United States
Department of
Agriculture

Soil
Conservation
Service

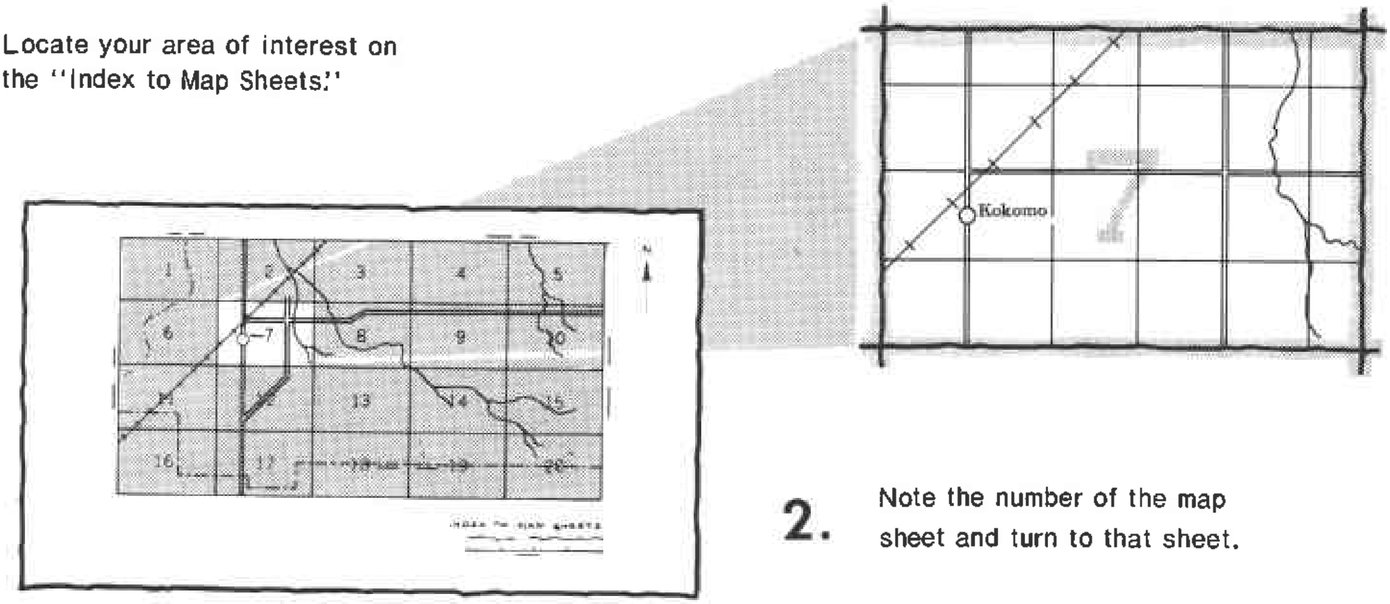
In cooperation with
the Louisiana Agricultural
Experiment Station
and the Louisiana State Soil and
Water
Conservation Committee

Soil Survey of St. Bernard Parish, Louisiana

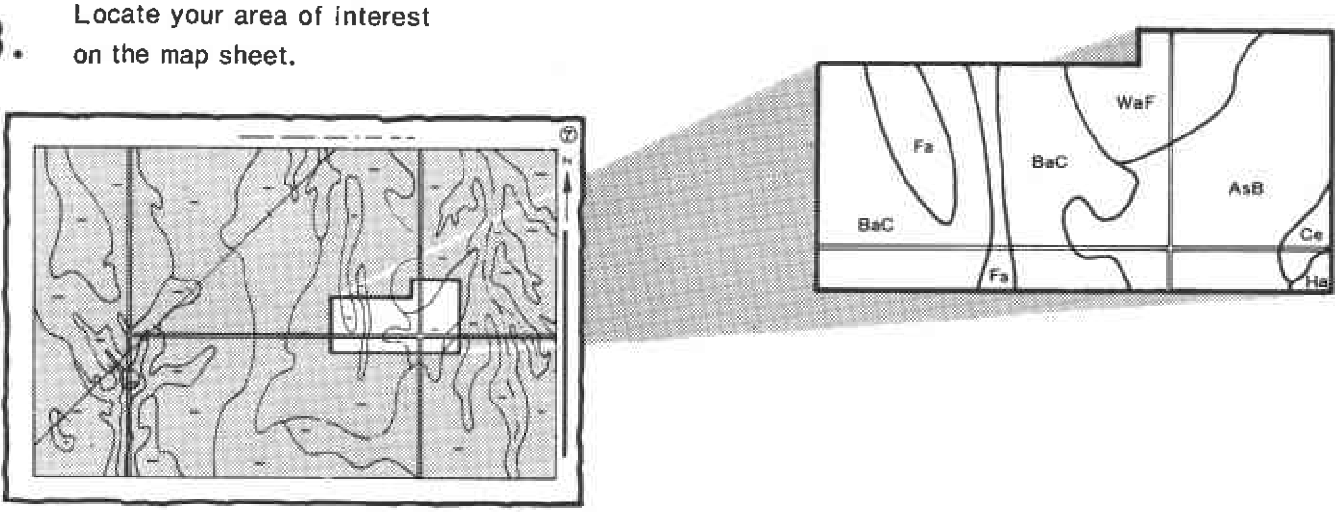
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets."

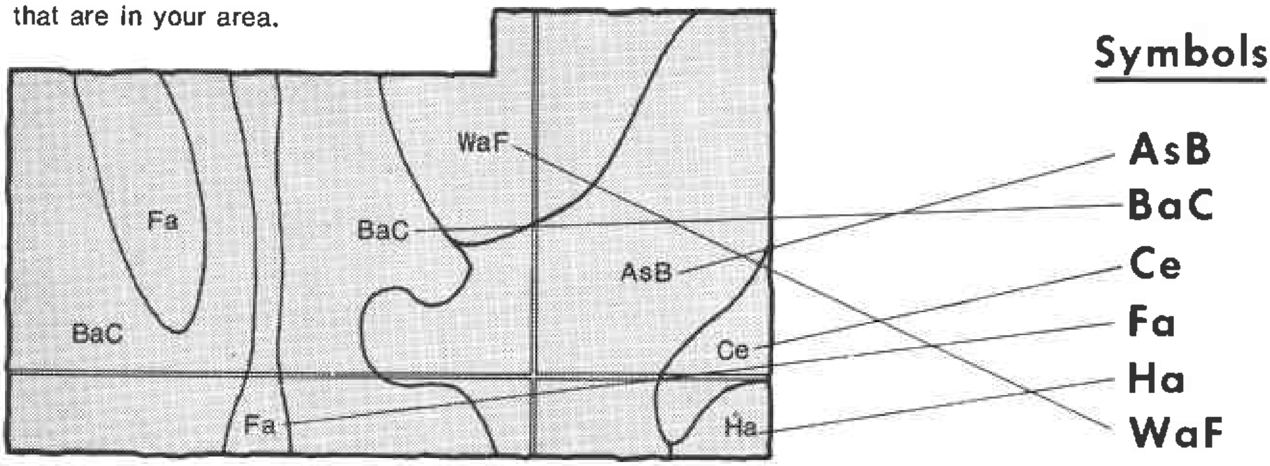
2. Note the number of the map sheet and turn to that sheet.



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

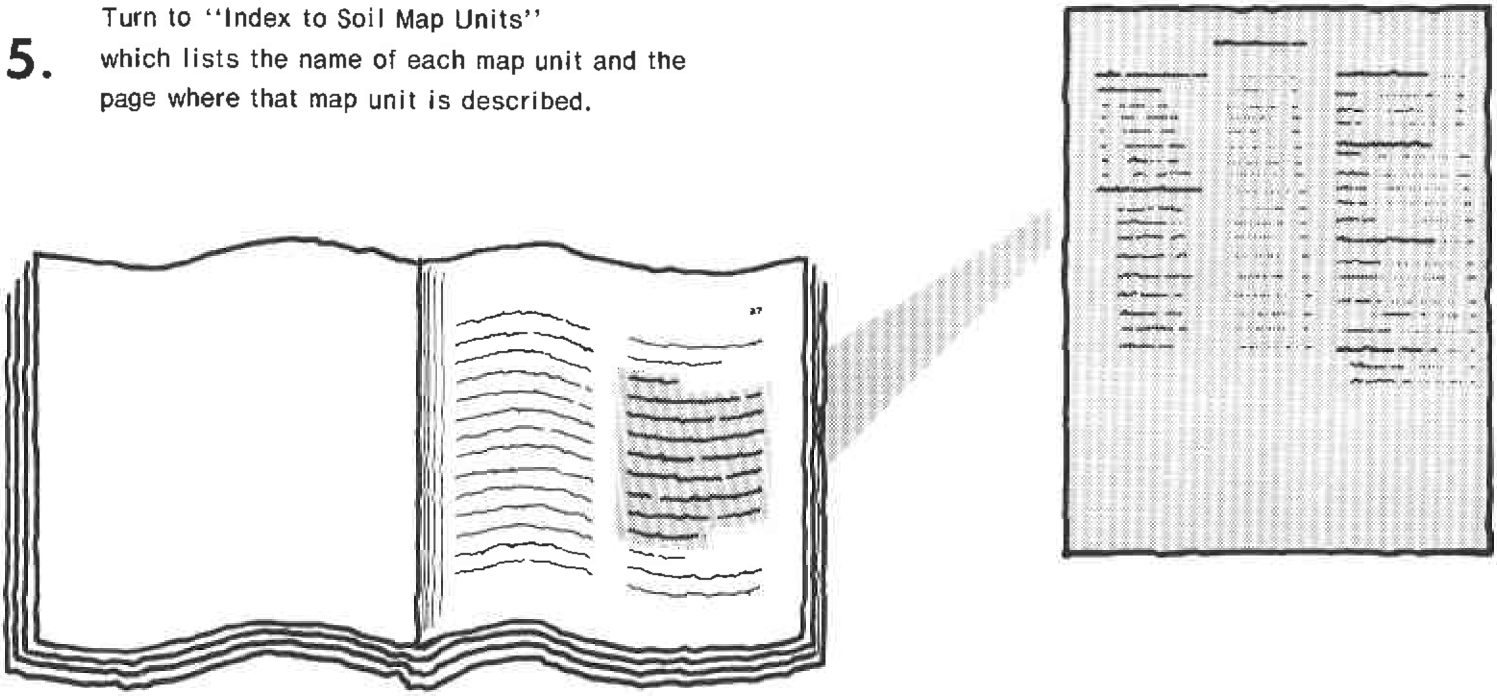


4. List the map unit symbols that are in your area.

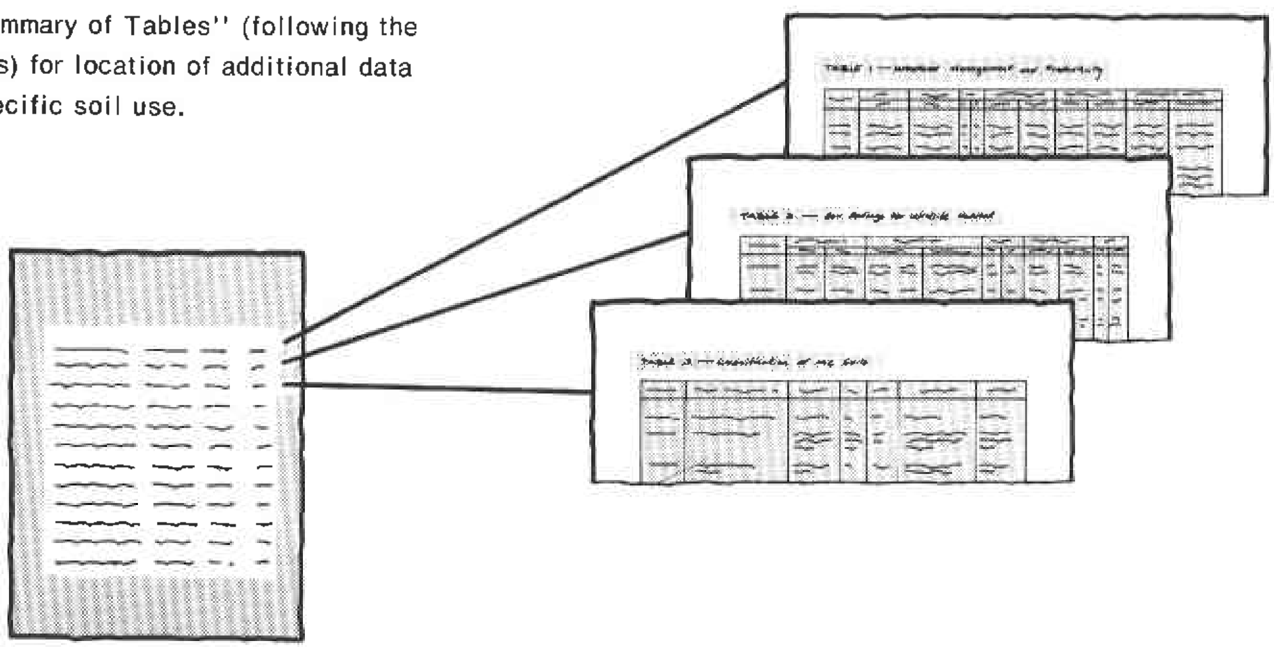


THIS SOIL SURVEY

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



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



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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

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

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

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

Cover: The many natural bayous and manmade canals in the parish provide ample fishing and recreation opportunities. The landing on the left is Sharkey clay.

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Soil Series

Issued June 1989

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Summary of Tables

Foreword

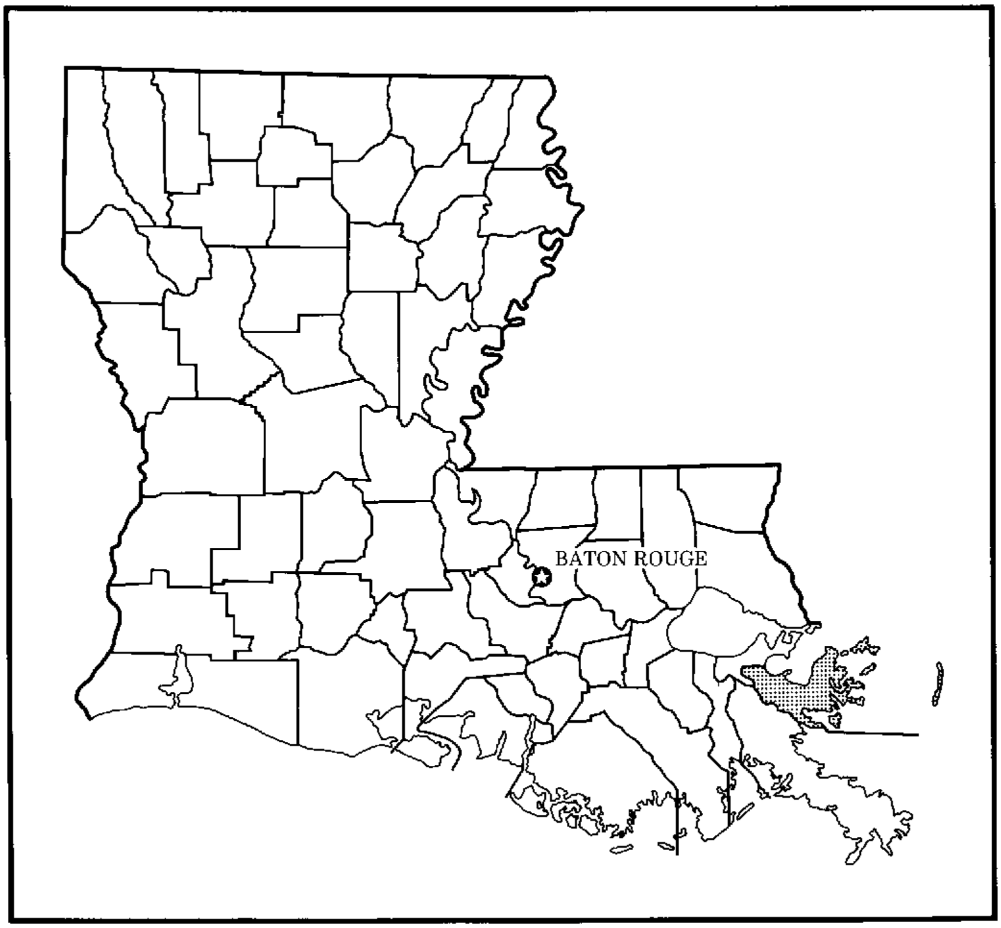
This soil survey contains information that can be used in land-planning programs in St. Bernard Parish. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact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

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

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

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

Horace J. Austin
State Conservationist
Soil Conservation Service



Location of St. Bernard Parish in Louisiana.

Soil Survey of St. Bernard Parish, Louisiana

By Larry J. Trahan, Jeanette J. Bradley, Lyfon Morris,
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United States Department of Agriculture, Soil Conservation Service
In cooperation with the
Louisiana Agricultural Experiment Station and the
Louisiana State Soil and Water Conservation Committee

ST. BERNARD PARISH, in southeastern Louisiana, has a total area of 1,292,810 acres of which 326,400 acres is land and 966,410 acres is large water areas—streams, lakes, and bays of the Gulf of Mexico. This parish is bordered by Plaquemines Parish on the south, Orleans Parish on the west, and the Gulf of Mexico on the north and east. In 1980, according to the census, the population of the parish was 64,097. Most of this population is concentrated in cities and towns located on the high natural levees along the Mississippi River, Bayou LaLoutre, and Bayou Terre aux Boeufs. This parish is chiefly rural and within the broad, coastal marshes of the Gulf of Mexico.

A current trend indicates that urban areas are expanding rapidly and areas of marshes and swamps are decreasing. The population density is expected to increase in the cities and towns that are concentrated on the natural levees *(11)*.

The parish is entirely within the Mississippi River Delta. The natural levees of the Mississippi River and its distributaries are dominated by firm, loamy and clayey soils. These soils make up about one-tenth of the total land area of the parish and are developed almost entirely for urban uses (fig. 1).

An extensive system of manmade levees protects these soils from flooding. The remaining nine-tenths of the land area of the parish consists mainly of ponded and frequently flooded, mucky and clayey soils in marshes and swamps. They are used mainly as habitat for wetland wildlife and for recreation. Large acreages of former marshes and swamps have been drained and developed for urban use. Elevation ranges from about 12 feet above sea level on the natural levees along the Mississippi River to about 3 feet below sea level in the former marshes and swamps that have been drained. Most of the undrained marshes and swamps; however, range in elevation from sea level to about 1 foot above sea level.

The first soil survey of parts of St. Bernard Parish was published in 1970 *(13)*. This survey updates the earlier survey and provides additional information.

General Nature of the Survey Area

This section gives general information concerning the parish. Climate, transportation water resources, history, and industry are briefly discussed.

Climate

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at New Orleans, Louisiana, in the period 1955 to 1977. 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 at New Orleans on January 24, 1963, is 14 degrees. In summer the average temperature is 81 degrees, and the average daily maximum temperature is 90 degrees. The highest recorded temperature, which

Figure 1.—More than 85 percent of the Chalmette area is covered by concrete, buildings, and other impervious materials.

occurred at New Orleans on June 27, 1967, is 98 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 59 inches. Of this, 33 inches, or 56 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 26 inches. The heaviest 1-day rainfall during the period of record was 9.8 inches at New Orleans on May 31, 1959. Thunderstorms occur on about 70 days each year, and most occur in summer.

The average relative humidity in midafternoon is about 65 percent. Humidity is higher at night, and the average at dawn is about 90 percent. The sun shines 60 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the southeast. Average windspeed is highest, 10 miles per hour, in spring. Every few years, a hurricane crosses the parish.

Transportation

Early land transportation corridors in St. Bernard Parish followed the major natural levees and deep water channels *(11)*. This dual land-water system satisfied the needs of the parish with minimum disturbance of the natural environment. Today, most of the major land transportation corridors are still located on the higher grounds of the natural levees, but they have been expanded substantially to meet growing needs.

St. Bernard was one of the first parishes in Louisiana to construct permanent highways. The first parish highway extended from the Orleans Parish line to Paris Road in Chalmette. Major thoroughfares today are Judge Perez Drive, Paris Road, St. Bernard Highway, Highway 624, and Highway 300. Judge Perez Drive, St. Bernard Highway, and Paris Road are the primary routes serving the urbanized area. Highway 46 is the main route serving the leveed area.

The principal natural waterway serving St. Bernard Parish is the Mississippi River. It accommodates ocean-going ships at docks located in Chalmette at the Chalmette Slip. The most significant manmade channel is the Mississippi River Gulf Outlet. In addition to the Mississippi River Gulf Outlet, a number of manmade canals cross the wetlands at various locations in St. Bernard Parish. These canals were primarily constructed for the exploration and extraction of petroleum and natural gas resources. The major natural bayous used for transportation into the marshes are Bayous LaLoutre, Terre aux Boeufs, Bienvenue, St. Malo, and Biloxi.

The New Orleans Terminal and the Louisiana Railway Companies of the Southern Railway System serve St. Bernard Parish. The New Orleans Terminal Company transports goods from the Orleans-St. Bernard Parish line to Chalmette and to other facilities along the Mississippi River. The Louisiana Southern Railroad runs from the Orleans-St. Bernard Parish line along the Mississippi River to the Plaquemines Parish line.

Numerous petroleum and natural gas pipelines are in St. Bernard Parish. These facilities transport oil and gas to refineries and processing plants in St. Bernard Parish and markets throughout the country.

Water Resources

Surface water—The hydrologic regime of St. Bernard Parish involves the movement of freshwater and saltwater masses through the region as a result of the interaction between the Mississippi River discharge, regional precipitation, winds, and tides *(11)*. This current hydrologic regime is influenced by both natural and manmade factors. The basic natural hydrologic system is governed by the pattern of major abandoned distributary channels of the ancient Mississippi River delta complex and interdistributary basin channels which serve to drain swamps and marshes into the estuarine lakes, bays, and sounds.

Under natural conditions, the Mississippi River flowed through the wetlands to the Gulf via the distributary channels. Rainfall and Mississippi River floodwaters flowed down the gentle slopes of the natural levees and slowly through the swamps and marshes as sheet flow and interdistributary basin channel flow. The wetland vegetation and the shallow, winding, interdistributary channels slowed the progress of this drainage and stored the freshwater for gradual release into the tidewaters. This situation contributed to a stable environment where water levels and salinity values changed gradually with changing tidal conditions.

During historic times, manmade factors greatly altered the natural hydrologic regime. Leveeing of the Mississippi River halted the annual overbank flooding, and a channelized drainage network within the leveed area collected precipitation to be discharged into the wetlands at pumping stations and floodgates.

Manmade modifications of the wetlands also occurred within the recent historic period. Deepwater canals and spoil banks appeared as a result of logging activity, drainage, navigation improvement, and later, oil and gas well drilling access and pipelines. These modifications allowed surplus freshwater to pass more quickly from the point discharge sources into the estuary. Spoil banks along the canals segmented the wetlands and hindered circulation. Greater water depths in the canals provided for greater tidal fluctuation and saltwater intrusion during dry periods. The Mississippi River Gulf Outlet, a 500-foot wide and 36-foot deep channel, opened to navigation in 1963. It has had a great impact on the hydrologic regime in most of the parish because it conducts a large mass of saltwater from the Gulf to interior drainage channels year-round, and it creates greater fluctuations in tide levels.

Under these conditions, influenced by man, the hydrologic circulatory system has shifted to reflect the competition between local runoff in the wetlands coupled with discharge from diked areas and daily tides. The overall effect of these modifications has been the rapid alteration of a stable hydrologic situation into one having a greater fluctuation of water levels and salinity values.

Ground water—Ground water is produced from three aquifers in St. Bernard Parish. The major aquifers are the St. Bernard Delta 200-foot sand aquifer, the 700-foot sand aquifer, and the 1,200-foot sand aquifer. Because of saltwater intrusion, the parish contains little or no potable water except for occasional lenses of freshwater floating on saltwater *(17)*.

History

St. Bernard was established in 1718, when immigrant settlers entered the region to develop indigo and sugarcane plantations. It received its name from the old ecclesiastical district of St. Bernard. It was included in the New Orleans District until 1807, when the Territorial

Legislature divided the territory into 19 parishes. Out of this division, St. Bernard Parish was created with the City of Chalmette as the parish seat.

The immigrants who settled the area included French, Spanish, British, and Acadians. These settlers were farmers, planters, and trappers. Cotton was introduced in 1740. From 1762 until 1803, the Spanish controlled Louisiana. In 1803, the territory was transferred to the United States. In 1815, the famous Battle of New Orleans, where Andrew Jackson defeated the British Forces, took place almost entirely in St. Bernard Parish *(11)*.

Many sites of the parish are commemorated by historical markers, such as the Kenilworth Plantation, a private residence, which was built in 1759.

The United States National Cemetery near Chalmette was established in 1864. More than 14,000 soldiers and sailors from every part of the United States are interred there, although about half of the graves are unidentified *(11)*.

After the Civil War, the economy of St. Bernard Parish began to change from the plantation economy to small farms. Lumbering began about this time. By the early 20th Century, nearly all the virgin cypress forests had been harvested from the area.

Since the 1920's, the character and economy of St. Bernard Parish have been changing gradually from rural-agricultural to urban-industrial. Urbanization of the most suitable parish lands on the natural levees has been almost total, and today the marginal, low-lying areas are increasingly in demand for urbanization, industrialization, and other development *(11)*.

Industry

St. Bernard Parish has been developing rapidly over the last 30 years. As the population grew, the land use in the parish changed. As population density increased, the nature of the economic base also changed. Agriculture and fishing, once the foundation of the economy in St. Bernard Parish, was replaced by a new economic base. The new economic base for the parish includes oil and gas production, shipping, manufacturing, residential development, and chemical and petroleum production *(11)*.

These new industries required large tracts of land that were once occupied by the agriculture, fishing, and trapping interests. The manufacturing and trade industry employs over half the residents in the parish. The major industrial employers are those in the petroleum industry. The number of farms and the acres in farms have decreased, but agricultural income has increased. The fisheries industry and agriculture are still important in St. Bernard Parish.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

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

Each map unit is rated for *cultivated crops, pastureland, woodland, urban uses,* and *intensive recreation areas*. Cultivated crops are those grown extensively in the survey area. Pastureland is land planted to improved pasture plants for grazing. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic. Extensive recreation areas are those used for nature study or as wilderness.

Soils on Natural Levees That are Protected From Flooding

The map unit in this group consists mainly of level, poorly drained and somewhat poorly drained, clayey and loamy soils that are on natural levees of the Mississippi River and its distributaries. Large earthen levees protect these soils from flooding by the Mississippi River.

This group makes up about 5 percent of the land area of the parish. Most areas of these soils are in urban use. Wetness, flooding from backwaters, and the shrinking and swelling of the subsoil are the main limitations for urban use.

1. Sharkey-Commerce

Level, poorly drained and somewhat poorly drained soils that have a clayey or loamy surface layer and a clayey subsoil or that are loamy throughout

The soils of this map unit are on natural levees of the Mississippi River and its distributaries. Elevation ranges from sea level to 15 feet above sea level. Slope is long and smooth and less than 1 percent.

This map unit makes up about 5 percent of the land area of the parish. It is about 50 percent Sharkey soils, 48 percent Commerce soils, and 2 percent soils of minor extent.

The poorly drained Sharkey soils are in intermediate and low positions on natural levees. These soils have a surface layer of dark grayish brown or dark gray clay or silty clay loam. The subsoil and underlying material are dark gray and gray clay.

The somewhat poorly drained Commerce soils are in intermediate and high positions on natural levees. These soils have a surface layer of dark grayish brown silt loam or silty clay loam. The subsoil and underlying material are grayish brown silty clay loam and silt loam.

Of minor extent are the somewhat poorly drained Vacherie soils in intermediate positions where the natural levees of the Mississippi River were breached by former floods. Also, small, narrow areas of frequently flooded Sharkey and Commerce soils are between the Mississippi River and protection levees. Areas where more than 85 percent of the ground is covered by concrete, buildings, and other impervious material have been designated as Urban land.

Most of the soils of this map unit are in urban use. Small acreages are used for crops, pasture, or as woodland. Some idle land has been reserved for future urban use.

Sharkey soils are poorly suited to building site development, sanitary facilities, and intensive recreation areas. Wetness, very slow permeability, and the shrinking and swelling of the subsoil are the main limitations. In addition, the Sharkey soils are subject to rare flooding after unusually severe storms.

Commerce soils are moderately well suited to building site development and sanitary facilities, and well suited to intensive recreation uses. Wetness, moderately slow permeability, and shrinking and swelling are the main limitations.

The soils of this map unit are well suited to use as pasture and woodland. Sharkey soils are moderately well suited to cultivated crops, and Commerce soils are well suited. A good drainage system is needed for optimum crop and forage production. The soils are well suited to the production of hardwood trees, although wetness can limit the use of equipment.

Soils in Marshes and Swamps That are Frequently Flooded and Ponded

The five map units in this group consist mainly of level, very poorly drained, clayey and mucky soils that are in marshes and swamps. These soils are flooded or ponded most of the time.

This group makes up about 85 percent of the land area of the parish. Most areas of these soils are in native vegetation and are used for recreation and as habitat for wetland wildlife.

2. Barbary

Level, very poorly drained soils that are clayey throughout; in freshwater swamps

The soils of this map unit are in swamps that are flooded or ponded most of the time by freshwater. Elevation ranges from sea level to about 2 feet above sea level. Slope is less than 1 percent.

This map unit makes up about 2 percent of the land area of the parish. It is about 98 percent Barbary soils and 2 percent soils of minor extent.

Barbary soils have a surface layer of dark gray, very fluid clay and underlying material of gray and greenish gray, very fluid and slightly fluid clay.

Of minor extent are the poorly drained Sharkey soils on narrow ridges and the Harahan soils in areas of swamps that were formerly drained.

Most of the acreage in this map unit is in native trees and aquatic vegetation. It is used for recreation and as habitat for wetland wildlife.

The soils of this map unit are well suited to extensive forms of recreation and to use as habitat for wetland wildlife. They provide habitat for waterfowl, furbearers, alligators, swamp rabbits, and nongame birds. This map unit is part of an estuary that helps support many species of marine fishes and crustaceans. Hunting, fishing, and other outdoor activities are popular in areas of this map unit.

These soils are not suited to crops, pasture, or urban use because flooding, wetness, and low strength are too severe. They are poorly suited to commercial timber production. Special equipment must be used to harvest timber.

3. Lafitte-Clovelly

Level, very poorly drained soils that have a thick or moderately thick, mucky surface layer and clayey underlying material; in brackish marshes

The soils of this map unit are in brackish marshes that are flooded or ponded most of the time. Elevation ranges from sea level to about 1 foot above sea level. Slope is less than 1 percent.

This map unit makes up about 30 percent of the land area of the parish. It is about 53 percent Lafitte soils, 44 percent Clovelly soils, and 3 percent soils of minor extent.

The Lafitte soils have a thick surface layer of very fluid, slightly saline muck and underlying material of very fluid, slightly saline clay and mucky clay.

The Clovelly soils have a moderately thick surface layer of very fluid, slightly saline muck and underlying material of very fluid, slightly saline clay.

Of minor extent are the very poorly drained Barbary soils in adjacent areas of swamp and the very poorly drained Scatlake, Bellpass, and Timbalier soils in adjacent areas of saline marsh. A few small areas of Fausse clay, saline soils are also included on low ridges that have subsided below sea level. Many small ponds and perennial streams are in most areas.

Most of the acreage in this map unit is in native vegetation and is used for recreation and as habitat for wetland wildlife. A small acreage has oil and gas wells.

These soils are well suited to use as habitat for wetland wildlife and provide suitable habitat for many species. Hunting, fishing, and other outdoor activities are popular. This map unit is part of the estuary that helps support marine life in the Gulf of Mexico.

These soils are not suited to crops, pasture, woodland, or urban use because flooding, wetness, salinity, and low strength are too severe.

4. Timbalier-Bellpass

Level, very poorly drained soils that have a thick or moderately thick, mucky surface layer and clayey underlying material; in saline marshes

The soils of this map unit are in saline marshes that are flooded most of the time. Elevation ranges from sea level to 1 foot above sea level. Slope is less than 1 percent.

This map unit makes up about 20 percent of the land area of the parish. It is about 62 percent Timbalier soils, 36 percent Bellpass soils, and 2 percent soils of minor extent.

The Timbalier soils have a thick surface layer of very fluid, saline muck and underlying material of very fluid, saline clay.

The Bellpass soils have a moderately thick surface layer of very fluid, saline muck and underlying material of very fluid, saline clay.

Of minor extent are the somewhat poorly drained Felicity soils on narrow, sandy ridges and the very poorly drained Clovelly, Lafitte, and Scatlake soils. The Clovelly and Lafitte soils are in adjacent areas of brackish marsh. The Scatlake soils are near natural streams and in positions similar to those of the Bellpass and Timbalier soils. Many small ponds and perennial streams are in most areas.

These soils are not suited to crops, pasture, woodland, or urban use because flooding, wetness, salinity, and low strength are too severe.

These soils are well suited to use as habitat for wetland wildlife and provide habitat for many species. Hunting, fishing, and other outdoor activities are popular. This map unit is part of an estuary that helps support many species of marine fishes and crustaceans in the Gulf of Mexico.

5. Scatlake

Level, very poorly drained soils that are clayey throughout; in saline marshes

The soils of this map unit are in saline marshes that are flooded or ponded most of the time. Elevation ranges from sea level to about 1 foot above sea level. Slope is less than 1 percent.

This map unit makes up about 29 percent of the land area of the parish. It is about 95 percent Scatlake soils and 5 percent soils of minor extent.

The Scatlake soils have a surface layer of very fluid, saline mucky clay and underlying material of very fluid, saline clay.

Of minor extent are the very poorly drained Bellpass and Timbalier soils in nearby positions and the somewhat poorly drained Felicity soils on sandy ridges. Many small ponds and perennial streams are in most areas.

The acreage in this map unit is mainly in native vegetation and is used for recreation and as habitat for wetland wildlife. Oil and gas wells are in some areas.

The soils are well suited to use as habitat for wetland wildlife and provide habitat for many species. Hunting, fishing, and other outdoor activities are popular in areas of these soils. This map unit is part of an estuary that helps support many species of marine fishes and crustaceans in the Gulf of Mexico.

These soils are not suited to crops, pasture, woodland, or urban use because flooding, wetness, salinity, and low strength are too severe.

6. Fausse

Level, very poorly drained soils that are clayey throughout; in saline swamps

The soils of this map unit are in swamps on natural levees that have subsided to near sea level. They are frequently flooded by high tides during storms. Elevation ranges from about sea level to less than 1 foot above sea level. Slope is less than 1 percent.

This map unit makes up about 4 percent of the land area of the parish. It is about 94 percent Fausse soils and 6 percent soils of minor extent.

Fausse soils have a surface layer of very dark grayish brown and dark gray clay. The subsoil and underlying material are gray, firm clay. Fausse soils are saline throughout.

Of minor extent are the very poorly drained Bellpass, Clovelly, Lafitte, and Scatlake soils in nearby marshes and the poorly drained Sharkey soils in higher positions.

Most of the acreage is used for recreation and as habitat for wetland wildlife. A small acreage is used for campsites.

These soils are well suited to use as habitat for wetland wildlife and provide habitat for ducks and other waterfowl. Hunting and other outdoor activities are popular.

These soils are not suited to crops, pasture, woodland, or urban and recreation uses. Flooding, wetness, salinity, low strength, very slow permeability, and shrinking and swelling are too severe for these uses.

Soils in Former Swamps That are Drained and Protected From Flooding

The map unit in this group consists of level, poorly drained, clayey soils in drained swamps. The soils are protected from most floods by levees, and they are in areas drained by pumps. Flooding is rare, but it can occur during severe storms or when protection levees fail.

This group makes up about 1 percent of the land area of the parish. Most areas are developed for urban uses, or they are idle land reserved for future urban uses. If the soils are used for urban development, they are limited mainly by flooding, wetness, low strength, subsidence, and shrinking and swelling of the underlying material.

7. Harahan-Westwego

Level, poorly drained soils that have a clayey surface layer and a clayey subsoil

The soils of this map unit are in former swamps that are protected from most floods by levees and are drained by pumps. Flooding is rare, but it can occur during severe storms or when levees or pumps fail. Elevation ranges from sea level to about 3 feet below sea level. Slope is less than 1 percent.

This map unit makes up about 1 percent of the land area of the parish. It is about 73 percent Harahan soils, 25 percent Westwego soils, and 2 percent soils of minor extent.

The Harahan soils have a surface layer of dark gray, firm clay; subsoil of gray, firm clay; and underlying material of gray, slightly fluid clay.

The Westwego soils have a surface layer of dark grayish brown, firm clay; subsoil of dark gray, firm clay; and underlying material of very dark grayish brown, very fluid muck and dark gray, very fluid clay. The subsoil contains a network of permanent cracks.

Of minor extent are the somewhat poorly drained Commerce soils and the poorly drained Sharkey soils on narrow ridges.

The acreage in this map unit is mainly in urban use. A small acreage is in pasture or is idle land that has been reserved for future urban uses.

These soils are poorly suited to most urban and intensive recreation uses mainly because of flooding, wetness, low strength, very slow permeability, and the shrinking and swelling of the subsoil. The water table is difficult to adequately control. Foundations for buildings need to be specially designed and set upon pilings.

These soils are moderately well suited to use as woodland, cropland, or pastureland. Wetness and poor tilth are the main limitations.

Soils on Spoil Banks and Sandy Ridges That are Frequently Flooded

The map units in this group consist mainly of level to gently sloping, poorly drained and somewhat poorly drained, variable textured soils on spoil banks and sandy soils on ridges and barrier islands. The soils are subject to frequent flooding by high storm tides.

This group makes up about 9 percent of the land area of the parish. Most areas are in native vegetation and are used for recreation and as habitat for wetland wildlife. A few areas have been developed for commercial uses. The soils are limited for urban uses mainly because of flooding, wetness, and salinity.

8. Aquents

Level, poorly drained soils that are stratified and clayey to mucky throughout; on spoil banks

The soils of this map unit are in areas of hydraulic fill dredged from nearby waterways, swamps, and marshes. The largest area of this map unit is the spoil area created by the dredging of the Mississippi River Gulf Outlet. This map unit is frequently flooded by high tides during storms. Elevation ranges from sea level to about 5 feet above sea level. Slope is 0 to 1 percent.

This map unit makes up about 7 percent of the land area of the parish. It is about 95 percent Aquents and 5 percent soils of minor extent.

The poorly drained Aquents are stratified with layers of clayey, loamy, mucky, and sandy material. The soil is slightly saline to saline throughout.

Of minor extent are the Fausse clay, saline soils in positions that are not covered by fill material.

The soils of this map unit are used mainly as habitat for wetland wildlife and for extensive recreation uses. A small acreage is in commercial use.

These soils are well suited to use as habitat for wetland wildlife and provide habitat for many species. Hunting and other outdoor activities are popular.

These soils are severely limited for most urban and intensive recreation uses mainly because of flooding, subsidence, wetness, salinity, low strength, and shrinking and swelling.

9. Felicity

Gently sloping, somewhat poorly drained soils that are sandy throughout; on sandy ridges

The soils of this map unit are on ridges that are mainly near the beaches of the Gulf of Mexico. The largest area of these soils is on the Chandeleur Islands. The soils are frequently flooded by high tides during storms. Elevation ranges from about 1 foot to 5 feet above sea level. Slope ranges from 1 to 3 percent.

This map unit makes up about 2 percent of the land area of the parish. It is about 98 percent Felicity soils and 2 percent soils of minor extent.

The Felicity soils have a surface layer of loamy fine sand and underlying material of loamy fine sand, sand, and loamy sand. The soils are saline throughout.

Of minor extent are the very poorly drained Bellpass, Scatlake, and Timbalier soils in low positions on the landward side of the ridges.

The soils of this map unit are mainly used as habitat for wetland and openland wildlife.

These soils are not suited to most urban and intensive recreation uses, and they are not suited to use as cropland or woodland. They are poorly suited to use as pasture. Flooding and wetness are too severe for these uses. Seepage is also a problem where the soils are used for sanitary facilities.

These soils are very poorly suited to use as habitat for wetland and openland wildlife. The areas are used mainly by shore birds. Soil salinity is the main limitation for managing vegetation for wildlife habitat.

Detailed Soil Map Units

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

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

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

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

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

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

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

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

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Dumps is an example. Miscellaneous areas are shown on the soil maps.

The soils on the detailed soil maps were mapped at the same level of detail, except for those soils that are not protected from flooding. Poor accessibility limited the number of observations that could be made in many of the areas. In addition, wetness from flooding or ponding limits the use and management of these soils, and separating all of the soils in these areas would be of little importance to the land user. Where flooding or ponding are the overriding limitations for expected land use, fewer onsite observations were made and the soils were not mapped separately.

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

AD—Aquents, dredged, frequently flooded. This map unit consists of level, poorly drained soil forming in hydraulically deposited fill material dredged from nearby marshes during the construction and maintenance of waterways. Areas extend a distance of 0.25 to 1 mile from one or both sides of the waterway. Slope is less than 1 percent.

Aquents are slightly saline or saline throughout, and they are stratified throughout with mucky, clayey, loamy, and sandy layers. Typically, the soil is firm in the upper part and slightly fluid or very fluid in the lower part. In places, the soil layers contain small to large quantities of oyster and clam shells. Reaction of the surface layer ranges from very strongly acid to moderately alkaline. The reaction in the underlying material ranges from strongly acid to moderately alkaline.

This soil is flooded by high tides for long or very long periods during storms. Flooding occurs more often than twice in 5 years, during any time of the year. The seasonal high water table ranges from the soil surface to a depth of 1.5 feet. The soil has low strength. The total subsidence potential ranges from medium to high.

Included in mapping are a few small to large areas of Fausse soils where the soil has not been covered by fill material. Also included are a few long, narrow areas of Aquents that have slopes of from 1 to 5 percent. The included soils make up about 10 percent of the map unit.

Natural vegetation consists mainly of eastern baccharis, marshhay cordgrass, saltmarsh bulrush, and sumpweed.

Most areas of this soil are used as habitat for wetland wildlife. A small acreage is developed for docks and other shipping facilities. Extensive forms of recreation are popular in the area.

This Aquents soil is well suited to extensive forms of recreation and to use as habitat for wetland wildlife. Food and roosting areas are available for ducks, geese, and other waterfowl. The soil also provides habitat for alligators and furbearers, such as mink, otter, raccoon, and muskrat.

This soil is not suited to crops, woodland, or pasture. Wetness, flooding, salinity, and low strength are too severe for these uses.

Unless additional fill material is added to this soil to raise the surface elevation and levees are improved to protect the soil from flooding, the soil is generally not suited to intensive recreation and urban uses. Flooding, wetness, low strength, and subsidence potential are too severe for these uses.

This Aquents soil is in capability subclass Vw.

BB—Barbary clay. This mineral soil is level, very poorly drained, and very fluid. It is in broad, ponded, freshwater swamps. Areas range from about 50 to 2,000 acres. Slope is less than 1 percent. Fewer observations were made in these areas than in areas of some other soils in the survey area. The mapping, however, was controlled well enough for the expected uses of the soil.

Typically, the surface layer is dark gray, very fluid clay about 6 inches thick. The underlying material to a depth of about 60 inches is gray, very fluid clay in the upper part and greenish gray, slightly fluid clay in the lower part. In some places, the surface layer is muck; in other places, buried logs are in the underlying material.

This soil is flooded most of the time by freshwater, and it is saturated throughout the year. Most areas are also occasionally flooded by saltwater during storms. During nonflood periods, the seasonal high water table ranges from 1 foot above the surface to 0.5 foot below the surface. Water and air move through this soil very slowly. This soil has moderate subsidence potential.

Included in mapping are a few small to large areas of Clovelly and Sharkey soils. The Clovelly soils are in brackish marshes that have encroached upon the swamps, and they have thick organic layers. The Sharkey soils are in higher positions than the Barbary soil and have firm mineral layers. Also included are large areas of mineral soils that are similar to the Barbary soil except that they are slightly saline and have been encroached upon by brackish marsh vegetation. The included soils make up about 20 percent of the map unit.

Natural vegetation on this Barbary soil consists of water-tolerant trees and aquatic understory plants. The common trees are baldcypress, black willow, and water tupelo. Understory and aquatic vegetation consist mainly of alligatorweed, butterweed, buttonbush, duckweed, pickerelweed, and water hyacinth.

Most areas of this soil are used as woodland, mainly for habitat for wildlife and for extensive forms of recreation.

This soil is well suited to use as habitat for wetland wildlife. It provides habitat for large numbers of crawfish, ducks, squirrels, alligators, wading birds, and furbearers, such as raccoon, muskrat, and otter. White-tailed deer and swamp rabbits use areas of this soil when it is dry or not flooded too deeply. Trapping of alligators, crawfish, and furbearers is an important enterprise. Constructing shallow ponds and artificially flooding this soil can improve the habitat for waterfowl.

This Barbary soil is poorly suited to use as woodland, mainly because of wetness, flooding, and poor trafficability. Few areas of this soil are managed for timber production because trees grow slowly and special equipment is needed to harvest the timber. This soil cannot support the load of most types of harvesting equipment.

Unless drained and protected from flooding, this soil is not suited to use as pasture or for crops. Wetness and flooding are too severe for these uses. This soil generally is too soft and boggy to support livestock grazing.

This soil is not suited to urban and intensive recreation uses. It is severely limited by wetness, low strength, and flooding. Drainage and protection from flooding are possible only by constructing large water-control structures. Drainage ditches are difficult to construct because stumps and logs are buried in the soil. In addition, subsidence is a problem if this soil is drained.

This Barbary soil is in capability subclass VIIw and in woodland group 4W.

BP—Bellpass muck. This organic soil is level, very poorly drained, saline, and very fluid. It is in saline marshes, and it is ponded or flooded by saltwater most of the time. Areas range from about 100 to 3,000 acres. Fewer observations were made in these areas than in areas of some other soils in the survey area. The mapping, however, was controlled well enough for the expected uses of the soil. Slope is less than 1 percent.

Typically, the organic surface layer is very dark grayish brown, very fluid muck about 29 inches thick. The next layer is mineral material to a depth of about 41 inches and is dark gray, very fluid clay. The underlying material to a depth of about 68 inches is gray, very fluid clay.

This Bellpass soil is flooded most of the time by saltwater and is wet throughout the year. During tidal storms, this soil is covered by as much as 5 feet of water. Water is perched above the surface most of the year, but during periods of sustained north wind and low tides the water table drops to about 0.5 foot below the surface. This soil has low strength and poor trafficability. Permeability is rapid in the organic surface layer and very slow in the clay underlying material. The total subsidence potential is high. If drained, the organic material, on drying, initially shrinks to about half the original thickness and then subsides further as a result of compaction and oxidation. These losses are most rapid during the first 2 years. If the soil is drained, it continues to subside at the rate of about 1 inch per year. The lower the water table, the more rapid the loss.

Included in mapping are a few small to large areas of Clovelly, Scatlake, and Timbalier soils. The Clovelly soils are in brackish marshes and are less saline throughout than the Bellpass soil. The Scatlake and Timbalier soils are in positions similar to those of the Bellpass soil. The Scatlake soils are very fluid mineral soils. The Timbalier soils have organic material that is more than 51 inches thick. The included soils make up about 20 percent of the map unit.

The natural vegetation consists mainly of marshhay cordgrass, needlegrass rush, seashore saltgrass, smooth cordgrass, bushy sea-oxeye, saltwort, and woody glasswort.

Most areas of this soil are used as habitat for wetland wildlife and for extensive forms of recreation, such as hunting and fishing.

This Bellpass soil is well suited to use as habitat for wetland wildlife. It is part of an estuary that provides a nursery for saltwater fish and crustaceans, such as shrimp, blue crab, menhaden, croaker, spot, and bay anchovy. These fish and estuarine larval forms are sources for a large fishing industry. This soil also provides habitat for moderate populations of geese, muskrat, mink, otter, raccoon, nutria, and ducks.

This soil is not suited to crops nor to use as woodland or pasture. Flooding, wetness, and low strength are too severe for these uses. This soil is generally too soft and boggy to support livestock grazing. Drainage and protection from flooding are possible, but extensive water-control structures, such as levees and water pumps, are required. Subsidence and low strength are continuing limitations after drainage.

This soil is not suited to urban or intensive recreation uses because of wetness, flooding, and low strength. Drainage is only feasible with an extensive system of levees and water pumps. This soil is poorly suited to the construction of levees because the soil shrinks and cracks as it dries, causing the levees to fail.

This Bellpass soil is in capability subclass VIIw.

CE—Clovelly muck. This level, organic soil is very poorly drained, very fluid, and slightly saline. It is in brackish marshes and is flooded and ponded most of the time. Areas range from about 500 to 1,000 acres. Fewer observations were made in these areas than in areas of some other soils in the survey area. The mapping, however, was controlled well enough for the expected uses of the soil. Slope is less than 1 percent.

Typically, the surface layer is dark brown, very fluid muck about 50 inches thick. The underlying material to a depth of about 70 inches is gray, very fluid clay.

This Clovelly soil is flooded most of the time by brackish water and is wet throughout the year. During tidal storms, this soil is covered by as much as 5 feet of water. Water is above the surface during most of the year, but during periods of sustained north wind and low tides, the water table drops to about 0.5 foot below the surface. This soil has low strength and poor trafficability. Permeability is rapid in the organic surface layer and very slow in the clayey underlying material. The total subsidence potential is high. If drained, the organic material, on drying, initially shrinks to about half the original thickness and then subsides further as a result of compaction and oxidation. These losses are most rapid during the first 2 years. If the soil is drained, it continues to subside at the rate of about 1 inch per year. The lower the water table, the more rapid the loss.

Included in mapping are a few small to large areas of Barbary, Bellpass, Lafitte, Scatlake, and Timbalier soils. The Barbary soils are in nearby swamps and are mineral soils. The Bellpass, Scatlake, and Timbalier soils are in saline marshes and are more saline throughout than the Clovelly soil. The Lafitte soils are in positions similar to those of the Clovelly soil, and they have a thicker organic layer. Few to many small ponds and tidal channels are in places. Also included are large areas of soils that are similar to Clovelly soil except that they have a few dead cypress trees and buried logs. The included soils make up about 20 percent of the map unit.

Most areas of this soil are used as habitat for wetland wildlife and for extensive forms of recreation, such as hunting and fishing.

The natural vegetation consists mainly of marshhay cordgrass, olney bulrush, big cordgrass, dwarf spikesedge, marsh morningglory, saltmarsh bulrush, widgeongrass, and sumpweed.

This soil is well suited to use as habitat for wetland wildlife. It provides habitat for large populations of geese and furbearers, such as mink, muskrat, otter, and raccoon. Intensive management of wildlife habitat generally is not practical. Water-control structures are difficult to construct and maintain because of the instability and very fluid nature of the soil. Saltwater intrusion is a problem in the management of the vegetation for wildlife habitat. The small ponds and streams included in this map unit provide areas for sport and commercial fishing.

This soil is not suited to crops nor to use as pasture or woodland because of wetness, flooding, salinity, low strength, and poor accessibility. These soils are generally too fluid and boggy to support livestock grazing.

This soil is not suited to urban and intensive recreation uses. Flooding, wetness, low strength, and high subsidence potential are too severe for these uses. If this soil is drained and protected from flooding, it will subside 1 foot to 5 feet below sea level.

This Clovelly soil is in capability subclass VIIw.

Cm—Commerce silt loam. This soil is level and somewhat poorly drained. It is on natural levees of the Mississippi River and its distributaries. Areas range from about 10 to 200 acres. Slope is less than 1 percent.

Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil extends to a depth of about 34 inches. It is dark grayish brown silty clay loam in the upper part and grayish brown silty clay loam in the middle and lower parts. The underlying material to a depth of about 60 inches is grayish brown silt loam.

This Commerce soil has high fertility. Water and air move through this soil at a moderately slow rate. Water runs off the surface slowly. Adequate water is available to plants in most years. A seasonal high water table fluctuates between depths of about 1.5 and 4 feet from December through April. This soil has moderate shrink-swell potential.

Included in mapping are a few small areas of Harahan, Sharkey, and Vacherie soils. The Harahan and Sharkey soils are in lower positions than Commerce soil and have a clayey subsoil. The Vacherie soils are in similar positions, and they are clayey in the lower part. The included soils make up about 10 percent of the map unit.

Most of the acreage is in urban areas. Small acreages are in pasture, crops, or woodland. About 25 to 75 percent of most urban areas is covered by houses, streets, buildings, and parking lots. The open areas are mostly lawns, vacant lots, playgrounds, or vegetable gardens.

This soil has moderate limitations for most urban uses. It is firm, consists of mineral material throughout, and can support the foundations of most low structures without the use of pilings. Wetness and the moderate shrink-swell potential are the main limitations for dwellings without basements. These limitations can be overcome by drainage and by using proper engineering designs. The moderately slow permeability and the high water table increase the possibility that septic tank absorption fields will fail. During the rainy season, effluent from onsite sewage disposal systems may seep at points downslope. Low strength is a limitation for local roads and streets, but this limitation can be minimized by adding sand or other suitable fill material to the road base.

This soil is well suited to use as pasture. Improved bermudagrass, common bermudagrass, Dallisgrass, ryegrass, tall fescue, vetch, arrowleaf clover, red clover, and white clover are the main pasture plants. Fertility generally is sufficient for sustained production of high quality, nonirrigated pasture. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This Commerce soil is well suited to cultivated crops and is one of the best soils in the survey area for this use. The main crops are vegetables and citrus; soybeans, sugarcane, and corn are also grown. This soil is friable, easy to keep in good tilth, and it can be worked throughout a wide range of moisture content. Proper row arrangement, field ditches, and vegetated outlets are needed to remove excess surface water. Land grading and smoothing can also help. A tillage pan forms easily if this soil is tilled when wet, but it can be broken up by chiseling or subsoiling. Surface crusting and soil compaction can be reduced by returning crop residue to the soil.

This soil is well suited to production of hardwoods. American sycamore and eastern cottonwood are suitable trees for planting. Equipment use limitations are moderate because of wetness.

This soil is moderately well suited to intensive recreation uses. Wetness is the main limitation. Excess surface water can be removed by shallow ditches and by providing the proper grade for drainage. Plant cover can be maintained by fertilizing and by controlling traffic.

This Commerce soil is in capability subclass IIw and in woodland group 13W.

Co—Commerce silty clay loam. This soil is level and somewhat poorly drained. It is on natural levees of the Mississippi River and its distributaries. Areas range from about 10 to 200 acres. Slope is less than 1 percent.

Typically, the surface layer is dark grayish brown silty clay loam about 12 inches thick. The subsoil and underlying material to a depth of about 60 inches are grayish brown silty clay loam.

This Commerce soil has high fertility. Water and air move through this soil at a moderately slow rate. Water runs off the surface slowly. Adequate water is available to plants in most years. A seasonal high water table fluctuates between depths of about 1.5 and 4 feet from December through April. This soil has moderate shrink-swell potential.

Included in mapping are a few small areas of Harahan, Sharkey, and Vacherie soils. The Harahan and Sharkey soils are in lower positions than Commerce soil and have a clayey subsoil. The Vacherie soils are in similar positions, and they have a clayey underlying material. The included soils make up about 5 percent of the map unit.

Most of the acreage is in urban areas. Small acreages are in pasture, crops, or woodland. About 25 to 75 percent of most urban areas is covered by houses, streets, buildings, and parking lots. The open areas are mostly lawns, vacant lots, playgrounds, or vegetable gardens.

This soil has moderate to severe limitations for most urban uses. It is firm, consists of mineral material throughout, and can support the foundations of most low structures without the use of pilings. Wetness and the moderate shrink-swell potential are the main limitations for dwellings without basements. These limitations can easily be overcome by drainage and by using proper engineering designs. The moderately slow permeability and the high water table increase the possibility that septic tank absorption fields will fail. During the rainy season, effluent from onsite sewage disposal systems may seep at points downslope. Low strength is a limitation for local roads and streets, but this limitation can be minimized by adding sand or other suitable fill material to the road base.

This soil is well suited to use as pasture. Improved bermudagrass, common bermudagrass, Dallisgrass, ryegrass, tall fescue, wheat, vetch, arrowleaf clover, red clover, and white clover are the main pasture plants. Fertility generally is sufficient for sustained production of high quality, nonirrigated pasture. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This Commerce soil is well suited to cultivated crops and is one of the best soils in the survey area for this use. This soil, however, is sticky when wet and hard when dry, and it becomes cloddy if tilled when it is too wet or too dry. The main crops are vegetables and citrus; soybeans, sugarcane, and corn are also grown. Wetness is the main limitation. Proper row arrangement, field ditches, and vegetated outlets are needed to remove excess surface water. Land grading and smoothing can also help. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Most crops, other than legumes, respond well to additions of nitrogen fertilizer.

This soil is well suited to production of hardwood trees. American sycamore and eastern cottonwood are suitable trees for planting. Equipment use limitations are moderate because of wetness and the silty clay loam surface layer.

This soil is moderately well suited to intensive recreation uses. Wetness is the main limitation. Good drainage should be provided for intensively used areas, such as campgrounds and playgrounds. Plant cover can be maintained by controlling traffic.

This Commerce soil is in capability subclass IIw and in woodland group 13W.

CS—Commerce and Sharkey soils, frequently flooded. These soils are level and somewhat poorly drained and poorly drained. They are on the unprotected river banks between the Mississippi River and the protection levees. These soils are subject to frequent flooding by rapidly moving water as the river seasonally rises and falls. The soil pattern is irregular; some areas are all Commerce soil, some areas are all Sharkey soil, and other areas have both soils. The soils were mapped together since the frequent flooding is a common feature controlling use and management. The texture of the surface layer changes as the river reworks the deposits. The Commerce soil makes up about 50 percent of the map unit, and the Sharkey soil makes up about 30 percent. Areas range from about 10 to 200 acres. Slope is less than 1 percent.

Typically, the surface layer of the Commerce soil is dark grayish brown silt loam about 7 inches thick. The subsoil extends to a depth of about 25 inches. It is grayish brown silty clay loam. The underlying material to a depth of about 60 inches is grayish brown silty clay loam and silt loam.

Typically, the surface layer of the Sharkey soil is dark gray silty clay loam about 8 inches thick. The subsoil and underlying material to a depth of about 60 inches is gray clay.

Commerce and Sharkey soils are frequently flooded by overflow from the Mississippi River, mostly in the spring. Flooding occurs more often than twice in 5 years, during any time of the year. Depth of the floodwater ranges from 2 to 10 feet. During nonflood periods, the Sharkey soil is wet and the water table is at the surface or within 2 feet of the surface. The Commerce soil has a water table at a depth of 1.5 to 4 feet during nonflood periods. The soils have low to fair strength. The Commerce soil is moderately slowly permeable. It has very high available water capacity and moderate shrink-swell potential. The Sharkey soil is very slowly permeable. It has very high shrink-swell potential.

Included with these soils in mapping are a few small areas where mineral fill material has been added to raise the elevation above flooding elevations. Several areas that are above normal flooding elevation are included. Also included are a few small areas of soils similar to the Commerce soil except that they have less clay in the subsoil. The included areas make up about 20 percent of the map unit.

Most of the acreage is in urban uses, or it is idle. A small acreage is used for extensive forms of recreation.

The soils in this map unit are not suited to cultivated crops and are poorly suited to use as pasture because of deep, frequent flooding. Scouring and sedimentation are also problems.

This Commerce soil is well suited to use as woodland, and the Sharkey soil is moderately well suited. Flooding and wetness limit the use of equipment on both soils. In addition, seedling mortality is severe. Eastern cottonwood and American sycamore are suitable trees for planting on the Commerce soil. Baldcypress is a suitable tree for planting on the Sharkey soil. Reforestation after harvesting must be carefully managed to reduce competition from undesirable plants.

Unless drained and protected from flooding, the soils in this map unit are generally not suited to urban uses or intensive forms of recreation because of flooding, wetness, and the very high shrink-swell potential. If the soils are developed for commercial uses, sufficient fill material is needed to raise the surface elevation above normal flood levels.

The soils in this map unit are well suited to use as habitat for woodland wildlife and moderately well suited to use as habitat for wetland wildlife and openland wildlife. The habitat for wildlife can be improved by maintaining undisturbed areas of permanent vegetation.

This map unit is in capability subclass Vw. The Commerce soil is in woodland group 12W, and the Sharkey soil is in woodland group 6W.

Dp—Dumps. This map unit consists of refuse dumps and sanitary landfills. It is mostly in swamps and marshes. Dumps are nearly level to moderately steep. Areas range from 5 to 20 acres.

Typically, these areas consist of successive layers of compacted refuse and thin soil layers. The combined thickness of these layers can range from 5 feet to more than 30 feet.

Included with these areas in mapping are a few small areas of Barbary, Clovelly, and Lafitte soils that are not yet covered by refuse.

This map unit is mainly used for the disposal of solid waste. Dumps are not suited to agricultural, forest, or urban uses. Dumps are, however, used as commercial sites occasionally, but numerous problems preclude this as a recommended use.

Dumps are not assigned to interpretative groups.

FA—Fausse clay, saline. This mineral soil is level, very poorly drained, and firm. It is in swamps on subsided natural levees of distributaries of the Mississippi River. The soil is at sea level and is frequently covered by saltwater. Areas range from 10 to 1,000 acres. Fewer observations were made in mapping this soil than in mapping some other soils. The detail in mapping, however, is adequate for the expected use of the soil. Slope is less than 1 percent.

Typically, the surface layer is about 5 inches thick. It is very dark grayish brown, very fluid clay in the upper part and dark gray, firm clay in the lower part. The subsoil and the underlying material to a depth of about 60 inches are gray, firm clay.

This soil is subject to frequent, shallow flooding by the highest of the normal tides. It is also subject to occasional, deep flooding by storm tides. Tides can be as much as 10 feet above normal when hurricanes and tropical storms pass over or near the parish. The water table fluctuates from about 1 foot above the surface to 1.5 feet below the surface year-round. This soil is seldom dry enough to crack. Water and air move through the soil very slowly.

Included in mapping are a few small to large areas of Bellpass, Clovelly, and Sharkey soils. The Bellpass and Clovelly soils are organic soils in nearby marshes. The Sharkey soils are not saline, and they are in higher positions than the Fausse soil. The included soils make up about 20 percent of the map unit.

Most areas of this Fausse soil are used as habitat for wetland wildlife or for campsites. The soil produces habitat for deer, rabbit, nutria, and associated species. Because of the intrusion of saltwater, the native vegetation is being killed back and salt-tolerant species are encroaching.

The native vegetation once consisted of baldcypress, water tupelo, and red maple trees. Most of this native vegetation has been damaged or killed by saltwater intrusion (fig. 2).

Unless drained and protected from flooding, this soil is not suited to cropland, pasture, or to urban uses. Flooding and wetness are generally too severe for these uses.

This soil is well suited to use as habitat for wetland wildlife. When the soil is flooded, it provides feeding and roosting areas for ducks and other waterfowl. Properly managed low-level weirs for water control, controlled burning, and controlled harvest are needed to improve the habitat for wetland wildlife. Hunting and fishing are popular in some areas.

This soil is not suited to use as woodland. Soil salinity, wetness, and flooding are too severe for this use. The remaining hardwood trees can be harvested only with the use of special equipment. Soil salinity is expected to prevent the natural regeneration of trees.

This Fausse soil is in capability subclass VIIw.

FE—Felicity loamy fine sand, frequently flooded. This saline soil is gently sloping and somewhat poorly drained. It is on ridges along the coast of the Gulf of Mexico and on barrier islands. This soil is subject to flooding by saltwater during high storm tides. Areas are long and narrow and range from 10 to 100 acres. Fewer observations were made in mapping this soil than in mapping some other soils. The detail in mapping, however, is adequate for the expected use of the soil. Slope ranges from 1 to 3 percent.

Typically, the surface layer is grayish brown loamy fine sand about 5 inches thick. The underlying material to a depth of about 60 inches is brown sand in the upper part, grayish brown loamy sand in the middle part, and dark gray loamy sand in the lower part. Fragments of shell are in all layers.

The Felicity soil is low in fertility. Permeability is very rapid above the water table. Water runs off the surface slowly. Adequate water is available to plants in most years. The water table fluctuates with the normal tides and is 2 to 3 feet below the surface most of the time. During storms this soil is frequently flooded by saltwater

Figure 2.—The native trees in this area of Fausse clay, saline, have been killed by saltwater intrusion. The trees in the background are on Sharkey clay.

from the Gulf of Mexico. Flooding occurs more often than twice in 5 years, during any time of the year.

Included in mapping are a few small areas of Bellpass, Scatlake, and Timbalier soils. The Bellpass and Timbalier soils are in lower positions than Felicity soil and have thick organic layers. The Scatlake soils are in lower positions and are very fluid and clayey. The included soils make up about 5 percent of the map unit.

The natural vegetation is mainly black mangrove, sumpweed, seashore saltgrass, saltwort, smooth cordgrass, bushy seaoxeye, marshhay cordgrass, and needlegrass rush. In some areas, the soil is barren of vegetation.

Most of the acreage is used as habitat for wetland and openland wildlife. Areas of this soil serve to break wave action from the Gulf of Mexico.

This soil is poorly suited to use as habitat for wetland wildlife. It provides some plant growth for food, and it is used mainly as a resting area by geese, ducks, and shore birds.

This Felicity soil is not suited to urban uses and to intensive forms of recreation, mainly because of flooding and wetness. Occasional hurricanes and high storm tides are severe hazards. Soil salinity and droughtiness are limitations to plants.

This soil is not suited to crops nor to use as woodland and is poorly suited to use as pasture. Wetness and salinity are the main limitations, and flooding is a hazard.

This Felicity soil is in capability subclass VIIw.

Ha—Harahan clay. This soil is level and poorly drained. It is in low positions on the Mississippi River flood plain, in former swamps. This soil is firm in the upper part and slightly fluid in the lower part. Areas range from about 20 to 500 acres. Slope is less than 1 percent.

Typically, the surface layer is dark gray clay about 5 inches thick. The subsoil extends to a depth of about 37 inches. It is gray, firm clay. The underlying material to a depth of about 63 inches is gray, slightly fluid clay.

This Harahan soil is protected from most flooding by levees, and it is drained by pumps. Under normal conditions the water table is maintained at a depth of about 1 foot to 3 feet. After heavy rains, the water table is near the surface for short periods. Flooding is rare, but it can occur during hurricanes or when water pumps or protection levees fail. Flooding occurs less often than once in 10 years, during any time of the year. Water and air move through this soil very slowly. Water runs off the surface slowly. Adequate water is available to plants in most years. This soil is high in fertility. It has very high shrink-swell potential and medium total subsidence potential.

Included in mapping are a few small areas of Sharkey and Westwego soils. The Sharkey soils are in higher positions than Harahan soil and are firm and clayey throughout. The Westwego soils are in positions similar to those of the Harahan soil, and they contain buried layers of organic material. Also included is one large area of soils similar to the Harahan soil except that they are subject to frequent flooding. The included soils make up about 5 percent of the map unit.

Most of the acreage is in urban uses. About 25 to 75 percent of most areas are covered by houses, streets, buildings, and parking lots. The open areas are mostly lawns, vacant lots, and playgrounds. A small acreage is in pasture or is idle land that is reserved for future urban uses.

This Harahan soil is moderately well suited to use as pasture and for crops. Common bermudagrass, improved bermudagrass, Dallisgrass, ryegrass, tall fescue, and white clover are the main pasture plants. Fertility generally is sufficient for sustained production of high-quality nonirrigated pasture. Water control is a major concern for crops and pasture.

This soil is moderately well suited to use as woodland. The soil is mainly reserved for future urban development, however, and it will not likely be used for commercial timber production.

This soil is poorly suited to urban uses and intensive forms of recreation. Flooding is a hazard, and wetness, very slow permeability, subsidence, low strength, and the very high shrink-swell potential are the main limitations. If buildings are constructed, pilings and specially constructed foundations are needed. Additional support and stability for buildings and roads can be provided by adding loamy fill material to the soil surface. Adequate water control is needed to reduce wetness and to control the rate of subsidence. Using proper design and backfilling with mineral material that has a low shrink-swell potential can minimize the effects of shrinking and swelling. Shallow excavations are difficult because of the buried stumps and logs in the soil and the slightly fluid nature of the underlying material. Septic tank absorption fields do not function properly because of wetness and the very slow permeability. If housing density is moderate to high, a community sewage system is needed.

This Harahan soil is in capability subclass IIIw.

Hf—Harahan clay, frequently flooded. This mineral soil is level and poorly drained. It is in swamps that previously were protected from most flooding by levees and were drained with water pumps. Because the water pumps are no longer in operation and the levees are not maintained, the soil is subject to ponding and frequent flooding. This soil is firm in the upper part and very fluid in the lower part. Areas range from about 20 to 500 acres. Slope is less than 1 percent.

Typically, the surface layer is dark gray clay about 4 inches thick. The subsoil is gray clay to a depth of about 27 inches. The underlying material to a depth of about 62 inches is gray, very fluid clay.

The Harahan soil is subject to ponding and frequent flooding following intense rains. Flooding occurs more often than twice in 5 years, during any time of the year. The water table is about 1 foot below the surface during dry periods and about 1 foot above the surface after rainstorms. Water and air move through this soil very slowly. This soil is high in fertility. It has very high shrink-swell potential and medium total subsidence potential.

Included in mapping are a few small areas of Barbary, Sharkey, and Westwego soils. The Barbary soils are in slightly lower positions than Harahan soil and are very fluid throughout. The Sharkey soils are in higher positions and are firm clay throughout. The Westwego soils are in positions similar to those of the Harahan soil, and they contain buried layers of organic material. The included soils make up about 10 percent of the map unit.

Most of the acreage is idle and is reserved for future urban development. A small acreage is in woodland and is used as habitat for wetland and woodland wildlife.

This Harahan soil is well suited to use as habitat for wetland wildlife. It provides habitat for large populations of crawfish, ducks, snakes, wading birds, and furbearers, such as raccoon, mink, nutria, and otter. Constructing shallow ponds and artificially flooding this soil can improve habitat for waterfowl and other wetland species.

This soil is poorly suited to use as woodland, mainly because of wetness, flooding, and poor trafficability. Few areas are managed for timber production because trees grow slowly and special equipment is needed to harvest the timber. Baldcypress can be planted, but seedling mortality is severe. This soil cannot support the load of some types of harvesting equipment.

Unless adequately drained and protected from flooding, this soil is poorly suited to use as pasture, and it is not suited to crops. It is limited mainly by wetness and flooding.

This soil is not suited to urban and intensive recreation uses, mainly because of wetness, low strength, very slow permeability, flooding, and very high shrink-swell potential. Drainage and protection from flooding are needed for further urban development.

This Harahan soil is in capability subclass Vw and in woodland group 5W.

LF—Lafitte muck. This organic soil is level, very poorly drained, slightly saline, and very fluid. It is in brackish marshes (fig. 3). This soil is flooded and ponded most of the time. Areas range from about 50 to 3,000 acres. Fewer observations were made in these areas than in areas of some other soils in the survey area. The mapping, however, was controlled well enough for the expected uses of the soil. Slope is less than 1 percent.

Typically, the surface layer is very dark grayish brown, very fluid muck about 12 inches thick. The next layer extends to a depth of about 53 inches. It is dark brown, very fluid muck in the upper part and black, very fluid muck in the lower part. The underlying layer is very dark gray, very fluid, mucky clay.

This soil is flooded most of the time by brackish water, and it is wet throughout the year. During storms this soil is covered by as much as 5 feet of water. Water is

Figure 3.—This area of Lafitte muck in brackish marsh is flooded and ponded most of the time.

perched above the surface most of the year, but during periods of sustained north wind and low tides, the water table drops to about 0.5 foot below the surface. This soil has low strength and poor trafficability. Permeability is moderately rapid in the organic surface layer and very slow in the clayey layers. The subsidence potential is high. If drained, the organic material, on drying, initially shrinks to about half the original thickness and then subsides further as a result of compaction and oxidation. These losses are most rapid during the first 2 years after reclamation. The soil continues to subside at the rate of about 1 inch per year after the initial subsidence following drainage. The lower the water table, the more rapid the loss.

Included in mapping are a few small to large areas of Bellpass, Clovelly, Scatlake, and Timbalier soils. The Bellpass, Scatlake, and Timbalier soils have higher salt content than the Lafitte soil and are in saline marshes. The Clovelly soils are in positions similar to those of the Lafitte soil, and they have a thinner layer of organic material over the clayey underlying material. Few to many small ponds and tidal channels are included in places. Also included are a few small areas of soils similar to Lafitte soil except that they contain buried logs and stumps. The included soils make up about 20 percent of the map unit.

The natural vegetation consists mainly of marshhay cordgrass, Olney bulrush, marsh morningglory, big cordgrass, widgeongrass, and sumpweed.

Most areas of this Lafitte soil are used as habitat for wetland wildlife and for extensive forms of recreation, such as hunting and fishing.

This soil is well suited to use as habitat for wetland wildlife. It provides habitat for large numbers of geese and furbearers, such as mink, muskrat, otter, and raccoon. Intensive management of wildlife habitat generally is not practical. Water-control structures are difficult to construct and maintain because of the instability and very fluid nature of the soil material. Saltwater intrusion is a problem in the management of the vegetation for wildlife habitat. The small ponds and streams included in this map unit provide areas for sport and commercial fishing. Hunting of geese is also popular.

This soil is not suited to crops nor to use as pasture or woodland because of wetness, flooding, salinity, low strength, and poor accessibility. This soil is generally too soft and boggy to support livestock grazing.

The soil is not suited to urban and intensive recreation uses. Flooding, wetness, low strength, and subsidence potential are too severe for these uses. If this soil is drained and protected from flooding, it will subside 1 foot to 5 feet below sea level.

This Lafitte soil is in capability subclass VIIIw.

SC—Scatlake mucky clay. This mineral soil is level, very poorly drained, and very fluid. It is in saline marshes that are flooded or ponded most of the time. Areas range from about 100 to 3,000 acres. Fewer observations were made in these areas than in areas of some other soils in the survey area. The mapping, however, was controlled well enough for the expected uses of the soil. Slope is less than 1 percent.

Typically, the surface layer is gray, very fluid mucky clay about 7 inches thick. The underlying material to a depth of about 70 inches is very fluid clay. It is dark gray in the upper part and gray in the lower part.

This soil is flooded most of the time by saltwater, and it is wet throughout the year. Floodwater can be as deep as 4 feet or more during tidal storms. Water is perched above the surface most of the year, but during periods of sustained north wind and low tides the water table drops to about 0.5 foot below the surface. Permeability is very slow. The total subsidence potential is medium.

Included in mapping are a few small to large areas of Bellpass and Timbalier soils. The Bellpass and Timbalier soils are in positions similar to those of the Scatlake soil, and they have thick organic layers. The included soils make up about 20 percent of the map unit. Few to many small ponds and tidal channels are also included in places.

The natural vegetation is mainly needlegrass rush, seashore saltgrass, smooth cordgrass, bushy seaoxeye, marshhay cordgrass, and saltwort.

This Scatlake soil is well suited to use as habitat for wetland wildlife and for extensive forms of recreation, such as hunting. The soil provides habitat for moderate populations of geese, muskrat, mink, otter, and raccoon. This soil is part of an estuary that provides a nursery for saltwater fish and crustaceans, such as shrimp, blue crab, menhaden, croaker, spot, and bay anchovy. These fish and estuarine larval forms are sources for a large fishing industry. The many natural ponds and waterways provide access for fishing, shrimping, and hunting.

This soil is not suited to crops nor to use as woodland or pasture because of wetness, flooding, salinity, low strength, and poor accessibility. This soil cannot support the weight of farm machinery or cattle.

This soil is not suited to urban and intensive recreation because of flooding, wetness, and low strength. In addition, hurricanes are common. If this soil has been drained and is protected from flooding, it shrinks, cracks, and subsides to elevations below sea level.

This Scatlake soil is in capability subclass VIIIw.

Sh—Sharkey silty clay loam. This mineral soil is level, poorly drained, and firm. It is in low and intermediate positions on the natural levees of the Mississippi River and its distributaries. The soil is protected from most flooding by earthen levees. Areas range from about 10 to 300 acres. Slope is less than 1 percent.

Typically, the upper part of the surface layer is dark grayish brown silty clay loam about 5 inches thick. The lower part is dark gray clay about 5 inches thick. The subsoil is dark gray clay in the upper part, gray clay in the middle part, and dark gray clay in the lower part. The underlying material to a depth of about 60 inches is gray clay.

This soil has high fertility. Water and air move through this soil very slowly. Water runs off the surface slowly and stands in low places for short periods after heavy rains. Flooding is rare, but it can occur after prolonged heavy rainfall at any time of the year. Adequate water is available to plants in most years. A seasonal high water table fluctuates between a depth of about 2 feet and the soil surface during the winter and spring. The surface layer of this soil is sticky when wet and hard when dry. This soil has very high shrink-swell potential.

Included in mapping are a few small areas of Commerce, Harahan, and Vacherie soils. The Commerce and Vacherie soils are in slightly higher positions than Sharkey soil and are loamy. The Harahan soils are in slightly lower positions and have slightly fluid, clayey underlying material. Also included are a few small areas of Sharkey soils that have a silt loam surface layer. The included soils make up about 5 percent of the map unit.

Most of the acreage is in urban use. About 25 to 75 percent of most urban areas is covered by buildings, streets, and parking lots. The open areas are mostly lawns, vacant lots, or playgrounds. Small acreages are in woodland, pasture, or crops.

This soil is poorly suited to urban or intensive recreation uses; however, it is firm, has mineral material throughout, and can support the foundation of most low structures without the use of piling. This soil is limited mainly by rare flooding, wetness, very slow permeability, and very high shrink-swell potential. Drainage is needed if roads and building foundations are constructed. Excess water can be removed by using shallow ditches and providing the proper grade for drainage. Septic tank absorption fields do not function properly because of wetness and the very slow permeability. Using sandy backfill for the trench and constructing long absorption lines help to compensate for the very slow permeability. Drainage and sandy or loamy material added to the surface improve this soil for use as playgrounds and for other intensive recreation uses.

This soil is well suited to use as pasture. Common bermudagrass, improved bermudagrass, Dallisgrass, ryegrass, tall fescue, wheat, vetch, red clover, and white clover are the main pasture plants. Fertility generally is sufficient for sustained production of high-quality, nonirrigated pasture. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This Sharkey soil is moderately well suited to crops, mainly vegetables and citrus, and soybeans, sugarcane, rice, corn, and grain sorghum are also grown. This soil is sticky when wet and hard when dry, and it becomes cloddy if tilled when it is too wet or too dry. Surface drainage is needed for most cultivated crops and pasture plants. Land grading and smoothing improve surface drainage, but in places, large volumes of soil need to be moved. Crop residue left on or near the surface reduces runoff and helps to maintain soil tilth and organic matter content.

This soil is well suited to production of hardwoods. American sycamore and eastern cottonwood are suitable trees for planting. Trees should be water-tolerant, and they should be planted or harvested during dry periods. Equipment use limitations are a concern unless drainage is provided.

This Sharkey soil is in capability subclass IIIw and in woodland group 7W.

Sk—Sharkey clay. This mineral soil is level, poorly drained, and firm. It is in low positions on the natural levees of the Mississippi River and its distributaries. The soil is protected from river overflows by large earthen levees. Areas range from about 10 to 1,000 acres. Slope is less than 1 percent.

Typically, the surface layer is dark gray and dark grayish brown clay about 8 inches thick. The subsoil is gray clay in the upper part and dark gray clay in the lower part. The underlying material to a depth of about 60 inches is dark olive gray clay.

This soil has high fertility. Water and air move through this soil very slowly. Water runs off the surface slowly and stands in low places for short periods after heavy rains. Flooding is rare, but it can occur after prolonged heavy rainfall at any time of the year. Adequate water is available to plants in most years. A seasonal high water table fluctuates between the soil surface and a depth of about 2 feet during the winter and spring. The surface layer of this soil is very sticky when wet and very hard when dry. This soil has very high shrink-swell potential.

Included in mapping are a few small areas of Commerce, Harahan, Vacherie, and Westwego soils. The Commerce and Vacherie soils are in slightly higher positions than Sharkey soil and have a loamy subsoil. The Harahan and Westwego soils are in slightly lower positions and have a fluid underlying material. The included soils make up less than 10 percent of the map unit.

Most areas of this Sharkey soil are in urban uses. Small acreages are in woodland, pasture, or crops.

This soil is poorly suited to urban uses or intensive recreation areas; however, this firm, mineral soil can support the foundation of most low structures without the use of piling. The soil is mainly limited by rare flooding, wetness, very slow permeability, and the very high shrink-swell potential. Drainage is needed if roads and building foundations are constructed. Excess water can be removed by using shallow ditches and providing the proper grade for drainage. Septic tank absorption fields do not function properly because of wetness and the very slow permeability. Using sandy backfill for the trench and constructing long absorption lines help to compensate for the very slow permeability. If this soil is used for playgrounds or other intensive recreation, surface drainage and sandy or loamy material added to the surface reduce wetness and stickiness of the surface layer.

This soil is well suited to use as pasture. Common bermudagrass, improved bermudagrass, Dallisgrass, ryegrass, tall fescue, wheat, vetch, red clover, and white clover are suitable pasture plants. Fertility generally is sufficient for sustained production of high quality, nonirrigated pasture. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is moderately well suited to crops, mainly vegetables and citrus, and soybeans, sugarcane, rice, corn and grain sorghum are also grown. This soil is difficult to keep in good tilth. The surface layer of this soil is very sticky when wet and very hard when dry, and it becomes very cloddy if tilled when it is too wet or too dry. It can be worked only within a narrow range of moisture content. Surface drainage is needed for most cultivated crops and pasture plants. Land grading and smoothing also help to remove excess water. Crop residue left on or near the surface reduces runoff and helps to maintain soil tilth and organic matter content.

This soil is well suited to the production of hardwoods. American sycamore and eastern cottonwood are suitable trees to plant. Trees should be water-tolerant, and they should be planted or harvested during dry periods. The clay surface layer and wetness limit the use of equipment.

This Sharkey soil is in capability subclass IIIw and in woodland group 7W.

TM—Timbalier muck. This organic soil is level and very poorly drained. It is in saline marshes. This soil is flooded and ponded most of the time. Areas range from about 100 to 3,000 acres. The number of observations made in these areas was fewer than in other areas because of poor accessibility. The detail in mapping, however, is adequate for the expected use of the soil. Slope is less than 1 percent.

Typically, the surface layer is dark brown muck about 12 inches thick. The next layer to a depth of about 64 inches is very dark gray muck in the upper part and black muck in the lower part. The underlying material to a depth of about 84 inches is gray clay. The soil is very fluid throughout.

This soil is flooded most of the time by saltwater, and it is wet throughout the year. During tidal storms this soil is covered by as much as 5 feet of water. Water is perched above the surface during most of the year, but during periods of sustained north wind and low tides the water table drops to about 0.5 foot below the surface. This soil has low strength and poor trafficability. Permeability is rapid in the organic surface layer and very slow in the underlying mineral layers. The total subsidence potential is high. If drained, the organic material, on drying, initially shrinks to about half the original thickness and then subsides further as a result of compaction and oxidation. These losses are most rapid during the first 2 years. If the soil is drained, it continues to subside at the rate of about 1 inch per year. The lower the water table, the more rapid the loss.

Included in mapping are a few large areas of Bellpass and Scatlake soils. These soils are in positions similar to those of the Timbalier soil. The Bellpass soils have a thinner layer of organic material overlying clay. The Scatlake soils are very fluid, mineral soils. The included soils make up about 20 percent of the map unit.

The natural vegetation consists mainly of smooth cordgrass, needlegrass rush, seashore saltgrass, saltwort, and marshhay cordgrass.

Most areas of this soil are used as habitat for wetland wildlife and for extensive forms of recreation, such as hunting and fishing.

This soil is well suited to use as habitat for wetland wildlife. Areas of this soil are part of the estuarine complex that helps support Gulf marine life. Saltwater fish and the young of crustaceans, such as shrimp, blue crab, menhaden, croaker, spot, and bay anchovy, use these areas as part of their nursery grounds (fig. 4). These fish and estuarine larval forms are sources for a major fishing and shrimping industry. The soils also provide habitat for moderate numbers of geese, muskrat, mink, otter, raccoon, nutria, and ducks. Sport fishing and hunting are popular in many areas of this soil.

This soil is not suited to crops, woodland, pasture, intensive recreation uses, or urban uses. Flooding and wetness are too severe for these uses. This soil is too fluid and boggy to support livestock grazing. If this soil is drained and protected from flooding, it shrinks, cracks, and subsides. The soil material is poorly suited to use as construction material because of the high content of organic matter and the very fluid nature of the mineral layers. In addition, areas of this soil are susceptible to severe damage from hurricanes.

This Timbalier soil is in capability subclass VIIIw.

Ub—Urban land. This map unit consists of areas where more than 85 percent of the surface is covered by asphalt, concrete, buildings, or other impervious surfaces. Examples are parking lots, oil storage tank farms, industrial parks, and shopping centers. These areas are mainly on the natural levees along the Mississippi River. The areas range from 10 to 200 acres. Slope is less than 1 percent.

Included in mapping are areas that are mostly miscellaneous, artificial fill material.

Examination and identification of soils or soil material in this map unit are impractical. Careful onsite investigation is needed to determine the potential and limitations for any proposed use.

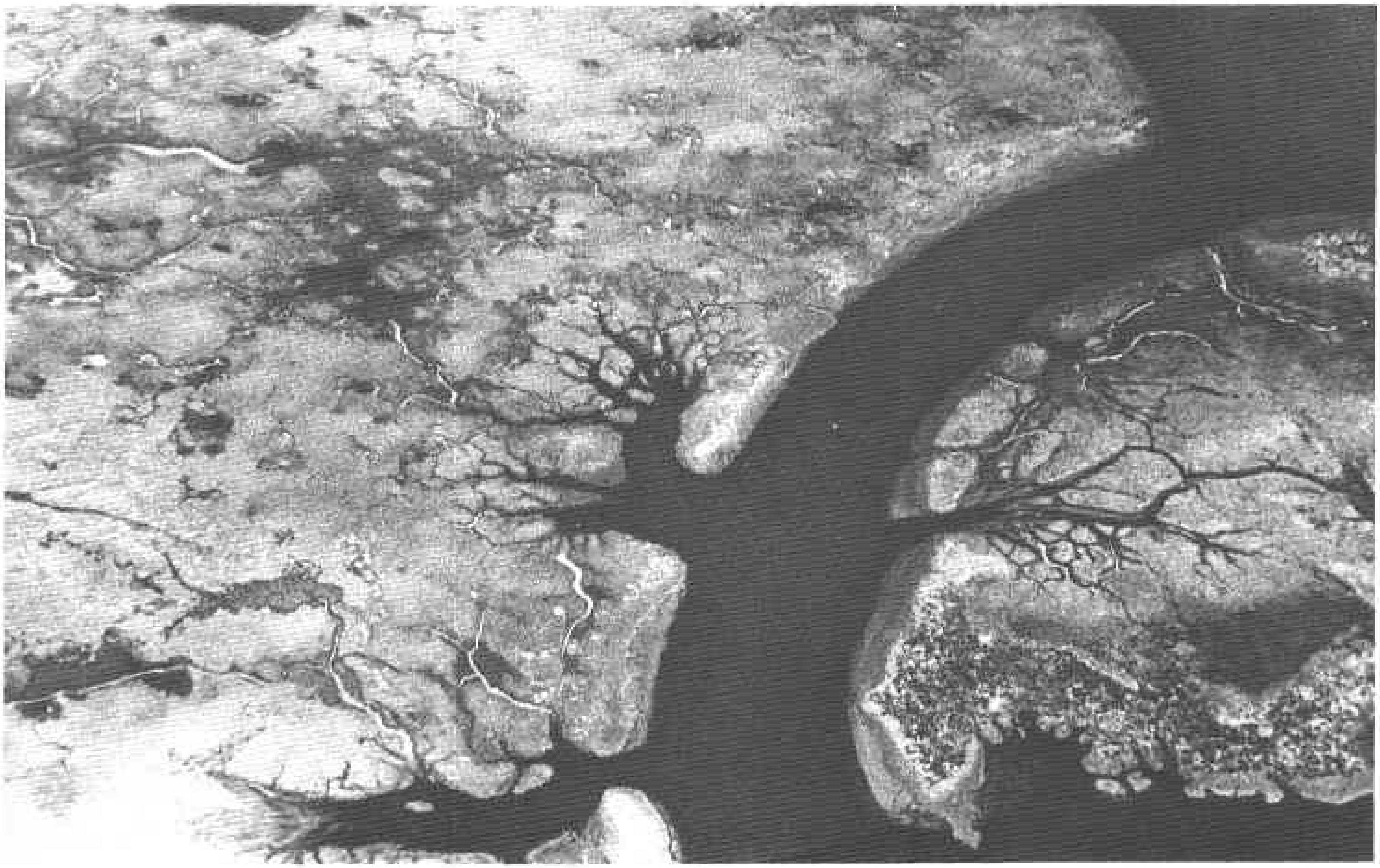

Figure 4.—The saline coastal marsh in this area of Timbalier muck is a nursery ground for saltwater fish and crustaceans.

Urban land is not assigned to interpretative groups.

Va—Vacherie silt loam, gently undulating. This soil is gently undulating and somewhat poorly drained. It is in intermediate positions where the natural levees of the Mississippi River were breached by former floods. It is protected from river overflow by large earthen levees. Areas range from about 10 to 300 acres. The landscape consists of parallel, low ridges and concave swales. The ridges are 1 foot to 3 feet high and 30 to 70 feet wide. The swales are about 50 to 200 feet wide. Slope is short and choppy and ranges from 0 to 3 percent.

Typically, the surface layer is dark grayish brown and brown silt loam about 12 inches thick. The subsoil extends to a depth of 60 inches. To a depth of 24 inches it is grayish brown silt loam. The next layer to a depth of about 34 inches is gray silty clay. The lower part of the subsoil is gray clay.

Included in mapping are a few small areas of Commerce, Harahan, and Sharkey soils. The Commerce soils are in positions similar to those of the Vacherie soil, and they are loamy throughout. The Harahan and Sharkey soils are in lower positions and have a clayey subsoil. Also included are small areas of soils that are similar to Vacherie soil except that they have a thinner layer of loamy material over the clayey subsoil. The included soils make up about 10 percent of the map unit.

This soil has high fertility. Permeability is moderate in the loamy upper part of the profile and very slow in the clayey lower part. Water runs off the surface slowly. A seasonal high water table fluctuates between depths of 1 foot and 3 feet during the winter and spring. The Vacherie soil in swales is subject to shallow ponding during heavy rains.

Most of the acreage is in urban uses. Small acreages are in woodland, crops, or pasture.

This soil is poorly suited to urban uses; however, it is firm, has mineral material throughout, and can support the foundation of most low structures without the use of pilings. The soil is limited mainly by wetness, the very high shrink-swell potential, low strength, and very slow permeability. Excess water can be removed by using shallow ditches and providing the proper grade for drainage. The high water table and the very slow permeability in the underlying clayey material increase the possibility that septic tank absorption fields will fail. During the rainy season, effluent from onsite sewage disposal systems may seep at points downslope. Designs for roads should offset the limited ability of the soil to support a load.

This soil is poorly suited to intensive recreation uses, such as playgrounds. It is limited mainly by wetness and the very slow permeability of the subsoil. These limitations, however, are more easily overcome in this soil than in most other soils in the parish. Shallow ditches and land smoothing or grading help to remove excess surface water. Plant cover can be maintained by fertilizing and controlling traffic.

This soil is well suited to use as pasture. Improved bermudagrass, common bermudagrass, Dallisgrass, tall fescue, white clover, arrowleaf clover, vetch, red clover, and ryegrass are the main pasture plants. Shallow surface ditches can remove excess surface water. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and soil in good condition. Fertility generally is sufficient for sustained production of high quality, nonirrigated pasture.

This soil is well suited to cultivated crops, mainly vegetables and citrus, and soybeans, sugarcane, corn, and small grains are also grown. This soil is friable and easy to keep in good tilth. It can be worked throughout a wide range of moisture content. A traffic pan forms easily if this soil is tilled when wet, but it can be broken up by chiseling or subsoiling. Irregular slopes hinder tillage operations. Proper row arrangement, field ditches, and vegetated outlets are needed to remove excess surface water. Land grading and smoothing also improve surface drainage and permit more efficient use of farm equipment. Most crops and pasture plants respond well to additions of fertilizer. Limiting tillage for seedbed preparation and weed control reduces runoff and erosion.

This soil is well suited to the production of hardwoods. Eastern cottonwood and American sycamore are suitable trees for planting. This soil has few limitations for production and management of hardwoods. Wetness, however, can limit the use of equipment somewhat during wet periods.

This Vacherie soil is in capability subclass IIw and in woodland group 13W.

Ww—Westwego clay. This mineral soil is level and poorly drained. It is in swamps that have been drained and are protected from most flooding. Areas range from about 10 to 1,000 acres. Slope is less than 1 percent.

Typically, the surface layer is dark grayish brown clay about 5 inches thick. The subsoil to a depth of about 32 inches is dark gray, firm clay. The subsoil has shrunk and cracked, and it remains cracked when re-wetted. The next layer to a depth of about 37 inches is very dark gray, firm clay. Below that, to a depth of 55 inches is very dark grayish brown, very fluid muck. The underlying material to a depth of about 75 inches is dark gray, very fluid clay. In places, many logs and stumps are buried in the lower layers. In many of the areas developed for urban uses, the surface layer has been covered with loamy and sandy fill material.

This Westwego soil has been drained by pumps and is protected from flooding by levees. Under normal conditions, the water table is maintained at a depth of about 1 foot to 3 feet. After heavy rains, the water table may be near the surface for short periods. In places where the soil has subsided, the water table is near the surface most of the time. Flooding is rare, but it can occur during hurricanes and when water pumps or protection levees fail. Flooding occurs less often than once in 10 years, during any time of the year. Permeability is very slow in the soil material, but water flows rapidly through the network of cracks. Even if the cracks in the surface layer are covered by fill material, the cracks in the subsoil remain open. Water and air move freely through these cracks. The total subsidence potential is medium to high. The shrink-swell potential is high.

Included in mapping are a few small areas of Harahan soils. They are in slightly higher positions than Westwego soil and are clayey throughout. The included soils make up about 5 percent of the map unit.

Most areas of this soil are in urban uses. A small acreage is in pasture or idle land that is reserved for future urban uses.

This soil is poorly suited to urban or intensive recreation uses, mainly because of rare flooding, wetness, subsidence, low strength, and the high shrink-swell potential. In places, buried stumps and logs cause uneven subsidence.

If the soil is used as sites for dwellings, pilings and specially constructed foundations are needed. Sandy or loamy fill material added to the surface reduces wetness and improves the load-supporting capacity of the soil for buildings and local roads and streets. The effects of shrinking and swelling can be minimized by properly designing buildings and roads. In places, buried logs and stumps cause uneven subsidence of the soil. Septic tank absorption fields do not function properly in this soil because of wetness, the very slow permeability, and the cracks in the soil. Community sewage systems are needed to prevent contamination of the water supplies by seepage through the cracks. Adequate water control is needed to reduce wetness and control the rate of subsidence. Drainage ditches and levees are difficult to construct and maintain because when the soil dries, the very fluid mineral and organic materials subside and crack.

This soil is moderately well suited to use as woodland, pasture, and cropland. Few areas remain, however, that are not in urban uses. Improved bermudagrass, common bermudagrass, Dallisgrass, tall fescue, white clover, arrowleaf clover, and ryegrass are suitable pasture plants. Maintaining adequate water control is the main concern. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This Westwego soil is in capability subclass IVw.

Prime Farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in St. Bernard Parish are listed.

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

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

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

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject to frequent flooding during the growing season. The slope ranges mainly from 0 to 3 percent.

The following map units, or soils, make up prime farmland in St. Bernard Parish. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 5. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

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

Cm Commerce silt loam
Co Commerce silty clay loam
Ha Harahan clay
Sh Sharkey silty clay loam
Sk Sharkey clay
Va Vacherie silt loam, gently undulating

Use and Management of the Soils

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

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

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

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

Contractors can use this survey to locate sources of roadfill and topsoil. They can use it to identify areas where wetness, fluid soil layers, 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

Dayton Matthews, conservation agronomist, Soil Conservation Service, helped prepare this section.

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

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

Perennial grasses or legumes, or mixtures of these, are grown for pasture and hay. The mixtures generally consist of either a summer or a winter perennial grass and a suitable legume. Excess grass in summer is harvested as hay for the winter.

Common bermudagrass and Dallisgrass are the most commonly grown summer perennials. Improved bermudagrass and Pensacola bahiagrass produce good quality forage. Tall fescue, the main winter perennial grass, grows well only on soils that have a favorable moisture content. All of these grasses respond well to fertilizers, particularly nitrogen.

White clover, crimson clover, vetch, and wild winter peas are the most commonly grown legumes.

Proper grazing is essential for high quality forage, stand survival, and erosion control. Brush and weed control, fertilization, and renovation of the pasture are also important.

Fertilization and liming. The soils of the parish are medium acid to mildly alkaline in the upper 20 inches. Most soils that are used for crops are moderately low in content of organic matter and in available nitrogen.

Most of the cropland consists of vegetable farms. The soils of the parish need small amounts of fertilizer for optimum production. The amount of fertilizer needed depends on the kind of crop, on past cropping history, on the level of yields desired, and on the kind of soil. The amount should be determined on the basis of soil test results. Information and instructions on collecting and testing soil samples can be obtained from the Cooperative Extension Service.

Organic matter content. Organic matter is an important source of nitrogen for crop growth. It also increases the rate of water intake, reduces surface crusting, and improves tilth. Most of the parish soils that are used for crops, especially those with a silt loam or very fine sandy loam surface layer, are moderately low in organic matter content. The level of organic matter can be maintained or improved by growing crops that produce an extensive root system and an abundance of foliage, by leaving plant residue on the surface, by growing perennial grasses and legumes in rotation with other crops, and by adding barnyard manure.

Soil tillage. Soils should be tilled only enough to prepare a seedbed and to control weeds. Excessive tillage destroys soil structure. A compacted layer, generally known as a traffic pan or plowpan, sometimes develops just below the plow layer in loamy soils. This condition can be avoided by not plowing when the soil is wet or by varying the depth of plowing. The plowpan can be broken up by subsoiling or chiseling. Tillage implements that stir the surface but leave crop residue in place protect the soil from beating rains. This kind of tillage helps control erosion, reduces runoff, increases infiltration, and reduces surface crusting.

Drainage. Most of the soils in the parish need surface drainage to make them more suitable for crops. Early drainage methods involved a complex pattern of main ditches, laterals, and surface field ditches. The more recent approach to drainage in this parish is a combination of land smoothing with a minimum of surface ditches. Larger and more uniformly shaped fields are created, and are more suited to the use of modern, multirow farm machinery.

Control of erosion. Erosion generally is not a serious problem in St. Bernard Parish mainly because of the level to nearly level gradient. Loamy soils, such as the Commerce and Vacherie soils, however, are susceptible to erosion when left without plant cover for extended periods. If the surface layer of the soil is lost by erosion, most of the available plant nutrients and most of the organic matter are also lost.

Soil erosion also results in sedimentation of drainage systems and pollution of streams by sediment, nutrients, and pesticides.

Cropping systems in which a plant cover is maintained on the soil for extended periods reduce soil erosion. Legume or grass cover crops reduce erosion, increase the content of organic matter and nitrogen in the soils, and improve tilth. Conservation tillage, contour farming, and cropping systems that rotate grass or close-growing crops with row crops help to control erosion on cropland and pasture. Constructing water control structures in drainageways to drop water to different levels can help prevent gullying.

Cropping system. A good cropping system includes a legume for nitrogen; a cultivated crop to aid in weed control; a deep-rooted crop to utilize subsoil fertility and maintain subsoil permeability; and a close-growing crop to help maintain organic matter content. The sequence of crops should keep the soil covered as much of the year as possible.

A suitable cropping system varies according to the needs of the farmer and the characteristics of the soil. Producers of livestock, for example, generally use cropping systems that have higher percentages of pasture than the cropping systems of cash-crop farms.

Additional information on erosion control, cropping systems, and drainage practices can be obtained from the local office of the Soil Conservation Service and the Cooperative Extension Service, or from the Louisiana Agricultural Experiment Station.

Yields Per Acre

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

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

The management needed to obtain the indicated yields of the various hay and pasture plants depends on the kind of soil and the plant species. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding plant species; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each plant species.

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

Land Capability Classification

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

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

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless a close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Woodland Management and Productivity

Soils vary in their ability to produce trees. Depth, fertility, texture, and the available water capacity influence tree growth. Elevation, aspect, and climate determine the kinds of trees that can grow on a site. Available water capacity and depth of the root zone are major influences of tree growth.

This soil survey can be used by woodland managers planning ways to increase the productivity of forest land. Some soils respond better to fertilization than others, some are more susceptible to landslides and erosion after building roads and harvesting timber, and some require special efforts to reforest. In the section "Detailed Soil Map Units," each map unit in the survey area suitable for producing timber presents information about productivity, limitations for harvesting timber, and management concerns for producing timber. Table 7 summarizes this forestry information and rates the soils for a number of factors to be considered in management. *Slight, moderate*, and *severe* are used to indicate the degree of the major soil limitations to be considered in forest management.

The first tree listed for each soil under the column "Common trees" is the indicator species for that soil. An indicator species is a tree that is common in the area and that is generally the most productive on a given soil.

Table 7 lists the *ordination symbol* for each soil. The first part of the ordination symbol, a number, indicates the potential productivity of a soil for the indicator species in cubic meters per hectare. The larger the number, the greater the potential productivity. Potential productivity is based on the site index and the point where mean annual increment is the greatest.

The second part of the ordination symbol, a letter, indicates the major kind of soil limitation for use and management. The letter *W* indicates a soil in which excessive water, either seasonal or year-round, causes a significant limitation.

Ratings of *equipment limitation* indicate limits on the use of forest management equipment, year-round or seasonal, because of such soil characteristics as wetness or susceptibility of the surface layer to compaction. The rating is *slight* if equipment use is restricted by soil wetness for less than 2 months and if special equipment is not needed. The rating is *moderate* if soil wetness restricts equipment use from 2 to 6 months per year or if special equipment is needed to avoid or reduce soil compaction. The rating is *severe* if soil wetness restricts equipment use for more than 6 months per year or if special equipment is needed to avoid or reduce soil compaction. Ratings of *moderate* or *severe* indicate a need to choose the most suitable equipment and to carefully plan the timing of harvesting and other management operations.

Ratings of *seedling mortality* refer to the probability of death of naturally occurring or properly planted seedlings of good stock in periods of normal rainfall as influenced by kinds of soil or topographic features. *Seedling mortality* is caused primarily by too much water or too little water. The factors used in rating a soil for seedling mortality are texture of the surface layer, depth and duration of the water table, and rooting depth. Mortality generally is greatest on soils that have a sandy or clayey surface layer. The risk is *slight* if, after site preparation, expected mortality is less than 25 percent; *moderate* if expected mortality is between 25 and 50 percent; and *severe* if expected mortality exceeds 50 percent. Ratings of *moderate* or *severe* indicate that it may be necessary to use containerized or larger than usual planting stock or to make special site preparations, such as bedding, furrowing, installing surface drainage, or providing artificial shade for seedings. Reinforcement planting is often needed if the risk is *moderate* or *severe.*

The potential productivity of *common trees* on a soil is expressed as a *site index*. Common trees are listed in the order of their observed general occurrence. Generally, only two or three tree species dominate.

The soils that are commonly used to produce timber have the yield predicted in cubic feet and board feet. The yield is predicted at the point where mean annual increment culminates. The productivity of the soils in this survey is mainly based on age 30 years for eastern cottonwood, 35 years for American sycamore, and 50 years for all other species.

The *site index* is determined by taking height measurements and determining the age of selected trees within stands of a given species. This index is the average height, in feet, that the trees attain in a specified number of years. This index applies to fully stocked, even-aged, unmanaged stands. The procedure and technique for determining site index are given in the site index tables used for the St. Bernard Parish soil survey (3, 4, 5, 16).

The *productivity class* represents an expected volume produced by the most important trees, expressed in cubic meters per hectare per year. Cubic meters per hectare can be converted to cubic feet per acre by multiplying by 14.3. It can be converted to board feet by multiplying by a factor of about 71. For example, a productivity class of 8 means the soil can be expected to produce 114 cubic feet per acre per year at the point where mean annual increment culminates, or about 568 board feet per acre per year.

Trees to plant are those that are used for reforestation or, if suitable conditions exist, natural regeneration. They are suited to the soils and will produce a commercial wood crop. Desired product, topographic position (such as a low, wet area), and personal preference are three factors of many that can influence the choice of trees to use for reforestation.

Recreation

In table 8, the soils of the survey area are rated according to the limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface absorbs rainfall readily but remains firm, and is not dusty when dry.

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 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 firm after rains and is not dusty when dry.

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.

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. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Billy R. Craft, state staff biologist, Soil Conservation Service, helped prepare this section.

The large acreages of marshes, swamps, bayous, and open-water areas in the parish provide habitat for many species of fish and wetland wildlife. Smaller acreages of cropland, hardwood forests, swamps, and pastureland provide habitat for openland and woodland wildlife. Much of the parish borders the Gulf of Mexico and provides a base for a large marine fishing industry. The annual value of marine fisheries and fur is over 7 million dollars.

This coastal parish is experiencing severe coastal marsh erosion as a result of land subsidence, the construction of navigation canals, oil and gas exploration, and saltwater intrusion. Special efforts are needed to retain the remaining coastal marshes.

The marshland part of St. Bernard Parish makes up about 65 percent of the land area. The acreage of marshland is decreasing, however, as urban areas continue to expand and as man-induced and geologic processes continue to erode away the land. The marshes provide habitat for the American alligator and for many species of waterfowl, furbearers, and nongame birds. The marshes are also a part of the coastal estuarine complex that significantly supports the marine life from the Gulf of Mexico.

Two types of marsh, based on levels of salinity and the types of vegetation growing, are in St. Bernard Parish. These are the brackish and saline marshes listed in the order of increasing salinity. The kinds and population densities of the wildlife using any given part of the marsh depend to a large extent upon the levels of salinity and native plants growing. The location and extent of the soils in each type of marsh is shown on the general soil map in the back of this publication.

The brackish marsh is the dominant marsh type in St. Bernard Parish. The main soils in the brackish marsh include those of the Clovelly and Lafitte series. The average level of salinity in soils of the brackish marsh is about 8 parts per thousand. The native plants growing in these soils are tolerant of moderate amounts of salt. The dominant plants are marshhay cordgrass, Olney bulrush, dwarf spikesedge, marsh morningglory, saltmarsh bulrush, big cordgrass, sumpweed, and widgeongrass.

Soils of the brackish marsh provide habitat for large numbers of geese, mink, otter, raccoon, and, especially muskrat. Moderate numbers of ducks, nutria, American alligator, and swamp rabbits use the brackish marsh. The brackish marsh is also part of the estuary that provides a nursery for some species of fish and crustaceans.

The saline marsh is adjacent to the Gulf of Mexico and extends inland for several miles. The main soils in the saline marsh include those of the Bellpass, Scatlake, and Timbalier series. Soils of the saline marsh are regularly inundated by saltwater from the Gulf. The average level of salinity is about 16 parts per thousand, which is about 46 percent of sea strength. The native plants growing in these soils are tolerant of high levels of salinity. The dominant plants include smooth cordgrass, needlegrass rush, seashore saltgrass, marshhay cordgrass, and saltwort.

The saline marsh is a very important part of the estuary that provides a nursery for crustaceans and saltwater fish, such as shrimp, blue crab, menhaden, croaker, spot, bay anchovy, and others that spawn in the Gulf of Mexico. The population density of ducks, nutria, American alligator, and swamp rabbit is low. Moderate numbers of geese, muskrat, mink, otter, and raccoon use the saline marsh.

No areas of freshwater marsh are known to be in St. Bernard Parish. In 1956, however, the parish contained about 20,000 acres of freshwater marsh. Saltwater intrusion, subsidence, and other factors have since converted these areas to brackish or saline marshes or to open water. The Mississippi River Gulf Outlet, a deep-water navigation channel, crosses the parish and provides a direct link to seawater in the Gulf.

About 19,000 acres of swamps are in the parish. Most of this acreage is damaged by saltwater intrusion. This intrusion has resulted in the death and stress of much of the native freshwater trees and other aquatic vegetation. The native trees in freshwater swamps are mainly baldcypress and lesser amounts of water tupelo, black willow, and red maple. The remaining forested swamps in the parish are in areas of the Barbary soils. Few native trees are in areas of the Fausse soils. No natural regeneration of these trees can be expected because of soil salinity. The quality of the habitat in swamps is rated as fair to excellent for wood ducks, wading birds, amphibians, and reptiles.

A small acreage of bottom land hardwood forests in St. Bernard Parish provides good habitat for woodland wildlife species, such as white-tailed deer, squirrels, rabbits, raccoons, opossum, coyote, otter, mink, wood ducks, nutria, and many nongame birds and animals. The main native trees include water oak, Nuttall oak, overcup oak, water hickory, white oak, elm, baldcypress, persimmon, sugarberry, and sweetgum.

Few areas of openland for habitat remain in the parish because of urbanization. Those areas are in pasture, vegetable crops, or are idle land and provide poor habitat for most species of wildlife. Inadequate cover and urban use limit the habitat available. Some small game species, however, such as cottontail rabbits, doves, bobwhite quail, and nongame species of birds, use these areas.

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

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, 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, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bahiagrass, bermudagrass, clover, and vetch.

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, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, panicum, and fescue.

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

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 hawthorn, persimmon, and sumac.

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

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

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

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

Habitat for woodland wildlife consists of areas of deciduous plants and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and swamp rabbits.

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

Marshland Management

Billy R. Craft, state staff biologist, Soil Conservation Service, helped prepare this section.

General management needed to control the losses of marshlands and to improve marshlands for use as habitat for wetland wildlife are suggested in this section.

Planners of management systems for individual areas should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the staff at the local office of the Soil Conservation Service, the Cooperative Extension Service, or the Louisiana Agricultural Experiment Station.

Marshland loss. The loss of Louisiana's coastal marshlands has reached a crisis level. St. Bernard Parish is within an area that is experiencing the highest rates of marshland losses in Louisiana. Both natural and manmade events are responsible for these losses.

Geologic subsidence of the Gulf Coastal marshes is the main natural cause. As the Continental Shelf and adjoining marshlands slowly subside, some of the marshlands at the lowest elevations become submerged below sea level. Little can be done about the losses caused by these natural events; however, the marshland deterioration caused by man's actions can be controlled with better management and restraint. Activities such as drainage and the construction of channels for navigation accelerate the rates of erosion, subsidence, and salt water intrusion (fig. 5).

Coastal marsh erosion changes areas of marshland to open water areas. In most cases, this is a permanent land loss because the open water areas are too deep to revegetate.

The production of fish and wildlife resources in the marshes of the parish is directly related to the marsh plant community. When the plants are killed by increases in salinity or for other reasons, the other dependent resources are degraded. Each plant species and community requires a definite range of salinity and water levels for growth. The marsh plants are the basic source of energy for dependent animal populations, such as muskrat, and conditions enhancing plant growth also serve to benefit the fish and wildlife resources. The fish

Figure 5.—The Mississippi River Gulf outlet is in an area of Scatlake mucky clay. This canal extends to the Gulf of Mexico and allows sea water to intrude into the marshes. The soil on the right is Aquents, dredged, frequently flooded.

and wildlife population density and diversity are dependent on the plants; therefore, the need for maintaining the marshland resource base is very important ecologically and economically.

The organic soils of the marshland are very sensitive to increases in salinity. Salt water intrusions into brackish and fresh marshes have increased in recent years. The increased salinity causes the loss of surface vegetation. When the plants die, they start decomposing and eventually are carried out of the marshes by tidal action. In a very short time, the surface soil is lost and the areas revert to open water. This is generally permanent land loss along with the associated loss of sustained annual soil productivity.

Management. Many opportunities exist for improving the marshes of St. Bernard Parish for fish, wildlife, and other resources *(15)*. The marshland is a delicately balanced ecosystem that requires an interdisciplinary approach to planning and implementing management practices that will improve the habitat for waterfowl, furbearers, and fisheries. Following are some suggested management practices:

Weirs are low level dams placed in marshwater courses to provide better water management capability. Fixed-crest weirs are normally placed so the weir crest is about 6 inches below average marsh level. These water-control structures are beneficial in several ways. They stabilize water levels in the marsh; reduce the turbidity levels of the water; improve plant community condition; and improve trapper and hunter access during the winter months by holding water in the bayous and canals. Weirs with fixed crests are most useful in brackish marshes.

Prescribed or controlled burning is a very useful and economical technique to improve marsh vegetative conditions. Periodic controlled burning helps maintain a good variety of marsh plants, which in turn will have a positive impact on furbearers, such as muskrat, and other wildlife species.

Prescribed burning results are best in brackish marshes. Control burning done in the fall of the year is the best for wildlife; however, winter burning also has some positive results.

Leveed impoundment is a management practice that can be installed if soils are suitable for construction. Almost every form of marsh wildlife uses the impoundments for feeding, roosting, or cover areas. Landowner objectives, marsh type, and other factors determine the management techniques to use on an impoundment.

Shoreline erosion control is one of the primary concerns for the parish and the entire coastal area. Numerous studies and field trials have been conducted to determine suitable techniques for shoreline erosion. Both structural and vegetative approaches or combinations of these are currently being used. Individual site conditions vary, and include soils, salinity, amount of boat traffic, and size of the water body. Smooth cordgrass is one of the most promising plants to use in the tidal zone of saline and brackish areas. It usually is locally available.

Some characteristics of smooth cordgrass are that it is easily established in the tidal zone where a large portion of the erosion is occurring; it withstands a wide salinity range; it expands rapidly in the tidal zone; it normally provides shoreline protection in one growing season; and it forms dense stands which dissipate wave energy.

Many other plants are available for alleviating shoreline erosion. Specific site information is needed to plan the proper combination of structural and vegetative measure.

Engineering

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

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

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. 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 earthfill and topsoil; plan drainage systems, irrigation systems, ponds, 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 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 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 mainly by soil texture. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

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

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to a high water table and flooding 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, depth to a high water table, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and that good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent and surfacing of effluent can affect public health. Ground water can be polluted if highly permeable sand is less than 4 feet below the base of the absorption field or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

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

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, depth to a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity.

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

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

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to a water table, and flooding affect both types of landfill. Texture, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

Soil texture and wetness affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

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

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by a high water table. 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. They have at least 5 feet of suitable material and low shrink-swell potential. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10 and a high shrink-swell potential. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

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 a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by a water table and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. 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 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 soluble salts, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and releases a variety of plant-available nutrients as it decomposes.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and the salinity of the soil.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on permeability, depth to a high water table or depth of standing water if the soil is subject to ponding, susceptibility to flooding, and subsidence of organic layers. Excavating and grading and the stability of ditchbanks are affected by the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

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

Soil Properties

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

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

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

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

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

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

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

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

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

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

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

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area, or from nearby areas, and on field examination.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They influence the soil's adsorption of cations, moisture retention, shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of movement of water through the soil when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

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

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

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 change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year *(18)*. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

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

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (there is a near 1 to 10 percent chance of flooding in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (there is an 11 to 40 percent chance of flooding in any year). *Frequent* means that flooding occurs often under normal weather conditions (there is more than a 40 percent chance of flooding in any year). *common* is used when classification as occasional or frequent does not affect interpretations. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. June-November, for example, means that flooding can occur during the period June through November. About two-thirds to three-fourths of all flooding occurs during the stated period.

The definitions of the frequency of flooding for the rare, occasional, and frequently flooded phases differ from the SCS definition of flooding found elsewhere, in that the frequency of flooding for each of these phases is slightly different.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, *perched or apparent;* and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

The two numbers in the "High water table-Depth" column indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that the water table exists for less than a month.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 16 shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severely corrosive environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

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

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

Urban Development Features

Expansion of the New Orleans metropolitan area into St. Bernard Parish has resulted in the development of portions of the nearby marshes and swamps for urban uses. The organic soils and fluid mineral soils in these marshes and swamps are severely limited for most urban uses because of flooding, wetness, and the low to high subsidence potential. Although wetness and flooding are common problems on many of the soils in the parish, subsidence is a problem unique to the organic soils and the fluid mineral soils in the marshes and swamps.

Subsidence is the loss of surface elevation after an organic soil or a fluid mineral soil is artificially drained. Subsidence on organic soils after drainage is attributed mainly to four factors: shrinkage caused by desiccation; consolidation from loss of the buoyant force of ground water or from loading, or both; compaction; and biochemical oxidation.

The problems associated with subsidence in the survey area are mainly in the following map units: Aquents, dredged, frequently flooded; Barbary clay; Bellpass muck; Clovelly muck; Harahan clay; Harahan clay, frequently flooded; Lafitte muck; Scatlake mucky clay; Timbalier muck; and Westwego clay.

Elevation loss caused by shrinkage and consolidation is termed *initial subsidence*, and it is normally completed about 3 years after the water table is lowered. Initial subsidence of organic soils causes about a 50 percent reduction in thickness of the organic material above the water table. The reduction is accompanied by permanent open cracks that do not close when the soil is re-wet.

After initial subsidence, shrinkage continues at a uniform rate because of the biochemical oxidation and subsequent disintegration of the organic material. This is termed *continued subsidence*, and it progresses until the mineral material or the permanent water table is reached. The rate of continued subsidence depends upon temperature (amount of time per year above 41 degrees Fahrenheit, 5 degrees Centigrade), the mineral content, and thickness of the organic layers above the water table. The average rate of continued subsidence in the survey area is about 1.5 to 2 inches per year. The total subsidence potential is as much as 144 inches for some soils.

An important feature of organic soils is low bulk density (weight per unit volume). The bulk density, in grams per cubic centimeter, for selected material is as follows:

	G/cc
Water	1.0
Mineral soil	1.2 to 1.7
Organic soil	0.15 to 0.5

The low bulk density reflects the small volume of mineral matter in organic soil material. The mineral content of organic soil material is about 6 percent on a volume basis compared to about 40 percent for mineral soil. The rest of the volume is organic matter and pore space filled with air and water. This accounts for compressibility under load, volume change upon drying, and general instability if used as foundation material.

Fluid mineral soil layers have a potential for initial subsidence caused by loss of water and consolidation after drainage. Each time the water table is lowered and the fluid soil material is drained, a new increment of initial subsidence takes place. Continued subsidence after drainage is minor on soils that have fluid mineral layers.

Additional urbanization on organic soils and fluid mineral soils can lead to increased subsidence if the water table is lowered. Because of the hard surface cover of streets, parking lots, buildings, and other structures, the absorptive capacity of the soil is decreased. This increases runoff; consequently, drainage canal size and pumping capacity are generally increased to accommodate the additional runoff. As a result of the more intensive drainage, the water table is lowered. This is accompanied by a new increment of initial subsidence. With this new depth of drainage ditches, pumping capacity must again be increased to prevent flooding. This cycle will continue until all of the organic material has been oxidized and the mineral layers dewatered; however, this seemingly endless cycle can be interrupted.

Subsidence of organic soils can be effectively controlled by maintaining the water table at the surface. Subsidence can be reduced to some degree by covering the surface with mineral soil material to slow oxidation. It can be further reduced by raising the water table as high as possible to reduce the thickness of organic material between the mineral soil fill material and the water table. In land use decisions, a choice must be made in controlling the water table—

- to use the land without drainage to control subsidence
- to use the land with some drainage, but to tolerate wet conditions and minimum subsidence
- to provide better drainage and tolerate subsidence at a greater rate.

Subsidence is a very severe limitation for most urban uses in the survey area. Unless piling is used to support buildings, they tilt and foundations crack. Organic soils around structures built on piling subside, and periodic filling is needed to maintain a desirable surface elevation. When organic soils subside, foundations are exposed, and unsupported driveways, patios, air conditioner slabs, and sidewalks crack and warp and gradually drop below original levels. Underground utility lines may be damaged.

The concern of homeowners and communities that have subsidence is to find ways to resolve the problems. Some things can be done to minimize subsidence problems.

Selection of building site—Avoid sites that have organic or fluid mineral soil layers. Table 16 gives the subsidence potential of each soil. The final selection should be based on onsite examination.

Structure design and minerals—The recommendations of qualified professionals, such as structural engineers, soil engineers, and architects, should be followed. New or innovative construction techniques and material can minimize some problems. For example, constructing buildings on piers above ground instead of on concrete slabs on the ground can help overcome some problems. The possibility of gas accumulating under the slabs would be eliminated as well as the need for fill material to cover exposed slabs. The use of small sections of easily moved, unjoined fabricated material or concrete in the construction of sidewalks, driveways, and patios would eliminate cracking, and possibly make re-leveling after subsidence easier. Other construction materials, such as brick, shell, gravel, or lightweight aggregate, could be considered for these uses.

Initial site fill practices—Subsidence can be reduced by adding mineral fill material to the organic soil surface. Thin blankets of fill that do not reach the permanent water table will reduce the rate of subsidence. The amount of reduction is related to the amount of oxygen that is excluded from organic layers and the thickness of organic layers above the water table. If the base of the mineral fill material is within the permanent water table, subsidence caused by oxidation of organic material will be eliminated. Future subsidence (unless the water table is lowered) will be limited to compaction or displacement. Loamy mineral soil material is generally considered the most desirable fill material. Fill material high in organic content should be avoided.

Maintenance or continual filling practices—Filling is necessary on organic soils to maintain the esthetic value of homesites. Filling helps avoid sunken lawns and exposed foundation footings that result from subsidence. If several inches or more of subsidence occur, adding small amounts or thin layers of fill is generally preferable over adding thick layers. Regularly adding 1 or 2 inches of fill material as needed generally will not permanently harm most lawn grasses and landscaping plants. If filling is postponed until several inches to a foot or more of fill is required, the thick layers of fill could permanently damage lawn grasses and landscape plants.

Underground utilities—Engineering innovations that allow utility lines to be moved as soil surface elevations change should reduce the number of failures. For example, flexible pipes at joints where pipes are connected to stationary structures could be used rather than rigid pipes.

Water level control—Water level or depth to the continuous water table is an important factor affecting the rate of subsidence. Generally, the nearer to the surface that the water table is maintained, the slower the rate of subsidence. Microdifferences in surface elevation that occur in most urban-developed areas contribute to uneven water table depths and to differences in rates of subsidence. Precision leveling within an area for urban uses would help eliminate the differences in water table depth. Also, a carefully designed and constructed drainage system would make it possible to maintain a desirable, uniform water table throughout the level area. In developed unleveled areas, a system to monitor the level of the water table would provide information needed to determine optimum water table levels.

Site development on organic soils—Generally, this involves first building a levee and a pumping system to lower the water table below the organic layers. Sufficient time (1 to 3 years) is necessary for initial subsidence. The area then could be backfilled hydrologically or by other methods with mineral fill material to a desired level to help reduce possible flooding. The mineral fill material would load and compact the organic layers. Then the water table could be raised to a level where the organic layers would be permanently inundated. By keeping the water table above the organic layers, oxygen would be excluded. Under this condition the organic material would be preserved; therefore, subsidence would be at a minimum and the soils of the area would be stable for urban use. In addition, a few feet of proper mineral fill material would provide a good environment for utility lines.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(14)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or on laboratory measurements. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is 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; 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 Fluvaquents (*Fluv*, meaning flood plain, 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 is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aeric* identifies the subgroup that typifies the great group. An example is Aeric Fluvaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, nonacid, thermic Aeric Fluvaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. There can be some variation in the texture of the surface layer or of the substratum within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (12)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (14)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Barbary Series

The Barbary series consists of level, very poorly drained, mineral soils that are very slowly permeable and very fluid. These soils formed in clayey alluvium. These soils are in swamps that are flooded or ponded by freshwater most of the time. Elevation ranges from sea level to about 2 feet above sea level. Slope is less than 1 percent.

Soils of the Barbary series are very-fine, montmorillonitic, nonacid, thermic Typic Hydraquents.

Barbary soils commonly are near Clovelly and Sharkey soils and are similar to the Scatlake soils. The Clovelly soils are in nearby brackish marshes and have thick organic layers. The Sharkey soils are in higher positions and are firm mineral soils. The Scatlake soils are in marshes, and they are more saline and contain fewer logs and stumps than Barbary soils.

Typical pedon of Barbary clay; 4 miles east of Poydras, 2.3 miles south of Mississippi River Gulf Outlet, 1 mile north of State Highway 46, 100 feet south of canal; Spanish Land Grant 58, T. 13 S., R. 14 E.

A—0 to 6 inches; dark gray (5Y 4/1) clay; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); mildly alkaline; clear smooth boundary.

Cg1—6 to 34 inches; gray (5Y 5/1) clay; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); common partly decomposed woody fragments and logs; moderately alkaline; clear smooth boundary.

Cg2—34 to 60 inches; greenish gray (5BG 5/1) clay; common medium distinct olive (5Y 5/6) mottles; massive; slightly fluid (flows with difficulty between fingers when squeezed leaving hand empty); common partly decomposed woody fragments; moderately alkaline.

Depth to firm mineral layers is 60 inches or more.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 5, and chroma of 1 to 3. Reaction is neutral or mildly alkaline.

The Cg horizon has hue of 10YR, 2.5Y, 5Y, 5GY, or 5BG, value of 4 or 5, and chroma of 1. Texture is very fluid or slightly fluid clay or mucky clay. Buried logs, stumps, and wood fragments range from few to many in the Cg horizon. Reaction ranges from neutral to moderately alkaline.

Bellpass Series

The Bellpass series consists of level, very poorly drained, organic soils that are very slowly permeable, saline, and very fluid. The soils formed in moderately thick accumulations of decomposed herbaceous plant material overlying very fluid clayey alluvium. These soils are in saline marshes that are ponded or flooded most of the time. Slope is less than 1 percent.

Soils of the Bellpass series are clayey, montmorillonitic, euic, thermic Terric Medisaprists.

Bellpass soils are similar to Clovelly soils and commonly are near Scatlake and Timbalier soils. The Clovelly soils are in brackish marshes and are less saline than Bellpass soils. The Scatlake and Timbalier soils are in positions similar to those of the Bellpass soils. The Scatlake soils are very fluid mineral soils, and the Timbalier soils have organic material that is more than 51 inches thick.

Typical pedon of Bellpass muck; 5 miles east of Shell Beach, 1 mile south of Bayou LaLourtre; southwest corner of sec. 29, T. 14 S., R. 16 E.

Oa1—0 to 7 inches; very dark grayish brown (10YR 3/2) muck; about 40 percent fiber, 15 percent rubbed; very fluid (flows easily between fingers when squeezed leaving hand empty); about 60 percent mineral; moderately alkaline; clear smooth boundary.

Oa2—7 to 29 inches; very dark grayish brown (10YR 3/2) muck; about 20 percent fiber, 10 percent rubbed; very fluid (flows easily between fingers when squeezed leaving hand empty); about 60 percent mineral; moderately alkaline; clear smooth boundary.

Agb—29 to 41 inches; dark gray (5Y 4/1) clay; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); moderately alkaline; gradual smooth boundary.

Cg—41 to 68 inches; gray (5Y 5/1) clay; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); moderately alkaline.

The organic material ranges in thickness from about 16 to 51 inches. The electrical conductivity ranges from 8 to 16 millimhos per centimeter in at least one layer between the surface and a depth of 40 inches.

The organic layers have hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 or 2. Reaction ranges from neutral to moderately alkaline.

The Agb horizon is mucky clay or clay. It has hue of 10YR or 5Y, value of 2 to 4, and chroma of 1 or 2. The *n* value ranges from 0.7 to 1 or more. Reaction is mildly alkaline or moderately alkaline. Some pedons do not have an Agb horizon.

The Cg horizon has hue of 10YR, 5Y, 5BG, 5GY, or 5G, value of 4 to 6, and chroma or 1, or it is neutral and has value of 4 to 6. Texture is clay or silty clay. Reaction is mildly alkaline or moderately alkaline. The *n* value to a depth of 60 inches or more ranges from 0.7 to more than 1.

Clovelly Series

The Clovelly series consists of level, very poorly drained, organic soils that are very slowly permeable, slightly saline, and very fluid. These soils formed in moderately thick accumulations of decomposed herbaceous plant material overlying very fluid clayey alluvium. These soils are in brackish coastal marshes that are ponded or flooded most of the time. Elevation ranges from sea level to about 1 foot above sea level. Slope is less than 1 percent.

Soils of the Clovelly series are clayey, montmorillonitic, euic, thermic Terric Medisaprists.

Clovelly soils commonly are near Barbary, Bellpass, and Lafitte soils. The Barbary soils are in swamps and are very fluid mineral soils. The Bellpass soils are in nearby marshes and are more saline than Clovelly soils. The Lafitte soils are in positions similar to those of the Clovelly soils, and they have organic layers that are more than 51 inches thick.

Typical pedon of Clovelly muck; 5 miles east of Poydras, 1.8 miles south of Mississippi River Gulf Outlet, 1 mile north of State Highway 46, 200 feet north of back protection levee; Spanish Land Grant 59, T. 13 S., R. 14 E.

Oa1—0 to 12 inches; dark brown (7.5YR 4/2) muck; about 50 percent fiber, 15 percent rubbed; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); about 40 percent minerai; moderately alkaline; gradual smooth boundary.

Oa2—12 to 50 inches; dark brown (7.5YR 3/2) muck; about 20 percent fiber, less than 5 percent rubbed; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); about 40 percent mineral; moderately alkaline; gradual smooth boundary.

Cg—50 to 70 inches; gray (5Y 5/1) clay; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); moderately alkaline.

The organic material ranges in thickness from about 16 to 51 inches. The electrical conductivity ranges from 4 to 8 millimhos per centimeter in at least one layer between the surface and a depth of 40 inches.

The organic layers have hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 or 2. The mineral content ranges from 40 to 60 percent. Reaction ranges from neutral to moderately alkaline.

Some pedons have an Ab horizon. Texture is mucky clay, clay, or silty clay. It has hue of 10YR or 5Y, value of 2 to 4, and chroma of 1 or 2. The *n* value ranges from 0.7 to 1 or more. Reaction ranges from neutral to moderately alkaline.

The Cg horizon has hue of 10YR, 5Y, 5BG, 5GY, or 5G, value of 4 to 6, and chroma of 1, or it is neutral and has value of 4 to 6. Texture is clay, silty clay, or mucky clay. Reaction ranges from neutral to moderately alkaline. The *n* value to a depth of 60 inches or more ranges from 0.7 to 1 or more.

Commerce Series

The Commerce series consists of level, somewhat poorly drained, mineral soils that are moderately slowly permeable and firm. These soils formed in loamy alluvium. They are in high and intermediate positions on natural levees along the Mississippi River and its distributaries. Slope is 0 to 1 percent.

Soils of the Commerce series are fine-silty, mixed, nonacid, thermic Aeric Fluvaquents.

Commerce soils commonly are near Harahan, Sharkey, and Vacherie soils. The Harahan and Sharkey soils are in lower positions than Commerce soils, and they have a clayey subsoil. The Vacherie soils are in positions similar to those of the Commerce soils, and they have a loamy surface layer and subsoil and clayey underlying material.

Typical pedon of Commerce silt loam; in Meraux, 3,200 feet east of Murphy Oil Company Refineries, 300 feet north of the intersection of State Highway 46 and Paul Street; Spanish Land Grant 2, T. 13 S., R. 13 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; few fine roots; slightly acid; clear smooth boundary.

Bw1—10 to 20 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine distinct brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; few fine roots; slightly acid; clear smooth boundary.

Bw2—20 to 26 inches; grayish brown (10YR 5/2) silty clay loam; many fine distinct brown (7.5YR 4/4) mottles, weak medium subangular blocky structure; friable; neutral; clear smooth boundary.

BC—26 to 34 inches; grayish brown (10YR 5/2) silty clay loam; many fine distinct brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; neutral; clear smooth boundary.

Ab—34 to 37 inches; grayish brown (10YR 5/2) silt loam; common fine distinct brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; few black stains; mildly alkaline; clear smooth boundary.

C—37 to 60 inches; grayish brown (10YR 5/2) silt loam; common medium distinct brown (7.5YR 4/4) mottles; massive; friable; common black stains; few thin strata of gray (5Y 5/1) clay; mildly alkaline.

The solum ranges in thickness from 20 to 40 inches.

The A horizon and the Ab horizon have hue of 10YR, value of 4 or 5, and chroma of 1 to 3. Some pedons have an A horizon that is less than 6 inches thick and has value of 3. The texture of the A or Ab horizon is silt loam or silty clay loam. Some pedons do not have an Ab horizon. The A horizon ranges in thickness from 4 to 12 inches. Reaction ranges from medium acid to moderately alkaline in the A horizon and from neutral to moderately alkaline in the Ab horizon.

The B and BC horizons have hue of 10YR, value of 4 or 5, and chroma of 1 or 2. Texture is silt loam, loam, or silty clay loam. Reaction ranges from neutral to moderately alkaline.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is silt loam or silty clay loam. Thin strata of silty clay or very fine sandy loam are in some pedons. Reaction ranges from neutral to moderately alkaline.

Fausse Series

The Fausse series consists of level, very poorly drained, mineral soils that are very slowly permeable, saline, and firm. These soils formed in clayey alluvium. They are in swamps that formerly were the natural levees of distributaries of the Mississippi River. These natural levees have subsided to near sea level. The soils are frequently flooded by saltwater from tides during storms and by freshwater following intense rainstorms. Elevation ranges from sea level to less than 1 foot above sea level. Slope is less than 1 percent.

Soils of the Fausse series are very-fine, montmorillonitic, nonacid, thermic Typic Fluvaquents.

Fausse soils commonly are near Bellpass, Clovelly, and Sharkey soils and are similar to Barbary soils. The Barbary soils are very fluid or slightly fluid throughout and are in nearby swamps. The Bellpass and Clovelly soils are organic soils and are in nearby marshes. The Sharkey soils are in slightly higher positions than Fausse soils and crack to a depth of 20 inches or more in most years.

Typical pedon of Fausse clay, saline; 5 miles east of Hopedale, 2 miles northeast of the Mississippi River Gulf Outlet, 200 feet north of Bayou LaLoutre; Spanish Land Grant 39, T. 14 S., R. 16 E.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) clay; very fluid (flows easily between fingers when squeezed leaving hand empty); few fine roots; mildly alkaline; clear smooth boundary.

A2—3 to 5 inches; dark gray (10YR 4/1) clay; few fine faint brown mottles; weak medium subangular blocky structure; firm, very sticky; few fine roots; mildly alkaline; clear smooth boundary.

Bg—5 to 36 inches; gray (5Y 5/1) clay; common medium prominent brown (10YR 4/3) mottles; weak coarse subangular blocky structure; firm, very sticky; mildly alkaline; gradual smooth boundary.

Cg—36 to 60 inches; gray (N 5/0) clay; massive; firm, very sticky; mildly alkaline.

The solum ranges in thickness from 25 to 50 inches. The moisture content of the soil is above field capacity continuously in all layers below a depth of 24 inches in most years. The *n* value is variable within 36 inches of the surface but is 0.7 or less in some subhorizons in the 8- to 20-inch section. The *n* value of subhorizons at depths below 36 inches is less than 0.7. Cracks do not form to a depth of 20 inches in most years. Electrical conductivity of the saturation extract ranges from 4 to 16 millimhos per centimeter throughout.

Some pedons have an O horizon. It has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is muck or mucky peat. Reaction ranges from neutral to strongly alkaline. This horizon is up to 4 inches thick.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 or 4, and chroma of 1 or 2. It ranges in thickness from 3 to 12 inches. Texture is clay or mucky clay. Reaction ranges from neutral to strongly alkaline.

The Bg horizon has hue of 10YR, 5Y, or 5GY, value of 4 or 5, and chroma of 1, or it is neutral and has value of 4 or 5. Reaction ranges from slightly acid to moderately alkaline.

The Cg horizon has hue of 5Y, 5GY, or 5GB, value of 4 or 5, and chroma of 1, or it is neutral and has value of 4 or 5. Texture is clay, silty clay, or silty clay loam. Reaction ranges from neutral to moderately alkaline.

Felicity Series

The Felicity series consists of gently sloping, somewhat poorly drained, mineral soils that are very rapidly permeable, saline, and firm. These soils formed in sandy tidal sediment and are on ridges and barrier islands along the Gulf of Mexico. They are frequently flooded by tidal waters during storms. They are also unstable because of the continuing erosion caused by wave action. Slope ranges from 1 to 3 percent.

Soils of the Felicity series are mixed, thermic Aquic Udipsamments.

Felicity soils commonly are near Bellpass, Scatlake, and Timbalier soils. The Bellpass and Timbalier soils are very fluid organic soils in nearby saline marshes. The Scatlake soils are also in nearby saline marshes, and they are very fluid clayey soils.

Typical pedon of Felicity loamy fine sand, frequently flooded; on the Chandeleur Islands, 10 miles south of Chandeleur Light, 4 miles northeast of the North Islands, 1,000 feet east of Chandeleur Sound, 200 feet west of the Gulf of Mexico.

C1—0 to 5 inches; grayish brown (10YR 5/2) loamy fine sand; single grained; very friable; common shell fragments; moderately alkaline; clear wavy boundary.

C2—5 to 24 inches; brown (10YR 4/3) sand; common medium faint light brownish gray (10YR 6/2) mottles; single grained; very friable; few shell fragments; moderately alkaline; clear wavy boundary.

C3—24 to 34 inches; grayish brown (10YR 5/2) loamy sand; common medium faint gray (5Y 5/1) mottles; single grained; very friable, few shell fragments; moderately alkaline, clear smooth boundary.

Ab—34 to 60 inches; dark gray (5Y 4/1) loamy sand; single grained; very friable, few shell fragments; moderately alkaline.

Depth to the Ab horizon ranges from 24 to 40 inches. Electrical conductivity ranges from 8 to 16 millimhos per centimeter throughout. Reaction ranges from neutral to moderately alkaline throughout the profile. Shells and fragments of shells range from 0 to 15 percent of the weight of the 10- to 40- inch control section. The texture throughout the profile is sand, loamy sand, or loamy fine sand.

Some pedons have an A horizon. It is thin and has hue of 10YR, value of 2 to 4, and chroma of 1 to 3.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. Mottles, having chroma of 1 or 2, are at a depth of 10 to 40 inches.

The Ab horizon has hue of 10YR, 2.5Y, or 5Y, value of 2 to 4, and chroma of 1 to 3. Some pedons do not have an Ab horizon. Some pedons are underlain by loamy, clayey, or organic material at a depth of from 40 to 60 inches.

Harahan Series

The Harahan series consists of level, poorly drained, very slowly permeable soils. These soils formed in clayey alluvium. They are firm in the upper part and slightly fluid in the lower part. These soils are in drained, former swamps in the lower part of the Mississippi River flood plain. They are rarely or frequently flooded. Elevation ranges from sea level to about 3 feet below sea level. Slope is less than 1 percent.

Soils of the Harahan series are very-fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts.

Harahan soils commonly are near Commerce, Sharkey, and Westwego soils. The Commerce and Sharkey soils are in higher positions than the Harahan soils. Commerce soils are fine-silty, and Sharkey soils have an *n* value of less than 0.7 throughout. The Westwego soils are in positions similar to those of the Harahan soils and have organic layers within the control section.

Typical pedon of Harahan clay; in Meraux, 3,000 feet southwest of back protection levee, 2,000 feet north of Judge Perez Drive, 200 feet east of Bartolo Street; Spanish Land Grant 2, T. 13 S., R. 13 E.

A—0 to 5 inches; dark gray (10YR 4/1) clay; few fine faint brown mottles; weak medium subangular blocky structure; firm; neutral; clear smooth boundary.

Bg1—5 to 25 inches; gray (5Y 5/1) clay; common medium prominent dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; few nonintersecting slickensides; neutral; clear smooth boundary.

Bg2—25 to 37 inches; gray (10YR 5/1) clay; common medium distinct brown (7.5YR 4/4) mottles; weak coarse subangular blocky structure; firm; neutral; clear smooth boundary.

Cg—37 to 63 inches; gray (5Y 5/1) clay; massive; slightly fluid (flows with difficulty between fingers when squeezed leaving a small residue in hand); mildly alkaline.

The solum ranges in thickness from 20 to 40 inches. Depth to layers with an *n* value greater than 0.7 ranges from 20 to 40 inches. Cracks as wide as 1.5 inches form and extend from the soil surface to a depth of 20 inches or more during dry periods in most years.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2, or it is neutral. Reaction ranges from strongly acid to neutral. This horizon ranges in thickness from 3 to 7 inches.

The Bg horizon has hue of 10YR, 2.5Y, 5Y, 5GY, or 5BG, value of 3 to 5, and chroma of 1 or 2, or it is neutral and has value of 3 to 5. Texture is clay or silty clay. Reaction ranges from strongly acid to neutral.

Some pedons have an Ab horizon. It has hue of 10YR, value of 2 to 4, and chroma of 1 or 2, or it is neutral and has value of 2 to 4. Texture is clay, silty clay, or mucky clay. Reaction ranges from strongly acid to neutral.

The Cg horizon has hue of 10YR, 2.5Y, 5Y, 5BG, 5GY, or 5G, value of 2 to 5, and chroma of 1 or 2, or it is neutral and has value of 2 to 5. Texture is clay, silty clay, or mucky clay. Reaction ranges from neutral to moderately alkaline.

Lafitte Series

The Lafitte series consists of level, very poorly drained, organic soils that are slightly saline and very fluid. These soils are moderately rapidly permeable in the organic layers and very slowly permeable in the mineral layers. They formed in decomposed herbaceous plant material. These soils are in the brackish Gulf Coast marshes, and they are ponded or flooded most of the time. Elevation ranges from sea level to about 1 foot above sea level. Slope is less than 1 percent.

Soils of the Lafitte series are euic, thermic Typic Medisaprists.

Lafitte soils commonly are near Bellpass, Clovelly, Scatlake, and Timbalier soils. The Bellpass, Scatlake, and Timbalier soils are in saline marshes, and they are more saline throughout than Lafitte soils. The Clovelly soils have a thinner organic layer over the mineral material than the Lafitte soils.

Typical pedon of Lafitte muck; 3 miles northeast of Chalmette, 0.5 mile southeast of Bayou Bienvenue, 0.7 mile southwest of the Mississippi River Gulf Outlet; Spanish Land Grant 20, T. 12 S., R. 13 E.

Oa1—0 to 12 inches; very dark grayish brown (10YR 3/2) muck; about 30 percent fiber, 10 percent rubbed; very fluid (flows easily between fingers when squeezed leaving hand empty); about 60 percent mineral; thin layer of dark gray (N 4/0) clay; moderately alkaline; clear smooth boundary.

Oa2—12 to 32 inches; dark brown (7.5YR 3/2) muck; about 60 percent fiber, 15 percent rubbed; very fluid (flows easily between fingers when squeezed leaving hand empty); few wood fragments; about 40 percent mineral; moderately alkaline; clear smooth boundary.

Oa3—32 to 53 inches; black (10YR 2/1) muck; about 40 percent fiber, less than 5 percent rubbed; very fluid (flows easily between fingers when squeezed leaving hand empty); about 50 percent mineral; moderately alkaline; clear smooth boundary.

Agb—53 to 80 inches; very dark gray (5YR 3/1) mucky clay; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); few wood fragments; few pockets of dark brown (7.5YR 3/2) clay; moderately alkaline.

Depth to mineral layers ranges from 51 inches to more than 100 inches.

The Oa horizon has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 to 3. Fiber content after rubbing is generally less than 10 percent, but thin strata of hemic or fibric material are common. The mineral content ranges from 40 to 60 percent. Reaction in the surface tier (0 to 12 inches) ranges from slightly acid to moderately alkaline. Reaction in the subsurface tier (12 to 36 inches) and the bottom tier (36 to 64 inches) ranges from slightly acid to moderately alkaline. The average conductivity of the saturation extract ranges from 4 to 8 millimhos per centimeter throughout the Oa horizon.

The Agb horizon and the Cg horizon, where present, have hue of 5Y or 5GY, value of 3 to 5, and chroma of 1, or they are neutral. They are stratified clay, silty clay, or mucky clay. Reaction ranges from neutral to moderately alkaline.

Scatlake Series

The Scatlake series consists of level, very poorly drained, mineral soils that are very slowly permeable, saline, and very fluid. These soils are in saline marshes that are ponded or flooded most of the time. They formed mainly in clayey alluvium. Elevation ranges from sea level to about 1 foot above sea level. Slope is less than 1 percent.

Soils of the Scatlake series are very-fine, montmorillonitic, nonacid, thermic Typic Hydraquents.

Scatlake soils commonly are near Bellpass and Timbalier soils. Bellpass and Timbalier soils are in positions similar to those of the Scatlake soils, and they are organic soils.

Typical pedon of Scatlake mucky clay; 19 miles east of Shell Beach, 3 miles north of Christmas Camp Lake, 0.5 mile southeast of Lake of the Mound; center of sec. 3, T. 14 S., R. 18 E.

A—0 to 7 inches; gray (10YR 5/1) mucky clay; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); about 75 percent mineral; moderately alkaline; abrupt smooth boundary.

Cg1—7 to 20 inches; dark gray (10YR 4/1) clay; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); moderately alkaline; clear smooth boundary.

Cg2—20 to 50 inches; dark gray (5Y 4/1) clay; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); moderately alkaline; clear smooth boundary.

Cg3—50 to 70 inches; gray (N 5/0) clay; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); moderately alkaline.

Depth to firm mineral material is more than 40 inches. In more than half of the upper 20 inches of the profile, the electrical conductivity ranges from 8 to 16 millimhos per centimeter. The *n* value of all mineral layers above a depth of 40 inches is 1 or more. Reaction ranges from neutral to moderately alkaline throughout.

The A horizon has hue of 10YR or 5Y, value of 2 to 4, and chroma of 1, or it is neutral and has value of 2 to 4.

The Cg horizon has hue of 10YR, 5Y, 5BG, or 5GY, value of 4 or 5, and chroma of 1, or it is neutral and has value of 4 or 5. Texture is slightly fluid or very fluid clay. In some pedons, thin layers of muck are in the Cg horizon.

Sharkey Series

The Sharkey series consists of poorly drained, mineral soils that are very slowly permeable and firm. These soils formed in clayey alluvium. They are in intermediate and low positions on natural levees and in backswamps on the Mississippi River flood plain. Slope is less than 1 percent.

Soils of the Sharkey series are very-fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts.

Sharkey soils commonly are near Barbary, Commerce, Harahan, and Vacherie soils. The very poorly drained Barbary soils are in swamps and have an *n* value of more than 0.7. The somewhat poorly drained Commerce soils are in higher positions than Sharkey soils and are fine-silty. The Harahan soils are in slightly lower positions and have a slightly fluid underlying material. The Vacherie soils are in slightly higher positions and are coarse-silty over clayey.

Typical pedon of Sharkey silty clay loam; in Violet, 3,800 feet north of Lake Borgne Canal, 1,900 feet southwest of Judge Perez Drive, 1,400 feet northeast of Highway 46, 100 feet east of A110 Mumphrey Street; Spanish Land Grant 5, T. 13 S., R. 13 E.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silty clay loam; weak fine granular structure; firm, plastic; few common roots; medium acid; clear smooth boundary.

A—5 to 10 inches; dark gray (10YR 4/1) clay; moderate medium subangular blocky structure; firm, plastic; medium acid; clear smooth boundary.

Bg1—10 to 23 inches; dark gray (10YR 4/1) clay; many coarse distinct dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; firm, plastic; few black stains; few nonintersecting slickensides; slightly acid; clear smooth boundary.

Bg2—23 to 33 inches; gray (5Y 5/1) clay; common fine distinct dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; firm, plastic; few nonintersecting slickensides; slightly acid; gradual smooth boundary.

BCg—33 to 46 inches; dark gray (5Y 4/1) clay; moderate medium distinct dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; firm, plastic; neutral; gradual smooth boundary.

Cg—46 to 60 inches; gray (N 5/0) clay; moderate medium distinct dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; firm, plastic; few thin strata of gray (5Y 5/1) silty clay loam; neutral.

The solum ranges in thickness from 36 to 60 inches. Cracks as wide as 1.5 inches form and extend from the soil surface to a depth of 20 inches or more during dry periods in most years.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. The texture is clay or silty clay loam. The A horizon ranges in thickness from 4 to 15 inches. Where value is 3, the horizon is less than 10 inches thick. Reaction ranges from strongly acid to moderately alkaline.

The Bg and BCg horizons have hue of 10YR or 5Y, value of 4 or 5, and chroma of 1, or they are neutral and have value of 4 or 5. The texture typically is clay, but some pedons have thin subhorizons of silty clay or silty clay loam. The average clay content ranges from 60 to 90 percent. Reaction ranges from medium acid to moderately alkaline.

The Cg horizon has the same range in colors as the Bg horizon. The texture is clay or silty clay. Reaction ranges from neutral to moderately alkaline.

Timbalier Series

The Timbalier series consists of level, very poorly drained organic soils that are very slowly permeable and very fluid. These soils formed in thick accumulations of herbaceous plant material. They are in saline marshes and are ponded or flooded most of the time. Elevation ranges from sea level to about 1 foot above sea level. Slope is less than 1 percent.

Soils of the Timbalier series are euic, thermic Typic Medisaprists.

Timbalier soils are similar to Lafitte soils and commonly are near Bellpass and Scatlake soils. The Bellpass and Scatlake soils are in positions similar to those of the Timbalier soils. The Bellpass soils have thinner organic material, and the Scatlake soils are very fluid mineral soils. The Lafitte soils are in brackish marshes and are not so saline as Timbalier soils.

Typical pedon of Timbalier muck; 7 miles east of Hopedale, 1 mile north of Mississippi River Gulf Outlet, 0.7 mile south of Bayou Pointe-en-Pointe; sec. 5, T. 15 S., R. 17 E.

Oa1—0 to 12 inches; dark brown (7.5YR 3/2) muck; about 40 percent fiber, 15 percent rubbed; massive; about 60 percent mineral; very fluid (flows easily between fingers when squeezed leaving hand empty); moderately alkaline; gradual smooth boundary.

Oa2—12 to 40 inches; very dark gray (10YR 3/1) muck; about 30 percent fiber, 10 percent rubbed; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); about 50 percent mineral; moderately alkaline; gradual smooth boundary.

Oa3—40 to 64 inches; black (10YR 2/1) muck; about 10 percent fiber, less than 5 percent rubbed; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); about 60 percent mineral; moderately alkaline; clear smooth boundary.

Cg—64 to 84 inches; gray (5Y 5/1) clay; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); moderately alkaline.

Depth to the clayey mineral layer ranges from 51 to more than 100 inches. Reaction ranges from neutral to moderately alkaline in the surface tier. It is moderately alkaline in the lower tiers. Conductivity of the saturation extract ranges from 8 to 16 millimhos per centimeter in some layers within a depth of 40 inches. Mineral content in the Oa horizon ranges from 30 to 70 percent.

The surface tier (0 to 12 inches) has hue of 10YR or 7.5YR, value of 2 to 4, and chroma or 1 to 3. The rubbed content of fiber ranges from 1 to 35 percent.

The subsurface tier (12 to 36 inches) and bottom tier (36 to 52 inches) have hue of 7.5YR or 10YR, value of 1 to 3, and chroma of 1, or it is neutral and has value of 1 to 3. The rubbed content of fiber ranges from 1 to 10 percent of the volume.

The Cg horizon has hue of 5Y, 5BG, 5G, or 5GY, value of 4 to 6, and chroma of 1, or it is neutral and has value of 4 to 6. Texture is very fluid clay or silty clay.

Vacherie Series

The Vacherie series consists of somewhat poorly drained, very slowly permeable soils. They formed in loamy alluvium over clayey alluvium. These soils are in intermediate positions where the natural levees of the Mississippi River were breached by former floods. Slope ranges from 0 to 3 percent.

Soils of the Vacherie series are coarse-silty over clayey, mixed, nonacid, thermic Aeric Fluvaquents.

Vacherie soils commonly are near Commerce, Harahan, and Sharkey soils. The Commerce soils are in positions similar to those of Vacherie soils, and they are loamy throughout. The Harahan soils are in drained swamps, and they are clayey throughout. The Sharkey soils are in low positions on natural levees and are clayey throughout.

Typical pedon of the Vacherie silt loam, gently undulating; in Violet, 4,000 feet west of Judge Perez Drive, 2,000 feet south of Millaudon School, 1,100 feet east of State Highway 46; Spanish Land Grant 10, T. 14 S., R. 13 E.

Ap1—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; common fine roots; neutral; clear smooth boundary.

Ap2—6 to 12 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; common fine roots; neutral; clear wavy boundary.

B—12 to 24 inches; grayish brown (10YR 5/2) silt loam; few fine faint strong brown mottles; weak medium subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.

Agb—24 to 34 inches; gray (10YR 5/1) silty clay; moderate medium subangular blocky structure; firm; few fine roots; mildly alkaline; clear smooth boundary.

Bgb—34 to 60 inches; gray (5Y 5/1) clay; many common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm, plastic; moderately alkaline.

The loamy part of the solum ranges in thickness from 15 to 36 inches.

The A horizon is dark gray (10YR 4/1; N 4/0), dark grayish brown (10YR 6/2), brown (10YR 4/3), or grayish brown (10YR 5/2). The reaction ranges from medium acid to moderately alkaline.

The B horizon is dominantly grayish brown (10YR 5/2; 2.5Y 5/2) or dark grayish brown (10YR 4/2; 2.5Y 4/2). Texture is silt loam or very fine sandy loam. The content of fine sand and coarser sand ranges from 3 to 15 percent. The content of clay ranges from 10 to 18 percent. Reaction ranges from slightly acid to moderately alkaline.

The Agb and Bgb horizons have hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 1, or they are neutral and have value of 4 or 5. Texture is clay or silty clay. Reaction ranges from neutral to moderately alkaline.

Westwego Series

The Westwego series consists of poorly drained, very slowly permeable soils. They formed in fluid clayey alluvium and organic material that dried and shrank irreversibly in the upper part as the result of artificial drainage. These soils are in broad, drained, former swamps on the delta of the Mississippi River. They are protected from flooding by a system of levees and are artificially drained by pumps. Elevation ranges from sea level to about 3 feet below sea level. Slope is less than 1 percent.

Soils of the Westwego series are very-fine, montmorillonitic, nonacid, thermic, cracked Thapto-Histic Fluvaquents.

Westwego soils commonly are near Commerce, Harahan, and Sharkey soils. The Commerce and Sharkey soils are in higher positions than Westwego soils and have an *n* value of less than 0.7 throughout. The Harahan soils are in positions similar to those of the Westwego soils, and they do not have thick organic layers within the control section.

Typical pedon of Westwego clay; in Violet, 4,000 feet northeast of Judge Perez Drive at Frances Place, 500 feet southwest of back protection levee, 500 feet northwest of Meraux Lane; Spanish Land Grant 4, T. 13 S., R. 13 E.

A—0 to 5 inches; dark grayish brown (10YR 4/2) clay; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bg1—5 to 17 inches; dark gray (10YR 4/1) clay; common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; common cracks as wide as 1 centimeter; root channels coated with very dark gray muck; medium acid; abrupt wavy boundary.

Bg2—17 to 32 inches; dark gray (N 4/0) clay; weak coarse prismatic structure; firm; root channels stained with dark brown; common cracks as wide as 1 centimeter between prisms; medium acid; abrupt wavy boundary.

Agb—32 to 37 inches; very dark gray (10YR 3/1) clay; weak moderate subangular blocky structure; firm; common cracks as wide as 1 centimeter; medium acid; abrupt wavy boundary.

Oa—37 to 55 inches; very dark grayish brown (10YR 3/2) muck; about 40 percent fiber, 10 percent rubbed; massive; very fluid (flows easily between fingers when squeezed leaving a small residue in hand); few logs and wood fragments; about 60 percent mineral; medium acid; clear smooth boundary.

Cgb—55 to 75 inches; dark gray (5Y 4/1) clay; massive; very fluid (flows easily between fingers when squeezed leaving hand empty); few wood fragments; mildly alkaline.

Depth to the fluid layers ranges from 28 to 40 inches. Depth to an organic layer more than 8 inches thick ranges from 20 to 40 inches. Reaction of the A, Bg, Agb, and Oa horizons ranges from very strongly acid to slightly acid. Reaction of the Cg horizon ranges from neutral to moderately alkaline.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2, or it is neutral and has value of 2 to 4. Thickness ranges from 2 to 7 inches.

The Bg horizon and Bgb horizon, where present, have hue of 10YR, 2.5Y, 5Y, 5BG, 5GY, or 5G, value of 2 to 5, and chroma of 1, or they are neutral and have value of 2 to 5. Texture is clay, silty clay, or mucky clay.

The Agb horizon has hue of 10YR or 5Y, value of 2 or 3, and chroma of 1, or it is neutral and has value of 2 or 3. Texture is clay or mucky clay. Some pedons do not have an Agb horizon.

The Oa horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral and has value of 2 or 3. It consists of sapric, hemic, or fibric material.

The Cgb horizon has hue of 10YR, 2.5Y, 5Y, 5BG, 5GY, or 5G, value of 2 to 5, and chroma of 1 or 2. Texture is clay or mucky clay.

Formation of the Soils

By Dr. Bobby J. Miller, Department of Agronomy, Agricultural Experiment Station, Louisiana State University.

This section explains the processes and factors of soil formation and relates them to the soils in the survey area.

Factors of Soil Formation

Soil is a natural, three-dimensional body that formed on the earth's surface. It has properties resulting from the integrated effect of climate and living matter acting on parent material, as conditioned by relief over time.

The interaction of five main factors influences the processes of soil formation and results in differences among the soils. These factors are the climate during the formation of soil material from the parent material; the physical and chemical composition of the parent material; the kinds of plants and other organisms living in and on the soil; the relief of the land and its effect on runoff, soil temperature, and moisture conditions; and the length of time for the soil to form.

The effect of any one factor can differ from place to place, but the interaction of all the factors determines the kind of soil that forms. Many of the differences in soils cannot be attributed to differences in only one factor. For example, the organic matter content in the soils of St. Bernard Parish is influenced by several factors, including relief, parent material, and living organisms. In the following paragraphs the factors of soil formation are described as they relate to soils in the survey area.

Climate

St. Bernard Parish has the subtropical, humid climate that is characteristic of areas near the Gulf of Mexico. The warm, moist climate has promoted rapid soil formation. Climate is uniform throughout the parish, although its effect is modified locally by relief. The minor climate differences within the parish are not considered significant enough to create soil differences. Detailed information about climate is given in the section "General Nature of the Survey Area."

Living Organisms

Living organisms, including plants, bacteria, fungi, and animals, are important in the formation of soils. Among the chemical and physical changes they cause are gains in content of plant nutrients and changes in structure and porosity. Plant roots force openings into the soil and modify porosity. As they grow, they break up and rearrange the soil particles. Plants transfer nutrients from the subsoil to the surface layer, and when they die, plant tissue supplies organic matter to the soils. Bacteria and other micro-organisms decompose organic matter and help improve the physical condition of the soil. The native vegetation and the associated complex communities of bacteria and fungi generally have had a greater influence on soil formation in this parish than other living organisms. Animals, such as crawfish and earthworms, also influence soil formation by mixing the soil. When animals die, they too decompose and enrich the soil with organic matter and nutrients.

Man's activities, such as cultivating, fertilizing, channel constructing, harvesting, burning, draining, diking, flooding, and land smoothing, affect the soil. Some soils in St. Bernard Parish have been changed significantly. Examples include the drained areas of Barbary soils, which are now mapped as Harahan or Westwego soils.

The soils of the natural levees along streams formed under bottom land hardwood forest vegetation.

Soils of the marsh formed under grass and sedge vegetation *(8)*. The thick layers of organic material in the Lafitte soils accumulated in fresh and brackish water. As the land surface subsided, the area was flooded with freshwater. The buildup of organic material by freshwater plants kept pace with subsidence. However, further land subsidence and sea level rise introduced seawater over the area *(7)*. With the change in salinity, brackish marsh types of vegetation became established; namely, marshhay cordgrass, coastal waterhyssop, dwarf spikerush, and saltmarsh bulrush. The Clovelly and Lafitte soils formed in the organic material accumulated in areas that are now brackish.

Further flooding by saline seawater in areas near the Gulf coast changed the vegetation to the saline marsh type. Saltwort, needlegrass rush, smooth cordgrass, woody glasswort, and seashore saltgrass are some of the plants of the saline marsh. The Timbalier soils formed mostly in the residue left by these plants.

Parent Material

Parent material is the initial material from which soil forms. It affects the chemical and mineralogical composition of the soils. It also influences the degree of leaching, the reaction, texture, permeability, and drainage, and the kind and color of the surface and subsoil layers. Textural differences in parent material are accompanied by differences in chemical and mineral composition. In general, soils that form in loamy and sandy parent material have a lower capacity to hold nutrients than those that form in clay.

The soils in St. Bernard Parish formed in alluvial and marine sediments and accumulations of organic material.

The alluvium is from distributary streams of present and former deltas of the Mississippi River *(9)*. Bordering the stream channels are low ridges called natural levees. These levees are highest next to the channels and slope gradually away from it. The levees are shaped by waters that overspread the streambanks. When the water slows, it first drops sand, then silt, and finally clay particles. Thus, the soils on the higher parts of natural levees formed in loamy material that has a moderate sand content. These soils are generally lighter colored, more permeable, and better drained than the soils on the lower part and beyond the natural levees. Examples are Commerce and Vacherie soils. On the lower part of the natural levees and in the backswamps beyond the natural levees are the clayey sediments that were dropped from slowly moving water. Sharkey and Barbary soils formed in this type of material. The Scatlake soils also formed in clayey alluvium, but they contain some marine sediment.

The Felicity soils formed in sandy material on former beach ridges deposited by the wave action of the sea.

Organic material accumulates in areas that are saturated or flooded with water. Water prevents the complete oxidation and decomposition of the plant residue. Water, vegetation, and time coupled with a rise in sea level and a land subsidence created the conditions in which thick layers of organic material accumulated in the marshes of St. Bernard Parish. The buildup of organic material kept pace with land subsidence and sea level rise. The Timbalier and Lafitte soils formed in thick accumulations of herbaceous organic material. The Bellpass and Clovelly soils formed in moderately thick accumulations of herbaceous organic material over clayey alluvium.

Relief

Relief and other physiographic features influence soil formation processes mainly by affecting internal soil drainage, runoff, erosion and deposition, salinity levels, and exposure to the sun and wind.

In St. Bernard Parish, sediment accumulated at a much faster rate than the erosion took place. This accumulation of sediment has occurred at a faster rate than many of the processes of soil formation. This is evident in the distinct stratification in lower horizons of some soils. Levee construction and other water-control measures may have reversed this trend for such soils as the Commerce soils. Soil slope and rate of runoff are low enough that erosion is not a major problem in the parish.

The land surface of the parish is level or nearly level. The slope is less than 1 percent, except on a few sandy and loamy ridges where the slope is as much as 3 percent. Relief and the landscape position have influenced formation of the different soils. Characteristically, the slopes are long and extend from the highest elevation on natural levees along the Mississippi River and bayous or distributary channels to an elevation that is several feet lower in the swamps and marshes.

Differences in the Commerce, Sharkey, and Clovelly soils illustrate the influence of relief on the soils in the parish. Commerce soils are on the highest elevation, contain the least amount of clay, and have the best natural drainage. Sharkey soils are on the lower parts of the natural levees, have a high content of clay, and are poorly drained. Clovelly soils, which are in the lower positions, are very poorly drained and are ponded most of the time unless they are artificially drained. These soils have a thick organic surface layer (the result of accumulations of decaying vegetation) and clayey underlying material. If the Clovelly soils are drained, their elevation is as low as 3 feet below sea level because of subsidence.

The dominant soils are the Commerce and Sharkey soils at the higher elevations and the Clovelly and Lafitte soils in marshes at the lower elevations. Soils at the lower elevations receive runoff from those at the higher elevations, and the water table is nearer the surface for longer periods. Differences in the organic matter content of the soils are related to the internal drainage of the soils and, consequently, to relief. The content of organic matter generally increases as internal soil drainage becomes more restricted.

Soils, such as the Commerce soils, in the higher and better drained positions, have an environment in which more extensive oxidation of organic matter takes place. The very poorly drained Clovelly and Lafitte soils are ponded for extended periods, which results in a more limited environment and in a greater accumulation of organic matter.

The relief factor in the parish is somewhat unique because the soils are on a low-lying, slowly subsiding landmass. Geologic investigations indicate that the overall area is very slowly decreasing in elevation *(6)*. Present elevation of undrained soils ranges from sea level to a maximum of about 12 feet above sea level. The subsidence can be attributed partly to the continued accumulation in the Gulf of Mexico of sediment from the Mississippi River and lesser sources. The added weight of this sediment results in a continuous downwarping of the adjoining landmass. This process causes a general lowering of the landmass and an increase in the regional gulfward slope. In addition, post-depositional sediment compaction may result in some subsidence, and local deposition of sediment may contribute to similar but more localized changes.

Some possible effects of this natural geologic subsidence are apparent. For example, some soils that were subject only to intermittent flooding are now flooded more frequently and are covered with deeper water for longer periods. Some of the soils on natural levees along distributary channels have subsided to an elevation below sea level and are now covered with water most of the time. As the soils subside, seawater moves landward with each increment of subsidence; consequently, some soils that were formerly in freshwater marshes are now in brackish or saline marshes.

Subsidence and the resulting intrusions of saltwater are accelerated by some of man's actions. Artificial drainage can cause organic soils to subside several feet in a short time. In addition, ditches and channels dug for drainage or navigation purposes create courses for seawater to intrude inland for great distances.

The resulting increase in soil and water salinity has a marked effect on marsh and swamp vegetation. The less salt-tolerant vegetation is quickly replaced by more salt-tolerant vegetation. In addition, numbers and species of fish and crustaceans in any given area change dramatically as salinity of the soil and water increases.

In many areas, natural and accelerated subsidence have lowered the elevation to such an extent that only lakes and ponds exist where land once was visible.

Time

Time influences the kinds of horizons and their degree of development. Long periods are generally required for prominent horizons to form.

In general, the soils of St. Bernard Parish are young; time has been too short for distinct horizons to develop. The Commerce, Sharkey, and Vacherie soils on the natural levees of streams, however, have been influenced by soil-forming processes long enough to develop faintly differentiated horizons. Development is evident by the darkening of the A horizon by organic matter and the weakly developed B horizon. These soils developed in alluvium about 2,000 years old *(9)*.

The youngest soils in the parish have little, if any, profile development. For example, in Felicity soils neither a darkened A horizon nor a B horizon has developed. The Bellpass and Clovelly soils are also young and show little evidence of profile development. The soils in the marshes are forming in recent accumulations of herbaceous organic material and alluvium.

Processes of Soil Formation

The processes of soil formation influence the kind and degree of development of soil horizons. The factors of soil formation—climate, living organisms, relief, parent material, and time—determine the rate and relative effectiveness of the different processes.

Important soil-forming processes result in additions of organic, mineral, and gaseous materials to the soil; losses of these same materials from the soil; translocation of materials from one point to another within the soil; and physical and chemical transformation of mineral and organic material within the soil *(10)*.

Many processes occur simultaneously. Examples in the survey area include accumulation of organic matter, the development of soil structure, and the leaching of bases from some soil horizons. The contribution of a particular process may change with time. Drainage and water control systems, for example, can change the length of time some soils are flooded or saturated with water. Some important processes that have contributed to the formation of the soils in St. Bernard Parish are discussed in the following paragraphs.

Organic matter has accumulated, has partly decomposed, and has been incorporated into all the soils. The organic accumulations range from the humus in mineral horizons of the Commerce and Sharkey soils to the organic horizons, muck, of the Clovelly and Barbary soils in the marshes and swamps. Because most of the organic matter is produced in and above the surface layer, the surface layer is higher in organic matter content than the deeper horizons. Living organisms decompose, incorporate, and mix organic residue into the soil. Some of the more stable products contribute to darker colors, increased water-holding and cation-exchange capacities, and granulation of the soil.

Processes that result in development of soil structure have occurred in most of the mineral soils. Plant roots and other organisms contribute to the rearrangement of soil material into secondary aggregates. The decomposition products of organic residue and the secretions of organisms serve as cementing agents that help stabilize structural aggregates. Alternate wetting and drying as well as shrinking and swelling contribute to the development of structural aggregates and are particularly effective in soils that have appreciable amounts of clay. Consequently, soil structure is typically most pronounced in the surface horizon, which contains the most organic matter, and in clayey horizons that alternately undergo wetting and drying.

Most of the soils mapped in the parish have horizons in which reduction of iron and manganese compounds is an important process. Reducing conditions prevail for long periods in poorly aerated horizons. Consequently, the relatively soluble reduced forms of iron and manganese predominate over the less soluble oxidized forms. The reduced compounds of these elements produce the gray colors in the Bg and Cg horizons that are characteristic of many of the soils. In the more soluble reduced form, appreciable amounts of iron and manganese can be removed from the soils or translocated by water from one position to another within the soil. Reduced forms of iron and manganese not removed can be reoxidized upon development of oxidizing conditions in the soil. The presence of gray and yellowish or reddish mottles indicates alternating oxidizing and reducing conditions in many of the soils.

Water moving through the soil has leached many soluble components from the upper horizon of some of the mineral soils in the parish. The components include any free carbonates that may have been present initially. The carbonates and other more readily soluble salts have been mostly leached from the soil or moved to lower horizons in the better drained, loamy soils, such as Commerce soils. In general, the permanently wet soils of the marshes and swamps have rarely been leached. Areas of organic soils, however, are readily leached during unusual and extended dry periods or when these soils are artificially drained.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Coarse textured soil. Sand or loamy sand.

Compressible (in tables). The volume of soft soil decreases excessively under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, such as fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay are in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil restrict the growth of most plants.

Fast intake (in tables). The movement of water into the soil is rapid.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

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.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

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.

Infiltration. The downward entry of water into the immediate surface of soil or other material. This contrasts with percolation, which is movement of water through soil layers or material.

Infiltration 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

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

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. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

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 permeability, the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). In these areas, surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of the acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rooting depth (in tables). There is a shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables.) Water 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.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

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.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

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). An excessive amount of toxic substances in the soil, such as sodium or sulfur, severely hinders the establishment of vegetation or severely restricts plant growth.

Trace elements. Chemical elements, such as zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). There is a risk of caving or sloughing on banks of fill material.

Weathering. All physical and chemical changes produced by atmospheric agents in rocks or other deposits at or near the earth's surface. These changes result in disintegration and decomposition of the material.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data recorded in the period 1955-77 at New Orleans, Louisiana]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	61.5	42.6	52.0	81	19	186	4.73	2.06	6.89	6	.0
February---	64.8	44.7	54.8	82	25	207	5.23	2.99	7.04	6	.1
March------	71.1	51.3	61.2	84	31	361	4.66	1.82	6.96	6	.0
April------	78.6	58.8	68.7	88	39	561	3.90	1.29	5.97	5	.0
May--------	84.4	65.1	74.8	92	50	769	5.01	2.27	7.23	6	.0
June-------	89.0	70.4	79.7	95	58	891	4.89	2.52	6.83	7	.0
July-------	90.4	73.1	81.8	97	67	986	6.25	4.42	7.94	10	.0
August-----	89.5	72.7	81.1	96	64	964	6.19	3.20	8.63	9	.0
September--	86.3	69.6	78.0	94	56	840	6.32	2.83	9.16	7	.0
October----	79.2	59.0	69.1	90	40	592	2.84	0.98	4.34	4	.0
November---	70.1	49.9	60.0	84	30	310	3.94	1.15	6.19	6	.0
December---	64.2	44.9	54.6	82	23	199	5.39	3.28	7.27	7	.1
Yearly:											
Average--	77.4	58.5	68.0	---	---	---	---	---	---	---	---
Extreme--	---	---	---	97	19	---	---	---	---	---	---
Total----	---	---	---	---	---	6,866	59.35	48.45	69.71	79	.2

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 °F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data recorded in the period 1955-77 at New Orleans, Louisiana]

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 10	February 26	March 25
2 years in 10 later than--	February 1	February 17	March 15
5 years in 10 later than--	January 8	January 30	February 25
First freezing temperature in fall:			
1 year in 10 earlier than--	December 16	November 22	November 13
2 years in 10 earlier than--	December 28	December 2	November 20
5 years in 10 earlier than--	January 31	December 22	December 5

TABLE 3.--GROWING SEASON

[Data recorded in the period 1955-77 at New Orleans, Louisiana]

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	326	281	245
8 years in 10	340	294	258
5 years in 10	>365	322	282
2 years in 10	>365	>365	306
1 year in 10	>365	>365	319

TABLE 4.--SUITABILITY AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map unit	Extent of area	Cultivated crops	Pasture	Woodland	Urban uses	Intensive recreation areas
	Pct					
1. Sharkey-Commerce----	5	Moderately well suited: wetness, poor tilth, very slow and moderately slow permeability.	Well suited----	Well suited------	Poorly suited: wetness, flooding, very slow and moderately slow permeability, shrink-swell, low strength for roads.	Poorly suited: wetness, flooding, very slow and moderately slow permeability, clayey surface layer.
2. Barbary-------------	2	Not suited: ponding, flooding, low strength.	Not suited: ponding, flooding, soft and boggy to cattle.	Poorly suited: ponding, flooding, poor trafficability.	Not suited: ponding, flooding, low strength, potential subsidence.	Not suited: ponding, flooding.
3. Lafitte-Clovelly----	30	Not suited: ponding, flooding, low strength, salinity.	Not suited: ponding, flooding, soft and boggy to cattle, salinity.	Poorly suited: ponding, flooding, poor trafficability, salinity.	Not suited: ponding, flooding, low strength, potential subsidence.	Not suited: ponding, flooding.
4. Timbalier-Bellpass	20	Not suited: ponding, flooding, low strength, salinity.	Not suited: ponding, flooding, soft and boggy to cattle, salinity.	Poorly suited: ponding, flooding, poor trafficability, salinity.	Not suited: ponding, flooding, low strength, potential subsidence.	Not suited: ponding, flooding.
5. Scatlake------------	29	Not suited: ponding, flooding, low strength, salinity.	Not suited: ponding, flooding, soft and boggy to cattle, salinity.	Poorly suited: ponding, flooding, poor trafficability, salinity.	Not suited: ponding, flooding, low strength, potential subsidence.	Not suited: ponding, flooding.
6. Fausse--------------	4	Not suited: ponding, flooding, salinity.	Not suited: ponding, flooding, salinity.	Poorly suited: ponding, flooding, salinity.	Not suited: ponding, flooding, low strength.	Not suited: ponding, flooding.
7. Harahan-Westwego----	1	Moderately well suited: wetness, poor tilth.	Moderately well suited: wetness.	Moderately well suited: wetness, equipment use limitations.	Poorly suited: wetness, flooding, low strength, very slow permeability, shrink-swell, subsidence.	Poorly suited: wetness, flooding.

TABLE 4.--SUITABILITY AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP--Continued

Map unit	Extent of area	Cultivated crops	Pasture	Woodland	Urban uses	Intensive recreation areas
	Pct					
8. Aquents-------------	7	Not suited: flooding, salinity, wetness, low strength.	Not suited: flooding, salinity, wetness.	Poorly suited: flooding, wetness, salinity, poor trafficability.	Not suited: flooding, wetness, low strength, subsidence.	Not suited: flooding, wetness.
9. Felicity------------	2	Not suited: flooding, salinity, wetness.	Poorly suited: flooding, salinity, soil droughtiness.	Not suited: flooding, wetness, salinity.	Not suited: flooding, wetness.	Not suited: flooding, wetness.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AD	Aquents, dredged frequently flooded	24,320	1.9
BB	Barbary clay	6,838	0.5
BP	Bellpass muck	24,240	1.9
CE	Clovelly muck	43,726	3.4
Cm	Commerce silt loam	3,723	0.3
Co	Commerce silty clay loam	3,742	0.3
CS	Commerce and Sharkey soils, frequently flooded	540	*
Dp	Dumps	155	*
FA	Fausse clay, saline	12,379	1.0
FE	Felicity loamy fine sand, frequently flooded	6,610	0.5
Ha	Harahan clay	2,676	0.2
Hf	Harahan clay, frequently flooded	300	*
LF	Lafitte muck	52,949	4.1
SC	Scatlake mucky clay	90,395	7.0
Sh	Sharkey silty clay loam	5,254	0.4
Sk	Sharkey clay	3,024	0.2
TM	Timbalier muck	41,545	3.2
Ub	Urban land	1,519	0.1
Va	Vacherie silt loam, gently undulating	1,315	0.1
Ww	Westwego clay	1,150	0.1
	Water	966,410	74.8
	Total	1,292,810	100.0

* Less than 0.1 percent.

TABLE 6.--LAND CAPABILITY CLASSES 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]

Map symbol and soil name	Land capability	Common bermudagrass	Improved bermudagrass	Tall fescue and white clover	Dallisgrass and white clover
		AUM*	AUM*	AUM*	AUM*
AD------------------------ Aquents	Vw	---	---	---	---
BB------------------------ Barbary	VIIw	---	---	---	---
BP------------------------ Bellpass	VIIw	---	---	---	---
CE------------------------ Clovelly	VIIw	---	---	---	---
Cm------------------------ Commerce	IIw	9.0	12.5	12.5	11.0
Co------------------------ Commerce	IIw	8.5	12.0	12.0	10.5
CS------------------------ Commerce and Sharkey	Vw	---	---	---	---
Dp. Dumps					
FA------------------------ Fausse	VIIw	---	---	---	---
FE------------------------ Felicity	VIIw	4.0	---	---	---
Ha------------------------ Harahan	IIIw	7.0	9.5	10.5	9.5
Hf------------------------ Harahan	Vw	6.0	---	---	---
LF------------------------ Lafitte	VIIIw	---	---	---	---
SC------------------------ Scatlake	VIIIw	---	---	---	---
Sh, Sk-------------------- Sharkey	IIIw	6.5	10.0	11.5	10.0
TM------------------------ Timbalier	VIIIw	---	---	---	---
Ub. Urban land					
Va------------------------ Vacherie	IIw	8.0	12.0	11.0	11.0
Ww------------------------ Westwego	IVw	6.0	10.3	9.0	10.0

* 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.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Map symbol and soil name	Ordination symbol	Management concerns		Potential productivity			Trees to plant
		Equipment limitation	Seedling mortality	Common trees	Site index	Productivity class*	
BB: Barbary	4W	Severe	Severe	Baldcypress	80	4	Baldcypress.
				Water tupelo	60	---	
				Black willow	---	---	
Cm, Co: Commerce	13W	Moderate	Slight	Eastern cottonwood	120	13	Eastern cottonwood, American sycamore.
				Green ash	80	---	
				Nuttall oak	90	---	
				Water oak	110	8	
				Pecan	---	---	
				American sycamore	---	---	
				Willow oak	---	---	
CS: Commerce	12W	Moderate	Severe	Eastern cottonwood	113	12	Eastern cottonwood, American sycamore.
				Nuttall oak	---	---	
				Overcup oak	---	---	
				Water hickory	---	---	
				Sugarberry	---	---	
Sharkey	6W	Severe	Severe	Baldcypress	96	6	Baldcypress.
				Water hickory	---	---	
				Overcup oak	---	---	
				Black willow	---	---	
Hf: Harahan	5W	Severe	Severe	Baldcypress	90	5	Baldcypress.
				Water hickory	70	---	
				Overcup oak	---	---	
				Black willow	---	---	
				Green ash	---	---	
				Sugarberry	---	---	
Sh, Sk: Sharkey	7W	Severe	Moderate	Sweetgum	90	7	Eastern cottonwood, American sycamore.
				Willow oak	100	7	
				Water oak	90	6	
				Nuttall oak	90	---	
				Sugarberry	---	---	
Va: Vacherie	13W	Moderate	Slight	Eastern cottonwood	120	13	Eastern cottonwood, American sycamore.
				Green ash	---	---	
				Sweetgum	110	12	
				American sycamore	---	---	
				Water oak	---	---	
				Pecan	---	---	

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

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. The flooding limitation in this table is based on the period of flooding shown in the map unit]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AD. Aquents					
BB Barbary	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, flooding, ponding.	Severe: ponding, too clayey.	Severe: ponding, flooding, too clayey.
BP Bellpass	Severe: ponding, percs slowly, flooding.	Severe: ponding, excess humus, percs slowly.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.	Severe: flooding, excess humus, excess salt.
CE Clovelly	Severe: flooding, ponding, percs slowly.	Severe: ponding, excess humus, percs slowly.	Severe: flooding, excess humus, ponding.	Severe: ponding, excess humus.	Severe: flooding, ponding, excess humus.
Cm, Co Commerce	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
CS:					
Commerce	Severe: flooding.	Moderate: flooding, wetness, percs slowly.	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.
Sharkey	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Dp. Dumps					
FA Fausse	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, excess salt.	Severe: too clayey, ponding, flooding.	Severe: ponding, too clayey.	Severe: excess salt, ponding, flooding.
FE Felicity	Severe: flooding, too sandy, excess salt.	Severe: too sandy, excess salt.	Severe: too sandy, excess salt, flooding.	Severe: too sandy.	Severe: excess salt, flooding, droughty.
Ha Harahan	Severe: flooding, wetness, percs slowly.	Severe: too clayey, excess humus, percs slowly.	Severe: too clayey, excess humus, wetness.	Severe: too clayey, excess humus, erodes easily.	Severe: too clayey.
Hf Harahan	Severe: flooding, wetness, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey, wetness, flooding.	Severe: too clayey.	Severe: too clayey, flooding.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
LF: Lafitte	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus, wetness.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.	Severe: excess humus, ponding, flooding.
SC: Scatlake	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, excess humus.	Severe: excess humus, ponding, too clayey.	Severe: ponding, too clayey, excess humus.	Severe: excess salt, ponding, flooding.
Sh: Sharkey	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
Sk: Sharkey	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.
TM: Timbalier	Severe: ponding, excess humus, flooding.	Severe: ponding, excess humus, excess salt.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.	Severe: excess salt, ponding, flooding.
Ub. Urban land					
Va: Vacherie	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
Ww: Westwego	Severe: flooding, wetness, percs slowly.	Severe: too clayey, percs slowly, excess humus.	Severe: wetness, too clayey, excess humus.	Severe: too clayey, excess humus.	Severe: too clayey.

TABLE 9.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AD. Aquents										
BB----------------- Barbary	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.	Fair.
BP----------------- Bellpass	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
CE----------------- Clovelly	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Cm, Co------------- Commerce	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
CS:										
Commerce----------	Poor	Fair	Fair	Good	Fair	Fair	Fair	Fair	Good	Fair.
Sharkey-----------	Poor	Poor	Fair	Good	Poor	Fair	Good	Poor	Fair	Fair.
Dp. Dumps										
FA----------------- Fausse	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Good	Poor	Poor	Good.
FE----------------- Felicity	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor.
Ha----------------- Harahan	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Hf----------------- Harahan	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
LF----------------- Lafitte	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Very poor.	Good.
SC----------------- Scatlake	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Sh, Sk------------- Sharkey	Fair	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
TM----------------- Timbalier	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Ub. Urban land										
Va----------------- Vacherie	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ww----------------- Westwego	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AD. Aquents					
BB Barbary	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding, too clayey.
BP Bellpass	Severe: excess humus, ponding.	Severe: flooding, low strength.	Severe: flooding, ponding, low strength.	Severe: flooding, low strength, ponding.	Severe: flooding, excess humus, excess salt.
CE Clovelly	Severe: excess humus, ponding.	Severe: flooding, ponding, low strength.	Severe: flooding, ponding, low strength.	Severe: flooding, ponding.	Severe: flooding, ponding, excess humus.
Cm, Co Commerce	Severe: wetness.	Moderate: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
CS:					
Commerce	Severe: wetness.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
Sharkey	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
Dp. Dumps					
FA Fausse	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: excess salt, ponding, flooding.
FE Felicity	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: excess salt, flooding, droughty.
Ha Harahan	Severe: excess humus, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Hf Harahan	Severe: excess humus, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, shrink-swell, flooding.	Severe: too clayey, flooding.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
LF: Lafitte	Severe: excess humus, ponding.	Severe: flooding, ponding, subsides.	Severe: flooding, ponding, subsides.	Severe: subsides, ponding, flooding.	Severe: excess humus, ponding, flooding.
SC: Scatlake	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: excess salt, ponding, flooding.
Sh: Sharkey	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
Sk: Sharkey	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness, too clayey.
TM: Timbalier	Severe: excess humus, ponding.	Severe: flooding, ponding, low strength.	Severe: flooding, ponding, low strength.	Severe: ponding, flooding.	Severe: excess salt, ponding, flooding.
Ub. Urban land					
Va: Vacherie	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
Ww: Westwego	Severe: excess humus, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell.	Severe: too clayey.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AD. Aquents					
BB: Barbary	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
BP: Bellpass	Severe: flooding, ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding, too clayey, excess humus.	Severe: flooding, seepage, ponding.	Poor: too clayey, ponding, excess humus.
CE: Clovelly	Severe: flooding, ponding, percs slowly.	Severe: flooding, seepage, excess humus.	Severe: ponding, flooding, excess humus.	Severe: flooding, seepage, ponding.	Poor: ponding, excess humus.
Cm, Co: Commerce	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
CS:					
Commerce	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
Sharkey	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Dp. Dumps					
FA: Fausse	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
FE: Felicity	Severe: flooding, poor filter, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness, seepage.	Poor: seepage.
Ha: Harahan	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey, excess humus.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Hf: Harahan	Severe: wetness, percs slowly, flooding.	Severe: wetness, flooding.	Severe: wetness, too clayey, flooding.	Severe: wetness, flooding.	Poor: too clayey, hard to pack, wetness.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
LF: Lafitte	Severe: flooding, ponding, subsides.	Severe: seepage, flooding, excess humus.	Severe: flooding, ponding, seepage.	Severe: flooding, seepage, ponding.	Poor: ponding, excess humus.
SC: Scatlake	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
Sh, Sk: Sharkey	Severe: wetness, percs slowly.	Severe: flooding, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
TM: Timbalier	Severe: flooding, ponding, poor filter.	Severe: flooding, seepage, excess humus.	Severe: ponding, excess humus, flooding.	Severe: flooding, seepage, ponding.	Poor: ponding, excess humus.
Ub. Urban land					
Va: Vacherie	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Ww: Westwego	Severe: wetness, percs slowly.	Severe: flooding, seepage, excess humus.	Severe: wetness, too clayey, excess humus.	Severe: seepage, wetness.	Poor: wetness, too clayey, hard to pack.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Roadfill	Topsoil
AD. Aquents		
BB-------------------- Barbary	Poor: low strength, wetness.	Poor: too clayey, wetness.
BP-------------------- Bellpass	Poor: low strength, wetness.	Poor: excess humus, wetness, excess salt.
CE-------------------- Clovelly	Poor: wetness.	Poor: excess humus, wetness.
Cm-------------------- Commerce	Poor: low strength.	Good.
Co-------------------- Commerce	Poor: low strength.	Fair: too clayey.
CS:		
Commerce-------------	Poor: low strength.	Good.
Sharkey--------------	Poor: low strength, wetness, shrink-swell.	Poor: wetness.
Dp. Dumps		
FA-------------------- Fausse	Poor: low strength, wetness, shrink-swell.	Poor: too clayey, excess salt, wetness.
FE-------------------- Felicity	Fair: wetness.	Poor: excess salt.
Ha, Hf---------------- Harahan	Poor: low strength, shrink-swell.	Poor: too clayey.
LF-------------------- Lafitte	Poor: excess humus, wetness.	Poor: excess humus, wetness.
SC-------------------- Scatlake	Poor: low strength, wetness.	Poor: too clayey, excess salt, wetness.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Topsoil
Sh Sharkey	Poor: low strength, wetness, shrink-swell.	Poor: wetness.
Sk Sharkey	Poor: low strength, wetness, shrink-swell.	Poor: too clayey, wetness.
TM Timbalier	Poor: low strength, wetness.	Poor: excess humus, excess salt, wetness.
Ub. Urban land		
Va Vacherie	Poor: low strength, shrink-swell.	Fair: thin layer.
Ww Westwego	Poor: low strength.	Poor: too clayey.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Limitations for--		Features affecting--	
	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation
AD. Aquents				
BB: Barbary	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.
BP: Bellpass	Severe: piping, ponding, excess humus.	Severe: salty water.	Flooding, percs slowly, subsides.	Flooding, percs slowly, excess salt.
CE: Clovelly	Severe: ponding, excess humus.	Slight	Flooding, percs slowly, subsides.	Flooding, ponding, percs slowly.
Cm, Co: Commerce	Severe: wetness.	Severe: slow refill.	Favorable	Wetness, erodes easily.
CS:				
Commerce	Severe: wetness.	Severe: slow refill.	Flooding	Wetness, erodes easily.
Sharkey	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding.	Wetness, percs slowly.
Dp. Dumps				
FA: Fausse	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.
FE: Felicity	Severe: seepage.	Severe: salty water, cutbanks cave.	Flooding, cutbanks cave, excess salt.	Wetness, fast intake, droughty.
Ha: Harahan	Severe: excess humus, hard to pack, wetness.	Severe: slow refill.	Percs slowly, subsides.	Wetness, slow intake, percs slowly.
Hf: Harahan	Severe: excess humus, hard to pack, wetness.	Severe: slow refill.	Percs slowly, subsides, flooding.	Wetness, percs slowly, flooding.
LF: Lafitte	Severe: excess humus, ponding.	Slight	Ponding, flooding, subsides.	Ponding, flooding, excess salt.
SC: Scatlake	Severe: excess humus, hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly, flooding.	Ponding, percs slowly, slow intake.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--	
	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation
Sh---------------- Sharkey	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly----------	Wetness, percs slowly.
Sk---------------- Sharkey	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly----------	Wetness, slow intake, percs slowly.
TM---------------- Timbalier	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, flooding.	Ponding, flooding, excess salt.
Ub. Urban land				
Va---------------- Vacherie	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly----------	Wetness, percs slowly, erodes easily.
Ww---------------- Westwego	Severe: wetness, hard to pack, excess humus.	Severe: slow refill.	Subsides, percs slowly.	Wetness, slow intake, percs slowly.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated. Some soils may have Unified classifications and USDA textures in addition to those shown. In general, the dominant classifications and textures are shown]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AD. Aquents											
BB------------- Barbary	0-6	Clay-------------	OH, MH	A-7-5, A-8	0	100	100	100	95-100	70-90	35-45
	6-60	Mucky clay, clay	OH, MH	A-7-5, A-8	0	100	100	100	95-100	70-90	35-45
BP------------- Bellpass	0-29	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	29-41	Mucky clay, clay	OH, MH, CH, CL	A-7-5, A-7-6	0	100	100	100	90-100	47-87	30-52
	41-68	Clay, silty clay	CH, MH, CL	A-7-6, A-7-5	0	100	100	100	90-100	47-87	30-52
CE------------- Clovelly	0-50	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	50-70	Clay, silty clay, mucky clay.	CH, CL, MH, ML	A-7-6, A-7-5	0	100	100	95-100	85-95	47-87	25-45
Cm------------- Commerce	0-10	Silt loam--------	CL-ML, CL, ML	A-4	0	100	100	100	75-100	<30	NP-10
	10-37	Silty clay loam, silt loam, loam.	CL	A-6, A-7-6	0	100	100	100	85-100	32-45	11-23
	37-60	Stratified very fine sandy loam to silty clay.	CL-ML, CL, ML	A-4, A-6, A-7-6	0	100	100	100	75-100	23-45	3-23
Co------------- Commerce	0-12	Silty clay loam	CL	A-6, A-7-6	0	100	100	100	90-100	32-50	11-25
	12-32	Silty clay loam, silt loam, loam.	CL	A-6, A-7-6	0	100	100	100	85-100	32-45	11-23
	32-60	Stratified very fine sandy loam to silty clay.	CL-ML, CL, ML	A-4, A-6, A-7-6	0	100	100	100	75-100	23-45	3-23
CS:											
Commerce--------	0-7	Silt loam--------	CL-ML, CL, ML	A-4	0	100	100	100	75-100	<30	NP-10
	7-25	Silty clay loam, silt loam, loam.	CL	A-6, A-7-6	0	100	100	100	85-100	32-45	11-23
	25-60	Stratified very fine sandy loam to silty clay.	CL-ML, CL, ML	A-4, A-6, A-7-6	0	100	100	100	75-100	23-45	3-23
Sharkey---------	0-8	Silty clay loam	CL	A-6, A-7-6	0	100	100	100	95-100	32-50	11-25
	8-45	Clay-------------	CH	A-7-6, A-7-5	0	100	100	100	95-100	56-85	30-50
	45-60	Clay, silty clay loam, silt loam.	CL, CH	A-6, A-7-6, A-7-5	0	100	100	100	95-100	32-85	11-50
Dp. Dumps											
FA------------- Fausse	0-5	Clay-------------	CH, OH, MH	A-7-6	0	100	100	100	95-100	50-100	21-71
	5-36	Clay-------------	CH	A-7-6	0	100	100	100	95-100	60-100	31-71
	36-60	Clay, silty clay, silty clay loam.	CH, MH, CL, ML	A-7-6	0	100	100	100	95-100	45-100	16-71

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
FE----------------- Felicity	0-60	Loamy fine sand	SP-SM, SM	A-2, A-3	0-10	85-100	75-100	51-80	5-30	<20	NP-4
Ha----------------- Harahan	0-5	Clay--------------	OH, MH, CH	A-7-5, A-8, A-7-6	0	100	100	100	95-100	60-90	35-50
	5-37	Clay, silty clay	CH, MH	A-7-6, A-7-5	0	100	100	100	95-100	60-90	35-50
	37-63	Clay, silty clay, mucky clay.	OH, MH, CH	A-7-5, A-8, A-7-6	0	100	100	100	95-100	60-90	35-50
Hf----------------- Harahan	0-4	Clay--------------	OH, MH, CH	A-7-5, A-8, A-7-6	0	100	100	100	95-100	60-90	35-50
	4-27	Clay, silty clay	CH, MH	A-7-6, A-7-5	0	100	100	100	95-100	60-90	35-50
	27-62	Clay, silty clay, mucky clay.	OH, MH, CH	A-7-5, A-8, A-7-6	0	100	100	100	95-100	60-90	35-50
LF----------------- Lafitte	0-53	Muck--------------	PT	A-8	0	---	---	---	---	---	---
	53-80	Variable----------	---	---	---	---	---	---	---	---	---
SC----------------- Scatlake	0-7	Mucky clay--------	OH, MH	A-7-5	0	100	100	100	95-100	55-90	15-45
	7-20	Mucky clay, clay, mucky silty clay loam.	OH, MH	A-7-5	0	100	100	100	95-100	55-90	15-45
	20-70	Clay--------------	MH, OH	A-7-5	0	100	100	100	95-100	70-90	35-45
Sh----------------- Sharkey	0-5	Silty clay loam	CL	A-6, A-7-6	0	100	100	100	95-100	32-50	11-25
	5-46	Clay--------------	CH	A-7-6, A-7-5	0	100	100	100	95-100	56-85	30-50
	46-60	Clay, silty clay loam, silt loam.	CL, CH	A-6, A-7-6, A-7-5	0	100	100	100	95-100	32-85	11-50
Sk----------------- Sharkey	0-8	Clay--------------	CH, CL	A-7-6, A-7-5	0	100	100	100	95-100	46-85	22-50
	8-43	Clay--------------	CH	A-7-6, A-7-5	0	100	100	100	95-100	56-85	30-50
	43-60	Clay, silty clay loam, silt loam.	CL, CH	A-6, A-7-6, A-7-5	0	100	100	100	95-100	32-85	11-50
TM----------------- Timbalier	0-64	Muck--------------	PT	A-8	0	---	---	---	---	---	---
	64-84	Mucky clay, clay, silty clay.	OH, CH, CL, MH	A-7-6, A-7-5	0	100	100	100	90-100	47-87	25-45
Ub. Urban land											
Va----------------- Vacherie	0-24	Silt loam---------	ML, CL-ML	A-4	0	100	100	95-100	65-90	<27	NP-7
	24-60	Clay, silty clay	CH	A-7-6	0	100	100	100	95-100	51-75	26-45
Ww----------------- Westwego	0-37	Clay--------------	CH	A-8, A-7-6	0	100	100	100	95-100	50-81	35-60
	37-55	Muck, peat--------	PT	A-8	0	---	---	---	---	---	---
	55-75	Clay, mucky clay	CH	A-8, A-7-6	0	100	100	100	95-100	50-82	35-60

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
									K	T	
	In	Pct	G/cc	In/hr	In/in	pH	Mmho/cm				Pct
AD. Aquents											
BB Barbary	0-6	60-95	0.25-1.00	<0.06	0.18-0.20	6.6-7.8	<2	Low	0.32	5	4-25
	6-60	60-95	0.25-1.00	<0.06	0.18-0.20	6.6-8.4	<2	Low	0.32		
BP Bellpass	0-29	---	0.15-0.50	>2.0	0.20-0.50	6.6-8.4	8-16	Low	----	---	30-60
	29-41	50-90	0.25-1.00	<0.06	0.18-0.32	7.4-8.4	8-16	Low	0.28		
	41-68	50-90	0.25-1.00	<0.06	0.14-0.22	7.4-8.4	4-16	Low	0.28		
CE Clovelly	0-50	---	0.05-0.25	>2.0	0.10-0.45	6.6-8.4	4-8	Low	----	---	30-60
	50-70	50-90	0.15-1.00	<0.06	0.11-0.18	6.6-8.4	4-8	Low	0.28		
Cm Commerce	0-10	14-27	1.35-1.65	0.6-2.0	0.21-0.23	5.6-8.4	<2	Low	0.43	5	.5-4
	10-37	14-39	1.35-1.65	0.2-0.6	0.20-0.22	6.6-8.4	<2	Moderate	0.32		
	14-39	14-60	1.35-1.65	0.2-2.0	0.20-0.23	6.6-8.4	<2	Low	0.37		
Co Commerce	0-12	27-39	1.45-1.70	0.2-0.6	0.20-0.22	5.6-8.4	<2	Moderate	0.37	5	.5-4
	12-32	14-39	1.35-1.65	0.2-0.6	0.20-0.22	6.6-8.4	<2	Moderate	0.32		
	14-39	14-60	1.35-1.65	0.2-2.0	0.20-0.23	6.6-8.4	<2	Low	0.37		
CS:											
Commerce	0-7	14-27	1.35-1.65	0.6-2.0	0.21-0.23	5.6-8.4	<2	Low	0.43	5	.5-4
	7-25	14-39	1.35-1.65	0.2-0.6	0.20-0.22	6.6-8.4	<2	Moderate	0.32		
	25-60	14-60	1.35-1.65	0.2-2.0	0.20-0.23	6.6-8.4	<2	Low	0.37		
Sharkey	0-8	27-35	1.35-1.75	0.2-0.6	0.20-0.22	5.1-8.4	<2	Moderate	0.37	5	.5-4
	8-45	60-90	1.20-1.50	<0.06	0.12-0.18	5.6-8.4	<2	Very high	0.28		
	45-60	25-90	1.20-1.65	0.06-0.2	0.12-0.18	6.6-8.4	<2	High	0.28		
Dp. Dumps											
FA Fausse	0-5	40-95	0.80-1.45	<0.06	0.18-0.20	6.6-9.0	4-16	Very high	0.20	5	2-15
	5-36	60-95	1.10-1.45	<0.06	0.18-0.20	6.1-8.4	4-16	Very high	0.24		
	36-60	35-95	1.10-1.45	<0.2	0.18-0.22	6.6-8.4	4-16	Very high	0.24		
FE Felicity	0-60	3-10	1.50-1.70	>20	0.03-0.06	6.6-8.4	8-16	Low	0.15	5	<.5
Ha Harahan	0-5	50-95	0.50-1.50	<0.06	0.11-0.30	5.1-7.3	<2	Very high	0.37	5	2-25
	5-37	60-95	1.20-1.50	<0.06	0.11-0.20	5.1-7.3	<2	Very high	0.37		
	37-63	60-95	0.25-1.00	<0.06	0.11-0.30	6.6-8.4	<2	Low	0.37		
Hf Harahan	0-4	50-95	0.50-1.50	<0.06	0.11-0.30	5.1-7.3	<2	Very high	0.37	5	2-25
	4-27	60-95	1.20-1.50	<0.06	0.11-0.20	5.1-7.3	<2	Very high	0.37		
	27-62	60-95	0.25-1.00	<0.06	0.11-0.30	6.6-8.4	<2	Low	0.37		
LF Lafitte	0-53	---	0.05-0.25	2.0-6.0	0.18-0.45	6.1-8.4	4-8	Low	----	---	30-70
	53-80	50-90	0.25-1.00	<0.06	0.11-0.30	6.6-8.4	4-8	Low	0.32		
SC Scatlake	0-7	27-60	0.25-1.00	<0.2	0.05-0.15	6.6-8.4	8-16	Low	0.24	5	2-25
	7-20	27-60	0.25-1.00	<0.2	0.05-0.15	6.6-8.4	8-16	Low	0.24		
	20-70	60-85	0.25-1.00	<0.06	0.05-0.15	6.6-8.4	8-16	Low	0.28		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH	Mmho/cm				Pct
Sh: Sharkey	0-5	27-35	1.30-1.65	0.2-0.6	0.20-0.22	5.1-8.4	<2	Moderate	0.37	5	.5-4
	5-46	60-90	1.20-1.50	<0.06	0.12-0.18	5.6-8.4	<2	Very high	0.28		
	46-60	25-90	1.20-1.65	0.06-0.2	0.12-0.22	6.6-8.4	<2	High	0.28		
Sk: Sharkey	0-8	40-60	1.20-1.50	<0.06	0.12-0.18	5.1-8.4	<2	Very high	0.32	5	.5-4
	8-43	60-90	1.20-1.50	<0.06	0.12-0.18	5.6-8.4	<2	Very high	0.28		
	43-60	25-90	1.20-1.65	0.06-0.2	0.12-0.22	6.6-8.4	<2	High	0.28		
TM: Timbalier	0-64	---	0.05-0.25	>2.0	0.20-0.50	6.6-8.4	8-16	Low	----	---	30-70
	64-84	50-80	0.25-1.00	<0.06	0.14-0.22	7.9-8.4	4-16	Low	0.28		
Ub. Urban land											
Va: Vacherie	0-24	10-18	1.35-1.65	0.6-2.0	0.11-0.24	5.6-8.4	<2	Low	0.43	5	.5-2
	24-60	40-65	1.20-1.35	<0.06	0.12-0.18	6.6-8.4	<2	Very high	0.32		
Ww: Westwego	0-37	50-95	0.50-1.50	<0.06	0.11-0.30	4.5-6.5	<2	High	0.37	5	2-25
	37-55	---	0.15-0.50	2.0-6.0	0.20-0.50	4.5-6.5	<2	Low	----		
	55-75	60-95	0.25-1.00	<0.06	0.11-0.30	6.6-8.4	<2	Low	0.37		

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total	Uncoated steel	Concrete
					Ft			In	In		
AD. Aquents											
BB: Barbary	D	Frequent	Very long.	Jan-Dec	+1-0.5	Apparent	Jan-Dec	3-12	6-15	High	Moderate.
BP: Bellpass	D	Frequent	Very long.	Jan-Dec	+1-0.5	Apparent	Jan-Dec	8-25	16-51	High	Low.
CE: Clovelly	D	Frequent	Very long.	Jan-Dec	+1-0.5	Apparent	Jan-Dec	8-20	16-51	High	Low.
Cm, Co: Commerce	C	None	---	---	1.5-4.0	Apparent	Dec-Apr	---	---	High	Low.
CS:											
Commerce	C	Frequent	Brief to long.	Dec-Jun	1.5-4.0	Apparent	Dec-Apr	---	---	High	Low.
Sharkey	D	Frequent	Brief to very long.	Dec-Jul	0-2.0	Apparent	Dec-Apr	---	---	High	Moderate.
Dp. Dumps											
FA: Fausse	D	Frequent	Brief to very long.	Jan-Dec	+1.-1.5	Apparent	Jan-Dec	---	---	High	Low.
FE: Felicity	A	Frequent	Brief	Jan-Dec	2.0-3.0	Apparent	Jan-Dec	---	---	High	Low.
Ha: Harahan	D	Rare	---	---	1.0-3.0	Apparent	Jan-Dec	2-5	4-10	High	Moderate.
Hf: Harahan	D	Frequent	Brief to very long.	Jan-Dec	1.0-3.0	Apparent	Jan-Dec	2-5	4-10	High	Moderate.
LF: Lafitte	D	Frequent	Very long.	Jan-Dec	+1-0.5	Apparent	Jan-Dec	15-30	>51	High	Moderate.
SC: Scatlake	D	Frequent	Very long.	Jan-Dec	+1-0.5	Apparent	Jan-Dec	---	6-12	High	Low.
Sh, Sk: Sharkey	D	Rare	---	---	0-2.0	Apparent	Dec-Apr	---	---	High	Moderate.
TM: Timbalier	D	Frequent	Very long.	Jan-Dec	+1-0.5	Apparent	Jan-Dec	25-45	51-99	High	Low.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Subsidence		Risk of corrosion	
		Frequency	Dura-tion	Months	Depth	Kind	Months	Initial	Total	Uncoated steel	Concrete
					Ft			In	In		
Ub. Urban land											
Va----------- Vacherie	C	None-------	---	---	1.0-3.0	Apparent	Dec-Apr	---	---	High-----	Moderate.
Ww----------- Westwego	D	Rare-------	---	---	1.0-3.0	Apparent	Jan-Dec	3-8	6-20	High-----	Moderate.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Barbary	Very-fine, montmorillonitic, nonacid, thermic Typic Hydraquents
Bellpass	Clayey, montmorillonitic, euic, thermic Terric Medisaprists
Clovelly	Clayey, montmorillonitic, euic, thermic Terric Medisaprists
Commerce	Fine-silty, mixed, nonacid, thermic Aeric Fluvaquents
Fausse	Very-fine, montmorillonitic, nonacid, thermic Typic Fluvaquents
Felicity	Mixed, thermic Aquic Udipsamments
Harahan	Very-fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts
Lafitte	Euic, thermic Typic Medisaprists
Scatlake	Very-fine, montmorillonitic, nonacid, thermic Typic Hydraquents
Sharkey	Very-fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts
Timbalier	Euic, thermic Typic Medisaprists
Vacherie	Coarse-silty over clayey, mixed, nonacid, thermic Aeric Fluvaquents
Westwego	Very-fine, montmorillonitic, nonacid, thermic, cracked Thapto-Histic Fluvaquents

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