.0	12.6	1.66
C3 --- 37-80	A-7-6(32)	CH	100	100	100	100	100	99	90	44	30	52	27	2.66	23.0	12.7	1.68
Hopco silty clay loam: 3/																	
(S82TX-159-003)																	
Ap --- 0-10	A-7-6(23)	CL	100	100	100	100	99	96	88	42	32	43	20	2.66	20.0	10.6	1.74
A1 --- 10-29	A-7-5(22)	MH	100	100	100	100	99	97	90	54	42	52	15	2.68	15.0	16.4	1.94
A2 --- 29-51	A-7-5(23)	MH	100	100	100	100	100	99	94	93	42	50	17	2.66	17.0	14.5	1.85
Bw --- 51-80	A-7-5(27)	MH	100	100	100	100	100	99	90	48	36	53	19	2.70	19.0	14.8	1.84
Kaufman clay: 3/																	
(S78TX-343-002)																	
A1 --- 0-6	A-7-6(75)	CH	100	100	100	100	100	100	97	91	86	96	62	2.71	12.0	27.7	1.96
Bg1 --- 12-34	A-7-6(74)	CH	100	100	100	100	100	100	98	91	85	93	60	2.72	11.0	27.5	2.00
Bg3 --- 48-72	A-7-6(85)	CH	100	100	100	100	100	100	98	91	85	102	71	2.74	12.0	29.1	2.00
Kirvin very fine sandy loam: 3/																	
(S82TX-063-002)																	
E --- 5-14	A-4(0)	CL-ML	100	100	98	97	88	65	46	9	5	21	4	2.69	19.0	1.2	1.79
Bt1 --- 14-27	A-7-6(30)	CH	100	100	100	98	96	90	79	52	47	54	30	2.70	19.0	14.8	1.79
Kirvin gravelly fine sandy loam: 4/																	
(S82TX-063-003)																	
Ap --- 0-9	A-2-4(0)	SC	87	70	57	47	40	33	26	5	4	29	8	2.64	22.0	3.8	1.66
Bt1 --- 9-17	A-7-6(42)	CH	100	100	100	100	100	94	86	56	46	67	35	2.76	19.0	18.3	1.80
Bt4 --- 33-40	A-7-5(31)	CH	100	100	100	100	95	86	83	39	28	61	31	2.69	21.0	16.7	1.79
Kullit very fine sandy loam: 3/																	
(S82TX-063-001)																	
E --- 7-14	A-4(1)	CL-ML	100	100	100	100	99	79	53	8	6	21	4	2.64	18.0	2.3	1.79
Bt1 --- 14-20	A-6(20)	CL	100	100	100	99	99	84	65	33	30	40	21	2.66	18.0	10.6	1.83
Bt3 --- 33-48	A-7-6(45)	CH	100	100	100	99	99	91	79	50	48	71	42	2.68	16.0	20.9	1.89

See footnotes at end of table.

TABLE 20.--ENGINEERING INDEX TEST DATA--Continued

Soil name, sample number, horizon, and depth (in inches)	Classification		Grain-size distribution 1/									Liquid limit 2/	Plasticity index 2/	Particle density	Shrinkage		
			Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
												Pct		G/cc	Pct	Pct	Pct
Nahatche silty clay loam: 3/ (S82TX-449-007)																	
Ap - - - 0-6	A-7-6(25)	CL	100	100	100	100	100	92	87	43	30	47	22	2.58	22.0	11.1	1.68
Cg1 - - - 6-11	A-6(16)	CL	100	100	100	100	100	85	76	35	25	37	18	2.64	20.0	8.6	1.75
Cg2 - - - 11-28	A-6(11)	CL	100	100	100	100	100	76	64	30	24	33	16	2.66	18.0	8.1	1.82
Cg3 - - - 28-44	A-6(11)	CL	100	100	100	100	99	75	66	32	30	33	17	2.66	16.0	8.8	1.86
Pickton fine sand: 3/ (S82TX-449-001)																	
A - - - 0-11	A-2-4(0)	SM-SC	100	100	100	100	100	13	10	3	2	25	4	2.65	21.0	0.0	1.61
E1 - - - 11-31	A-2-4(0)	SM	100	100	100	100	100	15	10	3	2	24	3	2.63	20.0	0.0	1.67
Bt1 - - - 48-59	A-2-4(0)	SC	100	100	100	100	100	35	30	22	20	28	8	2.66	21.0	3.3	1.67
Raino loam: 3/ (S82TX-159-002)																	
BE - - - 6-21	A-4(0)	ML	100	100	100	100	98	69	53	13	8	20	3	2.69	18.0	1.4	1.81
Bt/E1 - - - 21-35	A-4(3)	CL-ML	100	100	100	100	99	72	56	18	14	23	7	2.65	17.0	3.6	1.82
Bt/E2 - - - 35-45	A-7-6(42)	CH	100	100	100	100	100	89	79	54	42	66	39	2.69	13.0	21.0	1.96
Redsprings gravelly fine sandy loam: 3/ (S83TX-343-004)																	
A2 - - - 4-10	A-2-4(0)	SM-SC	100	99	87	69	53	26	24	9	7	22	5	2.68	18.0	2.7	1.91
Bt1 - - - 10-20	A-7-6(16)	CL	100	100	97	94	89	65	63	50	47	49	24	2.73	22.0	11.9	1.75
Talco silt loam: 3/ (S82TX-449-005)																	
E/B - - - 3-8	A-4(7)	CL	100	100	100	100	99	82	70	18	12	25	8	2.65	19.0	9.7	1.76
Btg/E1 - - - 13-22	A-6(13)	CL	100	100	100	100	99	85	70	30	25	31	15	2.68	20.0	5.8	1.75
Btg/E2 - - - 22-35	A-6(13)	CL	100	100	100	100	100	86	72	30	25	31	14	2.71	18.0	---	1.82
Btg2 - - - 49-66	A-7-6(26)	CL	100	100	100	100	98	88	79	42	40	46	27	2.66	16.0	---	1.88
Btg3 - - - 66-80	A-7-6(19)	CL	100	100	100	100	100	83	76	32	30	41	23	2.71	12.0	---	1.94
Tenaha loamy fine sand: 3/ (S82TX-343-003)																	
E - - - 12-26	A-4(0)	SM	100	100	98	96	95	39	---	---	---	24	3	2.61	22.0	2.7	1.64
Bt1 - - - 26-33	A-7-6(16)	CL	100	100	100	100	100	66	---	---	---	46	26	2.68	18.0	13.9	1.82
Texark clay: 3/ (S82TX-343-002)																	
A - - - 0-17	A-7-6(80)	CH	100	100	100	100	100	100	92	45	42	102	64	2.68	31.0	21.0	1.46
Bg1 - - - 17-28	A-7-5(48)	CH	100	100	100	100	100	98	92	66	60	70	40	2.65	15.0	21.1	1.88

See footnotes at end of table.

TABLE 20.--ENGINEERING INDEX TEST DATA--Continued

Soil name, sample number, horizon, and depth (in inches)	Classification		Grain-size distribution 1/									Liquid limit 2/	Plasticity index 2/	Particle density	Shrinkage		
	AASHTO	Unified	Percentage passing sieve--						Percentage smaller than--						Limit	Linear	Ratio
			5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm						
												Pct		G/cc	Pct	Pct	Pct
Wolfpen loamy fine sand: 3/ (S82TX-449-002)																	
A --- 0-11	A-2-4(0)	SM	100	100	100	100	100	18	---	---	---	22	3	2.61	19.0	0.0	1.73
BE --- 11-25	A-2-4(0)	SM	100	100	99	98	96	19	---	---	---	20	3	2.67	16.0	0.0	1.75
Bt1 --- 25-38	A-2-4(0)	SC	100	100	100	100	100	26	---	---	---	26	8	2.66	21.0	2.8	1.70
Bt2 --- 38-56	A-2-6(0)	SC	100	100	100	100	100	27	---	---	---	30	13	2.66	21.0	4.6	1.67
Woodtell fine sandy loam: 5/ (S82TX-449-004)																	
E --- 2-6	A-4(0)	ML	100	100	98	98	95	60	---	---	---	22	3	2.65	19.0	2.3	1.75
Bt2 --- 11-17	A-7-6(35)	CH	100	100	100	100	100	86	---	---	---	63	35	2.74	16.0	19.0	1.88
Bt5 --- 30-41	A-7-6(31)	CH	100	100	100	100	99	85	---	---	---	59	32	2.66	17.0	17.2	1.84
Woodtell fine sandy loam: 3/ (S78TX-343-003)																	
A --- 0-3	A-6(8)	CL	100	100	100	100	100	71	54	18	14	33	13	2.58	23.0	5.0	1.61
Bt1 --- 6-14	A-7-6(34)	CH	100	100	100	100	100	86	79	55	55	57	36	2.72	11.0	19.7	2.02
C --- 55-72	A-6(11)	CL	100	100	100	100	100	86	63	20	18	32	13	2.60	20.0	6.0	1.70

1/ For soil materials larger than 3/8 inch, square mesh wire sieves that are slightly larger than equivalent round sieves were used, but the difference does not seriously affect the data.

2/ Liquid limit and plasticity index values were determined by the AASHTO-89 and AASHTO-90 methods except that the soil was added to water.

3/ See the section "Soil Series and Their Morphology" for pedon location. This is the typical pedon for the soil series in this survey area.

4/ Pedon location of Kirvin soil: from Pittsburg, 0.7 mile west on Texas Highway 11, 0.8 mile north on Farm Road 1520, 0.2 mile east on powerline right-of-way, 30 feet north, in pine plantation.

5/ Pedon location of Woodtell soil: from Loop 271 in Mt. Pleasant, 5.6 miles west on Old Paris Road, 50 feet north, in woodland. This pedon is a taxadjunct to the series because the COLE is slightly less than required for a Vertic subgroup.

TABLE 21.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Ashford	Very-fine, montmorillonitic, thermic Vertic Ochraqualfs
Bazette	Fine, montmorillonitic, thermic Udic Haplustalfs
Bernaldo	Fine-loamy, siliceous, thermic Glossic Paleudalfs
Besner	Coarse-loamy, siliceous, thermic Glossic Paleudalfs
Bienville	Sandy, siliceous, thermic Psammentic Paleudalfs
Bowie	Fine-loamy, siliceous, thermic Plinthic Paleudults
Briley	Loamy, siliceous, thermic Arenic Paleudults
Crockett	Fine, montmorillonitic, thermic Udertic Paleustalfs
Cuthbert	Clayey, mixed, thermic Typic Hapludults
Darco	Loamy, siliceous, thermic Grossarenic Paleudults
Derly	Fine, montmorillonitic, thermic Typic Glossaqualfs
Duffern	Thermic, coated Typic Quartzipsamments
Ellis	Fine, montmorillonitic, thermic Vertic Ustochrepts
Elrose	Fine-loamy, siliceous, thermic Typic Paleudalfs
Estes	Fine, montmorillonitic, acid, thermic Aeric Haplaquepts
Freestone	Fine-loamy, siliceous, thermic Glossaquic Paleudalfs
Gladewater	Fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts
Grayrock	Fine-silty, mixed, nonacid, thermic Typic Udorthents
*Hopco	Fine-silty, mixed, thermic Cumulic Haplaquolls
Iuka	Coarse-loamy, siliceous, acid, thermic Aquic Udifluvents
Kaufman	Very-fine, montmorillonitic, thermic Typic Pelluderts
Kirvin	Clayey, mixed, thermic Typic Hapludults
Kullit	Fine-loamy, siliceous, thermic Aquic Paleudults
Lilbert	Loamy, siliceous, thermic Arenic Plinthic Paleudults
Nahatche	Fine-loamy, siliceous, nonacid, thermic Aeric Fluvaquents
Normangee	Fine, montmorillonitic, thermic Vertic Haplustalfs
Pickton	Loamy, siliceous, thermic Grossarenic Paleudalfs
Raino	Fine-loamy over clayey, siliceous, thermic Aquic Glossudalfs
Redsprings	Fine, kaolinitic, thermic Ultic Hapludalfs
Sacul	Clayey, mixed, thermic Aquic Hapludults
*Talco	Fine-silty, siliceous, thermic Aeric Glossaqualfs
Tenaha	Loamy, siliceous, thermic Arenic Hapludults
Texark	Very-fine, montmorillonitic, thermic Typic Pelluderts
Varro	Fine-loamy, mixed (calcareous), thermic Typic Udifluvents
Wilson	Fine, montmorillonitic, thermic Vertic Ochraqualfs
Wolfpen	Loamy, siliceous, thermic Arenic Paleudalfs
Woodtell	Fine, montmorillonitic, thermic Vertic Hapludalfs

* 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.

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