United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
Texas Agricultural
Experiment Station

Soil Survey of Matagorda County, Texas

How To Use This Soil Survey

General Soil Map

The general soil map, which is a color map, 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.

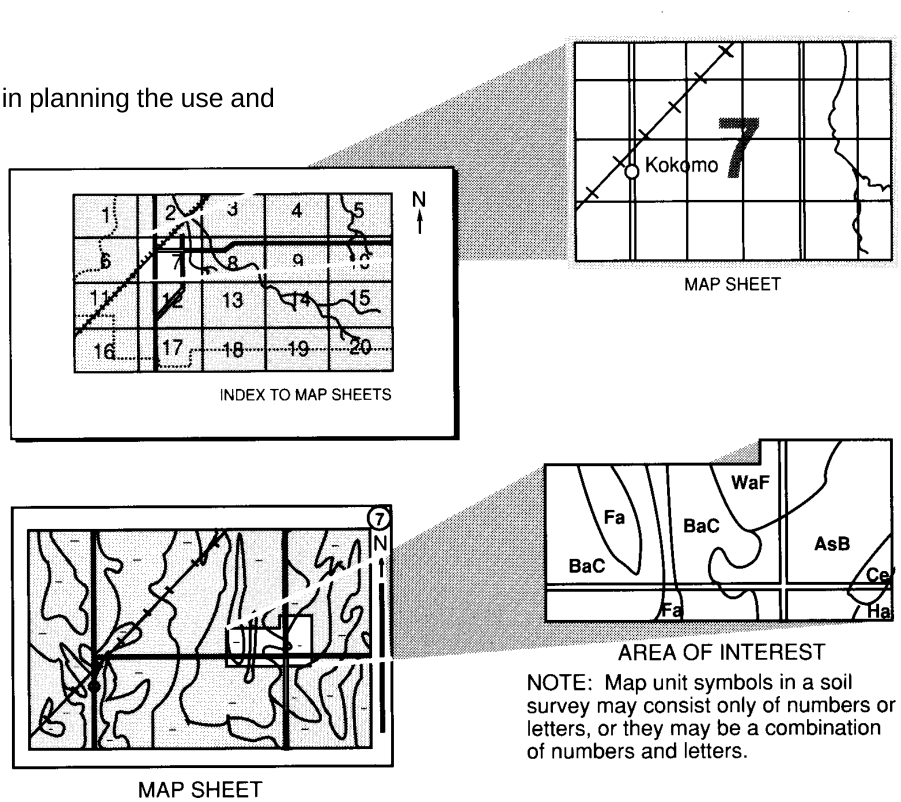
Detailed Soil Maps

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

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

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

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **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 Natural Resources Conservation Service (formerly 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 1989. Soil names and descriptions were approved in 1991. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1991. This survey was made cooperatively by the Natural Resources Conservation Service and the Texas Agricultural Experiment Station. The survey is part of the technical assistance furnished to the Matagorda County Soil and Water Conservation District.

Cover: A duned area of Galveston fine sand, undulating, on the Matagorda Peninsula. The dunes protect the peninsula from tidal waves during storms.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service homepage on the World Wide Web. The address is http://www.nrcs.usda.gov.

Contents

Issued 2001

Foreword

This soil survey contains information that affects land use planning in Matagorda County. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, 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, 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 ensure 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.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations that affect various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

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 Natural Resources Conservation Service or the Texas Agricultural Extension Service.

John P. Burt
State Conservationist
Natural Resources Conservation Service

Soil Survey of Matagorda County, Texas

By Harold W. Hyde, Natural Resources Conservation Service

Fieldwork by Harold W. Hyde, Plinio H. Flores, and Samuel E. Brown, Jr., Natural Resources Conservation Service

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

MATAGORDA COUNTY is in the southeastern part of Texas, along the Gulf of Mexico (fig. 1). It lies in two major land resource areas, the Gulf Coast Prairies and the Gulf Coast Saline Prairies. In 1990, the county population was about 41,000, and the population of Bay City, the county seat, was about 23,000. Other towns or communities include Blessing, Clemville, Collegeport, Elmaton, Markham, Matagorda, Midfield, Palacios, Pledger, Sargent, Wadsworth, and Van Vleck. The town of Matagorda was the original county seat.

The county is roughly rectangular, measuring about 35 miles from north to south and 40 miles from east to west. It covers about 1,388 square miles, or 888,173 acres. Matagorda Bay makes up a major part of the 166,784 acres of water areas. The bay is divided into East Bay and West Bay, which are separated by a delta that extends from the town of Matagorda to the Matagorda Peninsula. The peninsula separates Matagorda Bay from the Gulf of Mexico.

The landscape in the county generally is broad and nearly level. Most of the few sloping areas are next to the Colorado River, the Tres Palacios River, Caney Creek, Peyton Creek, and Wilson Creek. The land slopes upward from the southeast to the northwest. The elevation rises from sea level at the Gulf of Mexico to over 70 feet at points along the Wharton County line. Most drainage flows to the south and southeast through the rivers, creeks, sloughs, and bayous that dissect the county. In addition to these, Linnville Bayou and Cedar Lake Creek make up most of the east county line, which joins Brazoria County.

General Nature of the County

This section gives general information about Matagorda County. It describes history and settlement, agriculture, natural resources and industry, and climate.

History and Settlement

Matagorda County is one of 23 original counties in Texas. It was created in 1836 and organized in 1837 *(19)*. It is one of the 29 counties in Texas that have a physiographic name *(18)*. The origin of the name, Matagorda, has spurred some controversy. The name consists of the Spanish words “mata” (small brush, shrubs, sprigs, and blades) and “gorda” (fat, coarse, thick, and dense.) In Matagorda County, the main interpretation is “dense canebrake,” relating to the dense canebrake vegetation that existed on the flood plain along Caney Creek, an ancient bed of the Colorado River. Dense stands of salt cedar were once prevalent along the coast. Some historians refer to early Spanish dictionaries that defined the word “matagorda” as “big bush.” According to another interpretation *(12),* the word consists of the obsolete Spanish words “mata” (slaughter) and “gorda” (fat).

In 1570, a Dutch map of the Western Hemisphere had the name, Matabrigo, in the general locality of Matagorda County *(19)*. In 1528, Cabeza de Vaca was shipwrecked on the Texas coast near Galveston Island. He spent time with several Indian tribes in what are now Brazoria and Matagorda Counties. Most tribes in this area were part of the Karankawa Nation.

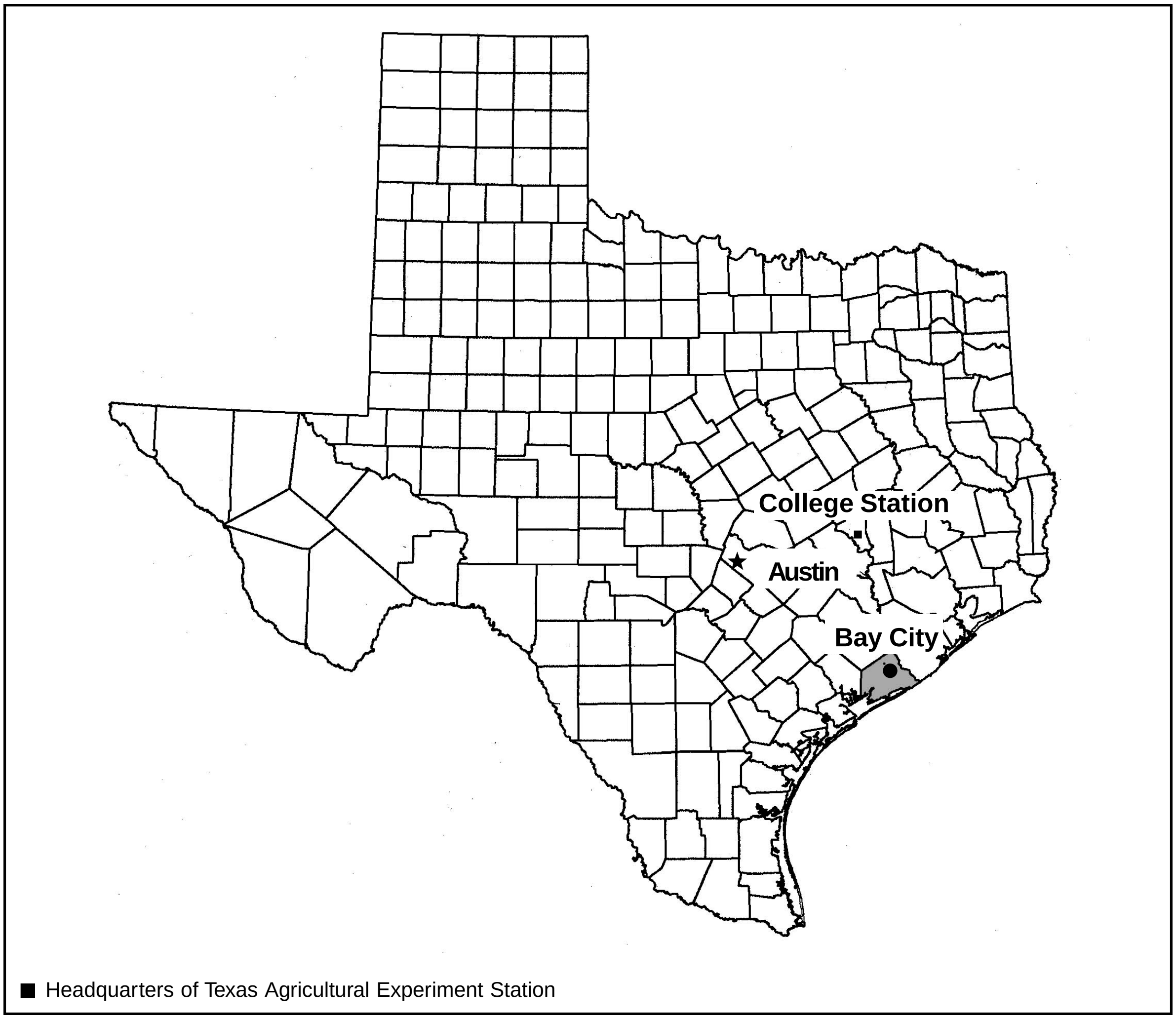


Figure 1.—Location of Matagorda County in Texas.

In about 1684, La Salle's expedition to the Mississippi River landed on the Texas coast near Corpus Christi. He missed his original destination because of navigational error and strong winds. Shortly thereafter, the expedition camped briefly in what is now southwestern Matagorda County.

In 1809, the Spanish representatives ruling the government of Texas proposed that a port be established on the shore of Matagorda Bay. This proposal was later rejected by Spain. In the 1820's, American colonists founded the port town of Matagorda on the east side of the Colorado River overlooking Matagorda Bay.

In 1823, under a new colonization law, Stephen F. Austin was given authority to bring 300 families to Texas. Fifty-three of these families were to be settled in what is now Matagorda County. On December 18, 1830, Austin "patented" 5,580 acres of land in the county adjoining a lake which afterwards was called Lake Austin *(19)*.

In 1835, a representative of the Mexican Government reported to his superiors that Matagorda, with a population of 1,400, was the third largest town in the Province of Texas. The towns of San Felipe and Columbus had populations of 2,500 and 2,100, respectively.

The community of Matagorda was a prominent seaport in early Texas history and a major port for Texas immigrants. From 1840 to 1865, it ranked second to Galveston as a leading port on the Texas coast *(19)*. By the 1870's, the construction of railroads to the Brazos River and the increased use of other nearby ports lessened Matagorda's importance as a seaport.

In comparison to Matagorda Bay, the Colorado River has never been important for navigation, mainly because the lower part of the river was obstructed for hundreds of years by a logjam that formed a huge log raft. The logjam had a pronounced effect on soils in the survey area. During rainy periods, the river overflowed outside the normal flood plain, and the resulting siltation left as much as 3 feet of clayey and silty sediments on nearby upland soils. For example, the overwashed phases of Edna and Laewest soils make up more than 18,000 acres in the county. These upland soils have 6 to 24 inches of reddish clay deposited over the original topsoil. In addition, Clemville soils, which have 24 to 36 inches of silty overburden, cover more than 5,600 acres.

According to historians, Spanish explorers reported the massive logjam in the 1600's. The first recorded description of the raft on the Colorado River was by Alonso de Leon in 1690. His report initiated an expedition from Mexico to map Matagorda Bay *(19)*.

The massive logjam hindered the transportation of agricultural products from the farms of settlers along the river to ports on the coast *(10)*. Residents in Matagorda County would circumvent the logjam by unloading cargo at the north end of the raft and transporting their goods overland to Matagorda *(19)*.

Attempts to clear the logjam in 1837 were largely unsuccessful. In the early 1850's, the U.S. Army Corps of Engineers cleared a narrow channel through the logjam. The channel was clear for about 6 years; however, by 1860, it was filled with logs and driftwood. County residents became increasingly concerned about the raft after the floods of 1913, 1914, 1919, and 1922, some of which submerged parts of Bay City in Matagorda County and Wharton in Wharton County. Human lives and livestock were lost, and large areas of cropland were flooded *(19)*.

In 1928, the reclamation districts of Matagorda and Wharton Counties finished a 3-year project that cleared a channel through the east side of the raft, which by then extended 46 miles upstream. A flood in 1929 swept nearly all of the collected driftwood into Matagorda Bay, clogging the bay and making it unnavigable. In 1934, the Matagorda Reclamation District cut a channel through the mass of logs in the bay. The channel extended across the bay and through Matagorda Island into the Gulf of Mexico. The Corps of Engineers now keeps the channel open to protect the Intracoastal Waterway *(19)*.

A delta at the mouth of the Colorado River developed from the floodwaters of 1929. This delta now extends 6 miles from the town of Matagorda to the Matagorda Peninsula and separates Matagorda Bay into two parts, East Bay and West Bay. The rapid deltaic action was influenced by the size of the massive logjam. By 1936, the delta extended to the Matagorda Peninsula, and by 1941, it covered an estimated 7,098 acres.

Some of the other streams in the county were more important than the Colorado River for shipping farm products. These included Caney Creek, the Tres Palacios River, and Wilson Creek, a tributary of the Tres Palacios. In 1838, the Caney Navigation Company was organized to clear the channel of Caney Creek. The long-range plans were to build a series of canals to connect Caney Creek with the Colorado River, Cedar Lake, and Matagorda Bay. A channel was eventually cleared to Matagorda Bay, and from 1849 to 1860, sailing vessels and steamships operated on Caney Creek. The main farm products shipped from the eastern part of the county were cotton and sugarcane.

In the western part of the county, agricultural products were shipped on the Tres Palacios River and Wilson Creek. The Tres Palacios River was navigable for 5 or 6 miles upstream to the port of Tidehaven.

Overall, the total acres of cropland in the county remained low until the late 1800's. The main crops produced in the county from 1841 to 1861 were cotton, sugarcane, and corn. Cotton and sugarcane were shipped to markets, and corn was used for livestock feed and corn meal. A few pecans were shipped as early as 1841. In 1853, Texas produced 39,686 bales of cotton, most of which was grown in Matagorda County. In 1858, the cropland consisted of 6,853 acres of cotton, 1,160 acres of sugarcane, and 4,291 acres of corn.

Cotton production greatly decreased during the Civil War and afterwards until World War I, mainly because farmers lost their major buyers in northern markets when the Union Navy blockaded gulf ports. Sugarcane, however, remained a stable commodity as local farmers continued to sell both sugarcane and molasses. After the war, livestock, along with sugarcane, were the main sources of agricultural income. The acres of cropland remained small until new crops were introduced and farm machinery was developed. For example, rice was grown on a total of only 600 acres in 1899. By 1913, the total increased to 60,000 acres.

Livestock production, or ranching, was the major agricultural industry until after 1900. As early as 1850, about 35,000 head of cattle were in the county. By 1870, the estimate was 70,000 head. During the years 1863 to 1890, several thousand head of cattle were driven to markets in Kansas.

Agriculture

The main agricultural enterprises in Matagorda County are raising beef cattle and growing crops, such as rice, grain sorghum (fig. 2), corn, cotton, and soybeans. Some pecans are harvested and sold commercially.

In some areas farmers or ranchers supplement their income by leasing hunting rights for deer, geese, and ducks. In the 1980's, turfgrass farming was expanded on a large scale; however, a downturn in the real estate and construction markets decreased the demand for turfgrass. Many turfgrass fields are being returned to row crops. Other sources of income, mostly in the experimental stage, are marine related. They include the construction of large aquaculture ponds for redfish and other types of fish, shrimp, or crayfish.

Most livestock operations are cow-calf enterprises. On prairie rangeland and pasture, supplemental feeding is usually needed in winter. Marsh rangeland provides limited winter grazing. Ranchers in the county played a major role in changing the livestock industry in south Texas by importing Brahman cattle in the early 1900's. Brahman cattle are suited to the coastal region of Texas because they are resistant to insects, diseases, heat, and humidity.

Although figs, peaches, and citrus fruits were grown in the 1920's, none are now produced on a commercial basis. Only a few isolated trees grow in

Figure 2.—An area of Laewest clay, 0 to 1 percent slopes, used for grain sorghum, a major crop in Matagorda County.

gardens or as landscape plants. One small commercial grape vineyard is in the county.

Rice and grain sorghum are the major crops in the county, but corn has increased in acreage. Rice is irrigated and is grown in a crop-fallow rotation system. After rice has been grown on a field for 1 or 2 years, the field is fallowed. Many fallowed fields are used for pasture, and cattle graze on the rice stubble.

The acreage of soybeans and cotton in the county is limited. Soybeans are grown mainly as part of a cropping program or rotation system. Yields are greatly affected by weather conditions during the growing season. Cotton, once a major crop, is grown mainly when market prices are high. Only one cotton gin remains in the county. When harvested, much of the cotton is transported to gins in nearby Jackson or Wharton County.

Natural Resources and Industry

Matagorda County has an abundance of natural resources, and soil is one of the most important. It is used productively as cropland, pasture, and rangeland. The only exceptions are soils in the marshes, which are used mainly as habitat for waterfowl and marine animals.

A major problem related to natural resources is tidal erosion of the shoreline and beaches along the Gulf of Mexico. Near the community of Sargent, the Matagorda Peninsula has been eroded inland for several hundred feet, resulting in the loss of both public and private property. The problem of shoreline erosion is a major challenge to the conservation and protection of natural resources in this part of the county.

Oil and gas are important natural resources in the county, and petroleum by-products support a large petrochemical industry.

Water is another important natural resource. The Colorado River, Caney Creek, and the Tres Palacios River, along with other streams, provide water for livestock, irrigation, and recreation. The Colorado River is the major source of irrigation water for rice growers in the county. The Lower Colorado River Authority distributes water from the river for cropland irrigation. The Intracoastal Waterway runs parallel to the gulf from Brownsville, Texas, to Florida. It extends for more than 60 miles through the southern part of the county, and numerous barges travel each way. The Gulf of Mexico, Matagorda Bay, and other bays are used extensively for fishing and other water-related activities. Shrimp harvesting is common along the coast, and the town of Palacios is a major processing center. The communities of Matagorda and Sargent are well known for their fishing and shrimping activities. Matagorda Beach is a popular recreational area, especially for sunbathers in summer months. Ducks, geese, and other waterfowl are numerous in bayous, marshes, rice fields, and other areas during winter months.

Wildlife on farms and ranches provide opportunities for recreation and income for many landowners. Deer, wild hogs, quail, and dove, along with many ducks, geese, and other waterfowl, are abundant. Alligators are common along the coast and are in streams throughout the county. Limited permits for hunting the alligators are issued in areas near the coast.

Climate

In Matagorda County the long summers are hot and humid; however, the coast is frequently cooled by sea breezes. Hurricanes that occur in the Gulf of Mexico cause damage to shoreline and property and loss of livestock. The main hurricane season is from July through September. Hurricanes cause periodic minor damage along the Texas coast. In 1961, Carla, one of the most devastating hurricanes, hit the county. Tidal waves as high as 10 feet surged inland near the town of Palacios. The hurricane spawned tornadoes and caused extensive property damage.

Winters are warm, only occasionally interrupted by incursions of cool air from the north. Major freeze damage to vegetation and property occurred in December 1983, January 1984, and December 1989. Rain falls throughout the year, and precipitation is adequate for most crops. The exception is rice, which is irrigated several times annually.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Bay City in the period 1961 to 1987. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 54 degrees F and the average daily minimum temperature is 44 degrees. The lowest temperature on record, which occurred on January 31, 1949, is 11 degrees. In summer, the average temperature is 82 degrees and the average daily maximum temperature is 91 degrees. The highest recorded temperature, which occurred on July 27, 1954, is 106 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 about 48 inches. Of this total, 27 inches, or 56 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 20.9 inches on October 19, 1983. Thunderstorms occur on about 61 days each year, and most occur in summer.

Snowfall is rare. The heaviest 1-day snowfall on record was 3.8 inches on February 12, 1958.

The average relative humidity in midafternoon is about 59 percent. Humidity is higher at night, and the average at dawn is about 90 percent. The sun shines 65 percent of the time possible in summer and 48 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 9.3 miles per hour, in March.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the county. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; 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 in 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 and miscellaneous areas in the county occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the county. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the county and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area 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-vegetation-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 color, texture, size and shape of soil aggregates, distribution of plant roots, reaction, 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. Soil taxonomy, 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 survey area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are 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 are 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 predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict 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.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey 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, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map unit can occur in another but in a different pattern.

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

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

The proportionate extent of each general soil map unit given in the following descriptions refers to land area, which makes up about 80 percent of the county. Areas of water make up the rest.

Clayey and Loamy Soils of Upland Prairies

This group of general soil map units makes up about 57 percent of the land area of the county. The dominant soils are the Dacosta, Edna, Laewest, Livco, Telferner, and Texana soils, which formed in the clayey and loamy sediments of the Beaumont Formation. These soils are nearly level to gently sloping. Most areas are cultivated; however, some areas are used as pasture, hayland, or rangeland. The native vegetation consists of live oak, other hardwoods, and an understory of woody shrubs and grasses. Trees range from sparse on clayey soils to dense on loamy soils.

Most of these soils are fertile and well suited to crops and grasses. The Dacosta and Laewest soils are well suited to corn, cotton, grain sorghum, and rice. The Edna, Telferner, and Texana soils are best suited to irrigated rice, coastal bermudagrass, and other grasses for pasture or hayland. Because of a high sodium content, the Livco soils are best suited to pasture and rangeland.

The clayey subsoil common to these soils affects the construction of building foundations, roads, and septic tank absorption fields. The major limitations are a high shrink-swell potential and very slow permeability. The nearly level landscape presents some drainage problems during rainy periods.

1. Laewest-Dacosta

Moderately well drained, nearly level to gently sloping, clayey and loamy soils

Areas of these soils are dissected by a few rivers, creeks, and their tributaries. Slopes are mainly less than 1 percent but range to 5 percent in areas adjacent to streams. About 80 percent of this map unit is used mainly as cropland, pasture, or hayland. The natural vegetation is an open prairie with scattered live oak trees. Scrub live oak and other hardwood trees have invaded overgrazed rangeland.

This map unit makes up about 37 percent of the land area of the county. It is about 56 percent Laewest soils, 35 percent Dacosta soils, and 9 percent soils of minor extent (fig. 3). The minor soils include Bacliff, Cieno, Edna, Faddin, Follet, Fulshear, Francitas, Livco, Palacios, Telferner, Texana, and Veston soils.

The Laewest soils are on broad, weakly convex upland plains. They are very deep, very slowly permeable, clayey soils and have a clayey subsoil. They are underlain by clayey and loamy sediments and are nearly level to gently sloping.

The Dacosta soils are on broad, linear upland plains. They are very deep, very slowly permeable, loamy soils and have a clayey subsoil. They are underlain by clayey and loamy sediments and are nearly level.

The Laewest and Dacosta soils are well suited to cropland, pasture, hayland, and rangeland. The main crops are dryland grain sorghum and corn. Several fields are used for irrigated rice. A few fields are planted to dryland cotton or soybeans. In some areas the soybeans are irrigated at least once during the growing season. Other fields are used for irrigated

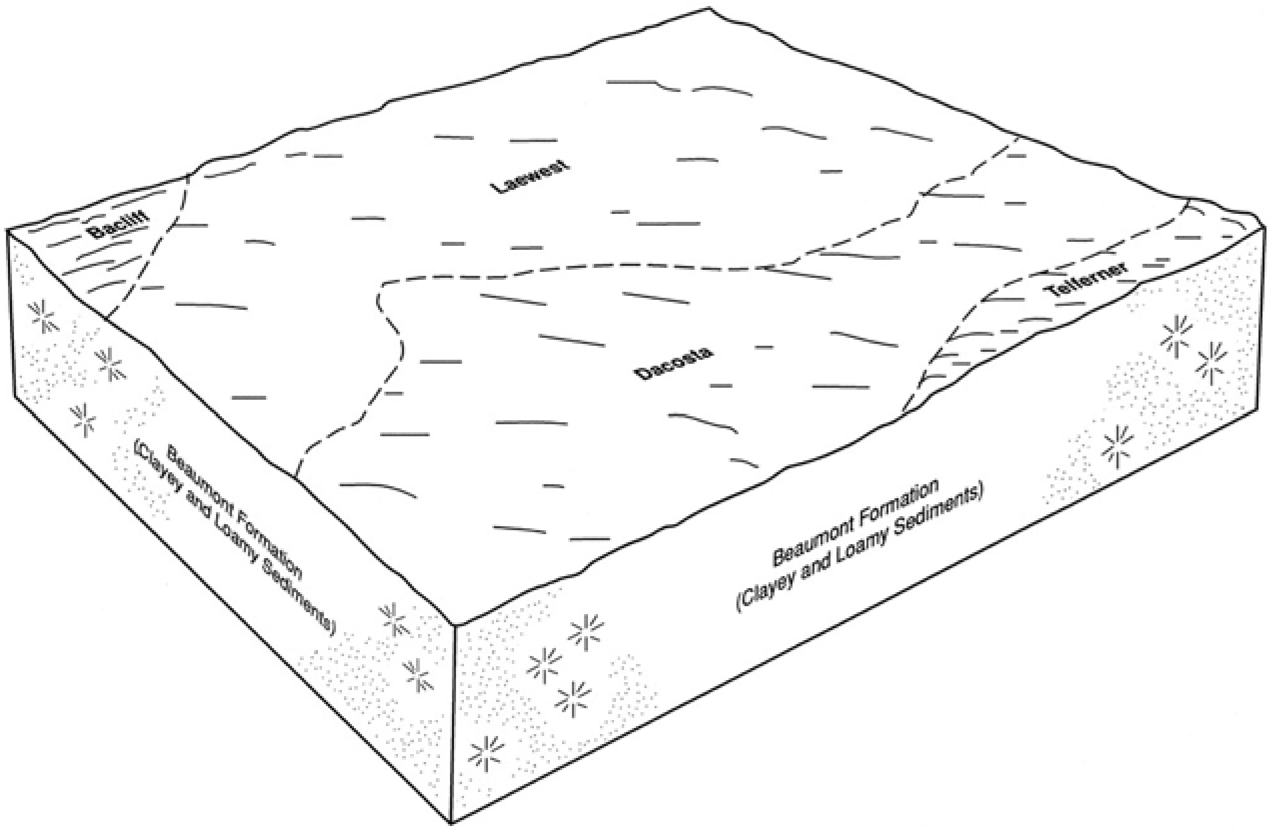


Figure 3.—Typical pattern of soils and underlying material in the Laewest-Dacosta general soil map unit.

commercial turfgrass, mainly varieties of St. Augustine grass. Pasture and hayland are planted mainly to bluestems, such as Gordo, and to bermudagrass varieties or sudan hybrids. These soils are fertile; however, a well managed fertilizer program is needed for maximum production. Rotational grazing and proper stocking rates are needed in areas of rangeland. The hazard of erosion is slight.

Urban uses are expanding in some areas of these soils. The major limitations are a high shrink-swell potential, clayey texture, and very slow permeability.

2. Edna-Texana-Telferner

Moderately well drained and somewhat poorly drained, nearly level to gently sloping, loamy soils

The landscape of this map unit is characterized by nearly level relief with small areas that are gently sloping. Areas of these soils are dissected by a few rivers, creeks, and their tributaries. Slopes are mainly less than 1 percent but range to 3 percent. About 60 percent of the areas are used mainly as cropland, pasture, or hayland. Most of the remaining areas are used as rangeland. The natural vegetation is an open prairie with scattered live oak trees; however, dense stands of live oak and other trees have invaded some areas of overgrazed rangeland.

This map unit makes up about 19 percent of the land area of the county. It is about 56 percent Edna soils, 15 percent Texana soils, 11 percent Telferner soils, and 18 percent soils of minor extent. The minor soils include Bacliff, Cieno, Dacosta, Faddin, Fordtran, Fulshear, Katy, Laewest, Livco, Livia, and Palacios soils.

The Edna, Texana, and Telferner soils are very deep, very slowly permeable, and loamy and have a clayey subsoil. They are underlain by clayey and loamy sediments. The Edna soils are somewhat poorly drained, and the Texana and Telferner soils are moderately well drained. The Edna and Telferner soils are nearly level and are on broad upland plains. The Texana soils are nearly level to gently sloping and are on weakly convex plains and small ridges. The Texana soils are darker than the Edna and Telferner soils and generally have more organic matter.

The soils in this map unit are moderately well suited to cropland, pasture, hayland, and rangeland. The main crop is irrigated rice. The production of other crops on these soils is limited because of the droughty nature of the clayey subsoil. Pasture and hayland are planted mainly to bermudagrasses or hybrid sudan. A few areas are planted to other grasses. Fertilizers are needed for maximum production on cropland and pasture. Rotational grazing and proper stocking rates are needed in areas of rangeland. The hazard of erosion generally is slight, although it can be moderate in gently sloping areas.

Urban uses are expanding in some areas of these soils. The major limitations affecting these uses are a high shrink-swell potential in the subsoil, wetness, and very slow permeability.

3. Livco-Dacosta

Moderately well drained, nearly level, loamy, mounded soils

These soils are on nearly level upland plains. A microrelief of small, low mounds is common. The major soils are mapped as a complex. The sodic Livco soils are on the mounds, and the nonsodic Dacosta soils are in nearly level areas. Areas of these soils are dissected by a few streams and their tributaries. The soils are used mostly as pasture, hayland, or rangeland. Cultivated areas are managed mainly for irrigated rice. The natural vegetation is an open prairie with scattered live oak trees. Gulf cordgrass has invaded many areas of overgrazed rangeland and abandoned cropland fields where the Livco soils are dominant.

This map unit makes up about 1 percent of the land area of the county. It is about 37 percent Livco soils, 36 percent Dacosta soils, and 27 percent soils of minor extent. The minor soils include Bacliff, Cieno, Edna, Laewest, Livia, Telferner, and Texana soils.

The Livco and Dacosta soils are very deep, very slowly permeable, and loamy and have a clayey subsoil. They are underlain by clayey and loamy sediments. The Livco soils have a high sodium content in the upper part of the subsoil and are slightly saline.

The soils in this map unit are best suited to pasture, hayland, and rangeland. Some areas are managed for irrigated rice. Fertilizers are needed for maximum production on these soils. Rotational grazing and proper stocking rates are needed in areas of rangeland.

These soils have major limitations affecting urban uses, including a high shrink-swell potential, excess sodium, poor surface drainage, and corrosivity of steel pipe.

Clayey and Loamy Soils of Flood Plains

This group of soils makes up about 23 percent of the land area of the county. The dominant soils are the Asa, Brazoria, Clemville, Norwood, and Pledger soils. These soils formed in clayey and loamy alluvial sediments that are Recent geologic materials. The reddish, calcareous sediments are from the Permian red beds at the headwaters of the Colorado River. The landscape consists of broad, nearly level flood plains along the Colorado River, Caney Creek, and other streams. These flood plains are extensive in the eastern part of the county. The native vegetation includes dense stands of pecan trees and other hardwoods with an understory of woody shrubs and grasses.

Most of the soils in this group are rarely flooded and remain wet only for brief periods. Because of the nearly level landscape, surface drainage is a problem. Water management systems have been installed to remove excess water during rainy periods. Large areas of these soils were cleared and farmed in the 1800's, but most fields are now used as pasture and hayland. A few areas are planted to corn or grain sorghum. Fertilizers are needed for maximum production on cropland, pasture, and hayland.

These soils have major limitations for urban development. Flooding can occur as often as once every 20 years. The clayey Brazoria and Pledger soils have a high shrink-swell potential and are very slowly permeable. The design of buildings, roads, and septic tank absorption fields should compensate for these limitations.

4. Pledger-Asa

Well drained and moderately well drained, nearly level, clayey and loamy soils

These soils are on nearly level, broad flood plains. Areas are dissected by various creeks, bayous, and their tributaries. The hazard of flooding is rare in most places. Slopes are mainly less than 1 percent, except on short, steep side slopes adjacent to streams. The natural vegetation is mainly hardwood trees, such as pecan, live oak, hickory, ash, and elm. About 70 percent of the unit was cleared when the survey area was first settled. Many of the cleared areas were used as cropland in the 1800's, but they are now used mainly as pasture and hayland.

This map unit makes up about 15 percent of the land area of the county. It is about 69 percent Pledger soils, 24 percent Asa soils, and 7 percent soils of minor extent (fig. 4). The minor soils include Brazoria, Clemville, Laewest, Norwood, and Sumpf soils.

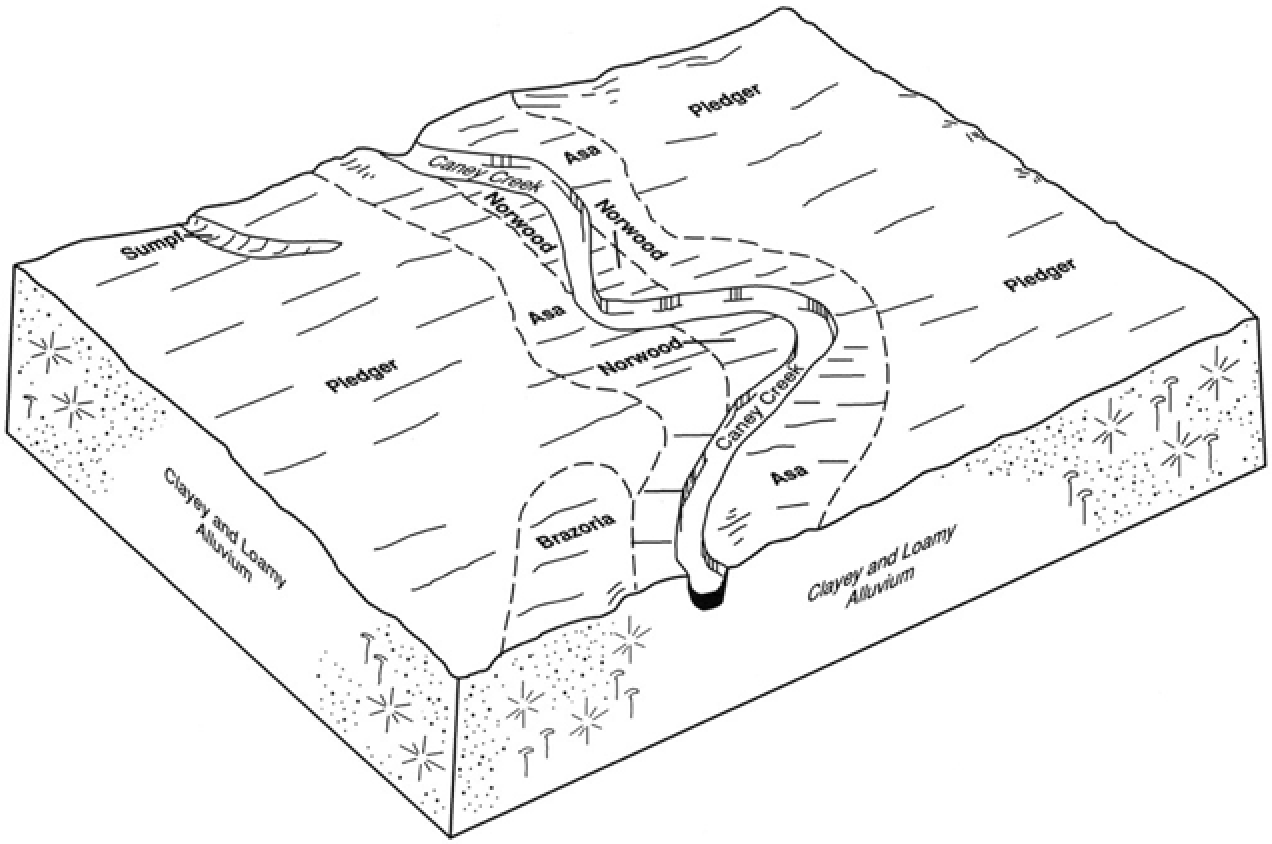


Figure 4.—Typical pattern of soils and underlying material in the Pledger-Asa general soil map unit.

The Pledger soils are very deep, moderately well drained, very slowly permeable, clayey soils that have a clayey subsoil. They are underlain by clayey and loamy alluvial sediments.

The Asa soils are very deep, well drained, moderately permeable, loamy soils that have a loamy subsoil. They are underlain by loamy and clayey alluvial sediments.

The soils in this map unit are very fertile and are well suited to cropland, pasture, and rangeland. They are used mainly as pasture or hayland. They are most commonly planted to bluestems, such as Gordo, and to bermudagrasses, sudan hybrids, and alfalfa. A few areas are used for dryland grain sorghum or corn, and some areas are used for commercial turfgrass. Fertilizers are needed for maximum production of pasture, hay, and crops. Rotational grazing and proper stocking rates, along with chemical or mechanical control of woody plants, are needed on rangeland.

Urban uses are expanding in some areas of these soils. The major limitations affecting these uses are wetness, clayey texture, a high shrink-swell potential, and corrosivity of steel pipe. Flooding is a hazard.

5. Brazoria-Norwood-Clemville

Well drained and somewhat poorly drained, nearly level, clayey and loamy soils

These soils are on nearly level to weakly undulating flood plains along the Colorado River. Flooding is rare because dredging has deepened and widened the channel of the river and because upstream dam structures have been built. Slopes are mainly less than 1 percent, except on the short, steep side slopes adjacent to the river. The native vegetation is mainly hardwood trees with an understory of woody shrubs and grasses. About two-thirds of the areas have been cleared. Some fields that were once used as cropland are now used as pasture and hayland.

This map unit makes up about 8 percent of the land area of the county. It is about 63 percent Brazoria soils, 11 percent Norwood soils, 9 percent Clemville soils, and 17 percent soils of minor extent (fig. 5). The minor soils include Asa soils; Edna clay, overwashed phase; Laewest clay, overwashed phase; and Pledger, Riolomas, Sumpf, Telferner, and Texana soils.

The nearly level to weakly undulating Brazoria soils are very deep, somewhat poorly drained, very slowly permeable, and clayey and have a clayey subsoil. They are underlain by clayey and loamy alluvial sediments.

The nearly level Norwood soils are very deep, well drained, moderately permeable, and loamy and have a loamy subsoil. They are underlain by loamy and clayey alluvial sediments.

The nearly level Clemville soils are very deep, well drained, slowly permeable, and loamy and have a loamy subsoil over buried clayey soils. They are underlain by clayey and loamy sediments.

The soils in this map unit are very fertile and are well suited to cropland, pasture, and rangeland. They are used mainly as pasture, hayland, or rangeland. A few areas are planted to grain sorghum or corn. Fertilizers are needed for maximum production on pasture, hayland, and cropland.

Proper stocking rates and rotational grazing are needed on rangeland.

The major limitations affecting urban uses on these soils are the clayey texture, a high shrink-swell potential, and low strength. In areas of the Brazoria soils, the corrosivity of steel pipe also is a limitation.

Dominantly Clayey Soils on Coastal Lowlands

This group of soils makes up about 16 percent of the land area of the county. The dominant soils are the Francitas, Harris, Livia, Palacios, Placedo, Surfside, and Velasco soils, which formed in clayey and loamy sediments of the Beaumont Formation and interspersed alluvium and coastal marsh sediments. The Francitas, Livia, and Palacios soils are on low-lying coastal uplands. Most of the soils have a high

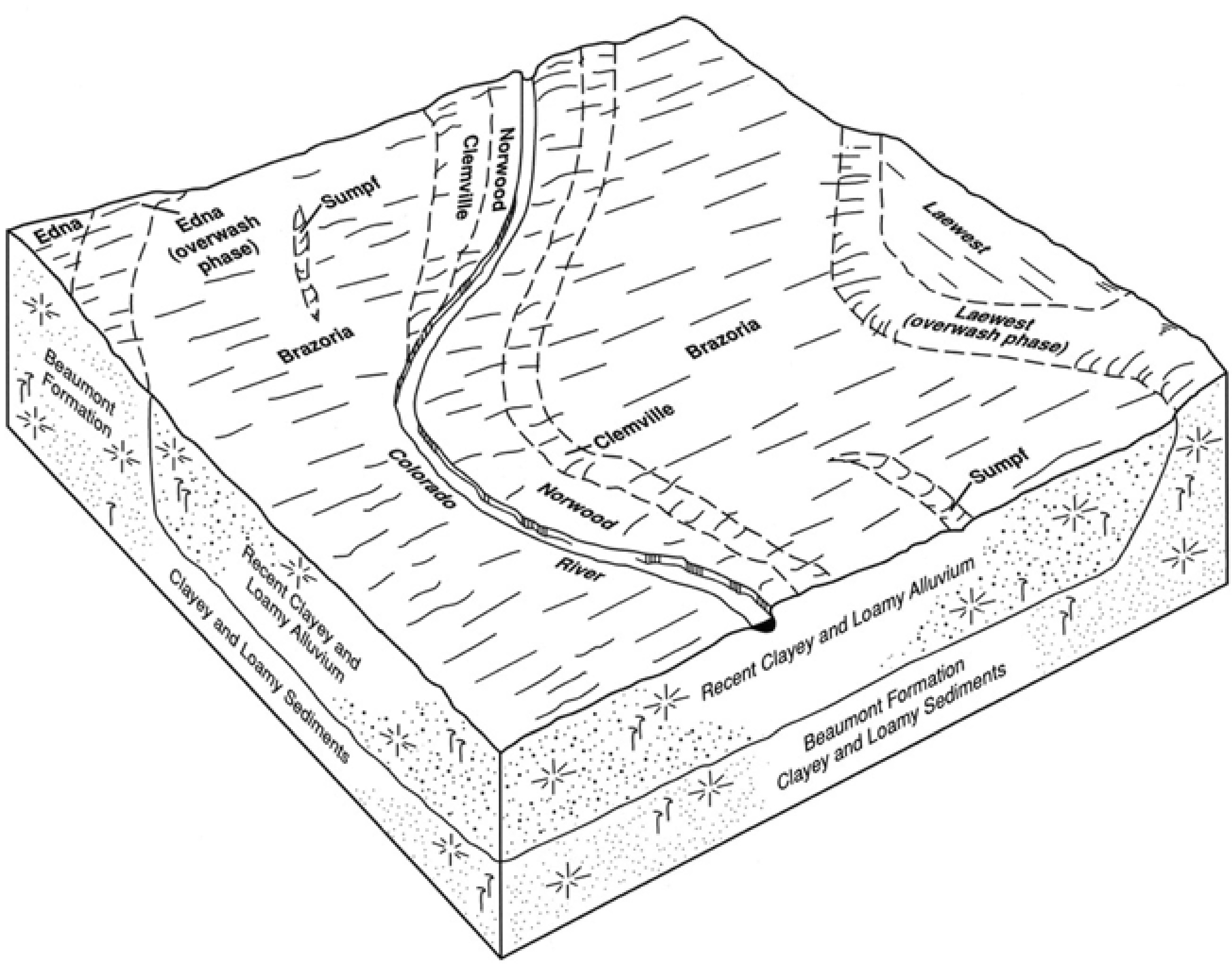


Figure 5.—Typical pattern of soils and underlying material in the Brazoria-Norwood-Clemville general map unit.

sodium content. Slopes are nearly level to weakly concave. The native vegetation is mainly gulf cordgrass and a few sparse woody shrubs.

Most of these soils are not suited to cropland because of salinity and wetness. A few areas of the Livia and Palacios soils are used for grain sorghum. These soils, along with the Francitas and Surfside soils, are suitable for use as pasture and hayland. The other soils are suited only to use as rangeland and wildlife habitat. Fertilizers are necessary for maximum production on cropland, pasture, and hayland.

Urban uses are expanding in some areas of the Francitas, Livia, Palacios, and Surfside soils. These soils have severe limitations for urban uses, including wetness, a high shrink-swell potential, a high sodium content, very slow permeability, and corrosivity of steel pipe. Also, flooding from tidal storms is a hazard at low elevations. The Harris, Velasco, and Placedo soils are in coastal marshes and are not suitable for homesites because of wetness and flooding.

6. Livia-Palacios-Francitas

Poorly drained, nearly level, loamy and clayey, saline soils

These soils are on broad, low-lying upland coastal plains and on coastal lowlands. They are occasionally dissected by small creeks and their tributaries. Slopes are mainly less than 1 percent, except on short, steep side slopes along streams. About 60 percent of this map unit has been farmed since the survey area was settled. Several of the fields are now used as pasture or hayland. The rest are used as rangeland. The natural vegetation is an open prairie with plants that are adapted to high salinity. Gulf cordgrass is the dominant grass on overgrazed rangeland.

This map unit makes up about 7 percent of the land area of the county. It is about 32 percent Livia soils, 31 percent Palacios soils, 18 percent Francitas soils, and 19 percent soils of minor extent. The minor soils include Bacliff, Dacosta, Edna, Harris, Ijam, Laewest, Livco, Placedo, Surfside, Texana, Velasco, and Veston soils.

The Livia, Palacios, and Francitas soils are very deep and very slowly permeable and have a clayey subsoil. The Livia and Palacios soils are loamy, and the Francitas soils are clayey. All three of the soils are underlain by clayey and loamy sediments.

Because of salinity, these soils are best suited to irrigated crops, such as rice. A few fields are planted to dryland grain sorghum. Pastures and hayland are planted to bluestems, bermudagrasses, and salt-tolerant grasses. Fertilizers are needed for maximum production on these soils. Rotational grazing and proper stocking rates are needed on rangeland.

Urban uses are expanding in some areas of these soils. The major limitations affecting these uses are a high shrink-swell potential, very slow permeability, wetness, excess sodium, corrosivity of steel pipe, and the clayey surface layer of the Francitas soils.

7. Harris-Velasco-Placedo

Very poorly drained, nearly level, clayey, saline soils

These soils have weakly convex relief and a water table at or near the surface. The relief is broken by standing ponds of water, small bayous, and small drains. This map unit is in coastal marshes and is commonly flooded. Slopes are mainly less than 0.5 percent. The natural vegetation consists mainly of low-growing, salt-tolerant plants. In places the surface is barren of vegetation.

This map unit makes up about 5 percent of the land area of the county. It is about 29 percent Harris soils, 24 percent Velasco soils, 22 percent Placedo soils, and 25 percent soils of minor extent. The minor soils include Follet, Francitas, Galveston, Ijam, Livia, Mustang, Norwood, Palacios, Surfside, and Veston soils.

The Harris, Velasco, and Placedo soils are very deep, very slowly permeable, clayey soils. They are underlain by clayey and loamy sediments.

These soils are poorly suited to uses other than wildlife habitat because of wetness, the hazard of flooding, salinity, and the clayey texture.

8. Surfside

Poorly drained, nearly level, clayey, saline soils

Areas of these nearly level soils are on weakly concave, broad coastal lowlands and are broken by Caney Creek and small, shallow creeks and bayous that drain into the Gulf of Mexico and East Matagorda Bay. Flooding from heavy rains is an occasional hazard. Slopes are mainly less than 1 percent. The natural vegetation consists of salt-tolerant prairie grasses and sedges.

In the 1800's, about 60 percent of this map unit was used for cotton or sugarcane. Currently, all of the unit is used as pasture, hayland, or rangeland.

This unit makes up about 4 percent of the land area of the county. It is about 75 percent Surfside soils and 25 percent soils of minor extent, including Asa, Harris, Ijam, Livia, Palacios, Pledger, and Velasco soils.

The nearly level Surfside soils are very deep, very slowly permeable, clayey soils. They are underlain by clayey and loamy sediments.

These soils are not suited to cropland because of high salinity and wetness. They are best suited to rangeland, pasture, and wildlife habitat.

The limitations affecting urban uses include the hazard of flooding, wetness, a high shrink-swell potential, excess sodium, clayey texture, and corrosivity.

Sandy and Loamy Soils on the Matagorda Peninsula

This group of soils makes up about 4 percent of the land area of Matagorda County. The Follet and Galveston soils are dominant on the elongated peninsula between the Gulf of Mexico and Matagorda Bay. These soils formed mainly in beach deposits. The landscape consists mainly of undulating dunes bounded by nearly level beaches facing the Gulf of Mexico and marshes on the side adjacent to the bay. The dunes have a sparse cover of forbs and grasses, such as panicums. The vegetation in the marsh areas is dominantly cordgrass.

These soils are suitable mainly for limited recreational uses and for wildlife habitat. They provide habitat for shore birds and marine animals. The dunes provide a barrier that helps to protect the coast from tidal storm damage.

9. Galveston-Follet

Somewhat excessively drained and very poorly drained, sandy and loamy, nonsaline and saline soils

This map unit makes up the Matagorda Peninsula, which runs almost the entire length of the survey area and separates it from the Gulf of Mexico. The Galveston soils are on high, undulating sand dunes, and the Follet soils are on flats. Slopes are extremely variable. The natural vegetation includes tall grasses on the dunes and salt-tolerant plants on the saline soils.

This map unit makes up about 4 percent of the land area of the county. It is about 32 percent Galveston soils, 31 percent Follet soils, and 37 percent areas of minor extent (fig. 6). The minor components include Beaches and Mustang and Veston soils.

The undulating Galveston soils are very deep,

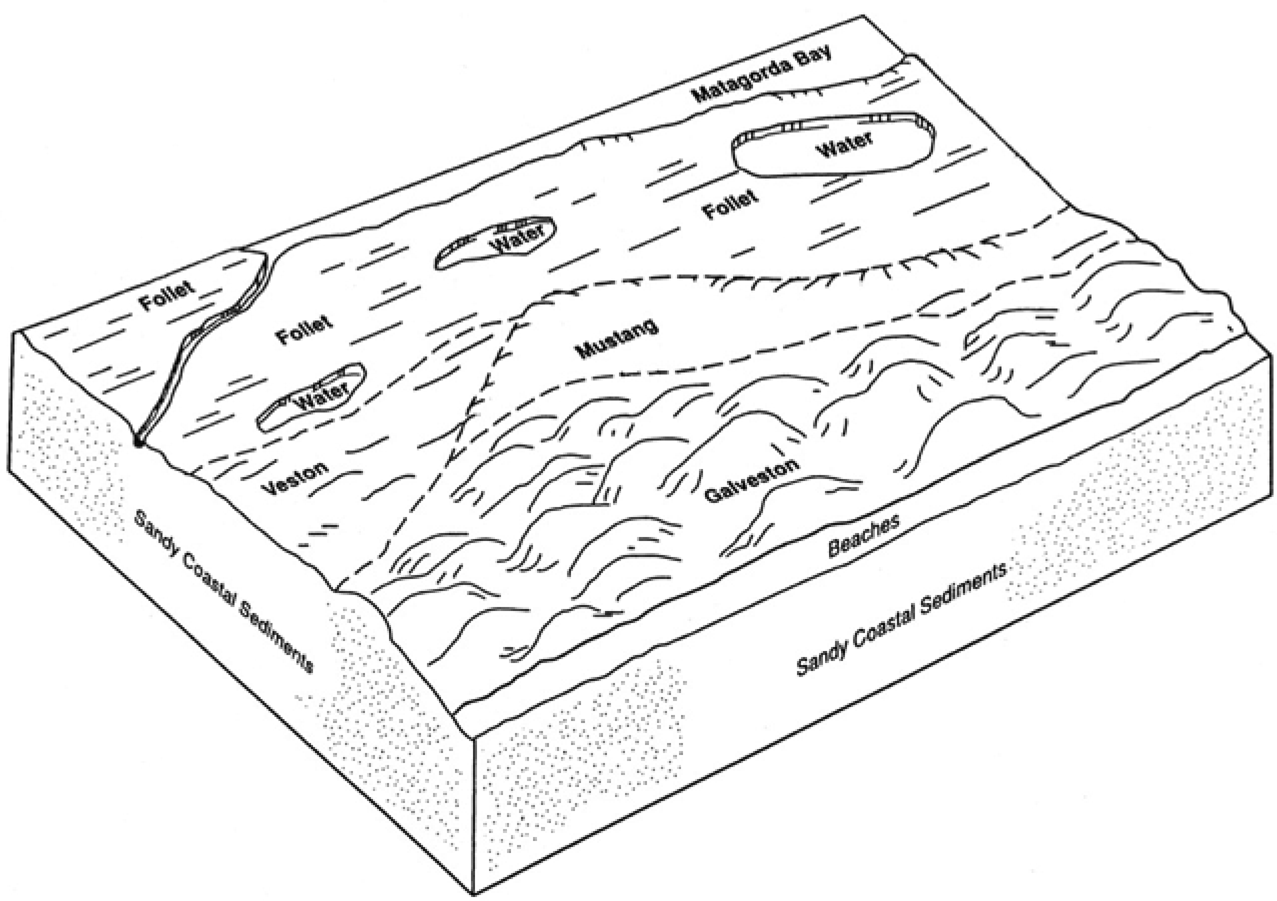


Figure 6.—Typical pattern of soils and underlying material in the Galveston-Follet general soil map unit.

somewhat excessively drained, rapidly permeable, nonsaline, and sandy and have a sandy subsoil. They are underlain by sandy sediments.

The nearly level Follet soils are very deep, very poorly drained, very slowly permeable, saline, and loamy and have a loamy subsoil. They are underlain by loamy and sandy sediments.

This map unit is suitable only for recreational uses and wildlife habitat because of high tides, salinity, a high water table, and the sandy surface layer.

Detailed Soil Map Units

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

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. 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 other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties 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, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit 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, 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, slope, stoniness, salinity, 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, Laewest clay, 0 to 1 percent slopes, is a phase of the Laewest series.

Some map units are made up of two or more major soils or miscellaneous areas and are called complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Livco-Dacosta complex, 0 to 1 percent slopes, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Beaches is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other 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 or miscellaneous areas.

Aa—Asa silt loam, rarely flooded

This very deep, nearly level soil is on flood plains in the eastern and central parts of the county, mainly along Caney Creek and its tributaries. Areas are broad and somewhat elongated and parallel to streams. They range from 20 to 500 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is about 17 inches thick. It is black, neutral silt loam to a depth of 5 inches. From a depth of 5 to 12 inches, it is black, neutral silty clay loam, and from a depth of 12 to 17 inches, it is dark brown, neutral silty clay loam. The subsoil, from a depth of 17 to 46 inches, is strong brown, moderately alkaline silt loam. The underlying material, from a depth of 46 to 75 inches, is reddish yellow loam in the upper part and strong brown silt loam in the lower part. It is moderately alkaline throughout. A buried soil that is dark reddish brown, moderately alkaline silty clay is at a depth of 75 to 90 inches.

The Asa soil is well drained. Surface runoff is slow. Permeability is moderate. Available water capacity is high. This soil is inherently fertile. Flooding occurs about 1 to 5 times in 100 years, and the duration is brief. The shrink-swell potential of this soil is low.

Included with this soil in mapping are small areas of Brazoria, Clemville, Norwood, and Pledger soils. The Brazoria and Pledger soils have a clayey subsoil. The Clemville and Norwood soils have a lighter color in the surface layer than the Asa soil. In addition, the Clemville soil has buried layers at a depth of 24 to 36 inches. Also included are small areas where the surface layer is dark colored and thick and a few small areas that have clayey overwash. Included soils make up less than 20 percent of the map unit.

The Asa soil is used mainly for rangeland and pecan orchards. Some small areas are used for alfalfa, turfgrass, or cropland. Production is high in most years because of the natural fertility and available water capacity. Wildlife uses play a major role in this part of the county, where wooded flood-plain soils are extensive.

The native vegetation includes hardwood trees and mid and tall grasses. Pecan trees are common. Saw palmetto is a common invader, and eradication is difficult. The potential for pasture grasses is high. Plant vigor should be maintained by proper stocking and rotation grazing. In areas where the tree canopy is dense, grass production can be increased by removing some of the trees. The proper use of fertilizer can promote vigorous grass growth and increase production.

This soil is well suited to pecan orchards because of the high natural fertility, adequate drainage and permeability, a deep rooting depth, and the high available water capacity. Intensive management practices that include applications of nitrogen fertilizer and a disease and insect control program can increase crop yields.

The extent of turfgrass farming is decreasing because of lower prices and less demand. The main grasses are improved varieties of St. Augustine and bermudagrass. Applications of fertilizer and proper irrigation increase yields.

Corn and grain sorghum are the main crops on small cultivated fields. The potential for crop production is high, but the extent of cultivated land is limited. Leaving crop residue on the surface helps to maintain soil fertility and conserve soil moisture during dry years. Crop yields can be increased by applying the proper kinds and amounts of fertilizer. This soil is not suited to rice production because it is moderately permeable. Alfalfa hay was once grown extensively; however, insects and climatic conditions, such as high humidity, have greatly reduced the number of acres.

The dense stands of trees on this soil make it an excellent habitat for deer, wild hogs, raccoon, and many species of birds. Overall, the habitat is good for openland wildlife, fair for rangeland wildlife, and very poor for wetland wildlife.

This soil is suitable for most urban and recreational uses. The hazard of flooding is a concern for some urban and recreational uses. Low strength is a limitation when this soil is used as a site for roads and streets; however, adding better suited base material helps to prevent damage. Seepage is a limitation affecting sewage lagoons, ponds, and embankments. Using heavier clays or commercially designed sealants helps to retain or divert water. High corrosivity of steel pipe can be partly overcome by treating or coating the pipe.

This soil is in capability class I and in the Loamy Bottomland range site.

As—Asa silty clay loam, rarely flooded

This very deep, nearly level soil is on flood plains, mainly in the eastern part of the county, along Caney Creek. A few smaller areas are along the Colorado

River. A thin layer of clayey overwash is commonly on the surface. Areas are 20 to 200 acres in size. Slopes are weakly convex or plane and are less than 1 percent.

Typically, the surface layer is dark reddish brown, moderately alkaline silty clay loam about 14 inches thick. The subsoil, from a depth of 14 to 45 inches, is moderately alkaline, stratified, dark brown silty clay loam and strong brown silt loam. The underlying material, from a depth of 45 to 80 inches, is brown, moderately alkaline silt loam.

This soil is well drained. Surface runoff is slow. Permeability is moderate in the subsoil. Available water capacity is high, but the soil can be droughty where a thin layer of clayey overwash restricts the movement of water and air. The shrink-swell potential is moderate in the surface layer. It is low in the subsoil and underlying material. Flooding occurs about 1 to 5 times in 100 years, and the duration is brief. This soil is inherently fertile.

Included with this soil in mapping are small areas of Asa silt loam and Brazoria, Clemville, Norwood, and Pledger soils. The Brazoria and Pledger soils have a thick, clayey subsoil. The Clemville and Norwood soils have a lighter color in the surface layer than the Asa soil. In addition, the Clemville soil has buried clayey layers at a depth of 24 to 36 inches. Also included are several small areas where the surface layer has an overlying layer of clayey overwash that is 3 to 8 inches thick. Included soils make up less than 25 percent of the map unit.

The Asa soil is used mainly for rangeland and pecan orchards. Some small areas are used for turfgrass or for alfalfa or other crops. Production is high in most years. Wildlife uses, such as hunting, are common in this part of the county because of the extensive areas of wooded flood-plain soils.

The native range plants include hardwood trees and mid and tall grasses. Pecan trees are common. Saw palmetto is a common invader.

This soil is well suited to pecan orchards because of the natural fertility, adequate drainage and permeability, a deep rooting depth, and the high available water capacity. Intensive management practices that include applications of nitrogen fertilizer and a disease and insect control program can increase crop yields.

The extent of turfgrass farming is decreasing because of a decrease in both prices and demand. The main grasses are improved varieties of St. Augustine and bermudagrass. Applications of fertilizer and proper irrigation increase yields.

The potential for pasture grasses is high. Plant vigor should be maintained by proper stocking and rotation grazing. In areas where the tree canopy is dense, grass production can be increased by removing some of the trees. The proper use of fertilizer can promote vigorous grass growth and increase production. Chemical treatments are needed to eradicate or limit the growth of saw palmetto.

A few small fields are planted to corn, grain sorghum, sudan hybrid, or alfalfa hay. The number of areas planted to alfalfa hay has decreased because of problems with insects and high humidity.

Cropland, pastures, and hay fields require applications of fertilizer and proper management practices. Leaving crop residue on the surface of cropland helps to maintain soil fertility and tilth. The residue also helps to conserve soil moisture in dry years. This soil is not suited to rice because of the moderate permeability in the subsoil.

Dense stands of trees and other woody plants are in uncleared areas. These areas are well suited to many types of wildlife. Deer are plentiful as are wild hogs, raccoon, and several species of birds. Overall, the habitat is good for openland wildlife, fair for rangeland wildlife, and very poor for wetland wildlife.

This soil is suited to many urban and recreational uses; however, the shrink-swell potential, corrosivity, seepage, and low strength are limitations. Building foundations require extra steel to compensate for shrinking and swelling. Seepage is a limitation affecting sewage lagoons, ponds, and embankments, which need to be sealed with layers of more clayey materials or with commercial sealants. The low strength can be partly overcome by mixing the soil with better suited base material when it is used for roadfill. Corrosivity can be partly overcome by treating or wrapping steel pipe.

This soil is in capability class I and in the Loamy Bottomland range site.

Az—Asa silty clay loam, saline, occasionally flooded

This very deep, nearly level soil is on flood plains in the extreme southeastern part of the county, at an elevation less than 10 feet above sea level. Areas are subject to occasional flooding by nearby streams and by high tides during hurricanes. This soil has a distinct rangeland vegetation of scattered mesquite trees, pricklypear, and sparse stands of gulf cordgrass, in direct contrast to the tall hardwood trees on other Asa soils. Areas are mainly narrow bands parallel to the adjacent streams. They range 20 to more than 100 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is slightly saline, moderately alkaline silty clay loam about 12 inches thick. It is very dark grayish brown in the upper part and very dark brown in the lower part. The subsoil, from a depth of 12 to 45 inches, is yellowish red, moderately saline and moderately alkaline silty clay loam. The underlying material, from a depth of 45 to 80 inches, is weak red, moderately alkaline silt loam.

This soil is well drained. Surface runoff is slow, and permeability is moderate. Available water capacity is low because of a high sodium content. Flooding occurs 5 to 50 times in 100 years, and the duration is brief. The shrink-swell potential is moderate in the surface layer and low in the subsoil and underlying material. This soil is moderately saline or strongly saline.

Included with this soil in mapping are small areas of Harris, Placedo, and Surfside soils. These soils are more clayey throughout than the Asa soil and have dense stands of cordgrass. Also included are small areas of an Asa soil that has a surface layer of silty clay. Included soils make up less than 20 percent of the map unit.

This saline Asa soil is best suited to rangeland and wildlife habitat. The amount of palatable vegetation on rangeland is limited. This soil provides fair habitat for deer and other wild game.

Urban and recreational uses are limited because of salinity and the hazard of flooding. Low strength is a limitation when this soil is used as a site for roads and streets; however, adding better suited base material helps to prevent damage. When seepage is a concern, ponds and embankments should be sealed with more clayey soils or with commercial sealants. High corrosivity of uncoated steel is a limitation affecting the installation of pipelines. Treating or coating the pipe before installation can help to overcome this limitation.

This soil is in capability subclass VIs and in the Salty Prairie range site.

BaA—Bacliff clay, 0 to 1 percent slopes

This very deep soil is on nearly level to weakly concave uplands. It is slightly lower on the landscape than most adjacent soils. In cultivated fields, this soil is lighter in color than other clayey soils. In undisturbed areas, gilgai microrelief consisting of small knolls and subrounded depressions is common (fig. 7). Areas are irregular in shape and range from 20 to more than 200 acres in size.

Typically, the surface layer is 20 inches thick. It is very dark gray, moderately acid clay in the upper part and gray, slightly acid clay in the lower part. The subsoil, from a depth of 20 to 68 inches, is gray, slightly acid clay in the upper part and light gray, slightly alkaline clay in the lower part. The underlying material, from a depth of 68 to 80 inches, is strong brown, moderately alkaline clay.

This soil is poorly drained. When dry, the soil has wide, deep cracks that permit rapid infiltration of water, but when the soil is wet and the cracks are sealed, infiltration is very slow. Permeability and surface runoff are very slow. Available water capacity is high. The shrink-swell potential is high throughout the soil. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Dacosta, Edna, Laewest, Livco, Livia, and Palacios soils. The Dacosta, Edna, Livco, Livia, and Palacios soils have a loamy surface layer. In addition, the Livco, Livia, and Palacios soils are saline. The Laewest soil has a clayey surface layer that is darker and thicker than that of the Bacliff soil. Included soils make up less than 20 percent of the map unit.

The Bacliff soil is used mainly as cropland and pasture. It is moderately suited to crops. The main crops are rice, corn, and grain sorghum. This soil is best suited to rice production because it is very slowly permeable and is easy to level. A well designed surface water management system that includes drainage, leveling, and irrigation water management is important for rice production. Fertilizers are essential for increased crop yields. Applications should be based on laboratory tests and local test plot demonstrations.

Improved pasture grasses include Gordo bluestem, dallisgrass, bermudagrasses, and bahiagrass. Periodic applications of fertilizer throughout the growing season are needed for maximum pasture and hay production. Rotation grazing also is an important management practice.

This soil provides fair habitat for openland, wetland, and rangeland wildlife. Ducks and geese are prevalent on rice fields in winter months. Other wildlife species include dove, quail, and rabbits.

This soil has many limitations for urban and recreational uses. Wetness, the shrink-swell potential, very slow permeability, low strength, and corrosivity are limitations that affect buildings with basements, septic tank absorption fields, roads and streets, and uncoated steel pipe. To overcome these limitations, drainage systems should be installed to divert runoff and reduce the amount of surface water. Building foundations require additional steel and, along with roads, may need to be constructed on raised fill material to avoid the cracking caused by shrinking and

Figure 7.—Gilgai microrelief in an area of Bacliff clay, 0 to 1 percent slopes. The microhighs (light colored areas) support different kinds of native grasses than the microlows.

swelling, low strength, and wetness. Uncoated steel pipe requires coating or wrapping to reduce corrosivity. The cracks that form during dry periods and the slippery surface during wet periods restrict some recreational uses. In some recreational areas, vegetation or another kind of protective cover is needed.

This soil is in capability subclass IIIw and in the Blackland range site.

Bb—Beaches

This map unit consists of the land area adjacent to the Gulf of Mexico, between the low tide mark and the front of coastal dunes, mainly along the extreme southern edge of the Matagorda Peninsula. The area is known locally as Matagorda Beach. Areas are long and narrow and range from 20 to about 100 acres in size. Slopes average less than 0.5 percent.

Areas consist of sandy marine deposits with less than 35 percent shell fragments. They are reworked by both tides and coastal winds.

The lower part of the beaches is flooded daily by high tides. The upper part is inundated seasonally by tides that are slightly higher than normal. The water table is at or near the surface throughout the year. These barren, sandy areas range from nonsaline to extremely saline.

Included in mapping are small areas of Follet, Galveston, and Mustang soils. These included soils have small amounts of vegetation, mainly marsh grasses. They are slightly higher on the landscape than the beaches. The Follet soil is weakly concave, saline, and loamy. The Galveston soil is on undulating sand dunes. The Mustang soil is weakly convex, wet, and sandy. Also included are elongated, mounded areas that are made up of 35 to 75 percent shell fragments. These areas are mainly south of East Matagorda Bay. Included areas make up less than 25 percent of the map unit.

This map unit is used only for recreational purposes. In summer months it is used for sunbathing and fishing. In winter months it is used sparsely for fishing. The beaches are barren and not capable of plant growth.

This unit is in capability subclass VIIIs. It is not assigned a range site.

Br—Brazoria clay, rarely flooded

This very deep, nearly level, reddish, clayey soil is on flood plains along the Colorado River and Caney Creek. In undisturbed areas, gilgai microrelief, consisting of small knolls and subrounded depressions, is common. On cultivated fields, this microrelief is barely visible, having been smoothed by plowing. Areas are irregular in shape and range from 20 to more than 500 acres in size. Slopes are mainly less than 1 percent.

Typically, the surface layer is dark reddish brown, moderately alkaline clay about 12 inches thick. The subsoil, from a depth of 12 to 65 inches, is reddish brown, moderately alkaline clay. The underlying material, from a depth of 65 to 90 inches, also is reddish brown, moderately alkaline clay.

This soil is moderately well drained. Surface runoff is slow, and permeability is very slow. Flooding occurs 1 to 5 times in 100 years, and the duration is brief. Available water capacity is high, but this soil can be droughty because the dense, clay subsoil restricts the movement of water and air. The shrink-swell potential is high throughout the profile. This soil is inherently fertile.

Included with this soil in mapping are small areas of Asa, Clemville, Norwood, and Pledger soils. The Asa, Clemville, and Norwood soils have a loamy surface layer and are on weakly convex ridges. The Pledger soil has a thick, dark, clayey surface layer. Included soils make up less than 20 percent of the map unit.

The Brazoria soil is used mostly as rangeland or pasture. Some areas are used for pecan orchards, and a few are used as cropland or for turfgrass production.

Rangeland has dense stands of hardwood trees, except where it is thinned or cleared. Grass production can be increased by thinning the canopy of trees and by using proper stocking rates and rotation grazing. In the past, excessive surface water prevented the proper use and management of rangeland. Extensive drainage systems have been installed by drainage districts in the eastern part of the county. Palmetto is a common invader on overgrazed rangeland, and chemical or mechanical control is needed. Once palmetto becomes established, it is difficult to eradicate.

The potential for pasture grasses is high. Plant vigor should be maintained by proper stocking and rotation grazing. A well managed fertilizer program is needed for maximum grass and hay production.

The main crops are corn and grain sorghum in the cultivated areas of this soil. Alfalfa, rye, and clover are planted on small fields for grazing or hay. This soil generally is not suited to rice because of the moderate alkalinity. A surface water management system is desirable to improve drainage and increase yields. The soil is seasonally wet or droughty. When dry, the soil has deep, wide cracks. The cracks seal when the soil is wet, and infiltration becomes very slow. Incorporating crop residue into the soil improves tilth and aeration. Deep-rooted plants improve the water intake rate.

This soil is well suited to woodland wildlife habitat. It provides fair habitat for openland and rangeland wildlife and poor habitat for wetland wildlife. Deer, wild hogs, raccoon, squirrel, and many species of birds are common, especially in areas where the dense stands of trees and woody shrubs have not been cleared.

This soil is poorly suited to urban and recreational uses because of the high shrink-swell potential, wetness, the clayey surface layer, very slow permeability, corrosivity. These limitations can be partly overcome by proper design and installation of buildings, roads, and pipelines. Wetness can be reduced by the installation of surface or tile drainage systems in areas of construction. Building foundations require additional steel, and roads should be constructed on raised fill material. Septic tank absorption fields should be enlarged. Steel pipe should be treated or wrapped before installation.

This soil is in capability subclass IIw and in the Clayey Bottomland range site.

CeA—Cieno sandy clay loam, 0 to 1 percent slopes

This very deep, poorly drained, loamy soil is in weakly concave depressions in the uplands. In most areas, water remains ponded after heavy rains. Areas are mainly elongated depressions bounded by slightly higher lying soils on weakly convex slopes. The areas range from 10 to more than 50 acres in size. Slopes are mainly less than 0.3 percent.

Typically, the surface layer is dark gray, neutral sandy clay loam about 12 inches thick. The subsoil, from a depth of 12 to 65 inches, is mottled dark gray, neutral clay loam in the upper part; mottled grayish brown, neutral and slightly alkaline sandy clay loam in the next part; and mottled light brownish gray, slightly alkaline sandy clay loam in the lower part. The subsoil has mottles in shades of brown, gray, red, or yellow. The underlying material, from a depth of 65 to 80 inches, is light gray, slightly alkaline fine sandy loam.

This soil is poorly drained. Permeability is very slow. Available water capacity is high. A perched water table is within a depth of 3 feet during rainy seasons. The shrink-swell potential is moderate throughout the soil.

Included with this soil in mapping are small areas of Edna, Fordtran, and Telferner soils. These soils are slightly higher on the landscape than the Cieno soil. The Edna and Telferner soils have a sandy loam surface layer. The Fordtran soil has a sandy surface layer. Also included are small areas of a Cieno soil where the surface layer and the upper part of the subsoil are darker than is typical for the series. Included soils make up less than 20 percent of the map unit.

The Cieno soil is used as cropland where the higher lying adjacent soils have been smoothed and the land leveled. Otherwise, crop yields are limited, especially in periods of high rainfall. This soil is best suited to rice production. A well managed fertilizer program is needed for maximum yields.

A few areas of this soil are used as rangeland. The native plants include mid and tall grasses. Sennabean plants and aquatic weeds are common in overgrazed or wet areas. McCartney rose often invades old abandoned fields.

This soil provides good habitat for wetland wildlife and fair habitat for openland and rangeland wildlife. Geese and ducks feed in the depressions in fields and rangeland. Dove and quail are common during summer months.

This soil has severe limitations for urban and recreational uses because of wetness, the moderate shrink-swell potential, and corrosivity. Proper drainage and land leveling are necessary on sites for streets and roads. Raised fill material is necessary for road and street construction. Very slow permeability makes this soil suitable for farm ponds but poorly suited to septic tank absorption fields. Corrosivity can be overcome by treating steel pipe. Dressing buried plastic pipe with sandy material helps to prevent breakage caused by shrinking and swelling.

This soil is in capability subclass IVw and in the Lowland range site.

Cm—Clemville silty clay loam, rarely flooded

This very deep, nearly level soil is on flood plains along the Colorado River and Caney Creek. Areas consist of 2 to 3 feet of reddish, loamy alluvium over buried clayey soils. The areas are elongated to subrounded in shape and parallel the associated stream. They range from 20 to more than 100 acres in size. Slopes are 0 to 1 percent.

Typically, the surface layer is reddish brown, slightly alkaline silty clay loam about 9 inches thick. The underlying material, from a depth of 9 to 33 inches, is dark brown, slightly alkaline silty clay loam in the upper part; brown, slightly alkaline silt loam in the next part; and dark brown, slightly alkaline silty clay loam in the lower part. A buried soil is between depths of 33 and 80 inches. It is black, slightly alkaline clay in the upper part and strong brown, moderately alkaline clay in the lower part.

This soil is well drained. Surface runoff and permeability are slow. Available water capacity is high. This soil is inherently fertile. Flooding occurs 1 to 5 times in 100 years, and the duration is brief. The shrink-swell potential is low in the surface layer and in the upper part of the subsoil and high in the lower part of the subsoil.

Included with this soil in mapping are small areas of Asa, Brazoria, Norwood, and Pledger soils. The Asa and Pledger soils have a dark surface layer. The Brazoria soil is clayey throughout. The Norwood soil does not have buried clayey soils within a depth of 40 inches. Also included are small areas of a Clemville soil that has a silty clay surface layer. Included soils make up less than 20 percent of the map unit.

This Clemville soil is limited in extent and is used mainly as rangeland or pasture. A few small areas are used as cultivated cropland, and a few areas are used for turfgrass production. The main crops are corn and grain sorghum on small cultivated fields. The potential for cropland is high. Leaving crop residue on the surface helps to maintain soil fertility and conserve moisture during dry years. Crop yields can be increased by applying the proper kinds and amounts of fertilizer.

This soil is well suited to pecan orchards because of the high natural fertility, adequate drainage and permeability, a deep rooting depth, and the high available water capacity. Intensive management practices that include applications of nitrogen fertilizer and a disease and insect control program can increase crop yields.

Rangeland should be managed by rotation grazing and by maintaining a proper stocking rate. In areas where the tree canopy is dense, grass production can be increased by removing some of the trees. The potential for pasture grasses on this soil is high. The proper use of fertilizer can promote vigorous grass growth and increase production.

This soil provides good habitat for woodland and openland wildlife and very poor habitat for wetland wildlife. Deer are common, as are birds, raccoons, squirrels, and other animals.

This soil is suitable for most recreational and urban uses. Low strength is a limitation affecting the construction of roads and streets. Adding a better suited base material helps to prevent damage. Seepage is a limitation affecting sewage lagoons, ponds, and embankments. Heavier clays or commercially designed sealants are needed for retaining or diverting water. High corrosivity of steel pipe can be partly overcome by treating or coating the pipe.

This soil is in capability class I and in the Loamy Bottomland range site.

DaA—Dacosta sandy clay loam, 0 to 1 percent slopes

This very deep, nearly level upland soil is on broad flats of the coastal plain. Cultivated areas are lighter in color than adjacent areas of the closely associated, clayey Laewest soils. Cultivated fields can have varying amounts of large clods because of the compacting nature of the surface layer. Areas are oval or irregular in shape and range from 20 to more than 200 acres in size.

Typically, the surface layer is black, neutral sandy clay loam about 9 inches thick. The subsoil extends to a depth of 80 inches. From a depth of 9 to 24 inches, it is very dark gray sandy clay; from a depth of 24 to 36 inches, it is mottled dark gray clay; from a depth of 36 to 48 inches, it is mottled grayish brown sandy clay loam; and from a depth of 48 to 80 inches, it is mottled light gray sandy clay loam. The subsoil is moderately alkaline throughout. Mottles in shades of brown, red, and yellow begin at a depth of 24 inches.

This soil is moderately well drained. Permeability and surface runoff are very slow. Available water capacity is high. The soil is seasonally wet or droughty. It has some cracks when dry. When the soil is wet, the cracks seal and infiltration is very slow. The shrink-swell potential is moderate in the surface layer. It is high in the subsoil. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Cieno, Edna, Laewest, Livco, Livia, and Palacios soils. The Cieno soil is in small, rounded depressions. The Edna soil has a sandy loam surface layer and is slightly higher on the landscape than the Dacosta soil. The Laewest soil has a dark, clayey surface layer. The Livco, Livia, and Palacios soils are saline. Included soils make up less than 20 percent of the map unit.

The Dacosta soil is used mainly as cropland, but a few areas are used for turfgrass production, rangeland, or pasture. Corn, grain sorghum, and rice are the main crops. Good management practices include leaving crop residue on the surface when crops are not being grown, tilling on a timely and limited basis, and rotating crops. Applications of fertilizer are needed for maximum crop production and should be based on laboratory test results. A surface water management system is desirable to improve drainage and increase yields.

Turfgrasses grown on this soil include St. Augustine and bermudagrass varieties. Pasture grasses include improved varieties of bermudagrass, mainly coastal, and improved bluestems in some areas. Fertilizers, especially nitrogen, are necessary for maximum yields of either turfgrass or improved pastures. Rotation grazing is a good management practice on the pastures.

This soil provides fair habitat for openland and rangeland wildlife. Ducks and geese are prevalent on rice fields in winter months. Other game, including deer, dove, quail, and rabbits, are mainly in uncleared areas.

This soil is poorly suited to many urban and recreational uses. The main limitations are wetness, the high shrink-swell potential, clayey texture, very slow permeability, and corrosivity. Proper design and installation of foundations, streets, pipelines, and septic systems can partly overcome these limitations.

Installing drainage systems to divert runoff and reduce the amount of surface water helps to overcome problems related to drainage. Expanding septic tank absorption fields helps to overcome the very slow permeability. Because of the shrink-swell potential, building foundations require extra steel and roads should be constructed on raised fill material. Steel pipe should be treated or wrapped because of corrosivity.

This soil is in capability subclass IIw and in the Blackland range site.

EdA—Edna fine sandy loam, 0 to 1 percent slopes

This very deep soil is on uplands, mainly in the western and central parts of the county. In cultivated areas, the fine sandy loam surface layer is lighter in color than the surface layer of the more clayey adjacent soils. Areas are oval or irregular in shape and range from 20 to more than 200 acres in size.

Typically, the surface layer is dark grayish brown, moderately acid fine sandy loam about 6 inches thick. The subsoil extends to a depth of about 65 inches. From a depth of 6 to 12 inches, it is dark grayish brown, slightly acid clay; from a depth of 12 to 25 inches, it is grayish brown, neutral clay; from a depth of 25 to 58 inches, it is light brownish gray, neutral clay loam; and from a depth of 58 to 65 inches, it is mottled yellowish red, brownish yellow, and light gray, slightly alkaline clay loam. The underlying material, from a depth of 65 to 80 inches, is light brownish gray, moderately alkaline sandy clay loam.

This soil is somewhat poorly drained. Permeability and surface runoff are very slow. Available water capacity is high. This soil remains wet in a zone above the subsoil for a period of 2 to 5 days following heavy rains. The subsoil has a high shrink-swell potential. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Cieno, Dacosta, Laewest, Livco, Livia, Telferner, and Texana soils. The Cieno soil is in small, rounded depressions and, like the Dacosta soil, has a sandy clay loam surface layer. The Laewest soil is clayey throughout. The Livco and Livia soils are saline. The Telferner and Texana soils have a sandy loam surface layer that is 10 to 20 inches thick. Included soils make up less than 20 percent of the map unit.

The Dacosta soil is used mainly as cropland, but some areas are used as rangeland or pasture. This soil is droughty because the dense clay subsoil restricts the movement of water and air. The main crop is rice (fig. 8), but corn, grain sorghum, and soybeans are grown in some areas.

Very slow runoff can result in excess water on the surface for several days after rains. A surface water management system is desirable to improve drainage and increase yields. Good cropland management practices include leaving crop residue on the surface, tilling on a timely and limited basis, and rotating crops. Applications of fertilizer are needed for maximum crop production.

Improved pastures support mostly coastal and other bermudagrasses. Fertilizers, especially nitrogen, are needed for maximum hay and pasture production. Rotation grazing is a good management practice on improved pastures and native rangeland.

This soil provides fair habitat for wildlife. Geese and ducks abound on rice fields during the migratory season. Deer from nearby wooded areas browse in areas of this soil.

This soil is poorly suited to most urban and recreational uses. The main limitations are very slow permeability, poor surface drainage, corrosivity, and shrinking and swelling with changes in moisture. Most of these limitations can be partly overcome. Installing drainage systems to divert runoff and reduce the amount of surface water can help to overcome the permeability, shrink-swell, and drainage limitations affecting septic tank absorption fields and buildings with basements. Enlarging septic tank absorption fields helps to increase the percolation area. Because of the shrink-swell potential, building foundations require additional steel and roads should be constructed on suitable base material. Steel pipe should be coated or wrapped because of corrosivity.

This soil is in capability subclass IIIw and in the Claypan Prairie range site.

EoA—Edna silty clay, 0 to 1 percent slopes, overwashed

This very deep soil is in areas of uplands that are 5 to 10 feet above flood plains along the Colorado River and Caney Creek. Before the early 1900’s, floodwaters deposited reddish, clayey sediment that is 6 to 20 inches thick over the original soil surface. Later, levees and drainage ditches were constructed to control flooding, so very little sediment is now being deposited. Areas are irregular in shape and range from 20 to more than 200 acres in size.

Typically, the surface layer of overwashed sediment is dark reddish brown, moderately alkaline silty clay about 11 inches thick. From a depth of about 11 to 14 inches, the original surface layer of this soil is dark grayish brown, moderately alkaline very fine sandy loam. It is brown, moderately alkaline sandy loam from a depth of 14 to 19 inches. The subsoil, from a depth of 19 to 30 inches, is grayish brown, moderately

Figure 8.—Harvesting rice on a field of Edna fine sandy loam, 0 to 1 percent slopes.

alkaline clay loam, and from a depth of 30 to 58 inches, it is gray, moderately alkaline clay. The underlying material, from a depth of 58 to 80 inches, is white, moderately alkaline sandy clay.

This soil is somewhat poorly drained. Permeability and surface runoff are very slow. Available water capacity is high. The clayey overwash is droughty, however, because it restricts the movement of water and air. This soil remains wet in a zone above the subsoil for 2 to 5 days following heavy rains. The overwash has a high shrink-swell potential. The soil has large cracks when dry, but the surface seals over when the soil is wet. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Brazoria, Dacosta, Laewest, Telferner, and Texana soils. The Brazoria soil is a reddish, clayey soil on flood plains. The Dacosta, Telferner, and Texana soils are loamy upland soils that are slightly higher on the landscape than the Edna soil. The Laewest soil is also slightly higher on the landscape and has an overwash of sediment similar to that of the Edna soil. Included soils make up less than 20 percent of the map unit.

The Edna soil is used mainly as rangeland, but a few small areas are used as improved pasture or as cropland. Use and management need to be adapted to the silty clay surface layer. A surface water management system is desirable to improve drainage and increase yields. Gordo and other bluestems are the best suited grasses on improved pastures. A few areas are planted to rice and some to corn or grain sorghum. Applications of fertilizer are needed for maximum pasture, hay, or crop production.

Rangeland vegetation includes scattered large live oak, native grasses, and a few shrubs. Rotation grazing is a good management practice on rangeland.

This soil provides fair habitat for wildlife. Deer are common because of the close proximity of the Colorado River and various creeks. Other wild game include birds, squirrels, and raccoons.

This soil is poorly suited to most urban and recreational uses. The main limitations are the clayey surface layer, the high shrink-swell potential, poor surface drainage, and corrosivity. Most of the limitations can be partly overcome by good design and careful installation of foundations, streets, pipelines, and septic systems. Additional steel in building foundations helps to overcome problems related to shrinking and swelling. Septic tank absorption fields should be expanded so that the percolation area is increased. Suitable base material should be incorporated and packed on sites for roads and streets. Steel pipe should be wrapped or coated because of corrosivity.

This soil is in capability subclass IIIw and in the Blackland range site.

ExA—Edna-Cieno complex, 0 to 1 percent slopes

These very deep, nearly level soils are on coastal prairie uplands. Areas are not extensive and are mainly in the northwest part of the county. The Edna soil is in nearly level areas, and the Cieno soil is in small, rounded depressions. The Edna soil makes up about 58 percent of the complex, the Cieno soil about 26 percent, and other soils about 16 percent. The Edna and Cieno soils are so intricately mixed that mapping them separately is not practical at the scale used. Areas range from 50 to 300 acres in size.

Typically, the Edna soil has a surface layer of dark grayish brown, neutral fine sandy loam about 8 inches thick. The subsoil, from a depth of 8 to 70 inches, is mottled grayish brown, moderately alkaline sandy clay in the upper part and mottled light brownish gray, moderately alkaline sandy clay loam in the lower part. The mottles are in shades of brown or yellow. The lower part of the subsoil has a few films, threads, and fine concretions of calcium carbonate. The underlying material, from a depth of 70 to 80 inches, is pink, moderately alkaline sandy loam.

The Edna soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. Surface runoff is slow, and the hazard of water erosion is slight. During rainy seasons, this soil remains wet for 2 to 5 days in a zone above the subsoil. The shrink-swell potential is high.

Typically, the Cieno soil has a surface layer of dark gray, neutral sandy clay loam about 12 inches thick. From a depth of 12 to 30 inches, the subsoil is mottled dark gray, neutral sandy clay loam. From a depth of 30 to 65 inches, it is mottled grayish brown and light brownish gray sandy clay loam that is neutral in the upper part and moderately alkaline in the lower part. The subsoil has mottles in shades of brown or yellow. The underlying material, from a depth of 65 to 80 inches, is light gray, slightly alkaline fine sandy loam.

The Cieno soil is poorly drained. Permeability is very slow, and available water capacity is high. This soil is ponded for several weeks during rainy seasons. It is either wet or droughty, depending on seasonal rainfall. The shrink-swell potential is moderate throughout the soil.

Included with these soils in mapping are small areas of Dacosta, Laewest, Livco, and Telferner soils. The Dacosta soil has a thick surface layer that is darker than that of the Edna and Cieno soils. It is in positions on the landscape similar to those of the Edna soil. The Laewest soil is clay throughout and dark in color. The Livco soil is saline; has visible white, salty crusts on the surface; and supports saline vegetation, such as gulf cordgrass. The Telferner soil has a surface layer that is thicker than that of the Edna and Cieno soils and is very fine sandy loam. Included soils make up less than 25 percent of the map unit.

The Edna and Cieno soils are used mainly as rangeland. Some areas are used as cropland or pasture. The dominant native vegetation on the Cieno soil is bushy sennabean, longtom, and some water-loving plants, such as sedges and rushes. The Edna soil has open grassland vegetation of mid and tall grasses and scattered groves of live oak. Live oak and woody shrubs increase in abundance with overgrazing.

These soils are well suited to irrigated crops, such as rice, if fields are machine leveled. Plowpans and surface crusts occur in cultivated areas. Leaving crop residue on the surface helps to overcome these problems. Other management practices, such as crop rotation and a fertilizer program, are needed for maximum crop production. A surface water management system is desirable to improve drainage and increase yields.

These soils provide fair or good habitat for wetland wildlife and fair habitat for openland and rangeland wildlife. Ducks and geese feed on rice fields and in ponded areas of the Cieno soil.

These soils are poorly suited to most urban and recreational uses. The main limitations are wetness, very slow permeability, ponding, and corrosivity. These limitations can be partly overcome by good design and careful installation of building foundations, streets and roads, septic tank absorption fields, and pipelines. A drainage system is needed to divert runoff water and prevent ponding. Raised fill material on sites for streets and roads increases the strength of the base material. Expanding septic tank absorption fields helps to overcome wetness and restricted permeability. Wrapping or coating steel pipe reduces corrosivity.

The Edna soil is in capability subclass IIIw, and the Cieno soil is in capability subclass IVw. The Edna soil is in the Claypan Prairie range site, and the Cieno soil is in the Lowland range site.

FaA—Faddin loam, 0 to 1 percent slopes

This very deep, nearly level soil is on weakly convex ridges on uplands in the north-central part of the county. Areas are mainly oval or oblong. They range from 10 to 100 acres in size, averaging about 50 acres. Slopes average about 0.7 percent.

Typically, the surface layer is slightly acid loam about 14 inches thick. It is very dark grayish brown in the upper part and very dark gray in the lower part. The subsoil, from a depth of 14 to 61 inches, is mottled dark gray, slightly acid clay in the upper part and mottled grayish brown, slightly alkaline clay in the lower part. The mottles are in shades of brown. The underlying material, from a depth of 61 to 80 inches, is yellowish red, moderately alkaline clay that has a few light yellowish brown mottles.

This soil is moderately well drained. Surface runoff and permeability are very slow. Available water capacity is high. The shrink-swell potential is low in the surface layer and high in the subsoil. The hazard of water erosion is slight. This soil is inherently fertile.

Included with this soil in mapping are small areas of Bacliff, Cieno, Dacosta, Edna, and Laewest soils. The Bacliff and Laewest soils have a clayey surface layer. The Cieno soil is in small, rounded depressions. The Dacosta soil is slightly lower on the landscape than the Faddin soil. The Edna soil has a surface layer that is thin and is lighter colored than that of the Faddin soil. Also included are a few small areas of a Faddin soil that has slopes of slightly more than 1 percent. Included soils make up less than 20 percent of the map unit.

This Faddin soil is used mainly as cropland. Some areas are used for pasture, turfgrass production, or rangeland. The soil is well suited to all of these uses.

The main crops are corn, rice, grain sorghum, and soybeans. Well managed tillage operations are essential for proper aeration, and additions of crop residue are needed for better water infiltration and natural fertility. A properly designed surface water management system is desirable to improve drainage and increase yields. A well planned fertilizer program is essential for high yields.

Improved pastures are planted mainly to coastal and other bermudagrasses. Fertilizers, especially nitrogen, are needed for maximum hay and pasture production. Rotation grazing is a good management practice on improved pastures and native rangeland.

This soil is well suited to turfgrasses. St. Augustine and bermudagrasses are the main turfgrasses grown on this soil. Applications of fertilizer are needed for better yields. Adequate irrigation systems are essential for maximum production.

Rangeland management practices should include proper stocking rates and a rotation grazing system, which help to maintain native grasses and improve beef production.

This soil provides fair wildlife habitat. Geese and ducks feed on rice fields during the migratory season. The food supply for deer is good, but protective cover is insufficient.

The potential of this soil for urban and recreation uses is moderate. The main limitations are surface drainage, restricted permeability, the shrink-swell potential, and corrosivity. Surface drainage can be improved by the proper design and careful installation of either tile or surface drainage systems. Septic tank absorption fields should be designed with extended lateral drains, which help to compensate for the restricted permeability. To overcome the shrink-swell potential, building foundations should have extra steel, be installed on raised fill material, or both. Steel pipe placed underground should be wrapped or coated because of corrosion.

This soil is in capability subclass IIw and in the Loamy Prairie range site.

Fe—Follet loam, frequently flooded

This very deep, nearly level, saline soil is in marshes along the Matagorda Peninsula and Tres Palacios Bay and between coastal dunes on the peninsula. The soil is continually wet because of a high water table and inundation by tidal water. Areas are covered with common reed and other salt-tolerant plants. Along Tres Palacios Bay, this soil is mapped on elongated flats below escarpments and the more sloping adjacent soils. Areas range from 20 to more than 100 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is very dark gray, strongly saline, moderately alkaline loam about 12 inches thick. From a depth of 12 to 42 inches, the underlying material is dark gray, strongly saline, moderately alkaline loam. From a depth of 42 to 54 inches, it is light gray, strongly saline, neutral clay loam. From a depth of 54 to 80 inches, it is dark gray, strongly saline, neutral loam.

This soil is very poorly drained. Water ponds on the surface most of the year. Surface runoff and permeability are very slow. The soil is flooded by daily or monthly high tides.

Included in mapping are small areas of Galveston, Harris, Mustang, and Veston soils, all of which are slightly higher on the landscape than the Follet soil. The Galveston and Mustang soils are deep and sandy. The Harris and Veston soils are not flooded by high tides so often as the Follet soil. Included soils make up less than 20 percent of the map unit.

The Follet soil is used mainly for wildlife habitat. Some small areas are used as rangeland. Because of flooding, salinity, and the high water table, this soil is not suitable for cropland or pasture. Grazing is limited because of boggy soil conditions. Mosquitoes and other insects are numerous except during winter.

This soil provides fair habitat for wetland wildlife. The marshes provide habitat for a variety of waterfowl and marine life. Oysters, post-larval shrimp, and several species of fish depend on these marsh communities for nutrients.

This soil is not suitable for urban uses because of the hazard of flooding. The only suitable recreational uses are those related to wildlife.

This soil is in capability subclass VIIw and in the Tidal Flat range site.

FoB—Fordtran loamy fine sand, 0 to 2 percent slopes

This very deep, sandy soil is on nearly level to weakly undulating uplands. It is limited in extent and is mainly in the northwestern part of the county. Areas are irregularly shaped or oval. They range from 20 to more than 400 acres in size.

Typically, the surface layer is slightly acid loamy fine sand about 29 inches thick. It is dark grayish brown in the upper part and light yellowish brown in the lower part. From a depth of 29 to 72 inches, the subsoil is light brownish gray with mottles in shades of red and yellow. It is slightly acid clay in the upper part and slightly alkaline sandy clay loam in the lower part. From a depth of 72 to 80 inches, the subsoil is pink, moderately alkaline fine sandy loam.

This soil is moderately well drained. Permeability and surface runoff are very slow. Available water capacity is low. Natural fertility also is low. The hazard of wind erosion or water erosion is slight or moderate. The shrink-swell potential is low in the surface layer and moderate in the clayey subsoil.

Included with this soil in mapping are small areas of Cieno, Edna, and Telferner soils. The Cieno soil is in small, rounded depressions and has a sandy clay loam surface layer. The Edna and Telferner soils have a loamy surface layer less than 20 inches thick. Also included are small areas of a sandy soil that has a surface layer more than 40 inches thick. Included soils make up less than 20 percent of the map unit.

The Fordtran soil is used mostly as rangeland. A few areas are used improved pasture. The rangeland is open prairie grassland with invading scrub live oak. Forage yields are medium. Deferred grazing is a good management practice, especially during extensive droughts.

Improved pastures mostly support coastal and other bermudagrasses. Applications of fertilizer, especially nitrogen, and rotation grazing are necessary practices for maximum hay and pasture production.

This soil provides good habitat for rangeland wildlife and fair habitat for openland and wetland wildlife. Deer, dove, and quail are common. Geese and ducks feed in areas of the included Cieno soil and in nearby rice fields.

The Fordtran soil has many limitations for most urban and recreational uses. The main limitations are wetness, very slow permeability, corrosivity, the sandy surface layer, and shrinking and swelling with changes in moisture. Most of the limitations can be partly overcome by good design and careful installation of foundations, septic systems, and pipelines. Reinforcing building foundations helps to overcome shrinking and swelling. Expanding septic tank filter fields helps to overcome wetness and very slow permeability. Wrapping or treating steel pipe reduces corrosivity. Recreation areas should be protected from wind erosion.

This soil is in capability subclass IIw and in the Sandy Prairie range site.

FrA—Francitas clay, 0 to 1 percent slopes

This very deep, saline, clayey soil is on nearly level coastal uplands. Areas are limited in extent and are mostly in the extreme southern and southwestern parts of the county. This soil strongly resembles the Laewest soil, except that it is saline. The source of the excess salts is related to saline parent material or flooding by sea water during high tides. Areas are irregular in shape and range from 20 to more than 200 acres in size.

Typically, the surface layer is very dark gray, slightly saline, moderately alkaline clay about 6 inches thick. From a depth of 6 to 55 inches, the subsoil is clay that is black in the upper part and grades to grayish brown in the lower part. From a depth of 55 to 80 inches, the subsoil is light yellowish brown clay in the upper part and yellowish red silty clay loam in the lower part. The subsoil is saline in the upper part and moderately alkaline throughout.

This soil is poorly drained. Permeability and surface runoff are very slow. Available water capacity is low or moderate because of a high sodium content. A perched water table is within a depth of 2 feet during rainy periods. The hazard of water erosion is slight. The shrink-swell potential is very high throughout the soil.

Included with this soil in mapping are small areas of Harris, Laewest, Livia, Palacios and Placedo soils. The Harris and Placedo soils are on the lower lying saline flood plains and have a high water table at or near the surface. The Laewest soil is mainly higher on the landscape than the Francitas soil and is not saline. The Livia and Palacios soils are in positions on the landscape similar to those of the Francitas soil. They have a loamy surface layer. Included soils make up less than 15 percent of the map unit.

The Francitas soil is used mainly for rangeland or wildlife habitat. A few areas are used as cropland. The main crops are rice and grain sorghum. Irrigation and proper use of fertilizer are needed for maximum yields. A surface water management system is desirable to improve drainage and increase yields.

Rangeland vegetation consists of gulf cordgrass and other salt-tolerant grasses and shrubs. Under continuous heavy grazing, gulf cordgrass becomes more dominant. Prolonged stocking and improper burning, however, can reduce the extent of cordgrass, and baccharis and sumpweed can invade. Good management practices include deferred grazing and proper stocking rates.

This soil has poor potential for openland wildlife habitat and fair potential for wetland and rangeland wildlife habitat. Geese and ducks feed on rice fields during winter months.

This soil is poorly suited to most urban and recreational uses. Limitations include the shrink-swell potential, wetness, clayey texture, and salinity. High corrosivity of uncoated steel affects pipeline installation. In addition, some areas at the lower elevations are subject to flooding by hurricane tides.

This soil is in capability subclass IVw and in the Salty Prairie range site.

FuC—Fulshear fine sandy loam, 2 to 5 percent slopes

This very deep, gently sloping soil is on coastal prairie uplands in the central part of the county. It is on side slopes of the Tres Palacios, Peyton’s and Live Oak Creeks, and their associated tributaries. Some areas are eroded, and in places the reddish subsoil is exposed. Areas are mainly elongated and narrow and range from 10 to 100 acres in size, averaging about 30 acres. Slopes are mainly more than 3 percent.

Typically, the surface layer is dark grayish brown, slightly acid fine sandy loam about 8 inches thick. From a depth of 8 to 31 inches, the subsoil is sandy clay loam that is dark brown and moderately acid in the upper part, moderately acid and strong brown in the next part, and yellowish red and neutral in the lower part. From a depth of 31 to 60 inches, it is yellowish red, moderately alkaline fine sandy loam in the upper part and reddish yellow, moderately alkaline sandy clay loam in the lower part. The underlying material, from a depth of 60 to 80 inches, is reddish yellow, moderately alkaline fine sandy loam.

This soil is well drained. Permeability is slow, and surface runoff is medium or rapid. Available water capacity is high. Natural fertility is medium. The shrink-swell potential is moderate. The hazard of water erosion is moderate or severe in sloping areas.

Included with this soil in mapping are small areas of Dacosta, Faddin, and Laewest soils. The Dacosta and Faddin soils have a clayey subsoil and are on nearly level landscapes. The Laewest soil is dark in color and clayey throughout. Also included are a few small gullies 2 to 4 feet deep and a few small areas where sheet erosion has removed the surface layer. Included soils make up less than 20 percent of the map unit.

This Fulshear soil is used mostly as rangeland because of the slope and the hazard of water erosion. The native vegetation includes live oak, other hardwood trees, and prairie grasses.

This soil provides good habitat for rangeland and openland wildlife.

This soil is not well suited to urban and recreational uses. Several limitations affect these uses, including slope, seepage, the shrink-swell potential, and the hazard of water erosion.

This soil is in capability subclass IIIe and in the Sandy Loam range site.

GaB—Galveston fine sand, undulating

This very deep, sandy soil is mainly on stabilized coastal dunes. This is the dominant soil on the Matagorda Peninsula, which is parallel to the Gulf of Mexico. Areas are long, narrow bands between coastal beaches and inland marshes. These weakly undulating, convex dunes support most of the vegetation along the coast. These areas are important as natural barriers that protect inland coastal sites from tidal storm damage. In addition, these dunes provide year-round protection for the Intracoastal Waterway and recreational developments along the coast. Areas are elongated and range from 50 to several hundred acres in size.

Typically, the surface layer is grayish brown, slightly alkaline fine sand about 6 inches thick. The underlying material, from a depth of 6 to 80 inches, is pale brown, slightly alkaline fine sand that has a few shell fragments below a depth of 62 inches.

This soil is somewhat excessively drained. Surface runoff is very slow, and permeability is very rapid above the water table. The water table is mainly at a depth of more than 40 inches. Salts are continually added to the soil by salt spray but are readily leached by rainfall. When protective vegetation is removed, these dunes are highly susceptible to erosion by wind and storm tides. In places the gulf shoreline has eroded inland several hundred feet.

Included with this soil in mapping are small areas of Follet, Mustang, and Veston soils along with small coastal beaches. The Follet and Mustang soils are in low marshy areas. The Veston soil is strongly saline and mainly barren of vegetation. Beaches are open areas subject to flooding by waves or high tides. Also included are small mounds of shells and shell fragments. Included areas make up less than 20 percent of the map unit.

The Galveston soil is best suited to wildlife habitat. Some areas are used for recreation and some for rangeland.

This soil has native vegetation that includes marshhay cordgrass, seashore saltgrass, seaoats, and various panicums. Because of the inherent low fertility of the soil, forage is deficient in phosphorus and protein, except in spring and early summer.

The undulating dunes provide good habitat for various shore and marsh birds. Overall, this soil provides fair habitat for rangeland and openland wildlife.

This soil is poorly suited to urban uses because of the hazard of flooding, wetness, seepage, and sandy texture. Areas have esthetic and recreational value because of flowering plants, grasses, and wildlife adjacent to beaches. Proper management is needed to protect the plant cover. These dunes are susceptible to wind erosion when the vegetation is removed.

This soil is in capability subclass VIe and in the Coastal Sand range site.

Ha—Harris clay, frequently flooded

This nearly level, saline, clayey soil is mainly in coastal marshes. Areas are only a few feet above sea level. They are mainly elongated depressions near the outlets of streams flowing into Matagorda Bay and Palacios Bay. Slopes are less than 0.5 percent. Areas range from 20 to more than 50 acres in size.

Typically, the surface layer is black, moderately alkaline, saline clay about 24 inches thick. The subsoil, from a depth of 24 to 59 inches, is moderately alkaline, saline clay that is gray in the upper part and light gray in the lower part. The underlying material, from a depth of 59 to 80 inches, is mottled light gray, moderately alkaline, saline clay.

This soil is very poorly drained. Permeability and surface runoff are very slow. The soil is saline throughout. The water table is at or near the surface most of the time. This soil is frequently flooded by runoff from adjacent soils, daily or monthly high tides, and storm tides.

Included with this soil in mapping are small areas of Follet, Francitas, Placedo, and Veston soils. The Follet and Veston soils are less clayey than the Harris soil. The Placedo soil is more stratified. The Follet, Francitas, and Veston soils are higher on the landscape than the Harris soil. Included soils make up less than 20 percent of the map unit.

The Harris soil is not suitable for cropland, improved pasture, or urban uses because of salinity, flooding by tides, wetness, and the shrink-swell potential. It is suitable mainly for rangeland and wildlife habitat. This soil can produce high yields of marsh range grasses when properly managed. Plant vigor can be maintained by proper stocking and by a rotation grazing system. Grazing is limited mostly to winter months because of numerous insects the rest of the year.

This soil provides good habitat for wetland wildlife. The salt marsh vegetation of cordgrass, saltgrass, paspalums, and other water-adapted plants attract large numbers of waterfowl. Ducks, geese, cranes, and other migratory fowl spend fall and winter months in these areas. Other wildlife species include large numbers of alligators, which are common in this part of the county.

This soil is in capability subclass VIIw and in the Salt Marsh range site.

ImB—Ijam clay, 1 to 3 percent slopes

This very deep, very gently sloping soil formed in material dredged from the channel of the Intracoastal Waterway. A distinct break between the stratified Ijam soil and an underlying darker colored soil is observable all along the Waterway. The vegetation is extremely variable. Areas are elongated and narrow and range from 20 to more than 100 acres in size. Slopes are mainly 1 to 3 percent.

Typically, the surface layer is grayish brown, moderately saline and moderately alkaline clay about 6 inches thick. From a depth of 6 to 63 inches, the underlying material is moderately saline and moderately alkaline, mottled clay that has strata in colors of dark grayish brown, grayish brown, and olive gray. From a depth of 63 to 80 inches, the underlying material is moderately alkaline, stratified sandy clay and sandy clay loam that is dark brown in the upper part and yellowish red in the lower part.

This soil is poorly drained. Permeability is very slow. Surface runoff is rapid. The degree of salinity is dependent on the original salinity of the dredged material and the length of time since dredging. Available water capacity is moderate. The shrink-swell potential of all layers is high. The water table is at the surface in some areas and as deep as 3 feet in other areas. The hazard of water erosion is slight or moderate. Some streambank caving occurs from wave action caused by the numerous barges and boats using the Intracoastal Waterway.

Included with this soil in mapping are small areas of Follet, Harris, Surfside, Velasco, and Veston soils. The Follet, Harris, Velasco, and Veston soils are in low-lying marshes. The Surfside soil is in the slightly higher areas and has thick stands of gulf cordgrass. Also included are areas of an Ijam soil that has slopes of as much as 5 percent; areas that are flooded by tides; areas where the dredge material is redder than is typical for the series because of the large amount of red, clayey sediments deposited along the coast from the Colorado River, Caney Creek, and other streams in the county; and a few small areas where the dredge material has a layer of shells and shell fragments 1 to 4 feet thick. Included areas make up less than 25 percent of the map unit.

The Ijam soil is not suitable for urban uses because of wetness, very slow permeability, the hazard of flooding, clayey texture, salinity, and the shrink-swell potential. Areas are used mainly for limited livestock grazing and wildlife habitat. Vegetation includes sparse stands of gulf cordgrass and weeds. Areas of this soil also serve as sites for livestock to seek refuge during floods. A few ranchers have scattered this soil over nearby pastures in the belief that it is helpful to native rangeland. This soil has some limited use as wildlife habitat, especially where some revegetation is in evidence.

This soil is in capability subclass VIIw. It is not assigned a range site.

KaB—Katy fine sandy loam, 0 to 2 percent slopes

This very deep, loamy soil is on weakly convex slopes and small mounds. It is not extensive but occurs in various places in the western and central parts of the county. Slopes range from 0.5 to 1.5 percent. Areas are oval or irregular in shape and range from 20 to more than 60 acres in size.

Typically, the surface layer is slightly acid fine sandy loam about 22 inches thick. It is dark grayish brown in the upper part and pale brown in the lower part. From a depth of 22 to 62 inches, the subsoil is brownish yellow, slightly acid clay loam in the upper part and reddish yellow, slightly acid sandy clay loam in the lower part. The upper part has grayish brown mottles. From a depth of 62 to 80 inches, the subsoil is yellowish red, neutral sandy clay loam.

This soil is moderately well drained. Permeability is moderately slow, and surface runoff is slow or very slow. Available water capacity is moderate. Natural fertility is medium. The hazard of wind erosion is slight or moderate, and the hazard of water erosion is slight. The shrink-swell potential is low in the surface layer and moderate in the subsoil.

Included with this soil in mapping are small areas of Cieno, Edna, Livia, Telferner, and Texana soils. The Cieno soil is in small, rounded depressions. The Edna, Telferner, and Texana soils have more clay in the subsoil than the Katy soil. The Livia soil is saline. Also included are areas where the surface layer is as much as 36 inches thick, thicker than is typical for the Katy series. These small areas also have slopes of as much as 5 percent. They are common between Farm Road 521 and Austin Lake. Included soils make up less than 20 percent of the map unit.

The Katy soil is used for cropland, rangeland, improved pasture, and turfgrass production. Corn, grain sorghum, and rice are the main crops. Good management practices include leaving crop residue on the surface, tilling on a timely and limited basis, and rotating crops. Applications of fertilizer are needed for maximum crop production. A surface water management system is desirable to improve drainage and increase yields.

Improved pastures support mostly coastal and other bermudagrasses. Applications of fertilizer and rotation grazing are good management practices for maximum hay and pasture production. Deferred grazing is needed for good native grass production on rangeland. A well managed fertilizer program is needed for turfgrass farming.

This soil provides good habitat for openland wildlife. Deer are common where trees and brush are invading.

This soil is suited to most urban and recreational uses. The moderate shrink-swell potential is a limitation affecting building foundations. The moderately slow permeability limits the use of the soil for septic tank absorption fields. Low strength is a limitation affecting the construction of roads and streets. These limitations can be partly overcome by special design and proper installation. Corrosivity can be overcome by coating steel pipe. Recreational areas should be managed so that the fine sandy loam surface layer is protected from wind erosion.

This soil is in capability subclass IIw and in the Loamy Prairie range site.

LaA—Laewest clay, 0 to 1 percent slopes

This soil is on broad coastal prairie uplands and is extensive throughout Matagorda County. Areas are irregularly shaped and range from 20 to 1,000 acres in size, averaging about 500 acres. Undisturbed areas have gilgai microrelief with slightly undulating highs and lows.

Typically, the surface layer is black clay about 38 inches thick. It is slightly acid in the upper part and neutral in the lower part. The subsoil, from a depth of 38 to 68 inches, is very dark gray clay that is neutral in the upper part and slightly alkaline in the lower part. The underlying material, from a depth of 68 to 80 inches, is reddish brown, moderately alkaline clay.

This soil is moderately well drained. Permeability and surface runoff are very slow. Available water capacity is high. The soil is seasonally wet or droughty and has deep, wide cracks when dry. When the soil is wet, the cracks seal and infiltration is very slow. The hazard of water erosion is slight. The shrink-swell potential is very high throughout the soil. This soil is inherently fertile.

Included with this soil in mapping are small areas of Bacliff, Faddin, Dacosta, Edna, Livco, and Telferner soils. The Bacliff soil has a much thinner surface layer and a lighter gray subsoil than the Laewest soil. The Faddin, Dacosta, Edna, Livco, and Telferner soils have a loamy surface layer. In addition, the Faddin soil is slightly higher on the landscape than the Laewest soil, and the Dacosta soil is slightly lower. The Livco soil is saline. Also included are small spots where the subsoil in the Laewest soil has more than 60 percent clay, but management and interpretations are the same. Included soils make up less than 20 percent of the map unit.

The Laewest soil is used extensively for cropland, pasture, and turfgrass production. Some areas are used as rangeland.

The main crops are corn, cotton, grain sorghum, rice, and soybeans. Applications of fertilizer can increase crop yields. Soil tillage operations that leave crop residue on the surface increase water infiltration and natural fertility.

The production of pasture grasses is high. This is one of the main soils in the county used as native hay meadow. Plant vigor should be maintained by proper stocking and rotation grazing. Forage yields can be increased by applying fertilizer. Water management systems are useful in removing excess surface water during rainy periods.

This soil is well suited to turfgrasses. St. Augustine and bermudagrasses are the main turfgrasses grown. Fertilizers are needed for better yields. Adequate irrigation systems are essential for good production.

This soil is well suited to rangeland. Rotation grazing and a proper stocking rate are good management practices.

This soil provides fair habitat for openland and rangeland wildlife. Dove and quail are common, as are deer where trees provide a sufficient canopy for cover.

This soil is poorly suited to most urban uses, mainly because of the high shrink-swell potential, very slow permeability, wetness, and corrosivity. With engineering techniques and proper design, however, the effects of these limitations can be decreased. Drainage systems divert runoff and remove excess surface water. Expanding septic tank absorption fields helps to compensate for the very slow permeability. Because of the shrink-swell potential, building foundations should be designed with additional steel and streets and roads should be constructed on road bases with raised fill material. Steel pipe should be wrapped or coated because of corrosivity.

This soil is in capability subclass IIw and in the Blackland range site.

LaB—Laewest clay, 1 to 3 percent slopes

This soil is mapped mainly along small drainageways and creeks that dissect large areas of Laewest clay, 0 to 1 percent slopes. Most areas are not being farmed, and many support native hardwood trees and grasses. Areas are narrow and elongated and are parallel to the associated drainageway. In undisturbed areas, the surface is characterized by gilgai microrelief consisting of knolls and depressions. Evidence of gilgai microrelief is destroyed after a few years of cultivation. Areas are 20 to 80 acres in size.

Typically, the surface layer is very dark gray, slightly acid clay about 5 inches thick. The subsoil extends to a depth of about 62 inches. From a depth of 5 to 54 inches, it is slightly acid clay that is very dark gray in the upper part, dark gray in the next part, and gray in the lower part. From a depth of 54 to 62 inches, it is grayish brown, moderately alkaline clay loam. The subsoil has a few mottles in shades of brown and yellow throughout. The underlying material, from a depth of 62 to 80 inches, is mottled reddish yellow, moderately alkaline loam.

This soil is moderately well drained. Permeability is very slow, and surface runoff is slow. Available water capacity is high. Deep, wide cracks form when the soil is dry. During heavy rains, the cracks seal rapidly and infiltration becomes very slow. The hazard of water erosion is moderate. The shrink-swell potential is very high.

Included with this soil in mapping are small areas of Faddin and Dacosta soils, which have a loamy surface layer. Also included are some areas that have a few small gullies 3 to 5 feet deep and some areas that have small streams and drainageways. Included soils make up less than 20 percent of the map unit.

These narrow bands of Laewest clay are not well suited to cropland because of the hazard of temporary overflow from the adjacent drainageways. Most areas support native hardwood trees and grasses and are used as rangeland or wildlife habitat.

This soil provides fair habitat for openland and rangeland wildlife. Deer and other wild game are common in these predominantly wooded areas.

This soil is poorly suited to most urban and recreational uses. The main limitations are the very slow permeability, which affects septic tank systems; clayey texture; the very high shrink-swell potential; slope; corrosivity; and low strength, which affects streets and roads. Proper design and careful installation of foundations, pipelines, roads, and septic systems are needed to help overcome the limitations.

This soil is in capability subclass IIe and in the Blackland range site.

LaD2—Laewest clay, 5 to 8 percent slopes, eroded

This very deep, sloping upland soil is mainly along the banks of East Carancahua Creek on the Jackson County line. Areas are too sloping to be farmed. The areas are narrow and elongated and are parallel to the associated drainageways. Gullies 5 to 10 feet deep are on some of the upper slopes. Areas range from 20 to 60 acres in size. Slopes are mainly 5 to 8 percent but range to 10 percent.

Typically, the surface layer is very dark gray, moderately alkaline clay about 12 inches thick. The subsoil, from a depth of 12 to 48 inches, is moderately alkaline clay that is dark gray in the upper part and gray in the lower part. The underlying material, from a depth of 48 to 80 inches, is strong brown, moderately alkaline clay.

This soil is moderately well drained. Permeability is very slow. Surface runoff is medium to rapid. When dry, this soil has wide, deep cracks that permit rapid infiltration of water, but when the soil is wet and the cracks are sealed, infiltration is very slow. Available water capacity is high. The hazard of water erosion is severe. The shrink-swell potential is very high.

Included with this soil in mapping are small areas of Dacosta and Fulshear soils. Also included are small areas of soils on bottom land. Included soils make up less than 20 percent of the map unit.

These narrow bands of Laewest clay are not suitable for cropland because of the slope and the hazard of erosion. Also, flooding can occur. The soil is used mainly for rangeland and wildlife habitat.

This soil provides habitat for several kinds of wildlife, including deer, coyotes, rabbits, dove, and quail.

This soil is poorly suited to urban and recreational uses because of many limitations. These limitations include the slope, the hazard of erosion, the very slow permeability, the shrink-swell potential, corrosivity, and clayey texture. Properly designed and installed erosion-control measures are needed.

This soil is in capability subclass IVe and in the Blackland range site.

LoA—Laewest silty clay, 0 to 1 percent slopes, overwashed

This nearly level, clayey soil is in upland areas that are 5 to 10 feet above flood plains along the Colorado River and part of Caney Creek. Most flooding occurred along the Colorado River before the early 1900’s, caused mainly by a logjam near the mouth of the river. This huge logjam was removed in the mid 1920’s. River overflow left thick deposits of calcareous, reddish, clayey sediment from the Permian red beds several hundred miles upstream. Overflow along the river and along Caney Creek has been greatly reduced in the last 50 years, mainly because levees and improved drainage systems were installed. Areas of this soil have as much as 20 inches of reddish clay over the darker colored Laewest clay. Areas are parallel to adjacent flood plains and range from 50 to 300 acres in size.

Typically, the surface layer is dark reddish brown, calcareous, moderately alkaline silty clay about 12 inches thick. The subsoil, from a depth of 12 to 70 inches, is noncalcareous, moderately alkaline clay that is black in the upper part and dark gray in the lower part. The underlying material, from a depth of 70 to 80 inches, is dark brown, calcareous, moderately alkaline silty clay.

This soil is moderately well drained. Surface runoff and permeability are very slow. Available water capacity is high, but the soil is droughty because the dense clay overwash restricts the movement of water and air. Deep, wide cracks form when the soil is dry. They seal when the soil is wet, and infiltration becomes very slow. The shrink-swell potential is very high.

Included with this soil in mapping are small areas of Brazoria, Clemville, Dacosta, Edna, and Pledger soils. The Brazoria, Clemville, and Pledger soils are slightly lower on the landscape than the Laewest soil. The Dacosta and Edna soils have reddish, clayey overwashed sediment and are in weakly convex areas. Included soils make up less than 20 percent of the map unit.

The Laewest soil is used mainly as rangeland. A few areas are used as improved pasture or as cropland. The main crops are corn and grain sorghum. This soil is more droughty than the Laewest clay that does not have a red, clayey overburden.

Rangeland areas support native grasses, such as bluestems and switchgrass. Overgrazed areas support mainly paspalums, dropseed, and invading weeds. There are a few groves of large live oak trees. Rotation grazing is a good management practice for both rangeland and improved pasture. Applications of fertilizer are needed for maximum hay production.

This soil provides good habitat for many kinds of wildlife, including deer, wild hogs, and several species of birds.

This soil has limitations for most urban and recreational uses. These limitations include the very high shrink-swell potential, clayey texture, and corrosivity of steel pipe. The limitations can be partly overcome by proper design and careful installation of building foundations, streets and roads, pipelines, and septic systems. Corrosivity can be overcome by treating steel pipe.

This soil is in capability subclass IIw and in the Blackland range site.

LtA—Livco-Dacosta complex, 0 to 1 percent slopes

These soils are very deep, moderately well drained, loamy soils on uplands in the western and southern parts of the county. Areas have a distinct light-dark pattern on the ground and on aerial photographs (fig. 9). The lighter colored Livco soil has a white, strongly sodic surface layer that restricts the growth of most plants. The Livco and Dacosta soils are so intermingled that it is impractical to map them separately. This map unit consists of 44 percent Livco soil, 36 percent Dacosta soil, and 20 percent other soils. Areas are irregular in shape and range from 20 to more than 200 acres in size.

Typically, the Livco soil has a surface layer of dark grayish brown, slightly alkaline fine sandy loam about 7 inches thick. The subsoil extends to a depth of about 72 inches. It is moderately sodic, slightly saline, and moderately alkaline throughout. From a depth of 7 to 16 inches, it is very dark gray clay loam; from a depth of 16 to 35 inches, it is grayish brown clay; from a depth of 35 to 52 inches, it is light brownish gray clay loam; and from a depth of 52 to 72 inches, it is grayish brown clay loam. The underlying material, from a depth of 72 to 80 inches, is strong brown, moderately alkaline silty clay loam.

Typically, the Dacosta soil has a surface layer of very dark gray, neutral sandy clay loam about 8 inches thick. The subsoil, to a depth of 74 inches, is moderately alkaline sandy clay and clay. It is very dark gray and dark gray in the upper part and grayish brown and gray in the lower part. The underlying material, from a depth of 74 to 80 inches, is strong brown, moderately alkaline sandy clay loam.

These soils are moderately well drained. Surface runoff and permeability are very slow. Available water capacity of the Livco soil is moderate and is related to the excess sodium, which makes the soil droughty. Available water capacity of the Dacosta soil is high. The hazard of water erosion is slight. The shrink-swell potential of the surface layer is low. It is high in the other layers.

Included with these soils in mapping are small areas of Bacliff, Cieno, Edna, Laewest, Telferner, and

Figure 9.—An area of Livco-Dacosta complex, 0 to 1 percent slopes. The complexity of the soils in this field is indicated by the surface color pattern.

Texana soils. The Bacliff and Laewest soils are clayey throughout. The Cieno soil is in small, rounded depressions. The Edna, Telferner, and Texana soils are nonsodic and nonsaline and have a sandy loam surface layer. Included soils make up about 20 percent of the map unit.

The Livco and Dacosta soils are used mainly as pasture and rangeland. A few areas are used for irrigated rice. Small areas are used for nonirrigated grain sorghum, but yields are limited, especially in dry years, because of the high sodium content. Surface crusts and plowpans are common in cultivated fields. Good management practices include leaving crop residue on the surface, using limited tillage, and rotating crops. Applications of fertilizer are needed to increase yields. Applying gypsum and leaching with water help to reduce soil sodicity. A well designed surface water management system is desirable to improve drainage and increase yields.

Improved pasture grasses include bluestems and bermudagrasses. Applications of fertilizer, weed control, controlled grazing, and proper stocking rates help to improve or maintain pasture and hay production.

Gulf cordgrass and other salt-tolerant grasses are common where the Livco soil is used as rangeland. Proper stocking rates, controlled grazing, and weed and brush control are good management practices. Proper burning is necessary in some areas of rangeland.

These soils provide fair habitat for dove, quail, and other kinds of birds. Ducks and geese are common in winter months.

These soils are poorly suited to many urban and recreational uses. The main limitations are the shrink-swell potential, excess sodium, the very slow permeability and runoff, and corrosivity. These limitations can be partly overcome by good design and careful installation of building foundations, streets and roads, pipelines, and septic systems. Installing drainage systems and shaping building sites can help to lessen the effect of very slow surface runoff. Additional steel in building foundations and raised fill material in road bases are needed because of the shrink-swell potential. Enlarging septic tank absorption fields minimizes the effects of very slow permeability. Steel pipe should be coated because of corrosivity.

The Livco soil is in capability subclass IIIs and in the Salty Prairie range site. The Dacosta soil is in capability subclass IIw and in the Blackland range site.

LvA—Livia loam, 0 to 1 percent slopes

This very deep, nearly level, saline, loamy soil is on ancient stream meander ridges on broad coastal uplands. Typically, it is at an elevation 10 to 40 feet above sea level. It is mapped mainly in the southern and western parts of the county. Areas have a distinct openland or prairie vegetation that is mainly gulf cordgrass. Areas are irregular in shape and range from 20 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown, slightly saline, slightly alkaline loam about 6 inches thick. The subsoil extends to a depth of about 61 inches. From a depth of 6 to 47 inches, it is saline, moderately alkaline clay that is very dark gray in the upper part, dark grayish brown in the next part, and grayish brown in the lower part. From a depth of 47 to 61 inches, it is light brownish gray, slightly saline, moderately alkaline clay. The subsoil has few to many mottles in shades of brown and yellow. The underlying material, from a depth of 61 to 80 inches, is pale olive, slightly saline, moderately alkaline clay that has grayish mottles.

This soil is poorly drained. Surface runoff and permeability are very slow. Available water capacity is moderate, but a high sodium content makes this soil droughty during dry periods. The soil is saturated at times during rainy periods in winter months. The shrink-swell potential is low in the surface layer and high in all other layers. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Dacosta, Edna, Francitas, Laewest, and Palacios soils. The Dacosta, Edna, and Laewest soils are not saline and are generally higher on the landscape than the Livia soil. The Francitas soil has a clayey surface layer and is lower on the landscape than the Livia soil. The Palacios soil is in positions on the landscape similar to those of the Livia soil and has a darker colored surface layer. Also included are small areas of a Livia soil that is more alkaline than is typical for the series. Included soils make up less than 20 percent of the map unit.

The Livia soil is used mostly as rangeland, but some areas are used as cropland or improved pasture. This soil is best suited to irrigated rice but can produce other crops, such as grain sorghum.

Soil sodicity and salinity, which cause droughty areas in fields, limit crop growth. Favorable soil structure and tilth are difficult to maintain. Surface crusts and plowpans are common. In large areas, surface runoff is very slow and excess water ponds during rainy periods. Good management practices include leaving crop residue on the surface, tilling on a timely and limited basis, and rotating crops. Incorporating crop residue into the soil helps to maintain favorable soil structure, tilth, and water intake. In some areas rows can be laid out so that they remove excess surface water. A surface water management system is desirable to improve drainage and increase yields. Applications of fertilizer are needed to increase yields. Adding sulfur-containing amendments, such as gypsum, and leaching with water help to overcome soil sodicity.

This soil is well suited to improved pastures of bermudagrass and also to Angleton and Gordo bluestems. Applications of fertilizer, weed control, controlled grazing, and proper stocking rates help to improve or maintain pasture productivity.

This soil has good potential for wetland wildlife habitat but is poorly suited to openland and rangeland wildlife habitat. Ducks and geese are common on rice fields in winter months.

This soil is poorly suited to most urban and recreational uses. The main limitations are the high shrink-swell potential, wetness, excess sodium, and clayey subsoil texture. Drainage systems can divert surface water away from buildings. Using fill material to increase the height of foundations helps to overcome wetness and shrink-swell problems. Using additional steel in building foundations is also helpful. Road and street construction may require additions of raised fill material and installation of drainage systems. Enlarging septic tank absorption fields minimizes the effects of wetness and permeability. High corrosivity of uncoated steel affects the installation of public utilities. Steel pipe should be treated or coated before being installed.

This soil is in capability subclass IVw and in the Salty Prairie range site.

MuA—Mustang fine sand, 0 to 1 percent slopes

This nearly level, sandy soil is on coastal lowlands. It is on tidal flats and in depressions between sand dunes on the Matagorda Peninsula. Slopes range from 0 to slightly more than 1 percent but are mainly less than 1 percent. Areas are irregular in shape or elongated and range from 20 to more than 100 acres in size.

Typically, the surface layer is light brownish gray, slightly saline, moderately alkaline fine sand about 10 inches thick. It has some brownish mottles. The underlying material, from a depth of 10 to 80 inches, is slightly saline, moderately alkaline fine sand that is light gray in the upper part, light olive gray in the next part, and gray in the lower part. Some brownish mottles are in the upper part.

This soil is poorly drained. Permeability is rapid above the water table, and surface runoff is very slow. The water table is within a depth of about 6 inches. The water is generally saline, but the soil is nonsaline in many areas. This soil is subject to occasional flooding by storm tides. Protection from wind erosion is needed, especially in recently disturbed areas.

Included with this soil in mapping are small areas of Follet, Galveston, and Veston soils. The Follet and Veston soils are in lower lying marshes and have a loamy surface layer. The Galveston soil is in the higher lying duned areas. Also included are areas of a Mustang soil that is moderately saline or strongly saline. Small ponds of saline water are in areas of this Mustang soil. Included soils make up less than 20 percent of the map unit.

The Mustang soil is suitable mainly for wildlife habitat. It is not suited to most agricultural uses because of wetness and the perched water table.

The native plants are salt tolerant and include grasses, woody plants, and forbs. The marsh plant community provides good habitat for waterfowl, such as shore and marsh birds.

This soil is not suitable for urban uses. The main recreational use is hunting.

This soil is in capability subclass VIw and in the Low Coastal Sand range site.

No—Norwood silty clay loam, rarely flooded

This nearly level, loamy soil is on flood plains along the Colorado River and Caney Creek. It is generally parallel to associated streams. Slopes are mainly less than 1 percent. Areas are elongated or irregular in shape and range from 20 to more than 50 acres in size.

Typically, the surface layer is dark brown, moderately alkaline silty clay loam about 4 inches thick. The subsoil, from a depth of 4 to 34 inches, is strong brown, moderately alkaline silt loam stratified with thin layers of silty clay loam. The underlying material, from a depth of 34 to 80 inches, is stratified and moderately alkaline. It is dark brown silty clay loam in the upper part and dark reddish brown silty clay in the lower part. Thin strata of other textures are common.

This soil is well drained. Flooding occurs about 1 to 5 times in 100 years, and the duration is brief. Surface runoff is slow, and permeability is moderate. This soil has high natural fertility. Available water capacity is high. The shrink-swell potential to a depth of 50 inches is moderate or low.

Included with this soil in mapping are small areas of Asa, Brazoria, Clemville, and Pledger soils. The Asa soil has a thick, dark, loamy surface layer. The Brazoria and Pledger soils are clayey throughout. The Clemville soil is loamy and has buried, clayey soils at a depth of 30 to 36 inches. Also included are small areas where the surface layer is silty clay, areas where clayey strata are below a depth of 40 inches, small areas where thin strata are sandier than is typical for the series, and short, steep banks along streams and rivers. Included soils make up less than 20 percent of the map unit.

The Norwood soil is limited in extent and is used mainly for rangeland or improved pasture. A few areas are used as cropland, mainly small fields of corn or grain sorghum. Leaving crop residue on the surface and using minimum tillage are good management practices on this soil. A well managed fertilizer program is needed for maximum yields.

Alfalfa and sudan hybrids are the main hay and pasture crops. Bermudagrass is common on improved pastures. Rotation grazing and proper stocking rates are good management practices for both improved pastures and rangeland. Pastures and hay fields need fertilizers and proper management for maximum production.

The native vegetation includes hardwood trees and mid and tall grasses. Pecan trees are common on this soil. The soil is well suited to pecan orchards because of the high natural fertility, adequate drainage and permeability, a deep rooting depth, and the high available water capacity. Intensive management practices that include applying nitrogen fertilizer and implementing a disease- and insect-control program can increase crop yields.

Deer are common because of the woody vegetation and the proximity of creeks and rivers. Other wildlife species include squirrels, raccoons, wild hogs, foxes, rabbits, and a great variety of birds.

This soil is suitable for most urban and recreational uses. Some limitations include seepage, corrosivity of steel pipe, and low strength, which affects the bases of roads and streets. Raised fill material that is more suitable for roads and streets should be added to the road base. Seepage is a limitation affecting sewage lagoons, ponds, and embankments. Heavier clays or commercial sealants may be needed. Corrosivity can be reduced by treating steel pipe.

This soil is in capability class I and in the Loamy Bottomland range site.

PaA—Palacios loam, 0 to 1 percent slopes

This very deep, nearly level, saline, loamy soil is on ancient stream meander ridges on broad coastal uplands. Typically, the soil is at an elevation 10 to 40 feet above sea level. It is mapped mainly in the southern and western parts of the county. Areas have a distinct openland or prairie vegetation that is mainly gulf cordgrass (fig. 10). They are irregular in shape and range from 20 to more than 100 acres in size.

Typically, the surface layer is neutral, very dark grayish brown loam about 5 inches thick. The upper part of the subsoil, from a depth of 5 to 13 inches, is

Figure 10.—This native pasture on Palacios loam, 0 to 1 percent slopes, supports mainly gulf cordgrass.

black, slightly alkaline clay loam. The lower part, from a depth of 13 to 72 inches, is moderately saline or slightly saline, slightly alkaline to strongly alkaline clay. It is very dark gray grading to light gray and light brownish gray with increasing depth. The subsoil has yellowish and brownish mottles below a depth of 25 inches. The underlying material, from a depth of 72 to 80 inches, is yellowish brown, moderately alkaline silty clay loam.

This soil is poorly drained. Surface runoff and permeability are very slow. Available water capacity is moderate, but a high sodium content makes this soil droughty except during rainy seasons. The soil is saturated at times during the winter. The shrink-swell potential is low in the surface layer and high in the subsoil and underlying material. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Dacosta, Edna, Francitas, Laewest, and Livia soils. The Dacosta, Edna, and Laewest soils are not saline and are generally higher on the landscape than the Palacios soil. The Francitas soil has a clayey surface layer and is lower on the landscape than the Palacios soil. The Livia soil is in positions on the landscape similar to the Palacios soil, but it has a lighter colored surface layer. Included soils make up less than 20 percent of the map unit.

The Palacios soil is used mainly as rangeland, but some areas are used as cropland or improved pasture. This soil is best suited to irrigated rice but can produce other crops, such as grain sorghum.

Soil sodicity, which causes droughty areas in fields, limits crop growth. Favorable soil structure and tilth are difficult to maintain. Surface crusts and plowpans are common. In large areas, surface runoff is very slow and excess water ponds during rainy periods. Good management practices include leaving crop residue on the surface, tilling on a timely and limited basis, and rotating crops. Incorporating crop residue into the soil helps to maintain favorable soil structure, tilth, and water intake. In some areas rows can be laid out in such a way as to remove excess surface water. Drainage ditches are beneficial when adequate outlets are available. Applications of fertilizer are needed to increase yields. Adding sulfur-containing amendments, such as gypsum, and leaching with water can help to overcome soil sodicity.

This soil is well suited to improved pastures of bermudagrass and Angleton and Gordo bluestems. Applications of fertilizer, weed control, controlled grazing, and proper stocking rates help to improve or maintain pasture productivity.

This soil has good potential for wetland wildlife habitat, but it is poorly suited to openland and rangeland wildlife. Ducks and geese are common on rice fields in winter months.

This soil is poorly suited to most urban and recreational uses. The main limitations are the high shrink-swell potential, wetness, excess sodium, and clayey subsoil texture. High corrosivity of uncoated steel affects the installation of public utilities. Steel pipes need to be treated or coated before installation. Other limitations can be partly overcome by good design and careful installation of building foundations, streets and roads, and septic systems. Examples are drainage systems that divert runoff water and reduce the amount of surface water from areas where buildings and streets are to be constructed. Building foundations can require additional steel to compensate for the high shrink-swell potential. Streets and roads can require added fill material to strengthen the road base. Expanding septic tank absorption fields minimizes the effects of very slow permeability. Nonsaline soil materials should be added to areas where plants, grasses, trees, and shrubs are to be planted.

This soil is in capability subclass IVw and in the Salty Prairie range site.

Pc—Placedo silty clay, frequently flooded

This very deep, saline, clayey soil is on nearly level to weakly concave flood plains along the coast. A high water table fluctuates from above the surface to a depth of about 12 inches. Ponding is common. It is caused by heavy rains, storm tides, or both. Vegetation is mainly marshhay cordgrass and saltgrass. Areas are irregular in shape and range from 20 to more than 100 acres in size. Slopes are mainly less than 1 percent.

Typically, the surface layer is dark gray, strongly saline, moderately alkaline silty clay and clay about 31 inches thick. It has brownish mottles. The underlying material, from a depth of 31 to 62 inches, is gray, strongly saline and moderately alkaline clay loam. It has yellowish mottles.

This soil is very poorly drained. Permeability is very slow, and surface runoff is very slow or ponded. The soil is moderately saline to extremely saline throughout. The water table is at or near the surface most of the time. This soil is frequently flooded for a duration of 7 days to a month by runoff from nearby uplands, by daily or monthly high tides, and by storm tides.

Included with this soil in mapping are small areas of Follet, Francitas, Harris, and Veston soils. The Follet and Veston soils are less clayey than the Placedo soil.

The Francitas, Harris, and Veston soils are higher on the landscape than the Placedo soil. Also, the Harris soil is less stratified. Included soils make up less than 20 percent of the map unit.

The Placedo soil is not suitable for cropland, improved pasture, or urban uses because of salinity, flooding by tides, and poor drainage. It is suitable mainly for rangeland and wildlife habitat. This soil can produce high yields of marsh range grasses when properly managed. Plant vigor can be maintained by proper stocking rates and by a rotational grazing system. Grazing is limited mostly to winter months because of numerous insects the rest of the year.

This soil provides fair habitat for wetland wildlife. The salt marsh vegetation of cordgrass, saltgrass, paspalums, and other water-adapted plants attract large numbers of waterfowl. Ducks, geese, cranes, and other migratory fowl spend fall and winter months in areas of this soil. Other wildlife species include large numbers of alligators, which are common in this part of the county.

This soil is in capability subclass VIIw and in the Salt Marsh range site.

Pe—Pledger clay, rarely flooded

This very deep, dark colored, clayey soil is on nearly level flood plains in the eastern part of the county. Areas generally are broad and irregular in shape. They range from 20 to more than 500 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is moderately alkaline, very dark gray clay about 18 inches thick. The subsoil, from a depth of 18 to 62 inches, is moderately alkaline clay that is very dark gray grading to dark brown. The underlying material, from a depth of 62 to 80 inches, is reddish brown, moderately alkaline clay.

This soil is moderately well drained. It is very slowly permeable, and surface runoff is slow. Flooding occurs about 1 to 5 times in 100 years, and the duration is brief. Available water capacity is high. When dry, this soil has large cracks that seal when the soil is wet. Undisturbed areas have some gilgai microrelief that consists of small microknolls and small subrounded depressions. The shrink-swell potential is high or very high throughout the soil.

Included with this soil in mapping are small areas of Asa, Brazoria, Clemville, and Norwood soils. The Asa, Clemville and Norwood soils are less clayey than the Pledger soil. The Brazoria soil has a reddish, clayey surface layer. Also included are small areas of a Pledger soil that is occasionally flooded and areas where sandy strata are below a depth of 40 inches. Included soils make up less than 15 percent of the map unit.

The Pledger soil is used mainly as rangeland and pasture. A few areas are used for turfgrass or for alfalfa or other crops. The main crops are nonirrigated corn and grain sorghum. This soil is not commonly used for irrigated rice because of the alkalinity.

The native vegetation includes dense stands of large trees, including pecan, elm, live oak, and green ash. In addition, grasses, shrubs, and saw palmetto are common. Overgrazed or cleared areas are heavily invaded by palmetto, which requires chemical control. Proper stocking and deferred grazing are good management practices on rangeland.

Improved pasture grasses include Gordo and other bluestems, bermudagrasses, and bahiagrass. Pasture grasses, along with alfalfa, require applications of fertilizer and rotation grazing for maximum hay and pasture production. Crop rotation and applications of fertilizer are good management practices on cropland. Turfgrasses require fertilizer and land leveling, which helps to remove excess water. A good drainage system is beneficial for all agricultural uses of this soil.

This soil provides good or fair habitat for wildlife. The major wildlife species include deer, squirrels, wild hogs, rabbits, and a large variety of birds.

This soil has some limitations for urban and recreational uses, including wetness, clayey texture, the shrink-swell potential, and corrosivity of steel pipe. Most limitations can be partly overcome by good design and careful installation, such as installing drainage systems to overcome the wetness and the clayey texture and shaping the surface to control runoff water. Enlarging septic tank absorption fields can minimize the effects of very slow permeability. Using steel in building foundations and raised fill material on roads and streets helps to overcome the shrink-swell potential. Steel pipe should be treated or wrapped because of corrosivity.

This soil is in capability subclass IIw and in the Clayey Bottomland range site.

Pg—Pledger clay, occasionally flooded

This very deep, moderately well drained, dark colored, clayey soil is in nearly level and slightly concave areas on flood plains in the eastern part of the county. The soil is slightly lower on the landscape than the adjacent areas of Pledger clay that are rarely flooded. Areas are elongated or irregular in shape and range from 20 to more than 200 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is very dark gray, moderately alkaline clay about 12 inches thick. The subsoil, from a depth of 12 to 55 inches, is moderately alkaline clay. The upper part of the subsoil is dark grayish brown and has dark yellowish brown mottles. The lower part is dark gray and grayish brown and has gray mottles. The underlying material, from a depth of 55 to 80 inches, is dark brown, moderately alkaline clay that has mottles in shades of yellow and gray.

This soil is moderately well drained. It is very slowly permeable, and surface runoff is slow. Flooding occurs about 5 to 50 times in 100 years, and the duration is brief. Available water capacity is high. When dry, this soil has large cracks that seal when the soil is wet. Undisturbed areas have some gilgai microrelief that consists of small microknolls and small, subrounded depressions that generally are not visible in cultivated areas. The shrink-swell potential is high or very high throughout the soil.

Included with this soil in mapping are small areas of Asa, Brazoria, Clemville, Norwood, and Sumpf soils. The Asa, Clemville, and Norwood soils are less clayey than the Pledger soil. The Brazoria soil has a reddish surface layer. The Sumpf soil is lower on the landscape than the Pledger soil and is subject to ponding. Also included are small areas of a Pledger soil that has a subsoil that is grayer than is typical for the series. Included soils make up less than 15 percent of the map unit.

The Pledger soil is used mainly as rangeland and pasture. The native vegetation includes dense stands of large trees, such as elm, green ash, water oak, and a few pecan trees. The pecan trees are not so common on this soil as on the Pledger soil that is rarely flooded. Grasses, shrubs, and saw palmetto are common. Overgrazed or cleared areas are heavily invaded by palmetto, which requires chemical control. Proper stocking and deferred grazing are good management practices on rangeland.

Improved pasture grasses include Gordo and other bluestems, bermudagrasses, and bahiagrass. Pasture grasses and alfalfa require applications of fertilizer and rotation grazing for maximum hay and pasture production. A well designed surface water management system is desirable to improve drainage and increase yields.

This soil provides good woodland wildlife habitat and fair rangeland and openland habitat. The major wildlife species include deer, squirrels, wild hogs, rabbits, and a large variety of birds.

This soil has some limitations for urban and recreational uses, including wetness, clayey texture, the shrink-swell potential, the hazard of flooding, and corrosivity. Most of the limitations can be partly overcome by good design and careful installation. Installing drainage systems and shaping the surface reduce the amount of runoff water on building sites and help to overcome the hazard of flooding, wetness, and clayey texture. Increasing the amount of steel in building foundations helps to alleviate problems relating to the shrink-swell potential. Raised fill material, along with drainage systems for roads and streets, can help to overcome wetness and the shrink-swell potential. Enlarging septic tank absorption fields can minimize the effects of wetness and clayey texture. Steel pipe should be treated or wrapped because of corrosivity.

This soil is in capability subclass IIw and in the Clayey Bottomland range site.

RoB—Riolomas fine sand, 1 to 3 percent slopes

This very deep soil is on large, high mounds adjacent to the Colorado River. It consists mostly of sandy and loamy materials dredged from the river. These materials are adjacent to the river channel from south of Bay City to near Matagorda. The vegetation varies. Areas are elongated and narrow and range from 20 to more than 100 acres in size.

Typically, the surface layer is dark brown, moderately alkaline fine sand about 8 inches thick. From a depth of 8 to 26 inches, the underlying material is stratified, strong brown fine sandy loam. From a depth of 26 to 80 inches, it is stratified fine sandy loam, fine sand, and loamy fine sand. These strata are light brown and pale brown in the upper part and dark yellowish brown in the lower part. The soil is moderately alkaline.

This soil is well drained and moderately rapidly permeable. Surface runoff is slow to medium, depending on the slope. Available water capacity is moderate. The shrink-swell potential is low or moderate. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Brazoria, Clemville, and Norwood soils and small areas of the overwashed Edna and Laewest soils. Also included are areas where slopes are as much as 5 percent and areas that are rarely flooded. Included soils make up less than 15 percent of the map unit.

The Riolomas soil is used mainly for wildlife habitat and rangeland. A few areas have been reseeded or sodded to pasture grasses. This soil is not suitable for cropland unless it is machine leveled.

This soil is not suitable for urban and recreational uses. Some revegetated areas have limited use as wildlife habitat.

This soil is in capability subclass IIIe. It is not assigned a range site.

Sf—Sumpf clay, frequently flooded

This very deep, clayey soil is in weakly concave depressions on flood plains, mainly oxbows or old channels near the Colorado River and Caney Creek. Water often ponds for weeks or months. The vegetation ranges from dense stands of weeds and a few water-tolerant trees to sedges and water-tolerant grasses. Areas are narrow and elongated and range from 10 to more than 50 acres in size. Slopes are mainly less than 0.3 percent.

Typically, the surface layer is slightly alkaline clay about 41 inches thick. It is dark reddish brown and dark brown in the upper part and dark reddish gray in the lower part. The underlying material, from a depth of 41 to 80 inches, is reddish brown, slightly alkaline clay.

This soil is very poorly drained. Permeability and surface runoff are very slow. Flooding occurs more than 50 times in 100 years, and the duration is very long. Water ponds for long periods during rainy seasons unless the soil is artificially drained. Available water capacity is high.

Included with this soil in mapping are small areas of Asa, Brazoria, Norwood, and Pledger soils. These soils are higher on the landscape than the Sumpf soil. The Asa and Norwood soils are loamy. Included soils make up less than 15 percent of the map unit.

This Sumpf soil is suited mainly to rangeland and wildlife habitat. The hazard of flooding limits the suitability for other uses. Some artificially drained areas are used as pasture. Very few areas are used as cropland.

This soil provides good habitat for wetland wildlife, especially during winter months and other rainy periods. In most areas it provides poor or very poor habitat for openland, rangeland, and woodland wildlife. Exceptions are areas that have been drained and those that receive little or no runoff water.

This soil is not suitable for most urban and recreational uses because of the hazard of flooding.

This soil is in capability subclass VIw and in the Clayey Bottomland range site.

Sr—Surfside clay, occasionally flooded

This very deep, saline, dark colored, clayey soil is on nearly level coastal lowlands. It is on flats that extend from near Sargent south to the Intracoastal Waterway and west to Lake Austin. The soil is at an elevation of 2 to 10 feet above sea level. The associated marshy soils are at an elevation of less than 2 feet. Areas are irregular in shape and range from 100 to more than 300 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is moderately saline, moderately alkaline clay about 26 inches thick. It is black in the upper part and very dark gray in the lower part. From a depth of 26 to 48 inches, the subsoil is reddish brown, moderately saline, moderately alkaline clay mottled with grayish brown. From a depth of 48 to 74 inches, it is mottled, very dark gray, grayish brown, and yellowish red, moderately alkaline clay. The underlying material, from a depth of 74 to 80 inches, is weak red, moderately alkaline silty clay.

This soil is very poorly drained. Permeability and surface runoff are very slow. Flooding occurs about 5 to 50 times in 100 years, and the duration is brief. This soil is saline throughout. Available water capacity is high. The water table is within a depth of 4 feet during rainy periods. Water can pond for long periods. This soil has deep, wide cracks when dry. The cracks seal when the soil is wet, causing slow infiltration of water. The shrink-swell potential is high throughout the soil.

Included with this soil in the mapping are small areas of Brazoria, Ijam, Pledger, Velasco, and Veston soils. The Brazoria and Pledger soils are not saline. The Ijam soil occurs as mounds of dredge material along the Intracoastal Waterway. In places thin layers of this material have been spread over the Surfside soil. The Velasco soil is clayey and is in marshes. The Veston soil is less clayey than the Surfside soil. Also included are soils that are in small, weakly concave, elongated or oval depressions and are grayer than is typical for the Surfside soil. Additional moisture in these areas affects vegetative patterns and, in turn, the color tones on aerial photographs. In some areas a thin layer of reddish, loamy sediment is on the surface of the Surfside soil. Included soils make up less than 20 percent of the map unit.

The Surfside soil is used mainly as rangeland, but a few areas are used as improved pasture. The early settlers planted large areas of this soil to cotton and smaller areas to grain. These fields have been abandoned because of excess sodium in the soil and wetness at harvest time. Mosquitoes are a hazard to livestock, and pastures are grazed mostly in winter months.

This soil provides fair habitat for wetland wildlife. Ducks and geese feed in areas of the soil during winter months.

This soil is poorly suited to most urban and recreational uses because of wetness, the high shrink-swell potential, excess sodium, clayey texture, corrosivity, and the hazard of flooding. Drainage systems and mechanical surface shaping help to divert runoff water from building sites, thereby reducing wetness and the hazard of flooding in urban and recreational areas. Enlarging septic tank absorption fields helps to overcome some of the limitations. Treating or wrapping steel pipe minimizes the effects of corrosivity and excess sodium.

This soil is in capability subclass VIw and in the Salty Prairie range site.

TfA—Telferner very fine sandy loam, 0 to 1 percent slopes

This very deep, nearly level soil is on broad coastal prairie uplands. It commonly is on weakly convex mounds 15 to 30 feet across and 1 to 2 feet high. Woody vegetation is more common on this Telferner soil than is typical for the Telferner series. Areas are irregular in shape and range from 20 to more than 100 acres in size.

Typically, the surface layer is moderately acid very fine sandy loam about 18 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The subsoil, from a depth of 18 to 80 inches, is very dark grayish brown clay in the upper part, light gray clay and sandy clay in the next part, and yellowish brown sandy clay loam in the lower part. The subsoil is moderately acid to neutral in the upper part and moderately alkaline in the lower part. It has mottles in shades of red, brown, and yellow throughout.

This soil is moderately well drained. Surface runoff is slow or very slow, and permeability is very slow. Available water capacity is high. The root zone is deep, but blocky structure in the subsoil tends to impede the movement of water and air. The hazard of water erosion is slight. The shrink-swell potential is low in the surface layer and high in the upper part of the subsoil.

Included with this soil in mapping are small areas of Cieno, Dacosta, Edna, Livco, and Texana soils. The Cieno and Dacosta soils have a surface layer of sandy clay loam. The Cieno soil is in small depressions. The Edna soil has a thin surface layer of fine sandy loam. The Livco soil is saline. The Texana soil is in positions on the landscape similar to those of the Telferner soil, but it has a darker surface layer. Also included are small areas of a Telferner soil in which the upper part of the subsoil is darker than is typical for the series. Included soils make up less than 20 percent of the map unit.

The Telferner soil is used as rangeland, pasture, and cropland. Live oak and other trees are common in the areas of rangeland, in contrast to survey areas to the west, where the Telferner soil has a dominant vegetation of openland prairie vegetation.

This soil is moderately well suited to crops. Irrigated rice is the best suited crop, but a few small fields are planted to row crops, such as grain sorghum and soybeans. Good management practices include leaving crop residue on the surface, tilling on a timely and limited basis, and rotating crops. Growing cover crops and soil-improving crops and incorporating crop residue into the soil help to control erosion and maintain productivity and tilth. Applications of fertilizer are needed for maximum crop production. Drainage ditches are beneficial where adequate outlets are available.

This soil is well suited to improved pasture of kleingrass and Pensacola bahiagrass. Applications of fertilizer, weed control, controlled grazing, and proper stocking rates help to improve or maintain the productivity of pasture and hayland.

This soil provides fair habitat for wildlife. Deer, dove, quail, and other wildlife are common in areas of rangeland. Ducks and geese are prevalent on rice and grain fields in winter months.

This soil is poorly suited to most urban and recreational uses. The main limitations are the shrink-swell potential in the subsoil and the very slow permeability. These limitations can be partly overcome by proper design and careful installation of foundations, pipelines, streets and roads, and septic systems. Increasing the amount of steel in building foundations helps to overcome the shrink-swell potential. Raised fill material on sites for roads and streets reduces the shrink-swell potential and the wetness. Enlarging septic tank absorption fields helps to overcome the restricted permeability.

This soil is in capability subclass IIw and in the Loamy Prairie range site.

TxA—Texana fine sandy loam, 0 to 1 percent slopes

This very deep, nearly level soil is on broad coastal prairie uplands. It is typically on meander ridges more than 15 feet above sea level. Small motts of live oak trees and occasional mounds, ranging from 10 to 15 feet in diameter and 1 to 2 feet high, are in some areas. Areas are oblong or irregular in shape. They range from 10 to 200 acres in size, averaging about 100 acres.

Typically, the surface layer is neutral fine sandy loam about 20 inches thick. It is very dark grayish brown in the upper part and grayish brown in the lower part. From a depth of 20 to 42 inches, the subsoil is mottled, very dark grayish brown, neutral clay in the upper part and mottled, grayish brown, slightly alkaline sandy clay in the lower part. The mottles are in shades of brown and red. From a depth of 42 to 63 inches, the subsoil is yellowish red, moderately alkaline silty clay loam. The underlying material, from a depth of 63 to 80 inches, is red, moderately alkaline silty clay.

This soil is moderately well drained. Surface runoff is slow, and permeability is very slow. Available water capacity is high. The root zone is deep, but blocky structure in the subsoil tends to impede the movement of water and air. The hazard of water erosion is slight. The shrink-swell potential is low in the surface layer and high in the upper part of the subsoil.

Included with this soil in mapping are small areas of Cieno, Dacosta, Edna, Livco, and Telferner soils. The Cieno and Dacosta soils have a sandy clay loam surface layer. The Edna and Telferner soils do not have a dark colored surface layer. The Livco soil is saline. Also included are small areas where the surface layer is dark colored throughout and some small areas where the subsoil is redder than is typical for the Texana series. Included soils make up less than 20 percent of the map unit.

The Texana soil is used mainly as cropland and rangeland. The main crops are rice, grain sorghum, and corn. Pasture grasses include bahiagrass and coastal bermudagrass. The native vegetation includes prairie grasses, sparse live oak, and other hardwood trees. Trees are more common in areas of overgrazed rangeland than in other areas.

This soil provides fair habitat for openland and rangeland wildlife. Deer are common where live oak trees are increasing in number.

This soil has some limitations for urban and recreational uses, including corrosivity of steel pipe, the very slow permeability, and the high shrink-swell potential. Specialized engineering design can reduce the effects of these limitations. Drainage systems and mechanical land shaping help to control surface runoff and reduce wetness on sites for buildings and in recreational areas. Enlarging septic tank absorption fields minimizes the limitations caused by restricted permeability and wetness. The use of increased amounts of steel or raised fill material helps to overcome the shrink-swell potential on sites for buildings, roads, and streets. Steel pipe should be wrapped or treated because of corrosivity.

This soil is in capability subclass IIw and in the Loamy Prairie range site.

TxB—Texana fine sandy loam, 1 to 3 percent slopes

This very deep, gently sloping soil is on broad coastal prairie uplands. It is typically on meander ridges more than 15 feet above sea level. Some areas have small mottes of live oak trees and occasional mounds ranging from 10 to 15 feet in diameter and 1 to 2 feet high. Areas are oblong or irregular in shape and range from 10 to 200 acres in size. Slopes are mainly less than 2.5 percent.

Typically, the surface layer is slightly acid fine sandy loam about 12 inches thick. It is very dark grayish brown in the upper part and grayish brown in the lower part. The subsoil, from a depth of 12 to 80 inches, is very dark grayish brown and grayish brown, neutral clay in the upper part and light yellowish brown and yellowish red, moderately alkaline sandy clay in the lower part. The subsoil has mottles in shades of red, yellow, brown, and gray throughout.

This soil is moderately well drained. Surface runoff is slow or moderately slow, and permeability is slow. Available water capacity is high. The root zone is deep, but blocky structure in the subsoil tends to impede the movement of water and air. The hazard of water erosion is moderate. The shrink-swell potential is low in the surface layer and high in the subsoil.

Included with this soil mapping are small areas of Cieno, Edna, Katy, Livco, and Telferner soils. The Cieno soil is in small depressions and has a sandy clay loam surface layer. The Edna, Katy, and Telferner soils do not have a dark colored surface layer. The Katy soil has a subsoil that is less clayey and redder than that of the Texana soil. The Livco soil is saline. Also included are small areas where the surface layer is dark colored throughout. Included soils make up less than 20 percent of the map unit.

The Texana soil is used mainly as cropland and rangeland. The main crops are rice, grain sorghum, and corn. Pasture grasses include bahiagrass and coastal bermudagrass. The native vegetation includes little bluestem, indiangrass, Florida and brownseed paspalums, and switchgrass. Live oak, hackberry, and ash trees are common in areas of rangeland and form dense stands in many places.

This soil provides fair wildlife habitat. Deer are common in areas adjacent to streams and in other wooded areas.

This soil has some limitations for urban and recreational uses, including corrosivity, wetness, the high shrink-swell potential, and the slow permeability. Specialized engineering design can reduce the effects of these limitations. Drainage systems and mechanical land shaping help to control runoff and reduce wetness. Additional steel in building foundations and raised fill material on sites for roads and streets are needed because of the shrink-swell potential. Enlarging septic tank absorption fields can minimize the effects of restricted permeability. Coating or treating underground pipe reduces the risk of corrosion.

This soil is in capability subclass IIIe and in the Loamy Prairie range site.

Ve—Velasco clay, frequently flooded

This very deep, nearly level, saline, clayey soil is in marshes on flood plains near the coast. The vegetation is mainly marshhay cordgrass and seashore paspalum. Areas are irregular in shape and range from 10 to more than 100 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is dark brown, moderately saline, moderately alkaline clay about 30 inches thick. The subsoil, from a depth of 30 to 65 inches, is reddish brown silty clay in the upper part and mottled reddish brown, dark brown, and brown silty clay loam in the lower part. The subsoil is calcareous, moderately alkaline, and moderately saline throughout.

This soil is very poorly drained. Surface runoff and permeability are very slow. The soil is flooded by high tides. A permanent water table is within a depth of 2.5 feet throughout the year.

Included with this soil in mapping are small areas of Harris, Surfside, and Veston soils. The Harris and Surfside soils are clayey and are higher on the landscape than the Velasco soil. The Veston soil is loamy and is lower on the landscape than the Velasco soil. Included soils make up about 15 percent of the map unit.

The Velasco soil is used mainly for rangeland and wildlife habitat. Because of salinity and wetness, it is unsuitable for crop production and pasture.

The native vegetation consists of gulf cordgrass, common reed, marshhay cordgrass, seashore saltgrass, shore grass, and bushy-oxeye. Because of mosquitoes in summer and the danger of hurricanes in late summer and in fall, areas of this soil generally are grazed by cattle only during the winter months. After heavy grazing or a damaging burn, seashore paspalum tends to dominate and baccharis and smooth rush invade the lower areas.

This soil provides important wildlife habitat for a variety of birds and animals. Mottled ducks use areas of the soil for nesting. Thousands of migratory ducks, geese, rails, coots, and cranes frequent these areas in fall and winter. The less saline inland areas are the preferred habitat for alligators.

Except for recreational hunting, this soil is not suitable for urban or recreational uses because of wetness, salinity, the hazard of flooding, and clayey texture.

This soil is in capability subclass VIIw and in the Salt Marsh range site.

Vs—Veston loam, strongly saline, frequently flooded

This nearly level, saline, loamy soil is on marshy flood plains near the coast. It is briefly flooded by storm tides. The vegetation includes gulf cordgrass and other salt-tolerant plants. Areas are irregular in shape and range from 20 to more than 150 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is gray, strongly saline, moderately alkaline loam about 5 inches thick. From a depth of 5 to 56 inches, the underlying material is strongly saline, moderately alkaline, stratified loam and silt loam. The strata are light gray, gray, and dark gray. From a depth of 56 to 72 inches, the underlying material is gray, strongly saline, moderately alkaline silty clay loam.

This soil is poorly drained. Surface runoff is very slow. Permeability is slow. The water table is within a depth of 2 feet most of the year. The salinity of the soil fluctuates, depending on the tide and rainfall.

Included with this soil in mapping are small areas of Follet, Galveston, Harris, and Mustang soils. The Follet soil is slightly lower on the landscape than the Veston soil. The Galveston and Mustang soils are sandy and are on dunes and beaches. The Harris soil is clayey and is higher on the landscape than the Veston soil. Included soils make up less than 30 percent of the map unit.

The Veston soil is suitable only for rangeland and wildlife habitat because of the hazard of flooding. The native vegetation consists of gulf cordgrass, common reed, marshhay cordgrass, seashore saltgrass, shore grass, and bushy sea-oxeye.

This soil provides good habitat for wetland wildlife. Geese, ducks, herons, and shore birds feed in areas of the soil.

This soil has severe limitations for urban and recreational uses because of wetness, salinity, and the susceptibility to flooding.

This soil is in capability subclass VIIs and in the Salt Flat range site.

Prime Farmland

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. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forest land, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 447,700 acres in the survey area, or 63 percent of the land area, meets the soil requirements for prime farmland. This land is mainly in general soil map units 1, 2, 4, and 5, which are described under the heading "General Soil Map Units."

A recent trend in land use in some parts of the survey area has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. On one soil included in the list (Bacliff clay, 0 to 1 percent slopes), measures that overcome wetness are needed. Onsite evaluation is needed to determine whether or not the wetness has been overcome by corrective measures. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

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 to prevent 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 behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational 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 in harmony with the natural soil.

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

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

Crops and Pasture

Tommy E. Wilson, soil conservationist, Natural Resources Conservation Service, Angleton, Texas, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The estimated yields of the main crops and pasture plants are listed for each soil, and the system of land capability classification used by the Natural Resources Conservation Service is explained.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading “Detailed Soil Map Units.” Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Texas Agricultural Extension Service.

More than 437,000 acres in the county was used as cropland or pasture in 1990. Of this, 129,000 acres was used for row crops, such as grain sorghum, corn, cotton (fig. 11), and soybeans; 35,000 acres was used for irrigated rice; and 190,000 acres was used for rotation hay and pasture. The rest was temporarily idle cropland or summer fallow.

The number of acres of cropland and pasture is decreasing as more land is converted to urban uses. In addition, some land is idle because landowners are holding the land for appreciation and for future urban uses.

Surface drainage is a major concern on the cropland and pasture in Matagorda County. Many soils have a drainage problem to some degree. Because of nearly level slopes, some soils remain wet for significant periods. Prolonged wetness affects plant growth. Drainage systems have been installed in many areas; however, in others, inadequate natural outlets make any improvement difficult and expensive. The well drained Asa, Clemville, and Norwood soils are the main soils that do not require drainage.

Crops

The soils in Matagorda County have good potential for increased production of food. About 130,000 acres of potentially good cropland is used as rangeland, and 190,000 is used as pasture. In addition to this potential increase in the acreage of cropland, food production can be increased by applying the latest crop production technology. This publication can facilitate the application of new technology.

The specialty crops that are grown commercially in the county include pecans and turfgrass. Many of the

Figure 11.—Cotton in an area of Laewest clay, 0 to 1 percent slopes.

soils in the county are suited to the production of pecans, especially the well drained Asa, Clemville, and Norwood soils. Turfgrass is grown on a variety of soils.

The main management concerns on the cropland in Matagorda County are improving drainage and maintaining soil tilth and fertility.

In many areas suitable for cropland, excess surface water moves very slowly because slopes are level or nearly level and the soils are slowly permeable or very slowly permeable. After rains, these soils are slow to dry and necessary land treatment is difficult to carry out in a timely manner. If installed properly, drainage systems help to remove the excess water. Many areas are not drained because adequate outlets are not available. In addition to the availability of adequate outlets, row direction should be considered and the system should be planned so that it does not hinder the operation of farm equipment.

Soil tilth is important in seed germination and water infiltration because it determines soil aeration. The surface layer should be granular and porous. Tillage is required to break up clayey soils, such as Bacliff, Laewest, and Pledger soils, which generally are dense. Preparing a good seedbed is difficult on these soils. Crop residue can improve soil structure and thus improve soil tilth.

Maintaining or increasing the content of organic matter in the soil by adding crop residue improves aeration, tilth, fertility, and water infiltration. If crop residue is not left on the surface of the soil, rain breaks up the natural soil aggregates. As a result, the intake rate is lowered, the runoff rate is increased, and erosion is accelerated.

Other management concerns on the cropland in the county are control of erosion and conservation of moisture. Erosion removes the most fertile upper part of the soil and clogs bayous, creeks, and rivers with sediment. Water erosion generally is underestimated on cropland because it is not easily noticed. Normal cropping sequences and tillage practices generally keep erosion within acceptable limits on nearly level soils. In areas of the more sloping soils, erosion can be controlled by intensive management. Installing and maintaining these management practices can be expensive. Because the acreages involved are small, most of these areas are not cropped.

During wet periods, conserving soil moisture is important for crops that are subject to drought stress during the summer when rainfall is below normal. Moisture-conserving practices include timely planting, proper tillage, and crop residue management.

Proper tillage, a management practice that can help to maintain soil productivity, should be used on all soils. Tillage should be used only to prepare a good seedbed and to control weeds. Organic matter is lost and good soil tilth is destroyed through excessive tillage or tilling when the soil is wet. Also, excessive tillage is an added expense and can cause the formation of a plowpan, a compact layer directly below the plow layer. A plowpan restricts the movement of air and water and is difficult for roots to penetrate. It increases the runoff rate and restricts plant growth.

Some form of minimum tillage is recommended in most areas of the county. Minimum tillage reduces the number of trips over a field with farm equipment. Also, more crop residue is left on the surface than with conventional tillage. The residue minimizes compaction and increases the rate of water intake, the available water capacity, and the natural fertility of the soil.

All cultivated soils in the county respond to commercial fertilizers. The kind and amount needed vary, depending on the soil, the crop, the desired production level, previous land use, and the season of the year. A soil test helps to determine the kind and amount of fertilizer to be applied. Nitrogen fertilizer can be added when crop residue is abundant. The additional nitrogen increases the rate at which the crop residue decomposes into humus. While the residue is decaying, much nitrogen is tied up as micro-organisms decompose the organic matter. Adding commercial nitrogen fertilizer ensures that there is enough nitrogen for both the micro-organisms and the growing crop. The nitrogen used by these organisms is not lost but is released back to the soil later in the season.

The method of applying fertilizer depends on the crop and the stage of plant growth. For row crops, the best method is to band the fertilizer below and to the side of the seed or plant roots. The fertilizer should be applied by broadcasting when the crop has been planted by that method.

Most of the soils in the county have favorable soil reaction, or pH, for the crops commonly grown in the county. Most have a high capacity to buffer the pH so that the soils do not become too acid. For plants that grow better in the more alkaline soils, lime can be applied. The applications should be based on the results of a recent soil test.

A cropping system, or crop rotation, is a management practice that improves soil tilth; protects the soil from heavy rains; helps to control weeds, insects, and plant diseases; and provides an economic return. Although a good cropping system can consist of only one crop, it generally consists of several crops grown in a sequence, or rotation, so that the crops that return little residue to the soil are balanced with the crops that return an abundant amount of residue. Under a good cropping system, the soils produce good yields indefinitely. The most common rotations in the county are rice and grain sorghum, rice and soybeans, grain sorghum and soybeans, and grain sorghum and cotton. Corn is grown in some rotations.

Many of the soils in the county are well suited to rice production because the topography is flat and the subsoil is very slowly permeable. The main rice-producing soils are Laewest and Edna soils. Rice production is especially extensive in the western and central parts of the county.

Flood irrigation is used in the rice fields. Irrigation water is supplied mainly by canal systems. Most of the management practices used for other crops are also relevant for rice production. Because the rice is grown under flood irrigation, however, there are some differences. Good soil aeration is important while the rice is young and the field is not flooded, but it is not a factor when the crop is older and the field is continuously flooded. When the rice field is not flooded, adequate surface drainage is important. Good surface drainage permits timely seedbed preparation, planting, and harvesting. After the soil has been flooded for several months, it becomes boggy and soft. If a good drainage system has been installed, the field can dry quickly after the excess water has been removed. Also, excess rainfall, which may occur during harvest, can drain off readily.

In areas where rice is grown, some kind of landforming is common. It can be done either with a land plane or by water land leveling. The objective is to make the land within the irrigation borders as smooth and level as possible so that a uniform water depth is maintained. Water land leveling consists of flooding the field and moving the soil hydraulically from the high areas to the low areas within the border by using blades attached to farm tractors. Water land leveling decreases the number of irrigation borders needed and keeps the existing ones straight. A properly designed landforming system also improves drainage.

A good irrigation system distributes water uniformly and in a timely manner. To ensure adequate flow during critical or low flow periods, reservoirs are used in some areas to supplement the water supply from canals. In places a tailwater recovery system is used with the reservoirs. This system allows the water that is drained from the field to be used again.

Because rice is continuously flooded from the time the plant reaches a height of about 6 inches to shortly before harvesting, conventional ground equipment is not used to apply chemicals or fertilizer. Airplanes are used instead.

Pasture and Hayland

Pasture is extensively used by livestock operations in the county. Dallisgrass and common bermudagrass are popular choices among livestock operations because they produce high forage yields, are adapted to a variety of soils, and can tolerate marginal drainage. In addition, these grasses are suited to intensive as well as extensive pasture management.

Pensacola bahiagrass and Gordo bluestem are warm-season plants that are grown in some pastures. Sometimes, pastures are overseeded with ryegrass, which provides grazing in winter.

The major management practices needed on pastures are applications of fertilizer, weed control, rotation grazing, and drainage. The kinds of soil and plants and the desired level of production determine the rate at which fertilizer is applied.

A variety of broadleaf weeds, Macartney rose, and smutgrass are the most common invading plants. Broadleaf weeds are controlled by good grazing management, chemicals, and mowing. Macartney rose can be controlled by chemicals. Chemicals and mowing can control smutgrass.

A surface drainage system is needed to remove excess surface water following rains. It improves soil aeration, which in turn promotes better plant growth. A lack of adequate outlets prevents the installation of good drainage systems in some areas.

Wooded areas are used extensively for pasture in Matagorda County. Most of these areas have a dense canopy of trees and can be managed only for native plants. The plant species vary greatly, depending on the kind of soil, the type of tree canopy, and the density of the canopy.

Proper grazing is the main management practice in the wooded areas. Most livestock operations do not use intensive management, such as opening the canopy to allow more sunlight to reach the ground; however, opening the canopy allows growth of the higher quality forage plants. It also allows a thicker stand of plants to grow, thus increasing forage production (fig. 12).

In most areas where more intensive management is used, the canopy is reduced to less than 25 percent. These areas can be managed for common bermudagrass and dallisgrass rather than native plants. Also, fertilizer can be applied in the areas to further increase production.

In Matagorda County, hay is made from improved bermudagrass, improved bluestems, forage sorghum, and native grasses. The areas of native grasses are commonly referred to as native hay meadows. They support a mixture of grasses dominated by bluestems and paspalums. They are mowed several times a year. Proper management consists mainly of mowing at the proper height and at the proper time to ensure that plant vigor is maintained. If properly managed, these areas can provide good-quality, low-cost hay. Because of the demand for land for other uses, however, the number of native hay meadows is slowly decreasing.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops *(30)*. 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

Figure 12.—Improved pasture in a cleared area of Pledger soils.

grouped at three levels—capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by 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 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 hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

The capability classification of each map unit is given in the section “Detailed Soil Map Units” and in the yields table.

Yields per Acre

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

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 ensures the smallest possible loss.

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

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

Rangeland

Homer Sanchez, range conservationist, Natural Resources Conservation Service, Temple, Texas, assisted with the preparation of this section.

Rangeland is the land on which the native vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. Rangeland receives no regular or frequent cultural treatment, such as applications of fertilizer and tillage. In areas that have similar climate and topography, the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between soils, vegetation, and water.

About 233,000 acres in Matagorda County, or 26 percent of the total acreage, is rangeland. The rangeland can be classified into two major kinds—marsh rangeland and prairie rangeland. Marsh rangeland is in the Gulf Coast Saline Prairies Major Land Resource Area, and prairie rangeland is in the Gulf Coast Prairies Major Land Resource Area. The marsh rangeland is in the lowlands nearest the gulf coast. It supports vegetation adapted to wet, saline soils. The prairie rangeland is in the higher lying areas of the county. It supports vegetation adapted to the better drained, nonsaline soils.

A range site is a distinctive kind of rangeland. It produces a characteristic natural plant community that differs from that on other range sites in kind, amount, and proportion of range plants. The natural plant community on the range site is also referred to as the climax plant community or climax vegetation because it represents the culmination of the effects of all the factors of the natural environment.

Climax vegetation is the stabilized plant community that reproduces itself and changes very little so long as the environment remains unchanged. It consists of the plants that grew on the site before the survey area was first settled. The most productive combination of native forage plants on a range site is generally the climax vegetation.

A range site is the product of the climate, soil, topography, and biotic factors responsible for its development. Range sites are subject to many influences that modify or even temporarily destroy vegetation. Examples are drought, overgrazing, wildfire, short-term tillage, and changes in soil characteristics, such as salinity and the level of the water table. In Matagorda County these changes can be brought about by drainage and hurricane storm tides. If these conditions are not too severe, the plant community can recover and return to climax condition.

Severe deterioration, however, can permanently alter the potential of the range site.

Grazing can change the quality and quantity of forage on a range site by changing the proportion of decreaser, increaser, and invader plants in the composition of the plant community.

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

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

Invaders are plants that are normally not included in the climax plant community because they cannot compete with the climax vegetation for moisture, nutrients, and light. They invade the site and grow along with increasers only after the amount of the climax vegetation has been reduced by continual heavy grazing. Most invader species have little grazing value.

Range management requires a knowledge of the kinds of soil and of the climax or potential natural plant community on a particular range site. The current range condition is assessed and compared to the climax plant community. The more closely the existing community resembles the climax community, the better the range condition. Range condition is an ecological rating only and does not have a specific meaning relating to the existing plant community in a given use.

Four range condition classes are used to show the degree of departure from the potential or climax vegetation. A range site is in excellent condition if 76 to 100 percent of the present plant community is the same as the climax vegetation, in good condition if the percentage is 51 to 75, in fair condition if the percentage is 26 to 50, and in poor condition if the percentage is 25 or less.

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

Good livestock and forage production on rangeland is achieved mainly by managing the time of grazing and limiting the amount of forage removed. Some of the food manufactured by the green parts of plants is used for growth, and some is stored for use in regrowth and seed production.

Following years of prolonged overuse of range, seed sources of desirable vegetation are eliminated. Vegetation can be reestablished by applying one or a combination of the following practices: fencing, water development, prescribed burning, mechanical or chemical treatment, range seeding, cattle walkways, or other treatments that revitalize stands of native plants or provide shelter for livestock. Thereafter, proper grazing use, deferred grazing, and planned grazing systems must be applied to maintain and improve the range. Following are some of the more commonly used resource management practices in Matagorda County.

Fencing.—This practice excludes livestock from areas needing protection from grazing and confines livestock to a specific area. Fencing also subdivides grazing land to permit use of a planned grazing system and protects new seedlings or plantings from grazing. This practice is used on both marsh and prairie rangeland.

Fences must be carefully planned, particularly in the marsh. They should allow cattle access to high ground during periods of high tides or rainfall. Fences should also fit into a good prescribed burning program. Because of the inherent salinity of the soil and water in the marsh, fresh water should be provided within each fenced area. An important consideration in planning fences is the high cost of maintaining them because of the corrosive salt spray in the marsh.

Fresh water supply.—Watering places should be provided for livestock at various locations in the grazing area. This practice reduces grazing pressure and overuse around a single watering place, creating a more uniform use of the entire range. Where earthen pits are used for a water supply, however, cattle can be infested with liver flukes.

Water in the marshes generally is salty, affecting most of the fresh water from natural lakes and drainageways that overflow in the marshes. Fresh water from wells or dug pits that trap rainfall generally is necessary. Pits dug in spoil banks along canals and walkways can also be used to trap and hold rainfall or fresh water that drains from inland areas.

Prescribed burning.—This practice is most widely used on marsh rangeland; however, it is used to some extent on prairie rangeland. Livestock operators and wildlife managers use this practice to periodically burn off a dense cover of mature vegetation. When done properly and at the right time, the practice stimulates new succulent growth, increases the availability of forage, restores climax plant species on upland rangeland, and reduces infestations of noxious weeds and brush. Forage can be severely damaged or killed, however, if the soil surface is too dry, allowing the fire to reach the plant crowns and roots. Livestock operators and wildlife managers usually attempt to burn marsh areas every 2 to 5 years when the surface is wet or covered with water. On upland soils burning more often than once every 3 years is not recommended because of the risk of harming perennial grasses. Prescribed burning is an effective management tool that can be substituted for chemical or mechanical treatment.

Cattle walkways.—This practice is used only on marsh rangeland. Cattle walkways are small, continuous earthen embankments built into marsh areas that are not very accessible. They result in a more uniform distribution of grazing, provide bedding grounds for livestock, facilitate ranching operations, and make the marsh more accessible to livestock, ranchers, and hunters. If walkways are constructed, staggering the borrow pits helps to prevent drainage of the marsh and allows cattle to enter the grazing area on both sides of the embankment. The pits also hold fresh water for livestock and wildlife use.

Shelters and windbreaks.—This is a common practice on marsh rangeland but is also important on prairie rangeland. Shelters protect livestock from cold, wet winds in winter. This practice is needed where no natural protection is available.

Proper grazing use.—The objective of this practice is to allow cattle to graze at an intensity that maintains enough cover to protect the soil and maintain or increase the quantity of desirable vegetation. This practice is used on both marsh and upland prairie rangeland.

Deferred grazing.—This is the deferment or restriction of grazing until the better forage plants have completed most of their seasonal growth or have made seed. This management practice helps to keep the desirable plants healthy and vigorous and permits plants that have been depleted to recover. Deferred grazing improves the plant cover, conserves water, and reduces soil losses. This practice is used on both marsh and prairie rangeland.

Planned grazing systems.—The objective of this practice is to rotate the grazing of livestock on two or more pastures in a planned sequence for a specified period of time. A planned grazing system may be relatively simple in design when only two pastures are used, or it may be more complex and management-intensive when one or two herds and many pastures are used. To be successful, it must be tailored to the conditions in each ranch unit and meet the needs of the plants and animals as well as the rancher. This practice is used on both marsh and prairie rangeland.

Table 7 shows for each soil in the survey area that supports range vegetation, the range site and the potential annual production in favorable, average, and unfavorable years. Only soils that are used as rangeland or are suited to rangeland are listed. Explanation of the column headings in table 7 follows.

A *range site* is listed for each map unit. Soils vary in their capability to produce grasses and other plants suitable for grazing. Soils that produce about the same kinds and amounts of forage are grouped into a range site. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Potential annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year’s growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Yields are adjusted to a common percentage of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Following is a description of the two kinds of rangeland and the range sites in Matagorda County.

Marsh Rangeland

Marsh rangeland borders the numerous bays in the county, the Gulf of Mexico, and the lower part of bayous that flow into the bays. The two general kinds of marsh rangeland are those having soils associated with the Matagorda Peninsula and those having soils associated with the mainland part of the county.

The rangeland along the gulf side of the Matagorda Peninsula consists of sandy soils that range from nonsaline and dry to extremely saline and wet. The vegetation ranges from plants that are associated with upland areas to those that grow in wet, saline areas. The other kind of marsh rangeland consists of soils that are predominantly loamy or clayey, saline, and wet much of the year. The vegetation consists of salt- and water-tolerant plants. In most areas the vegetation on marsh rangeland has not changed much from the original plant community. Any deterioration that has occurred generally is the result of a change in salinity or the water table and not because of grazing pressure from livestock.

Most plants respond to soil texture, frequency and duration of tidal inundation, salinity in the soil and water, and depth to the water table. Plants in the marsh adapt to a specific combination of these conditions. Altering any of these factors can change the plant community considerably. Depending on the objective, the rancher can alter or preserve the balance of the current plant community. Thus, it is important to have a thorough understanding of the potential effect any change will have on the plant community and how it will affect livestock use, wildlife habitat, and the marine ecosystem.

The usual grazing period on marsh rangeland is from about October to April. Cattle adapted to the marsh rangeland do well at that time of year, except during periods of severe storms or cold, wet weather. The cattle should be moved to other areas during the rest of the year because of the abundance of insects, particularly mosquitoes.

Marsh rangeland is divided into six range sites: Coastal Sand, Low Coastal Sand, Salt Flat, Salt Marsh, Salty Prairie, and Tidal Flat.

Coastal Sand range site. The Galveston soil in map unit GaB is in this range site, which consists of nearly level to undulating coastal ridges that parallel the Gulf of Mexico. Elevation is less than 12 feet above mean tide level.

The climax plant community on this site is dominated by little bluestem and switchgrass with lesser amounts of gulfdune paspalum, marshhay cordgrass, and brownseed paspalum. Several sedges and forbs are also native to this site. Woody vines and shrubs, such as dewberry and eastern baccharis, occur to some extent.

As retrogression takes place, slender bluestem and brownseed paspalum are strong increasers. As the site deteriorates, invader plants, such as broomsedge bluestem, carpetgrass, gulf muhly, ragweed, indigo, southern wax-myrtle, smutgrass, baccharis, woody vines, and annuals, dominate.

Low Coastal Sand range site. The Mustang soil in map unit MuA is in this range site, which consists of nearly level to gently sloping coastal sands that generally parallel the Gulf of Mexico. Elevation is mainly less than 10 feet above mean tide level.

The climax plant community is dominated by gulfdune paspalum, seacoast bluestem, and marshhay cordgrass. Broomsedge bluestem, red lovegrass, sedges, rushes, and knotroot bristlegrass occur in smaller amounts.

Under retrogression, gulfdune paspalum, marshhay cordgrass, and seacoast bluestem rapidly decrease in abundance and are replaced by such plants as red lovegrass, broomsedge bluestem, knotroot bristlegrass, and common bermudagrass. Under continued retrogression, common bermudagrass and red lovegrass dominate the site along with various weeds, vines, and forbs. Woody plants, such as baccharis and southern wax-myrtle, may also be abundant.

Revegetation after disturbance is not difficult with the understanding that the soil surface will become dry. Propagation is often desirable. This site is capable of growing many different kinds of vegetation. Plants that tolerate salt spray and are adapted to sandy soils that are not wet can probably grow on this site.

Salt Flat range site. The Veston soil in map unit Vs is in this range site, which consists of nearly level coastal marshes. Elevation ranges from slightly above to 3 feet above mean sea level. The water table is at the surface or within 15 inches of the surface. Salinity varies with the time of the year but is generally strong for much of the year. This site is low producing. When the site is in excellent condition, the maximum annual production is about 2,000 pounds per acre.

The climax plant community varies, depending on elevation, the water table, and drainage. It is about 30 to 40 percent shoregrass and some Virginia glasswort, Bigelow glasswort, maritime saltwort, and bushy sea-oxeye interspersed with barren areas. Seashore saltgrass, sea lavender, seepweed, Carolina wolfberry, and eastern baccharis also occur on the site.

When retrogression is induced by overgrazing, seashore saltgrass, bushy sea-oxeye, and Carolina wolfberry decrease in abundance. The site has no plants that occur as increasers and thus generally becomes more barren if overgrazed. If retrogression is climatically induced, maritime saltwort and glassworts slowly increase in abundance while other plants decrease rapidly, resulting in a higher percentage of barren areas.

Salt Marsh range site. The Harris, Placedo, and Velasco soils in map units Ha, Pc, and Ve, respectively, are in this range site, which consists of nearly level coastal marshes and flood plains that range from 1 to 6 feet above sea level. Small, shallow depressions that are filled with water at least part of the year are common in many areas. These open-water areas are important to waterfowl and other wildlife.

Marshhay cordgrass and seashore saltgrass make up most of the climax plant community. Seashore paspalum, seashore dropseed, olney bulrush, saltmarsh bulrush, dwarf spikesedge, saltmarsh aster, and needlegrass rush also occur in small amounts. Sedges and rushes are the major plants on this site.

Under retrogression, marshhay cordgrass decreases in abundance while seashore saltgrass and seashore paspalum increase, in some areas eventually dominating the site as retrogression continues. Saltmarsh aster, bushy sea-oxeye, spiny aster, and bulrushes somewhat increase in abundance. The less saline parts of this site are indicated by the presence of common reed, seashore paspalum, and longtom.

Salty Prairie range site. The saline Asa soil in map unit Az (fig. 13) and the Francitas, Livco, Livia, Palacios, and Surfside soils in map units FrA, LtA, LvA, PaA, and Sr, respectively, are in this range site, which is on broad, nearly level coastal flats and marshes. Elevation ranges from 2 to 15 feet above sea level.

The climax vegetation on this site is dominated by

Figure 13.—An area of Asa silty clay loam, saline, occasionally flooded, which is in the Salty Prairie range site. The thin grass cover is indicative of a high salt content.

Figure 14.—An area of Follet loam, frequently flooded. This soil is in the Tidal Flat range site.

gulf cordgrass, which makes up about 75 percent of the total vegetation. Lesser amounts of little bluestem, switchgrass, indiangrass, marshhay cordgrass, knotroot bristlegrass, and longspike tridens occur on this site.

With retrogression, little bluestem, switchgrass, and indiangrass decrease in abundance and gulf cordgrass and knotroot bristlegrass increase. Gulf cordgrass persists on this site even under adverse grazing. As retrogression continues, smutgrass, red lovegrass, croton, and bitter sneezeweed invade the site. Huisache, mesquite, and pricklypear invade at the higher elevations. The more saline areas have essentially pure stands of gulf cordgrass. Where salinity decreases in low-lying areas, common reed is more abundant.

Tidal Flat range site. The Follet soil in map unit Fe is in this range site, which is in broad, nearly level coastal marshes and tidal areas adjacent to bays and saline bayous (fig. 14). The soil is subject to daily tidal inundation. Elevation ranges from slightly below to about 1 foot above sea level. The water table is at or above the surface throughout the year. From 2 to 12 inches of water stands on the surface during most high tides. During low tides, all except 1 or 2 inches of the water normally drains off. The content of salt in the water usually ranges from 1.2 to 5 percent but can be lower during periods of high rainfall. This site is important for the marine ecosystem since it is the beginning of the food chain.

The climax plant community is dominated by smooth cordgrass, which makes up about 85 percent of the vegetation. Seashore saltgrass, glassworts, maritime saltwort, needlegrass rush, and saltmarsh bulrush may grow in small amounts. Widgeongrass grows in some of the shallow areas of fresher open water.

Retrogression usually is climatically induced. It causes a slight increase in the abundance of glassworts, bushy sea-oxeye, maritime saltwort, and saltmarsh bulrush, although these plants are not true increasers on this site. Retrogression induced by heavy grazing generally causes smooth cordgrass to thin out. This grass is not replaced appreciably by any other plants. As retrogression continues, smooth cordgrass decreases in abundance and is replaced by water.

Prairie Rangeland

The original vegetation on the prairie rangeland in Matagorda County has been drastically altered over the past 160 years. Many of the original native prairie plants are presently growing on some of the larger ranches and in areas historically protected from grazing. Some are also growing in native prairie hay meadows that are cut annually for prairie hay.

Heavy grazing pressure has resulted in a great change on most of the other grassland, where much of the higher quality vegetation has been grazed out. In most areas good grazing management allows these high-quality plants to reestablish themselves over a period of years.

The prairie soils generally are low in available phosphorus, and the forage generally lacks enough protein for a balanced diet for livestock during fall and winter. Mineral supplements are needed at this time.

Prairie rangeland is divided into eight range sites: Blackland, Clayey Bottomland, Claypan Prairie, Loamy Bottomland, Loamy Prairie, Lowland, Sandy Loam, and Sandy Prairie.

Blackland range site. The Bacliff, Dacosta, Edna, and Laewest soils in map units BaA, DaA, EoA, LtA, LaA, LaB, LaD2, and LoA, respectively, are in this range site. The climax vegetation is considered to be a true prairie. The composition, by weight, is about 95 percent grasses and 5 percent forbs.

This site is on broad uplands. Drainageways are shallow and widely spaced, resulting in slow or very slow surface drainage. Slopes are mainly less than 1 percent but range to 5 percent along drainageways. Some areas are hummocky, having microknolls 6 to 15 inches higher than microdepressions.

Almost three-fourths of the climax vegetation is dominated by little bluestem with smaller amounts of indiangrass, switchgrass, and eastern gamagrass. Also occurring in smaller amounts are Florida paspalum, big bluestem, brownseed paspalum, low panicums, and sedges. Several native forbs, such as sensitivebriar, Maximilian sunflower, and bundleflower, are prominent on this site. Woody vines also grow to some extent but contribute little to production.

As retrogression occurs, brownseed paspalum, meadow dropseed, and longspike tridens are likely increasers. When the site is in a deteriorated condition, common invaders include bushy and broomsedge bluestem, carpetgrass, smutgrass, vaseygrass, annual grasses and weeds, and many species of brush, such as baccharis, sumpweed, huisache, and sesbania.

Clayey Bottomland range site. The Brazoria, Pledger, and Sumpf soils in map units Br, Pe, Pg, and Sf, respectively, are in this range site (fig. 15). The climax vegetation is a tall grass savannah. The composition, by weight, is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

More than half of the climax vegetation is made up of switchgrass, indiangrass, eastern gamagrass, little bluestem, big bluestem, and Florida paspalum. The other grasses are Virginia wildrye, beaked panicum, rustyseed paspalum, buffalograss, broadleaf uniola, knotroot bristlegrass, and low panicums. Woody plants include oak, elm, water elm, hackberry, black willow, pecan, hawthorn, and woody vines. Forbs include perennial legumes, tickclover, gayfeather, and spiny aster.

If regression occurs as a result of heavy grazing, switchgrass, indiangrass, eastern gamagrass, little bluestem, big bluestem, and Florida paspalum are replaced by Virginia wildrye, sedges, beaked panicum, and rustyseed paspalum. If heavy grazing continues for many years, woody plants, such as oak, elm, cottonwood, and water elm, form a dense stand. The understory plants are broomsedge, bushy bluestem, smutgrass, carpetgrass, bitter sneezeweed, baccharis, sennabean, palmetto, and spiny aster.

Claypan Prairie range site. The Edna soils in map units EdA and ExA are in this range site. The climax vegetation is a true prairie. The composition, by weight, is about 95 percent grasses and 5 percent forbs.

Almost two-thirds of the climax vegetation is made up of little bluestem, switchgrass, and indiangrass. The other grasses are eastern gamagrass, Florida paspalum, big bluestem, brownseed paspalum, low panicums, low paspalums, longtom, knotroot bristlegrass, and sedges. Forbs include bundleflower, sensitivebriar, button snakeroot, yellow neptunia, croton, and ragweed.

Figure 15.—An area of Brazoria clay, rarely flooded, which is in the Clayey Bottomland range site. Palmetto is an invader plant on this range site.

If regression occurs as a result of heavy grazing, little bluestem, switchgrass, indiangrass, big bluestem, eastern gamagrass, and Florida paspalum are replaced by brownseed paspalum, low paspalums and panicums, knotroot bristlegrass, and sedges. If heavy grazing continues for many years, smutgrass, carpetgrass, common bermudagrass, bushybeard bluestem, broomsedge bluestem, vaseygrass, spiny aster, and woody species, such as Macartney rose, sennabean, huisache, and baccharis, significantly increase in abundance.

Loamy Bottomland range site. The Asa, Clemville, and Norwood soils in map units Aa, As, Cm, and No, respectively, are in this range site. The climax vegetation is a tall grass savannah. The composition, by weight, is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

About two-thirds of the climax vegetation is made up of eastern gamagrass, indiangrass, switchgrass, rustyseed paspalum, Virginia wildrye, beaked panicum, and sedges. The other grasses are little bluestem, big bluestem, broadleaf uniola, longtom, and knotroot bristlegrass. Woody plants include pecan, hackberry, oak, elm, and cottonwood. Forbs include snoutbean, lespedeza, wildbean, and tickclover.

If regression occurs as a result of heavy grazing, eastern gamagrass, indiangrass, switchgrass, and big bluestem are replaced by little bluestem, snoutbean, wildbean, and Virginia wildrye. If heavy grazing continues for many years, woody plants, such as oaks, pecans, and hackberry, form a dense stand. The understory plants include common bermudagrass, rustyseed paspalum, sedges, low panicums and paspalums, blood ragweed, cocklebur, white crownbeard, sumpweed, and spiny aster.

Loamy Prairie range site. The Faddin, Katy, Telferner, and Texana soils in map units FaA, KaB, TfA, TxA, and TxB, respectively, are in this range site. The climax vegetation is a true prairie. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

Almost two-thirds of the climax vegetation is made up of little bluestem. The other grasses are indiangrass, switchgrass, Florida paspalum, big bluestem, brownseed paspalum, Pan American balsamscale, fringeleaf paspalum, longtom, sedges, low panicums, and knotroot bristlegrass. Forbs include bundleflower, sensitivebriar, and yellow neptunia.

If regression occurs as a result of heavy grazing, little bluestem and Florida paspalum are replaced by brownseed paspalum, slender bluestem, low panicums, knotroot bristlegrass, common bermudagrass, sedges, and longspike tridens. If heavy grazing continues for many years, smutgrass, carpetgrass, Pan American balsamscale, broomsedge bluestem, common bahiagrass, and woody plants such as Macartney rose, running live oak, and sennabean, significantly increase in abundance.

Lowland range site. The Cieno soils in map units CeA and ExA are in this range site. The climax vegetation is a wet prairie. The composition, by weight, is about 95 percent grasses and grasslike plants and 5 percent forbs.

This site occurs as low-lying flats along drainageways, in swales, or in small potholes. Slopes are less than 1 percent. The plant community may have been drastically altered in the past because of drainage.

Over three-fourths of the climax vegetation is made up of switchgrass, maidencane, indiangrass, and eastern gamagrass. Also occurring, in lesser amounts, are little bluestem, big bluestem, Florida paspalum, longtom, squarestem spikesedge, brownseed paspalum, knotroot bristlegrass, and low panicums. Various sedges and rushes also occur, depending on the depth of water on the site. Areas of water occupy part of the site.

During retrogression, longtom, brownseed paspalum, and longspike tridens are strong increasers. Knotroot bristlegrass, sedges, and low panicum also are increasers. When the site is in a deteriorating condition, water areas may increase in extent and such plants as needlegrass rush, sedges, rushes, vaseygrass, carpetgrass, smutgrass, baccharis, and sesbania tend to dominate the site.

Sandy Loam range site. The Fulshear soil in map unit FuC is in this range site. The climax vegetation is a tall grass savannah that has a canopy of 20 to 25 percent. The composition, by weight, is about 70 percent grasses, 25 percent woody plants, and 5 percent forbs.

Over half of the climax vegetation is made up of little bluestem, switchgrass, Florida paspalum, indiangrass, and purpletop. The other grasses are brownseed paspalum, tall dropseed, silver bluestem, low panicums, low paspalums, Texas wintergrass, and sedges. Among the woody plants are post oak, live oak, yaupon, American beautyberry, and greenbrier. Forbs include partridgepea, bundleflower, snoutbean, wildbean, and sensitivebriar.

If regression occurs as a result of heavy grazing, little bluestem, indiangrass, purpletop, and switchgrass are replaced by brownseed paspalum and woody plants, such as running live oak and post oak. Oak, elm, American beautyberry, greenbrier, yaupon, and associated woody plants generally increase in abundance until the plant community resembles a scrub forest that has an understory of shade-tolerant, herbaceous plants, such as sedges and low panicums. If heavy grazing continues for many years, broomsedge bluestem, red lovegrass, sandbur, wild indigo, bitter sneezeweed, yankeeweed, and sennabean significantly increase in abundance.

Sandy Prairie range site. The Fordtran soil in map unit FoB is in this range site. The climax vegetation is a true prairie. The composition, by weight, is about 95 percent grasses and 5 percent forbs.

About two-thirds of the climax vegetation is made up of little bluestem, indiangrass, crinkleawn, and big bluestem. The other grasses are eastern gamagrass, Florida paspalum, switchgrass, brownseed paspalum, knotroot bristlegrass, low panicums, fringeleaf paspalum, sedges, slender bluestem, and Pan American balsamscale. Forbs include sensitivebriar, bundleflower, and yellow neptunia.

If regression occurs as a result of heavy grazing, little bluestem, indiangrass, crinkleawn, switchgrass, big bluestem, and eastern gamagrass are replaced by brownseed paspalum, knotroot bristlegrass, low panicums, slender bluestem, and sedges. If heavy grazing continues for many years, smutgrass, carpetgrass, red lovegrass, broomsedge, bluestem, balsamscale, yankeeweed, bitter sneezeweed, and woody plants, such as Macartney rose, huisache, sennabean, and running live oak, significantly increase in abundance.

Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. 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 uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational 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 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 mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

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

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

Jim E. Neaville, biologist, U.S. Fish and Wildlife Service, and Gary Valentine, biologist, Natural Resources Conservation Service, helped prepare this section.

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.

Wildlife is an important source of recreation and income in Matagorda County. Most of the land supporting wildlife species is leased for hunting. Resident and nonresident sportsmen engage in waterfowl hunting and saltwater fishing.

A wide variety of wildlife inhabits the county because of a great diversity of soil types and vegetation. Important game animals include ducks, geese, white-tailed deer, bobwhite quail, mourning doves, and tree squirrels. Others, such as coots, snipe, rails, and sandhill cranes, inhabit the county but are seldom hunted. Fur-bearing animals include bobcat, raccoon, nutria, mink, muskrat, river otter, beaver, coyote, fox, skunk, and opossum, some only in limited numbers. The county has a variety of raptorial birds, songbirds, marsh birds, and water birds. The wooded areas are important as stopping places for neotropical birds in their migration across the Gulf of Mexico. Fish, reptiles, and amphibians are abundant, mainly because of the vast complex of bays, freshwater and saltwater marshes, lakes, creeks, and the Colorado River. Important baywater fish, for example, speckled trout, redfish, and southern flounder, are always in demand by those who fish for sport. Saltmarsh water snake, water moccasin, turtles, and alligators are among the common reptiles. Frogs, toads, and other amphibians are well distributed throughout the county.

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, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, Japanese millet, small-seeded sunflower, and grain sorghum.

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, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are tall fescue, bahiagrass, little bluestem, clover, and winter 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 flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, paspalum, and panic grasses; sunflowers; wooly croton; black medic clover; and sweetclover.

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, available water capacity, and wetness. Examples of these plants are oak, red mulberry, pecan, elm, green ash, prickly ash, bois d'arc, and common persimmon.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are yaupon, coralberry, possumhaw, American elder, American beautyberry, grapes, greenbrier, Carolina snailseed, honeysuckle, and dewberry.

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, and slope. Examples of wetland plants are smartweed, wild millet, burhead, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds. Brackish and freshwater plants that grow in these areas are widgeongrass, dwarf spikerush, muskgrass, burhead, pond weeds, watershield, American lotus, and banana waterlily.

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

Openland wildlife habitat 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.

Openland habitat includes both irrigated and nonirrigated agricultural land. Rice is the most important irrigated crop used by waterfowl, followed by nonirrigated crops, such as grain sorghum, soybeans, hay, and minor crops, such as cotton, field corn, and various truck crops. Many of these crops supply food for seed-eating birds, such as doves, quail, and redwing blackbirds; insectivorous birds, such as nighthawk, eastern kingbird, and sparrow hawk; and white-tailed deer, raccoons, rabbits, and many other kinds of wildlife.

When the plants are allowed to set seed, improved pastures of bermudagrass, dallisgrass, pensacola bahiagrass, and tall fescue furnish bobwhite quail and doves additional sources of food. A few of the bermudagrass and tall fescue pastures are overseeded with Louisiana S-1 white clover. Overseeding improves the variety and quality of forage not only for livestock but also for rabbits and deer. Skunks frequent pastures at night, feeding mainly on adult and larval insects, frogs, toads, spiders, mice, and bird eggs.

If pastures are in large, open areas, depredation by waterfowl may often become severe.

When they are in a deteriorated condition, many pastures become infested with noxious plants, such as rattail smutgrass, carpetgrass, annual sumpweed, bitter sneezeweed, snow-on-the-prairie, western ragweed, and prickly sida, and a few undesirable trees and brush, such as Chinese tallow, eastern baccharis, and Macartney rose. If more food and cover become available, the habitat is improved, allowing the population of doves, quail, and other wildlife to increase.

Woodland wildlife habitat consists of areas of deciduous plants or coniferous plants, or both, and associated grasses, legumes, and wild herbaceous plants. The wooded areas are mostly along the rivers and major drainageways where the rich bottom-land soils, such as Asa, Pledger, and Clemville soils, are farmed. The highest populations of white-tailed deer, feral hogs, and tree squirrels are in the wooded areas along the Colorado River, Caney Creek, and the Tres Palacios River. Many other kinds of wildlife, such as opossum, owls, crows, cardinals, woodpeckers, wild bees, and armadillos, also inhabit these areas. Snakes, such as water moccasin, coral snake, and broad-banded copperhead, favor this habitat if conditions are suitable. The endangered southern bald eagle nests in the river bottom woodlands at two active nesting sites.

Wetland wildlife habitat consists of open brackish water marshes and shallow water bays (fig. 16). Most of this habitat is managed for wildlife because the characteristics of the soils preclude most uses other than rangeland.

Perhaps the most important function of this habitat is providing food for ocean species. This natural resource base is the cornerstone of a very important commercial and sport fishing industry based on the harvest and sale of seafood. Millions of tons of shrimp, crabs, finfish, oysters, clams, and other shellfish and marine life are dependent on the biological richness afforded by these estuaries.

This habitat also serves as the winter home for thousands of migratory waterfowl. Hundreds of thousands of fall- and spring-transient shore birds, gulls, terns, pelicans, rails, herons, egrets, ibis, gallinules, grebes, cormorants, cranes, curlews, plover, snipe, songbirds, and many other birds benefit from these coastal ecosystems. Many pass through the county en route to, and returning from, Central and South America. The endangered arctic peregrine falcons are spotted along the beaches and barrier islands each year during their migration.

Rangeland wildlife habitat consists of areas of shrubs and wild herbaceous plants on the coastal prairie soils that support stands of native grasses and related plants. The few fertile prairies remaining in the county are on some of the larger ranches and are used as native hay meadows or as rangeland. The acreage of these prairies is steadily decreasing.

The wildlife species on the prairies include coyote, bobwhite quail, doves, eastern meadowlark, horned lark, and other songbirds; rodents, such as rats and mice; reptiles, such as the ornate box turtle; and various hawks, owls, and vultures. Closely cropped areas on the prairie ridges and around livestock watering and bedding grounds are often frequented by Canada geese and sandhill cranes. Canada geese feed mainly on exposed grit and winter annuals, such as California burclover, black medic, annual bluegrass, Carolina geranium, chickweed, and filaree. Lesser sandhill cranes are more selective, feeding only in areas supporting stands of purple peatleaf, various nutgrasses, and related bulb-producing plants. Bobwhite quail and mourning doves often use the prairies after prescribed burns, heavy grazing

Figure 16.—Wetland wildlife habitat in an area of Veston loam, strongly saline, frequently flooded.

pressure, or mechanical disturbance. Use by other wildlife, such as white-tailed deer, feral hogs, and skunks, increases if a different kind of habitat, such as woodland, is nearby. The prairie habitat has a significant number of western diamondback rattlesnakes, which prefer this habitat. Because fire has been abandoned as a management practice and overgrazing has occurred, various kinds of trees and brush have encroached. The overall acreage of prairie habitat has decreased by several thousand acres.

Concerns in Habitat Management

Most wildlife requires varied kinds of cover and food along with other special needs. Often, a certain degree of interspersion of these factors is needed to maintain a healthy, productive wildlife community.

Cover can vary, consisting of plants, rocks, soil, or other living or nonliving things affording shelter, concealment, or protection. Many kinds of wildlife require cover for courtship, nesting, brooding, roosting, and escape and for protection from elements of inclement weather, such as wind, rain, and snow. Cover is not necessarily dense vegetation; for example, loafing cover for diving ducks may be a large body of open water.

Food includes water, fruits, berries, seeds, leaves, twigs, buds, roots, insects, and animals that provide energy, promote growth, and sustain life.

Special needs are characteristic of many kinds of wildlife. For example, aquatic creatures require a certain level of dissolved oxygen. Many birds require grit. White-tailed deer and other large mammals often require supplemental minerals, such as salt, vitamins, or other dietary components.

Interspersion generally is related to increasing the “edge effect” and is of utmost importance in that all elements needed by a species must occur within a limited area often referred to as the home range of the animal.

To achieve successful habitat management, a wildlife manager must know the essential habitat needs of a certain species or group of similar species, recognize the limiting factors or deficiencies within the area, and select the proper habitat factors to improve conditions. By determining the types of soil and becoming informed as to their properties, potentials, and limitations, the manager can select adapted plants to foster healthy wildlife populations.

Management of Marsh Habitat

The wetlands and rice fields of Matagorda County are well known for their abundance of migratory waterfowl, in addition to two resident species of ducks, the mottled duck and the wood duck. These areas provide essential habitat elements to more than 20 species of ducks and 6 species and subspecies of geese.

As a group, dabbling ducks are the most sought after game species in the county. They tend to favor the fresher and slightly brackish water marshes for feeding, resting, and other purposes. Their preferred foods are mainly the seeds of plants that are in the early stages of plant succession, the subdominant plants. These plants include grasses, sedges, and various forbs. Other plant parts, such as the roots, tubers, stems, and leaves of many emergent and submerged plants, are also important in the diet of the ducks. Shallow-flooded rice fields offer the ducks excellent feeding areas because waste grain, weed seeds, and red rice scattered during harvesting are available. A water depth of 1 to 6 inches represents ideal feeding habitat in both marsh and rice fields for most dabblers, such as northern mallards, pintails, teal, and mottled duck. A range of 10 to 12 inches approaches the maximum feeding depth that these species can tolerate.

The most abundant species of geese in Matagorda County are snow geese, represented by both the white and blue color phases, and the Ross’s goose. Canada geese inhabit the county in significant but declining numbers, the majority being the Richardson’s Canada goose followed by the lesser Canada goose. White-fronted geese also inhabit the county. Most dark geese, such as the Canadas and white-fronts, prefer the rice fields and plowed fallow fields over the marshes.

Snow geese are essentially grubbers, or root and tuber eaters. They prefer the foods in the fresher parts of the brackish marshes supporting stands of Olney bulrush, saltmarsh bulrush, and seashore paspalum. These three plants are subdominant, struggling against marshhay cordgrass, which is dominant in the climax plant community. When marshhay cordgrass marshes are correctly burned, snow geese feed on the succulent green regrowth, young sprouts, and various underground plant parts. They prefer to feed in large open areas where the vegetation is only a few inches tall. Shallow flood conditions create optimum feeding sites. Often, the favorite feeding sites used by geese become completely devoid of all standing vegetation. These exploited areas are called “eatouts.” Depending on weather and related conditions, these areas can become revegetated with many annuals, creating high-quality natural feeding areas for the following year. Examples of these “successional” annuals include spikesedges, sprangletops, wild millet, erect burhead, and Colorado river hemp.

In dry years, when the preferred food plants are in short supply, the geese feed on the stems and roots of seashore saltgrass, a more salt-tolerant species. Winter pastures planted for livestock are heavily damaged by large flocks of both light and dark geese when quality green browse is in short supply. These depredation problems are lessened if rotational marsh burns are used throughout the wintering period, especially during December, January, and February. The preferred roosting habitat of snow geese is mainly the larger shallow marsh flats or freshwater impoundments.

Prescribed marsh burning can have both good and bad effects. When the good exceed the bad, burning can be a valuable waterfowl management tool for maintaining or improving desirable vegetation. Prescription burns are used to accomplish the following objectives with minimal adverse effects: They restore or improve the habitat for waterfowl by reversing plant succession trends and favoring the emergence and growth of a variety of subdominant plants; improve production of food for waterfowl and provide lush green browse; increase the availability and consumption of food; reduce the hazard of wildfire by removing excessive grass roughs from areas in which the roughs cannot practically be reduced by grazing or other means; suppress the encroachment or growth of unwanted devilweed aster, bigleaf sumpweed, eastern baccharis, and sesbania; and improve grazing distribution and facilitate marsh travel. Many other minor objectives that are often beneficial to waterfowl are achieved when proper grazing is used in conjunction with planned burning and water control.

The time of burning is important. Controlled burns that benefit snow geese should be conducted in selected areas of marsh that have standing water 1 to 3 weeks prior to the initial mass migration of geese. A good burn removes the tall rank vegetation and makes roots, tubers, and regrowth readily available.

The normal burning season begins in October in wet years and ends in mid-February. Most wildlife managers recommend progressive burns spaced about 1 month apart. Under this system, large flocks of geese are more likely to rotate their grazing areas, reducing the probability of severe damage. The benefits of a good burn usually last 2 or 3 years when conditions are normal. Prolonged use by geese, especially near marsh potholes or where beds of bulrushes are unearthed, improves the habitat for a variety of ducks. Geese expose buried seeds and stir up aquatic grubs, which are eaten by such ducks as the pintail, gadwall, widgeon, and green-winged teal.

Early and late burns should be rotated on a unit basis as much as possible; for example, areas burned in October of one year should be burned during a later month of the next burn cycle year. In this way, plants benefited by late or early season burning receive equal consideration in chances of germination, emergence, and growth, resulting in a productive waterfowl area.

Water level management is a habitat management tool on marshland. Maintaining proper water levels and the proper level of salinity is very important. Water levels affect plant growth and waterfowl diversity, use, and abundance. Low water tidal weirs, earthen plugs, and flashboard risers with flapgates are widely used to hold water for waterfowl. Weirs and flapgate structures serve several useful purposes. They reduce water level fluctuations and the rate of tidal exchange, prevent drastic salinity changes, minimize water turbidity, reduce water temperature fluctuations, and increase the area and duration of flooding, all of which are essential to the production of vegetation attractive to waterfowl.

Levee plugs and flashboard risers commonly have water-level stabilization effects similar to those of weirs in semi-impounded areas. All can be used to benefit waterfowl and related wetland wildlife. Prescribed burning can be employed to a finer degree where the use of these structures makes intensive water control possible.

Proper grazing use opens up dense stands of grasses, sedges, and rushes and thus increases the availability of food for waterfowl, and it acts as a stimulating agent in encouraging plant retrogression. Carefully controlled cool-season marsh grazing also benefits waterfowl. Achieving varying degrees of retrogressive plant succession is the fundamental goal in marsh management for ducks and geese. Retrogression of the plant community to a vegetative composition of 30 percent or less marshhay cordgrass and 70 percent mixed rushes and related plants is an optimum goal.

Moderate grazing following a satisfactory burn often increases the benefits of burning by prolonging the time tender green sprouts are available as goose browse. Grazing is also a more dependable method of management because excessive rainfall and poor marsh drainage often prevent scheduled burning, sometimes for several growing seasons in succession. The churning effect of the hooves of cattle as they walk on the soft marsh floor unearths many seeds buried too deep in the organic duff to germinate. The presence of cattle induces the emergence of many plants that may not become fixed in the plant community until some type of disturbance affords the opportunity for further promotion of subclimax species.

Other Management Practices

Cropland, pasture, and woodland furnish quality habitat for many kinds of wildlife when such practices as the following are effectively applied—a planned crop rotation, crop residue management, fallow spring disking of the borders of idle fields, and leaving small areas of unharvested grain next to good cover.

Conservation practices, such as carefully planned mechanical mowing, deferred grazing, grazing management, selective brush management, planned pollination, and maintenance of shrub field borders, are often beneficial to wildlife on improved pastures.

A few of many management practices that are often employed in wooded areas are clearing and thinning selectively; planting winter annuals on pipeline rights-of-way and firebreaks and in open areas; protecting den trees and quality mast-producing trees; and using prescribed burning to ensure growth of low-growing shrubs and vines.

Some practices are harmful to wildlife. The most common of these are indiscriminate burning and use of chemicals for killing weeds and insects, heavy grazing, complete clean mowing early in the growing season, clean fall plowing, clearcutting of timber, drainage of wetland depressions, and removal of all den- and mast-producing trees.

Technical assistance in the planning or application of any of these wildlife management practices can be obtained from the Natural Resources Conservation Service, the Texas Agricultural Extension Service, and the Texas Parks and Wildlife Department.

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. Ratings are given for 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 in the “Soil Properties” section.

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

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

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should 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 or 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 kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to 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 a very firm dense layer, 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 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, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 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 a high water table, flooding, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic-supporting capacity.

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, a high water table, the available water capacity in the upper 40 inches, and the content of salts and sodium affect plant growth. Flooding, wetness, slope, 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 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 landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to 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, a high water table, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in 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 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 should be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, highly organic layers, soil reaction, and content of salts and sodium affect trench 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 sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, rock 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 wind erosion.

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 the 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 to 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 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, a low shrink-swell potential, 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 a moderate shrink-swell potential. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10 or a high shrink-swell potential. They are wet and have a water table at a depth of 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. They 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.

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 slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, 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, and soils that have an appreciable amount of gravel or soluble salts. 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 or soluble salts, or have a seasonal high water table at or near the surface.

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

Water Management

Table 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 for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to 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; and susceptibility to flooding. Excavating and grading and the stability of ditchbanks are affected by either slope or 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, and sulfur. Availability of drainage outlets is not considered in the ratings.

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

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope or wetness affects the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion 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. Wetness and slope affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

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

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

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

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, 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 the heading "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 about 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, CL-ML.

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.

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.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 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 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 determine the ability of the soil to adsorb cations and to retain moisture. They influence 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 earthmoving 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 downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

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 classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; *high*, 6 to 9 percent; and *very high*, greater than 9 percent.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.64. Other factors being equal, 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 without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.

8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

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 in 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 based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, 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 and very 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 to very deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a 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.

If a soil is assigned to two hydrologic groups in table 16, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

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 estimates are based mainly on observations of the water table at selected sites and on the evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) 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 high. 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.

Two numbers in the column showing depth to the water table 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 it is within a depth of 6 feet 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 results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(31)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; 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 Haplaquents (*Hapl*, meaning minimal horizonation, plus *aquent*, the suborder of the Entisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup 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 taxonomic class. 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 Haplaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, semiactive, nonacid, hyperthermic Typic Haplaquents.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the “Soil Survey Manual” *(33)*. Many of the technical terms used in the descriptions are defined in “Soil Taxonomy” *(31)* and in “Keys to Soil Taxonomy” *(32)*. Unless otherwise indicated, 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.”

Asa Series

The Asa series consists of very deep, well drained, moderately permeable, loamy soils formed in calcareous, silty and loamy alluvium (fig. 17). These soils are on the flood plains along Caney Creek, the Colorado River, and smaller streams in the eastern part of the county. Slopes generally are less than 1 percent.

Typical pedon of Asa silt loam, rarely flooded; from

Figure 17.—Typical profile of Asa silt loam.

the intersection of Farm Road 457 and Farm Road 521 about 15 miles southeast of Bay City, 4.2 miles south on Farm Road 457, about 1.5 miles east on a private road, and 200 feet north in a pasture:

A1—0 to 5 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; hard, friable; common fine roots; neutral; gradual smooth boundary.

A2—5 to 12 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate medium and fine subangular blocky structure; hard, firm; few fine and few medium roots; neutral; clear smooth boundary.

A3—12 to 17 inches; dark brown (7.5YR 3/2) silty clay loam, dark brown (7.5YR 4/2) dry; moderate medium and fine subangular blocky structure; hard, firm; few fine roots; very slightly effervescent; neutral; clear smooth boundary.

Bk—17 to 46 inches; strong brown (7.5YR 5/6) silt loam, reddish yellow (7.5YR 6/6) dry; moderate coarse subangular blocky structure; hard, friable; few fine roots and pores; few wormcasts; few organic stains on faces of peds; common films, threads, and masses of calcium carbonate; violently effervescent; moderately alkaline; clear smooth boundary.

C1—46 to 64 inches; reddish yellow (7.5YR 6/6) loam, reddish yellow (7.5YR 7/6) dry; massive; slightly hard, very friable; few films of calcium carbonate; violently effervescent; moderately alkaline; clear smooth boundary.

C2—64 to 75 inches; strong brown (7.5YR 5/6) silt loam, reddish yellow (7.5YR 6/6) dry; massive; hard, friable; few sand grains of lighter color on faces of peds; violently effervescent; moderately alkaline; abrupt smooth boundary.

Ab—75 to 90 inches; dark reddish brown (5YR 2/2) silty clay, dark reddish brown (5YR 3/2) dry; massive; very hard, very firm; very slightly and slightly effervescent; moderately alkaline.

The solum is 30 to 60 or more inches thick. Some pedons have buried soils below a depth of 40 inches. The content of organic matter decreases irregularly with increasing depth. The dark colored A horizon is 11 to 19 inches thick. The 10- to 40-inch control section is silt loam, silty clay loam, or loam that has 18 to 35 percent clay, more than 40 percent silt, and less than 15 percent fine sand or coarser sand.

The A horizon is black, very dark gray, very dark grayish brown, very dark brown, dark brown, or dark reddish brown. It has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3. This horizon ranges from silt loam to silty clay loam. In some pedons effervescence ranges from weak to strong. Reaction ranges from neutral to moderately alkaline. In some pedons near the coast, the soils are saline.

The B and C horizons are brown, strong brown, yellowish red, reddish brown, reddish yellow, dark brown, or light yellowish brown. They have hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 to 8. These horizons are silt loam, silty clay loam, or loam and have thin strata of silty clay, very fine sandy loam, or loamy sand. They have few to many films, threads, and masses of calcium carbonate. Effervescence is strong or violent. Reaction is slightly alkaline or moderately alkaline.

Bacliff Series

The Bacliff series consists of very deep, somewhat poorly drained, very slowly permeable, clayey soils on uplands. These soils formed in clayey sediments. Slopes generally are less than 1 percent.

Typical pedon of Bacliff clay, 0 to 1 percent slopes; from the intersection of Texas Highway 35 and Farm Road 1095 about 12 miles west of Bay City, 0.4 mile east on Texas Highway 35, about 0.5 mile north and 0.7 mile west on a county road, and 100 feet north in a cultivated field:

A—0 to 5 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; strong fine and medium subangular blocky structure parting to strong fine granular; very hard, firm, sticky and plastic; many fine and common medium roots; moderately acid; abrupt wavy boundary.

Ag—5 to 20 inches; gray (10YR 5/1) clay, light gray (10YR 6/1) dry; common fine distinct strong brown (7.5YR 5/6) mottles; weak coarse angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; common shiny surfaces on peds; few slickensides in the lower part; slightly acid; gradual smooth boundary.

Bssg1—20 to 38 inches; gray (10YR 5/1) clay, light gray (10YR 6/1) dry; few fine faint dark brown (10YR 4/3) mottles; moderate medium and coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few very fine roots; common pressure faces; few slickensides; slightly acid; gradual smooth boundary.

Bssg2—38 to 68 inches; light gray (10YR 6/1) clay, light gray (10YR 7/1) dry; many fine and few medium distinct yellow (10YR 7/8) mottles; moderate coarse angular blocky structure; very hard, very firm, very sticky and very plastic; common pressure faces and common slickensides; few fine masses of calcium carbonate in the lower part; slightly alkaline; clear wavy boundary.

2C—68 to 80 inches; strong brown (7.5YR 5/6) clay, reddish yellow (7.5YR 6/6) dry; many fine prominent weak red (2.5YR 5/2) mottles; massive; very hard, very firm, very sticky and plastic; few pressure faces; few masses of calcium carbonate; few fine mica flakes; strongly effervescent; moderately alkaline.

The solum is more than 60 inches thick. The soils are clay or silty clay throughout. The 10- to 40-inch control section ranges from 45 to 60 percent clay. Reaction in the control section ranges from moderately acid to moderately alkaline. In undisturbed areas gilgai microknolls are 6 to 16 inches higher than microdepressions. The centers of the microknolls are 6 to 15 feet from the centers of the microdepressions. When dry, these soils have cracks 1 to 2 inches wide that extend from the surface to a depth of more than 20 inches. Slickensides begin at a depth of about 5 to 15 inches.

The A horizon is 10 to 25 inches thick in the microdepressions and 6 to 10 inches thick on the microknolls. In some pedons the moist value is less than 3.5, but this layer averages less than 12 inches in thickness in more than 60 percent of the pedon. The A horizon is very dark gray, dark gray, or gray. It has hue of 10YR, value of 3 to 5, and chroma of 1 or less. Reaction ranges from moderately acid to slightly alkaline.

The Bssg horizon is gray or light gray. It has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1. It has few to many mottles in shades of yellow or brown. In some pedons this horizon has a mottled matrix. A few black or brown concretions are in some pedons.

The 2C horizon is gray, light gray, light brownish gray, brownish yellow, yellowish brown, olive brown, reddish yellow, strong brown, or yellowish red. It has hue of 2.5YR to 10YR, value of 5 to 7, and chroma of 1 to 6. It has few to many mottles in shades of brown, gray, red, or yellow and few to many black or brown concretions. The content of calcium carbonate concretions ranges from less than 1 to more than 5 percent. In some pedons the 2C horizon has a few mica flakes. Some pedons do not have a 2C horizon.

Some pedons have a Bk or BC horizon, which is similar to the 2C horizon in color and texture.

Brazoria Series

The Brazoria series consists of very deep, moderately well drained, very slowly permeable, clayey soils on flood plains. These soils are extensive from Caney Creek to the Brazoria County line. Smaller areas are along the Colorado River. These soils formed in reddish, calcareous, clayey alluvium. Slopes are 0 to 1 percent.

Typical pedon of Brazoria clay, rarely flooded; from the intersection of Texas Highway 35 and Farm Road 1728 about 10 miles east of Bay City, 5.6 miles north on Farm Road 1728 and 100 feet east-southeast in a pasture:

A—0 to 12 inches; dark reddish brown (5YR 3/2) clay, dark reddish gray (5YR 5/2) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; common fine and few medium roots; strongly effervescent; moderately alkaline; clear wavy boundary.

Bss—12 to 65 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 5/4) dry; thin strata of dark red (2.5YR 3/6) clay at a depth of 50 inches; strong medium angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots and pores; common pressure faces and few slickensides; few very fine and fine calcium carbonate concretions; few very fine mica flakes; violently effervescent; moderately alkaline; clear wavy boundary.

C—65 to 90 inches; reddish brown (5YR 4/3) clay, reddish brown (5YR 5/3) dry; few fine and medium prominent dark gray (10YR 4/1) mottles; massive; very hard, very firm, very sticky and very plastic; few very fine roots; violently effervescent; moderately alkaline.

The solum is more than 60 inches thick. The 10- to 40-inch control section is clay. The content of clay ranges from 60 to 80 percent. The COLE value of the upper part of the B horizon ranges from 0.08 to 0.11. The soils have few or common slickensides. Undisturbed areas have gilgai microrelief. When the soils are dry, cracks 1 to 3 inches wide extend from the surface to a depth of more than 30 inches.

The A horizon is dark reddish brown, very dark brown, or dark brown and is 7 to 18 inches thick. It has hue of 5YR or 7.5YR, value of 3, and chroma of 2 or 3.

The B horizon is reddish brown, dark reddish brown, reddish gray, dark brown, brown, red, or dark red. It has hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 2 to 6.

The C horizon is similar in color to the B horizon. It is clay or silty clay. It has few or common films, threads, masses, or concretions of calcium carbonate. Some pedons do not have a C horizon.

In some pedons a buried horizon that is typically noncalcareous and darker in color is below a depth of 40 inches. The texture of this horizon ranges from clay to clay loam or loam.

Cieno Series

The Cieno series consists of very deep, poorly drained, very slowly permeable, loamy soils on uplands. These soils generally are in the pothole-shaped depressions that dot the landscape of the Coast Prairie. In some areas they are in elongated drainageways. These soils formed in calcareous, loamy sediments.

Typical pedon of Cieno sandy clay loam, 0 to 1 percent slopes; from the intersection of Texas Highway

71 and Texas Highway 111 about 15 miles west of Bay City in Midfield, 2 miles west on Texas Highway 111, about 0.8 mile north on a county road, and 150 feet east in a pasture:

A—0 to 12 inches; dark gray (10YR 4/1) sandy clay loam, gray (10YR 5/1) dry; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; many fine and few medium roots and pores; common sand-filled cracks; neutral; gradual smooth boundary.

Btg1—12 to 30 inches; dark gray (10YR 4/1) clay loam, gray (10YR 5/1) dry; few fine distinct yellowish brown (10YR 5/6) mottles; strong medium subangular blocky structure; very hard, very firm, very sticky and plastic; few faint clay films on faces of peds; common fine roots and pores; neutral; gradual smooth boundary.

Btg2—30 to 36 inches; grayish brown (10YR 5/2) sandy clay loam, light brownish gray (10YR 6/2) dry; common fine and medium distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few faint clay films on faces of peds; few fine roots and pores; neutral; gradual smooth boundary.

BCg1—36 to 58 inches; grayish brown (2.5Y 5/2) sandy clay loam, light brownish gray (2.5Y 6/2) dry; common medium distinct olive yellow (2.5Y 6/8) and common fine prominent reddish yellow (7.5YR 6/8) mottles; moderate medium subangular blocky structure; hard, friable, slightly sticky and plastic; slightly alkaline; gradual smooth boundary.

BCg2—58 to 65 inches; light brownish gray (2.5Y 6/2) sandy clay loam, light gray (2.5Y 7/2) dry; many coarse prominent brownish yellow (10YR 6/8) and few coarse prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; hard, friable, slightly sticky and plastic; slightly alkaline; clear smooth boundary.

2C—65 to 80 inches; light gray (2.5Y 7/2) fine sandy loam, white (2.5Y 8/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; slightly alkaline.

The solum is 60 to more than 70 inches thick. The surface layer is hard and massive when dry. The average content of clay in the control section is 27 to 35 percent. Reaction is slightly acid or neutral in the A horizon and slightly acid to moderately alkaline below the A horizon. Uncoated sand grains are common on faces of peds and as crack fillings in the A and B horizons.

The A horizon is dark gray or dark grayish brown and is 6 to 13 inches thick. It has hue of 10YR, value of 4, and chroma of 1 or 2. It has no mottles or has few mottles in shades of red, brown, or yellow.

The Btg horizon is grayish brown, dark gray, dark grayish brown, or light brownish gray. It is 24 to 40 or more inches thick. It has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It has few to many mottles in shades of red, brown, yellow, or gray. This horizon is sandy clay loam, clay loam, or sandy clay.

The BC and C horizons are light gray, light brownish gray, grayish brown, or dark grayish brown. They have hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. They have few to many mottles in shades of red, brown, or yellow. These horizons are sandy clay loam or clay loam. The number of calcium carbonate concretions, black concretions, and pockets of sand grains ranges from none to many.

The 2C horizon has colors similar to those of the C horizon but has strongly contrasting textures ranging from silt loam to loamy fine sand. The number of calcium carbonate concretions ranges from none to many. Some pedons do not have a 2C horizon.

Clemville Series

The Clemville series consists of very deep, well drained, slowly permeable, loamy soils on bottom land. These soils formed in calcareous, silty alluvium over buried, dark colored, clayey soils. Slopes are 0 to 1 percent.

Typical pedon of Clemville silty clay loam, rarely flooded; from the Bay City Courthouse, 2.7 miles west on Texas Highway 35 to the Colorado River bridge, west on Texas Highway 35 to LeTulle Park, 0.2 mile north on a shell road, 0.5 mile east and 400 feet north in a pasture:

A—0 to 9 inches; reddish brown (5YR 4/3) silty clay loam, reddish brown (5YR 5/3) dry; moderate medium granular structure; very hard, firm, sticky and plastic; many fine and few medium roots and pores; strongly effervescent; slightly alkaline; abrupt smooth boundary.

C1—9 to 15 inches; dark brown (7.5YR 4/4) silty clay loam, brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few fine roots and many pores; violently effervescent; slightly alkaline; abrupt wavy boundary.

C2—15 to 29 inches; brown (7.5YR 5/4) silt loam, light brown (5YR 6/4) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few fine roots and common pores; violently effervescent; slightly alkaline; abrupt smooth boundary.

C3—29 to 33 inches; dark brown (7.5YR 4/4) silty clay loam, brown (7.5YR 5/4) dry; thin strata of silty clay; massive, with evident bedding planes; hard, friable, sticky and slightly plastic; few fine roots; violently effervescent; slightly alkaline; abrupt smooth boundary.

Ab—33 to 77 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few shiny surfaces on peds; slightly effervescent; slightly alkaline; gradual smooth boundary.

Cb—77 to 80 inches; strong brown (7.5YR 5/6) clay, reddish yellow (7.5YR 6/6) dry; massive; extremely hard, very firm, very sticky and very plastic; 3 to 5 percent calcium carbonate; violently effervescent; moderately alkaline.

The depth to clayey horizons ranges from 24 to 36 inches. The average content of clay in the control section ranges from 27 to 35 percent. The content of sand coarser than very fine sand is less than 15 percent.

The A horizon is reddish brown, brown, or light reddish brown and is 5 to 16 inches thick. It has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. This horizon is less than 8 inches thick where moist values and chromas are less than 3.5. Reaction is slightly alkaline or moderately alkaline. Effervescence is strong or violent.

The C horizon is reddish brown, dark brown, brown, or strong brown and is 16 to 28 or more inches thick. It has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. Some pedons have bedding planes of finer or coarser textures. Reaction is slightly alkaline or moderately alkaline. Effervescence is violent.

The Ab horizon is black, very dark gray, dark gray, or very dark brown. It has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. It is clay loam, clay, sandy clay loam, or loam. This horizon is slightly alkaline or moderately alkaline. Effervescence is none or slight.

The Cb horizon is black, dark gray, very dark gray, dark brown, strong brown, or reddish brown. It has hue of 5YR to 10YR, value of 2 to 5, and chroma of 1 to 6. It is clay, sandy clay, clay loam, silty clay, or loam. Reaction ranges from neutral to moderately alkaline. Effervescence ranges from none to violent. Some pedons have a Bb horizon, which is similar to the Cb horizon in color, texture, reaction, and effervescence.

Dacosta Series

The Dacosta series consists of very deep, moderately well drained, very slowly permeable, loamy soils on uplands. These soils formed in loamy and clayey sediments of the Beaumont and Lissie Formations. Slopes are 0 to 1 percent.

Typical pedon of Dacosta sandy clay loam, 0 to 1 percent slopes; from the intersection of Texas Highway 71 and Farm Road 111 about 15 miles west of Bay City in Midfield, 4.8 miles west on Farm Road 111 and 200 feet south in a pasture:

A—0 to 9 inches; black (10YR 2/1) sandy clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; hard and massive, firm, slightly sticky and slightly plastic; many fine and few medium roots and pores; neutral; gradual smooth boundary.

Bt1—9 to 24 inches; very dark gray (10YR 3/1) sandy clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; common fine roots and pores; common distinct clay films; moderately alkaline; gradual smooth boundary.

Bt2—24 to 36 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine faint yellowish brown (10YR 5/4) mottles; moderate medium and coarse angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; common distinct clay films; moderately alkaline; clear smooth boundary.

Btkg—36 to 48 inches; grayish brown (10YR 5/2) sandy clay loam, light brownish gray (10YR 6/2) dry; common medium faint yellowish brown (10YR 5/6) and olive yellow (2.5Y 6/6) mottles; moderate medium and coarse angular blocky structure; hard, firm, slightly sticky and slightly plastic; common faint clay films; few masses of calcium carbonate; few black concretions; strongly effervescent; moderately alkaline; gradual smooth boundary.

BCk—48 to 80 inches; light gray (10YR 7/2) sandy clay loam, white (10YR 8/2) dry; common medium distinct yellow (2.5Y 7/6) mottles; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; 3 to 5 percent masses of calcium carbonate; few fine black concretions; violently effervescent; moderately alkaline.

The solum is more than 60 inches thick. The surface horizon is dark colored and is hard and massive when dry. The COLE value of the upper part of the Btg horizon ranges from 0.09 to 0.12. When the soils are dry, cracks 0.05 inch to 2.0 inches wide form to a depth of more than 20 inches.

The A horizon is black, very dark gray, dark gray, very dark brown, very dark grayish brown, or dark grayish brown. It has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. Reaction is slightly acid or neutral.

Some pedons have a B/A or Bw horizon. These horizons are very dark gray, black, very dark grayish brown, dark gray, or dark grayish brown. They have hue of 10YR, value of 2 to 4, and chroma of 1 or 2. They are loam, sandy clay loam, clay loam, or sandy clay. Reaction ranges from slightly acid to slightly alkaline.

The Bt horizon is very dark gray, black, dark gray, gray, very dark grayish brown, or grayish brown. It has hue of 10YR and value of 2 to 5. It has chroma of 1 in the upper part and chroma of 1 or 2 in the lower part. It has no mottles or has few or common mottles in shades of brown, red, or yellow. This horizon is clay, sandy clay, or clay loam. Reaction ranges from slightly acid to moderately alkaline.

The Btk and BC horizons are gray, light gray, light brownish gray, grayish brown, yellowish brown, or very pale brown. They have hue of mainly 10YR but ranging to 2.5Y. They have value of 5 to 7 and chroma of 1 to 4. These horizons have few or common mottles in shades of brown, gray, red, or yellow. They are sandy clay, clay, clay loam, or sandy clay loam. The number of calcium carbonate films, threads, and concretions, including black concretions, ranges from none to common. Reaction ranges from neutral to moderately alkaline. Some pedons have a C horizon, which is similar in color, texture, and reaction to the Btk and BC horizons.

Some pedons have a 2C horizon below a depth of 60 inches. This horizon is light reddish brown, yellowish red, strong brown, or reddish yellow. It has hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 4 to 8. It is loam, sandy clay loam, clay loam, or clay. It has few or common concretions, masses, threads, or films of calcium carbonate. Reaction is slightly alkaline or moderately alkaline.

Edna Series

The Edna series consists of very deep, somewhat poorly drained, very slowly permeable, loamy soils on uplands. These soils formed in thick, loamy and clayey sediments. Slopes are 0 to 1 percent.

Typical pedon of Edna fine sandy loam, 0 to 1 percent slopes; from the intersection of Texas Highway 35 and Farm Road 1468 about 8 miles west of Bay City in Markham, 3.2 miles north on Farm Road 1468, about 1,200 feet west on a private road, and 200 feet south in a pasture:

A—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine and fine roots; few fine pores; moderately acid; abrupt smooth boundary.

Bt1—6 to 12 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; strong medium subangular blocky structure; very hard, very firm, sticky and very plastic; few very fine and fine roots; few fine pores; many prominent clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—12 to 25 inches; grayish brown (10YR 5/2) clay, light brownish gray (10YR 6/2) dry; common fine and medium distinct yellowish brown (10YR 5/8) mottles; strong medium angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; common faint clay films and few thin lenses of clean sand on faces of peds; neutral; gradual smooth boundary.

Bt3—25 to 41 inches; light brownish gray (10YR 6/2) clay loam, light gray (10YR 7/2) dry; common fine and medium distinct brownish yellow (10YR 6/8) mottles; moderate medium angular blocky structure; very hard, very firm, sticky and very plastic; few faint clay films on faces of peds; few fine black concretions; neutral; gradual smooth boundary.

Bt4—41 to 58 inches; light brownish gray (2.5Y 6/2) clay loam, light gray (2.5Y 7/2) dry; few fine distinct brownish yellow (10YR 6/8) mottles; moderate medium angular blocky structure; very hard, very firm, slightly sticky and plastic; few faint clay films on faces of peds; few fine and medium calcium carbonate concretions; neutral; abrupt smooth boundary.

BCtk—58 to 65 inches; mottled light gray (10YR 7/1), yellowish red (5YR 4/6), and brownish yellow (10YR 6/8) clay loam; moderate medium angular blocky structure; very hard, firm, slightly sticky and plastic; few faint clay films on faces of peds; common fine and medium calcium carbonate concretions; few fine black concretions; slightly alkaline; abrupt smooth boundary.

BCk—65 to 80 inches; light brownish gray (2.5Y 6/2) sandy clay loam, light gray (2.5Y 7/2) dry; weak fine subangular blocky structure; few fine faint yellow (2.5Y 7/6) mottles; hard, firm, slightly sticky and slightly plastic; common fine and medium calcium carbonate concretions; calcareous; moderately alkaline.

The solum is 60 to more than 80 inches thick. By weighted average, the content of clay in the control section is 35 to 50 percent.

The A horizon is dark grayish brown, very dark gray, very dark grayish brown, dark gray, gray, or grayish brown. It has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. It has no mottles or has few mottles in shades of brown or yellow. This horizon is loam, very fine sandy loam, or fine sandy loam 5 to 10 inches thick. Reaction ranges from moderately acid to neutral. Where the soils have been overwashed, the surface layer is 6 to 20 inches of reddish, moderately alkaline silty clay.

Some pedons have an E horizon. This horizon is pale brown, light brownish gray, grayish brown, or brown. It has hue of 10YR, value of 4 to 6, and chroma of 1 to 3. It has no mottles or has few or common mottles in shades of brown or yellow. The texture and reaction are the same as those in the A horizon.

The Bt horizon is dark gray, dark grayish brown, gray, grayish brown, or light brownish gray. It has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It has few or common mottles in shades of brown, red, or yellow. It is clay or clay loam. Reaction is moderately acid to neutral in the upper part of the horizon and slightly acid to moderately alkaline in the lower part. Some pedons have lenses of albic material on the faces of peds. This horizon has few to many black and brown concretions and has few or no calcium carbonate concretions.

The BC horizon is gray, grayish brown, brown, light brownish gray, pale brown, light yellowish brown, pink, light gray, white, very pale brown, olive brown, or light olive brown. In some pedons it has a mottled matrix. This horizon has hue of 10YR or 2.5Y, value of 4 to 8, and chroma of 1 to 4. It is clay, sandy clay loam, or clay loam. The number of calcium carbonate concretions ranges from none to common. Reaction is slightly alkaline or moderately alkaline. Some pedons have a Bk horizon, which is similar to the BC horizon in color, texture, and reaction.

Some pedons have a 2C horizon below a depth of 60 inches. This horizon generally has colors in shades of brown or red. It has hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 3 to 8. It ranges from fine sandy loam to clay loam. The number of calcium carbonate concretions and masses ranges from none to common. Reaction is slightly alkaline or moderately alkaline.

Faddin Series

The Faddin series consists of very deep, moderately well drained, very slowly permeable, loamy soils on uplands. These soils formed in clayey sediments. Slopes are mainly less than 1 percent.

Typical pedon of Faddin loam, 0 to 1 percent slopes; from the intersection of Texas Highways 60 and 35 in Bay City, 5.6 miles north on Texas Highway 60, about 0.5 mile east and 1.5 miles north on a county road, and 1,400 feet west in a pasture:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, dark brown (10YR 4/3) dry; moderate medium angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; slightly acid; clear smooth boundary.

A—7 to 14 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; slightly acid; abrupt wavy boundary.

Bt1—14 to 37 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; common fine prominent strong brown (7.5YR 4/6) mottles; weak coarse angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots and pores; many prominent clay films on faces of peds; few pressure faces; slightly acid; gradual wavy boundary.

Bt2—37 to 61 inches; grayish brown (10YR 5/2) clay, light brownish gray (10YR 6/2) dry; common fine prominent yellowish brown (10YR 5/8) mottles; moderate coarse angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots and pores; common faint clay films on faces of peds; few fine black concretions; slightly alkaline; gradual smooth boundary.

2Ck—61 to 80 inches; yellowish red (5YR 5/6) clay, reddish yellow (5YR 6/6) dry; few fine distinct light yellowish brown (10YR 6/4) mottles; massive; very hard, firm, sticky and plastic; common calcium carbonate concretions; strongly effervescent; moderately alkaline.

The solum is 60 to more than 80 inches thick. The mollic epipedon is 14 to 30 inches thick and includes the upper part of the argillic horizon in many pedons. By weighted average, the content of clay in the control section is 35 to 50 percent.

The A horizon is very dark grayish brown, very dark gray, very dark brown, or black. It is 12 to 20 inches thick. It has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Reaction is slightly acid or neutral.

The B horizon is dark gray, dark grayish brown, grayish brown, very dark grayish brown, light brownish gray, or gray. It has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 or 2. It has few or common mottles in shades of brown, red, or yellow. This horizon is clay, sandy clay, or clay loam 48 to 60 or more inches thick. Effervescence ranges from none to strong. Reaction ranges from slightly acid to moderately alkaline. Some pedons have a Btk horizon, which has few or common calcium carbonate films, threads, and concretions.

The C and 2C horizons are red, strong brown, yellowish red, brown, reddish brown, or pink. They have hue of 2.5YR to 10YR, value of 4 to 7, and chroma of 2 to 8. They have few or common mottles in shades of brown, gray, red, or yellow and few or common calcium carbonate films, threads, and concretions. Effervescence ranges from slight to violent. Reaction ranges from neutral to moderately alkaline. Some pedons do not have a C or 2C horizon.

Follet Series

The Follet series consists of very deep, very poorly drained, very slowly permeable soils that formed in saline coastal sediments. These saline soils are on broad tidal flats that are permanently saturated to the surface. Some areas are inundated daily by high tides. Slopes are less than 1 percent.

Typical pedon of Follet loam, frequently flooded; from the intersection of Texas Highway 35 and Farm Road 2853 north of Palacios, 4.3 miles northeast on Farm Road 2853, about 0.6 mile south on an unpaved road, and 0.61 mile east and 450 feet southeast on a tidal flat:

Ag—0 to 12 inches; very dark gray (10YR 3/1) loam, dark gray (N 4/0) dry; massive; very hard, firm, sticky and plastic; many fine and medium roots; strongly saline; moderately alkaline; abrupt wavy boundary.

Cg1—12 to 42 inches; dark gray (10YR 4/1) loam, gray (10YR 5/1) dry; massive; very hard, firm, nonsticky and nonplastic; few very fine roots; few or common lenses of sand and silt; strongly saline; moderately alkaline; gradual wavy boundary.

Cg2—42 to 54 inches; gray (10YR 5/1) clay loam, light gray (10YR 6/1) dry; massive; hard, friable, sticky and plastic; strongly saline; neutral; gradual wavy boundary.

Cg3—54 to 80 inches; dark gray (10YR 4/1) loam, gray (10YR 5/1) dry; massive; hard, friable, nonsticky and nonplastic; strongly saline; neutral.

Some pedons have a peaty or mucky layer as thick as 4 or more inches. These soils are neutral to moderately alkaline.

The Ag horizon is very dark gray, dark gray, or gray. It has hue of 10YR, value of 3 to 5, and chroma of less than 2. It has no mottles or has few or common mottles in shades of brown, red, or yellow.

The Cg horizon is dark gray, gray, light brownish gray, or light gray. It has hue of 10YR to 5Y, value of 4 to 7, and chroma of less than 2. It has no mottles or has few or common mottles in shades of brown, red, or yellow. This horizon is loam, clay loam, silty clay loam, or sandy clay loam that has sandy or clayey strata.

Fordtran Series

The Fordtran series consists of very deep, moderately well drained, very slowly permeable, sandy soils on uplands. These soils formed in sandy, loamy, and clayey sediments. Slopes range from 0 to 2 percent.

Typical pedon of Fordtran loamy fine sand, 0 to 2 percent slopes; from the intersection of Texas Highway 71 and Farm Road 111 about 15 miles west of Bay City in Midfield, 3.2 miles west on Farm Road 111, about 1.5 miles north on an unpaved county road, 0.2 mile east on a private road, and 150 feet north in a pasture:

A—0 to 21 inches; dark grayish brown (10YR 4/2) loamy fine sand, pale brown (10YR 6/3) dry; weak fine granular structure; slightly hard, very friable, nonsticky; common fine roots; slightly acid; clear smooth boundary.

E—21 to 29 inches; light yellowish brown (10YR 6/4) loamy fine sand, very pale brown (10YR 7/3) dry; very weak fine granular structure; soft, loose, nonsticky; few fine and medium roots; slightly acid; abrupt wavy boundary.

Bt1—29 to 58 inches; light brownish gray (10YR 6/2) clay, light gray (10YR 7/2) dry; common coarse prominent brownish yellow (10YR 6/8) and many coarse prominent red (2.5YR 4/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very hard, very firm, very sticky and plastic; many prominent clay films on faces of peds; few fine roots; few fine black concretions; slightly acid; gradual wavy boundary.

Bt2—58 to 72 inches; light brownish gray (10YR 6/2) sandy clay loam, light gray (10YR 7/2) dry; many coarse prominent red (2.5YR 5/6) and few coarse prominent reddish yellow (5YR 6/6) mottles; moderate medium angular blocky structure; hard, firm, sticky and plastic; few distinct clay films on faces of peds; few fine roots; few fine black concretions; slightly alkaline; clear wavy boundary.

BCt—72 to 80 inches; pink (7.5YR 7/4) fine sandy loam, pink (7.5YR 8/4) dry; few fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky; few faint clay films on faces of peds; moderately alkaline.

The solum is more than 60 inches thick. The sandy surface horizons are 20 to 40 inches thick. The content of clay in the particle-size control section ranges from 35 to 50 percent.

The A horizon is dark grayish brown, dark brown, or brown and is 12 to 22 inches thick. It has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Reaction is moderately acid or slightly acid.

The E horizon is pale brown, light yellowish brown, very pale brown, or light brownish gray and is 8 to 24 inches thick. It has hue of 10YR, value of 6 or 7, and chroma of 2 to 4. Reaction is moderately acid or slightly acid.

The Btg horizon is light brownish gray, gray, or grayish brown. It has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It has few to many mottles in shades of red, brown, or yellow. This horizon is clay or sandy clay in the upper part and clay loam or sandy clay loam in the lower part. It is 30 to more than 50 inches thick. Reaction is moderately acid or slightly acid in the upper part of the horizon and slightly acid to slightly alkaline in the lower part.

The BCt horizon is pink or has a mottled matrix in shades of red, brown, yellow, or gray. It has hue of 5YR to 2.5Y, value of 4 to 7, and chroma of 2 to 8. It is sandy clay loam, clay loam, or fine sandy loam. Reaction ranges from neutral to moderately alkaline. Some pedons have calcium carbonate films, threads, and concretions.

Francitas Series

The Francitas series consists of very deep, poorly drained, very slowly permeable, saline, clayey soils on nearly level coastal uplands. These soils formed in alkaline, clayey marine sediments. Slopes generally are less than 1 percent.

Typical pedon of Francitas clay, 0 to 1 percent slopes; from the intersection of Texas Highway 35 and Jensen Point Road about 2 miles west of Palacios, 1.6 miles south on Jensen Point Road and 100 feet west in a hay meadow:

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay, gray (10YR 5/1) dry; moderate medium subangular blocky structure; very hard, firm, very sticky and plastic; common fine and few medium roots and pores; slightly saline; moderately alkaline; clear smooth boundary.

Bss1—6 to 20 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate medium angular blocky structure; very hard, very firm, very sticky and plastic; common very fine and few fine roots; common pressure faces; common coarse slickensides in the lower part; moderately saline; moderately alkaline; clear smooth boundary.

Bss2—20 to 26 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; strong medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine and fine roots; common pressure faces; common coarse slickensides; moderately saline; moderately alkaline; gradual smooth boundary.

Bss3—26 to 37 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; strong medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine and fine roots; many pressure faces; common coarse slickensides; moderately saline; moderately alkaline; gradual wavy boundary.

Bgss1—37 to 45 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; moderate medium angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; many pressure faces; common coarse slickensides; strongly saline; moderately alkaline; clear smooth boundary.

Bgss2—45 to 55 inches; grayish brown (10YR 5/2) clay, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; few fine roots; many pressure faces; common coarse slickensides; 1 to 2 percent calcium carbonate concretions; few fine black concretions; strongly effervescent; strongly saline; moderately alkaline; clear smooth boundary.

BC—55 to 62 inches; light yellowish brown (10YR 6/4) clay, very pale brown (10YR 7/4) dry; massive; very hard, very firm, very sticky and plastic; 2 to 3 percent calcium carbonate concretions; few black stains on faces of peds; strongly effervescent; strongly saline; moderately alkaline; clear smooth boundary.

2C—62 to 80 inches; yellowish red (5YR 4/6) silty clay loam, yellowish red (5YR 5/6) dry; massive; hard, firm, sticky and plastic; 5 to 10 percent calcium carbonate concretions; few black stains on faces of peds; violently effervescent; strongly saline; moderately alkaline.

The solum is 60 to more than 80 inches thick. The average content of clay in the 10- to 40-inch control section ranges from 45 to 60 percent. Slickensides begin at a depth of about 10 to 30 inches. Salinity increases with increasing depth, and the exchangeable sodium percentage exceeds 15 percent in some part of the control section.

The A horizon is black or very dark gray. It has hue of 10YR, value of 2 or 3, and chroma of 1 or less. Reaction is slightly alkaline or moderately alkaline.

The Bss horizon is black, very dark gray, or dark gray. It has hue of 10YR, value of 2 to 4, and chroma of 1. It has no mottles or has few mottles in shades of brown or yellow. This horizon is clay or silty clay. Reaction is slightly alkaline or moderately alkaline. Effervescence ranges from none to strong.

The Bgss horizon is dark gray, gray, grayish brown, or light gray. It has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It has no mottles or has few or common mottles in shades of brown or yellow. This horizon is clay or silty clay. Reaction is moderately alkaline.

The BC horizon is gray, light gray, grayish brown, pale brown, light brownish gray, or light yellowish brown. It has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 4. Reaction is similar to that in the Bgss horizon. The BC horizon is mainly clay or silty clay but ranges to clay loam or silty clay loam. The number of calcium carbonate concretions and masses and black concretions ranges from none to common. Some pedons have a C horizon, which is similar to the BC horizon in color, texture, and reaction.

The 2C horizon is strong brown, yellowish red, reddish yellow, or red. It has hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 4 to 8. It is clay, silty clay, silty clay loam, or clay loam. This horizon has few or common calcium carbonate concretions and masses and black concretions. Reaction is slightly alkaline or moderately alkaline. Effervescence is strong or violent. Some pedons do not have a 2C horizon.

Fulshear Series

The Fulshear series consists of very deep, well drained, slowly permeable, loamy soils on upland terraces. These soils formed in alkaline, loamy sediments on ancient terraces parallel to streams. Slopes range from 1 to 8 percent. They are mainly 3 to 5 percent.

Typical pedon of Fulshear fine sandy loam, 2 to 5 percent slopes; from the intersection of Texas Highway 35 and Farm Road 1095 about 12 miles west of Bay City in Elmaton, 3.8 miles south on Farm Road 1095, about 0.6 mile east on a unpaved road, and 200 feet south in a wooded area:

A—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; slightly hard, friable; many fine and medium roots; slightly acid; clear smooth boundary.

Bt1—8 to 12 inches; dark brown (7.5YR 4/4) sandy clay loam, brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few distinct clay films on faces of peds; many fine roots; moderately acid; clear smooth boundary.

Bt2—12 to 20 inches; strong brown (7.5YR 4/6) sandy clay loam, strong brown (7.5YR 5/6) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common distinct clay films on faces of peds; common fine roots and pores; moderately acid; clear wavy boundary.

Bt3—20 to 31 inches; yellowish red (5YR 4/6) sandy clay loam, yellowish red (5YR 5/6) dry; weak medium subangular blocky structure; hard, friable, sticky and plastic; few faint clay films on faces of peds; few fine roots and pores; neutral; gradual smooth boundary.

BCk1—31 to 46 inches; yellowish red (5YR 5/6) fine sandy loam, reddish yellow (5YR 6/6) dry; weak medium subangular blocky structure; slightly hard, very friable; 2 to 5 percent masses and concretions of calcium carbonate; strongly effervescent; slightly alkaline; gradual smooth boundary.

BCk2—46 to 60 inches; reddish yellow (5YR 6/8) sandy clay loam, reddish yellow (5YR 7/8) dry; weak medium subangular blocky structure; slightly hard, very friable; thin strata of loam; 3 to 5 percent masses and concretions of calcium carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—60 to 80 inches; reddish yellow (5YR 6/6) fine sandy loam, reddish yellow (5YR 7/6) dry; single grain; slightly hard, very friable; few masses of calcium carbonate; strongly effervescent; moderately alkaline.

The solum is 60 to 80 or more inches thick. The depth to masses and concretions of calcium carbonate ranges from 28 to 40 inches.

The A horizon is brown, dark brown, dark grayish brown, or dark yellowish brown. It has hue of 10YR or 7.5YR, value of 4 or 5, and chroma or 2 to 4. Reaction ranges from moderately acid to neutral.

The B horizon is reddish brown, brown, yellowish red, dark brown, or strong brown. It has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 8. It has no mottles or has few or common mottles in shades of brown, red, or yellow. This horizon is clay loam, clay, sandy clay loam, or sandy clay. Reaction ranges from moderately acid to moderately alkaline. The number of calcium carbonate masses and concretions ranges from none to many.

The BC and C horizons are yellowish red, reddish yellow, or red. They have hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 6 to 8. They are sandy clay loam, fine sandy loam, or clay loam. Reaction is slightly alkaline or moderately alkaline. These horizons have few or common masses and concretions of calcium carbonate.

Galveston Series

The Galveston series consists of very deep, somewhat excessively drained, very rapidly permeable, sandy soils on coastal dunes along the Matagorda Peninsula. These soils formed in recent sandy coastal deposits that have been reworked by the wind. Slopes range from 1 to 8 percent.

Typical pedon of Galveston fine sand, undulating; from the intersection of Texas Highway 60 and Farm Road 2031 in Matagorda, 6.5 miles south on Farm Road 2031, about 0.2 mile east on a beach road, and 200 feet north in an area of beach dunes:

A—0 to 6 inches; grayish brown (10YR 5/2) fine sand, light gray (10YR 7/2) dry; very weak fine subangular blocky structure; loose, soft; many fine and common medium roots; slightly alkaline; gradual wavy boundary.

C1—6 to 62 inches; pale brown (10YR 6/3) fine sand, very pale brown (10YR 8/3) dry; single grain; loose, soft; common fine and few medium roots in the upper part; slightly alkaline; gradual wavy boundary.

C2—62 to 80 inches; pale brown (10YR 6/3) fine sand, very pale brown (10YR 8/3) dry; single grain; loose, soft; 2 to 5 percent small sea shells and shell fragments; slightly alkaline.

The depth to loamy strata is more than 72 inches. The 10- to 40-inch control section is fine sand or sand. The content of silt and clay is less than 10 percent. Reaction is moderately acid to moderately alkaline.

The A horizon is grayish brown, light brownish gray, pale brown, very pale brown, light gray, or white and is 3 to 6 inches thick. It has hue of 10YR or 2.5Y, value of 5 to 8, and chroma of 1 to 3.

The C horizon is light gray, pale brown, very pale brown, light brownish gray, or white. It has hue of 10YR, value of 6 to 8, and chroma of 1 to 3. In some pedons few to many brownish mottles are below a depth of 30 inches. This horizon is fine sand or sand. Few or common marine shells and shell fragments are below a depth of 40 inches.

Harris Series

The Harris series consists of very deep, very poorly drained, very slowly permeable, saline, clayey soils in coastal marshes. These soils formed in recent clayey marine deposits. Slopes are mainly less than 0.5 percent.

Typical pedon of Harris clay, frequently flooded; from the intersection of Texas Highway 60 and Gulf Hill Road about 4 miles north of Matagorda, 3.0 miles east on Gulf Hill Road, 0.1 mile north to a ranch gate, 1.4 miles east and 0.8 mile south to a large marshy flat, and 200 feet east in an area barren of vegetation:

Ag1—0 to 6 inches; black (10YR 2/1) clay, dark gray (10Y 4/1) dry; moderate medium and coarse subangular blocky structure; very hard, very firm, very sticky and plastic; few fine and medium calcium carbonate concretions; moderately saline; moderately alkaline; gradual wavy boundary.

Ag2—6 to 16 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; few fine faint yellowish brown mottles; strong coarse subangular and angular blocky structure; extremely hard, very firm, very sticky and very plastic; moderately saline; moderately alkaline; gradual wavy boundary.

Ag3—16 to 24 inches; black (10YR 2/1) clay, dark gray (10YR 4/1) dry; few fine faint yellowish brown (10YR 5/6) mottles; strong coarse and very coarse subangular and angular blocky structure; extremely hard, very firm, very sticky and very plastic; moderately saline; moderately alkaline; gradual wavy boundary.

Bg—24 to 48 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine distinct yellowish brown (10YR 5/4, 5/6) mottles; moderate medium and coarse subangular and angular blocky structure; very hard, very firm, very sticky and very plastic; few fine calcium carbonate concretions; a water table at a depth of 40 inches; moderately saline; strongly effervescent; moderately alkaline; clear wavy boundary.

BCg—48 to 59 inches; gray (10YR 5/1) clay, light gray (10YR 6/1) dry; few fine faint yellowish brown mottles; moderate medium coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine calcium carbonate concretions; moderately saline; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cg—59 to 80 inches; light gray (10YR 6/1) clay, light gray (10YR 7/1) dry; few fine faint yellowish brown mottles; massive; very hard, very firm, very sticky and plastic; few fine calcium carbonate concretions; moderately saline; strongly effervescent; moderately alkaline.

The solum is 40 to 60 inches thick. The 10- to 40-inch control section averages between 40 and 60 percent clay. Salinity ranges from slight to strong. Reaction is slightly alkaline to strongly alkaline. Sodium saturation is constant or increases with increasing depth in the control section.

The Ag horizon is black or very dark gray. It has hue of 10YR to 5Y, value of 2 or 3, and chroma of 1 or less. It has no mottles or has few or common mottles in shades of brown, gray, or yellow. Some pedons have a thin layer of overwashed loamy sediments, whereas others have thin organic layers at the surface. These layers generally are less than 4 inches thick.

The Bg horizon is dark gray, gray, or light gray. It has hue of 10YR to 5Y, value of 4 to 7, and chroma of 1 or less. This horizon has few or common mottles in shades of brown, gray, or yellow. It is clay or silty clay.

The BCg and Cg horizons have colors similar to those of the Bg horizon or have matrix colors that are mottled in shades of gray, brown, or yellow. The BCg and Cg horizons are clay or silty clay.

Ijam Series

The Ijam series consists of very deep, poorly drained, very slowly permeable, saline, clayey and loamy soils that formed in dredge material along the Intracoastal Waterway. These soils are on elongated mounds. Slopes range from 1 to 3 percent.

Typical pedon of Ijam clay, 1 to 3 percent slopes; from the intersection of Texas Highway 60 and Farm Road 521 about 10 miles south of Bay City in Wadsworth, 3 miles east on Farm Road 521, about 10 miles south-southeast on an unpaved county road to Chinquapin from a point where Live Oak Bayou flows into the Intracoastal Waterway, and 500 feet west and 50 feet north in a pasture:

A—0 to 6 inches; grayish brown (2.5Y 5/2) clay, light brownish gray (2.5Y 6/2) dry; massive; very hard, firm, sticky and plastic; common fine roots and pores; few fine calcium carbonate concretions; common fine and medium crushed oyster shells; violently effervescent; moderately saline; moderately alkaline; clear smooth boundary.

Cg1—6 to 17 inches; dark grayish brown (2.5Y 4/2) clay, grayish brown (2.5Y 5/2) dry; few medium prominent reddish yellow (7.5YR 6/8) mottles; massive; very hard, very firm, very sticky and plastic; few pressure faces; few fine roots; common fine and medium calcium carbonate concretions; few fine crushed oyster shells; violently effervescent; moderately saline; moderately alkaline; clear smooth boundary.

Cg2—17 to 25 inches; grayish brown (2.5Y 5/2) clay, light brownish gray (2.5Y 6/2) dry; few fine and medium prominent olive yellow (2.5Y 6/6) and brownish yellow (10YR 6/8) mottles; massive; very hard, very firm, very sticky and plastic; few fine calcium carbonate concretions; few fine black concretions; common very fine and fine crushed oyster shells; violently effervescent; moderately saline; moderately alkaline; clear smooth boundary.

Cg3—25 to 37 inches; olive gray (5Y 5/2) clay, light olive gray (5Y 6/2) dry; intermingled dark grayish brown (10YR 4/2) clods; common fine and medium prominent yellowish brown (10YR 5/4) mottles; massive; very hard, very firm, very sticky and plastic; few fine calcium carbonate concretions; few fine crushed oyster shells; violently effervescent; moderately saline; moderately alkaline; clear smooth boundary.

Cg4—37 to 63 inches; dark grayish brown (2.5Y 4/2) clay, grayish brown (2.5Y 5/2) dry; common medium prominent reddish yellow (5YR 6/8) and strong brown (7.5YR 5/8) mottles; massive; hard, firm, sticky and plastic; common very fine crushed oyster shells; violently effervescent; moderately saline; moderately alkaline; gradual smooth boundary.

2C1—63 to 69 inches; dark brown (10YR 4/3) sandy clay loam, brown (10YR 5/3) dry; thin strata of yellowish brown (10YR 5/4) loam; massive; hard, friable, slightly sticky; few shells and shell fragments; strongly effervescent; moderately alkaline; clear smooth boundary.

2C2—69 to 80 inches; yellowish red (5YR 4/6) sandy clay, yellowish red (5YR 5/6) dry; thin strata of dark brown (7.5YR 4/2) and brown (7.5YR 5/4) clay loam; massive; very hard, firm, sticky and plastic; strongly effervescent; moderately alkaline.

These soils are slightly alkaline to strongly alkaline throughout. Salinity ranges from slight to strong.

The A horizon is dark grayish brown, grayish brown, dark gray, or gray. It has hue of 10YR to 2.5Y, value of 4 or 5, and chroma of 1 or 2. This horizon has no mottles or has few or common mottles in shades of brown, gray, red, or yellow. The number of shells and shell fragments ranges from none to many.

The Cg horizon is dark grayish brown, grayish brown, dark gray, gray, light brownish gray, or light gray. It has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It has few to many mottles in shades of brown, gray, red, or yellow. This horizon has 5 to 25 percent shells and shell fragments. It is clay or sandy clay.

The 2C horizon is reddish brown, yellowish red, brown, dark brown, or reddish yellow. It has hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 3 to 8. It has no mottles or has few to many mottles in shades of brown, gray, red, or yellow. This horizon is clay, sandy clay, silty clay, silty clay loam, clay loam, or sandy clay loam. Some pedons do not have a 2C horizon.

The Ijam soils in this county are considered a taxajunct to the Ijam series because they are calcareous throughout. This difference does not affect the use and management of the soils.

Katy Series

The Katy series consists of very deep, moderately well drained, moderately slowly permeable, loamy soils on uplands. These soils formed in loamy sediments of the Beaumont and Lissie Formations. The soils are on small, weakly undulating mounds and are associated with other loamy soils and with sandy soils in the county. Slopes range from 0 to 2 percent.

Typical pedon of Katy fine sandy loam, 0 to 2 percent slopes; from the intersection of Texas Highway 60 and Farm Road 521 about 10 miles south of Bay City in Wadsworth, 0.45 mile north on Texas Highway 60, about 0.72 mile west on an unpaved shell road, and 700 feet north in a cultivated field:

A—0 to 17 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots; slightly acid; clear smooth boundary.

E—17 to 22 inches; pale brown (10YR 6/3) fine sandy loam, very pale brown (10YR 7/3) dry; few fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine roots; slightly acid; abrupt wavy boundary.

Bt1—22 to 29 inches; brownish yellow (10YR 6/6) clay loam, yellow (10YR 7/6) dry; common fine and medium prominent yellowish red (5YR 5/8) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common distinct clay films on faces of peds; slightly acid; gradual wavy boundary.

Bt2—29 to 44 inches; reddish yellow (7.5YR 6/8) sandy clay loam, reddish yellow (7.5YR 7/8) dry; common fine and medium light brown (7.5YR 6/4) mottles; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few distinct clay films on faces of peds; slightly acid; clear smooth boundary.

Bt3—44 to 62 inches; reddish yellow (7.5YR 7/6) sandy clay loam, pink (5YR 8/4) dry; few medium prominent yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; few faint clay films on faces of peds; slightly acid; gradual wavy boundary.

BC—62 to 80 inches; yellowish red (5YR 5/8) sandy clay loam, reddish yellow (5YR 7/8) dry; moderate medium subangular blocky structure; few coatings of sand grains on faces of peds; few very fine black concretions; neutral.

The solum is more than 60 inches thick. The content of clay in the 10- to 40-inch control section ranges from 25 to 35 percent.

The A horizon is brown, dark brown, dark grayish brown, or grayish brown. It has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It has no mottles or has few or common mottles in shades of brown, gray, red, or yellow. Reaction is slightly acid or moderately acid.

The E horizon is brown, light yellowish brown, pale brown, very pale brown, or yellowish brown. It has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It has mottles and reaction similar to those in the A horizon. The E horizon is fine sandy loam, sandy loam, or very fine sandy loam.

The Bt and BC horizons are brownish yellow, yellowish brown, reddish brown, reddish yellow, or yellowish red. They have hue of 10YR to 2.5YR, value of 4 to 6, and chroma of 4 to 8. They have few to many mottles in shades of brown, gray, red, or yellow. Reaction ranges from slightly acid to slightly alkaline. These horizons are clay loam or sandy clay loam.

Laewest Series

The Laewest series consists of very deep, moderately well drained, very slowly permeable, clayey soils on uplands. These soils formed in calcareous, clayey marine sediments. Slopes range from 0 to 8 percent.

Typical pedon of Laewest clay, 0 to 1 percent slopes; from the intersection of Texas Highway 35 and Farm Road 1468 near Markham, 7.5 miles south on Farm Road 1468, about 0.25 mile west, 3.1 miles south, and 0.85 mile west on a county road, and 100 feet northwest in a pasture:

Ap—0 to 10 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; common medium and fine roots; slightly acid; clear smooth boundary.

A—10 to 18 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; strong medium subangular blocky structure; very hard, very firm, very sticky and plastic; common pressure faces; few fine roots and pores; neutral; gradual smooth boundary.

Bss1—18 to 38 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; strong medium subangular blocky structure; very hard, very firm, very sticky and plastic; many pressure faces; common slickensides; neutral; gradual smooth boundary.

Bss2—38 to 47 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; many pressure faces; common slickensides; neutral; gradual smooth boundary.

Bss3—47 to 68 inches; very dark gray (10YR 3/1) clay, gray (10YR 5/1) dry; common fine and medium prominent reddish brown (5YR 4/4) mottles; weak medium angular blocky structure; very hard, very firm, very sticky and plastic; many pressure faces; common slickensides; 1 to 2 percent calcium carbonate concretions; slightly effervescent; slightly alkaline; clear smooth boundary.

2C—68 to 80 inches; reddish brown (5YR 4/4) clay, light reddish brown (5YR 6/4) dry; massive; very hard, very firm, very sticky and plastic; 1 percent calcium carbonate concretions; strongly effervescent; moderately alkaline.

The solum is 60 to more than 80 inches thick. The content of clay in the 10- to 40-inch control section ranges from 45 to 60 percent and averages more than 50 percent. When the soils are dry, cracks 1 to 3 inches wide extend from the surface into the Bss horizon, but the cracks remain open less than 90 cumulative days in most years. Slickensides and pressure surfaces begin at a depth of about 12 to 24 inches. Undisturbed areas have gilgai microrelief with microknolls 6 to 15 inches higher than microdepressions. The distance from the center of the microknolls to the center of the microdepressions is 4 to 16 feet. Eroded areas are moderately alkaline to the surface.

The A horizon is black or very dark gray. It has hue of 10YR, value of 2 or 3, and chroma of 1 or less. It is clay or silty clay. Reaction ranges from slightly acid to slightly alkaline.

The Bss horizon is very dark gray, dark gray, or black. It has hue of 10YR, value of 2 or 3, and chroma of 1 or less. It has no mottles or has few mottles in shades of brown. This horizon is clay or silty clay. Reaction is slightly acid to slightly alkaline.

Some pedons have a BCkss horizon. This horizon is dark gray, gray, grayish brown, light brownish gray, or light gray. It has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 or 2. The horizon has few or common mottles in shades of brown. It is clay or silty clay. It has few or common calcium carbonate concretions and masses. The number of black concretions ranges from none to common. Reaction is slightly alkaline or moderately alkaline.

The 2C horizon is yellowish red, reddish yellow, red, reddish brown, or strong brown. It has hue of 7.5YR to 2.5YR, value of 4 to 6, and chroma of 4 to 8. In some pedons it has mottles in shades of gray. This horizon is clay, silty clay, clay loam, loam, or silty clay loam. The faces of some peds have black stains. The horizon has few or common calcium carbonate concretions and black concretions. Effervescence ranges from very slight to violent. Reaction is slightly alkaline or moderately alkaline. Some pedons do not have a 2C horizon.

Livco Series

The Livco series consists of very deep, moderately well drained, very slowly permeable, loamy soils on ancient stream meander-belt ridges. These soils formed in loamy sediments. Slopes are 0 to 1 percent.

Typical pedon of Livco fine sandy loam, in an area of Livco-Dacosta complex, 0 to 1 percent slopes; about 3 miles west on Farm Road 616 from Blessing, 1 mile north on Farm Road 458, and 300 feet northwest in a pasture:

A—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; hard, firm; common fine roots; slightly alkaline; abrupt wavy boundary.

Btn1—7 to 16 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; few fine distinct dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm; few fine roots; few faint clay films on faces of peds; slightly saline; moderately alkaline; clear wavy boundary.

Btn2—16 to 35 inches; grayish brown (2.5Y 5/2) clay, light brownish gray (2.5Y 6/2) dry; common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, very firm; few fine roots; few faint clay films on faces of peds; slightly saline; moderately alkaline; gradual wavy boundary.

Btnk—35 to 52 inches; light brownish gray (2.5Y 6/2) clay loam, light gray (2.5Y 7/2) dry; common medium prominent reddish yellow (7.5YR 6/8) mottles; moderate medium subangular blocky structure; very hard, very firm; few faint clay films on faces of peds; few fine concretions and masses of calcium carbonate; slightly saline; moderately alkaline; gradual wavy boundary.

BCnk—52 to 72 inches; grayish brown (10YR 5/2) sandy clay loam, light brownish gray (10YR 6/2) dry; common medium prominent yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure; hard, firm; common medium concretions and masses of calcium carbonate; slightly saline; moderately alkaline; abrupt smooth boundary.

2C—72 to 80 inches; strong brown (7.5YR 4/6) silty clay loam, reddish yellow (7.5YR 6/6) dry; few fine prominent grayish brown (10YR 5/2) mottles; massive; very hard, very firm; few fine concretions and masses of calcium carbonate; moderately alkaline.

Salinity ranges from less than 2 mmhos/cm in the A horizon to more than 16 mmhos/cm in the lower part of the Bt horizon. SAR of the Bt horizon ranges from 13 to 40. The depth to secondary carbonates ranges from 20 to 50 inches. Some pedons have a few black concretions.

The A horizon is dark grayish brown, grayish brown, dark gray, or gray. It has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. In some pedons it has a few mottles in shades of brown or yellow. This horizon is fine sandy loam or very fine sandy loam. Reaction is neutral or slightly alkaline.

The Btn, Btnk, BCn, and BCnk horizons are dark grayish brown, very dark grayish brown, grayish brown, light brownish gray, very dark gray, dark gray, or gray. They have hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 or 2. They are clay loam, sandy clay loam, or clay. The content of calcium carbonate concretions and masses ranges from 0 to more than 5 percent. Reaction is slightly alkaline or moderately alkaline.

The 2C horizon has colors in shades of red, brown, or gray. It is very fine sandy loam, silt loam, or silty clay loam. Reaction is slightly alkaline or moderately alkaline. Some pedons do not have a 2C horizon.

Livia Series

The Livia series consists of very deep, poorly drained, very slowly permeable, moderately sodic, loamy soils on coastal uplands. These soils formed in saline, calcareous, clayey sediments. Slopes are 0 to 1 percent.

Typical pedon of Livia loam, 0 to 1 percent slopes; from Collegeport, about 25.0 miles southwest of Bay City, 2.0 miles south and 4.0 miles east on a county road to Mad Island Ranch headquarters, 1.2 miles southeast on a ranch road to a fence corner on the west side of the road, 100 feet south and 100 feet east from the center of the road, in an area of rangeland:

A—0 to 6 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; hard, friable, slightly sticky; common fine roots; slightly saline; slightly alkaline; abrupt wavy boundary.

Btng1—6 to 21 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium and coarse columnar structure parting to strong medium angular blocky; extremely hard, very firm, very sticky and plastic; few fine roots; few faint clay films on faces of peds; slightly saline; moderately alkaline; clear wavy boundary.

Btng2—21 to 33 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; few fine faint brown mottles; moderate medium and coarse prismatic structure parting to strong medium angular blocky; extremely hard, very firm, very sticky and plastic; few faint clay films on faces of peds; moderately saline; moderately alkaline; clear wavy boundary.

Btng3—33 to 47 inches; grayish brown (10YR 5/2) silty clay, light brownish gray (10YR 6/2) dry; common fine and medium distinct brownish yellow (10YR 6/6) mottles; strong medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few faint clay films on faces of peds; few fine black concretions; moderately saline; moderately alkaline; gradual wavy boundary.

Bnzg—47 to 61 inches; light brownish gray (2.5Y 6/2) silty clay, light gray (2.5Y 7/2) dry; common medium distinct olive yellow (2.5Y 6/6) mottles; moderate medium angular blocky structure; very hard, very firm, very sticky and plastic; few fine and medium calcium carbonate concretions; few fine black concretions; slightly saline; moderately alkaline; gradual wavy boundary.

Bnz—61 to 80 inches; pale olive (5Y 6/4) silty clay, pale yellow (5Y 7/4) dry; few fine distinct light brownish gray (2.5Y 6/2) mottles; massive; very hard, very firm, very sticky and plastic; 1 to 2 percent calcium carbonate concretions; few fine and medium black concretions; violently effervescent; slightly saline; moderately alkaline.

The solum is 60 to more than 80 inches thick. Salinity is less than 4 mmhos/cm in the A horizon, 2 to 8 mmhos/cm in the upper part the B horizon, and 4 to 16 mmhos/cm in the lower part of the B horizon. The exchangeable sodium percentage ranges from 15 to 35 percent to a depth of 16 inches.

The A horizon is dark grayish brown or grayish brown. It has hue of 10YR, value of 4 or 5, and chroma of 2 or less. It has no mottles or has few mottles in shades of brown or red. This horizon is hard and massive when dry. Reaction is neutral or slightly alkaline.

The Bt horizon is very dark grayish brown, very dark gray, dark grayish brown, dark gray, grayish brown, or gray. It has hue of 10YR, value of 2 to 5, and chroma of 2 or less. This horizon has few or common mottles in shades of brown or yellow. It is clay, silty clay, or clay loam. The content of calcium carbonate concretions ranges from 0 to about 5 percent. Reaction is slightly alkaline or moderately alkaline.

The Bn horizon is light brownish gray, pale brown, light yellowish brown, yellowish brown, pale olive, olive, or olive gray. It has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 2 to 6. This horizon has few to many mottles in shades of brown, gray, red, or yellow. It is silty clay, silty clay loam, or clay loam. It has few or common calcium carbonate concretions. Reaction is slightly alkaline or moderately alkaline.

Some pedons have a BC or C horizon. These horizons have colors in shades of brown, yellow, or red. They have few to many mottles in these colors and in shades of gray. The horizons are clay, silty clay, clay loam, or loam. They have few or common calcium carbonate concretions. Reaction is moderately alkaline.

Some pedons have a 2C horizon below a depth of 60 inches. This horizon has colors in shades of red, brown, or gray. It is very fine sandy loam, silt loam, or silty clay loam. Reaction is slightly alkaline or moderately alkaline.

Mustang Series

The Mustang series consists of very deep, poorly drained, rapidly permeable, sandy soils in depressions on the Matagorda Peninsula. These soils are saturated with water much of the year. Slopes are mainly less than 1 percent.

Typical pedon of Mustang fine sand, 0 to 1 percent slopes; from the Intracoastal Waterway bridge at Matagorda, 5.8 miles south on Farm Road 2031 and 200 feet west of a paved road in a marshy area on the east side of the Colorado River:

Ag—0 to 10 inches; light brownish gray (2.5Y 6/2) fine sand, light gray (2.5Y 7/2) dry; common fine distinct yellowish brown (10YR 5/4) mottles; single grain; loose, very friable; slightly saline; moderately alkaline; clear smooth boundary.

Cg1—10 to 35 inches; light gray (2.5Y 7/2) fine sand, light gray (2.5Y 7/2) dry; common fine faint brown mottles; single grain; loose, very friable; slightly saline; moderately alkaline; clear smooth boundary.

Cg2—35 to 50 inches; light olive gray (5Y 6/2) fine sand, light gray (5Y 7/2) dry; thin strata of olive gray (5Y 4/2) fine sand; single grain; loose, very friable; slightly saline; moderately alkaline; clear smooth boundary.

Cg3—50 to 80 inches; bluish gray (5B 5/1) fine sand, bluish gray (5B 6/1) dry; thin strata of dark bluish gray (5B 4/1) fine sand; single grain; loose, very friable; slightly saline; moderately alkaline.

The depth to loamy strata or layers of marine shells is 60 to 80 inches or more. The 10- to 40-inch control section is fine sand and has less than 10 percent silt plus clay. Coarse fragments of marine shells make up less than 15 percent of the control section. Reaction ranges from neutral to moderately alkaline. The soils are nonsaline or slightly saline.

The A horizon is light gray, gray, dark gray, light brownish gray, grayish brown, or dark grayish brown. It has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 or 2.

The Cg horizon is bluish gray, gray, light gray, light olive gray, light brownish gray, or grayish brown. It has hue of 10YR, 2.5Y, 5Y, or 5B, value of 5 to 7, and chroma of 1 or 2, or it is neutral in hue and has value of 5 to 7. It has few or common mottles in shades of brown or yellow. This horizon is fine sand or sand. Reaction is similar to that of the A horizon.

Norwood Series

The Norwood series consists of very deep, well drained, moderately permeable soils on flood plains. These soils formed in calcareous, reddish alluvium. Slopes generally are less than 1 percent.

Typical pedon of Norwood silty clay loam, rarely flooded; from the intersection of Texas Highway 60 and

Farm Road 521 about 10 miles south of Bay City in Wadsworth, 3.5 miles west on Farm Road 521, about 1.2 miles north-northwest on a ranch road, and 400 feet northwest in a pasture:

A—0 to 4 inches; dark brown (7.5YR 3/2) silty clay loam, dark brown (7.5YR 4/2) dry; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; violently effervescent; moderately alkaline; clear smooth boundary.

Bw—4 to 34 inches; strong brown (7.5YR 4/6) silt loam, reddish yellow (7.5YR 6/6) dry; weak fine and medium subangular blocky structure; thin strata of silty clay loam; slightly hard, friable, slightly sticky; common fine roots and pores; violently effervescent; moderately alkaline; clear smooth boundary.

C1—34 to 57 inches; dark brown (7.5YR 3/2) silty clay loam, dark brown (7.5YR 4/2) dry; massive; very hard, very firm, very sticky and very plastic; few fine roots; violently effervescent; moderately alkaline; abrupt smooth boundary.

C2—57 to 72 inches; dark brown (7.5YR 4/2) silty clay loam, brown (7.5YR 5/2) dry; massive; thin strata of yellowish red (5YR 4/6) silt loam; hard, firm, sticky and plastic; violently effervescent; moderately alkaline; clear smooth boundary.

C3—72 to 80 inches; dark reddish brown (5YR 3/3) silty clay, reddish brown (5YR 4/3) dry; massive; thin strata of silt loam and silty clay loam; very hard, very firm, very sticky and very plastic; violently effervescent; moderately alkaline.

The depth to bedding planes ranges from 4 to 36 inches. All layers are calcareous and are slightly alkaline or moderately alkaline.

The A horizon is dark reddish brown, dark brown, brown, or reddish brown. It has hue of 5YR or 7YR, value of 3 to 5, and chroma of 3 or 4. Where moist values are less than 3.5, the horizon is less than 6 inches thick.

The Bw horizon is reddish brown, light reddish brown, strong brown, yellowish red, or reddish yellow. It has hue of 5YR or 7.5YR, value of 4 to 7, and chroma of 3 to 6. It is silt loam or silty clay loam. Some pedons do not have a Bw horizon.

The C horizon is dark brown, brown, reddish brown, yellowish red, light reddish brown, or reddish yellow. It has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6. It is silty clay loam or silt loam that has strata of silty clay. This horizon has few or no masses and concretions of calcium carbonate.

Palacios Series

The Palacios series consists of very deep, poorly drained, very slowly permeable, saline, loamy soils on coastal uplands. These soils formed in calcareous, saline, clayey sediments. Slopes are mainly less than 1 percent.

Typical pedon of Palacios loam, 0 to 1 percent slopes; from the north city limits of Palacios, 3.0 miles north on Texas Highway 35, about 2.5 miles west on Slone Road, 0.22 mile south, and 250 feet east in a pasture:

A—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; massive; hard, firm, slightly sticky and slightly plastic; many fine roots and pores; neutral; clear wavy boundary.

Btn1—5 to 13 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; weak coarse columnar structure parting to moderate medium angular blocky; very hard, firm, sticky and plastic; many fine roots and pores; few faint clay films on faces of peds; slightly saline; slightly alkaline; gradual wavy boundary.

Btn2—13 to 25 inches; very dark gray (10YR 3/1) clay, gray (10YR 5/1) dry; weak coarse prismatic structure parting to strong medium angular blocky; very hard, very firm, very sticky and very plastic; few fine roots and pores; few faint clay films on faces of peds; few fine black concretions; moderately saline; moderately alkaline; gradual wavy boundary.

Btng—25 to 40 inches; light gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine prominent yellow (10YR 7/8) mottles; moderate medium angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots and pores; few faint clay films on faces of peds; 1 to 2 percent calcium carbonate concretions; moderately saline; moderately alkaline; gradual wavy boundary.

Btkg1—40 to 52 inches; light brownish gray (10YR 6/2) clay, light gray (10YR 7/2) dry; common fine prominent brownish yellow (10YR 6/8) mottles; moderate medium angular blocky structure; very hard, very firm, very sticky and very plastic; few faint clay films on faces of peds; 2 to 5 percent calcium carbonate concretions; slightly saline; violently effervescent; moderately alkaline; gradual wavy boundary.

Btkg2—52 to 72 inches; light gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine prominent brownish yellow (10YR 6/8) and yellow (10YR 7/8) mottles; moderate medium angular blocky structure; very hard, very firm, very sticky and plastic; few faint clay films on faces of peds; 10 to 15 percent calcium carbonate concretions; slightly saline; violently effervescent; strongly alkaline; clear smooth boundary.

2C—72 to 80 inches; yellowish brown (10YR 5/8) silty clay loam, yellow (10YR 7/8) dry; massive; very hard, very firm, very sticky and plastic; 5 percent calcium carbonate concretions; violently effervescent; moderately alkaline.

The solum is 60 to more than 80 inches thick. The content of clay in the control section ranges from 35 to 50 percent. Salinity is less than 4 mmhos/cm in the A horizon, 2 to 8 mmhos/cm in the upper part of the Btn horizon, and 4 to 8 mmhos/cm in the lower part of the Btn horizon. The exchangeable sodium percentage ranges from 15 to 35 percent below the A horizon.

The A horizon is black, very dark brown, very dark gray, or very dark grayish brown. It has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. This horizon has no mottles or has few mottles in shades of brown or yellow. Reaction ranges from slightly acid to slightly alkaline.

The Btn horizon is black, very dark gray, very dark brown, dark gray, dark grayish brown, grayish brown, gray, light gray, or light brownish gray. It has hue of 10YR or 2.5Y, value of 2 to 6, and chroma of 1 or 2. It has few to many mottles in shades of brown or yellow. It is clay, silty clay, or clay loam. Some pedons have calcium carbonate concretions within a depth of 30 inches. This horizon has few or no black concretions. Reaction is slightly alkaline or moderately alkaline.

The Btk horizon is gray, light gray, grayish brown, light brownish gray, or yellowish brown. It has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 4. This horizon has few to many mottles in shades of brown, gray, red, or yellow. The number of calcium carbonate concretions and black concretions ranges from none to common. Reaction ranges from slightly alkaline to strongly alkaline.

The 2C horizon has colors in shades of red, brown, or gray. It is silt loam or silty clay loam. Reaction is moderately alkaline. Some pedons do not have a 2C horizon below a depth of 60 inches.

Placedo Series

The Placedo series consists of very deep, very poorly drained, very slowly permeable, saline soils on flood plains near sea level. These soils formed in saline, alkaline, clayey alluvium. Slopes are mainly less than 1 percent.

Typical pedon of Placedo silty clay, frequently flooded; from the intersection of Farm Road 521 and Chinquapin Road about 10 miles south of Bay City in Wadsworth, 10.4 miles southeast on Chinquapin Road to the entrance of Big Boggy Wildlife Refuge, 1.4 miles south, and 300 feet southeast in a marsh:

Ag1—0 to 14 inches; dark gray (10YR 4/1) silty clay, gray (10YR 5/1) dry; few medium distinct dark brown (10YR 4/3) mottles; massive; very hard, firm, very sticky and plastic; few fine roots; strongly saline; moderately alkaline; gradual smooth boundary.

Ag2—14 to 31 inches; dark gray (10YR 4/1) clay, light gray (10YR 6/1) dry; common fine distinct light yellowish brown (2.5Y 6/4) mottles; massive; very hard, very firm, very sticky and plastic; strongly saline; moderately alkaline; clear smooth boundary.

Cg—31 to 62 inches; gray (10YR 5/1) clay loam, light gray (10YR 7/1) dry; common fine distinct olive yellow (2.5Y 6/6) mottles; massive; very hard, firm, sticky and plastic; strongly saline; moderately alkaline.

The clayey and loamy alluvium is more than 60 inches thick. The content of clay in the 10- to 40-inch control section is 35 to 50 percent. Salinity ranges from 16 to 30 mmhos/cm.

The A horizon is dark gray or gray. It has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or less. It has few to many mottles in shades of brown or yellow. This horizon is clay, silty clay, clay loam, or silty clay loam. Some pedons have a mucky peat horizon 1 to 3 inches thick.

The Cg horizon has the same colors as the Ag horizon, except that some pedons have strata in shades of red, brown, or yellow. The Cg horizon has few to many mottles in shades of brown or yellow. It is clay or silty clay. Some pedons have thin strata of loamy or sandy material.

Pledger Series

The Pledger series consists of very deep, moderately well drained, very slowly permeable, clayey soils on flood plains. These soils formed in calcareous, clayey alluvium. Slopes are 0 to 1 percent.

Typical pedon of Pledger clay, rarely flooded; from the intersection of Texas Highway 35 and Farm Road 457 in Bay City, about 23 miles southeast on Farm Road 457 to a large east-west drainage ditch about 2 miles south of the intersection with Farm Road 2611, about 300 feet east along the drainage ditch, and 100 feet north in a pasture:

A1—0 to 10 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate fine granular and subangular blocky structure; very hard, very firm, very sticky and plastic; common fine and few medium roots and pores; few slightly hard concretions of calcium carbonate; strongly effervescent; moderately alkaline; diffuse wavy boundary.

A2—10 to 18 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate fine granular structure; very hard, very firm, very sticky and plastic; common fine roots and pores; common pressure faces; few fine and very fine concretions of calcium carbonate; violently effervescent; moderately alkaline; gradual wavy boundary.

Bss1—18 to 30 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium subangular and angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots and pores; many pressure faces; common slickensides; few very fine and fine concretions of calcium carbonate; violently effervescent; moderately alkaline; gradual wavy boundary.

Bss2—30 to 46 inches; dark brown (7.5YR 4/4) clay, brown (7.5YR 5/4) dry; many crack fillings and coatings of very dark gray (10YR 3/1) clay; moderate medium angular blocky structure; very hard, very firm, very sticky and plastic; few fine roots; many pressure faces; common slickensides; few fine concretions of calcium carbonate; violently effervescent; moderately alkaline; gradual wavy boundary.

BCss1—46 to 62 inches; dark brown (7.5YR 4/4) clay, brown (7.5YR 5/4) dry; few faint dark grayish brown coatings on faces of peds; moderate medium angular blocky structure; very hard, very firm, very sticky and plastic; few fine roots; many pressure faces; common slickensides; 3 to 5 percent concretions and pockets of calcium carbonate; violently effervescent; moderately alkaline; diffuse smooth boundary.

BCss2—62 to 80 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 5/4) dry; strong medium angular blocky structure; extremely hard, very firm, very sticky and plastic; common pressure faces; common slickensides; few fine concretions of calcium carbonate; violently effervescent; moderately alkaline.

The solum is 60 to more than 80 inches thick. The content of clay in the 10- to 40-inch control section ranges from 60 to 80 percent. Cracks more than 0.4 inch wide extend to a depth of more than 20 inches during dry seasons. Undisturbed areas have gilgai, with microhighs 4 to 12 inches higher than microlows.

The A horizon is black or very dark gray. It has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or less. Reaction is slightly alkaline or moderately alkaline. This horizon is effervescent in most pedons.

The Bss horizon is very dark gray, very dark grayish brown, very dark brown, dark brown, dark reddish brown, dark grayish brown, gray, grayish brown, or reddish brown. It has hue of 2.5YR to 10YR, value of 2 to 5, and chroma of 1 to 4. Some pedons in weakly concave areas have few or common mottles in shades of brown, gray, or yellow. Material of a darker color is in the fillings of former cracks. This horizon is clay in the upper part and ranges to silty clay or silty clay loam below a depth of 40 inches in some pedons. Reaction is slightly alkaline or moderately alkaline. The horizon is effervescent.

The BCss horizon is reddish brown, dark brown, brown, red, yellowish red, or reddish yellow. It has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 2 to 8. It is mainly clay that has thin, discontinuous strata of silty clay or silty clay loam. Buried soils that have an A horizon of a darker color are common below a depth of 50 inches. The BCss horizon is moderately alkaline and is strongly effervescent or violently effervescent.

Riolomas Series

The Riolomas series consists of very deep, well drained, moderately rapidly permeable soils on terraces and bottom land bordering stream channels. These soils formed in calcareous, sandy and loamy alluvium dredged from rivers and creeks. Slopes are mainly 1 to 3 percent but range to 5 percent.

Typical pedon of Riolomas fine sand, 1 to 3 percent slopes; from the intersection of Texas Highway 35 and Farm Road 1468 about 8 miles west of Bay City near Markham, 8.7 miles south on Farm Road 1468 to a ranch entrance, 0.57 mile northeast on a private road to the ranch headquarters, 2.1 miles southeast, 1.0 mile east, and 1.6 miles southeast on ranch roads, 200 feet south in a pasture adjacent to the Colorado River:

A—0 to 8 inches; dark brown (7.5YR 4/4) fine sand, brown (7.5YR 5/4) dry; single grain; loose, nonsticky and nonplastic; few fine roots; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C1—8 to 26 inches; strong brown (7.5YR 5/6) fine sandy loam, reddish yellow (7.5YR 6/6) dry; few fragments of yellowish red (5YR 5/6) sandy clay loam 5 to 20 millimeters in diameter; single grain; soft, very friable, slightly sticky and slightly plastic; few fine roots and pores; few fine and few very fine calcium carbonate concretions; violently effervescent; moderately alkaline; gradual smooth boundary.

C2—26 to 32 inches; light brown (7.5YR 6/4) fine sandy loam, pink (7.5YR 7/4) dry; few fragments of yellowish red (5YR 5/6) sandy clay loam 5 to 20 millimeters in diameter; single grain; soft, very friable, slightly sticky and slightly plastic; few very fine white concretions; violently effervescent; moderately alkaline; abrupt smooth boundary.

C3—32 to 44 inches; pale brown (10YR 6/3) fine sand, very pale brown (10YR 7/3) dry; single grain; loose, nonsticky and nonplastic; few very fine white concretions; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C4—44 to 52 inches; dark yellowish brown (10YR 4/4) loamy fine sand, light yellowish brown (10YR 6/4) dry; single grain; loose, nonsticky and nonplastic; few very fine white concretions; violently effervescent; moderately alkaline; gradual smooth boundary.

C5—52 to 80 inches; light yellowish brown (10YR 6/4) fine sand, very pale brown (10YR 7/4) dry; single grain; loose, nonsticky and nonplastic; few very fine white concretions; strongly effervescent; moderately alkaline.

By weighted average, the content of clay in the particle-size control section is less than 18 percent. The control section has more than 50 percent fine sand or coarser sand. Reaction is slightly alkaline to strongly alkaline. Effervescence ranges from slight to violent. Some pedons have few or common concretions of calcium carbonate, black concretions, and mica flakes. Some pedons have 2 to 15 percent siliceous pebbles.

The A horizon is dark brown, brown, yellowish brown, dark yellowish brown, reddish brown, or yellowish red. It has hue of 5YR to 10YR, value of 3 to 5, and chroma of 4 to 6. It has various and mixed textures. The composite textures are fine sand, loamy fine sand, fine sandy loam, or sandy clay loam.

The C horizon has colors in shades of brown, red, yellow, or olive. It has hue of 5YR to 5Y, value of 3 to 7, and chroma of 3 to 6. It is loamy fine sand, fine sand, fine sandy loam, or sandy clay loam. Thin strata and fragments of clayey material are in some pedons.

Sumpf Series

The Sumpf series consists of very deep, very poorly drained, very slowly permeable, ponded, nonsaline, clayey soils on uplands. These soils formed in thick, clayey sediments in old stream channels. Slopes are less than 0.3 percent.

Typical pedon of Sumpf clay, frequently flooded; from the intersection of Farm Roads 1728 and 1301 in Pledger, 0.76 mile south on Farm Road 1728, about 0.8 mile south on a gravel road to a pasture gate on the south side of Caney Creek, 0.61 mile southwest on a pasture road, and 150 feet south in an oxbow depression:

A1—0 to 5 inches; dark reddish brown (5YR 3/2) clay, dark reddish gray (5YR 4/2) dry; few fine faint brown mottles; moderate fine angular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots and pores; strongly effervescent; slightly alkaline; clear smooth boundary.

A2—5 to 14 inches; dark brown (7.5YR 3/2) clay, dark brown (7.5YR 4/2) dry; few fine faint yellowish brown mottles; moderate medium angular blocky structure; very hard, very firm, very sticky and plastic; few fine roots and pores; strongly effervescent; slightly alkaline; clear smooth boundary.

Bss1—14 to 30 inches; dark reddish brown (5YR 3/2) clay, dark reddish gray (5YR 4/2) dry; few fine faint yellowish brown mottles; moderate medium angular blocky structure; very hard, very firm, very sticky and plastic; few very fine roots and pores; strongly effervescent; slightly alkaline; gradual wavy boundary.

Bss2—30 to 41 inches; dark reddish gray (5YR 4/2) clay, reddish gray (5YR 5/2) dry; many fine and medium distinct reddish brown (5YR 4/4) mottles; strong medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; 2 to 3 percent concretions and masses of calcium carbonate; violently effervescent; slightly alkaline; clear smooth boundary.

C—41 to 80 inches; reddish brown (5YR 4/3) clay, reddish brown (5YR 5/3) dry; few fine faint reddish gray mottles; massive; extremely hard, very firm, very sticky and very plastic; 1 to 2 percent films, threads, and concretions of calcium carbonate; violently effervescent; slightly alkaline.

The soils remain wet or moist most of the year and seldom have cracks below a depth of 20 inches. The average content of clay in the 10- to 40-inch control section ranges from 60 to 80 percent.

The A horizon is dark brown or dark reddish brown. It has hue of 5YR or 7.5YR, value of 3, and chroma of 2 or 3. It has few or common mottles in shades of brown, red, or yellow. The number of calcium carbonate concretions and masses ranges from none to common. Reaction is slightly alkaline or moderately alkaline. This horizon typically is calcareous.

The B horizon is very dark gray, dark reddish brown, dark gray, dark reddish gray, gray, reddish gray, dark brown, or brown. It has hue of 5YR or 7.5YR, value of 3 to 5, and chroma generally of 1 or 2. In some pedons it has chroma of 3 below a depth of 20 inches. This horizon has few or common mottles in shades of gray, yellow, brown, or red. It has few or no calcium carbonate concretions and masses. Reaction is slightly alkaline or moderately alkaline.

The C horizon is reddish brown, dark brown, brown, yellowish red, reddish yellow, or strong brown. It has hue of 5YR or 7.5YR and value and chroma of 4 to 6. This horizon has few or common mottles. It is mainly clay but ranges to fine sandy loam. Reaction is slightly alkaline or moderately alkaline. The horizon is calcareous.

Surfside Series

The Surfside series consists of very deep, very poorly drained, very slowly permeable, saline, clayey soils that formed in thick deposits of recent alluvium on coastal lowlands. Slopes are 0 to 1 percent, averaging about 0.5 percent.

Typical pedon of Surfside clay, occasionally flooded; from the intersection of Texas Highway 35 and Farm Road 457 in Bay City, 22.2 miles southeast on Farm Road 457, about 3.2 miles southwest on an unpaved county road to a ranch gate, 4.3 miles southwest on a private road to an old gas well site, 1,425 feet west in a pasture, and 25 feet across the pasture fence:

Ag1—0 to 10 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; many fine roots; moderately saline; noncalcareous; moderately alkaline; diffuse smooth boundary.

Ag2—10 to 26 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few fine faint gray mottles; moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; moderately saline; noncalcareous; moderately alkaline; clear smooth boundary.

Bg1—26 to 48 inches; reddish brown (5YR 4/3) clay, reddish brown (5YR 5/3) dry; common medium prominent grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; 2 to 3 percent calcium carbonate concretions; moderately saline; violently effervescent; moderately alkaline; gradual smooth boundary.

Bg2—48 to 74 inches; prominently and coarsely mottled very dark gray (10YR 3/1), grayish brown (10YR 5/2), and yellowish red (5YR 5/6 and 4/6) clay; moderate medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; slightly saline; violently effervescent; moderately alkaline; clear smooth boundary.

C—74 to 80 inches; weak red (10R 4/4) silty clay, weak red (10R 5/4) dry; massive; extremely hard, very firm, very sticky and very plastic; violently effervescent; moderately alkaline.

The solum is 60 to more than 70 inches thick. The soils are moderately saline or strongly saline. Some pedons have buried horizons at a depth of more than 40 inches. When the soils are dry, cracks 1 to 2 inches wide extend to a depth of 20 inches or more. Some pedons have a few slickensides.

The A horizon is dark gray, very dark gray, dark grayish brown, very dark grayish brown, black, or very dark brown and is 20 to 35 inches thick. It has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 or 2. Reaction is neutral to moderately alkaline.

The Bg horizon is reddish brown, light reddish brown, yellowish red, brown, strong brown, dark brown, or dark reddish brown. It has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It has few to many mottles in shades of gray, brown, or yellow. Some pedons have strata of silty clay or silty clay loam below a depth of 40 inches. Coatings of soil material are on the faces of peds in some pedons. Reaction is slightly alkaline or moderately alkaline. This horizon commonly is calcareous.

The C horizon has the same colors as the B horizon. It ranges from loam to clay and is stratified with more clayey and sandy material. Reaction is moderately alkaline. Some pedons do not have a C horizon.

Telferner Series

The Telferner series consists of very deep, moderately well drained, very slowly permeable, loamy soils on uplands. These soils formed in alkaline, clayey and loamy sediments. They are mainly in the western and central parts of the county. Slopes are 0 to 1 percent.

Typical pedon of Telferner very fine sandy loam, 0 to 1 percent slopes; from the intersection of Texas Highways 35 and 71 east of Blessing, 0.6 mile north on Texas Highway 71, about 0.4 mile west on a private road, and 100 feet north in an area of woodland:

A—0 to 13 inches; dark grayish brown (10YR 4/2) very fine sandy loam, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure; soft, very friable; few fine roots; moderately acid; abrupt smooth boundary.

E—13 to 18 inches; grayish brown (10YR 5/2) very fine sandy loam, light brownish gray (10YR 6/2) dry; weak coarse subangular blocky structure: soft, very friable; few fine roots; common fine pores; moderately acid; abrupt smooth boundary.

Bt1—18 to 21 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; common fine prominent red (2.5YR 5/6) mottles; strong fine and medium angular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots; few fine pores; common distinct clay films on faces of peds; moderately acid; clear smooth boundary.

Bt2—21 to 30 inches; light gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine prominent red (2.5YR 5/6) and common medium distinct strong brown (7.5YR 5/8) mottles; strong fine and medium angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; common distinct clay films on faces of peds; neutral; clear smooth boundary.

Bt3—30 to 41 inches; light gray (10YR 7/2) clay, white (10YR 8/1) dry; common fine and medium distinct reddish yellow (10YR 7/8) mottles; strong coarse angular blocky structure; very hard, very firm, sticky and very plastic; common distinct clay films on faces of peds; few small pressure faces; slightly alkaline; clear wavy boundary.

Btk—41 to 55 inches; light gray (10YR 7/1) sandy clay, white (10YR 8/1) dry; few fine distinct yellow (10YR 7/6) mottles; moderate medium angular blocky structure; very hard, firm, sticky and plastic; 5 to 8 percent calcium carbonate concretions; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk—55 to 80 inches; yellowish brown (10YR 5/6) sandy clay loam, brownish yellow (10YR 6/6) dry; weak medium angular blocky structure; hard, firm, sticky and plastic; 2 to 3 percent calcium carbonate concretions; strongly effervescent; moderately alkaline.

The solum is 60 to more than 80 inches thick. The depth to secondary carbonates ranges from 40 to 60 inches. The combined thickness of the A and E horizons ranges from 13 to 20 inches.

The A horizon is dark grayish brown, grayish brown, dark brown, or dark gray. It has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. Reaction ranges from moderately acid to neutral.

The E horizon is grayish brown, brown, pale brown, yellowish brown, light yellowish brown, or very pale brown. It has hue of 10YR, value of 5 to 7, and chroma of 2 or 3. It is loam, very fine sandy loam, or fine sandy loam. Reaction ranges from moderately acid to neutral.

The Bt horizon is very dark grayish brown, dark gray, light gray, gray, grayish brown, light brownish gray, or dark grayish brown. It has hue of 10YR to 2.5Y, value of 3 to 7, and chroma of 1 or 2. It has few or common mottles in shades of brown, gray, red, or yellow. This horizon is clay, sandy clay, or clay loam. It is moderately acid to moderately alkaline.

The Bk horizon is yellowish red, brown, strong brown, pale brown, or light brownish gray. It has hue of 5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6. It has few to many mottles in shades of brown, gray, or red. This horizon is sandy clay, clay, clay loam, or loam. It has common or many concretions and masses of calcium carbonate. Reaction is slightly alkaline or moderately alkaline. Some pedons have a BC horizon, which is similar to the Bk horizon in color, texture, and reaction.

Some pedons have a C horizon. This horizon is yellowish brown, yellowish red, brown, strong brown, pale brown, light brownish gray, or light gray. It has hue of 5YR to 2.5Y, value of 5 to 7, and chroma of 2 to 6. It has few to many mottles in shades of brown, gray, red, or yellow. It is sandy clay, sandy clay loam, clay loam, or loam. Reaction is slightly alkaline or moderately alkaline.

Texana Series

The Texana series consists of very deep, moderately well drained, very slowly permeable, loamy soils on uplands. These soils formed in loamy and clayey sediments. They are on small meander ridges in the western and central parts of the county. Slopes range from 0.5 to 2.5 percent.

Typical pedon of Texana fine sandy loam, 0 to 1 percent slopes; from the intersection of Texas Highway 60 and Farm Road 2668 south of Bay City, 2.5 miles southwest on Farm Road 2668, about 500 feet east, and 150 feet south in a field:

Ap—0 to 10 inches; very dark grayish brown (10YR

3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine and medium subangular blocky structure; slightly hard, very friable; common fine roots; neutral; abrupt smooth boundary.

E—10 to 20 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; soft, very friable; few fine roots; neutral; clear smooth boundary.

Bt1—20 to 30 inches; very dark grayish brown (10YR 3/2) clay, grayish brown (10YR 5/2) dry; common fine prominent strong brown (7.5YR 4/6) mottles; moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; common distinct clay films on faces of peds; neutral; gradual wavy boundary.

Bt2—30 to 42 inches; grayish brown (10YR 5/2) sandy clay, light brownish gray (10YR 6/2) dry; few fine prominent red (2.5YR 4/6) mottles; moderate medium angular blocky structure; very hard, very firm, very sticky and plastic; common distinct clay films on faces of peds; slightly alkaline; abrupt smooth boundary.

BCt—42 to 63 inches; yellowish red (5YR 5/6) silty clay loam, reddish yellow (5YR 6/6) dry; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few faint clay films on faces of peds; strongly effervescent; moderately alkaline; clear smooth boundary.

2C—63 to 80 inches; red (2.5YR 4/6) silty clay, red (2.5YR 5/6) dry; massive; extremely hard, very firm, very sticky and very plastic; strongly effervescent; moderately alkaline.

The solum is 60 to 80 or more inches thick. The combined thickness of the A and E horizons is 12 to 20 inches. The content of clay in the control section ranges from 35 to 45 percent. The depth to free carbonates ranges from 34 to 60 inches in most pedons.

The A horizon is very dark grayish brown or very dark brown. It has hue of 10YR and value and chroma of 2 or 3. In some pedons brownish mottles are in the lower part of this horizon. Reaction is slightly acid or neutral.

The E horizon is grayish brown or light brownish gray. It has hue of 10YR, value of 5 or 6, and chroma of 2. In some pedons it has brownish mottles. This horizon is fine sandy loam or very fine sandy loam. Reaction ranges from moderately acid to neutral.

The Bt horizon is dark grayish brown, grayish brown, light brownish gray, very dark grayish brown, or gray. It has hue of 7.5YR to 2.5Y, value of 3 to 6, and chroma of 1 or 2. It has few to many mottles in shades of red, brown, or yellow. This horizon is clay, sandy clay, sandy clay loam, or clay loam. Reaction ranges from slightly acid to moderately alkaline.

The BC horizon is strong brown, brown, reddish yellow, reddish brown, or yellowish red. It has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 to 6. It has few to many mottles in shades of red, brown, yellow, or gray. This horizon is sandy clay loam, clay loam, or sandy clay. It has few or common films, threads, and masses of calcium carbonate. Reaction is slightly alkaline or moderately alkaline. Some pedons have a Bk horizon, which is similar to the BC horizon in color, texture, and reaction.

The 2C horizon is yellowish red, reddish yellow, red, strong brown, or light gray. It has hue of 5YR to 10YR, value of 4 to 7, and chroma of 1 to 6. In some pedons it has a few mottles in shades of red, brown, or yellow. This horizon is mainly fine sandy loam having strata of sandy clay, sandy clay loam, loam, clay loam, silty clay loam, or silty clay that vary in thickness. It has few or no masses of calcium carbonate. Reaction ranges from neutral to moderately alkaline.

Velasco Series

The Velasco series consists of very deep, very poorly drained, very slowly permeable, saline, clayey soils in coastal marshes near the mouth of major streams. These soils formed in recent clayey alluvial deposits. Slopes are less than 0.5 percent.

Typical pedon of Velasco clay, frequently flooded; from the Intracoastal Waterway drawbridge on Farm Road 2031 at Matagorda, 0.7 mile south on Farm Road 2031 and 150 feet west in an area of rangeland:

A1—0 to 12 inches; dark brown (7.5YR 3/2) clay, dark brown (7.5YR 4/2) dry; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure; very hard, firm, very sticky and plastic; common fine and medium roots; common fine and medium organic stains on faces of peds; moderately saline; strongly effervescent; moderately alkaline; clear smooth boundary.

A2—12 to 30 inches; dark brown (7.5YR 3/2) clay, dark brown (7.5YR 4/2) dry; many medium and coarse distinct reddish brown (5YR 4/3) mottles; strong medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots and pores; many pressure faces on peds; moderately saline; very strongly effervescent; moderately alkaline; clear wavy boundary.

Bn1—30 to 54 inches; reddish brown (5YR 5/3) silty clay, light reddish brown (5YR 6/3) dry; common medium and coarse distinct brown (7.5YR 5/2) mottles; weak coarse prismatic structure parting to strong fine angular blocky; very hard, firm, very sticky and plastic; few fine organic stains on faces of peds; moderately saline; violently effervescent; moderately alkaline; gradual wavy boundary.

Bn2—54 to 65 inches; mottled reddish brown (5YR 4/3), dark brown (7.5YR 3/2), and brown (7.5YR 5/2) silty clay loam; massive; very hard, firm, very sticky and plastic; few fine pockets of fine sandy loam; moderately saline; violently effervescent; moderately alkaline.

The solum is 40 to more than 60 inches thick. The soils are calcareous throughout. The 10- to 40-inch control section averages between 60 and 70 percent clay. The soils are saturated for long periods and are seldom dry to the surface. Salinity is moderate or strong.

The A horizon is dark brown, very dark brown, or very dark gray. It has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3. It has few or common mottles in shades of brown, gray, red, or yellow. This horizon is mainly clay. Some pedons have thin layers of silty clay, silty clay loam, or silt loam overwash. Reaction is moderately alkaline or strongly alkaline.

The B horizon is reddish brown, grayish brown, brown, dark brown, strong brown, or red. It has hue of 2.5YR to 10YR, value of 3 to 5, and chroma of 2 to 8. It has few to many mottles in shades of brown, gray, red, or yellow. This horizon is dominantly clay or silty clay. It ranges to silty clay loam in the lower part in some pedons. The number of calcium carbonate concretions and black concretions ranges from none to common. Reaction is moderately alkaline or strongly alkaline.

Some pedons have a C horizon. This horizon has a mottled matrix in shades of red, brown, gray, or yellow. It has hue of 5YR to 5Y, value of 4 to 6, and chroma of 2 to 8. It is clay or silty clay that has strata of sands and silts. Some pedons have buried horizons below a depth of 50 inches.

Veston Series

The Veston series consists of very deep, poorly drained, slowly permeable, saline, loamy soils. These soils formed in recent loamy marine and fluvial deposits. They are in marshes near sea level, adjacent to various bays along the coast. Slopes are mainly less than 0.5 percent.

Typical pedon of Veston loam, strongly saline, frequently flooded; from the intersection of Texas Highway 35 and Farm Road 2853 north of Palacios, 4.3 miles northeast on Farm Road 2853, about 0.6 mile south on an unpaved road, and 425 feet southwest of oil storage tanks:

Ag—0 to 5 inches; gray (10YR 5/1) loam, light gray (10YR 7/1) dry; few fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many fine and medium roots; strongly saline; moderately alkaline; clear smooth boundary.

Cg1—5 to 10 inches; light gray (10YR 6/1) loam, light gray (10YR 7/1) dry; many fine prominent yellowish brown (10YR 4/6) mottles; massive; hard, friable, nonsticky and nonplastic; many fine and very fine roots; common fine pores; strongly saline; moderately alkaline; clear smooth boundary.

Cg2—10 to 34 inches; gray (10YR 5/1) silt loam, light gray (10YR 6/1) dry; few fine prominent yellow (10YR 7/6) and common medium faint dark gray (10YR 4/1) mottles; massive; hard, friable, nonsticky and nonplastic; common fine pores; few fine salt crystals; strongly saline; moderately alkaline; gradual smooth boundary.

Cg3—34 to 42 inches; light gray (10YR 6/1) loam, light gray (10YR 7/1) dry; common fine and medium prominent yellow (10YR 7/6) and common coarse faint dark gray (10YR 4/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine pores; few fine black concretions; strongly saline; moderately alkaline; gradual smooth boundary.

Cg4—42 to 56 inches; dark gray (10YR 4/1) silt loam, gray (10YR 5/1) dry; few fine distinct yellowish brown (10YR 5/4) mottles; massive; hard, friable, slightly sticky and nonplastic; few fine pores; few fine black concretions; strongly saline; moderately alkaline; gradual smooth boundary.

Cg5—56 to 72 inches; gray (10YR 5/1) silty clay loam, light gray (10YR 6/1) dry; common medium prominent yellowish brown (10YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; strongly saline; moderately alkaline.

The solum is 40 to more than 60 inches thick. These soils are saturated with water most of the year. Reaction is moderately alkaline or strongly alkaline. The soils are strongly saline throughout.

The A horizon is light brownish gray, gray, dark gray, or very dark grayish brown. It has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 2 or less. It has few or common mottles in shades of brown or gray. This horizon is loam, silt loam, or silty clay loam.

The Cg horizon is gray, grayish brown, light gray, very dark gray, light brownish gray, or dark gray. It has hue of 10YR to 5Y, value of 3 to 6, and chroma of 2 or less. It has few to many mottles in shades of brown, gray, red, or yellow. This horizon is loam, silt loam, silty clay loam, or clay loam. Some pedons have thin strata that are more sandy or clayey.

Formation of the Soils

This section describes the factors and processes of soil formation and relates them to the formation of the soils in Matagorda County. It also describes the surface geology of the county.

Factors of Soil Formation

Soil is formed by the action of soil-forming processes on material deposited or accumulated by geological forces. Five factors are important in the genesis of every soil, although some have influenced soil formation more than others. The characteristics of a soil depend on the physical and mineralogical composition of the parent material, the climate under which the soil formed, the plant and animal life on and in the soil, topography, and the length of time that the forces of soil formation have acted on the soil material.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the chemical and mineral composition of the soil. The soils in Matagorda County formed mainly in loamy and clayey sediments deposited by ancient rivers and streams. Sandy soils along the Matagorda Peninsula formed in beach deposits that have been reworked by the wind. Ijam soils formed in clayey sediments dredged from the channel of the Intracoastal Waterway, and Riolomas soils formed in sandy sediments dredged from the Colorado River. The geology of the parent materials in Matagorda County is described in more detail in the section “Surface Geology.”

Climate

The climate of Matagorda County is warm and moist. In past geologic ages, wet and dry climates influenced the way in which parent material was deposited. Wet climates were a major influence in the deposition of sediments as rivers and streams flowed into the Gulf of Mexico. The loamy and clayey sediments in which most of the soils on uplands in the county formed were carried and deposited by water. In addition, wet climates eroded the Permian red beds at the base of the High Plains. These sediments were carried downstream and are extensive along Caney Creek, an ancient channel of the Colorado River. They are along the present channel of the Colorado River to a lesser extent.

Plant and Animal Life

Plants, micro-organisms, and animals that live in the soil, such as earthworms, crawfish, and some insects, contributed to soil formation. The soil supplies nutrients to plants and animals, and receives organic matter in return. Plants and animals grow and burrow in the soil or parent material, changing the structure, making the soil porous, and thus promoting soil formation by allowing the movement of air and water.

In the past, abundant vegetation resulted in an accumulation of organic matter in the surface layer, darkening this layer in many of the soils in the county. This accumulation of organic matter is one reason why many soils in Matagorda County are naturally fertile.

In recent time, human activity has become an important factor of soil formation.

Topography

Topography influences soil formation through its effect on drainage, runoff, and the depth that moisture can penetrate the soil.

The topography in most of the county is nearly level. In a few areas it is gently sloping. Drainage has played a major role in the formation of soils in the county, especially the soils in areas along the coast where salinity is a major problem.

If other factors are equal, the degree of soil profile development depends on the amount of soil moisture and the depth of moisture penetration. The more often a soil passes through a wetting and drying cycle, the greater and more distinct the profile development.

Topography also affects the kind and amount of vegetation on a soil. Most of the soils in the county formed under dense vegetation, especially grasses, mainly because of the nearly level topography.

Time

A great length of time is required for the formation of soils that have distinct horizons. The length of time that the soil-forming processes have acted on the parent material to a large degree determines the soil characteristics if the soils are in a favorable landscape positions and have favorable materials for profile development. With the exception of such soils as Galveston and Mustang, the soils in Matagorda County are in favorable positions and have favorable materials for profile development.

Processes of Horizon Differentiation

Several processes are involved in the formation of soil horizons. These processes are the accumulation of organic matter, leaching of carbonates and other bases, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals. In most soils more than one of these processes have been active in the development of horizons.

The accumulation of organic matter in the upper part of a profile forms a distinct, dark surface layer. The soils in Matagorda County range from high to low in organic matter content. Asa, Laewest, and Pledger soils have accumulated enough organic matter for the formation of a dark surface layer.

Carbonates have been leached downward in many of the soils in the county. Much leaching has occurred in Faddin and Katy soils. Little has occurred in Brazoria and Norwood soils, which are still high in carbonates.

Gleying, or the reduction and transfer of iron, is evident in poorly drained and somewhat poorly drained soils. Gray colors in the lower layers of Cieno, Follet, and Veston soils indicate the reduction and loss of iron. Yellowish brown, strong brown, and reddish brown mottles and concretions in some horizons indicate the segregation of iron. Edna soils have such mottles.

The translocation of clay minerals has contributed to horizon development in many soils in the county. Clay minerals are the product of the weathering of primary minerals. The subsoil in many soils has accumulations of clay, or clay films, in pores and on faces of peds. These soils were probably leached of carbonates and bases before the translocation of silicate clay took place. Some soils have an argillic horizon, which has accumulations of translocated clay. Faddin soils are an example.

Surface Geology

Dr. Saul Aronow, Department of Geology, Lamar University, Beaumont, Texas, prepared this section.

Matagorda County, Texas, lies in the West Gulf geomorphic region *(15, 35).* The surface formations in this region dip toward the Gulf of Mexico at an angle of less than 6 degrees.

Geologic outcrops range from the late Pleistocene Beaumont Formation to Holocene sediments on the flood plain and delta of the Colorado River and barrier island, beach, and lagoonal-coastal marsh deposits. All outcrops and sediment probably are less than 130,000 years in age. The county is bisected by the narrow, poorly defined flood plain of the Colorado River, which terminates in a recently deposited delta that separates East Matagorda Bay from Matagorda Bay. The flood plain along an abandoned Holocene course of the Colorado River, now occupied by Caney Creek, lies along the northeastern margin of the county.

The surface geology of Matagorda County is shown on the Seguin, Houston, and Beeville-Bay City sheets of the “Geologic Atlas of Texas” *(3, 4, 5).* The general soil map at the back of this soil survey also is a reference for a discussion of the geology of the county.

Beaumont Formation

The Beaumont Formation is the oldest and major geologic outcrop in the county. The age of this formation is debated. Some investigators place its deposition during the Sangamon, a major interglacial stage between the Illinoian and Wisconsin glacial stages *(7, 25)*. It is possible that the formation was deposited less than 35,000 years BP (before present) in a late intra-Wisconsin high sea-level stand *(28)*. Other investigators suggest at least two intra-Wisconsin high sea-level periods of deposition *(6)*.

The Beaumont Formation generally is considered to be a regressive or prograding sedimentary geologic unit deposited during a late Pleistocene high sea-level stand similar to that of the present. During the Pleistocene, when the continental glaciers expanded several times, water was transferred from the ocean basins to the largely land-based glaciers and there was a worldwide lowering of sea level. Estimated sea levels below present-day levels range from about 250 to 450 feet. Streams draining into the oceans incised and regraded their channels as they flowed toward a lower, more distant seashore. When the sea level rose in response to periodic melting of the glaciers, the incised channels were flooded and backfilled or alluviated. Subsequently, broad alluvial plains were built along the gulf coast. The streams building the alluvial plains also deposited a succession of small deltas. Many of these deltas are buried beneath Holocene sediments now fringing the Gulf of Mexico.

The Beaumont Formation and its Louisiana correlative, the Prairie Formation, crop out along the western gulf coast from the western margin of the

Holocene Mississippi River flood plain southwestward to the vicinity of Corpus Christi Bay. The formations are mainly fluvial and deltaic in origin and are the result of overlapping strata deposited by late Pleistocene predecessors of streams presently draining into the gulf. Most of the Beaumont Formation in the county was probably laid down as an alluvial plain by a paleo-Colorado River. The ancient river's successive meandering courses distributed fluvial and deltaic sediments between the contemporaneous Pleistocene alluvial plains of the paleo-Lavaca and paleo-Navidad Rivers to the southwest and a paleo-Brazos River to the northeast *(13)*. The widespread Laewest, Francitas, and Palacios soils and logs of water wells and geotechnical boreholes indicate a high clay content in the Beaumont Formation, which suggests that the formation is largely the product of suspended-load streams *(14)*.

Local relief on the surface of the Beaumont Formation is less than 10 feet in most areas of the county. It is more than 20 feet, however, in the area north and northwest of Lake Austin. Some of this greater local relief may be the result of the incising of the surface during the sea level drop 18,000 years ago, when the depression now occupied by Lake Austin was formed.

The Beaumont Formation is the parent material for soils in the Laewest-Dacosta, Edna-Texana-Telferner, Livco-Dacosta, and Livia-Palacios-Francitas general soil map units. A relict fluvial depositional topography of slightly higher meander ridges with abandoned meandering channels, point bars, undrained depressions, and pimple mounds is preserved on the surface of the Beaumont Formation. At flanking lower elevations are the smoother, featureless flood basins. The Edna-Texana-Telferner and Livco-Dacosta general soil map units are on the meander ridges.

The Livia-Palacios-Francitas general soil map unit includes two fluvial facies as parent materials. The clayey Francitas soils apparently formed in flood-basin deposits, and the Livia and Palacios soils formed in meander-belt deposits. The members of this general soil map unit are saline and poorly drained. The soils of this unit are contiguous to all three of the other general soil map units. The soils of the Livia-Palacios-Francitas unit are saline, probably because of their proximity to the Gulf of Mexico. The saline components of this unit are entered, and probably maintained, by surface and subsurface incursions through tidal streams and channels, hurricane storm surges, and wind-blown salt spray.

The small, scattered patches of the saline Livco-Dacosta general soil map unit southwest of the Colorado River are anomalous in their distance from the gulf. They are seemingly outside the range of possible gulf-derived sources of saline materials, though some are contiguous to the Livia-Palacios-Francitas unit. The areal scatter of the Livco-Dacosta unit may reflect a more extensive former distribution, the remnants of which constitute the present distribution. The saline soils of the Livco-Dacosta unit may be undergoing progressive leaching of saline components. They even may be in equilibrium or stabilized in relation to the present-day climate by evaporation-induced capillary movements that retain calcic components in some gulf coast soils *(29)*.

The community of Wadsworth is sited on a relict meander ridge on which are Edna, Katy, Telferner, and Texana soils. The relict meander ridge is flanked by relict flood basins where Laewest and Dacosta soils occur. The difference in elevation of the two topographic facies is about 7 or 8 feet. The large-scale meandering pattern of Big Boggy Creek is probably inherited from a relict channel of the paleo-Colorado River. Many small undrained depressions, between 300 and 900 feet wide and less than 5 feet deep, are on the meander ridge surface. These depressions are too small to be separated as soil delineations. The community of McCroskey, about 7 miles northeast of Bay City, is on a slightly elevated, poorly defined ridge of Texana, Edna, and Cieno soils. The depressed Cieno soils in which Snead Slough flows outline another probable relict paleo-Colorado River channel.

An example of meander ridge-flood basin terrain is within the Livia-Palacios-Francitas general soil map unit where the lower flood-basin areas and meander channels are overlain by the Francitas soils and the higher areas are overlain by Palacios and Livia soils. The better drained soils have the same terrain as the Cieno, Edna, and Laewest soils in the low relict flood-basin areas and the Texana soils on the higher relict meander ridges.

Colorado River Pleistocene and Holocene deposits have characteristic colors of unreduced reddish brown or reddish yellow. This coloration is derived from Permian and Triassic red beds in the upper reaches of the river's drainage basin in northwest Texas *(27)*. Reduction processes, however, generally have removed this color from the deposits of the Beaumont Formation to a depth of 4 to 6 feet. In most soils unreduced colors are only in deep excavations and in borehole cores and cuttings. The reddish brown and reddish yellow colors commonly are preserved in the lower part of Laewest and Texana soils.

Pimple mounds and small undrained depressions, two kinds of microrelief features, are on the surface of the Beaumont Formation as well as on older Pleistocene formations along the gulf coast of

Louisiana and Texas. Pimple mounds occur throughout the county on Telferner, Texana, and Edna soils. The mounds are circular to elliptical hillocks as much as 100 feet in diameter and generally less than 3 feet high. On most mounds, relief can be attributed to a thickening of the loamy A and E horizons of the Telferner and Texana soils and of the A horizon of the Edna soils. These and similar mounds, sometimes called mima mounds or prairie mounds, are scattered throughout the United States west of the Mississippi River *(9)*. These mounds probably originated locally as wind-transported accumulations of sand and aggregations of clays and silts around clumps of vegetation. Relief probably was enhanced by sheet flood erosion at the margins of the mounds.

Small undrained depressions, less than 200 feet in diameter and less than 5 feet in depth, generally are too small to be identified by soil delineations. They occur mostly in soils on relict meander ridges. They occur in some Katy soils and in some Cieno, Edna, Telferner, and Texana soils. These depressions are not evident on Laewest soils within the relict flood-basin areas. Two of the many possible origins for these features are relevant for this part of the gulf coast. Some investigators suggest that they are unfilled remnants of the deepest parts, or thalwegs, of river channels or point bar swales as they were filled by sediment-laden floodwaters *(11)*. This view is plausible for some of the depressions. Filling and segmentation of relict channels are evident where elongated delineations, probably relict channels, of Cieno and Edna soils enclose some depressions. Other investigators suggest that they are eolian blowouts, possibly the result of the removal of dried sand-size pellets of clay and silt aggregation, formed during intermittent and recurrent desiccation of the floors of the depressions. Most depressions that originated as thalweg remnants probably were later deepened and enlarged by eolian erosion.

Many higher areas on the Beaumont Formation are topped with Fordtran loamy fine sand and Katy fine sandy loam, which have A and E horizons that can total as much as 40 inches and 30 inches in thickness, respectively. These great thicknesses may not be entirely pedogenic but may be caused by local eolian accumulations, which have enhanced the local relief. Also in this area are numerous undrained depressions of possible blowout origin.

Holocene Sediments

Holocene sediments and their soils can be divided into four areal groups—Matagorda Peninsula, Modern Colorado River delta and former log raft, Colorado River alluvial deposits, and Matagorda Bay and East Matagorda Bay nondeltaic landward margins.

Matagorda Peninsula.—Soils of the 26-mile-long Matagorda Peninsula that encloses Matagorda Bay and East Matagorda Bay are in the Galveston-Follet general soil map unit. This map unit also includes Beaches and Mustang and Veston soils.

Soil map units generally are related to the overall areal morphology of the peninsula. The peninsula's gulfward margin is bordered with beaches, inland of which is mostly Galveston fine sand. To the northwest and farther inland is Veston loam. Follet loam generally is restricted to the bayward margin of the peninsula. Locally, Veston loam is along the bayward margin. Mustang fine sand generally is bayward of the Galveston soil and can be flanked by Veston and Follet soils. Locally, the Veston and Follet soils directly impinge on the gulf-bordering beach.

The Matagorda Peninsula does not exhibit an accretionary series of beach ridges paralleling the shore, as do Matagorda Island to the southwest and Galveston Island to the northeast. The lack of a relict beach ridge pattern suggests that the Matagorda Peninsula has been transgressive or has retreated shoreward more or less continuously. Conversely, Matagorda Island and Galveston Island were regressive during the major part of their deposition. The islands were expanding and building toward the gulf. The ridge patterns are sometimes referred to as beach ridges; however, they are more likely parallel remnants of foredune ridges or storm berms above the level of the beaches along the immediate margins of Galveston Island and Matagorda Islands. These ridges have been fairly stable, whereas those of the Matagorda Peninsula have mainly continued a historic trend of shoreline retreat *(26)*.

Many scoured washover or storm channels eroded during hurricanes are transverse to the general trend of the peninsula *(20)*. Almost all are sealed from the gulf by the present-day beach. Some remain as fingerlike indentions along the northern edge of the peninsula or as elongated lakes within the peninsula. Because of the irregular northern bayward margin of the peninsula and the general transverse topographic grain, the entire peninsula has been characterized as a complex washover feature *(21)*. This characterization also emphasizes the peninsula's transgressive nature.

Hurricane Carla partly obliterated Matagorda Peninsula in 1961. Erosion effects, however, were soon repaired by shoreline deposition and wind-driven migration of shoreline sediments across the peninsula *(20)*.

Brown Cedar Cut, at the northeastern end of the peninsula, is a tidal pass with ebb-tidal and flood-tidal deltas *(21)*. The ebb-tidal delta is subaqueous and does not appear on the soil map. The flood-tidal delta is mapped mainly as Follet loam. Greens Bayou, in the southwestern half of the peninsula, is an intermittently open washover channel. On the general soil map at the back of this publication, it is shown to be closed with a partly subaqueous washover fan extending into Matagorda Bay *(22, 24)*. Galveston fine sand has been eroded away, and Veston loam indirectly contacts the beach area. Most of the subaereal parts of the fan are mapped as Follet loam.

Modern Colorado River delta and former log raft.—The Colorado River delta, deposited in the twentieth century, separates East Matagorda Bay from Matagorda Bay. The major part of this modern delta flanks the river and deposition in the vicinity of Dog Island, Culver Cut, and Egret Island.

The earliest modern delta covered about 45 acres in 1908, when the first accurate survey was made *(34)*. A logjam or log raft on the Colorado River essentially dammed the river, preventing delta development *(34, 16)*. The log raft was first noted by Spanish explorers in 1690. In 1824, the downstream edge of the raft was about 46 miles in length and entered Wharton County. Unsuccessful and poorly funded efforts to destroy the raft persisted until 1925, when a narrow pilot channel was blasted through the raft. A major flood on the Colorado River in 1929 carried substantial parts of the raft into Matagorda Bay and silted up the mouth of the river channel. The municipality of Matagorda and the surrounding lowlands were then subjected to periodic flooding. During the flood of 1935, the major flow of the Colorado River was almost diverted into Tres Palacios Creek and Tres Palacios Bay, one of the arms of Matagorda Bay.

The delta grew rapidly after 1929 and by 1935 reached Matagorda Peninsula, dividing the bay into what is now Matagorda Bay and East Matagorda Bay. In 1936, a channel was cut through the peninsula to relieve local flooding, and the Colorado River discharged directly into the Gulf of Mexico. The most rapid growth occurred from about 1929 to 1941, when deltaic deposition ceased *(34)*. Subsequently, the delta has been in a recessive mode of a deltaic cycle. Shallow lakes and embayments formed as the delta surface subsided and large marshes were inundated. Beach ridges developed on the delta plain as a result of the winnowing and concentration of coarser grained sediments. The effects on the delta of longshore currents, waves, tides, and storms are relatively minor because of the barrier island that protects the delta *(16)*.

Deltaic sediments deposited in the shallow waters of Matagorda Bay are less than 10 feet thick. On a miniature scale, they can be divided into delta-plain, delta front, prodelta, and bay depositional environments and facies *(16)*.

The delta area is included in the Harris-Velasco-Placedo general soil map unit. Veston and Follet soils are common in addition to the Velasco and Placedo soils.

Colorado River alluvial deposits.—The Colorado River, in the northwestern part of the county, has changed course several times. Live Oak and Boggy Bayous and Dead Slough are probably segments of relict Colorado River courses. The Colorado River abandoned its Caney Creek course near Wharton, in Wharton County to the north, and assumed its present, more direct course to the Gulf of Mexico several hundred years ago *(8, 17)*. This new course may have started as a small headward-eroding stream that was first incised during the lowering of sea level 18,000 years ago. A deep channel, presently filled and more than 100 feet below current sea level, was cut into the Beaumont Formation beneath the present course of the Colorado River *(36)*. The Colorado River was probably avulsed from its Caney Creek course during a major flood as this headward-eroding stream penetrated the flood plain.

The present Colorado River flood plain, as outlined by Holocene sediments on which soils of the Brazoria-Norwood-Clemville general soil map unit are sited, is narrow when compared to the width of Holocene parent material of the Pledger-Asa, Brazoria-Norwood-Clemville, and Surfside general soil map units on the northeast margin of the county. Holocene fluvial sediments in the northeastern part of the county are developed on the deposits of the abandoned course of the Colorado, now occupied by Caney Creek. Most of this area is in the Pledger-Asa general soil map unit. Smaller areas are in the Brazoria-Norwood-Clemville and Surfside general soil map units.

The Colorado River in Matagorda County displays very few landforms indicative of flood-plain widening. The meander loops are not well developed, especially when compared to the sinuous meander patterns of Caney Creek. A possible exception is in the northern part of the county, northwest of Bay City. The only obviously preserved Holocene oxbow or meander neck cutoff on the Colorado River is on the east side of the river. Two other possible abandoned meanders, on the west side of the river, are probably inherited from the patterns of meander ridges on the surface of the Beaumont Formation. Holocene fluvial sediments in both areas, as interpreted by the presence of Asa, Brazoria, Clemville, Norwood, and Sumpf soils, are interlaced with upland soils, such as Katy, Telferner, and Texana soils and the overwashed Edna and Laewest soils.

The loamy Norwood and Asa soils generally are on point-bar and levee deposits adjacent to the stream channel. The clayey Brazoria and Sumpf soils and the loamy Clemville soils are on the flood-basin deposits. Brazoria and Clemville soils impinge on the channel in a few places, as do the overwashed Edna soils.

Numerous delineations of the overwashed Edna and Laewest soils are within the Pledger-Asa and Brazoria-Norwood-Clemville general soil map units. These soils are along the western margin of the Caney Creek part of the Colorado River flood plain from the northern edge of the county to about the latitude of Bay City. The soils were associated with the previously obstructed flow and slack-water conditions resulting from the former log raft on the present course of the Colorado River. The soils in this area are also the result of deposition under slack-water conditions and, with the removal of the log raft, normal overbank flooding.

The large areas of the overwashed Edna and Laewest soils probably acquired their 6 to 20 inches of red clay during the slack-water conditions caused by the former log raft *(16)*. These surficial clays are essentially flood-basin sediments but are deposited outside a flood plain laterally traversed by the meandering Colorado River. Inclusions within the overwashed Edna and Laewest map units likely have surficial red clay caps.

Fluvial sediments comprise the southwestern margin of the large combined alluvial plains of the Colorado River and the Brazos River. The persistent, meandering pattern of Caney Creek to the edge of the Gulf of Mexico and the absence of a delta in this area strongly suggest that the edge of this broad alluvial plain extended farther into the gulf during the past 10,000 years. The extension was possibly as much as 9 miles beyond the present gulf margins *(23)*.

Colorado River Holocene deposits characteristically have unreduced reddish brown or reddish yellow colors. The unreduced colors are in material on and near the surface of Asa, Brazoria, Clemville, Norwood, and Pledger soils. This coloration, as in Pleistocene sediments, is derived from Permian and Triassic red beds in the Colorado River drainage basin in northwest Texas *(27)*.

Matagorda Bay and East Matagorda Bay nondeltaic landward margins.—Marsh deposits along the landward margin of Matagorda and East Matagorda Bays are represented by soils of the Harris-Velasco-Placedo general soil map unit. These marsh deposits merge laterally with sediments of the recently deposited Colorado River delta and with saline fluvial sediments underlying the Surfside general soil map unit to the northeast. The Beaumont Formation in the Livia-Palacios-Francitas general soil map unit generally crops out landward of the marsh sediments. The marsh deposits occur as a thin, bayward-thickening veneer of sediment over the buried surface of the Beaumont Formation. Probably, the major source of nonorganic marsh material is deposition by small streams, some tidal, that erode the adjacent upland surface of the Beaumont Formation. Marsh vegetation traps these sediments, and upon decaying, adds organic matter. Sediment probably is laterally transported from the delta area, from the Beaumont Formation outcrop east of Palacios Point at the southwest end of Matagorda Bay, and from Colorado River Holocene alluvium at the northeast end of East Matagorda Bay.

References

(1) American Association of State Highway and Transportation Officials. 1986. Standard specifications for highway materials and methods of sampling and testing. Ed. 14, 2 vols.

(2) American Society for Testing and Materials. 1993. Standard classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) Barnes, V.E. 1975. Geologic atlas of Texas, Beeville-Bay City sheet. Univ. Tex. Bur. of Econ. Geol.

(4) Barnes, V.E. 1979. Geologic atlas of Texas, Seguin sheet. Univ. Tex. Bur. of Econ. Geol.

(5) Barnes, V.E. 1982. Geologic atlas of Texas, Houston sheet. Univ. Tex. Bur. of Econ. Geol.

(6) Beard, J.H., J.B. Sangree, and L.A. Smith. Quaternary chronology, paleoclimate, depositional sequences, and eustatic cycles. Amer. Assoc. of Petro. Geol. Bull. 66:158-169.

(7) Bernard, H.A., and R.J. LeBlanc. 1965. Resume of the Quaternary of the northwestern Gulf of Mexico Province. *In* The Quaternary of the United States. Princeton University Press, pp. 137-185.

(8) Bouma, A.H., and W.R. Bryant. 1969. Rapid delta growth in Matagorda Bay, Texas. *In* Coastal lagoon, a symposium. Universidad Nacional Autonoma de Mexico, Mexico City, pp. 171-190.

(9) Carty, D.J., J.B. Dixon, L.P. Wilding, and F.T. Turner. 1988. Characterization of a pimple mound-intermound soil complex in the gulf coast region of Texas. Soil Sci. Soc. of Amer. Jour. 52: 1715-1721.

(10) Clay, Comer. 1949. The Colorado River raft. Southwest Hist. Quar. 52: 410-426.

(11) Fisk, H.N. 1940. Geology of Avoyelles and Rapides Parishes. La. Geol. Sur. Bul. 18.

(12) Fulmore, Z.T. 1925. The history and geography of Texas as told in county names.

(13) Galloway, W.E. 1982. Depositional architecture of Cenozoic Gulf Coastal Plain fluvial systems. Univ. Tex. Bur. of Econ. Geol. Circ. 82-5.

(14) Galloway, W.E., and D.K. Hobday. 1983. Terrigenous clastic depositional systems, applications to petroleum, coal, and uranium exploration.

(15) Hunt, C.B. 1974. Natural regions of the United States and Canada.

(16) Kanes, W.H. 1970. Facies and development of the Colorado Delta in Texas. *In* Deltaic sedimentation, modern and ancient. Soc. of Econ. Paleontologists and Mineralogists Spec. Pub. 15, pp. 78-106.

(17) LeBlanc, R.J., and W.D. Hodgson. 1959. Origin and development of the Texas shoreline. Gulf Coast Assoc. Geol. Soc. Trans. 9: 197-220.

(18) Marr, John C. 1928. The History of Matagorda County, Texas. Master's thesis completed in 1928 at University of Texas, Austin, Texas.

(19) Matagorda County Historical Commission. 1986. Historic Matagorda County. Vol. I.

(20) McGowen, J.H., and J.L. Brewton. 1975. Historical changes and related coastal processes, gulf and mainland shorelines, Matagorda Bay area, Texas. Univ. Tex. Bur. Econ. Geol.

(21) McGowen, J.H., L.F. Brown, T.J. Evans, W.L. Fisher, and C.G. Groat. 1976. Environmental geologic atlas of the Texas coastal zone, Bay City-Freeport area. Univ. Tex. Bur. Econ. Geol.

(22) McGowen, J.H., C.V. Proctor, L.F. Brown, T.J. Evans, W.W. Fisher, and C.G. Groat. 1976. Environmental geologic atlas of the Texas coastal zone, Port Lavaca area. Univ. Tex. Bur. Econ. Geol.

(23) Morton, R.A. 1979. Temporal and spatial variations in shoreline changes and their implications, examples from the Texas gulf coast. Jour. of Sedimentary Petrology 49: 1101-1112.

(24) Morton. R.A., M.J. Pieper, and J.H. McGowen. 1976. Shoreline changes on Matagorda Penisula (Brown Cedar Cut to Pass Cacallo) and analysis of historical changes of the Texas gulf shoreline. Univ. Tex. Bur. Econ. Geol. Circ. 76-6.

(25) Otvos, E.G. 1991. Houston Ridge, southwest Louisiana—end link in late Pleistocene Ingleside barrier chain. Prairie formation newly defined. Southeastern Geol. 31: 235-249.

(26) Paine, J.G., and R.A. Morton. 1989. Shoreline and vegetation line movement, Texas gulf coast, 1974-1982. Univ. Tex. Bur. Econ. Geol. Circ. 89-1.

(27) Price, W.A. 1934. Lissie Formation and Beaumont clay in south Texas. Amer. Assoc. of Petro. Geol. Bull.18: 948-959.

(28) Shideler, G.L. 1986. Stratigraphic studies of a late Quaternary coastal complex, south Texas—introduction and geologic framework. U.S. Geol. Surv. Prof. Pap. 1328A.

(29) Sobecki, T.M., and L.P. Wilding. 1983. Formation of calcic and argillic horizons in selected soils of the Texas Coast Prairie. Soil Sci. Soc. Amer. Jour. 47: 707-715.

(30) United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210.

(31) United States Department of Agriculture, Soil Conservation Service. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. U.S. Dep. Agric. Handb. 436.

(32) United States Department of Agriculture, Soil Conservation Service. 1992. Keys to soil taxonomy. 5th ed. Soil Surv. Staff, Soil Manage. Support Serv. Tech. Monogr. 19.

(33) United States Department of Agriculture, Soil Conservation Service. 1993. Soil survey manual. Soil Surv. Div. Staff, U.S. Dep. Agric. Handb. 18.

(34) Wadsworth. 1966. Historical deltation of the Colorado River, Texas. *In* Deltas in their geologic framework. Houston Geol. Soc., pp. 99-105.

(35) Walker, H.J., and J.M. Coleman. 1987. Atlantic and Gulf Coast Plain. *In* Geomorphic systems of North America. Geol. Soc. Amer. Centennial Spec. Vol. 2, pp. 51-110.

(36) Wilkinson, B.H., and J.R. Byrne. 1977. Lavaca Bay—transgressive deltaic sedimentation in central Texas estuary. Amer. Assoc. of Petro. Geol. Bull. 61: 527-545.

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.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial cone. The material washed down the sides of mountains and hills by ephemeral streams and deposited at the mouth of gorges in the form of a moderately steep, conical mass descending equally in all directions from the point of issue.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

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.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Arroyo. The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in alluvium.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

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:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Back slopes in profile are commonly steep, are linear, and may or may not include cliff segments.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

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.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

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 depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. 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 textured soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas 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 or miscellaneous areas are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conglomerate. A coarse grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

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. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the “Soil Survey Manual.”

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.

Coppice dune. A small dune of fine grained soil material stabilized around shrubs or small trees.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

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.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

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 grazing land for a prescribed period.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface. Runoff, or surface flow of water, from an area.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

Effervescence. The foaming reaction of 10 percent hydrochloric acid when applied to a substance such as soil or rock that contains calcium carbonate.

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.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

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 human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

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 clayey soils that shrink and swell considerably 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.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

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 as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 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. Water filling all the unblocked pores of the 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.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head out. To form a flower head.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

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 uppercase letter represents the major horizons. Numbers or lowercase 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.

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 A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

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 overlying soil material. 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, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it 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 potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

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.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

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.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

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.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

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. 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).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

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. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

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 or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 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, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities 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.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

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.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

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 outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

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.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly 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

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

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). 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.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables). Water that is too salty for consumption by livestock.

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-sized particles.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial soil horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. 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 (in tables). 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.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warmtemperate, humid regions, and especially those in the tropics, generally have a low ratio.

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.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

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. In this survey, classes for simple slopes are as follows:

Nearly level	0 to 1 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 5 percent
Moderately sloping	5 to 8 percent
Strongly sloping	8 to 12 percent
Moderately steep	12 to 20 percent
Steep	20 to 45 percent
Very steep	45 percent and higher

Classes for complex slopes are as follows:

Nearly level	0 to 3 percent
Gently undulating	1 to 5 percent
Undulating	1 to 8 percent
Rolling	5 to 10 percent
Hilly	10 to 30 percent
Steep	20 to 45 percent
Very steep	45 percent and higher

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

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, in millimeters, of separates recognized in the United States are as follows:

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 material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion 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 erosion 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.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

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.”

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

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. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Thin layer (in tables). Otherwise suitable soil material that 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.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1961-87 at Bay City, Texas)

Month	Temperature						Precipitation			
				2 years in 10 will have--				2 years in 10 will have--		
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more
	°F	*°F*	*°F*	*°F*	*°F*	*Units*	*In*	*In*	*In*	
January-----	61.6	41.5	51.6	80	19	158	3.11	1.57	4.44	5
February----	65.2	44.4	54.8	82	25	183	2.83	1.37	4.09	4
March-------	72.5	52.2	62.4	87	31	392	2.25	0.71	3.50	3
April-------	79.0	60.9	69.9	90	40	595	2.79	0.81	4.38	3
May---------	84.3	67.0	75.6	93	52	794	4.93	1.83	7.52	4
June--------	89.6	71.9	80.7	97	61	921	4.42	1.50	6.82	5
July--------	92.4	74.0	83.2	99	67	1023	4.36	1.36	6.81	5
August------	92.6	73.1	82.8	100	64	995	3.70	1.91	5.26	5
September---	88.7	69.1	78.9	97	52	864	6.75	2.40	10.36	7
October-----	83.0	60.3	71.7	93	42	672	5.65	1.37	9.04	4
November----	73.3	52.3	62.8	87	32	397	3.76	1.39	5.73	4
December----	66.1	44.8	55.5	82	23	229	3.07	1.51	4.65	4
Yearly:										
Average---	79.0	59.3	69.2	---	---	---	---	---	---	---
Extreme---			---	101	18	---	---	---	---	---
Total-----	---	---	---	---	---	7,222	47.61	35.54	56.68	53

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minumum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1961-87 at Bay City, 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--	February 3	February 22	March 7
2 years in 10 later than--	January 26	February 14	March 2
5 years in 10 later than--	January 4	January 29	February 20
First freezing temperature in fall:			
1 year in 10 earlier than--	December 16	December 6	November 21
2 years in 10 earlier than--	December 29	December 16	November 28
5 years in 10 earlier than--	February 6	January 5	December 14

Table 3.--Growing Season

(Recorded for the period 1961-87 at Bay City, 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	339	307	277
8 years in 10	363	320	284
5 years in 10	365	349	302
2 years in 10	365	365	365
1 year in 10	365	365	365

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
Aa	Asa silt loam, rarely flooded	17,603	2.0
As	Asa silty clay loam, rarely flooded	8,585	1.0
Az	Asa silty clay loam, saline, occasionally flooded	5,303	0.6
BaA	Bacliff clay, 0 to 1 percent slopes	19,003	2.1
Bb	Beaches	3,919	0.4
Br	Brazoria clay, rarely flooded	33,635	3.8
CeA	Cieno sandy clay loam, 0 to 1 percent slopes	1,819	0.2
Cm	Clemville silty clay loam, rarely flooded	5,629	0.6
DaA	Dacosta sandy clay loam, 0 to 1 percent slopes	102,692	11.6
EdA	Edna fine sandy loam, 0 to 1 percent slopes	71,158	8.0
EoA	Edna silty clay, 0 to 1 percent slopes, overwashed	5,614	0.6
ExA	Edna-Cieno complex, 0 to 1 percent slopes	4,852	0.5
FaA	Faddin loam, 0 to 1 percent slopes	1,400	0.2
Fe	Follet loam, frequently flooded	10,450	1.2
FoB	Fordtran loamy fine sand, 0 to 2 percent slopes	1,586	0.2
FrA	Francitas clay, 0 to 1 percent slopes	9,532	1.1
FuC	Fulshear fine sandy loam, 2 to 5 percent slopes	2,441	0.3
GaB	Galveston fine sand, undulating	9,766	1.1
Ha	Harris clay, frequently flooded	11,150	1.3
ImB	Ijam clay, 1 to 3 percent slopes	4,790	0.5
KaB	Katy fine sandy loam, 0 to 2 percent slopes	3,437	0.4
LaA	Laewest clay, 0 to 1 percent slopes	134,961	15.2
LaB	Laewest clay, 1 to 3 percent slopes	4,898	0.6
LaD2	Laewest clay, 5 to 8 percent slopes, eroded	529	0.1
LoA	Laewest silty clay, 0 to 1 percent slopes, overwashed	13,171	1.5
LtA	Livco-Dacosta complex, 0 to 1 percent slopes	12,487	1.4
LvA	Livia loam, 0 to 1 percent slopes	19,096	2.1
MuA	Mustang fine sand, 0 to 1 percent slopes	2,177	0.2
No	Norwood silty clay loam, rarely flooded	6,002	0.7
PaA	Palacios loam, 0 to 1 percent slopes	17,292	1.9
Pc	Placedo silty clay, frequently flooded	8,599	1.0
Pe	Pledger clay, rarely flooded	62,372	7.0
Pg	Pledger clay, occasionally flooded	10,730	1.2
RoB	Riolomas fine sand, 1 to 3 percent slopes	1,539	0.2
Sf	Sumpf clay, frequently flooded	2,177	0.2
Sr	Surfside clay, occasionally flooded	23,263	2.6
TfA	Telferner very fine sandy loam, 0 to 1 percent slopes	15,037	1.7
TxA	Texana fine sandy loam, 0 to 1 percent slopes	14,151	1.6
TxB	Texana fine sandy loam, 1 to 3 percent slopes	6,998	0.8
Ve	Velasco clay, frequently flooded	10,979	1.2
Vs	Veston loam, strongly saline, frequently flooded	7,278	0.8
	Water areas 5 to 40 acres in size	13,289	1.5
	Water areas more than 40 acres in size	166,784	18.8
	Total	888,173	100.0

Table 5.--Prime Farmland

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name.)

Map symbol	Soil name
Aa	Asa silt loam, rarely flooded
As	Asa silty clay loam, rarely flooded
BaA	Bacliff clay, 0 to 1 percent slopes (where drained)
Br	Brazoria clay, rarely flooded
Cm	Clemville silty clay loam, rarely flooded
DaA	Dacosta sandy clay loam, 0 to 1 percent slopes
FaA	Faddin loam, 0 to 1 percent slopes
FuC	Fulshear fine sandy loam, 2 to 5 percent slopes
KaB	Katy fine sandy loam, 0 to 2 percent slopes
LaA	Laewest clay, 0 to 1 percent slopes
LaB	Laewest clay, 1 to 3 percent slopes
LoA	Laewest silty clay, 0 to 1 percent slopes, overwashed
No	Norwood silty clay loam, rarely flooded
Pe	Pledger clay, rarely flooded
Pg	Pledger clay, occasionally flooded
TxA	Texana fine sandy loam, 0 to 1 percent slopes
TxB	Texana fine sandy loam, 1 to 3 percent slopes

Table 6.--Land Capability and 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.)

Soil name and map symbol	Land capability	Cotton lint	Grain sorghum	Corn	Rice	Improved bermudagrass
		Lbs	*Bu*	*Bu*	*Bu*	*AUM**
Aa, As: Asa	I	1,000	110	125	---	8.0
Az: Asa	VIs	---	---	---	---	4.0
BaA: Bacliff	IIIw	500	75	70	120	6.0
Bb: Beaches	VIIIs	---	---	---	---	---
Br: Brazoria	IIw	800	100	100	---	10.0
CeA: Cieno	IVw	---	---	---	100	6.0
Cm: Clemville	I	600	90	90	---	9.0
DaA: Dacosta	IIw	500	85	---	105	8.0
EdA, EoA: Edna	IIIw	400	65	45	120	8.0
ExA:						
Edna	IIIw	400	65	50	120	8.0
Cieno	IVw	---	---	---	100	6.0
FaA: Faddin	IIw	345	80	70	105	8.0
Fe: Follet	VIIw	---	---	---	---	---
FoB: Fordtran	IIw	250	55	---	---	5.5
FrA: Francitas	IVw	---	35	---	85	6.0
FuC: Fulshear	IIIe	300	40	55	---	5.5
GaB: Galveston	VIe	---	---	---	---	5.0
Ha: Harris	VIIw	---	---	---	---	---

See footnote at end of table.

Table 6.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Soil name and map symbol	Land capability	Cotton lint	Grain sorghum	Corn	Rice	Improved bermudagrass
		Lbs	*Bu*	*Bu*	*Bu*	*AUM**
ImB----------------------- Ijam	VIIw	---	---	---	---	---
KaB----------------------- Katy	IIw	450	70	65	120	10.0
LaA----------------------- Laewest	IIw	575	95	100	130	9.0
LaB----------------------- Laewest	IIe	450	85	90	---	9.0
LaD2---------------------- Laewest	IVe	---	---	---	---	5.0
LoA----------------------- Laewest	IIw	500	95	100	110	9.0
LtA:						
Livco--------------------	IIIs	---	---	---	85	4.5
Dacosta------------------	IIw	500	85	---	105	8.0
LvA----------------------- Livia	IVw	---	---	---	80	4.5
MuA----------------------- Mustang	VIw	---	---	---	---	---
No------------------------ Norwood	I	1,000	90	110	---	10.0
PaA----------------------- Palacios	IVw	---	40	---	80	4.5
Pc------------------------ Placedo	VIIw	---	---	---	---	---
Pe------------------------ Pledger	IIw	500	90	90	---	10.0
Pg------------------------ Pledger	IIw	500	90	90	---	10.0
RoB----------------------- Riolomas	IIIe	---	---	---	---	5.0
Sf------------------------ Sumpf	VIw	---	---	---	---	3.5
Sr------------------------ Surfside	VIw	---	---	---	---	---
TfA----------------------- Telferner	IIw	---	60	---	90	8.0
TxA----------------------- Texana	IIw	---	95	100	95	8.0

See footnote at end of table.

Table 6.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Soil name and map symbol	Land capability	Cotton lint	Grain sorghum	Corn	Rice	Improved bermudagrass
		Lbs	*Bu*	*Bu*	*Bu*	*AUM**
TxB----------------------- Texana	IIIe	---	80	80	80	7.0
Ve------------------------ Velasco	VIIw	---	---	---	---	---
Vs------------------------ Veston	VIIs	---	---	---	---	---

* 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 7.--Rangeland Productivity

(Only the soils that support rangeland vegetation suitable for grazing are listed.)

Soil name and map symbol	Range site	Potential annual production for kind of growing season: Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
Aa, As: Asa	Loamy Bottomland	8,000	6,500	5,000
Az: Asa	Salty Prairie	8,000	6,000	4,500
BaA: Bacliff	Blackland	9,500	7,500	6,500
Br: Brazoria	Clayey Bottomland	8,000	6,000	4,000
CeA: Cieno	Lowland	8,000	6,000	5,000
Cm: Clemville	Loamy Bottomland	8,000	6,500	5,000
DaA: Dacosta	Blackland	7,000	5,700	4,000
EdA: Edna	Claypan Prairie	8,000	6,000	5,000
EoA: Edna	Blackland	9,000	7,500	6,000
ExA:				
Edna	Claypan Prairie	8,000	6,000	5,000
Cieno	Lowland	8,000	6,000	5,000
FaA: Faddin	Loamy Prairie	8,000	6,500	5,000
Fe: Follet	Tidal Flat	16,000	14,000	12,000
FoB: Fordtran	Sandy Prairie	6,000	4,500	3,000
FrA: Francitas	Salty Prairie	9,000	7,000	5,000
FuC: Fulshear	Sandy Loam	5,000	4,000	2,000
GaB: Galveston	Coastal Sand	4,500	3,000	2,000
Ha: Harris	Salt Marsh	12,000	19,000	6,000
KaB: Katy	Loamy Prairie	8,500	6,500	5,000

Table 7.--Rangeland Productivity--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season: Favorable	Average	Unfavorable
		Lb/acre	*Lb/acre*	*Lb/acre*
LaA, LaB, LaD2, LoA: Laewest	Blackland	---	---	---
LtA:				
Livco	Salty Prairie	8,000	6,000	4,500
Dacosta	Blackland	7,000	5,700	4,000
LvA: Livia	Salty Prairie	8,000	6,000	4,500
MuA: Mustang	Low Coastal Sand	4,000	3,000	2,000
No: Norwood	Loamy Bottomland	8,000	6,500	5,000
PaA: Palacios	Salty Prairie	8,000	6,000	4,500
Pc: Placedo	Salt Marsh	12,000	10,000	8,000
Pe, Pg: Pledger	Clayey Bottomland	8,000	6,000	4,000
Sf: Sumpf	Clayey Bottomland	5,000	4,500	3,000
Sr: Surfside	Salty Prairie	13,000	8,700	7,000
TfA: Telferner	Loamy Prairie	6,500	5,000	3,500
TxA, TxB: Texana	Loamy Prairie	8,000	6,500	5,000
Ve: Velasco	Salt Marsh	14,000	11,000	8,000
Vs: Veston	Salt Flat	4,000	3,000	2,000

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.)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Aa, As: Asa	Severe: flooding.	Slight	Slight	Slight	Slight.
Az: Asa	Severe: flooding.	Moderate: excess salt.	Moderate: flooding, excess salt.	Slight	Moderate: excess salt, flooding.
BaA: Bacliff	Severe: wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Bb: Beaches	Severe: flooding, wetness, too sandy.	Severe: wetness, too sandy, excess salt.	Severe: too sandy, wetness, flooding.	Severe: wetness, too sandy.	Severe: excess salt, wetness, droughty.
Br: Brazoria	Severe: flooding, percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey.
CeA: Cieno	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
Cm: Clemville	Severe: flooding.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
DaA: Dacosta	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
EdA: Edna	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
EoA: Edna	Severe: percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey.
ExA:					
Edna	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
Cieno	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
FaA: Faddin	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
Fe: Follet	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly, excess salt.	Severe: flooding, wetness, percs slowly.	Severe: wetness.	Severe: excess salt, wetness, flooding.
FoB: Fordtran	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Moderate: too sandy.	Moderate: droughty.

Table 8.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FrA: Francitas	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
FuC: Fulshear	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
GaB: Galveston	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, flooding.
Ha: Harris	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, excess salt.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.	Severe: excess salt, wetness, droughty.
ImB: Ijam	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, excess salt.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: excess salt, wetness, too clayey.
KaB: Katy	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
LaA, LaB: Laewest	Severe: percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey.
LaD2: Laewest	Severe: percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: slope, too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey.
LoA: Laewest	Severe: percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey.
LtA:					
Livco	Severe: percs slowly, excess sodium.	Severe: excess sodium, percs slowly.	Severe: percs slowly, excess sodium.	Slight	Severe: excess sodium.
Dacosta	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
LvA: Livia	Severe: flooding, wetness, percs slowly.	Severe: wetness, excess sodium, percs slowly.	Severe: wetness, percs slowly, excess sodium.	Severe: wetness.	Severe: excess sodium, wetness.
MuA: Mustang	Severe: flooding, wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness, droughty.
No: Norwood	Severe: flooding.	Slight	Slight	Slight	Slight.

Table 8.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
PaA: Palacios	Severe: flooding, wetness, percs slowly.	Severe: wetness, excess sodium, percs slowly.	Severe: wetness, percs slowly, excess sodium.	Severe: wetness.	Severe: excess sodium, wetness.
Pc: Placedo	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, excess salt.	Severe: too clayey, ponding, flooding.	Severe: ponding, too clayey.	Severe: excess salt, ponding, droughty.
Pe, Pg: Pledger	Severe: flooding, percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey.
RoB: Riolomas	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
Sf: Sumpf	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, flooding.	Severe: ponding, too clayey.	Severe: ponding, flooding, too clayey.
Sr: Surfside	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, excess salt.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: excess salt, wetness.
TfA: Telferner	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
TxA, TxB: Texana	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
Ve: Velasco	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, excess salt.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.	Severe: excess salt, wetness, droughty.
Vs: Veston	Severe: flooding, wetness, percs slowly.	Severe: wetness, excess salt, percs slowly.	Severe: wetness, flooding, percs slowly.	Severe: wetness.	Severe: excess salt, wetness, droughty.

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.)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Aa, As------------- Asa	Good	Good	Fair	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Az----------------- Asa	Poor	Fair	Poor	---	Poor	Poor	Very poor.	Fair	---	Very poor.	Fair.
BaA---------------- Bacliff	Fair	Fair	Poor	Fair	Fair	Fair	Good	Fair	---	Fair	Fair.
Bb----------------- Beaches	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor	Poor	Very poor.	---	Poor	Very poor.
Br----------------- Brazoria	Fair	Fair	Fair	Good	Fair	Poor	Fair	Fair	Good	Poor	Fair.
CeA---------------- Cieno	Poor	Fair	Fair	---	Fair	Good	Good	Fair	Poor	Good	Fair.
Cm----------------- Clemville	Good	Good	Fair	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
DaA---------------- Dacosta	Fair	Fair	Fair	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
EdA, EoA----------- Edna	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	Fair.
ExA:											
Edna--------------	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	Fair.
Cieno-------------	Poor	Fair	Fair	---	Fair	Good	Good	Fair	Poor	Good	Fair.
FaA---------------- Faddin	Fair	Good	Fair	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
Fe----------------- Follet	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor	Good	Very poor.	---	Fair	Very poor.
FoB---------------- Fordtran	Poor	Fair	Good	---	Good	Fair	Fair	Fair	---	Fair	Good.
FrA---------------- Francitas	Poor	Fair	Fair	---	Fair	Poor	Good	Poor	---	Fair	Fair.
FuC---------------- Fulshear	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
GaB---------------- Galveston	Poor	Fair	Fair	---	Fair	Very poor.	Fair	Fair	---	Poor	Fair.
Ha----------------- Harris	Very poor.	Very poor.	Poor	---	Very poor.	Good	Good	Very poor.	---	Good	Very poor.
ImB---------------- Ijam	Very poor.	Very poor.	Poor	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---

Table 9.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
KaB-----Katy	Fair	Good	Good	Good	---	Fair	Fair	Good	Good	Fair	---
LaA-----Laewest	Fair	Fair	Fair	Good	Fair	Fair	Good	Fair	---	Fair	Fair.
LaB-----Laewest	Fair	Fair	Fair	Good	Fair	Poor	Poor	Fair	---	Poor	Fair.
LaD2-----Laewest	Fair	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	---	Poor	Fair.
LoA-----Laewest	Fair	Fair	Fair	Good	Fair	Fair	Good	Fair	---	Fair	Fair.
LtA:											
Livco-----	Poor	Fair	Poor	---	Poor	Poor	Poor	Poor	---	Poor	Poor.
Dacosta-----	Fair	Fair	Fair	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
LvA-----Livia	Poor	Fair	Poor	---	Poor	Good	Good	Poor	---	Good	Poor.
MuA-----Mustang	Poor	Poor	Fair	---	Fair	Fair	Good	Poor	---	Fair	Fair.
No-----Norwood	Good	Good	Fair	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
PaA-----Palacios	Poor	Fair	Poor	---	Poor	Good	Good	Poor	---	Good	Poor.
Pc-----Placedo	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor	Good	Very poor.	---	Fair	Very poor.
Pe, Pg-----Pledger	Fair	Fair	Fair	Good	Good	Poor	Good	Fair	Good	Fair	Fair.
RoB-----Riolomas	Fair	Good	Good	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Sf-----Sumpf	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Very poor.	Good	Poor.
Sr-----Surfside	Very poor.	Poor	Poor	---	Fair	Fair	Good	Poor	---	Fair	Poor.
TfA-----Telferner	Fair	Fair	Fair	---	Good	Fair	Fair	Fair	---	Fair	Fair.
TxA, TxB-----Texana	Fair	Good	Fair	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
Ve-----Velasco	Very poor.	Poor	Very poor.	---	Very poor.	Fair	Good	Very poor.	---	Fair	Very poor.
Vs-----Veston	Very poor.	Fair	Poor	---	Poor	Good	Good	Poor	---	Good	Poor.

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 but does not eliminate the need for onsite investigation.)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Aa, As: Asa	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
Az: Asa	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: excess salt, flooding.
BaA: Bacliff	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
Bb: Beaches	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: excess salt, wetness, droughty.
Br: Brazoria	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
CeA: Cieno	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
Cm: Clemville	Moderate: too clayey.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: low strength.	Slight.
DaA: Dacosta	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
EdA: Edna	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
EoA: Edna	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
ExA:						
Edna	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
Cieno	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
FaA: Faddin	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.

Table 10.--Building Site Development--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Fe---------------- Follet	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: excess salt, wetness, flooding.
FoB--------------- Fordtran	Severe: cutbanks cave.	Slight---------	Moderate: shrink-swell.	Slight---------	Slight---------	Moderate: droughty.
FrA--------------- Francitas	Severe: cutbanks cave, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
FuC--------------- Fulshear	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
GaB--------------- Galveston	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
Ha---------------- Harris	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: excess salt, wetness, droughty.
ImB--------------- Ijam	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: excess salt, wetness, too clayey.
KaB--------------- Katy	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
LaA, LaB, LaD2, LoA-------------- Laewest	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
LtA:						
Livco------------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: excess sodium.
Dacosta----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
LvA--------------- Livia	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: excess sodium, wetness.
MuA--------------- Mustang	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, droughty.
No---------------- Norwood	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.

Table 10.--Building Site Development--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
PaA--------------- Palacios	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: excess sodium, wetness.
Pc---------------- Placedo	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: excess salt, ponding, droughty.
Pe---------------- Pledger	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
Pg---------------- Pledger	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: too clayey.
RoB--------------- Riolomas	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: shrink-swell, flooding.	Moderate: droughty.
Sf---------------- Sumpf	Severe: cutbanks cave, ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, flooding, too clayey.
Sr---------------- Surfside	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: excess salt, wetness.
TfA--------------- Telferner	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
TxA, TxB---------- Texana	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
Ve---------------- Velasco	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: excess salt, wetness, droughty.
Vs---------------- Veston	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: excess salt, wetness, droughty.

Table 11.--Sanitary Facilities

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "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 but does not eliminate the need for onsite investigation.)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Aa, As: Asa	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Az: Asa	Severe: flooding.	Severe: flooding.	Severe: flooding, excess salt.	Severe: flooding.	Fair: too clayey, thin layer.
BaA: Bacliff	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Bb: Beaches	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Br: Brazoria	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
CeA: Cieno	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Cm: Clemville	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
DaA: Dacosta	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
EdA: Edna	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
EoA: Edna	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
ExA:					
Edna	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Cieno	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
FaA: Faddin	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.

Table 11.--Sanitary Facilities--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Fe------------------- Follet	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, excess salt.	Severe: flooding, wetness.	Poor: wetness, excess salt.
FoB----------------- Fordtran	Severe: percs slowly.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
FrA----------------- Francitas	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey, excess salt.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
FuC----------------- Fulshear	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
GaB----------------- Galveston	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
Ha------------------ Harris	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
ImB----------------- Ijam	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
KaB----------------- Katy	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey, thin layer.
LaA----------------- Laewest	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
LaB, LaD2----------- Laewest	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
LoA----------------- Laewest	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
LtA:					
Livco---------------	Severe: percs slowly.	Slight-----------	Severe: too clayey, excess sodium.	Slight-----------	Poor: too clayey, hard to pack, excess sodium.
Dacosta-------------	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
LvA----------------- Livia	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey, excess sodium.	Severe: wetness.	Poor: too clayey, hard to pack, excess sodium.

Table 11.--Sanitary Facilities--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MuA----------------- Mustang	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
No------------------ Norwood	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
PaA----------------- Palacios	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey, excess sodium.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Pc------------------ Placedo	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
Pe------------------ Pledger	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
Pg------------------ Pledger	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
RoB----------------- Riolomas	Severe: poor filter.	Severe: seepage.	Severe: cemented pan, seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Sf------------------ Sumpf	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
Sr------------------ Surfside	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
TfA----------------- Telferner	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
TxA----------------- Texana	Severe: percs slowly.	Moderate: seepage.	Severe: seepage.	Slight-----------	Fair: too clayey.
TxB----------------- Texana	Severe: percs slowly.	Moderate: seepage, slope.	Severe: seepage.	Slight-----------	Fair: too clayey.
Ve------------------ Velasco	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Vs------------------ Veston	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, excess salt.	Severe: flooding, wetness.	Poor: hard to pack, wetness, excess salt.

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 but does not eliminate the need for onsite investigation.)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Aa, As: Asa	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Az: Asa	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
BaA: Bacliff	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Bb: Beaches	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, excess salt, wetness.
Br: Brazoria	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CeA: Cieno	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Cm: Clemville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
DaA: Dacosta	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
EdA, EoA: Edna	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
ExA:				
Edna	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Cieno	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
FaA: Faddin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Fe: Follet	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
FoB: Fordtran	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, thin layer.
FrA: Francitas	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
FuC: Fulshear	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
GaB: Galveston	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Ha: Harris	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
ImB: Ijam	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
KaB: Katy	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LaA, LaB, LaD2, LoA: Laewest	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LtA:				
Livco	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess sodium.
Dacosta	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LvA: Livia	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
MuA: Mustang	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
No: Norwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
PaA: Palacios	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness, excess sodium.
Pc: Placedo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Pe, Pg: Pledger	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
RoB: Riolomas	Good	Probable	Improbable: too sandy.	Fair: too clayey, small stones, thin layer.
Sf: Sumpf	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Sr: Surfside	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
TfA: Telferner	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
TxA, TxB: Texana	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ve: Velasco	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
Vs: Veston	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.

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 but does not eliminate the need for onsite investigation.)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
Aa-Asa	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
As-Asa	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Az-Asa	Moderate: seepage.	Severe: excess salt.	Deep to water	Flooding, excess salt.	Erodes easily	Excess salt, erodes easily.
BaA-Bacliff	Slight	Severe: hard to pack, wetness.	Percs slowly	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Bb-Beaches	Severe: seepage.	Severe: seepage, wetness, excess salt.	Flooding, cutbanks cave, excess salt.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, excess salt, droughty.
Br-Brazoria	Slight	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Percs slowly	Droughty, percs slowly.
CeA-Cieno	Slight	Severe: ponding.	Ponding, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
Cm-Clemville	Slight	Moderate: hard to pack.	Deep to water	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
DaA-Dacosta	Slight	Moderate: hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
EdA-Edna	Slight	Severe: hard to pack.	Deep to water	Soil blowing, percs slowly.	Erodes easily, soil blowing, percs slowly.	Erodes easily, percs slowly.
EoA-Edna	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
ExA:						
Edna	Slight	Severe: hard to pack.	Deep to water	Soil blowing, percs slowly.	Erodes easily, soil blowing, percs slowly.	Erodes easily, percs slowly.
Cieno	Slight	Severe: ponding.	Ponding, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
FaA-Faddin	Slight	Severe: hard to pack.	Deep to water	Percs slowly	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Fe-Follet	Slight	Severe: wetness, excess salt.	Flooding, percs slowly, subsides.	Flooding, wetness, percs slowly.	Wetness, percs slowly, erodes easily.	Wetness, excess salt, erodes easily.

Table 13.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
FoB: Fordtran	Severe: seepage.	Moderate: hard to pack.	Deep to water	Droughty, fast intake.	Soil blowing, percs slowly.	Droughty, percs slowly.
FrA: Francitas	Slight	Severe: hard to pack, wetness, excess salt.	Percs slowly, excess salt.	Wetness, droughty, slow intake.	Wetness, percs slowly.	Wetness, droughty, percs slowly.
FuC: Fulshear	Moderate: seepage, slope.	Slight	Deep to water	Slope, soil blowing.	Soil blowing	Percs slowly.
GaB: Galveston	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Ha: Harris	Slight	Severe: hard to pack, wetness, excess salt.	Percs slowly, flooding, excess salt.	Wetness, droughty, slow intake.	Wetness, percs slowly.	Wetness, excess salt, droughty.
ImB: Ijam	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, slow intake.	Wetness, percs slowly.	Wetness, excess salt.
KaB: Katy	Moderate: seepage.	Slight	Deep to water	Soil blowing, percs slowly.	Erodes easily, soil blowing, percs slowly.	Erodes easily, percs slowly.
LaA, LaB: Laewest	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
LaD2: Laewest	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, slow intake, percs slowly.	Percs slowly	Percs slowly.
LoA: Laewest	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
LtA:						
Livco	Slight	Severe: excess sodium.	Deep to water	Droughty, soil blowing, percs slowly.	Erodes easily, soil blowing, percs slowly.	Excess sodium, erodes easily, droughty.
Dacosta	Slight	Moderate: hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
LvA: Livia	Slight	Severe: wetness, excess sodium.	Percs slowly, excess salt.	Wetness, droughty, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, excess sodium, erodes easily.
MuA: Mustang	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
No: Norwood	Moderate: seepage.	Severe: thin layer.	Deep to water	Favorable	Erodes easily	Erodes easily.

Table 13.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
PaA: Palacios	Slight	Severe: hard to pack, wetness, excess sodium.	Percs slowly, excess salt, excess sodium.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, excess sodium, erodes easily.
Pc: Placedo	Slight	Severe: hard to pack, ponding, excess salt.	Ponding, percs slowly, flooding.	Ponding, droughty, slow intake.	Erodes easily, ponding, percs slowly.	Wetness, excess salt, erodes easily.
Pe: Pledger	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
Pg: Pledger	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, flooding.	Percs slowly	Percs slowly.
RoB: Riolomas	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
Sf: Sumpf	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
Sr: Surfside	Slight	Severe: hard to pack, wetness, excess salt.	Percs slowly, flooding, excess salt.	Wetness, slow intake.	Wetness, percs slowly.	Wetness, excess salt.
TfA: Telferner	Slight	Moderate: hard to pack.	Deep to water	Soil blowing, percs slowly.	Erodes easily, soil blowing, percs slowly.	Erodes easily, percs slowly.
TxA, TxB: Texana	Slight	Moderate: thin layer.	Deep to water	Soil blowing, percs slowly, erodes easily.	Erodes easily, soil blowing, percs slowly.	Erodes easily, percs slowly.
Ve: Velasco	Slight	Severe: hard to pack, wetness, excess salt.	Percs slowly, flooding, excess salt.	Wetness, slow intake.	Wetness, percs slowly.	Wetness, excess salt.
Vs: Veston	Moderate: seepage.	Severe: wetness, excess salt.	Percs slowly, flooding, excess salt.	Wetness, droughty, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, excess salt, erodes easily.

Table 14.--Engineering Index Properties

(The symbol < means less than. Absence of an entry indicates that data were not estimated.)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				*Pct*					*Pct*	
Aa-------------- Asa	0-5	Silt loam--------	CL	A-6, A-4	0	98-100	98-100	90-100	70-100	28-35	9-15
	5-46	Silty clay loam, silt loam.	CL	A-6, A-4, A-7-6	0	98-100	98-100	90-100	70-100	28-42	9-20
	46-75	Very fine sandy loam, loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	98-100	98-100	85-100	60-100	20-42	6-25
As-------------- Asa	0-14	Silty clay loam	CL	A-6, A-7	0	98-100	98-100	95-100	85-100	32-42	15-25
	14-45	Silty clay loam, silt loam.	CL	A-6, A-4, A-7-6	0	98-100	98-100	90-100	70-100	28-42	9-20
	45-61	Very fine sandy loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	98-100	98-100	85-100	60-100	20-42	6-25
	61-80	Silt loam, silty clay loam.	CL	A-6, A-4, A-7-6	0	98-100	98-100	90-100	70-100	28-42	9-22
Az-------------- Asa	0-12	Silty clay loam	CL	A-6, A-7	0	98-100	98-100	95-100	85-100	32-42	15-25
	12-45	Silty clay loam, silt loam.	CL	A-6, A-4, A-7-6	0	98-100	98-100	90-100	70-100	28-42	9-20
	45-61	Very fine sandy loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	98-100	98-100	85-100	60-100	20-42	6-25
	61-80	Silt loam, silty clay loam.	CL	A-6, A-4, A-7-6	0	98-100	98-100	90-100	70-100	28-42	9-22
BaA------------- Bacliff	0-38	Clay-------------	CH	A-7	0	100	85-100	65-75	60-70	55-65	35-45
	38-80	Clay, silty clay	CH	A-7	0	100	90-100	70-80	65-75	60-85	35-60
Bb-------------- Beaches	0-60	Fine sand, sand	SP-SM	A-2-4, A-3	0	95-100	95-100	85-100	5-12	<25	NP
Br-------------- Brazoria	0-12	Clay-------------	CH	A-7	0	98-100	98-100	95-100	95-100	60-80	35-52
	12-80	Clay-------------	CH	A-7	0	98-100	98-100	95-100	95-100	60-80	35-52
CeA------------- Cieno	0-12	Sandy clay loam	CL	A-6	0	98-100	95-100	85-100	51-70	28-40	15-25
	12-65	Sandy clay loam, clay loam, sandy clay.	CL	A-6, A-7-6	0	98-100	95-100	90-100	59-85	32-48	20-30
	65-80	Sandy clay loam, clay loam, fine sandy loam.	CL, SC	A-6, A-7-6	0	98-100	95-100	85-100	40-70	28-45	15-28
Cm-------------- Clemville	0-9	Silty clay loam	CL, CL-ML	A-6, A-4, A-7-6	0	98-100	98-100	95-100	70-95	25-45	6-25
	9-33	Silt loam, silty clay loam.	CL	A-6	0	98-100	98-100	95-100	70-95	30-40	10-20
	33-80	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	98-100	98-100	95-100	85-100	41-70	22-50
DaA------------- Dacosta	0-9	Sandy clay loam	CL, SC	A-6, A-7	0	95-100	90-100	90-100	43-70	30-45	16-25
	9-36	Clay, clay loam, sandy clay.	CH, CL	A-7-6	0	95-100	90-100	90-100	50-80	42-65	26-40
	36-60	Sandy clay loam, sandy clay, clay loam.	CL, CH, SC	A-7-6	0	95-100	90-100	85-100	45-75	40-60	25-40

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				*Pct*					*Pct*	
EdA-------------- Edna	0-6	Fine sandy loam	SM, SC-SM, ML, SC	A-4, A-6	0	100	95-100	80-100	36-66	20-32	3-15
	6-25	Clay, clay loam	CH	A-7	0	100	98-100	90-100	60-80	50-72	28-46
	25-58	Clay, clay loam	CL, CH	A-7	0	100	98-100	80-100	70-80	41-60	20-36
	58-80	Clay, clay loam, sandy clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	80-100	55-80	30-60	13-35
EoA-------------- Edna	0-11	Silty clay-------	CH, CL	A-7	0	100	100	95-100	90-100	41-70	25-50
	11-19	Fine sandy loam, very fine sandy loam.	SM, SC-SM, ML, SC	A-4, A-6	0	100	95-100	80-100	36-66	20-32	3-15
	19-30	Clay, clay loam	CH	A-7	0	100	98-100	90-100	60-80	50-72	28-46
	30-58	Clay, clay loam	CL, CH	A-7	0	100	98-100	80-100	70-80	41-60	20-36
	58-80	Clay, clay loam, sandy clay loam, sandy clay.	CL, CH	A-7, A-6	0	98-100	98-100	80-100	55-80	30-60	13-35
ExA:											
Edna------------	0-8	Fine sandy loam	SM, SC-SM, ML, SC	A-4, A-6	0	100	95-100	80-100	36-66	20-32	3-15
	8-33	Clay, clay loam, sandy clay.	CH	A-7	0	100	98-100	90-100	60-80	50-72	28-46
	33-70	Clay, clay loam, sandy clay loam.	CL, CH	A-7	0	100	98-100	80-100	70-80	41-60	20-36
	70-80	Clay, clay loam, sandy clay loam, sandy loam.	CL, CH	A-7, A-6	0	98-100	98-100	80-100	55-80	30-60	13-35
Cieno-----------	0-12	Sandy clay loam	CL	A-6	0	98-100	95-100	85-100	51-70	28-40	15-25
	12-65	Sandy clay loam, clay loam, sandy clay.	CL	A-6, A-7-6	0	98-100	95-100	90-100	59-85	32-48	20-30
	65-80	Sandy clay loam, clay loam, fine sandy loam.	CL, SC	A-6, A-7-6	0	98-100	95-100	85-100	40-70	28-45	15-28
FaA-------------- Faddin	0-14	Loam-------------	CL, CL-ML	A-4, A-6	0	98-100	98-100	90-100	50-75	21-30	5-12
	14-61	Clay loam, sandy clay, clay.	CL, CH	A-7-6	0	100	98-100	90-100	55-75	41-66	25-45
	61-80	Sandy clay loam, clay loam, sandy clay, clay.	CL, SC	A-7-6	0-1	95-100	90-100	85-100	45-70	40-49	25-33
Fe--------------- Follet	0-12	Loam-------------	SC, CL, CL-ML, SC-SM	A-4, A-6	0	100	100	70-100	40-85	20-40	5-20
	12-80	Stratified silty clay loam to loam.	CL	A-4, A-6, A-7-6	0	100	100	85-100	51-85	28-44	9-21
FoB-------------- Fordtran	0-21	Loamy fine sand	SM, SC-SM	A-2-4	0	95-100	90-100	60-95	13-30	<25	NP-6
	21-29	Loamy fine sand	SM, SC-SM	A-2-4	0	95-100	95-100	75-100	13-30	<25	NP-6
	29-58	Sandy clay, clay, clay loam.	CH, CL	A-7	0	95-100	95-100	70-100	51-90	41-55	20-30
	58-80	Sandy clay loam, clay loam, fine sandy loam.	CL, SC, CH	A-6, A-7	0	95-100	90-100	70-100	36-95	30-60	12-35
FrA-------------- Francitas	0-6	Clay-------------	CH	A-7-6	0	100	100	95-100	80-95	51-65	30-40
	6-55	Clay, silty clay	CH	A-7-6	0	98-100	95-100	95-100	80-95	60-90	40-65
	55-80	Clay, silty clay, silty clay loam.	CH	A-7-6	0	98-100	95-100	95-100	80-95	60-90	40-65

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				*Pct*					*Pct*	
FuC-------------- Fulshear	0-8	Fine sandy loam	SC-SM, SC	A-2-4, A-4	0	95-100	95-100	90-100	25-50	20-30	4-10
	8-12	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	0	95-100	95-100	90-100	40-55	34-44	14-22
	12-31	Sandy clay, clay loam, sandy clay loam.	CL, SC, CH	A-7-6, A-6, A-7	0	95-100	90-100	85-100	45-70	37-56	21-33
	31-80	Sandy clay loam, clay loam, fine sandy loam.	SC	A-6	0	90-100	75-95	70-90	36-50	30-40	11-20
GaB-------------- Galveston	0-6	Fine sand--------	SP-SM, SM, SP	A-3, A-2-4	0	100	96-100	65-90	2-20	<30	NP-3
	6-80	Fine sand, sand	SP-SM, SP	A-3, A-2-4	0	100	96-100	65-90	2-10	<30	NP-3
Ha--------------- Harris	0-24	Clay-------------	CH	A-7	0	98-100	85-95	70-95	70-95	65-80	40-55
	24-59	Clay, silty clay	CH	A-7	0	98-100	94-100	90-100	80-90	60-75	40-55
	59-80	Silty clay, clay	CH	A-7	0	98-100	98-100	90-100	85-95	60-78	40-55
ImB-------------- Ijam	0-6	Clay-------------	CH, CL	A-7	0	98-100	90-100	90-99	70-95	45-80	25-55
	6-80	Clay, sandy clay	CH	A-7	0	100	90-100	90-100	80-98	60-85	35-55
KaB-------------- Katy	0-17	Fine sandy loam	ML, SM	A-4	0	98-100	98-100	98-100	38-60	<22	NP-3
	17-22	Fine sandy loam, sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	98-100	98-100	98-100	38-70	<22	NP-7
	22-44	Clay loam, sandy clay, sandy clay loam.	CL	A-6, A-7	0	100	98-100	96-100	55-75	33-48	18-30
	44-80	Clay loam, clay, sandy clay loam.	CL, CH	A-6, A-7	0	100	100	98-100	55-75	35-53	18-35
LaA-------------- Laewest	0-10	Clay-------------	CH	A-7	0	98-100	98-100	90-100	75-90	59-78	41-59
	10-68	Clay, silty clay	CH	A-7	0	98-100	98-100	90-100	75-90	59-78	41-59
	68-80	Clay, clay loam, silty clay.	CH	A-7	0	94-100	94-100	90-100	75-90	59-78	41-59
LaB-------------- Laewest	0-5	Clay-------------	CH	A-7	0	98-100	98-100	90-100	75-90	59-78	41-59
	5-54	Clay-------------	CH	A-7	0	98-100	98-100	90-100	75-90	59-78	41-59
	54-80	Clay, clay loam, loam.	CH, CL	A-7, A-6	0	94-100	94-100	90-100	75-90	35-78	18-59
LaD2------------- Laewest	0-12	Clay-------------	CH	A-7	0	98-100	98-100	90-100	75-90	59-78	41-59
	12-47	Clay-------------	CH	A-7	0	98-100	98-100	90-100	75-90	59-78	41-59
	47-60	Clay, clay loam	CH	A-7	0	94-100	94-100	90-100	75-90	59-78	41-59
LoA-------------- Laewest	0-12	Clay-------------	CH	A-7	0	98-100	98-100	90-100	75-90	59-78	41-59
	12-48	Clay-------------	CH	A-7	0	98-100	98-100	90-100	75-90	59-78	41-59
	48-80	Clay, clay loam, silty clay.	CH	A-7	0	94-100	94-100	90-100	75-90	59-78	41-59
LtA:											
Livco-----------	0-7	Fine sandy loam	ML, CL, CL-ML	A-4	0	100	100	95-100	65-90	20-30	NP-10
	7-35	Clay loam, clay	CH	A-7-6	0	100	100	95-100	75-98	51-70	30-45
	35-80	Clay loam, sandy clay loam, silty clay loam.	CH, CL	A-7-6	0	95-100	90-100	90-100	80-98	48-80	29-57

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
LtA:											
Dacosta	0-8	Sandy clay loam	CL, SC	A-6, A-7	0	95-100	90-100	90-100	43-70	30-45	16-25
	8-39	Clay, clay loam, sandy clay.	CH, CL	A-7-6	0	95-100	90-100	90-100	50-80	42-65	26-40
	39-80	Sandy clay loam, sandy clay, clay loam.	CL, CH, SC	A-7-6	0	95-100	90-100	85-100	45-75	40-60	25-40
LvA Livia	0-6	Loam	ML, CL, CL-ML	A-4	0	100	100	95-100	65-95	20-30	NP-10
	6-47	Silty clay, clay, clay loam.	CH	A-7-6	0	100	100	95-100	75-98	51-70	30-45
	47-61	Silty clay, clay, silty clay loam.	CH	A-7-6	0	95-100	90-100	90-100	80-98	51-70	30-45
	61-80	Silty clay loam, silty clay, clay loam, clay.	CH, CL	A-7-6	0	95-100	90-100	90-100	75-95	45-64	25-40
MuA Mustang	0-10	Fine sand	SW-SM, SP-SM, SP	A-2-4, A-3	0-3	85-100	80-100	60-80	2-12	<30	NP-3
	10-80	Fine sand, sand	SW-SM, SP-SM, SP	A-2-4, A-3	0-3	85-100	80-100	60-80	2-12	<30	NP-3
No Norwood	0-4	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	85-98	30-55	15-35
	4-34	Silt loam, silty clay loam.	CL	A-6, A-7, A-4	0	100	100	90-100	60-98	25-46	7-26
	34-80	Silt loam, silty clay loam.	CL, ML, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-98	20-45	2-25
PaA Palacios	0-5	Loam	CL, CL-ML	A-4, A-6	0	98-100	98-100	90-100	60-80	20-30	4-12
	5-25	Silty clay, clay, clay loam.	CH	A-7-6	0	95-100	90-100	90-100	75-95	51-70	30-45
	25-40	Silty clay, clay, clay loam.	CH	A-7-6	0	95-100	90-100	90-100	75-95	51-70	30-45
	40-80	Clay, silty clay, silty clay loam.	CL, CH	A-7-6	0	95-100	85-100	85-100	80-100	41-70	25-45
Pc Placedo	0-14	Silty clay	CL, CH	A-7-6	0	100	98-100	95-100	85-100	40-60	25-41
	14-31	Clay, silty clay, silty clay loam.	CH, CL	A-7-6	0	100	98-100	95-100	85-100	45-70	25-45
	31-62	Stratified clay to fine sandy loam.	CL, CH	A-6, A-7-6	0	100	98-100	95-100	75-100	35-60	20-40
Pe Pledger	0-18	Clay	CH	A-7-6, A-7-5	0	100	100	90-100	75-100	60-96	35-65
	18-62	Clay	CH	A-7-6	0	100	100	95-100	85-100	65-96	40-71
	62-80	Clay, silty clay	CH	A-7-6	0	100	100	95-100	85-100	65-96	40-71
Pg Pledger	0-12	Clay	CH	A-7-6, A-7-5	0	100	100	90-100	75-100	60-96	35-65
	12-55	Clay	CH	A-7-6	0	100	100	95-100	85-100	65-96	40-71
	55-80	Clay, silty clay	CH	A-7-6	0	100	100	95-100	85-100	65-96	40-71
RoB Riolomas	0-8	Fine sand	SP-SM, SM	A-3, A-2-4	0	90-100	85-100	75-90	9-30	<25	NP-3
	8-26	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	85-100	85-100	80-100	35-65	25-40	8-18
	26-80	Fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	90-100	90-100	65-90	9-30	<25	NP-3

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Sf-------------- Sumpf	0-5	Clay------------	CH	A-7	0	98-100	98-100	95-100	95-100	55-80	35-55
	5-41	Clay------------	CH	A-7	0	98-100	98-100	95-100	95-100	55-80	35-55
	41-80	Stratified clay to fine sandy loam.	CH, CL, CL-ML, SC-SM	A-7, A-6, A-4	0	98-100	98-100	70-100	40-100	18-80	4-55
Sr-------------- Surfside	0-26	Clay------------	CH	A-7	0	98-100	98-100	95-100	90-100	51-90	28-60
	26-80	Clay------------	CH	A-7	0	98-100	98-100	95-100	90-100	60-95	35-70
TfA------------- Telferner	0-18	Very fine sandy loam.	CL, SC, CL-ML, SC-SM	A-4	0	90-100	90-100	80-100	40-60	20-30	5-10
	18-41	Sandy clay, clay	CH	A-7-6	0	90-100	90-100	90-100	55-85	51-65	30-40
	41-80	Sandy clay loam, clay loam, sandy clay.	CL	A-6, A-7	0	90-100	90-100	85-100	50-75	30-50	15-32
TxA------------- Texana	0-20	Fine sandy loam	SM, SC-SM	A-4	0	98-100	98-100	90-100	36-49	<25	NP-7
	20-42	Clay, sandy clay	CL, CH	A-7-6	0	98-100	98-100	90-100	55-75	41-66	25-45
	42-80	Sandy clay loam, clay loam, silty clay loam, silty clay.	CL	A-7-6	0-1	95-100	90-100	85-100	51-70	40-49	25-33
TxB------------- Texana	0-12	Fine sandy loam	SM, SC-SM	A-4	0	98-100	98-100	90-100	36-49	<25	NP-7
	12-64	Clay, sandy clay	CL, CH	A-7-6	0	98-100	98-100	90-100	55-75	41-66	25-45
	64-80	Sandy clay loam, clay loam, sandy clay.	CL	A-7-6	0-1	95-100	90-100	85-100	51-70	40-49	25-33
Ve-------------- Velasco	0-12	Clay------------	CH	A-7	0	100	100	95-100	95-100	60-90	40-70
	12-65	Clay------------	CH	A-7	0	100	100	95-100	95-100	60-90	40-70
Vs-------------- Veston	0-5	Loam------------	ML, CL-ML, CL	A-4, A-6	0	98-100	98-100	80-100	51-85	18-30	3-15
	5-56	Stratified silt loam to fine sandy loam.	CL-ML, CL	A-4, A-6	0	98-100	98-100	85-100	60-85	20-30	5-15
	56-72	Stratified silty clay loam to fine sandy loam.	CL, CH	A-6, A-7-6	0	98-100	98-100	90-100	80-95	35-55	17-35

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 "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated.)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Aa---------------	0-5	18-27	1.20-1.45	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate	0.43	5	4L	1-3
Asa	5-46	18-35	1.25-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
	46-75	10-30	1.25-1.50	0.6-2.0	0.15-0.22	7.9-8.4	<2	Moderate	0.43			
As---------------	0-14	27-35	1.20-1.45	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.32	5	4L	1-3
Asa	14-45	18-35	1.25-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
	45-61	10-30	1.25-1.50	0.6-2.0	0.15-0.22	7.9-8.4	<2	Moderate	0.43			
	61-80	18-35	1.25-1.50	0.6-2.0	0.17-0.22	7.9-8.4	<2	Moderate	0.43			
Az---------------	0-12	27-35	1.20-1.45	0.6-2.0	0.16-0.20	6.6-8.4	2-8	Moderate	0.32	5	4L	1-3
Asa	12-45	18-35	1.25-1.50	0.6-2.0	0.11-0.16	7.4-8.4	8-16	Moderate	0.43			
	45-61	10-30	1.25-1.50	0.6-2.0	0.06-0.14	7.9-8.4	16-32	Moderate	0.43			
	61-80	18-35	1.25-1.50	0.6-2.0	0.06-0.14	7.9-8.4	16-32	Moderate	0.43			
BaA--------------	0-38	45-60	1.30-1.40	0.06-0.2	0.15-0.20	5.6-7.8	0-0	High------	0.32	5	4	1-4
Bacliff	38-80	40-60	1.30-1.50	0.00-0.06	0.15-0.20	5.6-8.4	0-0	High------	0.32			
Bb---------------	0-60	0-3	1.35-1.50	>20	0.0-0.02	7.4-9.0	>16	Low-------	0.15	5	1	<1
Beaches												
Br---------------	0-12	55-80	1.15-1.40	<0.06	0.08-0.18	7.4-8.4	0-2	Very high	0.32	5	4	2-6
Brazoria	12-80	60-80	1.20-1.50	<0.06	0.08-0.15	7.4-8.4	2-4	Very high	0.32			
CeA--------------	0-12	20-30	1.40-1.60	0.2-0.6	0.12-0.18	5.1-7.3	0-2	Moderate	0.32	5	5	1-3
Cieno	12-65	24-35	1.40-1.65	0.00-0.06	0.12-0.18	5.1-7.8	0-2	Moderate	0.32			
	65-80	16-30	1.40-1.65	0.06-0.2	0.12-0.18	6.1-8.4	0-2	Moderate	0.32			
Cm---------------	0-9	27-35	1.25-1.40	0.2-0.6	0.17-0.22	7.4-8.4	<2	Low-------	0.43	5	5	<1
Clemville	9-33	20-30	1.30-1.45	0.2-0.6	0.17-0.22	7.4-8.4	<2	Low-------	0.43			
	33-80	35-50	1.35-1.55	0.06-0.2	0.14-0.20	6.6-8.4	<2	High------	0.37			
DaA--------------	0-9	20-30	1.35-1.65	0.2-0.6	0.15-0.20	6.1-7.3	0-4	Moderate	0.32	5	6	1-3
Dacosta	9-36	35-55	1.40-1.60	<0.06	0.13-0.16	6.1-8.4	0-4	High------	0.32			
	36-60	25-45	1.40-1.65	<0.06	0.13-0.15	6.6-8.4	2-4	High------	0.32			
EdA--------------	0-6	4-15	1.40-1.60	0.6-2.0	0.10-0.15	5.1-7.3	<2	Low-------	0.37	5	3	.5-3
Edna	6-25	35-55	1.35-1.55	<0.06	0.12-0.17	5.6-7.3	<2	High------	0.32			
	25-58	35-55	1.35-1.55	<0.06	0.12-0.17	6.6-8.4	<2	High------	0.32			
	58-80	30-55	1.40-1.65	<0.06	0.12-0.17	6.6-8.4	<2	High------	0.32			
EoA--------------	0-11	40-60	1.35-1.50	<0.06	0.14-0.19	7.4-8.4	<2	High------	0.32	5	4	.5-2
Edna	11-19	4-15	1.40-1.60	0.6-2.0	0.10-0.15	5.1-7.3	<2	Low-------	0.37			
	19-30	35-55	1.35-1.55	<0.06	0.15-0.20	5.6-7.3	<2	High------	0.32			
	30-58	35-55	1.35-1.55	<0.06	0.15-0.20	6.6-8.4	<2	High------	0.32			
	58-80	30-55	1.30-1.60	<0.06	0.15-0.20	6.6-8.4	<2	High------	0.32			
ExA:												
Edna------------	0-8	4-15	1.40-1.60	0.6-2.0	0.10-0.15	5.1-7.3	<2	Low-------	0.37	5	3	.5-3
	8-33	35-55	1.35-1.55	<0.06	0.12-0.17	5.6-7.3	<2	High------	0.32			
	33-70	35-55	1.35-1.55	<0.06	0.12-0.17	6.6-8.4	<2	High------	0.32			
	70-80	30-55	1.40-1.65	<0.06	0.12-0.17	6.6-8.4	<2	High------	0.32			
Cieno-----------	0-12	20-30	1.40-1.60	0.2-0.6	0.12-0.18	6.1-7.3	0-2	Moderate	0.32	5	5	1-3
	12-65	24-35	1.40-1.65	0.00-0.06	0.12-0.18	6.1-7.8	0-2	Moderate	0.32			
	65-80	16-30	1.40-1.65	0.06-0.2	0.12-0.18	6.1-8.4	0-2	Moderate	0.32			

Table 15.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	*Pct*	*g/cc*	*In/hr*	*In/in*	*pH*	*mmhos/cm*					*Pct*
FaA--------------	0-14	8-20	1.30-1.50	0.6-2.0	0.15-0.18	6.1-7.3	<2	Low-------	0.43	5	5	1-3
Faddin	14-61	35-57	1.35-1.60	<0.06	0.14-0.19	6.1-8.4	<2	High------	0.32			
	61-80	30-45	1.45-1.70	0.06-0.2	0.14-0.18	6.6-8.4	<2	Moderate	0.32			
Fe---------------	0-12	15-27	1.10-1.30	<0.06	0.01-0.03	6.6-8.4	>16	Moderate	0.43	5	8	1-10
Follet	12-80	18-35	1.10-1.40	<0.06	0.01-0.03	6.6-8.4	>16	Moderate	0.43			
FoB--------------	0-21	5-12	1.45-1.65	2.0-6.0	0.06-0.10	5.1-6.5	0-2	Low-------	0.24	5	2	<1
Fordtran	21-29	5-12	1.40-1.65	2.0-6.0	0.06-0.10	5.1-6.5	0-2	Low-------	0.24			
	29-58	35-50	1.35-1.60	<0.06	0.12-0.16	5.1-7.8	0-2	Moderate	0.32			
	58-80	15-40	1.45-1.65	0.2-0.6	0.10-0.15	6.1-8.4	0-2	Moderate	0.32			
FrA--------------	0-6	40-50	1.30-1.50	0.00-0.06	0.10-0.18	7.4-8.4	1-4	High------	0.32	5	4	.5-2
Francitas	6-55	40-60	1.30-1.50	0.00-0.06	0.06-0.12	7.4-8.4	4-25	Very high	0.32			
	55-80	35-60	1.30-1.50	0.00-0.06	0.06-0.12	7.9-8.4	8-25	Very high	0.32			
FuC--------------	0-8	8-20	1.30-1.50	2.0-6.0	0.11-0.15	5.6-7.3	0-2	Low-------	0.32	5	3	.3-1
Fulshear	8-12	25-35	1.40-1.60	0.06-0.6	0.12-0.19	5.6-7.3	0-2	Moderate	0.28			
	12-31	28-40	1.40-1.60	0.06-0.2	0.13-0.18	5.6-8.4	0-2	Moderate	0.28			
	31-80	15-35	1.40-1.60	0.6-2.0	0.12-0.17	7.4-8.4	0-2	Moderate	0.28			
GaB--------------	0-6	2-8	1.50-1.70	6.0-20	0.05-0.10	5.6-8.4	<4	Low-------	0.15	5	1	<.5
Galveston	6-80	2-8	1.50-1.70	6.0-20	0.05-0.10	5.6-8.4	<4	Low-------	0.15			
Ha---------------	0-24	40-60	1.10-1.30	0.06-0.2	0.02-0.20	7.4-9.0	16-32	High------	0.20	5	8	2-15
Harris	24-59	40-60	1.10-1.30	0.00-0.06	0.01-0.10	7.4-9.0	16-32	High------	0.32			
	59-80	40-60	1.10-1.30	0.00-0.06	0.01-0.10	7.4-9.0	16-32	High------	0.32			
ImB--------------	0-6	40-50	1.30-1.50	0.00-0.06	0.10-0.12	7.4-9.0	4-16	High------	0.32	5	4	.5-1
Ijam	6-80	40-55	1.30-1.50	0.00-0.06	0.10-0.12	7.4-9.0	4-16	High------	0.32			
KaB--------------	0-17	5-15	1.30-1.50	0.6-2.0	0.15-0.20	5.6-6.5	<2	Low-------	0.37	5	3	<2
Katy	17-22	5-15	1.30-1.50	0.6-2.0	0.15-0.20	5.6-6.5	<2	Low-------	0.37			
	22-44	25-35	1.50-1.70	0.06-0.2	0.12-0.18	6.1-7.8	<2	Moderate	0.32			
	44-80	30-40	1.50-1.70	0.2-0.6	0.12-0.18	6.1-7.8	<2	Moderate	0.32			
LaA--------------	0-10	45-60	1.15-1.35	<0.06	0.12-0.18	6.1-7.8	0-2	Very high	0.32	5	4	2-5
Laewest	10-68	45-60	1.25-1.40	<0.06	0.12-0.18	6.1-7.8	0-2	Very high	0.32			
	68-80	35-60	1.30-1.45	<0.06	0.12-0.18	7.4-8.4	0-2	Very high	0.32			
LaB--------------	0-5	45-60	1.15-1.35	<0.06	0.12-0.18	6.1-7.8	0-2	Very high	0.32	5	4	2-5
Laewest	5-54	45-60	1.25-1.40	<0.06	0.12-0.18	6.1-7.8	0-2	Very high	0.32			
	54-80	25-60	1.30-1.45	<0.06	0.12-0.18	7.4-8.4	0-2	Very high	0.32			
LaD2-------------	0-12	45-60	1.15-1.35	<0.06	0.12-0.18	6.1-7.8	0-2	Very high	0.32	5	4	2-5
Laewest	12-47	45-60	1.25-1.40	<0.06	0.12-0.18	6.1-7.8	0-2	Very high	0.32			
	47-60	35-60	1.30-1.45	<0.06	0.12-0.18	7.9-8.4	0-2	Very high	0.32			
LoA--------------	0-12	45-60	1.15-1.35	<0.06	0.12-0.18	6.1-7.8	0-2	Very high	0.32	5	4	2-5
Laewest	12-48	45-60	1.25-1.40	<0.06	0.12-0.18	6.1-7.8	0-2	Very high	0.32			
	48-80	35-60	1.30-1.45	<0.06	0.12-0.18	7.9-8.4	0-2	Very high	0.32			
LtA:												
Livco-----------	0-7	5-20	1.45-1.65	0.6-2.0	0.12-0.16	6.1-7.8	0-2	Low-------	0.37	3	3	1-2
	7-35	35-45	1.25-1.45	<0.06	0.10-0.17	7.4-8.4	2-8	High------	0.32			
	35-80	25-40	1.50-1.70	<0.06	0.04-0.10	7.4-8.4	4-16	High------	0.32			
Dacosta---------	0-8	20-30	1.35-1.65	0.2-0.6	0.15-0.20	6.1-7.3	0-4	Moderate	0.32	5	6	1-3
	8-39	35-55	1.40-1.60	<0.06	0.13-0.16	6.1-8.4	0-4	High------	0.32			
	39-80	25-45	1.40-1.65	<0.06	0.13-0.15	6.6-8.4	2-4	High------	0.32			

Table 15.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	*Pct*	*g/cc*	*In/hr*	*In/in*	*pH*	*mmhos/cm*					*Pct*
LvA---------------	0-6	6-20	1.45-1.65	0.6-2.0	0.14-0.18	6.1-7.8	<2	Low--------	0.49	2	6	1-2
Livia	6-47	35-50	1.25-1.55	<0.06	0.12-0.17	7.4-8.4	2-8	High-------	0.32			
	47-61	35-50	1.40-1.60	<0.06	0.06-0.12	7.4-8.4	4-16	High-------	0.32			
	61-80	30-45	1.45-1.70	<0.06	0.06-0.12	7.4-8.4	4-16	High-------	0.32			
MuA---------------	0-10	2-8	1.40-1.60	6.0-20	0.01-0.07	6.6-8.4	0-4	Low--------	0.15	5	1	<1
Mustang	10-80	2-8	1.40-1.60	6.0-20	0.01-0.06	6.6-8.4	0-8	Low--------	0.15			
No----------------	0-4	27-40	1.30-1.50	0.6-2.0	0.18-0.22	7.4-8.4	0-2	Moderate	0.32	5	6	.5-2
Norwood	4-34	18-35	1.40-1.60	0.6-2.0	0.15-0.22	7.9-8.4	0-2	Low--------	0.43			
	34-80	10-35	1.40-1.60	0.6-2.0	0.15-0.22	7.9-8.4	0-2	Low--------	0.43			
PaA---------------	0-5	10-27	1.45-1.65	0.6-2.0	0.14-0.18	6.1-7.8	0-2	Low--------	0.49	2	4	1-2
Palacios	5-25	35-50	1.30-1.60	<0.06	0.12-0.16	7.4-8.4	2-8	High-------	0.32			
	25-40	35-50	1.25-1.55	<0.06	0.06-0.12	7.4-8.4	4-16	High-------	0.32			
	40-80	30-50	1.30-1.55	0.06-0.2	0.06-0.12	7.4-8.4	4-16	High-------	0.32			
Pc----------------	0-14	40-50	1.10-1.30	<0.06	0.06-0.14	7.4-8.4	8-16	High-------	0.32	5	8	1-10
Placedo	14-31	35-55	1.10-1.40	<0.06	0.04-0.10	7.4-8.4	16-32	High-------	0.32			
	31-62	20-50	1.10-1.40	<0.06	0.04-0.10	7.4-8.4	16-32	Moderate	0.37			
Pe----------------	0-18	40-80	1.20-1.40	0.06-0.2	0.11-0.16	7.4-8.4	0-2	High-------	0.32	5	4	1-3
Pledger	18-62	60-80	1.25-1.45	<0.06	0.11-0.16	7.4-8.4	0-2	Very high	0.32			
	62-80	40-80	1.25-1.45	<0.06	0.11-0.16	7.4-8.4	0-2	Very high	0.32			
Pg----------------	0-12	40-80	1.20-1.40	0.06-0.2	0.11-0.16	7.4-8.4	0-2	High-------	0.32	5	4	1-3
Pledger	12-55	60-80	1.25-1.45	<0.06	0.11-0.16	7.4-8.4	0-2	Very high	0.32			
	55-80	40-80	1.25-1.45	<0.06	0.11-0.16	7.4-8.4	0-2	Very high	0.32			
RoB---------------	0-8	2-12	1.40-1.60	6.0-20	0.05-0.10	7.4-8.4	<2	Low--------	0.17	4	1	<.5
Riolomas	8-26	18-25	1.35-1.60	0.6-2.0	0.12-0.16	7.4-8.4	<2	Moderate	0.32			
	26-80	2-12	1.40-1.60	6.0-20	0.05-0.10	7.4-8.4	<2	Low--------	0.17			
Sf----------------	0-5	60-80	1.25-1.45	<0.06	0.12-0.18	7.4-8.4	0-2	High-------	0.32	5	8	1-4
Sumpf	5-41	60-80	1.25-1.45	<0.06	0.12-0.16	7.4-8.4	0-2	High-------	0.32			
	41-80	10-80	1.30-1.50	0.06-0.2	0.10-0.16	7.4-8.4	0-2	High-------	0.32			
Sr----------------	0-26	40-70	1.20-1.40	<0.06	0.05-0.10	6.6-8.4	4-16	High-------	0.32	5	4	2-10
Surfside	26-80	60-80	1.25-1.45	<0.06	0.01-0.10	7.4-8.4	>16	High-------	0.32			
TfA---------------	0-18	8-18	1.45-1.60	0.6-2.0	0.10-0.15	5.6-7.3	0-2	Low--------	0.43	5	3	.5-1
Telferner	18-41	35-50	1.35-1.65	<0.06	0.12-0.17	5.6-8.4	0-2	High-------	0.32			
	41-80	20-40	1.35-1.65	0.06-0.2	0.12-0.15	7.4-8.4	0-2	Moderate	0.32			
TxA---------------	0-20	2-17	1.40-1.60	0.6-2.0	0.11-0.17	5.1-7.3	<2	Low--------	0.43	5	3	1-3
Texana	20-42	35-45	1.35-1.60	<0.06	0.14-0.19	6.1-8.4	<2	High-------	0.32			
	42-80	25-40	1.25-1.50	0.06-0.2	0.14-0.18	6.1-8.4	<2	Moderate	0.32			
TxB---------------	0-12	2-17	1.40-1.60	0.6-2.0	0.11-0.17	5.1-7.3	<2	Low--------	0.43	5	3	1-3
Texana	12-64	35-45	1.35-1.60	<0.06	0.14-0.19	6.1-8.4	<2	High-------	0.32			
	64-80	25-40	1.25-1.50	0.06-0.2	0.14-0.18	6.1-8.4	<2	Moderate	0.32			
Ve----------------	0-12	60-70	1.20-1.40	<0.06	0.06-0.12	7.9-9.0	>8	High-------	0.32	5	4	2-10
Velasco	12-65	60-70	1.20-1.40	<0.06	0.01-0.10	7.9-9.0	>16	High-------	0.32			
Vs----------------	0-5	15-27	1.20-1.40	0.6-2.0	0.02-0.10	7.9-9.0	8-32	Low--------	0.49	5	5	.5-1
Veston	5-56	12-27	1.20-1.50	0.6-2.0	0.02-0.10	7.9-9.0	8-32	Low--------	0.49			
	56-72	15-35	1.20-1.50	0.01-0.06	0.02-0.10	7.9-9.0	8-32	Moderate	0.32			

Table 16.--Soil and Water Features

("Flooding," "water table," and such terms as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Concrete
					Ft				
Aa, As------------ Asa	B	Rare--------	---	---	>6.0	---	---	High-----	Low.
Az---------------- Asa	B	Occasional	Very brief to brief.	Apr-Sep	>6.0	---	---	High-----	High.
BaA--------------- Bacliff	D	None--------	---	---	0-1.0	Perched	Nov-Mar	High-----	Low.
Bb---------------- Beaches	A/D	Frequent----	Brief-----	Jan-Dec	0-0.5	Apparent	Jan-Dec	High-----	High.
Br---------------- Brazoria	D	Rare--------	---	---	>6.0	---	---	High-----	Low.
CeA--------------- Cieno	D	None--------	---	---	+2-2.0	Perched	Sep-Jun	High-----	Low.
Cm---------------- Clemville	B	Rare--------	---	---	>6.0	---	---	High-----	Low.
DaA--------------- Dacosta	D	None--------	---	---	>6.0	---	---	High-----	Low.
EdA, EoA---------- Edna	D	None--------	---	---	>6.0	---	---	High-----	Low.
ExA:									
Edna-------------	D	None--------	---	---	>6.0	---	---	High-----	Low.
Cieno------------	D	None--------	---	---	+2-2.0	Perched	Sep-Jun	High-----	Low.
FaA--------------- Faddin	D	None--------	---	---	>6.0	---	---	High-----	Low.
Fe---------------- Follet	D	Frequent----	Very long	Jan-Dec	+1-0.5	Apparent	Jan-Dec	High-----	High.
FoB--------------- Fordtran	C	None--------	---	---	>6.0	---	---	High-----	Moderate.
FrA--------------- Francitas	D	Rare--------	---	---	0-1.0	Perched	Jan-Apr	High-----	Low.
FuC--------------- Fulshear	C	None--------	---	---	>6.0	---	---	Low------	Low.
GaB--------------- Galveston	A	Occasional	Very brief	Jun-Oct	3.0-6.0	Apparent	Jan-Dec	High-----	Low.
Ha---------------- Harris	D	Frequent----	Long------	Sep-Jun	0-2.5	Apparent	Sep-Jun	High-----	High.
ImB--------------- Ijam	D	Rare--------	---	---	0-3.0	Apparent	Sep-May	High-----	High.

Table 16.--Soil and Water Features--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Uncoated steel	Concrete
					Ft				
KaB--------------- Katy	D	None--------	---	---	>6.0	---	---	High-----	Moderate.
LaA, LaB, LaD2, LoA-------------- Laewest	D	None--------	---	---	>6.0	---	---	High-----	Low.
LtA:									
Livco------------	D	None--------	---	---	>6.0	---	---	High-----	High.
Dacosta----------	D	None--------	---	---	>6.0	---	---	High-----	Low.
LvA--------------- Livia	D	Rare--------	---	---	0-2.5	Perched	Dec-Apr	High-----	High.
MuA--------------- Mustang	D	Occasional	Brief to long.	Jun-Nov	0-0.5	Apparent	Jan-Dec	High-----	Low.
No---------------- Norwood	B	Rare--------	---	---	>6.0	---	---	High-----	Low.
PaA--------------- Palacios	D	Rare--------	---	---	0-2.5	Perched	Dec-Apr	High-----	Low.
Pc---------------- Placedo	D	Frequent----	Long------	Jan-Dec	+.5-1.0	Apparent	Jan-Dec	High-----	High.
Pe---------------- Pledger	D	Rare--------	---	---	>6.0	---	---	High-----	Low.
Pg---------------- Pledger	D	Occasional	Brief-----	Jan-Dec	>6.0	---	---	High-----	Low.
RoB--------------- Riolomas	B	Rare--------	---	---	>6.0	---	---	High-----	Low.
Sf---------------- Sumpf	D	Frequent----	Very long	Jan-Dec	+2-2.0	Apparent	Jan-Dec	High-----	Low.
Sr---------------- Surfside	D	Occasional	Brief-----	Sep-Jun	0-4.0	Apparent	Sep-Jun	High-----	Low.
TfA--------------- Telferner	D	None--------	---	---	>6.0	---	---	High-----	Low.
TxA, TxB---------- Texana	D	None--------	---	---	>6.0	---	---	High-----	Low.
Ve---------------- Velasco	D	Frequent----	Long------	Sep-Jun	0-2.5	Apparent	Sep-Jun	High-----	Low.
Vs---------------- Veston	D	Frequent----	Brief-----	Apr-Oct	0-2.0	Apparent	Jan-Dec	High-----	High.

Table 17.--Classification of the Soils

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.)

Soil name	Family or higher taxonomic class
Asa	Fine-silty, mixed, active, hyperthermic Fluventic Hapludolls
Bacliff	Fine, smectitic, hyperthermic Entic Hapluderts
Brazoria	Very-fine, mixed, superactive, hyperthermic Chromic Hapluderts
Cieno	Fine-loamy, siliceous, active, hyperthermic Typic Epiaqualfs
Clemville	Fine-silty, mixed, active, calcareous, hyperthermic Typic Udifluvents
Dacosta	Fine, smectitic, hyperthermic Vertic Argiudolls
Edna	Fine, smectitic, hyperthermic Vertic Hapludalfs
Faddin	Fine, smectitic, hyperthermic Aquic Argiudolls
Follet	Fine-silty, mixed, semiactive, nonacid, hyperthermic Typic Haplaquents
Fordtran	Clayey, smectitic, hyperthermic Aquic Arenic Hapludalfs
Francitas	Fine, smectitic, hyperthermic Typic Hapluderts
Fulshear	Fine-loamy, siliceous, superactive, hyperthermic Typic Hapludalfs
Galveston	Mixed, hyperthermic Typic Udipsamments
Harris	Fine, smectitic, hyperthermic Vertic Endoaquolls
*Ijam	Fine, smectitic, nonacid, hyperthermic Vertic Fluvaquents
Katy	Fine-loamy, siliceous, active, hyperthermic Aquic Paleudalfs
Laewest	Fine, smectitic, hyperthermic Typic Hapluderts
Livco	Fine, smectitic, hyperthermic Typic Natrudalfs
Livia	Fine, smectitic, hyperthermic Typic Natraqualfs
Mustang	Mixed, hyperthermic Typic Psammaquents
Norwood	Fine-silty, mixed, active, calcareoous, hyperthermic Typic Udifluvents
Palacios	Fine, smectitic, hyperthermic Mollic Natraqualfs
Placedo	Fine, smectitic, nonacid, hyperthermic Typic Fluvaquents
Pledger	Very-fine, smectitic, hyperthermic Typic Hapluderts
Riolomas	Coarse-loamy, mixed, semiactive, calcareous, hyperthermic Typic Udorthents
Sumpf	Very-fine, mixed, superactive, hyperthermic Aeric Endoaquerts
Surfside	Very-fine, mixed, active, hyperthermic Vertic Haplaquolls
Telferner	Fine, smectitic, hyperthermic Albaquic Hapludalfs
Texana	Fine, smectitic, hyperthermic Typic Argialbolls
Velasco	Very-fine, mixed, active, calcareous, hyperthermic Cumulic Haplaquolls
Veston	Fine-silty, mixed, superactive, nonacid, hyperthermic Typic Fluvaquents

NRCS Accessibility Statement

The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at helpdesk@helpdesk.itc.nrcs.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.