SOIL SURVEY OF

Pinellas County, Florida

United States Department of Agriculture
Soil Conservation Service
In cooperation with
University of Florida
Agricultural Experiment Stations

Issued September 1972

Major fieldwork for this soil survey was done in the period 1960–68. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1968. This survey was made cooperatively by the Soil Conservation Service, the University of Florida Agricultural Experiment Stations, and the Pinellas Board of County Commissioners. It is part of the technical assistance furnished to the Pinellas Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

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

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

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the descriptions of the capability units.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

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

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section "Town and Country Planning."

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

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

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

Cover: **Residential area on Made land at Indian Rocks Beach.**

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SOIL SURVEY OF PINELLAS COUNTY, FLORIDA

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATIONS

PINELLAS COUNTY is in the west-central part of Florida (fig. 1). It has an area of about 280 square miles. It is bounded on the north by Pasco County, on the east by Hillsborough County and Tampa Bay, and on the west and south by the Gulf of Mexico. Figure 1 shows distances from Clearwater, the county seat, to major cities in the State.

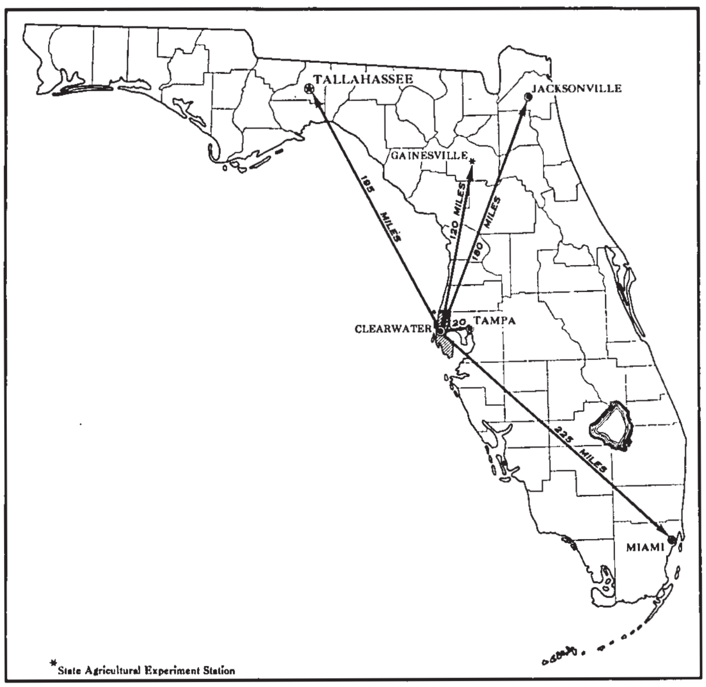

Figure 1.—**Location of Pinellas County in Florida.**

The county was formed in 1911 from part of Hillsborough County. Although it is the second smallest county in Florida, it is one of the most densely populated. The population currently exceeds 500,000. Four towns have a population of less than 1,000, and two have more than 40,000. Because the trend in land use is toward further urban expansion, a section on town and country planning has been included in this survey.

Pinellas County occupies a peninsula that ranges from 4 to 15 miles in width. The coastline is broken by many keys and offshore islands. Elevation ranges from sea level to 97 feet. The soils generally are sandy and excessively drained to very poorly drained. Many areas are affected by a high water table and ponding.

In the northwestern part of the county is an area of rolling ridgeland, commonly called the Pinellas Ridge. This ridge is 3 or 4 miles wide and extends southward from Palm Harbor to the vicinity of Oakhurst. It is 25 to 97 feet above sea level and is pocked with sinkholes, many of which are filled with water. A native vegetation of turkey oak, pine, and grasses still grows in places, but most of this area has been planted to citrus or is used for community development. This is the major citrus producing area in the county.

In the southern part of the county is a rounded area of flat uplands about 5 miles in diameter. Maximum elevation is about 50 feet. The city of St. Petersburg occupies nearly all of this upland area.

The northeastern part of the county and a large area northeast of Pinellas Park consist of saw-palmetto and pine flatwoods that are dotted by small ponds and are cut by swamp drainageways. Elevation in this area and on most offshore islands generally is less than 25 feet. The soils are generally sandy and are excessively drained to very poorly drained.

Throughout Pinellas County are areas of Made land built up by dredging and filling operations. Since 1959, when the total land area of the county was 168,960 acres, about 10,225 acres of Made land has been added. In 1969, the total land area of the county was 179,185 acres.

The climate of Pinellas County is humid and subtropical. The average annual rainfall is about 55 inches, and the period of greatest rainfall is June through September. The average temperature is about 63° F. in winter and 83° in summer.

The economy of the county is based primarily on tourism, which employs about 52 percent of the work force. Manufacturing and construction employ 23 percent, and farming and related work only about 2 percent.

For more information about Pinellas County, refer to the section "General Nature of the County" at the back of this survey.

How This Survey Was Made

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

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey (*5*).[1]

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

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Astatula fine sand, moderately deep water table, is one of several phases within the Astatula series.

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

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

Some mapping units are made up of soils of different series. One such kind of mapping unit, a soil complex, is shown on the soil map of Pinellas County.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. An example is Urban land-Astatula complex.

In some areas surveyed there are places where the soil material is so wet, so shallow, or so disturbed by urban development that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Made land is a land type in Pinellas County.

[1] Italic numbers in parentheses refer to Literature Cited, p. 62.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

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

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

Table 1 shows the degree of limitations and the chief limiting features by soil associations for selected nonfarm uses. For a discussion of these nonfarm uses of the soils refer to the section "Town and Country Planning."

The soil associations in Pinellas County are described in the following pages.

1. Astatula-St. Lucie Association

Nearly level and gently sloping, excessively drained, acid, deep sandy soils

Broad gently sloping areas and nearly level ridgetops make up most of this association. There are a few short steep slopes adjacent to streams and bayous and around sinks. This association is mostly in the northwestern part of the county. In some areas there is no surface drainage pattern, and all water drains through the soil. Sinks and

TABLE 1.—*Summary of limitations by soil associations for selected nonfarm uses*

Soil association	Building construction	Landscaping	Sanitation	Transportation	Recreation
1. Astatula-St. Lucie association.	Slight	Moderate: very low available water capacity; low natural fertility.	Slight	Severe: loose sand.	Severe: loose sand.
2. Made land-Palm Beach association.	Variable	Variable	Variable	Variable	Variable.
3. Astatula-Adamsville association.	Slight	Moderate: very low available water capacity; low natural fertility.	Moderate: water table.	Moderate: sand texture.	Severe: sand texture.
4. Myakka-Immokalee-Pomello association.	Severe: water table.	Moderate: water table; low natural fertility.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; sand texture.
5. Wabasso-Elred-Oldsmar association.	Severe: water table.	Moderate: water table; low natural fertility.	Severe: water table.	Severe: water table; flooding.	Severe: water table; sand texture.
6. Astor association	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.
7. Tidal swamp-Tidal marsh association.	Very severe: water table; flooding; salinity; low bearing capacity.	Very severe: water table; flooding; salinity.	Very severe: water table; flooding;	Very severe: water table; flooding.	Very severe: water table; flooding.
8. Urban land association This association is already intensively developed.					

depressions, ½ acre to 4 acres in size, occur throughout this association. Many are filled with water and form permanent lakes.

This association makes up 8 percent of the county. It is about 50 percent Astatula soils that are deep over a water table, 10 percent St. Lucie soils, and 8 percent Astatula soils that are moderately deep over a water table. The rest is mostly Immokalee, Myakka, Paola, and Pomello soils and Urban land.

Astatula soils that are deep over a water table have a surface layer of gray to dark grayish-brown fine sand 2 to 9 inches thick. Below this is yellow to yellowish-brown sand that extends to a depth of more than 80 inches. The water table is below a depth of 60 inches.

St. Lucie soils have a thin surface layer of gray to light-gray fine sand. Below this is nearly white fine sand. In some areas layers of brownish-yellow fine sand occur at a depth of about 60 inches. The water table is below a depth of 80 inches.

Astatula soils that are moderately deep over a water table have a surface layer of dark-gray fine sand 4 to 10 inches thick. Below this is gray to pale-brown fine sand. In most areas layers of white fine sand occur between depths of 40 and 60 inches. The water table is typically at a depth of 40 to 60 inches.

Approximately 36 percent of this association is in urban areas, mainly residential developments. Some areas, especially in the northern part of the county, are in native vegetation that consists mainly of turkey oak, blackjack oak, saw-palmetto, and various kinds of shrubs and grasses. Citrus is grown in some areas. Most of the soils are suited to citrus, but they are poorly suited to cultivated crops and improved pasture. This association is poorly suited as habitat for wildlife.

2. Made Land-Palm Beach Association

Nearly level land extensively altered by man

Nearly level land formed by diking and dredging and by transporting fill material makes up most of this association. The rest is characterized by narrow ridges and shallow valleys. This association is mostly on keys and in coastal areas. There is no surface drainage pattern; all drainage is through the soil.

This association makes up about 11.5 percent of the county. It is about 70 percent Made land, 18 percent Palm Beach soils, and 6 percent St. Lucie soils. The rest is mostly Coastal beaches and Tidal swamp.

Made land consists of dredged or fill material. The fill material is normally 2 to 8 feet thick and in places is underlain by rubble. It is a mixture of clay, sand, rocks, and shell fragments in varying proportions and ranges from coarse textured to fine textured.

Palm Beach soils are sands mixed with shell fragments. Some areas consist of material that was dredged from the bottom of the bay and used to fill dikes. Recent deposits are saline, but the salts have been leached from the older deposits. The water table is normally at a depth of about 50 inches.

St. Lucie soils are excessively drained. They have a surface layer of gray to dark-gray fine sand 2 to 6 inches thick. Below this is gray to light-gray sand that extends to a depth of more than 40 inches. A few shell fragments are scattered throughout the soil, and layers of shells and shell fragments occur below a depth of 40 inches.

Most of this association is used for urban development. Some areas are used for recreation. Topsoil, special fertilizers, and good management are needed to establish lawns and ornamental plants. Pine oak, sabal palm, saw-palmetto, scattered cedar, and various kinds of shrubs and grasses grow on islands where the soil has not been disturbed.

3. Astatula-Adamsville Association

Nearly level and gently sloping, deep sandy soils on broad, low ridges

Broad, low, nearly level to gently sloping ridgetops and a few narrow, steeper slopes adjacent to streams, lakes, and sinks characterize this association. Many small, intermittent ponds and a few deep lakes are included. There are a few weakly defined drainageways. This association occurs throughout the county.

This association makes up 13.5 percent of the county. It is about 50 percent Astatula soils that are moderately deep over a water table, 10 percent Adamsville soils, and 8 percent Astatula soils that are deep over a water table. The rest is mostly Myakka and Immokalee soils and Urban land.

Astatula soils that are moderately deep over a water table have a surface layer of dark-gray fine sand 4 to 10 inches thick. Below this are layers of pale-brown fine sand. In most areas layers of white fine sand occur between depths of 40 and 60 inches. The water table is at a depth of 40 to 60 inches.

Adamsville soils are somewhat poorly drained. They are similar to the Astatula soils that are moderately deep over a water table, but they occur in relatively lower positions on the landscape and are considerably more mottled below the surface layer. Normally the water table is at a depth of 10 to 40 inches.

Astatula soils that are deep to a water table have a surface layer of gray to dark grayish-brown fine sand 2 to 9 inches thick. Below this is yellow to yellowish-brown sand that extends to a depth of more than 80 inches. The water table does not rise above a depth of 60 inches.

Most of this association is used for citrus and for residential development. Urban expansion is rapidly encroaching on many areas that are now planted to citrus. Only a few small scattered areas are in native vegetation, dominantly pine, oak, saw-palmetto, and various shrubs and grasses.

This association is well suited to citrus and improved pasture. The main limitations to use for crops are very low available water capacity and low fertility. Some areas provide habitat for wildlife.

4. Myakka-Immokalee-Pomello Association

Nearly level and gently sloping, poorly drained and moderately well drained sandy soils that have layers weakly cemented with organic matter at depths of 40 inches or less

This association is characterized by broad flats between sloughs, low ridges and knolls, and many small, shallow, grassed ponds. It occurs extensively throughout the county. Drainage is through the soils and into a few small streams, drainage ditches, and lakes.

This association makes up 43 percent of the county. It is about 57 percent Myakka soils, 11 percent Immokalee soils, and 5 percent Pomello soils. The rest is mostly Astor and Astatula soils and Made land.

Myakka soils are poorly drained. They have a surface layer of gray to black fine sand 3 to 9 inches thick. Below this is a layer of leached, gray to white fine sand about 12 inches thick. At a depth of 30 inches or less is a layer of very dark brown fine sand, about 9 inches thick, that is weakly cemented with organic matter. Brown to pale-brown fine sand is below the weakly cemented layer. The water table is typically at a depth of 10 to 30 inches, but it may rise to the surface during wet periods or drop below 30 inches during dry periods.

Immokalee soils are poorly drained. They are similar to Myakka soils, but the depth to the pan stained by organic matter is 30 to 40 inches. The water table is at a depth of less than 10 inches for 1 or 2 months during wet periods and at a depth of 10 to 30 inches for 2 to 6 months in most years.

Pomello soils are moderately well drained. They have a surface layer of light-gray to gray fine sand 2 to 5 inches thick. Below this is leached, light-gray to white fine sand extending to a depth of more than 30 inches. At a depth of more than 30 inches is a layer of sand that is weakly cemented with organic matter. The water table is at a depth of 30 to 40 inches for a short time during wet periods and at a depth of 40 to 60 inches for about 8 months most years.

Some areas of this association, mainly in the northern part of the county, are in native vegetation consisting of saw-palmetto, scattered stands of slash and sand pine, gallberry, runner oak, and grasses. Cypress and water-tolerant hardwood trees, shrubs, and grasses grow in swampy areas. Many areas in other parts of the county are in urban uses. The seasonal high water table is the main limiting factor for urban uses, and special management is needed in residential areas to establish and maintain lawns and ornamental plants.

The high water table severely limits the use of this association for cultivated crops, citrus, and improved pasture. However, if management is intensive, citrus, truck crops, and pasture grasses grow well.

5. Wabasso-Elred-Oldsmar Association

Nearly level, poorly drained sandy soils, some of which have layers weakly cemented with organic matter

This association is characterized by nearly level areas and low swampy areas. It is mostly in the southern part of the county. Surface drainage is through the soils and into small streams, drainage ditches, and ponds. The lowest areas are covered with water for several months each year.

This association makes up 13 percent of the county. It is about 23 percent Wabasso soils, 21 percent Elred soils, and 15 percent Oldsmar soils. Of the rest, 10 percent is Felda soils, 9 percent is Pinellas soils, 8 percent is Myakka soils, and 14 percent is Wauchula soils, Urban land, and Made land.

Wabasso soils are poorly drained. They have a surface layer of black fine sand about 5 inches thick. Below this is a layer of gray fine sand about 22 inches thick. At a depth of about 27 inches is a layer of dark-brown fine sand that is weakly cemented with organic matter. Below this are layers of mottled clay and loam. The water table is at a depth of less than 10 inches for 1 or 2 months during wet periods and at a depth of 10 to 30 inches for 2 to 6 months every year.

Elred soils are similar to Wabasso soils, but they lack the layer weakly cemented with organic matter. Oldsmar soils also are similar to Wabasso soils, but the depth to the layer weakly cemented with organic matter is 30 to 40 inches.

Felda soils are poorly drained and occur mostly in depressions. Pinellas soils are somewhat poorly drained and have accumulated carbonates at a depth of about 20 inches. Myakka soils are poorly drained.

A large part of this association is in a native vegetation consisting of scattered stands of slash pine, saw-palmetto, myrtle, gallberry, and grasses. Some areas have been cleared and planted to improved pasture grasses. In some areas where adequate water control and a high level of management are provided, the soils are well suited to citrus and truck crops.

In the vicinity of St. Petersburg and Pinellas Park, much of the association has been developed for urban use, but many areas remain in native vegetation and some have been cleared and planted to improved pasture grasses. The seasonal water table severely limits many urban uses. In many areas the advantage of a desirable location would compensate for the expensive measures needed to overcome this limitation.

6. Astor Association

Nearly level, very poorly drained sandy soils that have a thick surface layer high in organic-matter content

This association is characterized by low, nearly level areas adjacent to cypress swamps and a few larger isolated swampy areas. It occurs mainly in the northern part of the county. Water covers most of this association for 6 months or more in most years. In some areas the water table has been lowered by ditches that provide drainage outlets for adjacent areas. Natural drainage is very slow. Excess water flows into natural streams, drainage ditches, and lakes.

This association makes up about 5 percent of the county. About 48 percent is Astor soils and the rest is mostly Terra Ceia, Placid, Pompano, Felda, Pamlico, and Okeechobee soils.

Astor soils are very poorly drained. They have a black, highly organic surface layer 10 to more than 20 inches thick. Below this is gray to dark-gray sand that extends to a depth of more than 80 inches.

No significant use has been made of this association, except as habitat for wildlife. Most areas are in native vegetation consisting of water-tolerant trees, shrubs, and grasses. The cost of reclamation prohibits most uses.

7. Tidal Swamp-Tidal Marsh Association

Level areas that are inundated daily by tides interspersed with somewhat higher areas that are inundated less frequently

This association is characterized by level areas subject to inundation by tidal waters. It occurs mainly northeast of St. Petersburg along the shoreline of Old Tampa Bay and along the Anclote River.

This association makes up about 3.5 percent of the county. It is about 65 percent Tidal swamp, 15 percent Tidal marsh, and 10 percent Coastal beaches. The rest is St. Lucie, Wabasso, and Myakka soils and Made land.

Tidal swamp occurs in low, broad coastal areas that are covered with several inches to as much as 1 or 2 feet of sea water at high tide. Numerous drainage ditches have been dug in these areas to remove trapped water left by falling tides. Tidal swamp consists mainly of sands, peaty sands, and a few organic soils that contain seashells and shell fragments. It has a dense growth of mangrove trees and a few small intermittent patches of other salt-tolerant plants.

Tidal marsh occurs in areas slightly above sea level that are covered with salt water or brackish water during high tides. Soils in areas of Tidal marsh range from organic material as much as 3 feet thick to gray mineral soils. The high concentration of salts inhibits the growth of all vegetation except salt-tolerant rushes, sedges, weeds, and grasses.

Coastal beaches occurs as narrow strips bordering islands and along parts of the mainland that are reached by tides. These beaches consist of sand and shell fragments that have been deposited, mixed, and reworked by water. Long stretches are practically devoid of vegetation, but sparse salt-tolerant grasses and plants grow in some areas. Most areas are covered with salt water at high tide and during storms.

Most of this association remains in its native condition. It provides food, cover, and breeding grounds for many shore birds and animals. Several brackish creeks have been dammed to form fresh-water lakes. Some areas of Tidal swamp have been filled with dredged materials to provide waterfront homesites (fig. 2). Most areas of Coastal beaches are used for recreation.

8. Urban Land Association

Areas 75 percent or more covered by urban structures and areas so much modified by urban development that kinds of soil cannot be identified

This association consists of areas that have undergone extensive urban development. The soils have been modified by cutting, grading, filling, and shaping, or otherwise generally altered. Urban facilities including paved parking areas, streets, industrial buildings, houses and other structures, and underground utilities have been constructed on 75 percent or more of this association. Places not covered by urban facilities remain as altered soils or soil material.

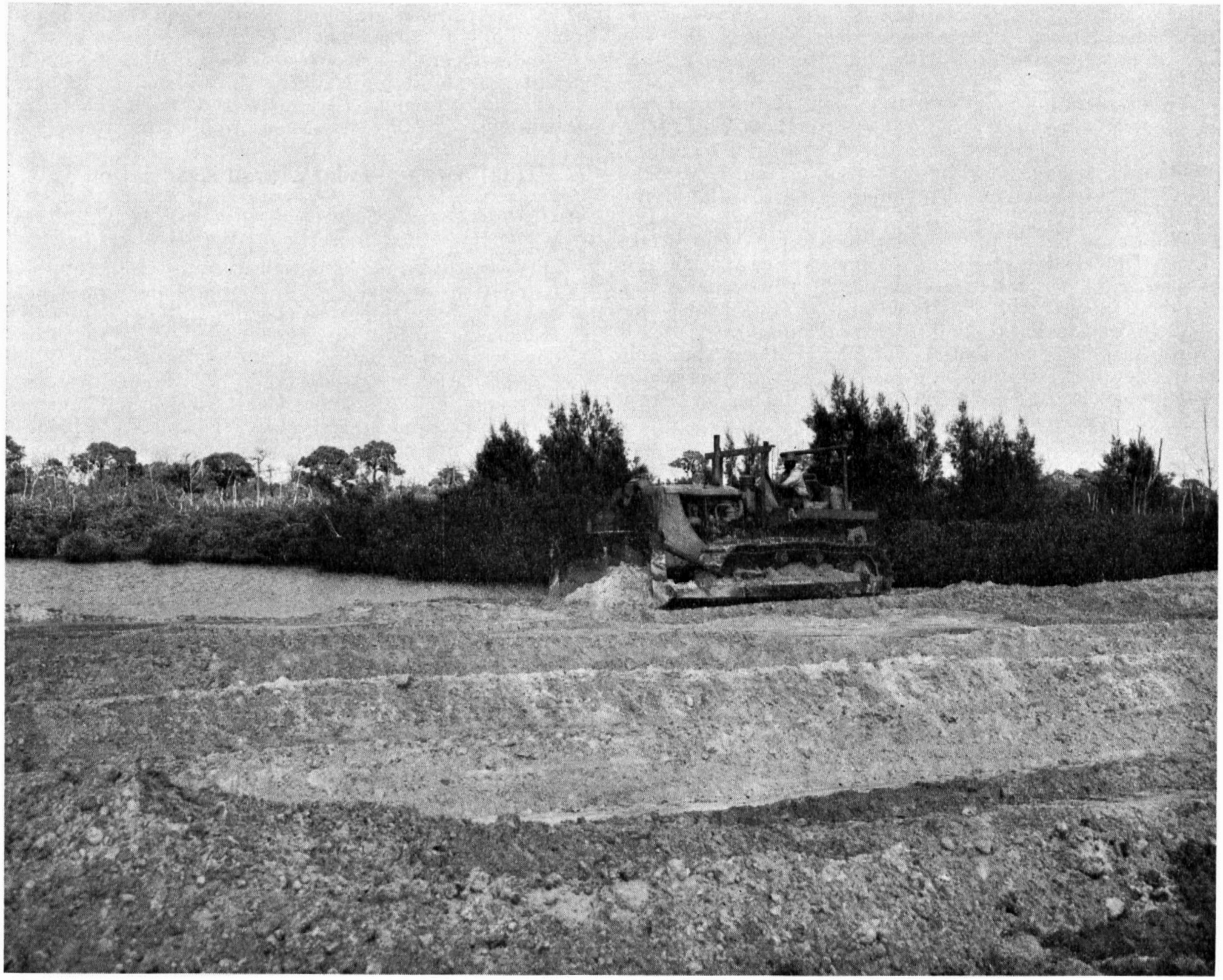

Figure 2.—**Areas of Tidal swamp are filled with dredged material and then leveled to provide waterfront homesites.**

Identification of soils within these areas is not feasible. This association occurs mainly in downtown shopping districts, industrial areas, and along main throughways of cities and towns. It also occurs in isolated shopping centers and in small business areas at intersections of primary roads.

About 2.5 percent of the county is Urban land. Less intensively developed areas and small areas of identifiable soils are included in some places.

Descriptions of the Soils

This section describes the soil series and the mapping units in Pinellas County. For full information on any one mapping unit, it is necessary to read both the description of that unit and the description of the soil series to which it belongs.

Each soil series contains two descriptions of a soil profile. The first is brief and in terms familiar to a layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Made land and Spoil banks, for example, do not belong to a series but, nevertheless, are listed in alphabetic order along with the soil series.

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

The acreage and proportionate extent of each mapping unit are shown in table 2. Many of the terms used in describing soils can be found in the Glossary at the end of of this survey.

TABLE 2.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Adamsville fine sand	2, 551	1. 4
Astatula fine sand, 0 to 5 percent slopes	9, 064	5. 1
Astatula fine sand, 5 to 12 percent slopes	1, 366	. 8
Astatula fine sand, moderately deep water table	10, 134	5. 7
Astor fine sand	833	. 5
Astor soils	7, 844	4. 4
Charlotte fine sand	271	. 1
Coastal beaches	758	. 4
Elred fine sand	4, 956	2. 8
Felda fine sand	791	. 4
Felda fine sand, ponded	1, 998	1. 1
Fellowship loamy fine sand	257	. 1
Immokalee fine sand	7, 918	4. 4
Made land	16, 325	9. 1
Made land, sanitary fill	662	. 4
Manatee loamy fine sand	601	. 3
Myakka fine sand	39, 118	21. 8
Okeechobee muck	512	. 3
Oldsmar fine sand	3, 657	2. 0
Orlando fine sand, wet variant	742	. 4
Palm Beach sand	4, 395	2. 4
Pamlico muck	584	. 3
Paola fine sand, 0 to 5 percent slopes	493	. 3
Pinellas fine sand	2, 148	1. 2
Placid fine sand	915	. 5
Pomello fine sand	2, 940	1. 6
Pompano fine sand	969	. 5
Pompano fine sand, ponded	1, 004	. 6
Spoil banks	437	. 2
St. Lucie fine sand, 0 to 5 percent slopes	959	. 5
St. Lucie fine sand, 5 to 12 percent slopes	545	. 3
St. Lucie fine sand, shell substratum	2, 097	1. 2
Terra Ceia muck, moderately deep variant	1, 171	. 7
Tidal marsh	1, 397	. 8
Tidal swamp	5, 357	3. 0
Urban land	4, 975	2. 8
Urban land-Astatula complex	11, 427	6. 4
Urban land-Immokalee complex	2, 640	1. 5
Urban land-Myakka complex	13, 560	7. 6
Urban land-Pomello complex	2, 786	1. 6
Urban land-Wabasso complex	2, 488	1. 4
Wabasso fine sand	4, 154	2. 3
Wauchula fine sand	1, 386	. 8
Total	179, 185	100. 0

Adamsville Series

The Adamsville series consists of nearly level, somewhat poorly drained sandy soils that formed in thick deposits of acid marine sands. These soils occur near the base of slopes on the upland ridge and on low ridges in the flatwoods.

Typically, the surface layer is black fine sand about 6 inches thick. Below this is a layer of dark grayish-brown loose fine sand about 11 inches thick. The next layers, extending to a depth of 52 inches, are very pale brown, light-gray, and brownish-yellow loose fine sand mottled with yellowish brown and white. Between depths of 52 and 80 inches or more is white fine sand mottled with yellowish brown and very dark grayish brown. All layers are strongly acid. The water table is normally at a depth of about 30 inches.

Adamsville soils have very rapid permeability, very low available water capacity, low organic-matter content, and low natural fertility.

Representative profile of Adamsville fine sand:

Ap—0 to 6 inches, black (10YR 2/1) fine sand; weak, fine, crumb structure; very friable; many fine roots; strongly acid; clear, wavy boundary.

C1—6 to 17 inches, dark grayish-brown (10YR 4/2) fine sand; single grain; loose; common fine roots; strongly acid; clear, smooth boundary.

C2—17 to 38 inches, very pale brown (10YR 7/3) fine sand; common, medium, distinct, yellowish-brown (10YR 5/8) mottles and common, fine, faint, white mottles; single grain; loose; few fine roots; many uncoated sand grains; strongly acid; gradual, wavy boundary.

C3—38 to 52 inches, coarsely mottled very pale brown (10YR 7/3), light-gray (10YR 7/1), and brownish-yellow (10YR 6/6) fine sand; single grain; loose; many uncoated sand grains; strongly acid; gradual, wavy boundary.

C4—52 to 80 inches, white (10YR 8/2) fine sand; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; few, common faint, very dark grayish brown (10YR 3/2) mottles; common, medium, faint, light-gray (10YR 6/1) mottles; single grain; loose; many uncoated sand grains; strongly acid.

The A or Ap horizon ranges from dark gray to black and is 3 to 8 inches thick. The upper part of the C horizon is brown, grayish brown, or dark grayish brown that grades with increasing depth to very pale brown or light yellowish brown. Below a depth of 50 inches is white fine sand mottled with yellowish brown or very dark grayish brown. Reaction is strongly acid to very strongly acid in all layers. The water table is normally between depths of 10 and 40 inches, but it is at less than 10 inches briefly during wet periods, and it falls below 40 inches during dry periods.

The Adamsville soils mapped in Pinellas County are more acid than the range defined for the series, but this does not appreciably affect use or management. Other properties are within the ranges defined.

Adamsville soils are associated with Myakka, Placid, and St. Lucie soils. They do not have a brown-stained Bh horizon at a depth of 30 inches as do Myakka soils. They have a thinner A horizon than Placid soils and are less wet. They are not so white or so well drained as St. Lucie soils.

Adamsville fine sand (Ad).—This is a nearly level, somewhat poorly drained soil near the base of slopes on the upland ridge and in a few areas in the flatwoods. The water table is at a depth of 10 to 40 inches for 6 months or more most years. It is within a depth of 10 inches for a short time after heavy rains and falls below 40 inches during dry periods.

Included in mapping are small areas where the soils are better drained and have fewer mottles in the lower layers than is typical. These inclusions make up no more than 10 percent of any mapped area. Also included are gently sloping areas, areas that are slightly acid below the surface layer, areas where the surface layer is thicker than typical because cover crops have been disked into the soil, and a few small areas that have sandy loam layers between depths of 60 and 80 inches. None of these inclusions makes up more than 5 percent of any mapped area.

This soil is used mostly for citrus. It is well suited to citrus if effective water control is provided. Some areas are seepy, but irrigation generally is needed during extended dry periods. Drainage, irrigation, and fertilizer are needed for citrus, truck and flower crops, and lawn

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grasses and ornamental plants. (Capability unit IIIw–1; woodland group 5)

Astatula Series

The Astatula series consists of undulating, excessively drained sandy soils that formed in thick deposits of marine sands. These soils occur mostly on the upland ridge.

Typically, the surface layer is dark-gray fine sand about 5 inches thick. Below this are layers of yellowish-brown and yellow fine sand that extend to a depth of 80 inches. All layers are strongly acid. The water table normally is at a depth of more than 60 inches.

Astatula soils have very rapid permeability, very low available water capacity, low organic-matter content, and low natural fertility.

Representative profile of Astatula fine sand, 0 to 5 percent slopes:

A1—0 to 5 inches, dark-gray (10YR 4/1), rubbed fine sand; weak, fine, crumb structure; loose; many fine roots; few fine charcoal fragments; strongly acid; clear, smooth boundary.

C1—5 to 18 inches, light yellowish-brown (10YR 6/4) fine sand; single grain; loose; many uncoated sand grains; common fine roots; few fine charcoal fragments; strongly acid; gradual, smooth boundary.

C2—18 to 70 inches, yellow (10YR 7/6) fine sand; single grain; loose; many uncoated sand grains; strongly acid; gradual, smooth boundary.

C3—70 to 80 inches, yellow (10YR 8/6) fine sand; single grain; loose; many uncoated sand grains; strongly acid.

The A1 or Ap horizon ranges from gray and dark gray to dark grayish brown in color and from 2 to 9 inches in thickness. In places where citrus trees have grown for many years, an AC horizon of pale-brown, yellowish-brown, and dark-gray fine sand, 2 to 16 inches thick, has formed below the surface layer. The upper part of the C horizon is very pale brown to light yellowish brown. Normally the lower part is yellow to yellowish brown, but in places it is white. Reaction ranges from very strongly acid to medium acid in all layers.

The depth to water table defined for the Astatula series is more than 60 inches. In one mapping unit, Astatula fine sand, moderately deep water table, the water table is at a depth of 40 to 60 inches. Other characteristics of this soil are within the ranges defined for the series.

Astatula soils are associated with Myakka, Paola, and Placid soils. They are better drained than Myakka soils and do not have a layer stained by organic matter. They do not have the white C horizon typical of Paola soils. They have a thinner surface layer than Placid soils and are less wet.

Astatula fine sand, 0 to 5 percent slopes (AfB).—This is a nearly level to gently sloping, excessively drained sandy soil on the upland ridge. It has the profile described as representative for the series. The water table is well below a depth of 60 inches all year.

Included in mapping are small areas of a similar soil that has a water table at a depth of 40 to 60 inches. This included soil makes up no more than 10 percent of any mapped area. Also included are a few small areas that have loamy layers at a depth of about 60 inches and small scattered areas of Paola fine sand. Neither of these inclusions makes up more than 2 percent of any mapped area.

This soil is well suited to citrus but is too porous and droughty for most cultivated crops. Sprinkler irrigation, special fertilizers, and good management are needed for all crops and for lawn grasses and ornamental plants. Many areas formerly used for citrus are now used for housing developments. (Capability unit IVs–1; woodland group 2)

Astatula fine sand, 5 to 12 percent slopes (AfC).—This is a sloping, excessively drained sandy soil near streams and drainageways on the upland ridge. It is similar to Astatula fine sand, 0 to 5 percent slopes, but it is steeper and its surface layer commonly is thinner and in some areas has been appreciably eroded.

Included with this soil in some mapped areas are small areas of Astatula fine sand, 0 to 5 percent slopes, and in others, small areas that have a water table within 40 inches of the surface for short periods. These inclusions make up less than 10 percent of any mapped area.

This soil is too porous and droughty to be well suited to most cultivated crops. It is moderately well suited to citrus. Sprinkler irrigation, special fertilizer, and good management are needed for all crops and for lawns and ornamental plants in residential areas. (Capability unit IVs–1; woodland group 2)

Astatula fine sand, moderately deep water table (As).—This is a nearly level to gently sloping sandy soil on low ridges and isolated knolls.

The surface layer is dark-gray fine sand about 7 inches thick. In old citrus groves it is generally underlain by a layer of pale-brown, dark-gray, and yellowish-brown loose fine sand about 10 inches thick. This layer does not occur in undisturbed areas. The next layers are pale-brown loose fine sand mottled with white and light yellowish brown. They extend to a depth of about 50 inches and become progressively paler brown with increasing depth. Between depths of 50 and 60 inches are layers of white fine sand. All layers are strongly acid.

The water table is at a depth of 40 to 60 inches for more than 6 months most years. It rises above 40 inches for a short time during wet periods and falls below 60 inches during extended dry periods.

Included in mapping are small areas where the water table is at a depth of 80 inches, small areas that are gently sloping, and a few small depressions that are wet. These inclusions make up no more than 15 percent of any mapped area.

This soil is well suited to citrus. Although the available water capacity is very low, the water table is usually near enough to the surface for citrus trees to obtain water during normal dry periods. Only during extended dry periods is this soil droughty. Fertilizer is needed for all crops and for lawns and ornamental plants in residential areas. (Capability unit IIIs–1; woodland group 3)

Astor Series

The Astor series consists of nearly level, very poorly drained sandy soils that formed in thick beds of marine sands in depressions, sloughs, and low swampy areas.

Typically, the surface layer is black fine sand about 25 inches thick. Below this are layers of light brownish-gray and grayish-brown fine sand that extend to a depth of more than 80 inches. Reaction is medium acid in the upper 14 inches and slightly acid below this to a depth of 80 inches. The water table is within a depth of 10 inches most of the year.

Astor soils have rapid permeability, high available water capacity, high organic-matter content, and moderately high natural fertility.

Representative profile of Astor fine sand:

A11—0 to 14 inches, black (10YR 2/1) fine sand; weak, fine, crumb structure; very friable; many fine roots; medium acid; clear, wavy boundary.

A12—14 to 26 inches, black (10YR 2/1), rubbed fine sand; common coarse pockets of light brownish gray (10YR 6/2); weak, fine, crumb structure; very friable; many fine roots; slightly acid; gradual, wavy boundary.

C1—26 to 40 inches, light brownish-gray (10YR 6/2) fine sand; single grain; loose; few fine roots; slightly acid; gradual, smooth boundary.

C2—40 to 80 inches, grayish-brown (10YR 5/2) fine sand; single grain; loose; few fine roots; slightly acid.

The A horizon ranges from black to very dark gray or very dark brown and is 24 to 36 inches thick. It is 5 to 15 percent organic matter. The A horizon is slightly acid to medium acid. In places a layer 3 to 6 inches thick, consisting of mixed material from the A and C horizons, is just below the A horizon.

The upper part of the C horizon is commonly light brownish gray or light gray but grades to darker colors in the lower part. The C horizon is slightly acid to mildly alkaline. The water table is typically within a depth of 10 inches for 2 to 9 months of the year. During wet periods it rises to the surface and the soils are often flooded. During dry periods it is usually at a depth of 20 to 40 inches.

The Astor soils mapped in Pinellas County are more acid in the C horizon than the range defined for the series, but this does not appreciably affect use or management.

Astor soils are associated with Immokalee, Myakka, Placid, and Pompano soils. They are more poorly drained than Immokalee and Myakka soils and have a thicker A1 horizon and no dark-brown stained underlying layer. They have a thicker surface layer than Placid and Pompano soils and are less acid than Pompano soils.

Astor fine sand (At).—This is a nearly level, very poorly drained soil in depressions and sloughs. It has the profile described as representative for the series. The water table is within a depth of 10 inches for more than 6 months most years. Shallow water covers many areas during wet periods.

Included in mapping are small areas near the outer edges of depressions where the surface layer is less than 20 inches thick. These inclusions make up no more than 15 percent of any mapped area. Also included are small areas that have loamy layers at a depth of 40 to 60 inches and small areas of Placid soils. Neither of these inclusions makes up more than 5 percent of any mapped area.

Where water control can be established, and drainage outlets are available, this Astor soil is well suited to improved pasture and to truck and flower crops. It is also well suited to lawns and ornamental plants. It is poorly suited to citrus because of difficulty in maintaining adequate water control. (Capability unit IIIw-3; woodland group 8)

Astor soils (Au).—These are nearly level, very poorly drained sandy soils in swamps. They were not investigated in enough detail to map the component soils separately because many areas are inaccessible or are covered with water.

In about 40 percent of the acreage the surface layer is black, medium acid sand 10 to 20 inches thick; in about 20 percent of the acreage it is black medium acid sand more than 20 inches thick; and in about 15 percent it is black acid sand 10 to 20 inches thick. The surface layer is underlain by brown or light-brown sand that extends to a depth of more than 80 inches. One or more of these soils makes up at least 75 percent of any mapped area. The proportion of each soil varies from area to area. About 25 percent of the acreage is made up of several kinds of wet sandy soils. Water covers these soils 2 to 9 months most years and 9 months or more during wet years.

Dense swamp vegetation and very poor drainage make these soils unsuited to farming. They are suited mainly to wildlife habitat. (Capability unit VIIw-1; woodland group 8)

Charlotte Series

The Charlotte series consists of nearly level, poorly drained sandy soils that formed in deep beds of marine sands. These soils occur in weakly defined drainageways and shallow depressions.

Typically, the surface layer is dark-gray fine sand about 5 inches thick. It is underlain by a layer of light brownish-gray fine sand 6 inches thick. Below this is yellowish-brown to pale-yellow fine sand that extends to a depth of 29 inches. Layers of nearly white and light-gray fine sand extend to a depth of 80 inches. Reaction is medium acid to a depth of 66 inches and slightly acid below. The water table is at a depth of about 10 inches for a few months in most years.

Charlotte soils have very rapid permeability, very low available water capacity, low organic-matter content, and low natural fertility.

Representative profile of Charlotte fine sand:

A1—0 to 5 inches, dark-gray (10YR 4/1), rubbed fine sand; weak, fine, crumb structure; very friable; mixture of organic matter and light-gray sand grains that has a salt-and-pepper appearance; many fine roots; medium acid; clear, smooth boundary.

A2—5 to 11 inches, light brownish-gray (10YR 6/2) fine sand; single grain; loose; common fine and medium roots; medium acid; clear, smooth boundary.

B2ir—11 to 25 inches, coarsely mottled, yellowish-brown (10YR 5/8) and strong-brown (7.5YR 5/8) fine sand; single grain; loose; few fine roots; yellow coatings on sand grains; few iron concretions 1 centimeter or less in size; medium acid; clear, smooth boundary.

B3ir—25 to 29 inches, pale-yellow (2.5Y 7/4) fine sand; single grain; loose; few fine roots; thin yellow coatings on most sand grains; medium acid; clear, smooth boundary.

C1—29 to 66 inches, white (2.5Y 8/2) fine sand; single grain; loose; medium acid; gradual, smooth boundary.

C2—66 to 80 inches, light-gray (2.5Y 7/2) fine sand; single grain; loose; slightly acid.

The A1 horizon ranges from dark gray or dark grayish brown to black and is 4 to 7 inches thick. The A2 horizon is dark gray or light brownish gray to nearly white and is 5 to 12 inches thick. A Bir horizon is below the A horizon. It has shades of brown and yellow and is 7 to 30 inches thick. The upper part of the C horizon is light gray or white, and the lower part commonly is grayish brown. Reaction ranges from medium acid to moderately alkaline in all layers. The water table is within a depth of 15 inches for 2 to 6 months in most years. During wet periods it rises to the surface and floods the soils. During dry periods it is at depths below 20 inches.

Charlotte soils are associated with Astor, Felda, Myakka, and Pompano soils. They do not have the thick black A horizon typical of Astor soils. They do not have a loamy layer within a depth of 30 inches as do Felda soils. They do not have the Bh horizon typical of Myakka soils. They differ from Pompano soils in having a yellow to strong-brown B2ir horizon.

Charlotte fine sand (Ch).—This is a nearly level, poorly drained soil in grassy sloughs and shallow depressions in the flatwoods. The water table is within a depth of 10 inches for 2 to 6 months in most years. It rises to the surface during wet periods, and the soil is flooded for a short time. During dry periods it is 20 to 40 inches below the surface.

Included in mapping are small areas of better drained soils that make up as much as 15 percent of some mapped areas. Also included are small areas of Felda fine sand and Pompano fine sand that make up no more than 10 percent of any mapped area.

If well managed, this soil is moderately well suited to truck crops, flowers, and improved pasture grasses. It is poorly suited to citrus, lawn grasses, and ornamental plants. A water-control system that protects the soils from floods and provides irrigation during dry periods is needed. Mineral fertilizers leach rapidly, and special fertilizing practices are needed. (Capability unit IVw-2; woodland group 8)

Coastal Beaches

Coastal beaches (Co) consists of narrow strips of tide-washed sand bordering islands and parts of the mainland. Most areas are covered during storms and daily at high tide. These beaches range from a few feet to as much as 500 feet in width. Long stretches are practically without vegetation, but sparse salt-tolerant grasses and other plants grow in places. Depth to the water table varies with the tide.

The beach sand has been deposited, mixed, and reworked by waves. It is firm or compact when moist and loose when dry. This sand is light gray to white and consists mainly of fine quartz particles in which there are varying quantities of medium to coarse shell fragments. The sand contains a few, fine, rounded, weakly cemented very dark gray to very dark brown particles.

Coastal beaches is used primarily for recreation. It provides habitat for shore birds. (No capability classification; woodland group 9)

Elred Series

The Elred series consists of nearly level, poorly drained, sandy soils that formed in thick beds of sandy and loamy marine deposits. These soils are on broad low ridges in the flatwoods.

Typically, the surface layer is very dark gray fine sand about 4 inches thick. Below this is loose fine sand that extends to a depth of 25 inches. It is light gray mottled with white and brownish yellow in the upper few inches and is very pale brown mottled with white and brownish yellow in the lower part. The next layer, about 5 inches thick, is yellowish-brown fine sand mottled with gray. It has an accumulation of iron oxides. Below this is yellowish-brown fine sandy loam about 5 inches thick. It is underlain by a layer of pale-yellow fine sand mixed with shell fragments. This layer extends to a depth of more than 62 inches. Reaction is medium acid to a depth of 25 inches, neutral between depths of 25 and 30 inches, and mildly alkaline below this to a depth of 62 inches. The water table commonly is at a depth of about 24 inches.

Elred soils have low available water capacity, low organic-matter content, and low natural fertility. Permeability is rapid to a depth of about 30 inches, moderate between 30 and 35 inches, and rapid below this depth.

Representative profile of Elred fine sand:

A1—0 to 4 inches, very dark gray (10YR 3/1) fine sand; weak, fine, crumb structure; very friable; mixture of organic matter and light gray sand grains has a salt-and-pepper appearance; many fine roots; medium acid; clear, smooth boundary.

A21—4 to 17 inches, light-gray (10YR 7/2) fine sand; common, coarse, white (10YR 8/1) mottles and few, fine, distinct, brownish-yellow (10YR 6/6) mottles; single grain; loose; many fine and medium roots; medium acid; gradual, smooth boundary.

A22—17 to 25 inches, very pale brown (10YR 7/3) fine sand; few, coarse, white (10YR 8/1) mottles and few, fine, distinct, brownish-yellow (10YR6/6) mottles; single grain; loose; common fine and medium roots; medium acid; gradual, smooth boundary.

Bir—25 to 30 inches, yellowish-brown (10YR 5/4) fine sand; few, fine, faint, light-gray mottles; single grain; loose; common fine roots; neutral; clear, wavy boundary.

Btg—30 to 35 inches, yellowish-brown (10YR 5/6) fine sandy loam; common, coarse, faint, yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; slightly sticky; many fine roots; sand grains coated and bridged with clay; mildly alkaline; clear, wavy boundary.

IIC—35 to 62 inches, pale-yellow (2.5Y 8/4) fine sand mixed with shell fragments; single grain; loose; calcareous; mildly alkaline.

The A1 horizon ranges from gray to black and is 3 to 5 inches thick. The A21 horizon is very pale brown to brownish yellow and is 7 to 14 inches thick. The A22 horizon is 4 to 14 inches thick and is very pale brown to brownish yellow. The A horizon ranges from medium acid to mildly alkaline.

A Btg horizon is below the Bir horizon. It is sandy loam to sandy clay loam, brown to very pale brown or yellowish brown and yellow, and 4 to 15 inches thick. It contains secondary carbonates along many root channels. In places the Btg horizon is gray and olive gray mottled with shades of yellow and brown. The Btg horizon ranges from slightly acid to mildly alkaline.

The IIC horizon consists of layers of sand mixed with shell fragments and is as much as 20 feet thick in places. The water table is at a depth of 10 to 30 inches for 2 to 6 months in most years and is within a depth of 10 inches for 1 or 2 months during wet seasons.

The Elred soils mapped in this county have a Btg horizon that is browner than the range defined for the series. This does not affect use or management.

Elred soils are associated with Charlotte, Felda, Manatee, Myakka, Oldsmar, Pinellas, and Wabasso soils. They have a Bt horizon that Charlotte soils do not have. They have accumulations of iron oxides just above the Bt horizon that are not present in Felda soils. They are not so poorly drained as Manatee soils. They do not have the stained Bh horizon typical of Myakka, Oldsmar, and Wabasso soils. They have accumulated iron oxides just above the Bt horizon whereas Pinellas soils have accumulated carbonates.

Elred fine sand (Ed).—This is a nearly level, poorly drained soil on broad low ridges in the flatwoods. The water table is at a depth of 10 to 30 inches for 2 to 6 months in most years and within a depth of 10 inches for 1 or 2 months during wet seasons.

Included in mapping are small areas of Wabasso fine sand, Pinellas fine sand, and Felda fine sand that make up about 15 percent of many mapped areas.

This soil is well suited to special truck and flower crops, improved pasture grasses, lawn grasses, and ornamental plants if adequate water control and good management are provided. It is moderately well suited to citrus. This soil is periodically wet but responds well to drainage and good management. Much of the acreage is in native vegetation consisting of scattered pine, saw-palmetto, and native grasses. (Capability unit IIIw-2; woodland group 6)

Felda Series

The Felda series consists of nearly level, poorly drained sandy soils that formed in stratified, unconsolidated sandy and loamy marine sediments. These soils occur mainly in depressions and grassy sloughs. They occupy slightly higher positions near streams and ponds in the flatwoods.

Typically, the surface layer is very dark gray fine sand about 3 inches thick. Below this is light-gray loose fine sand that extends to a depth of about 26 inches; it has common brown mottles and is leached. The next layer is dark grayish-brown fine sandy loam 8 inches thick that is mottled with yellowish brown. The next layer is grayish-brown loamy fine sand 4 inches thick mottled with gray and olive brown. Between depths of 38 and 62 inches is pale-brown loamy sand mixed with shells. Reaction is strongly acid to a depth of 26 inches, slightly acid between 26 and 34 inches, neutral between 34 and 38 inches, and moderately alkaline below this to a depth of 62 inches. The water table is at a depth of about 10 inches.

Felda soils have medium available water capacity, low organic-matter content, and moderate natural fertility. Permeability is rapid in the sand and shell layers and moderate in the loamy layers.

Representative profile of Felda fine sand, ponded:

A1—0 to 3 inches, very dark gray (10YR 3/1) fine sand; weak, fine, crumb structure; very friable; mixture of organic matter and light gray sand grains has a salt-and-pepper appearance; many fine roots; strongly acid; clear, smooth boundary.

A2—3 to 26 inches, light-gray (10YR 7/2) fine sand; common, medium, faint, brown (10YR 5/3) mottles; streaks of very dark gray along root channels; single grain; loose; few fine roots; strongly acid; clear, smooth boundary.

B2tg—26 to 34 inches, dark grayish-brown (10YR 4/2) fine sandy loam; common, coarse, faint, yellowish-brown (10YR 5/4) mottles and few, fine, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky structure; firm; many fine and medium roots; sand grains are coated and bridged with clay; few small lenses of sand; slightly acid; clear, wavy boundary,

B3—34 to 38 inches, grayish-brown (10YR 5/2) loamy fine sand; common, medium, faint, gray (10YR 6/1) mottles and many, coarse, distinct, light olive-brown (2.5Y 5/6) mottles; weak, fine, crumb structure; friable; many fine and medium roots; neutral; clear, smooth boundary.

IIC—38 to 62 inches, pale-brown (10YR 6/3) loamy sand mixed with shells and shell fragments; single grain; loose; calcareous; moderately alkaline.

The A1 horizon ranges from gray to black in color and from 2 to 6 inches in thickness. It is medium acid to strongly acid. The A2 horizon ranges from light gray to dark gray in the upper part and light gray to white mottled with brown in the lower part. It is 18 to 38 inches thick and strongly acid to neutral. The Btg horizon ranges from fine sandy loam to fine sandy clay loam in texture and from 6 to 24 inches in thickness. It is light gray, dark gray, or dark grayish brown mottled with yellowish brown to yellowish red and is neutral to mildly alkaline. The B3 horizon ranges from loamy fine sand to fine sandy loam in texture and from 3 to 12 inches in thickness. It is gray or grayish brown mottled with red and brown and is neutral or mildly alkaline.

Depth to the IIC horizon is generally less than 40 inches. This horizon extends to a depth of more than 60 inches. The texture ranges from fine sand to a mixture of sand and shell fragments. The water table is at a depth of 10 to 40 inches for 2 to 6 months in most years and at less than 10 inches for 2 to 6 months. The surface is covered with shallow water occasionally.

The Felda fine sand mapped in Pinellas County is outside the range defined for the series because it has a calcareous loamy sand C horizon. Also, Felda fine sand is not so wet as the range defined for the series and has accumulated carbonates in the lower horizons.

Felda soils are associated with Astor, Manatee, Myakka, Oldsmar, Pompano, and Wabasso soils. They have a thinner surface layer than Astor and Manatee soils. In contrast with Myakka soils, they have a loamy Bt horizon but do not have a layer stained by organic matter. They do not have the organic-matter stained layer typical of Oldsmar and Wabasso soils. They differ from Pompano soils in having a loamy Bt horizon.

Felda fine sand (Fd).—This is a nearly level, poorly drained soil that occupies slightly elevated areas bordering sloughs and ponds.

In most places the surface layer is black fine sand about 5 inches thick. Below this is gray fine sand about 25 inches thick. Next is a grayish-brown loamy layer that is mottled with yellow and brown. It is about 11 inches thick. Below this is a white sandy layer that has accumulated carbonates. It extends to a depth of 60 inches. Below this are strata of sand mixed with shell fragments. Reaction is medium acid to a depth of 26 inches, neutral between 26 and 36 inches, and alkaline below this to a depth of 75 inches. The water table is normally at a depth of 10 to 40 inches but rises above 10 inches for 2 to 6 months every year.

Included in mapping are small areas of Wabasso fine sand that make up as much as 10 percent of some mapped areas and small areas of Pinellas fine sand that make up as much as 5 percent.

Felda fine sand is moderately well suited to citrus, truck crops, and improved pasture grasses, and to lawn grasses and ornamental plants. A complete water-control system and adequate fertilization are needed. (Capability unit IIIw-2; woodland group 6)

Felda fine sand, ponded (Fe).—This is a nearly level, poorly drained soil in depressions and grassy sloughs. This soil has the profile described as representative for the series. It is covered with shallow water during wet periods, and the lowest areas are covered with water most of the time.

Places where the substratum does not contain shells make up as much as 20 percent of some mapped areas. Areas that have sandy layers to a depth of more than 40 inches or less than 20 inches make up no more than 5 percent of any mapped area. A few small areas of Manatee fine sand, which has a thick black surface layer, are included in some mapped areas.

If water control is established, Felda fine sand, ponded, is well suited to truck and flower crops and improved pasture. It is poorly suited to citrus. (Capability unit IIIw-3; woodland group 7)

Fellowship Series

The Fellowship series consists of poorly drained sandy soils that have a clayey subsoil. These are undulating soils on uplands. They formed in beds of mixed sandy and clayey marine sediments.

Typically, the surface layer is black loamy fine sand about 6 inches thick. Below this is very dark-gray, friable loamy fine sand about 5 inches thick. The next layer, about 12 inches thick, is gray fine sandy clay mottled with light gray and yellowish red. This layer is plastic when wet and very firm when moist. The next layer is gray, mottled clay about 26 inches thick. It is plastic when wet and is less acid than the layers above. Below this is light olive-gray clay that extends to a depth of 70 inches. Reaction is very strongly acid to a depth of 23 inches, strongly acid between 23 and 49 inches, and medium acid below this to a depth of 70 inches. These soils are seepy, and the water table is perched at a depth of less than 10 inches during wet periods.

Fellowship soils have medium available water capacity and moderately high organic-matter content and natural fertility. The underlying layers are very slowly permeable and have a high shrink-swell potential.

Representative profile of Fellowship loamy fine sand:

All—0 to 6 inches, black (10YR 2/1) loamy fine sand; weak, fine, crumb structure; very friable; many fine and coarse roots; very strongly acid; clear, smooth boundary.

A12—6 to 11 inches, very dark gray (10YR 3/1) loamy fine sand; common, fine, faint, light-gray mottles and few, medium, black (10YR 2/1) mottles; weak, fine, crumb structure; friable; common fine and medium roots; very strongly acid; abrupt, smooth boundary.

B21tg—11 to 23 inches, gray (10YR 5/1) fine sandy clay; common, fine, distinct, light-gray (10YR 7/1) mottles and common, fine, prominent, yellowish-red (5YR 5/6) mottles; moderate, coarse, subangular blocky structure; plastic; many fine and medium roots and few coarse roots; common clay films along ped faces and root channels; very strongly acid; gradual, smooth boundary.

B22tg—23 to 49 inches, gray (10YR 6/1) clay; common, medium, distinct, yellow (10YR 7/6) mottles and common, coarse, prominent, yellowish-red (5YR 4/6) mottles; coarse, subangular blocky structure; firm; few fine and medium roots; common clay films along ped faces and root channels; strongly acid; clear, smooth boundary.

Cg—49 to 70 inches, light olive-gray (5Y 6/2) clay; common, coarse, prominent, yellow (10YR 7/6) mottles; few, coarse, faint, gray (10YR 5/1) mottles of fine sandy loam; massive; plastic; few fine and medium roots; medium acid.

The A1 horizon ranges from 10 to 20 inches in thickness and from very dark grayish brown to black in color. It is friable to very friable. The B2tg horizon ranges from sandy clay loam to sandy clay in the upper part and clay loam to clay in the lower part. Reaction is strongly acid to very strongly acid in the upper 23 inches and medium acid to strongly acid below this to a depth of 70 inches. During wet periods the water table is perched at a depth of less than 10 inches.

Fellowship soils are associated with Astatula, Felda, Manatee Wabasso, and Wauchula soils. They are more poorly drained and finer textured than Astatula soils. They have a thicker A1 horizon than Felda soils. They are not so poorly drained as Manatee soils. They do not have the highly leached A2 horizon or the organic-matter stained Bh horizon typical of Wabasso and Wauchula soils.

Fellowship loamy fine sand (Fh).—This is an undulating poorly drained soil on uplands. The water table is perched at a depth of about 10 inches during wet periods.

Included in mapping are a few areas where slopes are 5 to 8 percent. In about 10 percent of the acreage the surface layer is gray and more than 20 inches thick. Wabasso fine sand and a few areas around sinkholes where slopes are 5 to 8 percent make up about 5 percent of some mapped areas.

This soil is moderately well suited to row crops, citrus, improved pasture, lawn grasses, and ornamental plants. Intensive erosion control is needed. A small acreage is in citrus, but most areas are in native vegetation. (Capability unit IIIw-4; woodland group 6)

Immokalee Series

The Immokalee series consists of nearly level, poorly drained sandy soils that formed in thick beds of acid marine sands. These soils occur mostly in broad areas between sloughs in the flatwoods.

Typically, the surface layer is black fine sand about 5 inches thick. It is underlain by gray to white fine sand about 31 inches thick. Below this is dark reddish-brown fine sand about 14 inches thick. The upper part of this layer is weakly cemented, friable, and slightly darker colored than the lower part. This layer is underlain by very pale brown fine sand that extends to a depth of more than 80 inches. Reaction is strongly acid to a depth of 36 inches, very strongly acid between 36 and 50 inches, and strongly acid below this to a depth of 80 inches. The water table is normally at a depth of about 30 inches.

Immokalee soils have very low available water capacity, low organic-matter content, and low natural fertility. Permeability is rapid to a depth of 36 inches, moderate between 36 and 50 inches, and rapid below this depth.

Representative profile of Immokalee fine sand:

A1—0 to 5 inches, black (10YR 2/1) fine sand; weak, fine, crumb structure; very friable; mixture of organic matter and light-gray sand grains has a salt-and-pepper appearance; many fine, medium, and coarse roots; strongly acid; clear, smooth boundary.

A21—5 to 11 inches, gray (10YR 6/1) fine sand; single grain; loose; common fine and coarse roots; strongly acid; clear, smooth boundary.

A22—11 to 36 inches, white (10YR 8/1) fine sand; single grain; loose; common fine roots; few vertical streaks of very dark gray (10YR 3/1) along root channels; strongly acid; clear, wavy boundary.

B21h—36 to 41 inches, dark reddish-brown (5YR 2/2) fine sand; weak, fine, crumb structure; very friable; weakly cemented; many fine and few coarse roots; most sand grains coated with organic matter; common coarse fragments of weakly cemented black (5YR 2/1) along root channels; very strongly acid; clear, wavy boundary.

B22h—41 to 50 inches, dark reddish-brown (5YR 3/4) fine sand; weak, fine, crumb structure; very friable; weakly cemented common fine roots; sand grains well coated with organic matter; few coarse, weakly cemented, black (5YR 2/1) fragments along root channels; very strongly acid; gradual, wavy boundary.

C—50 to 80 inches +, very pale brown (10YR 7/4) fine sand; single grain; loose; strongly acid.

The A1 horizon ranges from gray to black in color and from 4 to 8 inches in thickness. The A2 horizon ranges from gray to white in color and from 27 to 36 inches in thickness. It is typically darker just below the A1 horizon. Few to many narrow vertical streaks of gray to very dark gray are along root channels. A transitional horizon, ½ inch to 2 inches thick, is commonly between the A2 horizon and the Bh horizon. A very dark brown to black, organic stained horizon is at a depth of 30 to 60 inches. It is 4 to 19 inches thick and is loose to weakly cemented. The C horizon ranges from dark gray or gray to yellowish brown and very pale brown. It extends to a depth of 80 inches or more. Reaction ranges from strongly acid to very strongly acid in all layers. The water table is at a depth of 10 to 40 inches most of the year. It is at less than 10 inches for 1 or 2 months during wet seasons and is below 40 inches during prolonged dry periods.

Immokalee soils are associated with Adamsville, Myakka, Placid, Pomello, St. Lucie, and Wauchula soils. They are not so well drained as St. Lucie and Adamsville soils. They are more poorly drained than Pomello soils. They are similar to Myakka soils, which have an organic layer at a depth of less than 30 inches. They are better drained than Placid soils. They do not have loamy layers below the organic-stained Bh horizon as do Wauchula soils.

Immokalee fine sand (Im).—This is a nearly level, poorly drained soil on broad flats between sloughs. It also occurs in small areas at higher elevations in association with better drained soils. The water table normally is at a depth of 10 to 40 inches. It is within a depth of 10 inches for 1 or 2 months during rainy periods and is below 30 inches during prolonged dry periods.

Small areas of similar soils that have thinner, lighter colored, organic-matter stained underlying layers make up no more than 15 percent of any mapped area. Pomello and Myakka soils each make up about 5 percent of some mapped areas, and small areas where slopes are 2 to 5 percent make up less than 1 percent.

Immokalee fine sand is suited to truck crops, special flower crops, and improved pasture if the water-control system is well designed and fertilization is adequate. This soil is also suited to lawn grasses and ornamentals but requires water-control practices and heavy fertilization. It is poorly suited to citrus. Severe limitations result from wetness and poor inherent soil qualities. (Capability unit IVw-1; woodland group 4)

Made Land

Two types of Made land are mapped in Pinellas County. They are described in the following paragraphs.

Made land (Ma) consists of mixed sand, clay, hard rock, shells, and shell fragments that have been transported, reworked, and leveled by earth-moving equipment. Many areas consist of material that has been dredged from the bay and used to fill diked areas. Coarser sludge materials are deposited near the outlet of discharge pipes and finer materials settle in more distant positions. Rocks ½ inch to 12 inches in diameter are common. Numerous silicified oyster shells and some animal fossils occur in these materials. Stratification is apparent in the water-transported material. Materials transported by truck are similar but they usually are sandier and do not contain silicified shells and fossils.

Made land is underlain at a depth of 2 to 8 feet by various kinds of material. In some areas it is underlain by the sandy bay bottom, and in others by Tidal swamp that has layers of fibrous peat 20 inches or less thick. Some of the material transported by truck has been deposited over solid rubble consisting of chunks of concrete, discarded appliances, and broken asphalt.

Made land occurs mainly in urban areas, along the coast and keys, and as manmade islands built in shallow water. In coastal areas it has been built up to provide desirable locations for residential development. Recently deposited material shows very little profile development and has severe limitations for plants. Topsoil, irrigation, and special fertilizers are needed for good growth of lawns and ornamental plants. (No capability classification; woodland group 9)

Made land, sanitary fill (Md) consists of sand, clay, shells, and shell fragments in varying proportions deposited over refuse and garbage. Holes 12 to 36 feet deep are filled with refuse and garbage and then topped with 3 to 6 feet of soil material. The surface material is reworked and leveled. This mass of mixed material is highly compacted in the surface layer but is very loose in the underlying refuse. Most of these holes have been dug in soils that have a high water table, and most of the refuse is below water. The waterlogged refuse has low bearing capacity. (No capability classification; woodland group 9)

Manatee Series

The Manatee series consists of nearly level, very poorly drained sandy soils that have a loamy subsoil. These soils are in shallow depressions and broad drainageways. They formed in beds of loamy marine sediments under wet conditions.

Typically, the surface layer is black to very dark brown loamy fine sand about 18 inches thick. Below this is grayish-brown fine sandy loam, about 16 inches thick, that is mottled with yellowish brown, very dark grayish brown, and light gray. The next layer is grayish-brown fine sandy loam, about 10 inches thick, that is mottled with dark yellowish brown, yellowish brown, and gray. This layer has accumulated clay-sized carbonates that coat the sand grains; it also has scattered nodules and pockets of white marl. Below this is light brownish-gray, nonsticky fine sand that extends to a depth of 72 inches or more. All layers are mildly alkaline. The water table normally is within a depth of 10 inches. Some areas are covered with shallow water most of the year.

Manatee soils have very high available water capacity, high organic-matter content, and high natural fertility. Permeability is moderately rapid to a depth of about 18 inches, moderate between 18 and 44 inches, and rapid below this depth.

Representative profile of Manatee loamy fine sand:

Ap—0 to 11 inches, black (10YR 2/1) loamy fine sand; weak, fine, crumb structure; very friable; many fine roots; 8 to 12 percent organic matter; mildly alkaline; clear, smooth boundary.

Al—11 to 18 inches, very dark brown (10YR 2/2) loamy fine sand; weak, fine, crumb structure; very friable; many fine roots; mildly alkaline; clear, irregular boundary.

B21tg—18 to 34 inches, grayish-brown (10YR 5/2) fine sandy loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; few, fine, faint, light-gray and very dark grayish-brown mottles; weak, medium, subangular blocky structure; very friable; sand grains coated and bridged with clay; many fine roots; mildly alkaline; gradual, wavy boundary.

B22tgca—34 to 44 inches, grayish-brown (10YR 5/2) fine sandy loam; common, medium, faint, dark yellowish-brown (10YR 3/4) mottles; common, medium, distinct, yellowish-brown (10YR 5/6) mottles and common, coarse, faint gray (10YR 5/1) mottles; many coarse white (10YR 8/2) splotches of fine sandy loam marl; moderate, medium, crumb structure; sand grains coated and bridged with clay; slightly sticky; mildly alkaline; calcareous; gradual, wavy boundary.

Cg—44 to 72 inches, light brownish-gray (10YR 6/2) fine sand; single grain; mildly alkaline.

The Al and Ap horizons range from black to very dark brown and are 10 to 20 inches thick. The Btg horizon is dark grayish brown to light gray, is mottled with lighter and darker colors, and ranges from 12 to 28 inches in thickness. The C horizon is light brownish-gray or nearly white sand that extends to a depth of 72 inches or more. Reaction ranges from slightly acid to mildly alkaline in all layers. The water table is within a depth of 15 inches for 6 months or more in most years. Soils in depressions are covered with shallow water for more than 9 months.

Manatee soils are associated with Astor, Felda, Myakka, Pompano, and Wabasso soils. In contrast with Astor and Pompano soils, they have a Btg horizon. They have a finer textured and thinner A horizon than Felda and Pompano soils. They are more poorly drained than Myakka and Wabasso soils.

Manatee loamy fine sand (Mn).—This is a nearly level, very poorly drained soil that has a loamy subsoil. It occurs in depressions and along broad drainageways. The water table commonly is at a depth of less than 10 inches. Soils in depressions are covered with water for more than 6 months in most years.

Included in mapping are small areas of similar soils that are finer textured throughout. These inclusions make up about 15 percent of any mapped area. Also included are a few small areas that are strongly acid throughout and do not have marl accumulated in the lower layers.

This soil responds well to artificial drainage. If properly designed water-control practices are used, it is well suited to truck and flower crops and improved pasture. It is poorly suited to citrus unless intensive water control is established. (Capability unit IIIw-3; woodland group 7)

Myakka Series

The Myakka series consists of nearly level, poorly drained sandy soils that formed in thick beds of acid marine sands. These soils are on broad low ridges between sloughs and swamps in the flatwoods and in small areas on the upland ridge.

Typically, the surface layer is black fine sand about 4 inches thick. Below this is loose gray fine sand about 12 inches thick. The next layer is organic-matter stained, weakly cemented, friable fine sand about 14 inches thick. The upper part of this layer is black, the middle part is dark reddish brown, and the lower part is dark yellowish brown. Below this is lighter colored fine sand that extends to a depth of more than 84 inches. Reaction is very strongly acid to a depth of about 20 inches and strongly acid below this to a depth of 84 inches. The water table normally is at a depth of 24 inches.

Myakka soils have very low available water capacity, low organic-matter content, and low natural fertility. Permeability is rapid to a depth of about 16 inches, moderate between 16 and 25 inches, and rapid below this depth.

Representative profile of Myakka fine sand:

A1—0 to 4 inches, black (10YR 2/1) rubbed fine sand; weak, fine, crumb structure; very friable; mixture of organic matter and light-gray sand grains has a salt-and-pepper appearance; many fine and coarse roots; very strongly acid; clear, smooth boundary.

A2—4 to 16 inches, gray (10YR 6/1) fine sand; single grain; loose; many medium and coarse roots; very strongly acid; clear, smooth boundary.

B21h—16 to 20 inches, black (5YR 2/1) fine sand; weak, fine, crumb structure; weakly cemented; most sand grains well coated with organic matter; many fine and medium roots and few coarse roots; very strongly acid; clear, smooth boundary.

B22h—20 to 25 inches, dark reddish-brown (5YR 2/2) fine sand; weak, fine, crumb structure; weakly cemented; sand grains well coated with organic matter; common fine and medium roots; common fragments of weakly cemented black (5YR 2/1) along root channels; strongly acid; clear, wavy boundary.

B3&Bh—25 to 30 inches, dark yellowish-brown (10YR 3/4) fine sand; few, medium, distinct, dark reddish-brown (5YR 2/2) mottles and few medium, faint, brown (10YR 5/3) mottles; single grain; loose; most sand grains are weakly coated with organic matter; few fine and medium roots; strongly acid; gradual, wavy boundary.

C1—30 to 54 inches, light yellowish-brown (10YR 6/4) fine sand; single grain; loose; common coarse roots; few fragments of brown (7.5YR 4/4) along root channels; strongly acid; gradual, wavy boundary.

C2—54 to 84 inches, very pale brown (10YR 7/3) fine sand; single grain; nonsticky; strongly acid.

The A1 horizon ranges from gray to black and is 3 to 9 inches thick. The A2 horizon is gray and grayish brown to white and is 6 to 27 inches thick. In places it has few to many narrow vertical streaks of gray to very dark gray along root channels. Commonly a transitional horizon ½ inch to 2 inches thick is between the A horizon and the B horizon. The organic-matter stained Bh horizon is at a depth of 12 to 30 inches. It is very dark brown to black, is 4 to 19 inches thick, and is loose to weakly cemented. The C horizon is gray to very pale brown, light yellowish brown, and brown. It extends to a depth of 80 inches or more. Reaction is slightly acid to very strongly acid in all layers. The water table is at a depth of 10 to 30 inches for 4 to 6 months every year and at less than 10 inches for 1 to 4 months. It is below a depth of 30 inches during dry periods.

Myakka soils are associated with Adamsville, Astatula, Immokalee, Placid, and Pomello soils. They have a Bh horizon, whereas Adamsville soils do not. They are more poorly drained than Astatula and Pomello soils. They are similar to Immokalee soils but the organic-matter stained Bh horizon is closer to the surface. They are better drained than Placid soils.

Myakka fine sand (My).—This is a nearly level, poorly drained soil on broad flats between sloughs and swamps. In places it is gently sloping. The water table is normally at a depth of 10 to 30 inches. It rises to the surface for a short time during wet periods and falls below 30 inches during extended dry periods.

Included in mapping are small areas of similar soils in which the layer stained with organic matter is only weakly defined. These inclusions make up no more than 10 percent of any mapped area. Small areas of Immokalee soils make up no more than 10 percent of any mapped area. Small areas of Wabasso, Wauchula, and Oldsmar soils, which have loamy underlying layers in places, make up no more than 5 percent of any mapped area.

If good water control is practiced and the soil is fertilized and limed, Myakka fine sand is suited to truck crops, special flower crops, and improved pasture. It is poorly suited to citrus and is only moderately well suited to lawns and ornamental plants. (Capability unit IVw-1; woodland group 4)

Okeechobee Series

The Okeechobee series consists of nearly level, very poorly drained organic soils that formed in thick beds of aquatic plant residues. These soils are in depressions and low swampy areas.

Typically, the surface layer is black muck about 26 inches thick. Below this is very dark brown and dark reddish-brown felty peat that extends to a depth of 65 inches. Reaction is slightly acid to a depth of 26 inches and medium acid below this depth. The water table is within a depth of 10 inches or the soil is covered with shallow water most of the year.

Okeechobee soils have rapid permeability, very high available water capacity, very high organic-matter content, and high natural fertility.

Representative profile of Okeechobee muck:

Oa—0 to 26 inches, black (N 2/0) muck; weak, coarse, crumb structure; friable; less than 5 percent fiber, rubbed and unrubbed; about 80 percent organic matter; many fine roots in upper part of the horizon; sodium pyrophosphate extract color is dark brown (10YR 3/3); slightly acid; gradual, smooth boundary.

Oe1—26 to 34 inches, very dark brown (10YR 2/2) partly decomposed organic material; soft, felty, fibrous peat; black (10YR 2/1) when rubbed; massive; 60 percent fiber when unrubbed, 15 percent fiber when rubbed; about 85 percent organic matter; sodium pyrophosphate extract color is light gray (10YR 7/2); medium acid; gradual, smooth boundary.

Oe2—34 to 65 inches, dark reddish-brown (5YR 3/4) partly decomposed organic material; soft, felty, fibrous peat; dark reddish brown (5YR 3/2) when rubbed; massive; 60 percent fiber when unrubbed; 20 percent fiber when rubbed; about 90 percent organic matter; medium acid.

The Oa horizon is black or very dark brown muck 20 to 30 inches thick. The Oe horizon is dark-brown or dark reddish-brown felty peat 13 to more than 50 inches thick. Reaction ranges from medium acid to moderately alkaline in all layers.

Okeechobee soils are associated with Astor, Felda, Pamlico, Placid, Pompano, and Terra Ceia soils. They are organic soils, whereas Astor, Felda, Placid, and Pompano soils are mineral soils. In contrast with Pamlico and Terra Ceia soils, they have a layer of brown felty peat below the black muck surface layer. They are less acid than Pamlico soils.

Okeechobee muck (Ok).—This is a nearly level, very poorly drained organic soil in depressions and in broad low swampy areas. The water table is at a depth of less than 10 inches or the soil is covered with water for 6 to 12 months in most years.

Included in mapping are small areas of similar soils that have a highly decomposed organic surface layer more than 35 inches thick. These inclusions make up no more than 10 percent of any mapped area. Also included are small areas of organic soils that have mineral horizons within a depth of 50 inches.

If adequate water control can be provided, this soil is well suited to special truck and flower crops, improved pasture grasses, and lawn grasses and ornamental plants. The surface should be flooded when the soil is not used for crops. Many areas do not have drainage outlets, and water control is difficult to establish. Only a few areas have been drained. (Capability unit IIIw–5; woodland group 9)

Oldsmar Series

The Oldsmar series consists of nearly level, poorly drained sandy soils that formed in thick beds of sandy and loamy marine materials. These soils are on low ridges between sloughs or swamps in the flatwoods.

Typically, the surface layer is black fine sand about 5 inches thick. The next layer is loose fine sand about 29 inches thick. It is gray in the upper part, is light gray in the lower part, and has dark-gray vertical streaks along root channels. Between depths of about 34 and 44 inches is a layer of very friable fine sand that is weakly cemented with organic matter. The upper part is black, and the lower part is dark reddish brown. Between 44 and 65 inches is a layer of coarsely mottled, brown, grayish-brown, and olive-brown friable fine sandy loam. Reaction is very strongly acid to a depth of about 44 inches and slightly acid below this to a depth of 65 inches. The water table is at a depth of about 20 inches.

Oldsmar soils have low available water capacity, low organic-matter content, and low natural fertility. Permeability is rapid to a depth of about 34 inches, moderately rapid between 34 and 44 inches, and moderate below this depth.

Representative profile of Oldsmar fine sand:

A1—0 to 5 inches, black (10YR 2/1) fine sand; weak, fine, crumb structure; very friable; mixture of organic matter and light gray sand grains has a salt-and-pepper appearance; many fine, medium, and coarse roots; very strongly acid; clear, smooth boundary.

A21—5 to 12 inches, gray (10YR 5/1) fine sand; single grain; loose; common medium and coarse roots; common vertical streaks of dark gray (10YR 4/1) along root channels; very strongly acid; gradual, smooth boundary.

A22—12 to 34 inches, light-gray (10YR 7/1) fine sand; single grain; loose; common medium and coarse roots; common vertical streaks of dark gray (10YR 4/1) along root channels; very strongly acid; clear, wavy boundary.

B21h—34 to 38 inches, black (5YR 2/1) fine sand; massive; weakly cemented; crushes with slight pressure; very friable; most sand grains well coated with organic matter; common fine, medium, and coarse roots; very strongly acid; clear, wavy boundary.

B22h—38 to 44 inches, dark reddish-brown (5YR 2/2) fine sand; massive; weakly cemented; crushes with slight pressure; very friable; common fine, medium, and coarse roots; common coarse fragments of weakly cemented black (5YR 2/1) sand grains well coated with organic matter; very strongly acid; clear, wavy boundary.

B2t—44 to 65 inches, coarsely mottled, brown (10YR 4/3), grayish-brown (10YR 5/2), and olive-brown (2.5Y 4/4) heavy fine sandy loam; massive; friable; many fine roots and few medium roots; sand grains are bridged and coated with clay; slightly acid.

The A1 horizon ranges from dark gray to black and is 4 or 5 inches thick. The A2 horizon is gray to light-gray sand or fine sand and is 26 to 36 inches thick. The A horizons are strongly acid or very strongly acid. The Bh horizon occurs at a depth of 30 to 40 inches and is 6 to 18 inches thick. It is reddish-brown, dark-brown, or black sand or fine sand that is weakly cemented and very friable. The Bh horizon is slightly acid to very strongly acid. In places a thin horizon of light-brown sand occurs between the Bh horizon and the loamy Bt horizon. The Bt horizon is gray to brownish-yellow fine sandy loam to fine sandy clay loam and is 20 to 40 inches thick. In places the lower part of the Bt horizon has accumulated secondary carbonates along root channels and in scattered nodules. The Bt horizon ranges from slightly acid to moderately alkaline. In many places, a IIC horizon is below the Bt horizon. It consists of sand mixed with shell fragments and ranges from 1 foot to several feet in thickness. The water table is at a depth of 10 to 30 inches for 2 to 6 months in most years, and at less than 10 inches for 1 or 2 months during wet seasons.

The Oldsmar soils are closely associated with Wabasso, Elred, Pinellas, Myakka, Immokalee, Astor, and Pompano soils. They have a thicker A2 horizon and a deeper Bt horizon than Wabasso soils. They have a thicker A2 horizon than Elred soils and also have an organic-matter stained Bh horizon. In contrast with Pinellas soils, they have a Bh horizon and do not have accumulations of carbonates in the lower part of the A2 horizon. They differ from Myakka, Immokalee, and Pompanosoils mainly in having a loamy Bt horizon. They are not so poorly drained as Astor soils.

Oldsmar fine sand (Om).—This is a nearly level, poorly drained sandy soil on broad low ridges in the flatwoods. The water table is at a depth of less than 10 inches for 1 or 2 months during wet periods and at 10 to 30 inches for 2 to 6 months in most years. Most areas are periodically wet.

Included in mapping are small areas where black or brown stained layers are within a depth of 30 inches, where loamy layers are below 40 inches, and where loamy layers are within a depth of 40 inches. These inclusions make up about 10 percent of any mapped area. Similar soils that have a thin, light-brown, organic-matter stained underlying layer make up about 10 percent of some mapped areas, and small areas of Myakka and Wabasso soils make up about 5 percent.

If water control is adequate and the soil is well managed, Oldsmar fine sand is suited to special truck and flower crops, improved pasture grasses, and lawn grasses and ornamental plants. It is poorly suited to citrus. Response to drainage and management is good. Much of the acreage has been developed for residential use. (Capability unit IVw–1; woodland group 4)

Orlando Series, Wet Variant

The Orlando soils mapped in Pinellas County are a wet variant of the Orlando series. They are nearly level, somewhat poorly drained sandy soils that formed in thick beds of marine sands. These soils occur on low ridges in the flatwoods and in a few low flat areas at the base of slopes on the upland ridge.

Typically, the surface layer, about 16 inches thick, is black fine sand that grades with depth to very dark gray. The next layer is grayish-brown loose fine sand about 13 inches thick. Below this is very pale brown to light-brown loose fine sand mottled with yellow and brown. It extends to a depth of 80 inches. All layers are very strongly acid. The water table normally is at a depth of about 30 inches.

Orlando soils have very rapid permeability, low available water capacity, medium organic-matter content, and moderate natural fertility.

Representative profile of Orlando fine sand, wet variant:

Ap—0 to 8 inches, black (10YR 2/1) fine sand; weak, fine, crumb structure; very friable; many fine roots; very strongly acid; clear, wavy boundary.

A1—8 to 16 inches, very dark gray (10YR 3/1) fine sand; weak, fine, crumb structure; very friable; many fine roots; very strongly acid; gradual, wavy boundary.

C1—16 to 29 inches, grayish-brown (10YR 5/2) fine sand; few, fine, faint, brownish-yellow mottles along root channels; single grain; loose; few fine roots; very strongly acid; gradual, wavy boundary.

C2—29 to 53 inches, very pale brown (10YR 7/3) fine sand; common, medium, distinct, brownish-yellow (10YR 6/8) and strong-brown (7.5YR 5/8) mottles, and common, medium, faint, light-gray (10YR 7/2) mottles; single grain; loose; few fine roots; very strongly acid; gradual, wavy boundary.

C3—53 to 80 inches, light-brown (7.5YR 6/4) fine sand; common, coarse, distinct, dark-brown (7.5YR 4/2) mottles; single grain; nonsticky; very strongly acid; gradual, wavy boundary.

The A1 horizon is very dark gray to black and is 14 to 18 inches thick. The C1 horizon is brown to grayish brown or dark grayish brown and is 4 to 18 inches thick. The C2 horizon is brown to very pale brown, light brownish gray, and light yellowish brown mottled with shades of brownish yellow, strong brown, and light gray and extends to a depth of 55 inches. Below this are layers of dark-brown to yellowish-brown, light-brown, and very pale brown sand that extend to a depth of more than 80 inches. Reaction is strongly acid to very strongly acid in all layers. The water table fluctuates between a depth of 10 and 40 inches. It is at a depth of less than 10 inches for 1 or 2 months during wet periods and is below 40 inches during very dry periods.

The Orlando soils mapped in Pinellas County are a variant of the Orlando series. They are more poorly drained and have a seasonally higher water table than the range defined for the series. Other properties are within the range defined for the series.

Orlando soils, wet variant, are closely associated with Adamsville, Astatula, Myakka, Pamlico, Placid, and Wauchula soils. They have a thicker darker colored A horizon than Astatula soils. They do not have the organic-matter stained Bh horizon typical of Myakka soils. They have a thicker A horizon than Adamsville soils. They are not so poorly drained as Wauchula soils and do not have the loamy Bt horizon typical of those soils. They are better drained than Placid and Pamlico soils.

Orlando fine sand, wet variant (Or).—This is a nearly level, somewhat poorly drained sandy soil on low ridges in the flatwoods and near the base of slopes on the upland ridge. The water table is between depths of 10 and 40 inches for 6 months or more in most years. It is within a depth of 10 inches for 1 or 2 months during wet periods and below 40 inches during droughty periods.

Included in mapping are small areas that have 2 to 5 percent slopes. These inclusions make up about 15 percent of some mapped areas. Small areas of similar soils that have a thinner surface layer and small areas of similar soils that are better drained make up about 10 percent of some mapped areas.

Under intensive management that includes adequate water control and the use of mineral fertilizers, this soil is well suited to flower and truck crops, especially strawberries, and to pasture grasses, lawn grasses, and ornamental plants. It is also well suited to citrus trees and is used for citrus nurseries. (Capability unit IIIw-1; woodland group 5)

Palm Beach Series

The Palm Beach series consists of nearly level, well-drained shelly sands near the coast, on the mainland, and on isolated coastal islands. These soils consist of recent deposits of shelly sand material that has undergone little or no weathering.

Typically, the surface layer, about 20 inches thick, is light-gray sand that is about 18 percent small shells and shell fragments. Below this are layers of light-gray sand in which the content of shell fragments increases with increasing depth. These layers extend to a depth of 80 inches. The shell content is about 40 percent. All layers are mildly alkaline. The water table normally is at a depth of more than 40 inches.

Palm Beach soils have very rapid permeability, very low available water capacity, low organic-matter content, and low natural fertility.

Representative profile of Palm Beach sand:

A—0 to 20 inches, light-gray (10YR 7/1) sand; about 18 percent shell fragments; single grain; loose; mildly alkaline.

C1—20 to 44 inches, light-gray (10YR 7/1) sand; about 25 percent shell fragments; single grain; loose; mildly alkaline.

C2—44 to 80 inches, light-gray (10YR 7/1) sand; about 40 percent shell fragments; single grain; loose; mildly alkaline.

Reaction ranges from mildly alkaline to moderately alkaline in all layers. The percentage of shells and shell fragments varies from place to place and with depth. Natural deposits of sand and shells occur in a few areas near old shore lines. Most areas consist of dredged or hauled material used to fill depressions or to form new land areas in shallow waters. These deposits have been reworked and leveled by heavy earth-moving equipment. The water table is below a depth of 40 inches most of the time. In places it is nearer the surface during wet periods.

Palm Beach soils are associated with Immokalee, Myakka, Paola, St Lucie, and Wabasso soils In contrast with Immokalee, Myakka, and Wabasso soils, they are better drained, have shelly layers, and do not have an organic-matter stained Bh horizon. They are less acid than Paola and St. Lucie which do not have shell layers.

Palm Beach sand (Pa).—This is a nearly level, well-drained sand mixed with shells and fine shell fragments. It consists mainly of material dredged from nearby shallow water to fill dikes. This material has been reworked and leveled. Many areas contain lumps of clay and rock fragments. In most places the material has been deposited only recently and no soil development has occurred. The water table is below a depth of 40 inches most of the time but it is within 40 inches during heavy rains.

Included in mapping are small areas of St. Lucie soils that make up about 10 percent of the acreage.

This soil is used mainly for waterfront homesites. Recent deposits are saline, but the salts leach rapidly. These soils must be thoroughly leached of salts before vegetation can grow. Topsoiling, fertilization, and irrigation are needed to establish and maintain lawns and ornamental plants. (No capability classification; woodland group 9)

Pamlico Series

The Pamlico series consists of nearly level, very poorly drained muck that formed in thick layers of aquatic plant residue deposited over sands in depressions. These soils are in marshes and swamps.

Typically, the organic horizon is black muck about 44 inches thick. It is about 80 percent organic matter and about 5 percent fiber. Below this is very dark gray fine sand that extends to a depth of 65 inches. The organic layer is extremely acid, and the underlying sand is very strongly acid. These soils are covered with shallow water most of the year.

Pamlico soils have moderate permeability, very high available water capacity, very high organic-matter content, and moderate natural fertility.

Representative profile of Pamlico muck:

Oa—0 to 44 inches, black (N 2/0) muck; weak, fine, crumb structure; friable; less than 5 percent fiber rubbed and unrubbed; about 80 percent organic matter; many fine roots in upper part of horizon; sodium pyrophosphate extract color is dark brown (10YR 4/3); extremely acid; clear, smooth boundary.

Ab—44 to 65 inches, very dark gray (10YR 3/1) fine sand; single grain; nonsticky; very strongly acid.

The Oa horizon is 36 to 50 inches thick. It is black to dark reddish brown and strongly acid to extremely acid. The Ab horizon is sand or fine sand and is dark grayish brown to black. Reaction ranges from strongly acid to extremely acid in all layers. The water table is at a depth of less than 10 inches for 6 to 12 months. It rises to the surface and covers the soil with shallow water during wet periods.

The Pamlico soils mapped in Pinellas County have a higher temperature than the range defined for the series. This difference does not appreciably affect use and management.

Pamlico soils are associated with Astor, Immokalee, Myakka, Okeechobee, Placid, Pompano, and Terra Ceia soils. They are organic soils whereas Astor, Immokalee, Myakka, Placid, and Pompano soils are mineral soils. Pamlico soils are more poorly drained than Immokalee and Myakka soils. They lack the soft, brown fibrous peat horizon typical of Okeechobee soils and have sandy horizons within a depth of 50 inches. They are more acid than Terra Ceia soils.

Pamlico muck (Pc).—This is a nearly level, very poorly drained organic soil in depressions, marshes, and swamps. It is covered with water for 6 to 12 months. The rest of the time the water table is within a depth of 10 inches.

Included in mapping are small areas where the muck layer is more than 50 inches thick. These inclusions make up about 10 percent of most mapped areas. In about 5 percent of some mapped areas, acid sandy clay loam is within a depth of 50 inches.

This soil is very wet. A few areas do not have drainage outlets. Where a system of water control can be established, this soil is well suited to truck and flower crops and improved pasture. It is not suited to citrus. Most areas remain in native vegetation. Muck has been dug from some areas. (Capability unit IIIw-5; woodland group 9)

Paola Series

The Paola series consists of nearly level to gently sloping, excessively drained sandy soils that formed in thick beds of marine sand. These soils are on low undulating ridges on the upland.

Typically, the surface layer is light-gray fine sand about 3 inches thick. Below this is white, loose fine sand about 19 inches thick. A discontinuous layer of strong-brown, weakly cemented fine sand less than 1 inch thick occurs at irregular intervals below the layer of white sand. The next layer is yellow fine sand that has scattered, dark reddish-brown, weakly cemented round pebbles and numerous root channels coated with dark-brown, weakly cemented fine sand and filled with white fine sand. This layer is about 28 inches thick. It is underlain by very pale brown loose fine sand that extends to a depth of 80 inches. All layers are very strongly acid. The water table is below a depth of 60 inches all year.

Paola soils have very rapid permeability, very low available water capacity, low organic-matter content, and low natural fertility.

Representative profile of Paola fine sand, 0 to 5 percent slopes:

A1—0 to 3 inches light-gray (10YR 6/1) fine sand; single grain; loose; many fine and medium roots; few fine charcoal fragments; very strongly acid; gradual, wavy boundary.

A2—3 to 22 inches, white (10YR 8/1) fine sand; single grain; loose; common fine and medium roots; common medium charcoal fragments; very strongly acid; clear, irregular boundary.

C1—22 to 50 inches, yellow (10YR 8/6) fine sand; few, fine, faint, brownish-yellow mottles; single grain; loose; common coarse and very coarse root channels filled with light-colored fine sand from the A horizon; outer edges of the root channels are stained with dark reddish-brown (5YR 2/2) and dark-brown (7.5YR 4/4) fine sand that is weakly cemented; few to common, coarse, spheroidal, dark reddish-brown (5YR 2/2) and dark-brown (7.5YR 4/4) concretions. Thin (commonly less than 1 inch thick) discontinuous layers of dark-brown (7.5YR 4/4) weakly cemented fine sand occur at irregular intervals between the A2 and C horizon; many fine, medium, and coarse roots; very strongly acid; clear, wavy boundary.

C2—50 to 80 inches, very pale brown (10YR 8/4) fine sand; single grain; loose; few fine, medium, and coarse roots; very strongly acid.

The A1 horizon is gray to light gray and is 2 to 5 inches thick. The A2 horizon is light-gray to white sand or fine sand and is 6 to 38 inches thick. A discontinuous layer of strong-brown, weakly cemented fine sand less than 1 inch thick occurs in places between the A2 and C1 horizons. The C1 horizon occurs at a depth of 20 to 40 inches. It is yellow or yellowish-red sand or fine sand that contains, throughout, a few to many, soft, dark-brown or dark reddish-brown, round, weakly cemented concretions. It also contains thin accumulations of brown weakly cemented sand and loose white sand along root channels. The C1 horizon commonly is 20 to 30 inches thick. The C2 horizon is light yellowish-brown or very pale brown sand or fine sand that extends to a depth of more than 80 inches. The water table is below a depth of 60 inches.

Paola soils are associated with St. Lucie, Astatula, Pomello, Myakka, and Placid soils. They differ from St. Lucie soils in having yellow C1 and C2 horizons. They differ from Astatula soils in having a white A2 horizon. They are better drained than Pomello and Myakka soils and do not have the well defined, organic-matter stained underlying layers typical of those soils. They are better drained than Placid soils and do not have the thick black A1 horizon that is typical of those soils.

Paola fine sand, 0 to 5 percent slopes (PdB).—This is a nearly level to gently sloping, excessively drained soil on low undulating ridges on the upland.

Included in mapping are small areas of St. Lucie fine sand that make up as much as 10 percent of some mapped areas.

This soil is poorly suited to most crops. It is droughty and mineral fertilizers leach rapidly. It is moderately well suited to citrus once trees have established deep roots. Frequent irrigation and adequate fertilization are needed for citrus. Lawns and ornamental plants for landscaping also require irrigation and fertilization. (Capability unit VIs-1; woodland group 1)

Pinellas Series

The Pinellas series consists of nearly level, somewhat poorly drained sandy soils that formed in stratified sandy, loamy, and shelly marine sediments. These soils occur in the flatwoods, mainly near sloughs and shallow ponds.

Typically, the surface layer is black fine sand about 3 inches thick. Below this is loose fine sand about 15 inches thick that is gray in the upper part and pale brown in the lower part. The next layers are very pale brown and light-gray fine sand very weakly cemented with carbonates. These layers extend to a depth of about 35 inches. They are underlain by mottled grayish-brown fine sandy loam that extends to a depth of about 54 inches. Below this is fine sand mixed with shell fragments that extends to a depth of 80 inches. Reaction is medium acid to a depth of about 8 inches, slightly acid between 8 and 18 inches, mildly alkaline between 18 and 54 inches, and moderately alkaline below this to a depth of 80 inches. The water table is at a depth of about 24 inches.

Pinellas soils have low available water capacity, low organic-matter content, and low natural fertility. Permeability is rapid to a depth of about 35 inches, moderate between 35 and 55 inches, and rapid below this depth.

Representative profile of Pinellas fine sand:

A1—0 to 3 inches, black (10YR 2/1) fine sand; weak, fine, crumb structure; very friable; mixture of organic matter and light-gray sand grains has a salt-and-pepper appearance; many fine and medium roots; medium acid; clear, smooth boundary.

A21—3 to 8 inches, gray (10YR 6/1) fine sand; single grain; loose; many fine, medium, and coarse roots; medium acid; clear, wavy boundary.

A22—8 to 18 inches, pale-brown (10YR 6/3) fine sand; common, coarse, faint, very pale brown (10YR 7/4) mottles and few, medium, white (10YR 8/2) mottles; single grain; loose; many medium and few coarse roots; slightly acid; clear, wavy boundary.

A23ca—18 to 25 inches, very pale brown (10YR 8/3) fine sand; massive; crushes easily with slight pressure; firm; secondary carbonates occur in interstices between sand grains; sand grains are thinly coated with carbonates; few coarse roots; mildly alkaline; gradual, wavy boundary.

A24ca—25 to 35 inches, light-gray (10YR 7/2) fine sand; common, coarse, distinct, brownish-yellow (10YR 6/8) mottles; single grain; loose; secondary carbonates occur in interstices between sand grains; sand grains are thinly coated with carbonates; few fine and medium roots; mildly alkaline; clear, wavy boundary.

B21tg—35 to 49 inches, grayish-brown (2.5Y 5/2) fine sandy loam; common, coarse, faint, olive-brown (2.5Y 4/4) mottles; weak, fine, subangular blocky structure; sticky; many fine and medium roots; root channels filled with white (10YR 8/2) secondary carbonates; sand grains are bridged and coated with clay; few sand lenses; mildly alkaline; clear, wavy boundary.

B22tg—49 to 54 inches, gray (5Y 5/1) fine sandy loam; few, fine, faint, olive mottles; weak, fine, subangular blocky structure; sticky; many fine and medium roots; root channels filled with white (10YR 8/2) secondary carbonates; sand grains are bridged and coated with clay; mildly alkaline; clear, smooth boundary.

IIC—54 to 80 inches, light olive-brown (2.5Y 5/4) fine sand and shell fragments; single grain; loose; moderately alkaline; calcareous.

The A1 horizon ranges from dark gray to black and is 2 to 6 inches thick. It is medium acid to mildly alkaline. The A21 and A22 horizons are light-gray to very pale brown or yellowish sand or fine sand. Their combined thickness is 8 to 18 inches. They are medium acid to mildly alkaline. The A23ca and A24ca horizons are light-gray to grayish-brown or very pale brown sand or fine sand. They have accumulated lime or are neutral to mildly alkaline. The Btg horizon is mottled dark-gray to grayish-brown and light-gray fine sandy loam to sandy clay loam 6 to 19 inches thick. The Btg horizon is neutral to moderately alkaline. In places, a sandy C horizon is between the Btg horizon and the IIC horizon. The water table is at a depth of 10 to 40 inches from 2 to 6 months in most years. It is within 10 inches for 1 or 2 months during wet seasons. The rest of the year it is below 40 inches.

The Pinellas soils are associated with Elred, Felda, Manatee, Myakka, Pompano, and Wabasso soils. They have an accumulation of carbonates in the lower part of the A horizon that is not present in Elred, Myakka, and Wabasso soils. They are better drained than Felda, Manatee, and Pompano soils.

Pinellas fine sand (Pf).—This is a nearly level, somewhat poorly drained soil around sloughs and ponds in the flatwoods. The water table normally is at a depth of 10 to 40 inches for 2 to 6 months in most years. It is within a depth of 10 inches for a short time during wet periods.

Included in mapping are small areas where depth to the loamy layer is more than 40 inches. These inclusions make up about 15 percent of the acreage. Small areas where limestone is within a depth of 40 inches make up about 5 percent. Small areas of Elred, Felda, and Wabasso soils make up no more than 10 percent of any mapped area.

If adequate water control and good management are practiced, this soil is well suited to special truck and flower crops and improved pasture grasses. Many areas are moderately well suited to citrus if the water table is lowered, irrigation is provided, and special management is practiced. Most areas of this soil are small in size, irregular in shape, and adjoin wetter soils, all of which limit their suitability as sites for citrus groves. (Capability unit IVw-1; woodland group 6)

Placid Series

The Placid series consists of nearly level, very poorly drained sandy soils that formed in thick layers of marine sands under wet conditions that favored the accumulation of organic matter. These soils occur in depressions, sloughs, and low swampy areas.

Typically, the surface layer is black fine sand about 17 inches thick. The lower part contains pockets of light brownish gray. The next layer is light brownish-gray, loose fine sand mottled with very dark gray. It is about 12 inches thick. Below this is grayish-brown, loose fine sand that extends to a depth of 80 inches. Reaction is acid to a depth of about 29 inches and strongly acid below this to a depth of 80 inches. The water table is at the surface most of the year.

Placid soils have rapid permeability, high available water capacity, high organic-matter content, and moderately high natural fertility.

Representative profile of Placid fine sand:

A11—0 to 11 inches, black (10YR 2/1) fine sand; moderate, fine, crumb structure; very friable; many fine and medium roots; few coarse roots; very strongly acid; clear, smooth boundary.

A12—11 to 17 inches, black (10YR 2/1) fine sand; few coarse pockets of light brownish gray (10YR 6/2); weak, fine, crumb structure; very friable; many fine and medium roots; very strongly acid; gradual, smooth boundary.

C1—17 to 29 inches, light brownish-gray (10YR 6/2) fine sand; few, fine, faint, very dark gray mottles; single grain; few fine and coarse roots; very strongly acid; gradual, smooth boundary.

C2—29 to 80 inches, grayish-brown (10YR 5/2) fine sand; single grain; strongly acid.

The A horizon ranges from black to very dark gray or very dark grayish brown and is 10 to 24 inches thick. Organic-matter content in the A horizon is 4 to 15 percent. In many places the thickness and organic-matter content of the A horizon increase from the edge of an area toward the center. In some places materials from the A and C horizons have been mixed by burrowing animals to form a transitional layer that has mixed colors between the A and C horizons. The upper part of the C horizon commonly is brownish gray or lighter in color. Colors are darker at greater depth. This horizon is mottled with darker colors and extends to a depth of 80 inches or more. Reaction ranges from strongly acid to extremely acid in all layers. The water table is at or within a depth of 10 inches for 2 to 9 months in most years. Low-lying areas are covered with shallow water for 2 to 6 months.

Placid soils are associated with Astatula, Astor, Myakka, Pomello, and Pompano soils. They are more poorly drained than Astatula, Pomello, and Myakka soils and are more acid than Astor and Pompano soils.

Placid fine sand (Pn).—This is a nearly level, very poorly drained soil in depressions, sloughs, and swamps. The water table is within a depth of 10 inches for 2 to 9 months in most years, and the lowest areas are covered with water for 2 to 6 months.

Included in mapping are small areas where the underlying sandy layers are very pale brown to yellowish brown, and small areas where the black surface layer is more than 24 inches thick. Also included are a few small areas of Astor soils. These inclusions make up no more than 10 percent of any mapped area.

Placid fine sand is well suited to improved pasture and truck crops. Intensive water control is needed to lower the water table and reduce the hazard of flooding. This soil is poorly suited to citrus because adequate water control is difficult to maintain. (Capability unit IIIw–3; woodland group 8)

Pomello Series

The Pomello series consists of nearly level to gently sloping, moderately well drained sandy soils that formed in thick beds of almost pure quartz marine sand. These soils are on the upland ridge and on isolated knolls in the flatwoods.

Typically, the surface layer is light-gray fine sand about 3 inches thick. Below this is loose, fine sand about 41 inches thick. It is light gray in the upper part and white in the lower part and has few to many thin vertical streaks of very dark gray along root channels. At a depth of about 44 inches is a weakly cemented, organic-matter stained layer of black fine sand about 5 inches thick. Below this is a layer of dark reddish-brown fine sand about 10 inches thick. Dark yellowish-brown, loose fine sand extends to a depth of 80 inches. All layers are strongly acid. The water table is normally at a depth of about 50 inches.

Pomello soils have very low available water capacity, low organic-matter content, and low natural fertility. Permeability is rapid to a depth of about 44 inches, moderately rapid between 44 and 59 inches, and rapid below this depth.

Representative profile of Pomello fine sand:

A1—0 to 3 inches, light-gray (10YR 6/1) fine sand; single grain; loose; mixture of organic matter and light-gray sand grains has a salt-and-pepper appearance; many medium and coarse roots; strongly acid; clear, smooth boundary.

A21—3 to 15 inches, light-gray (10YR 7/1) fine sand; single grain; loose; few medium and coarse roots; vertical streaks of very dark gray (10YR 3/1) along root channels; strongly acid; gradual, wavy boundary.

A22—15 to 44 inches, white (10YR 8/1) fine sand; single grain; loose; few medium and coarse roots; vertical streaks of very dark gray (10YR 3/1) along root channels; strongly acid; clear, smooth boundary.

B21h—44 to 49 inches, black (10YR 2/1) fine sand; massive; very friable; weakly cemented but crushes easily with slight pressure; many fine roots; sand grains well coated with organic matter; strongly acid; clear, smooth boundary.

B22h—49 to 59 inches, dark reddish-brown (5YR 3/4) fine sand; massive; very friable; common medium roots; weakly cemented fragments of dark reddish brown (5YR 3/2); sand grains well coated with organic matter; strongly acid; gradual, smooth boundary.

C—59 to 80 inches, dark yellowish-brown (10YR 3/4) fine sand; single grain; strongly acid.

The A1 horizon ranges from light gray to gray and is 2 to 5 inches thick. The A2 horizon is light gray to white and has few to many very dark gray vertical streaks along root channels It is 30 to 50 inches thick. The Bh horizon is dark-brown to black organic-matter stained sand or fine sand that is weakly cemented. It occurs at a depth of 39 to 60 inches and is 4 to 20 inches thick. The C horizon is dark yellowish-brown to white sand or fine sand and extends to a depth of more than 80 inches. Reaction ranges from strongly acid to very strongly acid in all layers. The water table normally is at a depth of 40 to 60 inches, but it is at 10 to 40 inches for 1 or 2 months every year.

Pomello soils are associated with Astatula, Immokalee, Myakka, Oldsmar, Paola, Placid, and St. Lucie soils. In contrast with Astatula, Paola, and St. Lucie soils, they are more poorly drained and have a Bh horizon. They are better drained than Immokalee and Myakka soils. They are better drained than Oldsmar soils and do not have the loamy B2t horizon that is typical of those soils. They are better drained than Placid soils and have a thinner, lighter colored A1 horizon.

Pomello fine sand (Po).—This is a nearly level to gently sloping, moderately well drained soil on upland ridges and on isolated small ridges and knolls in the flatwoods. The water table is normally at a depth of 40 to 60 inches, but may rise within a depth of 40 inches for a short time during wet periods.

Included in mapping are a few small areas where the underlying organic-matter stained layer is only very weakly developed. These inclusions make up as much as 25 percent of some mapped areas. Also included are small areas of Immokalee fine sand that make up about 5 percent of some mapped areas.

Pomello fine sand is very porous, and plant nutrients leach rapidly. Under good management, including control of grazing, it is moderately well suited to improved pasture consisting of deep-rooted grasses. It is poorly suited to truck crops and citrus trees. Many areas near St. Petersburg have been used for community development. Lawns and ornamental plants in residential areas require intensive fertilization and irrigation. (Capability unit VIs–2; woodland group 3)

Pompano Series

The Pompano series consists of nearly level, poorly drained sandy soils that formed in deep beds of marine sand. These soils are in weakly defined drainageways and shallow depressions, and in slightly higher positions between sloughs.

Typically, the surface layer is very dark gray to dark grayish-brown fine sand about 14 inches thick. The lower part is mottled with yellowish brown and light gray. Below this is mottled yellowish-brown, pale-brown, and light-gray fine sand that extends to a depth of 80 inches. Reaction is strongly acid to a depth of 14 inches, medium acid between 14 and 58 inches, and slightly acid below this to a depth of 80 inches. The water table is at a depth of about 20 inches.

Pompano soils have rapid permeability, very low available water capacity, low organic-matter content, and low natural fertility.

Representative profile of Pompano fine sand:

A11—0 to 5 inches, very dark gray (10YR 3/1) rubbed fine sand; weak, fine, crumb structure; very friable; mixture of organic matter and light-gray sand grains has a salt-and-pepper appearance; many fine and few coarse roots; strongly acid; clear, smooth boundary.

A12—5 to 14 inches, dark grayish-brown (10YR 4/2) fine sand; few, medium, faint, light-gray (10YR 7/2) mottles and few, fine, distinct, yellowish-brown (10YR 5/6) mottles; single grain; loose; common fine roots; strongly acid; gradual, smooth boundary.

C1—14 to 36 inches, yellowish-brown (10YR 5/4) fine sand; few, medium, faint, light-gray (10YR 7/2) and very dark grayish brown (10YR 3/2) mottles; light-gray mottles are uncoated grains of sand; single grain; loose; few fine roots; medium acid; gradual, wavy boundary.

C2—36 to 58 inches, pale-brown (10YR 6/3) fine sand; few, fine, faint, very dark grayish brown (10YR 3/2) mottles; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; single grain; loose; few fine roots; medium acid; gradual, smooth boundary.

C3—58 to 80 inches, light-gray (10YR 7/2) fine sand; single grain; nonsticky; slightly acid.

The A11 horizon ranges from gray to black and is 3 to 6 inches thick. The A12 horizon is light gray to dark grayish brown and is 10 to 16 inches thick. The A horizon ranges from medium acid to neutral. The C1 horizon ranges from grayish brown, yellowish brown, or very pale brown to light gray mottled with strong and weak shades of brown. It is 16 to 48 inches thick. The lower layers of the C horizon are light brownish gray to white and extend to a depth of 80 inches or more. The C horizon ranges from medium acid to mildly alkaline. The water table normally is at a depth of 10 to 40 inches, but it rises to the surface during wet periods and drops below 40 inches during dry periods. Many areas are covered with water for 1 to 6 months in most years. Pompano fine sand, ponded, is covered with water for 2 to 6 months in most years, and the water table is within a depth of 10 inches the rest of the year.

Pompano soils are associated with Astor, Felda, Immokalee, Manatee, Myakka, Oldsmar, and Wabasso soils. They have a thinner A1 horizon than Astor soils. They do not have the loamy Bt horizon typical of Felda and Manatee soils. They do not have the Bh horizon typical of Immokalee and Myakka soils. They do not have the Bh and Bt horizons typical of Oldsmar and Wabasso soils.

Pompano fine sand (Pp).—This is a nearly level, poorly drained soil near ponds and in low areas between sloughs in the flatwoods. It has the profile described as representative for the series. The water table normally is at a depth of 10 to 40 inches. It is within 10 inches for 1 or 2 months during wet seasons and is below 40 inches during dry periods.

Included in mapping are a few small areas where the sand is stained dark brown below a depth of 30 inches. These inclusions make up less than 15 percent of any mapped area. Places where a loamy layer is at a depth of 40 to 60 inches make up as much as 10 percent of some mapped areas.

This soil is well suited to truck and flower crops and to improved pasture where effective water control is established and maintained. It is poorly suited to citrus and to lawn grasses and ornamental plants. (Capability unit IVw-2; woodland group 8)

Pompano fine sand, ponded (Ps).—This is a nearly level, poorly drained, sandy soil in grassy sloughs and shallow depressions in the flatwoods. In most places the surface layer is gray fine sand about 5 inches thick. The next layer is dark grayish-brown fine sand about 9 inches thick. Below this is pale-brown, loose fine sand mottled with reddish yellow and yellowish brown. It is about 17 inches thick. Below this is light brownish-gray, loose fine sand that extends to a depth of 80 inches. Reaction is medium acid to a depth of 31 inches and slightly acid below. This soil is covered with water for 2 to 6 months in most years, and the water table is within a depth of 10 inches the rest of the time.

Included in mapping are areas of similar soils that have dark-brown stained layers at a depth of about 30 inches. These included soils make up about 25 percent of some mapped areas. Small areas that have clayey materials below a depth of 60 inches make up about 5 percent of some mapped areas. Very small areas of Astor soils also are included in places.

Pompano fine sand, ponded, is moderately well suited to truck crops and improved pasture if the hazard of flooding is reduced. It is poorly suited to citrus. An effective water-control system is needed for all uses. (Capability unit IVw-2; woodland group 8)

Spoil Banks

Spoil banks (Sp) occurs mainly along the lower part of the Anclote River and along the west coast of the county. It consists of mixed sand, rock, sandy clay loam, and shells dredged from inland waterways and channels and dumped into harbors, bays, and inlets. These areas are used only to dispose of spoil materials from construction projects. No attempt has been made to level these areas, but material dumped in unprotected waters has been reworked by wave action. Sandy areas are nearly level and only a foot or so above water at high tide. In many places sandy materials above the waterline have been removed by wave action, leaving a small barren island of rocks.

Some areas provide suitable picnic sites for boaters but lack trees for shade. Many areas provide food and resting places for shore birds. (No capability or woodland classification)

St. Lucie Series

The St. Lucie series consists of nearly level to gently sloping, excessively drained sandy soils that formed in beds of nearly pure quartz marine sand. These soils are on low ridges on uplands and near the coast.

Typically, the surface layer is gray fine sand about 3 inches thick. Below this is a white loose fine sand about 55 inches thick. Yellow loose fine sand extends to a depth of 80 inches. Reaction is strongly acid in all layers. The water table is below a depth of 80 inches.

St. Lucie soils have very rapid permeability, very low available water capacity, low organic-matter content, and low natural fertility.

Representative profile of St. Lucie fine sand:

A1—0 to 3 inches, gray (10YR 5/1) fine sand; single grain; loose; common fine medium and coarse roots; many fine and medium charcoal fragments; strongly acid; clear, smooth boundary.

C1—3 to 58 inches, white (10YR 8/1) fine sand; single grain; loose; few medium and coarse roots; many uncoated sand grains; strongly acid; abrupt, irregular boundary.

C2—58 to 80 inches, yellow (10YR 8/6) fine sand; single grain; loose; few fine and medium roots; many uncoated sand grains; strongly acid.

The A1 horizon normally is very dark gray to light gray and is 2 to 6 inches thick. The C1 horizon is gray to white and is 40 to 80 inches or more thick. A C2 horizon of yellow sand that extends to a depth of 80 inches or more occurs in places. Near the coast are areas underlain by layers of sea shells and shell fragments at a depth of 40 inches or more. In these areas the water table normally is at a depth of 40 to 60 inches.

Some of the St. Lucie soils mapped in Pinellas County are outside the range defined for the series because their C2 horizon is yellow. This difference does not affect use or management.

St. Lucie soils are associated with Astatula, Myakka, Paola, Placid, and Pomello soils. Their C1 horizon is white, whereas that of Astatula soils is light yellow or brown. They are better drained than Myakka and Pomello soils and do not have the Bh horizon that is typical of those soils. They do not have the layer of yellow sand within a depth of 40 inches that is typical of Paola soils. They are better drained than Placid soils and do not have the thick black surface layer that is typical of those soils.

St. Lucie fine sand, 0 to 5 percent slopes (StB).—This is an excessively drained, undulating soil on high ridges. It has the profile described as representative for the series. The water table is below a depth of 80 inches all year.

Included in mapping are areas that are white sand to a depth of 80 inches or more and do not have the underlying layers of yellow or brown sand. Small areas of Paola fine sand make up as much as 15 percent of some mapped areas, and small areas of Pomello fine sand make up about 5 percent.

This soil is poorly suited to crops. It is droughty and is rapidly leached of mineral fertilizers. The response to fertilization is poor. (Capability unit VIIs-1; woodland group 1)

St. Lucie fine sand, 5 to 12 percent slopes (StC).—Except for slope, this soil is similar to St. Lucie fine sand, 0 to 5 percent slopes. (Capability unit VIIs-1; woodland group 1)

St. Lucie fine sand, shell substratum (Su).—This is a nearly level soil on low ridges on barrier islands in the western part of the county. In most places the surface layer is very dark gray fine sand about 3 inches thick. Below this is light-gray loose fine sand about 34 inches thick. The next layer is very pale brown, loose fine sand that extends to a depth of 40 inches or more. This is underlain by layers of mixed light-gray or white sand, seashells, and shell fragments. Reaction is medium acid in the surface layer and mildly alkaline below. The water table is at a depth of 40 to 60 inches for 6 months or more in most years. It is within 40 inches for less than 60 days.

Included in mapping are small areas of Palm Beach sand that make up no more than 15 percent of any mapped area and of Made land that make up as much as 5 percent.

Most areas of St. Lucie fine sand, shell substratum, are in State or county parks or have been used for building lots. No areas are available for farming. (Capability unit VIs-2; woodland group 3)

Terra Ceia Series, Moderately Deep Variant

The Terra Ceia series, moderately deep variant, consists of nearly level, very poorly drained organic soils in small depressions, marshes, and swamps. These soils are covered with shallow water most of the year.

Typically, the surface layer is black muck about 42 inches thick. The upper part is slightly acid and the lower part is mildly alkaline. Below this is neutral very dark brown fine sand.

Terra Ceia soils have rapid permeability, very high available water capacity, high organic-matter content, and moderate natural fertility.

Representative profile of Terra Ceia muck, moderately deep variant:

Oa1—0 to 7 inches, black (5YR 2/1) muck; weak, medium, crumb structure; very friable; 10 percent fiber unrubbed, less than 5 percent rubbed; about 90 percent organic matter; many fine, medium, and coarse roots; sodium pyrophosphate extract color is pale brown (10YR 6/3); slightly acid; gradual, smooth boundary.

Oa2—7 to 42 inches, black (N 2/0) muck; weak, coarse, crumb structure; 20 percent fiber unrubbed, 5 percent rubbed; about 95 percent organic matter; sodium pyrophosphate extract color is pale brown (10YR 6/3); mildly alkaline; gradual, smooth boundary.

Ab—42 to 65 inches, very dark brown (10YR 2/2) fine sand; single grain; neutral.

The Oa horizon ranges from black to dark reddish brown and is 18 to 50 inches thick. The mineral content is 5 to 40 percent. The Ab horizon is gray, grayish-brown, very dark brown, or black sand or fine sand.

The Terra Ceia soils mapped in Pinellas County are a moderately deep variant of the Terra Ceia series because the mucky Oa horizon is less than 50 inches thick. This difference does not appreciably affect use and management.

Terra Ceia soils are associated with Astor, Okeechobee, Pamlico, and Placid soils. They have an organic surface layer, whereas Astor and Placid soils have a thick, dark-colored mineral surface layer. They are less acid than Pamlico soils. They do not have the brown peat Oe horizon typical of Okeechobee soils.

Terra Ceia muck, moderately deep variant (Tc).—This is a nearly level, very poorly drained organic soil in depressions, broad marshes, and swampy areas. The water table commonly is at a depth of less than 10 inches or the soil is covered with shallow water for 6 to 12 months in most years.

Included in mapping are areas where the organic horizons are strongly acid and more than 50 inches thick. These inclusions make up about 25 percent of the acreage. Some mapped areas are made up entirely of these strongly acid soils. Also included are small areas of Okeechobee soils that make up not more than 10 percent of any mapped area.

This soil is very wet, and a few areas do not have drainage outlets. If water control is adequate, this soil is well suited to special truck and flower crops and improved pasture. The surface should be saturated with water during fallow periods to prevent oxidation. Special fertilization and management are needed for good crop growth. (Capability unit IIIw–5; woodland group 9)

Tidal Marsh

Tidal marsh (Td) consists of marshy areas slightly above sea level that are mostly along the Anclote River, Allen's Creek, and Cross Bayou, and in narrow strips adjacent to Tidal swamp. It differs from Tidal swamp mainly in vegetative cover. Tidal marsh is saturated by salt water or brackish water or inundated by tidal waters, but it is not subject to vigorous wave action. Strong concentrations of salt inhibit the growth of all vegetation except salt-tolerant weeds, rushes, sedges, and a few small scattered mangrove trees.

This land type consists mainly of mineral soils, but many areas have an organic surface layer as much as 50 inches thick. Some areas have stratified mineral and organic materials, and some have a highly organic surface layer over sand. Many areas have layers of sand mixed with shell fragments at varying depths. All areas are strongly saline and generally emit a strong odor of hydrogen sulfide when excavated. A small acreage of slightly higher soils is inundated only by extremely high tides and is less wet; only patches of salt-tolerant grasses and succulents grow in these higher areas.

Tidal marsh provides food, breeding grounds, and some cover for many species of birds and a few animals. Small creeks and streams in these areas are breeding grounds for numerous species of fish. (No capability classification; woodland group 9)

Tidal Swamp

Tidal swamp (Ts) is on small islands and in low, broad coastal areas that are covered with sea water. It occurs mostly in the southeastern part of the county. The water is several inches deep at low tide and 1 or 2 feet deep at high tide. Tidal swamp differs from Tidal marsh mainly in vegetation. Tidal swamp has a thick growth of mangrove trees and a few small patches of salt-tolerant plants. Tidal swamp is subject to wave action, whereas Tidal marsh usually is not.

This land type consists mainly of sand, peaty sand, a few organic soils, seashells, and shell fragments. The dense forest of mangrove trees and high water make detailed investigation of the soils impractical. In places the surface layer is fibrous peat, 6 to 18 inches thick, over gray to pale-brown sand mixed with shell fragments. In places the surface layer is sandy clay and the subsurface layers are loam or marl. Other areas are stratified sand and organic material. Most areas contain varying amounts of seashells and shell fragments at irregular depths.

Tidal swamp is not extensive in the county. It is mainly a source of food, cover, and breeding grounds for numerous shore birds and animals. Many mosquito-control ditches have been dug in most areas to remove water trapped by falling tides. The shallow water in these ditches provides food and breeding areas for many species of fish. Some areas in the vicinity of St. Petersburg, Clearwater, and Honeymoon Island have been filled with dredged material to provide waterfront homesites. (No capability classification; woodland group 9)

Urban Land

Much of Pinellas County has been developed for urban uses. Use of heavy earth-moving equipment to prepare building sites has altered much of the original soil material. Buildings and pavement cover parts of this reworked soil material. Other parts have been leveled or shaped. Only small remnants of the original soils are interspersed with areas covered by buildings and pavement and areas of reworked soil material. In older residential areas the proportion of undisturbed soil is larger.

Where very little of the original soil remains undisturbed, the areas are mapped as Urban land. Where enough remains to make identification of the original soil possible, the areas are mapped as a complex of Urban land and the identified soil.

Urban land (Ub).—This land type consists of areas where the original soil has been modified through cutting, grading, filling, and shaping or has been generally altered for urban development. Major soil properties that originally limited urban uses have been overcome to an acceptable extent. Urban facilities, including paved parking areas, streets, industrial buildings, houses, other structures, and underground utilities, have been constructed on 75 percent or more of these altered areas. Areas not covered by urban facilities generally have been altered. Identification of soils within these areas is not feasible.

Urban land occurs primarily in downtown areas, shopping districts, industrial parks, and along main traveled throughways of cities and towns. It also occurs in isolated shopping centers and small business areas at intersections of primary roads. Included in places are small, less intensively developed areas and small areas of identifiable soils. (No capability or woodland classification)

Urban land-Astatula complex (Uc).—This complex is about 30 to 70 percent Astatula fine sand, of which 10 to 20 percent has been modified by cutting, grading, and shaping. About 25 to 40 percent of this complex is Urban land that is covered with houses, industrial buildings, other structures, and pavement.

Soil material left after grading and leveling has been used to fill low wet areas. In a few places it has been shaped. In these small areas slopes are 5 to 8 percent.

Included in mapping are small areas of St. Lucie soils, small areas of poorly drained soils, and a few small areas that are more than 75 percent covered with urban facilities. These inclusions make up no more than 15 percent of any mapped area. (No capability or woodland classification)

Urban land-Immokalee complex (Uk).—About 35 to 55 percent of this complex is Immokalee fine sand, of which 10 to 25 percent has been modified by cutting, grading, and shaping. About 25 to 40 percent of this complex is Made land that is covered by houses, industrial buildings, other structures, and pavement. The rest is spoil materials from drainage canals and from street and other grading operations that have been used to fill low places or have been spread over the surface of other soils.

Included in mapping are small areas of Astatula fine sand and Myakka fine sand and a few small areas that are more than 75 percent covered with urban facilities. These inclusions make up no more than 15 percent of any mapped area. (No capability or woodland classification)

Urban land-Myakka complex (Um).—About 30 to 50 percent of this complex is Myakka fine sand, of which 15 to 30 percent has been modified by cutting, grading, and shaping. About 25 to 40 percent of this complex is Urban land that is covered with houses, industrial buildings, other structures, and pavement. Spoil materials from drainage canals and from street excavations have been used to fill low areas or spread on the surface of other soils.

Included in mapping are small areas of Adamsville, Astatula, and Immokalee soils that make up no more than 15 percent of any mapped area. Small areas of Made land and small areas more than 75 percent of which are covered with urban facilities also are included. (No capability or woodland classification)

Urban land-Pomello complex (Up).—About 25 to 55 percent of this complex is Pomello soils, of which 10 to 25 percent has been modified by cutting, grading, and shaping. About 25 to 40 percent of this complex is Urban land that is covered with houses, industrial buildings, other structures, and pavement. Spoil material from grading and leveling operations has been used to fill low areas or has been spread over the surface of other soils.

Included in mapping are small areas of Astatula fine sand, Immokalee fine sand, and Myakka fine sand that make up no more than 15 percent of any mapped area. As much as 75 percent of a few small areas is covered with structures and pavement. (No capability or woodland classification)

Urban land-Wabasso complex (Uw).—About 35 to 55 percent of this complex is Wabasso fine sand, of which 10 to 30 percent has been modified by cutting, grading, and shaping. About 25 to 40 percent of this complex is Urban land that is covered with houses, industrial buildings, other structures, and pavement. Spoil material from drainage canals and from street grading has been used to fill low areas or has been spread on the surface of other soils.

Included in mapping are areas of Oldsmar fine sand that make up as much as 15 percent of some mapped areas, and small areas of Pinellas fine sand and Elred fine sand that make up about 5 percent. (No capability or woodland classification)

Wabasso Series

The Wabasso series consists of nearly level, poorly drained sandy soils that formed in beds of sandy and loamy marine sediments. These soils are on broad low ridges in the flatwoods.

Typically, the surface layer is black fine sand about 5 inches thick. Below this is gray, loose, leached fine sand about 22 inches thick. It has a few vertical streaks of very dark gray along root channels. The next layer is black, weakly cemented, very friable fine sand 5 inches thick. Next is dark-brown, very friable fine sand that contains fragments of black, weakly cemented fine sand. This is underlain by dark grayish-brown fine sandy clay loam mottled with olive brown; it is about 6 inches thick. Below this is coarsely mottled dark-brown, olive-brown, and grayish-brown fine sandy loam about 6 inches thick. Light-gray sand mixed with shell fragments is between depths of about 50 inches and 62 inches. Reaction is very strongly acid to a depth of about 27 inches, slightly acid between 27 and 32 inches, medium acid between 32 and 38 inches, slightly acid between 38 and 50 inches, and mildly alkaline below this depth. The water table normally is at a depth of about 25 inches.

Wabasso soils have low available water capacity, low organic-matter content, and low natural fertility. Permeability is rapid to a depth of 27 inches, moderate between 27 and 50 inches, and rapid below this depth.

Representative profile of Wabasso fine sand:

A1—0 to 5 inches, black (10YR 2/1) fine sand; weak, fine, crumb structure; very friable; mixture of organic matter and light-gray sand grains; many fine and medium roots; very strongly acid; gradual, smooth boundary.

A2—5 to 27 inches, gray (10YR 6/1) fine sand; single grain; loose; few fine and medium roots; few vertical streaks of very dark gray along root channels; very strongly acid; clear, smooth boundary.

B2h—27 to 32 inches, black (5YR 2/1) fine sand; massive; firm; weakly cemented, crushes easily with slight pressure; sand grains well coated with organic matter; many fine and medium roots; few gray streaks along root channels; slightly acid; clear, smooth boundary.

B3 & Bh—32 to 38 inches, dark-brown (7.5YR 3/2) fine sand; weak, fine, crumb structure; very friable; most sand grains coated with organic matter; common fine roots; weakly cemented; common fragments of black (5YR 2/1) along root channels; medium acid; gradual, smooth boundary.

B'21t—38 to 44 inches, dark grayish-brown (10YR 4/2) fine sandy clay loam; common, medium and coarse, distinct, olive-brown (2.5Y 4/4) mottles; moderate, medium, subangular blocky structure; firm; many fine and medium roots; sand grains are bridged and coated with clay; slightly acid; abrupt, smooth boundary.

B'22t—44 to 50 inches, coarsely mottled, dark-brown (10YR 3/3), olive-brown (2.5Y 4/4), and grayish-brown (2.5Y 5/2) fine sandy loam; weak, moderate, subangular blocky structure; slightly sticky; common fine roots; sand grains are bridged and coated with clay; slightly acid; clear, wavy boundary.

IIC—50 to 62 inches, light-gray (2.5Y 7/2) sand and shell fragments; single grain; loose; mildly alkaline; calcareous.

The A1 horizon ranges from dark gray to black and is 4 to 7 inches thick. The A2 horizon is gray to light-gray sand or fine sand and is 10 to 23 inches thick. Depth to the B2h horizon is 20 to 30 inches. This horizon is dark reddish-brown, dark-brown, or black sand or fine sand and is 4 to 12 inches thick. The Bh horizon ranges from slightly acid to very strongly acid. In many places a B3 & Bh horizon, 4 to 6 inches thick, is below the Bh horizon. It is dark-brown to dark grayish-brown sand and has black, weakly cemented nodules of sand scattered through it. The B'2t horizon occurs at depths of 29 to 40 inches. It is gray to dark grayish-brown and brownish-yellow sandy loam or sandy clay loam and is mottled with gray, olive, olive brown, grayish brown, brownish yellow, and strong brown. The lower part of the B'2t horizon is more strongly mottled and, in places, contains carbonate along root channels and light-gray to white secondary carbonate material. The B't horizon ranges from medium acid to mildly alkaline. A IIC horizon of gray sand mixed with shell fragments occurs below the B'2t horizon, commonly within a depth of 60 inches. In places the IIC horizon is as much as 15 feet thick. The water table is within a depth of 10 inches for 1 or 2 months during wet seasons. The rest of the year it is at a depth of 10 to 40 inches.

The Wabasso soils mapped in Pinellas County have a B horizon that is less acid than the range defined for the series. This difference does not appreciably affect use or management.

Wabasso soils are associated with Astor, Elred, Felda, Manatee, Myakka, Oldsmar, and Pompano soils. They are not so poorly drained as Astor, Pompano, and Manatee soils. They have a Bh horizon that is lacking in Elred, Felda, and Pompano soils. They have a loamy Bt horizon that is lacking in Myakka soils. Their A horizon is less than 30 inches thick, whereas that of Oldsmar soils is more than 30 inches thick.

Wabasso fine sand (Wa).—This is a nearly level, poorly drained soil on broad low ridges in the flatwoods. The water table is within a depth of 10 inches for 1 or 2 months during wet seasons and at a depth of 10 to 40 inches for 2 to 6 months in most years.

Included in mapping are small areas that have a thin light-brown stained layer. Also included are areas of Oldsmar soils that make up no more than 15 percent of any mapped area and small areas of Myakka soils that make up about 5 percent.

Wabasso fine sand is periodically wet but responds well to water-control practices. It is well suited to special flower and truck crops and improved pasture grasses. It is moderately well suited to lawn grasses and ornamental plants and to citrus trees if water control is established and maintained. Response to mineral fertilizer is good. (Capability unit IIIw–2; woodland group 6)

Wauchula Series

The Wauchula series consists of nearly level, poorly drained sandy soils that formed in sandy over loamy marine sediments. These soils are on low ridges in the flatwoods.

Typically, the surface layer is black fine sand about 6 inches thick. Below this is light-gray fine sand about 20 inches thick. The next layer is fine sand, about 7 inches thick, that is weakly cemented with organic matter. This layer is black in the upper 2 inches and grades to dark reddish brown in the lower part. Below this is dark yellowish-brown loamy fine sand, 2 inches thick, over mottled grayish-brown fine sandy clay loam about 20 to 35 inches thick. Gray mottled fine sandy loam is between depths of 55 and 80 inches. All layers are very strongly acid. The water table is at a depth of about 20 inches.

Wauchula soils have low available water capacity, low organic-matter content, and low natural fertility. Permeability is rapid to a depth of 26 inches and moderate below.

Representative profile of Wauchula fine sand:

A1—0 to 6 inches, black (10YR 2/1) fine sand; weak, fine, crumb structure; very friable; mixture of organic matter and light-gray sand grains has a salt-and-pepper appearance; many fine, medium, and coarse roots; very strongly acid; clear, smooth boundary.

A2—6 to 26 inches, light-gray (10YR 6/1) fine sand; single grain; loose; few medium and coarse roots; streaks of dark gray (10YR 4/1) along root channels; very strongly acid; clear, smooth boundary.

B2h—26 to 33 inches, dark reddish-brown (5YR 2/1) fine sand; weak, fine, crumb structure; very friable; weakly cemented; firm; most sand grains well coated with organic matter; many fine roots; very strongly acid; clear, wavy boundary.

B3h—33 to 35 inches, dark yellowish-brown (10YR 3/4) loamy fine sand; weak, fine, crumb structure; very friable; many sand grains thinly coated with organic matter; few fine roots; very strongly acid; clear, wavy boundary.

B'1t—35 to 55 inches, grayish-brown (10YR 5/2) fine sandy clay loam; common medium mottles of yellowish red (5YR 4/8), red (2.5YR 4/8), and yellowish brown (10YR 5/6); moderate, medium, subangular blocky structure; friable; common fine roots; sand grains are bridged and coated with clay; very strongly acid; gradual, wavy boundary.

B'2t—55 to 80 inches, gray (N 6/0) fine sandy loam; few, medium, distinct, very dark gray (10YR 3/1) mottles; common, coarse, distinct, yellowish-brown (10YR 5/6) mottles; and few, medium, prominent, red (2.5YR 5/6) mottles; massive; friable; slightly sticky; sand grains are thinly coated and bridged with clay; few small sand lenses; very strongly acid.

The A1 horizon ranges from dark gray to black and is 4 to 8 inches thick. The A2 horizon is light-gray to gray sand or fine sand and is 14 to 23 inches thick. A B2h horizon occurs within a depth of 30 inches. It is dark reddish-brown to black sand or fine sand and is 4 to 13 inches thick. A B3h horizon, 2 to 4 inches thick, of lighter brown sand commonly is between the B2h and the B't horizon. The B'1t horizon is dark-gray or grayish-brown to light-gray sandy loam to sandy clay loam and is 6 to 28 inches thick. It is highly mottled with shades of gray, brown, red, and yellow. The content of sand increases between depths of 40 and 60 inches. Reaction is strongly acid to very strongly acid in all layers. The water table normally is at a depth of 10 to 30 inches, but it is within a depth of 10 inches during wet periods. It drops below 30 inches during dry periods.

Wauchula soils are associated with Adamsville, Felda, Immokalee, Manatee, Myakka, and Placid soils. They have an organic-stained Bh horizon and a loamy Bt horizon, both of which are lacking in Adamsville soils. They have a weakly cemented stained Bh horizon that is lacking in Felda soils. They have loamy underlying layers that are lacking in Immokalee and Myakka soils. They are better drained than Manatee and Placid soils.

Wauchula fine sand (Wc).—This is a nearly level, poorly drained soil on broad low ridges in the flatwoods and in a few low flat areas on the uplands. The water table is at a depth of 10 to 30 inches for 2 to 6 months in most years. It is within a depth of 10 inches for 1 or 2 months during wet seasons.

Included in mapping are small areas where the layer stained with organic matter is at a depth of 30 to 40 inches and the loamy underlying layers are at a depth of 40 inches or more. These inclusions make up no more than 10 percent of any mapped area. A few small areas have slopes of 2 to 5 percent. Areas of Myakka fine sand make up as much as 10 percent of some mapped areas.

This soil is well suited to lawn grasses and ornamental plants. It is well suited to special truck and flower crops, citrus, and improved pasture grasses in areas where a water-control system has been installed and maintained. Response to management is good. (Capability unit IIIw–2; woodland group 6)

Use and Management of the Soils

Pinellas County is urbanizing rapidly. Land that only a few years ago was used for commercial production of citrus, truck crops, other farm crops, and cattle has been converted to nonfarm uses. If the present trend continues soon very little land in Pinellas County will be put to farm uses.

In this section, the soils are rated for various nonfarm uses, their engineering properties are evaluated, and their suitability for farming, woodland, and wildlife is discussed.

Town and Country Planning

The population of Pinellas County is about 500,000 and is rapidly increasing. Much of the county is urbanized, and the population density is about 1,800 per square mile.

Because much of the land suited to farming has been diverted to nonfarm uses, further urban expansion must be on soils that have major limitations for both farm and nonfarm uses. A thorough knowledge of the soils is required to determine the kind and severity of limitations that have to be overcome before sites can be used for homes, schools, roads, shopping centers, and recreational areas. Careful consideration of the soil properties during early stages of development will prevent costly mistakes that are difficult to correct later.

In table 3 the soils are rated according to their limitations for building sites, landscaping, sanitation, transportation, recreation, and other nonfarm uses. The chief limiting characteristics of the soils or the main hazards affecting each use are indicated. Information given in the table, however, does not eliminate the need for onsite investigation of areas selected for a given use.

The soil limitations are described as slight, moderate, severe, and very severe. *Slight* limitations are so minor that they can be overcome easily. The soil properties generally are favorable for the particular use, and good performance and low maintenance cost can be expected. *Moderate* limitations can be overcome by careful planning and design or by special maintenance. The soil properties are moderately favorable for the particular use. *Severe* limitations are difficult and costly to overcome. They require major soil reclamation, special design, or intensive maintenance because the soils have one or more properties unfavorable for the particular use. *Very severe* limitations indicate that very difficult and expensive reclamation is required or the soil properties are so unfavorable that use is prohibited.

These ratings do not necessarily indicate suitability, because most soils can be made suitable for many uses if their limitations or hazards are overcome. The ratings do show the degree or intensity of the problems that require solution before the soils can be used for the purpose indicated. Many soils that have severe limitations for a specified use can be made suitable for that use, if it is feasible to apply the intensive management needed to overcome the limitations.

Some soil properties affect only one or two uses; others affect all the uses. Wetness and flooding, for example, affect most uses, but soil fertility affects only those uses that involve growing plants. In rating the soils, all of the soil properties pertinent to the given use were considered. However, only the most limiting properties are indicated. Others are significant, but their effect is not so great. The main nonfarm uses of the soils are described in the following paragraphs.

Building sites.—The first column in table 3 indicates the degree of soil limitations for the construction of foundations for low buildings. These include houses, churches, stores, filling stations, and motels, and light industrial plants no more than two stories high in which no heavy machinery is to be installed. All of these structures require stable foundations. They must be placed on soils that can support the weight of the building and must be reasonably free from the hazard of flooding (fig. 3). The bearing capacity of a soil, or its ability to support a dead weight without settling, is most important in designing and constructing foundations for buildings. The bearing capacity varies according to the texture, consistence, shrink-swell potential, depth to water table, and degree of compaction. Depth to water table is important because it also affects excavation.

Landscaping.—Soils differ widely in limitations for the various kinds of plants used in landscaping. Their limitations for lawns and ornamental trees and shrubs are especially important for homesites and for many business establishments, for highway beautification, and for most recreational uses. Soil properties that affect landscaping are the available water capacity, depth to water table, fertility, effective rooting depth, and susceptibility to flooding.

Sanitation.—The limitations of soils for septic tank filter fields and sanitary land fills are of major importance in community planning. Septic tanks are commonly used for sewage disposal in rural areas and in rapidly expanding residential areas that have outgrown existing sewer lines. Soil properties that affect the use of soils for septic tank filter fields are depth to water table, permeability, and flood hazard. To function properly, septic tanks must be installed in soils that have adequate absorptive capacity and are not affected by a high water table. A seasonal high water table severely limits the use of many soils for septic tanks. Septic tanks may function well on these soils during dry periods but fail when the water table rises during wet periods. Although septic tanks function well on soils that have very rapid permeability, pollution of the water supply is a hazard.

Transportation.—The soils are rated for paved highways, airports, roads, and parking areas and for unpaved roads and parking areas for which soils are graded and packed. Thr preparation of a strong foundation for pavement is affected by the soil bearing capacity and slope, depth to a water table, and flood hazard. Unpaved roads and streets normally carry less traffic and lighter loads than paved highways, and the trafficability of the soil generally determines the ease with which equipment and pedestrians can move about. Although texture is the main factor to be considered in determining the limitation of a soil for unpaved roads, the flood hazard, the depth to a water table, the permeability, and the slope also are important.

Recreation.—Pinellas County is extensively urbanized and requires adequate recreational facilities for its rapidly increasing population and the large seasonal influx of tourists. Limitations of the soils for campsites, picnic areas, playgrounds, trails, and golf courses are considered in table 3. Although soil properties that adversely affect these uses are indicated, the esthetic attraction of a given area may outweigh many soil limitations in choosing sites for a given use.

Campsites are small areas suitable for camping equipment and outdoor living for a period of several days. Picnic areas have similar requirements and should be suitable for outings during which a meal is eaten. Campsites and picnic areas are affected by the depth to water table, the flood hazard, and the trafficability of the soil.

Playgrounds include city parks, football and baseball fields, tracks, and other small areas where competitive sports are played outdoors. The soils should be nearly level, free from flooding or excessive wetness, easy to walk over, and suitable for landscape plantings. Depth to water table, soil texture, and the flood hazard affect the use of soils for playgrounds.

***Figure 3.*—Wetness is a hazard for homesites on Myakka fine sand.**

Golf courses can be established on sites where the soils vary widely, if the sites have a suitable proportion of fairways and rough areas or hazards. Only soil limitations affecting fairways are considered in the table, because greens normally are constructed from borrow material. A fairway requires moderately well drained soils, gentle slopes, and a good cover of grass. People should be able to move freely over the fairway on foot or in a golf cart or other light vehicle. The main limitations of the soils for golf fairways are susceptibility to flooding, seasonal high water table, low available water capacity, low natural fertility, poor soil texture, and strong slopes.

Paths and trails are affected mainly by wetness and poor trafficability.

Fallout shelters and basements should be located on well-drained soils that are free of ground water to a depth of 6 feet throughout the year and are not subject to flooding. Depth to bedrock should be 6 feet or more.

Cemeteries should be located on well-drained soils that are free of ground water to a depth of 6 feet throughout the year. Sites on wetter soils should be selected carefully to insure that adequate artificial drainage can be provided. The soils also should be suited to lawn grasses and ornamental plants. The main properties that limit the use of soils for cemeteries are a high water table and flooding. Depth to bedrock should be 6 feet or more.

Interpretations for other nonfarm uses can be made by determining from the soil descriptions the soil properties and hazards that most affect the intended use.

Engineering Uses of the Soils

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, and systems for storing water, controlling erosion, draining soils, and disposing of sewage. Among the properties most important in engineering are permeability, shear strength, density, shrink-swell potential, available water capacity, grain-size distribution, plasticity, and reaction.

Information concerning these and related properties of the soils in Pinellas County is given in tables 4, 5, and 6. The estimates and interpretations of soil properties in these tables can be used to:

1. Make studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary evaluations that will aid in selecting locations for highways and airports and in planning detailed surveys of the soils at the site.
3. Develop information for the design of drainage systems, farm ponds, diversion terraces, and other structures for soil and water conservation.
4. Locate possible sources of sand, shells, and other materials.
5. Correlate performance of engineering structures with soil mapping units to develop information that can be useful in designing and maintaining such structures.
6. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
7. Supplement other published information, such as maps, reports, and aerial photographs, for the purpose of making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to a particular area.

With the soil map for identification of soil areas, the engineering interpretations reported here can be useful for many purposes. It should be emphasized, however, that these interpretations may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and excavations deeper than the depth of layers here reported.

Some terms used by soil scientists have a special meaning in soil science that may not be familiar to engineers. These terms are defined in the Glossary.

Engineering classification systems

Two systems of soil classification are in general use by engineers. They are the system adopted by the American Association of State Highway Officials (AASHO) (*1*), and the Unified system (*7*) developed by the Waterways Experiment Station, Corps of Engineers, and now used by the U.S. Department of Defense.

The AASHO system is used to classify soils according to those properties that affect use in highway construction. In this system, all soil material is classified in seven principal groups. The groups range from A–1, which consists of soils that have the highest bearing strength and are the best soils for subgrade, to A–7, which consists of soils that have the lowest strength when wet and are the poorest soils for subgrade. Within each group the relative engineering value of a soil material is indicated by a group index number given in parentheses. The numbers range from 0, for the best material, to 20, for the poorest. The group index number is shown in parentheses following the soil group symbol (see table 4). The AASHO classification for tested soils is shown in table 4. The estimated classification for all soils mapped in the county is given in table 5.

In the Unified system, soils are classified as coarse grained, fine grained, or organic according to particle-size distribution, plasticity, liquid limit, and organic-matter content.

There are eight classes of coarse-grained soils. Each class consists of soils in which more than half the particles are larger than 0.074 millimeter. Symbols for these classes are G for gravel and S for sand combined with W for well graded, P for poorly graded, M for silty, or C for clayey.

There are six classes of fine-grained soils. More than half the particles in these soils are smaller than 0.074 millimeter. These classes are designated M for silts, C for clays, and O for organic soils, combined with L for low liquid limit or H for high liquid limit.

Highly organic, or peaty, soils are designated by the symbol Pt.

A significant difference between the Unified system and the system used by the U.S. Department of Agriculture (USDA) is the definition of silt and clay. The Unified system divides fine-grained soils into silt or clay depending upon their physical behavior at various moisture contents. In the USDA system, silt and clay soils are determined by particle size.

Engineering test data

Table 4 shows the results of engineering tests of samples of several soils taken in Pinellas County. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering. Some terms used in table 4 are explained in the following paragraphs.

Moisture density is determined by compacting a sample of soil material several times with a constant compactive effort, each time at a successively higher moisture content. The density or unit weight of the soil material increases until the optimum moisture content is reached. After that the density decreases with an increase in moisture content. The highest density obtained in the compaction test is termed "maximum dry density." Moisture-density data are important in construction, for as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

Mechanical analysis shows the percentage, by weight, of soil particles that pass sieves of specified sizes. Sand and other coarser materials do not pass the No. 200 sieve, but silt and clay do. In the AASHO system, silt is identified as material finer than 0.074 millimeter yet coarser than 0.005 millimeter. Clay is material finer than 0.005 millimeter. The particle-size distribution of materials passing the No. 200 sieve was determined by the hydrometer method.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a solid to a plastic state. The plastic limit is the moisture content at which the soil passes from solid to plastic. If the moisture content is further increased, the material changes from a plastic to a liquid state. The liquid limit is the moisture content at which the material changes from plastic to

TABLE 3.—*Degree and kind of limitation*

Soil series and mapping unit symbol	Foundations for low buildings	Lawns and ornamental plants	Septic tank filter fields	Paved highways, airports, streets, roads, and parking areas	Unpaved roads, streets, and parking areas
Adamsville: Ad	Moderate: water table.	Moderate: water table; very low available water capacity; low natural fertility.	Severe: water table.	Severe: water table.	Moderate: water table; sand texture.
Astatula:					
AfB	Slight	Moderate: very low available water capacity; low natural fertility.	Slight	Slight	Severe: loose sand
AfC	Moderate: slope	Moderate: very low available water capacity; low natural fertility.	Severe: slope; pollution hazard.	Moderate: slope	Severe: loose sand
As	Slight	Moderate: very low available water capacity; low natural fertility.	Moderate: water table.	Moderate: water table.	Moderate: sand texture.
Astor: At, Au	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.
Charlotte: Ch	Severe: water table; flooding.	Severe: water table; flooding; very low available water capacity; low natural fertility.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.
Coastal beaches: Co	Very severe: flooding.	Very severe: water table; flooding; salinity.	Very severe: flooding.	Very severe: tidal flooding.	Very severe: tidal flooding.
Elred: Ed	Severe: water table.	Moderate: water table; low natural fertility; flooding.	Severe: water table; flooding.	Severe: water table.	Severe: water table.
Felda: Fd, Fe	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.
Fellowship: Fh	Severe: water table; high shrink-swell potential.	Moderate: water table.	Severe: water table; very slow permeability.	Severe: water table; high shrink-swell potential.	Severe: water table.
Immokalee: Im	Severe: water table.	Moderate: water table; low natural fertility; flooding.	Severe: water table; flooding.	Severe: water table.	Severe: water table.
Made land: Ma, Md. Limitations vary because of varying properties of soil material. For Md, however, limitations are very severe for building sites because of low bearing capacity and are very severe for fallout shelters, basements, and cemeteries because of unstable underlying material.					

of soils for selected uses

Campsites and picnic areas	Playgrounds	Golf courses	Paths and trails	Fallout shelters and basements	Cemeteries
Moderate: water table; sand texture.	Severe: sand texture.	Moderate: water table; very low available water capacity; low natural fertility.	Moderate: water table; sand texture.	Severe: water table.	Severe: water table.
Severe: loose sand--	Severe: loose sand--	Moderate: very low available water capacity; low natural fertility.	Severe: loose sand--	Slight-------------	Moderate: very low available water capacity; low natural fertility.
Severe: loose sand--	Severe: loose sand--	Moderate: very low available water capacity; low natural fertility.	Severe: loose sand--	Slight-------------	Moderate: very low available water capacity; low natural fertility.
Moderate: sand texture.	Severe: sand texture.	Moderate: very low available water capacity; low natural fertility.	Moderate: sand texture.	Severe: water table.	Severe: water table.
Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.
Severe: water table; flooding.	Severe: water table; flooding; sand texture.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.
Very severe: flooding.	Very severe: flooding.	Very severe: water table; flooding.	Very severe: flooding.	Very severe: flooding.	Very severe: flooding.
Severe: water table.	Severe: water table.	Severe: water table; low natural fertility.	Severe: water table.	Severe: water table; flooding.	Severe: water table; flooding.
Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.
Moderate: water table.	Moderate: water table.	Moderate: water table.	Moderate: water table.	Severe: water table.	Severe: water table.
Severe: water table.	Severe: water table; sand texture.	Severe: water table; low natural fertility.	Severe: water table.	Severe: water table; flooding.	Severe: water table; flooding.

TABLE 3.—*Degree and kind of limitation*

Soil series and mapping unit symbol	Foundations for low buildings	Lawns and ornamental plants	Septic tank filter fields	Paved highways, airports, streets, roads, and parking areas	Unpaved roads, streets, and parking areas
Manatee: Mn	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.
Myakka: My	Severe: water table.	Moderate: water table; low natural fertility; flooding.	Severe: water table; flooding.	Severe: water table.	Severe: water table.
Okeechobee: Ok	Very severe: water table; flooding; low bearing capacity.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding; very poor traffic supporting capacity; high potential subsidence.	Very severe: water table; flooding; very poor traffic supporting capacity.
Oldsmar: Om	Severe: water table.	Moderate: water table; flooding.	Severe: water table; flooding.	Severe: water table.	Severe: water table.
Orlando: Or	Severe: water table.	Moderate: water table; flooding.	Severe: water table; flooding.	Severe: water table.	Severe: water table.
Palm Beach: Pa	Slight	Moderate: very low available water capacity; low natural fertility.	Severe: pollution hazard.	Slight	Severe: loose sand.
Pamilico: Pc	Very severe: low bearing capacity; water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding; very poor traffic supporting capacity; high potential subsidence.	Very severe: water table; flooding; very poor traffic supporting capacity.
Paola: PdB	Slight	Moderate: very low available water capacity; low natural fertility.	Severe: pollution hazard.	Slight	Severe: loose sand.
Pinellas: Pf	Severe: water table.	Moderate: water table; low natural fertility; flooding.	Severe: water table; flooding.	Severe: water table.	Severe: water table.
Placid: Pn	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.
Pomello: Po	Moderate: water table.	Moderate: very low available water capacity; low natural fertility.	Moderate: water table.	Slight	Severe: loose sand.
Pompano: Pp, Ps	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.
Spoil banks: Sp. Limitations vary because of varying properties of soil material.					

of soils for selected uses—Continued

Campsites and picnic areas	Playgrounds	Golf courses	Paths and trails	Fallout shelters and basements	Cemeteries
Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.
Severe: water table.	Severe: water table; sand texture.	Moderate: water table; low natural fertility.	Severe: water table.	Severe: water table; flooding.	Severe: water table; flooding.
Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.
Severe: water table.	Severe: water table; sand texture.	Severe: water table; flooding; low natural fertility.	Severe: water table.	Severe: water table; flooding.	Severe: water table; flooding.
Severe: water table.	Severe: water table; sand texture.	Severe: water table.	Severe: water table.	Severe: water table; flooding.	Severe: water table; flooding.
Severe: loose sand	Severe: loose sand	Moderate: very low available water capacity; low natural fertility.	Severe: loose sand	Severe: water table.	Severe: water table.
Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.
Severe: loose sand	Severe: loose sand	Moderate: very low available water capacity; low natural fertility.	Severe: loose sand	Slight	Moderate: very low available water capacity; low natural fertility.
Severe: water table.	Severe: water table; sand texture.	Moderate: water table; low natural fertility.	Severe: water table.	Severe: water table; flooding.	Severe: water table; flooding.
Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.
Severe: loose sand	Severe: loose sand	Moderate: very low available water capacity; low natural fertility.	Severe: loose sand	Moderate: water table.	Moderate: water table; very low available water capacity.
Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.	Severe: water table; flooding.

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TABLE 3.—*Degree and kind of limitation*

Soil series and mapping unit symbol	Foundations for low buildings	Lawns and ornamental plants	Septic tank filter fields	Paved highways, airports, streets, roads, and parking areas	Unpaved roads, streets, and parking areas
St. Lucie:					
StB	Slight	Moderate: low available water capacity; low natural fertility.	Slight	Slight	Severe: loose sand
StC	Moderate: slope	Moderate: very low available water capacity; low natural fertility.	Moderate: slope	Moderate: slope	Severe: loose sand
Su	Slight	Moderate: very low available water capacity; low natural fertility.	Severe: pollution hazard.	Slight	Severe: loose sand
Terra Ceia: Tc	Very severe: water table; flooding; low bearing capacity; high potential subsidence.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding; very poor traffic supporting capacity; high potential subsidence.	Very severe: water table; flooding; high potential subsidence.
Tidal marsh: Td	Very severe: water table; flooding; low bearing capacity; salinity.	Very severe: water table; flooding; salinity.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.
Tidal swamp: Ts	Very severe: water table; flooding; low bearing capacity; salinity.	Very severe: water table; flooding; salinity.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.
Urban land: Ub, Uc, Uk, Um, Up, Uw. Limitations vary because of varying properties of soil material.					
Wabasso: Wa	Severe: water table.	Moderate: water table; low natural fertility; flooding.	Severe: water table; flooding.	Severe: water table	Severe: water table
Wauchula: Wc	Severe: water table.	Moderate: water table; low natural fertility; flooding.	Severe: water table; permeability; flooding.	Severe: water table	Severe: water table

of soils for selected uses—Continued

Campsites and picnic areas	Playgrounds	Golf courses	Paths and trails	Fallout shelters and basements	Cemeteries
Severe: loose sand	Severe: loose sand	Moderate: very low available water capacity; low natural fertility.	Severe: loose sand	Slight	Moderate: very low available water capacity.
Severe: loose sand	Severe: loose sand	Moderate: very low available water capacity; low natural fertility.	Severe: loose sand	Slight	Moderate: very low available water capacity.
Severe: loose sand	Severe: loose sand	Moderate: very low available water capacity; low natural fertility.	Severe: loose sand	Slight	Severe: water table.
Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; poor trafficability.	Very severe: water table; flooding.	Very severe: water table; flooding.
Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding; salinity.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.
Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding; salinity.	Very severe: water table; flooding.	Very severe: water table; flooding.	Very severe: water table; flooding.
Severe: water table	Severe: water table; sand texture.	Moderate: water table; low natural fertility.	Severe: water table	Severe: water table; flooding.	Severe: water table; flooding.
Severe: water table	Severe: water table; sand texture.	Moderate: water table; low natural fertility.	Severe: water table	Severe: water table; flooding.	Severe: water table; flooding.

TABLE 4.—*Engineering*

[Tests performed by Florida Department of Transportation (FDOT) in accordance with

Soil name and location	Parent material	FDOT report number	Depth	Moisture density[1]	
				Maximum dry density	Optimum moisture content
Adamsville fine sand:			*In.*	*Lb./cu. ft.*	*Pct.*
1,200 feet north of State Road 580, 1⅜ miles west of U.S. Highway 19, 1½ miles northeast of Dunedin, SW¼NW¼ sec. 25, T. 28 S., R. 15 E. (Modal profile)	Acid marine sand.	21 22	6–17 17–38	104 108	12 13
¾ mile west of County Road 70, ⅝ mile north of State Road 580, NW¼SE¼NW¼ sec. 24, T. 28 S., R. 15 E. (Less mottling in C horizon than in modal)	Acid marine sand.	71 72	5–17 17–27	105 107	13 13
Astatula fine sand, 0 to 5 percent slopes:					
700 feet northeast of SCL Railroad overpass, SE¼NE¼ sec. 26, T. 27 S., R. 15 E. (Modal)	Acid marine sand.	1 22	18–70 70–84	104 103	16 15
⅜ mile south of Gandy Boulevard, ¼ mile southeast of Garden of Peace Cemetery, SE¼NE¼NE¼ sec. 26, T. 30 S., R. 16 E. (Mottling in C horizon)	Acid marine sand.	19 20	35–60 60–82	103 103	15 15
1⅛ miles south of State Road 582 and ¼ mile west of county line, NE¼NE¼NE¼ sec. 24, T. 27 S., R. 16 E. (Moderately shallow to water table)	Acid marine sand.	44 45 46	8–24 24–45 51–84	105 105 104	15 15 16
Elred fine sand:					
⅝ mile east of County Road 265 and 3 miles northeast of Pinellas Park, NW¼SE¼SW¼ sec. 11, T. 30 S., R. 16 E. (Modal)	Sandy over loamy marine sediments.	65 66	9–17 30–35	105 112	15 14
5/16 mile north of junction of State Road 694 and County Road 149, 2½ miles northeast of Pinellas Park, NE¼SE¼SW¼ sec. 23, T. 30 S., R. 16 E. (Thick, strong Bir horizon)	Sandy over loamy marine sediments.	40 41 43	5–13 16–24 33–42	102 103 114	16 15 12
¼ mile east of County Road 265 and ¼ mile north of State Road 688, SE¼NW¼SW¼ sec. 2, T. 30 S., R. 16 E. (Bt horizon coarser in texture and brighter in color than in modal)	Sandy over loamy marine sediments.	73 74	18–25 25–32	106 113	14 13
Felda fine sand, ponded:					
⅜ mile northeast of junction of State Road 686 and 9th Street North, NE¼SE¼NE¼ sec. 18, T. 30 S., R. 16 E. (Modal)	Stratified marine sand and sandy, loamy sediments.	38 39	8–26 26–34	102 114	15 13
Manatee loamy fine sand:					
500 feet north of intersection of 62nd Avenue North and 62nd Street North, SW¼SW¼NE¼ sec. 32, T. 30 S., R. 16 E. (Modal)	Loamy marine sediments.	11 12	18–34 34–44	112 114	15 13
Myakka fine sand:					
Southeast corner of junction of State Road 688 and 49th Street North, NW¼NE¼NE¼ sec. 9, T. 30 S., R. 16 E. (Modal)	Acid marine sand.	49 50 51	4–16 16–25 30–54	100 98 107	16 17 14
⅜ mile east of Starkey Road, ⅝ mile north of 54th Avenue North, NW¼SE¼NE¼ sec. 36, T. 30 S., R. 15. E. (Thinner Bh horizon than in modal)	Acid marine sand.	16 17 18	14–17 40–48 56–65	100 104 101	15 15 17

See footnotes at end of table.

test data

standard procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analysis [2]							Liquid limit	Plasticity index	Classification [3]	
Percentage passing sieve—			Percentage smaller than—							
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO	Unified
							Pct.			
100	99	9	8	7	5	4	[4] NP	[4] NP	A–3(0)	SP–SM
100	99	8	7	6	5	4	NP	NP	A–3(0)	SP–SM
100	99	7	6	5	2	1	NP	NP	A–3(0)	SP–SM
100	99	6	5	4	2	1	NP	NP	A–3(0)	SP–SM
100	96	2	2	2	0	0	NP	NP	A–3(0)	SP
100	97	1	1	1	0	0	NP	NP	A 3(0)	SP
100	99	2	2	1	1	0	NP	NP	A–3(0)	SP
100	99	3	3	3	1	1	NP	NP	A–3(0)	SP
100	97	3	2	1	0	0	NP	NP	A–3(0)	SP
100	98	3	2	1	0	0	NP	NP	A–3(0)	SP
100	97	2	1	0	0	0	NP	NP	A–3(0)	SP
100	97	2	2	1	1	0	NP	NP	A–3(0)	SP
100	95	23	23	22	19	18	29	14	A–2–6(0)	SC
100	98	1	1	0	0	0	NP	NP	A–3(0)	SP
100	98	3	3	1	0	0	NP	NP	A–3(0)	SP
100	98	13	12	11	11	10	NP	NP	A–2–4(0)	SM
100	97	4	4	3	1	0	NP	NP	A–3(0)	SP
100	97	13	12	11	10	9	NP	NP	A–2–4(0)	SM
100	98	2	2	1	0	0	NP	NP	A–3(0)	SP
100	99	19	18	16	15	15	23	6	A–2–4(0)	SM–SC
100	97	17	16	14	13	12	22	7	A–2–4(0)	SC–SM
100	97	23	20	19	15	14	22	8	A–2–4(0)	SC
100	98	3	3	1	0	0	NP	NP	A–3(0)	SP
100	98	8	7	4	3	1	NP	NP	A–3(0)	SP–SM
100	98	5	5	3	2	1	NP	NP	A–3(0)	SP–SM
100	99	7	6	5	4	3	NP	NP	A–3(0)	SP–SM
100	99	4	4	4	2	2	NP	NP	A–3(0)	SP
100	100	1	1	1	1	0	NP	NP	A–3(0)	SP

TABLE 4.—*Engineering*

Soil name and location	Parent material	FDOT report number	Depth	Moisture density [1] Maximum dry density	Moisture density [1] Optimum moisture content
			In.	*Lb./cu. ft.*	*Pct.*
Oldsmar fine sand:					
¼ mile southeast of junction of State Roads 584 and 580, ¾ mile northwest of Oldsmar. (Modal)	Sandy over loamy marine sediments.	27	12–34	100	16
		28	34–38	106	14
		29	38–44	105	14
		30	44–65	111	15
Orlando fine sand, wet variant:					
¼ mile south of junction of State Road 584 and County Road 39, 1⅛ miles east, 1½ miles southeast of Palm Harbor. (Modal)	Acid marine sand.	26	29–43	109	13
Palm Beach sand:					
⅜ mile west of junction of State Road 693 and Bayway. (Modal)	Sandy marine sediments and shell fragments.	67	20–44	104	16
Paola fine sand, 0 to 5 percent slopes:					
⅜ mile north of junction of County Road 77 and State Road 582, 200 yards west, NE¼NE¼ sec. 8, T. 27 S., R. 16 E. (Modal)	Acid marine sand.	4	50–86	102	16
¼ mile north of SCL Railroad east of Salt Lake, NW¼ SE¼ sec. 5, T. 27 S., R. 16 E. (Thinner A2 horizon than in modal)	Acid marine sand.	5	21–84	103	15
Pinellas fine sand:					
¾ mile southeast of junction of U.S. Highway 19 and 49th Street North, 200 feet east, SE¼NW¼ sec. 22, T. 30 S., R. 16 E. (Modal)	Sandy over loamy marine sediments and shell fragments.	35	8–18	104	15
		36	18–25	99	20
		37	35–49	113	14
St. Lucie fine sand, 0 to 5 percent slopes:					
3,000 feet east of edge of Lake Tarpon, SW¼SW¼ SW¼ sec. 21, T. 27 S., R. 16 E. (Modal)	Acid marine sand.	9	3–58	98	16
		10	58–82	102	14
Wabasso fine sand:					
¾ mile east of U.S. Highway 19, 2 miles northeast of Pinellas Park, SE¼NE¼SW¼ sec. 15, T. 30 S., R. 16 E. (Modal)	Sandy over loamy marine sediments.	52	5–27	103	15
		53	27–32	103	17
		54	38–44	114	13
½ mile north of junction of State Roads 584 and 586, ¾ mile east on Water Line, NE¼NE¼NE¼ sec. 15, T. 28 S., R. 16 E. (Bt horizon deeper than in modal)	Sandy over loamy marine sediments.	31	12–28	100	16
		32	28–32	105	13
		33	32–36	105	14
		34	42–47	111	15
Wauchula fine sand:					
½ mile west of State Road 590 and ⅜ mile south of County Road 102, 1½ miles north of town of Safety Harbor, SE¼SE¼NW¼ sec. 34, T. 28 S., R. 16 E. (Modal)	Sandy over loamy marine sediments.	23	16–26	101	15
		24	26–33	93	21
		25	49–55	104	18
100 yards southeast of junction of State Roads 580 and 593, NW¼SE¼NW¼ sec. 28, T. 28 S., R. 16 E. (Coarser textured Bt horizon than in modal)	Sandy over loamy marine sediments.	68	9–23	103	14
		69	23–27	100	17
		70	37–65	115	13

[1] Based on AASHO Designation: T 99–57 (*1*).

[2] Mechanical analyses according to AASHO Designation: T 88–57 (*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser

test data—Continued

Mechanical analysis [2]							Liquid limit	Plasticity index	Classification [3]	
Percentage passing sieve—			Percentage smaller than—							
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO	Unified
							Pct.			
100	98	3	2	0	0	0	NP	NP	A-3(0)	SP
100	98	8	7	4	4	3	NP	NP	A-3(0)	SP-SM
100	99	6	5	2	2	2	NP	NP	A-3(0)	SP-SM
100	98	22	21	20	18	18	27	11	A-2-6(0)	SC
100	99	8	7	4	4	3	NP	NP	A-3(0)	SP-SM
94	88	2	2	2	1	0	NP	NP	A-3(0)	SP
100	99	1	1	1	0	0	NP	NP	A-3(0)	SP
100	99	4	4	3	1	1	NP	NP	A-3(0)	SP
100	98	3	3	1	1	0	NP	NP	A-3(0)	SP
100	98	11	10	5	4	3	NP	NP	A-2-4(0)	SP-SM
100	98	19	17	16	16	15	NP	NP	A-2-4(0)	SM
100	98	1	1	1	0	0	NP	NP	A-3(0)	SP
100	98	2	2	2	0	0	NP	NP	A-3(0)	SP
100	98	2	2	1	0	0	NP	NP	A-3(0)	SP
100	98	8	7	4	3	2	NP	NP	A-3(0)	SP-SM
100	98	14	10	3	2	1	NP	NP	A-2-4(0)	SM
100	98	3	2	1	0	0	NP	NP	A-3(0)	SP
100	98	9	8	5	4	3	NP	NP	A-3(0)	SP-SM
100	98	7	6	4	3	2	NP	NP	A-3(0)	SP-SM
100	98	20	19	17	16	15	25	12	A-2-6(0)	SC
100	98	11	7	4	1	0	NP	NP	A-2-4(0)	SP-SM
100	99	21	17	14	9	8	NP	NP	A-2-4(0)	SM
100	99	44	38	32	31	30	33	18	A-6(4)	SC
100	98	6	4	2	1	0	NP	NP	A-3(0)	SP-SM
100	98	11	9	7	3	2	NP	NP	A-2-4(0)	SP-SM
94	92	20	18	17	13	12	NP	NP	A-2-4(0)	SM

than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

[3] Based on the Unified Soil Classification System (7). SCS and BPR have agreed to give all soils having a plasticity index within two points from A-line a borderline classification. An example of a borderline classification is SP-SM.

[4] Nonplastic.

TABLE 5.—*Estimated engineering*

[Absence of data means

Soil name and mapping unit symbol	Flood hazard	Depth to seasonal high water table	Depth from surface	Classification
				USDA
			Inches	
Adamsville: Ad	Once in 20 to 50 years for 2 to 7 days.	Less than 10 inches for 1 or 2 months.	0–80	Fine sand
Astatula:				
AfB	None	More than 80 inches all year	0–80	Fine sand
AfC	None	More than 80 inches all year	0–80	Fine sand
As	None	From 40 to 60 inches for 6 to 12 months.	0–80	Fine sand
Astor:				
At	Every year for 6 months or more.	Less than 10 inches for 6 months or more.	0–26	Fine sand
			26–80	Fine sand
Au	Every year for 6 months or more.	Less than 10 inches for 6 months or more.	(1)	Fine sand
Charlotte: Ch	Every year for 1 to 6 months	Less than 15 inches for 2 to 6 months.	0–80	Fine sand
Coastal beaches: Co	Varies with tide	Varies with tide	(1)	Fine sand, shell
Elred: Ed	Once in 5 to 20 years for 7 to 30 days.	Less than 10 inches for 1 or 2 months.	0–30	Fine sand
			30–35	Fine sandy loam
			35–62	Sand, shell
Felda:				
Fd	Once in 5 to 20 years for 7 to 30 days.	Less than 10 inches for 2 to 6 months.	0–30	Fine sand
			30–41	Fine sandy loam, loamy fine sand.
			41–60	Shell, sand
Fe	Every year for 1 to 6 months	Less than 10 inches for 6 to 12 months.	0–26	Fine sand
			26–38	Fine sandy loam, loamy fine sand.
			38–62	Shell
Fellowship: Fh	None	Less than 10 inches for 1 or 2 months.	0–11	Loamy fine sand
			11–23	Silty clay
			23–70	Clay
Immokalee: Im	Once in 5 to 20 years for 7 to 30 days.	Less than 10 inches for 1 or 2 months.	0–36	Fine sand
			36–50	Fine sand
			50–80	Fine sand
Made land: Ma, Md. No valid estimates can be made.				
Manatee: Mn	Every year for 1 to 6 months	Less than 10 inches for 6 to 12 months.	0–18	Loamy fine sand
			18–44	Fine sandy loam
			44–72	Fine sand
Myakka: My	Once in 5 to 20 years for 7 to 30 days.	Less than 10 inches for 1 to 4 months.	0–16	Fine sand
			16–25	Fine sand
			25–84	Fine sand
Okeechobee: Ok	Every year for 6 to 12 months	Less than 10 inches for 6 to 12 months.	0–26	Muck
			26–55	Peat
Oldsmar: Om	Once in 5 to 20 years for 7 to 30 days.	Less than 10 inches for 1 or 2 months.	0–34	Fine sand
			34–44	Fine sand
			44–65	Fine sandy loam
Orlando: Or	Once in 5 to 20 years for 7 to 30 days.	Less than 10 inches for 1 or 2 months.	0–16	Fine sand
			16–80	Fine sand
Palm Beach: Pa	None	From 40 to 60 inches for 6 to 12 months.	0–80	Sand, shell

See footnotes at end of table.

properties of the soils

no estimates were made]

Classification—Continued		Percentage of coarse fragments more than 3 inches in diameter	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
Unified	AASHO		No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
							In./hr.	*In./in. of soil*	*pH*	
SP, SP–SM	A–3	0	100	100	95–100	3–12	>20	<0. 05	4. 5–5. 5	Low.
SP	A–3	0	100	100	90–99	1–5	>20	<0. 05	4. 5–6. 0	Low.
SP	A–3	0	100	100	90–99	1–5	>20	<0. 05	4. 5–6. 0	Low.
SP–SM, SP	A–3	0	100	100	85–99	2–12	>20	<0. 05	4. 5–6. 0	Low.
SP–SM	A–2	0	100	100	90–99	5–12	6. 3–20. 0	>0. 20	5. 6–6. 5	Low.
SP	A–3	0	100	100	90–99	2–5	6. 3–20. 0	<0. 05	6. 1–7. 8	Low.
SP, SM	A–2 or A–3	0	100	100	85–99	5–12	(1)	(1)	(1)	Variable.
SP–SM, SP	A–3	0	100	100	75–98	2–12	>20	<0. 05	5. 6–8. 4	Low.
------------	------------	(1)	(1)	(1)	(1)	(1)	>20	<0. 05	----------	Low.
SP	A–3	0	100	100	90–99	1–5	6. 3–20. 0	0. 05	5. 6–7. 8	Low.
SC, SM	A–2–6, A–2–4	0	100	100	90–99	12–30	0. 63–2. 0	0. 10–0. 15	6. 6–7. 3	Low.
GP, SP	A–3	5–10	40–80	35–70	30–65	1–5	6. 3–20. 0	<0. 05	6. 1–7. 8	Low.
SP	A–3	0	100	100	90–99	2–5	6. 3–20. 0	<0. 05	5. 1–7. 3	Low.
SM–SC, SC	A–2	0	100	100	90–99	15–35	0. 63–2. 0	0. 10–0. 15	6. 1–7. 8	Low.
GP–SP	A–3	5–10	40–70	35–65	30–60	1–5	6. 3–20. 0	<0. 05	7. 9–8. 4	Low.
SP	A–3	0	100	100	90–99	2–5	6. 3–20. 0	<0. 05	5. 1–7. 3	Low.
SM–SC, SC	A–2–4	0	100	100	90–99	15–35	0. 63–2. 0	0. 10–0. 15	6. 1–7. 8	Low.
GP	A–3	5–10	40–70	35–65	30–60	1–5	6. 3–20. 0	<0. 05	7. 9–8. 4	Low.
SP–SM	A–2	0	100	100	90–99	5–12	0. 63–2. 0	0. 05–0. 10	4. 5–5. 5	Low.
CL, CH, SC	A–6, A–7	0	100	100	90–99	40–60	0. 06–0. 20	0. 10–0. 15	4. 5–5. 5	High.
CL, CH, SC	A–6, A–7	0	100	100	95–99	40–85	<0. 06	0. 10–0. 15	5. 1–6. 0	High.
SP	A–3	0	100	100	80–100	2–10	6. 3–20. 0	<0. 05	4. 5–5. 5	Low.
SP–SM, SM	A–3, A–2	0	100	100	80–100	5–20	0. 63–6. 3	0. 10–0. 15	4. 5–5. 5	Low.
SP	A–3	0	100	100	80–100	2–10	6. 3–20. 0	<0. 05	4. 5–5. 5	Low.
SP–SM	A–2	0	100	100	90–99	5–12	2. 0–6. 3	>0. 20	6. 1–7. 8	Low.
SC, SC–SM	A–2–4	0	100	100	90–99	15–35	0. 63–2. 0	0. 10–0. 15	6. 1–7. 8	Low.
SP	A–3	0	100	100	90–99	2–5	6. 3–20. 0	<0. 05	6. 1–7. 8	Low.
SP, SP–SM	A–3	0	100	100	80–100	2–10	6. 3–20. 0	<0. 05	4. 5–6. 5	Low.
SP–SM, SM	A–3	0	100	100	80–100	5–20	0. 63–2. 0	0. 10–0. 15	4. 5–6. 5	Low.
SP–SM, SP	A–3	0	100	100	80–100	2–10	6. 3–20. 0	<0. 05	4. 5–6. 5	Low.
Pt	------------	0	--------	--------	--------	--------	6. 3–20. 0	>0. 20	5. 6–8. 4	High.[2]
Pt	------------	0	--------	--------	--------	--------	6. 3–20. 0	>0. 20	5. 6–8. 4	High.[2]
SP	A–3	0	100	100	90–99	2–5	6. 3–20. 0	<0. 05	4. 5–5. 5	Low.
SP–SM, SM	A–3	0	100	100	90–99	5–20	2. 0–6. 3	0. 05–0. 10	4. 5–6. 5	Low.
SM–SC, SC	A–2–6	0	100	100	90–99	20–35	0. 63–2. 0	0. 10–0. 15	6. 1–8. 4	Low.
SP–SM	A–3	0	100	100	90–99	5–12	>20	0. 10–0. 15	4. 5–5. 5	Low.
SP–SM	A–3	0	100	100	90–99	5–12	>20	<0. 05	4. 5–5. 5	Low.
SP, GP	A–3, A–1	5–25	35–95	40–94	15–90	1–5	>20	<0. 05	7. 4–8. 4	Low.

TABLE 5.—*Estimated engineering*

Soil name and mapping unit symbol	Flood hazard	Depth to seasonal high water table	Depth from surface	Classification
				USDA
			Inches	
Pamlico muck: Pc	Every year for 6 to 12 months	Less than 10 inches for 6 to 12 months.	0–44 44–65	Muck Fine sand
Paola: PdB	None	More than 80 inches all year	0–80	Fine sand
Pinellas: Pf	Once in 5 to 20 years for 7 to 30 days.	Less than 10 inches for 1 or 2 months.	0–18 18–35 35–54 54–80	Fine sand Fine sand Fine sandy loam Sand
Placid: Pn	Every year for 6 months or more.	Less than 10 inches for 2 to 6 months.	0–17 17–80	Fine sand Fine sand
Pomello: Po	None	From 10 to 40 inches for 1 or 2 months.	0–44 44–59 59–80	Fine sand Fine sand Fine sand
Pompano:				
Pp	Once in 5 to 20 years for 7 to 30 days.	Less than 10 inches for 1 or 2 months.	0–14 14–80	Fine sand Fine sand
Ps	Every year for 1 to 6 months	Less than 10 inches for 2 to 6 months.	0–14 14–80	Fine sand Fine sand
Spoil banks: Sp. No valid estimates can be made.				
St. Lucie:				
StB	None	More than 80 inches all year	0–80	Fine sand
StC	None	More than 60 inches all year	0–80	Fine sand
Su	None	From 10 to 40 inches for less than 2 months.	0–40 40–80	Fine sand Shell
Terra Ceia: Tc	Every year for 6 to 12 months	Less than 10 inches for 6 to 12 months.	0–42 42–65	Muck Peat
Tidal marsh: Td	Daily	Less than 10 inches all year	(1)	(1)
Tidal swamp: Ts	Daily	Less than 10 inches all year	(1)	(1)
Urban land: Ub, Uc, Uk, Um, Up, Uw. No valid estimates can be made.				
Wabasso: Wa	Once in 5 to 20 years for 7 to 30 days.	Less than 10 inches for 1 or 2 months.	0–27 27–38 38–50 50–62	Fine sand Fine sand Fine sandy loam, fine silty clay loam. Shell
Wauchula: Wc	Once in 5 to 20 years for 7 to 30 days.	Less than 10 inches for 1 or 2 months.	0–26 26–35 35–80	Fine sand Fine sand Fine sandy loam, fine silty clay loam.

[1] Variable. [2] High potential subsidence.

properties of the soils—Continued

Classification—Continued		Percentage of coarse fragments more than 3 inches in diameter	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
Unified	AASHO		No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	*In./hr.*	*In./in. of soil*	*pH*	
OL	------------	0	--------	--------	--------	--------	0. 63–2. 0	>0. 20	--------	High.[2]
SP–SM	A–3	0	100	100	90–100	5–12	0. 63–2. 0	0. 05–0. 10	4. 5–5. 5	Low.
SP	A–3	0	100	100	90–100	1–5	>20	<0. 05	4. 5–5. 0	Low.
SP	A–3	0	100	100	90–100	2–5	6. 3–20. 0	<0. 05	5. 6–7. 8	Low.
SP–SM	A–2–4	0	100	100	90–100	5–12	6. 3–20. 0	0. 10–0. 15	6. 6–7. 8	Low.
SM, SM–SC	A–2–4	0	100	100	90–100	12–35	0. 63–2. 0	0. 10–0. 15	6. 6–8. 4	Low.
SP	A–1	0–5	80–100	75–100	60–95	2–5	6. 3–20. 0	<0. 05	7. 9–8. 4	Low.
SP, SP–SM	A–3	0	100	100	90–99	2–12	6. 3–20. 0	0. 15–0. 20	4. 5–5. 5	Low.
SP, SP–SM	A–3	0	100	100	90–99	2–12	6. 3–20. 0	<0. 05	4. 5–5. 5	Low.
SP, SP–SM	A–3	0	100	100	75–100	1–8	6. 3–20. 0	<0. 05	4. 5–5. 5	Low.
SP–SM, SM	A–3, A–2–4	0	100	100	85–100	5–20	2. 0–6. 3	0. 10–0. 15	4. 5–5. 5	Low.
SP, SP–SM	A–3	0	100	100	75–100	4–10	6. 3–20. 0	<0. 05	4. 5–5. 5	Low.
SP, SP–SM	A–3	0	100	100	80–100	4–12	6. 3–20. 0	<0. 05	5. 6–7. 3	Low.
SP, SP–SM	A–3	0	100	100	80–100	4–12	6. 3–20. 0	<0. 05	6. 1–7. 8	Low.
SP, SP–SM	A–3	0	100	100	80–100	4–12	6. 3–20. 0	<0. 05	5. 6–7. 3	Low.
SP, SP–SM	A–3	0	100	100	80–100	4–12	6. 3–20. 0	<0. 05	6. 1–7. 8	Low.
SP	A–3	0	100	100	95–99	1–4	>20	<0. 05	5. 1–5. 5	Low.
SP	A–3	0	100	100	95–99	1–4	>20	<0. 05	5. 1–5. 5	Low.
SP	A–3	0	100	100	95–99	1–4	>20	<0. 05	5. 6–6. 0	Low.
GP	A–3	20–30	20–50	20–45	15–40	1–4	>20	<0. 05	7. 4–7. 8	Low.
OL, PT	------------	0	--------	--------	--------	--------	6. 3–20. 0	<0. 20	7. 4–7. 8	High.[2]
PT	------------	0	--------	--------	--------	--------	------------	------------	6. 6–7. 3	High.[2]
(1)	(1)	0	(1)	(1)	(1)	(1)	(1)	(1)	8. 5–9. 0	Variable.
(1)	(1)	0	(1)	(1)	(1)	(1)	(1)	(1)	8. 5–9. 0	Variable.
SP, SP–SM	A–3	0	100	100	95–100	2–10	6. 3–20. 0	<0. 05	4. 5–5. 5	Low.
SP–SM	A–3	0	100	100	95–100	5–12	2. 0–6. 3	0. 05–0. 10	4. 5–6. 5	Low.
SC, SM	A–2, A–6	0	100	100	95–100	12–35	0. 63–2. 0	0. 10–0. 15	5. 6–7. 8	Low.
GP	A–3	20–30	20–50	20–45	15–40	2–5	6. 3–20. 0	<0. 05	7. 4–7. 8	Low.
SP–SM	A–3, A–2	0	100	100	90–100	5–12	>6. 3	<0. 05	4. 5–5. 5	Low.
SM, SP–SM	A–3, A–2	0	100	100	90–100	10–25	2. 0–6. 3	0. 05–0. 10	4. 5–5. 5	Low.
SC, SM	A–2, A–6	0	100	100	90–100	20–50	0. 63–2. 0	0. 10–0. 15	4. 5–5. 5	Moderate.

TABLE 6.—*Engineering interpretations*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Road fill	Shells	Highway location	Excavated ponds
Adamsville: Ad	Poor: texture	Fair: high water table.	Not available	High water table	Loose sand; unstable side slopes.
Astatula:					
AfB	Poor: texture	Good	Not available	Loose erodible sand	Rapid permeability; deep to water table.
AfC	Poor: texture	Good	Not available	Loose erodible sand; strong slopes.	Rapid permeability; deep to water table; strong slopes.
As	Poor: texture	Good	Not available	Loose erodible sand	Loose sand; rapid permeability; seasonal low water table; unstable side slopes.
Astor: At, Au	Poor: high water table; texture.	Poor: high water table.	Not available	Low position; high water table; frequent flooding.	Loose sand; unstable side slopes.
Charlotte: Ch	Poor: texture	Poor: high water table.	Not suitable	Low position; high water table; frequent flooding.	Loose sand; unstable side slopes.
Coastal beaches: Co	Poor: texture	Poor: tidal flooding.	Good	Low position; frequent flooding; loose sand.	Tidal flooding
Elred: Ed	Poor: texture	Poor: high water table.	Good below a depth of 3 feet.	High water table; occasional flooding.	Loose sandy surface layer; porous shell substratum.
Felda:					
Fd	Poor: texture	Poor: high water table.	Good below a depth of 3 feet.	High water table; occasional flooding.	Loose sandy surface layer; porous shell substratum.
Fe	Poor: texture; high water table.	Poor: high water table.	Good below a depth of 3 feet.	Low position; high water table; frequent flooding.	Frequent flooding
Fellowship: Fh	Poor: texture	Poor: high shrink-swell potential.	Not available	Seepy; slowly permeable; high shrink-swell potential; low traffic-supporting capacity.	Slowly permeable; firm clay; moderately sloping.
Immokalee: Im	Poor: texture	Poor: high water table.	Not available	High water table; occasional flooding.	Loose sand; unstable side slopes.
Made land: Ma, Md. No interpretations; properties too variable.					
Manatee: Mn	Poor: high water table.	Poor: high water table.	Not available	High water table; frequent flooding.	Features generally favorable.
Myakka: My	Poor: texture	Poor: high water table.	Not available	High water table; occasional flooding.	Loose sand; unstable side slopes.
Okeechobee: Ok	Poor: high water table.	Unsuited	Not available	Low position; high water table; high content of organic matter; frequent flooding.	High content of organic matter; frequent flooding.
Oldsmar: Om	Poor: texture	Poor: high water table.	Not available	High water table; occasional flooding.	Loose sand; unstable side slopes.
Orlando: Or	Fair: texture	Fair: high water table.	Not available	High water table; occasional flooding.	Loose sand; unstable side slopes.
Palm Beach: Pa	Poor: texture	Good	Poor	Loose erodible sand	Loose sand; unstable side slopes.

of the soils

Soil features affecting—Continued				
Embankments	Drainage	Sprinkler irrigation	Subsurface irrigation	Ditches and canals
Loose sand; rapid permeability.	Loose erodible sand	Very low available water capacity.	Features generally favorable.	Loose erodible sand; unstable side slopes.
Loose sand; rapid permeability.	No drainage needed	Very low available water capacity.	Very rapid permeability; deep to water table.	Loose erodible sand; unstable side slopes.
Loose erodible sand; rapid permeability.	No drainage needed	Very low available water capacity.	Very rapid permeability; deep to water table; strong slopes.	Loose erodible sand; unstable side slopes.
Loose erodible sand; rapid permeability.	Loose erodible sand	Very low available water capacity.	Very rapid permeability; seasonal low water table.	Loose erodible sand; moderate slopes.
Low position; frequent flooding.	Low position; loose sand; no suitable outlets in some areas.	Frequent flooding	Frequent flooding	Loose erodible sand unstable side slopes.
Low position; frequent flooding.	Low position; loose sand; no suitable outlets in some areas.	Very low available water capacity; frequent flooding.	Frequent flooding	Loose erodible sand; unstable side slopes.
Tidal flooding	Tidal flooding	Tidal flooding	Tidal flooding	Loose erodible sand; unstable side slopes.
Loose sand surface layer; rapid permeability.	Loose erodible sandy surface layer.	Low available water capacity.	Features generally favorable.	Loose erodible sandy surface layer.
Loose sandy surface layer; rapid permeability.	Loose erodible sandy surface layer.	Low available water capacity.	Features generally favorable.	Loose erodible sandy surface layer.
Low position; frequent flooding.	Low position; moderate permeability; frequent flooding.	Frequent flooding	Frequent flooding	Loose erodible sandy surface layer.
Low bearing capacity; high shrink-swell potential.	Very slow permeability; seepy.	Slow percolation; highly erodible.	Slow permeability; gentle slopes.	Plastic clay subsoil.
Loose sand; rapid permeability.	Loose erodible sand	Very low available water capacity.	Features generally favorable.	Loose erodible sand; unstable side slopes.
Low position; frequent flooding.	Moderately permeable subsoil.	Moderately permeable subsoil.	Frequent flooding	Features generally favorable.
Loose sand; rapid permeability.	Loose erodible sand	Very low available water capacity.	Features generally favorable.	Loose erodible sand; unstable side slopes.
Low bearing capacity; high water table; frequent flooding.	Low position; inadequate outlets; rapid oxidation.	Frequent flooding	Frequent flooding	High content of organic matter.
Loose sand; rapidly permeable surface layer.	Loose erodible sand	Low available water capacity.	Features generally favorable.	Loose erodible sand; unstable side slopes.
Loose sand; rapid permeability.	Loose erodible sand	Features generally favorable.	Features generally favorable.	Loose erodible sand; unstable side slopes.
Loose sand; rapid permeability.	Loose sand	Very low available water capacity.	Seasonal low water table	Loose erodible sand; unstable side slopes.

TABLE 6.—*Engineering interpretations*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Road fill	Shells	Highway location	Excavated ponds
Pamlico: Pc	Poor: high water table.	Unsuited	Not available	Low position; high water table; high content of organic matter; frequent flooding.	High content of organic matter; frequent flooding.
Paola: PdB	Poor: texture	Good	Not available	Loose erodible sand	Very rapid permeability; deep to water table.
Pinellas: Pf	Poor: texture	Fair: high water table.	Good below a depth of 4 feet.	High water table; occasional flooding.	Loose sandy surface layer; shell substratum.
Placid: Pn	Poor: texture	Poor: high water table.	Not available	Low position; high water table; frequent flooding.	Loose sand; unstable side slopes.
Pomello: Po	Poor: texture	Good	Not available	Loose sand	Rapid permeability; seasonal low water table; loose sand; unstable side slopes.
Pompano:					
Pp	Poor: texture	Poor: high water table.	Not available	High water table	Loose sand; unstable side slopes.
Ps	Poor: texture	Poor: high water table.	Not available	Low position; high water table; frequent flooding.	Loose sand; unstable side slopes.
Soil banks: Sp. No interpretations; properties too variable.					
St. Lucie:					
StB	Poor: texture	Good	Not available	Loose sand; difficult to establish protective cover vegetation.	Very rapid permeability; deep to water table; loose sand; unstable side slopes.
StC	Poor: texture	Good	Not available	Loose sand; difficult to establish protective cover vegetation.	Very rapid permeability; deep to water table; loose sand; unstable side slopes; strong slopes.
Su	Poor: texture	Good	Good below a depth of 40 inches.	Loose sand	Very rapid permeability; deep to water table; loose sand; unstable side slopes; shell substratum.
Terra Ceia: Tc	Poor: high water table.	Unsuited	Not available	Low position; high water table; high content of organic matter; frequent flooding.	High content of organic matter; frequent flooding.
Tidal marsh: Td	Unsuited	Poorly suited to unsuited: high water table.	Not available	Low position; high water table; frequent flooding; high content of organic matter in some areas.	High content of organic matter; frequent flooding.
Tidal swamp: Ts	Unsuited	Poorly suited to unsuited: high water table.	Not available	Low position; high water table; frequent flooding; high content of organic matter in some areas.	High content of organic matter; frequent flooding.

of the soils—Continued

Soil features affecting—Continued				
Embankments	Drainage	Sprinkler irrigation	Subsurface irrigation	Ditches and canals
Low bearing capacity; high water table; frequent flooding.	Low position; inadequate outlets; rapid oxidation.	Frequent flooding	Frequent flooding	High content of organic matter.
Loose erodible sand; rapid permeability.	No drainage needed	Very low available water capacity.	Very rapid permeability; deep to water table.	Loose erodible sand; unstable side slopes.
Loose sand; rapidly permeable surface layer.	Loose erodible surface layer; slowly permeable subsoil.	Low available water capacity.	Carbonates accumulated in surface layer impede movement of water.	Loose erodible sandy surface layer.
Low position; frequent flooding.	Low position; loose sand; no suitable outlets in some areas.	Frequent flooding	Frequent flooding	Loose erodible sand; unstable side slopes.
Rapid permeability; loose erodible sand.	Loose erodible sand	Very low available water capacity.	Rapid permeability; seasonal low water table.	Loose erodible sand; unstable side slopes.
Loose sand; rapid permeability.	Loose erodible sand	Very low available water capacity.	Features generally favorable.	Loose erodible sand; unstable side slopes.
Loose sand; rapid permeability; frequent flooding.	Low position; loose sand; no suitable outlets in some areas.	Very low available water capacity; frequent flooding.	Frequent flooding	Loose erodible sand; unstable side slopes.
Loose sand; erodible; very rapid permeability.	No drainage needed	Very low available water capacity.	Very rapid permeability; deep to water table.	Loose erodible sand; unstable side slopes.
Loose sand; erodible; very rapid permeability.	No drainage needed	Very low available water capacity.	Very rapid permeability; deep to water table; strong slopes.	Loose erodible sand; unstable side slopes.
Very rapid permeability; loose sand; erodible.	Loose erodible sand	Very low available water capacity.	Very rapid permeability; seasonal low water table.	Loose erodible sand; unstable side slopes.
Low bearing value; high water table; frequent flooding.	Low position; inadequate outlets; rapid oxidation.	Frequent flooding	Frequent flooding	High content of organic matter.
Low position; frequent flooding; variable soil material.	Low position; frequent flooding.	Frequent flooding	Frequent flooding	Frequent flooding; variable soil material.
Low position; frequent flooding; variable soil material.	Low position; frequent flooding.	Frequent flooding	Frequent flooding	Frequent flooding variable soil material.

TABLE 6.—*Engineering interpretations*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Road fill	Shells	Highway location	Excavated ponds
Urban land: Ub, Uc, Uk, Um, Up, Uw. No interpretations; properties too variable.					
Wabasso: Wa	Poor: texture	Poor: high water table.	Good below a depth of 4 feet.	High water table; occasional flooding.	Loose sandy surface layer; shell substratum.
Wauchula: Wc	Poor: texture	Fair: high water table.	Not available	High water table; occasional flooding.	Loose sandy surface layer.

liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Engineering properties of the soils

Table 5 gives estimates of soil properties important in engineering. The estimates are based on soil test data given in table 4, on experience in working with the soils, and on experience with similar soils in other counties. The estimates apply only to soils in Pinellas County. Some of the terms used in table 5 are defined in the following paragraphs.

Flood hazard refers to water standing or flowing above the surface of soil that is not artificially drained. Depth to the seasonal high water table refers to the highest level the water table is likely to reach during a normal wet season.

Permeability refers to the rate at which water moves downward through undisturbed and uncompacted soil when it is not restricted by a water table. The rate is expressed in inches per hour.

The available water capacity, measured in inches of water per inch of soil, is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. The following terms are used to express available water capacity: less than 0.05 inch, *very low;* 0.05 to 0.10, *low;* 0.10 to 0.15, *medium;* 0.15 to 0.20, *high;* and more than 0.20, *very high.*

Reaction refers to the acidity or alkalinity of the soils. It is the estimated range in pH values for each major horizon as determined in the field. A pH of 7 indicates a neutral soil, a lower pH value indicates acidity, and a higher value indicates alkalinity.

The shrink-swell potential of a soil refers to the change in volume that results from a change in moisture content. It is estimated on the basis of the amount and type of clay. In general, soils classified as CH in the Unified system or A–7 in the AASHO system have high shrink-swell potential. Clean sand and gravel and soils that contain only a small amount of nonplastic to slightly plastic soil material have low shrink-swell potential.

Engineering interpretations

Table 6 rates the soils according to their suitability as a source of topsoil, road fill, and shells. It also gives features that adversely affect the use of the soils for highways, farm ponds, embankments, drainage and irrigation systems, and ditches and canals. These features should be taken into account in considering a soil for the stated use. Terms used in table 6 are defined in the following paragraphs.

Topsoil is fertile soil material that is used to topdress roadbanks, parks, gardens, and lawns. Suitability as a source for topsoil is affected by the surface texture and the organic-matter content of the soil material and by the depth of the water table. For example, Manatee loamy fine sand, which has a favorable surface texture and high organic-matter content, is rated poor as a source of topsoil because a high water table severely restricts excavation.

Road fill is borrow material used for embankments that support the subbase and base courses below the surface of a road. Suitability as a source of road fill is affected by the texture of the soil, the natural content of water, the shrink-swell potential, and the ease of excavation. Generally, soils that are clayey have a high shrink-swell potential and are not suitable road fill material, whereas sandy soils that contain some binder are suitable. Wetness or a high water table affects the ease of excavation. In Pinellas County, many sandy soils that have otherwise favorable characteristics have a high water table and are rated poor as road fill.

Shells are used in much the same way as road fill material. Suitability as a source of shells is affected mainly by the presence, extent, and quality of workable deposits. A high water table and flooding affect the ease of excavation.

Highway location is affected by a high water table, flood hazard, and seepage, and by the presence of sandy, loamy, or clayey layers in the soil that affect the bearing capacity and the stability of roadbeds (fig. 4).

Farm ponds commonly are constructed by excavating to a depth of several feet below the normal water table. Ground water fills the excavation, and the water level *of the soils*—Continued

Soil features affecting—Continued				
Embankments	Drainage	Sprinkler irrigation	Subsurface irrigation	Ditches and canals
Loose sandy surface layer; rapid permeability.	Loose erodible surface layer; moderately permeable subsoil.	Low available water capacity.	Features generally favorable.	Loose erodible sandy surface layer.
Loose sandy surface layer; rapid permeability.	Loose erodible surface layer; moderately permeable subsoil.	Low available water capacity.	Features generally favorable.	Loose erodible sandy surface layer.

***Figure 4.*—Asphalt street built on Pamlico muck. Poor bearing capacity of the muck caused the asphalt to crack.**

at any given time depends upon the height of the water table. Suitability of soils for excavated ponds depends mainly on the seepage rate and the stability of banks and side slopes.

Embankments consist of borrow material used to impound water. Soil features affecting this use are permeability, erodibility, and texture.

Surface and subsurface agricultural drainage systems are affected mainly by the availability of drainage outlets, the elevation of the soil, and the permeability of the least permeable layers.

Sprinkler irrigation and subsurface irrigation are the two methods commonly practiced in Pinellas County. Water for sprinkler irrigation is obtained from wells, ditches, lakes, and irrigation pits. Subsurface irrigation can be used on nearly level soils that have a water table near the surface. Soil features that affect irrigation are texture, depth to the water table, available water capacity, permeability, elevation, major surface irregularities, and flood hazards.

Open ditches and canals are used for controlling the level of the water table, for subsurface irrigation, and for drainage. Soil features affecting this use are mainly texture, slope, and erodibility.

Crops and Pasture

Most of the soils in Pinellas County have severe limitations for crops and pasture. These limitations must be overcome before cultivated crops can be grown successfully or the soils can be used for improved pasture.

Many soils are affected by a fluctuating water table. During the rainy season, the table rises and crops are damaged by excess water in the root zone. During droughty periods, the water table drops and crops are damaged by a shortage of water. A system that combines drainage and irrigation can be used to overcome these hazards (fig. 5).

Erosion generally is not a serious hazard because most of the soils are nearly level and very permeable. However, ditchbanks and dikes are highly erodible and require protective vegetation.

Most of the soils have low available water capacity, low natural fertility, and low capacity to hold plant nutrients. Response to fertilizer varies with the kind of soil and level of management, but heavy applications of fertilizer are needed on most soils. Intensive management generally is practical where climatic conditions are favorable.

Some soils that occupy relatively high positions on the landscape have a deep water table, are very rapidly permeable, and are somewhat droughty. If cultivated, they need to be irrigated. If used for citrus or peach trees and other deep-rooted plants, they need supplemental water during extended dry periods.

The droughty Astatula fine sand on ridgeland in the northwestern part of the county and a considerable acreage of the wet Adamsville and Myakka soils are used for citrus. All need irrigation. The Astatula soil is suited to sprinkler irrigation. For Adamsville and Myakka soils, subsurface or sprinkler irrigation can be used. In addition, these soils need intensive water control, including deep drainage ditches and bedding.

Citrus trees generally require fertilizers and pest control. A cover crop is needed in young groves to protect the soils against blowing and to prevent windblown sand from damaging the young trees. Many growers practice minimum tillage, especially on wetter soils.

About 5,000 acres in the county is used for improved pasture. Fertilizer and lime and good grazing management are needed on all pastures, and drainage is needed in wet areas. Subsurface irrigation is used on some improved pastures to provide adequate water for clover during winter months. Pangolagrass and bahiagrass are the pasture grasses most commonly grown. White clover, hubam clover, and clover-grass mixtures can be grown for winter forage where irrigation is provided. Good pasture not only supplies forage for livestock, but also controls soil blowing and water erosion and increases the organic-matter content of soils (fig. 6).

Current information about suitable crops, improved varieties of plants, and specific management practices can be obtained from local representatives of the Soil Conservation Service, the University of Florida Agricultural Experiment Stations, or the Agricultural Extension Service.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

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

In the capability system all kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These are discussed 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, defined as follows:

Class I soils have few limitations that restrict their use. (None in Pinellas County.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices. (None in Pinellas County.)

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife food and cover. (None in Pinellas County.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit

Figure 5.—**Harvesting oats for green feed on Myakka fine sand. The water table is maintained at optimum level through a system of control ditches. Water is applied by subsurface irrigation in dry periods and drained away in wet periods.**

their use largely to pasture or range, woodland, or wildlife food and cover.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife food and cover.

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

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 IIIw. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, but not in Pinellas County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture or range, woodland, wildlife food and cover, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar pro-

Figure 6.—**Bahiagrass pasture on Myakka fine sand.**

ductivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIw-1 or IVw-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Pinellas County are described and suggestions for the use and management of the soils are given. The soil series represented in a capability unit are named, but this does not mean that all soils in the series are in the unit. To find the unit in which a given soil has been placed, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT IIIs-1

Astatula fine sand, moderately deep water table, is the only soil in this unit. It is a nearly level or gently sloping, sandy soil that has a low organic-matter content and low natural fertility. The available water capacity is very low, and permeability is very rapid. The water table is typically 40 to 60 inches below the surface, but it is closer to the surface for a short time during wet periods and is at a depth of more than 60 inches during dry periods.

The water table within the root zone favors growth of deep-rooted plants. The low available water capacity and rapid permeability, however, cause this soil to be droughty during prolonged dry periods and to be quickly leached of plant nutrients. These and other unfavorable soil properties severely limit the choice of plants and the use of this soil for cultivated crops. Special management is needed.

The native vegetation consists of turkey oak, pine, scattered saw-palmetto, and numerous shrubs and grasses. Most areas have been cleared and planted to citrus or diverted to urban uses. Some small areas are used for pasture.

This soil has a limited capacity to produce cultivated crops. Some crops can be grown under intensive management that includes sprinkler irrigation, soil-building crops or pasture grasses, and frequent heavy applications of fertilizer and lime.

If well managed, this soil is capable of producing improved pasture of deep-rooted grasses. Such grasses utilize water that rises into the root zone from the water table. They grow well if they are fertilized and limed and grazing is controlled.

This soil is well suited to citrus. It does not require drainage or bedding but does require irrigation, particularly in newly established groves. Management should also include frequent applications of fertilizer and lime and the use of cover crops or grass to reduce wind erosion and improve tilth.

CAPABILITY UNIT IIIw-1

Adamsville soils and Orlando, wet variant, soils are in this unit. These are nearly level soils on low ridges in the flatwoods and near the base of slopes in the ridges. They have a low to medium organic-matter content and low to moderate natural fertility. They have low or very low available water capacity, are very rapidly permeable, and are rapidly leached of plant nutrients. The water table is typically 10 to 40 inches below the surface, but it rises to the surface during periods of heavy rainfall and drops to a depth below 40 inches during periods of extended drought.

Periodic wetness and droughtiness and unfavorable soil properties severely limit the choice of plants and the use of these soils for cultivated crops. The response to management, however, is good.

The native vegetation is dominantly oak, pine, saw-palmetto, and numerous woody shrubs and grasses. Most large areas have been cleared and planted to citrus. Some areas are used for improved pasture.

If well managed, these soils are suitable for most kinds of farming and for most crops commonly grown. Management should include a water-control system designed to remove excess surface water and provide a means of irrigation in dry seasons, cover crops to protect the soil and improve tilth, liberal applications of fertilizer, and additions of lime.

High-quality pasture of improved grasses or grass-clover mixtures can be produced if the soils are well managed. Management should provide for removal of excess surface water in wet periods and for irrigation in dry periods. Also needed are liberal applications of fertilizer, additions of lime, and control of grazing.

If well managed, these soils are well suited to citrus. They require a drainage system to intercept seepage water and control the depth of the water table. They also require sprinkler irrigation, especially in young groves, cover crops to protect the soil and improve tilth, and frequent applications of fertilizer and lime.

CAPABILITY UNIT IIIw-2

Elred, Felda, Wabasso, and Wauchula soils are in this unit. They have a low organic-matter content, low to moderately low natural fertility, a low available water capacity, and moderate to rapid permeability. The water table is typically at a depth of 10 to 30 inches, but it rises to the surface for a short time during wet periods and drops below a depth of 30 inches during extended dry periods.

Rapid leaching of plant nutrients and periodic wetness and droughtiness severely limit the choice of plants and the use of these soils for cultivated crops. The response to management, however, is good.

The native vegetation is dominantly pine, saw-palmetto, native grasses, and scattered oak and sabal palms. Much of the acreage remains in this vegetation, but a considerable part is under urban development.

These soils are well suited to most kinds of farming. If well managed, they can be used for special flower and truck crops. Such management includes fertilization and liming and a water-control system that provides both drainage and irrigation.

High-quality pasture of improved grasses or grass-clover mixtures can be produced under good management.

If well managed, these soils are well suited to citrus. Management should include bedding, drainage, water table control, irrigation, and frequent applications of fertilizer.

CAPABILITY UNIT IIIw-3

Astor, Felda, Manatee, and Placid soils are in this unit. They are nearly level soils in depressions. They have a water table at or near the surface most of the time, and in many areas they are covered with shallow water several months each year. Astor, Manatee, and Placid soils have a high organic-matter content and a high to very high available water capacity. The Felda soil is medium in organic-matter content and available water capacity. All have permeability that is rapid enough to permit easy functioning of water-control systems that regulate the depth of the water table, and all can be drained easily where natural drainage outlets are available.

Wetness and the need for constant and carefully planned water control severely limit the choice of plants and the use of these soils for cultivated crops. The response to management, however, is good.

The natural vegetation consists of wax myrtle, pickerelweed, maidencane, St. Johnswort, and numerous wetland grasses and other low-growing plants. Much of the acreage remains in native vegetation, but a few large areas have been planted to improved pasture grasses.

Wetness is the main limiting factor in growing special flower and truck crops. The management needed to overcome wetness and other limitations includes cover crops, applications of fertilizer and lime, and a well-designed, constructed, and maintained water-control system that removes excess surface water and regulates the level of internal water.

High-quality pasture of improved grasses or grass-clover mixtures can be produced under good management. Management should include a water-control system that removes excess surface water and provides for subsurface irrigation, frequent applications of fertilizer and small amounts of lime, and control of grazing.

Drained areas are well suited to citrus, but intensive management is required. Management should include bedding and a water-control system, cover crops to protect the beds from wind and water erosion, and proper applications of fertilizer and lime.

Soils are assigned to this capability unit on the assumption that adequate drainage outlets are available and that the major flood hazard can be removed.

CAPABILITY UNIT IIIw-4

Fellowship loamy fine sand, the only soil in this unit, is nearly level and gently sloping to undulating and is on uplands. It has a moderately high organic-matter content and moderately high natural fertility. Permeability is moderate in the surface layer but is very slow in the underlying clayey layers. The water table is perched within a depth of 10 inches 60 days or less each year.

Slow permeability and periodic wetness severely limit the choice of plants and the use of this soil for cultivated crops. The response to management, however, is good.

The natural vegetation consists of oak, hickory, scattered pine and saw-palmetto, and numerous shrubs and grasses. Much of the acreage remains in native vegetation. A few acres are planted to citrus, and a few small areas have been used for improved pasture.

This soil is suited to improved pasture and a few cultivated crops, but it requires intensive management. Periodic wetness and susceptibility to erosion are the principal limitations to the use of this soil for cultivated crops. Clean-tilled crops should not be grown more than one-third of the time. High-quality pasture of improved grasses or grass-clover mixtures can be produced under good management that includes regular use of complete fertilizers and lime and a water-control system designed to remove excess water safely and rapidly.

This soil is only moderately well suited to citrus. The very slowly permeable underlying clayey layers do not favor deep root development. Bedding to remove excess surface water and liberal applications of fertilizer and lime are needed.

CAPABILITY UNIT IIIw-5

Okeechobee, Pamlico, and Terra Ceia, moderately deep variant, soils are in this unit. They are nearly level, very poorly drained organic soils in depressions, swamps, and marshes. These soils are rapidly permeable and have a very high available water capacity. They are covered with shallow water most of the time, but permeability is rapid enough to permit easy functioning of water-control systems that regulate the depth to free water. The soils can be drained easily if adequate drainage outlets are available.

Wetness and the instability of the organic soil material severely limit the choice of plants and the use of these soils for cultivated crops. Constant and carefully planned water-control practices are needed. The response to management is good.

The native vegetation in some areas is mainly sawgrass but includes some pickerelweed and other aquatic grasses and plants. Other areas are wooded with swamp hardwoods and cypress. Most of the acreage remains in native vegetation, but a small part is used for improved pasture. Reclaimed areas are well suited to truck crops and improved pasture.

Excess water is the major limitation to the use of these soils for cultivated crops. If water control is adequate, the soils are excellent for special cultivated crops. Subsidence is a continuing hazard after drainage and initial subsidence. Management that reduces this hazard includes minimum tillage in cultivated areas and flooding in idle areas. Management should also include cover crops, frequent applications of fertilizers high in all plant nutrients except nitrogen, and control of soil reaction.

Under intensive management, these soils produce high-quality pasture of improved grasses or grass-clover mixtures. Management should include a water-control system designed to remove excess surface water and maintain the water table at a shallow depth, adequate applications of fertilizer and lime where needed, and controlled grazing.

These soils are not suited to citrus. They have many soil properties that do not favor citrus trees, and the drainage requirements of this crop cause rapid oxidation of the organic layer.

Soils are assigned to this capability unit on the assumption that adequate drainage outlets are available and that reclamation is feasible.

CAPABILITY UNIT IVs-1

Astatula soils are in this unit. They are excessively drained sandy soils on upland ridges. They have a low organic-matter content and low natural fertility. The available water capacity is very low, and permeability is very rapid. The water table is below a depth of 60 inches throughout the year. The soils are droughty, and plant nutrients leach away rapidly.

Unfavorable soil properties severely limit the choice of plants and the use of these soils for cultivated crops. Erosion is a hazard in strongly sloping areas. Special management is needed. The response to management is moderate to good.

The native vegetation consists of turkey oak, pine, scattered saw-palmetto, and numerous shrubs and grasses. Much of the acreage has been cleared and planted to citrus. A considerable acreage has been urbanized, and many acres planted to citrus have been cleared for urban development. A small acreage is in pasture.

These soils are poorly suited to most cultivated crops. Under intensive management, a few special crops can be grown. Such management includes sprinkler irrigation, soil-building crops or pasture grasses 2 years out of 3, and frequent heavy applications of fertilizer and lime.

If well managed, these soils have a capacity to produce good improved pasture consisting of deep-rooted grasses. These grasses make very good growth if they have adequate moisture and are properly fertilized and limed. During dry periods grass production is low.

These soils are well suited to citrus. Sprinkler irrigation, cover crops to improve the soils and protect them from wind and water erosion, and frequent applications of fertilizer and lime are among the management practices needed in citrus groves.

CAPABILITY UNIT IVw-1

Immokalee, Myakka, Oldsmar, and Pinellas soils are in this unit. They are nearly level, poorly drained sandy soils of the flatwoods. The Immokalee and Myakka soils are sandy in all layers. Oldsmar and Pinellas soils have a sandy surface layer and loamy underlying layers. The sandy layers are rapidly permeable and have a low available water capacity. The loamy layers are moderately permeable. All the soils have a low organic-matter content and low natural fertility. The water table is typically at a depth of 10 to 30 inches, but it rises to the surface during wet periods and drops below 30 inches during prolonged dry periods.

Periodic wetness, droughtiness, and generally unfavorable soil properties severely limit the choice of plants and the use of these soils for cultivated crops. The response to management, however, is moderate to good.

The native vegetation is dominantly grasses, sedges, and low-growing shrubs. Numerous scattered stands of pine edge the sloughs, and a few cypress grow in the deeper depressions. Most areas remain in native vegetation. Some small areas have been cleared for improved pasture, and others for a few special crops. Intensive management is needed.

These soils have a very limited capacity to produce most cultivated crops, but under intensive management they are moderately well suited to some truck and flower crops. A well-designed, constructed, and maintained water-control system that gives reliable control of the water table and provides subsurface irrigation is required. Also important are crop rotations that protect the soil and improve tilth and frequent applications of lime and fertilizer.

Good pasture of improved grasses or grass-clover mixtures can be grown under intensive management. Water control, frequent applications of lime and fertilizer, and careful control of grazing are needed.

These soils are poorly suited to citrus because it is difficult to maintain the water level. It is also difficult to maintain fertility because the soils are sandy and are typically low in fertility.

CAPABILITY UNIT IVw-2

Charlotte and Pompano soils are in this unit. They are nearly level, poorly drained soils in shallow depressions and grassy sloughs. They are sandy throughout and have a low organic-matter content and low natural fertility. The available water capacity is very low, and permeability is very rapid. Plant nutrients are leached away rapidly. The water table is within a depth of 10 inches most of the time but rises to the surface during wet periods. Some areas are covered with shallow water during wet periods. The soils can be drained easily if natural outlets are available.

Wetness, the need for constant and carefully planned water control, and generally unfavorable soil properties severely limit the choice of plants and the use of these soils for cultivated crops. The response to management, however, is moderate to good.

The native vegetation consists of stands of pine and an understory of saw-palmetto and a variety of grasses and shrubs. Much of the woodland has been cut over, and only a few scattered pines remain. Natural reseeding, however, has produced numerous stands of small trees.

These soils have a limited capacity to produce cultivated crops. Under intensive management, certain flower and truck crops can be grown. Such management includes (1) water control that provides drainage and irrigation through a well-designed, constructed, and maintained water table control system; (2) grass or other close-growing crops three-fourths of the time to protect the soils and improve tilth; and (3) frequent, heavy applications of lime and fertilizer.

High-quality pasture of improved grasses or grass-clover mixtures can be grown and maintained under intensive management. Water-control measures, frequent applications of lime and fertilizer, and careful management of grazing are needed.

These soils are poorly suited to citrus trees. Adequate water control is difficult because the water table fluctuates and ranges greatly in depth during wet and dry periods. Maintaining fertility is very difficult because of the very sandy nature of the soils.

CAPABILITY UNIT VIs-1

Paola fine sand, 0 to 5 percent slopes, is the only soil in this unit. It is a nearly level to gently sloping, excessively drained soil on upland ridges. It is sandy to a depth of more than 80 inches. The organic-matter content is low, and natural fertility is very low. The available water capacity is very low, and permeability is very rapid. The water table is below a depth of 80 inches at all times.

Unfavorable soil properties so severely limit the growth of most plants that this soil is not considered suitable for the cultivated crops commonly grown. It requires special management if it is used for pasture grasses and a few special crops.

The native vegetation consists mainly of turkey oak, scattered pine, saw-palmetto, a few shrubs, and native grasses. Large sand pine trees grow in some small areas. Most areas remain in this kind of vegetation, but some have been planted to citrus and others have been developed for urban uses.

This soil has very limited capacity to produce cultivated crops. Even under intensive management, only a few special crops, such as watermelons, can be grown. Cover crops are needed to protect the soil from wind erosion and to preserve tilth.

This soil is poorly suited to improved pasture. It is fairly productive of deep-rooted grasses if fertilizer is applied frequently and grazing is carefully controlled.

Under intensive management, this soil is moderately well suited to citrus. Management should include sprinkler irrigation, cover crops to protect the soil from wind and water erosion and to protect small trees from damage by windblown sand, and liberal use of fertilizer and lime.

CAPABILITY UNIT VIs-2

Pomello and St. Lucie soils are in this unit. They are nearly level to gently sloping, moderately well drained soils on low ridges and knolls. The soils are sandy or shelly to a depth of 80 inches or more. They have a very low organic-matter content and very low natural fertility. Both have a very low available water capacity and are very rapidly permeable. The water table is at a depth of 30 to 40 inches for a short time during wet periods, but it is typically between 40 and 60 inches. These soils are very droughty most of the time.

The unfavorable properties of these soils so severely limit the choice of plants that they are not suitable for most cultivated crops. Special management is required if these soils are used for pasture. The response to management is poor.

In some areas the dominant vegetation is sand pine. In others it is saw-palmetto, scattered slash pine, scrub oak, woody shrubs, and native grasses. Many areas are still wooded. Many have been used for urban development.

Fair improved pasture can be developed if this soil is intensively managed. Management should include the use of deep-rooted, drought-resistant grasses, frequent heavy applications of fertilizer and lime, and careful control of grazing.

This soil is not suited to cultivated crops or citrus. It is too porous and dry to respond well to high-level management.

CAPABILITY UNIT VIIs-1

St. Lucie soils are in this unit. They are nearly level to sloping, excessively drained, nearly white sandy soils on upland ridges and hillsides. The soils are sandy to a depth of more than 80 inches. They have a very low organic-matter content and very low natural fertility. All layers are very rapidly permeable and have a very low available water capacity. The water table is below a depth of 60 inches at all times, and the soils are droughty.

Severe droughtiness and inability of the soils to hold plant nutrients severely limit their capacity to produce useful plants. The response to management is poor.

The native vegetation is mainly a sparse growth of sand pine, rosemary bushes, scattered saw-palmetto, smilax, and ground lichens. Many areas are now in this vegetation, but a considerable acreage has been used for urban development.

These soils are not suited to cultivated crops and are poorly suited to improved pasture and citrus.

CAPABILITY UNIT VIIw-1

Only one mapping unit, Astor soils, is in this capability unit. These are nearly level, very poorly drained soils in swamps. They are basically the same as those in capability unit IIIw-3. Dense swamp vegetation and the general lack of suitable drainage outlets make development impractical.

The native vegetation is mainly cypress and water-tolerant hardwoods. Most of the acreage is in native swamp vegetation.

These soils are not suited to cultivated crops or to pasture. The danger of flooding, the general lack of available drainage outlets, and the dense swamp vegetation make reclamation unfeasible.

The natural swampy areas are well suited to cypress trees; most of the large trees have been cut. These swampy areas provide food, shelter, and nesting places for a variety of aquatic birds and habitat for other kinds of wildlife.

Estimated yields

Table 7 shows estimated yields per acre of citrus fruits and pasture grasses that can be expected under good management. For citrus, good management includes applying adequate amounts of fertilizer and lime, controlling insects and diseases, supplying drainage and irrigation where needed, and controlling runoff and erosion. For improved pasture, good management includes irrigating where feasible, applying adequate amounts of fertilizer and lime, controlling grazing, rotating pasture, selecting forage varieties that are well suited to the soils, controlling undesirable plants, and draining excess surface water.

The yields shown in table 7 are based largely on information obtained from farmers and local representatives of agricultural agencies, on comparisons of yields on similar soils in nearby counties, and on records of crop yields. The actual yields obtained may vary from year to year, depending on the weather and other conditions.

Woodland

Nearly a third of Pinellas County is woodland (fig. 7). Pine forest originally covered much of the county, but most of the pine trees have been cut. Large cypress trees and hardwoods in the swamps have been harvested also. Only a few stands are now managed commercially. Most woodland is privately held for real estate investment, and all stands are understocked. About 20,000 acres requires restocking with desirable trees.

In 1965 there were two sawmills in the county. Trees sold commercially are used mainly for veneer and crates. Pulpwood is shipped to mills in the northern part of Florida. Community development has increased the demand for trees and ornamental plants.

Woodland management

The primary importance of woodland in Pinellas County is to protect the soils and to improve their capacity to absorb and store water. The main practices of woodland management are maintaining firebreaks, planting trees and restocking existing stands, and proper cutting.

Firebreaks should be cut and maintained around and through all woodland. Controlled or prescribed burning should be done only with the approval and guidance of the Florida Forest Service, which provides fire protection service for the county.

Most of the woodland is understocked and needs improvement. Tree farming is a good use for most soils, and idle land can be profitably utilized by growing pine trees. Because pines grow well on various kinds of soil with a minimum of care, they are an ideal crop for land not readily suited or needed for other uses. Trees also add to the value of land that may be used later for residential development.

Proper cutting helps to protect the soil, to maintain ground water, and to increase yields. Cutting practices vary according to woodland condition and soils. Landowners can obtain advice from local soil conservationists and foresters.

The soils of Pinellas County have been assigned to nine groups according to their suitability for pine trees. Each group consists of soils that have similar characteristics, respond in about the same way to management, and have about the same productivity.

The soils vary greatly in their suitability for trees. Trees are affected by the depth of the root zone and the ability of the soil to supply moisture. Other significant soil characteristics are the thickness and texture of the surface layer, the organic-matter content, the depth to fine-textured soil material, the aeration of the soil, and the depth to the water table.

TABLE 7.—*Estimated average yields per acre of citrus crops and improved pasture under good management*

[Absence of a yield figure indicates the soil is not suited to the crop specified or data are not available. Urban land and Urban land complexes are not used for citrus or pasture]

Soil name	Citrus fruits		Improved pasture	
	Oranges	Grapefruit	Grass	Grass and clover
	Boxes	*Boxes*	*A.U.M.*[1]	*A.U.M.*[1]
Adamsville fine sand	375	500	7.0	10.0
Astatula fine sand, 0 to 5 percent slopes	400	575	6.5	
Astatula fine sand, 5 to 12 percent slopes	400	575	6.5	
Astatula fine sand, moderately deep water table	425	600	7.0	
Astor fine sand	375	425	8.5	11.0
Astor soils				
Charlotte fine sand	275	350	7.0	10.0
Coastal beaches				
Elred fine sand	425	500	8.5	11.0
Felda fine sand	425	500	8.5	11.0
Felda fine sand, ponded	425	500	8.5	11.0
Fellowship loamy fine sand	400	500	9.0	11.0
Immokalee fine sand	240	400	7.0	10.0
Made land				
Made land, sanitary fill				
Manatee loamy fine sand	425	500	9.0	11.0
Myakka fine sand	300	450	7.0	10.0
Okeechobee muck				
Oldsmar fine sand	240	400	7.0	10.0
Orlando fine sand, wet variant	400	500	8.5	11.5
Palm Beach sand				
Pamlico muck				
Paola fine sand, 0 to 5 percent slopes	350	500		
Pinellas fine sand	275	350	7.0	10.0
Placid fine sand	375	425	8.5	11.0
Pomello fine sand	200	300	5.5	
Pompano fine sand	275	350	7.0	10.0
Pompano fine sand, ponded	275	350	7.5	9.5
Spoil banks				
St. Lucie fine sand, 0 to 5 percent slopes				
St. Lucie fine sand, 5 to 12 percent slopes				
St. Lucie fine sand, shell substratum				
Terra Ceia muck, moderately deep variant				
Tidal marsh				
Tidal swamp				
Wabasso fine sand	350	350	7.5	10.5
Wauchula fine sand	350	450	7.5	10.5

[1] Animal unit month refers to the number of months during a normal growing season that 1 acre will provide grazing for 1 animal unit without injury to the sod. One animal unit is defined as 1 cow, horse, or steer; 5 hogs; or 7 sheep.

Only pine trees are considered in the groupings. Some soils in the county, especially those in low areas and along streams, are suited to hardwoods, however, and some are suited to exotic trees and ornamentals. Landowners should consult local foresters or nurserymen before planting these trees extensively.

The potential growth of pine trees on the soils of a given group is expressed as a site index. The site index is the height, in feet, that a specified kind of tree will reach at 50 years of age. The site indexes given in the groups are based on research, on measurements by foresters and soil scientists, and on the experience of foresters and land managers. These ratings are tentative and subject to change as more information becomes available.

The woodland groups are described in the following paragraphs. To determine in which group a given soil has been placed, refer to the "Guide to Mapping Units" at the back of this survey. Land types are too variable to be be considered in the groupings.

WOODLAND GROUP 1

This group consists of excessively drained sandy soils on ridges and hilltops. These soils are well above ground water level and have very low available water capacity.

The soils in this group are not well suited to commercial production of most pine trees. Sand pine is the main species that grows naturally. Its site index is about 50 feet. The annual growth per acre is 0.6 to 1.0 cord on a well-stocked, uncut natural stand 30 years old.

The soils are droughty, and natural regeneration of trees is unreliable. Mortality of planted seedlings is 50 percent or more, and spot replanting often is necessary. Site preparation and control of weed trees are essential in establishing new stands.

Figure 7.—**Pine and palmetto flatwoods on Wabasso fine sand. Woodland group 6.**

WOODLAND GROUP 2

This group consists of excessively drained sandy soils on ridges and hilltops. These soils are well above ground water level and have very low available water capacity.

The soils in this group are well suited to sand pine, slash pine, and longleaf pine. The site index for all three species is about 60 feet. The annual growth per acre on a well-stocked, uncut natural stand 30 years old is 1.0 to 1.3 cords for slash pine, 0.8 to 1.2 for sand pine, and 0.6 to 0.9 for longleaf pine.

The soils are droughty, and natural regeneration of trees is unreliable. Site preparation and control of weed trees and brush are needed in establishing new stands.

WOODLAND GROUP 3

This group consists of sandy soils that have a water table at a depth of 40 to 60 inches.

Fair to good stands of slash and longleaf pines grow on these soils. The site index is about 70 feet for slash pine and about 60 feet for longleaf pine. The annual growth per acre on a well-stocked, uncut natural stand 30 years old is 1.3 to 1.7 cords for slash pine and 0.8 to 1.2 for longleaf pine.

To insure optimum growth, pine seedlings must be cleared of weed trees and shrubs.

WOODLAND GROUP 4

This group consists of sandy soils that are poorly drained and very strongly acid and of sandy soils that are slightly acid in the underlying layers. The water table normally is at a depth of 10 to 30 inches.

These soils are moderately well suited to slash pine. The site index is about 70 feet for slash pine and 60 feet for longleaf pine and South Florida slash pine. The annual growth per acre on a well-stocked, uncut natural stand 30 years old is 1.0 to 1.5 cords for slash pine and 0.5 to 0.9 for longleaf pine and South Florida slash pine.

Seedlings must be cleared of weed trees, shrubs, and vines. The high water table restricts the root zone, and heavy cuts made in immature stands cause a severe windthrow hazard. Soil wetness restricts planting and logging operations for 3 or 4 months in most years.

WOODLAND GROUP 5

This group consists of somewhat poorly drained, very strongly acid to strongly acid sands that have a water table at a depth of 10 to 40 inches.

These soils are moderately well suited to pine trees. The site index is about 80 feet for slash pine and South Florida slash pine and about 70 feet for longleaf pine. The annual growth per acre on a well-stocked, uncut natural stand 30 years old is 1.0 to 1.5 cords for slash pine, 0.7 to 1.1 for longleaf pine, and 0.6 to 1.1 for South Florida slash pine.

Seedlings must be cleared of weed trees, shrubs, and vines. The high water table restricts the root zone, and heavy cuts made in immature stands cause a severe windthrow hazard. Soil wetness restricts logging and planting operations for 3 or 4 months in most years.

WOODLAND GROUP 6

This group consists of somewhat poorly drained and poorly drained soils. These soils have a sandy surface layer and loamy or clayey underlying layers that are slowly to moderately rapidly permeable. The water table is at a depth of less than 10 inches as much as 60 days every year.

These soils are well suited to pine trees. The site index is about 70 feet for slash pine and South Florida slash pine and 60 feet for longleaf pine. The annual growth per acre on a well-stocked, uncut natural stand 30 years old is 0.9 to 1.3 cords for slash pine, 0.8 to 1.1 for longleaf pine, and 0.7 to 1.2 for South Florida slash pine.

These soils can be planted and seeded, but seedlings must be cleared of weed trees and shrubs. Wetness is a seasonal hazard, and compaction caused by heavy equipment may damage the soils.

WOODLAND GROUP 7

This group consists of very poorly drained, sandy to l amy soils. The underlying layers are moderately permeable and slightly acid to mildly alkaline. The water table is within a depth of 10 inches most of the year.

If drained and well managed, these soils are well suited to pine trees. The site index on drained soils is about 70 feet for slash pine and South Florida slash pine. The annual growth per acre on a well-stocked, uncut natural stand 30 years old is 1.0 to 1.4 cords for slash pine and 0.7 to 1.2 for South Florida slash pine.

Site preparation is needed for new plantings. Plant competition is severe, and in places seedling mortality is high. Drainage is needed to lower the water table and prevent restriction of the root zone.

WOODLAND GROUP 8

This group consists of poorly drained to very poorly drained soils that are sandy to a depth of more than 80 inches. Permeability is rapid to very rapid. The water table is within a depth of 10 inches most of the year.

If drained and well managed, these soils are well suited to pine trees. The site index is about 80 feet for slash pine and South Florida slash pine, and less than 70 feet for longleaf pine. The annual growth per acre on a well-stocked, uncut natural stand 30 years old is 1.4 to 1.8 cords for slash pine, 0.8 to 1.2 for South Florida slash pine, and 0.4 to 0.8 for longleaf pine.

The water table is high most of the year, and the soils require drainage. Site preparation is needed to establish new stands. Plant competition and seedling mortality are severe. Wetness restricts the use of logging equipment.

WOODLAND GROUP 9

This group consists of organic soils that are very poorly drained; soils in coastal areas that are poorly drained and very poorly drained and are affected by salt water; and areas, generally reworked and leveled, of sand, shell fragments, and rocky and clayey material. These soils are not suited to pine trees becaus) they are wet and saline and because they vary in composition.

Wildlife

Wildlife is no longer a major resource in Pinellas County. Urbanization has eliminated habitat suitable for many game and nongame species, and only in the northeastern part of the county is wildlife still numerous. Bobwhite quail, mourning doves, gray squirrels, turkey, white-tailed deer, wild ducks, gray fox, and raccoons once were common. Wild turkeys and raccoons are still fairly common, but nearly all white-tailed deer have left the county. Bobwhite quail are numerous in the drier areas.

All soils in the county are suited to and can support one or more species of wildlife. The district representative of the Soil Conservation Service can provide landowners with technical guides for establishing and maintaining wildlife habitat and for stocking and managing fishponds. Information about the major species of wildlife and fish in the county is given in the following paragraphs.

Wild turkeys.—Turkeys require large areas on which to roam and feed. In swamps they find suitable habitat mainly on Astor, Pamlico, and Terra Ceia soils; they roost in the larger trees and feed on various tree seeds and on understory plants that grow in small open areas. In open flatwoods, they feed on palmetto berries, gallberries, myrtle berries, grass seeds, and acorns, mainly on Immokalee and Myakka soils. Dense stands of runner oak trees, mainly on Felda, Manatee, and Pinellas soils, provide acorns and shady resting places during hot summer days.

Bobwhite quail.—Quail nest on the ground and are relatively common in predominantly rural areas. Quail can live in most areas, except in very wet sloughs and ponded areas. The population varies from year to year, depending on wetness in spring and early in summer during the nesting season. Quail feed on berries, seeds, and acorns in the flatwoods. They find food in scrub vegetation that grows on Pomello soils and near swamps on Felda, Pompano, and Wabasso soils.

Mourning doves.—Doves are both resident and migratory. They inhabit the same areas as quail, but they feed more commonly in groves and pasture and on idle land. They also seek grit in dry sandy areas of Astatula, Paola, and St. Lucie soils.

Gray squirrels.—Gray squirrels live mostly in heavily wooded flatwoods and in dense stands of oak trees around ponds on Felda and Manatee soils. Squirrels also live in swamps. They adapt to urbanized areas if hardwood trees are available.

Raccoons.—Raccoons are numerous in rural areas. They feed on native berries, small rodents, and shell fish, and on garden crops and citrus. In many recreational areas they are almost tame.

Shore birds.—The number of snowy egrets, white ibis, wood ibis, and little blue herons has decreased drastically in recent years. These birds frequent marshy areas and nest in bushes and trees near water. They feed on snails, small fish, frogs, and insects, mainly in ponded areas and in sloughs. Many shore birds live along the coast in tidal marshes, on coastal beaches, and in open areas of tidal swamp. A favorite pastime in recreational areas along the coast is feeding bits of fish and bread to sea gulls.

Songbirds.—The number of songbirds can be increased by providing local refuges. These refuges can be established in private yards or in small parks by planting trees and shrubs that provide cover, food, and nesting areas.

Fish.—Lake Tarpon provides good to excellent fishing. Speckled perch, largemouth black bass, bluegill bream, and shellcrackers are the most common fish. Other smaller lakes and canals throughout the county provide fair to good fishing. Excavated ponds can be established almost anywhere in soils that have a relatively stable high water table. Ponds one-half acre or more in size that are properly stocked and managed provide good fishing.

Formation and Classification of the Soils

This section describes the major factors of soil formation, explains some of the processes in horizon development, and defines the current system of classifying soils.

Factors of Soil Formation

Five major factors determine the formation of soils: (1) the type of parent material, (2) the topography, or lay of the land, (3) the plant and animal life in and on the soil, (4) the climate under which the soil formed, and (5) the length of time these factors have acted on the soil material.

Parent material

The main geological formations in Pinellas County are Caloosahatchee Marl of the lower Pliocene, which consists mainly of sand and shells, and the Hawthorn Formation of the lower Miocene, which consists of interbedded sand, clay, marl, limestone, lenses of fuller's earth, and land pebble phosphate. These formations are covered by layers of sand ranging from several feet to more than 50 feet in thickness. They influence the characteristics of only a few soils in the county. Fellowship soils that occur around the sides of small "dry sink" depressions contain phosphatic material from the Hawthorn Formation, and some soils near Oldsmar in the southern part of the county are affected by the underlying Caloosahatchee Marl.

During the Pleistocene Epoch, unconsolidated marine sediments were deposited over these formations to form four terraces: the Pamlico, at 0 to 25 feet above mean sea level; the Talbot, at 25 to 42 feet; the Penholoway, at 42 to 70 feet; and the Wicomico, at 70 to 97 feet. Each terrace was covered by a mantle of sand. Most soils in the county formed in these sandy materials.

In places recent accumulations of organic material cover the sand on the terraces. Lake Flirt Marl, also a recent deposit that occurs in numerous small areas, is not associated geologically with any of the underlying formations.

Topography

Topography, or relief, affects the formation of soils mainly through its influence on erosion, drainage, soil temperature, and plant cover. There are four topographic areas in the county: ridgelands at elevations of 60 to 100 feet; flat uplands at 40 to 60 feet; flatwoods at 10 to 40 feet; and flood plains at less than 10 feet. The topography and, especially, the depth to a water table in each of these areas have affected the formation of the soils. For example, Pomello soils on the ridges are deep over a water table, low in organic-matter content, and highly leached. Myakka soils in the flatwoods are shallower over a water table, periodically wet, and low to medium in organic-matter content. Placid soils in depressions are very shallow over a water table and are medium to high in organic-matter content. Although Pomello, Myakka, and Placid soils formed in the same parent material, they differ because of their relative topographic position.

Plants and animals

The kinds and numbers of plants and animals that live in and on soils determine to a great extent the soil characteristics. Plants and animals furnish organic matter, mix soil material, and draw plant nutrients from lower horizons to upper horizons. They also affect soil structure and porosity. Bacteria, fungi, and other micro-organisms help to break down minerals and decompose organic matter. They are most numerous in the upper few inches of the soil. Earthworms and small animals also alter the chemical composition of soils and mix soil material.

The native vegetation on uplands was a forest of pine and scattered oak. Cypress, bay, maple, and gum trees grew in swamps, and pine trees and an understory of saw-palmetto, gallberry, and numerous native grasses grew in the flatwoods. Vegetation in the marshes consisted of water-tolerant shrubs, sedges, and grasses.

Man has influenced the formation of soils by clearing the forests, cultivating the soils, draining wet areas, and introducing different kinds of plants. The complex of living organisms that affect soil formation has been drastically changed by these activities.

Climate

Pinellas County has long humid summers and mild winters. Temperatures are moderated by the waters of the Gulf of Mexico and Tampa Bay. The climate is uniform throughout the county and accounts for few differences among soils. Rainfall averages about 55 inches a year.

The warm wet climate favors the rapid decomposition of organic matter and hastens chemical reactions in the soil. Because rainfall is heavy, the most easily weathered minerals and less soluble fine particles are leached. Consequently, many of the soils are sandy, are strongly acid, and have low organic-matter content, low natural fertility, and low available water capacity.

Time

Geologically, a long time is required for well-defined, genetically related horizons to form in a soil. Soils that formed in material resistant to weathering require more time to reach a particular stage of development than do soils that formed in easily weathered material. The time required for translocation of fine particles within the soils also varies under different conditions.

The dominant soil material in Pinellas County is quartz sand that is almost pure and is highly resistant to weathering. Relatively little time for the development of well-defined horizons has elapsed since this material was laid down or emerged from the sea. Some thin sandy loam and sandy clay loam horizons have formed in place through weathering, but most of the finer textured horizons were derived from loamy marine deposits that have been only slightly altered by weathering. Some soils have a thick, black surface layer and layers of organic-matter stained sand, but the time required for these layers to develop is relatively short.

Processes of Soil Formation

Among the processes involved in the formation of soil horizons, or horizon differentiation, are (1) accumulation of organic matter, (2) leaching of calcium carbonates and bases, (3) formation and translocation of silicate clay materials, and (4) reduction and transfer of iron. These processes produce a succession of layers, or horizons, that differ in such properties as color, texture, structure, consistence, reaction, and thickness. Soils can have three main horizons: A, B, and C. However, in many young sandy soils, a B horizon has not developed.

The A horizon is either the horizon of maximum organic-matter content, called the A1 horizon, or the surface layer, or it is the horizon of maximum leaching of soluble or suspended materials, called the A2 horizon, or the subsurface layer.

The B horizon lies immediately below the A horizon and is called the subsoil. It is the horizon of maximum accumulation of organic matter, iron, clay, and other dissolved or suspended material. The B horizon is usually firmer than the horizons immediately above and below and in places has a blocky structure.

The C horizon is the substratum. It is only slightly affected by soil-forming processes but is somewhat modified by weathering.

The following paragraphs explain the processes by which soil horizons form.

Accumulation of organic matter.—Some organic matter has accumulated in the surface layers of all soils in the county to form an A1 horizon. The content of organic matter in the soils ranges from very low to high. In many places the A1 horizon has been mixed with material from underlying horizons through cultivation.

Leaching of calcium carbonates and bases.—Some leaching has occurred in nearly all the soils. Most carbonates and bases had been removed from the parent material before it was deposited. The leaching of bases in soils usually precedes translocation of silicate clay materials.

Translocation of clay.—Weathering, movement, or alteration of clay has occurred in a few soils to form light-colored, leached A2 horizons and loamy B2 horizons. Sand grains in the B2 horizons are coated with clay and a few patchy clay films are on ped faces and in root channels. A few soils also have a thin B1 horizon that is intermediate in texture between the A2 and B2 horizons.

Reduction and transfer of iron.—This process, also known as gleying, has occurred in most of the soils in Pinellas County, except for dry soils at higher elevations. Gleying is caused generally by wetness. Gray colors in the subsoil and grayish mottles in other horizons indicate the reduction and transfer of iron. Some horizons have reddish-brown mottles and concretions, which indicate the segregation of iron.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and revised later (*4*). The system currently used by the National Cooperative Soil Survey was developed in the early sixties (*3*) and was adopted in 1965 (*6*). It is under continual study.

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 8 shows the classification of each soil series of Pinellas County by family, subgroup, and order, according to the current system.

Order.—Ten orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the orders are those that tend to give broad climatic groupings of soils. Exceptions to this are the Entisols, Histosols, and Inceptisols, which occur in many different climates. The soil orders represented in Pinellas County are Entisols, Inceptisols, Mollisols, Spodosols, Alfisols, and Histosols.

Entisols are recent mineral soils that lack genetic horizons or have only the beginnings of such horizons. Inceptisols are mineral soils that most often develop on young but not recent land surfaces.

Mollisols are mineral soils that have thick dark colored mollic horizons from the surface downward. They developed under grass-type vegetation and moist conditions

TABLE 8.—*Soil series classified according to the current system of classification*

Series	Family	Subgroup	Order
Adamsville [1]	Siliceous, hyperthermic, uncoated	Aquic Quartzipsamments	Entisols.
Astatula	Siliceous, hyperthermic, uncoated	Typic Quartzipsamments	Entisols.
Astor [2]	Sandy, siliceous, noncalcareous, hyperthermic	Cumulic Haplaquolls	Mollisols.
Charlotte	Sandy, siliceous, hyperthermic	Entic Sideraquods	Spodosols.
Elred [3]	Sandy over loamy, siliceous, hyperthermic	Alfic Sideraquods	Spodosols.
Felda [4]	Loamy, mixed, hyperthermic	Arenic Ochraqualfs	Alfisols.
Fellowship	Fine, montmorillonitic, hyperthermic	Typic Umbraqualfs	Alfisols.
Immokalee	Sandy, siliceous, hyperthermic	Arenic Haplaquods	Spodosols.
Manatee	Coarse-loamy, mixed, noncalcareous, hyperthermic	Typic Argiaquolls	Mollisols.
Myakka	Sandy, siliceous, hyperthermic	Aeric Haplaquods	Spodosols.
Okeechobee	Euic, hyperthermic	Hemic Medisaprists	Histosols.
Oldsmar	Sandy, siliceous, hyperthermic	Alfic Arenic Haplaquods	Spodosols.
Orlando (variant)	Sandy, siliceous, hyperthermic	Psammaquentic Haplumbrepts	Inceptisols.
Palm Beach	Carbonatic, hyperthermic	Typic Udipsamments	Entisols.
Pamlico [5]	Sandy, siliceous, dysic, thermic	Typic Medisaprists	Histosols.
Paola	Siliceous, hyperthermic, uncoated	Spodic Quartzipsamments	Entisols.
Pinellas	Loamy, mixed, hyperthermic	Arenic Ochraqualfs	Alfisols.
Placid	Sandy, siliceous, hyperthermic	Typic Humaquepts	Inceptisols.
Pomello	Sandy, siliceous, hyperthermic	Typic Haplohumods	Spodosols.
Pompano	Siliceous, hyperthermic	Typic Psammaquents	Entisols.
St. Lucie [6]	Siliceous, hyperthermic, uncoated	Typic Quartzipsamments	Entisols.
Terra Ceia (variant)	Sandy, siliceous, euic, hyperthermic	Terric Medisaprists	Histosols.
Wabasso [7]	Sandy over loamy, siliceous, hyperthermic	Alfic Haplaquods	Spodosols.
Wauchula	Sandy over loamy, siliceous, hyperthermic	Udic Haplaquods	Spodosols.

[1] The Adamsville soils in Pinellas County are taxadjuncts to the Adamsville series. They are more acid than is appropriate to the classification shown. They are strongly acid to very strongly acid.

[2] The Astor soils in this county are taxadjuncts to the Astor series. They are more acid in the C horizon than is appropriate to the classification shown. Their C horizon is slightly acid.

[3] The Elred soils in this county are taxadjuncts to the Elred series. They have a browner Bt horizon than is appropriate to the classification shown. Their Bt horizon is yellowish brown (10YR 5/6).

[4] Some of the Felda soils in this county are taxadjuncts to the Felda series. They have a calcareous loamy sand C horizon.

[5] The Pamlico soils in this county are taxadjuncts to the Pamlico series. The mean annual soil temperature at a depth of 20 inches is 72° F., which is higher than is appropriate to the classification shown.

[6] Some of the St. Lucie soils in this county are taxadjuncts to the St. Lucie series. Colors in the lower part of the C horizon are outside the range described for the St. Lucie series.

[7] The Wabasso soils in this county are taxadjuncts to the Wabasso series. They are less acid in the Bh horizon than is appropriate to the classification shown.

and have a high base saturation. Spodosols are mineral soils that have a spodic horizon locally. Alfisols are mineral soils that have clay-enriched B horizons high in base saturation.

Histosols are organic soils that have formed in swamps and marshes where conditions were favorable for the accumulation of decaying plant remains.

Suborder.—Each order is divided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders have a narrower climatic range than the order. The criteria for suborders reflect either the presence or absence of waterlogging or soil differences resulting from climate or vegetation.

Great group.—Each suborder is divided into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons. The horizons used to make divisions are those in which clay, iron, or humus have accumulated or those that have pans that interfere with growth of roots or movement of water.

Subgroup.—Each great group is divided into subgroups. One subgroup represents the central (typic) segment of the group, and others, called intergrades, have properties of the group and one or more properties of another great group, suborder, or order.

Families.—Families are established within a subgroup, primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

Series.—The series, which has the narrowest range of characteristics of the categories in the classification system, is a group of soils that developed from the same type of parent material and have major horizons that are similar in important characteristics and sequence in the profile.

General Nature of the County

Pinellas Peninsula was permanently settled in 1823. Citrus was introduced to the area and became the major crop. Settlements along the coast engaged mainly in fishing. Clearwater was incorporated in 1859, and by 1868 Pinellas Peninsula had access by road to Tampa, the commercial center for the area. In 1888 a railroad line was opened between Sanford and St. Petersburg, and the favorable climate began to attract a tourist trade that bolstered the economy based mainly on agricultural and fishing enterprises.

Pinellas County was formed from part of Hillsborough County in 1911. The population nearly doubled between 1920 and 1940, but less than 10 percent of the county was urbanized at the end of this period. Between 1950 and 1960 the population increased to 215,000 and by 1968, to about 500,000. Now, about 50 percent of the county is urbanized.

Urbanization, large increases in tourism, and the advent of light industry have greatly reduced the role of farming in the economy of the county. In 1966 only about 2 percent of the work force was employed on farms.

Information about the geology, climate, and farming enterprises in the county is given in the following pages.

Geology

The two major geologic formations in Pinellas County are the Hawthorn Formation of the lower Miocene and Caloosahatchee Marl of the lower Pliocene. The border between these formations extends across the peninsula north of the Cross Bayou Canal through Safety Harbor and Oldsmar. Soils north of this line are underlain by the Hawthorn Formation.

Caloosahatchee Marl is of marine origin. It consists of sand, sandy clay, and marl and is from 2 to 85 percent shells. In places near St. Petersburg and Pinellas Park, these shells are excavated for use in road construction. The maximum thickness of this formation is about 50 feet. In areas near Oldsmar, north of St. Petersburg, near Pinellas Park, and south and east of Largo, it is near enough to the surface to affect the soils. Some Astor and Manatee soils formed in this material.

The Hawthorn Formation consists of interbedded sand, clay, marl, limestone, lenses of fuller's earth, and land-pebble phosphate. In only a few places is it near enough to the surface to affect the soils. Soils that occur on the side slopes of depressions northeast of Clearwater and in cuts made by Curlew Creek north of Dunedin contain phosphatic material from this formation. Fellowship soils also contain material from this formation.

During the Pleistocene these formations were covered by marine deposits that formed four terraces. These terraces were covered by a mantle of sand that ranges from 2 to 35 feet in thickness.

The Pamlico terrace occurs at elevations of 0 to 25 feet above mean sea level. It is mainly sand 1 to 15 feet thick. In areas near Oldsmar, St. Petersburg, and Pinellas Park, the sand is only 1 to 4 feet thick and is underlain by Caloosahatchee Marl. Soils of the Oldsmar and Wabasso series that have acid sand upper horizons and a nonacid loamy subsoil formed on this terrace.

The Talbot terrace is 25 to 42 feet above mean sea level. It is fine sand not more than 16 feet thick. In a few places the sand mantle is thin and the soils have been affected by phosphatic material from the underlying Hawthorn Formation. Most soils of the Talbot terrace are acid. Soils of the Astatula, Immokalee, Myakka, and Pomello series formed on this terrace.

The Penholoway terrace is 42 to 70 feet above mean sea level. It is mostly fine sand as much as 28 feet thick. It is underlain by the Hawthorn Formation. On sides of depressions the sand mantle is thin, and materials from the Hawthorn Formation have affected the soils. Most soils on this terrace are acid. A few nonacid soils occur in small isolated areas in depressions and along streams. Soils of the Astatula, Immokalee, Myakka, Paola, Pomello, and St. Lucie series formed on this terrace.

The Wicomico terrace is 70 to 97 feet above mean sea level. It is mainly fine sand as much as 27 feet thick. It is underlain by the Hawthorn Formation. The soils on this terrace are dominantly acid sands of the Astatula, Immokalee, Paola, Pomello, and St. Lucie series.

A few pockets of recently deposited muck and fresh-water marl occur in low areas.

With few exceptions, individual soils are not confined to a particular geologic formation or marine terrace. For example, Pinellas soils that formed in fresh-water alkaline deposits on upland terraces are very similar to Pinellas soils that formed in alkaline sediments of Caloosahatchee Marl. Though variations in characteristics of the parent material are apparent in the field, they do not affect soil classification.

Climate [2]

Pinellas County has long humid summers and mild winters. Annual rainfall is about 55 inches. About 60 percent of the total falls from June through September. The rest is more or less evenly distributed throughout the remainder of the year. Temperatures are moderated by the waters of the Gulf of Mexico and Tampa Bay.

Summer temperatures vary little from day to day, and seldom reach 95° F. Periodic invasions of cold, dry air from the north cause considerable daily variation in temperature in winter. Data on temperature and precipitation based on records from St. Petersburg are given in table 9.

A temperature of 32° F. occurs on an average of 5 to 10 days every year. Temperatures drop to 28° or lower about three times every year. Table 10 shows the probable dates of last critical temperatures in spring and first in fall, based on records at St. Petersburg.

In summer, rain falls mainly in afternoon and evening thundershowers. Sometimes as much as 2 or 3 inches falls within 2 hours. Rainfall in autumn, winter, and spring usually is not as intense as in summer. Daylong rains are rare in summer. When they occur, they are almost always associated with a tropical storm. A 24-hour rainfall in excess of 8 inches can be expected 1 year in 10 on the average.

Tropical storms affect the area from early in June through mid November. The probability that windspeeds of hurricane force, 74 miles per hour or more, will occur in Pinellas County in any given year is about 1 in 20. Heavy rainfall during tropical storms may cause considerable flood damage.

Hail falls occasionally in thundershowers, but the hailstones usually are small and seldom cause much damage. It rarely snows in Pinellas County.

Extended periods of dry weather occur in any season but are most common in spring and fall. Such dry periods affect plant growth. Dry periods in April and May, although generally shorter than those in fall, tend to be more damaging to plants because temperatures are higher and the plants require more moisture in spring.

Prevailing winds are from the south in March and from the north and east the rest of the year. Windspeeds are

[2] By Jack E. Mickelson, State climatologist, National Weather Service, U.S. Department of Commerce.

TABLE 9.—*Temperature and precipitation*

[All data from St. Petersburg. Elevation 50 feet]

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Highest average monthly maximum	Temperature: Lowest average monthly minimum	Precipitation: Average total	Precipitation: One year in 10 will have— Less than—	Precipitation: One year in 10 will have— More than—	Precipitation: Average number of days with— 0.10 inch	Precipitation: Average number of days with— 0.50 inch
	°F.	°F.	°F.	°F.	In.	In.	In.		
January	72	55	80	37	2.5	0.1	5.3	4	2
February	73	56	81	41	3.0	.5	6.0	4	2
March	76	59	84	46	3.7	.3	7.8	5	3
April	81	65	88	54	3.2	.3	7.4	4	2
May	87	70	93	54	2.6	.3	6.1	4	2
June	90	74	94	69	6.3	2.4	10.0	9	4
July	90	75	94	71	9.2	4.1	16.5	12	6
August	90	76	94	71	9.0	4.8	15.3	12	6
September	89	74	92	69	8.4	2.9	14.0	9	5
October	84	69	90	55	3.9	.3	8.6	5	2
November	77	61	84	46	1.7	.2	6.0	3	1
December	73	56	81	37	2.1	.6	5.5	4	2
Year	82	66	[1] 95	[2] 34	55.6	32.7	79.3	75	37

[1] Highest average annual maximum. [2] Lowest average annual minimum.

TABLE 10.—*Probable dates of last critical temperatures in spring and first in fall*

[All data from St. Petersburg. Elevation 50 feet]

Probability	Dates for given probability and temperature of— 32° F. or lower	36° F. or lower	40° F. or lower
Spring:			
1 year in 10 later than	Jan. 31	Feb. 19	Mar. 6
2 years in 10 later than	(1)	Feb. 4	Feb. 22
5 years in 10 later than	(1)	Jan. 15	Jan. 28
Fall:			
1 year in 10 earlier than	Dec. 12	Nov. 30	Nov. 18
2 years in 10 earlier than	(1)	Dec. 12	Nov. 26
5 years in 10 earlier than	(1)	(1)	Dec. 13

[1] No reliable data.

usually 10 to 15 miles per hour in the afternoon and 5 to 10 miles per hour at night.

Farming

Citrus fruit is the major crop in the county. Truck crops are grown in small areas, and several companies and individuals raise flowers and bulbs, most of which are shipped north to market. Cattle graze native range and improved pasture, and dairy operations are scattered throughout the county. Many nurseries provide landscaping plants for expanding urban areas. Since 1960 much of the farmland in the county has been converted to urban uses.

Less than 6,000 acres is used for fruit trees, mostly citrus. Citrus is grown mainly on well-drained soils, but a considerable acreage of wetter soils also is used. These wet soils require tile drainage systems and intensive water control. Most citrus groves are irrigated by sprinklers during dry periods.

There are several small peach orchards in the county. Most peach trees are planted in low, wet areas within citrus groves. Pears, grapes, figs, avocados, and pecans are grown on several farms but are not of commercial importance. Blackberries are grown on several farms. They generally are planted on soils that have a shallow water table and require drainage and irrigation.

About 40 acres in the southern part of the county is used for vegetable crops. Most produce is sold at the field. Fertile soils that have high organic-matter content and adequate water capacity generally are used for vegetables.

Several hundred nurseries and greenhouses raise flowers, vegetable seed, vegetable plants and bulbs, landscape plants, potted plants, and florists greens.

About 5,000 acres is used for improved pasture consisting mostly of pangolagrass and bahiagrass. Part of this is used for hay. White clover is planted on about 20 percent of the pasture acreage. Clover pasture requires irrigation during winter months.

The dairy industry has declined in the last few years. There are now fewer than 2,000 dairy cows in the county. The largest dairy has about 500 cows. All dairies use improved pastures of clover and grass, but most feed for dairy cows is shipped into the county. There are about 4,000 head of beef cattle in the county. Beef production is chiefly a cow-calf operation.

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Glossary

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

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.

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

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

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

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

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

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

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

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

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher.
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit

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of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Soil variant. A soil having properties sufficiently different from those other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. In referring to a capability unit or woodland group, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 2, p. 7.
Limitations of soils for nonfarm uses, table 3, p. 28.
Engineering uses of soils, tables 4, 5, and 6, pp. 34 through 47.
Estimated yields, table 7, p. 55.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group	
			Symbol	Page	Number	Page
Ad	Adamsville fine sand	7	IIIw-1	51	5	57
AfB	Astatula fine sand, 0 to 5 percent slopes	8	IVs-1	52	2	56
AfC	Astatula fine sand, 5 to 12 percent slopes	8	IVs-1	52	2	56
As	Astatula fine sand, moderately deep water table	8	IIIs-1	50	3	56
At	Astor fine sand	9	IIIw-3	51	8	57
Au	Astor soils	9	VIIw-1	54	8	57
Ch	Charlotte fine sand	9	IVw-2	53	8	57
Co	Coastal beaches	10	---------	--	9	57
Ed	Elred fine sand	10	IIIw-2	51	6	57
Fd	Felda fine sand	11	IIIw-2	51	6	57
Fe	Felda fine sand, ponded	11	IIIw-3	51	7	57
Fh	Fellowship loamy fine sand	12	IIIw-4	52	6	57
Im	Immokalee fine sand	12	IVw-1	52	4	56
Ma	Made land	13	---------	--	9	57
Md	Made land, sanitary fill	13	---------	--	9	57
Mn	Manatee loamy fine sand	13	IIIw-3	51	7	57
My	Myakka fine sand	14	IVw-1	52	4	56
Ok	Okeechobee muck	15	IIIw-5	52	9	57
Om	Oldsmar fine sand	15	IVw-1	52	4	56
Or	Orlando fine sand, wet variant	16	IIIw-1	51	5	57
Pa	Palm Beach sand	16	---------	--	9	57
Pc	Pamlico muck	17	IIIw-5	52	9	57
PdB	Paola fine sand, 0 to 5 percent slopes	17	VIs-1	53	1	55
Pf	Pinellas fine sand	18	IVw-1	52	6	57
Pn	Placid fine sand	19	IIIw-3	51	8	57
Po	Pomello fine sand	19	VIs-2	53	3	56
Pp	Pompano fine sand	20	IVw-2	53	8	57
Ps	Pompano fine sand, ponded	20	IVw-2	53	8	57
Sp	Spoil banks	20	---------	--	---	--
StB	St. Lucie fine sand, 0 to 5 percent slopes	21	VIIs-1	54	1	55
StC	St. Lucie fine sand, 5 to 12 percent slopes	21	VIIs-1	54	1	55
Su	St. Lucie fine sand, shell substratum	21	VIs-2	53	3	56
Tc	Terra Ceia muck, moderately deep variant	21	IIIw-5	52	9	57
Td	Tidal marsh	22	---------	--	9	57
Ts	Tidal swamp	22	---------	--	9	57
Ub	Urban land	22	---------	--	---	--
Uc	Urban land-Astatula complex	22	---------	--	---	--
Uk	Urban land-Immokalee complex	22	---------	--	---	--
Um	Urban land-Myakka complex	23	---------	--	---	--
Up	Urban land-Pomello complex	23	---------	--	---	--
Uw	Urban land-Wabasso complex	23	---------	--	---	--
Wa	Wabasso fine sand	24	IIIw-2	51	6	57
Wc	Wauchula fine sand	24	IIIw-2	51	6	57

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