United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with the University of Florida, Institute of Food and Agricultural Sciences, Agricultural Experiment Stations, and Soil Science Department, and the Florida Department of Agriculture and Consumer Services

Soil Survey of Flagler County, Florida

How To Use This Soil Survey

General Soil Map

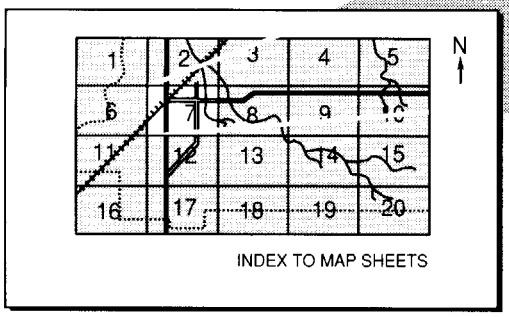
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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

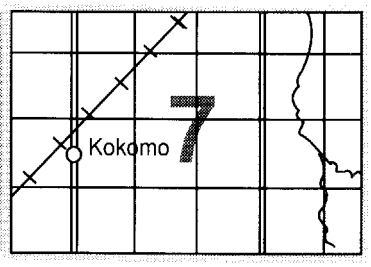
Detailed Soil Maps

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

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



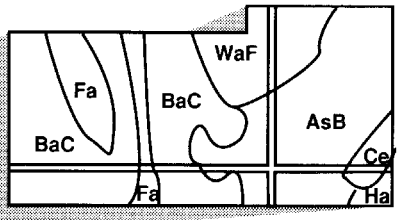
INDEX TO MAP SHEETS



MAP SHEET

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

MAP SHEET



AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal, State, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1989. Soil names and descriptions were approved in 1990. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1990. This soil survey was made cooperatively by the Natural Resources Conservation Service and the University of Florida's Institute of Food and Agricultural Sciences, Agricultural Experiment Stations, and Soil Science Department and the Florida Department of Agriculture and Consumer Services. It is part of the technical assistance furnished to the Flagler Soil and Water Conservation District. The Flagler County Board of County Commissioners contributed office space for the soil survey party.

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

A prior soil survey was made for Flagler County in 1918 *(19)*. This survey updates the 1918 survey. It is a more detailed soil survey on aerial photography and contains more interpretative information.

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

Cover: Coquina rock outcrop in an area of Beaches. This clastic rock, composed of cemented shells and sand, is part of the Anastasia Formation.

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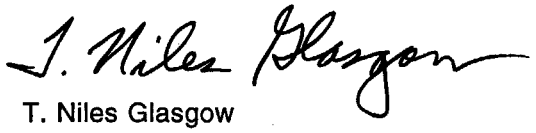
Foreword

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

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

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

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



T. Niles Glasgow
State Conservationist
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Soil Survey of Flagler County, Florida

By Elmer L. Readle, Robert Baldwin, Kim C. Goerg, and Jeffrey E. Leppo,
Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service,
In cooperation with
University of Florida, Institute of Food and Agricultural Sciences, Agricultural Experiment Stations, and Soil Science Department, and the Florida Department of Agriculture and Consumer Services

FLAGLER COUNTY is in the northeastern part of peninsular Florida (fig. 1). It is bordered by St. Johns County to the north, by Putnam County to the west, by Volusia County to the south, and by the Atlantic Ocean to the east.

The total area of the county is 314,090 acres, or about 507 square miles. Areas of water more than 40 acres in size make up 10,688 acres. The county is about 29 miles from the north to south and about 23 miles from the east to west. The county seat, Bunnell, is in the east-central part of the county.

The economy of Flagler County is somewhat diversified, although agriculture, construction, tourism, and light industry are the main economic elements.

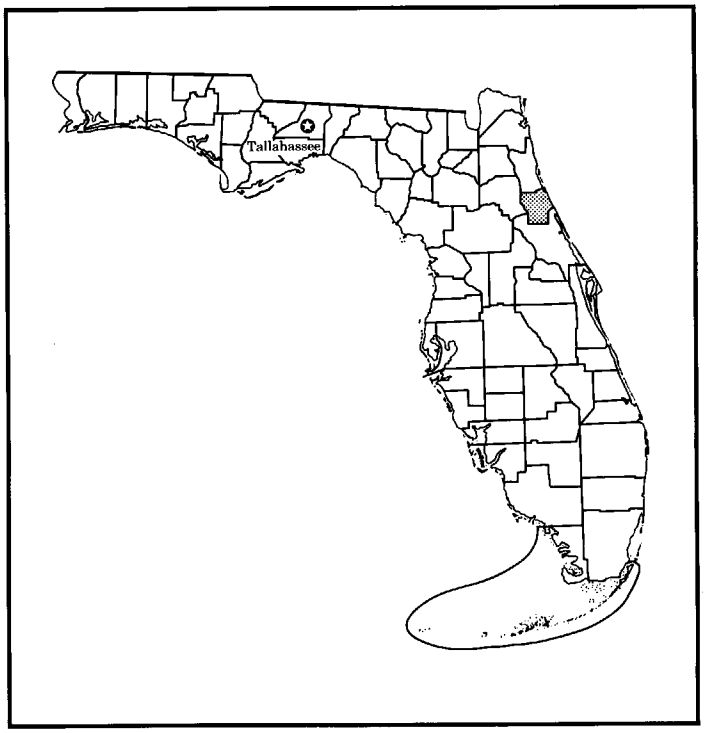

Figure 1.—Location of Flagler County in Florida.

General Nature of the County

In this section, environmental and cultural factors that affect the use and management of soils in Flagler County are described. These factors include climate, history and development, physiography and geomorphology, water and mineral resources, farming, recreation, and transportation.

Climate

This section was compiled from data and information provided by the National Climatic Data Center in Asheville, North Carolina, and from data collected by the University of Florida Agriculture Research Center in Hastings, Florida.

Flagler County has a subtropical maritime climate that is characterized by long, warm and humid summers and mild winters. Both summer and winter temperatures are moderated by the close proximity to the Atlantic Ocean. The frequency of frost and freezing temperatures is greater in the western part of the county, and rainfall is more frequent in the eastern part.

The average annual temperature is about 70 degrees F, and the average annual rainfall is about 53 inches. Rainfall is heaviest during the summer. The winters are generally mild, except for brief invasions of cold, dry air associated with cold fronts that move southward across the state. The prevailing winds are primarily from the east, but many are from the southwest or northwest. The average wind speed is about 10 to 12 miles per hour but is slightly higher during a period from mid-February through March. The hurricane season extends from June to November.

In summer, temperatures vary only slightly from day to day. The afternoon temperatures can reach 90 degrees or more, and by morning the temperature can fall into the low 70's. Although temperatures above 100 degrees have been recorded, they rarely occur. Daytime temperatures rarely exceed 95 degrees because of the cooling effects of sea breezes near the coast and because of the thunderstorms that occur further inland. The probability of a thunderstorm occurring at a given location on any summer day is about 50 percent.

The temperatures in winter vary considerably from day to day as periodic cold fronts move southward across the state. Temperatures may vary from the 70-degree range during the middle of the day to below freezing in the early morning. The coldest days generally occur on the second or third day after a front passes through the area. The average daily maximum winter temperature is 67 degrees, and the average daily minimum temperature is 40 degrees. Temperatures of 32 degrees or lower, which occur 12 to 15 times per year, have been recorded as early as the middle of November and as late as the middle of March. Table 1 gives data on temperatures and precipitation for the survey area from 1952 to 1987. Table 2 shows freeze dates in spring and fall.

The average annual rainfall is about 53 inches. About 60 percent of the rainfall occurs during the rainy season, which extends from June through the middle of October. The remainder is evenly distributed during the rest of the year and can occur at any time during the day. The rainfall during the summer is generally a result of convection thundershowers that occur late in the afternoon and early in the evening. These showers are local in extent and of short duration. They may produce more than 3 inches of rain in an hour or less. During the late summer and early fall, temperatures begin to moderate and the showers occur earlier in the day and diminish in frequency. Day-long rains in the summer are rare and are usually associated with a tropical depression. After the end of the rainy season, rainfall is generally associated with the passage of a front. The rainfall is generally over a wide area and can occur at any time of the day. Overcast, drizzly conditions can sometimes last for 2 or 3 days. Droughty conditions can occur at any time, even during the rainy season, but these conditions are generally more severe in the spring because the temperatures are higher and the rate of plant growth is increased.

Tropical storms or depressions can produce very heavy rainfall at any time from June to November. These low pressure systems produce very high winds and large amounts of rainfall, which may affect weather conditions for several days. The more intense storm systems can cause considerable damage and flooding in the lower areas. High surf and storm-driven waves can inundate the lower areas along bays and inlets. They can cause severe erosion along beaches, especially in areas where the natural vegetation has been removed or is badly disturbed.

During fall and early winter, heavy fog is common early in the morning, but it usually dissipates soon after sunrise. The dew is usually heavy in the morning because of the high humidity. In the spring, the relative humidity in the afternoon ranges from 40 to 50 percent. From June through September, the relative humidity early in the morning ranges from 40 to 60 percent and results in a heavy dew.

History and Development

John A. Clegg, historian and author, prepared this section.

The Timicuan Indians were early inhabitants of the area now known as Flagler County. They lived in the hammocks beside the rivers on the East Coast *(8)*. As the Spanish settled Florida, Indian missions were established at St. Joseph and Bulowville. The first permanent European family to settle in this area was the Duponts. They arrived in 1792. Many descendants of this family still live in Flagler County.

Although large sugar plantations were established in the early 1800's, all of these plantations were burned during the Seminole Indian War from 1835 to 1836. After about 1850, orange groves, cattle ranches, and truck farms were established along the Old Kings Road, which traversed the eastern part of the county from the north to south. When the railroad was built in 1885, settlers began to establish the communities of Espanola, St. Johns Park, Dupont, Haw Creek, Korona, and Bunnell. Timber, turpentine, and truck farming made up the economic base for these communities.

The town of Bunnell was established in 1913. Flagler County was created out of St. Johns and Volusia Counties in 1917, and Bunnell was chosen as the county seat. Flagler County was named after Henry M. Flagler, the railroad builder. Ocean City, on the East Coast, became Flagler Beach in 1923. The largest

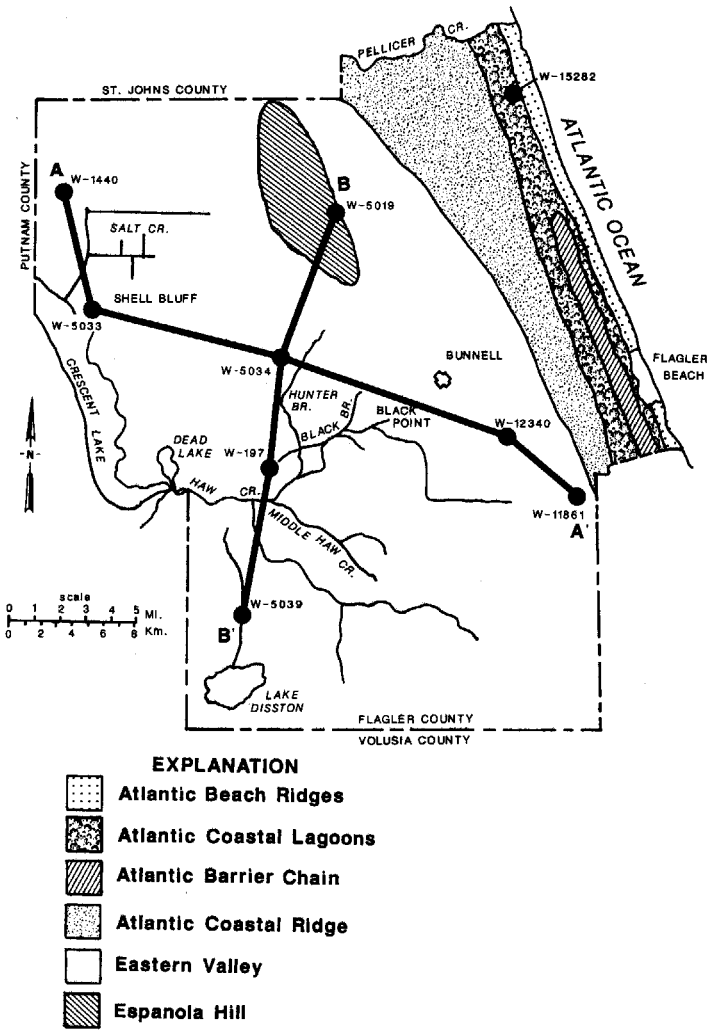

Figure 2.—Geomorphology of Flagler County. The locations of the cross-sections in figures 3 and 4 are also indicated.

community is presently Palm Coast, which ITT began to develop in 1970.

Physiography and Geomorphology

Jonathan D. Arthur, geologist, Florida Geological Survey, helped to prepare this section.

Flagler County is in the Atlantic Coastal Lowlands physiographic zone. White *(24)* has delineated six geomorphic features within Flagler County (fig. 2). The following discussion is primarily a summary of his observations.

The largest geomorphic feature in Flagler County is the Eastern Valley, which covers the western two-thirds of the county. This valley is approximately 20 miles wide and contains most of the low wetlands of Flagler County. Elevations in this region range from 5 to 28 feet above mean sea level. Crescent Lake is the major drainage basin in the western half of the county. Tributaries flowing into the lake include Salt Creek, Haw Creek, Black Branch, and Hunter Branch. Lake Diston, located in the southwestern corner of the county, receives drainage from the surrounding wetlands and from Little Haw Creek.

Espanola Hill, a topographic high point within the Eastern Valley, is an elongated feature that parallels the coastline of the Atlantic Ocean. It has a maximum elevation of 59 feet above mean sea level. The orientation of Espanola Hill and its location, which is proximal to the Atlantic Coastal Ridge, suggest that the feature may be a relict beach ridge.

Four narrow, linear geomorphic provinces are in the eastern third of Flagler County and run parallel to the Atlantic coastline. These geomorphic provinces include the Atlantic Coastal Ridge, the Atlantic Coastal Lagoons, the Atlantic Barrier Chain, and the Atlantic Beach Ridges. During the Pamlico sea-level stands about 340,000 years ago *(18)*, the shoreline known as the Atlantic Coastal Ridge was developed. The oscillating regression of the Pamlico seas produced linear coastal deposits, which are components of the Atlantic Barrier Chain. The Atlantic Beach Ridges and Coastal Lagoons are products of Holocene shoreline sedimentation.

Geology and Stratigraphy

Flagler County is underlain by several thousand feet of sedimentary rocks that overlie the upper Precambrian and lower Cambrian crystalline basement, beginning at approximately 5,000 feet in depth *(3)*. The Avon Park Formation, which is of Middle Eocene age, is the oldest geologic formation penetrated by water wells in the county. It is overlain by the limestones of the Ocala Group and the phosphatic clays, sands, and limestones of the Hawthorn Group. These units underlie Pleistocene and Recent undifferentiated sand, shell, and clay deposits, which are exposed at the surface. Figure 2 shows the location of geologic cross-sections. Figures 3 and 4 show the geologic formations that are penetrated by wells in Flagler County.

The Avon Park Formation *(15)* in this region contains a variable lithology, both vertically and laterally. It generally consists of dense, reddish brown to buff, organic-rich, seamed limestone and brown to gray, crystalline dolomitic limestone near the base. It grades upward to interbedded gray to white, chalky limestone and hard, crystalline dolomite near the top *(5)*. Some of the limestone beds contain numerous foraminifera and echinoids. The top of the Avon Park Formation is at a depth ranging from 205 feet to 370 feet below mean

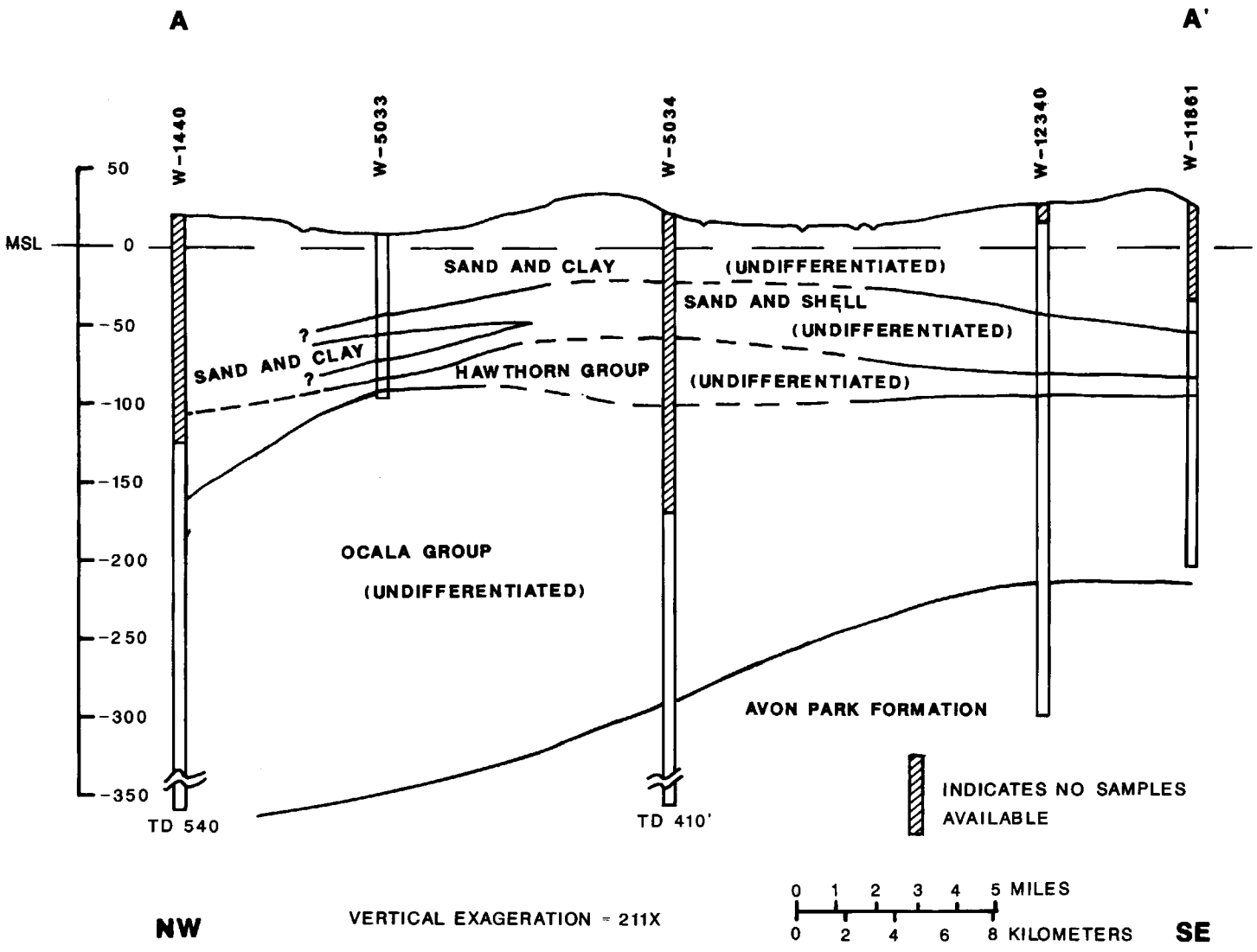

Figure 3.—A geologic cross-section of A to A′, as indicated in figure 2, in Flagler County.

sea level. This formation is a component of the Floridan aquifer system.

The Ocala Group *(16)* consists of three formations. In ascending order, they are the Inglis Formation, the Williston Formation, and the Crystal River Formation. The lithology of the Ocala Group generally consists of tan to buff, coarsely granular limestone of the Inglis Formation at the base, which becomes more indurated in the Williston Formation, and white to cream, chalky, massive marine limestone in the Crystal River Formation. The fossils within these formations include a variety of foraminifera, bryzoans, mollusks, and echinoids. The delineation of the Ocala Group into formations was based upon the presence of these fossils and the lithology. Sediments from the Ocala Group range in thickness from 50 feet in the southern part of Flagler County to approximately 200 feet in the northwestern part. The depth to the top of the Ocala Group averages about 100 feet below mean sea level. The Ocala Group is a component of the Floridan aquifer system and is the principle source of water in the area.

The Hawthorn Group *(17)* unconformably overlies the Ocala Group beneath Flagler County. Three formations are in the Hawthorn Group in northern Florida. In ascending order, they are the Penney Farms Formation, which consists of interbedded phosphatic sand, clay, and carbonate; the Marks Head Formation, which consists of complexly interbedded phosphatic clay, sand, and carbonate; and the Coosawatchee Formation, which consists of green to tan phosphatic quartz sand

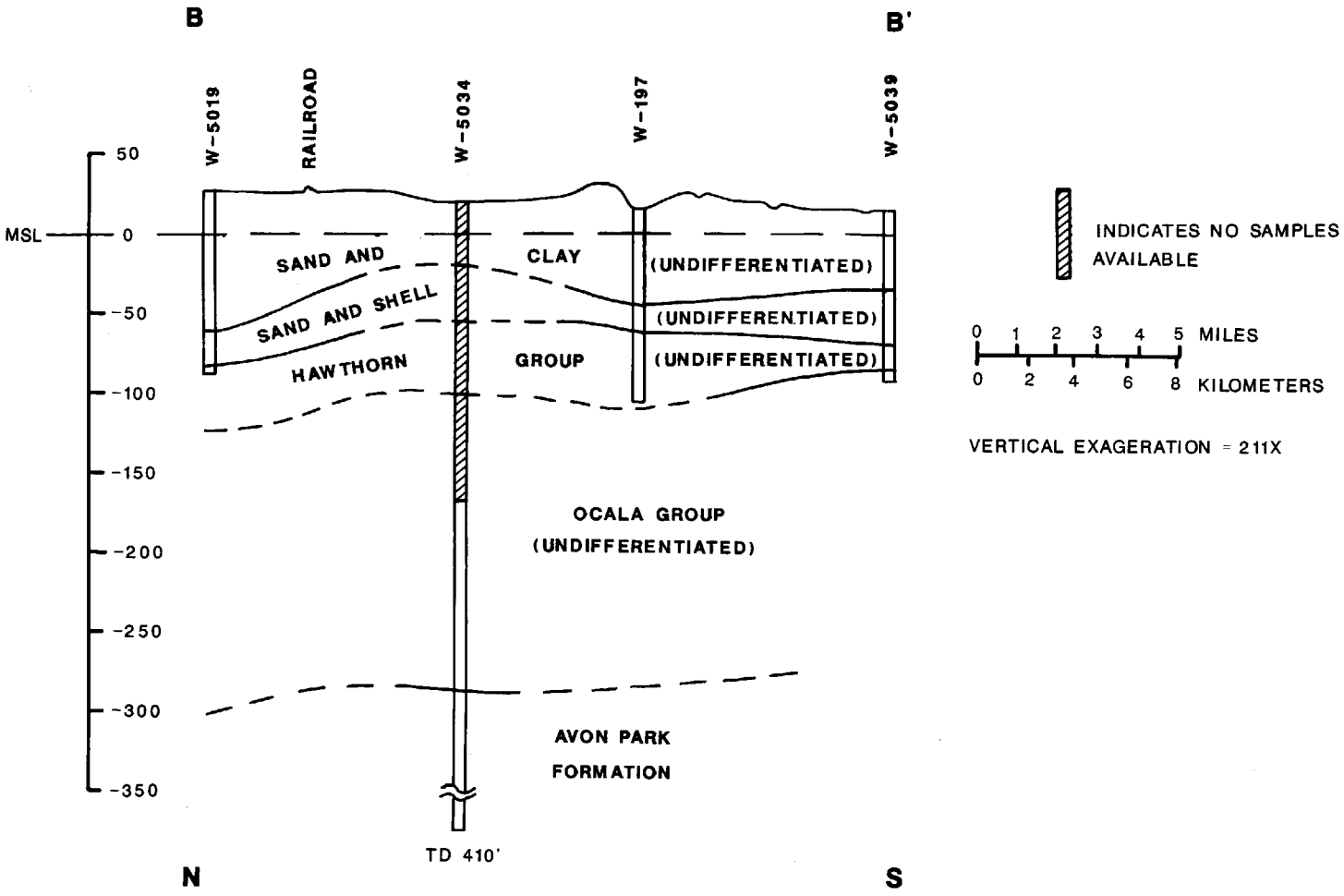

Figure 4.—A geologic cross-section of B to B′, as indicated in figure 2, in Flagler County.

that contains variable amounts of clay and dolomite. These formations have been described separately in one core (W-15282) located in northeastern Flagler County. A lithologic description of this well indicates 9 feet of the Penney Farms Formation overlain by 33 feet of the Coosawatchee Formation. The Marks Head Formation is absent *(12)*. The Hawthorn Group is approximately 35 feet in thickness. It becomes thinner toward the southern and eastern parts of Flagler County. The depth to the top of the Hawthorn Group sediments ranges from 60 to 80 feet below mean sea level. The clayey sediments of the Hawthorn Group serve as confining beds for the Floridan aquifer system. Small bodies of sand in the Hawthorn Group are components of a near-surface aquifer in the area.

In the subsurface layer of coastal northeastern Florida, Pliocene and Pleistocene Formations have been delineated on a regional basis; however, in Flagler County, the sand, shells, and clay at or near the surface have not been assigned to a specific formation. As a result, these surficial and coastal lithologies are called Pliocene to Holocene (undifferentiated) sediments.

The Pliocene component of this undifferentiated package is the Nashua Formation. This formation represents a near-shore marine depositional environment. It was named by Matson and Clapp *(14)*. The Nashua Formation consists of quartz sand that contains variable amounts of clay and carbonate matrix and common mollusk shells.

The remaining overlying sand, shells, and clay are either part of the Pleistocene Anastasia Formation or are Pleistocene to Holocene undifferentiated deposits. Variably cemented shell beds, or coquina, and unconsolidated sand and shells make up the Anastasia Formation, which is found only near the coast in Flagler County.

Shell-bearing lithologies vary in thickness. They are over 100 feet thick in areas near the coast but thin and

eventually become absent in areas toward the western part of Flagler County. The total thickness of Pliocene to Holocene deposits in the area ranges from about 50 to 140 feet.

Water and Mineral Resources

Jonathan D. Arthur, geologist, Florida Geological Survey, helped to prepare this section.

Water Resources

The water resources in Flagler County are used for agricultural, industrial, residential, and recreational purposes. In most parts of the county, adequate supplies of fresh water are available for most uses. However, during periods of high usage or during seasonal dry periods, temporary shortages may be experienced. An increasing population and urban development in the county are placing increased demands upon the water supplies in Flagler County.

Three main sources of water, or aquifer systems, are in Flagler County. They are a surficial aquifer system, which is made up of surface water and ground water; an intermediate aquifer system; and the Floridan aquifer system.

The surficial aquifer system is the uppermost freshwater aquifer in Flagler County. The surface water in lakes, ponds, and streams and the ground water is used to a limited extent for irrigation or domestic purposes. Ground water is subsurface water in the zone of saturation. The zone of saturation is a zone in which all pore spaces are filled with water under a pressure no greater than atmospheric pressure. The quantity of surface water and ground water available is directly and immediately affected by the amount of rainfall received. The surficial aquifer system is not confined, and its upper surface reflects the depth to the water table. In general, the water table fluctuates with the rate of precipitation and conforms to the topography of the land surface. The surficial aquifer system is recharged primarily by rainfall percolating downward through the loose surficial siliciclastic sediments and, to a lesser extent, by seepage upward from the underlying Floridian aquifer system. The surficial aquifer system can yield quantities of water suitable for consumption, but in some areas, the concentration of iron and tannic acid color the water and impart a poor taste.

The intermediate aquifer system is primarily within the sediments of the Hawthorn Group. These sediments consist of variable amounts of sand and shell fragments and some silt and clay. The aquifer underlies all of Flagler County. It ranges in thickness from 5 to 80 feet. It yields good quality water that is the primary source for domestic uses and, to a limited extent, municipal uses. The intermediate aquifer system is recharged primarily by rainfall in the county.

The Floridan aquifer system is the major source of water for irrigation, public uses, and industry. It underlies all of Flagler County at a depth that ranges from about 80 to 190 feet. This aquifer consists mainly of Eocene limestone and dolomite from the Avon Park Formation and the Ocala Group. The Floridan aquifer is recharged by the overlying surficial and intermediate aquifers. In some parts of the county, this aquifer yields water that has a high chloride content as a result of the intrusion of salt water.

Dead Lake and Crescent Lake are the major freshwater bodies in Flagler County. Several smaller lakes are on the Espanola Ridge northwest of Espanola. Haw Creek, Pellicer Creek, and Bulow Creek are the major streams in the county. These water areas are intensively used for recreational purposes.

Mineral Resources

The mineral resources in Flagler County include sand, clay, and coquina. An overview of these resources and their commercial use is provided in the following paragraphs.

Sand accumulations cover about 75 percent of Flagler County. The maximum thickness of the sand is in the northwestern part of the county, where it reaches a depth of 140 feet. The sand commonly contains small shell fragments and localized clay lenses. Recent tests by the Florida Geological Survey indicate that the sand is suitable for brick masonry, sand-cement, riprap, sand-asphalt hot mix, and sand seal coat. Because it contains a large percentage of impurities, the sand is probably not suitable for the manufacture of glass. Although economic heavy mineral deposits occur in north-central and northeastern Florida, no public information exists regarding the abundance or distribution of heavy minerals in the sand bodies in Flagler County.

Few relatively pure clay deposits occur near the surface in Flagler County. Most of the clay is found as a clayey-sand lithology. Calver *(7)* reports pure clay deposits located near Black Point and Haw Creek that are suitable for the manufacture of common brick, hollow block, and drain tile. Bell *(4)* reports an eight-foot thick unit of clay at a depth of three feet in the vicinity of Shell Bluff, which borders Crescent Lake. This clay is thought to underlie an extensive portion of western Flagler County. Physical properties suggest that the Shell Bluff clay may also be used for brick, tile, and hollow blockware. Bell also reports exposures of clay beds near St. Johns Park, on the north shore of Dead Lake.

Coquina is a clastic sedimentary rock composed of shells and shell fragments cemented by calcium

carbonate. The Anastasia Formation is the source of coquina in Flagler County. Cooke *(9)* reports two coquina pits exposed on either side of the State Road 100, about 2.6 miles west of Flagler Beach. These pits, along with several others, are currently in operation. Well cemented coquina is suitable for use as building material. Less consolidated varieties are useful as concrete mix and road surfacing material.

Farming

The soils and climate of Flagler County are favorable for farming. Since the early 1800's, when a large plantation in the Bulowville area produced sugar cane, cotton, indigo, corn, and rice, agriculture has been an important part of the economy of Flagler County *(8)*.

The commonly grown crops currently include Irish potatoes, cabbage, and a variety of vegetable crops. A small acreage is planted to blueberries, and a few acres of watermelons are planted in most years.

The production of beef cattle is an important livestock operation in Flagler County. Most cattle ranches are cow-calf operations that utilize improved pastures supplemented by small acreages of range and grazeable woodland. In 1982, approximately 9,000 head of beef cattle were in Flagler County *(23)*.

Urban development has removed some land that was previously farmed from agricultural uses, but the loss of acreage has been small. Most of the land that was converted to urban uses was previously used for the commercial production of pine trees.

Recreation

A wide variety of areas that support recreational activities are available in Flagler County. These areas offer opportunities for such diversified recreational activities as freshwater or saltwater fishing, boating, birdwatching, surfing, sunbathing, camping, hunting, playing organized sports, and many other activities.

The coastal section of Flagler County provides many recreational opportunities on the Atlantic Ocean and Intracoastal Waterway. The Flagler Beach Pier and beach are important access points. A large commercial marine and water show facility is on Florida State Road A1A, adjacent to the Atlantic Ocean in the northeastern part of the county. It is world-renowned for a variety of marine attractions and shows. The Whitney Laboratory for Marine Science Research at the University of Florida also is nearby. The Washington Oaks State Gardens and Flagler Beach State Recreation Area provide natural settings for outdoor activities. Wadsworth Park has facilities for football, soccer, baseball, racquetball, and other sports.

Bulow Creek State Reserve and Bulow Plantation Ruins State Monument are on the mainland, south of Florida State Road 100 and west of Old Kings Road. The Bulow Plantation Ruins State Monument is a historical preservation that contains an old plantation mansion and sugarcane mill ruins. The Flagler County recreation area and fairground is west of Bunnell. It has facilities for baseball, rodeo, agricultural exhibitions, and open play. The Palm Coast area also has many sites for organized recreational activities. It offers several golf courses, a swimming and tennis club, a racquet club, and a marina. The Pelay Wildlife Management Area offers seasonal hunting opportunities for the public on 25,463 acres in the southern part of the county. Crescent Lake is accessible by two boat ramps. It provides good fishing and boating opportunities.

Many other community centers, parks and play areas, and school facilities are available for recreational activities throughout Flagler County.

Transportation

Flagler County is served by several major highways. U.S. Highway 1 and Interstate 95 cross the eastern half of the county in a north to south direction. They provide access to many areas within the county and link Flagler County to St. Johns County to the north and to Volusia County to the south. Florida State Road A1A serves as a major road, extending the entire length of the county on the barrier island that is adjacent to the Atlantic Ocean and is separated from the mainland by the Intracoastal Waterway. Florida State Road 11 extends southward from Bunnell to the central part of Volusia County. Florida State Road 100 is the major east-west road, extending from Flagler Beach on the Atlantic Ocean to the western boundary with Putnam County. Several county roads connect the outlying communities to the major roads in the county.

The Florida East Coast Railroad runs north to south, roughly parallel to U.S. Highway 1. The Intracoastal Waterway runs parallel to the Atlantic Ocean and provides a route for transportation by boats and barges. The Flagler County Airport is adjacent to Florida State Highway 100, east of Bunnell. Air transportation is not regularly scheduled out of the Bunnell airport. The Daytona Beach International Airport, about 25 miles south of Bunnell, has scheduled passenger service provided by major domestic air carriers.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a

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

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

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

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

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

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

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

Map Unit Composition

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

In the general soil map units, they are called soils of minor extent.

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

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

In Flagler County, a ground-penetrating radar (GPR) system and hand transfers were used to document the type and variability of soils occurring within map units *(10, 11, 13)*. The GPR system was successfully used on all the soils to detect the presence of major soil horizons or other soil features, to determine their variability, and to measure their depth. In Flagler County, 325 random transects were made with the GPR and by hand. Information from notes and ground-truth observations made in the field were used, along with radar data from this study, to classify the soils and to determine the composition of map units. The map units, described in the section "Detailed Soil Map Units," are based on this data.

General Soil Map Units

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

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

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

Soils on Flatwoods

The five general soil map units in this group consist dominantly of nearly level, poorly drained and very poorly drained soils. Some of the soils are sandy throughout. Some soils are sandy to a depth of 20 to 40 inches or less and are loamy below that depth. Other soils are clayey throughout. The map units make up about 221,721 acres, or about 71 percent of the county.

1. Pineda-Winder-Riviera

Nearly level, poorly drained and very poorly drained soils that are sandy to a depth of 20 to 40 inches or less and are loamy below that depth

This map unit consists mainly of soils on low flatwoods and in sloughs interspersed with scattered areas of swamps and depressional areas that are ponded for long periods. It is in the northwestern and southwestern parts of the county north of Lake Disston. Slopes range from 0 to 2 percent.

The overstory vegetation on these soils consists of slash pine, longleaf pine, cabbage palm, scattered baldcypress, sweetgum, red maple, and water oak. The understory vegetation consists of native shrubs, saw palmetto, maidencane, pineland threeawn, gallberry, bluestem, panicum, and sedges.

This map unit makes up about 18,952 acres, or about 7 percent of the county. It is about 37 percent Pineda soils, 25 percent Winder soils, 18 percent Riviera soils, and 20 percent soils of minor extent.

Pineda soils are poorly drained and are in sloughs and low areas on flatwoods. Slopes range from 0 to 1 percent. Typically, the surface layer is gray fine sand about 3 inches thick. The subsurface layer is light gray fine sand about 10 inches thick. The upper part of the subsoil is brownish yellow fine sand to a depth of 19 inches and yellowish brown fine sand to a depth of 24 inches. A layer of grayish brown fine sand about 2 inches thick is between the upper and lower parts of the subsoil. The lower part of the subsoil, to a depth of 33 inches, is light gray fine sandy loam that has tongues of grayish brown fine sand. It is gray fine sandy loam to a depth of 40 inches. The underlying material is dark gray loamy fine sand to a depth of 47 inches and greenish gray loamy fine sand to a depth of 80 inches or more.

Winder soils are poorly drained and are in low flatwood areas. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark gray fine sand about 7 inches thick. The subsurface layer is grayish brown fine sand about 5 inches thick. The upper part of the subsoil is grayish brown sandy loam to a depth of about 25 inches. It is mixed with tongues of fine sand from the overlying subsurface layer. The lower part of the subsoil is gray, light gray, and greenish gray sandy clay loam to a depth of about 58 inches. The underlying material to a depth of 80 inches or more is greenish gray sandy loam.

Riviera soils are poorly drained and very poorly drained. They are in low areas on flatwoods and in depressions. Slopes are 0 to 1 percent. Typically, the surface layer is black fine sand about 6 inches thick. The subsurface layer extends to a depth of 28 inches. It is gray fine sand in the upper part and is light gray and grayish brown fine sand in the lower part. The upper part of the subsoil, to a depth of 35 inches, is gray fine sandy loam that has tongues of light gray fine sand. The lower part of the subsoil is gray sandy clay loam to

a depth of 51 inches. The underlying material is gray loamy fine sand to a depth of 80 inches or more.

The soils of minor extent in this map unit are Chobee, Favoretta, and Wabasso soils. Chobee and Favoretta soils are near drainageways and are on flood plains. Wabasso soils are on broad flatwoods and have an organic-stained subsoil.

Most areas of this map unit are used for commercial woodland. Some areas are used for woodland grazing. A small acreage has been cleared and seeded to improved pasture. A few areas have been drained, cleared, and used for cultivated crops. The soils in this map unit are well suited to the commercial production of slash pine. They are moderately suited to cultivated crops. Wetness is the major limitation.

2. Wabasso-Pineda-EauGallie

Nearly level, poorly drained soils that are underlain by loamy material; some are sandy to a depth of less than 20 inches over a yellowish, iron-stained subsoil, and some are sandy to a depth of 20 to 40 inches over a dark, organic-stained subsoil

This map unit consists mostly of soils in low, broad flatwood areas that are interspersed with sloughs. It is in the south-central and west-central parts of the county east of Crescent Lake. Slopes range from 0 to 2 percent.

The natural vegetation on these soils consists of slash pine, longleaf pine, cabbage palm, and water oak. The understory vegetation consists of saw palmetto, gallberry, pineland threeawn, panicum, and bluestem. The dominant vegetation in the depressions and swamps consists of cypress, bay, red maple, gum, and other hardwoods.

This map unit makes up about 67,390 acres, or about 22 percent of the county. It is about 35 percent Wabasso soils, 25 percent Pineda soils, 20 percent EauGallie soils, and 20 percent soils of minor extent.

Wabasso soils are poorly drained and are on broad flatwoods. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark gray fine sand about 4 inches thick. The subsurface layer is light gray fine sand to a depth of about 15 inches and gray fine sand to a depth of about 22 inches. The upper part of the subsoil is black fine sand to a depth of 30 inches. The lower part of the subsoil extends to a depth of about 53 inches and is dark gray and gray fine sandy loam in the upper part and dark gray loamy fine sand in the lower part. The underlying material is greenish gray loamy fine sand to a depth of 80 inches or more.

Pineda soils are poorly drained and are in sloughs and on low flatwoods. Slopes range from 0 to 2 percent. Typically, the surface layer is gray fine sand about 3 inches thick. The subsurface layer is light gray fine sand about 10 inches thick. The upper part of the subsoil is brownish yellow fine sand to a depth of about 19 inches and yellowish brown fine sand to a depth of about 24 inches. A layer of grayish brown fine sand about 2 inches thick is between the upper and lower parts of the subsoil. The lower part of the subsoil, to a depth of 33 inches, is light gray fine sandy loam that has tongues of grayish brown fine sand. The lower part of the subsoil is gray fine sandy loam to a depth of 40 inches. The underlying material is dark gray loamy fine sand to a depth of about 47 inches and greenish gray loamy fine sand to a depth of 80 inches or more.

EauGallie soils are poorly drained and are on broad flatwoods. Slopes range from 0 to 2 percent. Typically, the surface layer is black fine sand about 6 inches thick. The subsurface layer is light gray fine sand to a depth of 22 inches. The subsoil is black and dark reddish brown fine sand that is well coated with organic material to a depth of about 33 inches, dark brown to brown fine sand to a depth of about 45 inches, light gray fine sand to a depth of about 56 inches, and light gray fine sandy loam to a depth of about 70 inches. The substratum is light gray loamy fine sand to a depth of 80 inches or more.

The soils of minor extent in this map unit are Gator, Hicoria, Malabar, and Riviera soils. Gator and Hicoria soils are in depressions. They are very poorly drained. Malabar soils are in low areas on the flatwoods. Riviera soils are in low areas and depressions. They are poorly drained and very poorly drained.

Most areas of this map unit are used for the commercial production of pine trees and for woodland grazing for cattle. A few areas have been cleared and seeded to improved pasture. Some small acreages have been drained and used for cultivated crops. The soils in this map unit are well suited to the commercial production of slash pine. They are moderately suited to cultivated crops. Wetness is the major limitation.

3. Myakka-Smyrna-Valkaria

Nearly level, poorly drained soils that are underlain by sandy material; some are sandy to a depth of 20 to 40 inches or less over a dark, organic-stained subsoil, and some are sandy to a depth of less than 20 inches over a yellowish, iron-stained subsoil

This map unit, which is the largest in the county, consists of soils on broad flatwoods that are interspersed with depressional areas and small swamps that are ponded for long periods of time. It is in the eastern part of the county west of the coastal sand ridges and is in the southwestern part of the county east of Disston Lake. A small area extends from north

of Espanola to the St. Johns County line. Slopes range from 0 to 2 percent.

The natural vegetation on these soils consists of slash pine, longleaf pine, and scattered areas of waxmyrtle. The understory vegetation consists of saw palmetto, gallberry, pineland threeawn, bluestem, and panicum. In the depressions and swamps, the vegetation consists of cypress, bay, and mixed hardwoods with an understory of St. Johnswort, maidencane, and cordgrass.

This map unit makes up about 77,336 acres, or about 25 percent of the county. It is about 34 percent Myakka and similar soils, 29 percent Smyrna and similar soils, 16 percent Valkaria soils, and 21 percent soils of minor extent.

Myakka soils are poorly drained and are on broad flatwoods. Slopes range from 0 to 2 percent. Typically, the surface layer is black fine sand about 6 inches thick. The subsurface layer is gray fine sand about 19 inches thick. The subsoil, to a depth of about 31 inches, is black fine sand in the upper part and dark reddish brown fine sand in the lower part. The next layer extends to a depth of about 40 inches and is dark yellowish brown fine sand. The underlying material to a depth of 80 inches or more is fine sand. It is brown in the upper part and light gray in the lower part.

Smyrna soils are poorly drained and are in broad areas on the flatwoods. Slopes range from 0 to 2 percent. Typically, the surface layer is black fine sand about 4 inches thick. The subsurface layer is gray and light gray fine sand about 9 inches thick. The subsoil is dark reddish brown fine sand to a depth of 21 inches. The next layer, to a depth of 50 inches, is brown fine sand. Gray fine sand extends to a depth of 70 inches, and very dark gray fine sand extends to a depth of 80 inches or more.

Valkaria soils are poorly drained and are on low flats and in low areas connecting depressions in the flatwoods. Slopes are 0 to 1 percent. Typically, the surface layer is dark gray fine sand about 6 inches thick. The subsurface layer is light gray fine sand about 11 inches thick. The subsoil is brownish yellow and yellow fine sand to a depth of about 38 inches. The underlying layer is gray fine sand to a depth of 80 inches or more.

The soils of minor extent in this map unit are EauGallie, Immokalee, and Pomona soils on the flatwoods. Small areas of Basinger, Hontoon, Placid, St. Johns, and Samsula soils are in depressions and swamps. The soils are very poorly drained.

Most areas of this map unit in the northern and southwestern parts of the county are used as commercial woodland. Some small areas in the southwestern part are used for sod farming and for improved pasture. Most areas in the eastern part are used for urban development, although some small areas are used as commercial woodland. The soils in this map unit are moderately suited to the commercial production of trees, are well suited to pasture, and are moderately suited to cultivated crops. Wetness is the major limitation.

4. Pomona-Malabar

Nearly level, poorly drained soils that are underlain by loamy material below a depth of 40 inches; some are sandy to a depth of 20 to 40 inches over a dark, organic-stained subsoil, and some are sandy to a depth of less than 20 inches over a yellowish, iron-stained subsoil

This map unit consists of soils on broad flatwoods and low flatwoods interspersed with scattered depressions and swamps that are ponded for long periods. It is mainly in the north-central and southern parts of the county. A small area is in the central part of the county near Bunnell, and another small area is in the western part of the county along the Putnam County line. Slopes range from 0 to 2 percent.

The natural vegetation on these soils consists of slash pine, longleaf pine, water oak, cabbage palm, scattered maple, and sweetgum. The understory vegetation consists of saw palmetto, gallberry, maidencane, pineland threeawn, chalky bluestem, panicum, and lopsided indiangrass. The vegetation in the depressions and swamps consists of cypress, bay, gum, maple, and other hardwoods.

This map unit makes up about 28,469 acres, or about 8 percent of the county. It is about 48 percent Pomona and similar soils, 32 percent Malabar and similar soils, and 20 percent soils of minor extent.

Pomona soils are poorly drained and are in broad areas on the flatwoods. Slopes range from 0 to 2 percent. Typically, the surface layer is black fine sand about 4 inches thick. The subsurface layer is gray fine sand about 17 inches thick. The upper part of the subsoil is black loamy fine sand to a depth of about 28 inches and dark reddish brown fine sand to a depth of about 50 inches. The lower part of the subsoil is grayish brown fine sandy loam to a depth of about 63 inches. The underlying material is dark grayish brown fine sandy loam to a depth of 80 inches or more.

Malabar soils are poorly drained and are in low areas on the flatwoods. Typically, the surface layer is black fine sand about 4 inches thick. The subsurface layer is gray fine sand about 6 inches thick. The upper part of the subsoil is yellowish brown fine sand to a depth of about 30 inches. Gray and grayish brown fine sand extends to a depth of about 60 inches, and grayish brown sandy clay loam extends to a depth of 80 inches

or more. Slopes range from 0 to 2 percent.

The soils of minor extent in this map unit are Basinger, EauGallie, Hicoria, Myakka, Wabasso, and Valkaria soils. Basinger and Hicoria soils are in depressions. Hicoria soils are very poorly drained. EauGallie, Myakka, and Wabasso soils are in broad areas on the flatwoods. Valkaria soils are on low flats and in low areas that connect depressions in the flatwoods.

Most areas of this map unit are used for the commercial production of pine trees and for woodland grazing for cattle. Some small areas are used as improved pasture. Some areas in the vicinity of Bunnell have been cleared and used for urban development. The soils in this map unit are well suited to the commercial production of trees and to woodland grazing for cattle. Wetness is the main limitation.

5. Winder-Favoretta

Nearly level, poorly drained and very poorly drained soils; some are sandy to a depth of less than 20 inches and are loamy below that depth, and some are clayey throughout

This map unit consists mainly of soils on narrow to broad, low flatwoods near major streams and drainageways in the western part of the county. The areas near the streams and drainageways are subject to flooding. Slopes are 0 to 1 percent.

The natural vegetation on these soils consists of water oak, cabbage palm, sweetgum, slash pine, and red maple and a few scattered areas of bay and cypress. The understory consists of scattered saw palmetto, bluestem, pineland threeawn, maidencane, gallberry, panicum, and sedges.

This map unit makes up about 29,574 acres, or about 9 percent of the county. It is about 58 percent Winder and similar soils, 18 percent Favoretta and similar soils, and 24 percent soils of minor extent.

Winder soils are poorly drained and are in low flatwood areas, on flood plains, and in drainageways. Slopes are 0 to 1 percent. Typically, the surface layer is very dark gray fine sand about 7 inches thick. The subsurface layer is grayish brown fine sand about 5 inches thick. The upper part of the subsoil is grayish brown sandy loam to a depth of about 25 inches. It is mixed with tongues of grayish brown fine sand from the overlying subsurface layer. The lower part of the subsoil is gray, light gray, and greenish gray sandy clay loam to a depth of about 58 inches. The underlying material to a depth of 80 inches or more is greenish gray sandy loam.

Favoretta soils are poorly drained and are in low flatwood areas near streams and drainageways and on flood plains. Slopes are 0 to 1 percent. Typically, the surface layer is very dark gray clay about 12 inches thick. The subsoil is dark gray and gray clay to a depth of about 66 inches and light brownish gray clay to a depth of 80 inches or more.

The soils of minor extent in this map unit are Gator, Hicoria, Pineda, and Riviera soils. Gator and Hicoria soils are in depressions. They are very poorly drained. Pineda soils are in sloughs and on low flatwoods. Riviera soils are on low flatwoods and in depressions.

Most areas of this map unit are used for the commercial production of pine trees. Some small areas are used for row crops and as improved pasture. The soils in this map unit are poorly suited to the commercial production of trees, to cultivated crops, and to improved pasture. Flooding, wetness, and the high content of clay in the soils are the major limitations.

Soils on Inland and Coastal Wetlands

The six general soil map units in this group consist of nearly level, poorly drained and very poorly drained soils. The coastal wetlands, which are dominated by organic soils, are in the tidal marshes near the Atlantic coast. The inland wetlands are on the flood plains and in the large swamps, marshes, and poorly defined drainageways that are throughout the county. The map units make up about 52,602 acres, or about 16 percent of the county.

6. Samsula-Hontoon

Nearly level, very poorly drained soils; some are organic to a depth of 16 to 51 inches and are sandy below that depth, and some are organic to a depth of 51 inches or more

This map unit consists mainly of soils along drainageways in wetland swamps, marshes, and depressions on the flatwoods. The largest areas of this map unit are in the northwestern parts of the county. Some small areas are in the north-central and southeastern parts of the county. Slopes are 0 to 1 percent.

The natural vegetation is mainly cypress, bay, and other hardwoods. The understory vegetation consists of maidencane, sawgrass, St. Johnswort, greenbrier, sedges, and water-tolerant grasses.

This map unit makes up about 16,316 acres, or about 6 percent of the county. It is about 55 percent Samsula soils, 20 percent Hontoon soils, and about 25 percent soils of minor extent.

Samsula soils are very poorly drained and are in depressions. Slopes are less than 1 percent. Typically, the surface soil is muck. It is about 31 inches thick. It is dark reddish brown in the upper 10 inches and is black

in the lower 21 inches. The underlying material, to a depth of 80 inches, is fine sand. The upper 10 inches is very dark gray, the following 9 inches is grayish brown, and the lower 30 inches is light brownish gray.

Hontoon soils are very poorly drained and are in depressions. Slopes are less than 1 percent. Typically, the surface soil is muck. It is more than 80 inches thick. It is dark reddish brown in the upper 25 inches and is black in the lower 55 inches.

The soils of minor extent in this map unit are Basinger, Placid, and St. Johns soils. These minor soils did not form in organic material. They are usually along the outer margin of depressional areas.

Most areas of this map unit support the natural vegetation and are used for wildlife habitat. The map unit is not suited to the commercial production of pine trees. Wetness is the major limitation. In some areas cypress and other hardwoods are harvested during extended dry periods.

7. Hicoria-Riviera-Gator

Nearly level, poorly drained and very poorly drained soils; some have a thick or thin dark sandy or mucky surface layer over a loamy subsoil, and some have a thick layer of muck over a loamy substratum

This map unit consists mainly of very poorly drained soils in swamps and depressions on the flatwoods. These areas are ponded for long periods. The map unit is mainly in the northwestern part of the county, but a small area is in the center of the county, about 5 miles west of Bunnell. Slopes range from 0 to 2 percent.

The natural vegetation on these soils consists of cypress, red maple, sweetgum, and waxmyrtle and scattered areas of slash pine and water oak. The understory vegetation consists of sawgrass, maidencane, needlegrass, fern, sedges, and other water-tolerant grasses.

This map unit makes up about 8,583 acres, or about 3 percent of the county. It is about 45 percent Hicoria soils, 25 percent Riviera soils, 18 percent Gator soils, and 12 percent soils of minor extent.

Hicoria soils are very poorly drained and are in depressions. Slopes are 0 to 1 percent. Typically, the surface soil is about 20 inches thick. It is black mucky fine sand in the upper 10 inches and very dark gray fine sand in the lower 10 inches. The subsurface layer is dark gray fine sand to a depth of 32 inches. The subsoil is gray sandy clay loam to a depth of about 55 inches and is gray fine sandy loam to a depth of 80 inches or more.

Riviera soils are very poorly drained and are in depressions. Slopes are 0 to 1 percent. Typically, the surface layer is very dark gray fine sand about 3 inches thick. The subsurface layer is grayish brown fine sand to a depth of 22 inches. The subsoil extends to a depth of 50 inches. The upper 13 inches is dark grayish brown fine sandy loam that has tongues of light gray fine sand, the next 5 inches is dark grayish brown sandy clay loam, and the lower 10 inches is gray sandy clay loam. The next layer is dark grayish brown fine sandy loam about 10 inches thick. The underlying material is light brownish gray loamy sand to a depth of 80 inches or more.

Gator soils are very poorly drained and are in depressions. Typically, the surface soil is muck to a depth of about 26 inches. The upper part is black, and the lower part is very dark gray. The underlying material is dark grayish brown fine sandy loam to a depth of about 29 inches, dark gray fine sandy loam to a depth of about 49 inches, and gray sandy clay loam to a depth of 80 inches or more.

The soils of minor extent in this map unit are Basinger, Favoretta, Hontoon, Samsula, and Winder soils. Basinger, Favoretta, and Winder soils formed in mineral materials. They are on the outer edges of the swamps and depressions. Hontoon and Samsula soils are in depressions. Hontoon soils formed in organic layers more than 80 inches thick, and Samsula soils formed in organic layers less than 52 inches thick.

Most areas of this map unit support the natural vegetation and are used for wildlife habitat. In some areas hardwoods are harvested during extended dry periods. This map unit is poorly suited or is generally not suited to the commercial production of trees. Wetness is the major limitation.

8. Placid-Basinger-St. Johns

Nearly level, very poorly drained sandy soils; some have a thick or thin dark surface layer over a dark organic-stained subsoil, and some have a thick dark-colored surface layer over sandy underlying material

This map unit consists of soils in swamps, depressions, and poorly defined drainageways on the flatwoods. It is mainly in the northeastern part of the county north of Bunnell, but a small area is in the southeastern part of the county west of Favoretta. Slopes are 0 to 1 percent.

The natural vegetation on these soils consists of pondcypress, red maple, sweetgum, and swamp elm. The understory vegetation consists of sawgrass, maidencane, sedges, iris, waxmyrtle, and greenbrier.

This map unit makes up about 5,949 acres, or about 1 percent of the county. It is about 55 percent Placid soils, 25 percent Basinger soils, 15 percent St. Johns soils, and 5 percent soils of minor extent.

Placid soils are very poorly drained and are in depressions and narrow drainageways. Slopes are 0 to 1 percent. Typically, the surface layer is fine sand about 15 inches thick. It is black in the upper 8 inches and very dark gray in the lower 7 inches. The underlying material, to a depth of about 80 inches, is grayish brown fine sand in the upper part, light brownish gray fine sand in the next part, and light gray fine sand in the lower part.

Basinger soils are very poorly drained and are in depressions. Slopes are 0 to 1 percent. Typically, the surface layer is black fine sand about 2 inches thick. The subsurface layer is about 27 inches thick. It is light gray fine sand in the upper part and grayish brown fine sand in the lower part. The subsoil is dark yellowish brown and grayish brown fine sand about 21 inches thick. The underlying material is pale brown fine sand to a depth of about 80 inches.

St. Johns soils are very poorly drained and are in depressions. Slopes are 0 to 1 percent. Typically, the surface layer is black fine sand about 10 inches thick. The subsurface layer is gray fine sand about 15 inches thick. The subsoil is very dark grayish brown fine sand to a depth of about 39 inches and dark yellowish brown fine sand to a depth of about 54 inches. The underlying material is dark gray fine sand to a depth of 80 inches or more.

The soils of minor extent in this map unit are Hontoon, Samsula, and Valkaria soils. Hontoon and Samsula soils formed in organic material in depressions. They are very poorly drained. Valkaria soils are in low areas between depressions. They are poorly drained.

Most areas of this map unit support the natural vegetation and are used for wildlife habitat. In some areas hardwoods are harvested from natural stands during extended dry periods. The soils in this map unit are poorly suited to the commercial production of trees. Wetness and flooding are the major limitations.

9. Favoretta-Chobee

Nearly level, very poorly drained soils that are frequently flooded; some have a sandy surface less than 20 inches thick and are underlain by loamy material, and some are clayey throughout

This map unit is made up of frequently flooded soils in the freshwater swamps on the flood plains of Haw Creek, Black Branch, and Sweetwater Branch. Slopes range from 0 to 2 percent.

The natural vegetation on these soils consists of red maple, sweetgum, swamp ash, water oak, cabbage palm, and baldcypress. The understory vegetation consists of waxmyrtle, greenbrier, sawgrass, maidencane, and a few water-tolerant sedges and grasses.

This map unit makes up about 8,752 acres, or about 3 percent of the county. It is about 55 percent Favoretta soils, 35 percent Chobee soils, and 10 percent soils of minor extent.

Favoretta soils are very poorly drained and are along drainageways and on flood plains. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark gray clay about 12 inches thick. The subsoil is dark gray and gray clay to a depth of about 66 inches and is light brownish gray clay to a depth of 80 inches or more.

Chobee soils are very poorly drained and are along drainageways and on flood plains. Slopes range from 0 to 2 percent. Typically, the surface layer is about 10 inches thick. The upper part is black loamy fine sand, and the lower part is very dark gray loamy fine sand. The subsoil is dark gray sandy clay loam to a depth of about 25 inches and is gray sandy clay loam to a depth of 55 inches. The underlying material, to a depth of 80 inches or more, is gray fine sandy loam.

The soils of minor extent in this map unit are Pineda, Riviera, Samsula, and Winder soils. Pineda soils are poorly drained and are on low flatwoods. Riviera and Winder soils are on low flatwoods and in depressions. Samsula soils formed in organic material in depressions.

Most areas of this map unit support the natural vegetation and are used for wildlife habitat. In some areas natural stands of hardwoods are commercially harvested. These areas are allowed to reseed themselves naturally. The soils in this map unit are poorly suited to the commercial production of trees. Flooding and wetness are the major limitations.

10. Turnbull-Pellicer

Nearly level, very poorly drained soils that are subject to frequent tidal flooding; some have an organic surface layer underlain by loamy and sandy material, and some are loamy and clayey throughout

This map unit consists of soils in the very poorly drained tidal marshes along the Atlantic coastline, which are inundated by saltwater twice daily during high tides. The marshes are flooded by storm-driven tides during hurricanes and severe weather conditions. Slopes are less than 1 percent.

The natural vegetation on these soils consists of needlegrass rush, seashore saltgrass, smooth cordgrass, bushy seaoxeye, marshy cordgrass, glasswort, and bigleaf sumpweed.

This map unit makes up about 5,949 acres, or about 1 percent of the county. It is about 42 percent Turnbull

soils, 37 percent Pellicer soils, and 21 percent soils of minor extent.

Turnbull soils are very poorly drained and are in the tidal marshes. Slopes are less than 1 percent. Typically, the surface layer is very dark gray muck about 8 inches thick. The underlying material is olive gray clay to a depth of 42 inches and is gray loamy fine sand to a depth of 80 inches.

Pellicer soils are very poorly drained and are in the tidal marshes. Slopes are less than 1 percent. Typically, the surface layer is very dark grayish brown silty clay loam about 10 inches thick. The underlying material is dark gray clay loam to a depth of 50 inches, dark gray sandy clay to a depth of 55 inches, and dark gray fine sandy loam to a depth of 80 inches or more.

The soils of minor extent in this map unit are Terra Ceia soils, which formed in organic material. They are subject to tidal flooding.

Most areas of this map unit support the natural vegetation and are used for wildlife habitat. Flooding and wetness are the major limitations for other uses.

11. Terra Ceia-Winder

Nearly level, very poorly drained and poorly drained soils that are frequently flooded; some are organic to a depth of 51 inches or more, and some are sandy to a depth of less than 20 inches and are loamy below that depth

This map unit consists mainly of soils in broad, swampy areas on the flood plains along lakes and streams. It is mainly along Crescent Lake and Dead Lake, along the southwestern part of Lake Disston, and on the flood plain along Haw Creek. Slopes range from 0 to 2 percent.

The natural vegetation on these soils consists of sweetgum, red maple, cypress, bay, and cabbage palm. Some areas do not have trees, but they support a dense growth of marsh vegetation consisting mostly of sawgrass.

This map unit makes up about 7,053 acres, or about 2 percent of the county. It is about 60 percent Terra Ceia soils, 25 percent Winder soils, and 15 percent soils of minor extent.

Terra Ceia soils are very poorly drained and are on flood plains. Slopes range from 0 to 1 percent. Typically, the soil is muck. It is more than 80 inches thick. The upper 25 inches is dark reddish brown. Below that depth, black muck extends to a depth of 80 inches or more.

Winder soils are poorly drained and are on flood plains and in depressions. Slopes are 0 to 1 percent. Typically, the surface layer is very dark gray fine sand about 7 inches thick. The subsurface layer is grayish brown fine sand about 5 inches thick. The upper part of the subsoil is grayish brown sandy loam to a depth of 25 inches. It has tongues of grayish brown fine sand mixed from the overlying subsurface layer. The lower part of the subsoil is gray, light gray, and greenish gray sandy clay loam to a depth of about 58 inches. The underlying material is greenish gray sandy loam to a depth of 80 inches or more.

Most areas of this map unit support the natural vegetation and are used for wildlife habitat. Flooding and wetness are the major limitations for other uses.

Soils on Sand Ridges and Coastal Dunes

The five general map units in this group consist mainly of excessively drained to somewhat poorly drained, nearly level to sloping soils on ridges and slopes adjacent to well defined drainageways and coastal areas. These soils are sandy throughout. Some have a dark, organic-stained subsoil layer, and some have a clastic rock subsoil layer. They generally are along the Atlantic coast, but small areas are north of Espanola in the north-central part of the county and border St. Johns County in the northeast. The map units make about 31,362 acres, or about 10 percent of the county.

12. Orsino-Astatula-Tavares

Nearly level to sloping, excessively drained and moderately well drained soils that are sandy throughout

This map unit consists of soils on narrow sand ridges west of the intracoastal waterway and on the adjoining sand ridges that extend from St. Johns County in the northern part of the county. Slopes range from 0 to 8 percent.

The natural vegetation on these soils consists of sand pine, scrub live oak, turkey oak, and blackjack oak and scattered areas of slash pine and longleaf pine. The understory vegetation consists of saw palmetto, pineland threeawn, bluestem, indiangrass, panicum, and paspalum.

This map unit makes up about 8,752 acres, or about 3 percent of the county. It is about 30 percent Orsino and similar soils, 28 percent Astatula and similar soils, 22 percent Tavares and similar soils, and 20 percent soils of minor extent.

Orsino soils are moderately well drained and are on moderately high ridges and knolls. Slopes range from 0 to 5 percent. Typically, the surface layer is grayish brown fine sand about 3 inches thick. The subsurface layer is white fine sand about 9 inches thick. The

subsoil, to a depth of 49 inches, is brown fine sand. It has common tongues of white fine sand in the upper part and is pale brown fine sand in the lower part. The underlying layer is light gray fine sand to a depth of 80 inches.

Astatula soils are excessively drained and are on high ridges and knolls. Slopes range from 0 to 8 percent. Typically, the surface layer is dark grayish brown fine sand about 7 inches thick. The underlying material is very pale brown fine sand to a depth of 80 inches or more.

Tavares soils are moderately well drained and are on narrow to broad ridges and knolls. Slopes range from 0 to 5 percent. Typically, the surface layer is gray fine sand about 5 inches thick. The underlying material is pale brown and very pale brown sand about 46 inches thick. It has a few fine faint brownish yellow mottles and pockets of white fine sand below a depth of 32 inches. From a depth of 46 to 80 inches is white fine sand that has a few distinct yellow and strong brown mottles.

Similar soils are Adamsville, Cassia, and Paola soils. Adamsville and Cassia soils are somewhat poorly drained. Paola soils have a yellowish brown subsoil. The soils of minor extent are Bulow and Cocoa soils, which are underlain by coquina limestone at a depth of 20 to 60 inches.

Many areas of this map unit are used for the commercial production of pine trees. Some areas are used for residential development. Other areas have been cleared and are used as improved pasture and for hay. Some large areas in the northern part of the county support the natural vegetation and are used for wildlife habitat. The soils in this map unit are moderately suited to the production of trees. The soils are sandy, and droughtiness is the main limitation.

13. Pomello-Cassia-Orsino

Nearly level and gently sloping, moderately well drained and somewhat poorly drained soils that are sandy throughout; some have an organic-stained layer at a depth of 20 to 50 inches

This map unit consists mainly of soils on low ridges and knolls in the flatwoods and on coastal ridges. It is mainly west of Graham Swamp. Some other areas are along the Atlantic coastline at Bonn Terra and north of Espanola. Slopes range from 0 to 5 percent.

The natural vegetation on these soils consists of sand live oak, laurel oak, sand pine, slash pine, longleaf pine, and turkey oak. The understory consists of bluestem, lopsided indiangrass, pineland threeawn, runner oak, and saw palmetto.

This map unit makes up 12,918 acres, or about 4 percent of the county. It is about 36 percent Cassia and similar soils, 32 percent Pomello and similar soils, 10 percent Orsino soils, and 22 percent soils of minor extent.

Pomello soils are moderately well drained and are on moderately high ridges and knolls. Slopes range from 0 to 5 percent. Typically, the surface layer is dark gray fine sand about 5 inches thick. The subsurface layer is light gray fine sand about 36 inches thick. The subsoil, to a depth of about 66 inches, is very dark brown fine sand in the upper 14 inches and is very dark gray fine sand in the lower 11 inches. The underlying material, to a depth of 80 inches, is grayish brown fine sand in the upper part and gray fine sand in the lower part.

Cassia soils are somewhat poorly drained and are on low ridges and knolls. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark gray fine sand about 5 inches thick. The subsurface layer is gray and white fine sand about 21 inches thick. The subsoil, to a depth of 42 inches, is very dark brown fine sand in the upper 10 inches and dark yellowish brown fine sand in the lower 6 inches. The underlying material is pale brown fine sand to a depth of 69 inches and is light brownish gray fine sand to a depth of 80 inches or more.

Orsino soils are moderately well drained and are on moderately high ridges and knolls. Slopes range from 0 to 5 percent. Typically, the surface layer is grayish brown fine sand about 3 inches thick. The subsurface layer is white fine sand about 9 inches thick. The subsoil, to a depth of 49 inches, is brown fine sand. It has common tongues of white fine sand in the upper part and is pale brown fine sand in the lower part. The underlying layer is light gray fine sand to a depth of 80 inches.

Similar soils in this map unit are Adamsville and Tavares soils. Adamsville soils are on low knolls. Tavares soils are on slightly higher knolls. Soils of minor extent in this map unit are Bulow, Cocoa, Immokalee, Myakka, and Paola soils. Bulow and Cocoa soils are underlain by coquina limestone. Immokalee and Myakka soils are poorly drained. Paola soils are on high knolls.

Most areas of this map unit are used for residential development. Some small areas still support the natural vegetation. The area north of Espanola is used mainly for the production of pine, but small areas support the natural vegetation and are used for woodland grazing. The soils in this map unit are moderately suited to building site development. Wetness is the main limitation.

14. Palm Beach-Narcoossee-Welaka

Nearly level to sloping, well drained to excessively drained, somewhat poorly drained and well drained soils; some are sandy and have shell fragments throughout, and some have shell fragments in the substratum below a depth of 40 inches

This map unit consists of soils on narrow, rolling sandy ridges that are interspersed with narrow swales. The ridges and swales are elongated and are generally parallel to the Atlantic coastline. The ridges form the primary dunes adjacent to the ocean beach and the relict dunes farther inland. The slopes in the ridges are complex. They range from 0 to 8 percent. The slopes in the swales range from 0 to 2 percent.

The overstory vegetation consists of dwarf live oak, scrub oak, shore bay, cabbage palm, eastern redcedar, longleaf pine, slash pine, and sand pine. The understory vegetation consists of yaupon holly, saw palmetto, waxmyrtle, pineland threeawn, and runner oak and scattered areas of rosemary and sea oats.

This map unit makes up 2,805 acres, or about 1 percent of the county. It is about 31 percent Palm Beach soils, 10 percent Narcoossee soils, 5 percent Welaka soils, and 54 percent soils of minor extent.

Palm Beach soils are well drained to excessively drained and are on primary sand dunes. Slopes range from 0 to 8 percent. Typically, the surface layer is grayish brown gravelly sand about 4 inches thick. It contains about 15 percent sand-sized shell fragments. The underlying layer is light brownish gray gravelly sand that has about 15 percent shell fragments to a depth of about 22 inches, pale brown very gravelly sand that has about 40 percent sand-sized shell fragments to a depth of about 47 inches, and light gray extremely gravelly sand to a depth of 80 inches. It is about 75 percent, by volume, shell fragments.

Narcoossee soils are somewhat poorly drained and are on swales and low knolls. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark gray fine sand about 3 inches thick. The subsurface layer is fine sand about 14 inches thick. It is gray in the upper 2 inches and is light gray in the lower 12 inches. The subsoil extends to a depth of 41 inches. The upper part is dark brown fine sand about 6 inches thick. The upper 2 inches of the subsoil is weakly expressed and is discontinuous in 20 to 25 percent of the pedons. The lower part of the subsoil is brown fine sand about 18 inches thick. The underlying material is light gray extremely gravelly fine sand and gravelly fine sand. It is stratified with layers of light gray fine sand to a depth of more than 80 inches.

Welaka soils are well drained and are on secondary and primary sand dunes and also on the lower back slopes of primary dunes and high knolls. Slopes range from 2 to 5 percent. Typically, the surface layer is dark gray fine sand about 3 inches thick. The subsurface layer is light gray fine sand about 9 inches thick. The subsoil is brownish yellow fine sand to a depth of about 42 inches. The underlying material is very pale brown gravelly fine sand to a depth of about 50 inches and is light gray very gravelly fine sand to a depth of 80 inches or more.

The soils of minor extent in this map unit are Myakka, Orsino, and Paola soils. These soils are not underlain by materials that have a high content of shell fragments within a depth of 80 inches.

Some areas of this map unit, along the primary sand dunes, have been preserved. They support the natural vegetation and are used for wildlife habitat. Because this map unit contains attractive beaches, it is used extensively for recreation and urban development. The soils generally have slight to moderate limitations for building site development. Wetness is the main limitation for the Narcoossee soils.

15. Paola-Pomello-Cocoa

Nearly level to sloping, excessively drained to moderately well drained soils that are sandy throughout; some have a dark, organic-stained subsoil, and some have a grayish and brownish sandy surface soil underlain by coquina rock

This map unit consists of soils on narrow, rolling, low ridges and knolls that are interspersed with narrow swales. The ridges are old relict sand dunes and are generally parallel to the coastline. The map unit is mainly west of the intracoastal waterway, south of Flagler Beach and west of Graham Swamp. Another large area is west of the primary sand dunes at Washington Oaks Garden State Park and Marineland. Slopes range from 0 to 8 percent.

The natural vegetation on these soils consists of cabbage palm, laurel oak, live oak, longleaf pine, pignut hickory, and sand pine and scattered areas of turkey oak, scrub live oak, southern magnolia, and southern redcedar. The understory vegetation consists of creeping bluestem, dogfennel, iron bush, panicum, pineland threeawn, rosemary, saw palmetto, and wild grapes.

This map unit makes up about 6,887 acres, or about 2 percent of the county. It is about 54 percent Paola and similar soils, 19 percent Pomello soils, 17 percent Cocoa soils, and 10 percent soils of minor extent.

Paola soils are excessively drained and are on high knolls and ridges. Slopes range from 0 to 8 percent. Typically, the surface layer is gray fine sand about 6 inches thick. The subsurface layer is white fine sand,

about 10 inches thick, that tongues into the underlying horizon. The subsoil is yellowish brown fine sand to a depth of 31 inches. The underlying material is yellowish brown fine sand to a depth of 80 inches.

Pomello soils are moderately well drained and are on moderately high knolls and ridges. Slopes range from 0 to 5 percent. Typically, the surface layer is dark gray fine sand about 5 inches thick. The subsurface layer is light gray fine sand about 36 inches thick. The subsoil, to a depth of about 66 inches, is very dark brown fine sand in the upper 14 inches and very dark gray fine sand in the lower 11 inches. The underlying material to a depth of about 80 inches is grayish brown fine sand in the upper part and is gray fine sand in the lower part.

Cocoa soils are well drained and are on narrow coastal ridges. Slopes range from 0 to 5 percent. Typically, the surface layer is grayish brown sand about 3 inches thick. The subsurface layer is pale brown sand about 13 inches thick. The upper part of the subsoil is reddish yellow sand to a depth of 29 inches. The lower part of the subsoil is yellowish red loamy sand to a depth of about 35 inches. Coquina limestone is at a depth of about 35 inches, but the depth varies from about 20 to 40 inches within a short distance.

Similar soils are Adamsville, Astatula, and Tavares soils. Adamsville and Tavares soils are in the lower areas. Astatula soils do not have a light-colored subsurface layer. The soils of minor extent are Bimini, Bulow, Cassia, and Orsino soils. Bimini soils have shells in the substratum. Bulow soils are underlain by limestone below a depth of 42 inches. Cassia and Orsino soils have an organic-stained subsoil or a high-chroma subsoil.

Most areas of this map unit support the natural vegetation and are used for wildlife habitat. Some areas are used for homesites. A few areas have been cleared and are used for improved pasture. A large area in the northeastern part of the county is used for Washington Oaks State Garden Park and Marineland. Some areas west of Graham Swamp are used for the commercial production of pine trees. The soils in this map unit are well suited to building site development, are moderately suited to the production of trees, and are poorly suited to pasture. Droughtiness is the main limitation for the production of trees or for pasture.

Soils on a Low-Lying Hammock

The general soil map unit in this group consists of nearly level, poorly drained and very poorly drained soils. Some have a sandy surface layer less than 20 inches thick and are loamy below that depth. Others are clayey throughout. This map unit makes up about 8,414 acres, or about 3 percent of the county.

16. Favoretta-Tuscawilla

Nearly level, poorly drained and very poorly drained soils; some have a sandy surface layer less than 20 inches thick and are loamy below that depth, and some are clayey throughout

This map unit consists mainly of soils on a narrow, hardwood hydric hammock that runs parallel to the Atlantic coastline and is about 1 mile inland. It consists mainly of poorly drained areas that are interspersed with numerous very poorly drained depressional areas, which are ponded for long periods of time, and poorly to well defined drainageways, which are periodically flooded. Slopes range from 0 to 2 percent.

The natural vegetation on these soils consists mainly of deciduous hardwoods, such as American hornbeam, pignut hickory, red maple, sweetgum, and southern magnolia. Other trees include cabbage palm, laurel oak, longleaf pine, slash pine, and water oak. The understory vegetation consists of bluestem, maidencane, panicum, pineland threeawn, saw palmetto, sedges, and waxmyrtle.

This map unit makes up about 8,414 acres, or about 3 percent of the survey area. It is about 52 percent Favoretta soils, 32 percent Tuscawilla soils, and 16 percent soils of minor extent.

Favoretta soils are very poorly drained. Slopes are less than 1 percent. Typically, the surface layer is very dark gray clay about 12 inches thick. The subsoil is dark gray and gray clay to a depth of 66 inches and is light brownish gray clay to a depth of 80 inches or more.

Tuscawilla soils are poorly drained. Slopes are 0 to 1 percent. Typically, the surface layer is black fine sand about 5 inches thick. The subsurface layer is dark gray fine sand about 7 inches thick. The upper part of the subsoil is dark gray sandy clay loam to a depth of about 25 inches. The lower part of the subsoil is gray sandy clay loam that is mixed with shells and calcium carbonate nodules to a depth of about 45 inches. The underlying layer is gray loamy fine sand that is mixed with shells and calcium carbonate nodules to a depth of 60 inches and light gray gravelly fine sandy loam that has about 20 percent shells and nodules to a depth of 80 inches or more.

The soils of minor extent in this map unit are EauGallie, Pineda, Pomona, Wabasso, and Winder soils. These soils are poorly drained. They are in low flatwood areas.

Most areas of this map unit support the natural vegetation and are used as wildlife habitat. Wetness and flooding are the main limitations for other uses.

Detailed Soil Map Units

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

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

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

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

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

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

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

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

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

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

Table 3 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

2—Riviera fine sand. This very deep, nearly level, poorly drained soil is in broad to narrow, low areas on the flatwoods. Individual areas of this soil are irregular in shape. They range from 3 to 700 acres in size. Slopes are smooth and are less than 2 percent.

In 80 percent of the areas mapped as Riviera fine sand, Riviera and similar soils make up 84 to 96 percent of the map unit. Dissimilar soils make up 4 to 16 percent.

Typically, the surface layer is black fine sand about 6 inches thick. The subsurface layer extends to a depth of 28 inches. It is gray fine sand in the upper part and light gray and grayish brown fine sand in the lower part. The upper part of the subsoil, to a depth of 35 inches, is gray fine sandy loam that has tongues of light gray fine sand. The lower part of the subsoil is gray sandy clay loam to a depth of 51 inches. The underlying material is gray loamy fine sand to a depth of 80 inches or more.

Some areas contain soils that are similar to the Riviera soil but have a surface layer more than 8 inches thick or have a brown or pale brown sandy layer above the subsoil.

The dissimilar soils in this map unit include small areas of Favoretta, EauGallie, and Wabasso soils. They are in landscape positions similar to those of the Riviera soil. Favoretta soils are clayey throughout. EauGallie and Wabasso soils have an organic-stained layer in the subsoil.

The seasonal high water table is at a depth of 6 to 18 inches for as much as 6 months during most years. It recedes to a depth of more than 40 inches during long dry periods. Permeability is slow or very slow. Available water capacity is low.

Most areas are used for woodland or for the production of vegetable crops. A few areas are used for pasture and hay. The natural vegetation consists of slash pine, longleaf pine, cabbage palm, scattered baldcypress, sweetgum, water oak, and red maple. The understory vegetation consists of gallberry, maidencane, saw palmetto, pineland threeawn, and bluestem.

This soil is moderately suited to cultivated crops. The main limitations are excessive wetness and poor soil quality. Irish potatoes and cabbage are the main crops grown. Proper row management, lateral ditches or tiles, and well constructed outlets help to remove the excess surface water. A furrow irrigation system is suited to this soil. Land grading and smoothing improve the surface drainage, allow a more uniform application of irrigation water, and permit the more efficient use of farm equipment. Returning all of the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to conserve moisture, maintain fertility, and control erosion. Frequent applications of fertilizer and lime are needed for the best yields.

With good water-control management, this soil is well suited to pasture. The main limitations are a result of the wetness. Excessive water on the surface can be removed by using field ditches and tile drains. Grasses and legumes grow well if adequate fertilizer is used. The low available water capacity limits the production of plants during extended dry periods. Deep-rooted plants, such as coastal bermudagrass and bahiagrass, tolerate droughty conditions better if they are properly fertilized and limed. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 80. The potential for commercial production of pulpwood is 42 cords per acre harvested from a fully stocked stand of trees 25 years old. The main management concerns for producing and harvesting timber are the equipment limitation, the seedling mortality rate, the windthrow hazard, and plant competition. Planting on beds helps to overcome the limitations caused by the excessive wetness. Although conventional methods of harvesting timber generally can be used, their use can be limited during rainy seasons. The use of equipment during wet periods can cause soil compaction. Using special equipment, such as high-flotation rubber tires or crawler machinery, can reduce the equipment limitation. Site preparation, such as chopping, applying herbicide, and bedding, reduces debris, reduces immediate plant competition, and facilitates hand and mechanical planting. Other good management practices include the selection of appropriate species, restricted burning, and a harvesting system that leaves residual biomass distributed throughout the site.

This soil is well suited to range and grazeable woodland. It has a moderate to high potential for the production of native forage. The dominant plants suitable for grazing include chalky bluestem, creeping bluestem, indiangrass, and panicum. This soil is in the North Florida Flatwoods range site.

This soil has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings because of the wetness caused by the seasonal high water table. If suitable outlets are available, shallow surface drainage can help to remove the excess water. Suitable fill material can be used to elevate building sites and increase the effective depth to the water table. The limitations are severe for shallow excavations because cutbacks are unstable and excavations fill with water when the water table is high. Shoring sidewalls of excavations can help to prevent caving. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness and the slow permeability in the subsoil are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome these limitations. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining the lagoons and trenches with impervious soil material can reduce the excess seepage. Water-control measures should be used to remove the excess surface and ground water.

The wetness, the slow permeability in the subsoil, and the sandy surface are severe limitations for recreational development. This soil remains wet for long periods because water percolates through it slowly. The installation of a water-control system that removes excess water can reduce the wetness caused by the seasonal high water table and the slow permeability.

The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential of this soil as habitat for openland, woodland, and wetland wildlife is fair. Areas of this soil provide nesting sites, den sites, and food and cover for a diverse and numerous wildlife population. Many larger animals are found in areas where this soil joins other ecological communities. Areas of this soil are well suited to deer, quail, bobcat, skunk, opossum, and raccoon. Other species typically include cottontail rabbit, fox squirrel, gray fox, and a variety of birds, reptiles, and amphibians.

This Riviera soil is in capability subclass IIIw. The woodland ordination symbol is 10w. The ecological community is North Florida Flatwoods.

3—Samsula and Hontoon soils, depressional. These very deep, nearly level, very poorly drained soils are in depressions on the flatwoods. Individual areas are circular to irregular in shape. They range from 3 to 6,000 acres in size. Slopes are smooth to concave. They are less than 2 percent, although they are mainly less than 1 percent.

Hontoon, Samsula, and similar soils make up 85 to 99 percent of the map unit in 95 percent of the areas mapped as Samsula and Hontoon soils, depressional. Dissimilar soils make up 1 to 15 percent.

Generally, the mapped areas are about 60 percent Samsula and similar soils and 33 percent Hontoon and similar soils. Each of the soils is not present in every mapped area, and the relative proportion of the soils is variable. Although individual areas of the soils are large enough to map separately, they were mapped as one unit based upon the present and predicted uses.

Typically, the surface soil of the Samsula soil is muck. It is about 31 inches thick. It is dark reddish brown in the upper 10 inches and black in the lower 21 inches. The underlying material, to a depth of 80 inches, is fine sand. The upper 10 inches is very dark gray, the next 9 inches is grayish brown, and the lower 30 inches is light brownish gray. Some areas contain soils that are similar to Samsula muck but are mineral soils that have a thin layer of organic material or are mineral soils that have a thick, dark surface layer.

Typically, the muck layer of the Hontoon soil is more than 80 inches thick. It is dark reddish brown in the upper 25 inches and black in the lower 55 inches. Some areas contain soils that are similar to the Hontoon muck but have a higher soil reaction.

The dissimilar soils in this map unit include small areas of Basinger soils and other mineral soils that have a loamy subsoil. Basinger soils are sandy throughout and do not have the surface layer of muck. These dissimilar soils are usually along the outer margin of depressional areas.

In most years, undrained areas of this map unit are ponded for 6 months or more. The water table is ponded as much as 24 inches above the surface, except during long dry periods. The permeability of the Samsula and Hontoon soils is rapid. The available water capacity is moderate in the Samsula soil and very high in the Hontoon soil.

Most areas of this map unit are used for wildlife habitat. The natural vegetation consists of bay and cypress and scattered areas of red maple and sweetgum. The understory vegetation consists of maidencane, sawgrass, greenbrier, sedges, ferns, and other water-tolerant grasses.

In their natural state, these soils are poorly suited to cultivated crops. Because the map unit is typically in the flatwoods, adequate water outlets for drainage are not generally available or are difficult to install.

This map unit is poorly suited to pasture. The main limitations are the excessive wetness and the ponding. Water stands above the surface for long periods. Because the map unit is in a low position on the landscape, adequate drainage is difficult to establish.

This map unit is generally not suited to the commercial production of pine trees. Some areas are suited to the production of cypress and hardwoods, but harvesting and planting are more effective during extended dry periods. The main management concern is the water table, which is above the surface for much of the year. The ponding and the high content of organic matter in the surface layer prevent the use of heavy equipment. The high water table will kill planted seedlings. Outlets are generally not present in these areas, and drainage is not practical.

This map unit is poorly suited to range or grazeable woodland. Water covers the surface of the soil for long periods of time. The growth of forage suitable for use by cattle is limited by the excessive wetness and the dense shade caused by thick stands of cypress hardwoods. This map unit is not assigned to a range or grazeable woodland site.

The excessive wetness and the low strength are severe limitations for dwellings without basements, local roads and streets, and small commercial buildings. Because the map unit is in a low position on the landscape, overcoming these limitations is difficult. Outlets needed for water control are often not readily available. The organic layers have low strength and cannot support a heavy load. Removing the organic layers and using fill to elevate the building sites and

roadbeds can help to overcome the wetness and the low strength. The limitations are severe for shallow excavations because cutbanks are unstable, the content of organic matter is high, and water stands on the surface. Shoring the sidewalls of excavations prevents caving. The installation of water-control measures that remove the excess surface water and ground water helps to overcome the limitations caused by wetness. The ponding and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound absorption fields can help to overcome these limitations. Because the map unit is in a low position on the landscape, large amounts of fill may be required to adequately elevate the absorption field. This map unit is unsuited to sewage lagoons and trench-type sanitary landfills. The seepage, the high content of organic matter, and ponding are severe limitations.

The limitations for recreational development are severe because water stands above the surface of the soil for long periods and because the surface of the soil contains too much organic matter. Water-control measures and the stabilization of the surface can help to overcome these limitations. During dry seasons, blowing dust produced by the high content of organic matter is a hazard.

The potential of this map unit as habitat for openland and woodland wildlife is poor or very poor and for wetland wildlife is good. The dense vegetative cover provides good cover and fair sources of food. This map unit supports a large variety of wildlife. It is especially well suited to waterfowl, reptiles, amphibians, and many birds. Other species include black bear, bobcat, deer, gray squirrel, otter, and raccoon.

This map unit is in capability subclass VIIw. The woodland ordination symbol is 6w. The ecological community is Swamp Hardwoods.

4—Wabasso fine sand. This very deep, nearly level, poorly drained soil is in broad flatwood areas. Individual areas of this soil are irregular in shape. They range from 4 to 200 acres in size. Slopes are smooth and range from 0 to 2 percent.

In 95 percent of the areas mapped as Wabasso fine sand, Wabasso and similar soils make up 84 to 95 percent of the map unit. Dissimilar soils make up 5 to 16 percent.

Typically, the surface layer is very dark gray fine sand about 4 inches thick. The subsurface layer is light gray fine sand to a depth of about 15 inches and gray fine sand to a depth of about 22 inches. The upper part of the subsoil is black fine sand to a depth of 30 inches. The lower part of the subsoil extends to a depth of about 53 inches. It is dark gray and gray fine sandy loam in the upper part and dark gray loamy fine sand in the lower part. The underlying material is greenish gray loamy fine sand to a depth of 80 inches or more. Some areas contain soils that are similar to the Wabasso soil but have a very weakly expressed upper subsoil layer.

The dissimilar soils in this map unit include small areas of Malabar and Riviera soils, and also included are areas of soils that have a thick, dark surface layer. The soils are in landscape positions similar to those of the Wabasso soil. Malabar and Riviera soils do not have an organic-stained layer in the upper part of the subsoil.

The seasonal high water table is at a depth of 6 to 18 inches for as much as 3 months during most years. It recedes to a depth of more than 40 inches during dry periods. Permeability is slow or very slow. The available water capacity is low.

Most areas are used for the commercial production of pine trees. A few areas are used for improved pasture and vegetable crops. A small acreage is used as sites for homes. The natural vegetation consists mostly of slash pine, cabbage palm, water oak, and longleaf pine. The understory vegetation consists of saw palmetto, gallberry, pineland threeawn, and bluestem.

This soil is moderately suited to most cultivated crops. The main limitations are the wetness and the poor soil quality. By installing a good water-control system, a variety of vegetable crops can be grown. Irish potatoes and cabbage are the main crops grown. If suitable outlets are available, lateral ditches and tile drains can be used to lower the water table. A furrow irrigation system is suited to this soil. Irrigation is generally feasible in most areas where irrigation water is readily available. Land grading and smoothing improve the surface drainage, allow a more uniform application of irrigation water, and permit the more efficient use of farm equipment. Returning all of the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to maintain fertility and tilth. Most crops respond well to applications of complete fertilizer. Lime is generally necessary. Soil blowing is a hazard in cultivated areas. It can be controlled with a good ground cover of close-growing plants.

This soil is moderately suited to pasture. The main limitations are the wetness and the poor soil quality. Excessive water on the surface can be removed by using surface ditches. The low available water capacity limits the production of plants during extended dry periods. Deep-rooted plants, such as coastal bermudagrass and bahiagrass, tolerate droughty conditions better if they are properly fertilized and limed. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture

in good condition. Applications of fertilizer and lime are necessary for the optimum growth of grasses and legumes.

This soil is well suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 80. The potential for commercial production of pulpwood is 42 cords per acre harvested from a fully stocked stand of trees 25 years old. The main management concerns for producing and harvesting timber are the equipment limitation, the seedling mortality rate, and plant competition. The sandy texture of the surface layer and the wetness limit the use of equipment. After harvesting, reforestation must be carefully managed to reduce competition from undesirable understory plants. Competing vegetation can be controlled by proper site preparation that eliminates unwanted weeds, brush, or trees. Planting on beds helps to overcome the limitations caused by the excessive wetness. Although conventional methods of harvesting timber generally can be used, their use can be limited during rainy periods. Using special equipment, such as high-flotation rubber tires or crawler machinery, and harvesting during dry periods can reduce the equipment limitation. Harvesting during dry periods reduces soil compaction and minimizes root damage during thinning operations. Special site preparation, such as chopping and bedding, helps to establish seedlings, reduces the seedling mortality rate, and increases early plant growth. Other good management practices include selecting appropriate species and leaving debris onsite to conserve organic matter.

This soil is well suited to range and grazeable woodland. It has a moderate to high potential for producing native forage. The dominant plants suitable for grazing include chalky bluestem, creeping bluestem, indiangrass, and panicum. This soil is in the North Florida Flatwoods range site.

This soil has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings because of the wetness caused by the seasonal high water table. If suitable outlets are available, shallow surface drainage can help to remove the excess water. Suitable fill material can be used to elevate building sites and increase the effective depth to the water table. The wetness is a severe limitation for shallow excavations. Excavations fill with water when the water table is high. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness, the slow permeability, and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome these limitations. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining the lagoons and trenches with impervious soil material can reduce the excess seepage. Water-control measures should be used to remove the excess surface and ground water.

The wetness, the slow permeability in the subsoil, and the sandy surface are severe limitations for recreational development. This soil remains wet for long periods because water runs through it slowly. The installation of a water-control system that removes excess water can reduce the wetness caused by the seasonal high water table and the slow permeability. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential of this soil as habitat for openland and wetland wildlife is poor and for woodland wildlife is fair. Areas of this soil provide nesting sites, den sites, and food and cover for a diverse and numerous wildlife population. Many larger animals are found in areas where this soil joins other ecological communities. Areas of this soil are well suited to deer, quail, bobcat, skunk, opossum, and raccoon. Other species typically include cottontail rabbit, fox squirrel, gray fox, and a variety of birds, reptiles, and amphibians.

This Wabasso soil is in capability subclass IIIw. The woodland ordination symbol is 10w. The ecological community is North Florida Flatwoods.

5—Pineda-Wabasso complex. These very deep, nearly level, poorly drained soils are on broad, low flats on the flatwoods. The Wabasso soil is in a slightly higher position on the landscape than the Pineda soil. Individual areas of this complex are irregular in shape. They range from 5 to 600 acres in size. Slopes are smooth to concave and range from 0 to 2 percent.

In 95 percent of the areas mapped as Pineda-Wabasso complex, Pineda, Wabasso, and similar soils make up 87 to 99 percent of the map unit. Dissimilar soils make up 1 to 13 percent.

Generally, the mapped areas are about 52 percent Pineda and similar soils and 42 percent Wabasso and similar soils. The components of this map unit are so small or so intricately intermingled that they could not be mapped separately at the scale used. The proportions and the patterns of the soils and similar soils are relatively consistent in most delineations of the map unit.

Typically, the surface layer of the Pineda soil is about 3 inches thick. It is very dark gray fine sand. The subsurface layer is light gray fine sand to a depth of 12

inches. The subsoil extends to a depth of 56 inches. In sequence downward, it is yellowish brown and brown fine sand, grayish brown fine sand, gray sandy clay loam that has light gray tongues from the overlying layer, and greenish gray sandy clay loam. The substratum is greenish gray fine sandy loam to a depth of 80 inches or more. Some areas contain soils that are similar to the Pineda soil but in which the depth to the subsoil is more than 24 inches.

Typically, the surface layer of the Wabasso soil is very dark gray fine sand about 7 inches thick. The subsurface layer is light brownish gray fine sand about 18 inches thick. The upper part of the subsoil is dark reddish brown fine sand to a depth of 30 inches. The lower part of the subsoil is about 27 inches thick. It is brown sandy clay loam in the upper part and light brownish gray fine sandy loam in the lower part. The underlying material, to a depth of about 80 inches, is greenish gray loamy fine sand. Some areas contain soils that are similar to the Wabasso soil but have a loamy subsoil below a depth of 40 inches.

The dissimilar soils in this map unit include small areas of Favoretta and Winder soils in landscape positions similar to those of the Pineda and Wabasso soils. Favoretta soils are clayey throughout. Winder soils have a loamy subsoil above a depth of 20 inches.

The seasonal high water table is at a depth of 6 to 18 inches for as much as 6 months. It can recede to a depth of more than 40 inches during extended dry periods. Permeability is slow or very slow. Available water capacity is low.

Most areas of this map unit are used for the commercial production of pine trees. Large areas are used for cultivated crops or as pasture. The natural vegetation consists of an open forest of longleaf pine or slash pine, scattered cabbage palm, and saw palmetto. The Wabasso soil has a more dense growth of saw palmetto than the Pineda soil. The understory vegetation consists of pineland threeawn, bluestem, gallberry, sedges, and maidencane.

This map unit is moderately suited to cultivated crops. The main limitations are excessive wetness and poor soil quality. By installing a good water-control system, Irish potatoes, cabbage, and a variety of other vegetable crops can be grown. Proper row management, lateral ditches or tiles, and well constructed outlets help to remove the excess surface water. A furrow irrigation system is suited to this map unit. Land grading and smoothing improve the surface drainage, allow a more uniform application of irrigation water, and permit the more efficient use of farm equipment. Returning all of the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to conserve moisture, maintain fertility, and control erosion. Frequent applications of fertilizer and lime are generally needed for the best yields.

With good water-control management, this map unit is well suited to pasture. The main limitations are a result of the wetness. Excessive water can be removed by using field ditches and tile drains. Grasses and legumes grow well if adequate fertilizer is used. The low available water capacity limits the production of plants during extended dry periods. Deep-rooted plants, such as coastal bermudagrass and bahiagrass, tolerate droughty conditions better if they are properly fertilized and limed. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition.

This map unit is well suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 80 for both soils. The potential for commercial production of pulpwood is 42 cords per acre harvested from a fully stocked stand of trees 25 years old. The main management concerns for producing and harvesting timber are the equipment limitation, the seedling mortality rate, and plant competition. Planting on beds helps to overcome the limitations caused by the excessive wetness. Although conventional methods of harvesting timber generally are suitable, the soil may be compacted if heavy equipment is used when the soil is wet. Using special equipment, such as high-flotation rubber tires or crawler machinery, and harvesting during dry periods can reduce the equipment limitation. Site preparation, such as chopping, burning, applying herbicide, and bedding, reduces debris, reduces immediate plant competition, and facilitates hand and mechanical planting. Other good management practices include the selection of appropriate species, restricted burning, and a harvesting system that leaves debris onsite to conserve organic matter.

This map unit is well suited to range and grazeable woodland. The tree and shrub vegetation on the Pineda soil is less dense than the vegetation on the Wabasso soil and in the surrounding flatwood areas. The canopy is more open, and grasses, such as maidencane and chalky bluestem, are the main forage species. When well managed, this map unit has the potential to produce a large amount of forage. The Pineda soil is in the Slough range site, and the Wabasso soil is in the North Florida Flatwoods range site.

This map unit has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings because of the wetness caused by the seasonal high water table. If suitable outlets are available, shallow surface drainage can help to remove the excess water. Suitable fill material can be used to

elevate building sites and increase the effective depth to the water table. The limitations are severe for shallow excavations because cutbanks are unstable and excavations fill with water when the water table is high. Shoring sidewalls of excavations can help to prevent caving. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness, the slow permeability, and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome these limitations. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining the lagoons and trenches with impervious soil material can reduce the excess seepage. Water-control measures should be used to remove the excess surface and ground water.

The wetness, the slow permeability in the subsoil, and the sandy surface are severe limitations for recreational development. This map unit remains wet for long periods because water percolates through the soils very slowly. The installation of a water-control system can reduce the wetness caused by the seasonal high water table and the slow permeability. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential as habitat for openland and wetland wildlife is fair and for woodland wildlife is poor on the Pineda soil. The potential as habitat for openland and wetland wildlife is poor and for woodland wildlife is fair on the Wabasso soil. Areas of this map unit are good sources of food for bobwhite quail, deer, and wading birds. This map unit produces poor cover for most wildlife species, but the adjacent flatwoods produce good escape routes and an edge effect. Other species include fox, rabbit, opossum, and a variety of birds, reptiles, and amphibians.

This map unit is in capability subclass IIIw. The woodland ordination symbol is 10w. The ecological community for the Pineda soil is Slough and for the Wabasso soil is North Florida Flatwoods.

6—Favoretta clay. This very deep, nearly level, poorly drained soil is in narrow to broad flatwood areas near major streams and drainageways. It is subject to rare flooding. Individual areas are irregular in shape. They range from 10 to more than 500 acres in size. Slopes are smooth to concave and are less than 1 percent.

In 95 percent of the mapped as Favoretta clay, Favoretta and similar soils make up 93 to 99 percent of the map unit. Dissimilar soils make up 1 to 7 percent.

Typically, the surface layer is very dark gray clay about 12 inches thick. The subsoil is dark gray and gray clay to a depth of 66 inches and light brownish gray clay to a depth of 80 inches or more. Some areas contain soils that are similar to the Favoretta soil but have a thin, light surface layer of loamy fine sand or very fine sandy loam. Other areas contain soils that have a surface layer 2 to 4 inches in thickness.

The dissimilar soils in this map unit include small areas of Favoretta soils in depressions. These wet areas have water above the soil surface for more than 6 months in most years.

The seasonal high water table is within a depth of 12 inches for 4 to 6 months during most years. During extended dry seasons, it recedes to below a depth of 40 inches. Permeability is very slow. Available water capacity is moderate to high.

Most areas are used for the commercial production of pine trees. Some areas are used for vegetable crops and as improved pasture. The natural vegetation consists of water oak, cabbage palm, laurel oak, sweetgum, and red maple. The understory vegetation consists of waxmyrtle, saw palmetto, bluestem, pineland threeawn, maidencane, sedges, and panicum.

This soil is moderately suited to vegetable crops. The main limitations are the wetness and the poor soil quality. When good water-control and soil-improving measures are applied, this soil is well suited to most cultivated crops. Suitable crops include cabbage, cucumbers, peppers, and squash. Good tilth is difficult to maintain because of the fine texture. The soil can be worked only within a narrow range in moisture content. A drainage system is needed to grow most cultivated crops and pasture plants. If suitable outlets are available, lateral ditches and tile drains can be used to lower the water table. Irrigation is generally feasible in most areas where irrigation water is readily available. A well designed and managed sprinkler irrigation system helps to maintain optimum soil moisture and ensure the highest possible yields. Land grading and smoothing improve the surface drainage, allow a more uniform application of irrigation water, and permit the more efficient use of farm equipment. Returning all of the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to maintain fertility and tilth. Most crops and pasture plants respond well to applications of complete fertilizer. Soil blowing is a hazard in cultivated areas. It can be controlled with a good ground cover of close-growing plants.

This soil is well suited to pasture. The main limitation is the wetness. The excessive water on the surface can be removed by using surface ditches. The wetness

limits the choice of plants and the period of grazing. The main suitable pasture plants are bermudagrass, bahiagrass, and clover. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition. Periodic mowing and clipping help to maintain uniform growth, discourage selective grazing, and reduce clumpy growth. Applications of fertilizer are needed for the optimum growth of grasses and legumes.

This soil is well suited to the commercial production of pine trees. Slash pine or loblolly pine are the recommended trees to plant. The wetness limits the use of equipment. Using special equipment, such as rubber tires or crawler machinery, and harvesting during dry periods can reduce the equipment limitation. Harvesting during dry periods reduces soil compaction and minimizes root damage during thinning operations. Planting on beds helps to overcome the limitations caused by the excessive wetness. Only those trees that can tolerate seasonal wetness should be planted. Site preparation, such as chopping, burning, applying herbicide, and bedding, reduces debris, reduces immediate plant competition, and facilitates hand and mechanical planting. Special site preparation, such as harrowing and bedding (or double bedding), helps to establish seedlings, reduces the seedling mortality rate, and increases early plant growth. Harvesting systems that remove all of the tree biomass from a site will reduce the fertility of that site. A logging system that leaves residual logging biomass distributed over the site is preferred.

This soil is highly suited to grazeable woodland. The dominant forage includes chalky bluestem, maidencane, indiangrass, and various species of panicum and sedges.

This soil has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings. A drainage system is needed to overcome the wetness. Fill material is needed to make this soil suitable for most urban uses. The low strength is a limitation in areas where this soil is used for roads, streets, or buildings. The subsoil shrinks and swells excessively as the moisture content changes. Roads and streets can be built if they are designed to compensate for the instability of the subsoil. Buildings and roads can be designed to offset the effects of shrinking and swelling. If buildings are constructed on this soil, properly designed foundations and footings and the diversion of runoff away from buildings help to prevent the structural damage that results from shrinking and swelling. The wetness is a severe limitation for shallow excavations. Water-control measures are needed to keep the excavations from filling with water. The wetness and the very slow permeability are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption fields can help to overcome the wetness. Excavating the clayey soil material and backfilling with suitable fill material may also be needed to ensure the proper functioning of the system. The wetness is a severe limitation for sewage lagoons and trench-type sanitary landfills. Water-control measures that maintain the seasonal high water table at a lower depth can help to overcome the wetness.

The wetness, the slow permeability, and the high content of clay in the surface layer are severe limitations for recreational development. The seasonal high water table at or near the surface of the soil causes the excessive wetness. Because of the very slow permeability, the soil dries out slowly. The installation of a well designed water-control system can help to overcome these limitations. The high content of clay in the surface layer results in poor trafficability during wet seasons and can create a hazard of blowing dust during dry seasons. Using vegetation and mulch or constructing paved areas can help to overcome these limitations.

The potential of this soil as habitat for openland and woodland wildlife is fair and for wetland wildlife is good. Areas of this soil provide some of the most productive and diverse wildlife habitat in the county. The hardwoods provide good food and cover for a number of species. The animals generally include wild hogs, deer, turkey, black bear, gray squirrel, woodpeckers, owls, and reptiles.

This Favoretta soil is in capability subgroup IIIw. The woodland ordination is 6w. The ecological community is Wetland Hardwood Hammock.

7—Favoretta, Chobee, and Winder soils, frequently flooded. These very deep, nearly level, poorly drained and very poorly drained soils are in drainageways and on flood plains along major streams on the flatwoods. These soils are frequently flooded during wet seasons. Individual areas range from elongated to irregular in shape. They range from 20 to more than 1,000 acres in size. Slopes are smooth to concave and range from 0 to 2 percent.

Favoretta, Chobee, Winder, and similar soils make up 93 to 99 percent of the map unit in 90 percent of the areas mapped as Favoretta, Chobee, and Winder soils, frequently flooded. Dissimilar soils make up 1 to 7 percent.

Generally, the mapped areas are 48 percent Favoretta and similar soils, 28 percent Chobee and similar soils, and 21 percent Winder and similar soils. The soils do not occur in a regular and repeating pattern. Each of the soils is not present in every

mapped area, and the relative proportion of the soils is variable. Although individual areas of the soils are large enough to map separately, they were mapped as one unit based upon the present and predicted uses.

Typically, the surface layer of the Favoretta soil is very dark gray clay about 10 inches thick. The subsoil extends to a depth of 80 inches or more. It is dark gray clay in the upper 28 inches, gray clay in the next 30 inches, and light brownish gray clay to a depth of 80 inches or more. Some areas contain soils that are similar to the Favoretta soil but in which the black or very dark gray surface layer is more than 24 inches thick or is less than 7 inches thick.

Typically, the surface layer of the Chobee soil is about 10 inches thick. The upper part is black loamy fine sand, and the lower part is very dark gray loamy fine sand. The subsoil is dark gray sandy clay loam to a depth of about 25 inches and gray sandy clay loam to a depth of 55 inches. The underlying material, to a depth of 80 inches or more, is gray fine sandy loam. Some areas contain soils that are similar to the Chobee soil but have a gray surface layer.

Typically, the surface layer of the Winder soil is black loamy sand about 6 inches thick. The subsurface layer is gray loamy sand to a depth of 10 inches. The upper part of the subsoil, to a depth of 25 inches, is gray sandy clay loam that has tongues of gray loamy sand. The lower part of the subsoil is gray sandy clay loam to a depth of 50 inches. The substratum, to a depth of 80 inches or more, is gray sandy clay loam that has accumulations of light gray calcium carbonate. Some areas contain soils that are similar to the Winder soil but have a black or very dark gray surface layer more than 7 inches thick.

The dissimilar soils in this map unit include small areas of Gator and Pineda soils. They are in landscape positions similar to those of the Favoretta, Chobee, and Winder soils. Gator soils have a surface layer that formed in organic material. Pineda soils have a loamy subsoil below a depth of 20 inches.

In most years, areas of this map unit are flooded for 1 month or more during periods of high rainfall. The seasonal high water table is at a depth of 0 to 6 inches for 6 months or more. During extended dry periods, it is at a depth of more than 40 inches. Permeability is very slow in the Favoretta soil and slow or very slow in the Chobee and Winder soils. Available water is moderate to high in the Favoretta soil, moderate in the Chobee soil, and low to moderate in the Winder soil.

Most areas of this map unit support the natural vegetation, which includes red maple, sweetgum, water oak, cabbage palm, and baldcypress. The understory vegetation is sparse and consists of waxmyrtle, greenbrier, sawgrass, maidencane, and a few water-tolerant sedges and grasses. Most areas of this map unit are used as wildlife habitat. The natural-growth hardwoods are harvested in some areas.

In their natural state, these soils are generally unsuited to most cultivated crops because of the high content of clay, the flooding, and the excessive wetness (fig. 5). Water-control measures that include protection from flooding can help to overcome these limitations.

In their natural state, these soils are poorly suited to improved pasture grasses. By installing a water-control system that includes protection from flooding, these soils have moderate suitability. The main suitable pasture plants are bahiagrass, bermudagrass, and clover. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help keep pasture and soil in good condition. Applications of fertilizer are needed for the optimum growth of grasses and legumes.

This map unit is poorly suited to the commercial production of pine trees because of the flooding and the excessive wetness. Pine seedlings will be killed or seriously stunted by flood water or by a water table that is at or near the surface of the soil for long periods of time. The high content of organic matter or clay in the surface layer restricts the use of equipment. The map unit may be suited to cypress and hardwoods. Although trees are harvested from areas, regrowth is a result of natural regeneration rather than the planting of seedlings. A source of desirable seedlings may not be readily available. Harvesting during extended dry periods helps to overcome the limitations.

This map unit is poorly suited to range or grazeable woodland. The dominant forage includes sawgrass, sedges, and ferns. The dense canopy restricts the growth of plants suitable for forage. Areas of this map unit are used by cattle for shade during summer months and for shelter during bad weather. This map unit is not assigned to a range site.

This map unit has severe limitations for urban development. The main limitations are the flooding, the excessive wetness, the slow permeability in the subsoil, and the moderate or high shrink-swell potential. Major flood control structures and an extensive local drainage system are needed to protect this map unit from flooding. Roads, streets, and building sites should be elevated with fill material to overcome the wetness. Special designs can be used to offset the effects of shrinking and swelling. Septic tank absorption fields need to be mounded to overcome the wetness and the slow permeability.

If this map unit is used for recreational development, the high content of clay, the flooding, and the excessive wetness are the main limitations. Because the permeability is slow or very slow, the soils dry out very

Figure 5.—An area of Favoretta, Chobee, and Winder soils, frequently flooded. This map unit has severe limitations for most uses because of the flooding.

slowly. Protection from flooding is needed when this map unit is used for camp areas and playgrounds. Trafficability limitations on the Favoretta soil are a result of the high content of clay. They can be overcome by establishing suitable vegetation or by constructing paved areas.

The potential of this map unit as habitat for openland and woodland wildlife is fair and for wetland wildlife is good. The dense hardwood vegetation provides a good source of food and cover. The animals in this unit are adapted to wet conditions and to periodic flooding. The map unit is especially well suited to waterfowl, reptiles, amphibians, and mammals. Species include deer, gray squirrel, otter, raccoon, and black bear.

This map unit is in capability subclass VIw. The woodland ordination symbol is 6w for the Favoretta and Chobee soils and is 11w for the Winder soil. The ecological community is Swamp Hardwoods.

8—Hicoria, Riviera, and Gator soils, depressional. These very deep, nearly level, very poorly drained soils are in depressions on the flatwoods. Individual areas

are circular to irregular in shape. They range from 3 to 1,500 acres in size. Undrained areas are ponded for 6 to 9 months or more each year. Slopes are concave and range from 0 to 1 percent.

Hicoria, Riviera, Gator, and similar soils make up 75 to 96 percent of the map unit in 90 percent of the areas mapped as Hicoria, Riviera, and Gator soils, depressional. Dissimilar soils make up 4 to 25 percent.

Generally, the mapped areas are about 41 percent Hicoria and similar soils, 25 percent Riviera and similar soils, and 19 percent Gator and similar soils. The soils do not occur in a regular and repeating pattern. Each of the soils is not present in every mapped area, and their relative proportion is variable. Although individual areas of the soils are large enough to map separately, they were mapped as one unit based upon the present and predicted uses.

Typically, the surface soil of the Hicoria soil is about 20 inches thick. It is black mucky fine sand in the upper 10 inches and very dark gray fine sand in the lower 10 inches. The subsurface layer is dark gray fine sand to a depth of 32 inches. The subsoil is gray sandy clay loam to a depth of 55 inches and gray fine sandy loam to a depth of 80 inches or more. Some areas contain soils that are similar to the Hicoria soil but have a mucky surface layer less than 10 inches thick.

Typically, the surface layer of the Riviera soil is very dark gray fine sand about 3 inches thick. The subsurface layer is grayish brown fine sand to a depth of 22 inches. The subsoil extends to a depth of 50 inches. It is dark grayish brown fine sandy loam that has tongues of light gray fine sand in the upper 13 inches, dark grayish brown sandy clay loam in the next 5 inches, and gray sandy clay loam in the lower 10 inches. The next layer is dark grayish brown fine sandy loam about 10 inches thick. The underlying material, to a depth of 80 inches or more, is light brownish gray loamy sand. Some areas contain soils that are similar to the Riviera soil but have a surface layer that is black or very dark gray and is 6 or more inches thick.

Typically, the surface soil of the Gator soil is muck about 26 inches thick. The upper part is black, and the lower part is very dark gray. The underlying material is dark grayish brown fine sandy loam to a depth of about 29 inches, dark gray fine sandy loam to a depth of about 49 inches, and gray sandy clay loam to a depth of 80 inches or more. Some areas contain soils that are similar to the Gator soil and include the Hontoon and Samsula soils.

The dissimilar soils in this map unit include small areas of Favoretta, Wabasso, and Basinger soils. These soils are on the outer edge of depressions. Favoretta soils are clayey throughout. Wabasso soils have an organic-stained layer in the subsoil. Basinger soils are sandy throughout.

In most years, undrained areas of this map unit are ponded, and as much as 24 inches of water is above the surface for 6 months or more except during extended dry periods. Permeability is slow and moderately slow in the Hicoria soil and is slow and very slow in the Riviera and Gator soils. The available water capacity is moderate to high in the Hicoria soil, low in the Riviera soil, and very high in the Gator soil.

Most areas of this map unit support the natural vegetation. Some areas have been filled and are used for vegetable crops. Most areas are used for wildlife habitat. The natural-growth hardwoods are harvested in some areas. The natural vegetation consists of a mixed stand of pondcypress, sweet bay, red maple, sweetgum, waxmyrtle, and water oak. The understory vegetation consists of sawgrass, maidencane, needlegrass, fern, sedges, and other water-tolerant grasses.

This map unit is poorly suited to most cultivated crops because of the ponding that occurs for long periods. Because the map unit is typically in the flatwoods, adequate water outlets for drainage are not generally available or are difficult to install.

This map unit is poorly suited to pasture. The main limitations are the excessive wetness and the ponding. Water stands above the surface for long periods during rainy seasons. Because the map unit is in a low position on the landscape, adequate drainage is difficult to establish.

This map unit is generally not suited to the commercial production of pine trees. Some areas are suited to the production of cypress and hardwoods, but harvesting and planting are more effective during extended dry periods. The main management concern is the water table, which is above the surface for much of the year. The ponding and the high content of organic matter in the surface layer prevent the use of heavy equipment. The high water table will kill planted seedlings. Outlets are generally not present in these areas, and drainage is not practical.

This map unit is poorly suited to range or grazeable woodland. Water covers the surface of the soil for long periods of time. The growth of forage suitable for use by cattle is limited by the excessive wetness and the dense shade caused by thick stands of cypress hardwoods. This map unit is not assigned to a range site.

The excessive wetness is a severe limitation for dwellings without basements, local roads and streets, and small commercial buildings. Water stands above the surface of the soil for long periods of time, and the organic layers have low strength. Because the map unit is in a low position on the landscape, overcoming these

limitations is difficult. Outlets needed for water control are often not readily available. Using fill to elevate building sites and roadways and removing the organic layers can help to overcome the wetness and the low strength. The limitations are severe for shallow excavations because cutbanks are unstable, the content of organic matter is high, and water stands on the surface. Shoring the sidewalls of excavations prevents caving. The installation of a water-control system that removes excess surface water can help to overcome the limitations caused by the wetness. The ponding, the slow permeability, and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound absorption fields can help to overcome these limitations. Because the map unit is in a low position on the landscape, large amounts of fill may be required to adequately elevate the absorption field. This map unit is unsuited to sewage lagoons and trench-type sanitary landfills. The seepage, the excess humus, and the ponding are severe limitations for these uses.

This map unit has severe limitations for recreational development. Water stands above the surface of the soil for long periods, and the surface of the soil is either too sandy or has too much organic matter to use for recreational purposes. Water-control measures and the stabilization of the surface can help to overcome these limitations. During dry seasons, blowing dust produced by the organic material is a hazard.

The potential of this map unit as habitat for openland and woodland wildlife is very poor and for wetland wildlife is good. The dense vegetative cover provides good cover and fair sources of food. This map unit supports a large variety of wildlife. It is especially well suited to waterfowl, reptiles, amphibians, and many types of birds. Other species include black bear, bobcat, deer, gray squirrel, otter, and raccoon.

This map unit is in capability subclass VIIw. The woodland ordination symbol is 2w for the Hicoria and Gator soils and is 3w for the Riviera soil. The ecological community is Swamp Hardwoods.

9—EauGallie fine sand. This very deep, nearly level, poorly drained soil is in broad flatwood areas. Individual areas of this soil are irregular in shape. They range from 3 to more than 500 acres in size. Slopes are smooth and range from 0 to 2 percent.

In 95 percent of the areas mapped as EauGallie fine sand, EauGallie and similar soils make up 95 to 99 percent of the map unit. Dissimilar soils make up 1 to 5 percent.

Typically, the surface layer is black fine sand about 6 inches thick. The subsurface layer is light gray fine sand to a depth of 22 inches. The subsoil is black and dark reddish brown fine sand that is well coated with organic material to a depth of 33 inches, dark brown to brown fine sand to a depth of about 45 inches, light gray fine sand to a depth of 56 inches, and light gray fine sandy loam to a depth of 70 inches. The substratum is light gray loamy fine sand to a depth of 80 inches or more. Some areas contain soils that are similar to the EauGallie soil but do not have an organic-stained layer in the subsoil. Some soils have a loamy subsoil above a depth of 40 inches, and other soils do not have a loamy subsoil above a depth of 80 inches.

The dissimilar soils in this map unit include small areas of Hicoria and Riviera soils in small depressions or in lower, wet areas. Hicoria soils have a mucky surface layer and do not have a organic-stained layer in the subsoil. Riviera soils also do not have a organic-stained layer in the subsoil.

The seasonal high water table is at a depth of 6 to 18 inches for 2 to 4 months. It is within a depth of 40 inches for more than 6 months, and it recedes to a depth of more than 40 inches during extended dry periods. The available water capacity is low. Permeability is slow to moderate.

Most of the areas are used as woodland or support the natural vegetation. A few areas are used for cultivated crops, improved pasture, or urban development. The natural vegetation consists of slash pine, saw palmetto, cabbage palm, pineland threeawn, panicum, and bluestem grasses.

By applying good water-control and soil-improving measures, this soil is moderately suited to cultivated crops. It is limited mainly by excessive wetness during rainy seasons and by poor soil quality. It is droughty during dry seasons. A drainage system is needed for most cultivated crops and pasture plants. If suitable outlets are available, lateral ditches and tile drains can be used to lower the water table. Irrigation is generally feasible in most areas where irrigation water is readily available. A furrow irrigation system is suited to this soil. Land grading and smoothing improve the surface drainage, allow a more uniform application of irrigation water, and permit the more efficient use of farm equipment. Returning all of the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to maintain fertility and tilth. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Soil blowing is a hazard. Most crops and pasture plants respond well to applications of complete fertilizer. Frequent applications of fertilizer and lime are generally needed to improve soil quality.

This soil is moderately suited to the commercial production of pine trees. Based on a 50-year site curve, the mean site index for slash pine is 80. The potential

for commercial production of pulpwood is 42 cords per acre harvested from a fully stocked stand of trees 25 years old. The main management concerns for producing and harvesting timber are the equipment limitation, the seedling mortality rate, and plant competition. The sandy texture of the surface layer and the wetness limit the use of equipment. Using special equipment, such as large rubber tires or crawler machinery, and harvesting during dry periods can reduce the equipment limitation. Harvesting during dry periods reduces soil compaction and minimizes root damage during thinning operations. Planting on beds helps to overcome the limitations caused by the excessive wetness. The soil often has a very low content of organic matter, and a harvest system that removes all of the tree biomass from the site reduces the fertility of the soil in these areas. A logging system that leaves residual biomass distributed over the site is preferred.

This soil is well suited to range and grazeable woodland. It has a moderate to high potential for the production of native forage. The dominant plants suitable for grazing include chalky bluestem, creeping bluestem, indiangrass, and panicum. This soil is in the North Florida Flatwoods range site.

This soil has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings because of the wetness caused by the seasonal high water table. If suitable outlets are available, shallow surface drainage can help to remove the excess water. Suitable fill material can be used to elevate building sites and increase the effective depth to the water table. The limitations are severe for shallow excavations because cutbanks are unstable and excavations fill with water when the water table is high. Shoring sidewalls of excavations can help to prevent caving. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome these limitations. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining the lagoons and trenches with impervious soil material can reduce the excess seepage. Water-control measures should be used to remove the excess surface and ground water.

The wetness and the sandy surface are severe limitations for recreational development. The installation of a water-control system can reduce the wetness caused by the seasonal high water table. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential of this soil as habitat for openland, woodland, and wetland wildlife is poor. Areas of this soil provide nesting sites, den sites, and food and cover for a diverse and numerous wildlife population. Many larger animals are found in areas where this soil joins other ecological communities. Areas of this soil are well suited to deer, quail, bobcat, skunk, opossum, and raccoon. Other species typically include cottontail rabbit, fox squirrel, gray fox, and a variety of birds, reptiles, and amphibians.

This EauGallie soil is in capability subclass IVw. The woodland ordination symbol is 10w. The ecological community is North Florida Flatwoods.

10—Winder fine sand. This very deep, nearly level, poorly drained soil is on low flatwoods. Individual areas are irregular in shape. They range from 5 to 2,000 acres in size. Slopes are smooth to concave and are less than 2 percent.

In 95 percent of the areas mapped as Winder fine sand, Winder and similar soils make up 87 to 99 percent of the map unit. Dissimilar soils make up 1 to 13 percent.

Typically, the surface layer is very dark gray fine sand about 7 inches thick. The subsurface layer is grayish brown fine sand about 5 inches thick. The upper part of the subsoil is grayish brown sandy loam to a depth of 25 inches. It has tongues of fine sand mixed from the overlying subsurface layer. The lower part of the subsoil is gray, light gray, and greenish gray sandy clay loam to a depth of about 58 inches. The underlying material, to a depth of 80 inches or more, is greenish gray sandy loam. Some areas contain soils that are similar to the Winder soil but in which the depth to the subsoil is more than 20 inches. Other areas contain soils that have a surface layer thicker than 8 inches or have a very strongly acid subsoil.

The dissimilar soils in this map unit include small areas of Favoretta, Chobee, and Pineda soils. Favoretta soils are in slightly lower areas and are clayey throughout. Chobee soils are in lower areas and have a loamy subsoil at a shallower depth. Pineda soils are in landscape positions similar to those of the Winder soil. They have a thicker sandy layer over the loamy subsoil.

A seasonal high water table is within a depth of 6 inches for 2 to 6 months. Permeability is slow or very slow. Available water capacity is low to moderate.

Most areas are used for the commercial production of pine trees. A few areas are used for vegetables and as improved pasture. The natural vegetation consists mainly of slash pine. The understory vegetation consists

Figure 6.—Furrow irrigation on a field of cabbage in an area of Winder fine sand.

of gallberry, saw palmetto, pineland threeawn, bluestem, panicum, and sedges.

This soil is moderately suited to vegetable crops. The main limitations are excessive wetness during rainy seasons and droughtiness during dry seasons. Cabbage, Irish potatoes, and other vegetables are the main crops grown. An adequate drainage system is needed. Ditches and tile drains can be used to lower

the water table. Proper arrangement and bedding of tree rows, lateral ditches or tiles, and well constructed outlets help to remove the excess surface water and lower the water table. Land grading and smoothing improve the surface drainage and permit the more efficient use of farm equipment. Irrigation is generally feasible in most areas where irrigation water is readily available (fig. 6). Because of the slow permeability, sprinkler irrigation systems are suited to this soil. Returning all of the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to conserve moisture, maintain fertility, and control erosion. Crops respond well to applications of lime and fertilizer.

This soil is well suited to pasture. The main limitations are the wetness and the poor soil quality. Excessive water on the surface can be removed by applying surface drainage. The main suitable pasture plants are bermudagrass, bahiagrass, and white clover. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition. Periodic mowing and clipping help to maintain uniform growth, discourage selective grazing, and reduce clumpy growth. Applications of fertilizer are needed for the optimum growth of grasses and legumes.

This soil is well suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 90. The potential for commercial production of pulpwood is 42 cords per acre harvested from a fully stocked stand of trees 25 years old. The main management concerns for producing and harvesting timber are the equipment limitation, the seedling mortality rate, the windthrow hazard, and the plant competition. The excessive wetness and the sandy surface layer limit the use of equipment. Using special equipment, such as high-flotation rubber tires or crawler machinery, and harvesting during dry periods can reduce the equipment limitation. The high water table will kill planted seedlings. Outlets are generally not present, and drainage is not practical in many areas. Planting on beds helps to overcome the limitations caused by the excessive wetness. Special site preparation, such as harrowing and bedding (or double bedding), helps to establish seedlings, reduces the seedling mortality rate, and increases early plant growth. The soil often has a very low content of organic matter, and a harvest system that removes all of the tree biomass reduces the fertility of the soil in these areas. A logging system that leaves residual biomass distributed over the site is preferred. Using a nitrogen fertilizer combined with phosphorus, based on a soil test or tissue analysis, at mid-rotation can provide an excellent growth response. Other good management practices include the selection of appropriate species and restricted burning.

This soil is poorly suited to range or grazeable woodland. Areas that support the natural vegetation generally are densely shaded by the closed canopy of the hardwoods. Grasses and other plants that provide forage for animals do not grow well, but areas of this soil provide shade and shelter for cattle during periods of bad weather. This map unit is not assigned to a range site.

This soil has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings because of the wetness caused by the seasonal high water table. If suitable outlets are available, shallow surface drainage can help to remove the excess water. Suitable fill material can be used to elevate building sites and increase the effective depth to the water table. The limitations are severe for shallow excavations because cutbanks are unstable and excavations fill with water when the water table is high. Shoring sidewalls of excavations can help to prevent caving. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness and the slow permeability in the subsoil are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome these limitations. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining the lagoons and trenches with impervious soil material can reduce the excess seepage. A water-control system should be installed to remove the excess surface water and ground water.

The wetness, the slow permeability in the subsoil, and the sandy surface are severe limitations for recreational development. Installing water-control measures can reduce the wetness caused by the seasonal high water table and the slow rate at which water moves through the soil. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential of this soil as habitat for openland, woodland, and wetland wildlife is fair. Areas provide productive and diverse wildlife habitats. The hardwoods provide good food and cover for numerous species. The species generally include wild hogs, deer, turkey, black bear, gray squirrel, woodpeckers, owls, and reptiles.

This Winder soil is in capability subclass IIIw. The woodland ordination symbol is 11w. The ecological community is Wetland Hardwood Hammock.

11—Myakka fine sand. This very deep, nearly level, poorly drained soil is in broad flatwood areas. Individual areas are irregular in shape. They range from 5 to 600 acres in size. Slopes are smooth to convex and range from 0 to 2 percent.

In 90 percent of the areas mapped as Myakka fine sand, Myakka and similar soils make up 78 to 99 percent of the map unit. Dissimilar soils make up 1 to 22 percent.

Typically, the surface layer is black fine sand about 6 inches thick. The subsurface layer is gray fine sand to a depth of about 19 inches. The subsoil, to a depth of about 31 inches, is black fine sand in the upper part and dark reddish brown fine sand in the lower part. The next layer extends to a depth of about 40 inches and is dark yellowish brown fine sand. The underlying material, to a depth of 80 inches or more, is fine sand. It is brown in the upper part and light gray in the lower part. Some areas contain soils that are similar to the Myakka soil but in which the depth to the organic-stained layer is less than 20 inches or is more than 40 inches.

The dissimilar soils in this map unit include small areas of Cassia, EauGallie, Myakka, Pineda, and Valkaria soils. Cassia soils are in the higher areas and are better drained than the Myakka soil. EauGallie, Pineda, and Valkaria soils are in landscape positions similar to those of the Myakka soil. EauGallie and Pineda soil have a loamy subsoil layer. Valkaria soils do not have an organic-stained subsoil layer. Myakka soils are in depressions.

A seasonal high water table is at a depth of 6 to 18 inches for 1 to 4 months during the wet season in most years. It is at a depth of 10 to 40 inches for more than 6 months. Permeability is moderately slow to moderately rapid. Available water capacity is very low or low.

The natural vegetation consists of slash pine and longleaf pine. The understory vegetation consists of saw palmetto, pineland threeawn, bluestem, and panicum. Most areas are used for the commercial production of pine trees and as improved pasture for cattle. A large acreage is being developed for residential and commercial uses.

This soil is well suited to pasture. The main limitations are the wetness and the poor soil quality. Excessive water on the surface can be removed by using shallow surface ditches. The wetness limits the choice of plants and the period of grazing. The main suitable pasture plants are bermudagrass and bahiagrass. Proper stocking rates, a system of pasture rotation, and restricted grazing during wet periods help keep the pasture in good condition. Periodic mowing and clipping help to maintain uniform growth, discourage selective grazing, and reduce clumpy growth. Applications of fertilizer and lime are needed for the optimum growth of grasses and legumes.

This soil is moderately suited to the commercial production of pine trees. Based on a 50-year site curve, the mean site index for slash pine is 70. The potential for commercial production for pulpwood is 35 cords per acre harvested from a fully stocked stand of trees 25 years old. The main management concerns for producing and harvesting timber are the equipment limitation, the seedling mortality rate, the windthrow hazard, and plant competition. The sandy texture of the surface layer and the wetness limit the use of equipment. Using special equipment, such as large rubber tires or crawler machinery, and harvesting during dry periods can reduce the equipment limitation. Harvesting during dry periods reduces soil compaction and minimizes root damage during thinning operations. Site preparation, such as chopping, burning, applying herbicide, and bedding, reduces debris, reduces immediate plant competition, and facilitates hand and mechanical planting. Planting on beds helps to overcome the limitations caused by the excessive wetness. The soil often has a very low content of organic matter, and a harvest system that removes all of the tree biomass reduces the fertility of the soil in these areas. A logging system that leaves residual logging biomass distributed over the site is preferred.

This soil is well suited to range and grazeable woodland. It has a moderate to high potential for the production of native forage. The dominant plants suitable for grazing include chalky bluestem, creeping bluestem, indiangrass, and panicum. This soil is in the North Florida Flatwoods range site.

This soil has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings because of the wetness caused by the seasonal high water table. If suitable outlets are available, shallow surface drainage can help to remove the excess water. Suitable fill material can be used to elevate building sites and increase the effective depth to the water table. The limitations are severe for shallow excavations because cutbanks are unstable and excavations fill with water when the water table is high. Shoring sidewalls of excavations can help to prevent caving. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome these limitations. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining the lagoons and trenches with impervious soil material can reduce the excess seepage. Water-control measures should be used to

remove the excess surface and ground water.

The wetness and the sandy surface are severe limitations for recreational development. Installing water-control measures can reduce the wetness caused by the seasonal high water table. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential of this soil as habitat for openland wildlife is fair and for woodland and wetland wildlife is poor. Areas of this soil provide nesting sites, den sites, and food and cover for a diverse and numerous wildlife population. Many larger animals are found in areas where this soil joins other ecological communities. Areas of this soil are well suited to deer, quail, bobcat, skunk, opossum, and raccoon. Other species typically include cottontail rabbit, fox squirrel, gray fox, and a variety of birds, reptiles, and amphibians.

This Myakka soil is in capability subclass IVw. The woodland ordination symbol is 8w. The ecological community is North Florida Flatwoods.

12—Placid, Basinger, and St. Johns soils, depressional. These very deep, nearly level, very poorly drained soils are in depressions on the flatwoods. Undrained areas are ponded for long periods. Individual areas of this map unit are irregular in shape. They range from 3 to more than 400 acres in size. Slopes are concave and are less than 1 percent.

Placid, Basinger, and St. Johns soils make up 91 to 99 percent of the map unit in 95 percent of the areas mapped as Placid, Basinger, and St. Johns soils, depressional. Dissimilar soils make up 1 to 9 percent.

Generally, the mapped areas are about 42 percent Placid and similar soils, 28 percent Basinger and similar soils, and 27 percent St. Johns and similar soils. The soils do not occur in a regular repeating pattern. Each of the soils is not present in every mapped area, and their relative proportion is variable. Although individual areas of the soils are large enough to map separately, they were mapped as one unit based upon the present and predicted uses.

Typically, the surface layer of the Placid soil is fine sand about 15 inches thick. It is black in the upper 8 inches and very dark gray in the lower 7 inches. The underlying material, to a depth of about 80 inches, is grayish brown fine sand in the upper part, light brownish gray fine sand in the next part, and light gray fine sand in the lower part. Some areas contain soils that are similar to the Placid soil but have a surface layer thicker than 24 inches or have a loamy subsoil at a depth of more than 20 inches.

Typically, the surface layer of the Basinger soil is black fine sand about 2 inches thick. The subsurface layer is about 27 inches thick. It is light gray fine sand in the upper part and grayish brown fine sand in the lower part. The subsoil is dark yellowish brown and grayish brown fine sand about 21 inches thick. The underlying material, to a depth of about 80 inches, is pale brown fine sand. Some areas contain soils that are similar to the Basinger soil but do not have a dark layer in the subsoil.

Typically, the surface layer of the St. Johns soil is black fine sand about 10 inches thick. The subsurface layer is gray fine sand about 15 inches thick. The subsoil is very dark grayish brown fine sand to a depth of about 39 inches and dark yellowish brown fine sand to a depth of about 54 inches. The underlying material to a depth of 80 inches or more is dark gray fine sand. Some areas contain soils that are similar to the St. Johns soil but have an organic-stained subsoil layer at a depth of more than 30 inches.

The dissimilar soils in this map unit include small areas of Hontoon and Samsula soils in landscape positions similar to those of the St. Johns soil. They formed in organic material.

In most years, undrained areas of this map unit are ponded for more than 6 months, and the seasonal high water table is as much as 2 feet above the surface. Permeability is rapid in the Placid and Basinger soils and moderately slow or moderate in the St. Johns soil. Available water capacity is low in the Basinger and St. Johns soils and low to moderate in the Placid soil.

Most areas of this map unit support the natural vegetation. Most areas are used as wildlife habitat. The natural-growth hardwood timber is harvested from some areas of this map unit. The natural vegetation consists of pondcypress, red maple, sweetgum, and sweetbay. The understory vegetation consists of sawgrass, maidencane, sedges, iris, waxmyrtle, and greenbrier.

This map unit is poorly suited to most cultivated crops because of the ponding that occurs for long periods. Because the map unit is typically in the flatwoods, adequate water outlets for drainage are not generally available or are difficult to install.

This map unit is poorly suited to pasture. The main limitations are the excessive wetness and the ponding. Water stands above the surface for long periods during rainy seasons. Because the map unit is in a low position on the landscape, adequate drainage is difficult to establish.

This map unit is generally not suited to the commercial production of pine trees. Some areas are suited to the production of cypress and hardwoods, but harvesting and planting are more effective during extended dry periods. The main management concern

is the water table, which is above the surface for much of the year. The ponding and the high content of organic matter in the surface layer prevent the use of heavy equipment. The high water table will kill planted seedlings. Outlets are generally not present in these areas, and drainage is not practical.

This map unit is poorly suited to range or grazeable woodland. Water covers the surface of the soil for long periods of time. The growth of forage suitable for use by cattle is limited by the excessive wetness and the dense shade caused by thick stands of cypress hardwoods. This map unit is not assigned to a range site.

This map unit has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings because of the excessive wetness. Water stands above the surface of the soil for long periods of time. Because the map unit is in a low position on the landscape, overcoming this limitation is difficult. Outlets needed for water control are often not readily available. Using fill to elevate building sites and roadways can help to overcome the wetness. The limitations are severe for shallow excavations because cutbanks are unstable and water stands on the surface. Shoring the sidewalls of excavations prevents caving. The installation of a water-control system that removes excess surface water can help to overcome the limitations caused by the wetness. The ponding and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound absorption fields can help to overcome these limitations. Because the map unit is in a low position on the landscape, large amounts of fill may be required to adequately elevate the absorption field. This map unit is unsuited to sewage lagoons and trench-type sanitary landfills. The seepage and the ponding are severe limitations for these uses.

This map unit has severe limitations for recreational development. Water stands above the surface of the soil for long periods, and the surface of the soil is too sandy to use for recreational purposes. Water-control measures and the stabilization of the surface can help to overcome these limitations.

The potential of this map unit as habitat for openland and wetland wildlife is very poor and for wetland wildlife is good. The dense vegetative cover provides good cover and fair sources of food. This map unit supports a large variety of wildlife. It is especially well suited to waterfowl, reptiles, amphibians, and many birds. Other species include black bear, bobcat, deer, gray squirrel, otter, and raccoon.

This map unit is in capability subclass VIIw. The woodland ordination symbol is 2W. The ecological community is Swamp Hardwoods.

13—Immokalee fine sand. This very deep, nearly level, poorly drained soil is on broad flats and low knolls on the flatwoods. Individual areas are irregular in shape. They range from 5 to 600 acres in size. Slopes are smooth to convex and range from 0 to 2 percent.

In 95 percent of the areas mapped as Immokalee fine sand, Immokalee and similar soils make up 93 to 99 percent of the map unit. Dissimilar soils make up 1 to 7 percent.

Typically, the surface layer is black fine sand about 5 inches thick. The subsurface layer is light brownish gray fine sand about 34 inches thick. The subsoil, from a depth of 39 to 60 inches, is very dark gray fine sand in the upper 8 inches and dark brown fine sand in the lower 13 inches. The subsoil is coated with organic matter. The underlying material, to a depth of 80 inches, is dark grayish brown fine sand. Some areas contain soils that are similar to the Immokalee soil but have a organic-stained layer within a depth of 30 inches. Also included in mapping are some soils that are similar to the Immokalee soil but have a subsoil layer at a depth of more than 50 inches and other soils that have a subsoil layer directly below the surface layer.

The dissimilar soils in this map unit include small areas of St. Johns and Basinger soils in depressions. St. Johns soils have a thicker surface layer than the Immokalee soil and are more poorly drained. Basinger soils have a weakly expressed, organic-stained subsoil layer.

In most years, the seasonal high water table is at a depth of 6 to 18 inches for about 2 months and is at a depth of 10 to 40 inches for more than 8 months. During extended dry periods, it recedes to a depth of more than 40 inches. Permeability is moderate. Available water capacity is low.

The natural vegetation consists of slash pine and longleaf pine. The understory vegetation consists of saw palmetto, fetterbush, inkberry, runner oak, pineland threeawn, bluestem, panicum, and sumac. Most areas of this soil are used for the commercial production of pine trees. Some small areas have been cleared and planted to improved pasture.

This soil is moderately suited to cultivated crops. The main limitations are the wetness caused by a seasonal high water table and the droughtiness during periods of low rainfall. By installing a good water-control system, a variety of vegetable crops can be grown. If suitable outlets are available, lateral ditches and tile drains can be used to lower the water table. A furrow irrigation system is suited to this soil. Land grading and smoothing improve the surface drainage, allow a more uniform application of irrigation water, and permit the more efficient use of farm equipment. Returning all of

the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to maintain fertility and tilth. Maintaining crop residue on or near the surface helps to control runoff, maintain soil tilth, and maintain the content of organic matter. Soil blowing is a hazard in cultivated areas. It can be controlled with a good ground cover of close-growing plants. Crops respond well to applications of lime and nitrogen, phosphorus, and potassium fertilizer.

This soil is moderately suited to pasture. The main limitations are excessive wetness during rainy seasons and droughtiness during extended dry periods. The wetness limits the choice of plants and the period of grazing. Grazing when the soil is wet results in the compaction of the surface layer and damages the plant community. Excessive water on the surface can be removed by using shallow surface ditches. The low or very low available water capacity of the soil limits the production of plants during extended dry periods. Deep-rooted plants, such as coastal bermudagrass and bahiagrass, tolerate droughty conditions better if they are properly fertilized and limed. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition. Applications of fertilizer and lime are needed for the optimum growth of grasses and legumes.

This soil is moderately suited to the commercial production of pine trees. Based on a 50-year site curve, the mean site index for slash pine is 70. The potential for commercial production of pulpwood is 35 cords per acre harvested from a fully stocked stand of trees 25 years old. The main management concerns for producing and harvesting timber are the equipment limitation, the seedling mortality rate, the windthrow hazard, and plant competition. The sandy texture of the surface layer and the wetness limit the use of equipment. Using special equipment, such as large rubber tires or crawler machinery, and harvesting during dry periods can reduce the equipment limitation. Harvesting during dry periods reduces soil compaction and minimizes root damage during thinning operations. After harvesting, reforestation must be carefully managed to reduce competition from undesirable understory plants. Site preparation, such as chopping, burning, applying herbicide, and bedding, reduces debris, reduces immediate plant competition, and facilitates hand and mechanical planting. If site preparation is not adequate, competition from undesirable plants can prevent or prolong the natural or artificial reestablishment of trees. Planting on beds helps to overcome the limitations caused by the excessive wetness. Only those trees that can tolerate seasonal wetness should be planted. Although conventional methods of harvesting timber generally are suitable, the soil can be compacted if heavy equipment is used when the soil is wet. The soil often has a very low content of organic matter, and a harvest system that removes all of the tree biomass reduces the fertility of the soil in these areas. A logging system that leaves residual logging biomass distributed over the site is preferred.

This soil is moderately suited to range and grazeable woodland. It has a moderate to high potential for the production of native forage. The dominant plants suitable for grazing include chalky bluestem, creeping bluestem, indiangrass, and panicum. This soil is in the North Florida Flatwoods range site.

This soil has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings because of the wetness caused by the seasonal high water table. If suitable outlets are available, shallow surface drainage can help to remove the excess water. Suitable fill material can be used to elevate building sites and increase the effective depth to the water table. The limitations are severe for shallow excavations because cutbanks are unstable and excavations fill with water when the water table is high. Shoring sidewalls of excavations can help to prevent caving. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome these limitations. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining the lagoons and trenches with impervious soil material can reduce the excess seepage. Water-control measures should be used to remove the excess surface and ground water.

The wetness and the sandy surface are severe limitations for recreational development. Installing water-control measures can reduce the wetness caused by the seasonal high water table. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential of this soil as habitat for all forms of wildlife is poor. Although it is only a poor to fair source of food and cover and sites for nesting and dens, the soil supports a diverse and numerous wildlife population. Many larger animals are found where areas of this soil join other ecological communities. Areas of this soil are well suited to deer, quail, bobcat, skunk, opossum, and raccoon. Other species generally include cottontail rabbit, fox squirrel, gray fox, and a variety of birds, reptiles, and amphibians.

This Immokalee soil is in capability subclass IVw. The woodland ordination symbol is 8w. The ecological community is North Florida Flatwoods.

14—Pineda fine sand. This very deep, nearly level, poorly drained soil is in sloughs and on low flatwoods. Individual areas are irregular in shape. They range from 5 to 1,000 acres in size. Slopes are smooth to concave. They are mainly less than 1 percent but range from 0 to 2 percent.

In 95 percent of the areas mapped as Pineda fine sand, Pineda and similar soils make up 92 to 99 percent of the map unit. Dissimilar soils make up 1 to 8 percent.

Typically, the surface layer is gray fine sand about 3 inches thick. The subsurface layer is light gray fine sand about 10 inches thick. The upper part of the subsoil is brownish yellow fine sand to a depth of 19 inches and yellowish brown fine sand to a depth of 24 inches. A grayish brown fine sand layer about 2 inches thick is between the upper and lower parts of the subsoil. The lower part of the subsoil is light gray and has tongues of grayish brown fine sand to a depth of 33 inches. It is gray fine sandy loam to a depth of 40 inches. The underlying material is dark gray loamy fine sand to a depth of 47 inches and greenish gray loamy fine sand to a depth of 80 inches or more. Some areas contain soils that are similar to the Pineda soil but in which the depth to the loamy subsoil is more than 40 inches. Also included in mapping are some soils that are similar to the Pineda soil but have a brown upper subsoil layer and other soils that have a loamy subsoil at a depth of less than 20 inches.

The dissimilar soils in this map unit include small areas of Wabasso and Winder soils. Wabasso and Winder soils are in landscape positions similar to those of the Pineda soil. Wabasso soils have an organic-stained subsoil layer. Winder soils have a loamy layer at a depth of less than 20 inches.

A seasonal high water table is within a depth of 6 inches for 1 to 6 months. Permeability is slow or very slow. Available water capacity is low.

Most areas are used for the commercial production of pine trees. Areas that have water-control measures are used for vegetable crops, mostly cabbage and Irish potatoes. Some areas are used for pasture and hay. The natural vegetation consists of slash pine, cabbage palm, sweetgum, and water oak. The understory vegetation consists of gallberry, maidencane, saw palmetto, pineland threeawn, and bluestem.

This soil is moderately suited to cultivated crops. The main limitations are the excessive wetness and the poor soil quality. By installing a good water-control system, Irish potatoes, cabbage, and a variety of other vegetable crops can be grown. Proper row management, lateral ditches or tiles, and well constructed outlets help to remove the excess surface water. A furrow irrigation system is suited to this soil. Land grading and smoothing improve the surface drainage, allow a more uniform application of irrigation water, and permit the more efficient use of farm equipment. Returning all of the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to conserve moisture, maintain fertility, and control erosion. Frequent applications of fertilizer and lime are generally needed for the best yields.

With good water-control management, this soil is well suited to pasture. The main limitations are a result of the wetness. Excessive water can be removed by using field ditches and tile drains. Grasses and legumes grow well if adequate fertilizer is used. The low available water capacity limits the production of plants during extended dry periods. Deep-rooted plants, such as coastal bermudagrass and bahiagrass, tolerate droughty conditions better if they are properly fertilized and limed. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 80. The potential for commercial production of pulpwood is 42 cords per acre harvested from a fully stocked stand of trees 25 years old. The main management concerns for producing and harvesting timber are the equipment limitation, the seedling mortality rate, and plant competition. Planting on beds helps to overcome the limitations caused by the excessive wetness. Although conventional methods of harvesting timber generally are suitable, the soil can be compacted if heavy equipment is used when the soil is wet. Using special equipment, such as high-flotation rubber tires or crawler machinery, and harvesting during dry periods can reduce the equipment limitation. Site preparation, such as chopping, applying herbicide, and bedding, reduces debris, reduces immediate plant competition, and facilitates hand and mechanical planting. Other good management practices include the selection of appropriate species, restricted burning, and a harvesting system that leaves debris onsite to conserve organic matter.

This soil is well suited to range and grazeable woodland. In most areas, the tree and shrub vegetation is less dense than in the surrounding flatwood areas. The canopy is more open, and grasses, such as maidencane and chalky bluestem, are the main forage species. When well managed, this soil has the potential

to produce a large amount of forage. It is in the Slough range site.

This soil has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings because of the wetness caused by the seasonal high water table. If suitable outlets are available, shallow surface drainage can help to remove the excess water. Suitable fill material can be used to elevate building sites and increase the effective depth to the water table. The limitations are severe for shallow excavations because cutbanks are unstable and excavations fill with water when the water table is high. Shoring sidewalls of excavations can help to prevent caving. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness, the slow permeability, and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome these limitations. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining trenches with impervious soil material can reduce the excess seepage. A water-control system should be installed to remove the excess surface water and ground water.

The wetness, the slow permeability in the subsoil, and the sandy surface are severe limitations for recreational development. Installing water-control measures can reduce the wetness caused by the seasonal high water table. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential of this soil as habitat for openland and wetland wildlife is fair and for woodland wildlife is poor. Areas of this soil provide a good source of food for bobwhite quail, deer, and wading birds. They produce poor cover for most wildlife species, but the adjacent flatwoods produce good escape routes and an edge effect. Other species include fox, rabbit, opossum, and a variety of birds, reptiles, and amphibians.

This Pineda soil is in capability subclass IIIw. The woodland ordination symbol is 10w. The ecological community is Slough.

15—Pomello fine sand, 0 to 5 percent slopes. This very deep, nearly level to gently sloping, moderately well drained soil is on low ridges and knolls on the flatwoods and coastal ridge. Individual areas are irregular in shape. They range from 5 to 400 acres or more in size. Slopes are smooth to convex and range from 0 to 5 percent.

In 95 percent of the areas mapped as Pomello fine sand, 0 to 5 percent slopes, Pomello and similar soils make up 85 to 99 percent of the map unit. Dissimilar soils make up 1 to 15 percent.

Typically, the surface layer is dark gray fine sand about 5 inches thick. The subsurface layer is light gray fine sand about 36 inches thick. The subsoil, to a depth of about 66 inches, is very dark brown fine sand in the upper 14 inches and very dark gray fine sand in the lower 11 inches. The underlying material, to a depth of about 80 inches, is grayish brown fine sand in the upper part and gray fine sand in the lower part. Some areas contain soils that are similar to the Pomello soil but have a organic-stained layer within a depth of 30 inches. Also included in mapping are some soils that are similar to the Pomello soil but have a loamy subsoil layer at a depth of more than 50 inches and are better drained and other soils that have a loamy subsoil layer at a depth of less than 30 inches.

The dissimilar soils in this map unit include small areas of Adamsville, Bulow, and Tavares soils. They are in landscape positions similar to those of the Pomello soil. Adamsville, Bulow, and Tavares soils do not have an organic-stained layer in the subsoil. Bulow soils are underlain by limestone bedrock. Also included are some soils that have a loamy subsoil below the sandy subsoil and other soils that have a subsoil at a depth of more than 50 inches and are poorly drained.

A seasonal high water table is at a depth of 24 to 42 inches for 1 to 4 months. Permeability is moderately rapid. Available water capacity is low.

Most areas are used as wildlife habitat. A few areas are used as sites for homes or for the commercial production of pine trees. The natural vegetation consists of live oak, laurel oak, longleaf pine, and slash pine. A few areas have sand pine. The understory vegetation consists of saw palmetto, ironbush, pineland threeawn, bluestem, panicum, and annual forbs.

This soil is poorly suited to cultivated crops, but if intensive management practices are used, a few specialized crops can be grown. The soil is limited mainly by the poor soil quality. It is droughty, and nutrients are leached rapidly. For maximum yields, irrigation should be provided and fertilizer and lime should be applied as needed by the crop being grown. Using minimum tillage and returning all of the crop residue to the soil or regularly adding other organic material improves the fertility and helps to maintain the soil tilth and the content of organic matter. Soil blowing is a hazard in cultivated areas. It can be controlled with a good ground cover of close-growing plants.

This soil is poorly suited to pasture. The very low available water capacity of the soil limits the production of plants during extended dry periods. Deep-rooted plants, such as coastal bermudagrass and bahiagrass,

tolerate droughty conditions better if they are properly fertilized and limed. A system of grazing rotation helps to maintain the quality of forage. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition. Periodic mowing and clipping help to maintain uniform growth, discourage selective grazing, and reduce clumpy growth.

This soil is moderately suited to the production of slash pine. Based on a mean site index of 50 for slash pine, the yield from an even-aged, fully stocked stand of trees 25 years old is 35 cords per acre. Seedling mortality, the equipment limitation, plant competition, and the windthrow hazard are management concerns. The high temperature of the surface layer in the summer and the very low available water capacity also increase the seedling mortality rate. The sandy surface layer restricts the use of wheeled equipment, especially when the soil is very dry. If site preparation is not intensive, competition from undesirable plants can prevent or prolong the natural or artificial reestablishment of trees. Site preparation, such as chopping, applying herbicide, and bedding, reduces debris, controls plant competition, and facilitates mechanical planting. The soil has a very low content of organic matter, and harvesting systems that remove all of the tree biomass reduce the fertility of a site. A preferred harvesting system leaves residual biomass distributed over the site.

This soil is poorly suited to range or grazeable woodland. Because a fairly dense stand of trees and shrubs generally grows on this soil, the growth of native plants suitable for forage is limited. Some areas provide good shade and winter shelter for livestock. This soil is in the Sand Pine Scrub range site.

This soil has a moderate limitation for dwellings without basements, local roads and streets, and small commercial buildings because of the wetness caused by a seasonal high water table. Suitable fill material, used to elevate building sites and roads, can help to overcome the wetness. In areas that have slopes of more than 4 percent, the slope is an additional limitation for small commercial buildings. Minor land smoothing can help to overcome this limitation. The limitations are severe for shallow excavations because cutbanks are unstable and ground water flows into excavations. Shoring the sidewalls of excavations and installing dewatering wells lower the water table. The wetness and the poor filtering of effluent are severe limitations for septic tank absorption fields. Suitable fill material can be used to increase the effective depth to the seasonal high water table. The wetness and the seepage are severe limitations for sewage lagoons and trench-type sanitary landfills. Using water-control measures and lining the lagoons and trenches with impervious soil material can help to overcome the limitations.

The sandy surface is a severe limitation for recreational development. Maintaining good trafficability in the loose, sandy surface is difficult, and the hazard of blowing sand exists. Establishing a good vegetative cover, planting windbreaks, adding good topsoil, or constructing paved areas can help to overcome the limitation.

The potential of this soil as habitat for openland and woodland wildlife is poor and for wetland wildlife is very poor. Although the production of food for wildlife is limited, good escape cover for deer and turkey is present. Other species include gopher, tortoise, raccoon, armadillos, and several kinds of songbirds.

This Pomello soil is in capability subclass VIs. The woodland ordination symbol is 8s. The ecological community is Sand Pine Scrub.

16—Malabar fine sand. This very deep, nearly level, poorly drained soil is in low flatwood areas. Individual areas are irregular in shape. They range from 3 to 450 acres in size. Slopes are smooth to concave. They are mainly less than 1 percent but range to 2 percent.

In 80 percent of the areas mapped as Malabar fine sand, Malabar and similar soils make up 77 to 89 percent of the map unit. Dissimilar soils make up 11 to 23 percent.

Typically, the surface layer is black fine sand about 4 inches thick. The subsurface layer is gray fine sand about 6 inches thick. The upper part of the subsoil is yellowish brown fine sand to a depth of about 30 inches, gray and grayish brown fine sand to a depth of about 60 inches, and grayish brown sandy clay loam to a depth of 80 inches or more. Some areas contain soils that are similar to the Malabar soil but in which the depth to the subsoil layer is less than 40 inches. Also included in mapping are some soils that are similar to the Malabar soil but have a thin, dark, sandy layer above the loamy subsoil layer and other soils that have a loamy sand subsoil.

The dissimilar soils in this map unit include small areas of Valkaria, EauGallie, Basinger, Wabasso, and Hicoria soils. Basinger and Hicoria soils are in depressions. Basinger soils have an organic-stained layer in the subsoil. Hicoria soils have a thicker surface layer and do not have the subsoil layer. Valkaria, EauGallie, and Wabasso soils are in landscape positions similar to those of the Malabar soil. Valkaria soils do not have the subsoil layer. EauGallie and Wabasso soils have an organic-stained layer in the subsoil.

A seasonal high water table is at a depth of 0 to 6 inches for 2 to 6 months in most years. Permeability is slow or very slow. The available water capacity is low.

The natural vegetation consists of scattered areas of slash pine, cabbage palm, water oak, red maple, sweetgum, and cypress. The understory vegetation consists of maidencane, pineland threeawn, chalky bluestem, and panicum and scattered areas of saw palmetto. Most areas are used for the commercial production of pine trees. A few areas are used as improved pasture.

By applying good water-control and soil-improving measures, this soil is moderately suited to cultivated crops. It is limited mainly by the seasonal high water table and droughtiness during periods of low rainfall. The root zone is limited by the seasonal high water table, which is less than 10 inches below the surface of the soil during the growing season. Irish potatoes, cabbage, and a variety of other vegetable crops are grown. Proper row management, lateral ditches or tiles, and well constructed outlets help to remove the excess surface water. A furrow irrigation system is suited to this soil. Land grading and smoothing improve the surface drainage, allow a more uniform application of irrigation water, and permit the more efficient use of farm equipment. Returning all of the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to conserve moisture, maintain fertility, and control erosion. Frequent applications of fertilizer and lime are generally needed to improve soil quality.

With good water-control management, this soil is well suited to pasture. The main limitations are a result of the wetness. Excessive water on the surface can be removed by using field ditches and tile drains. Grasses and legumes grow well if adequate fertilizer is used. The low available water capacity limits the production of plants during extended dry periods. Deep-rooted plants, such as coastal bermudagrass and bahiagrass, tolerate droughty conditions better if they are properly fertilized and limed. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 80. The potential for commercial production of pulpwood is 42 cords per acre harvested from a fully stocked stand of trees 25 years old. The main management concerns for producing and harvesting timber are the equipment limitation, the seedling mortality rate, and plant competition. If site preparation is not adequate, the competition from undesirable plants can prevent or prolong the natural or artificial reestablishment of trees. Planting on beds helps to overcome the limitations caused by the excessive wetness. Although conventional methods of harvesting timber generally can be used, their use can be limited during rainy seasons, which are generally from June to December. The use of equipment during wet periods can cause soil compaction. Soil compaction results in less infiltration and aeration and restricted root growth. Site preparation, such as chopping, burning, applying herbicide, and bedding, reduces debris, reduces immediate plant competition, and facilitates hand and mechanical planting. Using a nitrogen fertilizer combined with phosphorus, based on a soil test or tissue analysis, at mid-rotation can provide an excellent growth response. Other good management practices include the selection of appropriate species, restricted burning, and a harvesting system that leaves debris onsite to conserve organic matter.

This soil is well suited to range and grazeable woodland. In most areas, the tree and shrub vegetation is less dense than in the surrounding flatwood areas. The canopy is more open, and grasses, such as maidencane and chalky bluestem, grow well and are the main forage species. When well managed, this soil has the potential to produce a large amount of forage. It is in the Slough range site.

This soil has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings because of the wetness caused by the seasonal high water table. If suitable outlets are available, shallow surface drainage can help to remove the excess water. Suitable fill material can be used to elevate building sites and increase the effective depth to the water table. The limitations are severe for shallow excavations because cutbanks are unstable and excavations fill with water when the water table is high. Shoring sidewalls of excavations can help to prevent caving. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome these limitations. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining trenches with impervious soil material can reduce the excess seepage. Water-control measures should be used to remove the excess surface and ground water.

The wetness and the sandy surface are severe limitations for recreational development. Installing water-control measures can reduce the wetness caused by the seasonal high water table. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing

paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential of this soil as habitat for openland and woodland wildlife is poor and for wetland wildlife is fair. Areas of this soil provide a good source of food for bobwhite quail, deer, and wading birds. They produce poor cover for most wildlife species, but the adjacent flatwoods produce good escape routes and an edge effect. Other species include fox, rabbit, opossum, and a variety of birds, reptiles, and amphibians.

This Malabar soil is in capability subclass IVw. The woodland ordination symbol is 10w. The ecological community is Slough.

17—Holopaw fine sand. This very deep, nearly level, poorly drained soil is in broad to narrow, low flatwood areas. Individual areas are irregular in shape. They range from 5 to 80 acres or more in size. Slopes are smooth to concave. They are mainly less than 1 percent but range from 0 to 2 percent.

In 80 percent of the areas mapped as Holopaw fine sand, Holopaw and similar soils make up 79 to 98 percent of the map unit. Dissimilar soils make up 2 to 21 percent.

Typically, the surface layer is very dark gray fine sand about 4 inches thick. The subsurface layer is light gray and gray fine sand to a depth of 45 inches. The subsoil is light gray fine sandy loam to a depth of 55 inches. The underlying material, to a depth of 80 inches or more, is light gray loamy fine sand. Some areas contain soils that are similar to the Holopaw soil but in which the depth to the subsoil layer is less than 40 inches. Also included in mapping are some soils that are similar to the Holopaw soil but have a thin, dark sandy layer above the subsoil and other soils that have a loamy sand subsoil.

The dissimilar soils in this map unit include small areas of Valkaria soils that are sandy throughout. Valkaria soils are in landscape positions similar to those of the Holopaw soil.

A seasonal high water table is at a depth of 0 to 6 inches for 2 to 6 months during most years. Permeability is moderate to moderately slow. Available water capacity is low to moderate.

The natural vegetation consists of slash pine, longleaf pine, cabbage palm, sweetgum, red maple, and water oak. The understory vegetation consists of waxmyrtle and gallberry and scattered areas of saw palmetto, bluestem, and panicum. Most areas are used for the commercial production of pine trees. A few areas are used as improved pasture, and some areas are used as sites for homes.

By applying good water-control and soil-improving measures, this soil is moderately suited to cultivated crops. It is limited mainly by excessive wetness during rainy seasons and by droughtiness during periods of low rainfall. The root zone is limited by the seasonal high water table, which is less than 10 inches below the surface of the soil during the growing season. Irish potatoes, cabbage, and a variety of other vegetable crops are grown. Proper row management, lateral ditches or tiles, and well constructed outlets help to remove the excess surface water. A furrow irrigation system is suited to this soil. Land grading and smoothing improve the surface drainage, allow a more uniform application of irrigation water, and permit the more efficient use of farm equipment. Returning all of the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to conserve moisture, maintain fertility, and control erosion. Frequent applications of fertilizer and lime are generally needed to improve soil quality.

With good water-control management, this soil is moderately suited to pasture. The main limitations are a result of the wetness. Excessive water on the surface can be removed by using field ditches and tile drains in areas where water outlets are available. Grasses and legumes grow well if adequate fertilizer is used. The low available water capacity limits the production of plants during extended dry periods. Deep-rooted plants, such as coastal bermudagrass and bahiagrass, tolerate droughty conditions better if they are properly fertilized and limed. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to the production of pine trees. Slash pine is the recommended species for commercial woodland production. Based on a mean site index of 80 for slash pine, the yield from an even-aged, fully stocked stand of trees 25 years old is 42 cords per acre. Seedling mortality, the equipment limitation, and plant competition are management concerns. Droughtiness causes seedling mortality. Using special equipment, such as oversized rubber tires on harvesting equipment, reduces the equipment limitation, minimizes the damage to roots, and reduces soil compaction during thinning operations. The seedling mortality rate can be reduced by providing good site preparation. Site preparation, such as chopping, applying herbicide, and bedding reduces debris, controls immediate plant competition, and facilitates mechanical planting. Planting trees on bedded rows lowers the effective depth of the water table. The soil often has a very low content of organic matter, and harvesting systems that remove all of the tree biomass reduce the fertility of the site. A preferred harvesting system leaves residual biomass distributed over the site.

This soil is well suited to range and grazeable

woodland. It has a moderate to high potential for the production of native forage. The dominant plants suitable for grazing include chalky bluestem, creeping bluestem, indiangrass, and panicum. This soil is in the North Florida Flatwoods range site.

This soil has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings because of the wetness caused by the seasonal high water table. If suitable outlets are available, shallow surface drainage can help to remove the excess water. Suitable fill material can be used to elevate building sites and increase the effective depth to the water table. The limitations are severe for shallow excavations because cutbanks are unstable and excavations fill with water when the water table is high. Shoring sidewalls of excavations can help to prevent caving. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome these limitations. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining the lagoons and trenches with impervious soil material can reduce the excess seepage. Water-control measures should be used to remove the excess surface and ground water.

The wetness and the sandy surface are severe limitations for recreational development. Installing water-control measures can reduce the wetness caused by the seasonal high water table. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential of this soil as habitat for all forms of wildlife is fair. Areas of this soil provide good food and cover, nesting sites, and den sites for a diverse and numerous wildlife population. The species generally include deer, quail, turkey, feral hog, raccoon, opossum, and a variety of birds.

This Holopaw soil is in capability subclass IVw. The woodland ordination symbol is 10w. The ecological community is North Florida Flatwoods.

18—Valkaria-Smyrna complex. These very deep, nearly level, poorly drained soils are on the flatwoods. The Valkaria soil is in low, grassy sloughs. The Smyrna soil is in broad areas and slightly higher landscape positions. Individual areas of this map unit are irregular in shape. They range from 40 to 300 acres in size. Slopes range from 0 to 2 percent but are generally less than 1 percent.

In 95 percent of the areas mapped as Valkaria-Smyrna complex, Valkaria, Smyrna, and similar soils make up 88 to 99 percent of the map unit. Dissimilar soils make up 1 to 12 percent.

Generally, the mapped areas are about 50 percent Valkaria and similar soils and about 41 percent Smyrna and similar soils. This map unit consists of areas of Valkaria and Smyrna soils that are so small or so intricately intermingled that they could not be mapped separately at the scale used. However, the proportions and the patterns of the soils are relatively consistent in most delineations of the map unit.

Typically, the surface layer of Valkaria soil is dark gray fine sand about 6 inches thick. The subsurface layer is light gray fine sand about 11 inches thick. The subsoil is brownish yellow and yellow fine sand to a depth of 38 inches. The underlying layer, which extends to a depth of 80 inches or more, is gray fine sand. Some areas contain soils that are similar to the Valkaria soil but have a dark sandy layer below the subsoil.

Typically, the surface layer of Smyrna soil is black fine sand about 4 inches thick. The subsurface layer is gray fine sand to a depth of 15 inches. The subsoil is about 5 inches thick. It is very dark brown in the upper 2 inches and dark reddish brown in the lower 3 inches. It is fine sand that is coated with organic matter. The next layer is brown fine sand and extends to a depth of 39 inches. The underlying layer, which extends to a depth of 80 inches or more, is gray fine sand. Some areas contain soils that are similar to the Smyrna soil but in which the depth to an organic-stained layer in the subsoil is 20 to 30 inches.

The dissimilar soils in this map unit include small areas of soils that have a weakly cemented subsoil layer and areas of Basinger soils in small depressions. Basinger soils have a very weakly expressed, organic-stained layer.

A seasonal high water table is at a depth of 0 to 6 inches for 1 to 6 months in the Valkaria soil and is at a depth of 6 to 18 inches for 1 to 4 months in the Smyrna soil. It is at a depth of 10 to 40 inches for more than 6 months in most years in both soils. Permeability is rapid in the Valkaria soil and moderate or moderately rapid in the Smyrna soil. The available water capacity is low in both soils.

Most areas of this map unit support the natural vegetation. Some areas are used for pine plantations. The natural vegetation consists of slash pine, longleaf pine, cabbage palm, and water oak and scattered areas of sweetgum and red maple. The understory vegetation consists of pineland threeawn, bluestem, panicum, maidencane, sedges, St. Johnswort, inkberry, and waxmyrtle.

The map unit is poorly suited to cultivated crops. The

wetness is a severe limitation. With the use of a complete water-control system that removes excess water rapidly and provides a means of applying surface irrigation, this map unit is suited to a number of vegetable crops. Good management includes a crop rotation that keeps the soil in close-growing crops to help to maintain soil quality. Soil-improving cover crops and all other crop residue should be plowed under the surface. Seedbed preparation should include bedding. Fertilizer and lime should be applied according to the needs of the crop and the soil condition.

This map unit is moderately suited to pasture and hay. Excess surface water can be removed from most areas by field drains. Suitable pasture plants include bermudagrass, bahiagrass, and clover. Proper grazing management, weed control, and applications of fertilizer are needed to ensure the maximum quality of forage.

This map unit is moderately suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 68 for the Valkaria soil and 80 for the Smyrna soil. The yield is 33 cords per acre for the Valkaria soil and 42 cords per acre for the Smyrna soil from fully stocked stand of trees 25 years old. The main management concern is the seasonal wetness that results in seedling mortality, plant competition, and equipment limitations. Site preparation, such as chopping and bedding (or double bedding), helps to establish seedlings, reduces the mortality rate, and increases early plant growth. Planting on beds should be done so that it does not block the natural drainage. Restricting the use of equipment to drier periods and using low-pressure ground equipment reduce the problems associated with soil compaction. The hardwood understory can be reduced by girdling, burning, cutting unwanted trees, and chopping late in fall and winter, followed by a second chopping or herbicide application in spring and burning in summer. Using a nitrogen fertilizer combined with phosphorus and potassium at planting time can provide an excellent growth response. Additional applications of fertilizer at mid-rotation should be based on soil test or tissue analyses. Pine trees grow best with an adequate phosphorus supply.

This map unit is well suited to range and grazeable woodland. The dominant forage is bluestem, maidencane, and pineland threeawn. The natural vegetation on the Valkaria soil is scattered areas of trees and shrubs. It has a more open canopy than the vegetation on the Smyrna soil. When well managed, this map unit has the potential to produce large amounts of forage. The Valkaria soil is in the Slough range site, and the Smyrna soil is in the North Florida Flatwoods range site.

This map unit has severe limitations for dwellings without basements, local roads and streets, and small commercial buildings because of the wetness caused by the seasonal high water table. If adequate water outlets are available, shallow surface drainage can help remove the excess wetness. Suitable fill material can be used to elevate building sites and increase the effective depth to the water table. The limitations are severe for shallow excavations because cutbanks are unstable and excavations fill with water when the water table is high. Shoring sidewalls of excavations can help to prevent caving. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome the limitations. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining trenches with impervious soil material can reduce the excess seepage. Water-control measures should be used to remove the excess surface and ground water.

The wetness and the sandy surface are severe limitations for recreational development. Installing water-control measures can reduce the wetness caused by the seasonal high water table. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential of the Valkaria soil as habitat for openland and woodland wildlife is poor and for wetland wildlife is good. Areas of this soil provide a good source of food for bobwhite quail, deer, and wading birds. They produce poor cover for most wildlife species, but the adjacent flatwoods produce good escape routes and an edge effect. Other species in areas of this soil include fox, rabbit, opossum, and variety of birds, reptiles, and amphibians.

The potential of the Smyrna soil as habitat for all forms of wildlife is fair. Areas of this soil provide good food and cover, nesting sites, and den sites for a diverse and numerous wildlife population. The species typically include deer, quail, turkey, feral hog, raccoon, opossum, and a variety of birds.

The unit is in capability subclass IVw. The Valkaria soil has a woodland ordination symbol of 8w, and the ecological community is Slough. The Smyrna soil has a woodland ordination symbol of 10w, and the ecological community is North Florida Flatwoods.

19—Valkaria fine sand. This very deep, nearly level, poorly drained soil is on low broad flats and in sloughs connecting depressions. Individual areas are irregular in

shape. They range from 5 to 100 acres in size. Slopes are smooth to concave. They are mainly less than 1 percent but range to 2 percent.

In 95 percent of areas mapped as Valkaria fine sand, Valkaria and similar soils make up 81 to 99 percent of the map unit. Dissimilar soils make up 1 to 19 percent.

Typically, the surface layer is dark gray fine sand about 6 inches thick. The subsurface layer is light gray fine sand about 11 inches thick. The subsoil is brownish yellow and yellow fine sand to a depth of about 38 inches. The underlying layer is gray fine sand to a depth of 80 inches or more. Some areas contain soils that are similar to the Valkaria soil but have a loamy subsoil layer below a depth of 60 inches. Also included in mapping are some soils that are similar to the Valkaria soil but have a dark sandy layer below the subsoil, do not have a subsoil, or have a loamy sand layer beneath the subsoil.

The dissimilar soils in this map unit include small areas of Pineda, Riviera, and Myakka soils. Pineda and Riviera soils are in landscape positions similar to those of the Valkaria soil, but they have a loamy subsoil layer. Myakka soils are in broad areas of flatwoods and have an organic-stained layer in the subsoil.

A seasonal high water table is at a depth of 0 to 6 inches for 2 to 6 months. It is at the surface for a few days to several weeks, and it is at a depth of 10 to 40 inches during dry periods. Permeability is rapid. The available water capacity is low.

The natural vegetation consists of St. Johnswort, maidencane, panicum, pineland threeawn, cordgrass, bluestem, and sundew. A large acreage is used for pine plantations.

This soil is poorly suited to cultivated crops. It is limited mainly by the wetness and the poor soil quality. Unless very extensive management is applied, the types of crops that can be grown on this soil are limited. By applying good water-control and soil-improving measures, this soil can be suitable for some vegetable crops. A water-control system is needed to remove the excess water in wet seasons and to provide water by subsurface irrigation in dry seasons. Row crops should be rotated with close-growing, soil-improving crops.

This soil is moderately suited to pasture. Bahiagrass, bermudagrass, and clover grow well when they are properly managed. Water-control measures that remove the excess water are necessary. Regular applications of fertilizer and lime are also necessary. Controlled grazing, proper stocking rates, and pasture rotation help to maintain the proper plant growth and prevent problems associated with overgrazing.

This soil is moderately suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 70. The potential for commercial production of pulpwood is 35 cords per acre harvested from a fully stocked stand of trees 25 years old. Seedling mortality, plant competition, and the equipment limitation are management concerns. Site preparation, such as double bedding, helps to establish seedlings and reduces the mortality rate. Planting on beds should be done so that it does not block the natural drainage pattern. Other site preparation, such as chopping and burning, reduces debris and controls competing vegetation. Using low pressure, high-flotation equipment and harvesting during dry periods reduces the soil compaction.

This soil is well suited to range and grazeable woodland. The dominant forage includes maidencane, chalky bluestem, and panicum. The canopy is more open and has fewer trees and shrubs. When well managed, this soil has the potential to produce a large amount of forage. It is in the Slough range site.

This soil has severe limitations for dwellings without basements, small commercial buildings, and local roads and streets. The wetness caused by the seasonal high water table at or near the soil surface is the main limitation. Building sites and local roads and streets may require additions of fill to elevate the site and to increase the effective depth to the seasonal high water table. Where drainage outlets are available, a water-control system that lowers the high water table can help to overcome the wetness.

The limitations for shallow excavations are severe. Cutbanks are unstable, and excavations fill with water when the water table is high. Shoring sidewalls of excavations can help to prevent caving. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome these limitations. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining the lagoons and trenches with impervious soil material can reduce the excess seepage. Water-control measures should be used to remove the excess surface and ground water.

The wetness and the sandy surface are severe limitations for recreational development. Installing water-control measures can reduce the wetness caused by the seasonal high water table. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential of this soil as habitat for openland and woodland wildlife is poor and for wetland wildlife is

good. Areas of this soil provide a good source of food for bobwhite quail, deer, and wading birds. They produce poor cover for most wildlife species, but the adjacent flatwoods produce good escape routes and an edge effect. Other species in areas of this soil include fox, rabbit, opossum, and variety of birds, reptiles, and amphibians.

This Valkaria soil is in capability subclass IVw. The woodland ordination symbol is 8w. The ecological community is Slough.

20—Orsino fine sand, 0 to 5 percent slopes. This very deep, nearly level to gently sloping, moderately well drained soil is on ridges and knolls on the flatwoods and coastal ridges near the Atlantic Ocean. Individual areas are circular to irregular in shape. They range from 5 to 100 acres in size. Slopes are short and convex.

In 95 percent of areas mapped as Orsino fine sand, Orsino and similar soils make up 86 to 99 percent of the map unit. Dissimilar soils make up 1 to 14 percent.

Typically, the surface layer is grayish brown fine sand about 3 inches thick. The subsurface layer is white fine sand about 9 inches thick. The subsoil, to a depth of 49 inches, is brown fine sand that has common tongues of white fine sand in the upper part and is pale brown fine sand in the lower part. The underlying layer, to a depth of 80 inches, is light gray sand. Some areas contain soils that are similar to the Orsino soil but do not have a weakly expressed, organic-stained layer in the subsoil. Also included in mapping are some soils that are similar to the Orsino soil but have a thicker organic-stained layer in the subsoil.

The dissimilar soils in this map unit include small areas of Cocoa and Paola soils. Cocoa soils are in landscape positions similar to those of the Orsino soil, and they are underlain by limestone within a depth of 80 inches. Paola soils are in the slightly higher landscape positions and are excessively drained.

A seasonal high water table is at a depth of 48 to 60 inches for 6 months in most years. Permeability is very rapid. The available water capacity is very low or low.

Most areas support the natural vegetation. A small acreage is used for urban development, and some areas are used for pine plantations. The natural vegetation consists of sand pine, scrub live oak, and turkey oak. The understory vegetation consists of saw palmetto and greenbrier and a sparse growth of grasses that includes pineland threeawn, bluestem, indiangrass, and panicum.

This soil is poorly suited to cultivated crops, but if intensive management practices are applied, a few specialized crops can be grown. The soil is mainly limited by the poor soil quality. It is droughty, and nutrients are leached rapidly. The variety of crops that can be grown without irrigation is limited. Ornamental fern is a crop that is suited to this soil. To achieve maximum yields, an irrigation system should be used to maintain the optimum soil moisture and provide freeze protection during cold periods. Frequent applications of fertilizer and lime are generally needed for the best yields. Soil-improving crops should be used in rotation, and all of the crop residue should be returned to the soil.

This soil is poorly suited to pasture. The natural fertility is low, and the moisture available to plants is also low. Plant nutrients leach rapidly from the soil. Deep-rooted plants, such as coastal bermudagrass and bahiagrass, tolerate droughty conditions better if they are properly fertilized and limed. Periodic mowing and clipping help to maintain uniform growth, discourage selective grazing, and reduce clumpy growth. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition.

This soil is moderately suited to the production of slash pine and sand pine. Based on a 50-year site curve, the mean site index for slash pine is 70. The potential for commercial production of pulpwood is 35 cords per acre harvested from a fully stocked stand of trees 25 years old. Sand pine also is suited to this soil. Seedling mortality, the equipment limitation, and plant competition are management concerns. The high temperature of the surface layer in the summer and the very low available water capacity increase the seedling mortality rate. Site preparation, such as chopping, applying herbicide, and bedding, reduces debris, controls plant competition, and facilitates mechanical planting. The sandy surface layer restricts the use of wheeled equipment, especially when the surface is very dry. The soil often has a very low content of organic matter, and harvesting systems that remove all the biomass from the site reduce the fertility. Logging methods that leave residual biomass distributed over the site are preferred.

This soil is poorly suited to range or grazeable woodland. The dominant preferred forage is indiangrass, low panicum, bluestem, grapevine, greenbrier, and perennial legumes. The soil supports a fairly dense stand of sand pine, and the canopy cover is thick. Livestock will not use the soil if other range sites are available, although the soil does furnish winter protection. This soil is in the Sand Pine Scrub range site.

This soil has only slight limitations for dwellings without basements, small commercial buildings, and local roads and streets. In areas that have slopes of more than 4 percent, the limitations are moderate for

small commercial buildings. Land smoothing can help to overcome the slope. Lawn grasses and landscaping plants require frequent irrigation. Shoring the sidewalls of excavations helps to prevent caving. The limitations are slight for septic tank absorption fields, but the hazard of ground-water contamination exists in areas that have many septic tanks. Lining the trench-type sanitary landfills and sewage lagoons with impervious soil material can reduce the excess seepage.

The sandy surface is a severe limitation for recreational development. Maintaining good trafficability in the loose sandy surface is difficult, and the hazard of blowing sand is present. Establishing a good vegetative cover, planting windbreaks, adding good topsoil, or constructing paved areas can help to overcome the limitation.

The potential of this soil as habitat for openland and woodland wildlife is poor and for wetland wildlife is very good. Although the production of food for wildlife is limited, good escape cover for deer and turkey is present. Other species include gopher, tortoise, raccoon, armadillos, and several kinds of song birds.

This Orsino soil is in capability subclass VIs. The woodland ordination symbol is 4s. The ecological community is Sand Pine Scrub.

21—Smyrna fine sand. This very deep, nearly level, poorly drained soil is on the flatwoods. Individual areas are broad to narrow and irregular in shape. They range from 4 to 400 acres in size. Slopes are smooth and range from 0 to 2 percent.

In 95 percent of the areas mapped as Smyrna fine sand, Smyrna and similar soils make up 80 to 99 percent of the map unit. Dissimilar soils make up 1 to 20 percent.

Typically, the surface layer is black fine sand about 4 inches thick. The subsurface layer is gray and light gray fine sand about 9 inches thick. The subsoil is dark reddish brown fine sand to a depth of 21 inches. The next layer, to a depth of 50 inches, is brown fine sand. Gray fine sand extends to a depth of 70 inches, and very dark gray fine sand extends to a depth of 80 inches or more. Some areas contain soils that are similar to the Smyrna soil but have a organic-stained subsoil layer at a depth of 20 to 30 inches. Also included in mapping are some soils that are similar to the Smyrna soil but do not have a gray subsurface layer.

The dissimilar soils in this map unit include small areas of Placid and Pomona soils. Placid soils are in small depressions. Pomona soils have a loamy subsoil layer at a depth of 40 to 60 inches. They are in landscape positions similar to those of the Smyrna soil. Also included are areas of soils that have a loamy layer within a depth of 40 inches.

A seasonal high water table is at a depth of 6 to 18 inches for 1 to 4 months during wet seasons in most years. It is at a depth of 10 to 40 inches for more than 6 months. Permeability is moderate or moderately rapid. Available water capacity is low.

The natural vegetation consists of slash pine and longleaf pine. The understory vegetation consists of saw palmetto, pineland threeawn, bluestem, and panicum. Most areas of this soil are used for the commercial production of pine trees and as improved pasture for cattle. A large acreage is being developed for residential and commercial uses.

This soil is moderately suited to cultivated crops. The main limitations are excessive wetness and poor soil quality. By using a good water-control system, Irish potatoes and a variety of cabbage and vegetable crops can be grown. Proper row management, lateral ditches or tiles, and well constructed outlets help to remove the excess surface water. A furrow irrigation system is suited to this soil. Land grading and smoothing improve the surface drainage, allow a more uniform application of irrigation water, and permit the more efficient use of farm equipment. Returning all of the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to conserve moisture, maintain fertility, and control erosion. Frequent applications of fertilizer and lime are generally needed to improve soil quality.

With good water-control management, this soil is well suited to pasture. The main limitations are a result of the wetness. Excessive water can be removed by using field ditches and tile drains. Grasses and legumes grow well if adequate fertilizer is used. The low available water capacity limits the production of plants during extended dry periods. Deep-rooted plants, such as coastal bermudagrass and bahiagrass, tolerate droughty conditions better if they are properly fertilized and limed. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition.

Most areas support the natural vegetation. A few areas are used as improved pasture. The natural vegetation consists of slash pine, pineland threeawn, bluestem, and saw palmetto.

This soil is well suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 80. The potential for commercial production of pulpwood is 42 cords per acre harvested from a fully stocked stand of trees 25 years old. The main management concerns for producing and harvesting timber are the equipment limitation, the seedling mortality rate, and plant competition. If site

preparation is not adequate, competition from undesirable plants can prevent or prolong the natural or artificial reestablishment of trees. Planting on beds helps to overcome the limitations caused by the excessive wetness. Although conventional methods of harvesting timber generally can be used, their use can be limited during rainy periods, which are generally from June to December. The use of equipment during wet periods can cause soil compaction. Soil compaction results in less infiltration and aeration and restricted root growth. Site preparation, such as chopping, burning, applying herbicide, and bedding, reduces debris, reduces immediate plant competition, and facilitates hand and mechanical planting. Using a nitrogen fertilizer combined with phosphorus, based on a soil test or tissue analysis, at mid-rotation can provide an excellent growth response. Other good management practices include the selection of appropriate species, restricted burning, and a harvesting system that leaves debris onsite to conserve organic matter.

This soil is well suited to range and grazeable woodland. It has a moderate to high potential for the production of native forage. The dominant plants suitable for grazing include chalky bluestem, creeping bluestem, indiangrass, and panicum. This soil is in the North Florida Flatwoods range site.

This soil has severe limitations for dwellings without basements, local roads and streets and small commercial buildings because of the wetness caused by the seasonal high water table. If suitable outlets are available, shallow surface drainage can help to remove the excess water. Suitable fill material can be used to elevate building sites and increase the effective depth to the water table. The limitations are severe for shallow excavations because cutbanks are unstable and excavations fill with water when the water table is high. Shoring sidewalls of excavations can help to prevent caving. Installing dewatering wells can lower the water table and help to overcome the wetness. The wetness and the poor filtering of effluent are severe limitations for septic tank absorption fields. Using suitable fill to mound the absorption field can help to overcome these limitations. The wetness and the seepage are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining the lagoons and trenches with impervious soil material can reduce the excess seepage. Water-control measures should be used to remove the excess surface and ground water.

The wetness and the sandy surface are severe limitations for recreational development. Installing water-control measures can reduce the wetness caused by the seasonal high water table. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose, unstable sand. Planting a vegetative cover, adding mulch or suitable topsoil, or constructing paved areas can help to overcome the limitations caused by the sandy surface layer.

The potential of this soil as habitat for all forms of wildlife is fair. Areas of this soil provide good food and cover, nesting sites, and den sites for a diverse and numerous wildlife population. The species generally include deer, quail, turkey, feral hog, raccoon, opossum, and a variety of birds.

This Smyrna soil is in capability subclass IVw. The woodland ordination symbol is 10w. The ecological community is North Florida Flatwoods.

22—Astatula fine sand, 0 to 8 percent slopes. This very deep, nearly level to sloping, excessively drained soil is on ridges and knolls on the flatwoods and coastal ridges near the Atlantic Ocean. Individual areas are oval to irregular in shape. They range from 5 to 100 acres in size. Slopes are convex and range from 0 to 8 percent.

In 95 percent of areas mapped as Astatula fine sand, 0 to 8 percent slopes, Astatula and similar soils make up 85 to 99 percent of the map unit. Dissimilar soils make up 1 to 15 percent.

Typically, the surface layer is dark grayish brown fine sand about 7 inches thick. The underlying material is very pale brown fine sand to a depth of 80 inches. Some areas contain soils that are similar to the Astatula soil but have a light-colored subsurface layer. Also included in mapping are some soils that are similar to the Astatula soil but have thin bands of loamy material below a depth of 40 inches and other soils that have a black fine sand layer below a depth of 52 inches.

The dissimilar soils in this map unit include small areas of Tavares soils. Tavares soils are slightly lower on the landscape than the Astatula soil and are moderately well drained.

A seasonal high water table is at a depth of more than 72 inches in most years. Permeability is very rapid. The available water capacity is very low.

Most areas support the natural vegetation. A few areas are used for improved pasture, pine plantations, and urban development. The natural vegetation consists of sand pine, scrub live oak, and turkey oak. The understory vegetation consists of pineland threeawn, bluestem, paspalum, and greenbrier and scattered areas of saw palmetto.

This soil is poorly suited to cultivated crops. The available water capacity and the natural fertility are very low in the root zone. Rainfall is rapidly absorbed, and nutrients are quickly leached from the soil.

This soil is poorly suited to pasture. Grasses, such as bermudagrass and bahiagrass, only make fair growth

if fertilizer is used. The very low natural fertility and the available water capacity are limitations.

This soil is moderately suited to the production of sand pine. Based on a 50-year site curve, the mean site index for sand pine is 60. The potential for commercial production of pulpwood is 12 cords per acre from a fully stocked stand of trees 25 years old. The equipment limitation and the seedling mortality rate are the main management concerns. Using specialized equipment, such as high-flotation, oversized tires, reduces the damage to roots and minimizes soil compaction during thinning and harvesting activities. Planting special oversized or containerized stock can reduce the seedling mortality rate that results from the droughtiness. Road construction, logging, and site preparation should include the stabilization of roads and trails. Using culverts and bridges over drainageways and other maintenance measures prevent soil erosion and water flow problems. A preferred harvesting system leaves residual biomass distributed over the site.

This soil is poorly suited to range or grazeable woodland. The dominant preferred forage includes indiangrass, low panicum, bluestem, paspalum, greenbrier, and perennial legumes. Livestock will not use this soil if other range sites are available. The soil furnishes winter protection. It is in the Sand Pine Scrub range site.

This soil has slight limitations for building site development. The soil properties are favorable for dwellings without basements and for local roads and streets. The limitations for small commercial buildings are slight in areas where the slope is less than 4 percent and are moderate in areas where the slope is more than 4 percent. Some land smoothing may be needed to overcome the slope. The cutbanks of shallow excavations are unstable and are subject to slumping. Shoring the sidewalls of excavations helps to prevent caving. The limitations are slight for septic tank absorption fields, but the hazard of ground-water contamination exists because of poor filtration of effluent in areas that have many septic tanks. The seepage is a severe limitation for sewage lagoons and trench-type sanitary landfills. Lining the trenches and lagoons with impervious soil material can reduce the excess seepage.

The sandy surface is a severe limitation for recreational development. In areas that have slopes of more than 6 percent, the slope is an additional limitation. Maintaining good trafficability in the loose sandy surface is difficult, and the hazard of blowing sand is present. Establishing a good vegetative cover, planting windbreaks, adding good topsoil, or constructing paved areas can help to overcome the limitations. Land smoothing may be required in the steeper areas.

The potential of this soil as habitat for openland and woodland wildlife is poor and for wetland wildlife is very poor. Although the production of food for wildlife is limited, good escape cover for deer and turkey is present. Other species include gopher tortoise, raccoon, armadillos, and several kinds of songbirds.

This Astatula soil is in capability subclass VIs. The woodland ordination symbol is 3s. The ecological community is Sand Pine Scrub.

23—Adamsville fine sand, 0 to 3 percent slopes. This very deep, nearly level to gently sloping, somewhat poorly drained soil is on low knolls, broad elevated flats, and side slopes of ridges on the flatwoods and coastal areas adjacent to the Atlantic Ocean. Individual areas are irregular in shape. They range from 5 to 100 acres in size. Slopes are short and convex and range from 0 to 3 percent.

In 95 percent of the areas mapped as Adamsville fine sand, 0 to 3 percent slopes, Adamsville and similar soils make up 83 to 99 percent of the map unit. Dissimilar soils make up 1 to 17 percent.

Typically, the surface layer is grayish brown fine sand about 7 inches thick. Very pale brown fine sand extends to a depth of 34 inches, and light gray fine sand that has brown mottles extends to a depth of 80 inches or more. Some areas contain soils that are more brownish in the substratum than the Adamsville soil and are better drained. Other areas contain soils that have a weakly developed layer darkened by accumulations of organic material.

The dissimilar soils in this map unit include small areas of Myakka and Smyrna soils. These soils have an organic-stained layer in the subsoil. They also are in lower positions on the landscape than the Adamsville soil and are more poorly drained.

A seasonal high water table is at a depth of 24 to 42 inches for 2 to 6 months in most years. Permeability is rapid. Available water capacity is low.

Most areas are used as woodland and wildlife habitat. A few small areas are used for urban development. The natural vegetation consists of live oak and slash pine and scattered areas of turkey oak. The understory vegetation consists of saw palmetto, goldleaf aster, and pineland threeawn.

This soil is moderately suited to cultivated crops. Periodic wetness, poor soil quality, and droughty conditions during dry periods are the main management concerns. The number of adapted crops is limited unless intensive water-control measures are used with a water-control system that removes excess water in wet periods and provides irrigation in dry periods. This

soil is suited to some vegetable crops. Good management includes water-control measures and a crop rotation that has a close-growing crop on the land at least two-thirds of the time. Soil-improving crops and the residue from all the other crops should be plowed under the surface. Fertilizer and lime should be applied according to the needs of the crops.

This soil is moderately suited to pasture. Bahiagrass and bermudagrass are well adapted species. Fertilizer and lime should be applied according to the needs of the grasses. Periodic mowing and clipping help to maintain uniform growth and discourage selective grazing. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition.

This soil is moderately suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 80. The potential for commercial production of pulpwood is 42 cords per acre from a fully stocked stand of trees 25 years old. The main management concerns are the equipment limitation, the seedling mortality rate, and plant competition. Using specialized equipment, such as high-flotation, oversized tires, reduces the damage to roots and minimizes soil compaction. Wetness can restrict the use of equipment to dry periods. It also increases seedling mortality. Planting on beds helps to overcome the wetness, but it should not block the natural surface drainage. Droughtiness of the surface during dry periods can cause seedling mortality. Other methods of site preparation, including chopping and applying herbicide, can minimize plant competition. Road construction, logging, and site preparation should include the stabilization of roads and trails. Using culverts and bridges over drainageways and other maintenance measures prevent soil erosion and water flow problems. A preferred harvesting system leaves residual biomass distributed over the site.

Because of the unusually dense canopy cover and the relatively open understory, this soil is poorly suited to range or grazeable woodland. It does provide good shade and resting areas. Creeping bluestem, indiangrass, low panicum, and other grass and grasslike plants are the primary species used for forage. This soil is in the Upland Hardwood Hammock range site.

This soil has a moderate limitation for dwellings without basements, small commercial buildings, and local roads and streets mainly because of the wetness caused by the seasonal high water table. Using water-control measures helps to overcome the limitations. Stabilizing the sidewalls of excavations helps to prevent caving. The wetness and the poor filtering properties of the sandy soil are severe limitations for septic tank absorption fields. Using suitable soil material to mound the septic tank absorption field can help to overcome these limitations. The seepage is a severe limitation for sewage lagoons and trench-type sanitary landfills. Sealing or lining the lagoons and trenches with impervious soil material can reduce the excessive seepage.

The sandy surface is a severe limitation for recreational development. Maintaining good trafficability is difficult, and the hazard of blowing sand is present. Stabilizing the surface with vegetation, adding suitable topsoil, or constructing paved areas can help to overcome the limitation.

The potential of this soil as habitat for openland and wetland wildlife is poor and for woodland wildlife is good. The hardwoods and shrubs provide a fair source of food and cover for deer, turkey, squirrel, raccoon, and armadillos.

This Adamsville soil is in capability subclass IIIw. The woodland ordination symbol is 10w. The ecological community is Upland Hardwood Hammock.

24—Samsula and Placid soils, frequently flooded. These very deep, nearly level, very poorly drained soils are in long, narrow drainageways that are mainly in upland areas. A few areas of this map unit are on the flatwoods. Individual areas are elongated in shape. They range from 50 to more than 200 acres in size. The soils are frequently flooded during wet seasons. Slopes are concave and range from 0 to 2 percent.

In 80 percent of the areas mapped as Samsula and Placid soils, Samsula, Placid, and similar soils make up 79 to 99 percent of the map unit. Dissimilar soils make up 1 to 21 percent.

Generally, the mapped areas are 70 percent Samsula and similar soils and 23 percent Placid and similar soils. Each of the soils is not present in every mapped area, and the relative proportion of the soils is variable. Although individual areas of the soils are large enough to map separately, they were mapped as one unit based upon the present and predicted uses.

Typically, the surface soil of the Samsula soil is dark reddish brown in the upper 10 inches and is black muck in the lower 23 inches. The substratum is very dark gray fine sand to a depth of 45 inches and light gray fine sand to a depth of 80 inches or more. Some areas contain soils that are similar to the Samsula soil but have a muck surface soil more than 52 inches thick.

Typically, the surface layer of the Placid soil is very dark brown fine sand about 11 inches thick. The upper part of the substratum is dark grayish brown and light gray fine sand to a depth of about 67 inches. The lower part is grayish brown fine sand to a depth of 80 inches or more. Some areas contain soils that are similar to

the Placid soil but have a thin layer of muck on the surface.

The dissimilar soils in this map unit include small areas of sandy soils that have several layers or strata of muck and loamy sediments of varying thickness and at varying depths. They are in landscape positions similar to those of the Samsula and Placid soils.

In most years, this map unit is flooded for 1 month or more during periods of high rainfall. The water table is within 6 inches of the surface for 6 months or more in most years. The permeability of the Samsula and Placid soils is rapid. The available water capacity is moderate in the Samsula soil and low to moderate in the Placid soil.

Most areas of this map unit support the natural vegetation, which includes red maple, sweetgum, water oak, cabbage palm, and baldcypress. The understory vegetation is sparse and consists of waxmyrtle, greenbrier, sawgrass, maidencane, and a few water-tolerant sedges and grasses. Some areas of this map unit are used as wildlife habitat.

In their natural state, these soils are generally unsuited to most cultivated crops because of the flooding and the excessive wetness.

In their natural state, these soils have a low suitability for improved pasture grasses. By installing a water-control system that includes protection from flooding, these soils have fair suitability for improved pasture. The main suitable pasture plants include bahiagrass, bermudagrass, and clover. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep pasture and soil in good condition. Fertilizer is needed for the optimum growth of grasses and legumes.

The soils in this map unit are not suited to the commercial production of pine trees because of the flooding and the excessive wetness. Pine seedlings will be killed or seriously stunted by flood water or by a water table that is at or near the surface of the soil for long periods of time. The high content of organic matter content in the surface layer of the Samsula soil restricts the use of equipment. The organic layers and the shallow root system result in a high windthrow hazard. The Placid soil may be suited to cypress and hardwoods. Trees are harvested from some areas, but regrowth is a result of natural regeneration rather than the planting of seedlings. A source of desirable seedlings is not readily available. Harvesting during extended dry periods helps to overcome the limitations.

This map unit has low suitability for range and grazeable woodland. The dominant forage includes sawgrass, sedges, and maidencane. The dense canopy restricts the growth of forage. Cattle use this map unit for shade during the summer months. This map unit is not assigned to a range site.

This map unit has severe limitations for urban development. The main limitations are the flooding and the excessive wetness. Also, the Samsula soil has a very low bearing strength for building foundations and roads. Major flood control structures and an extensive local drainage system are needed to protect this map unit from flooding. Roads, streets, and building sites should be elevated with fill material to overcome the wetness. The organic layers should be removed and replaced with suitable fill. Septic tank absorption fields need to be mounded to overcome the wetness.

If this map unit is used for recreational development, the flooding and the excessive wetness are the main limitations. Good drainage is needed to keep the water table from rising above a depth of about 2 to 2½ feet. Protection from flooding is needed in areas where this map unit is used for camp areas and playgrounds. During dry seasons, excessively dusty conditions can be produced by the organic surface of the Samsula soil.

The potential of this map unit as habitat for openland and woodland wildlife is poor or very poor and for wetland wildlife is good. The map unit provides good sources of food and cover and nesting areas for several kinds of wading birds and other waterfowl. It also provides good escape cover and travel routes for many species. Other wildlife species in this map unit include bobcat, deer, gray squirrel, otter, and raccoon.

This map unit is in capability subclass VIIw. The woodland ordination symbol is 6w. The ecological community is Swamp Hardwoods.

25—Tavares fine sand, 0 to 5 percent slopes. This very deep, nearly level to gently sloping, moderately well drained soil is on narrow to broad ridges and knolls on the flatwoods and on upland sand ridges near streams and drainageways. Individual areas range from 3 to 150 acres in size. Slopes are convex and range from 0 to 5 percent.

In 80 percent of the areas mapped as Tavares fine sand, 0 to 5 percent slopes, Tavares and similar soils make up 76 to 99 percent of the map unit. Dissimilar soils make up 1 to 24 percent.

Typically, the surface layer is gray fine sand about 5 inches thick. The underlying material is pale brown and very pale brown sand to a depth of 46 inches. It has a few fine faint brownish yellow mottles and pockets of white fine sand below a depth of 32 inches. White fine sand that has few distinct yellow and strong brown mottles extends from a depth of 46 to 80 inches. Some areas contain soils that are similar to the Tavares soil but the lower part of the subsoil has a weakly developed, dark reddish brown layer. Also included in

mapping are some soils that are not as well drained as the Tavares soil.

The dissimilar soils in this map unit include small areas of Astatula and Cassia soils and other soils that have a loamy subsoil at a depth of 20 to more than 40 inches. Astatula soils are in landscape positions higher than those of the Tavares soil and are excessively drained. Cassia soils are in slightly lower landscape positions, have an organic-stained subsoil layer, and are somewhat poorly drained.

In most years, a seasonal high water table is at a depth of 48 to 72 inches for more than 6 months, but it recedes to a depth of more than 80 inches during droughty periods. Permeability is rapid and very rapid. Available water capacity is very low.

Most areas are used for the production of pine trees. A few areas have been cleared and are used for urban development. Some small areas remain in their natural state. The natural vegetation consists of blackjack oak and turkey oak and scattered areas of slash pine and longleaf pine. The understory vegetation consists of pineland threeawn and goldleaf aster and scattered areas of saw palmetto.

This soil is poorly suited to cultivated crops because of droughtiness and low natural fertility. Returning all of the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to conserve moisture, maintain fertility, and control erosion. The soil can be used for a variety of crops. Frequent applications of fertilizer and lime are needed for good yields. A well designed and managed irrigation system helps to maintain optimum soil moisture and ensures the highest possible yields.

This soil is moderately suited to improved pastures under a high level of management. The low natural fertility and the low available water capacity limit the production of plants during extended dry periods. Deep-rooted plants, such as coastal bermudagrass and bahiagrass, tolerate droughty conditions better if they are properly fertilized and limed. Frequent applications of fertilizer and lime are necessary for the sustained production of high quality pasture. A rotation grazing system helps to maintain the quality of forage.

This soil is moderately suited to the production of slash pine. The main management concerns are the low fertility and the low available water capacity, which result in increased seedling mortality, increased plant competition, and reduced growth rates. Special site preparation, such as chopping, helps to establish seedlings, reduces the seedling mortality rate, and increases early plant growth. Using a nitrogen fertilizer combined with phosphorus, based on a soil test or tissue analysis, at mid-rotation can provide an excellent growth response. Other good management practices include the selection of appropriate species, restricted burning, and a harvesting system that leaves debris onsite to conserve organic matter. Based on a 50-year site curve, the mean site index for slash pine is 80. The potential commercial production of pulpwood is 42 cords per acre harvested from a fully stocked stand of trees 25 years old.

This soil is moderately suited to range and grazeable woodland. The production of vegetation suitable for livestock grazing is limited by the poor soil condition. The production and quality of forage are poor, and cattle do not readily graze these areas if better sites are available. Little or no grazing occurs when the canopy cover exceeds 60 percent. This soil is in the Longleaf Pine-Turkey Oak Hill range site.

This soil has only slight limitations for dwellings without basements, small commercial buildings, and local roads and streets. In areas where the slope is more than 4 percent, the limitations are moderate for small commercial buildings. Land smoothing can help to overcome the slope. Lawn grasses and landscaping plants require frequent irrigation. Shoring the sidewalls of excavations helps to prevent caving. The limitations are slight for septic tank absorption fields, but the hazard of ground-water contamination exists in areas that have many septic tanks. Lining the trench-type sanitary landfills and sewage lagoons with impervious soil material can help to prevent excess seepage.

This soil has severe limitations for recreational development. The main limitation is the loose, sandy surface layer. In intensively used areas, the sandy surface needs to be stabilized by the addition of suitable topsoil, the establishment of vegetation, or the construction of paved areas.

The potential of this soil as habitat for openland and woodland wildlife is fair and for wetland wildlife is very poor. Undisturbed areas of this soil provide good escape cover for turkey and deer. Other wildlife include many songbirds, fox, squirrel, quail, gopher, and tortoise.

This Tavares soil is in capability subclass IIIs. The woodland ordination symbol is 10s. The ecological community is Longleaf Pine-Turkey Oak Hills.

26—Turnbull and Pellicer soils, tidal. These very deep, nearly level, very poorly drained soils are in tidal marsh areas. These soils do not occur in a regular and repeating pattern. They are frequently flooded. Individual areas are broad to narrow and elongated in shape. They range from 5 to 800 acres in size. Slopes are smooth to convex and are less than 1 percent.

Turnbull, Pellicer, and similar soils make up 84 to 99 percent of the map unit in 95 percent of the areas

mapped as Turnbull and Pellicer soils, tidal. Dissimilar soils make up 1 to 16 percent.

Generally, the mapped areas are about 52 percent Turnbull and similar soils and about 43 percent Pellicer and similar soils. Each of the soils is not present in every mapped area, and the relative proportion of the soils is variable. Although individual areas of the soils are large enough to map separately, they were mapped as one unit based upon the present and predicted uses.

Typically, the surface layer of the Turnbull soil is very dark gray muck about 8 inches thick. The underlying material is olive gray clay to a depth of 42 inches and gray loamy fine sand to a depth of 80 inches. Some areas contain soils that are similar to the Turnbull soil but have more than 16 inches of muck on the surface, have a clayey surface layer, or have a dark sandy layer below the clayey layers.

Typically, the surface layer of the Pellicer soil is very dark grayish brown silty clay loam about 10 inches thick. The underlying material is dark gray clay loam to a depth of 50 inches, dark gray sandy clay to a depth of 55 inches, and dark gray fine sandy loam to a depth of 80 inches or more. Some areas contain soils that are similar to the Pellicer soil but have a surface layer of muck or have a thin layer of sandy fill deposited on the surface.

The dissimilar soils in this map unit include small areas of EauGallie and Riviera soils that are subject to tidal flooding. Also included are areas of soils that have an organic layer 16 to more than 80 inches thick. The soils are in landscape positions similar to those of the Turnbull and Pellicer soils. EauGallie soils have an organic-stained layer in the subsoil. Riviera soils have a loamy subsoil layer.

Most areas of this map unit are flooded twice daily by the normal high tides (fig. 7). Some areas are flooded only a few times each year, when weather or other conditions cause unusually high tides. The soils are continuously saturated. The water table is at a depth of 2 feet above the surface in the Turnbull soil and at a depth of 0 to 6 inches in the Pellicer soil. The permeability is very slow in the Turnbull and Pellicer soils. The available water capacity is moderate to high in the Turnbull soil and high in the Pellicer soil.

Most areas of this map unit support the natural vegetation. The natural vegetation consists of black needlerush, seashore saltgrass, smooth cordgrass, bushy seaweed, marshhay cordgrass, glasswort, and bigleaf swampweed.

This map unit is not suited to cultivated crops, improved pasture, range, grazeable woodland, or trees. Reclaiming the soil for agricultural uses would require extensive water-control structures, such as dikes and pumps. The high content of salt and sulfur, the high content of clay, and the low strength severely restrict the use of this soil for agricultural purposes. The soil becomes extremely acid when dried. The low soil strength will not support grazing cattle or equipment.

This map unit has severe limitations for building site development. The hazard of flooding, the excessive wetness, the low strength, and the seepage make this map unit poorly suited to dwellings, small commercial buildings, local roads and streets, and sanitary facilities. Overcoming these limitations is impractical.

This map unit has severe limitations for recreational development. Tidal flooding, wetness, and low soil strength are severe limitations that are difficult to overcome.

The potential of this map unit as habitat for openland and woodland wildlife is very poor and for wetland wildlife is fair. The native vegetation and fauna are important links in the food chain for many sport and commercial finfish and shellfish. Many species of duck, wading birds, and shore birds use this map unit for food, shelter, and nesting.

This map unit is in capability subclass VIIIw. A woodland ordination symbol is not assigned. The ecological community is Salt Marsh.

27—Cassia fine sand. This very deep, nearly level, somewhat poorly drained soil is on low ridges and knolls on the flatwoods. Individual areas range from 4 to 150 acres in size. Slopes are convex and range from 0 to 2 percent.

In 80 percent of the areas mapped as Cassia fine sand, Cassia and similar soils make up 77 to 99 percent of the map unit. Dissimilar soils make up 1 to 23 percent.

Typically, the surface layer is very dark gray fine sand about 5 inches thick. The subsurface layer is gray and white fine sand about 21 inches thick. The subsoil, to a depth of 42 inches, is very dark brown fine sand in the upper 10 inches and dark yellowish brown fine sand in the lower 6 inches. The underlying material is pale brown fine sand to a depth of 69 inches and is light brownish gray fine sand to a depth of 80 inches. Some areas contain soils that are similar to the Cassia soil but have a more weakly developed subsoil. Also included in mapping are some soils that an organic-stained layer at a depth of more than 30 inches in the subsoil.

The dissimilar soils in this map unit include small areas of Adamsville and Myakka soils. Also included are soils that have sandy loam or sandy clay loam in the lower part of the subsoil or have a sandy subsoil at a depth of more than 50 inches. Adamsville soils are in slightly lower landscape positions than the Cassia soil. They do not have the organic stains in the subsoil.

Figure 7.—Needlegrass rush in an area of Turnbull and Pellicer soils, tidal. These soils are frequently flooded by tidal water.

Myakka soils are in lower positions on the landscape and are poorly drained.

In most years, the seasonal high water table is at a depth of 18 to 42 inches for about 6 months. It can recede to a depth of more than 42 inches during prolonged dry periods. Permeability is moderate or moderately rapid. Available water capacity is low.

Most areas support the natural vegetation. A few areas are used as sites for homes and for urban development. The natural vegetation consists of longleaf pine, slash pine, and sand pine. The understory vegetation consists of bluestem, low panicum, lopsided indiangrass, pineland threeawn, runner oak, and saw palmetto.

Under natural conditions, this soil is poorly suited to cultivated crops. The shallow water table, which is 15 to 40 inches below the surface during wet seasons, severely restricts the root zone. After a good water-control system is applied, selected crops can be grown. This soil is droughty and has a very low natural fertility. Returning all of the crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the crop rotation help to conserve moisture, maintain fertility, and control erosion.

Under natural conditions, this soil is poorly suited to improved pastures. The low available water capacity of the soil causes droughty conditions during extended dry periods and limits the growth of plants. Deep-rooted

plants, such as coastal bermudagrass and bahiagrass, tolerate droughty conditions better if they are properly fertilized and limed. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition.

This soil is moderately suited to the production of pine trees. Because this soil has a sandy surface, is very droughty, and has a low natural fertility, unsatisfactory seedling survival rates can be expected during dry years. If site preparation is not adequate, competition from undesirable plants can prevent or prolong the natural or artificial establishment of trees. Site preparation, such as chopping, burning, applying herbicide, and bedding, reduces debris, reduces immediate plant competition, and facilitates planting. Using a nitrogen fertilizer combined with phosphorus, based on a soil test or tissue analysis, at mid-rotation can provide an excellent growth response. Based on a 50-year site curve, the mean site index for slash pine is 70. The potential for commercial production of pulpwood is 35 cords per acre harvested from a fully stocked stand of trees 25 years old.

This soil is poorly suited to range and grazeable woodland. The production of vegetation suitable for livestock grazing is limited by the low natural soil fertility and the droughtiness. The dominant plants suitable for forage are creeping bluestem, indiangrass, and panicum. Some areas provide good shade and winter shelter for livestock. This soil is in the Sand Pine Scrub range site.

This soil has moderate limitations for dwellings without basements, small commercial buildings, and local roads and streets. The wetness caused by the depth to the water table during wet seasons is a severe limitation for septic tank absorption fields. Adding suitable fill to elevate building sites, roads, and septic tank absorption fields increases the effective depth of the water table and helps to overcome the wetness. If suitable outlets are available, a system of surface drainage can be installed. The sidewalls of shallow excavations are unstable, and they should be shored to prevent caving. Trench-type sanitary landfills and sewage lagoons should be lined with impervious soil material to help prevent excess seepage.

The sandy surface is a severe limitation for recreational development. The soil surface should be stabilized with additions of topsoil, the maintenance of an adequate vegetative cover, or the construction of pavement. The plant cover can be maintained by controlling traffic in the area.

Although the potential of this soil as wildlife habitat is poor or very poor, in its natural state it provides good escape cover and habitat for a number of wildlife species. The wildlife include deer, quail, turkeys, bobcat, skunks, raccoons, and a variety of song birds. The habitat for wildlife can be improved by controlled burning and by planting supplemental food plots.

This Cassia soil is in capability subclass VIs. The woodland ordination symbol is 8s. The ecological community is Sand Pine Scrub.

29—Udarents, moderately wet. This map unit consists of heterogeneous soil material that was removed from other soils and used in land-leveling operations, as fill material, or as a cover for sanitary landfills. The material is a mixture of fine sand or of sand and fragments of loamy subsoil material. Individual areas are throughout the county, but most areas are west of Interstate Highway 95 and are used for urban development. The mapped areas are square or rectangular or are irregular in shape. They range from 3 to 200 acres in size. Slopes are smooth and range from 0 to 2 percent.

Udarents do not have an orderly sequence of soil layers. In most areas, the upper 20 to 40 inches is variable and contains discontinuous lenses, pockets, and streaks of light gray, gray, grayish brown, brown, and yellowish brown fine sand. The average thickness of the fill material is about 30 inches. It has few or common fragments of a black or dark reddish brown sandy loam subsoil. The underlying material, to a depth of about 80 inches, is undisturbed grayish brown and gray fine sand.

In some areas, large cells of solid waste refuse are at a depth of more than 2 to 4 feet. The refuse consists of paper, plastic, wood, glass, concrete, metal, and other materials. It ranges from 2 to 10 feet in thickness. It generally is stratified with layers of soil material that were used for daily cover. A final layer of soil material was spread on top of the refuse and then smoothed. These sanitary landfill areas are identified on the soil map by the words "sanitary landfill" or in small areas by the letters "SLF" and by the map symbol.

Included in mapping are a few small areas in which the mixed material contains shell fragments or loamy subsoil fragments that are slightly acid to moderately alkaline. Some areas have pockets of muck or other fragments of organic material. In some areas the fill material is less than 20 inches thick, and in other areas about 40 inches of fill material is underlain by muck.

The seasonal high water table is at a depth of 18 to 36 inches for 2 to 6 months. In sanitary landfill areas, the high water table is controlled by using perimeter drainage ditches or other water-control measures. The available water capacity is very low to low. The permeability is rapid.

The natural vegetation consists of waxmyrtle,

inkberry, saw palmetto, longleaf pine, and slash pine. The understory vegetation consists of bluestem, panicum, and pineland threeawn.

This map unit generally is not suited to vegetable crops because of the extreme variability of the soil properties and the poor soil quality.

In some areas, improved pasture grasses can be grown. Deep-rooting plants, such as bahiagrass, should be selected. A large amount of fertilizer is needed.

The potential of this map unit for the production of pine trees is low. In many areas, the map unit is not suited because of the wide range of soil properties.

This map unit has severe limitations for urban development. The areas that have less than 2 feet of fill material may need additional fill material to elevate building foundation sites and subgrades for local roads and streets. Areas that have less than 3 feet of fill material may require additional fill material to elevate septic tank absorption fields. The sanitary landfill areas are not suited to urban development. The differential settling of the buried refuse severely limits use of this map unit for dwellings without basements and for local roads and streets. The sanitary landfill areas are not suitable as septic tank absorption fields. The refuse would not provide an adequate filtering capacity for effluent. The differential settling would cause the septic tank absorption field to cease functioning.

This map unit is severely limited for recreational development because the surface is too sandy. Stabilizing the surface layer by adding suitable fill material or by paving high traffic areas helps to overcome this limitation.

Udarents are not assigned to a capability subclass, a woodland ordination symbol, or an ecological community.

30—Pits. This map unit consists of excavated areas from which soil and geologic material was removed for use mainly in road construction and as fill material. These areas are commonly called borrow pits. Most of the areas have been excavated to a depth of 6 feet or more.

Included in mapping is spoil material, which is mostly a mixture of sand, sandy loam, shell fragments, and coquina limestone that has been scattered around the edge of the pits. This map unit has little or no value as agricultural areas or woodland. Areas that support wildlife habitat or recreational development can be established after excavation operations are discontinued.

Pits are not assigned to a capability subclass, a woodland ordination symbol, or an ecological community.

31—Palm Beach gravelly sand, 0 to 8 percent slopes. This very deep, nearly level to sloping, well drained to excessively drained soil is on primary dune ridges parallel to the Atlantic Coast. Individual areas are irregular to elongated in shape. They range from 20 to over 200 acres in size. Slopes are convex and range from 0 to 8 percent.

In 95 percent of the areas mapped as Palm Beach gravelly sand, 0 to 8 percent slopes, Palm Beach and similar soils make up 82 to 99 percent of the map unit. Dissimilar soils make up 1 to 18 percent.

Typically, the surface layer is grayish brown gravelly sand about 4 inches thick. It has about 15 percent shell fragments. The underlying layer is light brownish gray gravelly sand that has about 15 percent shell fragments to a depth of 22 inches, pale brown very gravelly sand that has about 40 percent shell fragments to a depth of 47 inches, and light gray extremely gravelly sand to a depth of 80 inches. The bottom layer is about 75 percent, by volume, shell fragments. Some areas contain soils that are similar to the Palm Beach soil but do not contain the shell fragments.

The dissimilar soils in this map unit include Orsino soils. Orsino soils are on the back slopes of dunes and do not have shell fragments. Also included are some soils that have been disturbed. In some areas the surface layer has been removed or leveled for urban development.

In most years, a seasonal high water is at a depth of more than 80 inches. Permeability is very rapid. Available water capacity is very low.

Most areas support the natural vegetation. A few small areas have been cleared and used for urban development, parks, and recreational areas. The natural vegetation consists of sand live oak and red cedar. The understory vegetation consists of runner oak, prickly pear cactus, sea oats, saw palmetto, and waxmyrtle.

This soil is not suited to cultivated crops, pasture, woodland, range, or grazeable woodland. It receives salt spray from the Atlantic Ocean. If the natural protective vegetation is disturbed, this soil is subject to severe wind erosion.

This soil has only slight limitations for building site development. Areas that have steep slopes have an additional limitation for small commercial buildings. Land smoothing may be required in areas where the slope is more than about 4 percent. Lawns and landscaping plants require frequent irrigation during dry seasons. Some areas of this soil receive wind-blown salt spray when high winds blow from the ocean. Shoring the sidewalls of excavations prevents caving. The limitations are slight for septic tank absorption fields, but the hazard of ground-water contamination exists because of poor filtration of effluent in areas that

have many septic tanks. The excess seepage is a severe limitation for sewage lagoons and trench-type sanitary landfills. Lining the lagoons and trenches with imperious soil material can help to reduce the excess seepage.

The sandy surface is a severe limitation for recreational development. The slope is an additional limitation in some areas. The trafficability is difficult to maintain in areas of heavy traffic. Blowing sand is a hazard during periods of high wind. The surface should be stabilized by planting a vegetative cover, adding suitable topsoil, or constructing paved areas. Areas that have slopes of more than 6 percent should be smoothed if they are to be used for playgrounds.

The potential of this soil for use as wildlife habitat is poor or very poor. The native vegetation provides very limited food sources, but the dense growth of shrubs provides good travel routes and escape cover. Because of intense urban development, the numbers of wildlife are low. Wildlife species include foxes, raccoons, armadillos, mice, and a variety of birds.

This Palm Beach soil is in capability subclass VIIs. It has not been assigned a woodland ordination symbol. The ecological community is North Florida Coastal Strand.

32—Narcoossee, shell substratum-Welaka complex, 0 to 5 percent slopes. The very deep, nearly level, somewhat poorly drained Narcoossee soil and the very deep, well drained, gently sloping Welaka soil are on the Coastal Strand, between the Atlantic Ocean and the intercoastal waterway. The soils occur in a regular, repeating pattern. The Welaka soil is on the lower back slopes of primary sand dunes, on the lower relic secondary and tertiary sand dunes, and on high knolls in the areas between the sand dunes and the salt marshes. The Narcoossee soil is in swales between sand dunes and on low knolls between dunes and the salt marshes.

Narcoossee, Welaka, and similar soils make up 83 to 99 percent of the map unit in 95 percent of the areas mapped as Narcoossee, shell substratum-Welaka complex, 0 to 5 percent slopes. Dissimilar soils make up 1 to 17 percent.

Generally, the mapped areas are about 61 percent Narcoossee and similar soils and about 29 percent Welaka and similar soils. The components of this map unit are so intricately intermingled that they could not be mapped separately at the scale used. However, the proportions and patterns of the soils are relatively consistent in most delineations of the map unit.

Typically, the surface layer of the Narcoossee soil is very dark gray fine sand about 3 inches thick. The subsurface layer is fine sand about 14 inches thick. It is gray in the upper 2 inches and light gray in the lower 12 inches. The subsoil extends to a depth of 41 inches. The upper part is dark brown fine sand about 6 inches thick. The upper 3 inches of the subsoil is weakly expressed and is discontinuous in 20 to 25 percent of the pedons. The lower part of the subsoil is brown fine sand about 18 inches thick. The underlying material is light gray extremely gravelly fine sand and gravelly fine sand. It is stratified with layers of light gray fine sand to a depth of more than 80 inches. Some areas contain soils that are similar to the Narcoossee soil but have a more strongly expressed and continuous subsoil. Also included in mapping are some soils that are similar to the Narcoossee soil but have weak, discontinuous organic-stained layers in the subsoil and other soils that contain about 75 percent, by volume, shell fragments at a depth of about 32 inches.

Typically, the surface layer of Welaka soil is dark gray fine sand about 3 inches thick. The subsurface layer is light gray fine sand about 9 inches thick. The subsoil is brownish yellow fine sand to a depth of about 42 inches. The underlying material is very pale brown gravelly fine sand to a depth of 50 inches and light gray very gravelly fine sand to a depth of 80 inches. Some areas contain soils that are similar to the Welaka soil but do not have the light gray subsurface layer. Also included in mapping are some soils that are similar to the Welaka soil but are in lower positions on the landscape and are moderately well drained.

The dissimilar soils in this map unit include small areas of Myakka soils. Myakka soils are in lower positions on the landscape than the soils in this map unit. They are also poorly drained.

In most years, the seasonal high water table in the Narcoossee soil is at a depth of 24 to 42 inches for 4 to 6 months. During extended dry periods, the water table recedes to a depth of more than 42 inches. The seasonal high water table in the Welaka soil is generally at a depth of more than 80 inches. Permeability is very rapid in the Welaka soil and rapid and very rapid in the Narcoossee soil. The available water capacity is low in the Narcoossee soil and very low in the Welaka soil.

A few small areas of this map unit support the natural vegetation. Most areas have been subdivided and are used for urban development. The natural vegetation on the Narcoossee soil consists of sand live oak, longleaf pine, and slash pine. The understory vegetation on the Narcoossee soil consists of yaupon holly, saw palmetto, bluestem, panicum, waxmyrtle, and pineland threeawn. The vegetation on the Welaka soil consists of sand pine, dwarf live oak, and scrub oak and scattered areas of rosemary, saw palmetto, and pineland threeawn.

The Narcoossee soil is poorly suited to cultivated

crops, and the Welaka soil is very poorly suited. The poor soil quality is a limitation. The soils have a low available water capacity and low natural fertility, and they are droughty. In some areas, periodic salt spray from the Atlantic Ocean limits plant growth.

This map unit is poorly suited to improved pasture. The poor soil quality, the low available water capacity, the droughtiness, and the salt spray from the ocean limit the production of plants suitable for pastures. Deep-rooted plants that are drought- and salt-tolerant, when properly fertilized, produce the best forage.

This map unit is not used for the commercial production of pine trees. The competition from undesirable plants and the salt spray from the ocean severely limit tree growth.

This map unit is poorly suited to range or grazeable woodland. It is not generally used for these purposes and is not assigned to a range site.

The wetness is a moderate limitation for dwellings without basements, small commercial buildings, and local roads and streets in the Narcoossee soil. It is a severe limitation for septic tank absorption fields. The wetness can be overcome by adding suitable fill to help maintain the water table at an effective depth. If outlets are available, a drainage system can be installed. The Welaka soil has slight limitations for dwellings without basements, local roads and streets, and septic tank absorption fields. The limitations may be severe because of the poor filtration of the effluent and contamination of ground water in areas that have many septic tanks. In areas where the slope exceeds 4 percent, the limitations are moderate for small commercial buildings. The seepage is a severe limitation for sewage lagoons and trench sanitary landfills in the Narcoossee and Welaka soils. Lining the lagoons and trenches with impervious soil material can reduce the excess seepage. The sidewalls of excavations are unstable in both soils, and they should be shored to help prevent caving.

This map unit has severe limitations for recreational development. Because of the close proximity to coastal beaches, demand is placed upon the soils for use as campgrounds and as areas for parks and picnics. The sandy surface should be stabilized by the addition of suitable topsoil or the construction of paved areas. Establishing and maintaining the plant cover on trails and paths can be accomplished by properly applying fertilizer, seeding, mulching, and shaping slopes.

The potential of this map unit as habitat for openland and wetland wildlife is poor and for woodland wildlife is fair. The native grasses and legumes are poor or fair food sources. The map unit does have good nesting sites for songbirds and shore birds, such as terns and gulls. Undisturbed areas provide escape cover and food for various mammals, such as rabbits, raccoons, and armadillos.

The Narcoossee soil is in capability subclass IIIw. The woodland ordination symbol is 10w, and the ecological community is North Florida Coastal Strand. The Welaka soil is in capability subclass VIs. The woodland ordination symbol is 3s, and the ecological community is North Florida Coastal Strand.

33—Beaches. This map unit consists of nearly level to sloping, narrow strips of tide- and surf-washed areas that are adjacent to the Atlantic Ocean. These areas commonly are a mixture of moderately alkaline sand and shell fragments. Exposures of coquina limestone, washed by ocean tides, are with the sand and shell fragments along the beaches in the northern part of Flagler County. Slopes range from 1 to 3 percent.

Beaches range in width from less than 100 feet to about 200 feet. About 50 percent of the beach area can be flooded daily by high tides, and all of the beaches can be flooded by storm tides. Beach slopes can change during every storm.

Beaches do not have a sequence of layers. However, they are generally sand in the surface and coarse sand and fine sand in the underlying material.

Beaches are generally devoid of vegetation, although a sparse growth of sea oats, fiddleleaf morningglory, spartina, and other salt-tolerant plants can grow down from the dune or from the inland edge.

The depth to the seasonal high water table ranges from 0 to 72 inches. It is highly variable and depends upon the topography of the beach, the distance from the shore, and the tidal conditions. Available water capacity is very low. Permeability is rapid or very rapid.

This map unit is generally not used for uses other than recreation and wildlife habitat. Erosion is often a severe hazard during strong storms.

Beaches have not been assigned to a capability subclass or a woodland ordination symbol. They are in the North Florida Coastal Strand ecological community.

34—Cocoa-Bulow complex, 0 to 5 percent slopes. These moderately deep to deep, nearly level to gently sloping, well drained soils are on low, narrow ridges parallel to the Atlantic coastline. These soils are underlain by a coquina limestone formation. Slopes are convex and range from 0 to 5 percent. Individual areas are elongated. They range from 10 to 200 acres in size.

In 95 percent of the areas mapped as Cocoa-Bulow complex, 0 to 5 percent slopes, Cocoa, Bulow, and similar soils make up 80 to 99 percent of the map unit. Dissimilar soils make up 1 to 20 percent.

Generally, the mapped areas are about 53 percent Cocoa and similar soils and about 37 percent Bulow

and similar soils. The components of this map unit are so small or so intricately intermingled that they could not be mapped separately at the scale used. However, the proportions and patterns of the soils are relatively consistent in most delineations of this map unit.

Typically, the Cocoa soil has a surface layer of grayish brown sand about 3 inches thick. The subsurface layer is pale brown sand 13 inches thick. The upper part of the subsoil is reddish yellow sand to a depth of 29 inches. The lower part of the subsoil is yellowish red loamy sand to a depth of 35 inches. Coquina limestone is at a depth of about 35 inches, but the depth varies from 20 to 40 inches within a short distance. Some areas contain soils that are similar to the Cocoa soil but have a lower subsoil of sandy loam or sandy clay loam.

Typically, the Bulow soil has a surface layer of dark grayish brown sand about 5 inches thick. The subsurface layer is very pale brown sand about 15 inches thick. The upper part of the subsoil is reddish yellow sand to a depth of 50 inches. The lower part of the subsoil is yellowish red sandy clay loam to a depth of 59 inches. Coquina limestone is at a depth of about 59 inches. Some areas contain soils that are similar to the Bulow soil but have coquina rock at a depth of more than 80 inches, do not have a lower subsoil, or have a lower subsoil of loamy sand.

The dissimilar soils in this map unit include small areas of Bimini, Orsino, Paola, Placid, and Pomello soils. Orsino, Paola, and Pomello soils are in landscape positions similar to those of the Bulow and Cocoa soils. Bimini and Placid soils are in lower areas. These soils are sandy or loamy to a depth of 80 inches or more. Also included are areas of dissimilar soils that are somewhat poorly drained and have a black or very dark gray sandy upper subsoil over a loamy lower subsoil.

A seasonal high water table is at a depth of more than 72 inches in most years. In both soils, the permeability is moderately rapid in the layers above the coquina limestone. Available water capacity is very low in both soils. Limestone bedrock is at a depth of 20 to 40 inches in the Cocoa soil and is at a depth of 40 to 60 inches in the Bulow soil.

Most areas of this map unit support the natural vegetation. They are used as wildlife habitat and recreational sites. A few areas have been cleared as sites for homes. Some areas are used as improved pasture. The natural vegetation consists of live oak, laurel oak, cabbage palm, hickory, and southern magnolia. The understory vegetation consists of saw palmetto, creeping bluestem, low panicum, and wild grape.

This map unit is poorly suited to cultivated crops because of poor soil qualities and the moderately deep coquina limestone. The soils require intensive management practices. Droughtiness and the rapid leaching of plant nutrients are the main limitations. The variety of crops that produce good yields without irrigation is limited. Soil-improving cover crops should be used in rotation, and all of the crop residue should be left on the land or plowed under the surface.

This map unit is poorly suited to pasture. The available moisture limits the growth of plants, and the plant nutrients leach rapidly from the root zone. Deep-rooted species, such as bahiagrass and bermudagrass, can be used with high levels of fertilizer to maintain the potential production. Periodic mowing helps to maintain uniform growth and discourages selective grazing. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition.

This map unit is moderately suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 80. The potential for commercial production of pulpwood is 42 cords per acre from a fully stocked stand of trees 25 years old. The main management concerns are the equipment limitation, the seedling mortality rate, and plant competition. Using specialized equipment, such as high-flotation, oversized tires, reduces the damage to roots and minimizes soil compaction. The droughtiness causes seedling mortality. Planting special oversized or containerized stock can reduce the seedling mortality rate. Site preparation, such as chopping, bedding, and applying herbicide, can minimize plant competition and help to establish the seedlings. Road construction, logging, and site preparation should include the stabilization of roads and trails. Using culverts and bridges over drainageways and other maintenance measures prevent soil erosion and water flow problems. A preferred harvesting system leaves residual biomass distributed over the site.

This map unit is poorly suited to range and grazeable woodland because of the dense canopy cover, which reduces the quality and quantity of forage. Areas of this map unit provide excellent shade and resting areas for cattle. Important range forage includes several species of bluestem, longleaf uniola, and low panicum. This map unit is in the Upland Hardwood Hammock range site.

The Cocoa soil in this map unit has moderate limitations for dwellings without basements, small commercial buildings, and local roads and streets. The shallow depth of the coquina rock is the main limitation. The Bulow soil has only slight limitations for these uses. In areas that have slopes of more than 4 percent, Bulow soils have an additional limitation for small commercial buildings because of the steepness of the

slope. Lawn grasses and landscaping plants require frequent irrigation during dry seasons. Shoring the sidewalls of shallow excavations helps to prevent caving. The depth to rock and the poor filtering qualities are severe limitations for septic tank absorption fields on the Cocoa soil. Removing the rock and unsuitable material, backfilling with suitable material, and mounding the absorption field can help to overcome these limitations. The seepage is a severe limitation for trench-type sanitary landfills and sewage lagoons on both soils. Cocoa soils also have a severe limitation because of the shallow rock. Removing the rock and lining the trenches and lagoons with impervious soil material can help to overcome these limitations.

This map unit has severe limitations for recreational development. The main limitation is the loose sandy surface. Maintaining good trafficability in high usage areas is difficult. Soil blowing is also a hazard. Establishing a good vegetative cover, establishing windbreaks, and adding suitable topsoil or another surface stabilizer can help to overcome the limitations.

The potential as habitat for wildlife habitat for openland and woodland wildlife is fair or poor and for wetland wildlife is very poor. The hardwoods and shrubs provide fair sources of food and shelter for deer, turkey, squirrel, raccoon, opossum, and many types of birds.

Both soils are in capability subclass IVs. The woodland ordination symbol is 10s. The ecological community is Upland Hardwood Hammock.

35—Quartzipsamments, dredged. This map unit consists of nearly level, somewhat poorly drained, stratified soil material that was derived from the hydraulic dredging of the Intracoastal Waterway and was deposited on the adjacent landscape. The soil and geologic material is composed mostly of sand that is stratified with loamy, clayey, and organic fragments, with shells, and with coquina limestone cobbles. Many areas are used as a source of construction material or have been leveled and are used as a source of fill for building sites. Slopes mainly range from 0 to 2 percent.

No single pedon represents this map unit. The soil and geologic material is deposited in circular or oval mounds that range in size from a few acres to 100 acres. Generally, the surface is fine sand and the underlying material is sand, fine sand, or loamy fine sand.

The water table varies with the position and thickness of the overburden but generally ranges from a depth of 18 to 36 inches during wet seasons. The permeability is variable, but it is mostly rapid and very rapid. The available water capacity also is variable. It depends upon the stratified soil material and is mostly very low or low.

The existing vegetation consists of a few areas of slash pine, southern red cedar, cabbage palm, and wax myrtle. The understory vegetation consists of prickly pear, dog fennel, and other weeds.

This map unit is not suited to crops or pasture because of the poor soil quality. It is droughty, and plant nutrients leach rapidly. Many areas are near salty or brackish water bodies and receive some wind-borne salt spray during stormy weather conditions.

The map unit has a very low suitability for pine trees. The suitability for range or grazeable woodland is also very low. This map unit is well suited to urban development. The limitations are slight for homes, small commercial buildings, local roads and streets, or septic tank absorption fields. However, the hazard of groundwater contamination exists because of poor filtration of effluent in areas that have a concentration of septic tanks.

This map unit has severe limitations for recreational development. Because of the loose sandy surface, maintaining good trafficability is difficult. Soil blowing is a hazard. Establishing and maintaining a good vegetative cover or windbreaks or adding suitable topsoil or another surface stabilizer helps to overcome these limitations.

The potential of this soil as habitat for all forms of wildlife is very poor. The sparse vegetation on this soil produces little food or cover. Planting adapted varieties of trees, shrubs, and food-producing plants can improve conditions and provide more a suitable habitat for such species as bobwhite quail, ground tortoise, rabbit, and raccoon.

This map unit was not assigned a capability subclass, a woodland ordination symbol, or an ecological community.

36—Bimini sand. This very deep, nearly level, somewhat poorly drained soil is on low knolls and ridges that are a short distance inland and are parallel to the Atlantic Ocean. Individual areas are elongated. They range from 10 to 100 acres in size. Slopes are convex and range from 0 to 2 percent.

In 80 percent of areas mapped as Bimini sand, Bimini and similar soils make up 76 to 97 percent of the map unit. Dissimilar soils make up 3 to 24 percent.

Typically, the surface layer is gray sand about 6 inches thick. The subsurface layer is light gray sand about 22 inches thick. The subsoil is dark grayish brown sand to a depth of 32 inches, very dark brown sand to a depth of 41 inches, and dark brown sandy loam to a depth of 46 inches. The underlying material is light gray gravelly coarse sand. Some areas contain soils that are similar to the Bimini soil but the upper subsoil is deeper than 30 inches.

The dissimilar soils in this map unit include small areas of Bulow, Cocoa, and Placid soils. Bulow and Cocoa soils are in landscape positions similar to those of the Bimini soil and are underlain by limestone bedrock within a depth of 68 inches. Placid soils are in lower areas and are more poorly drained than the Bimini soil.

A seasonal high water table ranges from 18 to 42 inches in most years. It recedes to a depth of 60 inches during extended dry periods. Permeability is slow. Available water capacity is low.

Most areas support the natural vegetation. They are used as wildlife habitat. A few small areas are used for urban development. The natural vegetation consists of laurel oak, live oak, hickory, and cabbage palm. The understory consists of saw palmetto, greenbrier, and bluestem.

This soil is poorly suited to cultivated crops because of the wetness and the poor soil quality. The root zone is limited by a high water table during wet periods. The available water capacity is very low in the root zone. The natural fertility is very low, and the response to applications of fertilizer is limited. Nutrients leach rapidly through the soil.

This soil is poorly suited to pasture. A water-control system is needed to remove the excess water during wet periods. Because of the low available water capacity, this soil is droughty during long, dry seasons. Clover, ryegrass, or a combination of both can be grown successfully with other grasses for grazing during late winter and early spring. Irrigation helps to maintain high production levels during dry periods. Applications of fertilizer and lime are recommended according to the needs of the grasses. Periodic mowing and clipping help to maintain uniform growth and discourage selective grazing. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition.

This soil is moderately suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 70. The potential for commercial production of pulpwood is 35 cords per acre from a fully stocked stand of trees 25 years old. The main management concerns are the equipment limitation and the seedling mortality rate. Using specialized equipment, such as high-flotation, oversized tires, reduce the damage to roots and minimizes soil compaction. Droughtiness causes seedling mortality. Planting special oversized or containerized planting stock reduces the seedling mortality rate. Special site preparation, including chopping and bedding, helps to establish the seedlings. Road construction, logging, and site preparation should include the stabilization of roads and trails. Using culverts and bridges over drainageways and other maintenance measures prevent soil erosion and water flow problems. A preferred harvesting system leaves residual biomass distributed over the site.

This soil is poorly suited to range and grazeable woodland. Because of the unusually dense canopy cover, the soil is used as grazeable woodland primarily for shade and resting areas. Creeping bluestem and low panicum are the primary forage plants. This soil is in the Upland Hardwood Hammock range site.

This soil has slight limitations for dwellings without basements, small commercial buildings, and local roads and streets. Because this soil is droughty, lawns and landscaping plants need regular irrigation. The sidewalls of shallow excavations should be shored to help prevent caving. Water-control measures are needed to help overcome the wetness. The limitations are severe for septic tank absorption fields because of wetness caused by the seasonal high water table. This limitation can be overcome by mounding the absorption field. The seepage and the wetness are severe limitations for sewage lagoons. The depth to the underlying coquina rock and the wetness are severe limitations for trench-type sanitary landfills. Lining the lagoons and trenches with impervious soil material can reduce the seepage. If outlets are available, water-control measures can be established to help overcome the wetness.

This soil has severe limitations for recreational development. During dry periods, the sandy surface is very loose, which causes poor trafficability and increases the hazard of soil blowing. Establishing and maintaining a good vegetative cover or windbreaks or adding suitable topsoil or another surface stabilizer helps to overcome these limitations

The potential of this soil as habitat for wildlife is poor. Although the native vegetation produces good cover for woodland wildlife, the production of food is low. The habitat can be improved by planting food plots and maintaining the existing cover.

This Bimini soil is in capability subclass VIs. The woodland ordination symbol is 8s. The ecological community is Upland Hardwood Hammock.

37—Tuscawilla fine sand. This nearly level, poorly drained soil is on broad, low hammocks that are parallel to and a short distance inland from the Atlantic coastline. Individual areas are elongated. They range from 20 to 400 acres in size. Slopes are nearly smooth to concave and range from 0 to 2 percent.

In 95 percent of areas mapped as Tuscawilla fine sand, Tuscawilla and similar soils make up 87 to 99 percent of the map unit. Dissimilar soils make up 1 to 13 percent.

Typically, the surface layer is black fine sand about 5

inches thick. The subsurface layer is dark gray fine sand about 7 inches thick. The upper part of the subsoil is dark gray sandy clay loam to a depth of about 25 inches. The lower part of the subsoil is gray sandy clay loam that is mixed with shells and calcium carbonate nodules to a depth of 45 inches. The underlying layer is gray loamy fine sand mixed with shells and calcium carbonate nodules to a depth of 60 inches and is light gray gravelly fine sandy loam that contains about 20 percent shells and nodules to a depth of 80 inches or more. Some areas contain soils that are similar to the Tuscawilla soil but have a higher content of clay in the subsoil and do not have shells and marl in the underlying material.

The dissimilar soils in this map unit include small areas of EauGallie, Pomona, and Wabasso soils. They are in landscape positions similar to those of the Tuscawilla soil and have an organic-stained layer in the subsoil.

A seasonal high water is at a depth of 6 to 18 inches for 2 to 6 months in most years. Permeability is moderate. Available water capacity is low.

Most areas are used as recreation sites or wildlife habitat. The natural vegetation consists of live oak, sweetgum, pignut hickory, cabbage palm, and southern magnolia. The understory vegetation consists of waxmyrtle and maidencane.

This soil is moderately suited to cultivated crops. The main limitation is the wetness. By installing a good water-control system, a variety of vegetable crops can be grown. The water-control system should be designed to remove excess surface water and internal water rapidly. Irrigation is necessary during dry seasons. Because the subsoil has only moderate permeability, overhead sprinkler irrigation may provide better results. Good management includes rotating crops, planting soil-improving cover crops between vegetable cycles, and plowing under the crop residue to improve the tilth. Other important management practices are seedbed preparation, including bedding, and applications of fertilizer according to the needs of the crop.

This soil is moderately suited to pasture. A water-control system is needed to remove the excess surface water during wet periods. Appropriate applications of fertilizer will provide good growth rates for bahiagrass, bermudagrass, and limpograss. Applications of lime are generally not required. White clover and ryegrass can be grown with grass for late winter and early spring grazing. Periodic mowing helps to maintain uniform growth and discourages selective grazing. Proper stocking rates, a system of pasture rotation, and the timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to the production of slash pine. Based on a 50-year site curve, the mean site index for slash pine is 88. The potential for commercial production of pulpwood is 47 cords per acre from a fully stocked stand of trees 25 years old. The main management concerns are the equipment limitation, the seedling mortality rate, and plant competition. Using specialized equipment, such as high-flotation, oversized tires, reduces the damage to roots and minimizes soil compaction. The wetness restricts the use of equipment to dry periods and can cause a high rate of seedling mortality. Planting on beds helps to overcome the limitation, but it should not block the natural surface drainage. Other methods of site preparation, including chopping and applying herbicide, can minimize plant competition and help to establish the seedlings. Road construction, logging, and site preparation should include the stabilization of roads and trails. Using culverts and bridges over drainageways and other maintenance measures prevent soil erosion and water flow problems. Ensuring adequate surface drainage is recommended before trees are planted. A preferred harvesting system leaves residual biomass distributed over the site.

Because of the unusually dense canopy cover, this soil is poorly suited to range or grazeable woodland. The production of forage is limited because of the deep shade. Areas can provide shade for cattle during summer and provide shelter during cold, windy weather. Longleaf uniole and low panicum are the primary forage plants. This soil is not assigned to a range site.

This soil has severe limitations for dwellings without basements, small commercial buildings, and local roads and streets. The wetness caused by a seasonal high water table is the main limitation. Elevating building sites and roadways with suitable fill material can increase the effective depth to the water table and can help to overcome the wetness. If outlets are available, surface ditches can provide some drainage and help to remove the excess water. The limitations for shallow excavations are severe because the cutbanks are unstable. The excessive wetness is also a limitation. Excavations rapidly fill with ground water unless water-control measures, such as dewatering wells, are established prior to excavation. The sidewalls of excavations should be shored to help prevent caving. The wetness is a severe limitation for septic tank absorption fields. Using suitable fill material to mound the absorption fields can help to overcome the wetness. The seepage and the wetness are severe limitations for sewage lagoons and trench-type sanitary landfills. Lining the lagoons and trenches with impervious soil material and using water-control measures can help to overcome the limitations.

The wetness and the sandy surface are severe

limitations for recreational development. Installing water-control measures, which help to maintain the water table at a suitable depth, can help to overcome the wetness. The trafficability of the sandy surface layer is poor in areas of high use as a result of the loose sand. The surface can be stabilized by planting a vegetative cover, adding suitable topsoil, or constructing paved areas.

The potential of this soil as habitat for woodland wildlife is good and for openland and wetland wildlife is fair. The hardwoods and shrubs provide good food and cover. The wildlife species include deer, wild hogs, turkey, squirrels, armadillos, reptiles, and a variety of birds.

This Tuscawilla soil is in capability subclass IIIw. The woodland ordination symbol is 11w. The ecological community is Wetland Hardwood Hammock.

38—Paola fine sand, 0 to 8 percent slopes. This nearly level to sloping, excessively drained soil is on dunelike high knolls and ridges on the flatwoods and coastal ridges. Individual areas are irregular in shape. They range from 5 to 200 acres in size. Slopes are convex and range from 0 to 8 percent.

In 80 percent of the areas mapped as Paola fine sand, 0 to 8 percent slopes, Paola and similar soils make up 76 to 94 percent of the map unit. Dissimilar soils make up 6 to 24 percent.

Typically, the surface layer is gray fine sand about 6 inches thick. The subsurface layer is white fine sand, about 10 inches thick, that tongues into the underlying horizon. The subsoil is yellowish brown fine sand to a depth of 31 inches. The underlying material, to a depth of 80 inches, is yellowish brown fine sand. Some areas contain soils that are similar to the Paola soil but do not have a subsurface layer or have limestone bedrock within a depth of 80 inches.

The dissimilar soils in this map unit include small areas of Cassia, Orsino, Pomello, and Tavares soils. These soils are in slightly lower positions on the landscape than the Paola soil and are not as well-drained. Cassia and Pomello soils have an organic-stained layer in the subsoil. Tavares soils do not have a light-colored subsurface layer.

In most years, a seasonal high water table is below a depth of 72 inches. Permeability is very rapid. Available water capacity is very low.

Most areas are used for the commercial production of pine trees. Some areas are used as improved pasture. A few small areas have been cleared and are used as sites for homes and for urban development. The natural vegetation consists of sand pine, a few areas of slash pine and longleaf pine, scrub live oak, and scattered areas of turkey oak. The understory vegetation consists of prickly pear cacti, dog fennell, panicum, bluestem, and rosemary and scattered areas of saw palmetto.

This soil is generally unsuited to most cultivated crops because of the low natural fertility and the droughtiness. The low available water capacity in the root zone, the low content of organic matter, and the sandy texture cause poor growing conditions for most crops. The crops respond poorly to applications of fertilizer because nutrients are rapidly leached from the seed.

This soil is poorly suited to improved pasture. The low available water capacity limits the production of plants during extended dry periods. Under high levels of management, such deep-rooted plants as coastal bermudagrass and bahiagrass can be grown. Irrigation, proper grazing practices, weed control, and applications of lime and fertilizer are needed for the optimum growth of grasses and legumes.

This soil is suited to the commercial production of pine trees. With proper management, sand pine grows best. Site preparation, such as chopping, burning, and applying herbicide, reduces debris, reduces immediate plant competition, and facilitates planting. The soil has a very low content of organic matter, and a harvest system that removes all of the tree biomass reduces the fertility of these areas. A logging system that leaves residual biomass distributed over the site is preferred. Based on a 50-year site curve, the mean site index for sand pine is 50. The potential yield is 8 cords per acre from a fully stocked stand of trees 25 years old.

This soil is poorly suited to range or grazeable woodland. The poor soil quality limits the growth of desirable native species. Most areas of this soil suitable for livestock grazing also are limited by a fairly dense stand of trees and shrubs that limit the production of native forage. Indiangrass, panicum, and bluestem are the most valuable forage plants. Unless intense grazing management is applied, this soil is easily overgrazed. Livestock will not use these areas if other range sites are available. This soil is in the Sand Pine Scrub range site.

This soil is well suited to homesites and urban development. The limitations for dwellings with or without basements, small commercial buildings, and local roads and streets are slight. The roads should be designed to offset the instability of the deep, sandy soil surface, which offers poor traction for construction vehicles. Areas of this soil that are used for lawns and landscaping require frequent irrigation and applications of fertilizer. Those plants that are native to the area should be given special preference in landscaping. They are more easily established and require less maintenance. The potential for an onsite sewage disposal system is very high. If the density of housing is

moderate or high, a community sewage system is needed to prevent the possible contamination of ground water as a result of seepage. Sealing or lining sewage lagoons and trench-type sanitary landfills with impervious soil material can reduce the excess seepage. The cutbanks are not stable and should be shored to prevent caving.

This soil is poorly suited to recreational development. It has severe limitations for this use. Because of the loose sandy soil surface, trafficability is poor and soil blowing is a hazard. The sandy surface can be stabilized by adding suitable topsoil, seeding, mulching, or constructing paved areas for walkways and parking areas.

The potential of this soil as wildlife habitat is very poor or poor. The soil provides minimal habitat for deer, squirrels, gopher turtles, turkeys, quail, and several species of song birds. The animals in these areas are adapted to high temperatures and to droughty conditions. The production of food for wildlife is low, but the dense vegetation provides good escape cover for many animals. The habitat can be improved by planting food plots and improving the vegetative cover.

This Paola soil is in capability subclass VIs. The woodland ordination symbol is 2s. The ecological community is Sand Pine Scrub.

39—Udarents, smoothed. This map unit consists of somewhat poorly drained soils that have been reworked, cut and filled, and smoothed or shaped by man. They are in the eastern part of the county, mostly in urban areas. Most of these soils are in low areas, adjacent to canals from which the soil material has been excavated. Individual areas range from irregular and rounded to straight and angular in shape. They range from 10 to 200 acres in size. Slopes are smooth and range from 0 to 2 percent.

Udarents do not have an orderly sequence of soil layers. In most areas, the surface or fill layer is about 30 to 50 inches thick. It is dark gray, gray, dark grayish brown, or grayish brown sand or loamy sand that is mixed with discontinuous gray, dark gray, or grayish brown fragments of sandy loam, sandy clay loam, or sandy clay. Also mixed with the surface layer are 5 to 10 percent, by volume, shells or shell fragments that range from ¼ to ½ inch in diameter. Secondary accumulations of light gray or white calcium carbonates also are mixed with the fill layer. They range in size from ⅛ to ¼ inch in diameter and are from 2 to 5 percent, by volume. The upper 5 inches of the undisturbed soil below the fill layer is dark gray sand. It is underlain by gray fine sand to a depth of 80 inches or more.

Included in mapping are small areas of Udarents, moderately wet, soils. Other similar soils are soils that do not have the loamy or clayey fragments and are sandy throughout and some soils that have less than 30 inches of fill. A few areas have continuous loamy or clayey layers at a depth of more than 50 inches.

A seasonal high water table is at a depth of 36 to 48 inches, depending upon the thickness of the fill. It recedes to depth of more than 60 inches during dry seasons. Available water capacity is low. Permeability is moderately rapid and rapid.

Most areas of these soils are used for urban development. The natural vegetation is variable. The vegetative growth is very sparse in some areas, but a good growth of shrubs and grasses is present in others. The natural vegetation consists mostly of waxmyrtle, southern red cedar, inkberry, and saw palmetto. Some areas have a few areas of slash pine, longleaf pine, and cabbage palm. The grasses include creeping bluestem, bushybeard bluestem, panicum, and pineland threeawn.

Because the extent of these soils is limited, and they are mostly used for urban development, they are not used for cultivated crops, pasture, or commercial woodland.

These soils have severe limitations for use as septic tank absorption fields because of the wetness and the poor filtering qualities of the fill material. Mounding the absorption fields can overcome these limitations. The limitations are moderate for dwellings without basements, small commercial buildings, and local roads and streets. The wetness is the main limitation. Water-control measures may be necessary to overcome these limitations. The differential settling of the variable fill material may be a hazard in some areas. Special construction measures may be required to help to overcome this hazard. Shallow excavations are subject to caving of the sidewalls and ground water entering the excavations. The sidewalls should be stabilized, and the wetness should be reduced by drainage and the use of well points or other water-control measures.

The loose sandy surface is a severe limitation for recreational development. The trafficability can be improved by stabilizing the surface with paved areas or a vegetative cover.

The potential of this soil as wildlife habitat is poor. The growth of vegetation that provides adequate food and shelter is minimal. The wildlife habitat can be improved by planting food plots and by improving protective cover.

This map unit has not been assigned a capability subclass, a woodland ordination symbol, or an ecological community.

40—Pomona fine sand. This very deep, poorly drained, nearly level soil is in broad flatwood areas.

Individual areas are irregular in shape. They range from 80 to 400 acres in size. Slopes are smooth and range from 0 to 2 percent.

In 95 percent of the areas mapped as Pomona fine sand, Pomona and similar soils make up 92 to 99 percent of the map unit. Dissimilar soils make up 1 to 8 percent.

Typically, the surface layer is black fine sand about 4 inches thick. The subsurface layer is gray fine sand about 17 inches thick. The upper part of the subsoil is black loamy fine sand to a depth of about 28 inches and dark reddish brown fine sand to a depth of about 50 inches. The lower part of the subsoil is grayish brown fine sandy loam to a depth of about 63 inches. The underlying material is dark grayish brown fine sandy loam to a depth of 80 inches or more.

The dissimilar soils in this map unit include small areas of soils that are in depressions and have water standing above the surface for 6 to 9 months of the year.

The seasonal high water table is at a depth of 6 to 18 inches for 1 to 3 months and is at a depth of 10 to 40 inches for more than 6 months in most years. Available water capacity is low. The permeability is moderate to moderately slow.

Most areas support the native vegetation, which consists of slash pine and longleaf pine. The understory vegetation consists of saw palmetto, gallberry, threeawn, bluestem, and lopsided indiangrass. Large areas are used for the commercial production of slash pine, and some areas are used for vegetable crops.

This soil is moderately suited to cultivated crops. The main limitations are the seasonal wetness and the poor soil quality. Unless intensive management is applied, the number of adapted crops is limited. By using an adequate water-control system, this soil is well suited to a number of vegetable crops, including cabbage and Irish potatoes. The water-control system removes excess surface water after heavy rainfalls and provides subirrigation during dry seasons (fig. 8). Close-growing cover crops should be grown when the soil is not used for cultivated crops. Returning all of the crop residue to the soil and using a system of conservation tillage minimize the hazard of wind erosion and maintain soil quality.

This soil is moderately suited to pasture and hay crops. Bermudagrass and bahiagrass grow well when properly managed. Water-control measures are needed to remove the excess surface water after heavy rains. Regular applications of fertilizer and lime and controlled grazing are necessary to maintain plant vigor.

This soil is well suited to the commercial woodland production of pine trees. Slash pine is the recommended tree to plant. Based on a mean site index of 80 for slash pine, the yield from an even-aged, fully stocked stand of trees 25 years old is 42 cords per acre. The main management concerns are the restricted use of equipment and the seedling mortality that results from the seasonal wetness and periods of droughtiness. Plant competition also is a management concern. Site preparation, such as harrowing and bedding, helps to establish seedlings, reduces the seedling mortality rate, and increases early plant growth. Chopping and bedding reduce debris, control competing vegetation, and facilitate planting operations. Using field machinery equipped with high-flotation rubber tires or using tracked vehicles reduces the equipment limitation, soil compaction, and the damage to roots during thinning operations. Site preparation, planting, and harvesting during drier periods help to overcome the equipment limitation. A logging system that leaves residual biomass well distributed over the site will increase the content of organic matter and the residual fertility of the soil. Applications of a fertilizer that has nitrogen and phosphorous can provide excellent growth response.

This soil has good suitability for range and grazeable woodland. The dominant forage includes pineland threeawn, bluestem, and panicum. This soil is in the North Florida Flatwoods range site.

The wetness is a severe limitation for dwellings and local roads and streets. The wetness is a severe limitation for septic tank absorption fields. Installing water-control measures or elevating the building sites, roadways, and septic tank absorption fields is necessary to help overcome the wetness.

The main limitations for recreational areas are the high water table and the sandy surface layer. A water-control system is needed to help overcome the wetness. Trafficability is poor, and blowing sand is a hazard. Maintaining a good vegetative cover or windbreaks or adding suitable topsoil or another surface stabilizer helps to overcome these limitations.

This soil provides wildlife habitat for deer, red fox, turkey, quail, armadillos, and several species of birds. The potential as habitat for openland and wetland wildlife is fair and for woodland wildlife is poor. The habitat can be improved by improving the cover and planting food plots.

This Pomona soil is in capability subclass IVw. The woodland ordination symbol is 10w. The ecological community is North Florida Flatwoods.

41—Terra Ceia muck, frequently flooded. This very deep, very poorly drained, nearly level soil is on broad to narrow flood plains along Haw Creek and Cresent Lake. It is frequently flooded. Individual areas are irregular in shape. They range from 500 to 1,000 acres in size. Slopes are less than 1 percent.

Figure 8.—Subsurface irrigation on a field of Irish potatoes in an area of Pomona fine sand.

In 90 percent of the areas mapped as Terra Ceia muck, frequently flooded, Terra Ceia and similar soils make up 83 to 99 percent of the map unit. Dissimilar soils make up 1 to 17 percent.

Typically, the surface soil is more than 80 inches thick. The upper 25 inches is dark reddish brown muck. It is underlain by black muck to a depth of 80 inches or more. Some areas contain soils that are similar to the

Terra Ceia soil, but they have a muck surface soil about 30 inches thick and are underlain by a mineral soil.

The dissimilar soils in this map unit include small areas of Favoretta and Placid soils. They are in landscape positions similar to those of the Terra Ceia soil. They formed in clayey and sandy mineral material.

The seasonal high water table is within a depth of 6 inches, except during long, dry seasons. The soil is flooded during rainy seasons. Available water capacity is very high. Permeability is rapid.

Most areas support the native vegetation, which consists of sweetgum, red maple, cypress, bay, and cabbage palm. The understory vegetation is sparse. Some areas do not have trees, and they support a dense marsh vegetation that mostly consists of sawgrass.

This soil is generally unsuited to cultivated crops because of the wetness and the flooding. The root zone is limited by the high water table and the water that covers the surface during rainy seasons.

By using proper water-control measures, improved pasture grasses and clover grow well on this soil. The water table should be maintained close to the surface to prevent the excessive oxidation of the organic soil layers. Applications of fertilizers with minor elements are needed. Controlled grazing allows the best yields.

The potential productivity for pine trees is very low. This soil is not suited to the commercial production of trees. Flooding and the excessive wetness cause a high seedling mortality rate. The low strength of the organic layers result in a hazard of windthrow. The equipment limitation is also a management concern.

This soil has a very low suitability for range or grazeable woodland. The flooding, the excessive wetness, and the low strength for the support of grazing animals are the main limitations. The growth of understory plants suitable for forage is minimal. Open areas are dominated by a dense growth of sawgrass. This map unit is not assigned to a range site.

This soil has severe limitations for use as septic tank absorption fields, dwellings without basements, and local roads and streets. It is frequently flooded and is saturated with water for long periods. The organic materials do not provide adequate filtration for septic tank absorption fields because the water runs through the soil too rapidly. Flooding, excessive wetness, and the low strength of the organic materials are limitations for the use of this soil as a building site for dwellings or for local roads and streets. Removing the organic layers and elevating the building sites and roadbeds are necessary to overcome the limitations. This soil is not suited to trench-type sanitary landfills or sewage lagoons because of the hazard of flooding, the excessive wetness, and the high content of organic matter. Overcoming these limitations is impractical.

This soil has severe limitations for recreational development. Flooding, the high water table at the surface of the soil, and the organic surface layer are limitations. The soil is in low areas, and water-control measures, which include flood control and lower the high water table to a necessary depth of 2 to 2½ feet, are difficult to establish. The surface layer has poor trafficability because of the low strength of the organic material. During dry seasons, soil blowing will occur.

In areas where this soil supports a good growth of hardwoods, it provides habitat for deer, gray squirrel, otter, turkey, and raccoon. The potential as habitat for wetland wildlife is good and for openland and woodland wildlife is poor. It can be improved by planting food plots.

This Terra Ceia soil is in capability subclass VIIw. It is not assigned to a woodland ordination group. The ecological community is Swamp Hardwoods.

Use and Management of the Soils

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

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

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

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

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

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

Crops and Pasture

William Kuenstler, agronomist, Natural Resources Conservation Service, helped prepare this section.

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

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

Approximately 11,000 acres in Flagler County is used for pasture and crop production, according to estimates from the Flagler County Extension Service. Of this total, about 5,000 acres is used for vegetable and agronomic crops, about 1,000 acres for hay, and about 5,000 acres for pasture. Irish potatoes and cabbage are the most extensively grown vegetable crops. Other vegetable crops include broccoli, cucumbers, eggplant, peppers, zucchini, squash, yellow squash, sweet corn, and watermelons. The pasture grasses that are most often grown for grazing and hay are bahiagrass and coastal bermudagrass.

The crops are grown mostly in the Bimini, Deansville, and St. Johns Park areas. EauGallie, Pineda, Riviera, Wabasso, and Winder soils are most commonly used for growing vegetable crops. These poorly drained, nearly level soils have established water-control measures that provide subirrigation during dry periods and drain the excess water during wet periods. Many of these soils have been leveled to provide for a more efficient use of irrigation water. Prior to the severe freezes that occurred during the late 1970's and early 1980's, about 200 acres of citrus crops were grown in Flagler County. Presently, no commercial citrus groves are in Flagler County. A small acreage is used for the production of ornamental landscape plants and for commercial sod farming. Small acreages of blueberries are also grown commercially.

Agronomic crops in the county include small acreages of corn and grain sorghum. A tropical variety of field corn is planted in the late spring or early

Figure 9.—Blueberries in an area of Wabasso fine sand. Water-control measures and an irrigation system are needed to overcome the limitations of this soil for growing crops.

summer, following the harvest of cabbage or Irish potatoes. The corn uses residual fertilizer from the vegetable crops and requires few or no additions of fertilizer. On other cultivated land, a close-growing crop of sweet sorghum or a sorghum-sudan grass hybrid is usually planted after the cash crop is harvested to help to prevent the leaching of residual fertilizer, to add organic matter to the soil, and to protect the soil from erosion.

The potential of the soils in Flagler County for the increased production of food is high. About 253,000 acres of potentially good cropland is currently used as woodland, and about 5,000 acres is used as improved pasture. Food production could also be increased considerably by applying the latest technology to all of the cropland in the county. The use of this soil survey can greatly facilitate the application of such technology. The acreage used as woodland in the county has decreased as more land is used for farming and urban uses. Food production can also be increased by growing crops that are not presently grown commercially. If water is adequately controlled, soils that are poorly drained and very poorly drained and that warm up early in the spring are well suited to many

vegetable crops and small fruits, such as grapes, blueberries, and strawberries (fig. 9). Other crops, such as sweet potatoes and tomatoes, can be grown if economic conditions are favorable. Rice, sugarcane, corn, and similar crops are well suited to the organic soils. Organic soils oxidize and subside, however, when pore space is exposed to the air. As a result, water must be maintained at the level required for the crops during the growing season and then raised during other times of the year to minimize the oxidation and subsidence.

Although the soils in Flagler County have the potential for increased food production, other factors must be considered when choosing crops and selecting sites. These factors include the risk of possible adverse weather conditions, the intrusion of saltwater into the aquifer and the availability of an adequate supply of freshwater for irrigation, and such environmental considerations as preservation of wetlands, the possibility of polluting nearby waters, and the desirability of using the land for other purposes.

As the population increases, the demand for food will also increase. A knowledge of soils and soil properties is essential for the increased production of food. Some of the major soil properties that should be considered include water erosion, soil blowing, wetness, fertility, and tilth.

Soil erosion by water is not as serious a problem in the agricultural areas of Flagler County as it is in many areas in the southern part of the United States. Most of the soils are sandy and nearly level. Erosion resulting from rapid runoff occurs only during periods of torrential rainfall and only in a few bare areas that have short, steep slopes. In the rapidly developing urban areas, erosion can be a hazard in areas where water quantities are concentrated and runoff is accelerated. Installation of a properly designed water-control system can help to prevent erosion in built-up areas.

In other areas where erosion is a hazard, erosion-control measures that provide a protective surface cover, help to control runoff, and increase the infiltration rate can help to keep the soil in place. A system of conservation tillage that minimizes soil disturbance and leaves a maximum amount of crop residue on the surface increases the infiltration rate and reduces the hazard of runoff and erosion.

Wind erosion is a significant hazard on the sandy soils and the mucky soils. Blowing soil can damage both the soils and the tender truck crops in only a few hours if winds are strong and the soils are not protected by vegetation or by a surface mulch. A system of conservation tillage that maintains a plant cover or a surface mulch minimizes the hazard of soil blowing on these soils. Wind erosion damages crops by sandblasting the leaves of young plants. Cover crops, regularly spaced strips of small grain aligned at right angles to the prevailing winds, and windbreaks of adapted trees and shrubs, such as slash pine, sand pine, and waxmyrtle, also effectively reduce wind erosion and the subsequent crop damage. Wind erosion can also spread plant diseases, insects, and weed seeds and can create a health hazard and present cleaning problems.

Water control is a major management concern in areas used for crops and pasture. About 85 percent of the soils in the county are poorly drained or very poorly drained. In most years, these soils are too wet for the crops commonly grown in the area. The sandy soils also have a low water-holding capacity and are droughty during dry periods. Most of the poorly drained soils require a combination of surface drainage and subirrigation in areas where they are intensively used to grow row crops. The design of both surface drainage and irrigation systems varies according to the kind of soil and the crop grown. More information about water control and practices that can prevent wind erosion is available at the local office of the Natural Resources Conservation Service.

Soil fertility is naturally low for most of the soils in the county. The soils generally have loose, sandy surface layers and subsurface layers that are rapidly permeable or very rapidly permeable, thus allowing the rapid leaching of fertilizer and lime following heavy rains. Mineral soils that have a dark surface generally contain more organic matter and more plant nutrients. Organic soils require applications of a special fertilizer because they are low in copper and other trace elements. Most of the soils in the county are very strongly acid or extremely acid. If they have never been limed, applications of lime are needed to ensure the good growth of legumes and other crops. The levels of nitrogen and available phosphorus and potash are naturally low in most of the mineral soils. Soil fertility, however, changes as the soil is used. Additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help to determine the kinds and amounts of fertilizer and lime that should be applied.

Soil tilth refers to the condition of the soil in relation to plant growth. It is an important factor in the germination of seeds, the infiltration of water into the soil, and the available water holding capacity of the soil. Soils that have good tilth are granular, porous, and easily cultivated. Most soils used for crops in the survey area have a sandy surface layer and a granular structure. Soils that have little or no structure seal over during intense rainstorms, restricting water infiltration.

Soil structure can be improved by the regular addition of organic material, such as crop residue and manure. Soils that have a light-colored surface also are low in organic matter. Adding organic matter also increases the fertility and water-holding capacity.

The pastures in the survey area produce forage and hay crops for beef cattle and horses. The main cattle enterprises are beef cattle cow-calf operations. No dairy farms are in the county. Occasionally, sod is harvested from some areas of pasture. Bahiagrass, coastal bermudagrass, and Alicia bermudagrass are the main pasture plants. Extensive areas of pasture are throughout the county, mostly on soils in the flatwoods.

Differences in the amount and kind of pasture yields are related closely to the differences among the soils. Pasture management is based upon the relationship between soils, pasture plants, lime, fertilizer, moisture, and grazing systems. In many parts of the county, pasture has been greatly depleted by continuous excessive grazing. Yields can be increased by using a management system that includes grass-legume mixtures, controlled grazing, and applications of lime and fertilizer.

If drained, the poorly drained soils of the flatwoods, such as EauGallie, Myakka, Riviera, Smyrna, and Winder soils, are moderately suited to well suited to use as pasture. Subsurface irrigation increases both the length of time that the forage is available and the total forage produced. If irrigated and adequately limed and fertilized, these poorly drained soils are well suited to white clover and other legumes. If adequately limed and fertilized, the well drained and moderately well drained Astatula and Tavares soils are moderately suited to improved bahiagrass and bermudagrass. Irrigation is needed for the best possible production levels.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

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

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

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

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

Crops other than those shown in table 4 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

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

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

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

Rangeland and Grazeable Woodland

Greg Hendricks, range conservationist, Natural Resources Conservation Service, helped to prepare this section.

Native grasses are an important part of the overall, year-round supply of forage for livestock producers in Flagler County. The forage is readily available, is economical, and provides the roughage important to cattle. About 19,000 acres of rangeland and grazeable woodland is in the county. Most of this acreage is west of U.S. Highway 1 and south of State Road 100.

Rangeland

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils, vegetation, and water.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect the moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and the seasonal high water table also are important.

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

The vegetation that grew originally in the natural plant community is called the *climax vegetation.* It generally is the most productive vegetation on that particular site and the most suitable vegetation for livestock. The climax vegetation consists of three kinds of plants that are characterized according to their response to grazing. These are *decreasers, increasers,* and *invaders.* Decreasers generally are the most palatable climax plants; therefore, they are eliminated first if the range is subjected to continuous, heavy grazing. Increasers are plants that are less palatable to livestock; they eventually also are eliminated. Invaders are plants that are native to the site which have little value as forage. Invaders will become established after the other vegetation has been reduced.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community or climax vegetation for the range site. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Four classes are used to measure range condition. They are:

- Excellent condition—Sites that produce more than 75 percent of their potential
- Good condition—Sites that produce 51 to 75 percent of their potential

• Fair condition—Sites that produce 25 to 50 percent of their potential

• Poor condition—Sites that produce less than 26 percent of their potential

Potential production refers to the amount of herbage that can be expected to grow on a well-managed range site. Yields are expressed in terms of pounds of airdry herbage per acre. Herbage refers to total vegetation produced and does not reflect forage value or grazing potentials. Favorable years are those in which climatic factors, such as rainfall and temperature, are favorable for plant growth. The productivity of range sites is closely related to the natural drainage of the soil. The wettest soils, such as those soils in marshes, produce the greatest amount of vegetation, while the deep, droughty sandhill areas generally produce the least amount of herbage annually.

Manipulations of a range site often involve mechanical brush control, controlled burning, and, most importantly, controlled livestock grazing. Predicting the effects of these practices on range sites is of utmost importance. Without exception, proper management of the native range plant community will result in maximum sustained production, conservation of the soil and water resources, and improvement of the habitat for many wildlife species.

Grazeable Woodland

Grazeable woodland is forested land that is primarily managed for the production of wood that has an understory of native grasses, legumes, and forbs. The understory is an integral part of the forest plant community. Under proper management, the native plants can be grazed without significantly impairing other forest values. All of the management factors discussed for rangeland also apply to grazeable woodland; however, several additional factors must be taken into consideration to manage grazeable woodland. For the purpose of this discussion, the management considerations will be limited to those needed for planted pine.

In a forest, both trees and herbaceous vegetation compete for sunlight and growth. As the trees mature, their height growth and subsequent canopy closure influence the growth of understory forage. The forest canopy is measured by the percent foliar cover of all woody vegetation 4½ feet or more above the ground. A sharp decline in forage production results after the canopy closure reaches a certain point. The factors that determine when this decline will occur are the spacing, planting configuration, and growth rate of the planted pines on the particular site. Wider tree spacings and alternate planting configurations can extend the period of higher forage production further into the tree rotation; however, this usually results in some reduction in wood production. Managers should consider alternate spacings and planting configurations. Before planting, they should determine what, if any, reduction in wood production is acceptable in order to extend the period of higher forage production.

Another factor to consider in managing grazeable woodland is restricting the use of burning in the early years of the rotation. Young slash pine do not tolerate fire until they are 12 to 15 feet tall. On wet, loamy or clayey soils that support native plant communities with a dense hardwood overstory, woody invader species begin to reestablish themselves within one year after the final site preparation. They are difficult to control. Thorough site preparation and mechanical brush control are essential if sustained woodland grazing is planned on these soils.

Management for woodland grazing should also include such practices as maintaining proper stocking rates, cross fencing to allow the rotation and timing of grazing in different areas, and prescribed burning in established stands. Careful management and planning can increase the quality and duration of woodland grazing, maintain high levels of wood production, and enhance wildlife habitat.

Range Sites

In the following paragraphs, the range sites found in Flagler County are described. Each site is named for a landscape feature, such as "Slough," or a combination of dominant plant species and a landscape feature, such as "Longleaf Pine-Turkey Oak Hills." Several other sites or ecological communities have extensive acreage in the county but have little use for livestock production.

The *North Florida Flatwoods* range site is generally on nearly level, poorly drained soils. It generally consists of a sparse to fairly dense stand of slash, loblolly, and longleaf pines. Creeping bluestem, chalky bluestem, indiangrass, and various panicum grasses represent the major desirable native forage species growing on mesic to xeric phases of this site when the site is in excellent condition. Uncontrolled grazing tends to reduce the availability of desirable forage species. Unpalatable species, such as pineland threeawn, saw palmetto, gallberry, sedges, and rushes become dominant on sites that are in poor condition. The total annual production is 5,500 pounds of air-dry material per acre in favorable growth years and 3,000 pounds of air-dry material per acre in unfavorable growth years when the site is in excellent range condition. The relative percentage of annual vegetative production, by

weight, is approximately 65 percent grasses and grasslike plants, 10 percent forbs, and 25 percent woody plants and trees when the site is in excellent range condition. EauGallie, Holopaw, Immokalee, Myakka, Pomona, Smyrna, and Wabasso soils are in this range site.

The *Longleaf Pine-Turkey Oak Hills* range site is generally on nearly level to gently rolling, well drained to excessively drained soils. It generally consists of a sparse to fairly dense stand of longleaf pine, turkey oak, bluejack oak, and myrtle oak. Creeping bluestem, indiangrass, green silkyscale, and various other bluestem grasses represent the major desirable native forage species growing on this site when the site is in excellent condition. Uncontrolled grazing tends to reduce the availability of desirable forage species. Unpalatable species, such as pineland threeawn, prickly pear, saw palmetto, Lyonia species, sedges, and rushes become dominant on sites that are in poor condition. The total annual production is 4,000 pounds of air-dry material per acre in favorable growth years and 2,000 pounds of air-dry material per acre in unfavorable growth years when the site is in excellent range condition. The relative percentage of annual vegetative production, by weight, is approximately 60 percent grass and grasslike plants, 20 percent forbs, and 20 percent woody plants and trees when the site is in excellent range condition. Astatula and Tavares soils are in this range site.

The *Sand Pine Scrub* range site is generally on rolling, moderately well drained to excessively drained soils. It generally consists of a fairly dense to extremely dense stand of sand pine, sand live oak, turkey oak, and scrub bay. Baked panicum, indiangrass, and various bluestem grasses represent the major desirable native forage species growing on this site when the site is in excellent condition. Uncontrolled grazing tends to reduce the availability of desirable forage species. Unpalatable species, such as broomsedge, threeawn grasses, rosemary, and saw palmetto, become dominant on sites that are in poor condition. The total annual production is 3,500 pounds of air-dry material per acre in favorable growth years and 1,500 pounds of air-dry material per acre in unfavorable growth years when the site is in excellent range condition. The relative percentage of annual vegetative production, by weight, is approximately 40 percent grass and grasslike plants, 20 percent forbs, and 40 percent woody plants and trees when the site is in excellent range condition. Cassia, Orsino, Paola, and Pomello soils are in this range site.

The *Slough* range site is generally on nearly level, poorly drained and very poorly drained soils in association with North Florida Flatwood sites. It generally consists of a mostly herbaceous ecosystem and a few scattered trees. Blue maidencane, chalky bluestem, and toothachegrass represent the major desirable native forage species growing on this site when the site is in excellent condition. Uncontrolled grazing tends to reduce the availability of desirable forage species. Unpalatable species, such as pineland threeawn, bottlebrush threeawn, sloughgrass, and sand cordgrass, become dominant on sites that are in poor condition. The total annual production is 8,000 pounds of air-dry material per acre in favorable growth years and 4,000 pounds of air-dry material per acre in unfavorable growth years when the site is in excellent range condition. The relative percentage of annual vegetative production, by weight, is approximately 90 percent grasses and grasslike plants, 10 percent forbs, and trace amounts of woody plants and trees when the site is in excellent range condition. Malabar, Pineda, and Valkaria soils are in this range site.

The *Freshwater Marshes and Ponds* range site is generally on nearly level, very poorly drained soils. It generally consists of a treeless, herbaceous ecosystem. Maidencane and cutgrass represent the major desirable native forage species growing on this site when the site is in excellent condition. Uncontrolled grazing tends to reduce the availability of desirable forage species. Unpalatable species, such as sawgrass, carpetgrass, peckerelweed, smartweed, and various woody species, become dominant on sites that are in poor condition. The total annual production is 10,000 pounds of air-dry material per acre in favorable growth years and 5,000 pounds of air-dry material per acre in unfavorable growth years when the site is in excellent range condition. The relative percentage of annual vegetative production, by weight, is approximately 90 percent grasses and grasslike plants, 10 percent forbs, and trace amounts of woody plants and trees. Terra Ceia soils are in this range site.

The *Wetland Hardwood Hammock* range site is generally on nearly level, somewhat poorly drained to poorly drained soils. It generally consists of a diverse forest canopy consisting of live oak, water oak, laurel oak, cabbage palm, red maple, and gum trees. Switchgrass, longleaf uniola, eastern gamagrass, chalky bluestem, and maidencane grasses represent the major desirable native forage species growing on this site when the site is in excellent condition. Uncontrolled grazing tends to reduce the availability of desirable forage species. Unpalatable species, such as sedges, rushes, pineland threeawn, annual forbs, and carpetgrass, become dominant on sites that are in poor condition. The total annual production is 3,500 pounds of air-dry material per acre in favorable growth years and 2,000 pounds of air-dry material per acre in

Figure 10.—An area of Tuscawilla fine sand in the Wetland Hardwood Hammock range site.

unfavorable growth years when the site is in excellent range condition. The relative percentage of annual vegetative production, by weight, is approximately 40 percent grasses and grasslike plants, 20 percent forbs, and 40 percent woody plants and trees. Riviera, Tuscawilla, and Winder soils are in this range site (fig. 10).

The *Upland Hardwood Hammock* range site is generally in nearly level to gently rolling, moderately well drained to excessively drained areas. It generally consists of a diverse forest canopy consisting of live oak, laurel oak, water oak, hickory, magnolia, and gums. Indiangrass, switchgrass, purple top, and various bluestem and panicum grasses represent the major desirable native forage species growing on this site when the site is in excellent condition. Uncontrolled grazing tends to reduce the availability of desirable forage species. Unpalatable species, such as

broomsedge, pineland threeawn, blackberry, and sedges, become dominant on sites that are in poor condition. The total annual production is 4,500 pounds of air-dry material per acre in favorable growth years and 2,500 pounds of air-dry material per acre in unfavorable growth years when the site is in excellent range condition. The relative percentage of annual vegetative production, by weight, is approximately 50 percent grasses and grasslike plants, 20 percent forbs, and 30 percent woody plants and trees. Adamsville, Bulow, and Cocoa soils are in this range site.

The *Salt Marsh* range site is generally on level, low-energy, tidal influenced soils. It generally consists of a treeless, herbaceous ecosystem. Smooth cordgrass, big cordgrass, marshhay cordgrass, seashore dropseed, seashore paspalum, and seashore saltgrass represent the major desirable native forage species growing on this site when the site is in excellent condition. Uncontrolled grazing tends to reduce the availability of desirable forage species. Unpalatable species, such as black needlerush, sawgrass, glasswort, sea pursland, and Baccharis, become dominant on sites that are in poor condition. The total annual production is 8,000 pounds of air-dry material per acre in favorable growth years and 4,000 pounds of air-dry material per acre in unfavorable growth years when the site is in excellent range condition. The relative percentage of annual vegetative production, by weight, is approximately 90 percent grasses and grasslike plants, 5 percent forbs, and 5 percent woody plants and trees. Turnbull and Pellicer soils are in this range site.

Woodland Management and Productivity

Kurt Stoughton, Flagler County forester, Florida Division of Forestry, helped prepare this section.

An understanding of the influence that soils have on forestry productivity can increase the capability of woodland owners and managers to make optimal silvicultural and economic decisions. The relationship between soils and the species suitability, growth potential, and forest operations is examined later in this section.

Woodland makes up 253,000 acres, or about 80 percent of the area in Flagler County (fig. 11). Private forest industry controls about 150,000 acres, most of which is under intensive management for pulpwood and sawtimber products. These areas are either corporately owned or are under long-term lease from other private owners *(6)*.

Most of the woodland in the county is on EauGallie, Immokalee, Myakka, Pineda, Pomona, Riviera, Wabasso, Smyrna, and Winder soils of the flatwoods. Slash pine is the most widely planted species on these soils. Loblolly pine, however, is also planted, especially in areas of soils that have a shallow, loamy or clayey subsoil. Longleaf pine also occurs naturally in the flatwoods. It was once the dominant species because it is well adapted to the frequent fires that occurred throughout the Southern Pine Forest. It is currently being planted, to some extent, on moderately well drained to excessively drained soils.

Sand pine is grown commercially on very droughty, sandy soils, including Astatula, Orsino, Pomello, and Paola soils. Slash pine, longleaf pine, loblolly pine, sand pine, pond pine, and cypress are the coniferous tree species that are actively harvested. The hardwood species that are harvested include red maple, sweetbay, sweetgum, and loblolly bay. Most of the hardwood timber is harvested from depressions, sloughs, and drainageways.

Forestry has traditionally influenced the economic development of Flagler County. This influence is currently evident in the thriving local forest industry. The wood products produced by the mills and businesses in Flagler County and surrounding counties include paper, mulch, plywood, lumber, trusses, crates, furniture, wood chips, and fuel wood. The strong market for forest resources has encouraged the intensive management of these resources. However, many opportunities still exist for increasing the productivity of the woodland, especially on the many privately owned, nonindustrial properties that have stocking levels which are lower than optimal.

Forestry practices focus on the elimination of cull or weed trees and the reduction of acreage that is understocked with preferred timber species. In the flatwoods, these goals frequently are accomplished by clear cutting, intensive site preparation, and replanting with an appropriate commercial pine species. Seeding and natural regeneration methods also are utilized in reforestation. Long-term, multiple-use management of the forest resources and the reforestation of harvested or idle lands will be a continuing requirement for the woodland in Flagler County.

The optimal growth rate of the commercial pine species is encouraged by reducing the stress of plant competition. Prescribed burning reduces competition from undesirable hardwoods, reduces dangerous fuel levels, and improves accessibility, aesthetics, and wildlife habitat. Thinning reduces excessive competition between the pines, eliminates diseased or poorly formed trees, and increases the amount of light reaching the grass and herbaceous understory growth, thus improving the habitat for wildlife and cattle. On sites in the flatwoods, where excessive water may cause seedling mortality or limited growth, planting on a prepared soil bed may be necessary. Several factors

Figure 11.—A slash pine plantation in an area of Valkaria-Smyrna complex. These 15-year old trees, which remain after the area was thinned for pulpwood, will be harvested for plywood veneer.

that influence the soil productivity include the ability of the soil to provide water and nutrients and the amount of root development allowed by the physical qualities of the soil and the depth to the water table. A consideration of these soil factors will provide a fundamental basis for many of the timber management decisions facing the woodland owner and manager. These factors are further examined for each woodland grouping in the following paragraphs. Additional information on timber management is available from the Natural Resources Conservation Service, the Florida Division of Forestry, and the Florida Cooperative Extension Service.

This soil survey can be used by woodland managers planning ways to increase the productivity of forest land. Some soils respond better to applications of fertilizer than others, and some are more susceptible to landslides and erosion after roads are built and timber is harvested. Some soils require special reforestation efforts. In the section "Detailed Soil Map Units," the description of each map unit in the survey area suitable for timber includes information about

productivity, limitations in harvesting timber, and management concerns in producing timber. The common forest understory plants also are listed. Table 5 summarizes this forestry information and rates the soils for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of the major soil limitations to be considered in forest management.

Table 5 lists the *ordination symbol* for each soil. The first part of the ordination symbol, a number, indicates the potential productivity of a soil for the indicator species in cubic meters per hectare. The larger the number, the greater the potential productivity. Potential productivity is based on the site index and the point where mean annual increment is the greatest.

The second part of the ordination symbol, a letter, indicates the major kind of soil limitation affecting use and management. The letter *W* indicates a soil in which excessive water, either seasonal or year-round, causes a significant limitation. The letter *T* indicates a soil that has, within the root zone, excessive alkalinity or acidity, sodium salts, or other toxic substances that limit the development of desirable trees. The letter *D* indicates a soil that has a limitation because of a restricted rooting depth, such as a shallow soil that is underlain by hard bedrock, a hardpan, or other layers that restrict roots. The letter *S* indicates a dry, sandy soil. The letter *A* indicates a soil that has no significant limitations affecting forest use and management. If a soil has more than one limitation, the priority is as follows: W, T, D, and S.

Ratings of the *erosion hazard* indicate the probability that damage may occur if site preparation or harvesting activities expose the soil. The risk is *slight* if no particular preventive measures are needed under ordinary conditions; *moderate* if erosion-control measures are needed for particular silvicultural activities; and *severe* if special precautions are needed to control erosion for most silvicultural activities. Ratings of moderate or severe indicate the need for construction of higher standard roads, additional maintenance of roads, additional care in planning harvesting and reforestation activities, and the use of special equipment.

Ratings of *equipment limitation* indicate limits on the use of forest managment equipment, year-round or seasonal, because of such soil characteristics as slope, wetness, stoniness, and susceptibility of the surface layer to compaction. As slope gradient and length increase, it becomes more difficult to use wheeled equipment. On the steeper slopes, tracked equipment is needed. On the steepest slopes, even tracked equipment cannot be operated and more sophisticated systems are needed. The rating is *slight* if equipment use is restricted by wetness for less than 2 months and if special equipment is not needed. The rating is *moderate* if slopes are so steep that wheeled equipment cannot be operated safely across the slope, if wetness restricts equipment use from 2 to 6 months per year, if stoniness restricts the use of ground-based equipment, or if special equipment is needed to prevent or minimize compaction. The rating is *severe* if slopes are so steep that tracked equipment cannot be operated safely across the slope, if wetness restricts equipment for more than 6 months per year, if stoniness restricts the use of ground-based equipment, or if special equipment is needed to prevent or minimize compaction. Ratings of moderate or severe indicate a need to choose the best suited equipment and to carefully plan the timing of harvesting and other management activities.

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

Ratings of *windthrow hazard* indicate the likelihood that trees will be uprooted by the wind. A restricted rooting depth is the main reason for windthrow. The rooting depth can be restricted by a high water table, a fragipan, or bedrock or by a combination of such factors as wetness, texture, structure, and depth. The risk is *slight* if strong winds cause trees to break but do not uproot them; *moderate* if strong winds cause an occasional tree to be blown over and many trees to break; and *severe* if moderate or strong winds commonly blow trees over. Ratings of moderate or severe indicate that care is needed in thinning or that the stand should not be thinned at all. Special equipment may be needed to prevent damage to shallow root systems in partial cutting operations. A

plan for the periodic removal of windthrown trees and the maintenance of a road and trail systems may be needed.

Ratings of *plant competition* indicate the likelihood of the growth or invasion of undesirable plants. Plant competition is more severe on the more productive soils, on poorly drained soils, and on soils having a restricted root zone that holds moisture. The risk is *slight* if competition from undesirable plants hinders adequate natural or artificial reforestation but does not necessitate intensive site preparation and maintenance. The risk is *moderate* if competition from undesirable plants hinders natural or artificial reforestation to the extent that intensive site preparation and maintenance are needed. The risk is *severe* if competition from undesirable plants prevents adequate natural or artificial reforestation unless the site is intensively prepared and maintained. A moderate or severe rating indicates the need for site preparation to ensure the development of an adequately stocked stand. Managers must plan site preparation measures to ensure reforestation without delays.

The *potential productivity* of *common trees* on a soil is expressed as a *site index* and a *volume* number. Common trees are listed in the order of their observed general occurrence. Generally, only two or three tree species dominate. The first tree listed for each soil is the indicator species for that soil. An indicator species is a tree that is common in the area and that is generally the most productive on a given soil.

The *site index* is determined by taking height measurements and determining the age of selected trees within stands of a given species. This index is the average height, in feet, that trees attain in a specified number of years. This index applies to fully stocked, even-aged, unmanaged stands.

The *productivity class* is the yield likely to be produced by the most important trees, expressed in cubic meters per hectare per year calculated at the age of culmination of mean annual increment. Cubic meters per hectare can be converted to cubic feet per acre by multiplying by 14.3. It can be converted to board feet by multiplying by a factor of about 71. For example, a productivity class of 8 means the soil can be expected to produce 114 cubic feet per acre per year at the age of culmination of mean annual increment, or about 568 board feet per acre per year. Cubic feet per acre can be converted to cords per acre by dividing by 85.

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

Windbreaks and Environmental Plantings

Windbreaks protect crops, livestock, buildings, and yards from wind and blowing sand. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Planting several rows of low- and high-growing broadleaf and coniferous trees and shrubs around field borders and planting intermittent rows of small grain among crops provide the most protection from the wind.

Field windbreaks and field windstrips are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. Windbreaks generally consist of two to four rows of slash pine, loblolly pine, or redcedar trees that are planted around field borders. Field windstrips generally consist of intermittent rows of rye or sorghum that are planted among row crops, such as watermelons and tobacco. The interval depends on the erodibility of the soil and the crop being grown. The combination of field wind rows and windstrips helps to protect young crops from the sandblasting effects of blowing topsoil, minimizes the loss of topsoil, and provides food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and help to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition. Irrigation and mulching may be needed on some of the more droughty soils.

Additional information about planning windbreaks, windstrips, and screens and about planting and caring for trees and shrubs can be obtained from the local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from local nurseries.

Recreation

The mild climate and the wide variety of recreational facilities available throughout Flagler County attract many people to the area. The beautiful beaches along the Atlantic Ocean, such as the Flagler Beach area, are extremely popular. As the population of the county rapidly increases, the need for more outdoor recreational facilities and cultural attractions continues to grow. The knowledge of soil properties is valuable when planning and selecting sites for additional recreational areas.

Hunting is a very popular activity, not only for local enthusiasts but also for sportsmen who travel great distances to hunt in the county. Also, the hunters often camp in the area, and numerous hunting camps and privately operated campgrounds are maintained throughout the county. Sport-fishing, both for freshwater and saltwater species, is very popular. The numerous creeks, ponds, and shallow lakes and the Atlantic Ocean provide a diversity of opportunities for anglers. The Atlantic Ocean and the Inland Waterway support saltwater fishing, while Dead Lake and Crescent Lake are noted for their freshwater fishing opportunities. Boating is a common activity in the county.

In table 6, the soils of the survey area are rated according to the limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 6, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 6 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 9 and interpretations for dwellings without basements and for local roads and streets in table 8.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

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

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

John F. Vance, biologist, Natural Resources Conservation Service, helped prepare this section.

Wildlife is a valuable natural resource in Flagler County. Although agriculture and urban development have significantly reduced the number of acres of wildlife habitat, extensive areas still support a large variety and number of wildlife species. These areas can be assigned to a distinct ecological community, based on the kind of animals and plants that inhabit and grow in the area *(21)*.

Game species include white-tailed deer, squirrel, turkey, dove, feral hogs, bobwhite quail, rail, and waterfowl. Nongame species include raccoon, rabbit, armadillo, opossum, skunk, bobcat, gray fox, red fox, otter, and a variety of songbirds, wading birds, shore birds, woodpeckers, reptiles, and amphibians.

Wildlife habitat is located throughout all parts of the

county except for those intensively developed areas. Relay Wildlife Management Area, located in the south-central part of Flagler County, includes 25,463 acres of mostly poorly drained flatwoods. This public hunting area is corporately owned by a major wood products company and is jointly managed for wildlife by the owner and the Florida Game and Freshwater Fish Commission. The salt marshes of the county are a particularly valuable part of the marine ecosystem.

Flagler County has numerous endangered or threatened species, ranging from the rare red-cockaded woodpecker and the indigo snake to more commonly known species, such as the alligator and wood stork. A complete list of such species, with detailed information on range and habitat, can be obtained from the local office of Natural Resources Conservation Service.

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

In table 7, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are bahiagrass, lovegrass, white clover, sweet clover, sesbania, and hairy vetch.

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

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

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

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are waxmyrtle and sawpalmetto.

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

sawgrass, saltgrass, cordgrass, rushes, sedges, and reeds.

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

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

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

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

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

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

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

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

Table 8 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or

site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

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

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, depth to a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 9 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 9 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and that good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, depth to a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

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

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly

level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 9 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, depth to a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

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

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

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

The ratings in table 9 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, depth to a water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction Materials

Table 10 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

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

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

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 10, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as limestone and dolomite, are not considered to be sand and gravel.

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

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

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

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

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

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

Water Management

Table 11 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features

include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

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

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

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

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

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

Soil Properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

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

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

Engineering Index Properties

Table 12 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

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

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

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

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

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

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated

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

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

Physical and Chemical Properties

Table 13 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence the shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

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

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

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

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

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

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The

classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

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

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

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are extremely erodible. Crops can be grown if intensive measures to control wind erosion are used.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loam, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 13, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Soil and Water Features

Table 14 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

of water transmission. Some soils in the survey area are assigned to two hydrologic soil groups. The dual grouping is used if the soils have a seasonal high water table and if the intake of water improves with drainage by at least 2 classes. The first letter in the dual grouping refers to the drained condition and the second letter to the undrained condition. Since management practices differ from site to site, it is recommended that site-specific investigations be made to determine the proper hydrologic group.

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

Table 14 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year). *Frequent* means that flooding occurs often under normal weather conditions (the chance of flooding is more than a 50 percent in any year). *Common* is used when the occasional and frequent classes are grouped for certain purposes. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. The water table in seven pedons, representing seven soil series, was measured twice a month during the course of the soil survey. The pedons were selected because they are typical of the series mapped in the county. They were as far removed as possible from any source of artificial drainage. Indicated in table 14 are the depth to the seasonal high water table; the kind of water table, that is, *perched* or *apparent*; and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 14. Table 15 shows the depth to the water table in selected soils.

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

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

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 14 shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be

needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

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

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

Physical, Chemical, and Mineralogical Analyses of Selected Soils

Dr. Mary E. Collins, professor, and Dr. Willie Harris, associate professor, Soil Science Department, University of Florida, helped prepare this section.

The parameters for the physical, chemical, and mineralogical properties of representative pedons sampled in Flagler County are presented in tables 16, 17, and 18. The analyses were conducted and coordinated by the Environmental Pedology and Land Use Laboratory, University of Florida, Gainesville, Florida. Detailed profile descriptions of the soils sampled and analyzed are given in alphabetical order in the section "Classification of the Soils." Laboratory data and profile information for additional soils sampled in Flagler County, as well as for other counties in Florida, are on file at the Soil Science Department, University of Florida.

The typical pedons were sampled from pits at carefully selected locations. The samples were air dried, crushed, and sieved through a 2-millimeter screen. Most of the analytical methods used are outlined in Soil Survey Investigations Report No. 1, revised July 1984.

Particle-size distribution was determined by a modified pipette method, using sodium hexametaphosphate as the dispersing agent. Hydraulic conductivity and bulk density were determined on undisturbed soil cores. Water-retention parameters were obtained from duplicate undisturbed soil cores placed in tempe pressure cells. Weight percentages of water retained at 1/10 bar and 1/3 bar were calculated from volumetric water percentages divided by the bulk density. Samples were oven dried and ground to pass a 2-millimeter sieve, and the 15-bar water retention was determined. The organic carbon content of the samples was determined by a modified Walkley-Black wet combustion method.

Extractable bases were determined by leaching the samples with 1.0 Normal ammonium acetate buffered at pH 7.0. Sodium and potassium in the extract obtained were determined by flame emission. Calcium and magnesium were determined by atomic absorption spectrophotometry. Extractable acidity was determined using the 0.5 Normal barium chloride - 0.2 Normal triethanolamine buffered at pH 8.2. Cation-exchange capacity was calculated by summation of extractable bases and extractable acidity. Base saturation is expressed as a percentage, using the ratio of extractable bases to cation-exchange capacity. The pH measurements were made with a glass electrode using a soil-water ratio of 1:1 soil-solution ratio. Electrical conductivity was determined using a conductivity bridge on the 1:1 soil-water mixtures.

Iron and aluminum ions were extracted from all Bt and Bh horizons using sodium-citrate dithionite extraction solution and determined by atomic absorption spectrophotometry. Iron, aluminum, and carbon were determined on all Bh horizons using 0.1 Molar sodium pyrophosphate solution. The iron and aluminum ions were determined using atomic absorption and the pyrophosphate carbon was determined using the modified Walkley-Black wet combustion method.

Mineralogy performed on the .002 millimeter size fraction was obtained with the use of X-ray diffraction. The peaks are measured at various angstrom positions identifying the various clay minerals, such as kaolinite, montmorillonite, quartz, and others. The peaks are measured, summed, and normalized to estimate the percent of soil minerals identified in the x-ray diffractograms. The percentages do not indicate absolute determined quantities of soil minerals but do imply a relative distribution of minerals in a particular mineral suite. Absolute percentages would require additional knowledge of particle size, crystallinity, unit structure substitution, and matrix characteristics.

Physical Properties

The results of physical analyses are shown in table 16. Most of the soils in Flagler County are inherently sandy; however, some of the pedons have an argillic horizon in the lower part of the solum. With the exception of Gator and Favoretta soils, all of the soils sampled contain 90 percent sand in one or more horizons. Astatula, Adamsville, Cassia, Orsino, Paola, Pomello, Smyrna, Tavares, and Valkaria soils contain 90 percent or more sand in each horizon to a depth of 80 inches. Most of these soils contain more than 95 percent sand. The soils sampled that have less than 90 percent sand in a horizon from a depth of 40 to 80 inches are the Bimini, Bulow, Favoretta, Gator, Myakka,

Pineda, Pomona, Riviera, and Wabasso soils. Most of the finer textured material was found in the deeper horizons, with the exception of the Favoretta soils, where the content of clay was greater than 40 percent throughout the entire soil. Bulow, Favoretta, Gator, and Riviera soils were the only soils that have greater than 20 percent clay in one or more horizons.

The content of clay in these soils generally is less than 5 percent. The content of clay in the deeper argillic horizons ranges from 13.4 percent in the Pineda soils to 55.8 percent in the Favoretta soils.

The content of silt was less than 10 percent in all soils sampled, with the exception of the Favoretta and Gator soils, where it was as high as 33.1 percent in one horizon of the Favoretta series.

Most of the soils sampled are dominated by fine sand, with the exception of the Bimini and Bulow soils, where the amount of sand is relatively high. Every soil sampled had at least one horizon that contained more than 75 percent fine sand, with the exception of the Bimini, Bulow, Favoretta, Gator, Paola, Pineda, Pomona, Riviera, Valkaria, and Wabasso soils. Bulow soils have more than 50 percent sand in at least one horizon. Coarse sand is less than 10 percent in all of the soils except for the Bimini, Bulow, and Paola soils. All of the soils contained 1 percent or less coarse sand, except for the Bimini, Bulow, Paola, Pomona, Valkaria, and Wabasso soils. Very coarse sand is generally rare in Florida soils. In Flagler County, the content of very coarse sand is not more than 2 percent in any of the soils sampled except in the lowest horizon of the Bimini soil. A common characteristic of these sandy soils is droughtiness, particularly in those soils that are well drained and excessively drained.

The hydraulic conductivity values exceeded 40 centimeters per hour in at least one horizon in all of the soils with the exception of the Favoretta, Myakka, Pineda, Pomona, Riveria, and Wabasso soils. In contrast, the hydraulic conductivity in the argillic horizons rarely exceeded 1 centimeter per hour. Low hydraulic conductivity values at a shallow depth in soils can affect the design and function of septic tank absorption fields. Low hydraulic conductivity values also are recorded for spodic horizons in the Bimini, Cassia, Pomello, Pomona, and Wabasso soils, but values are higher in the Smyrna soil. The available water for plants can be estimated from the bulk density and water data. The excessively sandy soils, such as the Adamsville, Astatula, Orsino, Paola, and Tavares soils, retain very low amounts of available water for plants; conversely, soils such as the Favoretta soils have a high content of fine-textured material and retain much larger amounts of available water.

Chemical Properties

Chemical analyses, presented in table 17, indicate that most of the soils in the county have a relatively low amount of extractable bases. The sum of extractable calcium, magnesium, sodium, and potassium exceeds 3 milliequivalents per 100 grams in only two of the surface horizons sampled. These horizons were found to be in the only two surface horizons sampled. They were found in the Favoretta and Gator series. The sum of extractable cations was greater than 25 milliequivalents per 100 grams in the Favoretta soils and greater than 75 milliequivalents per 100 grams in the Gator soils. Only the subsurface horizons in the Bimini, Bulow, Favoretta, Gator, and Riveria soils were greater than 10 milliequivalents per 100 grams. Numerous series sampled had less than 1 milliequivalent per 100 grams extractable bases in every horizon. These series include the Adamsville, Astatula, Cassia, Orsino, Pomello, Smyrna, and Tavares series. Bulow, Myakka, Paola, Pomona, and Valkaria soils were found to have one or two horizons with extractable bases exceeding 1 milliequivalent per 100 grams. The relatively mild, humid climate in Flagler County results in the depletion of basic soil cations (calcium, magnesium, sodium, and potassium) through leaching.

Generally, calcium was the dominant base, followed by much smaller amounts of magnesium. This situation was true in all of the soils, except for the Myakka, Pomona, and Smyrna soils. Sodium was very low, less than 1 milliequivalent per 100 grams, in all horizons of all soils except for the Favoretta and Gator soils. The extractable potassium content is less than 0.1 milliequivalents per 100 grams in the Adamsville, Astatula, Cassia, Myakka, Orsino, Paola, Pineda, Pomello, Pomona, Smyrna, Tavares, Valkaria, and Wabasso soils. All of the soils except the Favoretta and Gator soils had at least one horizon that did not have extractable potassium.

Cation-exchange capacity, an indicator of plant nutrient-holding capacity, exceeds 5 milliequivalents per 100 grams in the surface horizons of all soils except for the Adamsville, Astatula, Bulow, Pineda, Pomello, Tavares, and Valkaria soils. Cation-exchange capacity was greater than 10 milliequivalents per 100 grams in the surface horizons of the Favoretta, Gator, Myakka, Riveria, and Wabasso soils. Cation-exchange capacity is almost entirely a result of the amount and kind of clay present and the amount of organic matter present. The cation-exchange capacities in the Bt horizons range from 10.98 milliequivalents per 100 grams in the Pomona soils to 15.33 milliequivalents per 100 grams in the Wabasso soils. In the Bh horizons, the cation-

exchange capacity ranged from 10.41 to 36.15 milliequivalents per 100 grams in the Smyrna soils. Those soils that have a very low cation-exchange capacity, such as Adamsville sand, require only a small amount of lime to alter the base status of the soil and the soil reaction in the surface horizon. Soils that have low soil fertility generally have low values for extractable bases and a low cation-exchange capacity. Fertile soils generally have a high extractable base value, a high cation-exchange capacity, and a high percent base saturation.

Organic carbon values greater than 1 percent were found in the surface horizons of the Bimini, Cassia, Favoretta, Gator, Myakka, Orsino, Paola, Pomona, Riveria, Smyrna, and Wabasso soils. Organic carbon values in the pedons were generally found to be less than 2 percent with the exception of the Gator, Myakka, Pomona, and Riveria soils. Significant increases occur in the Bh horizon of the Bimini, Cassia, Myakka, Smyrna, Pomello, Pomona, and Wabasso soils. The highest organic carbon values were found in the Gator series. The organic carbon content in the surface horizon is directly related to soil nutrient and water retention characteristics. Management practices that conserve and maintain organic carbon are very desirable.

Electrical conductivity in the pedons sampled was found to be more than 0.1 millimhos per centimeter in all horizons of the Favoretta soils, below 30 inches in the Bimini soils, in the surface and Bh horizons of the Pomona soils, in the surface horizon of the Riviera soils, in the Bh horizon of the Smyrna soils, and in the C horizon of the Valkaria soils. All of the other pedons tested showed very low electrical conductivities. These data indicate that the soluble salt content in Flagler County is insufficient to detrimentally affect the growth of plants that are sensitive to salt.

Reaction of soil in water mostly ranged between pH 4.0 to 6.0. Higher values were recorded in one or more horizons of the Bimini, Bulow, Gator, Favoretta, and Riveria soils. Lower values were recorded in one or more horizons of the Bimini, Cassia, Myakka, Orsino, Pomello, Pomona, and Smyrna soils. Reaction is generally 0.5 to 1.5 pH units lower in calcium chloride and potassium chloride solutions than in water. The maximum plant nutrition availability is generally attained when soil reaction is in the range of pH 6.5 to 7.0. For most of the crops growing in Florida, however, maintaining the reaction of strongly acid soils in excess of pH 6.0 is usually not economically feasible.

Sodium pyrophosphate extractable iron ranged from 0.00 percent in the Cassia, Pomello, and Smyrna soils to 0.20 percent in the Bimini soils. Sodium pyrophosphate extractable aluminum ranged from 0.04 percent in the Pomello soils to 0.22 percent in the Smyrna soils. Sodium pyrophosphate extractable carbon ranged from 0.90 percent in the Bimini soils to 3.34 percent in the Pomona soils. The ratio of sodium pyrophosphate extractable carbon and aluminum to clay in the Bh horizons of the Myakka, Pomello, Pomona, Smyrna, and Wabasso soils is sufficient to meet the chemical criteria for spodic horizons. Pyrophosphate extractable iron and aluminum were insufficient to meet the spodic horizon criteria for Bimini and Cassia soils.

Iron extracted by citrate-dithionite ranged from 0.02 percent in the Pomona soils to 2.20 percent in the Bimini soils. Aluminum extracted by citrate-dithionite ranged from 0.04 percent in one horizon of the Pineda soils to 0.87 percent in the spodic horizon of the Smyrna soils. The amount of citrate-dithionite extractable iron in the Bt horizon is generally larger than that in the Bh horizon. The amount of iron and aluminum in the soils in the county is not sufficient to detrimentally affect the availability of phosphorus.

Mineralogical Properties

The mineralogy of the sand fraction (2 to 0.05 millimeters) was not determined, but in Florida it is consistently dominated by quartz, thus making it siliceous. Small amounts of heavy minerals also are present in some pedons and are found mainly in the very fine sand fraction. Otherwise, no weatherable minerals were observed. The crystalline mineral components of the clay fraction (less that 0.002 millimeters) are reported in table 18 for selected horizons of the pedons sampled. The mineralogical suite for Flagler County is composed of montmorillonite, 14-hydroxyinterlayered vermiculite, 14-angstrom intergrade, kaolinite, and quartz.

Montmorillonite was present in the Bimini, Favoretta, Gator, Myakka, Paola, Pineda, Pomello, Pomona, Riveria, Tavares, Valkaria, and Wabasso soils. Relatively large amounts (50 percent or more) of montmorillonite were found in the lower horizons (below a depth of 40 inches) of the Favoretta, Gator, Pineda, Riveria, and Wabasso soils. Kaolinite and the 14-angstrom intergrade mineral were found in all the pedons sampled. Clay-size quartz was also identified in all of the pedons sampled.

The general tendency to find increased amounts of montmorillonite in the deeper horizons indicates that this mineral was probably inherited. Montmorillonite is most stable in alkaline, minimally-leached soil environments, which are more likely to occur in deeper horizons. Montmorillonite in the surface horizons can be the result of aerosolic dust. Hydroxyinterlayered vermiculite, the weathering product of sedimentary mica, is widespread in soils in Florida. It tends to be

more prevalent in moderately acidic, relatively well drained conditions, although it occurs in a variety of soil environments. Generally, this mineral is mainly in the clay fractions of sand-grain coatings, whereas montmorillonite and kaolinite are more prevalent in finer textured argillic horizons. Kaolinite was likely inherited from the parent material as a colloidal component; however, it may have formed as a weathering product of other minerals. Kaolinite is relatively stable in the acidic environment of the soils in the county. The clay-size quartz is a result of weathering of the silt-size quartz found in the soil.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the county. The pedons are typical of the series and are described in the section "Soil Series and their Morphology." The soil samples were tested by the Florida Department of Transportation Soils Laboratory, Bureau of Materials and Research.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) *(1)* or the American Society for Testing and Materials (ASTM) *(2)*.

Table 19 contains engineering test data about some of the major soils in Flagler County. These tests help to evaluate the soils for engineering purposes. The classifications given are based on data obtained by mechanical analysis and by tests to determine liquid limits and plastic limits.

The mechanical analyses were made by a combined sieve and hydrometer method. In this method, the various grain-size fractions are calculated on the basis of all the material in the soil sample, including that material coarser than 2 millimeters in diameter. The mechanical analyses used in this method should not be used in naming textural classes of soils.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of the soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from a semisolid to a plastic state, and the liquid limit is the moisture content at which the soil material changes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range in moisture content within which a soil material is plastic. The data on liquid limit and plasticity index in table 19 are based on laboratory tests of soil samples.

Compaction, or moisture-density, data are important in earthwork. If soil material is compacted at a successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, density decreases and the moisture content increases. The highest dry density obtained in the compactive test is called the maximum dry density. As a rule, the maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(20)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or on laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquods (*Hapl*, meaning minimal horizonation, plus *aquod*, the suborder of the Spodosols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquods.

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

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

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(22)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(20)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

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

Adamsville Series

The Adamsville series consists of very deep, somewhat poorly drained soils that formed in thick sandy marine sediments. These soils are on low knolls,

broad elevated flats, and lower ridge slopes in the flatwoods. Slopes range from 0 to 3 percent. Adamsville soils are hyperthermic, uncoated Aquic Quartzipsamments.

Adamsville soils are geographically associated with Astatula, Cassia, Orsino, and Tavares soils. Astatula soils are excessively drained. Cassia soils have a spodic horizon. Orsino soils have a high-chroma Bw horizon. Orsino and Tavares soils are moderately well drained. Astatula, Orsino, and Tavares soils generally are in higher positions on the landscape.

Typical pedon of Adamsville fine sand, 0 to 3 percent slopes, about 1,200 feet north and 500 feet west of the southeast corner of sec. 9, T. 10 S., R. 30 E.

A—0 to 7 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; common fine and medium roots; many uncoated sand grains; very strongly acid; abrupt wavy boundary.
C1—7 to 22 inches; very pale brown (10YR 7/4) fine sand; single grained; loose; few fine, medium, and coarse roots; few medium pockets of charcoal; very strongly acid; gradual wavy boundary.
C2—22 to 34 inches; very pale brown (10YR 7/3) fine sand; common coarse distinct yellowish brown (10YR 5/6) and yellow (10YR 7/6) mottles; single grained; loose; few fine, medium, and coarse roots; few medium pockets of light gray (10YR 7/2) fine sand; very strongly acid; gradual wavy boundary.
C3—34 to 57 inches; light gray (10YR 7/2) fine sand; common coarse distinct yellowish brown (10YR 5/6) and few medium distinct red (2.5YR 4/6) mottles; single grained; loose; very strongly acid; gradual wavy boundary.
C4—57 to 80 inches; light gray (10YR 7/2) fine sand; common coarse distinct brown (7.5YR 5/2) mottles; single grained; loose; very strongly acid.

Reaction ranges from very strongly acid to mildly alkaline. The texture is sand or fine sand throughout the profile.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. Thickness ranges from 3 to 10 inches.

The C horizon has hue of 10YR, value of 5 to 8, and chroma of 1 to 4.

Astatula Series

The Astatula series consists of very deep, excessively drained soils that formed in thick sandy marine sediments. These soils are on the Atlantic Coastal Ridge and the ridges and knolls of the Atlantic Ridge. Slopes range from 0 to 8 percent. Astatula soils are hyperthermic, uncoated, Typic Quartzipsamments.

Astatula soils are geographically associated with Adamsville, Paola, Pomello, and Tavares soils. Adamsville soils are in lower positions on the landscape and are somewhat poorly drained. Paola soils have a light-colored E horizon. Tavares soils are in lower positions on the landscape and are moderately well drained. Pomello soils are in lower positions on the landscape, have a spodic horizon, and are moderately well drained.

Typical pedon of Astatula fine sand, 0 to 8 percent slopes, about 1,200 feet north and 600 feet west of the southeast corner of sec. 9, T. 10 S., R. 30 E.

A—0 to 7 inches; dark grayish brown (10YR 4/2) fine sand; single grained; loose; common fine and medium and few coarse roots; few pockets of gray (10YR 6/1) uncoated sand grains; very strongly acid; clear wavy boundary.
C1—7 to 29 inches; very pale brown (10YR 7/4) fine sand; single grained; loose; few fine and medium roots; many uncoated sand grains; pockets of charcoal 2 to 5 centimeters in diameter; very strongly acid; gradual wavy boundary.
C2—29 to 54 inches; very pale brown (10YR 8/4) fine sand; single grained; loose; few fine and medium roots; many uncoated sand grains; very strongly acid; gradual wavy boundary.
C3—54 to 80 inches; very pale brown (10YR8/3) fine sand; single grained; loose; few fine roots; dark brown (10YR 4/3) stains along root channels; pockets of charcoal 2 to 5 centimeters in diameter; very strongly acid.

Reaction ranges from very strongly acid to slightly acid, except in limed areas.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. Thickness ranges from 2 to 7 inches.

The C horizon has hue of 7.5YR or 10YR, value of 5 to 8, and chroma of 3 to 8. It may or may not have light gray or white pockets or streaks of uncoated sand grains. The texture is sand or fine sand.

Basinger Series

The Basinger series consists of very deep, very poorly drained soils that formed in sandy marine sediments. These soils are in depressions in the flatwoods. Slopes are less than 1 percent. Basinger soils are siliceous, hyperthermic Spodic Psammaquents.

Basinger soils are geographically associated with Hontoon, Immokalee, Myakka, Placid, Samsula, Smyrna, and St. Johns soils. Hontoon and Samsula soils have an organic horizon more than 16 inches thick. Immokalee, Myakka, Smyrna, and St. Johns soils

have a spodic horizon. Additionally, Immokalee, Myakka, and Smyrna soils are in higher positions in the landscape. Placid soils have a dark A horizon that is 10 or more inches thick.

Typical pedon of Basinger fine sand, in an area of Placid, Basinger, and St. Johns soils, depressional; 1.4 miles east of the intersection of State Road 100 and County Road 205, 1.3 miles north of State Road 100, about 2,000 feet south and 100 feet west of the northeast corner of sec. 1, T. 12 S., R. 29 E.

A—0 to 2 inches; black (10YR 2/1) fine sand; weak fine granular structure; very friable; few fine, medium, and coarse roots; very strongly acid; clear smooth boundary.
E1—2 to 15 inches; light gray (10YR 7/1) fine sand; single grained; loose; few medium and coarse roots; strongly acid; gradual wavy boundary.
E2—15 to 29 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; strongly acid; gradual wavy boundary.
Bh/E—29 to 50 inches; dark yellowish brown (10YR 4/4) (Bh) and grayish brown (10YR 5/2) (E) fine sand; single grained; loose; strongly acid; gradual wavy boundary.
C—50 to 80 inches; pale brown (10YR 6/3) fine sand; single grained; loose; strongly acid.

Reaction of this soil ranges from extremely acid to strongly acid in the A and E horizons, from extremely acid to moderately acid in the Bh/E horizon, and from very strongly acid to moderately acid in the C horizon.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. Thickness ranges from 2 to 8 inches.

The E horizon and the E part of the Bh/E horizon have hue of 10YR, value of 5 to 7, and chroma of 1 to 3. Thickness ranges from 7 to 29 inches. The texture is sand or fine sand.

The Bh part of the Bh/E horizon has hue of 10YR, value of 3, and chroma of 1 to 4 or has value of 4 and chroma of 3 or 4. Thickness ranges from 6 to 23 inches. The texture is sand or fine sand.

The C horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 4. The texture is sand or fine sand.

Bimini Series

The Bimini series consists of very deep, somewhat poorly drained soils that formed in sandy and loamy marine sediments. These soils are on low, elongated, narrow to broad ridges parallel to the Atlantic Ocean. Slopes range from 0 to 2 percent. Bimini soils are sandy, siliceous, hyperthermic Arenic Ultic Haplohumods.

Bimini soils are geographically associated with Bulow, Cocoa, EauGallie, Narcoossee, Pellicer, Pomello, Turnbull, Wabasso, and Welaka soils. Bulow, Cocoa, Pomello, and Welaka soils are in higher positions on the landscape, are better drained, and, except for the Pomello soils, do not have a spodic horizon. Pomello soils do not have shells in the substratum. Narcoossee soils have a thin, discontinuous spodic horizon. EauGallie and Wabasso soils are poorly drained and do not have shells in the substratum. Pellicer and Turnbull soils are very poorly drained soils in the salt marsh, and they are subject to tidal flooding.

Typical pedon of Bimini sand, 2 miles north of the intersection of State Road 100 and Roberts Road, 25 feet west of Roberts Road, 2,800 feet south and 3,000 feet east of the northwest corner of sec. 35, T. 11 S., R. 31 E.

A—0 to 6 inches; gray (10YR 5/1) sand; single grained; loose; many fine, medium, and coarse roots; extremely acid; gradual wavy boundary.
E—6 to 28 inches; light gray (10YR 7/1) sand; single grained; loose; common fine and medium roots; very dark grayish brown (10YR 3/2) stains along root channels; extremely acid; gradual wavy boundary.
BE—28 to 32 inches; dark grayish brown (10YR 4/2) sand; single grained; loose; few fine and medium roots; very dark grayish brown (10YR 3/2) stains along root channels; extremely acid; clear wavy boundary.
Bh—32 to 41 inches; very dark brown (10YR 2/2) sand; moderate medium granular structure; friable; very weakly cemented in about 60 percent of the lower third of the horizon; very strongly acid; clear wavy boundary.
Bt—41 to 46 inches; dark brown (10YR 3/3) sandy loam; common medium distinct reddish brown (2.5YR 4/4) and common medium distinct olive (5Y 5/4) mottles; moderate medium subangular blocky structure; friable; very strongly acid; abrupt wavy boundary.
2C—46 to 80 inches; light gray (10YR 7/2) gravelly coarse sand containing about 30 percent coquina shell fragments up to ¼ inch in diameter; single grained; loose; neutral.

The thickness of the solum ranges from 35 to 75 inches. Reaction ranges from extremely acid to strongly acid in the A, E, and Bh horizons and from very strongly acid to neutral in the Bt horizon. The 2C horizon is neutral or mildly alkaline.

The A horizon has hue of 10YR, value of 2 to 5, and chroma of 1 or 2.

The E horizon has hue of 10YR, value of 5 to 7, and

chroma of 1 or 2. The texture is sand or fine sand.

The BE horizon, if it occurs, has hue of 10YR, value of 3 to 5, and chroma of 1 to 4. It does not meet the requirements for a spodic horizon. The texture is sand, fine sand, or loamy fine sand.

The Bh horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3. The texture is sand, fine sand, or loamy fine sand.

The Bt horizon has hue of 10YR, value of 3 or 4, and chroma of 3 or 4; hue of 10YR, value of 5, and chroma of 2 to 6; hue of 7.5YR, value of 6, and chroma of 6; or hue of 5YR, value of 4, and chroma of 4. The texture is sandy loam, fine sandy loam, or sandy clay loam.

The 2C horizon has hue of 10YR, value of 6 to 8, and chroma of 1 to 3. The texture is gravelly coarse sand, sand, or fine sand. In some pedons the shell fragments and sand are stratified.

Bulow Series

The Bulow series consists of deep, well drained soils that formed in sandy and loamy marine sediments that are underlain by coquina limestone. These soils are on discontinuous, narrow coastal ridges parallel to the Atlantic Ocean. Slopes range from 0 to 5 percent. Bulow soils are loamy, siliceous, hyperthermic Arenic Hapludalfs.

Bulow soils are geographically associated with Astatula, Bimini, Cocoa, Orsino, Paola, and Tuscawilla soils. Astatula, Paola, and Orsino soils are sandy to a depth of 80 inches or more. Orsino soils are moderately well drained. Bimini soils are somewhat poorly drained, are in lower positions on the landscape, and have a spodic horizon within 40 inches of the surface. Cocoa soils have coquina rock within a depth of 40 inches. Tuscawilla soils are in lower positions on the landscape and are poorly drained.

Typical pedon of Bulow sand, in an area of Cocoa-Bulow complex, 0 to 5 percent slopes; 1,800 feet north and 4,400 feet east of the southwest corner of sec. 22, T. 12 S., R. 31 E.

A—0 to 5 inches; dark grayish brown (10YR 4/2) sand; single grained; loose; many fine and medium and few coarse roots; many sand-sized organic particles; very strongly acid; clear wavy boundary.

E—5 to 20 inches; white (10YR 8/2) sand; common coarse distinct yellow (10YR 7/6) and few medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; few medium and coarse roots; few pockets of light gray (10YR 7/2) sand; few pockets of charcoal 1 inch in diameter; strongly acid; gradual wavy boundary.

Bw—20 to 50 inches; reddish yellow (7.5YR 6/6) sand; few coarse distinct yellowish red (5YR 5/8) mottles; single grained; loose; few fine, medium, and coarse roots; strongly acid; abrupt irregular boundary.

Bt—50 to 59 inches; yellowish red (5YR 4/6) sandy clay loam; medium coarse subangular blocky structure; friable; few fine and medium roots; few loose shells in the lower 2 inches of the horizon; slightly acid; abrupt irregular boundary.

2R—59 inches; coquina limestone that is pitted with solution holes.

The depth to limestone ranges from 40 to 60 inches but is more than 80 inches in the cavities of the solution holes. The depths vary within a short distance. Reaction ranges from very strongly acid to neutral in the A and E horizons and from strongly acid to neutral in the Bw and Bt horizons.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. Thickness ranges from 2 to 5 inches.

The E horizon has hue of 10YR, value of 5 to 8, and chroma of 1 or 2. The texture is sand or coarse sand. Thickness ranges from 9 to 25 inches.

The Bw horizon has hue of 7.5YR, value of 5 or 6, and chroma of 4 to 8. The texture is sand or coarse sand. Thickness ranges from 15 to 45 inches.

The Bt horizon has hue of 5YR, value of 4 to 6, and chroma of 6 to 8. The texture is sandy loam or sandy clay loam. Thickness ranges from 3 to 20 inches.

The 2R horizon is coquina rock, which consists of porous limestone. The rock is pitted at irregular intervals by vertical solution chambers and relic tree and root cavities. The horizons are often broken and irregular over these cavities. Sandy soil material from the overlying horizons fills the rock cavities.

Cassia Series

The Cassia series consists of very deep, somewhat poorly drained soils that formed in thick beds of sandy marine sediments. They are on low knolls and ridges that are slightly higher than the adjacent flatwoods. Slopes range from 0 to 2 percent. Cassia soils are sandy, siliceous, hyperthermic Typic Haplohumods.

Cassia soils are geographically associated with Adamsville, Myakka, Orsino, and Pomello soils. Adamsville soils do not have a spodic horizon. Myakka soils are in lower positions on the landscape and are poorly drained. Orsino soils have a high-chroma Bw horizon and are moderately well drained. Pomello soils have a spodic horizon below a depth of 30 inches and are moderately well drained.

Typical pedon of Cassia fine sand, about 400 feet north and 2,200 feet west of the southeast corner of sec. 19, T. 12 S., R. 31 E.

A—0 to 5 inches; very dark gray (10YR 3/1) fine sand; weak medium granular structure; very friable; few fine and medium roots; extremely acid; clear wavy boundary.
E1—5 to 12 inches; gray (10YR 5/1) fine sand; single grained; loose; few fine and medium roots; very strongly acid; abrupt smooth boundary.
E2—12 to 26 inches; white (10YR 8/1) fine sand; single grained; loose; common fine and medium roots; very strongly acid; abrupt smooth boundary.
Bh1—26 to 36 inches; very dark brown (10YR 2/2) fine sand; massive; firm; sand grains coated with organic matter; extremely acid; gradual irregular boundary.
Bh2—36 to 42 inches; dark yellowish brown (10YR 3/4) fine sand; weak fine granular structure; friable; few fine roots; sand grains coated with organic matter; extremely acid; gradual irregular boundary.
C1—42 to 69 inches; pale brown (10YR 6/3) fine sand; single grained; loose; few fine distinct dark brown (10YR 3/3) mottles; few fine roots; extremely acid; gradual wavy boundary.
C2—69 to 80 inches; light brownish gray (10YR 6/2) fine sand; single grained; loose; few medium distinct dark brown (7.5YR 4/2) mottles; few fine roots; extremely acid.

Reaction ranges from extremely acid to moderately acid in all horizons.

The A horizon has hue of 10YR and value of 3 to 5. Thickness ranges from 3 to 6 inches.

The E horizon has hue of 10YR, value of 5 to 8, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 8 to 27 inches.

The Bh horizon has hue of 5YR to 10YR, value of 2 to 4, and chroma of 1 to 4 or is neutral. The texture is sand or fine sand. Most of the sand grains are coated with organic matter. Thickness ranges from 3 to 20 inches.

Some pedons have an E horizon that has hue of 10YR, value of 5 to 8, and chroma of 1 to 4. The texture is sand, fine sand, or loamy fine sand. Thickness ranges from 10 to 35 inches.

Some pedons have a B'h horizon that has hue of 5YR to 10YR, value of 3 or 4, and chroma of 1 to 3. The texture is sand or fine sand. Thickness ranges from 5 to 25 inches.

The C horizon has hue of 7.5YR to 10YR, value of 4 to 7, and chroma of 1 to 4. The texture is sand or fine sand.

Chobee Series

The Chobee series consists of very deep, very poorly drained soils that formed in loamy alluvial sediments. These soils are in narrow to broad drainageways and on flood plains. These soils are frequently flooded for brief to very long periods during wet seasons. Slopes are dominantly less than 1 percent but range to 2 percent. Chobee soils are fine-loamy, siliceous, hyperthermic Typic Argiaquolls.

Chobee soils are geographically associated with Favoretta, Pineda, Riviera, Terra Ceia, Wabasso, and Winder soils. Favoretta and Winder soils are in similar positions in drainageways. Terra Ceia soils are on flood plains. Pineda, Riviera, and Winder soils are in higher positions on the landscape. Favoretta soils are clayey throughout. None of the other associated soils have a mollic epipedon. Pineda and Riviera soils have an argillic horizon below a depth of 20 inches. Wabasso soils have a spodic horizon. Terra Ceia soils formed in organic material.

Typical pedon of Chobee loamy fine sand, in an area of Favoretta, Chobee, and Winder soils, frequently flooded; 200 feet south and 300 feet west of the junction of Sixteen Mile Creek and Old Railroad Grade, about 2,300 feet south and 500 feet east of the northwest corner of sec. 26, T. 10 S., R. 28 E.

A1—0 to 6 inches; black (10YR 2/1) loamy fine sand; weak medium granular structure; friable; common medium and coarse roots; moderately acid; clear wavy boundary.
A2—6 to 10 inches; very dark gray (10YR 3/1) loamy fine sand; moderate medium granular structure; friable; common medium and coarse roots; moderately acid; clear wavy boundary.
Btg1—10 to 25 inches; dark gray (10YR 4/1) sandy clay loam; moderate medium subangular blocky structure; friable; few medium and fine roots; sand grains coated and bridged with clay; mildly alkaline; gradual wavy boundary.
Btg2—25 to 35 inches; gray (10Y 5/1) sandy clay loam; moderate medium subangular blocky structure; firm; few medium and fine roots; sand grains coated and bridged with clay; mildly alkaline; gradual wavy boundary.
Btg3—35 to 55 inches; gray (10YR 5/1) sandy clay loam; few medium distinct yellow (10YR 7/8) mottles; moderate medium subangular blocky structure; friable; few light gray calcium carbonate accumulations; moderately alkaline; gradual wavy boundary.
Cg—55 to 80 inches; gray (10YR 5/1) fine sandy loam; massive; slightly sticky; moderately alkaline.

The A horizon is moderately acid or slightly acid, and the Bt horizon is slightly acid to moderately alkaline. Some pedons have thin layers of muck on the surface.

The A horizon has hue of 10YR, value of 2 or 3, and

chroma of 1. Thickness ranges from 4 to 18 inches.

The upper part of the Btg horizon has hue of 10YR and value of 2 to 6. The lower part has hue of 10YR, value of 4 to 6, and chroma of 1 or 2 or has hue of 5Y, value of 5 or 6, and chroma of 2. The texture is fine sandy loam or sandy clay loam.

The Cg horizon has hue of 10YR, value of 4 to 7, and chroma of 1 or 2 or has hue of 5Y, value of 4 or 5, and chroma of 1 or 2. The texture is loamy sand, loamy fine sand, fine sandy loam, or sandy loam.

Cocoa Series

The Cocoa series consists of moderately deep, well drained soils that formed in fine marine eolian sediments and are underlain by coquina limestone. These soils are on discontinuous, narrow coastal ridges that are parallel to the Atlantic Ocean. Slopes range from 0 to 5 percent. Cocoa soils are sandy, siliceous, hyperthermic Psammentic Hapludalfs.

Cocoa soils are associated with Astatula, Bimini, Bulow, Orsino, Paola, and Tuscawilla soils. Astatula, Orsino, and Paola soils are sandy to a depth of 80 inches or more. Orsino soils are moderately well drained. Bimini soils are somewhat poorly drained, are in lower positions on the landscape, and have a spodic horizon. Bulow soils have coquina limestone at a depth of more than 40 inches. Tuscawilla soils are in lower positions on the landscape and are poorly drained.

Typical pedon of Cocoa sand, in an area of Cocoa-Bulow complex, 0 to 5 percent slopes; 1 mile north and 1,600 feet east of the intersection of Old Kings Road (County Road 2001) and the entrance road to Bulow Ruins State Historic Site, about 1,800 feet north and 4,600 feet east of the southwest corner of sec. 22, T. 12 S., R. 31 E.

A—0 to 3 inches; grayish brown (10YR 5/2) sand; single grained; loose; many fine and medium roots; slightly acid; abrupt wavy boundary.

E—3 to 16 inches; pale brown (10YR 6/3) sand; single grained; common fine and few medium roots; slightly acid; gradual wavy boundary.

Bw1—16 to 22 inches; reddish yellow (7.5YR 6/6) sand; single grained; loose; common coated sand grains; slightly acid; gradual wavy boundary.

Bw2—22 to 29 inches; reddish yellow (7.5YR 6/8) sand; single grained; loose; common coated sand grains; slightly acid; gradual wavy boundary.

Bt—29 to 35 inches; yellowish red (5YR 5/8) loamy sand; weak medium granular structure; very friable; sand grains coated and bridged with clay; neutral; abrupt irregular boundary.

R—35 inches; hard pale brown (10YR 6/3) coquina limestone pitted with solution chambers.

The depth to limestone ranges from 20 to 40 inches. The depths vary within a short distance. Reaction ranges from very strongly acid to neutral in the A and E horizons and from moderately acid to neutral in the Bw and Bt horizons.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 1 to 3. Thickness ranges from 4 to 12 inches.

The E horizon has hue of 10YR, value of 5 to 8, and chroma of 1 to 4. It is sand, fine sand, or loamy sand. Thickness ranges from 7 to 16 inches.

The Bw horizon has hue of 5YR, value of 4 to 7, and chroma of 6 to 8. It is sand, fine sand, or loamy sand. Thickness ranges from 4 to 14 inches.

The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 6 to 8. The texture is sand or loamy sand. Thickness ranges from 6 to 16 inches. Some pedons have carbonate nodules and shell fragments within this horizon.

The 2R horizon is coquina limestone. The rock is pitted at irregular intervals by vertical solution chambers and relict tree and root cavities. The horizons are often broken and irregular over these cavities.

EauGallie Series

The EauGallie series consists of very deep, poorly drained soils that formed in sandy and loamy marine sediments. These soils are in the flatwoods. Slopes are smooth and range from 0 to 2 percent. EauGallie soils are sandy, siliceous, hyperthermic Alfic Haplaquods.

EauGallie soils are geographically associated with Holopaw, Malabar, Pineda, Riviera, and Wabasso soils. Holopaw and Malabar soils do not have a spodic horizon. Pineda and Riviera soils do not have a spodic horizon and have an argillic horizon above a depth of 40 inches. Pineda soils have a Bw horizon. Wabasso soils have an argillic horizon above a depth of 40 inches.

Typical pedon of EauGallie fine sand, about 3,100 feet west and 1,200 feet north of the southeast corner of sec. 1, T. 12 S., R. 28 E.

A—0 to 6 inches; black (10YR 2/1) fine sand; weak medium granular structure; very friable; many fine and medium roots; many uncoated sand grains mixed with black organic matter; very strongly acid; clear smooth boundary.

E—6 to 22 inches; light gray (10YR 7/1) fine sand; few fine and medium roots; single grained; loose; very strongly acid; abrupt wavy boundary.

Bh1—22 to 28 inches; black (10YR 2/1) fine sand; weak medium subangular blocky structure; friable; sand grains coated with organic matter; moderately acid; gradual wavy boundary.

Bh2—28 to 33 inches; dark reddish brown (5YR 3/2)

fine sand; weak medium granular structure; very friable; sand grains coated with organic matter; moderately acid; gradual wavy boundary.

BE—33 to 45 inches; dark brown to brown (10YR 4/3) fine sand; single grained; loose; common medium dark brown (10YR 3/3) mottles; slightly acid; gradual wavy boundary.

E′—45 to 56 inches; light gray (10YR 7/2) fine sand; single grained; loose; slightly acid; abrupt wavy boundary.

Btg—56 to 70 inches; light gray (5Y 6/1) fine sandy loam; moderate medium subangular blocky structure; friable; slightly acid; gradual wavy boundary.

Cg—70 to 80 inches; light gray (5Y 6/1) loamy fine sand; lenses of fine sand and pockets of fine sandy loam; few medium distinct yellowish brown (10YR 5/6) mottles; massive; very friable; slightly acid.

Reaction of the soil ranges from very strongly acid to moderately acid in the A, E, and Bh horizons, from moderately acid or slightly acid in the BE horizon, and from very strongly acid to neutral in all other horizons.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1. Thickness ranges from 3 to 7 inches.

The E horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. Thickness of the E horizon ranges from 12 to 19 inches. The texture is sand or fine sand.

The Bh horizon has hue of 5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 9 to 31 inches.

The BE horizon, if it occurs, has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The texture is sand or fine sand. Thickness ranges from 0 to 24 inches.

The E′ horizon, if it occurs, has hue of 10YR, value of 5 to 7, and chroma of 1 to 3. The texture is sand or fine sand. Thickness ranges from 0 to 24 inches.

Some pedons have a loamy fine sand EB horizon above the Btg horizon. If it occurs, it has hue of 10YR, value of 5, and chroma of 1 or 2. Thickness ranges from 0 to 7 inches.

The Btg horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 to 3. It has none to common mottles in shades of yellow, brown, and gray. The texture is sandy loam, fine sandy loam, or sandy clay loam.

The Cg horizon, if it occurs, has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 to 3. The texture is sand, fine sand, or loamy fine sand.

Favoretta Series

The Favoretta series consists of very deep, very poorly drained soils that formed in clayey marine sediments with a high silt content. These soils are in narrow to broad flatwood areas near major streams and drainageways and on flood plains. They are subject to rare to frequent flooding. Slopes are dominantly less than 1 percent but range from 0 to 2 percent. Favoretta soils are fine, montmorillonitic, hyperthermic Typic Argiaquolls.

Favoretta soils are geographically associated with Chobee, Pineda, Riviera, Terra Ceia, Wabasso, and Winder soils. Chobee and Winder soils have a loamy argillic horizon at a depth of less than 20 inches and are in drainageways or on flood plains. Pineda and Riviera soils are in low flatwood positions. Pineda and Riviera soils have a loamy argillic horizon at a depth of 20 to 40 inches. Terra Ceia soils formed in organic material on flood plains. Wabasso soils have a spodic horizon at a depth of less than 30 inches over an argillic horizon at a depth of less than 40 inches. Wabasso soils are in slightly higher positions on the landscape.

Typical pedon of Favoretta clay, 2,900 feet south of the intersection of County Roads 304 and 305, about 4,000 feet west of County Road 305, about 200 feet south and 1,350 feet east of the northwest corner of sec. 34, T. 13 S., R. 29 E.

A—0 to 12 inches; very dark gray (N 3/0) clay; many fine distinct brownish yellow (10YR 6/8) mottles; coarse angular blocky structure; firm; many fine, medium, and coarse roots; strongly acid; gradual smooth boundary.

Btg1—12 to 21 inches; dark gray (N 4/0) clay; common medium prominent yellowish brown (10YR 5/8) mottles; moderate medium angular blocky structure; firm; few fine, medium, and coarse roots; few faint clay films on faces of peds; slightly acid; gradual smooth boundary.

Btg2—21 to 36 inches; dark gray (N 4/0) clay; many coarse prominent yellowish brown (10YR 5/8) mottles; strong coarse angular blocky structure; firm; few fine, medium, and coarse roots; few prominent shiny clay films on the vertical faces of peds; moderately acid; gradual smooth boundary.

Btg3—36 to 66 inches; gray (N 5/0) clay; many coarse prominent brownish yellow (10YR 6/8) and common medium prominent red (10R 4/8) and few coarse faint dark gray (N 4/0) mottles; strong coarse subangular blocky structure; firm; few fine, medium, and coarse roots; few prominent shiny clay films along the faces of peds throughout the horizon; slightly acid; clear wavy boundary.

Btg4—66 to 80 inches; light brownish gray (2.5Y 6/2) clay; few medium distinct yellowish red (5YR 4/6) mottles; moderate coarse subangular blocky structure; firm; few fine, medium, and coarse roots; dark gray (N 4/0) clay loam flows along old root channels throughout the horizon; few prominent clay

films along the vertical faces of peds; slightly acid.

The thickness of the solum ranges from 45 to more than 80 inches. Soil reaction ranges from strongly acid to mildly alkaline in the A horizon and from moderately acid to moderately alkaline in the Btg horizon. The weighted average silt content in the particle-size control section ranges from 20 to 28 percent. The weighted average content of clay ranges from 35 to 49 percent.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or is neutral and has value of 2 or 3. Thickness ranges from 12 to 21 inches.

The upper part of the Btg horizon has hue of 10YR, value of 3 to 5, and chroma of 1 or 2 or is neutral and has value of 4. If the value is 3 or less, the combined thickness of the A horizon and the upper part of the Btg horizon is less than 24 inches. The lower part of the Btg horizon has hue of 10YR, value of 4 to 7, and chroma of 1 or 2; hue of 2.5Y, value of 4 to 6, and chroma of 2; hue of 5Y, value of 4 to 6, and chroma of 1; or is neutral and has value of 4 or 5. The texture is sandy clay, clay loam, or clay.

Some pedons have a Btgk horizon. If it occurs, it has colors and textures similar to those of the Btg horizon. Nodules or soft accumulations of irregular or rounded, light gray or gray, calcium carbonates range from few to many and from fine to coarse. Thickness ranges from 0 to 41 inches.

Some pedons have a Cg or Cgk horizon at a depth of more than 45 inches. If it occurs, it has hue of 10YR, value of 6 or 7, and chroma of 1 or 2; hue of 2.5Y, value of 5, and chroma of 2; hue of 5Y, value of 5 or 6, and chroma of 1 or 2; or hue of 5GY, value of 5, and chroma of 1. The texture ranges from sandy clay loam to sand. The Cgk horizon also has nodules or soft accumulations of irregular or rounded, light gray or gray, calcium carbonates that range from few to many and from fine to coarse.

Gator Series

The Gator series consists of very deep, very poorly drained soils that formed in moderately thick deposits of sapric organic material and are underlain by loamy and sandy material. These soils are in depressions in the flatwoods. Slopes are less than 1 percent. Gator soils are loamy, siliceous, euic, hyperthermic Terric Medisaprists.

Gator soils are geographically associated with Hicoria, Hontoon, Pineda, Riviera, and Wabasso soils. Hontoon soils have an organic layer more than 52 inches thick. All of the other associated soils are mineral soils and do not have a histic epipedon. Hicoria soils are sandy to a depth of 20 to 40 inches. Pineda, Riviera, and Wabasso soils are in higher positions on the landscape and have an argillic horizon within a depth of 40 inches.

Typical pedon of Gator muck, in an area of Hicoria, Riviera, and Gator soils, depressional; 2.5 miles north of the intersection of County Roads 305 and 304, about 1,200 feet east of County Road 305, about 100 feet north and 4,300 feet west of the southeast corner of sec. 11, T. 13 S., R. 29 E.

Oa1—0 to 9 inches; black (5YR 2/1) muck; about 20 percent fiber, less than 15 percent rubbed; weak medium granular structure; friable; few fine, medium, and coarse roots; few uncoated sand grains; very strongly acid in 0.01M calcium chloride; clear wavy boundary.

Oa2—9 to 26 inches; very dark gray (10YR 3/1) muck; about 15 percent fiber, less than 10 percent rubbed; moderate medium subangular blocky structure; many fine, medium, and coarse roots; few pockets of pale brown (10YR 6/3) fine sand; strongly acid in 0.01M calcium chloride; clear wavy boundary.

Cg1—26 to 29 inches; dark grayish brown (10YR 4/2) fine sandy loam; common medium distinct yellowish brown (10YR 5/6) and very dark gray (10YR 3/1) mottles; massive; slightly sticky and slightly plastic; very strongly acid; clear wavy boundary.

Cg2—29 to 49 inches; dark gray (5Y 4/1) fine sandy loam; massive; slightly sticky and slightly plastic; few fine, medium, and coarse roots; few pockets of gray (5Y 6/1) fine sand and streaks of gray (5Y 5/1); strongly acid; gradual wavy boundary.

Cg3—49 to 80 inches; gray (5Y 5/1) sandy clay loam; few medium distinct olive (5Y 4/4) mottles and streaks of gray (N 5/0); massive; sticky, slightly plastic; strongly acid in upper part, moderately acid in lower part.

Reaction of the Oa horizon ranges from very strongly acid to moderately acid and has pH more than 4.5 in 0.01M calcium chloride. Reaction of the Cg1 horizon ranges from very strongly acid to moderately acid. The Cg2 and Cg3 horizons range from strongly acid to moderately alkaline. Thickness of the organic material ranges from 16 to 45 inches but is commonly 20 to 30 inches.

The Oa horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. The content of fiber after rubbing ranges from less than 5 percent to about 15 percent.

The Cg horizon has hue of 10YR to 5Y, value of 2 to 6, and chroma of 1 or 2. It may or may not have mottles in shades of brown. The texture is dominantly sandy loam, fine sandy loam, or sandy clay loam but can be stratified with sand, fine sand, or loamy fine sand. Some pedons have a layer of fine sand or loamy fine

sand, less than 12 inches thick, that underlies the Oa horizon. Some pedons have a Cg4 horizon that is sand, fine sand, or loamy fine sand.

Hicoria Series

The Hicoria series consists of very deep, very poorly drained soils that formed in sandy and loamy marine sediments. These soils are in depressions in the flatwoods. Slopes are less than 1 percent. Hicoria soils are loamy, siliceous, hyperthermic Arenic Umbraqualfs.

Hicoria soils are geographically associated with Gator, Hontoon, Pineda, Riviera, and Wabasso soils. Gator and Hontoon soils have a histic epipedon. Pineda, Riviera, and Wabasso soils have an ochric epipedon and are in higher positions on the landscape. Additionally, Pineda soils have a Bw horizon and Wabasso soils have a spodic horizon.

Typical pedon of Hicoria mucky fine sand, in an area of Hicoria, Riviera, and Gator soils, depressional; 4,000 feet east and 1,300 feet north of the southwest corner of sec. 35, T. 10 S., R. 29 E.

A1—0 to 10 inches; black (10YR 2/1) mucky fine sand; moderate medium granular structure; friable; common medium and few coarse roots; strongly acid; gradual wavy boundary.

A2—10 to 20 inches; very dark gray (10YR 3/1) fine sand; few medium distinct gray (10YR 5/1) mottles; moderate medium granular structure; friable; few medium and coarse roots; strongly acid; clear smooth boundary.

Eg—20 to 32 inches; dark gray (10YR 4/1) fine sand; single grained; loose; few medium and coarse roots; neutral; clear smooth boundary.

Btg—32 to 55 inches; gray (10YR 5/1) sandy clay loam; few medium distinct light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; friable; neutral; gradual wavy boundary.

BCg—55 to 80 inches; gray (10YR 5/1) fine sandy loam; weak medium subangular blocky structure; friable; few white calcium carbonate accumulations; neutral.

The thickness of solum ranges from 40 to more than 80 inches. Soil reaction is strongly acid to moderately acid in the A horizon. The Btg and BCg horizons are very strongly acid to neutral.

The A horizon has hue of 7.5YR or 10YR, value of 1 to 3, and chroma of 1 or 2. The texture is fine sand or mucky fine sand. Thickness ranges from 10 to 20 inches.

The Eg horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. The texture is sand, fine sand, or loamy fine sand. Thickness ranges from 5 to 25 inches.

The Btg horizon has hue of 10YR, value of 4 to 7, and chroma of 1 or 2 or has hue of 5GY, value of 5 or 6, and chroma of 1. The texture is sandy loam, fine sandy loam, or sandy clay loam. Thickness ranges from 10 to 34 inches.

The BCg horizon, if it occurs, has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. The texture is sandy loam, fine sandy loam, or sandy clay loam.

Some pedons have a Cg horizon below a depth of 60 inches. It has hue of 10YR, value of 5 or 6, and chroma of 1 or has hue of 5GY, value of 5, and chroma of 1. The texture is fine sand or loamy fine sand.

Holopaw Series

The Holopaw series consists of very deep, poorly drained soils that formed in stratified sandy and loamy marine sediments. These soils are in low, broad to narrow areas in the flatwoods. Slopes range from 0 to 2 percent. Holopaw soils are loamy, siliceous, hyperthermic Grossarenic Ochraqualfs.

Holopaw soils are geographically associated with EauGallie, Malabar, Riviera, Pineda, Wabasso, and Valkaria soils. EauGallie soils have a spodic horizon at a depth of less than 30 inches and an argillic horizon at a depth of more than 40 inches. Malabar and Valkaria soils have a high-chroma Bw horizon. Valkaria soils are sandy throughout. Pineda, Riviera, and Wabasso soils have an argillic horizon at a depth of 20 to 40 inches below the surface. Wabasso soils have a spodic horizon.

Typical pedon of Holopaw fine sand, about 200 feet south and 400 feet east of the northwest corner of sec. 24, T. 10 S., R. 28 E.

A—0 to 4 inches; very dark gray (10YR 3/1) fine sand; weak medium granular structure; very friable; many fine and medium roots; slightly acid; gradual wavy boundary.

E1—4 to 15 inches; light gray (10YR 6/1) fine sand; few medium distinct dark gray (10YR 4/1) mottles; single grained; loose; common fine and medium roots; slightly acid; gradual wavy boundary.

E2—15 to 45 inches; gray (10YR 5/1) fine sand; many coarse distinct very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) mottles; single grained; loose; few fine roots; slightly acid; abrupt wavy boundary.

Btg—45 to 55 inches; light gray (5Y 6/1) fine sandy loam; few coarse distinct dark gray (10YR 4/1) mottles; weak coarse subangular blocky structure; friable; few pockets of fine sand; clay bridges between sand grains; mildly alkaline; gradual wavy boundary.

Cg—55 to 80 inches; light gray (5Y 6/1) loamy fine

sand; common fine distinct olive (5Y 5/4) mottles; massive; very friable; few pockets of fine sandy loam; few pockets of fine sand; neutral.

The thickness of the solum ranges from 46 to more than 80 inches. Reaction is strongly acid to slightly acid in the A and E horizons and is strongly acid to moderately alkaline in the Btg and Cg horizons.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. Thickness ranges from 3 to 7 inches.

The E horizon has hue of 10YR, value of 4 to 7, and chroma of 1 to 3. The texture is sand or fine sand. Thickness ranges from 36 to 56 inches.

The Btg horizon has hue of 10YR to 5Y, value of 4 to 7, and chroma of 1 or 2. The texture is sandy loam, fine sandy loam, or sandy clay loam. Thickness ranges from 5 to 18 inches.

The Cg horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1. The texture is fine sand or loamy fine sand.

Hontoon Series

The Hontoon series consists of very deep, very poorly drained soils that formed in thick beds of well decomposed hydrophytic, nonwoody plant remains. These soils are in depressions in the flatwoods. Slopes are less than 2 percent. Hontoon soils are dysic, hyperthermic Typic Medisaprists.

Hontoon soils are geographically associated with Gator, Hicoria, Immokalee, Myakka, Riviera, Samsula, Smyrna, St. Johns, and Wabasso soils. All of the associated soils, except for the Gator and Samsula soils, are mineral soils. Gator and Samsula soils have an organic layer less than 52 inches thick. Gator, Hicoria, Riviera, Samsula, and St. Johns soils are in depressions. Immokalee, Myakka, and Smyrna soils are in broad areas on the flatwoods.

Typical pedon of Hontoon muck, in an area of Samsula and Hontoon soils, depressional; 1,600 feet north and 2,400 feet west of the southeast corner of sec. 10, T. 12 S., R. 30 E.

Oa1—0 to 25 inches; dark reddish brown (5YR 3/3) muck; about 20 percent fiber, 5 percent rubbed; weak medium subangular blocky structure; friable; color of sodium pyrophosphate extract is dark grayish brown (10YR 4/2); extremely acid; clear wavy boundary.

Oa2—25 to 80 inches; black (N 2/0) muck; about 15 percent fiber, 5 percent rubbed; weak coarse subangular blocky structure; friable; color of sodium pyrophosphate is brown (10YR 4/3); extremely acid.

Reaction is less than 4.5 in 0.01M calcium chloride. It is extremely acid to strongly acid in 1:1 water.

The Oa horizon has hue of 5YR or 10YR, value of 2 or 3, and chroma of 1 to 3. The fiber content is less than 33 percent, unrubbed. Thickness ranges from 65 to 80 inches or more. The sodium pyrophosphate extract of the Oa horizon has hue of 10YR, value of 2 to 4, and chroma of 4 or less.

Some pedons have an AC horizon at a depth of 65 inches or more. If it occurs, the AC horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The texture is sand or fine sand.

Immokalee Series

The Immokalee series consists of very deep, poorly drained soils that formed in thick deposits of sandy marine sediments. These soils are on broad flats and low knolls in the flatwoods. Slopes are less than 2 percent. Immokalee soils are sandy, siliceous, hyperthermic Arenic Haplaquods.

Immokalee soils are geographically associated with Basinger, Hontoon, Myakka, Placid, Pomona, St. Johns, and Samsula soils. Basinger soils have a grayish brown to dark brown, weakly developed subsoil and are in depressions. Myakka soils have a spodic horizon with an upper boundary less than 30 inches. Hontoon and Samsula soils have a histic epipedon and are in depressions. Placid and St. Johns soils have an umbric epipedon and are in depressions. Additionally, St. Johns soils have a spodic horizon at a depth of less than 30 inches. Pomona soils have an argillic horizon.

Typical pedon of Immokalee fine sand, about 400 feet north and 800 feet west of the southeast corner of sec. 4, T. 11 S., R. 30 E.

A—0 to 5 inches; black (10YR 2/1) fine sand; weak medium granular structure; very friable; common fine and medium roots; extremely acid; common uncoated light gray sand grains; gradual wavy boundary.

E—5 to 39 inches; light brownish gray (10YR 6/2) fine sand; single grained; loose; few medium and coarse roots; very strongly acid; abrupt wavy boundary.

Bh1—39 to 47 inches; very dark gray (10YR 3/1) fine sand; weak medium granular structure; very friable; few fine roots; extremely acid; gradual wavy boundary.

Bh2—47 to 60 inches; dark brown (10YR 3/3) fine sand; weak fine subangular blocky structure; friable; extremely acid; gradual wavy boundary.

C—60 to 80 inches; dark grayish brown (10YR 4/2) fine sand; single grained; loose; extremely acid.

The thickness of the solum ranges from 40 to more than 80 inches. Soil reaction ranges from extremely acid to moderately acid.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. Thickness ranges from 5 to 10 inches.

The E horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 30 to 42 inches.

The Bh horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3. The texture is sand, fine sand, or loamy fine sand. Thickness ranges from 10 to 30 inches.

Some pedons have a BC horizon. It has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. The texture is sand or fine sand.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. The texture is sand or fine sand.

Malabar Series

The Malabar series consists of very deep, poorly drained soils that formed in sandy and loamy marine sediments. These soils are in low, narrow to broad areas on the flatwoods. Slope ranges from 0 to 2 percent. Malabar soils are loamy, siliceous, hyperthermic Grossarenic Ochraqualfs.

Malabar soils are geographically associated with EauGallie, Holopaw, Pineda, Pomona, and Valkaria soils. These soils are in landscape positions similar to those of the Malabar soils. EauGallie and Pomona soils have a spodic horizon. Holopaw soils do not have a high-chroma Bw horizon. Pineda soils have an argillic horizon at a depth of 20 to 40 inches. Valkaria soils do not have an argillic horizon.

Typical pedon of Malabar fine sand, about 2,600 feet east and 50 feet south of the northwest corner of sec. 33, T. 11 S., R. 28 E.

A—0 to 4 inches; black (10YR 2/1) fine sand; weak fine granular structure; very friable; common fine and medium and few coarse roots; strongly acid; gradual smooth boundary.

E—4 to 10 inches; gray (10YR 5/1) fine sand; single grained; loose; few fine, medium, and coarse roots; strongly acid; clear wavy boundary.

Bw—10 to 30 inches; yellowish brown (10YR 5/6) fine sand; single grained; loose; few medium and coarse roots; iron coatings on sand grains; moderately acid; clear wavy boundary.

E'1—30 to 50 inches; gray (10YR 6/1) fine sand; single grained; loose; slightly acid; clear wavy boundary.

E'2—50 to 60 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; slightly acid; abrupt wavy boundary.

Btg—60 to 80 inches; grayish brown (10YR 5/2) sandy clay loam; moderate medium subangular blocky structure; friable; sand grains coated and bridged with clay; slightly acid.

The thickness of the solum ranges from 50 to more than 80 inches. Reaction ranges from strongly acid to moderately acid in the A and E horizons, from strongly acid to slightly acid in the Bw and E' horizons, and from strongly acid to moderately alkaline in the Bt horizon.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. Thickness ranges from 2 to 6 inches.

The E horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 3. The texture is sand or fine sand. Thickness ranges from 5 to 32 inches.

The Bw horizon has hue of 10YR, value of 5 to 7, and chroma of 3 to 8. The texture is sand or fine sand. Thickness ranges from 5 to 33 inches.

The E' horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 3. The texture is sand or fine sand. Thickness ranges from 5 to 30 inches.

The Btg horizon has hue of 10YR, value of 4 to 7, and chroma of 1 or 2 or has hue of 2.5Y, value of 5 to 7, and chroma of 1 or 2. The texture is sandy loam, fine sandy loam, or sandy clay loam.

Some pedons have a Cg horizon that has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. The texture is sand or fine sand.

Myakka Series

The Myakka series consists of very deep, poorly drained soils that formed in marine or eolian sandy materials. These soils are on broad flatwoods. Slopes range from 0 to 2 percent. Myakka soils are sandy, siliceous, hyperthermic Aeric Haplaquods.

Myakka soils are geographically associated with Basinger, Cassia, Immokalee, Placid, Pomona, St. Johns, Smyrna, and Valkaria soils. Basinger soils are in depressions and have a weakly developed Bh horizon. Placid soils are in depressions, are very poorly drained, have a thicker A horizon, and do not have a spodic horizon. Pomona soils have an argillic horizon. Immokalee soils have a spodic horizon at a depth of 30 to 50 inches. Smyrna soils have a spodic horizon at a depth of less than 20 inches. St. Johns soils have a thicker surface layer and are in depressions. Valkaria soils do not have a spodic horizon.

Typical pedon of Myakka fine sand, about 1,300 feet south and 1,000 feet west of the northeast corner of sec. 1, T. 12 S., R. 29 E.

A—0 to 6 inches; black (10YR 2/1) fine sand; common medium distinct (10YR 4/1) mottles; weak medium granular structure; very friable; common fine and

medium roots; extremely acid; clear smooth boundary.
E—6 to 25 inches; gray (10YR 5/1) fine sand; common medium distinct very dark gray (10YR 3/1) mottles; single grained; loose; common fine and medium roots; extremely acid; clear wavy boundary.
Bh1—25 to 29 inches; black (10YR 2/1) fine sand; moderate medium subangular blocky structure; friable; common fine, medium, and coarse roots; strongly acid; clear wavy boundary.
Bh2—29 to 31 inches; dark reddish brown (5YR 3/2) fine sand; weak fine subangular blocky structure; common fine, medium, and coarse roots; extremely acid; clear wavy boundary.
BC—31 to 40 inches; dark yellowish brown (10YR 4/4) fine sand; single grained; loose; extremely acid; clear wavy boundary.
C1—40 to 50 inches; brown (10YR 5/3) fine sand; single grained; loose; extremely acid; clear smooth boundary.
C2—50 to 80 inches; light gray (10YR 7/1) fine sand; single grained; loose; extremely acid.

The thickness of the solum ranges from 30 to 80 inches or more. Soil reaction ranges from extremely acid to moderately acid.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1. Thickness ranges from 4 to 8 inches.

The E horizon has hue of 10YR, value of 4 to 7, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 12 to 24 inches.

The Bh horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3 or is neutral and has value of 2 or 3. The texture is sand, fine sand, or loamy fine sand. The combined thickness of the Bh horizons ranges from 4 to 30 inches.

Some pedons have E′ and B′h horizons. If they occur, the E′ horizon has the same colors as those of the E horizon and the B′h horizon has the same colors as those of the Bh horizon.

The BC horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 3 or 4. The texture is sand or fine sand. Thickness ranges from 0 to 35 inches.

The C horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 3. The texture is sand or fine sand.

Narcoossee Series

The Narcoossee series consists of very deep, somewhat poorly drained soils that formed in sandy marine sediments mixed with shell and shell fragments. They are on swales and low knolls between the relict sand dunes and the tidal marshes. Slopes range from 0 to 2 percent. Narcoossee soils are sandy, siliceous, hyperthermic Entic Haplohumods.

Narcoossee soils are geographically associated with Palm Beach, Pellicer, Turnbull, and Welaka soils. All of the associated soils do not have a spodic horizon. Palm Beach soils are excessively drained and are on primary oceanfront dunes. Pellicer and Turnbull soils are in tidal salt marshes and are flooded by normal high tides. Welaka soils are well drained and are on relict secondary and tertiary dunes. They have a high-chroma Bw horizon at a depth of less than 30 inches.

Typical pedon of Narcoossee fine sand, shell substratum, in an area of Narcoossee, shell substratum-Welaka complex, 0 to 5 percent slopes; about 2 miles south of State Highway 100, 500 feet west of State Highway A1A in the northeastern quadrant of the intersection of 27th Street and South Daytona Avenue, about 2,000 feet east and 900 feet south of the northwest corner of sec. 19, T. 12 N., R. 32 E.

A—0 to 3 inches; very dark gray (10YR 3/1) fine sand; weak fine granular structure; very friable; many fine and few medium and coarse roots; many uncoated sand grains; very strongly acid; clear wavy boundary.
E1—3 to 5 inches; gray (10YR 5/1) fine sand; single grained; loose; few fine, medium, and coarse roots; strongly acid; gradual wavy boundary.
E2—5 to 17 inches; light gray (10YR 7/1) fine sand; single grained; loose; few medium and coarse roots; strongly acid; abrupt wavy boundary.
Bh1—17 to 19 inches; dark brown (7.5YR 3/2) fine sand; common coarse distinct reddish brown (5YR 4/3) mottles; moderate coarse granular structure; friable; few medium and coarse roots; few shell fragments up to ¼ inch in diameter; discontinuous in about 25 percent of pedons; slightly acid; clear wavy boundary.
Bh2—19 to 23 inches; dark brown (7.5YR 3/2) fine sand; weak medium granular structure; very friable; few medium and coarse roots; few shell fragments up to ¼ inch in diameter; mildly alkaline; gradual wavy boundary.
BC—23 to 41 inches; brown (10YR 5/3) fine sand; common coarse distinct yellowish brown (10YR 5/6) mottles; single grained; loose; few medium roots; few shell fragments up to ½ inch in diameter in the lower 5 inches; mildly alkaline; gradual smooth boundary.
C1—41 to 65 inches; light gray (10YR 7/1) extremely gravelly fine sand; single grained; loose; about 75 percent, by volume, shell fragments up to 1 inch in diameter stratified with thin layers of light gray (10YR 7/1) fine sand; strong effervescence; moderately alkaline; abrupt smooth boundary.
C2—65 to 80 inches; light gray (10YR 7/1) gravelly fine

sand; single grained; loose; about 15 percent, by volume, sand-sized shell fragments up to 1 inch in diameter; strong effervescence; moderately alkaline.

Soil reaction ranges from very strongly acid to slightly acid in the A and E horizons. It is moderately acid to mildly alkaline in the Bh horizon and is neutral to moderately alkaline in the C horizon.

The A horizon has hue of 10YR, value of 3, and chroma of 1 or 2. Thickness ranges from 2 to 7 inches.

The E horizon has hue of 10YR, value of 4 to 8, and chroma of 1 or 2. The texture is fine sand or sand. Thickness ranges from 7 to 20 inches.

The Bh1 horizon has hue of 7.5YR, value of 2 or 3, and chroma of 2 or has hue of 10YR, value of 2, and chroma of 1 to 3. The texture is sand or fine sand. Thickness ranges from 2 to 4 inches and is discontinuous in about 25 to 50 percent of the pedons. The Bh2 horizon has hue of 7.5YR, value of 3 or 4, and chroma of 2 to 4. The texture is sand or fine sand. Thickness ranges from 1 to 6 inches.

The BC horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. Mottles are in shades of yellow and brown. Thickness ranges from 6 to 9 inches. The texture is sand or fine sand. The content of shells and shell fragments ranges from 0 to 5 percent.

The color of the C horizon depends largely upon the color of the shells. The fine sand portion of the C horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. The texture is gravelly to extremely gravelly fine sand. The content of shells and shell fragments, which are sand-sized to ½ inch in diameter, ranges from 15 to 75 percent, by volume. The C horizon extends to a depth of 80 inches or more.

Orsino Series

The Orsino series consists of very deep, moderately well drained soils that formed in thick beds of sandy marine or eolian deposits. They are on low to moderately high ridges and knolls in the flatwoods and along dunes. Slopes range from 0 to 5 percent. Orsino soils are hyperthermic, uncoated Spodic Quartzipsamments.

Orsino soils are geographically associated with Adamsville, Cassia, Palm Beach, Pomello, and Tavares soils. Adamsville and Cassia soils are somewhat poorly drained and are slightly lower on the landscape. Adamsville and Tavares soils do not have a B horizon. Cassia and Pomello soils have a spodic horizon. Palm Beach soils have shell fragments throughout the soil.

Typical pedon of Orsino fine sand, 0 to 5 percent slopes, 2 miles northwest of Espanola along Tram Road and 0.3 mile east on the trail north of Neoga Lake, about 1,000 feet north and 2,200 feet east of the southwest corner of sec. 24, T. 11 S., R. 29 E.

A—0 to 3 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; few fine, medium, and coarse roots; extremely acid; gradual wavy boundary.

E—3 to 12 inches; white (10YR 8/1) fine sand; single grained; loose; few fine, medium, and coarse roots; extremely acid; abrupt irregular boundary.

B/E and Bh—12 to 17 inches; brown (7.5YR 5/4) fine sand; single grained; loose; few fine and medium roots; common tongues of white (10YR 8/1) fine sand 1 to 4 inches in diameter with very dark grayish brown (10YR 3/2) stains at the upper contact with the E horizon; very strongly acid; gradual wavy boundary.

Bw—17 to 49 inches; pale brown (10YR 6/3) fine sand; common fine distinct yellowish brown (10YR 5/6) and common coarse distinct light gray (10YR 7/2) mottles; single grained; loose; few fine roots; very strongly acid; gradual wavy boundary.

C—49 to 80 inches; light gray (10YR 7/2) fine sand; few coarse prominent strong brown (7.5YR 5/6) and dark yellowish brown (10YR 4/4) mottles; single grained; loose; few fine roots; very strongly acid.

Soil reaction is extremely acid or very strongly acid in the A and E horizons and ranges from very strongly acid to moderately acid in the other horizons.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. Thickness ranges from 2 to 5 inches.

The E horizon and the E part of the B/E and Bh horizons has hue of 10YR, value of 7 or 8, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 3 to 32 inches.

The B/E and Bh horizon is thin and discontinuous. The Bh part has hue of 10YR, value of 2 or 3, and chroma of 2. The Bw part has hue of 10YR, value of 5 to 7, and chroma of 3 to 6 or has hue of 7.5YR, value of 5, and chroma of 3 or 4. The E part has the same colors as those of the E horizon. The texture is sand or fine sand. Thickness ranges from 5 to 20 inches.

The Bw horizon has colors similar to those of the Bw part of the B/E and Bh horizon. The texture is sand or fine sand. Thickness ranges from 3 to 32 inches.

The C horizon has hue of 10YR, value of 5 to 7, and chroma of 2 to 4. The texture is sand or fine sand.

Palm Beach Series

The Palm Beach series consists of very deep, well drained to excessively drained soils that formed in marine deposits consisting of thick beds of sand and shell fragments. They are on primary sand dunes bordering the Atlantic Ocean. Slopes range from 0 to 8

percent. Palm Beach soils are hyperthermic, uncoated Typic Quartzipsamments.

Palm Beach soils are geographically associated with Narcoossee, Orsino, Paola, and Welaka soils. Narcoossee soils are on nearly level positions between sand dunes and on gently sloping lower back slopes of dunes. They are somewhat poorly drained, have a thin discontinuous spodic horizon, and have shell fragments below a depth of 40 inches in the C horizon. Paola and Orsino soils are on back slopes of dunes and ridges and do not have shell fragments. They have a distinct, thick E horizon and a high-chroma Bw horizon. Welaka soils are on secondary and tertiary dunes and do not have shell fragments throughout.

Typical pedon of Palm Beach gravelly sand, 0 to 8 percent slopes, about 50 feet west of State Road A1A, about 1,200 feet north of the boundary between Volusia and Flagler County, about 500 feet east and 100 feet north of the southwest corner of sec. 29, T. 12 S., R. 32 E.

A—0 to 4 inches; grayish brown (10YR 5/2) gravelly sand; single grained; loose; few coarse and many fine and medium roots; about 15 percent, by volume, shell fragments 2 to 5 millimeters in diameter; strong effervescence; moderately alkaline; gradual wavy boundary.

C1—4 to 22 inches; light brownish gray (10YR 6/2) gravelly sand; single grained; loose; many medium and few fine roots; about 15 percent, by volume, shell fragments 2 to 5 millimeters in diameter; strong effervescence; moderately alkaline; calcareous; clear wavy boundary.

C2—22 to 47 inches; pale brown (10YR 6/3) very gravelly sand mixed with multicolored shell fragments; single grained; loose; few fine roots; about 35 to 40 percent, by volume, shell fragments 2 to 5 millimeters in diameter; strong effervesence; moderately alkaline; clear wavy boundary.

C3—47 to 80 inches; light gray (10YR 7/1) extremelly gravelly sand; single grained; loose; about 75 percent, by volume, shell fragments 2 millimeters to 2 centimeters in diameter; strong effervescence; moderately alkaline.

Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has hue of 10YR, value of 2 to 5, and chroma of 2 or 3. The content of shell fragments, which are 2 to 5 millimeters in diameter, ranges from 3 to 30 percent, by volume. Thickness ranges from 2 to 6 inches.

The C1 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. The content of shell fragments, which are 2 to 8 millimeters in diameter, ranges from 15 to 25 percent, by volume. The texture is sand or fine sand or the gravelly modifiers of those textures. Thickness ranges from 8 to 20 inches.

The C2 and C3 horizons have colors similar to those of the C1 horizon. Additionally, it can have colors, which are influenced by the content and color of shells, that have value of 7 and chroma of 1. The content of shell fragments, which are 2 to 8 millimeters in diameter, ranges from less than 5 percent to 75 percent, by volume. The textures are sand or fine sand or the gravelly to extremely gravelly modifiers of those textures. The weighted average shell content of the control section is less than 35 percent.

Paola Series

The Paola series consists of very deep, excessively drained soils that formed in thick sandy marine sediments. These soils are on dunelike high knolls and ridges in the flatwoods and on coastal ridges. Slopes range from 0 to 8 percent. Paola soils are hyperthermic, uncoated Spodic Quartzipsamments.

Paola soils are geographically associated with Astatula, Bulow, Cocoa, Palm Beach, Pomello, Tavares, and Orsino soils. Bulow and Cocoa soils have consolidated coquina limestone within a depth of 80 inches. Astatula soils are in landscape positions similar to those of the Paola soils. Astatula and Tavares soils do not have an E horizon. Tavares and Pomello soils are in lower positions on the landscape. Tavares soils have a B horizon. Pomello soils have a spodic horizon. Orsino soils are in lower positions on the landscape and are moderately well drained. Palm Beach soils are on primary dunes and have shells throughout.

Typical pedon of Paola fine sand, 0 to 8 percent slopes, about 2.5 miles northwest of the Volusia county line on Old Kings Road, 300 feet east of Old Kemp Road, on the north side of Woods Road, about 2,000 feet south and 2,900 feet east of the northwest corner of sec. 22, T. 12 S., R. 31 E.

A—0 to 6 inches; gray (10YR 6/1) fine sand; single grained; loose; common fine and medium and few coarse roots; very dark gray (10YR 3/2) particles of organic matter throughout the horizon; very strongly acid; gradual wavy boundary.

E—6 to 16 inches; white (10YR 8/1) fine sand; single grained; loose; common fine and medium and few coarse roots; few root channels 1 to 2 inches in size filled with gray (10YR 6/1) fine sand from the overlying horizon; few pockets of black charcoal

sand-sized to ¼ inch in diameter; strongly acid; clear irregular boundary.

B/E—16 to 31 inches; yellowish brown (10YR 5/8) fine sand (Bw); single grained; loose; few fine, medium, and coarse roots; tongues 1 to 3 inches in width filled with white (10YR 8/1) fine sand from the overlying E horizon throughout the horizon; the outer edges of the tongues are stained with weakly cemented dark brown (7.5YR 4/4) fine sand; few pockets of white (10YR 8/1) sand about ½ to 1 inch in diameter throughout the horizon; strongly acid; gradual wavy boundary.

C—31 to 80 inches; yellowish brown (10YR 5/6) fine sand; single grained; loose; few fine, medium, and coarse roots; strongly acid.

Reaction of the soil ranges from extremely acid to moderately acid in the A and E horizons, from very strongly acid to slightly acid in the B horizon, and from strongly acid to slightly acid in the C horizon.

The A horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. Thickness ranges from 2 to 5 inches.

The E horizon has hue of 10YR, value of 6 to 8, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 10 to 40 inches.

The Bw part of the B/E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 8. Tongues filled with E material are not in all pedons. These pedons have only a weak Bw horizon. Weakly cemented Bh fragments are throughout the B/E horizon in most pedons. The Bh fragments form thin, discontinuous layers that have hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 3 or 4. The texture is sand or fine sand. Thickness ranges from 5 to 40 inches.

The C horizon has hue of 10YR, value of 5 to 8, and chroma of 1 to 8. The texture is sand or fine sand.

Pellicer Series

The Pellicer series consists of very deep, very poorly drained soils that formed in clayey tidal sediments. These soils are in tidal marshes near the Atlantic Coast and are frequently flooded. Slopes are less than 1 percent. Pellicer soils are fine, montmorillonitic, nonacid, hyperthermic Typic Sulfaquents.

Pellicer soils are geographically associated with Bimini, Narcoossee, Turnbull, Wabasso, and Welaka soils and Quartzipsamments and Udarents. All of the associated soils, except for the Turnbull soils, are sandy soils that are in the higher positions on the landscape adjacent to areas of tidal marsh. Bimini and Narcoossee soils have a spodic horizon with loose to weakly cemented coquina shells in the substratum. Additionally, Bimini soils have an argillic horizon. Turnbull soils formed in muck overlying clayey and sandy estuary deposits. They contain less than 1 percent sulfur. Udarents are adjacent to canals that have been altered by the addition of sandy and loamy fill dug out of the canals. Quartzipsamments are excessively drained soils that were formed by the deposition of hydraulic fill dredged from the Intracoastal Waterway. These soils are sandy and contain fragments of shells. Wabasso soils have a spodic horizon over an argillic horizon. Welaka soils are gravelly in the substratum.

Typical pedon of Pellicer silty clay loam, in an area of Turnbull and Pellicer soils, tidal; 1 mile south and 3 miles east of the intersection of Interstate Highway 95 and County Road 2001 (Old Kings Highway), about 8,700 feet north and 2,900 feet west of the northeast corner of sec. 31, T. 10 S., R 31 E.

A—0 to 10 inches; very dark grayish brown (10YR 3/2) silty clay loam; massive; slightly sticky; many fine and medium roots; strong sulfur odor; soil material flows easily between fingers; estimated N value greater than 1; mildly alkaline, extremely acid after drying; gradual smooth boundary.

Cg1—10 to 50 inches; dark gray (5Y 4/1) clay loam; massive; very sticky; very fluid; soil flows easily between fingers; estimated N value greater than 1; strong sulfur odor; mildly alkaline, extremely acid after drying; gradual smooth boundary.

Cg2—50 to 55 inches; dark gray (5Y 4/1) sandy clay; massive; very sticky; very fluid; soil flows easily between fingers; estimated N value greater than 1; common coarse pockets and lenses of fine sand, loamy fine sand, or fine sandy loam; mildly alkaline, extremely acid after drying; gradual wavy boundary.

Cg3—55 to 80 inches; dark gray (5Y 4/1) fine sandy loam; massive; slightly sticky; mildly alkaline.

Soil reaction ranges from slightly acid to moderately alkaline in the natural state and is extremely acid after drying or exposure to air. The content of sulfur ranges from about 1 to 4 percent within a depth of 20 inches.

The A horizon has hue of 10YR to 5Y, value of 2 to 4, and chroma of 1 or 2. Thickness ranges from 4 to 12 inches.

The Cg1 horizon has hue of 10YR or 5Y, value of 4 to 7, and chroma of 1 or 2 or has hue of 5GY, value of 5 or 6, and chroma of 1. The texture is sandy clay, clay loam, or clay. Thickness ranges from 38 to 54 inches.

The Cg2 horizon has the same range of colors and textures as the Cg1 horizon. Additionally, it has few or common medium and coarse pockets and lenses of fine sand, loamy fine sand, or fine sandy loam. Thickness ranges from 10 to 20 inches.

The Cg3 horizon has hue of 5Y, value of 4 to 7, and chroma of 1 or 2 or has hue of 5GY, value of 4 to 6,

and chroma of 1. The texture is fine sand, loamy fine sand, or fine sandy loam.

Pineda Series

The Pineda series consists of very deep, poorly drained soils that formed in thick beds of sandy and loamy marine sediments. These soils are in sloughs and low flatwoods. Slopes are dominantly less than 1 percent but range to 2 percent. Pineda soils are loamy, siliceous, hyperthermic Arenic Glossaqualfs.

Pineda soils are geographically associated with Chobee, EauGallie, Favoretta, Malabar, Riviera, Wabasso, and Winder soils. Chobee and Winder soils do not have a high-chroma Bw horizon and have an argillic horizon above a depth of 20 inches. Chobee, Favoretta, and Winder soils are in lower positions in drainageways. EauGallie soils have a spodic horizon. Favoretta soils are clayey throughout. Malabar soils have an argillic horizon below a depth of 40 inches. Wabasso soils have a spodic and an argillic horizon between a depth of 20 and 40 inches. Riviera soils do not have a high-chroma Bw horizon.

Typical pedon of Pineda fine sand, about 700 feet south and 1,500 feet east of the northwest corner of sec. 31, T. 11 S., R. 29 E.

A—0 to 3 inches; gray (10YR 5/1) fine sand; weak medium granular structure; very friable; common fine, medium, and coarse roots; very strongly acid; gradual wavy boundary.

E—3 to 13 inches; light gray (10YR 6/1) fine sand; few medium distinct dark brown (10YR 3/3) and few fine distinct brownish yellow (10YR 6/6) mottles; single grained; loose; common medium and fine roots; strongly acid; gradual irregular boundary.

Bw1—13 to 19 inches; brownish yellow (10YR 6/6) fine sand; common medium faint brownish yellow (10YR 6/8) mottles; single grained; loose; few fine roots; strongly acid; gradual wavy boundary.

Bw2—19 to 24 inches; yellowish brown (10YR 5/6) fine sand; common coarse distinct brownish yellow (10YR 6/8) mottles; single grained; loose; few fine roots; strongly acid; gradual wavy boundary.

E'—24 to 26 inches; grayish brown (10YR 5/2) fine sand; common coarse distinct yellow (10YR 7/6) mottles; single grained; loose; strongly acid; clear irregular boundary.

B/E—26 to 33 inches; light gray (10YR 6/1) fine sandy loam (Btg); common coarse distinct reddish yellow (5YR 5/4 and 4/4) mottles; moderate medium subangular blocky structure; friable; tongues of grayish brown (10YR 5/2) fine sand (E) extend into the horizon; strongly acid; gradual wavy boundary.

Btg—33 to 40 inches; gray (N 5/0) fine sandy loam; common coarse distinct reddish yellow (5YR 5/4) mottles; moderate medium subangular blocky structure; friable; few gray (10YR 6/1) pockets of fine sand; olive brown (2.5Y 4/4) clay films on faces of peds; strongly acid; gradual wavy boundary.

Cg1—40 to 47 inches; dark gray (5Y 4/1) loamy fine sand; common medium distinct dark gray (5Y 5/1) and olive (5Y 4/4) mottles; massive; very friable; moderately acid; gradual wavy boundary.

Cg2—47 to 80 inches; greenish gray (5GY 5/1) loamy fine sand; common medium distinct gray (5Y 5/1) and olive (5Y 4/4) mottles; single grained; loose; few shell fragments in the lower part; moderately acid.

Reaction ranges from very strongly acid to moderately acid in the A horizon, from very strongly acid to slightly acid in the E horizon, from strongly acid to slightly acid in the Bw horizons, and from moderately acid to moderately alkaline in the other horizons.

The A horizon has hue of 10YR, value of 2 to 5, and chroma of 1 or 2. Thickness ranges from 3 to 8 inches.

The E horizon has hue of 10YR, value of 5 to 8, and chroma of 1 to 3. The texture is fine sand or sand. Thickness ranges from 5 to 17 inches.

The Bw horizon has hue of 10YR, value of 4 to 8, and chroma of 3 to 8. The texture is fine sand or sand. Thickness ranges from 4 to 25 inches.

The E' horizon, if it occurs, and the E part of the B/E horizon have hue of 10YR, value of 5 to 8, and chroma of 2 to 4. The texture is sand or fine sand. Thickness ranges from 0 to 14 inches.

The Btg horizon and the Btg part of the B/E horizon have hue of 10YR to 5BG, value of 4 to 7, and chroma of 0 to 2 or are neutral in hue. The texture is fine sandy loam or sandy clay loam. Thickness ranges from 10 to 32 inches.

The BCg horizon, if it occurs, has colors similar to those of the Btg horizon. The texture is sandy loam or fine sandy loam.

The Cg horizon has hue of 10YR to 5GY, value of 5 to 8, and chroma of 1 or 2. The texture is loamy fine sand, fine sandy loam, or sandy clay loam.

Placid Series

The Placid series consists of very deep, very poorly drained soils that formed in sandy marine sediments. These soils are in depressions in the flatwoods and in long, narrow drainageways in the uplands. The soils in the drainageways are frequently flooded. Slopes are concave and are less than 2 percent. Placid soils are sandy, siliceous, hyperthermic Typic Humaquepts.

Placid soils are geographically associated with Basinger, Hontoon, Immokalee, Myakka, Samsula,

Smyrna, St. Johns, and Terra Ceia soils. Basinger soils have a BE or Bh horizon. Hontoon, Samsula, and Terra Ceia soils have a histic epipedon. Immokalee, Myakka, Smyrna, and St. Johns soils have a spodic horizon. Immokalee, Myakka, and Smyrna soils are in slightly higher positions on the landscape.

Typical pedon of Placid fine sand, in an area of Placid, Basinger, and St. Johns soils, depressional; 1.1 mile east and 0.4 mile north of the intersection of County Road 205 and State Road 100, about 2,000 feet west and 2,100 feet north of the southeast corner of sec. 1, T. 12 S., R. 29 E.

A1—0 to 8 inches; black (10YR 2/1) fine sand; weak medium granular structure; very friable; common fine roots; few uncoated light gray (10YR 7/1) sand grains; very strongly acid; clear wavy boundary.
A2—8 to 15 inches; very dark gray (10YR 3/1) fine sand; weak fine granular structure; very friable; few small pockets of dark gray (10YR 4/1) fine sand; very strongly acid; clear wavy boundary.
Cg1—15 to 32 inches; grayish brown (10YR 5/2) fine sand; few fine faint very dark brown (10YR 2/2) mottles; single grained; loose; very strongly acid; gradual wavy boundary.
Cg2—32 to 62 inches; light brownish gray (10YR 6/2) fine sand; few fine faint very dark gray (10YR 3/1) mottles; single grained; loose; very strongly acid; gradual wavy boundary.
Cg3—62 to 80 inches; light gray (10YR 7/1) fine sand; few fine faint dark gray (10YR 4/1) mottles; single grained; loose; strongly acid.

Soil reaction ranges from extremely acid to strongly acid in the A horizon and the upper part of the C horizon and ranges from extremely acid to slightly acid in the lower part of the C horizon.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Thickness ranges from 10 to 22 inches. Some pedons have a thin Oa horizon at the surface. The texture of the Oa horizon is muck. Thickness is 3 inches or less.

The Cg horizon has hue of 10YR, value of 4 to 7, and chroma of 1 or 2. It has none to common mottles in shades of gray, brown, yellow, or red. The texture is sand or fine sand.

Pomello Series

The Pomello series consists of very deep, moderately well drained soils that formed in sandy marine sediments. These soils are on ridges and knolls in the flatwoods. Slopes range from 0 to 5 percent. Pomello soils are sandy, siliceous, hyperthermic Arenic Haplohumods.

Pomello soils are geographically associated with Astatula, Cassia, Immokalee, Myakka, Orsino, and Paola soils. Astatula soils are in higher positions and are excessively drained. Cassia soils are somewhat poorly drained and have a spodic horizon within a depth of 30 inches. Immokalee and Myakka soils are in lower positions and are poorly drained. Orsino soils have a high-chroma Bw horizon. Paola soils are in higher positions and are excessively drained.

Typical pedon of Pomello fine sand, 0 to 5 percent slopes, 600 feet south and 500 feet east of the northwest corner of sec. 27, T. 10 S., R. 29 E.

A—0 to 5 inches; dark gray (10YR 4/1) fine sand; single grained; loose; common fine and few medium and coarse roots; many uncoated light gray (10YR 7/1) sand grains; many sand-sized particles of black organic matter; extremely acid; clear wavy boundary.
E—5 to 41 inches; light gray (10YR 7/1) fine sand; single grained; loose; many fine and medium and few coarse roots; many very dark grayish brown (10YR 3/2) stains ¼ to ½ inch in diameter, mostly along root channels; very strongly acid; abrupt wavy boundary.
Bh1—41 to 55 inches; very dark brown (10YR 2/2) fine sand; massive in places parting to moderate medium subangular blocky structure; friable; many fine and medium roots; few coarse black (N 2/0) spodic bodies; extremely acid; gradual wavy boundary.
Bh2—55 to 66 inches; very dark gray (10YR 3/1) fine sand; moderate coarse subangular blocky structure; friable; few fine and common medium roots; streaks of uncoated yellowish brown (10YR 5/4) sand grains; extremely acid; gradual wavy boundary.
C1—66 to 75 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; common dark gray (10YR 4/1) stains ¼ to ½ inch in diameter, mostly along old root channels; extremely acid; gradual wavy boundary.
C2—75 to 80 inches; gray (10YR 5/1) fine sand; single grained; loose; extremely acid.

Soil reaction ranges from extremely acid to moderately acid in all horizons.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. Thickness ranges from 3 to 5 inches.

The E horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. Thickness ranges from 27 to 45 inches. The texture is sand or fine sand.

The Bh horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3. Thickness ranges from 4 to 26 inches. The texture is sand or fine sand.

Some pedons have a Bw horizon that has hue of

5YR to 10YR, value of 3 to 5, and chroma of 3 or 4. The texture is sand or fine sand.

The C horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 4. The texture is sand or fine sand.

Pomona Series

The Pomona series consists of very deep, poorly drained soils that formed in sandy and loamy marine sediments. These soils are in the flatwoods. Slopes range from 0 to 2 percent. Pomona soils are sandy, siliceous, hyperthermic Ultic Haplaquods.

Pomona soils are geographically associated with Immokalee, Malabar, Myakka, and Smyrna soils. These soils are in landscape positions similar to those of the Pomona soils. All of the associated soils, except for the Malabar soils, do not have an argillic horizon. Malabar soils do not have a spodic horizon.

Typical pedon of Pomona fine sand, about 0.8 mile west and 0.3 mile south of the intersection of U.S. Highway 1 and County Road 13, about 1,300 feet south and 2,300 feet east of the northwest corner of sec. 9, T. 12 S., R. 30 E.

A—0 to 4 inches; black (10YR 2/1) fine sand; single grained; loose; many fine and few medium and coarse roots; many uncoated sand grains; extremely acid; abrupt wavy boundary.

E1—4 to 10 inches; gray (10YR 5/1) fine sand; common medium distinct very dark gray (10YR 3/1) mottles; single grained; loose; few medium and coarse roots; extremely acid; gradual wavy boundary.

E2—10 to 21 inches; gray (10YR 6/1) fine sand; few medium distinct dark grayish brown (10YR 4/2) mottles; single grained; loose; few fine roots; very dark grayish brown (10YR 3/2) stains along old root channels; extremely acid; abrupt wavy boundary.

Bh1—21 to 28 inches; black (10YR 2/1) loamy fine sand; moderate medium subangular blocky structure; friable; few fine roots; extremely acid; gradual wavy boundary.

Bh2—28 to 50 inches; dark reddish brown (5YR 3/2) fine sand; weak medium subangular blocky structure; friable; few fine roots; few black (5YR 2/1) streaks throughout the horizon; extremely acid; abrupt wavy boundary.

Btg—50 to 63 inches; grayish brown (10YR 5/2) fine sandy loam; weak medium subangular blocky structure; very friable; few very fine roots; sand grains coated and bridged with clay; extremely acid; gradual wavy boundary.

Cg—63 to 80 inches; dark grayish brown (10YR 5/2) fine sandy loam; massive; very friable; few very fine roots; extremely acid.

Reaction of the soil ranges from extremely acid to moderately acid in all horizons.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1. Thickness ranges from 4 to 6 inches.

The E horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. Thickness ranges from 9 to 23 inches.

The Bh horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. Thickness ranges from 6 to 30 inches.

The E′ horizon, if it occurs, has hue of 10YR, value of 5 to 7, and chroma of 1 to 3. Thickness ranges from 0 to 10 inches.

The Btg horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. Some pedons have a Bt horizon that has chroma of 3 or 4. This horizon has none to common mottles in shades of yellow, brown, and gray. The texture is sandy loam, fine sandy loam, or sandy clay loam.

The BCg horizon, if it occurs, has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. The texture is sandy loam or fine sandy loam.

The Cg horizon, if it occurs, has hue of 10YR, value of 5 to 7, and chroma of 1. The texture is sand, fine sand, or loamy fine sand.

Riviera Series

The Riviera series consists of very deep, poorly drained and very poorly drained soils that formed in stratified sandy and loamy marine sediments. These soils are in low, broad to narrow areas in the flatwoods and in depressions. Slopes are dominantly less than 1 percent but range to 2 percent. Riviera soils are loamy, siliceous, hyperthermic Arenic Glossaqualfs.

Riviera soils are geographically associated with Chobee, Gator, Hicoria, Holopaw, Hontoon, Pineda, Wabasso, and Winder soils. Chobee soils have a mollic epipedon. Gator and Hontoon soils formed in organic material and are in depressions. Hicoria soils have a mollic epipedon and are in depressions. Holopaw, Pineda, and Winder soils are on low flatwoods. Holopaw soils have an argillic horizon below a depth of 40 inches. Pineda soils have a Bw horizon. Wabasso soils have a spodic horizon above the argillic horizon. Winder soils have an argillic horizon at a depth of less than 20 inches.

Typical pedon of Riviera fine sand, about ¾ mile north of the intersection of County Road 2008 and County Road 305, about 1,000 feet south and 3,400 feet east of the northwest corner of sec. 28, T. 12 S., R. 29 E.

A—0 to 6 inches; black (10YR 2/1) fine sand; moderate medium granular structure; very friable; many fine

and medium and few coarse roots; many uncoated sand grains; very strongly acid; gradual wavy boundary.

E1—6 to 17 inches; gray (10YR 5/1) fine sand; single grained; loose; few fine and medium roots; very strongly acid; gradual wavy boundary.

E2—17 to 25 inches; light gray (10YR 7/1) fine sand; few medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; very strongly acid; abrupt irregular boundary.

E3—25 to 28 inches; grayish brown (10YR 5/2) fine sand; few medium distinct brownish yellow (10YR 6/6) mottles; single grained; loose; light gray (10YR 7/1) fine sand tongues extending through the horizon; strongly acid; abrupt irregular boundary.

B/E—28 to 35 inches; gray (5Y 5/1) fine sandy loam (Btg); common coarse distinct brownish yellow (10YR 6/6) and few coarse distinct light olive brown (2.5Y 5/6) mottles; weak coarse subangular blocky structure; friable; massive; light gray (10YR 7/1) fine sand tongues 4 inches wide and 2 to 15 inches deep from the E horizon extend into the Btg horizon; moderately acid; gradual wavy boundary.

Btg—35 to 51 inches; gray (5Y 5/1) sandy clay loam; common coarse distinct brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; friable; slightly acid; gradual wavy boundary.

2Cg—51 to 80 inches; gray (5Y 6/1) loamy fine sand; common coarse distinct olive yellow (5Y 6/6) mottles; massive; very friable; slightly acid.

The thickness of the solum ranges from 45 to 65 inches. Reaction ranges from very strongly acid to slightly acid in the A horizon, from very strongly acid to neutral in the E horizon, and from slightly acid to mildly alkaline in the B and C horizons.

The A horizon has hue of 10YR, value of 2 to 5, and chroma of 1 or 2. Thickness ranges from 3 to 6 inches.

The E horizon and the E part of the B/E horizon have hue of 10YR, value of 5 to 7, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 18 to 32 inches.

The Btg part of the B/E horizon has hue of 10YR to 5Y, value of 4 to 7, and chroma of 1 or 2. Thickness ranges from 6 to 22 inches. The texture of the B part is sandy loam, fine sandy loam, or sandy clay loam that has vertical tongues of the E horizon extending into it.

The Btg horizon has hue of 10YR or 5Y, value of 4 to 7, and chroma of 1 or 2. The texture is sandy loam, fine sandy loam, or sandy clay loam. Thickness ranges from 5 to 16 inches.

The 2Cg horizon has hue of 10YR, value of 6 or 7, and chroma of 1 or 2 or has hue of 5Y or 5GY, value of 4 to 6, and chroma of 1. The texture ranges from fine sandy loam to a mixture of sand and shell fragments or marl.

Samsula Series

The Samsula series consists of very deep, very poorly drained soils that formed in moderately thick beds of hydrophytic nonwoody plant remains. These soils are in depressions in the flatwoods and long narrow drainageways in the uplands. The soils in the drainageways are frequently flooded. Slopes are concave and are less than 2 percent. Samsula soils are sandy or sandy-skeletal, siliceous, euic, hyperthermic Terric Medisaprists.

Samsula soils are geographically associated with Adamsville, Astatula, Basinger, Hontoon, Immokalee, Myakka, Placid, Smyrna, St. Johns, and Tavares soils. All of the associated soils are mineral soils except for the Hontoon soils. Hontoon soils have an organic layer more than 52 inches thick. Adamsville, Astatula, and Tavares soils are in higher positions and are better drained. Basinger, Placid, and St. Johns soils are in landscape positions similar to those of the Samsula soils. Immokalee, Myakka, and Smyrna soils are in broad areas on the flatwoods.

Typical pedon of Samsula muck, in an area of Samsula and Hontoon soils, depressional; about 800 feet west and 500 feet north of the southeast corner of sec. 12, T. 14 S., R. 30 E.

Oa1—0 to 10 inches; dark reddish brown (5YR 3/3) muck; moderate medium granular structure; friable; many fine and medium and few coarse roots; about 20 percent fiber, 15 percent rubbed; color of sodium pyrophosphate is dark grayish brown (10YR 4/2); about 15 percent mineral matter; extremely acid; gradual smooth boundary.

Oa2—10 to 31 inches; black (N 2/0) muck; moderate medium granular structure; friable; few fine, medium, and coarse roots; about 15 percent fiber, 5 percent rubbed; about 10 percent mineral matter; color of sodium pyrophosphate is very dark grayish brown (10YR 3/2); extremely acid; abrupt wavy boundary.

2Cg1—31 to 41 inches; very dark gray (10YR 3/1) fine sand; common medium distinct dark gray (10YR 4/1) mottles; single grained; loose; extremely acid; clear wavy boundary.

2Cg2—41 to 50 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; extremely acid; gradual wavy boundary.

2Cg3—50 to 80 inches; light brownish gray (10YR 6/2) fine sand; single grained; loose; extremely acid.

Soil reaction of the organic material is less than 4.5 in 0.01M calcium chloride and ranges from less than 4.5 to 5.5 in 1:1 water. The mineral material ranges from extremely acid to moderately acid. Thickness of the organic material ranges from 25 to 45 inches.

The Oa horizons have hue of 10YR or 5YR, value of 2 or 3, and chroma of 1 or 2 or have hue of 5YR, value of 3, and chroma of 3. The fiber content ranges from 10 to 75 percent unrubbed and from 5 to 16 percent rubbed. The sodium pyrophosphate extract has hue of 10YR, value of 2 to 4, and chroma of 1 to 4 or has value of 5 or 6 and chroma of 3 to 7.

The 2Cg1 horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 5 to 17 inches.

The 2Cg2 and 2Cg3 horizons have hue of 10YR, value of 5 to 7, and chroma of 1 or 2. Some pedons have mottles in shades of gray and brown. The texture is sand or fine sand.

Smyrna Series

The Smyrna series consists of very deep, poorly drained soils that formed in thick deposits of sandy marine sediments. These soils are in broad areas on the flatwoods. Slopes range from 0 to 2 percent. Smyrna soils are sandy, siliceous, hyperthermic Aeric Haplaquods.

Smyrna soils are geographically associated with Basinger, Hontoon, Myakka, Placid, Pomona, St. Johns, Samsula, and Valkaria soils. Basinger, Hontoon, Placid, Samsula, and St. Johns soils are in depressions. Basinger and Placid soils do not have a spodic horizon, and Placid and St. Johns soils have an umbric epipedon. Hontoon and Samsula soils formed in organic material. Myakka and Pomona soils have a spodic horizon at a depth of 20 to 30 inches. Valkaria soils have a high-chroma Bw horizon.

Typical pedon of Smyrna fine sand, about 900 feet east and 600 feet south of the northwest corner of sec. 32, T. 12 S., R. 31 E.

A—0 to 4 inches; black (10YR 2/1) fine sand; moderate medium granular structure; very friable; many fine and few medium roots; few pockets of dark gray (10YR 4/1) fine sand; extremely acid; clear smooth boundary.

E1—4 to 8 inches; gray (10YR 5/1) fine sand; single grained; loose; few fine and medium roots; few pockets of light gray (10YR 7/1) fine sand; extremely acid; gradual wavy boundary.

E2—8 to 13 inches; light gray (10YR 7/1) fine sand; common coarse distinct dark gray (10YR 4/1) mottles; single grained; loose; few medium roots; extremely acid; abrupt wavy boundary.

Bh1—13 to 18 inches; dark reddish brown (5YR 3/2) fine sand; strong coarse subangular blocky structure; firm; many fine, medium, and coarse roots in the upper part of the horizon; about 30 percent orstein in the lower part of the horizon; extremely acid; clear wavy boundary.

Bh2—18 to 21 inches; dark reddish brown (5YR 3/3) fine sand; moderate medium subangular blocky structure; friable; few medium roots; extremely acid; gradual wavy boundary.

BE—21 to 50 inches; brown (10YR 5/3) fine sand; few coarse distinct dark brown (10YR 3/3) mottles; single grained; loose; few fine and medium roots; extremely acid; gradual wavy boundary.

E'—50 to 70 inches; gray (10YR 6/1) fine sand; few medium distinct light yellowish brown (10YR 6/4) mottles; single grained; loose; extremely acid; gradual wavy boundary.

B'h—70 to 80 inches; very dark gray (10YR 3/1) fine sand; moderate medium granular structure; very friable; few medium roots; few pockets of light gray (10YR 7/1) fine sand; very strongly acid.

Soil reaction is extremely acid to moderately acid in all horizons.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. Thickness ranges from 3 to 6 inches.

The E horizon has hue of 10YR, value of 5 to 8, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 4 to 14 inches.

Some pedons have a BE horizon that has hue of 10YR, value of 4 or 5, and chroma of 3. The texture is sand or fine sand. Thickness ranges from 0 to 2 inches.

The Bh horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 3. Some pedons have vertical to horizontal tongues extending into the Bh horizon from the E horizon. The texture is sand or fine sand. Thickness ranges from 5 to 18 inches.

The E' and B'h horizons have colors and textures similar to the overlying E and Bh horizons.

Some pedons have a C horizon that has hue of 10YR, value of 4 to 8, and chroma of 2 or 4. The texture is sand or fine sand.

St. Johns Series

The St. Johns series consists of very deep, very poorly drained soils, that formed in thick deposits of sandy marine sediments. These soils are in depressions in the flatwoods. Slopes are less than 1 percent. St. Johns soils are sandy, siliceous, hyperthermic Typic Haplaquods.

St. Johns soils are geographically associated with Basinger, Hontoon, Immokalee, Myakka, Placid, and Samsula soils. Basinger and Placid soils do not have a

spodic horizon. Hontoon and Samsula soils formed in organic material. Immokalee and Myakka soils are in higher positions on the landscape and are better drained.

Typical pedon of St. Johns fine sand, in an area of Placid, Basinger, and St. Johns soils, depressional; 2.0 miles northwest of the intersection of County Road 205 and an abandoned railroad grade, about 0.6 mile south of the abandoned railroad grade, about 1,200 feet south and 200 feet east of the northwest corner of sec. 25, T. 11 S., R. 29 E.

A—0 to 10 inches; black (10YR 2/1) fine sand; moderate medium granular structure; friable; common fine roots; strongly acid; gradual smooth boundary.

E—10 to 25 inches; gray (10YR 5/1) fine sand; single grained; loose; few fine roots; very strongly acid; abrupt wavy boundary.

Bh1—25 to 34 inches; very dark grayish brown (10YR 3/2) fine sand; strong medium subangular blocky structure; friable; common fine and medium roots; few pockets of dark gray (10YR 4/1) fine sand; very strongly acid; gradual smooth boundary.

Bh2—34 to 39 inches; very dark grayish brown (10YR 3/2) fine sand; moderate medium subangular blocky structure; friable; common fine and medium roots; very strongly acid; gradual wavy boundary.

BC—39 to 54 inches; dark yellowish brown (10YR 4/4) fine sand; single grained; loose; strongly acid; gradual wavy boundary.

C—54 to 80 inches; dark gray (10YR 4/1) fine sand; single grained; loose; strongly acid.

Soil reaction ranges from extremely acid to strongly acid in all horizons.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2 or is neutral and has value of 2. Thickness ranges from 8 to 18 inches.

The E horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 7 to 19 inches.

The Bh horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. The texture is sand, fine sand, or loamy fine sand. Thickness ranges from 9 to 21 inches.

The BC horizon, if it occurs, has hue of 10YR, value of 3 to 6, and chroma of 3 or 4. The texture is sand or fine sand. Thickness ranges from 0 to 25 inches.

The C horizon has hue of 10YR, value of 4 to 7, and chroma of 1 to 3. The texture is sand or fine sand.

Some pedons have a bisequum of E′ and B′h horizons. If they occur, the E′ horizon has colors similar to those of the E horizon and the B′h horizon has colors similar to those of the Bh horizon.

Tavares Series

The Tavares series consists of moderately well drained soils that formed in thick beds of sandy marine or eolian deposits. These soils are on narrow to broad ridges and knolls in the flatwoods and on upland sand ridges near drains and streams. Slopes range from 0 to 5 percent. Tavares soils are hyperthermic, uncoated Typic Quartzipsamments.

Tavares soils are geographically associated with Adamsville, Astatula, Cassia, Immokalee, Myakka, Orsino, and Paola soils. Adamsville soils are somewhat poorly drained and are slightly lower on the landscape. Astatula soils are in higher positions on the landscape and are excessively drained. Cassia soils are in slightly lower positions in the landscape and have a Bh horizon. Immokalee and Myakka soils are in lower positions in the landscape, are poorly drained, and have a Bh horizon. Orsino and Paola soils have an E horizon over a high-chroma Bw horizon. Paola soils are excessively drained and are in higher positions on the landscape.

Typical pedon of Tavares fine sand, 0 to 5 percent slopes, about 4,800 feet west and 3,300 feet north of the southeast corner of sec. 17, T. 10 S., R. 30 E.

A—0 to 5 inches; gray (10YR 5/1) fine sand; weak medium granular structure; very friable; few fine and common coarse roots; few common pockets of dark gray (10YR 4/1) sand grains; very strongly acid; gradual wavy boundary.

C1—5 to 32 inches; pale brown (10YR 6/3) fine sand; few medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; few fine, medium, and coarse roots; few pockets of light gray (10YR 7/2) sand grains; very strongly acid; gradual smooth boundary.

C2—32 to 46 inches; very pale brown (10YR 7/3) fine sand; few medium distinct brownish yellow (10YR 6/6) mottles; single grained; loose; few medium and coarse roots; many pockets of white (10YR 8/1) sand grains; very strongly acid; gradual wavy boundary.

C3—46 to 80 inches; white (10YR 8/1) fine sand; common coarse distinct yellow (10YR 7/6) and few medium distinct strong brown (7.5YR 5/6) mottles; single grained; loose; few medium roots; very strongly acid.

Reaction ranges from extremely acid to moderately acid in the A horizon and from very strongly acid to slightly acid in the C horizons.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. Thickness ranges from 3 to 6 inches.

The C1 and C2 horizons have hue of 10YR, value of

5 to 8, and chroma of 3 to 8. The C3 and C4 horizons have hue of 10YR, value of 6 to 8, and chroma of 1 to 4. The horizons have none to common mottles in shades of yellow or brown. The texture is sand or fine sand.

Terra Ceia Series

The Terra Ceia series consists of very poorly drained, rapidly permeable soils that formed in nonwoody hydrophytic plant remains. These soils are on flood plains and are frequently flooded. Slopes are less than 1 percent. Terra Ceia soils are euic, hyperthermic Typic Medisaprists.

Terra Ceia soils are geographically associated with Chobee, Favoretta, Placid, and Winder soils. All of the associated soils are mineral and are in landscape positions similar to those of the Terr Ceia soils. Winder soils are also in slightly higher positions on the landscape.

Typical pedon of Terra Ceia muck, frequently flooded, about 500 feet southeast of the intersection of the Volusia County Line and Haw Creek, about 1,000 feet north and 300 feet east of the southwest corner of sec. 6, T. 13 S., R. 28 E.

Oa1—0 to 25 inches; dark reddish brown (5YR 3/2) muck; weak medium granular structure; very friable; many medium and coarse roots; about 30 percent fiber unrubbed, 10 percent rubbed; color of sodium pyrophosphate extract is brown (10YR 5/3); strongly acid; gradual wavy boundary.

Oa2—28 to 80 inches; black (5YR 2/1) muck; moderate medium granular structure; friable; few woody fragments; about 25 percent fibers, about 5 percent rubbed; color of sodium pyrophosphate extract is very dark grayish brown (10YR 3/2); mildly alkaline.

Soil reaction is strongly acid to mildly alkaline in 1:1 water. Soil reaction is 4.5 or more in 0.01M calcium chloride.

The Oa horizon has hue of 5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. The fiber content, when rubbed, ranges from 5 to 15 percent. Thickness is more than 52 inches.

Some pedons have a C horizon below a depth of 55 inches. If it occurs, the C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 3. The texture ranges from sand to clay. The content of shells ranges from none to common.

Turnbull Series

The Turnbull series consists of very deep, very poorly drained soils that formed in hydrophytic plant remains overlying clayey and sandy estuary deposits. These soils are in broad to narrow tidal marshes and are frequently flooded. Slopes are less than 1 percent. Turnbull soils are clayey over sandy or sandy-skeletal, montmorillonitic, nonacid, hyperthermic Typic Hydraquents.

Turnbull soils are geographically associated with Bimini, Narcoossee, Pellicer, Palm Beach, and Welaka soils. All of the associated soils are mineral and, except for the Pellicer soils, are in higher positions on the landscape and are better drained. Bimini soils have a spodic horizon and have coquina shell or rock below a depth of 40 inches. Narcoossee soils have a thin discontinuous spodic horizon at a depth of less than 30 inches and have mixed sand and shell below the spodic horizon. Palm Beach soils are on primary dunes along the Atlantic Coast. Palm Beach soils are excessively drained and have stratifications of mixed sand and shell. Welaka soils are on the back slopes of primary, secondary, and tertiary dunes. They are sandy throughout and have a seasonal high water table at a depth of 60 to 80 inches. They also have stratifications of mixed sand and shell.

Typical pedon of Turnbull muck, in an area of Turnbull and Pellicer soils, tidal; 4,000 feet east and 500 feet north of the intersection of County Road 2001 (Old Kings Road) and Forrest Grove Road, about 2,300 feet west and 1,000 feet north of the southeast corner of sec. 30, T. 10 S., R. 31 E.

Oa—0 to 8 inches; very dark gray (10YR 3/1) muck that has an estimated content of clay about 20 percent; 40 percent fibers, 18 percent rubbed; massive; slightly sticky; many fine and medium roots; sulfur odor is strong; neutral, strongly acid after drying; clear smooth boundary.

Cg1—8 to 42 inches; olive gray (5Y 5/2) clay; massive; very sticky; few fine and medium roots; moderately alkaline, strongly acid after drying; gradual wavy boundary.

Cg2—42 to 80 inches; gray (5Y 5/1) loamy fine sand; single grained; loose; shell fragments sand-sized to 1 inch in diameter; moderately alkaline.

Soil reaction ranges from slightly acid to mildly alkaline under natural conditions. The sulfur content is high within a depth of 20 inches. The estimated N values are greater than 1.

The Oa horizon has hue of 2.5Y or 10YR, value of 2 to 4, and chroma of 1 or 2. Thickness ranges from 6 to 10 inches.

The Cg1 horizon has hue of 5Y or 5GY, value of 4 to 6, and chroma of 1. Thickness ranges from 23 to 36 inches.

The Cg2 horizon has hue of 5Y or 5GY, value of 4 to

6, and chroma of 1. The texture is loamy fine sand or fine sand that has pockets or thin strata of fine sandy loam to clay.

Tuscawilla Series

The Tuscawilla series consists of very deep, poorly drained soils that formed in sandy and loamy marine sediments deposited over stratified layers of sand, marl, and shell. These soils are on broad hammocks. Slopes range from 0 to 2 percent. Tuscawilla soils are fine-loamy, siliceous, hyperthermic Typic Ochraqualfs.

Tuscawilla soils are geographically associated with Bulow, Cocoa, Favoretta, Riviera, and Wabasso soils. Bulow and Cocoa soils are in higher positions on the landscape and are better drained. Favoretta soils are clayey throughout and are not underlain by shells and marl. Riviera soils have an argillic horizon between a depth of 20 and 40 inches and do not have shells or marl. Wabasso soils have a spodic horizon between a depth of 20 and 30 inches, have an argillic horizon between a depth of 20 and 40 inches, and are not underlain by shells or marl.

Typical pedon of Tuscawilla fine sand, about 3,400 feet south and 3,500 feet east of the northwest corner of sec. 24, T. 10 S., R. 31 E.

A—0 to 5 inches; black (10YR 2/1) fine sand; weak medium granular structure; very friable; many fine, medium, and coarse roots; many uncoated sand grains; moderately acid; clear wavy boundary.

E—5 to 12 inches; dark gray (10YR 4/1) fine sand; few fine distinct brownish yellow (10YR 6/6) mottles; single grained; loose; few fine, medium, and coarse roots; moderately acid; abrupt wavy boundary.

Btg—12 to 25 inches; dark gray (10YR 4/1) sandy clay loam; many coarse prominent light olive brown (2.5Y 5/6) mottles; weak subangular blocky structure; few medium and coarse roots; few fine calcium carbonate nodules; mildly alkaline; gradual wavy boundary.

Btkg1—25 to 30 inches; gray (10YR 6/1) sandy clay loam; many coarse prominent light olive brown (2.5Y 5/6) and many coarse distinct dark gray (5Y 4/1) mottles; moderate medium subangular blocky structure; friable; few medium and coarse roots; many fine and medium calcium carbonate nodules throughout the horizon; mildly alkaline; gradual wavy boundary.

Btkg2—30 to 45 inches; gray (10YR 6/1) sandy clay loam; few fine distinct light olive brown (2.5Y 5/6) mottles; moderate coarse subangular blocky structure; friable; few medium roots; many fine and medium calcium carbonate nodules throughout the horizon; few oyster shells up to 3 inches in size; moderately alkaline; clear wavy boundary.

Cg1—45 to 60 inches; gray (5Y 7/1) loamy fine sand; many coarse prominent greenish gray (5GY 5/1) and few fine distinct yellow (2.5Y 7/6) mottles; massive; friable; few medium roots; many fine and medium calcium carbonate nodules throughout the horizon; few oyster shells throughout the horizon; mildly alkaline; clear wavy boundary.

2Cg2—60 to 80 inches; light gray (5Y 7/1) gravelly fine sandy loam; massive; many fine calcium carbonate nodules throughout the horizon; about 20 percent fine coquina shells up to 2 inches in diameter; mildly alkaline.

Reaction ranges from moderately acid to neutral in the A horizon, from moderately acid to moderately alkaline in the E horizon, and is mildly alkaline or moderately alkaline in the Btg, Btkg, and Cg horizons.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2 or is neutral and has value of 2 to 4. Thickness ranges from 3 to 5 inches.

The E horizon has hue of 10YR, value of 4 to 7, and chroma of 1 or has value of 6 or 7 and chroma of 2. The texture is sand or fine sand. Thickness ranges from 3 to 12 inches.

The Btg and Btkg horizons have hue of 10YR, value of 3 to 8, and chroma of 1 or 2. The texture is sandy loam, fine sandy loam, or sandy clay loam. Thickness of Btg horizon ranges from 1 to 13 inches. Thickness of the Btkg horizon ranges from 16 to 35 inches.

The Cg horizon has hue of 10YR to 5Y, value of 5 to 8, and chroma of 1. The texture is fine sand or loamy fine sand. Thickness ranges from 15 to 23 inches.

The 2Cg horizon consists of loose beds of sandy and loamy material, calcium carbonate nodules, and shells or shell fragments which are stratified in varying proportions. In some pedons, the 2Cg horizon is composed of discontinuous layers of marl or hard limestone.

Valkaria Series

The Valkaria series consists of very deep, poorly drained soils that formed in thick beds of sandy marine sediments. These soils are in broad, low flats and in low areas connecting depressions in the flatwoods. Slopes are less than 2 percent. Valkaria soils are siliceous, hyperthermic Spodic Psammaquents.

Valkaria soils are geographically associated with Malabar, Myakka, Pineda, Smyrna, and Wabasso soils. These soils are in landscape positions similar to those of the Valkaria soils. Malabar and Pineda soils have an argillic horizon. Smyrna and Myakka soils have a spodic horizon. Wabasso soils have a spodic horizon overlying an argillic horizon.

Typical pedon of Valkaria fine sand, in an area of Valkaria-Smyrna complex; 800 feet south and 900 feet east of the northwest corner of sec. 8, T. 14 S., R. 30 E.

A—0 to 6 inches; dark gray (10YR 4/1) fine sand; many coarse distinct gray (10YR 6/1) and many medium distinct yellowish red (5YR 4/6) and yellowish brown (10YR 5/8) mottles; single grained; loose; few fine, medium, and coarse roots; very strongly acid; gradual wavy boundary.

E1—6 to 12 inches; light gray (10YR 7/1) fine sand; common coarse distinct dark grayish brown (10YR 4/2) and few medium distinct dark brown (7.5YR 4/4) mottles; single grained; loose; few fine and medium roots; moderately acid; gradual wavy boundary.

E2—12 to 17 inches; light gray (10YR 7/2) fine sand; many coarse distinct very pale brown (10YR 8/4) mottles; single grained; loose; moderately acid; gradual wavy boundary.

Bw1—17 to 28 inches; brownish yellow (10YR 6/8) fine sand; few medium distinct light gray (10YR 7/2) mottles; single grained; loose; sand grains well coated with iron oxides; discontinuous layers of reddish brown (5YR 4/3) weakly cemented sand at irregular intervals at the contact between E and Bw horizon; moderately acid; gradual wavy boundary.

Bw2—28 to 38 inches; yellow (10YR 7/6) fine sand; common medium distinct light gray (10YR 7/2) mottles; single grained; loose; sand grains coated with iron oxides; moderately acid; gradual wavy boundary.

Cg—38 to 80 inches; gray (10YR 5/1) fine sand; few coarse faint light gray (10YR 7/1) mottles; single grained; loose; moderately acid.

Soil reaction ranges from very strongly acid to slightly acid in the A horizon, from strongly acid to slightly acid in the E horizon, from strongly acid to neutral in the Bw horizon, and from strongly acid to mildly alkaline in the underlying material.

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

The E horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 9 to 27 inches.

Some pedons have a BE horizon. If it occurs, the BE horizon has hue of 10YR, value of 5 to 7, and chroma of 3 or 4. The texture is sand or fine sand. Thickness ranges from 0 to 10 inches.

The Bw1 horizon has hue of 10YR, value of 5 to 7, and chroma of 4 to 8. The texture is sand or fine sand. Thickness ranges from 5 to 17 inches.

The Bw2 and Bw3 horizons have hue of 10YR, value of 5 to 7, and chroma of 3 to 8. The texture is sand or fine sand. Thickness ranges from 5 to 23 inches. Some pedons do not have a Bw3 horizon. Mottles in the Bw horizons have hue of 10YR, value of 5 to 7, and chroma of 1 or 2.

The Cg horizon has hue of 10YR, value of 4 to 8, and chroma of 1 to 3 or has hue of 2.5Y or 5Y, value of 6 or 7, and chroma of 1 or 2. The texture is sand or fine sand.

Wabasso Series

The Wabasso series consists of very deep, poorly drained soils that formed in thick beds of sandy and loamy marine sediments. These soils are on broad flatwoods. Slopes are less than 2 percent. Wabasso soils are sandy, siliceous, hyperthermic Alfic Haplaquods.

Wabasso soils are geographically associated with Chobee, EauGallie, Favoretta, Hicoria, Holopaw, Pineda, and Riviera soils. Chobee soils have a mollic epipedon and are in lower positions in the drainageways. EauGallie soils have an argillic horizon below a depth of 40 inches. Favoretta soils are clayey throughout and are in lower areas near drainageways and on flood plains. Hicoria soils are in lower positions in the drainageways. Hicoria, Holopaw, and Riviera soils do not have a spodic horizon. Pineda soils have a high-chroma Bw horizon.

Typical pedon of Wabasso fine sand, about 1,100 feet north and 1,500 feet east of the southwest corner of sec. 25, T. 11 S., R. 28 E.

A—0 to 4 inches; very dark gray (10YR 3/1) fine sand; weak medium granular structure; very friable; common fine and medium roots; many uncoated sand grains; extremely acid; gradual wavy boundary.

E1—4 to 15 inches; light gray (10YR 7/1) fine sand; few medium distinct dark grayish brown (10YR 4/2) mottles; single grained; loose; few fine and medium roots; dark reddish brown (5YR 3/2) stains along root channels; very strongly acid; gradual wavy boundary.

E2—15 to 22 inches; gray (10YR 6/1) fine sand; single grained; loose; few fine and medium roots; common medium distinct dark brown (7.5YR 3/2) stains along root channels; strongly acid; abrupt irregular boundary.

Bh—22 to 30 inches; black (5YR 2/1) fine sand; weak medium subangular blocky structure; friable; few fine roots; strongly acid; gradual wavy boundary.

Btg1—30 to 35 inches; dark gray (10YR 4/1) fine sandy loam; moderate medium subangular blocky structure; friable; few medium roots; few pockets of

very dark grayish brown (10YR 3/2) fine sand; strongly acid; gradual wavy boundary.

Btg2—35 to 47 inches; gray (10YR 5/1) fine sandy loam; moderate medium subangular blocky structure; friable; few fine roots; dark brown (7.5YR 3/2) stains along root channels; few pockets of light gray (10YR 6/1) fine sand; strongly acid; gradual wavy boundary.

BCg—47 to 53 inches; dark gray (5Y 4/1) loamy fine sand; few coarse distinct olive brown (2.5Y 4/4) mottles; weak medium subangular blocky structure; very friable; dark brown (7.5YR 3/2) stains along old root channels; strongly acid; gradual wavy boundary.

Cg—53 to 80 inches; greenish gray (5GY 5/1) loamy fine sand; few coarse distinct brown (7.5YR 5/3) mottles; single grained; loose; few lenses of dark grayish brown (10YR 4/2) fine sandy loam; strongly acid.

Soil reaction ranges from extremely acid to slightly acid in the A and E horizons, except in limed areas. It ranges from very strongly acid to neutral in the Bh horizon and from strongly acid to moderately alkaline in the Bt horizon.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. Thickness ranges from 4 to 8 inches.

The E horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 7 to 24 inches.

The Bh horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2; hue of 7.5YR or 10YR, value of 3, and chroma of 3 or 4; or hue of 5YR, value of 2 or 3, and chroma of 1 to 4. The texture is sand, fine sand, or loamy fine sand. Thickness ranges from 8 to 16 inches.

The Bt horizon has hue of 10YR, value of 4 to 7, and chroma of 1 to 3 or has hue of 5Y or 5GY, value of 4 to 7, and chroma of 1 or 2. It has none to common, fine to coarse mottles in shades of yellow, red, and brown. The texture is sandy loam, fine sandy loam, or sandy clay loam. Thickness ranges from 6 to 36 inches.

The C horizon has colors similar to those of the Bt horizon. The texture is fine sand or loamy fine sand.

Welaka Series

The Welaka series consists of very deep, well drained soils that formed in thick beds of sandy marine and eolian deposits. These soils are on secondary and tertiary sand dunes and on the lower side slopes of primary sand dunes along the Atlantic Coast. They are also on the high knolls that are between the sand dunes and tidal marshes. Slopes range from 2 to 5 percent. Welaka soils are hyperthermic, uncoated Spodic Quartzipsamments.

Welaka soils are geographically associated with Narcoossee, Palm Beach, Pellicer, and Turnbull soils. Narcoossee soils are in lower positions on the landscape and a have discontinuous spodic horizon. Palm Beach soils are on the front slopes and summit positions of primary sand dunes, are excessively drained, and have mixed sand and shell fragments throughout. Pellicer and Turnbull soils are in tidal salt marshes and are flooded by normal high tides.

Typical pedon of Welaka fine sand, in an area of Narcoossee, shell substratum-Welaka complex, 0 to 5 percent slopes; 2 miles north of Flagler Beach and 300 feet west of State Highway A1A, about 4,000 feet east and 700 feet north of the southwest corner of sec. 26, T. 11 S., R. 31 E.

A—0 to 3 inches; dark gray (10YR 4/1) fine sand; weak medium granular structure; very friable; many medium and coarse roots; very strongly acid; clear wavy boundary.

E—3 to 12 inches; light gray (10YR 7/1) fine sand; single grained; loose; many medium and coarse roots; very strongly acid; clear irregular boundary.

Bw—12 to 42 inches; brownish yellow (10YR 6/6) fine sand; single grained; loose; many uncoated sand grains; many medium and coarse roots; strongly acid; clear wavy boundary.

2C1—42 to 50 inches; very pale brown (10YR 7/3) gravelly fine sand; few medium distinct brown (7.5YR 5/4) mottles in the lower 4 inches of the horizon; single grained; loose; few fine and coarse roots; about 15 percent gray (10YR 5/1) shell fragments less than ⅛ inch in diameter in the lower 3 inches; moderately alkaline; abrupt wavy boundary.

2C2—50 to 80 inches; light gray (10YR 7/2) very gravelly fine sand; single grained; loose; about 45 percent, by volume, shell fragments less than ⅛ inch in diameter; moderately alkaline.

Reaction ranges from very strongly acid to moderately acid in the A, E, and Bw horizons and is mildly alkaline or moderately alkaline in the C horizon.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. Thickness ranges from 2 to 5 inches.

The E horizon has hue of 10YR, value of 6 to 8, and chroma of 1 or 2. The texture is sand or fine sand. Thickness ranges from 9 to 24 inches.

The Bw horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 6 to 8. The texture is sand or fine sand. Thickness ranges from 16 to 58 inches.

The 2C horizon has hue of 10YR, value of 6 to 8, and chroma of 1 to 3. The texture is gravelly sand,

gravelly fine sand, very gravelly sand, or very gravelly fine sand. The content of shell and shell fragments, which are sand-sized to ½ inch in diameter, ranges from 15 to 45 percent, by volume.

Winder Series

The Winder series consists of poorly drained soils that formed in unconsolidated sandy and loamy marine sediments. These soils are in broad, low flatwood areas and on flood plains. The soils on flood plains are frequently flooded. Slopes are usually less than 1 percent but range to 2 percent. Winder soils are fine-loamy, siliceous, hyperthermic Typic Glossaqualfs.

Winder soils are geographically associated with Chobee, Favoretta, Pineda, Riviera, and Terra Ceia soils. Chobee soils have a mollic epipedon and are on flood plains. Riviera and Pineda soils have sandy A and E horizons about 20 to 40 inches thick over the Bt horizon. Additionally, Pineda soils have a high-chroma Bw horizon. Favoretta soils are sandy clay, clay loam, or clay throughout and are in flatwood areas near drainageways and on flood plains. Terra Ceia soils formed in organic material on flood plains.

Typical pedon of Winder fine sand, about 2,600 feet west and 1,800 feet south of the northeast corner of sec. 31, T. 13 S., R. 30 E.

A—0 to 7 inches; very dark gray (10YR 3/1) fine sand; weak medium granular structure; very friable; many fine and few medium and coarse roots; moderately acid; abrupt wavy boundary.

E—7 to 12 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; many medium and coarse roots; moderately acid; gradual wavy boundary.

B/E—12 to 25 inches; grayish brown (10YR 5/2) sandy loam (Btg); few medium distinct brownish yellow (10YR 6/8) mottles; few coarse distinct grayish brown (10YR 5/2) fine sand intrusions from the overlying E horizon; moderate medium subangular blocky structure; friable; few fine roots; sand grains in the B part coated and bridged with clay; moderately acid; gradual irregular boundary.

Btg1—25 to 34 inches; gray (10YR 6/1) sandy clay loam; few medium distinct brownish yellow (10YR 6/8) mottles; weak medium subangular blocky structure; sand grains coated and bridged with clay; moderately acid; gradual wavy boundary.

Btg2—34 to 45 inches; light gray (10YR 7/1) sandy clay loam; many coarse prominent brownish yellow (10YR 6/8), few fine prominent yellowish red (5YR 5/8), and few fine faint dark gray mottles; moderate medium subangular blocky structure; friable; moderately acid; gradual wavy boundary.

Btg3—45 to 58 inches; greenish gray (5GY 5/1) sandy clay loam; moderate medium subangular blocky structure; friable; sand grains bridged and coated with clay; moderately acid; gradual wavy boundary.

2Cg—58 to 80 inches; greenish gray (5GY 5/1) sandy loam; many coarse prominent brownish yellow (10YR 6/8) and few fine and medium prominent yellowish red (5YR 4/6) mottles; massive; friable; few coarse pockets of calcium carbonate and shell fragments; few medium pockets of fine sand; moderately acid.

The thickness of the solum ranges from 36 to 60 inches. Soil reaction ranges from moderately acid to slightly acid in the A and E horizons, from moderately acid to mildly alkaline in the B/E horizon, and from moderately acid to moderately alkaline in the Btg and Cg horizons.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1. The texture is fine sand or loamy fine sand. Thickness ranges from 4 to 8 inches.

The E horizon and the E part of the B/E horizon have hue of 10YR, value of 4 to 7, and chroma of 1 or 2. The texture is sand, fine sand, or loamy sand. Thickness ranges from 4 to 12 inches.

The B/E horizon is 4 to 20 inches thick.

The Btg horizon and the Btg part of the B/E horizon have hue of 10YR to 5GY, value of 4 to 7, and chroma of 0 to 2 or are neutral. The texture is sandy loam, fine sandy loam, or sandy clay loam. Calcium carbonate accumulations are in the Btg horizon of some pedons. Thickness of the Btg horizon ranges from 13 to 40 inches.

The 2Cg horizon has hue of 10YR to 5Y or 5GY, value of 4 to 8, and chroma of 1 to 8. Some pedons do not have accumulations of calcium carbonate. The texture is sandy loam, fine sandy loam, or sandy clay loam that has few or common pockets of shells.

Formation of the Soils

In this section, the factors and processes of soil formation are discussed and related to the soils in the survey area.

Factors of Soil Formation

Soil is produced by forces of weathering acting on the parent material that has been deposited or accumulated by geologic agencies. The kind of soil that develops depends on five major factors. These factors are—

- the type of parent material
- the climate under which soil material has existed since accumulation
- the plant and animal life in and on the soil
- the relief, or lay of the land
- the length of time the forces of soil formation have acted on the soil material

The five soil-forming factors are interdependent; each modifies the effect of the others. Any one of the five factors can have more influence than the others on the formation of a soil and can account for most of its properties. For example, if the parent material is quartz sand, the soil generally has weakly expressed horizons. In some places, the effect of the parent material is modified greatly by the effects of climate, relief, and plants and animals in and on the soil. Similarly, if a soil is located in the flatwoods, it generally is mostly quartz sand and will have a distinct, dark horizon that has a high content of organic matter. In this case, relief and vegetation are important factors that modify the parent material and form a different soil. As a soil forms, it is influenced by each of the five factors, but in some places one factor has a predominant effect. A modification or variation in any of these factors results in a different kind of soil.

Parent Material

Parent material is the unconsolidated mineral and organic material from which a soil is formed. It determines the physical, chemical, and mineralogical composition of the soil.

The parent material of the soils in Flagler County consists of various-aged marine sediments. The youngest marine sediments consist of beds of sandy and loamy materials that were transported by the sea during the Pleistocene epoch and subsequently were deposited to form marine terraces. Some of this material is actually reworked sediments that were deposited during the Miocene and Pliocene epochs.

In many areas, the sediments have been reworked by relict rivers and streams, shallow ocean currents, or by the wind. The parent material on the flood plains along rivers and streams and in the tidal marshes consists of Holocene-aged, alluvial sand and clay.

Climate

The climate of Flagler County generally is warm and humid. Temperature extremes are moderated somewhat by the proximity to the Atlantic Ocean. The average temperature is about 56 degrees F from December through February and about 80 degrees F from June through August. The average annual rainfall is about 53 inches, and most of the rain falls from June through September.

Few differences among soils in the survey area are caused by the climate; however, the climate encourages the rapid decomposition of organic matter and hastens chemical reactions in the soil. The heavy rainfall leaches the soils of most plant nutrients and produces an acid condition in many of the sandy soils. Percolating water also carries many of the less soluble fine particles and humified organic matter downward.

As a result of the climatic conditions in Flagler County, many of the soils have a low content of organic matter, low natural fertility, and a low available water capacity.

Plants and Animals

Plants have been the principal biological factor in the formation of the soils in the survey area. Animals, insects, bacteria, and fungi have also been important agents. Plants and animals furnish organic matter to the soil and bring nutrients from the lower layers of the soil to the upper layers. They cause differences in the

amount of organic matter, nitrogen, and nutrients in the soil and cause differences in soil structure and porosity. For example, some soils, such as Terra Ceia and Gator soils, have an upper layer that is composed almost entirely of partially decomposed plant remains.

Microorganisms, including bacteria and fungi, help to weather and break down minerals and to decompose organic matter. These organisms are most numerous in the upper few inches of the soil. Earthworms and other small animals inhabit the soil, alter its chemical composition, and mix it with other soil material.

Humans have influenced the formation of soils by clearing forests, cultivating the soils, draining wet areas, and introducing different kinds of plants. The complex interactions of living organisms that affect soil formation have been drastically altered in many areas because of human activities. In many areas, these activities have resulted in a general decrease in the content of organic matter in the topsoil, the loss of topsoil through accelerated erosion, and some mixing of surface, subsurface, and subsoil layers.

Relief

Relief has affected the formation of the soils in Flagler County mainly through its influence on soil-water relationships. Other factors of soil formation generally associated with relief, such as temperature and exposure, are of minor importance.

Four general physiographic areas are in the survey area. They are the Flatwoods, the Inland and Coastal Wetlands, the Sand Ridges and Coastal Dunes, and the Low-Lying Hammock. Many differences between the soils are directly related to relief and its subsequent effect on soil wetness. The soils in the Flatwoods have a high water table, and the surface is periodically wet. The soils in the Inland and Coastal Wetlands are covered by water for a long period of time, and the content of organic matter in the surface layer is high in many places. The tidal marsh and flood plains in the Inland and Coastal Wetlands generally are on the lowest elevations in the survey area. The soils on the Sand Ridges are on higher elevations than those in the Flatwoods and in the Inland and Coastal Wetlands. Most of the deep, sandy soils on the Sand Ridges are better drained than the soils in the Flatwoods and in the Inland and Coastal Wetlands. They are influenced less by a water table.

In the Flatwoods, the water table is commonly near the surface, and it rarely drops below a depth of 5 feet. Organic matter is translocated down a short distance and forms a humus-rich, spodic horizon, or a Bh horizon. This horizon is locally called a "hardpan."

In the low depressional areas of the Inland and Coastal Wetlands, where the water is above the surface, muck accumulates under the marsh or swamp vegetation. As plants die, they accumulate in the water. Oxygen is excluded, and plant decay is only partial and is slow. The amount of muck that accumulates depends largely upon the depth of the standing water and its duration. In some wet areas, accumulations of organic matter have formed a thick black topsoil on the mineral soil instead of a surface layer of muck.

Time

Time is an important factor in soil formation. The physical and chemical changes brought about by climate, living organisms, and relief are slow. The length of time needed to convert raw geological material into soil varies according to the nature of the geological material and the interaction of the other factors. Some basic minerals from which soils are formed weather fairly rapidly; other minerals are chemically inert and show little change over long periods. The translocation of fine particles within the soil to form the horizons is variable under different conditions, but the processes always take a relatively long time.

The dominant geologic material, sand, is inactive. The sand is almost pure quartz and is highly resistant to weathering. The finer textured silt and clay are products of earlier weathering.

In terms of geologic time, relatively little time has elapsed since the parent material of the soils in Flagler County was laid down or emerged from the sea. The loamy and clayey horizons formed in place through the process of clay translocation.

Processes of Soil Formation

Soil genesis refers to the formation of soil horizons. The differentiation of most of the soil horizons in Flagler County is a result of the accumulation of organic matter, the leaching of carbonates and colloidal organic matter, the reduction and transfer of iron and aluminum, the accumulation of silicate clay minerals, or the weathering of limestone.

Some organic matter has accumulated in the upper layers of most of the soils. Some soils have an upper layer that is composed almost entirely of organic matter, while other soils in the survey area have a relatively low content of organic matter. Generally, the amount of organic matter that soils in the survey area accumulate and retain is directly related to the soil wetness.

Some degree of leaching has occurred in most of the soils in Flagler County. Carbonates and salts have been leached from nearly all of the soils. In some soils, the effects of leaching have been indirect because the

leaching permitted the subsequent translocation of silicate clay material.

The reduction and transfer of iron and the leaching of colloidal organic matter has occurred in many of the sandy soils. Leached colloidal organic matter, iron, and aluminum accumulate as dark, weakly cemented layers in many of the wetter soils, such as Smyrna, Cassia, and EauGallie soils.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

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

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

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

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

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

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

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

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

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

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

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

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

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

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

Clastic. Rock or sediment that is composed mainly of fragments derived from pre-existing rocks or minerals and was moved from its place of origin.

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

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

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

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

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

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

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

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

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

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

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

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

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

Coquina. A clastic sedimentary rock that consists mainly of marine shells cemented by a siliceous agent.

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

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

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

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

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

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic)—Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated)—Erosion much more rapid than geologic erosion, mainly as a result of the human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

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

Excess sulfur (in tables). An excessive amount of sulfur is in the soil. The sulfur causes extreme acidity if the soil is drained, and the growth of most plants is restricted.

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

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

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

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

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

Forb. Any herbaceous plant that is not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

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

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

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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

Infiltration. The downward entry of water into the immediate surface of soil or other material. This contrasts with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments that are 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential climax vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of the acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Rippable bedrock or hardpan can be excavated using a single-tooth ripping attachment

mounted on a tractor with a 200-300 drawbar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables). Water is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). The soil mass is susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). An otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, such as zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). There is a risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced by atmospheric agents in rocks or other deposits at or near the earth's surface. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1952-87 at Hastings, Florida)

Month	Temperature					Precipitation		
	Average daily	Average daily maximum	Average daily minimum	Average number of days with temperatures of--		Average total	Average number of days with rainfall of--	
				90 °F or higher	32 °F or lower		0.10 inch or more	0.50 inch or more
	°F	°F	°F			In		
January-----	53.3	64.4	42.3	0	5	2.59	3	2
February----	58.7	68.8	47.8	0	3	3.85	5	2
March-------	61.9	74.2	51.2	0	2	3.80	5	2
April-------	66.3	78.6	54.2	1	0	2.30	3	1
May---------	72.8	84.9	60.3	6	0	3.60	5	2
June--------	78.7	89.3	69.3	15	0	5.85	8	5
July--------	80.6	90.5	70.0	18	0	6.37	9	4
August------	80.1	90.0	70.4	17	0	7.20	10	5
September---	77.4	86.4	69.2	8	0	7.26	8	4
October-----	73.0	82.5	64.5	2	0	4.03	5	2
November----	67.6	76.4	58.3	0	1	2.29	4	1
December----	57.0	68.5	48.0	0	4	2.78	5	2
Total-------	68.9	79.5	58.8	67	16	53.19	70	33

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Freeze threshold temperature	Mean date of last spring occurrence	Mean date of first spring occurrence	Mean number of days between dates	Years of record, spring	Number of occurrences in spring	Years of record, fall	Number of occurrences in fall
32 °F---	Feb. 21	Dec. 10	293	35	74	35	36
28 °F---	Jan. 25	Dec. 26	335	35	35	35	19

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
2	Riviera fine sand	12,441	3.8
3	Samsula and Hontoon soils, depressional	18,729	5.8
4	Wabasso fine sand	19,482	6.0
5	Pineda-Wabasso complex	13,615	4.2
6	Favoretta clay	8,627	2.6
7	Favoretta, Chobee, and Winder soils, frequently flooded	16,643	5.1
8	Hicoria, Riviera, and Gator soils, depressional	36,036	11.1
9	Eaugallie fine sand	15,918	4.9
10	Winder fine sand	19,473	6.0
11	Myakka fine sand	18,499	5.7
12	Placid, Basinger, and St. Johns soils, depressional	17,638	5.4
13	Immokalee fine sand	9,914	3.1
14	Pineda fine sand	17,065	5.3
15	Pomello fine sand, 0 to 5 percent slopes	4,691	1.4
16	Malabar fine sand	7,272	2.2
17	Holopaw fine sand	780	0.2
18	Valkaria-Smyrna complex	4,544	1.4
19	Valkaria fine sand	10,141	3.1
20	Orsino fine sand, 0 to 5 percent slopes	2,009	0.6
21	Smyrna fine sand	14,927	4.6
22	Astatula fine sand, 0 to 8 percent slopes	1,277	0.4
23	Adamsville fine sand, 0 to 3 percent slopes	1,292	0.4
24	Samsula and Placid soils, frequently flooded	2,049	0.6
25	Tavares fine sand, 0 to 5 percent slopes	1,013	0.3
26	Turnbull and Pellicer soils, tidal	3,828	1.2
27	Cassia fine sand	3,821	1.2
29	Udarents, moderately wet	5,876	1.8
30	Pits	942	0.3
31	Palm Beach gravelly sand, 0 to 8 percent slopes	887	0.3
32	Narcoossee, shell substratum-Welaka complex, 0 to 5 percent slopes	493	0.2
33	Beaches	335	0.1
34	Cocoa-Bulow complex, 0 to 5 percent slopes	1,484	0.5
35	Quartzipsamments,dredged	922	0.3
36	Bimini sand	660	0.2
37	Tuscawilla fine sand	2,700	0.8
38	Paola fine sand, 0 to 8 percent slopes	829	0.3
39	Udarents, smoothed	919	0.3
40	Pomona fine sand	11,593	3.6
41	Terra Ceia muck, frequently flooded	3,598	1.1
	Areas of water less than 40 acres	1,138	0.3
	Areas of water more than 40 acres	10,700	3.3
	Total	324,800	100.0

TABLE 4.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or that the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Potatoes, irish	Cabbage	Bahiagrass
		Cwt	Crates	AUM*
2--- Riviera	IIIw	250	400	8.0
3--- Samsula and Hontoon	VIIw	---	---	---
4--- Wabasso	IIIw	240	400	8.0
5--- Pineda-Wabasso	IIIw	240	250	8.0
6--- Favoretta	IIIw	210	---	12.0
7--- Favoretta, Chobee and Winder	VIw	---	---	---
8--- Hicoria, Riviera and Gator	VIIw	---	---	---
9--- Eaugallie	IVw	185	---	8.0
10--- Winder	IIIw	240	300	9.0
11--- Myakka	IVw	180	320	9.0
12--- Placid, Basinger and St. Johns	VIIw	---	---	---
13--- Immokalee	IVw	180	200	7.5
14--- Pineda	IIIw	175	250	8.0
15--- Pomello	VIs	---	---	3.5
16--- Malabar	IVw	175	300	8.0
17--- Holopaw	IVw	180	300	8.0
18--- Valkaria-Smyrna	IVw	---	---	10.0
19--- Valkaria	IVw	---	---	8.0

See footnotes at end of table.

TABLE 4.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Potatoes, irish	Cabbage	Bahiagrass
		Cwt	Crates	AUM*
20---------- Orsino	VIs	---	---	5.0
21---------- Smyrna	IVw	175	250	8.0
22---------- Astatula	VIs	---	---	3.0
23---------- Adamsville	IIIw	150	400	7.0
24---------- Samsula and Placid	VIIw	---	---	---
25---------- Tavares	IIIs	---	---	8.0
26---------- Turnbull and Pellicer	VIIIw	---	---	
27---------- Cassia	VIs	---	---	6.0
29---------- Udarents	---	---	---	---
30**. Pits				
31---------- Palm Beach	VIIs	---	---	---
32:		---	---	5.6
Narcoossee----------	IIIw			
Welaka----------	VIs			
33**---------- Beaches	---	---	---	---
34---------- Cocoa-Bulow	IVs	---	---	---
35---------- Quartzipsamments	---	---	---	---
36---------- Bimini	VIs	---	---	6.0
37---------- Tuscawilla	IIIw	---	---	9.0
38---------- Paola	VIs	---	---	4.0
39---------- Udarents	---	---	---	---
40---------- Pomona	IVw	225	320	8.0

See footnotes at end of table.

TABLE 4.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Potatoes, irish	Cabbage	Bahiagrass
		Cwt	Crates	AUM*
41---------- Terra Ceia	VIIw	---	---	---

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Productivity class*	
2---------- Riviera	10W	Slight	Moderate	Moderate	Moderate	Moderate	Slash pine----------	80	10	Slash pine.
							Longleaf pine-------	70	6	
							Water oak----------	---	---	
							Cabbage palm--------	---	---	
							Baldcypress---------	---	---	
							Sweetgum-----------	---	---	
							Red maple----------	---	---	
3**:										
Samsula----------	6W	Slight	Severe	Severe	Severe	Severe	Baldcypress---------	100	6	
Hontoon----------	6W	Slight	Severe	Severe	Severe	Severe	Baldcypress---------	100	6	
							Blackgum-----------	---	---	
							White ash----------	---	---	
							Loblollybay gordonia	---	---	
							Red maple----------	---	---	
							Sweetbay-----------	---	---	
							Cypress------------	---	---	
							Pond pine----------	---	---	
4---------- Wabasso	10W	Slight	Moderate	Moderate	Slight	Moderate	Slash pine----------	80	10	Slash pine, longleaf pine.
							Longleaf pine-------	65	5	
							Live oak-----------	---	---	
							Water oak----------	---	---	
							Cabbage palm--------	---	---	
5**:										
Pineda----------	10W	Slight	Moderate	Severe	Slight	Moderate	Slash pine----------	80	10	Slash pine, South Florida slash pine.
							Longleaf pine-------	70	6	
							Cabbage palm--------	---	---	
Wabasso----------	10W	Slight	Moderate	Moderate	Slight	Moderate	Slash pine----------	80	10	Slash pine.
							Longleaf pine-------	65	5	
6---------- Favoretta	6W	Slight	Moderate	Severe	Severe	Severe	Baldcypress---------	100	6	
							Cabbage palm--------	---	---	
							Red maple----------	---	---	
							Sweetgum-----------	---	---	
							Water oak----------	---	---	
							Laurel oak----------	---	---	

See footnotes at end of table.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Productivity class*	
7**:										
Favoretta	12W	Slight	Moderate	Severe	Severe	Severe	Baldcypress	100	6	
							Cabbage palm	---	---	
							Red maple	---	---	
							Sweetgum	---	---	
							Water oak	---	---	
							Laurel oak	---	---	
Ohobee	6W	Slight	Severe	Moderate	Slight	Severe	Baldcypress	100	6	
							Red maple	---	---	
							Sweetgum	---	---	
							Blackgum	---	---	
Winder	11W	Slight	Moderate	Moderate	Moderate	Moderate	Slash pine	90	11	Slash pine.
8**:										
Hicoria	2W	Slight	Severe	Severe	Moderate	Severe	Pondcypress	75	2	
							Baldcypress	---	---	
							Blackgum	---	---	
							Red maple	---	---	
							Sweetbay	---	---	
							Redbay	---	---	
							Water oak	---	---	
Riviera	3W	Slight	Severe	Severe	Moderate	Severe	Pondcypress	75	3	
							Baldcypress	---	---	
							Blackgum	---	---	
							Cabbage palm	---	---	
							Pond pine	---	---	
							Loblollybay gordonia	---	---	
							Red maple	---	---	
							Sweetbay	---	---	
Gator	2W	Slight	Severe	Severe	Severe	Severe	Pondcypress	75	2	
							Red maple	---	---	
							Pond pine	---	---	
							Cabbage palm	---	---	
							Baldcypress	---	---	
9---------- Eaugallie	10W	Slight	Moderate	Moderate	Slight	Moderate	Slash pine	80	10	Slash pine.
							Cabbage palm	---	---	
10---------- Winder	11W	Slight	Moderate	Moderate	Moderate	Moderate	Slash pine	90	11	Slash pine.

See footnotes at end of table.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Productivity class*	
11---------- Myakka	8W	Slight	Moderate	Moderate	Moderate	Moderate	Slash pine---------- Longleaf pine--------	70 60	8 4	Slash pine.
12**: Placid----------	2W	Slight	Severe	Severe	Moderate	Severe	Pondcypress----------	75	2	
Basinger----------	2W	Slight	Severe	Severe	Moderate	Severe	Pondcypress---------- Loblollybay gordonia Red maple---------- Sweetbay----------	75 --- --- ---	2 --- --- ---	
St. Johns---------	2W	Slight	Severe	Severe	Moderate	Severe	Pondcypress---------- Loblollybay gordonia Red maple---------- Sweetbay----------	75 --- --- ---	2 --- --- ---	
13---------- Immokalee	8W	Slight	Moderate	Moderate	Moderate	Moderate	Slash pine---------- Longleaf pine--------	70 65	8 5	Slash pine.
14---------- Pineda	10W	Slight	Moderate	Severe	Slight	Moderate	Slash pine---------- Cabbage palm-------- Water oak---------- Sweetgum----------	80 --- --- ---	10 --- --- ---	Slash pine, South Florida slash pine.
15---------- Pomello	8S	Slight	Moderate	Severe	Moderate	Moderate	Slash pine---------- Longleaf pine------- Live oak---------- Laurel oak----------	70 60 60 35	8 4 3 3	Sand pine, slash pine.
16---------- Malabar	10W	Slight	Moderate	Severe	Slight	Moderate	Slash pine---------- Cabbage palm-------- Water oak---------- Red maple---------- Sweetgum----------	80 --- --- --- ---	10 --- --- --- ---	Slash pine.
17---------- Holopaw	10W	Slight	Moderate	Severe	Slight	Moderate	Slash pine---------- Longleaf pine------- Cabbage palm-------- Sweetgum---------- Red maple---------- Water oak----------	80 70 --- --- --- ---	10 6 --- --- --- ---	Slash pine.

See footnotes at end of table.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Productivity class*	
18**:										
Valkaria	8W	Slight	Severe	Moderate	Slight	Moderate	Slash pine	70	8	Slash pine.
							Longleaf pine	60	4	
							Water oak	---	---	
							Sweetgum	---	---	
							Red maple	---	---	
Smyrna	10W	Slight	Moderate	Moderate	Slight	Moderate	Slash pine	80	10	Slash pine.
							Longleaf pine	70	6	
19---Valkaria	8W	Slight	Severe	Moderate	Slight	Moderate	Slash pine	70	8	Slash pine.
20---Orsino	4S	Slight	Moderate	Severe	Slight	Moderate	Sand pine	70	4	Sand pine.
							Longleaf pine	60	4	
							Sand live oak	---	---	
							Turkey oak	---	---	
21---Smyrna	10W	Slight	Moderate	Moderate	Slight	Moderate	Slash pine	80	10	Slash pine.
22---Astatula	3S	Slight	Severe	Moderate	Slight	Slight	Sand pine	60	3	Sand pine.
							Turkey oak	---	---	
							Scrub live oak	---	---	
23---Adamsville	10W	Slight	Moderate	Moderate	Slight	Moderate	Slash pine	80	10	Slash pine.
							Live oak	---	---	
							Turkey oak	---	---	
24**:										
Samsula	6W	Slight	Severe	Severe	Severe	Severe	Baldcypress	100	6	
							Sweetgum	---	---	
							Cabbage palm	---	---	
							Red maple	---	---	
							Pond pine	---	---	
Placid	6W	Slight	Severe	Severe	Moderate	Moderate	Baldcypress	100	6	
							Sweetgum	---	---	
							Water oak	---	---	
							Red maple	---	---	
25---Tavares	10S	Slight	Moderate	Moderate	Slight	Moderate	Slash pine	80	10	Slash pine.
							Longleaf pine	70	6	
							Turkey oak	---	---	
							Bluejack oak	---	---	

See footnotes at end of table.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Productivity class*	
27---------- Cassia	8S	Slight	Moderate	Severe	Slight	Moderate	Slash pine----------	70	8	Sand pine.
							Longleaf pine-------	60	4	
							Sand pine----------	---	---	
32**:										
Narcoossee--------	10W	Slight	Moderate	Moderate	Slight	Moderate	Slash pine----------	80	10	Slash pine.
							Longleaf pine-------	70	6	
Welaka----------	3S	Slight	Moderate	Severe	Slight	Moderate	Sand pine----------	60	3	Sand pine.
							Sand live oak-------	---	---	
34**:										
Cocoa----------	10S	Slight	Moderate	Moderate	Slight	Moderate	Slash pine----------	80	10	Slash pine.
							Longleaf pine-------	70	6	
							Sand pine----------	60	3	
							Cabbage palm--------	---	---	
Bulow----------	10S	Slight	Slight	Moderate	Slight	Moderate	Slash pine----------	80	10	Slash pine, sand pine.
							Longleaf pine-------	70	6	
							Sand pine----------	70	4	
							Southern magnolia---	---	---	
							Live oak-----------	---	---	
							Laurel oak----------	---	---	
36---------- Bimini	8S	Slight	Moderate	Severe	Slight	Slight	Slash pine----------	70	8	Slash pine, sand pine.
							Hickory------------	---	---	
							Cabbage palm--------	---	---	
							Longleaf pine-------	65	5	
							Laurel oak----------	---	---	
							Live oak-----------	---	---	
37---------- Tuscawilla	11W	Slight	Moderate	Moderate	Slight	Severe	Slash pine----------	90	11	Slash pine.
							Live oak-----------	---	---	
							Laurel oak----------	---	---	
							Pignut hickory------	---	---	
							Southern magnolia---	---	---	
							Sweetgum-----------	---	---	
							Cabbage palm--------	---	---	
38---------- Paola	2S	Slight	Moderate	Severe	Slight	Slight	Sand pine----------	50	2	Sand pine.
							Sand live oak-------	---	---	
							Turkey oak----------	---	---	
40---------- Pomona	10W	Slight	Moderate	Moderate	Slight	Moderate	Slash pine----------	80	10	Slash pine.
							Longleaf pine-------	70	6	

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
2---------- Riviera	Severe: wetness, percs slowly.	Severe: wetness, too sandy, percs slowly.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness.
3*:					
Samsula----------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Hontoon----------	Severe: ponding, excess humus, too acid.	Severe: ponding, excess humus, too acid.	Severe: excess humus, ponding, too acid.	Severe: ponding, excess humus.	Severe: too acid, ponding, excess humus.
4---------- Wabasso	Severe: wetness, percs slowly, too sandy.	Severe: wetness, too sandy, percs slowly.	Severe: too sandy, wetness, percs slowly.	Severe: wetness, too sandy.	Severe: wetness.
5*:					
Pineda----------	Severe: wetness, percs slowly, too sandy.	Severe: wetness, too sandy, percs slowly.	Severe: too sandy, wetness, percs slowly.	Severe: wetness, too sandy.	Severe: wetness, droughty.
Wabasso----------	Severe: wetness, percs slowly, too sandy.	Severe: wetness, too sandy, percs slowly.	Severe: too sandy, wetness, percs slowly.	Severe: wetness, too sandy.	Severe: wetness.
6---------- Favoretta	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
7*:					
Favoretta----------	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Chobee----------	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, flooding, percs slowly.	Severe: wetness.	Severe: wetness, flooding.
Winder----------	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
8*:					
Hicoria----------	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.	Severe: ponding.

See footnote at end of table.

TABLE 6.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
8*:					
Riviera	Severe: ponding, percs slowly, too sandy.	Severe: ponding, too sandy, percs slowly.	Severe: too sandy, ponding, percs slowly.	Severe: ponding, too sandy.	Severe: ponding.
Gator	Severe: ponding, percs slowly, excess humus.	Severe: ponding, excess humus, percs slowly.	Severe: excess humus, ponding, percs slowly.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
9--- Eaugallie	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness.
10--- Winder	Severe: wetness, percs slowly, too sandy.	Severe: wetness, too sandy, percs slowly.	Severe: too sandy, wetness, percs slowly.	Severe: wetness, too sandy.	Severe: wetness.
11--- Myakka	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness.
12*:					
Placid	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.	Severe: ponding.
Basinger	Severe: ponding.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.	Severe: ponding.
St. Johns	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.	Severe: ponding.
13--- Immokalee	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness, droughty.
14--- Pineda	Severe: wetness, percs slowly, too sandy.	Severe: wetness, too sandy, percs slowly.	Severe: too sandy, wetness, percs slowly.	Severe: wetness, too sandy.	Severe: wetness, droughty.
15--- Pomello	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
16--- Malabar	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness, droughty.
17--- Holopaw	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness.
18*:					
Valkaria	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: wetness, droughty.

See footnote at end of table.

TABLE 6.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
18*:					
Smyrna	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness.
19--- Valkaria	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: wetness, droughty.
20--- Orsino	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
21--- Smyrna	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness.
22--- Astatula	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
23--- Adamsville	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
24*:					
Samsula	Severe: flooding, wetness, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness, flooding.	Severe: wetness, excess humus.	Severe: wetness, flooding, excess humus.
Placid	Severe: flooding, wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness, flooding.	Severe: wetness, too sandy.	Severe: wetness, flooding.
25--- Tavares	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
26*:					
Turnbull	Severe: flooding, ponding, percs slowly.	Severe: ponding, excess humus, excess salt.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.	Severe: excess salt, ponding, flooding.
Pellicer	Severe: flooding, wetness, percs slowly.	Severe: wetness, excess salt, percs slowly.	Severe: wetness, flooding, percs slowly.	Severe: wetness.	Severe: excess salt, excess sulfur, wetness.
27--- Cassia	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: wetness, droughty.
29--- Udarents	Severe: too sandy.	Severe: too sandy.	Moderate: wetness.	Severe: too sandy.	Severe: droughty.
30*--- Pits	Variable---	Variable---	Variable---	Variable---	Variable.
31--- Palm Beach	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.

See footnote at end of table.

TABLE 6.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
32*:					
Narcoossee	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
Welaka	Severe: too sandy.	Severe: too sandy.	Severe: small stones, too sandy.	Severe: too sandy.	Severe: droughty.
33*	Severe: flooding, wetness, too sandy.	Severe: wetness, too sandy, excess salt.	Severe: too sandy, wetness, flooding.	Severe: wetness, too sandy.	Severe: excess salt, wetness, droughty.
Beaches					
34*:					
Cocoa	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Bulow	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
35	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Quartzipsamments					
36*	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Bimini					
37	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness.
Tuscawilla					
38	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Paola					
39	Severe: too sandy.	Severe: too sandy.	Severe: small stones, too sandy.	Severe: too sandy.	Severe: droughty.
Udarents					
40	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness.
Pomona					
41	Severe: flooding, wetness, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness, flooding.	Severe: wetness, excess humus.	Severe: wetness, flooding, excess humus.
Terra Ceia					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
2---------- Riviera	Poor	Fair	Fair	Fair	Fair	---	Poor	Fair	Fair	Fair	Fair	---
3*:												
Samsula----------	Very poor.	Very poor.	Poor	Fair	Very poor.	---	Good	Good	Very poor.	Poor	Good	---
Hontoon----------	Very poor.	Very poor.	Poor	Poor	Very poor.	---	Good	Good	Very poor.	Poor	Good	---
4---------- Wabasso	Poor	Poor	Poor	Poor	Good	---	Fair	Poor	Poor	Fair	Poor	---
5*:												
Pineda----------	Poor	Fair	Fair	Poor	Poor	---	Good	Fair	Fair	Poor	Fair	---
Wabasso----------	Poor	Poor	Poor	Poor	Good	---	Fair	Poor	Poor	Fair	Poor	---
6---------- Favoretta	Very poor.	Poor	Poor	Fair	Poor	---	Good	Good	Poor	Poor	Good	---
7*:												
Favoretta---------	Poor	Fair	Fair	Fair	Fair	---	Good	Fair	Fair	Fair	Good	---
Chobee----------	Poor	Poor	Poor	Fair	Poor	---	Good	Good	Poor	Poor	Good	---
Winder----------	Poor	Fair	Fair	Fair	Fair	---	Fair	Fair	Fair	Fair	Fair	---
8*:												
Hicoria----------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
Riviera----------	Very poor.	Poor	Very poor.	Very poor.	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
Gator----------	Very poor.	Very poor.	Very poor.	Poor	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
9---------- Eaugallie	Poor	Poor	Fair	Poor	Poor	---	Poor	Poor	Poor	Poor	Poor	---
10---------- Winder	Poor	Fair	Fair	Fair	Fair	---	Fair	Fair	Fair	Fair	Fair	---
11---------- Myakka	Poor	Fair	Fair	Poor	Poor	---	Fair	Poor	Fair	Poor	Poor	---
12*:												
Placid----------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
Basinger----------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
St. Johns---------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	Fair	Good	Very poor.	Very poor.	Good	---

See footnote at end of table.

TABLE 7.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
13---- Immokalee	Poor	Poor	Fair	Poor	Poor	---	Fair	Poor	Poor	Poor	Poor	---
14---- Pineda	Poor	Fair	Fair	Poor	Poor	---	Good	Fair	Fair	Poor	Fair	---
15---- Pomello	Poor	Poor	Poor	Poor	Poor	---	Very poor.	Very poor.	Poor	Poor	Very poor.	---
16---- Malabar	Poor	Poor	Poor	Poor	Poor	---	Fair	Fair	Poor	Poor	Fair	---
17---- Holopaw	Poor	Fair	Fair	Poor	Fair	---	Fair	Fair	Fair	Fair	Fair	---
18*:												
Valkaria----	Poor	Fair	Fair	Fair	Fair	---	Good	Fair	Poor	Poor	Good	---
Smyrna----	Poor	Fair	Fair	Poor	Fair	---	Fair	Fair	Fair	Fair	Fair	---
19---- Valkaria	Poor	Fair	Fair	Fair	Fair	---	Good	Fair	Poor	Poor	Good	---
20---- Orsino	Very poor.	Poor	Poor	Poor	Poor	---	Very poor.	Very poor.	Poor	Poor	Very poor.	---
21---- Smyrna	Poor	Fair	Fair	Poor	Fair	---	Fair	Fair	Fair	Fair	Fair	---
22---- Astatula	Very poor.	Poor	Poor	Poor	Poor	---	Very poor.	Very poor.	Poor	Poor	Very poor.	---
23---- Adamsville	Poor	Poor	Fair	Fair	Fair	---	Poor	Poor	Poor	Fair	Poor	---
24*:												
Samsula----	Very poor.	Poor	Very poor.	Very poor.	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
Placid----	Very poor.	Very poor.	Poor	Fair	Poor	---	Good	Fair	Very poor.	Poor	Good	---
25---- Tavares	Poor	Fair	Fair	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
26*:												
Turnbull----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	Fair	Good	Very poor.	Very poor.	Fair	---
Pellicer----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	Poor	Good	Very poor.	Very poor.	Fair	---
27---- Cassia	Very poor.	Poor	Poor	Poor	Fair	---	Very poor.	Very poor.	Poor	Poor	Very poor.	---
29. Udarents												
30*---- Pits	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 7.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
31---------- Palm Beach	Very poor.	Poor	Poor	Very poor.	Very poor.	---	Very poor.	Very poor.	Poor	Very poor.	Very poor.	---
32*:												
Narcoossee--------	Poor	Poor	Fair	Fair	Fair	---	Poor	Poor	Poor	Fair	Poor	---
Welaka----------	Poor	Poor	Poor	Very poor.	Poor	---	Very poor.	Very poor.	Poor	Poor	Very poor.	---
33*---------- Beaches	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
34*:												
Cocoa----------	Poor	Poor	Fair	Poor	Poor	---	Very poor.	Very poor.	Poor	Poor	Very poor.	---
Bulow----------	Poor	Poor	Poor	Fair	Poor	---	Very poor.	Very poor.	Poor	Fair	Very poor.	---
35. Quartzipsamments												
36---------- Bimini	Poor	Poor	Fair	Poor	Poor	---	Poor	Poor	Poor	Poor	Poor	---
37---------- Tuscawilla	Poor	Fair	Fair	Good	Fair	---	Fair	Fair	Fair	Good	Fair	---
38---------- Paola	Very poor.	Poor	Poor	Poor	Poor	---	Very poor.	Very poor.	Poor	Poor	Very poor.	---
39. Udarents												
40---------- Pomona	Poor	Poor	Fair	Poor	Poor	---	Fair	Poor	Poor	Poor	Poor	---
41---------- Terra Ceia	Very poor.	Poor	Poor	Poor	Poor	---	Good	Good	Poor	Poor	Good	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2---------- Riviera	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
3*: Samsula----------	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: ponding, excess humus.
Hontoon----------	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: too acid, ponding, excess humus.
4---------- Wabasso	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
5*: Pineda----------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty.
Wabasso----------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
6---------- Favoretta	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
7*: Favoretta--------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
Chobee----------	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
Winder----------	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
8*: Hicoria----------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Riviera----------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
8*: Gator	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: ponding, excess humus.
9--- Eaugallie	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
10--- Winder	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
11--- Myakka	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
12*: Placid	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Basinger	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
St. Johns	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
13--- Immokalee	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty.
14--- Pineda	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty.
15--- Pomello	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: droughty.
16--- Malabar	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty.
17--- Holopaw	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
18*: Valkaria	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty.
Smyrna	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
19--- Valkaria	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty.
20--- Orsino	Severe: cutbanks cave.	Slight---	Moderate: wetness.	Slight---	Slight---	Severe: droughty.
21--- Smyrna	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
22--- Astatula	Severe: cutbanks cave.	Slight---	Slight---	Moderate: slope.	Slight---	Severe: droughty.
23--- Adamsville	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: droughty.
24*: Samsula---	Severe: cutbanks cave, excess humus, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding, excess humus.
Placid---	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
25--- Tavares	Severe: cutbanks cave.	Slight---	Moderate: wetness.	Slight---	Slight---	Severe: droughty.
26*: Turnbull---	Severe: cutbanks cave, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, shrink-swell, low strength.	Severe: excess salt, ponding, flooding.
Pellicer---	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: excess salt, excess sulfur, wetness.
27--- Cassia	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
29--- Udarents	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: droughty.
30*--- Pits	Variable---	Variable---	Variable---	Variable---	Variable---	Variable.
31--- Palm Beach	Severe: cutbanks cave.	Slight---	Slight---	Moderate: slope.	Slight---	Severe: droughty.
32*: Narcoossee---	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
32*:						
Welaka	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
33*	Severe:	Severe:	Severe:	Severe:	Severe:	Severe:
Beaches	cutbanks cave, wetness.	flooding, wetness.	flooding, wetness.	flooding, wetness.	wetness, flooding.	excess salt, wetness, droughty.
34*:						
Cocoa	Severe: depth to rock, cutbanks cave.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: droughty.
Bulow	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
35	Severe:	Moderate:	Severe:	Moderate:	Moderate:	Severe:
Quartzipsamments	cutbanks cave, wetness.	wetness.	wetness.	wetness.	wetness.	droughty.
36	Severe:	Moderate:	Severe:	Moderate:	Moderate:	Severe:
Bimini	cutbanks cave, wetness.	wetness.	wetness.	wetness.	wetness.	droughty.
37	Severe:	Severe:	Severe:	Severe:	Severe:	Severe:
Tuscawilla	cutbanks cave, wetness.	wetness.	wetness.	wetness.	wetness.	wetness.
38	Severe:	Slight	Slight	Moderate:	Slight	Severe:
Paola	cutbanks cave.			slope.		droughty.
39	Severe:	Moderate:	Severe:	Moderate:	Moderate:	Severe:
Udarents	cutbanks cave, wetness.	wetness.	wetness.	wetness.	wetness.	droughty.
40	Severe:	Severe:	Severe:	Severe:	Severe:	Severe:
Pomona	cutbanks cave, wetness.	wetness.	wetness.	wetness.	wetness.	wetness.
41	Severe:	Severe:	Severe:	Severe:	Severe:	Severe:
Terra Ceia	excess humus, wetness.	subsides, flooding, wetness.	subsides, flooding, wetness.	subsides, flooding, wetness.	subsides, wetness, flooding.	wetness, flooding, excess humus.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2---------- Riviera	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
3*:					
Samsula----------	Severe: subsides, ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Hontoon----------	Severe: subsides, ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus, too acid.
4---------- Wabasso	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
5*:					
Pineda----------	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Wabasso----------	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
6---------- Favoretta	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
7*:					
Favoretta----------	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Chobee----------	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
Winder----------	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness, thin layer.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
8*:					
Hicoria	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding, thin layer.
Riviera	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Gator	Severe: ponding, percs slowly, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding, thin layer.
9--- Eaugallie	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
10--- Winder	Severe: wetness, percs slowly.	Severe: seepage.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness, thin layer.
11--- Myakka	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
12*:					
Placid	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Basinger	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
St. Johns	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
13--- Immokalee	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
14--- Pineda	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
15--- Pomello	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
16--- Malabar	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
17--- Holopaw	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
18*:					
Valkaria---	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Smyrna---	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
19--- Valkaria	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
20--- Orsino	Moderate: wetness.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
21--- Smyrna	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
22--- Astatula	Slight---	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
23--- Adamsville	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
24*:					
Samsula---	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, excess humus.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Placid---	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
25--- Tavares	Moderate: wetness.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
26*:					
Turnbull	Severe: flooding, ponding, percs slowly.	Severe: seepage, flooding, excess humus.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: too clayey, hard to pack, ponding.
Pellicer	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
27--- Cassia	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
29--- Udarents	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
30*--- Pits	Variable---	Variable---	Variable---	Variable---	Variable.
31--- Palm Beach	Slight---	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
32*:					
Narcoossee	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Welaka	Slight---	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
33*--- Beaches	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
34*:					
Cocoa	Severe: depth to rock, poor filter.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage, too sandy.	Severe: depth to rock, seepage.	Poor: depth to rock, seepage, too sandy.
Bulow	Severe: poor filter.	Severe: seepage.	Severe: depth to rock, seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
35--- Quartzipsamments	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
36--- Bimini	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
37--- Tuscawilla	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness, thin layer.
38--- Paola	Slight---	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
39--- Udarents	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
40--- Pomona	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
41--- Terra Ceia	Severe: subsides, flooding, wetness.	Severe: seepage, flooding, excess humus.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness, excess humus.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
2---------- Riviera	Poor: wetness.	Probable----------	Probable----------	Poor: too sandy, wetness.
3*:				
Samsula----------	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: excess humus, wetness.
Hontoon----------	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness, too acid.
4---------- Wabasso	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: too sandy, wetness.
5*:				
Pineda----------	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: too sandy, wetness.
Wabasso----------	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: too sandy, wetness.
6---------- Favoretta	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
7*:				
Favoretta----------	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Chobee----------	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: wetness.
Winder----------	Poor: wetness.	Probable----------	Probable----------	Poor: wetness.
8*:				
Hicoria----------	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: thin layer, wetness.
Riviera----------	Poor: wetness.	Probable----------	Probable----------	Poor: too sandy, wetness.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
8*:				
Gator	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
9---- Eaugallie	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
10---- Winder	Poor: wetness.	Probable	Probable	Poor: wetness.
11---- Myakka	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
12*:				
Placid	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Basinger	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
St. Johns	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
13---- Immokalee	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
14---- Pineda	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
15---- Pomello	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
16---- Malabar	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
17---- Holopaw	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
18*:				
Valkaria	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness, too sandy.
Smyrna	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
19---- Valkaria	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness, too sandy.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
20--- Orsino	Good	Probable	Improbable: too sandy.	Poor: too sandy.
21--- Smyrna	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
22--- Astatula	Good	Probable	Improbable: too sandy.	Poor: too sandy.
23--- Adamsville	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
24*:				
Samsula	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Placid	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness, too sandy.
25--- Tavares	Good	Probable	Improbable: too sandy.	Poor: too sandy.
26*:				
Turnbull	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too clayey, excess humus, excess salt.
Pellicer	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too clayey, excess salt, wetness.
27--- Cassia	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
29--- Udarents	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
30*--- Pits	Variable	Variable	Variable	Variable.
31--- Palm Beach	Good	Probable	Improbable: too sandy.	Poor: too sandy.
32*:				
Narcoossee	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Welaka	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
33*--- Beaches	Poor: wetness.	Probable	Improbable: too sandy.	Poor: area reclaim, too sandy, excess salt.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
34*:				
Cocoa	Poor: depth to rock.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
Bulow	Fair: depth to rock, thin layer.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
35 Quartzipsamments	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
36 Bimini	Fair: thin layer, wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
37 Tuscawilla	Poor: wetness.	Probable	Improbable: too sandy.	Poor: small stones, wetness.
38 Paola	Good	Probable	Improbable: too sandy.	Poor: too sandy.
39 Udarents	Fair: wetness.	Probable	Improbable: thin layer.	Poor: too sandy, small stones.
40 Pomona	Poor: wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, wetness.
41 Terra Ceia	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
2---------- Riviera	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Percs slowly, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty, percs slowly.
3*: Samsula----------	Severe: seepage.	Severe: excess humus, ponding.	Severe: cutbanks cave.	Ponding, subsides, too acid.	Ponding, soil blowing, too acid.	Ponding, soil blowing.	Wetness.
Hontoon----------	Severe: seepage.	Severe: excess humus, ponding.	Severe: cutbanks cave.	Ponding, subsides, too acid.	Ponding, soil blowing, too acid.	Ponding, soil blowing.	Wetness.
4---------- Wabasso	Severe: seepage.	Severe: thin layer, wetness.	Severe: slow refill, cutbanks cave.	Percs slowly---	Wetness, droughty, fast intake.	Wetness, soil blowing, percs slowly.	Wetness, droughty, rooting depth.
5*: Pineda----------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Percs slowly, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty, percs slowly.
Wabasso----------	Severe: seepage.	Severe: thin layer, wetness.	Severe: slow refill, cutbanks cave.	Percs slowly---	Wetness, droughty, fast intake.	Wetness, soil blowing, percs slowly.	Wetness, droughty, rooting depth.
6---------- Favoretta	Slight---------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding.	Wetness, slow intake, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
7*: Favoretta--------	Slight---------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly---	Wetness, slow intake, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Chobee----------	Slight---------	Severe: wetness.	Severe: slow refill, cutbanks cave.	Percs slowly, flooding.	Wetness, fast intake, soil blowing.	Wetness, soil blowing, percs slowly.	Wetness, rooting depth, percs slowly.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
7*:							
Winder	Severe: seepage.	Severe: seepage, wetness.	Severe: slow refill, cutbanks cave.	Percs slowly, flooding.	Wetness, droughty, fast intake.	Wetness, soil blowing, percs slowly.	Wetness, droughty, percs slowly.
8*:							
Hicoria	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, percs slowly.	Ponding, fast intake.	Ponding, soil blowing, percs slowly.	Wetness, rooting depth.
Riviera	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, percs slowly, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty, percs slowly.
Gator	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, percs slowly, subsides.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
9--- Eaugallie	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
10--- Winder	Severe: seepage.	Severe: seepage, wetness.	Severe: slow refill, cutbanks cave.	Percs slowly---	Wetness, droughty, fast intake.	Wetness, soil blowing, percs slowly.	Wetness, droughty, percs slowly.
11--- Myakka	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
12*:							
Placid	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, fast intake, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
Basinger	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
12*:							
St. Johns	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
13---------- Immokalee	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
14---------- Pineda	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Percs slowly, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty, percs slowly.
15---------- Pomello	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
16---------- Malabar	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
17---------- Holopaw	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
18*:							
Valkaria	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Smyrna	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
19---------- Valkaria	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
20---------- Orsino	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
21---------- Smyrna	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
22---------- Astatula	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
23---------- Adamsville	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
24*:							
Samsula----------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, subsides, cutbanks cave.	Wetness, flooding.	Wetness, too sandy.	Wetness.
Placid----------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
25---------- Tavares	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
26*:							
Turnbull----------	Severe: seepage.	Severe: excess humus, hard to pack, ponding.	Severe: slow refill, salty water, cutbanks cave.	Ponding, percs slowly, flooding.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, excess salt, percs slowly.
Pellicer----------	Slight----------	Severe: hard to pack, wetness, excess salt.	Severe: slow refill, salty water, cutbanks cave.	Percs slowly, flooding, excess salt.	Wetness, percs slowly, flooding.	Wetness, percs slowly.	Wetness, excess salt, percs slowly.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
27---------- Cassia	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
29---------- Udarents	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
30*---------- Pits	Variable-------	Variable-------	Variable-------	Variable-------	Variable-------	Variable-------	Variable.
31---------- Palm Beach	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
32*: Narcoossee-------	Severe: seepage.	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
Welaka----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
33*---------- Beaches	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: salty water, cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, excess salt, droughty.
34*: Cocoa----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake.	Depth to rock, too sandy, soil blowing.	Droughty, depth to rock.
Bulow----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
35---------- Quartzipsamments	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
36---------- Bimini	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
37---------- Tuscawilla	Severe: seepage.	Severe: wetness.	Severe: cutbanks cave.	Favorable------	Wetness, droughty, fast intake.	Wetness, soil blowing.	Wetness, droughty.
38---------- Paola	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
39---------- Udarents	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
40---------- Pomona	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
41---------- Terra Ceia	Severe: seepage.	Severe: excess humus, wetness.	Slight---------	Flooding, subsides.	Wetness, soil blowing, flooding.	Wetness, soil blowing.	Wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
2---------- Riviera	0-28	Fine sand--------	SP, SP-SM	A-3, A-2-4	0	100	100	80-100	4-12	---	NP
	28-35	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC-SM, SC	A-2-4	0	100	100	80-100	15-35	<35	NP-15
	35-51	Sandy loam, fine sandy loam, sandy clay loam.	SC-SM, SC	A-2-4, A-2-6	0	100	100	80-100	20-35	20-40	4-20
	51-80	Sand, fine sand, loamy fine sand.	SP, SP-SM, SC-SM, SM	A-3, A-1, A-2-4, A-2-6	0	60-80	50-75	40-70	5-20	---	NP
3*:											
Samsula----------	0-31	Muck----------	PT	A-8	---	---	---	---	---	---	---
	31-80	Sand, fine sand	SP-SM, SM, SP	A-3, A-2-4	0	100	100	80-100	2-20	---	NP
Hontoon----------	0-80	Muck----------	PT	A-8	0	---	---	---	---	---	---
4---------- Wabasso	0-4	Fine sand--------	SP, SP-SM	A-3	0	100	100	95-100	2-10	---	NP
	4-22	Sand, fine sand	SP, SP-SM	A-3	0	100	100	95-100	2-10	---	NP
	22-30	Sand, fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	100	100	95-100	5-20	---	NP
	30-47	Sandy loam, fine sandy loam, sandy clay loam.	SC, SC-SM	A-2-4, A-2-6	0	100	100	95-100	20-35	20-30	5-13
	47-80	Fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	100	100	95-100	5-20	---	NP
5*:											
Pineda----------	0-3	Fine sand--------	SP, SP-SM	A-3	0	100	100	80-95	2-8	---	NP
	3-32	Sand, fine sand	SP, SP-SM	A-3	0	100	100	80-95	2-10	---	NP
	32-80	Sandy loam, fine sandy loam, sandy clay loam.	SC, SC-SM, SM	A-2-4, A-2-6	0	100	100	65-95	15-35	<35	NP-20
Wabasso----------	0-7	Fine sand--------	SP, SP-SM	A-3	0	100	100	95-100	2-10	---	NP
	7-19	Sand, fine sand	SP, SP-SM	A-3	0	100	100	95-100	2-10	---	NP
	19-36	Sand, fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	100	100	95-100	5-20	---	NP
	36-63	Sandy loam, fine sandy loam, sandy clay loam.	SC, SC-SM	A-2-4, A-2-6	0	100	100	95-100	20-35	20-30	5-13
	63-80	Fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	100	100	95-100	5-20	---	NP
6---------- Favoretta	0-12	Clay----------	CH, CL	A-7, A-6	0	100	100	85-100	65-95	45-85	24-52
	12-80	Sandy clay, clay loam, clay.	CH, CL	A-7, A-6	0	100	100	85-100	65-95	45-85	24-52
7*:											
Favoretta-------	0-10	Clay----------	CH, CL	A-7	0	100	100	85-100	65-95	45-85	24-52
	10-80	Sandy clay, clay loam, clay.	CH, CL	A-7	0	100	100	85-100	65-95	45-85	24-52

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
7*:											
Chobee----------	0-10	Loamy fine sand	SP-SM, SM	A-2-4	0	100	100	85-99	12-25	<40	NP-10
	10-55	Sandy clay loam, fine sandy loam.	SC	A-2-6, A-2-7, A-6	0	100	100	85-99	25-45	35-45	20-25
	55-80	Loamy sand, sandy loam, clay loam.	SP-SM, SM, SC, SC-SM	A-2-4, A-2-6, A-6	0	100	100	80-99	12-45	<45	NP-25
Winder----------	0-10	Loamy fine sand	SP-SM, SM	A-2-4	0	100	100	80-100	12-25	---	NP
	10-25	Loamy sand, sandy loam, fine sandy loam.	SM	A-2-4	0	100	100	80-100	15-25	<35	NP-10
	25-50	Sandy clay loam	SC	A-2-4, A-2-6	0	100	100	80-100	18-35	20-40	9-26
	50-80	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC-SM, SC, GM-GC	A-2-4, A-2-6, A-1-b	0	60-80	50-75	40-70	15-35	<35	NP-20
8*:											
Hicoria----------	0-10	Mucky fine sand	SP-SM, SM, SC-SM	A-3, A-2-4	0	100	100	90-100	5-20	<20	NP-5
	10-32	Sand, fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	100	100	90-100	5-20	---	NP
	32-55	Sandy loam, fine sandy loam, sandy clay loam.	SC-SM, SC, SM	A-2-4, A-2-6, A-4, A-6	0	100	100	90-100	20-40	<30	NP-15
	55-80	Sand, fine sandy loam, sandy clay loam.	SC-SM, SC, SM, SP-SM	A-3, A-2-4, A-2-6	0	100	100	90-100	5-35	<30	NP-15
Riviera----------	0-22	Fine sand--------	SP, SP-SM	A-3, A-2-4	0	100	100	80-100	4-12	---	NP
	22-35	Sandy loam, sandy clay loam.	SM, SC-SM, SC	A-2-4, A-2-6	0	100	100	80-100	15-35	<35	NP-15
	35-50	Sandy loam, sandy clay loam.	SC-SM, SC	A-2-4, A-2-6	0	100	100	80-100	20-35	20-40	4-20
	50-80	Sand, fine sand, loamy fine sand.	SP-SM, SM	A-3, A-1, A-2-4	0	60-100	50-95	40-90	5-20	---	NP
Gator----------	0-26	Muck----------	PT	A-8	0	---	---	---	---	---	---
	26-80	Fine sandy loam, sandy clay loam.	SC-SM, SC, SM	A-2-4, A-2-6	0	100	100	80-99	25-35	<40	NP-15
9----------	0-22	Fine sand--------	SP, SP-SM	A-3	0	100	100	80-98	2-5	---	NP
Eaugallie	22-33	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	100	100	80-98	5-20	---	NP
	33-56	Sand, fine sand	SP, SP-SM	A-3, A-2-4	0	100	100	80-98	2-12	---	NP
	56-70	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC-SM, SC	A-2-4, A-2-6	0	100	100	80-98	20-35	<40	NP-20
	70-80	Sand, fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	100	100	80-98	5-25	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
10---------- Winder	0-12	Fine sand--------	SP, SP-SM	A-3, A-2-4	0	100	100	80-100	2-12	---	NP
	12-58	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC, SC-SM	A-2-4, A-2-6	0	100	100	80-100	15-35	<35	NP-20
	58-80	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC-SM, SC	A-2-4	0	60-80	50-75	40-70	15-35	<35	NP-20
11---------- Myakka	0-6	Fine sand--------	SP, SP-SM	A-3	0	100	100	85-100	2-10	---	NP
	6-25	Sand, fine sand	SP, SP-SM	A-3	0	100	100	85-100	2-10	---	NP
	25-31	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-3, A-2-4	0	100	100	85-100	5-20	---	NP
	31-80	Sand, fine sand	SP, SP-SM	A-3	0	100	100	85-100	2-10	---	NP
12*:											
Placid----------	0-15	Fine sand--------	SP, SP-SM, SM	A-3, A-2-4	0	100	100	90-100	1-20	---	NP
	15-80	Sand, fine sand	SP, SP-SM, SM	A-3, A-2-4	0	100	100	90-100	1-20	---	NP
Basinger--------	0-2	Fine sand--------	SP	A-3	0	100	100	85-100	1-4	---	NP
	2-29	Sand, fine sand	SP, SP-SM	A-3, A-2-4	0	100	100	85-100	2-12	---	NP
	29-50	Sand, fine sand	SP, SP-SM	A-3, A-2-4	0	100	100	85-100	2-12	---	NP
	50-80	Sand, fine sand	SP, SP-SM	A-3, A-2-4	0	100	100	85-100	2-12	---	NP
St. Johns-------	0-10	Fine sand--------	SP, SP-SM	A-3	0	100	100	75-95	3-10	---	NP
	10-25	Sand, fine sand	SP, SP-SM	A-3	0	100	100	85-95	3-10	---	NP
	25-39	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-3, A-2-4	0	100	100	85-95	5-20	---	NP
	39-80	Sand, fine sand	SP, SP-SM	A-3	0	100	100	80-90	2-10	---	NP
13---------- Immokalee	0-5	Fine sand--------	SP, SP-SM	A-3	0	100	100	70-100	2-10	---	NP
	5-39	Fine sand, sand	SP, SP-SM	A-3	0	100	100	70-100	2-10	---	NP
	39-60	Fine sand, sand	SP-SM, SM	A-3, A-2-4	0	100	100	70-100	5-21	---	NP
	60-80	Fine sand, sand, loamy fine sand.	SP, SP-SM	A-3	0	100	100	70-100	2-10	---	NP
14---------- Pineda	0-3	Fine sand--------	SP, SP-SM	A-3	0	100	100	80-95	2-8	---	NP
	3-26	Sand, fine sand	SP, SP-SM	A-3	0	100	100	80-95	2-10	---	NP
	26-40	Sandy loam, fine sandy loam, sandy clay loam.	SC, SC-SM, SM	A-2-4, A-2-6	0	100	95	65-95	15-35	<35	NP-20
	40-80	Loamy fine sand, fine sandy loam, sandy clay loam.	SP-SM, SM, SP, SC-SM	A-3, A-2-4, A-2-6	0	95-100	90-100	80-95	20-35	<35	NP-20
15---------- Pomello	0-41	Fine sand--------	SP, SP-SM	A-3	0	100	100	60-100	1-8	---	NP
	41-66	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	100	100	60-100	6-15	---	NP
	66-80	Coarse sand, sand, fine sand.	SP, SP-SM	A-3	0	100	100	60-100	4-10	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
16----------	0-10	Fine sand--------	SP, SP-SM	A-3	0	100	100	80-100	2-10	---	NP
Malabar	10-30	Sand, fine sand	SP, SP-SM	A-3, A-2-4	0	100	100	80-100	3-12	---	NP
	30-60	Sand, fine sand	SP, SP-SM	A-3	0	100	100	80-100	2-10	---	NP
	60-80	Sandy clay loam, fine sandy loam, sandy loam.	SC, SC-SM, SM	A-2, A-4, A-6	0	100	100	80-100	20-40	<35	NP-20
17----------	0-45	Fine sand--------	SP, SP-SM	A-3	0	100	95-100	70-95	2-10	---	NP
Holopaw	45-55	Sandy loam, sandy clay loam, fine sandy loam.	SM, SC-SM	A-2-4	0	100	95-100	70-99	15-30	<25	NP-7
	55-80	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM	A-2-4	0	100	95-100	70-99	11-20	---	NP
18*:											
Valkaria--------	0-6	Fine sand--------	SP, SP-SM	A-3	0	100	75-100	75-100	2-10	---	NP
	6-17	Sand, fine sand	SP, SP-SM	A-3	0	100	75-100	75-100	2-10	---	NP
	17-38	Sand, fine sand	SP, SP-SM	A-3	0	100	75-100	75-100	3-10	---	NP
	38-80	Sand, fine sand	SP, SP-SM	A-3	0	100	75-100	75-100	2-10	---	NP
Smyrna----------	0-15	Fine sand--------	SP, SP-SM	A-3, A-2-4	0	100	100	80-100	2-12	---	NP
	15-20	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-3, A-2-4	0	100	100	80-100	5-20	---	NP
	20-80	Sand, fine sand	SP, SP-SM	A-3	0	100	100	80-100	2-10	---	NP
19----------	0-4	Fine sand--------	SP, SP-SM	A-3	0	100	75-100	75-100	2-10	---	NP
Valkaria	4-18	Sand, fine sand	SP, SP-SM	A-3	0	100	75-100	75-100	2-10	---	NP
	18-47	Sand, fine sand	SP, SP-SM	A-3	0	100	75-100	75-100	3-10	---	NP
	47-80	Sand, fine sand	SP, SP-SM	A-3	0	100	75-100	75-100	2-10	---	NP
20----------	0-3	Fine sand--------	SP	A-3	0	100	100	88-100	1-3	---	NP
Orsino	3-12	Sand, fine sand	SP	A-3	0	100	100	88-100	1-3	---	NP
	12-80	Sand, fine sand	SP, SP-SM	A-3	0	100	100	88-100	2-5	---	NP
21----------	0-13	Fine sand--------	SP, SP-SM	A-3, A-2-4	0	100	100	80-100	2-12	---	NP
Smyrna	13-21	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-3, A-2-4	0	100	100	80-100	5-20	---	NP
	21-80	Sand, fine sand	SP, SP-SM	A-3	0	100	100	80-100	2-10	---	NP
22----------	0-7	Fine sand--------	SP, SP-SM	A-3	0	100	100	75-99	1-7	---	NP
Astatula	7-80	Sand, fine sand	SP, SP-SM	A-3	0	100	100	75-99	1-7	---	NP
23----------	0-7	Fine sand--------	SP-SM	A-3, A-2-4	0	100	100	90-100	5-12	---	NP
Adamsville	7-80	Fine sand, sand	SP-SM, SP	A-3, A-2-4	0	100	100	90-100	2-12	---	NP
24*:											
Samsula---------	0-31	Muck------------	PT	A-8	0	---	---	---	---	---	---
	31-80	Fine sand, sand, loamy sand.	SP, SP-SM, SM	A-3, A-2-4	0	100	85-100	80-95	2-15	---	NP
Placid----------	0-20	Fine sand--------	SP, SP-SM, SM	A-3, A-2-4	0	100	100	90-100	1-20	---	NP
	20-80	Fine sand, sand, loamy fine sand.	SP, SP-SM, SM	A-3, A-2-4	0	100	100	90-100	1-20	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
25---------- Tavares	0-5	Fine sand--------	SP, SP-SM	A-3	0	100	95-100	85-100	2-10	---	NP
	5-80	Sand, fine sand	SP, SP-SM	A-3	0	100	95-100	85-100	2-10	---	NP
26*:											
Turnbull--------	0-8	Muck----------	PT	A-8	0	---	---	---	---	---	---
	8-42	Clay----------	CH	A-7	0	100	100	90-100	75-95	70-95	45-60
	42-80	Loamy fine sand, fine sand.	SP-SM, SM	A-2-4, A-3	0	95-100	90-100	75-90	5-20	---	NP
Pellicer--------	0-10	Silty clay loam	CH, SC	A-7	0	100	100	90-100	40-85	60-100	30-60
	10-55	Sandy clay, clay loam, clay.	CH, SC	A-7	0	100	100	85-100	50-90	50-100	25-60
	55-80	Fine sand, loamy fine sand, fine sandy loam.	SP-SM, SM	A-2-4, A-3	0	100	90-100	80-100	5-20	---	NP
27---------- Cassia	0-26	Fine sand--------	SP, SP-SM	A-3	0	100	100	90-100	2-7	---	NP
	26-42	Sand, fine sand, loamy sand.	SP-SM, SM	A-3, A-2-4	0	100	100	90-100	5-20	---	NP
	42-80	Sand, fine sand	SP, SP-SM	A-3	0	100	100	90-100	2-10	---	NP
29---------- Udarents	0-3	Fine sand--------	SP, SP-SM	A-3, A-2-4, A-1-b	0-15	60-90	50-80	40-70	2-12	---	NP
	3-31	Sand, fine sand	SP, SP-SM	A-3, A-2-4	0	100	100	80-95	2-12	---	NP
	31-80	Sand, fine sand	SP, SP-SM	A-3, A-2-4	0	100	100	80-95	2-12	---	NP
30*---------- Pits	0-80	Variable---------	---	---	---	---	---	---	---	---	---
31---------- Palm Beach	0-22	Gravelly sand, sand, fine sand.	SP, SW	A-1-b, A-3, A-2-4	0	100	70-100	15-90	1-4	---	NP
	22-47	Very gravelly sand, sand, gravelly fine sand.	SP-SW	A-1-b	0-5	85-95	35-100	15-90	1-4	---	NP
	47-80	Extremely gravelly sand, sand, very gravelly sand.	SP-SW	A-1-b	0-5	85-95	15-100	10-90	1-4	---	NP
32*:											
Narcoossee------	0-3	Fine sand--------	SP-SM	A-3	0	100	100	95-100	5-10	---	NP
	3-17	Fine sand, sand	SP, SP-SM	A-3	0	100	100	95-100	2-8	---	NP
	17-41	Fine sand, sand	SP-SM	A-3, A-2-4	0	85-95	80-95	75-95	5-12	---	NP
	41-80	Extremely gravelly fine sand, very gravelly fine sand.	SP, SP-SM, GP	A-3, A-1, A-2-4	0-5	85-95	15-90	10-85	2-8	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
32*:											
Welaka----------	0-12	Fine sand--------	SP, SP-SM	A-3	0	100	70-100	80-90	1-5	---	NP
	12-42	Sand, fine sand	SP, SP-SM	A-3	0	100	65-100	80-90	1-5	---	NP
	42-80	Gravelly sand, gravelly fine sand, very gravelly fine sand.	SP, SP-SM	A-1-a, A-1-b, A-3, A-2-4	0-5	95-100	40-80	20-60	1-5	---	NP
33*----------	0-6	Sand----------	SP	A-1, A-3	0	100	75-100	5-85	0-5	---	NP
Beaches	6-60	Coarse sand, sand, fine sand.	SP	A-1, A-3	0	100	75-100	5-85	0-5	---	NP
34*:											
Cocoa----------	0-29	Sand----------	SP, SP-SM, SM	A-3, A-2-4	0	100	100	70-90	4-15	<40	NP-10
	29-35	Sand, loamy sand, fine sand.	SP-SM, SM	A-2-4	0	100	100	80-90	10-25	<40	NP-10
	35-80	Bedrock	---	---	---	---	---	---	---	---	---
Bulow----------	0-5	Sand----------	SP	A-3	0	100	100	70-95	1-4	---	NP
	5-20	Sand, coarse sand	SP	A-3	0	100	100	70-95	1-4	---	NP
	20-50	Sand, coarse sand	SP	A-3	0	100	100	70-95	1-4	---	NP
	50-59	Sandy loam, sandy clay loam.	SC, SC-SM	A-2-4, A-2-6	0	100	100	70-95	18-35	20-40	4-15
	59-80	Bedrock	---	---	---	---	---	---	---	---	---
35----------	0-80	Fine sand--------	SP, SP-SM	A-3	0	100	100	85-100	2-10	---	NP
Quartzipsamments											
36----------	0-6	Sand----------	SP, SP-SM	A-3	0	100	95-100	80-100	3-10	---	NP
Bimini	6-28	Sand, fine sand	SP, SP-SM	A-3	0	100	95-100	80-100	3-10	---	NP
	28-41	Sand, fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	100	95-100	80-100	8-15	---	NP
	41-46	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC-SM, SC	A-2-4, A-2-6	0	100	95-100	80-100	20-36	<40	NP-20
	46-80	Gravelly coarse sand, sand, fine sand.	SM	A-2-4	0-5	90-100	55-100	45-90	5-15	---	NP
37----------	0-12	Fine sand--------	SP-SM	A-3, A-2-4	0	85-100	85-100	75-95	5-12	---	NP
Tuscawilla											
	12-45	Sandy clay loam, fine sandy loam, sandy loam.	SC	A-2, A-4, A-6	0-15	85-100	85-100	80-95	25-55	28-40	8-20
	45-60	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	100	100	95-100	5-15	---	NP
	60-80	Loamy fine sand, gravelly fine sandy loam.	SP-SM, SM, SC, SC-SM	A-2-4, A-3, A-4, A-6	0-5	85-100	70-95	65-95	5-40	<40	NP-20
38----------	0-6	Fine sand--------	SP	A-3	0	100	100	85-100	1-2	---	NP
Paola	6-80	Sand, fine sand	SP-SM, SP	A-3	0	100	100	85-100	1-5	---	NP
39----------	0-41	Gravelly sand----	SP, SP-SM	A-3	0-15	70-85	70-85	60-80	2-10	---	NP
Udarents	41-80	Fine sand--------	SP, SP-SM	A-3	0	100	100	85-100	2-10	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
40---------- Pomona	0-4	Fine sand--------	SP, SP-SM	A-3, A-2-4	0	100	100	85-100	2-12	---	NP
	4-21	Sand, fine sand	SP, SP-SM	A-3, A-2-4	0	100	100	85-100	2-12	---	NP
	21-28	Sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	100	100	85-100	5-15	---	NP
	28-50	Sand, fine sand	SP, SP-SM	A-3, A-2-4	0	100	100	85-100	2-12	---	NP
	50-80	Sandy clay loam, fine sandy loam, sandy loam.	SC, SC-SM, SM	A-2, A-4, A-6	0	100	95-100	85-100	25-50	<40	NP-16
41---------- Terra Ceia	0-80	Muck----------	PT	A-8	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
2----------	0-28	1-6	1.40-1.65	6.0-20	0.05-0.08	4.5-7.3	<2	Low--------	0.10	4	2	.1-2
Riviera	28-35	12-25	1.50-1.70	<0.2	0.10-0.14	5.6-8.4	<2	Low--------	0.24			
	35-51	15-25	1.50-1.70	<0.2	0.12-0.15	6.1-8.4	<2	Low--------	0.24			
	51-80	1-8	1.40-1.65	0.6-6.0	0.05-0.08	6.1-8.4	<2	Low--------	0.15			
3*:												
Samsula----------	0-31	---	0.10-0.50	6.0-20	0.20-0.25	<4.5	<2	Low--------	----	2	2	>20
	31-80	1-14	1.35-1.55	6.0-20	0.02-0.05	3.6-6.0	<2	Low--------	0.17			
Hontoon----------	0-80	---	0.20-0.40	6.0-20	0.30-0.50	<4.5	<2	Low--------	----	2	2	75-85
4----------	0-4	1-5	1.25-1.50	6.0-20	0.03-0.08	3.6-6.5	<2	Low--------	0.10	5	2	1-4
Wabasso	4-22	0-5	1.35-1.70	6.0-20	0.02-0.05	3.6-6.5	<2	Low--------	0.10			
	22-30	1-12	1.50-1.75	0.6-2.0	0.10-0.15	4.5-7.3	<2	Low--------	0.15			
	30-47	12-30	1.60-1.85	<0.2	0.10-0.15	5.1-8.4	<2	Low--------	0.24			
	47-80	2-12	1.40-1.70	6.0-20	0.05-0.10	5.1-8.4	<2	Low--------	0.10			
5*:												
Pineda----------	0-3	1-6	1.25-1.60	6.0-20	0.05-0.10	4.5-7.3	<2	Low--------	0.10	5	2	.5-6
	3-32	1-8	1.40-1.70	6.0-20	0.02-0.05	4.5-7.3	<2	Low--------	0.10			
	32-80	10-25	1.50-1.70	<0.2	0.10-0.15	5.1-8.4	<2	Low--------	0.24			
Wabasso----------	0-7	1-5	1.25-1.50	6.0-20	0.03-0.08	3.6-6.5	<2	Low--------	0.10	5	2	1-4
	7-19	0-5	1.35-1.70	6.0-20	0.02-0.05	3.6-6.5	<2	Low--------	0.10			
	19-36	1-12	1.50-1.75	0.6-2.0	0.10-0.15	4.5-7.3	<2	Low--------	0.15			
	36-63	12-30	1.60-1.85	<0.2	0.10-0.15	5.1-8.4	<2	Low--------	0.24			
	63-80	2-12	1.40-1.70	6.0-20	0.05-0.10	5.1-8.4	<2	Low--------	0.10			
6----------	0-12	40-50	1.55-1.65	<0.2	0.10-0.20	5.1-7.8	<2	High-------	0.37	5	4	1-4
Favoretta	12-80	35-65	1.55-1.65	<0.06	0.10-0.20	5.6-8.4	<2	High-------	0.37			
7*:												
Favoretta--------	0-10	30-50	1.55-1.65	<0.2	0.10-0.20	5.1-7.8	<2	High-------	0.37	5	4	1-4
	10-80	35-65	1.55-1.65	<0.06	0.10-0.20	5.6-8.4	<2	High-------	0.37			
Chobee----------	0-10	7-15	1.45-1.50	2.0-6.0	0.10-0.15	5.6-7.3	<2	Low--------	0.10	5	2	2-7
	10-55	18-35	1.55-1.75	<0.2	0.12-0.17	6.1-8.4	<2	Moderate	0.32			
	55-80	7-30	1.60-1.75	0.2-6.0	0.06-0.10	7.4-8.4	<2	Low--------	0.20			
Winder----------	0-10	6-8	1.45-1.65	6.0-20	0.06-0.10	5.6-7.8	<2	Low--------	0.15	5	2	.5-3
	10-25	10-18	1.45-1.65	0.2-0.6	0.06-0.10	5.6-7.8	<2	Low--------	0.20			
	25-50	20-30	1.60-1.70	<0.2	0.10-0.15	5.6-8.4	<2	Low--------	0.24			
	50-80	15-30	1.50-1.70	<0.2	0.06-0.12	5.6-8.4	<2	Low--------	0.24			
8*:												
Hicoria----------	0-10	2-8	0.80-1.25	6.0-20	0.15-0.30	3.6-6.5	<2	Low--------	0.10	5	2	10-20
	10-32	1-7	1.65-1.80	6.0-20	0.05-0.10	3.6-7.3	<2	Low--------	0.10			
	32-55	13-30	1.65-1.80	0.06-0.6	0.10-0.20	3.6-7.3	<2	Low--------	0.24			
	55-80	2-30	1.65-1.80	0.06-0.6	0.10-0.20	3.6-7.3	<2	Low--------	0.24			
Riviera----------	0-22	1-6	1.40-1,65	6.0-20	0.05-0.08	4.5-7.3	<2	Low--------	0.10	4	2	.1-2
	22-35	12-25	1.50-1.70	<0.2	0.10-0.14	5.6-8.4	<2	Low--------	0.24			
	35-50	15-25	1.50-1.70	<0.2	0.12-0.15	6.1-8.4	<2	Low--------	0.24			
	50-80	1-8	1.40-1.65	0.6-6.0	0.05-0.08	6.1-8.4	<2	Low--------	0.15			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
8*:												
Gator	0-26	---	0.10-0.30	6.0-20	0.30-0.40	3.6-6.0	<2	Low	----	2	2	55-85
	26-80	13-25	1.60-1.70	<0.2	0.10-0.15	4.5-8.4	<2	Low	0.32			
9	0-22	<5	1.25-1.50	6.0-20	0.02-0.07	4.5-6.0	<2	Low	0.10	5	2	2-8
Eaugallie	22-33	1-8	1.45-1.60	0.6-6.0	0.15-0.25	4.5-6.5	<2	Low	0.15			
	33-56	1-5	1.45-1.65	6.0-20	0.02-0.05	4.5-7.8	<2	Low	0.10			
	56-70	13-31	1.55-1.70	0.06-2.0	0.10-0.20	4.5-7.8	<2	Low	0.20			
	70-80	1-13	1.45-1.55	0.6-6.0	0.05-0.15	4.5-7.8	<2	Low	0.15			
10	0-12	1-6	1.40-1.65	6.0-20	0.03-0.08	5.6-7.8	<2	Low	0.10	5	2	.1-2
Winder	12-58	7-30	1.45-1.65	0.2-0.6	0.06-0.10	5.6-7.8	<2	Low	0.20			
	58-80	15-30	1.50-1.70	<0.2	0.06-0.12	5.6-8.4	<2	Low	0.24			
11	0-6	1-3	1.25-1.45	6.0-20	0.05-0.15	3.6-6.5	<2	Low	0.10	5	2	2-5
Myakka	6-25	0-2	1.45-1.60	6.0-20	0.02-0.05	3.6-6.5	<2	Low	0.10			
	25-31	1-8	1.45-1.60	0.6-6.0	0.10-0.20	3.6-6.5	<2	Low	0.15			
	31-80	0-2	1.48-1.70	6.0-20	0.02-0.10	3.6-6.5	<2	Low	0.10			
12*:												
Placid	0-15	<10	1.20-1.40	6.0-20	0.15-0.20	3.6-5.5	<2	Low	0.10	5	2	2-10
	15-80	<10	1.30-1.60	6.0-20	0.05-0.08	3.6-6.0	<2	Low	0.10			
Basinger	0-2	0-4	1.40-1.55	6.0-20	0.05-0.10	3.6-7.3	<2	Low	0.10	5	2	1-8
	2-29	0-4	1.40-1.55	6.0-20	0.05-0.10	3.6-7.3	<2	Low	0.10			
	29-50	1-3	1.40-1.65	6.0-20	0.10-0.15	3.6-7.3	<2	Low	0.10			
	50-80	1-3	1.50-1.70	6.0-20	0.05-0.10	3.6-7.3	<2	Low	0.10			
St. Johns	0-10	1-4	1.30-1.50	6.0-20	0.10-0.15	3.6-5.5	<2	Low	0.10	5	2	2-4
	10-25	1-3	1.50-1.70	6.0-20	0.03-0.08	3.6-5.5	<2	Low	0.10			
	25-39	2-6	1.50-1.58	0.2-2.0	0.10-0.30	3.6-5.5	<2	Low	0.15			
	39-80	1-4	1.50-1.65	6.0-20	0.03-0.08	3.6-5.5	<2	Low	0.10			
13	0-5	1-5	1.20-1.50	6.0-20	0.05-0.10	3.6-6.0	<2	Low	0.10	5	2	1-2
Immokalee	5-39	1-5	1.45-1.70	6.0-20	0.02-0.05	3.6-6.0	<2	Low	0.10			
	39-60	2-7	1.30-1.70	0.6-2.0	0.10-0.25	3.6-6.0	<2	Low	0.15			
	60-80	1-5	1.40-1.70	6.0-20	0.02-0.05	3.6-6.0	<2	Low	0.10			
14	0-3	1-6	1.25-1.60	6.0-20	0.05-0.10	4.5-7.3	<2	Low	0.10	5	2	.5-6
Pineda	3-26	1-8	1.40-1.70	6.0-20	0.02-0.05	4.5-7.3	<2	Low	0.10			
	26-40	10-25	1.50-1.70	<0.2	0.10-0.15	5.1-8.4	<2	Low	0.24			
	40-80	3-25	1.45-1.60	2.0-6.0	0.02-0.05	5.6-8.4	<2	Low	0.10			
15	0-41	<2	1.35-1.65	>20	0.02-0.05	3.6-6.0	<2	Low	0.10	5	1	<1
Pomello	41-66	<2	1.45-1.60	2.0-6.0	0.10-0.30	3.6-6.0	<2	Low	0.15			
	66-80	<2	1.35-1.65	6.0-20	0.02-0.05	3.6-6.0	<2	Low	0.10			
16	0-10	0-4	1.35-1.55	6.0-20	0.03-0.08	5.1-8.4	<2	Low	0.10	5	1	1-4
Malabar	10-30	1-5	1.35-1.70	6.0-20	0.05-0.10	5.1-8.4	<2	Low	0.10			
	30-60	1-5	1.40-1.70	6.0-20	0.02-0.05	5.1-8.4	<2	Low	0.10			
	60-80	12-25	1.55-1.75	<0.2	0.10-0.15	5.1-8.4	<2	Low	0.24			
17	0-45	1-7	1.35-1.60	6.0-20	0.07-0.10	5.1-7.3	<2	Low	0.10	5	1	1-4
Holopaw	45-55	13-28	1.60-1.70	0.2-2.0	0.15-0.20	5.1-8.4	<2	Low	0.20			
	55-80	7-13	1.50-1.60	6.0-20	0.05-0.10	5.1-8.4	<2	Low	0.15			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
18*:												
Valkaria	0-6	1-3	1.35-1.50	6.0-20	0.05-0.10	4.5-7.3	<2	Low	0.10	5	2	1-4
	6-17	0-2	1.45-1.60	6.0-20	0.03-0.08	4.5-7.3	<2	Low	0.10			
	17-38	2-5	1.45-1.60	6.0-20	0.05-0.10	4.5-7.3	<2	Low	0.10			
	38-80	1-5	1.45-1.60	6.0-20	0.03-0.08	5.1-8.4	<2	Low	0.10			
Smyrna	0-15	1-6	1.35-1.45	6.0-20	0.03-0.07	3.6-7.3	<2	Low	0.10	5	2	1-5
	15-20	3-8	1.35-1.45	0.6-6.0	0.10-0.20	3.6-7.3	<2	Low	0.15			
	20-80	1-6	1.50-1.65	6.0-20	0.03-0.07	3.6-5.5	<2	Low	0.10			
19	0-4	1-3	1.35-1.50	6.0-20	0.05-0.10	4.5-7.3	<2	Low	0.10	5	2	1-4
Valkaria	4-18	0-2	1.45-1.60	6.0-20	0.03-0.08	4.5-7.3	<2	Low	0.10			
	18-47	2-5	1.45-1.60	6.0-20	0.05-0.10	4.5-7.3	<2	Low	0.10			
	47-80	1-5	1.45-1.60	6.0-20	0.03-0.08	5.1-8.4	<2	Low	0.10			
20	0-3	0-1	1.25-1.50	>20	0.02-0.08	3.6-6.0	<2	Low	0.10	5	1	0-1
Orsino	3-12	0-1	1.35-1.60	>20	0.02-0.07	3.6-6.0	<2	Low	0.10			
	12-80	0-1	1.35-1.60	>20	0.02-0.08	3.6-6.0	<2	Low	0.10			
21	0-13	1-6	1.35-1.45	6.0-20	0.03-0.07	3.6-7.3	<2	Low	0.10	5	2	1-5
Smyrna	13-21	3-8	1.35-1.45	0.6-6.0	0.10-0.20	3.6-7.3	<2	Low	0.15			
	21-80	1-6	1.50-1.65	6.0-20	0.03-0.07	3.6-6.0	<2	Low	0.10			
22	0-7	1-3	1.25-1.55	>20	0.04-0.10	4.5-6.5	<2	Low	0.10	5	1	.5-2
Astatula	7-80	1-3	1.45-1.60	>20	0.02-0.05	4.5-6.5	<2	Low	0.10			
23	0-7	1-8	1.35-1.65	6.0-20	0.05-0.10	4.5-7.8	<2	Low	0.10	5	1	<2
Adamsville	7-80	1-7	1.35-1.65	6.0-20	0.03-0.08	4.5-7.8	<2	Low	0.10			
24*:												
Samsula	0-31	---	0.15-0.35	6.0-20	0.20-0.45	<4.5	<2	Low	----	2	8	60-85
	31-80	1-5	1.30-1.55	6.0-20	0.05-0.10	3.6-6.0	<2	Low	0.10			
Placid	0-20	0-10	1.20-1.40	6.0-20	0.15-0.20	3.6-5.5	<2	Low	0.10	5	2	2-10
	20-80	0-10	1.30-1.60	6.0-20	0.05-0.08	3.6-6.0	<2	Low	0.10			
25	0-5	0-4	1.25-1.65	>6.0	0.05-0.10	3.6-6.0	<2	Low	0.10	5	1	.5-2
Tavares	5-80	0-4	1.40-1.70	>6.0	0.02-0.05	3.6-6.0	<2	Low	0.10			
26*:												
Turnbull	0-8	5-20	0.10-0.20	6.0-20	0.25-0.35	6.1-7.8	>16	Low	----	2	2	22-55
	8-42	60-85	0.50-1.00	<0.06	0.15-0.20	6.1-8.4	>16	High	0.32			
	42-80	3-12	1.40-1.60	6.0-20	0.05-0.10	6.1-8.4	>16	Low	0.10			
Pellicer	0-10	30-40	0.60-1.00	0.06-0.2	0.20-0.30	6.1-8.4	>16	High	0.32	5	4	15-25
	10-55	35-60	0.50-1.00	<0.06	0.15-0.20	6.1-8.4	>16	High	0.24			
	55-80	5-20	1.30-1.50	6.0-20	0.05-0.10	6.1-8.4	>16	Low	0.24			
27	0-26	1-4	1.30-1.55	6.0-20	0.03-0.07	3.6-6.0	<2	Low	0.10	5	2	<1
Cassia	26-42	2-10	1.30-1.55	0.6-6.0	0.10-0.15	3.6-6.0	<2	Low	0.15			
	42-80	1-5	1.40-1.60	6.0-20	0.03-0.07	3.6-6.0	<2	Low	0.10			
29	0-3	1-10	1.35-1.55	6.0-20	0.02-0.08	6.6-8.4	<2	Low	0.10	5	2	<.5
Udarents	3-31	1-10	1.35-1.55	6.0-20	0.02-0.08	5.6-8.4	<2	Low	0.10			
	31-80	1-10	1.35-1.55	6.0-20	0.02-0.08	5.6-6.5	<2	Low	0.10			
30*	0-80	---	---	---	---	---	<2	---	----	---	8	---
Pits												
31	0-4	<2	1.25-1.50	>20	0.02-0.05	7.4-8.4	<2	Low	0.10	5	1	1-5
Palm Beach	4-80	<2	1.20-1.45	>20	0.01-0.04	7.4-8.4	<2	Low	0.10			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
32*:												
Narcoossee	0-3	1-5	1.40-1.50	>20	0.03-0.10	3.6-6.0	<2	Low	0.10	5	2	.5-1
	3-17	1-5	1.40-1.60	>20	0.02-0.05	3.6-6.0	<2	Low	0.10			
	17-41	2-6	1.45-1.60	>20	0.05-0.10	5.1-6.5	<2	Low	0.10			
	41-80	1-5	1.40-1.50	>6.0	0.05-0.10	6.6-8.4	<2	Low	0.10			
Welaka	0-12	2-4	1.30-1.45	>20	0.02-0.05	4.5-7.8	<2	Low	0.10	5	1	1-4
	12-42	<2	1.40-1.60	>20	0.02-0.05	4.5-7.8	<2	Low	0.10			
	42-80	<3	1.45-1.70	>20	0.02-0.05	7.4-8.4	<2	Low	0.10			
33*	0-6	0-1	1.35-1.85	>6.0	0.03-0.05	5.1-7.8	>4	Low	0.05	5	1	<.1
Beaches	6-60	0-1	1.35-1.85	>6.0	0.03-0.05	5.1-7.8	>4	Low	0.05			
34*:												
Cocoa	0-29	2-5	1.35-1.60	6.0-20	0.02-0.05	4.5-7.8	<2	Low	0.10	2	2	1-3
	29-35	4-10	1.45-1.65	6.0-20	0.05-0.10	5.6-7.8	<2	Low	0.15			
	35-80	---	---	2.0-20.0	---	---	---	---	----			
Bulow	0-5	1-3	1.30-1.40	6.0-20	0.05-0.07	4.5-7.3	<2	Low	0.10	3	2	.5-1
	5-20	1-3	1.30-1.45	6.0-20	0.02-0.05	5.1-7.3	<2	Low	0.10			
	20-50	1-3	1.40-1.60	6.0-20	0.02-0.05	6.1-7.3	<2	Low	0.10			
	50-59	15-30	1.55-1.65	2.0-6.0	0.10-0.15	6.1-7.3	<2	Low	0.24			
	59-80	---	---	2.0-20.0	---	---	---	---	----			
35	0-80	1-3	1.50-1.65	6.0-20	0.03-0.05	4.5-7.3	<2	Low	0.10	5	2	<.5
Quartzipsamments												
36	0-6	1-5	1.40-1.55	6.0-20	<0.05	3.6-5.5	<2	Low	0.10	5	1	1-4
Bimini	6-28	1-5	1.45-1.70	6.0-20	<0.05	3.6-5.5	<2	Low	0.10			
	28-41	1-12	1.50-1.75	0.6-2.0	0.10-0.15	3.6-5.5	<2	Low	0.15			
	41-46	18-34	1.60-1.75	0.06-0.2	0.10-0.15	4.5-7.3	<2	Low	0.28			
	46-80	1-5	1.60-1.75	2.0-20.0	<0.05	6.6-7.8	<2	Low	0.28			
37	0-12	1-5	1.10-1.40	6.0-20	0.05-0.10	5.6-8.4	<2	Low	0.10	5	1	1-3
Tuscawilla	12-45	18-30	1.25-1.55	0.6-2.0	0.08-0.12	6.6-9.0	<2	Low	0.24			
	45-60	1-7	1.55-1.70	6.0-20	0.03-0.08	7.4-9.0	<2	Low	0.10			
	60-80	1-20	1.55-1.70	0.6-20	0.03-0.12	7.4-9.0	<2	Low	0.17			
38	0-6	0-2	1.20-1.45	>20	0.02-0.05	3.6-7.3	<2	Low	0.10	5	1	<.5
Paola	6-80	0-2	1.45-1.60	>20	0.02-0.05	3.6-7.3	<2	Low	0.10			
39	0-41	3-8	1.65-1.75	2.0-6.0	0.05-0.08	5.6-8.4	<2	Low	0.10	5	2	---
Udarents	41-80	1-2	1.50-1.65	6.0-20	0.03-0.05	5.6-7.3	<2	Low	0.17			
40	0-4	1-6	1.10-1.50	>6.0	0.05-0.15	3.6-6.0	<2	Low	0.10	5	1	1-4
Pomona	4-21	1-6	1.45-1.70	6.0-20	0.03-0.08	3.6-6.0	<2	Low	0.10			
	21-28	2-7	1.30-1.60	0.6-6.0	0.10-0.20	3.6-6.0	<2	Low	0.15			
	28-50	1-6	1.40-1.65	2.0-20	0.03-0.15	3.6-6.0	<2	Low	0.10			
	50-80	13-35	1.50-1.80	0.2-2.0	0.10-0.17	3.6-6.0	<2	Low	0.20			
41	0-80	---	0.15-0.35	6.0-20	0.30-0.50	4.5-8.4	<2	Low	----	2	2	>60
Terra Ceia												

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Initial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
2---- Riviera	C/D	None	---	---	0.5-1.5	Apparent	Jun-Dec	>60	---	---	---	High	High.
3*:													
Samsula	B/D	None	---	---	+2-0	Apparent	Jun-Apr	>60	---	16-20	30-36	High	High.
Hontoon	B/D	None	---	---	+2-0	Apparent	Jun-Apr	>60	---	16-24	>52	High	High.
4---- Wabasso	B/D	None	---	---	0.5-1.5	Apparent	Jun-Sep	>60	---	---	---	Moderate	High.
5*:													
Pineda	B/D	None	---	---	0.5-1.5	Apparent	Jun-Nov	>60	---	---	---	High	Low.
Wabasso	B/D	None	---	---	0.5-1.5	Apparent	Jun-Sep	>60	---	---	---	Moderate	High.
6---- Favoretta	D	Rare	---	---	0-1.0	Apparent	Jul-Nov	>60	---	---	---	High	Low.
7*:													
Favoretta	D	Frequent	Long	Jul-Nov	0-0.5	Apparent	Jul-Nov	>60	---	---	---	High	Low.
Chobee	B/D	Frequent	Brief to very long.	Jun-Feb	0-0.5	Apparent	Jun-Oct	>60	---	---	---	Moderate	Low.
Winder	B/D	Frequent	Long	Jul-Oct	0-1.0	Apparent	Jun-Dec	>60	---	---	---	High	Low.
8*:													
Hicoria	D	None	---	---	+2-0	Apparent	Jun-Mar	>60	---	---	---	High	High.
Riviera	D	None	---	---	+2-0	Apparent	Jun-Mar	>60	---	---	---	High	High.
Gator	D	None	---	---	+2-0	Apparent	Jun-Apr	>60	---	6-14	20-23	High	High.
9---- Eaugallie	B/D	None	---	---	0.5-1.5	Apparent	Jun-Sep	>60	---	---	---	High	Moderate.
10---- Winder	B/D	None	---	---	0-0.5	Apparent	Jun-Dec	>60	---	---	---	High	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Initial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
11--Myakka	B/D	None	---	---	0.5-1.5	Apparent	Jun-Sep	>60	---	---	---	High	High.
12*:													
Placid	D	None	---	---	+2-1.0	Apparent	Jun-Mar	>60	---	---	---	High	High.
Basinger	D	None	---	---	+2-0	Apparent	Jun-Mar	>60	---	---	---	High	Moderate.
St. Johns	D	None	---	---	+2-1.0	Apparent	Jun-Apr	>60	---	---	---	High	High.
13--Immokalee	B/D	None	---	---	0.5-1.5	Apparent	Jun-Sep	>60	---	---	---	High	High.
14--Pineda	B/D	None	---	---	0-0.5	Apparent	Jun-Nov	>60	---	---	---	High	Low.
15--Pomello	C	None	---	---	2.0-3.5	Apparent	Jul-Nov	>60	---	---	---	Low	High.
16--Malabar	B/D	None	---	---	0-0.5	Apparent	Jun-Oct	>60	---	---	---	High	Moderate.
17--Holopaw	B/D	None	---	---	0-0.5	Apparent	Jun-Nov	>60	---	---	---	High	Moderate.
18*:													
Valkaria	B/D	None	---	---	0-1.0	Apparent	Jun-Sep	>60	---	---	---	High	Moderate.
Smyrna	B/D	None	---	---	0.5-1.5	Apparent	Jun-Sep	>60	---	---	---	High	High.
19--Valkaria	B/D	None	---	---	0-0.5	Apparent	Jun-Sep	>60	---	---	---	High	Moderate.
20--Orsino	A	None	---	---	4.0-5.0	Apparent	Jun-Dec	>60	---	---	---	Low	Moderate.
21--Smyrna	B/D	None	---	---	0.5-1.5	Apparent	Jun-Sep	>60	---	---	---	High	High.
22--Astatula	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
23--Adamsville	C	None	---	---	2.0-3.5	Apparent	Jun-Nov	>60	---	---	---	Low	Moderate.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Initial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
24*:													
Samsula	D	Frequent	Very long	Mar-Sep	0-0.5	Apparent	Jun-Apr	>60	---	4-8	10-18	High	Moderate.
Placid	D	Frequent	Brief	Jun-Nov	0-0.5	Apparent	Jun-Nov	>60	---	---	---	High	High.
25--Tavares	A	None	---	---	4.0-6.0	Apparent	Jun-Dec	>60	---	---	---	Low	High.
26*:													
Turnbull	D	Frequent	Very long	Jan-Dec	+2-0	Apparent	Jan-Dec	>60	---	12-14	14-24	High	High.
Pellicer	D	Frequent	Very long	Jan-Dec	0-0.5	Apparent	Jan-Dec	>60	---	---	---	High	High.
27--Cassia	C	None	---	---	1.5-3.5	Apparent	Jul-Jan	>60	---	---	---	Moderate	High.
29--Udarents	C	None	---	---	1.5-3.0	Apparent	Jun-Nov	>60	---	---	---	High	Moderate.
30*--Pits	-	None	---	---	>6.0	---	---	>60	---	---	---	---	---
31--Palm Beach	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	Low.
32*:													
Narcoossee	C	None	---	---	2.0-3.5	Apparent	Jun-Nov	>60	---	---	---	Moderate	Low.
Welaka	A	None	---	---	>6.0	---	---	>60	---	---	---	High	High.
33*--Beaches	D	Frequent	Very brief to long.	Jan-Dec	0-6.0	Apparent	Jan-Dec	>60	---	---	---	High	High.
34*:													
Cocoa	A	None	---	---	>6.0	---	---	20-40	Hard	---	---	Low	Low.
Bulow	A	None	---	---	>6.0	---	---	40-60	Hard	---	---	Low	Low.
35--Quartzipsamments	A	None	---	---	2.0-8.0	Apparent	---	>60	---	---	---	Low	High.
36--Bimini	C	None	---	---	1.5-3.5	Apparent	Jul-Oct	>60	---	---	---	Moderate	High.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Initial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
37---------- Tuscawilla	D	None--------	---	---	0.5-1.5	Apparent	Jun-Sep	>60	---	---	---	High-----	Low.
38---------- Paola	A	None--------	---	---	>6.0	---	---	>60	---	---	---	Low------	High.
39---------- Udarents	C	None--------	---	---	3.0-4.0	Apparent	Jun-Oct	>60	---	---	---	High-----	Low.
40---------- Pomona	B/D	None--------	---	---	0.5-1.5	Apparent	Jun-Sep	>60	---	---	---	High-----	High.
41---------- Terra Ceia	D	Frequent----	Long------	Jun-Nov	0-0.5	Apparent	Jun-Apr	>60	---	16-20	50-60	Moderate	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--DEPTH TO WATER TABLE IN SELECTED SOILS

(Measurements of water table depths are in inches. The monthly readings were based on the average of two readings, taken on the first and fifteenth of each month. An entry of "---" indicates that readings were not taken that month)

Soil name and year	January	February	March	April	May	June	July	August	September	October	November	December
Adamsville:												
1986	---	---	---	---	---	---	62	40	46	51	55	54
1987	48	41	33	23	51	60	70	70	69	62	61	62
1988	57	36	24	34	51	58	67	67	58	64	70	45
1989	62	45	60	57	---	---	---	---	---	---	---	---
Bimini:												
1986	---	---	---	---	---	---	---	---	---	---	---	---
1987	---	---	---	---	---	53	38	37	43	32	28	25
1988	34	32	27	36	40	43	40	46	42	45	44	31
1989	40	38	41	42	---	---	---	---	---	---	---	---
Pineda:												
1986	---	---	---	28	30	16	12	4	5	21	26	18
1987	12	6	2	3	28	26	30	31	30	29	28	26
1988	2	0	6	16	28	20	26	22	20	23	29	14
1989	24	10	23	30	---	---	---	---	---	---	---	---
Pomello:												
1986	---	---	---	---	---	---	---	---	---	61	47	---
1987	42	40	33	28	37	48	53	55	44	42	49	58
1988	60	46	30	33	43	54	61	65	52	51	54	40
1989	49	37	44	46	---	---	---	---	---	---	---	---
Valkaria:												
1986	---	---	---	---	---	---	---	---	---	19	22	3
1987	2	1	5	2	28	28	21	14	16	17	18	6
1988	6	0	3	11	27	28	28	12	1	5	20	8
1989	16	6	11	15	---	---	---	---	---	---	---	---
Wabasso:												
1986	---	---	---	28	31	22	23	6	10	23	27	19
1987	17	10	7	5	31	37	59	41	32	30	32	26
1988	27	6	7	10	29	23	28	29	23	25	30	16
1989	27	20	27	31	---	---	---	---	---	---	---	---

TABLE 16.--PHYSICAL PROPERTIES OF SELECTED SOILS

(Absence of an entry indicates that data were not available)

Soil name and sample number	Depth	Horizon	Particle-size distribution: Sand: Very coarse (2-1 mm)	Sand: Coarse (1-0.5 mm)	Sand: Medium (0.5-0.25 mm)	Sand: Fine (0.25-0.1 mm)	Sand: Very fine (0.1-0.05 mm)	Sand: Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	Hydraulic conductivity*	Bulk density (field moist)*	Water content: 1/10 bar	Water content: 1/3 bar	Water content: 15 bar
	In		Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Cm/hr	g/cm^3	Pct (wt)	Pct (wt)	Pct (wt)
Adamsville fine sand:															
S18-14-1	0-7	A	0.0	0.2	5.1	90.6	2.7	98.6	0.8	0.6	49.7	1.40	5.6	3.4	1.2
-2	7-22	C1	0.0	0.2	5.7	90.3	2.2	98.4	0.9	0.7	46.5	1.48	3.9	2.0	0.4
-3	22-34	C2	0.0	0.2	5.5	90.6	2.2	98.5	0.8	0.7	64.6	1.41	3.6	1.8	0.4
-4	34-57	C3	0.0	0.2	5.3	90.3	2.2	98.0	1.4	0.6	42.5	1.50	4.1	1.8	0.4
-5	57-80	C4	0.0	0.2	5.0	91.3	2.2	98.8	1.0	0.2	46.5	1.49	3.2	1.5	0.2
Astatula fine sand:															
S18-13-1	0-7	A	0.0	0.2	5.8	89.8	3.2	98.9	0.9	0.2	35.1	1.48	4.7	2.1	0.6
-2	7-29	C1	0.0	0.3	5.8	89.4	2.9	98.4	1.5	0.1	60.7	1.44	3.4	1.7	0.4
-3	29-54	C2	0.0	0.3	6.3	89.4	2.8	98.8	0.1	0.8	65.3	1.44	3.3	1.4	0.4
-4	54-80	C3	0.0	0.4	7.8	88.7	2.6	99.5	0.1	0.4	61.4	1.44	2.8	1.1	0.3
Bimini sand:															
S18-18-1	0-6	A	0.4	11.6	44.8	39.5	1.2	97.5	1.5	1.0	69.7	1.29	9.2	6.1	1.8
-2	6-28	E	0.5	12.4	45.4	38.5	1.1	97.9	1.6	0.5	82.8	1.50	3.5	2.2	0.1
-3	28-32	EB	0.6	12.1	38.9	42.2	1.4	95.2	3.0	1.8	27.8	1.59	6.3	4.5	0.4
-4	32-41	Bh	0.7	12.6	38.8	39.6	1.1	92.8	2.5	4.7	9.4	1.47	16.4	12.8	3.0
-5	41-46	Btg	0.2	10.4	36.6	29.7	0.8	77.7	4.1	18.2	1.3	1.49	24.2	20.0	7.2
-6	46-80	2C	15.0	25.5	27.9	23.5	1.6	93.5	3.6	2.9	62.6	1.40	13.2	10.4	4.2
Bulow sand:															
S18-15-1	0-5	A	0.6	15.0	48.9	30.6	1.6	96.7	2.3	1.0	103.0	1.27	8.9	6.5	2.5
-2	5-20	E	1.3	18.1	53.6	24.1	1.0	98.1	1.0	0.9	116.0	1.54	3.6	2.3	0.3
-3	20-50	Bw	1.4	16.4	53.0	24.8	0.9	96.5	2.2	1.3	114.0	1.58	2.9	1.9	0.3
-4	50-68	Bt	0.6	12.1	39.4	23.3	0.9	76.3	3.0	20.7	12.0	1.61	10.3	8.3	3.9
Cassia fine sand:															
S18-8-1	0-5	Ap	0.0	0.6	10.6	85.5	1.3	98.1	1.3	0.6	59.4	1.19	12.6	8.2	3.0
-2	5-12	E1	0.0	0.6	10.2	81.9	1.3	94.0	5.4	0.6	41.9	1.42	6.5	3.6	1.5
-3	12-26	E2	0.0	0.4	8.8	87.9	1.5	98.6	1.1	0.3	64.4	1.49	3.1	1.9	0.4
-4	26-36	Bh	0.0	0.3	8.2	82.8	1.6	92.8	3.0	4.2	4.4	1.27	26.1	19.4	4.7
-5	36-42	C1	0.0	0.4	8.6	84.2	1.4	94.7	1.7	3.6	24.6	1.37	13.8	10.1	2.6
-6	42-69	C1	0.0	0.4	8.3	86.0	1.1	95.8	1.7	2.5	1.0	1.67	13.1	9.1	3.1
-7	69-80	C2	0.0	0.2	7.3	86.2	0.7	94.4	1.5	4.1	7.4	1.59	13.6	9.6	2.9
Favoretta clay:															
S18-21-1	0-8	A	0.0	0.3	3.0	17.5	8.4	29.1	30.7	40.2	0.5	1.33	34.3	30.0	18.7
-2	8-21	BA	0.0	0.2	2.4	14.2	6.4	23.2	30.6	46.2	0.1	1.46	30.4	28.3	18.3
-3	21-36	Bg1	0.0	0.2	2.2	12.2	5.4	20.0	29.8	50.2	0.1	1.38	34.6	31.8	20.8
-4	36-66	Bg2	0.0	0.2	2.2	11.2	4.2	17.8	26.4	55.8	0.1	1.40	33.8	31.4	21.4
-5	66-80	Bg3	0.0	0.0	1.2	8.4	14.2	23.8	33.1	43.1	0.3	1.35	35.8	31.3	20.4

TABLE 16.--PHYSICAL PROPERTIES OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Particle-size distribution: Sand: Very coarse (2-1 mm)	Sand: Coarse (1-0.5 mm)	Sand: Medium (0.5-0.25 mm)	Sand: Fine (0.25-0.1 mm)	Sand: Very fine (0.1-0.05 mm)	Sand: Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	Hydraulic conductivity*	Bulk density (field moist)*	Water content: 1/10 bar	Water content: 1/3 bar	Water content: 15 bar
	In		Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Cm/hr	g/cm^3	Pct (wt)	Pct (wt)	Pct (wt)
Gator muck:															
S18-7-1	0-9	Oa1									0.0	0.00	0.0	0.0	0.0
-2	9-26	Oa2									45.8	0.88	58.4	51.9	18.7
-3	26-29	Cg1	0.0	1.0	11.5	56.6	10.5	79.6	14.4	6.0	4.7	1.59	15.5	10.7	3.4
-4	29-49	Cg2	0.0	1.0	10.2	50.6	9.7	71.5	11.8	16.7	0.1	1.68	18.7	13.8	6.2
-5	49-64	Cg3	0.0	0.6	7.6	40.5	9.1	57.8	14.7	27.5	0.0	1.74	20.1	18.3	10.9
-6	64-80	Cg3	0.0	0.4	5.9	37.5	10.2	54.0	20.3	25.7	0.0	1.65	23.4	20.3	10.9
Myakka fine sand:															
S18-1-1	0-5	A	0.0	0.2	6.1	83.7	5.3	95.3	2.7	2.0	37.8	1.23	12.1	7.9	3.2
-2	5-14	E1	0.0	0.3	10.5	83.1	2.9	96.6	1.2	2.2	34.9	1.40	4.2	2.2	0.4
-3	14-23	E2	0.0	0.2	6.7	87.1	3.7	97.7	0.2	2.1	38.5	1.41	3.4	2.0	0.4
-4	23-29	Bh1	0.0	0.2	5.1	82.8	5.6	93.8	2.1	4.1	10.0	1.33	21.7	15.2	5.1
-5	29-41	Bh2	0.0	0.3	5.0	84.0	5.6	95.0	1.7	3.3	12.7	1.47	11.3	8.4	2.7
-6	41-48	BC	0.0	0.2	4.0	79.6	2.9	86.8	2.2	11.1	12.1	1.64	13.7	9.7	4.8
-7	48-68	BC/Bh	0.0	0.2	4.5	81.9	4.0	90.6	2.8	6.6	11.9	1.58	11.2	8.3	3.7
-8	68-80	C	0.0	0.2	4.8	88.0	4.2	97.2	0.1	2.7	12.7	1.59	6.7	3.9	1.0
Orsino fine sand:															
S18-10-1	0-3	A	0.0	0.1	8.9	87.9	2.0	98.8	1.0	0.2	48.0	1.39	5.8	4.4	1.8
-2	3-12	E	0.0	0.8	9.1	87.3	1.7	98.9	1.0	0.1	34.0	1.54	3.8	2.3	0.7
-3	12-17	Bw/Bh	0.0	0.1	9.1	86.0	1.4	96.6	2.8	0.6	56.5	1.43	5.1	3.4	0.7
-4	17-49	Bw	0.0	0.1	9.1	86.9	1.6	97.7	2.2	0.1	72.1	1.42	4.6	2.5	0.5
-5	49-80	C	0.0	0.1	7.7	89.3	1.4	98.5	1.4	0.1	76.5	1.47	2.9	1.6	0.2
Paola fine sand:															
S18-16-1	0-6	A	0.2	7.7	34.6	54.4	1.5	98.4	1.5	0.1	53.9	1.39	6.1	4.4	2.3
-2	6-16	E	0.2	6.6	34.3	56.2	1.5	98.8	0.9	0.3	76.3	1.48	3.6	2.1	0.3
-3	16-31	B/E	0.2	6.4	31.4	56.6	1.2	95.8	2.4	1.8	112.0	1.46	4.5	3.1	1.3
-4	31-55	C	0.5	7.9	28.4	57.5	1.8	96.1	1.9	2.0	86.8	1.54	3.1	1.9	0.6
-5	55-80	C	0.6	7.7	27.7	58.9	1.7	96.6	1.5	1.9	86.8	1.57	3.0	1.6	0.6
Pineda fine sand:															
S18-4-1	0-3	A	0.0	0.6	16.2	78.8	1.3	96.9	2.9	0.2	40.3	1.50	3.4	2.7	0.4
-2	3-13	E	0.0	0.7	9.4	85.1	2.4	97.6	2.0	0.4	24.8	1.59	3.5	2.1	0.1
-3	13-19	Bw1	0.0	0.8	9.1	84.7	3.0	97.6	1.5	0.9	13.8	1.62	5.5	2.5	0.6
-4	19-24	Bw2	0.0	0.9	9.5	83.1	2.9	96.4	1.7	1.9	12.5	1.63	4.1	2.1	0.5
-5	24-26	E'	0.0	0.8	9.4	84.3	2.3	96.8	1.6	1.6	17.4	1.63	5.7	3.3	0.6
-6	26-33	Btg/E	0.0	0.6	7.8	69.1	2.9	80.4	0.8	18.8	0.06	1.62	14.9	11.9	5.1
-7	33-40	Btg1	0.0	0.6	8.1	70.6	2.8	82.1	0.8	17.1	0.6	1.66	15.8	12.3	5.3
-8	40-47	Btg2	0.0	0.6	8.3	72.4	2.8	84.1	2.5	13.4	1.7	1.62	15.9	12.4	5.0
-9	47-63	Cg	0.0	0.7	8.6	75.7	3.0	88.0	1.0	11.0	4.3	1.54	10.7	7.5	2.6
-10	63-80	Cg	0.0	0.7	9.6	76.9	2.7	89.9	2.1	8.0	2.9	1.50	12.3	9.2	3.2

TABLE 16.--PHYSICAL PROPERTIES OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Particle-size distribution: Sand: Very coarse (2-1 mm)	Sand: Coarse (1-0.5 mm)	Sand: Medium (0.5-0.25 mm)	Sand: Fine (0.25-0.1 mm)	Sand: Very fine (0.1-0.05 mm)	Sand: Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	Hydraulic conductivity*	Bulk density (field moist)*	Water content: 1/10 bar	Water content: 1/3 bar	Water content: 15 bar
	In		Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Cm/hr	g/cm^3	Pct (wt)	Pct (wt)	Pct (wt)
Pomello fine sand:															
S18-11-1	0-5	A	0.0	0.3	15.1	80.1	2.4	98.0	1.5	0.5	37.7	1.47	6.2	3.8	1.3
-2	5-41	E	0.0	0.3	13.0	81.9	2.7	97.9	2.0	0.1	50.8	1.45	4.1	3.1	0.8
-3	41-55	Bh1	0.0	0.2	12.8	78.1	2.3	93.4	3.5	3.1	4.2	1.20	30.9	19.7	6.3
-4	55-66	Bh2	0.0	0.4	13.9	81.7	1.5	97.1	2.3	0.6	19.3	1.50	12.2	8.8	2.4
-5	66-75	C1	0.0	0.3	13.6	81.7	1.5	97.1	2.3	0.6	14.1	1.50	12.1	7.9	1.5
-6	75-80	C2	0.0	0.3	12.5	81.8	0.9	95.5	3.6	0.9	0.0	0.00	0.0	0.0	0.0
Pomona fine sand:															
S18-19-1	0-6	Ap	0.1	1.5	12.3	76.3	4.2	94.4	4.3	1.3	25.9	1.33	15.3	9.8	2.8
-2	6-10	E1	0.2	1.3	11.9	79.5	3.8	96.7	2.7	0.6	29.4	1.46	5.8	3.2	0.6
-3	10-21	E2	0.2	1.4	11.4	80.6	3.7	97.3	2.2	0.5	27.2	1.52	4.7	2.6	0.1
-4	21-28	Bh1	0.2	1.2	9.6	70.9	3.7	85.6	9.6	4.9	2.6	1.60	21.6	15.6	2.9
-5	28-50	Bh2	0.2	1.2	10.0	74.3	3.8	89.5	5.5	5.0	2.2	1.40	25.4	19.6	4.1
-6	50-63	Bt	0.1	1.1	9.8	66.4	3.0	80.4	3.4	16.2	1.8	1.63	20.2	16.4	5.5
-7	63-80	C	0.2	1.1	9.8	67.0	3.4	81.5	2.9	15.6	0.0	1.66	18.0	14.9	5.4
Riviera fine sand:															
S18-5-1	0-6	A	0.0	0.0	0.7	73.9	14.9	89.5	7.0	3.5	9.6	1.42	12.9	7.4	2.1
-2	6-17	E1	0.0	0.0	0.6	81.7	12.3	94.6	4.4	1.0	13.7	1.50	7.6	3.8	0.5
-3	17-25	E2	0.0	0.0	0.7	80.3	15.0	96.0	2.1	1.9	21.3	1.52	6.1	2.4	0.3
-4	25-28	EB	0.0	0.0	0.6	76.3	13.2	90.1	5.0	4.9	6.8	1.62	8.6	4.5	1.7
-5	28-35	Btg/E	0.0	0.0	0.4	66.9	12.9	80.2	1.2	18.6	0.3	1.60	15.7	11.1	5.0
-6	35-51	Btg	0.0	0.0	0.3	61.4	13.3	75.0	2.5	22.5	0.2	1.62	22.0	16.2	7.4
-7	51-65	Cg	0.0	0.0	0.3	69.3	14.1	83.7	2.3	14.0	0.9	1.59	12.9	8.3	3.1
-8	65-80	Cg	0.0	0.0	0.3	68.8	17.8	86.9	1.5	11.6	2.0	1.50	16.2	9.7	3.9
Smyrna fine sand:															
S18-9-1	0-4	Ap	0.0	0.5	12.9	80.2	2.4	96.0	2.9	1.1	21.5	1.48	8.2	4.9	1.2
-2	4-8	E1	0.0	0.7	11.6	81.7	2.5	96.5	3.1	0.4	23.7	1.56	5.4	2.6	0.4
-3	8-13	E1	0.0	0.7	10.7	82.7	2.6	96.7	3.2	0.1	28.5	1.57	4.0	2.1	0.4
-4	13-18	Bh1	0.0	0.7	10.1	77.8	2.3	91.0	4.1	4.9	7.6	1.05	30.2	22.9	9.3
-5	18-21	Bh2	0.0	0.8	10.7	80.2	2.4	94.1	2.7	3.1	58.3	1.31	12.8	9.3	3.4
-6	21-50	BC	0.0	0.9	11.1	80.5	2.2	94.7	3.4	0.8	26.1	1.54	6.9	4.9	1.2
-7	50-70	E'	0.0	0.9	13.1	77.5	1.5	93.0	2.3	4.4	5.5	1.59	9.8	5.4	2.0
-8	70-80	B'h	0.0	1.0	12.8	79.5	1.6	94.9	2.1	3.0	10.8	1.57	10.0	6.1	1.7
Tavares fine sand:															
S18-12-1	0-5	A	0.0	0.1	4.4	91.1	2.3	97.9	2.0	0.1	37.7	1.44	5.3	2.6	0.7
-2	5-32	C1	0.0	0.1	4.6	90.7	2.1	97.5	2.2	0.3	49.1	1.42	4.6	2.4	0.3
-3	32-46	C2	0.0	0.1	4.7	90.9	2.0	97.7	2.1	0.2	63.5	1.44	11.1	1.9	0.2
-4	46-80	C3	0.0	0.1	4.5	91.9	2.0	98.5	1.4	0.1	54.8	1.47	3.2	1.4	0.1

TABLE 16.--PHYSICAL PROPERTIES OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Particle-size distribution: Sand: Very coarse (2-1 mm)	Sand: Coarse (1-0.5 mm)	Sand: Medium (0.5-0.25 mm)	Sand: Fine (0.25-0.1 mm)	Sand: Very fine (0.1-0.05 mm)	Sand: Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	Hydraulic conductivity*	Bulk density (field moist)*	Water content: 1/10 bar	Water content: 1/3 bar	Water content: 15 bar
	In		Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Cm/hr	g/cm^3	Pct (wt)	Pct (wt)	Pct (wt)
Valkaria fine sand:															
S18-20-1	0-6	A	0.0	2.7	22.5	69.8	1.4	96.5	2.2	1.3	51.9	1.43	4.9	2.7	0.4
-2	6-12	E1	0.0	3.5	24.0	70.2	0.8	98.5	1.2	0.3	51.9	1.43	3.2	1.5	0.2
-3	12-17	E2	0.0	3.7	23.2	71.6	0.9	99.4	0.4	0.2	61.8	1.57	2.3	1.0	0.2
-4	17-21	Bw1	0.0	3.1	22.3	68.7	0.9	95.0	2.4	2.6	12.5	1.66	6.2	4.1	1.5
-5	21-25	Bw2	0.0	3.8	23.7	66.4	0.9	94.8	3.1	2.1	20.2	1.63	4.4	2.7	0.8
-6	25-52	C	0.0	2.7	20.3	67.0	0.5	90.5	1.9	7.6	4.0	1.69	9.2	6.3	2.3
-7	52-80	C	0.0	2.4	19.8	69.7	0.4	92.3	1.7	6.0	6.2	1.63	9.4	6.4	2.2
Wabasso fine sand:															
S18-3-1	0-4	A	0.0	1.0	10.0	76.3	3.1	90.4	7.6	2.0	9.3	1.54	12.2	7.9	1.1
-2	4-15	E1	0.0	1.1	10.3	76.3	3.1	90.4	7.6	2.0	28.0	1.54	3.7	2.3	0.7
-3	15-22	E2	0.0	1.3	10.6	84.8	1.9	98.6	0.4	1.0	21.1	1.55	3.0	1.4	0.2
-4	22-30	Bh	0.0	1.1	8.9	80.1	1.6	91.7	3.8	4.5	10.0	1.48	15.2	11.1	1.7
-5	30-35	Btg1	0.0	0.9	8.1	66.3	1.5	76.8	3.4	19.8	7.2	1.65	17.7	14.5	6.0
-6	35-47	Btg2	0.1	1.1	9.2	69.0	1.5	80.9	2.8	16.3	0.7	1.66	15.2	11.8	5.3
-7	47-53	BCg	0.0	0.9	8.7	74.1	1.3	85.0	2.4	12.6	0.8	1.67	13.2	10.3	4.1
-8	53-67	Cg	0.0	0.9	7.9	76.5	1.3	86.6	2.8	10.6	2.1	1.64	11.8	8.9	4.1
-9	67-63	Cg	0.0	1.1	9.3	76.9	1.6	88.9	1.8	9.3	3.4	1.57	9.8	6.5	3.0

TABLE 17.--CHEMICAL PROPERTIES OF SELECTED SOILS

Soil name and sample number	Depth	Horizon	Extractable bases					Extractable acidity	Sum of cations	Base saturation	Organic carbon	Electrical conductivity	pH			Pyrophosphate extractable			Citrate-dithionite extractable	
			Ca	Mg	Na	K	Sum						H_2O (1:1)	$CaCl_2$ 0.01M (1:2)	KCl 1N (1:1)	C	Fe	Al	Fe	Al
	In		Milliequivalents/100 grams of soil							Pct	Pct	Mmhos/cm				Pct	Pct	Pct	Pct	Pct
Adamsville fine sand:																				
S18-14-1	0-7	A	0.07	0.03	0.02	0.01	0.13	2.82	2.95	4	0.49	0.02	4.5	4.1	3.9					
-2	7-22	C1	0.02	0.02	0.01	0.00	0.05	1.42	1.47	3	0.20	0.02	4.7	4.7	4.7					
-3	22-34	C2	0.01	0.01	0.01	0.00	0.03	1.41	1.33	2	0.10	0.01	4.6	4.7	4.7					
-4	34-57	C3	0.02	0.02	0.02	0.00	0.06	1.27	1.33	5	0.11	0.01	4.4	4.6	4.6					
-5	57-80	C4	0.06	0.03	0.03	0.00	0.12	1.36	1.48	8	0.08	0.03	4.6	4.6	4.7					
Astatula fine sand:																				
S18-13-1	0-7	A	0.03	0.03	0.02	0.01	0.09	3.37	3.46	3	0.55	0.02	4.4	4.1	3.9					
-2	7-29	C1	0.01	0.01	0.02	0.00	0.04	1.43	1.47	3	0.52	0.02	4.8	4.8	4.8					
-3	29-54	C2	0.01	0.01	0.02	0.00	0.04	1.52	1.56	3	0.09	0.01	5.0	4.9	4.9					
-4	54-80	C3	0.08	0.06	0.03	0.00	0.17	1.25	1.42	12	0.05	0.02	4.8	5.0	5.0					
Bimini sand:																				
S18-18-1	0-6	A	0.28	0.15	0.04	0.03	0.50	6.00	6.50	8	1.35	0.09	3.9	3.1	3.0					
-2	6-28	E	0.11	0.04	0.03	0.00	0.18	1.51	1.69	11	0.16	0.05	4.3	3.7	3.8					
-3	28-32	EB	0.17	0.07	0.03	0.02	0.29	3.46	3.75	8	0.39	0.07	4.0	3.6	3.6					
-4	32-41	Bh	1.10	0.25	0.20	0.10	1.65	11.71	13.36	12	1.21	0.16	4.6	4.2	4.1	0.90	0.20	0.18	0.29	0.15
-5	41-46	Btg	7.17	0.95	0.37	0.32	8.81	13.36	22.17	40	0.99	0.80	4.6	4.6	4.4				2.20	0.24
-6	46-80	2C	20.50	0.11	0.17	0.02	20.80	0.61	21.41	97	0.25	0.42	7.0	6.8	7.2					
Bulow sand:																				
S18-15-1	0-5	A	0.45	0.14	0.03	0.02	0.64	1.98	2.62	24	0.81	0.04	4.8	4.4	4.4					
-2	5-20	E	0.11	0.06	0.02	0.00	0.19	1.19	1.38	14	0.10	0.01	5.2	4.7	4.6					
-3	20-60	Bw	0.16	0.09	0.02	0.01	0.28	1.11	1.39	20	0.09	0.01	5.2	4.7	4.6					
-4	60-68	Bt	10.12	0.20	0.12	0.11	10.55	4.54	15.09	70	0.62	0.07	6.2	6.3	6.0					
Cassia fine sand:																				
S18-8-1	0-5	Ap	0.52	0.31	0.06	0.02	0.91	7.35	8.26	11	1.88	0.06	3.9	3.1	3.0					
-2	5-12	E1	0.07	0.06	0.02	0.00	0.15	1.58	1.73	9	0.19	0.02	4.3	3.6	3.6					
-3	12-26	E2	0.03	0.02	0.02	0.00	0.07	0.40	0.47	15	0.14	0.01	4.6	4.0	4.0					
-4	26-36	Bh	0.04	0.04	0.08	0.02	0.18	19.17	19.35	1	2.64	0.07	3.9	3.9	3.8	1.84	0.00	0.10	0.04	0.21
-5	36-42	C1	0.03	0.02	0.05	0.01	0.11	15.51	15.62	1	1.46	0.04	4.1	3.8	4.0	1.21	0.00	0.10	0.07	0.20
-6	42-69	C1	0.06	0.04	0.04	0.01	0.15	1.12	1.27	12	0.16	0.03	4.3	4.3	4.7					
-7	69-80	C2	0.01	0.02	0.03	0.00	0.06	2.16	2.22	3	0.16	0.02	4.4	4.2	4.5					
Favoretta clay:																				
S18-21-1	0-8	A	18.50	6.58	0.35	0.16	25.59	12.88	38.38	66	1.86	0.15	5.4	4.7	4.4					
-2	8-21	BA	24.25	8.64	4.26	0.24	34.39	9.95	43.89	78	0.86	0.34	6.3	5.5	5.3					
-3	21-36	Bg1	26.00	9.05	2.59	0.26	37.40	9.52	46.92	80	0.50	0.60	6.0	6.0	5.9					
-4	36-66	Bg2	26.50	9.05	2.59	0.31	38.45	10.97	49.42	78	0.30	0.84	6.1	5.9	5.6					
-5	66-80	Bg3	26.75	7.82	2.07	0.35	36.99	10.79	47.69	78	0.18	0.92	6.3	6.2	5.6					

TABLE 17.--CHEMICAL PROPERTIES OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Extractable bases					Extractable acidity	Sum of cations	Base saturation	Organic carbon	Electrical conductivity	pH			Pyrophosphate extractable			Citrate-dithionite extractable	
			Ca	Mg	Na	K	Sum						H_2O (1:1)	$CaCl_2$ 0.01M (1:2)	KCl 1N (1:1)	C	Fe	Al	Fe	Al
	In		Milliequivalents/100 grams of soil							Pct	Pct	Mmhos/cm				Pct	Pct	Pct	Pct	Pct
Gator muck:																				
S18-7-1	0-9	Oa1	52.99	16.46	5.39	0.42	75.26	24.96	100.22	75	22.40	0.00	5.5	5.8	5.9					
-2	9-26	Oa2	26.00	7.41	2.41	0.14	35.96	11.03	46.99	77	7.17	0.00	5.8	5.7	6.0					
-3	26-29	Cg1	5.34	1.69	1.00	0.04	8.07	3.50	11.57	70	0.47	0.00	4.7	4.7	4.9					
-4	29-49	Cg2	7.92	2.72	1.35	0.13	12.12	3.48	15.60	78	0.13	0.00	5.5	5.9	5.8					
-5	49-64	Cg3	11.74	5.35	1.85	0.22	18.81	4.74	23.55	80	0.11	0.10	5.9	5.9	6.1					
-6	64-80	Cg4	12.74	4.94	1.67	0.20	19.55	4.59	24.14	81	0.06	0.06	6.1	6.1	6.3					
Myakka fine sand:																				
S18-1-1	0-5	A	0.53	1.27	0.21	0.08	2.09	25.64	27.73	8	5.66	0.08	3.7	3.1	2.9					
-2	5-14	E1	0.10	0.12	0.03	0.00	0.25	3.07	3.32	8	0.51	0.02	4.3	3.6	3.4					
-3	14-23	E2	0.04	0.05	0.02	0.00	0.11	0.80	0.91	12	0.22	0.01	4.7	4.1	4.0					
-4	23-29	Bh1	0.04	0.49	0.14	0.01	0.68	32.44	33.12	2	3.44	0.04	4.0	3.3	3.3	3.06	0.01	0.20	0.06	0.20
-5	29-41	Bh2	0.03	0.14	0.05	0.00	0.22	23.78	24.00	1	2.50	0.02	4.2	3.9	3.8	1.84	0.00	0.19	0.06	0.24
-6	41-48	BC	0.03	0.19	0.07	0.01	0.30	12.92	13.22	2	0.87	0.03	4.1	4.2	4.4					
-7	48-68	BC/Bh	0.04	0.11	0.05	0.00	0.20	9.83	10.03	2	0.70	0.02	4.4	4.4	4.6					
-8	68-80	C	0.06	0.05	0.03	0.00	0.14	1.38	1.52	9	0.10	0.04	4.4	4.6	4.9					
Orsino fine sand:																				
S18-10-1	0-3	A	0.24	0.16	0.05	0.03	0.48	7.53	8.01	6	1.53	0.06	3.6	3.1	3.0					
-2	3-12	E	0.02	0.04	0.02	0.00	0.08	0.31	0.39	21	0.18	0.07	3.7	4.7	5.0					
-3	12-17	Bw/Bh	0.01	0.01	0.02	0.00	0.04	2.63	2.67	1	0.34	0.06	4.8	4.5	4.5					
-4	17-49	Bw	0.01	0.01	0.01	0.00	0.03	1.15	1.18	3	0.13	0.03	4.7	4.7	4.8					
-5	49-80	C	0.01	0.00	0.02	0.00	0.03	0.50	0.56	5	0.06	0.02	4.7	4.7	4.9					
Paola fine sand:																				
S18-16-1	0-6	A	0.96	0.29	0.04	0.02	1.31	5.41	6.72	19	1.41	0.08	5.0	3.8	4.0					
-2	6-16	E	0.28	0.06	0.02	0.00	0.36	1.31	1.67	22	0.24	0.03	5.1	4.3	4.4					
-3	16-31	B/E	0.25	0.09	0.03	0.01	0.38	4.53	4.91	8	0.30	0.04	5.1	4.4	4.5					
-4	31-55	C	0.15	0.10	0.02	0.01	0.28	2.67	2.95	9	0.10	0.03	5.1	4.3	4.5					
-5	55-80	C	0.15	0.09	0.05	0.01	0.30	1.98	2.28	13	0.06	0.05	5.6	4.5	4.7					
Pineda fine sand:																				
S18-4-1	0-3	A	0.15	0.05	0.03	0.00	0.23	3.06	3.29	7	0.57	0.03	4.5	4.1	4.1					
-2	3-13	E	0.07	0.02	0.01	0.00	0.10	0.45	0.55	18	0.18	0.01	5.1	4.9	4.9					
-3	13-19	Bw1	0.35	0.06	0.05	0.00	0.46	0.58	1.04	44	0.12	0.01	5.2	5.5	5.6					
-4	19-24	Bw2	0.56	0.08	0.03	0.00	0.67	0.88	1.55	43	0.07	0.01	5.4	5.7	5.8					
-5	24-26	E'	0.38	0.05	0.03	0.00	0.46	0.54	1.00	46	0.10	0.01	5.3	5.5	5.5					
-6	26-33	Btg/E	6.42	1.15	0.15	0.06	7.78	3.36	11.14	70	0.27	0.02	5.3	5.3	5.0				0.68	0.08
-7	33-40	Btg1	6.74	1.19	0.17	0.07	8.17	3.46	11.63	70	0.23	0.04	5.4	5.6	5.3				0.26	0.04
-8	40-47	Btg2	5.54	1.07	0.14	0.07	6.82	3.06	9.88	69	0.15	0.02	5.6	5.8	5.5				0.30	0.06
-9	47-63	Cg	5.12	0.82	0.12	0.07	6.13	2.37	8.50	72	0.13	0.02	5.7	6.1	6.0					
-10	63-80	Cg	5.72	0.58	0.14	0.07	6.51	1.76	8.27	79	0.92	0.06	5.9	6.4	6.5					

TABLE 17.--CHEMICAL PROPERTIES OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Extractable bases					Extractable acidity	Sum of cations	Base saturation	Organic carbon	Electrical conductivity	pH			Pyrophosphate extractable			Citrate-dithionite extractable	
			Ca	Mg	Na	K	Sum						H_2O (1:1)	$CaCl_2$ 0.01M (1:2)	KCl 1N (1:1)	C	Fe	Al	Fe	Al
	In		Milliequivalents/100 grams of soil							Pct	Pct	Mmhos/cm				Pct	Pct	Pct	Pct	Pct
Pomello fine sand:																				
S18-11-1	0-5	A	0.11	0.15	0.04	0.02	0.32	3.84	4.16	8	0.82	0.04	4.2	3.3	3.0					
-2	5-41	E	0.03	0.02	0.02	0.00	0.07	0.57	0.64	11	0.15	0.01	4.6	3.8	3.8					
-3	41-55	Bh1	0.02	0.03	0.08	0.01	0.14	16.43	16.48	1	1.60	0.06	3.7	3.6	3.6	1.01	0.00	0.06	1.05	0.11
-4	55-66	Bh2	0.02	0.02	0.03	0.00	0.07	10.88	10.95	1	1.25	0.03	4.1	3.6	3.7	1.17	0.00	0.04	0.10	0.06
-5	66-75	C1	0.04	0.02	0.03	0.00	0.09	3.33	3.42	3	0.33	0.02	4.3	3.4	3.5					
-6	75-80	C2	0.05	0.02	0.02	0.00	0.09	7.19	7.28	1	0.59	0.03	4.0	3.7	3.7					
Pomona fine sand:																				
S18-19-1	0-4	Ap	0.52	0.37	0.06	0.03	0.98	8.06	9.04	11	2.67	0.12	3.9	3.1	3.0					
-2	4-10	E1	0.10	0.07	0.02	0.00	0.19	0.44	0.63	30	0.36	0.06	4.1	3.3	3.4					
-3	10-21	E2	0.08	0.03	0.02	0.00	0.13	0.58	0.71	18	0.24	0.05	4.2	3.6	3.7					
-4	21-28	Bh1	0.16	0.58	0.09	0.00	0.83	29.10	29.93	3	4.18	0.13	3.7	3.1	3.1	3.34	0.03	0.13	0.07	0.09
-5	28-50	Bh2	0.05	0.16	0.07	0.00	0.28	23.25	23.53	1	2.41	0.09	3.8	3.5	3.6	2.28	0.01	0.23	0.02	0.16
-6	50-63	Bt	0.19	1.48	0.16	0.03	1.86	9.12	10.98	17	0.42	0.09	4.1	3.8	3.9				0.06	0.07
-7	63-80	C	0.19	1.97	0.26	0.06	2.48	6.34	8.82	28	0.36	0.08	4.4	3.8	3.8					
Riviera fine sand:																				
S18-5-1	0-6	A	1.24	0.53	0.58	0.18	2.53	10.17	12.70	20	2.80	0.18	4.2	4.1	4.1					
-2	6-17	E1	0.21	0.09	0.07	0.00	0.37	2.66	3.03	12	0.44	0.04	4.8	4.8	4.8					
-3	17-25	E2	5.05	0.11	0.10	0.00	5.38	1.14	6.52	83	0.20	0.04	5.0	5.3	5.4					
-4	25-28	EB	1.62	0.34	0.19	0.03	2.18	0.75	2.93	74	0.23	0.05	5.3	5.6	5.5					
-5	28-35	Btg/E	6.72	1.23	0.29	0.10	8.34	2.70	11.04	76	0.21	0.03	5.7	5.7	5.4					
-6	35-51	Btg	8.54	1.40	0.33	0.07	10.34	3.59	13.93	74	0.14	0.02	5.8	5.9	5.6				0.72	0.14
-7	51-65	Cg	6.84	0.95	0.25	0.06	8.10	2.48	10.58	77	0.04	0.02	5.8	6.2	6.0					
-8	65-80	Cg	6.27	0.78	0.23	0.08	7.36	1.39	8.75	84	0.03	0.04	6.1	6.4	6.5					
Smyrna fine sand:																				
S18-9-1	0-4	Ap	0.38	0.26	0.08	0.03	0.75	5.30	6.05	12	1.82	0.06	3.7	3.1	3.2					
-2	4-8	E1	0.07	0.05	0.03	0.01	0.16	0.66	0.82	20	0.50	0.02	4.2	3.3	3.4					
-3	8-13	E1	0.02	0.03	0.03	0.00	0.08	0.16	0.24	33	0.28	0.02	4.2	3.6	3.7					
-4	13-18	Bh1	0.01	0.03	0.11	0.01	0.16	35.59	36.15	1	3.44	0.11	3.3	3.8	3.8	2.55	0.00	0.22	0.18	0.87
-5	18-21	Bh2	0.02	0.02	0.06	0.00	0.10	10.31	10.41	1	1.00	0.04	4.1	4.1	4.1	0.82	0.00	0.12	0.06	0.18
-6	21-50	BC	0.01	0.01	0.02	0.00	0.04	3.30	3.34	1	0.18	0.02	4.3	4.5	4.7					
-7	50-70	E'	0.04	0.66	0.13	0.03	0.86	2.99	3.85	22	0.08	0.06	4.4	4.1	4.3					
-8	70-80	B'h	0.05	0.25	0.03	0.01	0.24	5.06	5.40	6	0.55	0.03	4.5	4.2	4.4	0.37	0.00	0.04	0.09	0.05

TABLE 17.--CHEMICAL PROPERTIES OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Extractable bases					Extractable acidity	Sum of cations	Base saturation	Organic carbon	Electrical conductivity	pH			Pyrophosphate extractable			Citrate-dithionite extractable	
			Ca	Mg	Na	K	Sum						H_2O (1:1)	$CaCl_2$ 0.01M (1:2)	KCl 1N (1:1)	C	Fe	Al	Fe	Al
	In		Milliequivalents/100 grams of soil							Pct	Pct	Mmhos/cm				Pct	Pct	Pct	Pct	Pct
Tavares fine sand:																				
S18-12-1	0-5	A	0.07	0.02	0.03	0.00	0.12	2.23	2.35	5	0.44	0.02	4.5	4.2	3.8					
-2	5-32	C1	0.03	0.04	0.02	0.00	0.09	1.18	1.27	7	0.18	0.02	4.4	4.7	4.8					
-3	32-46	C2	0.02	0.03	0.02	0.00	0.07	1.11	1.18	6	0.09	0.02	4.5	4.6	4.7					
-4	46-80	C3	0.05	0.04	0.02	0.00	0.11	0.38	0.49	22	0.12	0.01	4.7	4.8	4.9					
Valkaria fine sand:																				
S18-20-1	0-6	A	0.74	0.06	0.05	0.00	0.85	1.56	2.41	35	0.34	0.08	4.9	4.7	5.0					
-2	6-12	E1	0.48	0.02	0.04	0.00	0.54	0.63	1.17	46	0.12	0.07	5.4	5.5	5.8					
-3	12-17	E2	0.31	0.01	0.02	0.00	0.34	0.77	1.11	31	0.04	0.06	5.5	5.8	6.1					
-4	17-21	Bw1	0.40	0.02	0.04	0.00	0.46	0.53	0.99	46	0.06	0.08	5.6	5.9	6.0					
-5	21-25	Bw2	0.67	0.06	0.04	0.01	0.78	0.60	1.38	57	0.06	0.07	5.6	5.7	5.8					
-6	25-52	C	2.85	0.14	0.11	0.03	3.13	1.27	4.40	71	0.13	0.09	5.7	5.6	5.5					
-7	52-80	C	2.27	0.11	0.09	0.03	2.50	1.17	3.67	68	0.12	0.12	5.7	5.6	5.5					
Wabasso fine sand:																				
S18-3-1	0-4	A	0.40	0.10	0.05	0.02	0.57	9.72	10.29	6	1.53	0.04	4.1	3.7	3.6					
-2	4-15	E1	0.07	0.04	0.02	0.00	0.13	1.75	1.88	7	0.11	0.01	4.8	4.5	4.6					
-3	15-22	E2	0.08	0.02	0.03	0.00	0.13	1.73	1.86	7	0.11	0.01	5.1	4.9	5.0					
-4	22-30	Bh	4.50	0.49	0.12	0.01	5.12	11.55	16.67	31	2.23	0.03	5.1	4.9	5.1	1.36	0.08	0.12	0.16	0.14
-5	30-35	Btg1	6.70	1.40	0.18	0.06	8.34	6.99	15.33	54	0.41	0.03	5.2	5.0	4.8				0.14	0.08
-6	35-47	Btg2	6.72	1.48	0.17	0.05	8.42	4.62	13.04	65	0.32	0.03	5.3	5.0	5.0				0.16	0.06
-7	47-53	BCg	4.84	1.27	0.16	0.05	6.32	3.51	9.83	64	0.23	0.03	5.3	5.0	4.9					
-8	53-67	Cg	4.79	1.07	0.11	0.05	6.02	3.61	9.63	63	0.11	0.03	5.2	5.0	4.8					
-9	67-63	Cg	4.42	0.82	0.11	0.05	5.40	1.90	7.30	74	0.16	0.03	5.2	5.0	4.7					

TABLE 18.--CLAY MINERALOGY OF SELECTED SOILS

Soil name and sample number	Depth	Horizon	Clay minerals				
			Montmorillonite	14-angstrom intergrade	Kaolinite	Gibbsite	Quartz
	In		Pct	Pct	Pct	Pct	Pct
Adamsville fine sand:							
S18-14-1	0-7	A		48	19		33
-2	7-22	C1					
-3	22-34	C2		46	19		35
-4	34-57	C3					
-5	57-80	C4		45	19		36
Astatula fine sand:							
S18-13-1	0-7	A		40	20		40
-2	7-29	C1					
-3	29-54	C2					
-4	54-80	C3		21	14		65
Bimini sand:							
S18-18-1	0-6	A	36	14	14		36
-2	6-28	E					
-3	28-32	EB					
-4	32-41	Bh	13	40	28		19
-5	41-46	Btg	21	38	28		13
-6	46-80	2C	33	29	24		14
Bulow sand:							
S18-15-1	0-5	A		60	23		17
-2	5-20	E					
-3	20-50	Bw		62	30		8
-4	50-68	Bt		58	34		8
Cassia fine sand:							
S18-8-1	0-5	Ap			23		77
-2	5-12	E1					
-3	12-26	E2					
-4	26-36	Bh		23	20		57
-5	36-42	C1					
-6	42-69	C1					
-7	69-80	C2		17	72		11
Favoretta clay:							
S18-21-1	0-8	A	67	7	19		7
-2	8-21	BA					
-3	21-36	Bg1	65	8	19		8
-4	36-66	Bg2					
-5	66-80	Bg3	82	4	10		4
Gator muck:							
S18-7-1	0-9	Oa1					
-2	9-26	Oa2					
-3	26-29	Cg1	68	9	12		11
-4	29-49	Cg2					
-5	49-64	Cg3					
-6	64-80	Cg3	56	11	18		15
Myakka fine sand:							
S18-1-1	0-5	A					
-2	5-14	E1					
-3	14-23	E2					
-4	23-29	Bh1		17	34	49	
-5	29-41	Bh2					
-6	41-48	BC					
-7	48-68	BC/Bh					
-8	68-80	C	16	18	53		13

TABLE 18.--CLAY MINERALOGY OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Clay minerals				
			Montmorillonite	14-angstrom intergrade	Kaolinite	Gibbsite	Quartz
	In		Pct	Pct	Pct	Pct	Pct
Orsino fine sand:							
S18-10-1	0-3	A		9	10		81
-2	3-12	E					
-3	12-17	Bw/Bh		33	11		56
-4	17-49	Bw					
-5	49-80	C		27	12		61
Paola fine sand:							
S18-16-1	0-6	A	27	20	12		41
-2	6-16	E					
-3	16-31	B/E	17	45	16		22
-4	31-55	C					
-5	55-80	C	24	46	21		9
Pineda fine sand:							
S18-4-1	0-3	A		38	20		42
-2	3-13	E					
-3	13-19	Bw1					
-4	19-24	Bw2		39	32		29
-5	24-26	E'					
-6	26-33	Btg/E					
-7	33-40	Btg1	50	24	18		8
-8	40-47	Btg2					
-9	47-63	Cg					
-10	63-80	Cg	72	10	14		4
Pomello fine sand:							
S18-11-1	0-5	A					100
-2	5-41	E					
-3	41-55	Bh1	15	15	9		61
-4	55-66	Bh2					
-5	66-75	C1					
-6	75-80	C2					100
Pomona fine sand:							
S18-19-1	0-6	A					100
-2	6-10	E1					
-3	10-21	E2					
-4	21-28	Bh1			11		89
-5	28-50	Bh2					
-6	50-63	Bt	46	15	30		9
-7	63-80	C	41	13	36		10
Riviera fine sand:							
S18-5-1	0-6	A		38	28		34
-2	6-17	E1					
-3	17-25	E2					
-4	25-28	EB					
-5	28-35	Btg/E					
-6	35-51	Btg		39	44		17
-7	51-65	Cg					
-8	65-80	Cg	68	13	13		6
Smyrna fine sand:							
S18-9-1	0-4	Ap			10		90
-2	4-8	E1					
-3	8-13	E1					
-4	13-18	Bh1		24	12		64
-5	18-21	Bh2					
-6	21-50	BC					
-7	50-70	E'					
-8	70-80	B'h		16	56		28

TABLE 18.--CLAY MINERALOGY OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Clay minerals				
			Montmorillonite	14-angstrom intergrade	Kaolinite	Gibbsite	Quartz
	In		Pct	Pct	Pct	Pct	Pct
Tavares fine sand:							
S18-12-1	0-5	A	17	36	12		35
-2	5-32	C1					
-3	32-46	C2					
-4	46-80	C3		45	10		45
Valkaria fine sand:							
S18-20-1	0-6	A	13	14	9		64
-2	6-12	E1					
-3	12-17	E2					
-4	17-21	Bw1	24	39	12		25
-5	21-25	Bw2					
-6	25-52	C	33	15	41		11
-7	52-80	C					
Wabasso fine sand:							
S18-3-1	0-4	A		22	12		66
-2	4-15	E1					
-3	15-22	E2					
-4	22-30	Bh		42	21		37
-5	30-35	Btg1					
-6	35-47	Btg2		45	21		37
-7	47-53	BCg					
-8	53-67	Cg					
-9	67-63	Cg	50	23	18		9

TABLE 19.--ENGINEERING INDEX TEST DATA

(Tests were performed by the Florida Department of Transportation (FDOT) in cooperation with the U.S. Bureau of Public Roads, in accordance with standard procedures of the American Association of State Highway and Transportation Officials (AASHTO). NP means nonplastic)

Soil name, report number, horizon, and depth in inches	FDOT report number	Classification		Mechanical analysis* Percentage smaller than--							Liquid limit	Plasticity index	Moisture density**	
		AASHTO***	Unified (est.)	No. 10	No. 40	No. 200	.05 mm	.02 mm	.005 mm	.002 mm			Maximum dry density	Optimum moisture
											Pct		Lb/cu ft	Pct
Adamsville fine sand: (S86FL-035-14) C1 ------- 7-22	22	A-3	SP-SM	100	100	3	3	3	2	2	NP	NP	98.9	12.2
Astatula fine sand: (S86FL-035-13) C2 ------- 29-54	21	A-3	SP-SM	100	99	3	3	3	2	1	NP	NP	99.4	16.2
Bimini fine sand: (S87FL-035-18) E -------- 6-28	27	A-3	SP-SM	100	82	3	3	2	1	1	NP	NP	102.3	14.6
Bulow sand: (S86FL-035-15) Bw ------- 20-50	23	A-3	SP-SM	100	72	3	3	3	3	2	NP	NP	107.1	10.5
Cassia fine sand: (S86FL-035-08) E2 ------- 12-26	16	A-3	SP-SM	100	99	2	2	1	1	1	NP	NP	96.2	17.3
Favoretta clay: (S87FL-035-21) Btg2 ----- 21-36	30	A-7-6	CH, CL	100	99	84	80	71	61	55	68	46	102.8	17.5
Gator muck: (S86FL-035-07) Cg2 ------ 29-49	15	A-2-4	SM-SC	100	98	33	29	27	22	19	NP	NP	118.1	12.3
Orsino fine sand: (S86FL-035-10) Bw ------- 17-49	18	A-3	SP-SM	100	99	3	3	3	2	1	NP	NP	101.7	11.6
Paola fine sand: (S87FL-035-16) C -------- 31-80	24	A-3	SP-SM	100	87	5	5	4	4	4	NP	NP	105.3	12.2
Pineda fine sand: (S86FL-035-04) E -------- 3-13	9	A-3	SP-SM	100	99	2	2	2	2	1	NP	NP	97.7	10.5
Bw2 ------ 19-24	10	A-3	SP-SM	100	98	4	4	4	2	2	NP	NP	101.1	14.0
Btg ------ 33-40	11	A-2-4	SM-SC	100	99	16	16	16	15	14	NP	NP	112.7	13.3
Pomello fine sand: (S86FL-035-11) E -------- 5-41	19	A-3	SP-SM	100	99	4	4	4	2	1	NP	NP	97.2	10.8
Pomona fine sand: (S87FL-035-19) E2 ------- 10-21	28	A-3	SP-SM	100	98	4	3	2	1	1	NP	NP	97.1	16.5
Riveria fine sand: (S86FL-035-05) E1 ------- 6-17	12	A-3	SP-SM	100	100	7	7	5	3	2	NP	NP	100.2	15.6
Btg ------ 35-51	13	A-2-6	SM-SC	100	100	25	22	20	20	19	24	12	110.9	14.9

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	FDOT report number	Classification		Mechanical analysis*							Liquid limit	Plasticity index	Moisture density**	
				Percentage smaller than--										
		AASHTO***	Unified (est.)	No. 10	No. 40	No. 200	.05 mm	.02 mm	.005 mm	.002 mm			Maximum dry density	Optimum moisture
											Pct		Lb/cu ft	Pct
Smyrna fine sand: (S86FL-035-09)														
BE ------- 21-50	17	A-3	SP-SM	100	99	6	6	6	4	4	NP	NP	103.1	11.2
Tavares fine sand: (S86FL-035-12)														
C1 ------- 5-32	20	A-3	SP-SM	100	99	4	4	4	3	3	NP	NP	99.2	11.0
Valkaria fine sand: (S87FL-035-20)														
E1 ------- 6-12	29	A-3	SP-SM	100	87	5	5	4	4	4	NP	NP	105.3	12.2
Wabasso fine sand: (S86FL-035-03)														
E1 ------- 4-15	6	A-3	SP-SM	100	97	2	2	2	1	1	NP	NP	96.2	8.8
Bh ------- 22-30	7	A-3	SP-SM	100	98	8	7	6	4	4	NP	NP	103.9	13.8
Btg2 ----- 35-47	8	A-2-4	SM-SC	100	98	21	20	20	18	18	NP	NP	108.3	11.0

* Mechanical analyses according to AASHTO designation T88-78. Results by this procedure differ somewhat from results obtained by the soil survey procedure of the Natural Resources Conservation Service (NRCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-sized fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the NRCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from the calculations of grain-sized fractions. The mechanical analyses used in the table are not suitable for use in naming textural classes for soil.

** Based on AASHTO designation T99-74.

*** Based on AASHTO designation M 145-73.

TABLE 20.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Adamsville	Hyperthermic, uncoated Aquic Quartzipsamments
Astatula	Hyperthermic, uncoated Typic Quartzipsamments
Basinger	Siliceous, hyperthermic Spodic Psammaquents
Bimini	Sandy, siliceous, hyperthermic Arenic Ultic Haplohumods
Bulow	Loamy, siliceous, hyperthermic Arenic Hapludalfs
Cassia	Sandy, siliceous, hyperthermic Oxyaquic Alorthods
Chobee	Fine-loamy, siliceous, hyperthermic Typic Argiaquolls
Cocoa	Sandy, siliceous, hyperthermic Psammentic Hapludalfs
Eaugallie	Sandy, siliceous, hyperthermic Alfic Alaquods
Favoretta	Fine, montmorillonitic, hyperthermic Typic Argiaquolls
Gator	Loamy, siliceous, euic, hyperthermic Terric Medisaprists
Hicoria	Loamy, siliceous, hyperthermic Arenic Umbraqualfs
Holopaw	Loamy, siliceous, hyperthermic Grossarenic Ochraqualfs
Hontoon	Dysic, hyperthermic Typic Medisaprists
Immokalee	Sandy, siliceous, hyperthermic Arenic Alaquods
Malabar	Loamy, siliceous, hyperthermic Grossarenic Ochraqualfs
Myakka	Sandy, siliceous, hyperthermic Aeric Haplaquods
Narcoossee	Sandy, siliceous, hyperthermic Oxyaquic Alorthods
Orsino	Hyperthermic, uncoated Spodic Quartzipsamments
Palm Beach	Hyperthermic, uncoated Typic Quartzipsamments
Paola	Hyperthermic, uncoated Spodic Quartzipsamments
Pellicer	Fine, montmorillonitic, nonacid, hyperthermic Typic Sulfaquents
Pineda	Loamy, siliceous, hyperthermic Arenic Glossaqualfs
Placid	Sandy, siliceous, hyperthermic Typic Humaquepts
Pomello	Sandy, siliceous, hyperthermic Oxyaquic Alorthods
Pomona	Sandy, siliceous, hyperthermic Ultic Haplaquods
Quartzipsamments	Quartzipsamments
Riviera	Loamy, siliceous, hyperthermic Arenic Glossaqualfs
Samsula	Sandy or sandy-skeletal, siliceous, euic, hyperthermic Terric Medisaprists
Smyrna	Sandy, siliceous, hyperthermic Aeric Haplaquods
St. Johns	Sandy, siliceous, hyperthermic Typic Haplaquods
Tavares	Hyperthermic, uncoated Typic Quartzipsamments
Terra Ceia	Euic, hyperthermic Typic Medisaprists
Turnbull	Clayey over sandy or sandy-skeletal, montmorillonitic, nonacid, hyperthermic Typic Hydraquents
Tuscawilla	Fine-loamy, siliceous, hyperthermic Typic Ochraqualfs
Udarents	Sandy, siliceous, hyperthermic Alfic Udarents
Valkaria	Siliceous, hyperthermic Spodic Psammaquents
Wabasso	Sandy, siliceous, hyperthermic Alfic Alaquods
Welaka	Hyperthermic, uncoated Spodic Quartzipsamments
Winder	Fine-loamy, siliceous, hyperthermic Typic Glossaqualfs

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