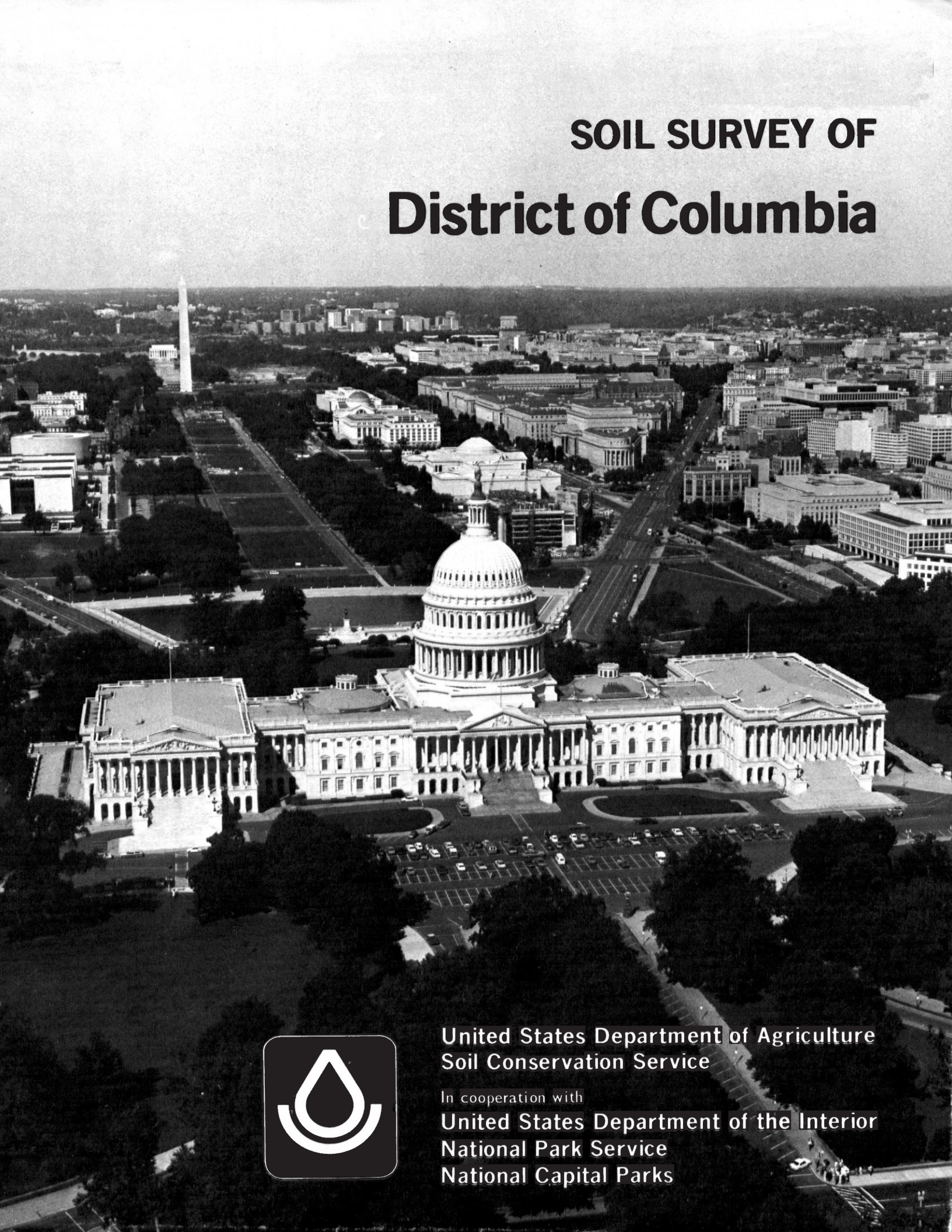
SOIL SURVEY OF
District of Columbia



United States Department of Agriculture
Soil Conservation Service

In cooperation with

United States Department of the Interior
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HOW TO USE

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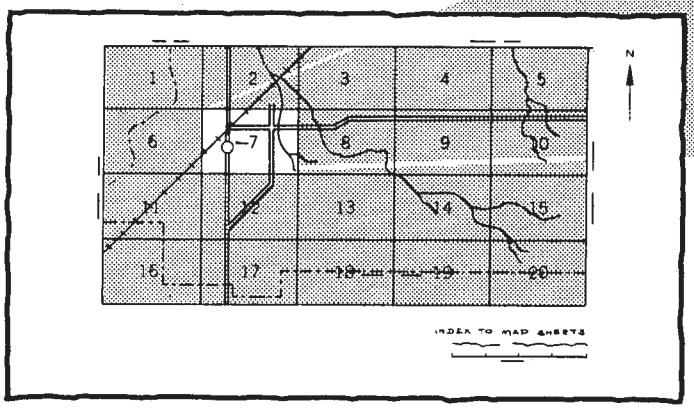

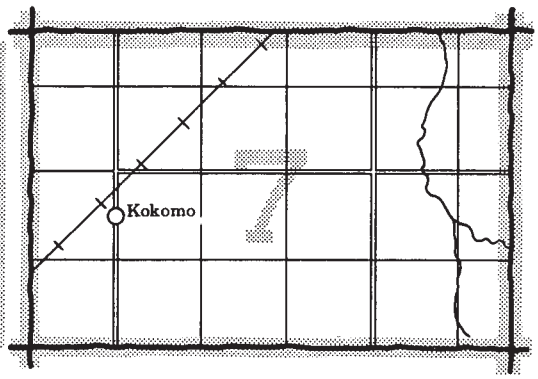

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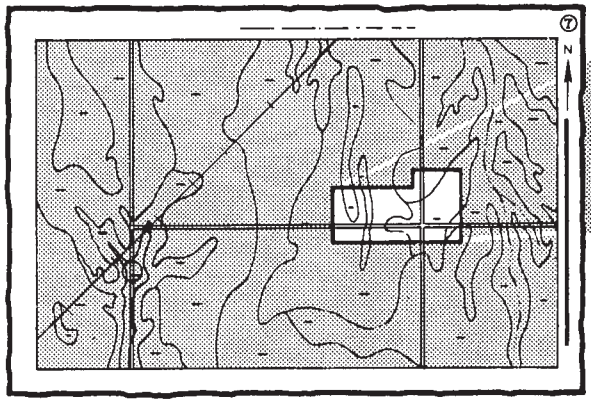

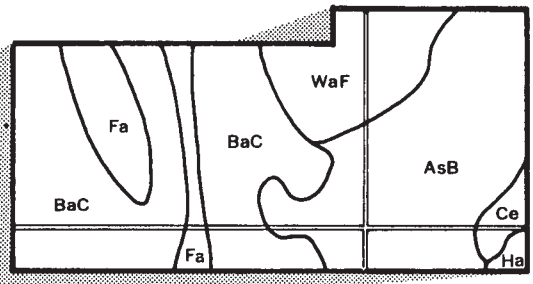

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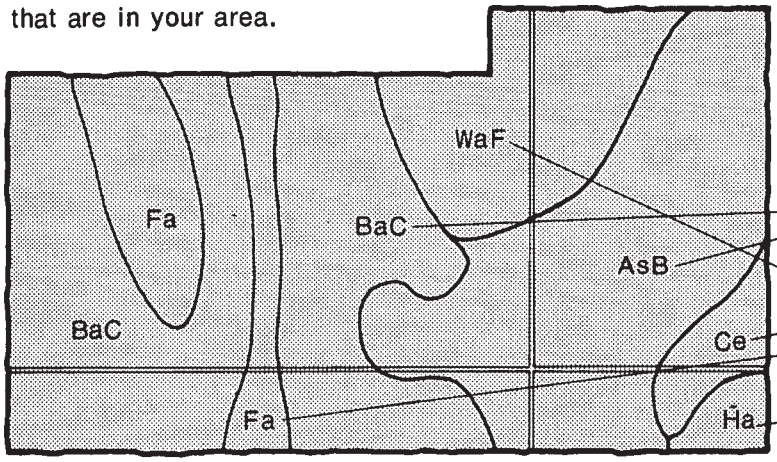
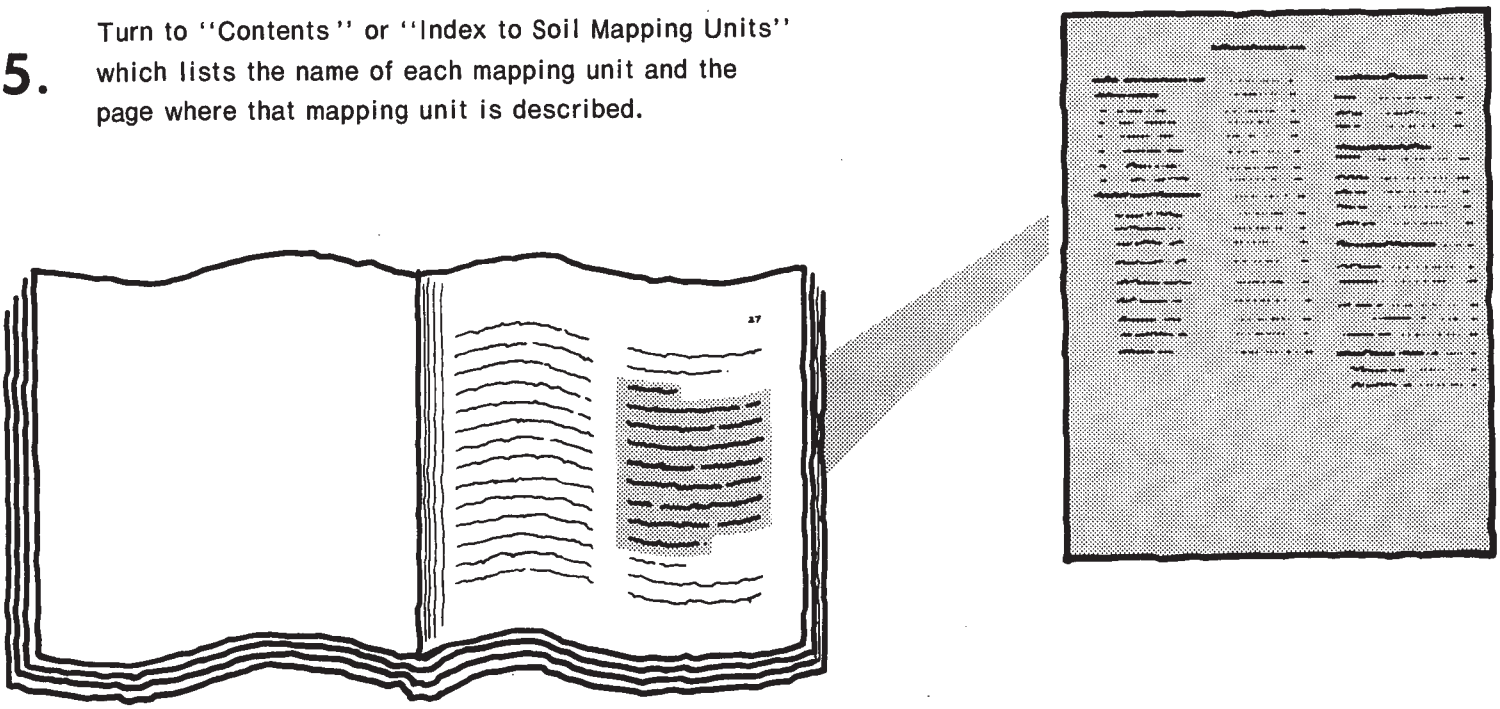


Symbols

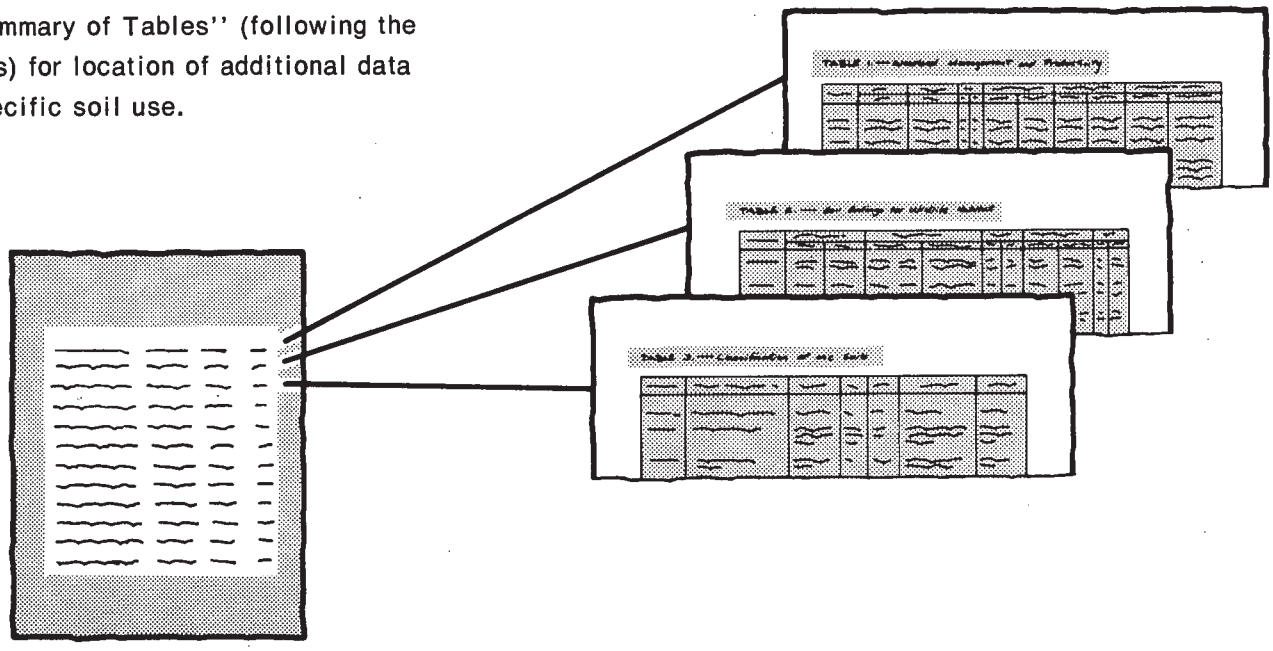
AsB
BaC
Ce
Fa
Ha
WaF

THIS SOIL SURVEY

5. Turn to "Contents" or "Index to Soil Mapping Units" which lists the name of each mapping unit and the page where that mapping unit is described.



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



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

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1974-75. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the District in 1975. This survey was made cooperatively by the Soil Conservation Service and the U.S. Department of the Interior, National Park Service. Others who contributed to the survey are: Maryland Agricultural Experiment Station, U.S. Geological Survey, District of Columbia Department of Environmental Services, and the Washington Technical Institute. This survey is part of the technical assistance furnished to the Office of National Capital Parks and the various agencies of the government of the District of Columbia.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

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Foreword

We would like to introduce the Soil Survey of the District of Columbia. You will find herein much basic information useful for any land planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land use will have on the environment.

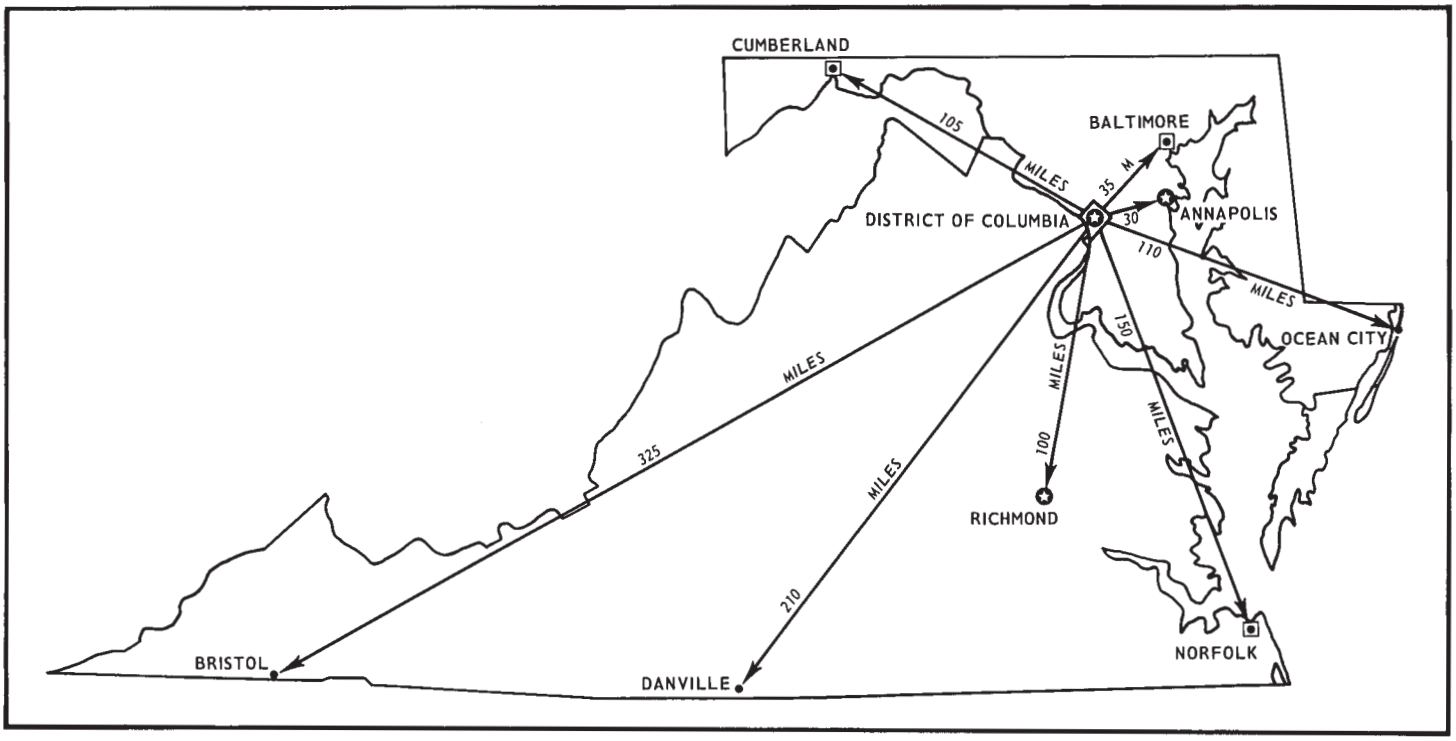
This soil survey has been prepared for many different users. Landscape architects and gardeners can use it to determine the potential of the soils for shrubs, ornamental and shade trees, lawn grasses, and flower and vegetable gardens. Planners, community decisionmakers, engineers, developers, builders, or homebuyers can use it to plan use of land, select sites for construction, pinpoint areas where potential landslides, slumps, or similar soil problems are likely to occur, develop soil resources, and identify any special practices that may be needed to assure proper performance. Conservationists, recreationists, teachers, students, or specialists in wildlife management, waste disposal, or pollution control can use the soil survey to help understand, protect, and enhance the environment.

Why do you need soil information? Many people assume that soils are all more or less alike. They are unaware that great differences in soil properties can occur within even short distances.

Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. 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. It also shows, on the general soil map, the location of broad areas of soils; the location of each kind of soil is shown on detailed soil maps at the back. The publication provides descriptions of each kind of soil in the survey area, and much information is given about each soil for specific uses. If you need additional information or assistance in using this publication please call the Soil Conservation Service, the National Park Service, or the Cooperative Extension Service at Washington Technical Institute.

We believe that use of the information in this soil survey will help you to have a better environment and a better life. The widespread use of this information will greatly assist all of us in the conservaton, development, and productive use of our soil, water, and related resources.



Location of the District of Columbia.

SOIL SURVEY OF DISTRICT OF COLUMBIA

By Horace Smith, Soil Conservation Service

Fieldwork by Horace Smith, Linton Wright, Jr., Edgar A. White, and Joseph W. Gibson, Soil Conservation Service, and Clifford E. Stein, University of Maryland

United States Department of Agriculture, Soil Conservation Service, in cooperation with United States Department of the Interior, National Park Service, National Capital Parks

Introduction

The DISTRICT OF COLUMBIA is located between the States of Maryland and Virginia at the head of navigation of the Potomac River (see map on facing page). The area is 44,160 acres, or about 69 square miles. The District of Columbia is bounded on the northwest by Montgomery County, Maryland; on the northeast by Montgomery and Prince Georges Counties, Maryland; and on the southeast by Prince Georges County, Maryland. The longest segment of boundary is the Potomac River, which separates the District from Virginia to the southwest. The city of Washington, Capital of the United States of America, is coextensive with the District of Columbia.

Most of the soils in the District of Columbia have been altered by urbanization and other activities of man. About 81 percent of the area has been disturbed during urbanization or other related activities, and about 14 percent of this is soils made from various kinds of fill material. About 19 percent of the area is relatively undisturbed. These relatively undisturbed soils are mostly in parks.

General Nature of the Area

This section provides general information about the District of Columbia. It discusses history and population, climate, transportation, water supply, and native vegetation.

History and population

In July 1790 Congress authorized the creation of the District of Columbia on the Potomac River (*31*). In 1791 President George Washington personally chose the site, and Andrew Ellicott and Benjamin Banneker were appointed to survey the boundaries and prepare topographic information (*16*, *32*). Also in 1791 Major Pierre Charles L'Enfant was commissioned to plan the future city of Washington, which was to be our National Capital (*31*).

The District of Columbia was originally laid out as a square 10 miles by 10 miles. It extended across the Potomac and included areas ceded in 1791 by Virginia and by Maryland (fig.1). The land given to the District by Virginia, including Arlington County and the City of Alexandria, was returned to that state in 1846. The District has since comprised only the former Maryland territory on the north bank of the Potomac River.

The area chosen by President Washington as the site for the District of Columbia was suitable in every respect. Settlers arriving in this area a century earlier had recognized the beauty and potential of the Potomac Valley (*23*). The Indians who once camped on what is now Capitol Hill introduced the settlers to tobacco, and a profitable trade developed along the river. Around 1700 the area was dotted with estates with names such as Widow's Mite, Mexico, Duddington Pasture, Abby Manor, and Jamaica (fig.2). Goose Creek, a large perennial stream that drained much of the area, flowed through a large, low-lying, swampy tract called Rome and was locally called Tiber Creek. Much of the Mall area was created when the Tiber Creek valley was drained and filled.

In 1882, a project to improve navigation of the Potomac River transformed marshes and tidal flats into 600 acres of riverside recreational areas. East and West Potomac Parks (fig.3) were formed when the U. S. Army Corps of Engineers dredged the river channel and filled in the tidal flats south and west of the Washington Monument (*23*). The original shoreline was modified by the creation of East Potomac Park, an island parallel to the old Potomac shore. The deepened Washington Channel between the riverbank and the newly created island afforded access to the city's wharves and docks. West Potomac Park, to the north, was created where swampy tidal flats once reached to the base of the Washington Monument.

This dredging project was substantially completed by 1900, allowing twentieth-century designers to develop L'Enfant's scheme of symmetrical pattern of monuments on the reclaimed land. The pattern is produced by the Capitol, the White House, the Lincoln Memorial, and the Jefferson Memorial, with the Washington Monument grounds serving as a pivotal point.

Since the days of L'Enfant the representatives of the people in Congress and the White House have continued to alter and add to his original design of 1791. In this sense, Washington is a city still being planned.

In 1970, according to the U. S. Bureau of the Census, the population of the District of Columbia was 756,510, which makes Washington, D.C., the ninth largest city in the United States. The District of Columbia is truly cosmopolitan; its inhabitants include persons from each of the 50 states and from almost every country in the world. The 1970 population data for the District of Columbia show a decline of about 1 percent from 1960.

Climate

The District of Columbia is hot in summer and rather cold in winter. Precipitation is well distributed throughout the year. Some winter precipitation occurs as snow, but the ground does not usually stay covered for more than a few days at a time.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Washington National Airport for the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season. Observational records have been kept continuously at locations within the city since November 1870 and at Washington National and Dulles Airports.

In winter the average temperature is 37 degrees F and the average daily minimum is 29 degrees. The lowest temperature, -15 degrees, was recorded at the Weather Bureau Office in Februrary 1899. In summer the average temperature is 77 degrees and the average daily maximum is 86 degrees. The highest temperature, 106 degrees, was recorded in July 1930.

Heating degree days, shown in Table 1, give an indication of the energy required for space heating in winter. Beginning in fall, heating degree days accumulate by the amount that the average temperature each day is less than the base temperature of 65 degrees.

Of the total annual precipitation, 21 inches, or 54 percent, usually falls during the period April through September. Two years in 10, the April-September rainfall is less than 17 inches. The heaviest 1-day rainfall during the period of record was 7.31 inches in August 1928. Thunderstorms number about 29 each year, 16 of which occur in summer.

Average annual snowfall is 18 inches. The greatest snow depth at any one time during the period of record was 16 inches. On the average, 7 days have at least 1 inch of snow on the ground, but the number of days varies greatly from year to year.

The average relative humidity in midafternoon in spring is less than 50 percent; during the rest of the year it is about 55 percent. Humidity is higher at night in all seasons, and the average at dawn is about 73 percent. The percentage of possible sunshine is 63 percent in summer and 49 percent in winter. The prevailing direction of the wind is from the south. Average windspeed is highest, 11 miles per hour, in March.

Significant local variation in climate is mainly in nighttime temperature. On many nights during the year, park areas within the District of Columbia, such as Rock Creek, and suburban areas surrounding the District experience minimum temperatures as much as 5 to 10 degrees lower than those in urbanized areas of the District. These lower temperatures cause a later last-freeze date in spring and an earlier first-freeze date in fall and a 1- to 2-month shorter growing season for sensitive plants (Figs. 4 and 5).

The climatic factors that occasionally cause increased air pollution in Washington are usually light winds and a high-level temperature inversion. These factors occur most often in summer, and pollutants are usually well mixed throughout a fairly deep layer of air. The pollution, while widespread and sometimes causing discomfort, is seldom hazardous. Low level inversions, which trap hazardous concentrations of pollutants near the source, are rare.

The chief climatic factor in soil erosion is heavy, prolonged rain, such as that associated with some tropical storms. The rain causes serious slippage for a few days in exposed and disturbed soils that are underlain by unstable red and variegated clays in numerous locations in the Coastal Plain areas of the District of Columbia. Such a rain occurs between late spring and early fall in about 3 or 4 years out of 10. Slippage can also occur during the winter, even though precipitation is much less, because low evaporation will permit the accumulation of moisture in the soils.

Transportation

Several major local, state, and federal highways serve the District of Columbia. Among these are the Baltimore-Washington Parkway, the George Washington Memorial Parkway, and Suitland Parkway; U. S. Routes 1, 29, 50, and 301; and Interstates 66, 95, 295, and 495.

Nine railroads serve the District of Columbia (*24*). The District's great rail terminus, Union Station, completed in 1907, provides the incoming traveler with a dramatic first view of the Capitol. The main railroad freight terminals for the Washington area are at Alexandria, Virginia. In 1965 a rapid transit system was approved for the District of Columbia that would link the main railway terminal to principal employment centers in the metropolitan area. The first phase of this system is due to start operations in 1976.

The District of Columbia is provided with excellent air terminals. National Airport, one of the busiest airports in the United States, is on the Virginia side of the Potomac River across from downtown Washington. Dulles International Airport is at Chantilly, Virginia, about 26 miles west of the District of Columbia. Baltimore-Washington International Airport, near Baltimore, Maryland, is about 32 miles northeast of the District. Andrews Air Force

Base, in Maryland, about 5 miles east of the District, is a major base for military and official government aircraft.

Water supply

A large portion of the discussion of water supply is based on unpublished data from the D. C. Department of Environmental Services, Bureau of Water and Sewer Services.

Water for the District of Columbia comes from the Potomac River. Since 1867 the U.S. Army Corps of Engineers has had the responsibility for supplying water to the District. The agency of the Corps that supplies the water is known as the Washington Aqueduct. The supply system consists of the necessary facilities to collect the water from the Potomac River at its Great Falls and Little Falls intakes above Washington, to convey it to the city, and to filter, chlorinate, fluoridate, and pump a portion of it into the distribution system. This system includes dams, conduits, reservoirs, filtration plants, pumping stations, and transmission mains.

The water is filtered at two plants. The McMillan plant, completed in 1905, is one of the few large slow-filtration plants still in use. It has a capacity of 125 million gallons per day. The Dalecarlia, a rapid sand-filtration plant that has a rated capacity of 164 million gallons per day, was completed in 1928.

Water is supplied not only to the District of Columbia but also to areas in Virginia such as Arlington County, the City of Falls Church, and parts of Fairfax County, including Dulles International Airport. The Washington Suburban Sanitary Commission in Maryland has a number of connections for emergency use. In 1970 the average daily water consumption in the Washington area was 193 gallons per capita. The distribution system includes eight covered reinforced-concrete reservoirs and four elevated steel tanks. The District of Columbia is divided into five pressure areas west of the Anacostia River, which serve elevations from sea level to approximately 400 feet, and three pressure areas east of the Anacostia River, which serve elevations from sea level to 300 feet.

Within the District of Columbia there are several very high yielding private wells in Coastal Plain formations, which supply water for a variety of commercial establishments. In the part of the Piedmont west of Rock Creek, there are a few low-yielding wells that are used for irrigation.

Original vegetation

The dominant native vegetation on most of the well drained and somewhat excessively drained loamy soils of the Piedmont was a deciduous forest (*29*, *38*). The major species were chestnut, black oak, white oak, chestnut oak, scarlet oak, mockernut hickory, and pignut hickory. On the moderately well drained or somewhat poorly drained soils on flats, in depressions, at the foot of hills, and around the heads of drainageways, the dominant vegetation was beech, red maple, bitternut hickory, yellow-poplar, black walnut, and blackgum. Small pure stands of Virginia pine were not uncommon in the nearly level to gently sloping areas of the Piedmont. These areas represented the earliest stage in the reforestation of areas formerly occupied by deciduous forest. The understory on the Piedmont consisted of dogwoods and such evergreens as holly, laurel, and rhododendron. On the flood plains the dominant species were swamp oak, river birch, white ash, white willow, and hornbeam. Many of the species native to the area still grow in Rock Creek Park.

The native vegetation of most of the Coastal Plain in the District was stands of hardwoods that had softwoods scattered throughout. In many areas of the well drained upland soils that are underlain by Cretaceous clay, chestnut oak, white oak, black oak, blackjack oak, sassafras, and Virginia pine were dominant (*29*). In upland depressions and other areas where the soils are not well drained, the dominant species were sweetgum, ash, elm, birch, sycamore, blackgum, hickory, and willow oak. On sandy and loamy upland soils, the major species were white oak, pin oak, black oak, red oak, chestnut, and hickory. In depressional areas where the soils are not well drained, yellow-poplar and beech were common; and in the sandy, nearly level, moist areas, sweetgum and loblolly pine were dominant. On the droughty gravelly soils of the Coastal Plain, the dominant vegetation was Virginia pine, blackjack oak, post oak, black locust, and red cedar. The plants that made up much of the understory on the Coastal Plain were holly, dogwood, laurel, redcedar, persimmon, sassafras, and sumac. The dominant species on the flood plains were birch, elm, alder, willow, swamp maple, sycamore, and beech.

Many years ago much of the upper part of the Anacostia River estuary was an extensive marsh of Indian rice (*19*). Other marshes along the Anacostia River and on Goose and Roosevelt Islands supported pondweeds, cattails, various grasses, sedges, herbs, and other marsh and aquatic plants (*19*, *30*).

Since the creation of the District of Columbia in 1790, most of the native vegetation has been destroyed during urbanization and other activities of man. The relatively undisturbed park areas, such as Rock Creek, Fort Dupont, and Glover-Archbold, are the few areas where a number of species that were a part of the native vegetation still grow. Many parks and other areas of the District of Columbia contain trees and shrubs that were brought in from other parts of this country and from other countries (*10*).

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil and soillike material are in the survey area, where they are located, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and

perhaps identify some they had never seen before. They knew they would locate manmade soils that traditionally had not been recognized in soil surveys. They observed the steepness, length, and shape of slopes, the size of streams and the general pattern of drainage, the kinds of native plants, the percentage of soils that are disturbed or covered with impervious surfaces, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

Because the survey area is highly urbanized, the soil scientists were limited as to the location and number of holes they could dig. To aid them in identifying and classifying the soils, they examined holes and trenches dug by utility companies and commercial contractors, open graves, and open excavations at construction sites. They also made inferences and interpolations from logs of foundation borings, test holes for the subway, and various other test and drill holes.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in nearby counties of Maryland and Virginia and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey. In this soil survey most of the manmade soils are classified at higher categories than the soil series and soil phase.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Soil series commonly are named for towns or other geographic features near the place where they were first observed and mapped. Manor and Sassafras, for example, are the names of two soil series. All of the soils in the United States having the same series name are essentially alike.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Manor loam, 8 to 15 percent slopes, is one of several phases within the Manor series.

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

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

Some mapping units are made up of soils of different series or of different phases within one series, and some have little or no soil. These kinds of mapping units are discussed in the section "Soil Maps for Detailed Planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. Existing ratings of suitabilities and limitations (interpretations) of the soils are field-tested and modified as necessary during the course of the survey, and new interpretations are added to meet local needs. This is done mainly through field observations of behavior of different kinds of soil for different uses. Also, data are assembled from other sources, such as test results, records, field experience, and other information available from state, federal, and local specialists.

Only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so it will be readily useful to different groups of users, among them landscape architects, gardeners, science teachers, engineers, planners, developers and builders, homebuyers, and those seeking recreation. Presenting the detailed information in an organized, understandable manner is the purpose of this publication.

Soil Map for General Planning

The general soil map at the back of this publication shows, in color, the soil associations described in the survey area. Each soil association is a unique natural landscape unit that has a distinctive pattern of soils and relief and drainage features. It normally consists of one or more soils or miscellaneous areas of major extent and some soils or miscellaneous areas of minor extent, and it is named for the major soils. The kinds of soils or miscellaneous areas in one association may occur in another association, but in a different pattern.

The map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas of the District of Columbia for general kinds of land use. From the map, areas that are generally suitable for certain kinds of land uses can be identified. Likewise, areas with soil properties distinctly unfavorable for certain land uses can be located.

Because of the somewhat small scale of the map, it does not show the kind of soil at a specific site. Thus, this is not a suitable map for planning the management of a park or for selecting the exact location of a road, building,

or similar structure, because the kinds of soil in any one soil association ordinarily differ from place to place in slope, degree of disturbance, depth, stoniness, drainage, or other characteristics that affect the potential use and management.

The soil associations in the survey area vary widely in their potential for major land uses, as indicated in the table on the general soil map. General ratings of the potential of each soil association, in relation to the other soil associations, are given for each major land use. Adverse soil properties that pose limitations to the use are indicated. The ratings of soil potential assume that practices in common use in the District of Columbia are used to overcome soil limitations. These ratings reflect the relative ease of overcoming such soil limitations and the probability of soil related problems persisting after such practices are adopted. The ratings do not consider location in relation to existing transportation systems or other kinds of facilities.

Major land uses considered are for landscaping, vegetable gardens, urban uses, intensive recreation areas, and extensive recreation areas. Landscaping includes those grasses, shrubs, trees, and other similar plants used extensively in the survey area. Vegetable gardens include the common and most extensively grown vegetables in the survey area. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ball diamonds, and similar areas that are subject to heavy foot traffic. Extensive recreation areas include those for native study and wilderness use.

The general soil map at the back of this survey does not join, in all instances, with the general soil maps of adjacent counties. Differences in the maps have resulted from the differences in the occurrence of soil patterns, the larger publication scale of this map, which allows for more detail, and the recent advances in classification. Following are discussions of each of the 11 soil associations in the District of Columbia.

Descriptions and Potentials of Soil Associations

1. Urban land-Beltsville-Chillum association

Urban land and deep, nearly level to steep, well drained and moderately well drained soils that are underlain by sandy or gravelly deposits; on uplands that have broad ridgetops

This association consists of areas of Urban land and nearly level to steep soils in the Coastal Plain part of the District of Columbia (fig. 6). The largest of these areas is east of the Anacostia River.

This association makes up about 9 percent of the total land area of the District of Columbia. It is about 45 percent Urban land, about 20 percent Beltsville soils, about 20 percent Chillum soils, and about 15 percent soils of minor extent.

Urban land consists of areas that are occupied by structures and works. Most soil materials around building foundations and most fill materials used to support structures consist mainly of Beltsville or Chillum soils that have been cut or graded. Urban land generally occupies the gentler slopes.

Beltsville soils are moderately well drained and have a fragipan. They are loamy, and they overlie older, commonly gravelly sediment at a depth of 40 to 60 inches. These soils have a seasonally perched water table. They are mainly at the higher elevations on a smooth to undulating landscape.

Chillum soils are well drained. They are loamy in the upper part, and they overlie compacted gravel and sand at a depth of about 20 to 30 inches. The Chillum soils are generally in the more rolling and hilly parts of the landscape.

Minor in this association are the well drained Croom, Sassafras, and Matapeake soils and Udorthents and the moderately well drained Bourne and Iuka soils. The Croom, Sassafras, Matapeake, and Bourne soils are on uplands. Udorthents are areas of cut, filled, or otherwise disturbed land. Iuka soils are on flood plains. The minor soils are scattered throughout this soil association.

About half of this association is occupied by structures and works. Areas that have not been urbanized include parks, playgrounds, vacant lots, isolated wooded tracts, and yards and open space around and between buildings.

Seasonal wetness is a limitation for most land uses in the areas of nearly level to gently sloping Beltsville soils. Overall, this soil association has good potential for landscaping. It has only fair potential for vegetable gardens and intensive recreation because of seasonal wetness and urbanization. It has only fair potential for urban uses because of seasonal wetness. It has poor potential for extensive recreation areas because of limited space.

2. Urban land-Galestown-Rumford association

Urban land and deep, nearly level to moderately sloping, somewhat excessively drained soils that are mostly sand throughout; on terraces

This association consists of areas of Urban land and nearly level to moderately sloping soils in the Coastal Plain part of the District of Columbia. There are only two areas of this association in the survey area. These areas are narrow and elongated, and they occur on a sandy terrace that runs along the east side of the Anacostia River and separates the Anacostia River flood plains from the uplands to the east.

This association occupies about 3 percent of the total land area of the District of Columbia. About 45 percent of the association is Urban land, 30 percent is Galestown soils, 15 percent is Rumford soils, and the remaining 10 percent is soils of minor extent.

Urban land consists of areas that are occupied by structures and works. Most soil materials around building foundations and most fill materials used to support struc-

tures consist mainly of Galestown or Rumford soils that have been cut or graded. Urban land generally occupies the gentler slopes.

Galestown and Rumford soils are deep, are somewhat excessively drained, and have a sandy surface layer. Galestown soils are somewhat more sandy throughout than Rumford soils.

Minor in this association are the well drained Sassafras soils, the moderately well drained Woodstown soils, and the poorly drained Fallsington soils.

About half of this association is occupied by structures and works. Areas that have not been urbanized include playgrounds, small parks, vacant lots, small isolated tracts of land, and yards and open space around and between buildings.

This association has only fair potential for landscaping because of droughtiness. It has good potential for vegetable gardens and urban uses. It has only fair potential for intensive recreation areas and poor potential for extensive recreation areas because of limited space.

3. Urban land-Christiana-Sunnyside association

Urban land and deep, nearly level to steep, well drained soils that are underlain by unstable clayey sediment; on uplands

This association is in the Coastal Plain part of the District of Columbia. The soils of this association are nearly level to steep, and most areas are in the eastern part of the survey area (fig. 7).

This association makes up about 17 percent of the total land area of the District of Columbia. It is about 45 percent Urban land, about 25 percent Christiana soils, about 10 percent Sunnyside soils, and about 20 percent soils of minor extent.

Urban land consists of areas that are occupied by structures and works. Most soil materials around building foundations and most fill materials used to support structures consist mainly of Christiana and Sunnyside soils that have been cut or graded. Urban land generally occupies the gentler slopes.

Christiana soils have a thin silty mantle about 10 inches thick, which rests abruptly on very unstable clayey sediment. They are especially unstable after they have been disturbed or graded. These soils are on a rolling and hilly landscape.

Sunnyside soils are loamy or sandy throughout, and they overlie unstable clayey sediment at a depth of about 60 inches or more. These soils are on a dissected, rolling and hilly landscape.

Minor in this association are the well drained Udorthents and Muirkirk Variant complex and the moderately well drained Iuka and Keyport soils. Muirkirk Variant complex and Keyport soils are on uplands. Udorthents are areas of fill or cut and fill land. Iuka soils are on flood plains. These minor soils are scattered throughout this soil association.

About half of this association is occupied by structures and works. Areas that have not been urbanized include parks, playgrounds and vacant lots, isolated wooded tracts, and yards and open space around and between buildings.

Poor stability is a severe limitation for most urban uses in this association. Overall, this association has only fair potential for landscaping and vegetable gardens because of slope and clayey material exposed during urbanization. It has only fair potential for intensive recreation areas and poor potential for extensive recreation areas because of limited space.

4. Urban land-Sassafras-Chillum association

Urban land and deep, nearly level to steep, well drained soils that are underlain by sandy and gravelly sediment; on uplands

This association consists of Urban land and nearly level to steep soils that are scattered throughout the Coastal Plain part of the District of Columbia. The largest areas of this association are in the central and eastern parts of the District of Columbia.

This association makes up about 22 percent of the total land area of the District of Columbia. It is about 45 percent Urban land, about 30 percent Sassafras soils, about 15 percent Chillum soils, and about 10 percent soils of minor extent.

Urban land consists of areas that are occupied by structures and works. Most soil materials around building foundations and most fill materials used to support structures consist mainly of Sassafras or Chillum soils that have been cut or graded. Urban land generally is in the less sloping areas.

Sassafras soils are deep and loamy, and they are underlain by sandy material at a depth of about 25 to 45 inches. They are dominantly undulating to rolling.

Chillum soils are deep and loamy in the upper part. They overlie compacted gravel and sand at a depth of about 20 to 30 inches. They are generally on the more rolling and hilly parts of the landscape.

Minor in this association are the well drained Manor, Croom, Joppa, and Neshaminy soils and Udorthents and the moderately well drained Bourne, Beltsville, and Woodstown soils. The Manor, Croom, Joppa, Neshaminy, Bourne, Beltsville, and Woodstown soils are on uplands. Udorthents are areas of cut, filled, or otherwise disturbed land. Iuka soils are on flood plains. These minor soils are scattered throughout this association.

About half of this association is occupied by structures and works. Areas that have not been urbanized include parks, playgrounds, vacant lots, isolated tracts of wooded land, and yards and open space around and between buildings.

This association has good to fair potential for landscaping and vegetable gardens because of slope and urbanization. It has good to fair potential for urban uses because of slope. It has fair potential for intensive recreation

areas and poor potential for extensive recreation areas because of limited space.

5. Manor-Glenelg association

Deep, steep to nearly level, well drained and somewhat excessively drained soils that are underlain by acid crystalline rocks; on uplands that have broad ridgetops

This association consists of nearly level to steep soils in the Piedmont part of the District of Columbia (fig. 8). Almost all areas are wooded and are in the Rock Creek Park area.

This association makes up about 4 percent of the total land area of the District of Columbia. It is about 65 percent Manor soils, about 20 percent Glenelg soils, and about 15 percent soils of minor extent.

Manor soils are deep and are well drained to somewhat excessively drained, and they overlie micaceous saprolite at a depth of about 15 to 24 inches. These soils are generally on the rolling to steep parts of the landscape.

The well drained Glenelg soils are deep, and they overlie micaceous saprolite at a depth of about 20 to 30 inches. These soils are generally in smooth, undulating areas.

Minor in this association are Urban land; the well drained Udorthents and Sassafras and Joppa soils; and the moderately well drained Glenelg Variant and Codorus soils. Urban land consists of areas that are occupied by structures and works. Udorthents are areas of cut, filled, or otherwise disturbed land. Sassafras, Joppa, and Glenelg Variant soils are on uplands. Codorus soils are on flood plains. These minor soils are scattered throughout this association.

This association has only fair potential for landscaping, vegetable gardens, and urban uses because of slope. It has good potential for intensive and extensive recreation areas.

6. Urban land-Manor-Glenelg association

Urban land and deep, steep to gently sloping, somewhat excessively drained and well drained soils that are underlain by acid crystalline rocks; on uplands

This association consists of areas of Urban land and steep to nearly level soils that are scattered throughout the Piedmont part of the District of Columbia.

This association makes up about 10 percent of the total land area of the District of Columbia. It is about 45 percent Urban land, about 30 percent Manor soils, about 15 percent Glenelg soils, and about 10 percent soils of minor extent.

Urban land consists of areas that are occupied by structures and works. Most soil materials around building foundations and most fill materials used to support structures consist of mainly Manor or Glenelg soils that have been cut or graded. Urban land generally occupies the gentler slopes.

Manor soils are deep and well drained to somewhat excessively drained, and they overlie micaceous saprolite at a depth of about 15 to 24 inches. These soils are generally on the rolling to steep parts of the landscape.

The Glenelg soils are deep and well drained, and they overlie micaceous saprolite at a depth of about 20 to 30 inches. These soils are generally on the smooth undulating parts of the landscape.

Minor in this association are the well drained Udorthents and Neshaminy soils and the moderately well drained Glenelg Variant and Codorus soils. Udorthents are areas of cut, filled, or otherwise disturbed soils. Neshaminy and Glenelg Variant soils are on uplands. Codorus soils are on flood plains.

About half of this association is occupied by structures and works. Areas that have not been urbanized include parks, playgrounds, vacant lots, isolated tracts of wooded land, and yards and open space around and between buildings.

This association has only fair potential for landscaping and vegetable gardens because of slope and urbanization. It has only fair potential for urban uses because of slope. It has only fair potential for intensive recreation areas and poor potential for extensive recreation areas because of limited space.

7. Urban land-Brandywine association

Urban land and deep, steep to moderately sloping, somewhat excessively drained and excessively drained soils that are underlain by acid crystaline rocks; on uplands

This association consists of areas of Urban land and steep to moderately sloping soils in the Piedmont part of the District of Columbia. The largest area is a long narrow belt that runs along the west side of Rock Creek Park.

This association makes up about 4 percent of the total land area of the District of Columbia. It is about 40 percent Urban land, about 40 percent Brandywine soils, and about 20 percent soils of minor extent.

Urban land consists of areas that are occupied by structures and works. Most soil materials around building foundations and most fill materials used to support structures consist mainly of Brandywine soils that have been cut or graded. Urban land is commonly in the less sloping areas.

Brandywine soils are deep, somewhat excessively drained and excessively drained, and gravelly, and they overlie acid sandy saprolite at a depth of about 15 to 25 inches. These soils are generally in the rolling to steep parts of the landscape.

Minor in this association are the somewhat excessively drained Ashe soils, the well drained to somewhat excessively drained Manor soils, the well drained Glenelg soils and Udorthents, and the moderately well drained Glenelg Variant and Codorus soils. The Ashe, Manor, Glenelg, and Glenelg Variant soils are on uplands. Udorthents are areas of cut, filled, or otherwise disturbed soils. Codorus soils are on flood plains. These minor soils are scattered throughout this association.

About 40 percent of this association is occupied by structures and works. Areas that have not been urbanized include parks, playgrounds, vacant lots, isolated tracts of wooded land, and yards and open space around and between buildings.

This association has only fair potential for landscaping and vegetable gardens because of slope, a gravelly surface layer, and urbanization. It has only fair potential for urban uses because of slope and the gravelly surface layer. It has only fair potential for intensive recreation areas and poor potential for extensive recreation areas because of limited space.

8. Neshaminy-Urban land association

Deep, steep to moderately sloping, well drained soils, which are underlain by semibasic or mixed basic and acidic rocks, and Urban land; on uplands

This association consists of areas of steep to moderately sloping soils and Urban land in the Piedmont part of the District of Columbia. Most areas are small and are near Georgetown.

This association makes up only about 1 percent of the total land area of the District of Columbia. It is about 50 percent Neshaminy soils, about 35 percent Urban land, and about 15 percent soils of minor extent.

Neshaminy soils are deep, well drained, loamy soils that overlie semibasic or mixed basic and acidic rock at a depth of about 4 to 10 feet. They are moderately sloping to steep and generally are on the highest parts of the landscape.

Urban land consists of areas that are occupied by structures and works. Most soil materials around building foundations and most fill materials used to support structures consist mainly of Neshaminy soils that have been cut or graded. Urban land is commonly on the less sloping parts of the landscape.

Minor in this association are the somewhat excessively drained to excessively drained Brandywine soils, the well drained to somewhat excessively drained Manor soils, the well drained Chillum and Sassafras soils and Udorthents, and the moderately well drained Codorus soils. The Brandywine, Manor, Chillum, and Sassafras soils are on uplands. Udorthents are areas of cut, filled, or otherwise disturbed soils. Codorus soils are on flood plains.

Areas in this soil association that have not been urbanized include parks, playgrounds, vacant lots, isolated tracts of wooded land, and yards and open space around and between buildings.

This association has fair potential for landscaping and vegetable gardens because of slope and urbanization. It has only fair potential for urban uses because of slope. In eroded areas and areas that have been disturbed, the surface layer tends to be sticky. This association has only fair potential for intensive and extensive recreation uses because of limited space.

9. Iuka-Lindside-Codorus association

Deep, nearly level, moderately well drained soils that are underlain by stratified alluvial sediment or man-deposited dredged material; on flood plains

This association consists of nearly level soils on flood plains along the Potomac and Anacostia Rivers and other major streams and tributaries in the District of Columbia. Some of these areas are manmade islands. This association is in both the Coastal Plain and Piedmont parts of the District of Columbia.

This association makes up about 5 percent of the total land area of the District of Columbia. It is about 20 percent Iuka soils, about 11 percent Lindside soils, about 11 percent Codorus soils, and about 58 percent soils of minor extent.

Iuka and Codorus soils are deep, loamy, and moderately well drained, and they overlie stratified alluvial sediment. Iuka soils are on flood plains in the Coastal Plain area, and Codorus soils are on flood plains in the Piedmont area. These soils are subject to frequent flooding.

Lindside soils are deep, loamy, and moderately well drained, and they overlie man-deposited, dredged material. These soils are on flood plains along the Potomac River and on manmade islands in the Potomac River. Most areas of these soils are subject to flooding. A few areas on manmade islands are rarely, if ever, flooded.

Minor in this soil association are the Bibb, Melvin, and Dunning soils; and Fluvaquents, Udifluvents, and Udorthents. All are on flood plains, and all are subject to flooding except Udorthents. Udorthents are generally on higher elevations and are normally not subject to flooding. These minor soils are scattered throughout this association.

This association has poor potential for landscaping, vegetable gardens, and urban uses because of flooding. It has only fair potential for intensive recreation because of flooding. It has good potential for extensive recreation.

10. Udorthents association

Deep to moderately deep, nearly level to steep, well drained soils that consist of cuts, fills, or otherwise disturbed land; on all landscape positions

This association consists of areas of nearly level to steep soils that are scattered throughout the District of Columbia. The largest areas are in the Mall area and along the Anacostia River.

This association makes up about 10 percent of the total land area of the District of Columbia. It is about 90 percent Udorthents and about 10 percent soils and miscellaneous areas of minor extent.

Udorthents consist of nearly level to steep soils that have been created or strongly influenced by man. These soils consist of cut, filled, or otherwise disturbed areas. The cut areas are generally the steepest parts of the landscape, and the fill areas generally have smoother, less sloping topography. Some of the fill areas are hummocky.

The texture of these soils is quite variable, but it generally reflects the texture of the soils mapped in adjacent areas. Some of these soils contain artifacts; some were once used as sanitary landfills and are underlain by refuse. The largest areas of soils used as sanitary landfills are at the Kenilworth and Oxon Cove landfills.

Minor in this association are Urban land and areas of soils that were not appreciably disturbed during cutting and filling. These minor soils are scattered throughout this soil association.

This association has only fair potential for landscaping and vegetable gardens because of slope, droughtiness, and compaction. It has poor potential for urban use because of stability and subsidence. The fill areas that are sanitary landfills contain high levels of natural gas, which is considered a hazard for most urban uses. This association has poor to good potential for intensive recreation areas. It has poor potential for extensive recreation areas because of a lack of wildlife and woody plants.

11. Urban land association

Nearly level to moderately sloping areas, most of which are built up and occupied by structures and works; on all landscape positions

This association consists of nearly level to moderately sloping areas that are occupied by structures and works. This association occurs throughout the survey area but the largest areas are near the downtown business district and in corridors along main roads and streets.

This association makes up about 15 percent of the total land area of the District of Columbia. It is about 95 percent Urban land and about 5 percent soils of minor extent.

Urban land consists of nearly level to moderately sloping areas that are more than 80 percent covered by asphalt, concrete, buildings, or other impervious surfaces. Examples are parking lots, shopping and business centers, and industrial parks.

Minor in this association are Udorthents, which consist of areas of cut, filled, or otherwise disturbed soils scattered throughout this association.

Because of the high percentage of urbanization, this association is too variable to rate for vegetable gardens, recreation, and urban uses. Onsite investigation is needed to determine the potentials for these uses.

Soil Maps for Detailed Planning

The kinds of soil (mapping units) shown on the detailed soil maps at the back of this publication are described in this section. These descriptions, together with the soil maps, can be useful in determining the potential of soil, in planning land use and developing soil resources, and in enhancing, protecting, and preserving the environment. More detailed information for each soil is given in the section "Planning the Use and Management of Soils."

Preceding the name of each mapping unit is the symbol that identifies the unit on the detailed soil map. Each mapping unit description includes general facts about the soil and a brief description of the soil profile. The potential of the soil for various major land uses is estimated. The principal hazards and limitations are indicated, and the management concerns and practices for the major uses are discussed.

A mapping unit represents an area on the landscape and consists of a dominant soil or soils for which the unit is named. Most mapping units have one dominant soil, but some have two or more dominant soils. A mapping unit commonly includes small, scattered areas of other soils. The properties of some included soils can differ substantially from those of the dominant soil or soils and thus greatly influence the use of the dominant soil. How the included soils may affect the use and management of the mapping unit is discussed.

In most areas surveyed there is land that has little or no identifiable soil and supports no vegetation. This land, called miscellaneous areas, is delineated on the map and given descriptive names. Urban land is an example. Areas too small to be delineated are identified by special symbols on the soil maps.

The acreage and proportionate extent of each mapping unit are given in table 4, and additional information on each unit is given in interpretive tables in other sections (see "Summary of Tables"). Many of the terms used in describing soils are defined in the Glossary.

Soil Descriptions and Potentials

AsC—Ashe loam, 8 to 15 percent slopes. This moderately sloping, somewhat excessively drained soil is on ridgetops and side slopes in strongly dissected areas of the Piedmont Plateau. Slopes are dominantly smooth and convex. Most areas are irregular in shape and range from about 1 to 10 acres in size.

A representative profile has a surface layer of dark yellowish brown loam about 6 inches thick. The upper part of the subsoil is yellowish brown sandy loam about 3 inches thick, and the lower part is strong brown and brown loam about 14 inches thick. The upper part of the substratum, between depths of 23 and 36 inches, is variegated sandy loam; the lower part, between depths of 36 and 60 inches, is variegated saprolite that crushes to loamy sand.

Included with this soil in mapping are areas of Brandywine channery loam, Manor channery loam, Manor loam, and Glenelg silt loam. Also included are a few areas of soils that have slopes of less than 8 percent. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderately rapid. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is low. In unlimed areas this soil is generally strongly acid or very strongly acid throughout the profile. Internal drainage is good.

This soil is generally well suited to foundations and footings. In making shallow excavations for basements or other purposes, bedrock is encountered in places, but the rock is mostly highly weathered and is not difficult to remove. This soil is only moderately suited to most building purposes because of slope. Because of slope and low available water capacity, it has only fair potential for grasses, shade trees, ornamental trees, shrubs, vines, and vegetables. It has fair potential for most recreational uses.

AsD—Ashe loam, 15 to 40 percent slopes. This strongly sloping to steep, somewhat excessively drained soil is in strongly dissected areas along streams and drainageways on the Piedmont Plateau. Slopes are complex, and areas range from about 1 to 50 acres in size.

A representative profile has a surface layer of dark yellowish brown loam about 6 inches thick. The upper part of the subsoil is yellowish brown sandy loam about 3 inches thick, and the lower part is strong brown and brown loam about 14 inches thick. The upper part of the substratum, between depths of 23 and 36 inches, is variegated sandy loam; and the lower part, between depths of 36 and 60 inches, is variegated saprolite that crushes to loamy sand.

Included with this soil in mapping are areas of Brandywine channery loam, Manor channery loam, Manor loam, and Glenelg silt loam. Also included are areas of soils that have slopes of more than 40 percent. Included areas make up about 15 percent of the mapped acreage.

Runoff is rapid, and the hazard of erosion is moderate to severe. Permeability is moderately rapid. The available water capacity is low. This soil is generally strongly acid or very strongly acid throughout the profile if not limed. Internal drainage is good.

This soil is poorly suited to building sites because of slopes. Also, in making shallow excavations for basements or other purposes, moderately hard bedrock is encountered in places. Because of slope and low available water capacity, this soil has poor potential for lawn grasses, landscaping plants, and vegetables. This soil has poor potential for most recreational uses. It provides excellent habitat for certain species of wildlife.

BdB—Beltsville silt loam, 0 to 8 percent slopes. This nearly level to gently sloping, moderately well drained soil is in irregularly shaped upland areas of the Coastal Plain. This soil is generally on the highest and most stable part of the landscape. Areas range from about 2 to 10 acres in size.

A representative profile has a surface layer of dark brown silt loam about 3 inches thick over a subsurface layer of pale brown silt loam about 8 inches thick. The subsoil, about 34 inches thick, is yellowish brown silt loam in the upper part and light olive brown loam in the lower part. The lower 24 inches of this horizon is a very dense fragipan. The substratum, between depths of 45 and 60 inches, is variegated gravelly fine sandy loam.

Included with this soil in mapping are areas of Bourne fine sandy loam, Chillum silt loam, Matapeake silt loam, and Sassafras sandy loam. Also included are areas of soils that have slopes of more than 8 percent and a few areas where the surface layer is loam. Included areas make up about 15 percent of the mapped acreage.

This soil has slow permeability and a seasonally perched water table above the fragipan. Runoff is slow to medium, and the hazard of erosion is moderate. This soil has moderate available water capacity. If not limed, this soil is very strongly acid.

This soil becomes saturated quickly when it rains or when snow melts, and it normally remains wet for fairly long periods of time. The nearly level areas of this soil have a tendency to pond after heavy rainfall (fig. 9). Because of the problems caused by wetness, ponding, and a seasonally perched water table, this soil has only fair potential for building sites. It has good potential for lawns and landscaping plants. It has fair potential for vegetable gardens and most recreational uses.

BeB—Beltsville-Urban land complex, 0 to 8 percent slopes. This complex is made up of nearly level to gently sloping, moderately well drained soils of the Beltsville series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on high elevations of the Coastal Plain. Areas generally range from about 2 to 250 acres in size. Slopes are long and smooth. The Beltsville soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Beltsville soils. In these areas, a representative profile has a surface layer of dark brown silt loam about 3 inches thick and a subsurface layer of pale brown silt loam about 8 inches thick. The subsoil, about 34 inches thick, is yellowish brown silt loam in the upper part and light olive brown loam in the lower part. The lower 24 inches of this horizon is a very dense fragipan. The substratum, between depths of 45 and 60 inches, is variegated gravelly fine sandy loam. About 20 percent of the complex is areas of disturbed Beltsville soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by fill material to a depth of more than 20 inches; and where most of the profile or all of it has been cut away. The fill material is most commonly from adjacent areas of Beltsville soils that have been cut or graded.

Included with this complex in mapping are areas of Bourne fine sandy loam, Chillum silt loam, Matapeake silt loam, Sassafras sandy loam, and Sassafras-Urban land complex. Also included are a few areas where the slope of this complex is greater than 8 percent. Included areas make up about 20 percent of this complex.

Permeability and internal drainage are generally slow throughout this complex. Runoff is medium to rapid, and

the hazard of erosion is moderate to severe. The available water capacity is moderate in the relatively undisturbed areas, and it generally is low to very low in areas that have been highly urbanized. Most unlimed areas are very strongly acid.

The areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. Seasonal wetness moderately limits the suitability of this complex for building sites. Filled areas are less stable for foundations than the less disturbed areas. The soils and fill material, especially the cut or graded areas, have fair potential for lawn grasses, shrubs, vegetable gardens, trees, and other plants. Areas that are deeply cut or excavated are generally droughty. Because of seasonal wetness and limited open space, this complex has fair to poor potential for most recreational uses. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

Bg—Bibb sandy loam. This nearly level, poorly drained soil is on flood plains of the Coastal Plain. Areas are long and narrow and follow major streams. These areas range from 1 acre to 25 acres in size.

A representative profile has a surface layer of very dark brown sandy loam about 8 inches thick over grayish brown sandy loam about 6 inches thick. The substratum, between depths of 14 and 60 inches, is gray or light gray sandy loam in the upper part and loamy sand in the lower part.

Included with this soil in mapping are areas of Iuka sandy loam and Fluvaquents, ponded. Also included is about 82 acres of soils that have a surface layer of silt loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate, and runoff is very slow. The water table is within 8 inches of the surface during most of the year. The hazard of erosion is none to slight. In unlimed areas this soil is extremely acid or very strongly acid.

Because of a high water table during most of the year and a hazard of flooding, this soil has poor potential for use as building sites. It has poor potential for vegetable gardens, lawn grasses, shrubs, trees, and other plants because of wetness and flooding. It has poor potential for most recreational uses. This soil provides suitable habitat for some kinds of wildlife. It should be valuable for nature areas within a densely populated area such as this survey area.

BnB—Bourne fine sandy loam, 0 to 8 percent slopes. This nearly level to gently sloping, moderately well drained soil is on broad ridgetops at the higher elevations of the Coastal Plain. Areas are generally irregularly shaped and range from about 4 to 7 acres in size.

A representative profile has a surface layer of dark brown fine sandy loam about 5 inches thick. The upper part of the subsoil is brownish yellow fine sandy loam about 6 inches thick, the middle part is strong brown clay loam 7 inches thick, and the lower part, 23 inches thick, is a very dense fragipan that is strong brown sandy clay loam in the upper part and variegated fine sandy loam in the lower part. The substratum, between depths of 41 and 60 inches, is variegated fine sandy loam.

Included with this soil in mapping are areas of Sassafras fine sandy loam, Woodstown sandy loam, Beltsville silt loam, and Chillum silt loam. Also included are a few areas of soils that have a surface layer of loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is slow or very slow. Internal drainage is slow. Runoff is slow to medium. Seasonally, there is a perched water table on top of the fragipan, and ponding occurs after heavy rainfall. The available water capacity is low to moderate. In unlimed areas this soil is strongly acid or very strongly acid.

Because of seasonal wetness this soil has only fair potential for building sites. Shallow excavations for basements or other purposes tend to fill with water in winter and early in spring. This soil has good potential for lawn grasses, shade trees, ornamental trees, shrubs, and vines. It has only fair potential for vegetable gardens because of droughtiness and seasonal wetness. This soil has only fair potential for most recreational uses because of seasonal wetness and slow permeability.

BnC—Bourne fine sandy loam, 8 to 15 percent slopes. This moderately sloping, moderately well drained soil is on broad ridgetops at the higher elevations of the Coastal Plain. Areas are generally irregularly shaped and range from 2 to 20 acres in size.

A representative profile has a surface layer of dark brown fine sandy loam about 5 inches thick. The upper part of the subsoil is brownish yellow fine sandy loam about 6 inches thick, the middle part is strong brown clay loam, and the lower part is a very dense fragipan that is strong brown sandy clay loam in the upper layer and variegated fine sandy loam in the lower layer. The substratum, between depths of 41 and 60 inches, is variegated fine sandy loam.

Included with this soil in mapping are areas of Chillum silt loam, Sassafras fine sandy loam, and Woodstown sandy loam, and a few areas of Bourne soils that are severely eroded. Also included are a few areas of soils that have a silty profile. Included areas make up about 15 percent of the mapped acreage.

Permeability is slow or very slow. Internal drainage is slow. Runoff is medium. There is a seasonally perched water table on top of the fragipan. The available water capacity is low to moderate. In unlimed areas this soil is strongly acid or very strongly acid.

Because of seasonal wetness and slope, this soil has only fair potential for building sites. Shallow excavations for basements or other purposes tend to fill with water in winter and early in spring. Because of slope, droughtiness, and seasonal wetness, this soil has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetables. This soil has fair to poor potential for most recreational uses because of slope and seasonal wetness.

BpB—Bourne-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to moderately sloping, moderately well drained soils of the Bourne series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on the higher elevations of broad ridgetops that have been urbanized on the Coastal Plain. Areas are generally irregularly shaped and range from about 2 to 7 acres in size. The Bourne soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Bourne soils. In these areas, a representative profile has a surface layer of dark brown fine sandy loam about 5 inches thick. The upper part of the subsoil is brownish yellow fine sandy loam about 6 inches thick; the middle part is strong brown clay loam 7 inches thick; the lower part, 23 inches thick, is a very dense fragipan of strong brown sandy clay loam over variegated fine sandy loam. The substratum, between depths of 41 and 60 inches, is variegated fine sandy loam.

About 20 percent of this complex is areas of disturbed Bourne soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Bourne soils that have been cut or graded.

Included with this complex in mapping are areas of Sassafras fine sandy loam, Woodstown sandy loam, and Chillum silt loam. Also included are a few areas of soils that have slopes of as much as 15 percent. Included areas make up about 20 percent of this complex.

Permeability and internal drainage are generally slow or very slow throughout this complex. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. The available water capacity is low to moderate in the relatively undisturbed areas of this complex, and it is generally low to very low in the urbanized areas. Most unlimed areas are very strongly acid.

The areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. Seasonal wetness moderately limits the potential of this complex for building sites. Filled areas have less stable foundation conditions than the less disturbed areas. The soils and fill material have fair to good potential for lawn grasses, shrubs, trees, or other plants. This soil has only fair potential for vegetable gardens because of seasonal wetness. Areas that are deeply cut or excavated are generally very droughty. Because of seasonal wetness and the lack of open space, this complex has fair to poor potential for most recreational uses. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

BrC—Brandywine gravelly loam, 8 to 15 percent slopes. This moderately sloping, somewhat excessively drained to excessively drained soil is on ridgetops and side slopes in strongly dissected areas of the Piedmont Plateau. Slopes are dominantly convex and long. Most areas of this soil are wooded and range from about 2 to 10 acres in size.

A representative profile has a surface layer of dark grayish brown gravelly loam about 3 inches thick over a subsurface layer of yellowish brown gravelly loam about 7 inches thick. The subsoil, about 12 inches thick, is strong brown gravelly loam. The substratum, between depths of 22 and 60 inches, is variegated gravelly loamy sand.

Included with this soil in mapping are areas of Manor channery loam, Ashe loam, and Joppa gravelly sandy loam. Also included are a few areas of Brandywine gravelly loam that has slopes of less than 8 percent. The included areas make up about 15 percent of the mapped acreage.

Permeability is moderately rapid, and runoff is medium. The hazard of erosion is moderate on this soil. The available water capacity is low. In unlimed areas this soil is generally strongly acid throughout the profile. Internal drainage is good.

In making shallow excavations for basements or other purposes, bedrock or very gravelly material is encountered. In places the rock is rather hard and somewhat difficult to remove. Slope and stoniness moderately limit this soil for most building purposes. Because of slope, low available water capacity, and stoniness, this soil has fair potential for lawn grasses, shade trees, ornamental trees, shrubs, and vines. It has fair to poor potential for vegetable gardens because of slope, stoniness, and droughtiness. This soil has only fair potential for most recreational uses because of slope and stoniness.

BrD—Brandywine gravelly loam, 15 to 40 percent slopes. This strongly sloping to steep, somewhat excessively drained to excessively drained soil is on side slopes and bluffs above streams and ravines in strongly dissected areas of the Piedmont Plateau. Slopes are dominantly convex and long. Most areas of this soil are elongated and range from about 2 to 65 acres in size.

A representative profile has a surface layer of dark grayish brown gravelly loam about 3 inches thick and a subsurface layer of yellowish brown gravelly loam about 7 inches thick. The subsoil, about 12 inches thick, is strong brown gravelly loam. The substratum, between depths of 22 and 60 inches, is variegated gravelly loamy sand.

Included with this soil in mapping are areas of Manor channery loam, Ashe loam, and Joppa gravelly sandy loam. Also included are areas of rock outcrop and areas of soils that have slopes of more than 40 percent. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderately rapid, and runoff is rapid. The hazard of erosion is severe on this soil. The available water capacity is low. In unlimed areas this soil is

generally strongly acid throughout the profile. Internal drainage is good.

In making shallow excavations for basements or other purposes, bedrock or very gravelly material is encountered. In places the rock is rather hard and somewhat difficult to remove. Slope and stoniness severely limit this soil for most building purposes. Because of slope, low available water capacity, and stoniness, this soil has poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. This soil has fair to poor potential for most recreational uses because of slope and stoniness. It has good potential for use as habitat for some kinds of upland wildlife.

BtB—Brandywine-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping, somewhat excessively drained to excessively drained soils of the Brandywine series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and other similar uses. Areas range from about 2 to 20 acres in size. The Brandywine soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Brandywine soils. In these areas, a representative profile has a surface layer of dark grayish brown gravelly loam about 3 inches thick and a subsurface layer of yellowish brown gravelly loam about 7 inches thick. The subsoil, about 12 inches thick, is strong brown gravelly loam. The substratum, between depths of 22 and 60 inches, is variegated gravelly loamy sand.

About 20 percent of this complex is areas of Brandywine soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Brandywine soils that have been cut or graded.

Included with this complex in mapping are areas of Ashe loam, Manor channery loam, and Joppa gravelly sandy loam. The included areas make up about 20 percent of the complex.

Permeability is moderately rapid in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. The available water capacity is low. Most unlimed areas of the complex are strongly acid.

The areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. Areas that have not been urbanized have fair to good potential for building sites. In making shallow excavations for basements or other purposes, bedrock or gravelly material is encountered in places. In places the bedrock is rather hard and somewhat difficult to remove. The soils and fill material of this complex have good potential for lawn grasses, shade trees, ornamental trees, shrubs, and vines. This soil has only fair potential for vegetable gardens because of droughtiness. Areas that are very deeply cut or excavated are generally gravelly and droughty and, therefore, have poor potential for most types of vegetation. Because of stoniness and the lack of open space, this complex has fair to poor potential for most recreational uses. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed land use.

BtC—Brandywine-Urban land complex, 8 to 15 percent slopes. This complex consists of moderately sloping, somewhat excessively drained to excessively drained soils of the Brandywine series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and other similar uses. Areas range from about 3 to 200 acres in size. The Brandywine soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Brandywine soils. In these areas, a representative profile has a surface layer of dark grayish brown gravelly loam about 3 inches thick and a subsurface layer of yellowish brown gravelly loam about 7 inches thick. The subsoil, about 12 inches thick, is strong brown gravelly loam. The substratum, between depths of 22 and 60 inches, is variegated gravelly loamy sand.

About 20 percent of this complex is areas of disturbed Brandywine soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of this complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Brandywine soils that have been cut or graded.

Included with this complex in mapping are areas of Ashe loam, Manor channery loam, and Joppa gravelly sandy loam. Included areas make up about 20 percent of the complex.

Permeability is moderately rapid in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is moderate to severe. The available water capacity is low. Most unlimed areas of the complex are strongly acid.

The areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in

size. Areas that have not been urbanized have only fair potential for building sites because of slope. In making shallow excavations for basements or other purposes, bedrock or gravelly material is encountered in places. In places the bedrock is rather hard and somewhat difficult to remove. The soils and fill material of this complex have only fair to poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of slope and small stones. Areas that are very deeply cut or excavated are generally gravelly and droughty and, therefore, have poor potential for most types of vegetation. Because of slope, stoniness, and limited open space, this complex has fair to poor potential for most recreational uses. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed land use.

BtD—Brandywine-Urban land complex, 15 to 40 percent slopes. This complex consists of strongly sloping to steep, somewhat excessively drained to excessively drained soils of the Brandywine series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and other similar uses. Areas range from about 2 to 20 acres in size. The Brandywine soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Brandywine soils. In these areas, a representative profile has a surface layer of dark grayish brown gravelly loam about 3 inches thick and a subsurface layer of yellowish brown gravelly loam about 7 inches thick. The subsoil, about 12 inches thick, is strong brown gravelly loam. The substratum, between depths of 22 and 60 inches, is variegated gravelly loamy sand.

About 20 percent of this complex is areas of disturbed Brandywine soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Brandywine soils that have been cut or graded.

Included with this complex in mapping are areas of Ashe loam, Manor loam, and Joppa gravelly sandy loam. Also included are areas of soils that have slopes of more than 40 percent. Included areas make up about 20 percent of the complex.

Permeability is moderately rapid in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is very rapid, and the hazard of erosion is severe. The available water capacity is low. Most unlimed areas of the complex are strongly acid.

The areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. Areas that have not been urbanized have poor potential for building sites because of slope and stoniness. In making shallow excavations for basements or other purposes, bedrock or gravelly material is encountered in places. In places the bedrock is rather hard and somewhat difficult to remove. The soils and fill materials of this complex have poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of slope, stoniness, and droughtiness. Areas that are very deeply cut or excavated are generally gravelly and droughty and, therefore, have poor potential for most types of vegetation. Because of slope, stoniness, and limited open space, this complex has poor potential for most recreational uses. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed land use.

CcB—Chillum silt loam, 0 to 8 percent slopes. This nearly level to gently sloping, well drained soil is on well dissected uplands of the Coastal Plain. Slopes are dominantly smooth and gradual. Areas are generally irregularly shaped and range from about 2 to 15 acres in size.

A representative profile has a surface layer of very dark gray silt loam about 2 inches thick and a subsurface layer of pale brown silt loam about 10 inches thick. The subsoil, about 16 inches thick, is brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is strong brown very gravelly sandy loam (fig. 10).

Included with this soil in mapping are areas of Croom very gravelly sandy loam, Sassafras fine sandy loam, Beltsville silt loam, Matapeake silt loam, and Bourne fine sandy loam. Included areas make up about 15 percent of the total mapped acreage.

This soil has moderate permeability. The available water capacity is moderate to high. Runoff is slow to medium, and the hazard of erosion is moderate. Most unlimed areas are very strongly acid.

This soil has good potential for most building purposes. In making shallow excavations for basements or other purposes, compacted gravel is often encountered, but the gravel is not difficult to remove. This soil has good potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. It has good potential for most recreational uses.

CcC—Chillum silt loam, 8 to 15 percent slopes. This moderately sloping, well drained soil is on well dissected uplands of the Coastal Plain. Slopes are dominantly smooth and gradual. Areas are generally irregularly shaped and range from about 2 to 20 acres in size.

A representative profile has a surface layer of very dark gray silt loam about 2 inches thick and a subsurface layer of pale brown silt loam about 10 inches thick. The subsoil, about 16 inches thick, is brown heavy silt loam in

the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is strong brown very gravelly sandy loam.

Included with this soil in mapping are areas of Croom gravelly sandy loam, Sassafras fine sandy loam, Matapeake silt loam, and Bourne fine sandy loam. Included areas make up about 15 percent of the total mapped acreage.

This soil has moderate permeability. The available water capacity is moderate to high. Runoff is medium, and the hazard of erosion is moderate to severe. Most unlimed areas are very strongly acid.

This soil has only fair potential for most building purposes because of slope. In making shallow excavations for basements or other purposes, compacted gravel is commonly encountered, but the gravel is not difficult to remove. This soil has fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. It has fair potential for most recreational uses.

CcD—Chillum silt loam, 15 to 40 percent slopes. This strongly sloping to steep, well drained soil is on well dissected uplands of the Coastal Plain. Slopes are dominantly complex and concave. Areas are generally irregularly shaped and range from about 2 to 12 acres in size.

A representative profile has a surface layer of very dark gray silt loam about 2 inches thick and a subsurface layer of pale brown silt loam about 10 inches thick. The subsoil, about 16 inches thick, is brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is strong brown very gravelly sandy loam.

Included with this soil in mapping are areas of Croom very gravelly sandy loam and Sassafras fine sandy loam. Also included are areas of Chillum soils that have slopes of more than 40 percent. Included areas make up about 15 percent of the total mapped acreage.

This soil has moderate permeability. The available water capacity is moderate to high. Runoff is rapid, and the hazard of erosion is severe. Most unlimed areas are very strongly acid.

This soil has poor potential for most building purposes because of slope. In making shallow excavations for basements or other purposes, compacted gravel is often encountered, but the gravel is not difficult to remove. This soil has poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. It has poor potential for most recreational uses. It has good potential for use as parks and habitat for some kinds of upland wildlife.

CdB—Chillum-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping, well drained soils of the Chillum series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is in urbanized upland areas of the Coastal Plain. Areas range from about 3 to 50 acres in size. The Chillum soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Chillum soils. In these areas, a representative profile has a surface layer of very dark gray silt loam about 2 inches thick and a subsurface layer of pale brown silt loam about 10 inches thick. The subsoil, about 16 inches thick, is brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is strong brown very gravelly sandy loam.

About 20 percent of the complex is areas of disturbed Chillum soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Chillum soils that have been cut or graded.

Included with this complex in mapping are areas of Bourne fine sandy loam, Sassafras fine sandy loam, Beltsville silt loam, and Croom very gravelly sandy loam. Included areas are about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. The available water capacity is moderate in the relatively undisturbed areas of this complex, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

The areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. This complex has good potential for most building purposes. In making shallow excavations for basements or other purposes, compacted gravel is commonly encountered, but the gravel is not difficult to remove. The soils and fill material of this complex have good potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Areas that are very deeply cut or excavated are generally very gravelly and droughty and, therefore, have poor potential for vegetation. Most areas of this complex have only fair potential for most recreational uses because of limited open space.

CdC—Chillum-Urban land complex, 8 to 15 percent slopes. This complex consists of moderately sloping, well drained soils of the Chillum series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is on high elevations of urbanized areas of the Coastal Plain. Areas are generally irregularly shaped and

range from about 2 to 75 acres in size. The Chillum soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Chillum soils. In these areas, a representative profile has a surface layer of very dark gray silt loam about 2 inches thick and a subsurface layer of pale brown silt loam about 10 inches thick. The subsoil, about 16 inches thick, is brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is strong brown very gravelly sandy loam.

About 20 percent of this complex is areas of disturbed Chillum soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Chillum soils that have been cut or graded.

Included with this complex in mapping are areas of Bourne fine sandy loam, Sassafras fine sandy loam, and Croom very gravelly sandy loam. The total of these included areas is about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is moderate in the relatively undisturbed areas of this complex, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. This complex has only fair potential for most building purposes because of slope. In making shallow excavations for basements or other purposes, compacted gravel is commonly encountered, but the gravel is not difficult to remove. The soil material and fill material of this complex have only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of slope. Areas that are very deeply cut or excavated are generally very gravelly and droughty and, therefore, have poor potential for vegetation. Most areas of this complex have only fair to poor potential for most recreational uses because of slope and limited open space.

CdD—Chillum-Urban land complex, 15 to 40 percent slopes. This unit consists of strongly sloping to steep, well drained soils of the Chillum series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This unit is at high elevations of urbanized areas of the Coastal Plain. Areas generally range from about 2 to 20 acres in size. The Chillum soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Chillum soils. In these areas, a representative profile has a surface layer of very dark gray silt loam about 2 inches thick and a subsurface layer of pale brown silt loam about 10 inches thick. The subsoil, about 16 inches thick, is brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is strong brown very gravelly sandy loam.

About 20 percent of this complex is areas of disturbed Chillum soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of this complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Chillum soils that have been cut or graded.

Included with this complex in mapping are areas of Sassafras fine sandy loam and Croom very gravelly sandy loam. Also included are several areas of soils that have slopes of more than 40 percent. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. External drainage is rapid, and the hazard of erosion is severe. Available water capacity is moderate in the relatively undisturbed areas of this complex, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. This complex has poor potential for most building purposes because of slope. In making shallow excavations for basements or other purposes, compacted gravel is often encountered, but this gravel is not difficult to remove. Soil material and fill material of this complex have poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of slope. Areas that are very deeply cut or excavated are generally very gravelly and droughty and, therefore, have poor potential for almost any vegetation. Most areas of this complex have poor potential for most recreational uses because of slope and limited open space.

CeB—Christiana silt loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is on the higher elevations of the Coastal Plain. The topography is generally strongly dissected. Slopes are dominantly convex, and areas are generally irregularly shaped and range from about 2 to 20 acres in size.

A representative profile has a surface layer of dark brown silt loam about 4 inches thick. The upper part of the subsoil is yellowish brown heavy silt loam about 6 inches thick. The rest of the subsoil, about 50 inches thick, is red silty clay. The substratum, between depths of 60 and 75 inches, is variegated silty clay.

Included with this soil in mapping are areas of Keyport silt loam, Muirkirk Variant complex, and Sunnyside fine sandy loam. Also included are areas of soils that have a surface layer of silty clay loam, silty clay, or clay. Included areas make up about 15 percent of the mapped acreage.

This soil has moderately slow to slow permeability. Runoff is slow to medium, and the internal drainage is medium. The available water capacity is high. The hazard of erosion is moderate to severe. In unlimed areas this soil is very strongly acid to extremely acid.

This soil has poor potential for most building purposes because of poor stability. Cuts or excavations in this soil are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of the cuts onto roads or other areas below. This soil is severely limited or even sometimes dangerous for most building purposes, especially where it has been disturbed or graded. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of this material have been known to collapse, causing severe and costly damage to property. This soil has good potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. This soil has only fair potential for most recreational uses because of its clayey subsoil and moderately slow to slow permeability.

CeC—Christiana silt loam, 8 to 15 percent slopes. This moderately sloping soil is on the higher elevations of the Coastal Plain. The topography is generally strongly dissected. Slopes are dominantly convex. Areas are generally irregularly shaped and range from about 2 to 30 acres in size.

A representative profile has a surface layer of dark brown silt loam about 4 inches thick. The upper part of the subsoil is yellowish brown heavy silt loam about 6 inches thick. The rest of the subsoil, about 50 inches thick, is red silty clay. The substratum, between depths of 60 and 75 inches, is variegated silty clay.

Included with this soil in mapping are areas of Keyport silt loam, Muirkirk Variant complex, and Sunnyside fine sandy loam. Also included are areas of severely eroded Christiana soils that have a surface layer of silty clay loam, silty clay, or clay. Included areas make up about 15 percent of the mapped acreage.

This soil has moderately slow to slow permeability. Runoff is medium to rapid, and internal drainage is medium. The available water capacity is high. The hazard of erosion is severe. In unlimed areas this soil is very strongly acid to extremely acid.

This soil has poor potential for most building purposes because of poor stability and slope. Cuts or excavations in this soil are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This soil is severely limited or even sometimes dangerous for most building purposes, especially where it has been disturbed or graded. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases, buildings have been severely damaged. Banks and fills of this material have been known to collapse, causing severe and costly damage to property. This soil has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of slope. Because of poor trafficability in some areas and slope, this soil has fair to poor potential for most recreational uses.

CeD—Christiana silt loam, 15 to 40 percent slopes. This strongly sloping to steep soil is on the higher elevations of the Coastal Plain. The topography is generally strongly dissected. Slopes are dominantly convex, and areas are generally 2 to 12 acres in size.

A representative profile has a surface layer of dark brown silt loam about 4 inches thick. The upper part of the subsoil is yellowish brown heavy silt loam about 6 inches thick. The rest of the subsoil, about 50 inches thick, is red silty clay. The substratum, between depths of 60 and 75 inches, is variegated silty clay.

Included with this soil in mapping are areas of Muirkirk Variant complex and Sunnyside fine sandy loam. Also included are areas of severely eroded Christiana soils that have a surface layer of silty clay loam, silty clay, or clay and a few areas of soils that have slopes of more than 40 percent. Included areas make up about 15 percent of the mapped acreage.

This soil has moderately slow to slow permeability. Runoff is rapid to very rapid, and internal drainage is medium. The available water capacity is high. The hazard of erosion is severe. In unlimed areas this soil is very strongly acid to extremely acid.

This soil has poor potential for most building purposes because of poor stability and slope. Cuts or excavations in this soil are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This soil is severely limited or even sometimes dangerous for most building purposes, especially where it has been disturbed or graded. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of this material have been known to collapse, causing severe and costly damage to property and instances of injury and even loss of life. Because of the clayey subsoil and slope, this soil has poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Because of slope and poor traf-

ficability in some areas, this soil has poor potential for most recreational uses. It has good potential for use as parks and as habitat for some kinds of upland wildlife.

CfB—Christiana-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping, well drained soils of the Christiana series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is on high elevations of urbanized areas of the Coastal Plain. Areas are generally irregularly shaped and range from about 2 to 45 acres in size. The Christiana soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is relatively undisturbed Christiana soils. In these areas, a representative profile has a surface layer of dark brown silt loam about 4 inches thick. The upper part of the subsoil is yellowish brown heavy silt loam about 6 inches thick. The rest of the subsoil, about 50 inches thick, is red silty clay. The substratum, between depths of 60 and 78 inches, is variegated silty clay.

About 20 percent of this complex is areas of disturbed Christiana soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Christiana soils that have been cut or graded.

Included with this complex in mapping are areas of Keyport silt loam, Muirkirk Variant complex, and Sunnyside fine sandy loam. Also included are areas of severely eroded Christiana soils that have red clayey material exposed at the surface. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderately slow to slow in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is severe. The available water capacity is high in the relatively undisturbed areas of this complex, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid to extremely acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. This complex has poor potential for most building purposes because of poor stability. Cuts or excavations in this complex are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This complex, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. This complex has good potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Because of poor trafficability and limited open space, this complex has fair to poor potential for most recreational uses.

CfC—Christiana-Urban land complex, 8 to 15 percent slopes. This complex consists of moderately sloping, well drained soils of the Christiana series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is on high elevations of urbanized areas of the Coastal Plain. Areas are generally irregularly shaped and range from about 1 acre to 95 acres in size. The Christiana soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Christiana soils. In these areas, a representative profile has a surface layer of dark brown silt loam about 4 inches thick. The upper part of the subsoil is yellowish brown heavy silt loam about 6 inches thick. The rest of the subsoil, about 50 inches thick, is red silty clay. The substratum, between depths of 60 and 78 inches, is variegated silty clay.

About 20 percent of this complex is areas of disturbed Christiana soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting and grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Christiana soils that have been cut or graded.

Included with this complex in mapping are areas of Keyport silt loam, Muirkirk Variant complex, and Sunnyside fine sandy loam. Also included are areas of severely eroded Christiana soils that have red clayey material exposed at the surface. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderately slow to slow in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is high in the relatively undisturbed areas of this complex, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid to extremely acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. This

complex has poor potential for most building purposes because of poor stability and slope. Cuts or excavations are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This complex, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of soil material in this complex have been known to collapse, causing severe and costly damage to property. Because of the clayey subsoil and slope, this complex has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Because of limited open space, poor trafficability, and slope, this complex has poor potential for most recreational uses.

CfD—Christiana-Urban land complex, 15 to 40 percent slopes. This complex consists of strongly sloping to steep, well drained soils of the Christiana series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is on high elevations of urbanized areas of the Coastal Plain. Areas are generally irregularly shaped and range from about 2 to 18 acres in size. The Christiana soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is relatively undisturbed Christiana soils. In these areas, a representative profile has a surface layer of dark brown silt loam about 4 inches thick. The upper part of the subsoil is yellowish brown heavy silt loam about 6 inches thick. The rest of the subsoil, about 50 inches thick, is red silty clay. The substratum, between depths of 60 and 78 inches, is variegated silty clay.

About 20 percent of this complex is areas of disturbed Christiana soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Christiana soils that have been cut or graded.

Included with this complex in mapping are areas of Muirkirk Variant complex and Sunnyside fine sandy loam. Also included are areas of soils that have slopes of more than 40 percent, areas of severely eroded Christiana soils that have red clayey material exposed at the surface, and areas where Urban land makes up as much as 70 percent of the complex. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderately slow to slow in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is very rapid, and the hazard of erosion is severe. The available water capacity is high in the relatively undisturbed areas of this complex, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas of this complex are very strongly acid to extremely acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. This complex has poor potential for most building purposes because of poor stability and slope (fig. 11). Cuts or excavations are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below (fig. 12). This complex, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of soil material in this complex have been known to collapse, causing severe and costly damage to property. Because of the clayey subsoil and slope, this complex has poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Because of poor trafficability and slope, this complex has poor potential for most recreational uses.

Ck—Codorus silt loam. This nearly level, moderately well drained to somewhat poorly drained soil is on flood plains of the Piedmont Plateau. Areas are generally elongated and are along major streams. Most areas range from about 3 to 40 acres in size.

A representative profile has a surface layer of dark grayish brown silt loam about 8 inches thick. The subsoil, about 42 inches thick, is yellowish brown silt loam in the upper part and brown or dark brown silt loam in the lower part. The lower part of the subsoil is mottled. The substratum, between depths of 50 and 60 inches, is dark yellowish brown, stratified loam, silt loam, and sandy loam.

Included with this soil in mapping are areas of Fluvaquents-Udifluvents complex, frequently flooded. Also included are areas of Codorus soils that have a surface layer of loam or sandy loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate, and runoff is slow. There is little or no hazard of erosion. In unlimed areas this soil is strongly acid.

Because of a seasonal high water table and the hazard of frequent flooding throughout the year, this soil has poor potential for most building purposes. It has only fair potential for lawn grasses, shrubs, trees, vegetable gardens, and other plants because of flooding. It has poor

potential for most recreational uses other than hiking or riding trails. This soil provides suitable habitat for some kinds of wildlife. It should be valuable for natural areas within a densely populated survey area such as this.

Cn—Codorus-Urban land complex. This complex consists of nearly level, moderately well drained to somewhat poorly drained soils of the Codorus series, most areas of which have been altered by grading and filling for roads, buildings, and similar uses. This complex is on flood plains of the Piedmont Plateau. Areas are generally narrow and elongated and range from about 2 to 25 acres in size. The Codorus soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Codorus soils. In these areas, a representative profile has a surface layer of dark grayish brown silt loam about 8 inches thick. The subsoil, about 42 inches thick, is yellowish brown silt loam in the upper part and brown or dark brown silt loam in the lower part. The lower part of the subsoil is mottled. The substratum, between depths of 50 and 60 inches, is dark yellowish brown, stratified loam, silt loam, and sandy loam.

About 20 percent of this complex is areas of disturbed Codorus soils that have been covered by as much as 20 inches of fill material.

About 40 percent of the complex is Urban land, where the soils are largely covered by roads, streets, and a few buildings or where the soils have been covered by more than 20 inches of fill material. The fill material is generally heterogeneous and can be from almost any source.

Included with this complex in mapping are areas of Fluvaquents-Udifluvents complex, frequently flooded. Also included are bouldery and rocky areas. These areas are along Rock Creek. These included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in the relatively undisturbed areas and variable in the disturbed areas. Runoff is medium, and there is little or no hazard of erosion. Most unlimed areas of this complex are strongly acid.

Areas of this complex that have not been urbanized include narrow areas between roads and streams and a few open areas around buildings. Because of a seasonal high water table and the hazard of frequent flooding throughout the year, this complex has poor potential for most building purposes. Because of wetness and the hazard of flooding, it has only fair potential for lawn grasses, shrubs, trees, vegetable gardens, and other plants. It has poor potential for most recreational uses because of limited open space and the hazard of flooding.

CwB—Croom very gravelly sandy loam, 0 to 8 percent slopes. This nearly level to gently sloping, well drained soil is on ridgetops of strongly dissected upland areas of the Coastal Plain. Slopes are dominantly smooth and gradual. The areas are generally irregularly shaped and range from about 4 to 15 acres in size.

A representative profile has a surface layer of dark brown very gravelly sandy loam about 2 inches thick and a subsurface layer of yellowish brown very gravelly loam about 10 inches thick. The subsoil, about 30 inches thick, is yellowish brown or yellowish red very gravelly sandy loam in the upper part and strong brown very gravelly sandy clay loam in the lower part. The substratum, between depths of 42 and 72 inches, is strong brown very gravelly sandy loam (fig. 13).

Included with this soil in mapping are areas of Chillum silt loam, Sassafras gravelly sandy loam, and Beltsville silt loam. Also included are areas of Croom soils that have a surface layer of gravelly sand. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate to moderately slow. Runoff is slow to medium, and the hazard of erosion is moderate. The available water capacity is low. In unlimed areas this soil is generally very strongly acid throughout the profile.

This soil has good potential for use as building sites. In making shallow excavations for basements or other purposes, gravel is encountered, but the gravel is generally not too difficult to remove. Because of a very gravelly surface layer and low available water capacity, this soil has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Because of a very gravelly surface layer, this soil has only fair potential for most recreational uses.

CwC—Croom very gravelly sandy loam, 8 to 15 percent slopes. This moderately sloping, well drained soil is on ridgetops of strongly dissected upland areas of the Coastal Plain. Slopes are dominantly complex. The areas are generally irregularly shaped and range from about 3 to 15 acres in size.

A representative profile has a surface layer of dark brown very gravelly sandy loam about 2 inches thick and a subsurface layer of yellowish brown very gravelly loam about 10 inches thick. The subsoil, about 30 inches thick, is yellowish brown or yellowish red very gravelly sandy loam in the upper part and strong brown very gravelly sandy clay loam in the lower part. The substratum, between depths of 42 and 72 inches, is strong brown very gravelly sandy loam.

Included with this soil in mapping are areas of Chillum silt loam and Sassafras gravelly sandy loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate to moderately slow. Runoff is medium, and the hazard of erosion is severe. The available water capacity is low. In unlimed areas this soil is generally very strongly acid throughout the profile.

This soil has only fair potential for use as building sites because of slope. In making shallow excavations for basements or other purposes, gravel is encountered but the gravel is generally not too difficult to remove. Because of a very gravelly surface layer, slope, and low available water capacity, this soil has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. This soil has fair to poor potential for most recreational uses because of small stones and limited open space.

CwD—Croom very gravelly sandy loam, 15 to 40 percent slopes. This strongly sloping to steep, well drained soil is on side slopes of strongly dissected uplands of the Coastal Plain. Slopes are dominantly short and convex. The areas are generally narrow and elongated and range from 2 to 20 acres in size.

A representative profile has a surface layer of dark brown very gravelly sandy loam about 2 inches thick and a subsurface layer of yellowish brown very gravelly loam subsurface layer about 10 inches thick. The subsoil, about 30 inches thick, is yellowish brown or yellowish red very gravelly sandy loam in the upper part and strong brown very gravelly sandy clay loam in the lower part. The substratum, between depths of 42 and 72 inches, is strong brown very gravelly sandy loam.

Included with this soil in mapping are areas of Chillum silt loam and Sassafras gravelly sandy loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate to moderately slow. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is low. In unlimed areas this soil is generally very strongly acid throughout the profile.

This soil has poor potential for use as building sites because of slope. Because of a very gravelly surface layer, slope, and low available water capacity, this soil has poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Because of a very gravelly surface layer and slope, this soil has poor potential for most recreational uses. It has good potential for use as parks or as habitat for some kinds of wildlife.

CxB—Croom-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping, well drained soils of the Croom series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on ridgetops of urbanized areas of the Coastal Plain. Areas are generally irregularly shaped and range from about 2 to 10 acres in size. The Croom soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Croom soils. In these areas, a representative profile has a surface layer of dark brown very gravelly sandy loam about 2 inches thick and a subsurface layer of yellowish brown very gravelly loam about 10 inches thick. The subsoil, about 30 inches thick, is yellowish brown or yellowish red very gravelly sandy loam in the upper part and strong brown very gravelly sandy clay loam in the lower part. The substratum, between depths of 42 and 72 inches, is strong brown very gravelly sandy loam.

About 20 percent of this complex is areas of disturbed Croom soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Croom soils that have been cut or graded.

Included with this complex in mapping are areas of Chillum silt loam, Beltsville silt loam, and Sassafras gravelly sandy loam. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate to moderately slow in areas of this complex where the soils are relatively undisturbed, and it is variable in the urbanized areas. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. The available water capacity is low or very low throughout this complex. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. This complex has good potential for most building purposes. In making shallow excavations for basements or other purposes, gravel is encountered, but the gravel is commonly not very difficult to remove. Because of the very gravelly nature and low available water capacity, this complex has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. This complex has fair to poor potential for most recreational uses because of a very gravelly surface layer and limited open space.

CxC—Croom-Urban land complex, 8 to 15 percent slopes. This complex consists of moderately sloping, well drained soils of the Croom series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on ridgetops and side slopes of urbanized areas of the Coastal Plain. Areas are generally large and irregularly shaped and range from about 1 acre to 50 acres in size. The Croom soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Croom soils. In these areas, a representative profile has a surface layer of dark brown very gravelly sandy loam about 2 inches thick and a subsurface layer of yellowish brown very gravelly loam about 10 inches thick. The subsoil, about 30 inches thick, is yellowish brown or yellowish red very gravelly sandy loam in the upper part and strong brown very gravelly sandy clay loam in the lower part. The substratum, between depths of 42 and 72 inches, is strong brown very gravelly sandy loam.

About 20 percent of this complex is areas of disturbed Croom soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Croom soils that have been cut or graded.

Included with this complex in mapping are areas of Chillum silt loam and Sassafras gravelly sandy loam. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate to moderately slow in areas of this complex where the soils are relatively undisturbed, and it is variable in the urbanized areas. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is low or very low throughout this complex. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. This complex has only fair potential for most building purposes because of slope. In making shallow excavations for basements or other purposes, gravel is encountered, but the gravel is generally not very difficult to remove. Because of the very gravelly nature, slope, and low available water capacity, this complex has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. This complex has poor potential for most recreational uses because of slope, a very gravelly surface layer, and limited open space.

CxD—Croom-Urban land complex, 15 to 25 percent slopes. This complex consists of strongly sloping to steep, well drained soils of the Croom series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on ridgetops and side slopes of urbanized areas of the Coastal Plain. Areas are generally irregularly shaped and range from about 3 to 12 acres in size. The Croom soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Croom soils. In these areas, a representative profile has a surface layer of dark brown very gravelly sandy loam about 2 inches thick and a subsurface layer of yellowish brown very gravelly loam about 10 inches thick. The subsoil, about 30 inches thick, is yellowish brown or yellowish red very gravelly sandy loam in the upper part and strong brown very gravelly sandy clay loam in the lower part. The substratum, between depths of 42 and 72 inches, is strong brown very gravelly sandy loam.

About 20 percent of this complex is areas of disturbed Croom soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils have been covered by more than 20 inches of fill material or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Croom soils that have been cut or graded.

Included with this complex in mapping are areas of Chillum silt loam and Sassafras gravelly sandy loam. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate to moderately slow in areas of this complex where the soils are relatively undisturbed, and it is variable in the urbanized areas. Runoff is very rapid, and the hazard of erosion is severe. The available water capacity is low or very low throughout this complex. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. This complex has poor potential for most building purposes because of slope. In making shallow excavations for basements or other purposes, gravel is encountered, but the gravel is generally not very difficult to remove. Because of a very gravelly nature, slope, and low available water capacity, this complex has poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Because of slope, a very gravelly surface layer, and limited open space, this complex has poor potential for most recreational uses.

Dn—Dunning soils. These nearly level, very poorly drained soils are on flood plains of the Coastal Plain. Areas are irregularly shaped and generally range from about 3 to 15 acres in size.

A representative profile has a surface layer of very dark grayish brown silty clay loam about 11 inches thick covered with about 16 inches of variegated, stratified fill material. The subsoil, between depths of 27 and 46 inches, is mottled very dark gray silty clay loam. The substratum, between depths of 46 and 60 inches, is black, stratified sandy loam, loam, and sandy clay loam. It is distinctly mottled.

Included with these soils in mapping are areas of Udorthents and Melvin silt loam. Also included are areas of Dunning soils that do not have fill material on the surface. Included areas make up about 15 percent of the mapped acreage.

Permeability is slow in these soils. Runoff is slow or very slow. The water table is at or near the surface for long periods. Some areas of these soils are depressional and are ponded for long periods. These soils are on military reservations along the Anacostia River and are commonly protected from frequent flooding by levees.

Because of wetness, these soils have poor potential for most building purposes. They have poor potential for lawn grasses, shrubs, trees, and other plants. Because of wetness, they have only fair potential for most recreational uses.

Fa—Fallsington sandy loam. This nearly level, poorly drained soil is on low-lying flats of the Coastal Plain. Areas generally are irregularly shaped and range from about 2 to 6 acres in size.

A representative profile has a surface layer of black sandy loam about 6 inches thick and a subsurface layer of light brownish gray sandy loam about 7 inches thick. The subsoil, about 20 inches thick, is mottled grayish brown sandy loam. The substratum, between depths of 33 and 60 inches, is gray loamy sand and yellowish brown mottles.

Included with this soil in mapping are areas of Bibb sandy loam, Iuka sandy loam, and Woodstown sandy loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate, and runoff is very slow to ponded. There is little or no hazard of erosion. The available water capacity is high. In most areas the water table is at or near the surface for long periods. Unlimed areas are very strongly acid.

Because the water table is high for long periods, this soil has poor potential for most building purposes. Because of wetness, it has poor potential for lawn grasses, shrubs, trees, and other plants. It has poor potential for most recreational uses because of wetness. This soil provides suitable habitat for some kinds of wildlife. It should be valuable for natural areas within such a densely populated area as this survey area.

FB—Fluvaquents, bouldery. These nearly level soils consist of bouldery alluvium. They are small in total acreage and are in Palisades Park along the Potomac River and on Three Sisters Islands. Areas range from about 1 acre to 24 acres in size. From 70 to 90 percent of the acreage of these soils is covered with boulders (fig. 14).

Included in mapping are areas where the alluvium has been completely washed away, exposing outcrops of hard bedrock.

These soils are frequently flooded and are poorly suited to most uses. They have potential for use as natural areas. Areas of these soils are suitable as habitat for some kinds of wildlife. In some areas, small, isolated, shallow ponds have been created between the boulders. These ponds provide excellent habitat for bullfrogs, muskrats, and other small wetland wildlife.

FD—Fluvaquents, ponded. These nearly level to depressional soils consist of soil material that has recently been washed from uplands and deposited on islands, on margins of rivers, and in deltalike areas. This soil material is unconsolidated stratified alluvium. It varies widely in texture over short distances but is dominantly sandy. It contains thin layers of decomposing plant material. These soils are very poorly drained and are under freshwater all or nearly all of the time. Areas range from about 3 to 14 acres in size. They are along the Anacostia River and on islands in the Potomac and Anacostia Rivers.

Included with these soils in mapping are small areas of Bibb sandy loam. Also included is about 18 acres of these soils that are regularly covered by tidal waters. Included areas make up about 10 percent of the mapped acreage.

These soils have poor potential for most uses. They have good potential for use as natural areas or as habitat for some kinds of wildlife.

FF—Fluvaquents-Udifluvents complex, frequently flooded. These nearly level soils consist of soil material that has recently been washed from uplands and deposited on flood plains. This soil material is unconsolidated alluvium that is stratified. It varies in drainage over short distances. Texture generally ranges from loamy sand to fine sandy loam. These soils are subject to frequent changes through stream overflow. Most areas are flooded at least twice a year. They occur in long, narrow strips along flood plains and range from about 3 to 24 acres in size. Fluvaquents and Udifluvents occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 50 percent of this mapping unit is Fluvaquents, and 35 percent is Udifluvents.

Included with these soils in mapping are small areas of such soils as the moderately well drained Iuka soils, the moderately well drained to somewhat poorly drained Codorus soils, and the poorly drained Bibb soils. Also included are areas of soils that contain as much as 20 inches of miscellaneous fill. Included areas make up about 15 percent of the mapped acreage.

A large part of this complex is wooded; other areas are so gravelly or sandy that they support little or no vegetation. These soils are frequently flooded and are poorly suited to most uses. They are suitable habitat for some kinds of wetland wildlife. They should be valuable as natural areas within a densely populated area such as this survey area.

FH—Fluvaquents-Udifluvents-Urban land complex. This complex consists of nearly level areas of recent alluvium, some of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on flood plains of major streams throughout the survey area. Areas are generally 4 to 20 acres in size. Fluvaquents, Udifluvents, and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

A typical area of this complex is about 35 percent Fluvaquents and about 30 percent Udifluvents. The soil material is unconsolidated alluvium that is generally stratified. It varies widely in texture and in drainage over short distances. About 30 percent of the complex is Urban land, where the surface is largely covered by concrete, asphalt, buildings, or other impervious surfaces.

Included with this complex in mapping are areas of Iuka sandy loam, Codorus silt loam, and Udorthents. Included areas make up about 5 percent of the mapped acreage.

Where unprotected, this complex is subject to flooding. The unurbanized part consists of open areas between roads and streams and of yards and open space around and between buildings. Where protected from flooding, these areas have fair potential for most uses.

GeB—Galestown-Urban land complex, 0 to 8 percent slopes. This complex is made up of nearly level to gently sloping areas of Galestown soils and areas of Urban land. This complex is on urbanized uplands and terraces of the Coastal Plain. Areas are generally irregularly shaped and range from about 3 to 75 acres in size. The Galestown soils in this unit have been altered by grading for housing developments, shopping centers, industrial areas, and other similar uses. Galestown soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Galestown soils. In these areas, a representative profile has a surface layer of very dark grayish brown loamy sand about 6 inches thick and a subsurface layer of dark yellowish brown loamy sand about 8 inches thick. The subsoil, about 28 inches thick, is strong brown loamy sand. The substratum, between depths of 42 and 60 inches, is dark brown and yellowish brown loamy sand.

About 20 percent of this complex is disturbed areas of Galestown soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Galestown soils that have been cut or graded.

Included with this complex in mapping are areas of Sassafras sandy loam and Rumford loamy fine sand. Also included are a few areas of soils that have slopes of as much as 15 percent. Included areas make up about 20 percent of the mapped acreage.

Permeability is rapid to very rapid in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion moderate. The available water capacity is low. Most unlimed areas are very strongly acid.

Areas that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. Areas of this complex that have not been urbanized have good potential for use as building sites. The soils and fill material have only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of sandiness. Many areas tend to be droughty late in summer and early in fall. These areas may require irrigation if they are used for lawn grasses, landscaping, and vegetable gardens. This complex has only fair potential for most recreational uses because of sandiness and limited open space. An onsite investigation is needed to determine the potentials and limitations for any proposed land use.

GfB—Galestown and Rumford soils, 0 to 8 percent slopes. This undifferentiated group is made up of nearly level to gently sloping soils. Galestown soils are more common in this unit than Rumford soils. Where the two soils are in the same area, Galestown soils generally make up the higher percentage. These soils are on uplands and terraces of the Coastal Plain. Areas are irregularly shaped and generally range from about 2 to 10 acres in size.

A representative profile of Galestown soils has a surface layer of very dark grayish brown loamy sand about 6 inches thick and a subsurface layer of dark yellowish brown loamy sand about 8 inches thick. The subsoil, about 28 inches thick, is strong brown loamy sand. The substratum, between depths of 42 and 60 inches, is dark brown and yellowish brown loamy sand.

A representative profile of Rumford soils has a surface layer of very dark grayish brown loamy fine sand about 6 inches thick and a subsurface layer of dark yellowish brown loamy fine sand about 13 inches thick. The subsoil, about 20 inches thick, is strong brown fine sandy loam in the upper part and yellowish brown loamy sand in the lower part. The substratum, between depths of 39 and 60 inches, is dark yellowish brown fine sand.

Included with these soils in mapping are a few areas of Sassafras sandy loam and a few areas of soils that have a gravelly surface layer. Included areas make up about 15 percent of the mapped acreage.

Permeability is rapid to very rapid in these soils. Runoff is slow, and there is little or no hazard of erosion. These soils have low to moderate available water capacity. Most unlimed areas are low in natural fertility.

These soils have good potential for most building purposes. They have only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of the sandy surface layer. Some areas of this mapping unit tend to be droughty late in summer and early in fall. These areas may require irrigation if they are used for vegetable gardens, lawn grasses, ornamental shrubs and trees, and other plants. Because of the sandy surface layer, these soils have only fair potential for most recreational uses.

GfC—Galestown and Rumford soils, 8 to 15 percent slopes. This undifferentiated group is made up of moderately sloping soils. Galestown soils are more common in this group than Rumford soils. Where the two soils are in the same area, Galestown soils generally make up the higher percentage. These soils are on uplands and terraces of the Coastal Plain. Areas are irregularly shaped and generally range from about 2 to 5 acres in size.

A representative profile of Galestown soils has a surface layer of very dark grayish brown loamy sand about 6 inches thick and a subsurface layer of dark yellowish brown loamy sand about 8 inches thick. The subsoil, about 28 inches thick, is strong brown loamy sand. The substratum, between depths of 42 and 60 inches, is dark brown and yellowish brown loamy sand.

A representative profile of Rumford soils has a surface layer of very dark grayish brown loamy fine sand about 6 inches thick and a subsurface layer of dark yellowish brown loamy fine sand about 13 inches thick. The subsoil, about 20 inches thick, is strong brown fine sandy loam in the upper part and yellowish brown loamy sand in the lower part. The substratum, between depths of 39 and 60 inches, is dark yellowish brown fine sand.

Included with these soils in mapping are a few areas of Sassafras sandy loam and a few areas of soils that have a gravelly surface layer. Also included are a few areas of soils that have slopes of more than 15 percent. Included areas make up about 15 percent of the mapped acreage.

Permeability is rapid to very rapid in these soils. Runoff is slow to medium, and the hazard of erosion is moderate to slight. These soils have low to moderate available water capacity. Most unlimed areas are very strongly acid. Most areas are low in natural fertility.

These soils have only fair potential for most building purposes because of slope. They have only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of sandiness and slope. Some areas tend to be droughty late in summer and in early fall. These areas may require irrigation if they are used for vegetable gardens, lawn grasses, ornamental shrubs and trees, and other plants. Because of slope and sandiness, these soils have fair to poor potential for most recreational uses.

GgB—Glenelg loam, 0 to 8 percent slopes. This nearly level to gently sloping, well drained soil is on ridgetops of strongly dissected areas of the Piedmont Plateau. Slopes are smooth and convex. Areas are irregularly shaped and range from 1 acre to 10 acres in size.

A representative profile has a surface layer of dark brown loam about 2 inches thick and a subsurface layer of yellowish brown loam about 7 inches thick. The subsoil, about 19 inches thick, is strong brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is variegated loam.

Included with this soil in mapping are areas of Brandywine gravelly loam, Glenelg Variant silt loam, and Manor loam. Also included are a few areas of soils that have a gravelly or channery surface layer. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate, and runoff is slow to medium. The hazard of erosion is moderate, and the available water capacity is high. In unlimed areas this soil is very strongly acid.

This soil has good potential for use as building sites. It has good potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. This soil has good potential for most recreational uses.

GgC—Glenelg loam, 8 to 15 percent slopes. This moderately sloping, well drained soil is on ridgetops of strongly dissected areas of the Piedmont Plateau. Slopes are smooth and convex. Areas are irregularly shaped and are about 2 to 40 acres in size.

A representative profile has a surface layer of dark brown loam about 2 inches thick and a subsurface layer of yellowish brown loam about 7 inches thick. The subsoil, about 19 inches thick, is strong brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is variegated loam.

Included with this soil in mapping are areas of Brandywine gravelly loam, Manor loam, and Manor channery loam. Also included are a few areas of soils that have a gravelly surface layer. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate, and runoff is medium. The hazard of erosion is moderate to severe, and the available water capacity is high. In unlimed areas this soil is very strongly acid.

Because of slope, this soil has only fair potential for use as building sites, for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens; and for most recreational uses.

GgD—Glenelg loam, 15 to 25 percent slopes. This strongly sloping, well drained soil is on ridgetops and side slopes of strongly dissected areas of the Piedmont Plateau. Slopes are generally short and convex. Areas are irregularly shaped and range from about 2 to 15 acres in size.

A representative profile has a surface layer of dark brown loam about 2 inches thick and a subsurface layer of yellowish brown loam about 7 inches thick. The subsoil, about 19 inches thick, is strong brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is variegated loam.

Included with this soil in mapping are areas of Brandywine gravelly loam, Manor loam, and Ashe loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate, and runoff is rapid. The hazard of erosion is severe, and the available water capacity is high. In unlimed areas this soil is very strongly acid.

Because of slope, this soil has poor potential for use as building sites; for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens; and for most recreational uses.

GhB—Glenelg-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping, well drained soils of the Glenelg series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on ridgetops of urbanized areas of the Piedmont Plateau. Areas are irregularly shaped and are 2 to 30 acres in size. Glenelg soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Glenelg soils. In these areas, a representative profile has a surface layer of dark brown loam about 2 inches thick and a subsurface layer of yellowish brown loam about 7 inches thick. The subsoil, about 19 inches thick, is strong brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is variegated loam.

About 20 percent of this complex is areas of disturbed Glenelg soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt,

buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Glenelg soils that have been cut or graded.

Included with this complex in mapping are areas of Brandywine gravelly loam, Manor loam, and Glenelg Variant silt loam. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid. The hazard of erosion is moderate to severe. The available water capacity is high in the relatively undisturbed areas, and it is variable in the urbanized areas. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open space around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. Areas that have not been urbanized have good potential for building sites. The soils and fill material have good potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Areas that are very deeply cut or excavated are generally very micaceous and droughty and, therefore, have poor potential for most types of vegetation. This complex has only fair potential for most recreational uses because of limited open space. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed land use.

GhC—Glenelg-Urban land complex, 8 to 15 percent slopes. This complex consists of moderately sloping, well drained soils of the Glenelg series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on ridgetops of urbanized areas of the Piedmont Plateau. Areas are irregularly shaped and are 3 to 75 acres in size. Glenelg soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Glenelg soils. In these areas, a representative profile has a surface layer of dark brown loam about 2 inches thick and a subsurface layer of yellowish brown loam about 7 inches thick. The subsoil, about 19 inches thick, is strong brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is variegated loam.

About 20 percent of this complex is areas of disturbed Glenelg soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Glenelg soils that have been cut or graded.

Included with this complex in mapping are areas of Brandywine gravelly loam and Manor loam. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is high in the relatively undisturbed areas, and it is variable in the urbanized areas. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. Areas that have not been urbanized have only fair potential for building sites because of slope. Because of slope, the soils and fill material have only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Areas that are very deeply cut or excavated are generally very micaceous and droughty and, therefore, have poor potential for most types of vegetation. This complex has poor potential for most recreational uses because of slope and limited open space. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed land use.

GhD—Glenelg-Urban land complex, 15 to 25 percent slopes. This complex consists of strongly sloping, well drained soils of the Glenelg series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on ridgetops and side slopes of urbanized areas of the Piedmont Plateau. Areas are irregularly shaped and range from about 2 to 15 acres in size. Glenelg soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Glenelg soils. In these areas, a representative profile has a surface layer of dark brown loam about 2 inches thick and a subsurface layer of yellowish brown loam about 7 inches thick. The subsoil, about 19 inches thick, is strong brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is variegated loam.

About 20 percent of this complex is areas of disturbed Glenelg soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Glenelg soils that have been cut or graded.

Included with this complex in mapping are areas of Brandywine gravelly loam and Manor loam. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is very rapid, and the hazard of erosion is severe. The available water capacity is high in the relatively undisturbed areas, and it is variable in the urbanized areas. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. Because of slope, areas that have not been urbanized have poor potential for building sites. Because of slope, the soils and fill material of this complex have poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Areas that are very deeply cut or excavated are generally very micaceous and droughty and, therefore, have poor potential for most types of vegetation. This complex has poor potential for most recreational uses because of slope and limited open space. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed land use.

GlB—Glenelg Variant silt loam, 0 to 8 percent slopes. This nearly level to gently sloping, moderately well drained soil is on flats, in depressions, at the foot of hillsides, and around the head of drainageways. It is on the Piedmont Plateau. Slopes are dominantly concave. Areas are generally irregularly shaped and range from about 2 to 30 acres in size.

A representative profile has a surface layer of very dark grayish brown silt loam about 3 inches thick and a subsurface layer of yellowish brown silt loam about 3 inches thick. The subsoil, about 35 inches thick, is yellowish brown heavy silt loam in the upper 20 inches and mottled yellowish brown loam in the lower 15 inches. The substratum, between depths of 41 and 60 inches, is variegated fine sandy loam.

Included with this soil in mapping are areas of Ashe loam, Brandywine gravelly loam, and Glenelg loam. Included areas are about 15 percent of the mapped acreage.

Permeability is moderate. Runoff is slow to medium. The available water capacity is high, and there is little or no hazard of erosion. In unlimed areas this soil is generally very strongly acid. This soil has a seasonally high water table. Temporary ponding occurs in some areas after heavy rainfall.

Because of a seasonal high water table, this soil has only fair potential for building sites, landscaping, lawns, vegetable gardens, and most recreational uses.

GmB—Glenelg Variant-Urban land complex, 0 to 8 percent slopes. This complex is made up of nearly level to gently sloping, moderately well drained Glenelg Variant soils, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on urbanized flats and depressional areas of the Piedmont Plateau. Areas are generally irregularly shaped and range from about 1 acre to 40 acres in size. Glenelg Variant soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Glenelg Variant soils. In these areas, a representative profile has a surface layer of very dark grayish brown silt loam about 3 inches thick. The subsoil, about 35 inches thick, is yellowish brown heavy silt loam in the upper 20 inches and mottled, yellowish brown loam in the lower 15 inches. The substratum, between depths of 41 and 60 inches, is variegated fine sandy loam.

About 20 percent of this complex is areas of disturbed Glenelg soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Glenelg Variant soils that have been cut or graded.

Included with this complex in mapping are areas of Brandywine gravelly loam and Glenelg loam. Included areas make up about 20 percent of the mapped acreage.

Permeability and internal drainage are generally moderate throughout this complex. Runoff is medium to rapid, and the hazard of erosion is moderate. The available water capacity is high in the relatively undisturbed areas, and it is generally variable in the urbanized areas. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that range from about 500 to 7,000 square feet in size. Seasonal wetness moderately limits the potential of this complex for building sites. Filled areas have less stable foundation conditions than the less disturbed areas. Because of seasonal wetness, this complex has only fair potential for lawns, landscaping, and vegetable gardens. It has poor potential for most recreational uses because of seasonal wetness and limited open space. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed land use.

Ik—Iuka sandy loam. This nearly level, moderately well drained soil is on flood plains of the Coastal Plain. Areas are generally long and narrow, and they are along major streams. Areas generally range from about 1 acre to 20 acres in size.

A representative profile has a surface layer of dark grayish brown sandy loam about 10 inches thick. The subsoil, about 11 inches thick, is yellowish brown sandy loam with distinct mottling. The substratum, between depths of 21 and 60 inches, is light brownish gray sandy loam.

Included with this soil in mapping are areas of Fluvaquents-Udifluvents complex, frequently flooded; Bibb

sandy loam; and Fallsington sandy loam. Also included are areas of soils that have a surface layer of silt loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate, and runoff is slow. There is little or no hazard of erosion. In unlimed areas, this soil is strongly acid. Because of the hazard of flooding, it has poor potential for building sites. Because of the seasonal high water table and the hazard of flooding, it has only fair potential for lawn grasses, shrubs, trees, and other plants. It has only fair potential for most recreational uses because of flooding. This soil provides suitable habitat for some kinds of wildlife. It should be of value for nature areas within a densely populated area such as this survey area.

Ip—Iuka-Urban land complex. This complex consists of nearly level, moderately well drained soils of the Iuka series, most areas of which have been altered by grading and filling for roads, buildings, and similar uses. This complex is on flood plains of the Coastal Plain. Areas are generally narrow and elongated and range from about 2 to 60 acres in size. Iuka soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Iuka soils. In these areas, a representative profile has a surface layer of dark grayish brown sandy loam about 10 inches thick. The subsoil, about 11 inches thick, is yellowish brown sandy loam with distinct mottling. The substratum, between depths of 21 and 60 inches, is light brownish gray sandy loam.

About 20 percent of this complex is areas of disturbed Iuka soils that have been covered by as much as 20 inches of fill material.

About 40 percent of the complex is Urban land, where the soils are largely covered by roads, streets, and some buildings or where the soils have been covered by more than 20 inches of fill material. The fill material is generally variable and can be from almost any source.

Included with this complex in mapping are areas of Fluvaquents-Udifluvents complex, frequently flooded, and Bibb sandy loam. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in the relatively undisturbed areas, and it is variable in the disturbed areas. Runoff is medium, and there is little or no hazard of erosion. Most unlimed areas are strongly acid.

Areas of this complex that have not been urbanized include open areas between roads and streams and areas around and between buildings. These areas make up management units that range from about 500 to 7,000 square feet in size. Areas that are not protected from flooding have poor potential for most building purposes. Because of the hazard of flooding, this complex has only fair potential for lawn grasses, shrubs, trees, vegetable gardens, and other plants. It has poor potential for most recreational uses because of limited open space.

JtB—Joppa gravelly sandy loam, 0 to 8 percent slopes. This nearly level to gently sloping, well drained to excessively drained soil is on ridgetops at high elevations where the Coastal Plain has formed isolated caps on the Piedmont Plateau. Slopes are dominantly smooth, and areas range from about 2 to 7 acres in size.

A representative profile has a surface layer of dark grayish brown gravelly sandy loam about 3 inches thick and a subsurface layer of yellowish brown gravelly sandy loam about 4 inches thick. The subsoil, about 20 inches thick, is brown very gravelly sandy loam. The substratum, between depths of 27 and 60 inches, is strong brown very gravelly sand.

Included with this soil in mapping are areas of Brandywine gravelly loam and Sassafras gravelly sandy loam. Also included are a few areas of soils that have a surface layer of gravelly loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is rapid, and runoff is slow to medium. The hazard of erosion is moderate. The available water capacity and natural fertility are low. In unlimed areas this soil is generally very strongly acid throughout the profile.

This soil generally has good potential for use as building sites. In making shallow excavations for basements or other purposes, gravel is encountered in most places, but the gravel is loose and generally is not very difficult to remove. Because of low available water capacity and a very high percentage of coarse fragments, this soil has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. This soil has only fair potential for most recreational uses because of a gravelly surface layer.

JtC—Joppa gravelly sandy loam, 8 to 15 percent slopes. This moderately sloping, well drained to excessively drained soil is on ridgetops and side slopes at high elevations where the Coastal Plain has formed isolated caps on the Piedmont Plateau. Slopes are dominantly smooth, and areas range from about 3 to 12 acres in size.

A representative profile has a surface layer of dark grayish brown gravelly sandy loam about 3 inches thick over a subsurface layer of yellowish brown gravelly sandy loam about 4 inches thick. The subsoil, about 20 inches thick, is brown very gravelly sandy loam. The substratum, between depths of 27 and 60 inches, is strong brown very gravelly sand.

Included with this soil in mapping are areas of Brandywine gravelly loam, Manor channery loam, and Sassafras gravelly sandy loam. Also included are a few areas of soils that have a surface layer of gravelly loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is rapid, and runoff is medium. The hazard of erosion is moderate to severe. The available water capacity and natural fertility are low. In unlimed areas this soil is generally very strongly acid throughout the profile.

This soil generally has only fair potential for use as building sites because of slope. In making shallow excavations for basements or other purposes, gravel is encountered in most places, but the gravel is loose and generally is not very difficult to remove. Because of slope, low available water capacity, and a very high percentage of coarse fragments, this soil has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. This soil has only fair potential for most recreational uses because of slope and a gravelly surface layer.

JtD—Joppa gravelly sandy loam, 15 to 40 percent slopes. This strongly sloping to steep, well drained to excessively drained soil is on side slopes in strongly dissected areas of the Coastal Plain. Slopes are dominantly long, and areas are generally about 2 to 15 acres in size.

A representative profile has a surface layer of dark grayish brown gravelly sandy loam about 3 inches thick and a subsurface layer of yellowish brown gravelly sandy loam about 4 inches thick. The subsoil, about 20 inches thick, is brown very gravelly sandy loam. The substratum, between depths of 27 and 60 inches, is strong brown very gravelly sand.

Included with this soil in mapping are areas of Brandywine gravelly loam, Manor channery loam, and Sassafras gravelly sandy loam. Also included are some areas of soils that have slopes of as much as 50 percent. Included areas make up about 15 percent of the mapped acreage.

Permeability and runoff are rapid. The hazard of erosion is severe. The available water capacity and natural fertility are low. In unlimed areas this soil is generally very strongly acid throughout the profile.

This soil generally has poor potential for use as building sites because of slope. In making shallow excavations for basements or other purposes, gravel is encountered in most places, but the gravel is loose and generally is not very difficult to remove. Because of slope, low available water capacity, and a very high percentage of coarse fragments, this soil has poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. It has poor potential for most recreational uses because of slope and a gravelly surface layer. It has good potential for use as habitat for some kinds of upland wildlife.

JuB—Joppa-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping, well drained soils of the Joppa series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is at high elevations in upland areas of the Coastal Plain that have been urbanized. Areas are generally 1 acre to 17 acres in size. Joppa soils and Urban land occur together in such as intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Joppa soils. In these areas, a representative profile has a surface layer of dark grayish brown gravelly sandy loam about 3 inches thick and a subsurface layer of yellowish brown gravelly sandy loam about 4 inches thick. The subsoil, about 20 inches thick, is brown very gravelly sandy loam. The substratum, between depths of 27 and 60 inches, is strong brown very gravelly sand.

About 20 percent of this complex is disturbed areas of Joppa soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Joppa soils that have been cut or graded.

Included with this complex in mapping are areas of Brandywine gravelly loam and Sassafras gravelly sandy loam. Included areas make up about 20 percent of the mapped acreage.

Permeability is rapid in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. The available water capacity is low in the relatively undisturbed areas of this complex, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that range from about 500 to 7,000 square feet in size. This complex has good potential for most building purposes. In making shallow excavations for basements or other purposes, loose gravel is generally encountered, but the gravel is not difficult to remove. The soils and fill material of this complex have only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of gravel. Areas that are very deeply cut or excavated are generally very gravelly and droughty and, therefore, have poor potential for almost any type of vegetation. Most areas of this complex have poor potential for most recreational uses because of gravelly material and limited open space.

JuC—Joppa-Urban land complex, 8 to 15 percent slopes. This complex consists of moderately sloping, well drained soils of the Joppa series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is at high elevations in upland areas of the Coastal Plain that have been urbanized. Areas are generally 2 to 25 acres in size. Joppa soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Joppa soils. In these areas, a representative profile has a surface layer of dark grayish brown gravelly

sandy loam about 3 inches thick and a subsurface layer of yellowish brown gravelly sandy loam about 4 inches thick. The subsoil, about 20 inches thick, is brown very gravelly sandy loam. The substratum, between depths of 27 and 60 inches, is strong brown very gravelly sand.

About 20 percent of this complex is areas of disturbed Joppa soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Joppa soils that have been cut or graded.

Included with this complex in mapping are areas of Brandywine gravelly loam and Sassafras gravelly sandy loam. Included areas make up about 20 percent of the mapped acreage.

Permeability is rapid in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is low in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that range from about 500 to 7,000 square feet in size. This complex has only fair potential for most building purposes because of slope. In making shallow excavations for basements or other purposes, loose gravel is generally encountered, but the gravel is not difficult to remove. The soils and fill material have only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of slope and gravelly material. Areas that are very deeply cut or excavated are generally very gravelly and droughty and, therefore, have poor potential for most types of vegetation. Most areas of this complex have poor potential for most recreational uses because of slope and limited open space.

JuD—Joppa-Urban land complex, 15 to 25 percent slopes. This complex consists of strongly sloping, well drained soils of the Joppa series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is at high elevations in upland areas of the Coastal Plain that have been urbanized. Areas are generally about 2 to 20 acres in size. Joppa soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Joppa soils. In these areas, a representative profile has a surface layer of dark grayish brown gravelly sandy loam about 3 inches thick and a subsurface layer of yellowish brown gravelly sandy loam about 4 inches thick. The subsoil, about 20 inches thick, is brown very gravelly sandy loam. The substratum, between depths of 27 and 60 inches, is strong brown very gravelly sand.

About 20 percent of this complex is areas of disturbed Joppa soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Joppa soils that have been cut or graded.

Included with this complex in mapping are areas of Brandywine gravelly loam and Sassafras gravelly sandy loam. Included areas make up about 20 percent of the mapped acreage.

Permeability is rapid in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. The available water capacity is low in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. Because of slope, this complex has poor potential for most building purposes. In making shallow excavations for basements or other purposes, loose gravel is generally encountered, but the gravel is not difficult to remove. The soils and fill material of this complex have poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of slope and gravelly material. Areas that are very deeply cut or excavated are generally very gravelly and droughty and, therefore, have poor potential for most types of vegetation. Most areas of this complex have poor potential for most recreational uses because of slope and limited open space.

KeB—Keyport fine sandy loam, 0 to 8 percent slopes. This nearly level to gently sloping, moderately well drained soil is on dissected, low-lying uplands of the Coastal Plain. Slopes are dominantly smooth, and areas are generally about 2 to 15 acres in size.

A representative profile has a surface layer of brown or dark brown fine sandy loam about 5 inches thick. The subsoil is 47 inches thick. In sequence downward, it is 7 inches of brownish yellow fine sandy loam, 9 inches of strong brown silty clay loam, 19 inches of mottled strong brown silty clay, and 12 inches of gray or light gray silty clay that has yellowish red mottles. The substratum, between depths of 52 and 60 inches, is variegated silty clay loam and thin lenses of sandy clay loam.

Included with this soil in mapping are areas of Christiana silt loam, Muirkirk Variant complex, and Sun-

nyside sandy loam. Also included are areas of soils that have a surface layer of silt loam and a few areas of severely eroded soils that have a surface layer of silty clay loam or silty clay. Included areas make up about 15 percent of the mapped acreage.

This soil has slow permeability. Runoff is slow to medium. Water is ponded on the nearly level areas in winter and early in spring. The available water capacity is high, and the hazard of erosion is moderate. In unlimed areas this soil is very strongly acid or extremely acid.

This soil has only fair potential for most building purposes because of a seasonal high water table and poor stability. Cuts or excavations in this soil are difficult to stabilize. These cuts or excavations tend to fill with water in winter or early in spring. This soil, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of this material have been known to collapse, causing severe and costly damage to property. Because of a seasonal high water table and a clayey subsoil, this soil has only fair potential for lawns, landscaping, and vegetable gardens. It has fair potential for recreational uses because of seasonal wetness.

KeC—Keyport fine sandy loam, 8 to 15 percent slopes. This moderately sloping, moderately well drained soil is on dissected uplands of the Coastal Plain. Slopes are dominantly smooth, and areas are generally about 2 to 10 acres in size.

A representative profile has a surface layer of brown or dark brown fine sandy loam about 5 inches thick. The subsoil is 47 inches thick. In sequence downward, it is 7 inches of brownish yellow fine sandy loam, 9 inches of strong brown silty clay loam, 19 inches of mottled strong brown silty clay, and 12 inches of gray or light gray silty clay that has yellowish red mottles. The substratum, between depths of 52 and 60 inches, is variegated silty clay loam and thin lenses of sandy clay loam.

Included with this soil in mapping are areas of Christiana silt loam, Muirkirk Variant complex, and Sunnyside sandy loam. Also included are several areas of soils that have a surface layer of silt loam and a few areas of severely eroded soils that have a surface layer of silty clay loam or silty clay. Included areas make up about 15 percent of the mapped acreage.

This soil has slow permeability. Runoff is medium. The available water capacity is high, and the hazard of erosion is moderate to severe. In unlimed areas this soil is very strongly acid or extremely acid.

This soil has only fair potential for most building purposes because of slope, a seasonal high water table, and poor stability. Cuts or excavations in this soil are difficult to stabilize. These cuts or excavations tend to fill with water in winter or early in spring. This soil, especially where it has been disturbed or graded, is severely limited or even dangerous for most building purposes. Because of instability the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of this material have been known to collapse, causing severe and costly damage to property. Because of slope, a seasonal high water table, and a clayey subsoil, this soil has only fair potential for lawns, landscaping, and vegetable gardens. It has only fair potential for most recreational uses because of slope.

KmB—Keyport-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping, moderately well drained soils of the Keyport series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is at low elevations in urbanized upland areas of the Coastal Plain. Areas are generally irregularly shaped and are about 2 to 35 acres in size. Keyport soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Keyport soils. In these areas, a representative profile has a surface layer of brown or dark brown silt loam about 5 inches thick. The subsoil is 47 inches thick. In sequence downward, it is 7 inches of brownish yellow fine sandy loam, 9 inches of strong brown silty clay loam, 19 inches of mottled, strong brown silty clay; and 12 inches of gray or light gray silty clay that has yellowish red mottles. The substratum, between depths of 52 and 60 inches, is variegated silty clay loam and thin lenses of sandy clay loam.

About 20 percent of this complex is areas of disturbed Keyport soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Keyport soils that have been cut or graded.

Included with this complex in mapping are areas of Christiana silt loam, Muirkirk Variant complex, and Sunnyside fine sandy loam. Also included are areas of severely eroded Keyport soils that have gray clayey material exposed at the surface. Included areas make up about 20 percent of the mapped acreage.

Permeability is slow in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is severe. Water is ponded on the nearly level areas in winter and early in spring. The available water capacity is high in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid to extremely acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. This complex has only fair potential for most building purposes because of a seasonal high water table and poor stability. Cuts or excavations are difficult to stabilize. They tend to fill with water in winter and early in spring. This complex, especially where it has been disturbed or graded, is severely limited or even dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of soil material in this complex have been known to collapse, causing severe and costly damage to property. Because of its clayey nature and seasonal high water table, this complex has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. This complex has poor potential for most recreational uses because of a seasonal high water table and limited open space.

KmC—Keyport-Urban land complex, 8 to 15 percent slopes. This complex consists of moderately sloping, moderately well drained soils of the Keyport series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is at low elevations in urbanized upland areas of the Coastal Plain. Areas are generally irregularly shaped and range from about 2 to 35 acres in size. Keyport soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Keyport soils. In these areas, a representative profile has a surface layer of brown or dark brown silt loam about 5 inches thick. The subsoil is 47 inches thick. In sequence downward, it is 7 inches of brownish yellow fine sandy loam, 9 inches of strong brown silty clay loam, 19 inches of mottled, strong brown silty clay, and 12 inches of gray or light gray silty clay that has yellowish red mottles. The substratum, between depths of 52 and 60 inches, is variegated silty clay loam and thin lenses of sandy clay loam.

About 20 percent of this complex is disturbed areas of Keyport soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces, where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Keyport soils that have been cut or graded.

Included with this complex in mapping are areas of Christiana silt loam, Muirkirk Variant complex, and Sunnyside fine sandy loam. Also included are areas of severely eroded Keyport soils that have gray clayey material exposed at the surface. Included areas make up about 20 percent of the mapped acreage.

Permeability is slow in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is high in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid to extremely acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that range from about 500 to 7,000 square feet. This complex has only fair potential for most building purposes because of a seasonal high water table, poor stability, and slope. Cuts or excavations are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This complex, especially where it has been disturbed or graded, is severely limited or is even dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of soil material in this complex have been known to collapse, causing severe and expensive damage to property. Because of its clayey nature, a seasonal high water table, and slope, this complex has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. This complex has poor potential for most recreational uses because of a seasonal high water table, slope, and limited open space.

Ld—Lindside loam. This nearly level, moderately well drained soil is in Potomac Park and on flood plains along the Potomac River. Areas are generally irregularly shaped and range from about 1 acre to 35 acres in size.

A representative profile has a surface layer of dark brown loam about 4 inches thick. The subsoil is 44 inches thick. In sequence downward, it is 2 inches of dark brown loam; 11 inches of dark brown silt loam; 6 inches of dark brown silty clay loam; and 25 inches of dark grayish brown silt loam. The subsoil is mottled throughout. The substratum, between depths of 48 and 60 inches, is dark grayish brown silt loam with dark reddish brown mottles.

Included with this soil in mapping are areas of Melvin silt loam; Udorthents; and Udifluvents, sandy. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate in this soil. Runoff is very slow, and there is little or no hazard of erosion. Some areas tend to pond after heavy rainfall. The available water capacity is high. This soil is subject to periodic flooding in winter and early in spring. Most unlimed areas are medium acid.

Because of wetness and the hazard of flooding, this soil has poor potential for use as building sites. It has only fair potential for lawns, landscaping, and vegetable

gardens and for most recreational uses because of wetness and the hazard of flooding. A large acreage of this soil is used for a golf course in Potomac Park.

Lp—Lindside silt loam, bedrock substratum. This nearly level, moderately well drained soil is on flood plains of the Potomac River, in Palisades Park near the Montgomery County line. Areas are generally 3 to 45 acres in size.

A representative profile has a surface layer of brown or dark brown silt loam about 5 inches thick. The subsoil, about 31 inches thick, is yellowish brown silt loam in the upper 24 inches and brown loam in the lower 7 inches. The lower part of the subsoil has mottles. The substratum, about 8 inches thick, is gray loam with reddish brown mottles. Hard bedrock is at a depth of 44 inches.

Included with this soil in mapping are areas of Fluvaquents-Udifluvents complex, frequently flooded; Fluvaquents, bouldery; and Melvin silt loam. Also included are a few areas of soils that are shallow or moderately deep over bedrock. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate to moderately slow, and runoff is slow. There is little or no hazard of erosion. In unlimed areas this soil is generally slightly acid.

Because of a seasonal high water table and the hazard of frequent flooding throughout the year, this soil has poor potential for most building purposes. It has poor potential for lawns, landscaping, vegetable gardens, and other kinds of vegetation because of wetness and flooding. It has poor potential for most recreational uses because of wetness and flooding. This soil is suitable for habitat for some kinds of wildlife. It should be valuable for natural areas within a densely populated area such as this survey area.

MbC—Manor loam, 8 to 15 percent slopes. This moderately sloping, well drained to somewhat excessively drained soil is on ridgetops and side slopes of strongly dissected areas of the Piedmont Plateau. Slopes are dominantly long and convex. Areas are irregularly shaped and are about 4 to 30 acres in size.

A representative profile has a surface layer of dark brown loam about 4 inches thick and a subsurface layer of yellowish brown loam about 4 inches thick. The subsoil, about 15 inches thick, is brown to dark brown silt loam in the upper part and strong brown loam in the lower part. The substratum, between depths of 23 and 60 inches, is variegated loam.

Included with this soil in mapping are areas of Ashe loam, Brandywine gravelly loam, Manor channery loam, and Glenelg silt loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate. Runoff is medium, and the hazard of erosion is severe. The available water capacity is moderate. In unlimed areas this soil is generally very strongly acid through the profile. Internal drainage is good.

This soil generally has good potential for foundations and footings. In making shallow excavations for basements or other purposes, bedrock is encountered in places, but the rock is mostly highly weathered and is not difficult to remove. Slope moderately limits this soil for most building purposes. Because of slope, moderate available water capacity, and a few small quartz fragments on the surface, it has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. It has only fair potential for most recreational uses because of slope.

MbD—Manor loam, 15 to 40 percent slopes. This strongly sloping to steep, well drained to somewhat excessively drained soil is on ridgetops and side slopes of strongly dissected areas of the Piedmont Plateau. Slopes are long and dominantly convex. Areas are irregularly shaped and are quite variable in size.

A representative profile has a surface layer of dark brown loam about 4 inches thick and a subsurface layer of yellowish brown loam about 4 inches thick. The subsoil, about 15 inches thick, is brown to dark brown silt loam in the upper part and strong brown loam in the lower part. The substratum, between depths of 23 and 60 inches, is variegated loam.

Included with this soil in mapping are areas of Joppa gravelly sandy loam, Ashe loam, and Brandywine gravelly loam. Also included are some areas of soils that have slopes of as much as 50 percent and areas of soils that have a channery surface layer. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is moderate. In unlimed areas this soil is generally very strongly acid throughout the profile. Internal drainage is good.

In making shallow excavations for basements or other purposes, bedrock is encountered in places, but the rock is mostly highly weathered and is not difficult to remove. Slope severely limits this soil for most building purposes. Because of slope, moderate available water capacity, and a few small quartz fragments on the surface, this soil has poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. This soil has poor potential for most recreational uses because of slope. It has good potential for use as parkland or as habitat for some kinds of upland wildlife.

McC—Manor channery loam, 8 to 15 percent slopes. This moderately sloping, well drained to somewhat excessively drained soil is on ridgetops and side slopes of strongly dissected areas of the Piedmont Plateau. Slopes are dominantly long and convex. The areas are irregularly shaped and are about 2 to 10 acres in size.

A representative profile has a surface layer of dark brown channery loam about 4 inches thick and a subsurface layer of yellowish brown loam about 4 inches thick. The subsoil, about 15 inches thick, is brown to dark brown silt loam in the upper part and strong brown loam in the lower part. The substratum, between depths of 23 and 60 inches, is variegated loam.

Included with this soil in mapping are areas of Ashe loam, Brandywine gravelly loam, Manor loam, and Glenelg silt loam. Also included are a few areas of soils that have slopes of less than 8 percent. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate. Runoff is medium, and the hazard of erosion is severe. The available water capacity is moderate. In unlimed areas this soil is generally very strongly acid throughout the profile. Internal drainage is good.

This soil is generally good for foundations and footings. In making shallow excavations for basements or other purposes, bedrock is encountered in places, but the rock is mostly highly weathered and is not difficult to remove. Slope moderately limits this soil for most building purposes. Because of slope, moderate available water capacity, and a channery surface layer, this soil has fair to poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. It has only fair potential for most recreational uses because of slope and a channery surface layer.

MdB—Manor-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping, well drained to somewhat excessively drained soils of the Manor series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on ridgetops and side slopes of urbanized areas of the Piedmont Plateau. Slopes are generally long and complex. Areas are generally irregularly shaped and are about 2 to 80 acres in size. Manor soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Manor soils. In these areas, a representative profile has a surface layer of dark brown loam about 4 inches thick and a subsurface layer of yellowish brown loam about 4 inches thick. The subsoil, about 15 inches thick, is brown to dark brown silt loam in the upper part and strong brown loam in the lower part. The substratum, between depths of 23 and 60 inches, is variegated loam.

About 20 percent of this complex is disturbed areas of Manor soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Manor soils that have been cut or graded.

Included with this complex in mapping are areas of Brandywine gravelly loam, Glenelg silt loam, and Ashe loam. Included areas make up about 20 percent of the complex.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. The available water capacity is moderate in the relatively undisturbed areas, and it is moderate to very low in the areas dominated by cuts, fills, and Urban land. Internal drainage is good. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. The areas generally are good for foundations and footings. In making shallow excavations for basements or other purposes, bedrock is encountered in places, but the rock is highly weathered and is not difficult to remove. This complex has good potential for most building purposes. The soils and fill material have good potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Areas that are very deeply cut or excavated are generally droughty and, therefore, have poor potential for vegetation. This complex has only fair potential for most recreational uses because of limited open space.

MdC—Manor-Urban land complex, 8 to 15 percent slopes. This complex consists of moderately sloping, well drained to somewhat excessively drained soils of the Manor series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on ridgetops and side slopes of urbanized areas of the Piedmont Plateau. Slopes are very complex and are convex or concave. Areas are generally irregularly shaped and range from 5 to 100 acres or more in size. Manor soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Manor soils. In these areas, a representative profile has a surface layer of dark brown loam about 4 inches thick and a subsurface layer of yellowish brown loam about 4 inches thick. The subsoil, about 15 inches thick, is brown to dark brown silt loam in the upper part and strong brown loam in the lower part. The substratum, between depths of 23 and 60 inches, is variegated loam.

About 20 percent of this complex is disturbed areas of Manor soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Manor soils that have been cut or graded.

Included with this complex in mapping are areas of Brandywine gravelly loam, Glenelg silt loam, and Ashe loam. Included areas make up about 20 percent of the complex.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is moderate in the relatively undisturbed areas, and it is moderate to very low in the areas dominated by cuts, fills, and Urban land. Internal drainage is good. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas between and around buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. The areas generally are good for foundations and footings. In making shallow excavations for basements or other purposes, bedrock is encountered in places, but the rock is highly weathered and is not difficult to remove. The slope moderately limits use of this complex for most building purposes. Because of slope, the soil material and fill materials have only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Areas that are very deeply cut or excavated are generally droughty and, therefore, have poor potential for vegetation. Because of slope and limited open space, this complex has poor potential for most recreational uses.

MdD—Manor-Urban land complex, 15 to 40 percent slopes. This complex consists of strongly sloping to steep, well drained to somewhat excessively drained soils of the Manor series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on ridgetops and side slopes of urbanized areas of the Piedmont Plateau. Slopes are very complex and are convex or concave. Areas are generally irregularly shaped and range from about 3 to 25 acres in size. Manor soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Manor soils. In these areas, a representative profile has a surface layer of dark brown loam about 4 inches thick and a subsurface layer of yellowish brown loam about 4 inches thick. The subsoil, about 15 inches thick, is brown to dark brown silt loam in the upper part and strong brown loam in the lower part. The substratum, between depths of 23 and 60 inches, is variegated loam.

About 20 percent of this complex is areas of disturbed Manor soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the area is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Manor soils that have been cut or graded.

Included with this complex in mapping are areas of Brandywine gravelly loam and Ashe loam. Also included are some areas of soils that have slopes of more than 40 percent. Included areas make up about 20 percent of the complex.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is very rapid, and the hazard of erosion is severe. The available water capacity is moderate in the relatively undisturbed areas, and it is moderate to very low in the areas dominated by cuts, fills, and Urban land. Internal drainage is good. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas generally make up management units that range from about 500 to 7,000 square feet in size. In making shallow excavations for basements or other purposes, bedrock is encountered in places, but the rock is highly weathered and is not difficult to remove. The slope severely limits use of this complex for most building purposes. Because of slope, the soils and fill material have poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Areas that are very deeply cut or excavated are generally droughty and, therefore, have poor potential for vegetation. Because of slope and limited open space, this complex has poor potential for most recreational uses.

MgB—Matapeake silt loam, 0 to 8 percent slopes. This nearly level to gently sloping, well drained soil is on broad, smooth uplands of the Coastal Plain. Slopes are generally long and gradual. Areas generally are irregularly shaped and range from about 1 acre to 6 acres in size.

A representative profile has a surface layer of brown to dark brown silt loam about 6 inches thick and a subsurface layer of yellowish brown silt loam about 4 inches thick. The subsoil, about 28 inches thick, is strong brown silty clay loam in the upper part and strong brown sandy clay loam in the lower part. The substratum, between depths of 38 and 60 inches, is strong brown sandy loam.

Included with this soil in mapping are areas of Beltsville silt loam, Chillum silt loam, and Sassafras sandy loam. Included areas make up about 15 percent of the mapped acreage.

This soil has moderate permeability. Runoff is slow to medium, and the hazard of erosion is moderate. The available water capacity is high. Most unlimed areas are strongly acid. Internal drainage is good.

This soil has good potential for use as building sites, for lawn grasses, shade trees, ornamental trees, shrubs, vines, vegetable gardens, and for most recreational uses.

MgC—Matapeake silt loam, 8 to 15 percent slopes. This moderately sloping, well drained soil is on broad, smooth uplands of the Coastal Plain. Slopes are generally long and gradual. Areas are generally irregularly shaped and range from about 6 to 11 acres in size.

A representative profile has a surface layer of brown to dark brown silt loam about 6 inches thick over a sub-

surface layer of yellowish brown silt loam about 4 inches thick. The subsoil, about 28 inches thick, is strong brown silty clay loam in the upper part and strong brown sandy clay loam in the lower part. The substratum, between depths of 38 and 60 inches, is strong brown sandy loam.

Included with this soil in mapping are areas of Chillum silt loam and Sassafras sandy loam. Included areas make up about 15 percent of the mapped acreage.

This soil has moderate permeability. The available water capacity is high. Runoff is high, and the hazard of erosion is moderate to severe. Most unlimed areas are strongly acid. Internal drainage is good.

Because of slope, this soil has only fair potential for use as building sites, for lawn grasses, shade trees, ornamental trees, shrubs, vines, vegetable gardens, and for most recreational uses.

MhB—Matapeake-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping, well drained soils of the Matapeake series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is in upland urbanized areas of the Coastal Plain. Areas are generally about 4 to 50 acres in size. Matapeake soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Matapeake soils. In these areas, a representative profile has a surface layer of brown to dark brown silt loam about 6 inches thick over a subsurface layer of yellowish brown silt loam about 4 inches thick. The subsoil, about 28 inches thick, is strong brown silty clay loam in the upper part and strong brown sandy clay loam in the lower part. The substratum, between depths of 38 and 60 inches, is strong brown sandy loam.

About 20 percent of this complex is areas of disturbed Matapeake soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Matapeake soils that have been cut or graded.

Included with this complex in mapping are areas of Chillum silt loam, Beltsville silt loam, and Sassafras sandy loam. Also included are a few acres of soils that have slopes of as much as 15 percent. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. The available water capacity is high in the relatively undisturbed areas of this complex, and it is variable in areas dominated by cuts, fills, and Urban land. Most unlimed areas are strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that range from about 500 to 7,000 square feet in size. This complex has good potential for most building purposes. The soils and fill material have good potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Areas that are very deeply cut or excavated are generally very sandy or gravelly and droughty and, therefore, have poor potential for vegetation. Most areas of this complex have fair potential for most recreational uses because of limited open space.

Mp—Melvin silt loam. This nearly level, poorly drained soil is on flood plains along the Anacostia and Potomac Rivers. Areas are generally irregularly shaped and range from about 2 to 50 acres in size.

A representative profile has a surface layer of brown to dark brown silt loam about 7 inches thick. The subsoil, between depths of 7 and 37 inches, is gray heavy silt loam. It is distinctly mottled. The substratum, between depths of 37 and 60 inches, is gray light silt loam and has prominent mottles.

Included with this soil in mapping are areas of Lindside loam and Dunning soils. Also included are areas of Melvin soils that contain as much as 20 inches of fill material. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in this soil. Runoff is slow, and there is little or no hazard of erosion. Some areas of this soil are subject to flooding. Most areas along the Anacostia River are protected from flooding by levees.

Because of wetness and the hazard of flooding, this soil has poor potential for building sites, landscaping, lawns, and vegetable gardens. This soil has fair to poor potential for most recreational uses. Areas along the Potomac River have good potential for use as natural areas or as habitat for some kinds of wildlife.

MvB—Muirkirk Variant complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping soils on the higher elevations of the Coastal Plain. The topography is generally a strongly dissected upland. Slopes are dominantly convex. Areas are generally irregularly shaped and are about 2 to 15 acres in size. Muirkirk Variant soils are so variable and occur together in such an intricate pattern with several other similar soils that it was not practical to separate them in mapping.

A representative profile has a surface layer of dark yellowish brown loamy sand about 5 inches thick over a subsurface layer of yellowish brown loamy sand about 6 inches thick. The subsoil, between depths of 11 and 60 inches, is strong brown sandy loam in the upper part and red clay in the lower part.

Included with this complex in mapping are areas of Keyport fine sandy loam, Christiana silt loam, and Sunnyside fine sandy loam. Also included are areas of severely eroded soils that have red or gray clay exposed at the surface, areas of soils that have sandy material at a depth of more than 60 inches, and areas of soils that have sand-

stone fragments or gravelly material at or near the surface. Included areas make up about 25 percent of the mapped acreage.

This complex has rapid permeability in the upper 31 inches and slow permeability below this depth. Runoff is slow to medium, and the available water capacity is low. There is a temporary perching or lateral movement of water on the clayey part of the subsoil.

This complex has poor potential for use as building sites because of poor stability. Cuts or excavations are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of the cuts onto roads or other areas below. This complex, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills constructed from the clayey material in this complex have been known to collapse, causing severe damage to property. Disturbed areas of this complex are highly erodible and, thus, present a pollution hazard to nearby streams if adequate sediment control devices are not installed. Because of low available water capacity, this complex has only fair potential for landscaping, lawns, and vegetable gardens. It has only fair potential for most recreational uses because of sandiness.

MvC—Muirkirk Variant complex, 8 to 15 percent slopes. This complex consists of moderately sloping soils on the higher elevations of the Coastal Plain. The topography is generally a strongly dissected upland. Slopes are dominantly convex. Areas are generally irregularly shaped and range from about 1 acre to 15 acres in size. Muirkirk Variant soils are so variable and occur together in such an intricate pattern with several other similar soils that it was not practical to separate them in mapping.

A representative profile has a surface layer of dark yellowish brown loamy sand about 5 inches thick and a subsurface layer of yellowish brown loamy sand about 6 inches thick. The subsoil, between depths of 11 and 60 inches, is strong brown sandy loam in the upper part and red clay in the lower part.

Included with this complex in mapping are areas of Keyport fine sandy loam, Christiana silt loam, and Sunnyside fine sandy loam. Included areas make up about 25 percent of the mapped acreage.

This complex has rapid permeability in the upper 31 inches and slow permeability below this depth. Runoff is medium, and the available water capacity is low. There is a temporary perching or lateral movement of water on the clayey part of the subsoil.

This complex has poor potential for use as building sites because of poor stability. Cuts or excavations in this soil are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This complex, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills constructed from the clayey material in this complex have been known to collapse, causing severe damage to property. Disturbed areas of this complex are highly erodible and, thus, present a pollution hazard to nearby streams if adequate sediment control devices are not installed. Because of slope and low available water capacity, this complex has only fair potential for landscaping, lawns, and vegetable gardens. It has only fair potential for most recreational uses because of slope and sandiness.

MvD—Muirkirk Variant complex, 15 to 40 percent slopes. This complex consists of strongly sloping to steep soils on the higher elevations of the Coastal Plain. The topography is generally a strongly dissected upland. Slopes are dominantly convex. Areas are generally irregularly shaped and range from 1 acre to 35 acres in size. Muirkirk soils are so variable and occur together in such an intricate pattern with several other similar soils that it was not practical to separate them in mapping.

A representative profile has a surface layer of dark yellowish brown loamy sand about 5 inches thick and a subsurface layer of yellowish brown loamy sand about 6 inches thick. The subsoil, between depths of 11 and 60 inches, is strong brown sandy loam in the upper part and red clay in the lower part.

Included with this complex in mapping are areas of Keyport fine sandy loam, Christiana silt loam, and Sunnyside fine sandy loam. Also included are areas of severely eroded soils that have red or gray clay exposed at the surface; areas of soils that have sandy material at a depth of more than 60 inches; areas of soils that have slopes of as much as 60 percent; and areas of soils that have sandstone fragments or gravelly material at or near the surface. Included areas make up about 25 percent of the mapped acreage.

This complex has rapid permeability in the upper 31 inches and slow permeability below this depth. Runoff is rapid, and the available water capacity is low. In some areas there is lateral movement of water on the clayey part of the subsoil.

This complex has poor potential for use as building sites because of slope and poor stability. Cuts or excavations are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This complex, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills constructed from the clayey

material have been known to collapse, causing severe damage to property. Disturbed areas are highly erodible, and this presents a pollution hazard to nearby streams if adequate sediment control devices are not installed. Because of slope and low available water capacity, this complex has poor potential for landscaping, lawns, and vegetable gardens. It has poor potential for most recreational uses because of slope and sandiness.

NeC—Neshaminy silt loam, 8 to 15 percent slopes. This moderately sloping, well drained soil is on ridgetops and side slopes of strongly dissected areas of the Piedmont Plateau. Slopes are dominantly convex. Areas are irregularly shaped and are about 2 to 9 acres in size.

A representative profile has a surface layer of dark grayish brown silt loam about 4 inches thick and a subsurface layer of yellowish brown silt loam about 5 inches thick. The subsoil is about 31 inches thick. It is 9 inches of strong brown heavy silt loam in the upper part; 16 inches of yellowish red clay loam in the middle part; and 6 inches of strong brown clay loam in the lower part. The substratum, between depths of 40 and 60 inches, is variegated loam.

Included with this soil in mapping are areas of Manor loam, Sassafras gravelly sandy loam, and Chillum silt loam. Also included are a few areas of Neshaminy soils that have a gravelly or stony surface and areas of severely eroded soils that have a surface layer of silty clay loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderately slow. Runoff is medium. The available water capacity is high, and the hazard of erosion severe. Unlimed areas are generally medium acid. Internal drainage is good.

Because of slope, this soil has only fair potential for use as building sites, for lawn grasses, shade trees, ornamental trees, shrubs, vines, vegetable gardens, and for most recreational uses.

NeD—Neshaminy silt loam, 15 to 40 percent slopes. This strongly sloping to steep, well drained soil is on side slopes of strongly dissected areas of the Piedmont Plateau. Slopes are complex. Areas are irregularly shaped and range from about 2 to 50 acres in size.

A representative profile has a surface layer of dark grayish brown silt loam about 4 inches thick and a subsurface layer of yellowish brown silt loam about 5 inches thick. The subsoil is about 31 inches thick. It is 9 inches of strong brown heavy silt loam in the upper part; 16 inches of yellowish red clay loam in the middle part; and 6 inches of strong brown clay loam in the lower part. The substratum, between depths of 40 and 60 inches, is variegated loam.

Included with this soil in mapping are areas of Sassafras gravelly sandy loam, Manor loam, and Chillum silt loam and areas of soils that have slopes of more than 40 percent. Also included are a few areas of Neshaminy soils that have a gravelly or stony surface layer and areas of severely eroded soils that have a surface layer of silty clay loam. These included areas make up about 15 percent of the mapped acreage.

Permeability is moderately slow. Runoff is rapid. The available water capacity is high, and the hazard of erosion is severe. Unlimed areas are generally medium acid. Internal drainage is good.

Because of slope, this soil has poor potential for use as building sites, for lawn grasses, shade trees, ornamental trees, shrubs, vines, vegetable gardens, and for most recreational uses. It has good potential for use as parkland or as habitat for some kinds of wildlife.

NuC—Neshaminy-Urban land complex, 8 to 15 percent slopes. This complex consists of moderately sloping, well drained soils of the Neshaminy series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on ridgetops and side slopes of urbanized areas of the Piedmont Plateau. Slopes are very complex and are convex or concave. Areas are generally about 1 acre to 13 acres in size. Neshaminy soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Neshaminy soils. In these areas, a representative profile has a surface layer of dark grayish brown silt loam about 4 inches thick and a subsurface layer of yellowish brown silt loam about 5 inches thick. The subsoil is about 31 inches thick. It is 9 inches of strong brown heavy silt loam in the upper part; 16 inches of yellowish red clay loam in the middle part; and 6 inches of strong brown clay loam in the lower part. The substratum, between depths of 40 and 60 inches, is variegated loam.

About 20 percent of this complex is areas of disturbed Neshaminy soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Neshaminy soils that have been cut or graded.

Included with this complex in mapping are areas of Chillum silt loam, Manor loam, and Sassafras gravelly sandy loam. Included areas make up about 20 percent of the complex.

Permeability is moderately slow in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is high in the relatively undisturbed areas, and it is moderate to very low in the areas dominated by cuts, fills, and Urban land. Most unlimed areas are medium acid. Internal drainage is good.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that range from about 500 to 7,000 square feet in size. The areas generally are good for foundations and footings. Severely eroded

areas and areas that have been graded are clayey and sticky on the surface. Slope moderately limits use of this complex for most building purposes. Because of slope, the soils and fill material have only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Areas that are very deeply cut or excavated are generally droughty and, therefore, have poor potential for vegetation. Because of slope and limited open space, this complex has poor potential for most recreational uses.

NuD—Neshaminy-Urban land complex, 15 to 40 percent slopes. This complex consists of strongly sloping to steep, well drained soils of the Neshaminy series, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. Slopes are very complex and are convex or concave. Areas are generally about 2 to 8 acres in size. Neshaminy soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping. This complex is on ridgetops and side slopes of urbanized areas of the Piedmont Plateau.

About 20 percent of this complex is areas of relatively undisturbed Neshaminy soils. In these areas, a representative profile has a surface layer of dark grayish brown silt loam about 4 inches thick and a subsurface layer of yellowish brown silt loam about 5 inches thick. The subsoil is about 31 inches thick. It is 9 inches of strong brown heavy silt loam in the upper part; 16 inches of yellowish red clay loam in the middle part; and 6 inches of strong brown clay loam in the lower part. The substratum, between depths of 40 and 60 inches, is variegated loam.

About 20 percent of this complex is areas of disturbed Neshaminy soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Neshaminy soils that have been cut or graded.

Included with this complex in mapping are areas of Chillum silt loam, Manor loam, and Sassafras gravelly sandy loam. Also included are areas of soils that have slopes of more than 40 percent. Included areas make up about 20 percent of the complex.

Permeability is moderately slow in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is very rapid, and the hazard of erosion is severe. The available water capacity is high in the relatively undisturbed areas of this complex, and it is moderate to very low in the areas dominated by cuts, fills, and Urban land. Most unlimed areas are medium acid. Internal drainage is good.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that generally range from about 500 to 7,000 square feet in size. Severely eroded areas and areas that have been graded are clayey and sticky on the surface. Slope severely limits use of this complex for most building purposes. Because of slope, the soils and fill material of this complex have poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Areas that are very deeply cut or excavated are generally droughty and, therefore, have poor potential for vegetation. Because of slope and limited open space, this complex has poor potential for most recreational uses.

SaB—Sassafras sandy loam, 0 to 8 percent slopes. This nearly level to gently sloping, well drained soil is on ridgetops and side slopes of strongly dissected upland areas of the Coastal Plain. Slopes are generally smooth and gradual. Areas are generally irregularly shaped and are about 2 to 15 acres in size.

A representative profile has a surface layer of very dark grayish brown sandy loam about 5 inches thick and a subsurface layer of brown sandy loam about 4 inches thick. The subsoil is about 22 inches thick. It is 11 inches of strong brown sandy loam in the upper part; 7 inches of yellowish red light sandy clay loam in the middle part; and 4 inches of strong brown sandy loam in the lower part. The substratum, between depths of 31 and 60 inches, is strong brown loamy coarse sand.

Included with this soil in mapping are areas of Chillum silt loam, Matapeake silt loam, Bourne fine sandy loam, Woodstown sandy loam, and Galestown and Rumford soils. Also included are areas of soils that have a gravelly surface layer. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate, and runoff is slow to medium. This soil has a moderate to high available water capacity. The hazard of erosion is moderate. In unlimed areas this soil is generally strongly acid or very strongly acid. Internal drainage is good.

This soil has good potential for most building purposes. It has only fair potential for lawns, landscaping, and vegetable gardens because of small stones on the surface. It has good potential for most recreational uses.

SaC—Sassafras sandy loam, 8 to 15 percent slopes. This moderately sloping, well drained soil is on ridgetops and side slopes of strongly dissected upland areas of the Coastal Plain. Slopes are generally complex. Areas are generally irregularly shaped and are about 2 to 40 acres in size.

A representative profile has a surface layer of very dark grayish brown sandy loam about 5 inches thick and a subsurface layer of brown sandy loam about 4 inches thick. The subsoil is about 22 inches thick. It is 11 inches of strong brown sandy loam in the upper part, 7 inches of yellowish red light sandy clay loam in the middle part, and 4 inches of strong brown sandy loam in the lower part. The substratum, between depths of 31 and 60 inches, is strong brown loamy coarse sand.

Included with this soil in mapping are areas of Chillum silt loam, Matapeake silt loam, Bourne fine sandy loam, and Galestown and Rumford soils. Also included are areas of soils that have a gravelly surface layer. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate in this soil, and runoff is medium. Available water capacity is moderate to high. The hazard of erosion is moderate to severe. In unlimed areas this soil is generally strongly acid or very strongly acid. Internal drainage is good.

Because of slope, this soil has only fair potential for most building purposes. It has only fair potential for lawns, landscaping, vegetable gardens, and most recreational uses because of slope and small stones on the surface.

ScB—Sassafras gravelly sandy loam, 0 to 8 percent slopes. This nearly level to gently sloping, well drained soil is on ridgetops and side slopes of strongly dissected upland areas of the Coastal Plain. Slopes are generally smooth and gradual. Areas are generally irregularly shaped and range in size from about 1 acre to 27 acres.

A representative profile has a surface layer of very dark grayish brown gravelly sandy loam about 5 inches thick and a subsurface layer of brown sandy loam about 4 inches thick. The subsoil is about 22 inches thick. It is 11 inches of strong brown sandy loam in the upper part, 7 inches of yellowish red light sandy clay loam in the middle part, and 4 inches of strong brown sandy loam in the lower part. The substratum, between depths of 31 and 60 inches, is strong brown loamy coarse sand.

Included with this soil in mapping are areas of Chillum silt loam, Bourne fine sandy loam, Joppa gravelly sandy loam, Croom very gravelly sandy loam, and Galestown and Rumford soils. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate in this soil, and runoff is slow to medium. Available water capacity is moderate to high. The hazard of erosion is moderate. In unlimed areas this soil is generally strongly acid or very strongly acid. Internal drainage is good.

This soil has good potential for most building purposes. It has a gravelly surface layer and, therefore, has only fair potential for lawns, landscaping, vegetable gardens, and most recreational uses.

ScC—Sassafras gravelly sandy loam, 8 to 15 percent slopes. This moderately sloping, well drained soil is on ridgetops and side slopes of strongly dissected upland areas of the Coastal Plain. Slopes are generally complex. Areas are generally medium to large. They are irregularly shaped and are about 2 to 25 acres in size.

A representative profile has a surface layer of very dark grayish brown gravelly sandy loam about 5 inches thick and a subsurface layer of brown sandy loam about 4 inches thick. The subsoil is about 22 inches thick. It is 11 inches of strong brown sandy loam in the upper part, 7 inches of yellowish red light sandy clay loam in the middle part, and 4 inches of strong brown sandy loam in the lower part. The substratum, between depths of 31 and 60 inches, is strong brown loamy coarse sand.

Included with this soil in mapping are areas of Chillum silt loam, Bourne fine sandy loam, Joppa gravelly sandy loam, Croom very gravelly sandy loam, and Galestown and Rumford soils. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate in this soil, and runoff is medium. Available water capacity is moderate to high. The hazard of erosion is moderate to severe. In unlimed areas this soil is generally strongly acid or very strongly acid. Internal drainage is good.

Because of slope, this soil has only fair potential for most building purposes. Because of slope and a gravelly surface layer, it has only fair potential for lawns, landscaping, vegetable gardens, and most recreational uses.

ScD—Sassafras gravelly sandy loam, 15 to 40 percent slopes. This strongly sloping to steep, well drained soil is on side slopes of strongly dissected upland areas of the Coastal Plain. Slopes are generally very complex. Areas are generally irregularly shaped and are about 2 to 20 acres in size.

A representative profile has a surface layer of very dark grayish brown gravelly sandy loam about 5 inches thick and a subsurface layer of brown sandy loam about 4 inches thick. The subsoil is about 22 inches thick. It is 11 inches of strong brown sandy loam in the upper part, 7 inches of yellowish red light sandy clay loam in the middle part, and 4 inches of strong brown sandy loam in the lower part. The substratum, between depths of 31 and 60 inches, is strong brown loamy coarse sand.

Included with this soil in mapping are areas of Chillum silt loam, Joppa gravelly sandy loam, and Croom very gravelly sandy loam. Also included are areas of soils that have slopes of more than 40 percent. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate in this soil, and runoff is rapid. Available water capacity is moderate to high. The hazard of erosion is severe. In unlimed areas this soil is generally strongly acid or very strongly acid. Internal drainage is good.

Because of slope, this soil has poor potential for most building purposes. Because of slope and a gravelly surface layer, it has poor potential for lawns, landscaping, vegetable gardens, and most recreational uses. It has good potential for use as parkland or as habitat for some kinds of wildlife.

SgB—Sassafras-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping, well drained soils of the Sassafras series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is in upland areas of the Coastal Plain that have been urbanized. Areas range from about 1 acre to 125 acres in size. Sassafras soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Sassafras soils. In these areas, a representative profile has a surface layer of very dark grayish

brown sandy loam about 5 inches thick over a subsurface layer of brown sandy loam about 4 inches thick. The subsoil is about 22 inches thick. It is 11 inches of strong brown sandy loam in the upper part, 7 inches of yellowish red light sandy clay loam in the middle part, and 4 inches of strong brown sandy loam in the lower part. The substratum, between depths of 31 and 60 inches, is strong brown loamy coarse sand.

About 20 percent of this complex is areas of disturbed Sassafras soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Sassafras soils that have been cut or graded.

Included with this complex in mapping are areas of Chillum silt loam, Joppa gravelly sandy loam, Woodstown sandy loam, Matapeake silt loam, and Croom very gravelly sandy loam. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. The available water capacity is moderate to high in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that range from about 500 to 7,000 square feet in size. This complex has good potential for most building purposes. The soils and fill material have fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Areas that are very deeply cut or excavated are generally very sandy and droughty and, therefore, have poor potential for vegetation. Most areas of this complex have only fair potential for most recreational uses because of limited open space.

SgC—Sassafras-Urban land complex, 8 to 15 percent slopes. This complex consists of moderately sloping, well drained soils of the Sassafras series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is in upland areas of the Coastal Plain that have been urbanized. Areas are generally about 2 to 100 acres in size. Sassafras soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Sassafras soils. In these areas, a representative profile has a surface layer of very dark grayish brown sandy loam about 5 inches thick and a subsurface layer of brown sandy loam about 4 inches thick. The subsoil is about 22 inches thick. It is 11 inches of strong brown sandy loam in the upper part, 7 inches of yellowish red light sandy clay loam in the middle part, and 4 inches of strong brown sandy loam in the lower part. The substratum, between depths of 31 and 60 inches, is strong brown loamy coarse sand.

About 20 percent of this complex is areas of disturbed Sassafras soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Sassafras soils that have been cut or graded.

Included with this complex in mapping are areas of Chillum silt loam, Joppa gravelly sandy loam, Matapeake silt loam, and Croom very gravelly sandy loam. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is moderate to high in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that range from about 500 to 7,000 square feet in size. This complex has only fair potential for most building purposes because of slope. The soils and fill material of this complex have only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of slope. Areas that are very deeply cut or excavated are generally very sandy and droughty and, therefore, have poor potential for most recreational uses.

SgD—Sassafras-Urban land complex, 15 to 40 percent slopes. This complex consists of strongly sloping to steep, well drained soils of the Sassafras series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is in urbanized upland areas of the Coastal Plain. Areas are generally about 1 acre to 12 acres in size. Sassafras soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Sassafras soils. In these areas, a representative profile has a surface layer of very dark grayish brown sandy loam about 5 inches thick and a subsurface layer of brown sandy loam about 4 inches thick. The subsoil is about 22 inches thick. It is 11 inches of strong brown sandy loam in the upper part, 7 inches of yellowish

red light sandy clay loam in the middle part, and 4 inches of strong brown sandy loam in the lower part. The substratum, between depths of 31 and 60 inches, is strong brown loamy coarse sand.

About 20 percent of this complex is areas of disturbed Sassafras soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Sassafras soils that have been cut or graded.

Included with this complex in mapping are areas of Chillum silt loam, Joppa gravelly sandy loam, and Croom very gravelly sandy loam. Also included are areas of soils that have slopes of more than 40 percent. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is very rapid, and the hazard of erosion is severe. The available water capacity is moderate to high in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that range from about 500 to 7,000 square feet in size. This complex has poor potential for most building purposes because of slope. Because of slope, the soil material and fill material of this complex have poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Areas that are very deeply cut or excavated are generally very sandy and droughty and, therefore, have poor potential for most types of vegetation. Because of slope and limited open space, most areas of this complex have poor potential for most recreational uses.

SmB—Sunnyside fine sandy loam, 0 to 8 percent slopes. This nearly level to gently sloping, well drained soil is on ridgetops and side slopes of strongly dissected upland areas of the Coastal Plain. Slopes are generally smooth and gradual. Areas are generally irregularly shaped and are about 3 to 25 acres in size.

A representative profile has a surface layer of dark grayish brown fine sandy loam about 2 inches thick and a subsurface layer of brown fine sandy loam about 3 inches thick. The subsoil is about 23 inches thick. It is 5 inches of yellowish red light sandy clay loam in the upper part, 10 inches of red sandy clay loam in the middle part, and 8 inches of yellowish red gravelly sandy clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is stratified red and reddish yellow loamy sand in the upper part and reddish yellow loamy very coarse sand in the lower part.

Included with this soil in mapping are areas of Muirkirk Variant complex, Keyport fine sandy loam, and Christiana silt loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate, and runoff is slow to medium. Available water capacity is moderate. The hazard of erosion is moderate. In unlimed areas this soil is generally very strongly acid.

This soil has good potential for use as building sites if deep cuts or excavations are avoided. Cuts deeper than 5 feet may encounter unstable clay. Deep cuts or excavations into this clay are difficult to stabilize, and the underlying clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This clay, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of this material have been known to collapse, causing severe and costly damage to property. This soil has good potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, vegetable gardens, and most recreational uses.

SmC—Sunnyside fine sandy loam, 8 to 15 percent slopes. This moderately sloping, well drained soil is on ridgetops and side slopes of strongly dissected upland areas of the Coastal Plain. Slopes are generally very complex. Areas are generally irregularly shaped and are about 1 acre to 16 acres in size.

A representative profile has a surface layer of dark grayish brown fine sandy loam about 2 inches thick and a subsurface layer of brown fine sandy loam about 3 inches thick. The subsoil is about 23 inches thick. It is 5 inches of yellowish red light sandy clay loam in the upper part, 10 inches of red sandy clay loam in the middle part, and 8 inches of yellowish red gravelly sandy clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is stratified red and reddish yellow loamy sand in the upper part and reddish yellow loamy very coarse sand in the lower part.

Included with this soil in mapping are areas of Muirkirk Variant complex, Keyport fine sandy loam, and Christiana silt loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate, and runoff is medium. Available water capacity is moderate. The hazard of erosion is moderate to severe. In unlimed areas this soil is generally very strongly acid.

This soil has fair potential for use as building sites if steep cuts or excavations are avoided. Cuts deeper than 5 feet may encounter unstable clay. Deep cuts or excavations into this clay are difficult to stabilize, and the underlying clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This clay, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most

building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of this material have been known to collapse, causing severe and expensive damage to property. Because of slope, this soil has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, vegetable gardens, and most recreational uses.

SmD—Sunnyside fine sandy loam, 15 to 40 percent slopes. This strongly sloping to steep, well drained soil is on side slopes of strongly dissected upland areas of the Coastal Plain. Slopes are generally very complex. Areas are generally irregularly shaped and are about 1 acre to 12 acres in size.

A representative profile has a surface layer of dark grayish brown fine sandy loam about 2 inches thick and a subsurface layer of brown fine sandy loam about 3 inches thick. The subsoil is about 23 inches thick. It is 5 inches of yellowish red light sandy clay loam in the upper part, 10 inches of red sandy clay loam in the middle part, and 8 inches of yellowish red gravelly sandy clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is stratified red and reddish yellow loamy sand in the upper part and reddish yellow loamy very coarse sand in the lower part.

Included with this soil in mapping are areas of Muirkirk Variant complex and Christiana silt loam. Also included are areas of soils that have slopes of more than 40 percent. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate in this soil, and runoff is rapid. Available water capacity is moderate. The hazard of erosion is severe. In unlimed areas this soil is generally very strongly acid.

This soil has poor potential for use as building sites because of slope. Cuts deeper than 5 feet may encounter unstable clay. Deep cuts or excavations into this clay are difficult to stabilize, and the underlying clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This clay, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of this material have been known to collapse, causing severe and costly damage to property and instances of injury and loss of life. Because of slope, this soil has poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, vegetable gardens, and most recreational uses. It has good potential for use as parkland or as habitat for some kinds of wildlife.

SpB—Sunnyside-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping, well drained soils of the Sunnyside series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is on high elevations of urbanized areas of the Coastal Plain. Areas are generally irregularly shaped and are about 3 to 9 acres in size. Sunnyside soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Sunnyside soils. In these areas, a representative profile has a surface layer of dark grayish brown fine sandy loam about 2 inches thick and a subsurface layer of brown fine sandy loam about 3 inches thick. The subsoil is about 23 inches thick. It is 5 inches of yellowish red light sandy clay loam in the upper part, 10 inches of red sandy clay loam in the middle part, and 8 inches of yellowish red gravelly sandy clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is stratified red and reddish yellow loamy sand in the upper part and reddish yellow loamy very coarse sand in the lower part.

About 20 percent of this complex is areas of disturbed Sunnyside soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Sunnyside soils that have been cut or graded.

Included with this complex in mapping are areas of Keyport fine sandy loam, Muirkirk Variant complex, and Christiana silt loam. Also included are areas of severely disturbed Sunnyside soils that have red clayey material exposed at the surface. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. The available water capacity is moderate in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid to extremely acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that generally range from about 500 to 7,000 square feet in size. This complex has good potential for most building purposes if steep cuts or excavations are avoided. Cuts deeper than 5 feet may encounter unstable clay. Deep cuts or excavations are difficult to stabilize, and the underlying clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This complex, especially where it has been severely disturbed or graded, is severely limited or even sometimes dangerous for most

building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of underlying clayey soil material have been known to collapse, causing severe and costly damage to property. This complex has good potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. This complex has only fair potential for most recreational uses because of limited open space. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed land use.

SpC—Sunnyside-Urban land complex, 8 to 15 percent slopes. This complex consists of moderately sloping, well drained soils of the Sunnyside series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is on high elevations in urbanized areas of the Coastal Plain. Areas are generally irregularly shaped and are about 2 to 75 acres in size. Sunnyside soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Sunnyside soils. In these areas, a representative profile has a surface layer of dark grayish brown fine sandy loam about 2 inches thick and a subsurface layer of brown fine sandy loam about 3 inches thick. The subsoil is about 23 inches thick. It is 5 inches of yellowish red light sandy clay loam in the upper part, 10 inches of red sandy clay loam in the middle part, and 8 inches of yellowish red gravelly sandy clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is stratified red and reddish yellow loamy sand in the upper part and reddish yellow loamy very coarse sand in the lower part.

About 20 percent of this complex is areas of disturbed Sunnyside soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Sunnyside soils that have been cut or graded.

Included with this complex in mapping are areas of Keyport fine sandy loam, Muirkirk Variant complex, and Christiana silt loam. Also included are areas of severely disturbed Sunnyside soils that have red clayey material exposed at the surface. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is moderate in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid to extremely acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that generally range from about 500 to 7,000 square feet in size. This complex has fair potential for most building purposes if steep cuts or excavations are avoided. Cuts deeper than 5 feet may encounter unstable clay. Deep cuts or excavations are difficult to stabilize, and the underlying clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This complex, especially where it has been severely disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of underlying clayey soil material have been known to collapse, causing severe and costly damage to property. This complex has only fair potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens because of slope. This complex has poor potential for most recreational uses because of limited open space and slope. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed land use.

SpD—Sunnyside-Urban land complex, 15 to 25 percent slopes. This complex consists of strongly sloping to steep, well drained soils of the Sunnyside series, most areas of which have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is on high elevations of urbanized areas of the Coastal Plain. Areas are generally irregularly shaped and are about 3 to 18 acres in size. Sunnyside soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of this complex is areas of relatively undisturbed Sunnyside soils. In these areas, a representative profile has a surface layer of dark grayish brown fine sandy loam about 2 inches thick and a subsurface layer of brown fine sandy loam about 3 inches thick. The subsoil is about 23 inches thick. It is 5 inches of yellowish red light sandy clay loam in the upper part, 10 inches of red sandy clay loam in the middle part, and 8 inches of yellowish red gravelly sandy clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is stratified red and reddish yellow loamy sand in the upper part and reddish yellow loamy very coarse sand in the lower part.

About 20 percent of this complex is areas of disturbed Sunnyside soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of this complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils

have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Sunnyside soils that have been cut or graded.

Included with this complex in mapping are areas of Muirkirk Variant complex and Christiana silt loam. Also included are areas of severely disturbed Sunnyside soils that have red clayey material exposed at the surface and areas of soils that have slopes of more than 40 percent. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is very rapid, and the hazard of erosion is severe. The available water capacity is moderate in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid to extremely acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that generally range from about 500 to 7,000 square feet in size. Because of slope, this complex has poor potential for most building purposes. Cuts deeper than 5 feet may encounter unstable clay. Deep cuts or excavations are difficult to stabilize, and the underlying clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This complex, especially where it has been severely disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged. Banks and fills of underlying clayey soil material have been known to collapse, causing severe and costly damage to property. Because of slope, this complex has poor potential for lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. It has poor potential for most recreational uses because of limited open space and slope. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed land use.

U1—Udorthents. This mapping unit is made up of very heterogenous, earthy fill material that has been placed on poorly drained to somewhat excessively drained soils on uplands, terraces, and flood plains of the Coastal Plain and Piedmont to provide sites for buildings, roads, railroads, recreation areas, and other uses. Areas range from 1 acre to about 350 acres in size. Slopes are very complex and irregular. They range from nearly level to steep but are dominantly nearly level to moderately sloping. Some areas are hummocky. The thickness of the fill is quite variable, but it is more than 20 inches. The source of fill material used in this unit is variable; consequently, the fill is a mixture of organic and inorganic waste from human activity and sandy, gravelly, clayey, silty, and micaceous soil material (fig. 15).

Miscellaneous earthy fill makes up about 80 percent of this unit. Making up the remaining percentage are areas where fills have been made by using nonsoil material, such as bricks, trash, wire, metal, boards, cinders, industrial wastes, incinerator ash, and pieces of concrete and stones, and small areas of soils that have not been significantly altered by filling.

Permeability is quite variable in this unit. The available water capacity is variable. In some areas that have been highly compacted, water tends to pond on the surface after heavy rainfall. Runoff and internal drainage are quite variable.

Many areas of this unit are almost totally covered with buildings, asphalt, concrete, or other impervious surfaces. Many of the uncovered, nearly level areas, which contain only small amounts of coarse fragments, are generally high in fertility and available water capacity and, thus, have good potential for lawns, trees, ornamental shrubs, vegetable gardens, and most recreational uses. Some of these uncovered areas are in Potomac Park, on the Mall, and on the grounds of the Capitol and the White House. Steep areas and areas containing large amounts of coarse fragments or solid waste are generally droughty and low in fertility. These areas have poor potential for almost any use. Most areas of this unit are subject to subsidence and, therefore, have poor potential for use as building sites. A detailed onsite investigation is needed to determine the potentials and limitations of these areas for any proposed use.

U2—Udorthents, gravelly. This mapping unit consists of mostly gravelly fill material that has been placed on soils of various drainage classes on uplands, terraces, and flood plains. The areas have been created to provide sites for buildings, roads, recreational facilities, and other uses. The areas range from about 2 to 17 acres in size and are almost exclusively on the Coastal Plain. Slopes are very complex and irregular. They range from nearly level to steep but are dominantly nearly level to moderately sloping. Some areas are hummocky. The thickness of the fill is quite variable but is more than 20 inches. The source of fill material in this unit is generally Croom, Chillum, or Joppa soils; consequently, the fill is a homogeneous mixture of gravelly material.

Included in mapping are small areas of Croom, Chillum, and Joppa soils and alluvial soils that were not covered during filling operations. In a few places, small areas of fill consist of nonsoil materials, such as building rubbish, cinders, industrial wastes, incinerator ash, and miscellaneous solid garbage wastes. Included areas make up about 20 percent of the mapped acreage.

Permeability is variable in this unit. The available water capacity is generally low. Internal drainage and runoff are quite variable.

Most areas of this unit are subject to subsidence and, therefore, have poor potential for use as building sites. The nearly level to gently sloping areas of this unit that are not highly compacted have fair potential for lawns, landscaping, vegetable gardens, and recreation areas. The

steep areas have poor potential for almost any kind of use. A careful onsite investigation is needed to determine the potentials and limitations of these steep areas for any proposed use.

U3—Udorthents, sandy. This mapping unit consists mostly of sandy fill material that has been placed on soils of various drainage classes on uplands, terraces, and flood plains. The areas have been created to provide sites for buildings, roads, recreational facilities, and other uses. The areas range from about 2 to 26 acres in size and are almost exclusively on the Coastal Plain. Slopes are very complex and irregular. They range from nearly level to steep but are dominantly nearly level to moderately sloping. Some areas are hummocky. The thickness of the fill is quite variable but is more than 20 inches. The sources of fill material in this unit are generally Galestown, Rumford, Sassafras, and Woodstown soils; consequently, the fill is a homogeneous mixture of sandy material.

Included in mapping are small areas of Galestown, Rumford, Sassafras, and Woodstown soils and alluvial soils that were not covered during filling operations. In a few places, small portions of fill have been made by using nonsoil materials, such as building rubbish, cinders, industrial wastes, incinerator ash, and miscellaneous solid garbage wastes. Included areas make up about 20 percent of the mapped acreage.

Permeability is variable in this unit. The available water capacity is medium to low. Internal drainage and runoff are quite variable.

Most areas of this unit are subject to subsidence and, therefore, have poor potential for use as building sites.

Nearly level to gently sloping areas of this unit that are not highly compacted have good to fair potential for lawns, landscaping, vegetable gardens, and recreation areas. Many of these areas tend to be droughty late in summer and early in fall. These areas may require irrigation if vegetable gardens, lawns, and landscaping are planned. Steep and highly compacted areas have poor potential for most uses. A careful onsite investigation is needed to determine the potentials and limitations of the areas of this unit for any proposed use.

U4—Udorthents, loamy. This mapping unit consists mostly of loamy fill material that has been placed on soils of various drainage classes on terraces, uplands, and flood plains. This unit is almost exclusively in the Piedmont. Areas range from about 1 acre to 25 acres in size. These areas have been created to provide sites for buildings, roads, recreational facilities, and other uses (fig. 16). Slopes are very complex and irregular. They range from nearly level to steep but are dominantly nearly level to moderately sloping. Some areas are hummocky. The thickness of the fill is quite variable but is more than 20 inches. The sources of fill material used in this mapping unit are Ashe, Manor, Glenelg, Beltsville, Matapeake, Neshaminy, and Brandywine soils; consequently, the fill is a homogeneous mixture of loamy material.

Included in mapping are small areas of Ashe, Manor, Brandywine, Glenelg, Beltsville, Matapeake, Neshaminy, and Codorus soils that were not covered during filling operations. In a few places, small areas of fill consist of nonsoil materials, such as building rubbish, cinders, industrial wastes, incinerator ash, and miscellaneous solid garbage wastes. Included areas make up about 20 percent of the mapped acreage.

Permeability is variable in this unit. The available water capacity is generally low to moderate. Internal drainage and runoff are quite variable.

Most areas of this unit are subject to subsidence and, therefore, have poor potential for use as building sites. The nearly level to gently sloping areas that are not highly compacted have good potential for lawns, landscaping, vegetable gardens, and recreation areas. The steep and severely compacted areas have low fertility and are droughty; consequently, these areas have poor potential for most types of vegetation. Steep areas also have poor potential for most recreational uses. A careful onsite investigation is needed to determine the potentials and limitations of the areas of this unit for any proposed land use.

U5—Udorthents, clayey. These soils consist of mostly clayey fill material that has been placed on soils of various drainage classes on uplands, terraces, and flood plains. These areas have been created to provide sites for buildings, roads, recreational facilities, and other uses. Most areas of this unit are on the Coastal Plain. Slopes are very complex and irregular. They range from nearly level to steep but are dominantly nearly level to moderately sloping. Some areas are hummocky. The thickness of the fill is quite variable but is more than 20 inches. The sources of fill material used in this unit are generally Christiana, Keyport, and Muirkirk Variant soils; consequently, the fill is a homogeneous mixture of clayey material.

Included in mapping are small areas of soils that formed in alluvium and Christiana, Keyport, and Muirkirk Variant soils, all of which were not covered during filling operations. In a few places, small areas of fill consist of nonsoil material, such as building rubbish, cinders, industrial wastes, incinerator ash, and miscellaneous solid garbage wastes. Also included are a few areas where the fill material is somewhat gravelly. Included areas make up about 20 percent of the mapped acreage.

Permeability is slow in the soils of this unit. The available water capacity is generally low. Runoff and internal drainage are quite variable. The hazard of erosion is severe.

Most areas of this unit are very unstable and are subject to subsidence and, therefore, have poor potential for use as building sites. This unit is so clayey and droughty that it has poor potential for lawns, landscaping, and vegetable gardens. It is very sticky on the surface and has poor trafficability and, thus, has poor potential for most recreational uses. A careful onsite investigation is needed to determine the potentials and limitations of these areas for any proposed use.

U6—Udorthents, smoothed. This unit consists of areas that have been altered during grading for roads, railroads, housing developments, recreation areas, and similar uses. Most of this unit is on the Coastal Plain. Areas are generally large and elongated and are commonly along four-lane highways. These areas range from about 3 to 75 acres in size. Slopes are very complex. They are nearly level to steep, ranging to more than 60 percent. The cuts and fills that make up this unit generally reflect the soils and underlying material in the adjacent areas. Cuts and fills occur together in such an intricate pattern that it was not practical to separate them in mapping.

Cuts mostly make up the steepest part of this unit. The material exposed in these cuts is generally very strongly acid geologic material of various texture. The fill in this unit is mainly made up of material removed from the cuts and is generally not so steep as the cuts. Slopes generally are complex, ranging from about 3 to 25 percent. The fill is generally a heterogeneous mixture of soil and geologic material. It can be almost any texture. It is generally highly compacted in places and is very strongly acid if not limed.

Included in mapping are natural soil areas that have not been appreciably altered by cutting and filling. Also included are a few areas that are made up entirely of cuts or entirely of miscellaneous fill material. Included areas make up about 20 percent of the mapped acreage.

Permeability, available water capacity, internal drainage, and runoff are variable.

The cut areas that have slopes of 0 to 8 percent generally have good potential for use as building sites and recreation areas. Cut areas generally are droughty and have poor potential for lawns, landscaping, and vegetable gardens. The fill areas generally are subject to subsidence and, therefore, have poor potential for use as building sites. The fill areas that are nearly level to gently sloping and that are not highly compacted generally have good to fair potential for lawns, landscaping, vegetable gardens, and recreation areas. Soils of this unit are extremely variable, and onsite investigation is needed to determine their potentials and limitations for any proposed use.

U7—Udorthents, gravelly, smoothed. This unit consists of areas that have been cut or filled during grading for roads, railroads, housing developments, recreation areas, and similar uses. Most of this unit is on the Coastal Plain. Areas generally range from about 1 acre to 28 acres in size. Slopes are very complex. They are nearly level to steep, ranging to more than 60 percent. Cuts and fills occur together in such a complex and intricate pattern that it was not practical to separate them in mapping.

The cuts commonly make up the steepest part of this unit. The material exposed in these cuts is generally very gravelly and very strongly acid. It is mainly the underlying material of Chillum, Croom, or Joppa soils. The fill in this unit is generally the material removed from areas of the cuts. The fill is generally not so steep as the cuts. Slopes generally are complex, ranging from about 3 to 25 percent. It is generally highly compacted and is extremely acid or very strongly acid if not limed.

Included in mapping are areas of soils that are somewhat clayey, areas of soils that have not been appreciably altered by cutting and filling, and a few areas that are made up entirely of cuts or entirely of gravelly fill material. Also included is 20 acres of abandoned sand and gravel pits. These pits range from 8 feet to more than 100 feet in depth. The sides of the pits generally are nearly vertical, and the bottoms are nearly level. Most of these pits have become completely revegetated. Included areas make up about 20 percent of the mapped acreage.

Permeability is variable in this unit. Runoff and internal drainage are variable. The available water capacity is generally low, and the hazard of erosion is moderate to severe.

Areas of this unit that have not been urbanized vary widely in their potentials and limitations for different uses. The nearly level to gently sloping cut areas generally have good potential for use as building sites. Very gravelly material is exposed, but this material is not too difficult to remove. These cut areas generally have only fair potential for most recreational uses because of very gravelly material. Most cut areas are very gravelly and droughty and, therefore, have poor potential for lawns, landscaping, and vegetable gardens. The fill areas of this unit generally are subject to subsidence and, therefore, have poor potential for use as building sites. The fill areas that are nearly level to gently sloping and that are not highly compacted have fair potential for lawns, landscaping, vegetable gardens, and recreation areas. This unit is so variable that onsite investigation is needed to determine its potentials and limitations for any proposed use.

U8—Udorthents, sandy, smoothed. This mapping unit consists of areas that have been cut or filled during grading for roads, railroads, housing developments, recreation areas, and similar uses. Most of this unit is on the Coastal Plain. Areas are generally about 1 acre to 36 acres in size. Slopes are very complex. They are nearly level to steep, ranging to more than 60 percent. Cuts and fills occur together in such a complex and intricate pattern that it was not practical to separate them in mapping.

The cuts mainly make up the steepest part of this unit. The material exposed in these cuts is generally sandy and very strongly acid and is mainly the underlying material from areas of Galestown, Sassafras, Rumford, and Woodstown soils. The fill is generally the material removed from the cuts. It is generally very sandy and very strongly acid. It can be almost any color. The fill is generally not so steep as the cuts. Slopes generally are complex, ranging from about 3 to 25 percent.

Included with this unit in mapping are areas that are somewhat gravelly and areas of soils that have not been appreciably altered by cutting and filling. Also included are a few areas that are made up entirely of cuts or entirely of sandy fill material. Included areas make up about 20 percent of the mapped acreage.

Permeability in this unit is moderate to rapid. Runoff is slow to rapid, and internal drainage is variable. The available water capacity is low, and the hazard of erosion is slight to moderate.

Areas of this unit that have not been urbanized vary widely in their potentials and limitations for different uses. The nearly level to gently sloping cut areas generally have good potential for use as building sites. These areas generally have fair to poor potential for lawns, landscaping, and vegetable gardens because of droughtiness. These areas generally have only fair potential for most recreational uses because of sandiness. The steep cut areas are generally poorly suited to most uses. The fill areas generally are subject to subsidence and, therefore, have poor potential for use as building sites. The nearly level to gently sloping fill areas have only fair potential for lawns, landscaping, vegetable gardens, and most recreational uses because of droughtiness and sandiness. This unit is so variable that onsite investigation is needed to determine its potentials and limitations for any proposed use.

U9—Udorthents, loamy, smoothed. This unit consists of areas that have been cut or filled during grading for roads, railroads, housing developments, recreation areas, and similar uses. This unit is mostly on the Piedmont Plateau, but a few acres are elsewhere in the survey area. Areas are about 3 to 18 acres in size. Slopes are very complex. They are nearly level to steep, ranging to more than 60 percent. Cuts and fills occur together in such an intricate pattern that it was not practical to separate them in mapping.

The cuts are generally the steepest part of this unit. The material exposed in these cuts is generally loamy and is very strongly acid. It is commonly the underlying material of the Ashe, Brandywine, Beltsville, Matapeake, Neshaminy, Manor, and Glenelg soils. The fill is generally variegated material removed from the cuts. The fill is generally not so steep as the cuts. Slopes generally are complex, ranging from about 3 to 25 percent. In some areas the fill is highly compacted.

Included with this unit in mapping are areas of soils that have not been appreciably altered by cutting and filling and areas where highly weathered schist or gneiss bedrock is exposed. Also included are a few areas that are made up entirely of cuts or entirely of loamy fill material. Included areas make up about 20 percent of the mapped acreage.

Permeability in the unit is variable. Runoff is medium to rapid, and internal drainage is variable. The available water capacity is low to moderate, and the hazard of erosion is moderate to severe.

Areas of this unit that have not been urbanized vary widely in their potentials and limitations for different land uses. The nearly level to gently sloping cut areas generally have good potential for use as building sites and recreation areas. These areas are somewhat droughty and have only fair potential for lawns, landscaping, and vegetable gardens. The steep cut areas generally are poorly suited to most land uses. The fill areas of this unit generally are subject to subsidence and, therefore, have poor potential for use as building sites. The nearly level to gently sloping fill areas that are not highly compacted have good potential for lawns, landscaping, vegetable gardens, and recreation areas. This mapping unit is so variable that potentials and limitations must be determined onsite for any proposed use.

U10—Udorthents, clayey, smoothed. This unit consists of areas that have been cut or filled during grading for roads, railroads, housing developments, recreation areas, and similar uses (fig. 17). Some areas are abandoned clay pits. Most areas of this unit are on the Coastal Plain. Areas are generally about 2 to 50 acres in size. Slopes are very complex. They are nearly level to steep, ranging to more than 60 percent. Cuts and fills occur together in such a complex and intricate pattern that it was not practical to separate them in mapping.

The cuts are generally the steepest part of this unit. The material exposed in these cuts is generally very strongly acid, very clayey and sticky, and variegated. It is commonly the underlying material of Muirkirk Variant, Sunnyside, Christiana, and Keyport soils. The fill in this unit is generally the material removed from the cuts. It is generally not so steep as the cuts. Some areas of fill are hummocky. Slopes generally are complex, ranging from about 3 to 25 percent. The fill is generally highly compacted and is extremely acid or very strongly acid if not limed.

Included with this unit in mapping are areas of soils that are somewhat gravelly or sandy and areas of soils that have not been appreciably altered by cutting and filling. Also included are a few areas that are made up entirely of cuts or of clayey fill material. Included areas make up about 20 percent of the mapped acreage.

Permeability in this unit is slow. Runoff is medium to very rapid, and internal drainage is slow. The available water capacity is low, and the hazard of erosion is severe.

The cut and fill areas of this mapping unit that have not been urbanized are so unstable, clayey, and sticky that they have poor potential for most uses. Some of the fill areas have been known to collapse, causing severe and costly damage to property. This unit is so variable that onsite investigation is needed to determine potentials and limitations for any proposed use.

U11B—Udorthents, deep, 0 to 8 percent slopes. This unit consists of areas that have been used for disposing of refuse. The areas were mainly created by placing several feet of refuse on flood plains or low-lying areas and covering the refuse with 3 to 4 feet of miscellaneous earthy fill. The largest areas of this mapping unit are at the Kenilworth and Oxon Cove landfills. Small areas of this unit are elsewhere in the survey area. Areas range from about 1 acre to 100 acres in size. Slopes are nearly level to gently sloping.

In a typical area of this unit, the surface is covered with a thin layer of sewage sludge. In many places this material has been mixed into the underlying fill material

by disking. The fill material extends to a depth of about 3 or 4 feet. It is a mixture of sandy, gravelly, clayey, silty, or micaceous soil material. It varies widely in texture over short distances. Many areas of this fill material are gravelly or stony. Most areas contain many artifacts, such as pieces of brick, glass, wood, wire, cement, and asphalt. Refuse extends from the base of the fill material to an undetermined depth. This refuse varies widely in degree of decomposition. In many areas it is raw, having undergone very little decomposition. In other areas it is slightly toasted or completely incinerated. In some places the refuse contains metallic objects, such as old bedsprings, car wheels, cans, and wire. An odor of natural gas emanates from pits dug into this refuse.

Included with this unit in mapping are a few areas where miscellaneous fill makes up the entire profile and there is no refuse in the underlying material. Also included are a few areas where the fill is somewhat thicker or thinner than 4 feet over refuse. Included areas make up about 5 percent of the mapped acreage.

Permeability is very slow in this unit. The available water capacity is low. Runoff is slow to rapid, and the hazard of erosion is moderate to severe. The upper 3 or 4 feet of this unit is very dense and compacted. Water tends to pond on the surface of nearly level areas after heavy rainfall.

This unit has poor potential for most building purposes. The refuse underlying this unit contains high levels of natural gas, which is considered a building hazard. Because of the various kinds of materials used in some of the areas of fill, some areas are subject to subsidence. Therefore, if these areas are to be used for building sites, careful onsite investigation is essential. Because of low available water capacity and a highly compacted surface, this unit has poor potential for shrubs, trees, vegetable gardens, and other vegetation. Vegetables grown on this land could receive toxic metals from the sewage sludge that is on the surface. This unit has fair to good potential for most recreational uses.

U11C—Udorthents, deep, 8 to 15 percent slopes. This unit consists of areas that have been used for disposing of refuse. The areas were mainly created by placing several feet of refuse on flood plains or low-lying areas and covering the refuse with 3 to 4 feet of miscellaneous earthy fill. The largest areas of this unit are at the Kenilworth and Oxon Cove landfills. Small acreages of this unit are elsewhere in the survey area. Areas range from about 2 to 30 acres in size and are moderately sloping.

In a typical area of this unit, the surface is covered with a thin layer of sewage sludge. In many places this material has been mixed into the underlying fill material by disking. The fill material extends to a depth of about 3 or 4 feet. It is a miscellaneous mixture of sandy, gravelly, clayey, silty, or micaceous soil material. It varies widely in texture over short distances. Many areas of this fill material are gravelly or stony. Most areas contain many artifacts, such as pieces of brick, glass, wood, wire, cement, and asphalt. Refuse extends from the base of the fill material to an undetermined depth. This refuse varies widely in degree of decomposition. In many areas it is raw, having undergone very little decomposition. In other areas it is slightly toasted or completely incinerated. In some places the refuse contains metallic objects, such as old bed springs, car wheels, cans, and wire. An odor of natural gas emanates from pits dug into this refuse.

Included with this unit in mapping are a few areas where miscellaneous fill makes up the entire profile and there is no refuse in the underlying material. Also included are a few areas where the fill is somewhat thicker or thinner than 4 feet over refuse. Included areas make up about 5 percent of the mapped acreage.

Permeability is very slow in this unit. The available water capacity is low. Runoff is rapid, and the hazard of erosion is severe. The upper 3 or 4 feet of this unit is very dense and compacted.

This unit has poor potential for most building purposes. The refuse underlying this unit contains high levels of natural gas, which is considered a building hazard. Because of the various kinds of materials used for fill, some areas are subject to subsidence. Therefore, if these areas are to be used for building sites, careful onsite investigation is essential. Because of slope, low available water capacity, and a highly compacted surface, this unit has poor potential for shrubs, trees, vegetable gardens, and other vegetation. Vegetables grown on this land could receive toxic metals from the sewage sludge that is on the surface. This unit has only fair potential for most recreational uses because of slope.

U11D—Udorthents, deep, 15 to 25 percent slopes. This unit consists of one area at the Kenilworth landfill that has been used for disposing of refuse. It has been mainly created by placing several feet of refuse on flood plains or low-lying areas and covering it with 3 to 4 feet of miscellaneous earthy fill. This area is 18 acres in size and is strongly sloping.

Typically, the surface of the area is covered with a thin layer of sewage sludge. In many places this material has been mixed into the underlying fill material by disking. The fill material extends to a depth of about 3 or 4 feet. It is a miscellaneous mixture of sandy, gravelly, clayey, silty, or micaceous soil material. It varies widely in texture over short distances. Many areas of this fill material are gravelly or stony. Most contain many artifacts, such as pieces of brick, glass, wood, wire, cement, and asphalt. Refuse extends from the base of the fill material to an undetermined depth. This refuse varies widely in degree of decomposition. In many places it is raw, having undergone very little decomposition. In other places it is slightly toasted or completely incinerated. In some places the refuse contains metallic objects, such as old bed springs, car wheels, cans, and wire. An odor of natural gas emanates from pits dug into this refuse.

Included with this unit in mapping are a few areas where miscellaneous fill makes up the entire profile and there is no refuse in the underlying material. Also included are a few areas where the fill is somewhat thicker

or thinner than 4 feet over refuse. Included areas make up about 5 percent of the mapped acreage.

Permeability is very slow in this unit. The available water capacity is low. Runoff is very rapid, and the hazard of erosion is severe. The upper 3 or 4 feet of this unit is very dense and compacted.

This unit has poor potential for most building purposes. The refuse underlying this unit contains high levels of natural gas, which is considered a building hazard. Because of the various kinds of materials used for fill, some areas are subject to subsidence. Therefore, if these areas are to be used for building sites, careful onsite investigation is essential. Because of slope, low available water capacity, and a highly compacted surface, this unit has poor potential for shrubs, trees, vegetable gardens, and other vegetation. Vegetables grown on this land could receive toxic metals from the sewage sludge that is on the surface. Because of slope, this unit has poor potential for most recreational uses.

UA—Udifluvents, sandy. This unit consists of sandy alluvium or sandy, man-deposited, dredged materials. It is on flood plains of the Coastal Plain. Many of these flood plains are manmade. Areas generally range in size from about 7 to 10 acres and are nearly level.

The soil material in this unit is unconsolidated, well drained alluvium or dredged material. Texture is generally loamy sand or sand and less extensive somewhat finer textures.

Included in mapping are areas of Iuka sandy loam and Lindside loam. Included areas make up about 10 percent of the mapped acreage.

Permeability is rapid in this unit. Runoff is slow, and there is little or no hazard of erosion. Available water capacity is low. Most unlimed areas are strongly acid. Areas of this unit that are on narrow flood plains, mostly in the southeastern part of the survey area, are generally subject to frequent flooding. Areas that are on manmade flood plains and terraces, such as Columbia Island, are very rarely, if ever, flooded.

Areas of this unit that are subject to frequent flooding have poor potential for most uses. Areas that are not subject to flooding have good potential for use as building sites. The areas of this unit have fair to poor potential for lawns, landscaping, vegetable gardens, and recreation areas because of sandiness and droughtiness. Many areas of this unit are suitable natural areas and habitats for some kinds of wildlife.

Ub—Urban land. This mapping unit consists of areas where more than 80 percent of the surface is covered by asphalt, concrete, buildings, or other impervious surfaces. Examples are parking lots, shopping and business centers, and industrial parks. These areas are throughout the survey area, but the largest are near the downtown business district and along main roads. They are on the Coastal Plain and in the Piedmont. The areas generally range from 2 acres to more than 1,000 acres in size and are nearly level to moderately sloping.

Included in mapping are large areas that are mostly miscellaneous artificial fill. In many areas, several feet of this fill have been placed over streams, swamps, flood plains, and tidal marshes. These areas are now almost totally covered with roads, buildings, or other structures. Also included are a few strongly sloping and steep areas.

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

UcB—Urban land-Beltsville complex, 0 to 8 percent slopes. This complex is made up of nearly level to gently sloping areas of Urban land and moderately well drained Beltsville soils. The soils of this complex have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is on high elevations of the Coastal Plain. Areas are generally about 5 to 100 acres in size, and slopes are long and gradual. Urban land and Beltsville soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

A typical area of this complex is about 70 percent Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces. About 5 percent is areas of relatively undisturbed Beltsville soils. In these areas, a representative profile has a surface layer of dark brown silt loam about 3 inches thick and a subsurface layer of pale brown silt loam about 8 inches thick. The subsoil, about 34 inches thick, is yellowish brown silt loam in the upper part and light olive brown loam in the lower part. The lower 24 inches of the subsoil is a very dense fragipan. The substratum, between depths of 45 and 60 inches, is variegated gravelly fine sandy loam.

Included with this complex in mapping are areas of Chillum silt loam, Bourne fine sandy loam, and Sassafras sandy loam. Also included are areas of cut and filled land and areas where slopes are as much as 15 percent. Included areas make up about 25 percent of this complex.

Permeability and internal drainage are generally slow throughout this complex. Runoff is medium to rapid, and the hazard of erosion is severe. The available water capacity is moderate in the relatively undisturbed areas, and it is generally low to very low in areas that have been highly urbanized. A seasonally perched water table is in the relatively undisturbed areas. Most unlimed areas are very strongly acid.

The few areas of this complex that are not urbanized include narrow areas between streets and sidewalks, very narrow front and back yards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these unurbanized areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of seasonal wetness, location, and size. Most building activity in this complex is on sites where old buildings have been razed. Most of the relatively unurbanized areas are in areas that receive heavy foot traffic and that are shaded by tall buildings during certain times of the day. These

areas are also seasonally wet; therefore, they have poor potential for lawn grasses, trees, shrubs, and vegetable gardens. Because of size, location, and seasonal wetness, the unurbanized areas have poor potential for most recreational uses. Onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UdB—Urban land-Brandywine complex, 0 to 8 percent slopes. This complex consists of areas of Urban land and somewhat excessively drained to excessively drained Brandywine soils that have been severely altered by grading for housing developments, shopping centers, industrial areas, and other similar uses. Areas range from about 2 to 50 acres in size and are nearly level to gently sloping. Urban land and Brandywine soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of the complex is areas of relatively undisturbed Brandywine soils. In these areas, a representative profile has a surface layer of dark grayish brown gravelly loam about 3 inches thick and a subsurface layer of yellowish brown gravelly loam about 7 inches thick. The subsoil, about 12 inches thick, is gravelly loam. The substratum, between depths of 22 and 60 inches, is variegated gravelly loamy sand.

Included with this complex in mapping are areas of Manor loam, Ashe loam, and Joppa gravelly sandy loam. Also included are a few areas of soils that have been cut or filled and areas of soils that have slopes of as much as 15 percent. Included areas make up about 25 percent of the complex.

Permeability is moderately rapid in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is severe. The available water capacity is low. Most unlimed areas are generally strongly acid.

The few areas of this complex that are not urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of location and size. Most building activity in this complex is on sites where old buildings have been razed.

Most of the relatively undisturbed areas of this complex are gravelly on the surface, are in areas where they are subject to heavy foot traffic, and are shaded by tall buildings during certain times of the day. These areas have poor potential for lawns, landscaping, and vegetable gardens. Because of limited open space, this complex has poor potential for use as recreational areas. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UeB—Urban land-Chillum complex, 0 to 8 percent slopes. This complex consists of areas of Urban land and well drained Chillum soils that have been severely altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is in upland areas of the Coastal Plain that have been urbanized. Areas range from about 2 to 130 acres in size and are nearly level to gently sloping. Urban land and Chillum soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of this complex is areas of relatively undisturbed Chillum soils. In these areas, a representative profile has a surface layer of very dark gray silt loam about 2 inches thick and a subsurface layer of pale brown silt loam about 10 inches thick. The subsoil, about 16 inches thick, is brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is strong brown gravelly sandy loam.

Included with this complex in mapping are areas of Bourne fine sandy loam, Sassafras sandy loam, and Croom very gravelly sandy loam. Also included are a few areas of soils that have been cut or filled. Included areas make up about 25 percent of the complex.

Permeability is moderate in areas of this complex where the soil is relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is severe. The available water capacity is moderate in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

The few areas of this complex that have not been urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of their location and size. Most building activity in this complex is on sites where old buildings have been razed.

Most of the relatively undisturbed areas of this complex are in areas that are subject to heavy foot traffic and that are shaded by tall buildings during certain times of the day. These areas have only fair potential for lawns and landscaping because they require shade-tolerant grasses and plants. Because of the size and location of these areas, they have fair to poor potential for vegetable gardens. Because of limited open space, this complex has poor potential for most recreational uses. An onsite investigation of this complex is needed to determine the potentials and limitations for any proposed use.

UeC—Urban land-Chillum complex, 8 to 15 percent slopes. This complex consists of areas of Urban land and well drained Chillum soils. The soils of this complex have

been severely altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is in upland areas of the Coastal Plain that have been urbanized. Areas range from about 2 to 80 acres and are moderately sloping. Urban land and Chillum soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of this complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of this complex is areas of relatively undisturbed Chillum soils. In these areas, a representative profile has a surface layer of very dark gray silt loam about 2 inches thick and a subsurface layer of pale brown silt loam about 10 inches thick. The subsoil, about 16 inches thick, is brown heavy silt loam in the upper part and yellowish red silty clay loam in the lower part. The substratum, between depths of 28 and 60 inches, is strong brown gravelly sandy loam.

Included with this complex in mapping are areas of Bourne fine sandy loam, Sassafras sandy loam, and Croom very gravelly sandy loam. Also included are a few areas of soils that have been cut or filled. Included areas make up about 25 percent of the complex.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is moderate in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

The few areas of this complex that have not been urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of location, slope, and size. Most building activity in this complex is on sites where old buildings have been razed.

Most of the relatively undisturbed areas of this complex are in areas that are subject to heavy foot traffic and are shaded by tall buildings during certain times of the day. These areas have poor potential for lawns, landscaping, and vegetable gardens because of slope and the need for shade-tolerant grasses and landscape plants. Because of limited open space, this complex has poor potential for most recreational uses. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UfB—Urban land-Christiana complex, 0 to 8 percent slopes. This complex consists of areas of Urban land and well drained Christiana soils that have been severely altered by grading for housing developments, shopping centers, industrial areas, and similar uses. It is on high elevations of urbanized areas of the Coastal Plain. Areas are generally irregularly shaped and are 3 to 20 acres in size. They are nearly level to gently sloping. Urban land and Christiana soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of this complex is areas of relatively undisturbed Christiana soils. In these areas, a representative profile has a surface layer of dark brown silt loam about 4 inches thick. The upper 6 inches of the subsoil is yellowish brown heavy silt loam. The rest of the subsoil, about 50 inches thick, is red silty clay. The substratum, between depths of 60 and 75 inches, is variegated silty clay.

Included with this complex in mapping are areas of Keyport fine sandy loam, Muirkirk Variant complex, and Sunnyside fine sandy loam. Also included are areas of severely eroded Christiana soils that have red clayey material exposed at the surface and areas of cut and fill land. Included areas make up about 25 percent of the complex.

Permeability is moderately slow to slow in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is severe. The available water capacity is high in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid to extremely acid.

The few areas of this complex that are not urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of location, size, and poor stability. Most building activity in this complex is on sites where old buildings have been razed. Cuts or excavations in this complex are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This complex, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged.

Most areas of the soils of this complex that have not been urbanized are in areas that are subject to heavy foot traffic and are shaded by tall buildings during certain times of the day. Therefore, this complex has only fair potential for lawn grasses, trees, shrubs, and vines because it requires shade-tolerant grasses and plants. Because of the size and location of the relatively unurbanized areas of this complex, they have fair to poor potential for vegetable gardens. Because of their size, lo-

cation, and clayey nature, the urbanized areas have poor potential for most recreational uses. A careful onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UfC—Urban land-Christiana complex, 8 to 15 percent slopes. This complex consists of areas of Urban land and well drained Christiana soils. The Christiana soils have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is on high elevations of urbanized areas of the Coastal Plain. Areas are generally irregularly shaped and are about 1 acre to 115 acres in size. They are moderately sloping. Urban land and Christiana soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of this complex is areas of relatively undisturbed Christiana soils. In these areas, a representative profile has a surface layer of dark brown silt loam about 4 inches thick. The upper 6 inches of the subsoil is yellowish brown heavy silt loam. The rest of the subsoil, about 50 inches thick, is red silty clay. The substratum, between depths of 60 and 75 inches, is variegated silty clay.

Included with this complex in mapping are areas of Muirkirk Variant complex, Keyport fine sandy loam, and Sunnyside fine sandy loam. Also included are areas of severely eroded Christiana soils that have red clayey material exposed at the surface and areas of cut and fill land. Included areas make up about 25 percent of the complex.

Permeability is moderately slow to slow in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is high in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid to extremely acid.

The few areas of this complex that have not been urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of slope, location, size, and poor stability. Cuts or excavations in this complex are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This complex, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged.

Most areas of the soils of this complex that have not been urbanized are in areas that are subject to heavy foot traffic and are shaded by tall buildings during certain times of the day. Because of slope and the location, these areas have poor potential for lawn grasses, trees, shrubs, vines, and vegetable gardens. Most of these areas require grasses and other vegetation that are somewhat shade tolerant. Because of slope and the lack of open space, this complex has poor potential for most recreational uses. A careful onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UkC—Urban land-Croom complex, 8 to 15 percent slopes. This complex consists of areas of Urban land and well drained Croom soils. The Croom soils have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is in urbanized areas of the Coastal Plain. Areas are generally irregularly shaped and are about 4 to 50 acres in size. They are moderately sloping. Urban land and Croom soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of this complex is areas of relatively undisturbed Croom soils. In these areas, a representative profile has a surface layer of dark brown very gravelly sandy loam about 2 inches thick and a subsurface layer of yellowish brown very gravelly sandy loam about 10 inches thick. The subsoil, about 30 inches thick, is yellowish brown very gravelly sandy loam in the upper part and strong brown or yellowish red very gravelly sandy clay loam in the lower part. The substratum, between depths of 42 and 72 inches, is strong brown very gravelly sandy loam.

Included with this complex in mapping are areas of Chillum silt loam and Sassafras gravelly sandy loam. Also included are areas of cut and fill land and areas of soils that have slopes of less than 8 percent and more than 15 percent. Included areas make up about 25 percent of the complex.

Permeability is moderate to moderately slow in areas of this complex where the soils are relatively undisturbed, and it is variable in the urbanized areas. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is low or very low throughout this complex. Most unlimed areas are very strongly acid.

The few areas of this complex that are not urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of location and size. Most building activity in this complex is on sites where old buildings have been razed.

Most of the relatively undisturbed areas of this complex have very compacted gravelly material on the surface, are located in areas that are subject to heavy foot traffic, and are shaded by tall buildings during certain times of the day. These areas have poor potential for lawns, landscaping, and vegetable gardens. Because of limited open space, this complex has poor potential for use as recreational areas. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UmB—Urban land-Galestown complex, 0 to 8 percent slopes. This complex is made up of areas of Urban land and Galestown soils. The Galestown soils have been altered by grading for housing developments, shopping centers, industrial areas, and other similar uses. This complex is on urbanized uplands and terraces of the Coastal Plain. Areas are generally irregularly shaped and are about 5 to 60 acres in size. They are nearly level to gently sloping. Urban land and Galestown soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of this complex is areas of relatively undisturbed Galestown soils. In these areas, a representative profile has a surface layer of very dark grayish brown loamy sand about 6 inches thick over a subsurface layer of dark yellowish brown loamy sand about 8 inches thick. The subsoil, about 28 inches thick, is strong brown loamy sand. The substratum, between depths of 42 and 60 inches, is dark brown and yellowish brown loamy sand.

Included with this complex in mapping are areas of Urban land-Sassafras complex, Woodstown sandy loam, and Rumford fine sandy loam. Also included are a few areas of cut and fill land. Included areas make up about 25 percent of the complex.

Permeability is rapid to very rapid in areas of this complex where the soil is relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. The available water capacity is low. Most unlimed areas are generally very strongly acid.

The few areas of this complex that are not urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of location and size. Most building activity in this complex is on sites where old buildings have been razed.

Most of the relatively undisturbed areas of this complex are somewhat droughty, are located in areas that are subject to heavy foot traffic, and are shaded by tall buildings during certain times of the day. These areas have poor potential for lawns, landscaping, and vegetable gardens. Because of limited open space, this complex has poor potential for use as recreational areas. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UoC—Urban land-Joppa complex, 0 to 15 percent slopes. This complex consists of areas of Urban land and well drained Joppa soils. The Joppa soils have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is at high elevations in upland areas of the Coastal Plain that have been urbanized. Areas generally range in size from about 10 to 85 acres and are nearly level to moderately sloping. Urban land and Joppa soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of this complex is areas of relatively undisturbed Joppa soils. In these areas, a representative profile has a surface layer of dark grayish brown gravelly sandy loam about 3 inches thick and a subsurface layer of yellowish brown gravelly sandy loam about 4 inches thick. The subsoil, about 20 inches thick, is brown very gravelly sandy loam. The substratum, between depths of 27 and 60 inches, is strong brown very gravelly sand.

Included with this complex in mapping are areas of Sassafras gravelly sandy loam, Manor channery loam, and Brandywine gravelly loam. Also included are a few areas of cut and fill land and areas of soils that have slopes of more than 15 percent. Included areas make up about 25 percent of the complex.

Permeability is rapid in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is severe. The available water capacity is low in the relatively undisturbed areas of this complex, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas of this complex are very strongly acid.

The few areas of this complex that are not urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of location and size. Most building activity in this complex is on sites where old buildings have been razed.

Most of the relatively undisturbed areas of this complex are droughty and have loose gravelly material on the surface. They are located in areas that are subject to heavy foot traffic and are shaded by tall buildings during certain times of the day. These areas have poor potential for lawns, landscaping, and vegetable gardens. Because of limited open space, this complex has poor potential for use as recreational areas. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UpB—Urban land-Keyport complex, 0 to 8 percent slopes. This complex consists of areas of Urban land and moderately well drained Keyport soils. The Keyport soils have been severely altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is at low elevations in urbanized areas on uplands of the Coastal Plain. Areas are generally irregularly shaped and range from about 2 to 50 acres in size. They are nearly level to gently sloping. Urban land and Keyport soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of this complex is areas of relatively undisturbed Keyport soils. In these areas, a representative profile has a surface layer of brown or dark brown fine sandy loam about 5 inches thick. The subsoil is about 47 inches thick. In sequence downward it is 7 inches of brownish yellow fine sandy loam; 9 inches of strong brown silty clay loam; 19 inches of mottled, strong brown silty clay; and 12 inches of gray or light gray silty clay that has yellowish red mottles. The substratum, between depths of 52 and 60 inches, is variegated silty clay loam that has thin lenses of sandy clay loam.

Included with this complex in mapping are areas of Muirkirk Variant complex, Christiana silt loam, and Sunnyside fine sandy loam. Also included are areas of severely eroded Keyport soils that have gray clayey material exposed at the surface and areas of cuts and fills. Included areas make up about 25 percent of the complex.

Permeability is slow in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is severe. The available water capacity is high in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid to extremely acid.

The few areas of this complex that are not urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of location, size, a seasonally high water table, and poor stability. Most building activity in this complex is on sites where old buildings have been razed. Cuts or excavations are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This complex, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes. Because of instability, the clay, particularly where it is under pressure or load, can squeeze out from under building foundations, allowing footings or basements to crack and settle. In extreme cases buildings have been severely damaged.

Most areas of the soils of this complex that have not been urbanized are in areas that are subject to heavy foot traffic, are shaded by tall buildings during certain times of the day, and are seasonally wet. This complex has poor potential for lawn grasses, trees, shrubs, and vines because it requires shade-tolerant grasses and plants. Because of seasonal wetness, size, and location, the relatively unurbanized areas of this complex have poor potential for vegetable gardens. Because of their size, location, and clayey nature, the urbanized areas of this complex have poor potential for most recreational uses. A careful onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UsB—Urban land-Manor complex, 0 to 8 percent slopes. This complex consists of areas of Urban land and well drained to somewhat excessively drained Manor soils. The Manor soils have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is in highly urbanized areas on the Piedmont Plateau. Areas are generally about 3 to 25 acres in size and are nearly level to gently sloping; slopes are generally long and complex. Urban land and Manor soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of the complex is areas of undisturbed Manor soils. In these areas, a representative profile has a surface layer of dark brown loam about 4 inches thick over a subsurface layer of yellowish brown loam also about 4 inches thick. The subsoil, about 15 inches thick, is brown to dark brown silt loam in the upper part and strong brown loam in the lower part. The substratum, between depths of 23 and 60 inches, is variegated loam.

Included with this complex in mapping are areas of Ashe loam, Glenelg silt loam, Brandywine gravelly loam, Sassafras sandy loam, and Joppa gravelly sandy loam. Also included are a few areas of cut and fill land. Included areas make up about 25 percent of the complex.

Permeability is moderate to moderately rapid in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is moderate in the relatively undisturbed areas, and it is moderate to very low in the areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

The few areas of this complex that have not been urbanized include narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of location and size. Most building activity in this complex is on sites where old buildings have been razed.

Most of the relatively undisturbed areas of this complex are in areas that are subject to heavy foot traffic

and are shaded by tall buildings during certain times of the day. These areas have only fair potential for lawns and landscaping because they require shade-tolerant grasses and plants. Because of size and location, these areas have fair to poor potential for vegetable gardens. Because of limited open space, this complex has poor potential for most recreational uses. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UsC—Urban land-Manor complex, 8 to 15 percent slopes. This complex consists of areas of Urban land and well drained to somewhat excessively drained Manor soils. The Manor soils have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is in highly urbanized areas on the Piedmont Plateau. Slopes are generally long and complex and are moderately sloping. Areas generally are irregularly shaped and are about 5 to 45 acres in size. Urban land and Manor soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of the complex is areas of relatively undisturbed Manor soils. In these areas, a representative profile has a surface layer of dark brown loam about 4 inches thick and a subsurface layer of yellowish brown loam also about 4 inches thick. The subsoil, about 15 inches thick, is brown to dark brown silt loam in the upper part and strong brown loam in the lower part. The substratum, between depths of 23 and 60 inches, is variegated loam.

Included with this complex in mapping are areas of Ashe loam, Brandywine gravelly loam, Glenelg silt loam, Joppa gravelly sandy loam, and Sassafras loam. Also included are areas of cut and fill land. Included areas make up about 25 percent of the complex.

Permeability is moderate to moderately rapid in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is moderate in the relatively undisturbed areas, and it is moderate to very low in the areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

The areas of this complex that have not been urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of location, slope, and size. Most building activity in this complex is on sites where old buildings have been razed.

Most of the relatively undisturbed areas of this complex are moderately sloping, are located in areas that are subject to heavy foot traffic, and are shaded by tall buildings during certain times of the day. These areas have poor potential for lawns, landscaping, and vegetable gardens because of size, location, and slope. Because of limited open space, this complex has poor potential for most recreational uses. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UxB—Urban land-Sassafras complex, 0 to 8 percent slopes. This complex consists of areas of Urban land and well drained Sassafras soils. The Sassafras soils have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is in urbanized upland areas of the Coastal Plain. Areas range from about 1 acre to 150 acres in size and are nearly level to gently sloping. Urban land and Sassafras soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of this complex is areas of relatively undisturbed Sassafras soils. In these areas, a representative profile has a surface layer of very dark grayish brown sandy loam about 5 inches thick and a subsurface layer of brown sandy loam about 4 inches thick. The subsoil is about 22 inches thick. It is strong brown sandy loam in the upper 11 inches; yellowish red light sandy clay loam in the middle 7 inches; and strong brown sandy loam in the lower 4 inches. The substratum, between depths of 31 and 60 inches, is strong brown loamy coarse sand.

Included with this complex in mapping are areas of Galestown loamy sand, Beltsville silt loam, Chillum silt loam, Bourne fine sandy loam, and Woodstown sandy loam. Also included are areas of cut and fill land. Included areas make up about 25 percent of the complex.

Permeability is moderate in areas of this complex where the soil is relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. The available water capacity is moderate to high in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

The few areas of this complex that are not urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of location and size. Most building activity in this complex is on sites where old buildings have been razed.

Most of the relatively undisturbed areas of this complex are somewhat droughty, are located in areas that receive heavy foot traffic and are shaded by tall buildings during certain times of the day. These areas have poor potential for lawns, landscaping, and vegetable gardens. Because of limited open space, this complex has poor

potential for use as recreational areas. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UxC—Urban land-Sassafras complex, 8 to 15 percent slopes. This complex consists of areas of Urban land and well drained Sassafras soils. The Sassafras soils have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is in urbanized upland areas of the Coastal Plain. Areas are generally 1 acre to 75 acres in size and are moderately sloping. Urban land and Sassafras soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of this complex is areas of relatively undisturbed Sassafras soils. In these areas, a representative profile has a surface layer of very dark grayish brown sandy loam about 5 inches thick and a subsurface layer of brown sandy loam about 4 inches thick. The subsoil is about 22 inches thick. It is strong brown sandy loam in the upper 11 inches; yellowish red light sandy clay loam in the middle 7 inches; and strong brown sandy loam in the lower 4 inches. The substratum, between depths of 31 and 60 inches, is strong brown loamy coarse sand.

Included with this complex in mapping are areas of Chillum silt loam, Bourne fine sandy loam, and Manor loam. Also included are areas of cut and fill land and areas of soils that have slopes of as much as 25 percent. Included areas make up about 25 percent of the complex.

Permeability is moderate in areas of this complex where the soil is relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is moderate to high in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid.

The few areas of this complex that are not urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of slope, location, and size. Most building activity in this complex is on sites where old buildings have been razed.

Most of the relatively undisturbed areas of this complex are moderately sloping, are somewhat droughty, are located in areas that are subject to heavy foot traffic, and are shaded by tall buildings during certain times of the day. These areas have poor potential for lawns, landscaping, and vegetable gardens. Because of slope and limited open space, this complex has poor potential for use as recreational areas. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UyC—Urban land-Sunnyside complex, 8 to 15 percent slopes. This complex consists of areas of Urban land and well drained soils of the Sunnyside series. The Sunnyside soils have been altered by grading for housing developments, shopping centers, industrial areas, and similar uses. This complex is on high elevations of highly urbanized areas of the Coastal Plain. Areas are generally about 2 to 40 acres in size and are moderately sloping. Urban land and Sunnyside soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of this complex is areas of relatively undisturbed Sunnyside soils. In these areas, a representative profile has a surface layer of dark grayish brown fine sandy loam about 2 inches thick and a subsurface layer of brown fine sandy loam about 3 inches thick. The subsoil is about 23 inches thick. It is yellowish red light sandy clay loam in the upper 5 inches; red sandy clay loam in the middle 10 inches; and yellowish red gravelly sandy clay loam in the lower 8 inches. The substratum, between depths of 28 and 60 inches, is stratified red and reddish yellow loamy sand in the upper part and reddish yellow loamy very coarse sand in the lower part.

Included with this complex in mapping are areas of Keyport fine sandy loam, Muirkirk Variant complex, and Christiana silt loam. Also included are areas of cut and fill land and areas of soils that have slopes of less than 8 percent and more than 15 percent. Included areas make up about 25 percent of the complex.

Permeability is moderate in areas of this complex where the soils are relatively undisturbed, and it is variable in areas dominated by cuts, fills, and Urban land. Runoff is rapid, and the hazard of erosion is severe. The available water capacity is moderate in the relatively undisturbed areas, and it is low to very low in areas dominated by cuts, fills, and Urban land. Most unlimed areas are very strongly acid to extremely acid.

The few areas of this complex that have not been urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of location, size, and slope. Most building activity in this complex is on sites where old buildings have been razed. Cuts deeper than 5 feet may encounter unstable clay. Deep cuts or excavations into the underlying clay are difficult to stabilize, and the clay frequently slides, slumps, or flows down the surface of cuts onto roads or other areas below. This clay, especially where it has been disturbed or graded, is severely limited or even sometimes dangerous for most building purposes.

Most of the relatively undisturbed areas of this complex are moderately sloping, are located in areas that are

subject to heavy foot traffic, and are shaded by tall buildings during certain times of the day. These areas have poor potential for lawns, landscaping, and vegetable gardens. Because of limited open space, this complex has poor potential for most recreational uses. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

UzB—Urban land-Woodstown complex, 0 to 8 percent slopes. This complex consists of areas of Urban land and well drained Woodstown soils. The Woodstown soils have been graded, cut, filled, or otherwise disturbed during urbanization. This complex is in urbanized uplands of the Coastal Plain. Areas are generally about 3 to 40 acres in size and are nearly level to gently sloping. Urban land and Woodstown soils occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 70 percent of the area is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces.

About 5 percent of the complex is areas of relatively undisturbed Woodstown soils. In these areas, a representative profile has a surface layer of brown or dark brown sandy loam about 8 inches thick and a subsurface layer of yellowish brown sandy loam about 4 inches thick. The subsoil, between depths of 12 and 40 inches, is yellowish brown sandy clay loam that has olive gray mottles in the lower part. The substratum, between depths of 40 and 60 inches, is grayish brown coarse sandy loam.

Included with this complex in mapping are areas of Sassafras sandy loam and Galestown loamy sand. Also included are areas of cut and fill land. Included areas make up about 25 percent of the complex.

Permeability is moderate in the relatively undisturbed areas of this complex, and it is variable in the disturbed areas. Runoff is medium to rapid, and the hazard of erosion is severe. The available water capacity is moderate to high in the relatively undisturbed areas, and it is generally low to very low in the urbanized areas. Most unlimed areas are very strongly acid.

The few areas of this complex that are not urbanized include narrow areas between streets and sidewalks, very narrow front yards and backyards of row houses, courtyards of apartment complexes or other large buildings, and small traffic islands and circles. The size of these unurbanized areas is generally less than 500 square feet. These areas have poor potential for use as building sites because of seasonal wetness, location, and size. Most building activity in this complex is on sites where old buildings have been razed. Most of the relatively unurbanized areas are subject to heavy foot traffic and are shaded by tall buildings during certain times of the day. These areas are also seasonally wet; therefore, they have poor potential for lawn grasses, trees, shrubs, and vegetable gardens. Because of the size, location, and seasonal wetness, this complex has poor potential for most recreational uses. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

WoB—Woodstown sandy loam, 0 to 8 percent slopes. This nearly level to gently sloping, moderately well drained soil is in upland areas of the Coastal Plain. Slopes are generally long and smooth. Areas are generally about 2 to 25 acres in size.

A representative profile has a surface layer of brown or dark brown sandy loam about 8 inches thick and a subsurface layer of yellowish brown sandy loam about 4 inches thick. The subsoil, between depths of 12 and 40 inches, is yellowish brown sandy clay loam that has olive gray mottles in the lower part. The substratum, between depths of 40 and 60 inches, is grayish brown coarse sandy loam.

Included with this soil in mapping are areas of Sassafras sandy loam and Matapeake silt loam. Included areas make up about 15 percent of the mapped acreage.

Permeability is moderate in this soil. Runoff is slow to medium. This soil has a high water table during winter and early in spring. Unlimed areas of this soil are strongly acid.

Because of a seasonal high water table, this soil has only fair potential for most building purposes. Shallow excavations for basements or other purposes have a tendency to fill with water during winter and early in spring. This soil has good potential for lawns, landscaping, and vegetable gardens. Because of seasonal wetness, this soil has only fair potential for most recreational uses.

WpB—Woodstown-Urban land complex, 0 to 8 percent slopes. This complex consists of nearly level to gently sloping, moderately well drained Woodstown soils, most areas of which have been graded, cut, filled, or otherwise disturbed during urbanization. It is in urbanized upland areas on the Coastal Plain. Areas are generally irregularly shaped and are about 2 to 30 acres in size. Woodstown soils and Urban land occur together in such an intricate pattern that it was not practical to separate them in mapping.

About 20 percent of the complex is areas of relatively undisturbed Woodstown soils. In these areas, a representative profile has a surface layer of brown or dark brown sandy loam about 8 inches thick over a subsurface layer of yellowish brown sandy loam about 4 inches thick. The subsoil, between depths of 12 and 40 inches, is yellowish brown sandy clay loam that has olive gray mottles in the lower part. The substratum, between depths of 40 and 60 inches, is grayish brown coarse sandy loam.

About 20 percent of the complex is areas of soils that have been covered by as much as 20 inches of fill material or have had as much as two-thirds of the original profile removed by cutting or grading.

About 40 percent of the complex is Urban land, where the soils are largely covered by concrete, asphalt, buildings, or other impervious surfaces; where the soils have been covered by more than 20 inches of fill material; or where most or all of the profile has been cut away. The fill material is most commonly from adjacent areas of Woodstown soils that have been cut or graded.

Included with this complex in mapping are areas of Sassafras-Urban land complex. Included areas make up about 20 percent of the mapped acreage.

Permeability is moderate in the relatively undisturbed areas of this complex, and it is variable in the disturbed areas. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. The available water capacity is moderate to high in the relatively undisturbed areas of this complex, and it is generally low to very low in the urbanized areas. Most unlimed areas of this complex are very strongly acid.

Areas of this complex that have not been urbanized include yards and open areas around and between buildings. These areas make up management units that range from about 500 to 7,000 square feet in size. Seasonal wetness moderately limits the potential of this complex for building sites. Filled areas are not so stable for foundations as the less disturbed areas. The soils and fill material have good potential for lawn grasses, shrubs, trees, and vegetable gardens. Areas that are deeply cut or excavated are generally very droughty. Because of seasonal wetness and limited open space, this complex has poor potential for most recreational uses. An onsite investigation is needed to determine the potentials and limitations of this complex for any proposed use.

Planning the Use and Management of the Soils

The soil survey is a detailed analysis and evaluation of the most basic resource of the survey area—the soil. It may be used to fit the use of the land, including urbanization, to the limitations and potentials of the natural resources and the environment and to help avoid soil-related failures in uses of the land.

During a soil survey soil scientists, conservationists, engineers, and others keep extensive notes, not only about the nature of the soils but also about unique aspects of behavior of these soils in the field and at construction sites. These notes include observations of erosion, damage to plants, flooding, soil slippage, and other factors relating the kinds of soil and their productivity, potentials, and limitations under various uses and management. In this way field experience incorporated with measured data on soil properties and performance is used as a basis for predicting soil behavior.

Information in this section will be useful in applying basic facts about the soils to plans and decisions for use and management of soils for many nonfarm uses, including building sites, highways and other transportation systems, sanitary facilities, parks and other recreational developments, and wildlife habitat. From the data presented, the potential of each soil for specified land uses may be determined, soil limitations to these land uses may be identified, and costly failures in homes and other structures, because of unfavorable soil properties, may be avoided. A site can be selected where the soil properties are favorable, or practices can be planned that will overcome the soil limitations. This soil survey, including geological data, can be useful in determining possible causes of damage to dwellings and other structures (fig. 18).

Planners and others using the soil survey can evaluate the impact of specific land uses on the environment. Plans can be made to maintain or create a land use pattern in harmony with the natural soil.

Contractors can find information useful in locating sources of sand and gravel, road fill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, trees and shrubs, and most other uses of land are influenced by the nature of the soil.

Effects of Man on the Soil

JAMES C. PATTERSON, research agronomist, Ecological Services Laboratory, National Capital Parks, Washington, D.C., prepared this section.

The only areas of soils in the District of Columbia that have been managed at all are some of the more intensively landscaped downtown parks and home lawns. Many of the park areas that have received some management have been subjected to very heavy use and sometimes overuse, so that the soils have been severely compacted.

Soils in the downtown corridor are largely manmade. Along the two major rivers of the District of Columbia many of the soils have been created from river dredgings (*6*). These soils, which have taken on the characteristics of naturally occurring alluvial soils over their approximately 80 years of existence, are relatively fertile and lend themselves to successful planting. In other areas of the District of Columbia, such as parts of Rock Creek Park and Glover-Archbold Park, the soils are largely undisturbed. The soils on the uplands of Rock Creek Park, for example, are criss-crossed by paths and trails and have received some management to control erosion. The soils within the stream valley are quite heterogeneous, particularly in localized areas where subway fill has been deposited. Some of the flood plain areas are used for picnicking and recreation and have become compacted through heavy use and have been eroded when the creek flooded. There are areas where roadway maintenance has necessitated some filling of the flood plain, thus narrowing the stream channel. This activity further restricts streamflow during flooding. Likewise, there is significant deposition of soil materials on the flood plains during flooding.

In the downtown corridor, or Mall area, much of the soil material has been imported from other areas (*26*). Much of the Mall was originally at or near sea level, and various amounts of fill have been added to the area at

various times. After each filling operation, the area was subjected to a variety of uses; it has been filled again and again to obtain a management or elevation objective. The soil profiles examined on the Mall indicate the relatively poor soil physical conditions and demonstrate their heterogeneity. Selected chemical and physical properties of some of the manmade soils discussed in this section are shown in the section "Laboratory Data."

Physical and Chemical Characteristics

The physical characteristics of soils in urban areas are distinctly different from the characteristics of the natural soils. The chemical characteristics are variable. The best measurement of the physical characteristics of soils in an urban area is bulk density. To illustrate the extreme bulk densities encountered in soils in the urban area, four typical Mall profiles were compared with ten typical agricultural soils. The range of bulk densities for the Mall soils was 1.81 to 2.18 grams per cubic centimeter (average of 2.05 grams per cubic centimeter), and the range was 1.33 to 1.66 grams per cubic centimeter (average 1.55 grams per cubic centimeter) for the agricultural soils. Bulk density indicates soil moisture and soil atmosphere relationships, thermal conductivity, percentage of pore space, and ability of plant roots to adequately penetrate the soil. When the soil becomes highly compacted, it often is droughty.

Other documented characteristics of these soils are heterogeneity from area to area; variability of content of organic matter with profile depth; unoriented coarse fragments (rocks and stones); highly variable fertility and reaction; and wide variation in the textural distribution (percentages of sand, silt, and clay) with depth in the profile.

Soil Compaction

Soil compaction is severe and causes plant stress. Soils in their natural state are composed ideally of four principal volume fractions: 45 percent mineral matter (sand, silt, and clay); 5 percent organic matter (decayed or decaying plant parts, soil organisms, and other biological matter); 25 percent soil atmosphere (a mixture of nitrogen, oxygen, and carbon dioxide); and 25 percent soil moisture (fig. 19). As depth in the natural soil profile increases, the oxygen content decreases and carbon dioxide content increases.

Similarly within the soil atmosphere of a compacted soil, there exists an inverse relationship between oxygen and carbon dioxide (fig. 20). Oxygen content can drop to 1 percent or less in extreme cases, and the carbon dioxide level can rise to 19 percent or higher (*39*, *40*). These extreme conditions can be brought about by a number of conditions such as paving over a soil surface, placing a layer of clay on the soil surface, heavy use, and flooding. Any one of these conditions can result in a change from a desired high-oxygen soil atmosphere to an undesirable low-oxygen one. Plants in general are vigorous if the soil is high in oxygen, and they tend to decline in vigor as the oxygen content decreases. A lack of oxygen, whether caused by compaction, sealing of the soil surface, or flooding, can limit plants. Once the condition is realized, it is often very expensive and difficult to correct. In some cases where mature trees exist, the condition is nearly impossible to correct because of the number of roots in the soil.

Soil Amendments

In flowerbeds or lawns, compacted conditions are most easily altered by using various soil amendments (*25*). However, the most realistic approach is to incorporate soil amendments into the soil prior to planting. The amendments should increase the organic matter content of the soil and assist the soil in resisting the deleterious long-term effects of compaction. In many areas, organic mulches can be used as needed to replace or maintain the organic material. This addition of material will gradually improve the soil. It will help to maintain good soil tilth and fertility and will assist in reducing compaction.

Soils in urban areas need modification to increase the pore space volume and thus improve the soil atmosphere and moisture relations. With increasing bulk density, there is a direct reduction of the pore space and a serious alteration of the soil atmosphere. The soil atmosphere tends toward a low-oxygen environment as opposed to the more desirable high-oxygen condition. Low-oxygen conditions can severely stress and often kill plants. Several soil amendments, organic and inorganic, have been used successfully to increase pore space and improve the soil atmosphere (*25*, *26*). The organic amendments used to improve soils include compost (aerobically composted sewage sludge and wood chips), leaf mold, wood chips, peat moss, sphagnum, and bark chips. The inorganic amendments include incinerated fly ash, expanded slate, coarse construction sand, shredded rubber tires, and similar materials. Each type of soil amendment has its use, and all of them are used for the primary purpose of improving the pore space relationships within the soil and assisting in reducing the effects of compaction.

Normally it is desirable to maintain an organic matter content of at least 5 percent. The inorganic soil amendments are usually added on a soil volume basis of between 20 and 30 percent. For some uses, such as athletic fields, coarse sand has been used to make up 99 percent of the "soil" mantle (as in Robert F. Kennedy Stadium). This type of soil amendment requires substantial management and corresponding economic support. The inorganic amendments, once incorporated into the soil surface layer, should persist over the years to reduce compaction.

Use of the Soils for Landscaping and Gardening

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land, prepared much of this section. The discussion of lawn grasses was prepared by ROBERT N. COOKE, management agronomist, National Capital Parks, National Park Service, Washington, D.C.

Table 5 lists examples of vines and ground covers, shrubs, trees, and grasses and legumes that are suitable for use on the soils indicated. Users of Table 5 should consult local nurserymen, horticulturists, landscape architects, extension agents, or library references for many additional species that can be used on the named kinds of soil. The 1972 U.S. Department of Agriculture Yearbook, "Landscape for Living" (*35*), covers many aspects of landscaping in urban areas, especially effects of heat from pavements, salts, shade, and microclimates of individual yards. This book is available in most public libraries.

Many of the soils in the District of Columbia have been disturbed to some degree during excavation for utilities and foundations for buildings and during construction of roads and walks. This is especially true of soils in Urban land complexes and soils that have been cut and filled. The species of plants in Table 5 will ordinarily do well on the specified soils unless the soil has been severely altered physically or chemically. The closer the soil is to a manmade object, the more likely this is to have happened. For instance, wood, brick, gypsum board, metal stripping, mortar, and other artifacts are commonly thrown or dumped around the foundation of a building while it is under construction. These items later find their way into the backfill around the foundation.

Practically all of the undisturbed or slightly disturbed soils in the District of Columbia are strongly acid to extremely acid and are generally suitable for acid-loving plants such as azaleas and rhododendron. However, these are commonly planted very close to foundations, where the natural soil reaction is most likely to have been severely altered during construction. For this reason, a soil reaction (pH) test should be made before making plantings around foundations or in any other area that may have been severely disturbed.

Selecting Plant Materials

The following factors, in addition to those already mentioned, need to be considered before plant materials for landscaping in the District are selected.

Shade.—Any mapping unit that is dominated by Urban land has a high density of buildings. As a result, what little soil is available between or around the buildings may be in shade much of the day. Although azaleas generally do well in these shaded locations, many of the common flowers and vegetables do poorly. Soil areas most subject to shade are by their very nature very close to foundations and were subject to extreme physical and chemical disturbance during construction. In the Urban land complexes, careful observation of shade patterns and chemical analysis of the soils are needed before plants are chosen. Lime is seldom needed in shaded areas because practically all shade-loving plants thrive in an acid soil. Some of these plants are rhododendrons, hollies, Oregon holly grape, camellia, azaleas, laurel, leucothoe, andromeda, and dogwoods. Regardless of the kind of soil indicated by the soil map, additions of peat moss, humus, or compost in and on the surface will benefit the foregoing species of shade-tolerant plants. The roots of black walnut trees are toxic to some kinds of plants, such as rhododendron. Shallow-rooted trees may draw moisture away from other plantings.

Wetness.—Except for ferns and mosses, not many plants thrive in wet soils such as Fluvaquents, Melvin silt loam, or Bibb sandy loam. Some things can be done to overcome the wetness. One is to install subsurface drainage, if the soil is permeable enough for excess water to move through the soil to the drain tile. Another approach is to bring in new soil and use raised beds to get a satisfactory rooting zone. In other places, the problem may be runoff from adjacent slopes accumulating as ponded water on low-lying plantings. In urban areas, alleviating wetness is sometimes difficult because of property line restrictions that limit the alternatives. With the consent of neighbors and advice from a soil conservationist, the problem may be solved.

Restricted root zone.—Generally, soils with a restricted root zone do not hold enough moisture for plants throughout the growing season. In urban areas there can be many such restrictions that cause failures or poor growth characteristics but that are not suspected until an investigation discloses impermeable barriers such as chunks of asphalt or concrete covered by grading and filling or by soil eroding or slipping in through the years. This can happen near the foot slopes of the Christiana or Muirkirk soils, for example, or in Urban land complexes of soils that are especially susceptible to slipping.

If any soil in the Beltsville, Bourne, Chillum, Christiana, or Croom series has been severely graded during construction, the dense, compact layers in the subsoil may have been exposed or left within a few inches of the surface. Shrubs, lawns, trees, and gardens planted under these conditions are likely to do poorly. Roots cannot penetrate the dense layers, and therefore plants have a very limited amount of available moisture during dry seasons and are susceptible to frost heave during freezing and thawing. Also, the exposed subsoil is a very poor medium to till because it is excessively clayey or otherwise compact. Slopes of these soils may contribute runoff or seepage to driveways and walks, causing wet, messy conditions in warm weather and ice hazards in winter.

Where root-restricting layers are near the surface, the root zone can be thickened by adding topsoil and by mixing as much organic matter as possible into the original soil. This will also increase the moisture holding capacity of the soil.

Compaction.—A noncompacted soil with good structure is about 50 percent actual mineral soil and 50 percent pore space. When the soil is in good condition for digging, about half of the pore space is filled with water. Therefore, most tilling of soil is done when the soil is about 50

percent mineral solids (soil), 25 percent air, and 25 percent water. In a highly compacted soil, the pore space has been greatly reduced by the weight of machinery or foot traffic forcing mineral soil solids into the pore space. As a result, the soil holds less air and water and is less permeable.

Any soil that is either naturally compact or has been mechanically compacted provides a very poor environment for roots, which is reflected in the poor quality of the part of the plant above ground. Some of the poorest mediums for plant growth are soils of the Beltsville, Bourne, Christiana, Croom, and Keyport series that have had their surface layer removed during grading, exposing the dense, firm subsoil that resists root penetration, absorbs little if any rainfall, and causes excessive runoff. These conditions are extensive where these soils are in Urban land complexes. Every effort should be made to incorporate organic matter in at least the upper 12 inches of a compacted soil and then keep it well covered with mulch that will protect it from future compaction by foot traffic. This can be pine bark, wood chips, or other locally available material.

Salt pollution.—Salts occur naturally in soils and water and may be considered pollutants only when man introduces extraneous salts, as when salt is used to deice walks, driveways, city streets, and highways (*17*). These salts can injure plants. Salt injury should be suspected wherever a planting is within splash distance of streets and gutters or where runoff from driveways and walks flows onto or over the planted area.

What are the symptoms of salt injury? On trees, shrubs, and vines, burns develop on the tips or margins of leaves and the burned leaves often drop off the plant. This may be followed by dieback of stems and eventual death of the plants. On nonwoody plants, the leaves, stems, flowers, and fruits are generally smaller. Stunting and, in extreme cases, death of plants are usually the only observable effects on most nonwoody plants.

Salt concentration in water draining off highways and streets can be so high that no plant adapted to the area may be able to survive. However, there are some that are more tolerant than others. Bermudagrass is able to tolerate salt concentrations about 10 times as great as those tolerated by the most sensitive species, such as African-violet, rose, and strawberry. Most shrubs are moderately tolerant of salt. The most sensitive include Algerian ivy, Burford holly, and rose. Among trees, black locust and honey locust are tolerant. Blue spruce and white pine are relatively sensitive, but ponderosa pine, eastern redcedar, white oak, red oak, spreading juniper, and arborvitae are moderately tolerant.

If salt injury is suspected, leaching is one way of reducing the salt concentration to below the injurious level. Leaching consists of applying more water to the planted area than can evaporate or be used by the plant. If the excess water can drain away below the roots, it will carry with it the excess, unwanted salts. This is effective on some soils but not on others. It works reasonably well on the well drained to excessively drained, permeable soils of the Ashe, Bibb, Brandywine, Galestown, Glenelg, Iuka, Joppa, Manor, Matapeake, Rumford, Sassafras, and Sunnyside series and on the sandy or loamy Udorthents and the sandy Udifluvents. The soil must have good internal drainage and not be severely compacted. On slowly permeable soils such as Beltsville, Bourne, Christiana, Croom, and Keyport soils, application of excess water may leach the salts into the slowly permeable subsoil, where they are likely to precipitate out and accumulate in the root zone.

One should not too quickly assume salt damage. Plantings most susceptible to salt damage, as at intersections, traffic circles, and corner sidewalks, are also most susceptible to heavy pedestrian traffic and trampling. Both salt damage and pedestrian damage should be considered.

Air pollution.—Air pollution can be very distressing, and the damage to many ornamentals is often serious. Furthermore, the symptoms may be mistaken for those caused by diseases, insects (*37*), or soil limitations.

Two of the most pernicious pollutants in the District of Columbia are ozone and PAN (peroxyacetal nitrate), both of which are photochemical pollutants. Oxides of nitrogen in the air, in the presence of sunlight, react with oxygen to form ozone. Similarly, PAN is formed in sunlight by the chemical combination of nitrogen oxides with hydrocarbons in the atmosphere.

General symptoms of ozone and PAN injury are spotted, streaked, and bleached leaves. Plant growth is also retarded, and early leaf drop sometime occurs.

Among the annuals most sensitive to ozone are geraniums, petunia, and wax begonia. Coleus, sultana, and garden verbena show only intermediate sensitivity. Kinds of annuals susceptible to PAN injury include China aster, petunia, and sultana; relatively resistant to it are balsam, calendula, coleus, Madagascar periwinkle, and wax begonia.

As a general rule, small-leaved plants are more resistant to air pollutants than large-leaved plants. Also, slow growing plants are more resistant than rapidly growing plants that have soft tissues.

Air pollution affects the plant more than it affects the soil in which it grows. Therefore, air pollution cannot be directly correlated with kinds of soil, unless a named kind of soil coincidentally occurs in an area of maximum air pollution. This is not the case in the District of Columbia. However, the discussion in this section is necessary to alert the reader that air pollution is a possible explanation for plant damage.

Use of the Soils for Flower and Vegetable Gardens

This use was not included in Table 5, because the list of adapted flowers and vegetables is extensive, and most of them have about the same soil requirements (fig. 21). So rather than attempt to provide a list of species suitable for each kind of soil, the characteristics for a good garden

soil are discussed, as well as the soils in the District that have those characteristics and those that do not.

The basic requirement for gardens is a nearly level or gently sloping, loamy, permeable soil with adequate aeration but medium to high available water capacity. The pH should be generally between 6.0 and 7.0. Soils in the District of Columbia are naturally strongly acid to extremely acid and require liming, except Lindside, Melvin, and Dunning soils along the Potomac and Anacostia Rivers. The amount of lime to be added should be determined by soil tests.

The soils in the District of Columbia that are well suited to flower and vegetable gardens are the nearly level or gently sloping Chillum silt loam, Glenelg loam, Manor loam, Matapeake silt loam, Neshaminy silt loam, Sassafras sandy loam, and Sunnyside fine sandy loam where undisturbed or only slightly disturbed (fig. 22). All of these soils are deep, well drained, and easily tilled and have moderate to high available water capacity.

Ashe, Brandywine, Croom, Joppa, channery Manor, and gravelly Sassafras soils are less desirable because they contain many fine to coarse pebbles or rock fragments that make tillage somewhat difficult and because available water capacity is less than optimum.

Beltsville, Bourne, Glenelg Variant, Keyport, and Woodstown soils are only moderately well drained. Planting in spring may be delayed 2 to 4 weeks after the frost-free dates because of wetness. Once these soils dry out, they are easy to till.

Soils of the Codorus, Iuka, and Lindside series are also moderately well drained but are subject to flooding in most places, making gardening risky in most years.

Bibb, Dunning, Fallsington, and Melvin soils and Fluvaquents are too wet for most flowers and vegetables. Except for Fallsington soils, these soils are subject to flooding. These soils occupy low positions on the landscape, many of which are frost pockets.

Galestown, Rumford, and Muirkirk Variant soils and the sandy Udifluvents are extremely sandy throughout. Although they are the earliest to warm up in spring, they hold inadequate moisture to carry flowers and vegetables through the growing season without irrigation. They are probably the best suited of all soils in the survey area for raising melons in home gardens.

If Christiana soils are to be used for gardens, it is essential that the silt loam surface layer be maintained. Below a depth of about 10 to 12 inches, the soil is a dense, sticky, plastic, red clay that is difficult to dig and cultivate, either by hand or with power equipment. It is a poor seedbed, and seed germination in it is generally poor. Once the red clay is exposed at the surface, there are only a few days each year that the soil is not either too wet and sticky or too hard and dry to work. Gardens should not be planted on strongly sloping Christiana soils. Stripping the permanent vegetation from these soils and tilling them may cause the entire slope to slip.

If urbanized (disturbed or graded) areas of Christiana soils are to be used for gardens, large amounts of organic material such as peat, compost, and other plant residue must be annually rototilled or spaded into the clayey surface layer. Winter cover crops should also be used.

The District of Columbia has a community gardening program that uses a number of open areas throughout the District. The government is often the guardian of vacant property and has responsibility for making best use of it. Urban gardening on selected government-owned parcels of land is one way of executing this responsibility. Bringing vacant lots into cultivation through gardening destroys weeds and debris that harbor vermin. It is necessary, however, that the gardens be well kept and harvested on time to avoid attracting vermin.

Inner-city gardens have a few problems that some gardens in more open areas do not. They are more likely to be detrimentally influenced by shade cast by buildings, by overhanging tree canopies, by root systems from nearby trees, and by shrubs sapping moisture away from the garden area during critical dry periods. On the other hand, many of the inner-city gardens have better access to irrigation water from hydrants and from spigots at dwellings and are less susceptible to killing frosts in spring and fall.

Air pollution damage to plants in gardens has been observed at some locations, such as at Fort Lincoln and other inner-city gardens.

Those interested in participating in a community gardening program can contact the Cooperative Extension Service at Washington Technical Institute or the National Capitol Parks of the National Park Service.

Vines and Ground Cover

In urban areas there are many places where the ground should be covered with plants but, because of topography, shade, or other conditions, it is not practical to grow grass. Even if grass will grow, other factors may make it more practical to use some other plant for ground cover.

A ground cover plant should grow under adverse conditions to which it may be subjected; it should grow rapidly enough to cover and protect the area; it should be easily propagated; and generally it should be low-growing and not be seriously injured if walked on (*37*).

In Table 5, the column "Vines and Ground Cover" lists a few of the more common vines and ground cover plants that will tolerate the properties of the soils rated. There are many more plants that could be listed if room were available. These additional species can be determined from library or Extension Service references. The same references should be consulted for adaptability of the plants to special conditions such as shade, sun, or steep slopes. These are especially important considerations for soils mapped in Urban land complexes, where multistory buildings may shade an area most of the day or where steep, dry slopes have been created by intensive grading and excavation.

Planting Trees and Shrubs

Table 5 names a few of the trees and shrubs that can be grown on the soils of the District of Columbia. Before the shrub or tree can begin growing, it must first be planted in a manner to permit survival. Soil preparation for planting is even more critical in urban areas where the soils have been severely disturbed than in the country or suburbs where there has been less soil disturbance.

In the soil complexes dominated by Urban land, the original soil material has, in many places, been graded, cut, filled, compacted, or all of these things. The soils also may have been chemically altered by salts, oil, lime, or other elements of the building trade. To avoid the risk of losing an expensive ornamental plant in these areas, one should consider backfilling around the root system with good hauled-in topsoil (*35*). This is also a good way of assuring that the roots have a good moisture-holding medium around them while the tree or shrub is becoming established.

Even where there has been little disturbance, there may be benefits from replacing excavated material from the subsoil of the Beltsville, Bourne, Chillum, Christiana, Croom, Galestown, Joppa, and Rumford soils with a good loam or silt loam topsoil.

Trees and Shrubs for Noise Abatement

Noise from moderate-speed car traffic in urban areas where the interaction of tires and roadway is the principal cause of noise can be reduced by planting 20- to 50-foot-wide belts of trees and shrubs, with the edge of the belt from 20 to 50 feet from the center of the nearest traffic lane. Shrubs 6 to 8 feet tall should be used next to the traffic lane, backed up by rows of trees 15 to 30 feet tall (*9*).

For best results, trees and shrubs should be planted close to the noise source rather than close to the area that needs protection. Where year-round noise screening is desired, evergreens or deciduous varieties that retain their leaves most of the year are recommended. Very thinly planted trees and trees in poor condition as a result of neglect or unfavorable growth environment offer little resistance to the passage of sound.

A knowledge of out-of-door sound propagation, aided by experience, is necessary to make valid judgments on the use of trees and shrubs as sound barriers. Once the general requirements are known, appropriate species can be selected by discussing with a nurseryman the kind of soil at the location, as shown on the soil map and as described in this report, and referring to the example list of trees and shrubs in Table 5. Although the best species for this purpose may not be in the list, by comparison the nurseryman will be able to determine if the species he has in mind will be suitable for the soil.

Lawn Grasses

The District of Columbia is in the heart of the crabgrass belt—the transition zone between the areas of adaptation of warm season grasses and cool season grasses. Neither kind of grass is well adapted to the area, but the turf grower has the opportunity to use both warm and cool season grasses. The following paragraphs discuss several aspects of growing lawn grasses in the District of Columbia.

Grasses for shaded areas.—Two factors complicate growing turf in shade: the lower light intensity, with its effect on physiological development, and competition of the trees for water and nutrients. The shade producers also commonly restrict air movement or drainage and thereby create humid, disease-favoring conditions. Shade has the advantage of moderating temperature.

Where the landscape plan calls for turf in shade, steps should first be taken to minimize the effect of that shade by removing unnecessary trees, pruning remaining trees to let in as much light as possible, immediately removing fallen leaves and branches, and otherwise practicing good management. This is especially necessary in the Urban land-soil complexes where so many buildings cast so much shade. Good management practices include using shade-tolerant grasses, using minimum amounts of nitrogen when trees are in leaf but maintaining an adequate level of nutrients for both trees and grass, maintaining nearly neutral reaction, irrigating deeply but infrequently, and in severe cases using fungicides.

Of the shade tolerant grasses, red fescue is most tolerant, and it should be included in any grass mixture for shaded conditions. Pennlawn red fescue is one of the better shade grasses. Chewing fescue is slightly less tolerant than red fescue. In the climatic transition zone, Kentucky bluegrass is favored by open shade and should also be included in any mixture for use in shade. When two or more bluegrasses are to be included, one should be selected for shade tolerance and resistance to powdery mildew. A-34, Aquila, Delta, Glade, Parade, and Sydsport are varieties of Kentucky bluegrass that have demonstrated these characteristics.

Grasses for sunny locations.—In full sun the problems of the transition zone are most apparent. A wide range of grasses can be grown. Warm season grasses such as bermudagrass and zoysia can be grown as well as cool season bluegrasses, bentgrasses, fine fescue, and coarse fescue.

Bermudagrass and zoysia do well in full sun during the summer. If these grasses are properly managed, winter survival is seldom a problem; however, winter dormancy causes these grasses to be brown for approximately 6 months each year. They are intolerant of traffic and heavy use during this period, but they can be overseeded with ryegrass for limited winter use.

Where summer use and reflected heat from adjacent buildings or pavement are not excessive, bluegrass does well. For best results, two or three varieties of bluegrass should be mixed with red fescue; no more than half the mixture should be fescue.

Kentucky-31 tall fescue is particularly well adapted to this area. It is resistant to most diseases and insects. It

tolerates the summer heat better than the other cool season grasses, and it does not have the long winter dormancy of the warm season grasses. Kentucky-31 tall fescue is one of few grasses that will grow in soil infested with common bermudagrass and not be crowded out by the bermudagrass. Kentucky-31 is a coarse textured grass, too coarse for some uses and tastes. It also is a bunchgrass, so if the turf of Kentucky-31 tall fescue is injured recovery is very slow. For best appearance Kentucky-31 must be sown at a high rate (5 pounds per 1,000 square feet) and 5 to 20 percent of the mixture should be Kentucky bluegrass.

Grasses for visual effect.—Lawns maintained for visual effect can be divided into two groups: those seen from a low angle at speed or from a distance, and those seen from a high angle at close range. For the first group any species which can be mowed and will control erosion is satisfactory. The second group is the generally small picture lawn in which every blade can be seen. Traffic is usually minimal on these lawns. In full sun, where high temperatures are anticipated, zoysia and more slowly growing turf varieties of bermudagrass are recommended. Colorants can be used to provide greenness during winter. For other show areas bluegrass and red fescue may be recommended for sun or partial shade.

Grasses for heavy use areas.—Heavy traffic causes problems by directly damaging the grass plants and indirectly by compacting the soil, thereby excluding air and water from the roots.

One of the most common forms of high traffic area is the shortcut or path. In these areas serious consideration should be given to paving a walkway on a smaller scale—stepping stones or gravel walks will often be sufficient—or redesigning the area so that traffic will naturally use existing paved walks. In relatively sheltered locations, where soil blowing is not a problem, wood chips can be used.

Larger areas such as ball fields, play areas, and other areas where turf is desired require wear-resistant grass and soil treatment to withstand the effects of compaction.

Only two grasses are suitable for these heavy duty areas; Kentucky-31 tall fescue for all-season use and Turfcote or U-3 bermudagrass where primary use will be in warm weather. With either, it is necessary to maintain the reaction near neutral, maintain adequate levels of phosphate and potash, and supply moderate amounts of nitrogen so that growth is vigorous but not lush. Soil treatment includes amendments, which are discussed elsewhere, and mechanical treatments such as vertical slicing and aeration to physically loosen the soil.

Capability Classification

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. This classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineerng purposes. Because the District of Columbia is an all-urban survey area, the soils were not grouped into capability units.

In the capability system, all kinds of soils are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, 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 require moderate conservation practices.

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

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

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

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 landforms have limitations that nearly preclude their use for commercial plants.

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

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

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

tivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

Engineering

RICHARD R. NAGLE, assistant conservation engineer, Soil Conservation Service, College Park, Maryland, assisted in preparing this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction materials, and water management. Among those who can benefit from this section are engineers, landowners, community decision makers and planners, town and city managers, land developers, builders, and contractors.

The ratings in tables in this section are based on test data and estimated data in the "Soil Properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by the soil survey and used in determining the ratings in this section are grain-size distribution, liquid limit, plasticity index, soil reaction, depth to and hardness of bedrock within 5 or 6 feet of the surface, soil wetness characteristics, depth to a seasonal water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

Based on the information assembled about soil properties, ranges of values may be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values may be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to—(1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternate routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternate sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations and testing.

The information is presented mainly in tables. Table 6 shows, for each kind of soil, ratings of the degree and kind of limitations for building site development; table 7, for sanitary facilities; and table 9, for water management. Table 8 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have different meanings in soil science and in engineering; the Glossary defines many of these terms.

Building Site Development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 6. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by the soil wetness of a high seasonal water table, the texture and consistence of soils, the tendency of soils to cave in or slough, and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and small commercial buildings referred to in table 6 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence from settling or shear failure of the foundation do not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and the large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

Local roads and streets referred to in table 6 have an all-weather surface that can carry light to medium traffic all year. They consist of subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The AASHTO and Unified classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones, all of which affect stability and ease of excavation, were also considered.

Sanitary Facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that deal with the ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 7 shows the degree and kind of limitations of each soil for these uses and for use of the soil as daily cover for landfills.

If the degree of soil limitation is indicated by the rating *slight*, soils are favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance are required.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect the absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and a shallow depth to bedrock interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth less than 4 feet below the tile lines. In these soils the absoption field does not adequately filter the effluent, and as a result ground water supplies in the area may be contaminated. Soils having a hazard of inadequate filtration are indicated by footnotes in table 7.

Percolation tests are performed to determine the absorptive capacity of the soil and its suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity.

In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that lower the seasonal water table or to increase the size of the absorption field so that satisfactory performance is achieved.

Sewage lagoons are shallow ponds constructed to hold sewage while bacteria decompose the solid and liquid wastes. Lagoons have a nearly level flow area surrounded by cut slopes or embankments of compacted, nearly impervious soil material. They generally are designed so that depth of the sewage is 2 to 5 feet. Impervious soil at least 4 feet thick for the lagoon floor and sides is required to minimize seepage and contamination of local ground water. Soils that are very high in organic matter and those that have stones and boulders are undesirable. Unless the soil has very slow permeability, contamination of local ground water is a hazard in areas where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce its capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the loca-

tion of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste, either in excavated trenches or on the surface of the soil. The waste is spread, compacted in layers, and covered with thin layers of soil. Landfill areas are subject to heavy vehicular traffic. Ease of excavation, risk of polluting ground water, and trafficability affect the suitability of a soil for this purpose. The best soils have a loamy or silty texture, have moderate or slow permeability, are deep to bedrock and a seasonal water table, are free of large stones and boulders, and are not subject to flooding. In areas where the seasonal water table is high, water seeps into the trenches and causes problems in excavating and filling the trenches. Also, seepage into the refuse increases the risk of pollution of ground water. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability that might allow noxious liquids to contaminate local ground water.

Unless otherwise stated, the ratings in table 7 apply only to soil properties and features within a depth of about 6 feet. If the trench is deeper, ratings of slight or moderate may not be valid. Site investigation is needed before a site is selected.

In the area type of sanitary landfill, refuse is placed on the surface of the soil in successive layers. The limitations caused by soil texture, depth to bedrock, and stone content do not apply to this type of landfill. Soil wetness, however, may be a limitation because of difficulty in operating equipment.

Daily cover for sanitary landfills should be soil that is easy to excavate and spread over the compacted fill during both wet and dry weather. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

In addition to these features, the soils selected for final cover of landfills should be suitable for growing plants. In comparison with other horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas, such as slope, erodibility, and potential for plant growth.

Construction Materials

The suitability of each soil as a source of road fill, sand, gravel, and topsoil is indicated in table 8 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed and described as the survey is made, generally about 6 feet.

Roadfill is soil material used in embankments for roads. The ratings reflect the ease of excavating and working the material and the expected performance of the material after it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about soil properties that determine such performance is given in the descriptions of soil series.

The ratings apply to the soil profile between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within the profile. The estimated engineering properties in table 11 provide more specific information about the nature of each horizon that can help determine its suitability for road fill.

Soils rated *good* have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as high shrink-swell potential, high potential frost action, steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*, regardless of the quality of the suitable material.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 11.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to sustain the growth of plants. Also considered is the damage that would result to the area from which the topsoil is taken.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones, are low in content of gravel and other coarse fragments, and have gentle slopes. They are low in soluble salts, which can limit plant growth. They are naturally fertile or respond well to fertilization. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils, very firm clayey soils, soils with suitable layers less than 8 inches thick, soils having large amounts of gravel, stones or soluble salt, steep soils, and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is much preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter. Consequently, careful preservation and use of material from these horizons is desirable.

Water Management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 9 soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitation are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the rated use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for this use have low seepage potential, which is determined by the permeability and depth over fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and is of favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability, texture, structure, depth to claypan or other layers that influence rate of water movement, depth to the water table, slope, stability of ditchbanks, susceptibility to flooding, salinity and alkalinity, and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments, or a combination of channels and ridges, constructed across a slope to intercept runoff and allow the water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity of slope and steepness, depth to bedrock or other unfavorable material, permeability, ease of establishing vegetation, and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff at nonerosive velocities to outlets. Features that affect the use of soils for waterways are slope, permeability, erodibility, and suitability for permanent vegetation.

Recreation

The District of Columbia has a setting of great natural beauty and has benefitted over the years from farsighted recreational planning. Because of the allocation of nearly a square mile of land to parks by the original L'Enfant plan, the District has been renowned as a city of parks and open spaces. Much of the District's elaborate system of public parks and other open spaces was originally designed to heighten the visual impression of the federal buildings, but it has been applied increasingly to recreational purposes. The original L'Enfant plan set aside 17 areas for parks, including the Mall, the Washington Monument grounds, the Capitol grounds, the White House, including the present Lafayette Square, and small plots of grass at the intersections of major avenues.

In 1970 there was a total of 8,525 acres, about 19 percent of the total area, of public open space in the District of Columbia (*24*). The National Park Service manages 7,500 acres of this land, and the other 1,025 acres is managed by the District of Columbia Government and various civilian and military agencies of the Federal Government. Rock Creek Park is the largest park in the District of Columbia. Other important public parks are the Mall, East and West Potomac, Anacostia, Fort Stanton, Fort Dupont, and Glover-Archbold. There are numerous small square, circular, and triangular parks, locally called postage stamp parks, scattered throughout the District of Columbia.

The parklands and open spaces of the Nation's Capital contain a broad diversity of soils and other resources. There are areas clearly intended for national functions, and there are other areas that by their location, size, nature, and use are of local or regional significance and relate more directly to the needs of local residents for recreation and open space. Knowledge of soils is necessary in planning, developing, and maintaining areas used for open space and recreation.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails (fig. 23). The ratings are based on such restrictive soil features

as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreational use by the duration of flooding and the season when it occurs. Onsite assessment of height, duration, and frequency of flooding is essential in planning recreational facilities.

In table 10 the limitations of soils are rated as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by additional information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 7, and interpretations for dwellings without basements and for local roads and streets, given in table 6.

Camp areas require such site preparation as shaping and leveling tent and parking areas, stabilizing roads and other 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 for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will 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 not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over rock should be sufficient to allow necessary grading.

The design and layout of paths and trails for walking, horseback riding, and bicycling should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife

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The District of Columbia exhibits a diverse fauna for an area that is principally urban in character. Approximately 35 species of mammals and 175 species of birds occur within its boundaries throughout the year. There does not, however, appear to be substantial geographical differentiation in animal populations. The major determinant of wildlife abundance and distribution is the presence of parklands, including Rock Creek Park (1,754 acres), Palisades Parkway and C & O Canal National Historical Park (328 acres), Anacostia Park (1,271 acres), and others. Many of these areas are connected with companion parks in surrounding Maryland, which aids the movement of species.

Throughout the city gray squirrels are abundant and represent the most visible diurnal mammal. In parklands, raccoon and opossum are common nocturnal species that often invade the residential communities in search of food. Both red and gray foxes are occasionally sighted. It is likely that they breed in scattered city locations. The once extirpated beaver and white-tailed deer are returning in small numbers, with the beaver notably reestablishing thin populations along the Potomac River and Rock Creek approaches to Washington. Numerous additional small mammals, including cottontail rabbits, muskrat, native rodents, and bats, can be found in many locations where appropriate habitat or food is available (fig. 24).

Large and small parklands also support a wide variety of terrestrial birds. Larger species such as the pileated woodpecker and barred owl are permanent residents. Broad-winged hawks nest in the larger forested parks, and red-tailed hawks regularly visit these same locations during winter. Black and turkey vultures soar throughout the city and maintain a large roost near the National Zoo. Bobwhite quail are frequently heard and seen in open land areas. During migration and winter months numerous species of waterfowl, gulls, and shore birds concentrate along the Potomac and Anacostia Rivers.

The current status of many reptiles and amphibians is not fully determined, but some frogs and smaller snakes seem to be withstanding pressures of urbanization. Local streams and rivers also support fishing for catfish, sunfish, carp, occasional bass, and abundant hickory shad during the spring migration season.

Soil Properties

Extensive data about soil properties collected during the soil survey are summarized on the following pages. The two main sources of these data are the many

thousands of soil borings made during the course of the survey and the laboratory analyses of samples selected from representative soil profiles in the field.

The soil scientist can identify several important soil properties when he makes soil borings during field mapping. He notes the seasonal soil moisture condition, or the presence of free water and its depth in the profile. For each horizon, he notes the thickness of the soil and its color; the texture, or the amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or natural pattern of cracks and pores in the undisturbed soil; and the consistence of soil in-place under the existing soil moisture conditions. He records the root depth of existing plants, determines soil pH or reaction, and identifies any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to characterize key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many of the soil series are available from nearby areas.

Based on summaries of available field and laboratory data, and listed in tables in this section, are estimated ranges in engineering properties and classifications and in physical and chemical properties for each major horizon of each soil in the survey area. Also, pertinent soil and water features and data obtained from laboratory analyses, both physical and chemical, are presented.

Engineering Properties

Table 11 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area. These estimates are presented as ranges in values most likely to exist in areas where the soil is mapped.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Information is presented for each of these contrasting horizons. Depth to the upper and lower boundaries of each horizon in a typical profile of each soil is indicated. More information about the range in depth and in properties of each horizon is given for each soil series in "Soil Series and Morphology."

Texture is described in table 11 in standard terms used by the United States Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms used by USDA are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified soil classification system (*2*) and the American Association of State Highway and Transportation Officials Soil Classification System (AASHTO) (*1*). In table 11 soils in the survey area are classified according to both systems.

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, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example CL-ML.

The AASHTO system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified as one of seven basic groups ranging 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. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified as A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or more for the poorest. The estimated classification, without group index numbers, is given in table 11. Also in table 11 the percentage, by weight, of cobbles or the rock fragments more than 3 inches in diameter are estimated for each major horizon. These estimates are determined largely by observing volume percentage in the field and then converting it, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four standard sieves is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistency of soil. These properties are used in both the Unified and the AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior.

Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

Physical and Chemical Properties

Table 12 shows estimates for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the representative profile of each

soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships between the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for water movement in a vertical direction when the soil is saturated. Not considered in the estimates are lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in the plannning and design of drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops and ornamental or other plants to be grown, in evaluating soil amendments for fertility and stabilization, and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others it was estimated on the basis of the kind of clay and on measurements of similar soils. Size of imposed loadings and the magnitude of changes in soil moisture content are also important factors that influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A *high* shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion, as used in table 12, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rating of soils for corrosivity to concrete is based mainly on the sulfate content, soil texture, and acidity. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Installations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values used in this table range from 0.10 to 0.64. The K value of a soil is modified by factors representing vegetative cover, slope gradient, slope length, management practices, and climate in order to estimate annual soil loss per acre. The soil-loss tolerance factor (T) is the maximum rate (measured in tons per acre per year) of soil erosion, whether from rainfall or wind, that can occur without reducing crop production or environmental quality.

Soil and Water Features

Features that relate to runoff or infiltration of water, to flooding, to grading and excavation, and to frost action of each soil are indicated in table 13. This information is helpful in planning land uses and engineering projects that are likely to be affected by the amount of runoff from watersheds, by flooding and a seasonal high water table, by the presence of bedrock in the upper 5 or 6 feet of the soil, or by frost action.

Hydrologic groups are used to estimate runoff after rainfall. Soil properties that influence the minimum rate of infiltration into the bare soil after prolonged wetting are depth to a water table, water intake rate and permeability after prolonged wetting, and depth to layers of slowly or very slowly permeable soil.

Flooding is rated in general terms that describe the frequency, duration, and period of the year when flooding is most likely. The ratings are based on indications in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content as depth increases; absence of distinctive soil horizons that form in soils of the area that are not subject to flooding; local information about floodwater heights and the extent of flooding; and local knowledge that relates the unique landscape position of each soil to historic floods. Most soils in low positions on the landscape where flooding is likely to occur are classified as fluvents at the suborder level or as fluventic subgroups. See the section "Classification of the Soils."

The generalized description of flood hazards is of value in land use planning and provides a valid basis for land use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

A high water table is the highest level of a saturated zone more than 6 inches thick in soils for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed during the course of the soil

survey. Indicated are the depth to the seasonal high water table; the kind of water table, whether perched, artesian, or the upper part of the ground water table; and the months of the year that the high water commonly is present. Only those saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not to construct basements and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at depths of 5 to 6 feet or less. For many soils, limited ranges in depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and other observations during the soil mapping. The kind of bedrock and its relative hardness as related to ease of excavation are also given. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200 horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action is defined as freezing temperatures in the soil and movement of soil moisture into the freezing zone, which causes the formation of ice lenses. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Laboratory Data

Selected physical and chemical properties of selected soils in the District of Columbia are shown in tables 14, 15, 16, and 17. Soils of the Ashe, Lindside, and Manor series; three profiles of Udorthents; and two profiles of Udorthents, deep, were sampled and characterized. Profiles for all soils sampled are described in this section except for the Ashe soil. The Ashe profile sampled is described in the section "Soil Series and Morphology".

Data for one profile of each series are presented for those soils classified at the series level. Data for three profiles of Udorthents and two profiles of Udorthents, deep, are presented to show the variability of the man-made soils. Samples were collected from each horizon that could be recognized in a pit dug through the solum and into the underlying material.

Laboratory analyses for the profile of the Lindside soil were made at the Ecological Services Laboratory, National Capital Parks, Washington, D. C., and the Soil Characterization Laboratory, Department of Agronomy, University of Maryland, College Park, Maryland. Analyses for the Ashe and Manor soils were made at the Soil Conservation Service Soil Characterization Laboratory that was formerly at Beltsville, Maryland.

Profile of Lindside silt loam formed in man-deposited river dredging in Hains Point area, north of Ecological Services Laboratory: Profile No. S73-DC-1-5 sampled for laboratory characterization.

Ap—0 to 9 inches, dark yellowish brown (10YR 4/4) and brown (10YR 4/3) loam; weak fine granular structure at top of horizon grading to moderate medium prismatic structure at the bottom of horizon; friable; many roots in upper part; very strongly acid; clear wavy boundary.

IIB21—9 to 18 inches, yellowish brown (10YR 5/4) heavy silt loam; many medium distinct mottles of strong brown (7.5YR 5/6), dark brown (10YR 4/3) and dark grayish brown (10YR 4/2); moderate medium prismatic structure; friable; common roots; strongly acid; clear wavy to irregular boundary.

IIIB22—18 to 28 inches, dark brown (10YR 4/3) silty clay; many medium to coarse distinct mottles of strong brown (7.5YR 5/6) and dark grayish brown (10YR 4/2); massive grading to coarse angular blocky structure; friable to firm, sticky; common roots; strongly acid; clear wavy boundary.

IVB23—28 to 49 inches, dark brown (10YR 4/3) to dark grayish brown (10YR 4/2) silty clay loam; many medium to coarse, distinct mottles of yellowish red (5YR 3/6) to dark reddish brown (5YR 3/4); moderate medium subangular blocky structure; friable; common roots; medium acid; abrupt smooth boundary.

VC1—49 to 65 inches, yellowish brown (10YR 5/6) fine sandy loam, massive; very friable; few small roots; slightly acid; abrupt smooth boundary.

V1C2g—65 inches, silt loam; neutral to gray, irreversible color change upon drying; sticky when wet.

Profile of Manor loam formed in acid residuum from Wissahickon Gneiss, in Rock Creek Park on east side of Rock Creek about 360 feet south of Sherrill Drive: Profile No. S74-DC-1-11 sampled for laboratory characterization.

O—2 inches to 0, partially decomposed leaf litter from hardwoods.

A1—0 to 4 inches, dark brown (10YR 3/3) loam; moderate medium granular structure; friable; many roots; common mica flakes; few quartz fragments less than 2 centimeters in length; extremely acid; gradual smooth boundary.

A2—4 to 7 inches, yellowish brown (10YR 5/6) loam; weak very thin platy structure parting to weak fine granular structure; friable; many roots; common mica flakes; few quartz fragments less than 2 centimeters in length; extremely acid; gradual wavy boundary.

B1—7 to 12 inches, strong brown (7.5YR 5/6) heavy loam; weak medium subangular blocky structure; friable; many roots; common mica flakes; about 2 percent hard quartz fragments as much as 3 centimeters in length; extremely acid; gradual wavy boundary.

B2—12 to 18 inches, yellowish red (5YR 5/6 and 5/8) silt loam; moderate medium subangular blocky structure; friable; many roots; many mica flakes; about 2 percent hard quartz fragments as much as 3 centimeters in length; very strongly acid; gradual smooth boundary.

B3—18 to 22 inches, yellowish red (5YR 5/6) heavy loam; weak coarse subangular blocky structure; friable; many roots; many mica flakes; about 3 percent hard quartz fragments as much as 5 centimeters in length; strongly acid; gradual wavy boundary.

C1—22 to 31 inches, strong brown (7.5YR 5/6) loam; massive; friable; many roots; many mica flakes; about 3 percent hard quartz fragments as much as 5 centimeters in length; medium acid; abrupt smooth boundary.

C2—31 to 38 inches, mixed yellowish red (5YR 5/8) and strong brown (7.5YR 5/8) channery loam; massive; friable; common roots; many

mica flakes; about 50 percent hard quartz fragments ranging from about 15 to 25 centimeters in length; medium acid; abrupt smooth boundary.

C3—38 to 60 inches, variegated strong brown (7.5YR 5/6 and 5/8), pink (7.5YR 8/4), and yellowish red (5YR 5/6) sandy loam; massive, inherent rock structure; friable; few roots; many mica flakes; about 10 percent hard gneiss and quartz fragments; very strongly acid.

Profile of Udorthents formed in mixed semistratified fill over old marshland of alluvial origin, on Mall near Smithsonian Museum of Natural History: Profile No. S70-DC-1-2 sampled for laboratory characterization.

Ap—0 to 4 inches, dark brown to dark yellowish brown (10YR 4/3 to 4/4) loam; massive; friable, slightly sticky and nonplastic; medium acid; clear wavy boundary. This horizon is reddish brown (2.5YR 5/4) moist, brown (10YR 5/3) dry, in the lower 1.5 inches.

A1—4 to 6 inches, mixed light gray (5YR 7/1), brownish yellow (10YR 6/8), and red (10YR 5/8) silt loam (colors of 10YR 8/1, 10YR 7/3, 10YR 6/4, and 7.5YR 5/8 were found when the soil was dry); massive; very firm; sticky, very hard; medium acid; abrupt wavy boundary.

C1—6 to 11 inches, yellowish red (5YR 5/6) clay loam; massive; friable, sticky, hard; medium acid; clear gradual boundary.

IIC2—11 to 15 inches, yellowish brown (10YR 5/6) clay loam; dark brown (10YR 3/3) mottles when moist, light yellowish brown (10YR 6/4) to yellowish brown (10YR 5/4) when dry; massive; friable, slightly sticky, slightly hard; strongly acid; gradual wavy boundary.

IIIC3—15 to 32 inches, reddish brown (5YR 4/4) gravelly loam; massive; very friable, nonsticky; medium acid; clear wavy boundary.

IVC4—32 to 50 inches, yellowish brown (10YR 5/4) sandy loam; massive; friable, slightly sticky, slightly hard; medium acid.

Profile of Udorthents formed in miscellaneous fill over old marshland, on Mall near Smithsonian Museum of Natural History: Profile No. S71-DC-1-2 sampled for laboratory characterization.

Ap—0 to 9 inches, reddish yellow (7.5YR 6/6) loam; light grayish brown (7.5YR 5/2 and 4/2) mottles; massive; friable, hard, slightly plastic and slightly sticky; medium acid; abrupt smooth boundary. The upper 2 inches of this horizon were reddish brown (5YR 4/3), light yellowish brown (10YR 6/4) when dry, and had weak granular structure and was very friable.

C1—9 to 23 inches, yellowish red (5YR 5/8 and 4/8) clay loam; light gray (5YR 7/1) mottles; weak medium subangular blocky structure and massive; friable, very hard, sticky and slightly plastic; strongly acid; clear wavy boundary.

IIC2—23 to 28 inches, mixed light gray (10YR 6/1 and 7/1), red (2.5YR 4/6), and yellowish red (5YR 5/8) loam, yellow (10YR 8/6) when dry; massive; friable, slightly hard, slightly sticky and slightly plastic. Oyster shells, gravel, stone, and brick fragments present; neutral; diffuse irregular boundary.

IIIC3—28 inches, yellowish red (5YR 5/6) and reddish brown (5YR 5/3) clay loam; massive; friable, very hard, slightly sticky and slightly plastic; neutral. This horizon contains much construction debris, particularly red bricks and brick fragments.

Profile of Udorthents formed in miscellaneous earthy fill containing artifacts, north of the White House, on Ellipse at site of the National Christmas Tree: Profile No. S73-DC-1-4 sampled for laboratory characterization.

Ap—0 to 8 inches, very dark grayish brown (10YR 3/2) loam; weak medium granular structure at top of horizon grading to massive in the lower part of horizon; hard; many roots; few to common coal fragments; strongly acid; abrupt smooth boundary.

IIAC—8 to 12 inches, yellowish red (5YR 4/6) loam; massive; hard; common roots in worm channels; slightly acid; abrupt wavy boundary.

IIICI—12 to 21 inches, brown (7.5YR 4/4) heavy silt loam; massive; friable to firm; common roots in worm channels; slightly acid; abrupt wavy boundary.

IVC—21 to 29 inches, red (2.5YR 4/6) silty clay loam; massive; friable to firm; common roots in worm channels; neutral; abrupt smooth boundary.

VC3—29 to 38 inches, mixed reddish brown (2.5YR 4/4), light brownish gray (2.5YR 6/4), and brownish yellow (10YR 6/6) silt loam; massive; friable to firm; many fragments of coal and slag; common roots in worm channels; neutral; abrupt smooth to broken boundary.

VIC4—38 to 42 inches, strong brown (7.5YR 5/6) fine sandy loam with gray streaks; massive; firm; coal and ash fragments; common roots in worm channels; neutral; abrupt wavy boundary.

VIIC5—42 to 96 inches, gray (2.5YR 5/2) ashy material interstratified with dark yellowish brown (10YR 4/4) earthy material; containing many anthropic artifacts (bottles, pottery, leather, oyster shells, bricks, etc.) primarily in the ashy material in addition to the slag and coal fragments throughout; the ashy material is very friable, the earthy friable; numerous worm channels and casts extending into this horizon; slightly acid.

Profile of Udorthents, deep, formed in miscellaneous earthy fill over raw refuse, at Kenilworth sanitary landfill: Profile No. S73-DC-1-1 sampled for laboratory characterization.

A1—0 to 3 inches, very dark brown (10YR 2/2) fine sandy loam; weak, fine, granular structure; very friable; many roots; common gravel; high organic-matter content composed mainly of sewage sludge; neutral; abrupt smooth boundary.

A2—3 to 5 inches, dark yellowish brown (10YR 4/4) sandy loam; massive; firm; some material from the C1 horizon present; neutral; clear smooth boundary.

C1—5 to 23 inches, yellowish red (5YR 4/6 to 4/8) sandy clay loam with patches of pinkish gray material (5YR 6/2) in some parts; weak coarse prismatic structure; firm; common gravel and glass, brick, and asphalt fragments; few roots concentrated on the prism faces; extremely acid; clear smooth boundary.

IIC2—23 to 28 inches, light olive brown (2.5Y 5/4) gravelly loam; massive; very firm; common stones and glass, brick, and asphalt fragments; neutral; abrupt smooth boundary.

IIIC3—28 to 43 inches, dark yellowish brown (10YR 4/3) fine sandy loam; massive; firm; common stones and glass, brick, and asphalt fragments; mildly alkaline; abrupt wavy boundary.

IVC4—43 to 48 inches, raw refuse; (paper packing material, magazine, comic book); clothing articles (sneaker, necktie); metallic objects (bed springs, beer cans, pieces of a toy wagon, Venetian blinds); glass, plastic bottles, bones. This material appeared to have undergone very little decomposition although a disagreeable odor emanated from it. Some of the print in a magazine was slightly faded as was the red color on the label of the beer cans. Also any meat that may have been on the bones apparently was decomposed.

Profile of Udorthents, deep, formed in miscellaneous earthy fill over partially incinerated trash, at Kenilworth sanitary landfill: Profile No. S73-DC-1-3 sampled for laboratory characterization.

Ap—0 to 3 inches, very dark grayish brown (10YR 3/2) fine sandy loam, brown (10YR 5/3) when dry; weak, medium, granular structure. This horizon is largely of sewage sludge, added as a soil amendment and mixed by disking; neutral; clear smooth boundary.

C1—3 to 25 inches, yellowish brown (10YR 5/6) heavy loam; many fine and medium mottles of higher and lower chroma; massive; very hard when dry; slightly acid; abrupt, smooth boundary.

IIC2—25 to 38 inches, dark red (2.5YR 3/6) clay loam; massive; extremely hard, very firm; strongly acid; abrupt, smooth boundary.

IIIC3—38 inches, partially incinerated trash. Contains glass, wire, metal, partially burned paper, etc. Because of incineration this material is mainly black in color.

Methods of analysis

Air-dry samples were crushed so that soil material would pass through a 2-millimeter sieve. The percentage of material larger than 2 millimeters is not reported in tables 14 or 15. All determinations in tables 14 and 15, except those for bulk density, are based on that part of the sample which was less than 2 millimeters in diameter. Analyses for the percentages of sand, silt, and clay were made by pipette and sieve separations (*21*). Bulk density was determined by the methods of Brasher and others (*5*). Particle density was determined by the methods of Blake (*3*). Pore space was determined using the methods of Vomocil (*3*). Organic matter content was determined by the procedures of Peech and others (*27*).

Reaction (pH) was determined electrometrically (glass electrode-pH meter) for samples that had been air dried, and a soil-water ratio of 1 to 1 was used. The amount of calcium, magnesium, sodium, and potassium extracted by neutral, normal ammonium acetate was determined by the methods of Peech and others (*27*). Extractable acidity (hydrogen) was determined by leaching with a barium chloride solution buffered at pH 8.1 with triethanolamine (*22*). The cation exchange capacity (sum) is the total of extractable cations including acidity. Cation exchange capacity (ammonium acetate) was determined by the methods of Peech and others (*27*), in which samples were saturated with ammonium and washed with ethanol. The ammonium was then displaced with sodium chloride and the amount determined by the Kjeldahl method. Free iron was determined by the procedure outlined by Fanning and others (*12*).

Physiography, Drainage, and Geology

By ALBERT J. FROELICH and JOHN T. HACK, U.S. Geological Survey, Reston, Virginia.

The north-northeast trending fall line (fig. 25) separates the Piedmont Province in the western part of the District of Columbia from the Coastal Plain in the eastern two-thirds. Much of the District is intricately dissected by erosion and is characterized by nearly level to gently rolling uplands, steep valley walls, widely separated interstream divides, and narrow valley bottoms. Most public buildings and memorials in downtown Washington are on nearly level lowlands formed on river terrace deposits, alluvium, and artificial fill.

South-flowing streams and their tributaries form an intricate dendritic drainage network; all of the drainage is into the Potomac River, which flows southeasterly and forms the natural southern boundary of the city. Rock Creek and the Anacostia River are the principal tributaries of the Potomac. Swift and turbulent Rock Creek is incised in a narrow precipitous valley that drains the Piedmont. Rock Creek is in striking geomorphic contrast with the sluggish Anacostia River, which meanders in the flood plain of a broad, gently sloping valley across the Coastal Plain.

Elevation ranges from sea level, where the Potomac and Anacostia Rivers are tidal estuaries, to as much as 415 feet at Tenleytown. Interstream ridges are highest in the part of the Piedmont that makes up the northwestern part of the city. These ridges descend gradually to the Coastal Plain to the south and east, where hilltop elevations rarely exceed 230 feet.

The Piedmont part of the District is underlain by old, metamorphosed, igneous and sedimentary rocks, and the Coastal Plain part is underlain by much younger, poorly consolidated sediment. Small areas in both provinces are covered by unconsolidated terrace and alluvial deposits. A preliminary map (fig. 26) shows the geology of the District of Columbia

Most of the interstream uplands of the Piedmont are formed on saprolite, which is a weathered mantle of reddish-brown, earthy material that retains the structure of the original metamorphic rock but that can readily be dug by shovel. Saprolite is predominantly a sticky, sandy, silty, clayey, and micaceous material that grades downward into unweathered rock at a depth that averages 50 feet but locally may exceed 160 feet. Saprolite is largely absent along the valley walls of Rock Creek, its tributaries, and the Potomac River where bold gorges are incised in hard bedrock.

Metamorphic rocks of the Wissahickon Formation of the Glenarm Series (*18*) are the predominant rocks that crop out in the Piedmont. They include quartzose boulder gneiss, mica, schist, and impure quartzite. The schists and gneisses are closely associated with mafic (dark ferromagnesian) igneous rocks of the Georgetown Complex. The metamorphic and mafic rocks are intruded by younger igneous rocks, mainly quartz diorites of the Georgetown and Kensington Gneisses (*20*). Minor intrusive dikes and veins of quartz, aplite, and pegmatite locally cut all older crystalline rocks. The igneous and metamorphic rocks are in north-trending belts (*8*) that are variably cleaved and foliated. The mica schists are most intensely cleaved and foliated, and the layered and massive feldspathic quartz diorite and gneisses are least intensely cleaved and foliated; all of the hard crystalline rocks are jointed. Most types of crystalline rocks have been locally quarried for building stone, riprap, and fill.

Poorly consolidated Coastal Plain sediments overlie the saprolite east of Rock Creek, and erosional outliers cap some of the ridges west of Rock Creek, mainly near Tenleytown. Coastal Plain strata thicken from a feather edge along the fall line zone to more than 1,000 feet along the southeastern border of the District.

The oldest Coastal Plain deposits are the basal beds of the non-marine Potomac Group of Cretaceous age; they dip to the southeast at increments of about 100 feet per mile. The Potomac Group thickens to more than 700 feet along the southeastern border of the District (*11*). The lower part of the Potomac Group (*7*) consists mostly of fluviatile channel-fill, sand, and gravel, with scattered lenticular bodies of silt and clay. The gravel is generally poorly sorted, containing subrounded quartz and quartzite

pebbles and minor sandstone and weathered lithic fragments in a medium- to coarse-grained quartzose sand matrix. Average diameter of the pebbles is 3/4 inch but elongated subrounded cobbles as much as 10 inches in diameter are also present. Crossbedded sand mixed with minor amounts of pebble gravel is abundant, occurring as lenses and extensive layers. Thin silt and clay beds and lenses are widespread, and hard concretionary ironstone layers are common. The lower Potomac Group sand and gravel crop out chiefly on hillsides in a belt between Rock Creek and the Baltimore and Ohio Railroad.

Silty and sandy clay (*7*) mixed with minor amounts of interbedded sand and gravel make up the upper part of the Potomac Group. The clay is mainly mottled red and green or gray to black where it is carbonaceous; it contains scattered limonite and siderite lenses. The main clay minerals are kaolinite and illite. The clays in the northern part of the District were once used as a source of brick clay, as at Terra Cotta. Minor amounts of montmorillonite and other mixed-layer clays form part of the clay in the southeastern part. The clays are generally poorly drained and have a moderate to high shrink-swell potential. Slope failures caused by slump, creep, and landsliding have commonly occurred. They pose hazards to construction on steep slopes or where the material is used as fill or is artificially cut. The clay crops out mainly on both sides of the Anacostia River. Plant spores and carbonaceous impressions, large logs, and rare dinosaur remains are the chief nonmarine fossils preserved in the Potomac Group beds.

According to Darton (*11*), the upper Cretaceous Monmouth Formation unconformably overlies the Potomac Group. The Monmouth consists of as much as 50 feet of pebbly, micaceous, glauconitic sand, dark gray silty clay, and fossiliferous shelly marl of marine origin. The Formation is limited in distribution to a small area that is mainly on the slopes of Good Hope Hill southeast of the Anacostia River.

The Paleocene Aquia Formation is mapped by Darton (*11*) on the southeast side of Good Hope Hill; it reportedly consists of weathered, gray to reddish brown, glauconitic sand and ironstone concretions and sparse, chalky, white marine fossil shells in places. The thickness ranges from zero to less than 50 feet.

According to Darton (*11*), the Miocene Calvert Formation unconformably overlies the Aquia Formation and overlaps it locally to rest unconformably on the Monmouth and the Potomac Group. The Calvert Formation reportedly is mostly fine-grained sands and clays. Where unweathered, the sands and clays are compact and are dark gray to greenish gray, but they are soft, meallike gray or buff where weathered. They are locally fossiliferous, and most of the remnants are marine organisms, including shark teeth. The thickness of the Calvert Formation ranges from 20 to 80 feet and is thickest near Good Hope Hill (*11*).

Post Miocene upland gravel and sand overlie the marine strata unconformably and overlap the Cretaceous Potomac Group and the saprolite of the Piedmont crystalline rocks. This unit caps remnants of a formerly extensive plateau in this area. The upland gravel and sand, which are in a weathered orange loam matrix, were deposited by an ancestral Potomac River (*15*, *28*). The upland gravel deposits are commonly deeply weathered; nevertheless, they are a local source of sand and gravel.

Gravel and sand in a gray or brown loam matrix are in river terrace deposits as much as 30 feet thick at various levels below the upland gravel plateau surface. Because these deposits are not so deeply weathered, they have been extensively used as a source of sand and gravel. Lenticular deposits of fine-grained silt, clay, and peat beds as much as 16 feet thick are locally interbedded with sand and gravel.

Alluvial gravel, sand, silt, and clay occupy the stream bottoms, only the larger deposits of which are shown on the map. The thickness ranges from a veneer to 25 feet or more. Alluvium is intermixed with many extensive areas of artificial fill, mainly river dredgings, especially along the Anacostia River and the Potomac River below Memorial Bridge. Alluvial sand and gravel have been extensively dredged from the Potomac River.

Artificial fill consists of extensive manmade or man-modified areas that are covered by locally derived unconsolidated material. Small areas of fill are present where roads and railroads cross streams and low points and at reservoirs and filtration plants; such areas commonly adjoin sites of cut and disturbed ground. Fill also includes reclaimed areas covered by spoil from excavations as well as sanitary landfills.

The preliminary geology map shows all geologic formations that are presently recognized in the District of Columbia.

Thickness of Overburden and Contours on the Top of Bedrock

By ALBERT J. FROELICH, U. S. Geological Survey, Reston, Virginia.

Thickness of overburden.—Overburden, as used in fig. 27, designates all the surficial earth materials that overlie hard bedrock. Overburden includes soil, disturbed ground and artificial fill, alluvial and terrace deposits, colluvium, upland gravel, Coastal Plain strata, and saprolite on crystalline bedrock. Overburden can generally be moved directly with power shovels, whereas bedrock is generally hard and requires blasting before removal.

Data from which the contours shown in fig. 28 are drawn are based on the ground surface elevation in relation to:

1. The approximate surface elevation of the contact between overburden and bedrock.
2. The distribution and elevation of hard rock outcrops.
3. Estimates of the thickness of overburden based on logs kept by drillers of holes (mainly for water wells) and on records of foundation, utility, subway, and highway borings and excavations.

Saprolite is the thickest, most extensive unit of overburden in the western part of the District of Columbia. It is soft, earthy, clay-rich, decomposed material formed in place by chemical weathering of crystalline bedrock. Saprolite ranges from zero to more than 160 feet in thickness. The thickness varies with topographic position, lithology, and structure of the underlying bedrock (*13*, *14*). Little or no saprolite overlies ultramafic rock or quartz veins and dikes. Thin to moderately thick, nearly impervious saprolite overlies mafic rocks of the Georgetown Complex. In general, saprolite is thickest and is moderately pervious beneath upland areas underlain by Wissahickon Schist, but in places belts of thick pervious saprolite overlie both Wissahickon Gneiss and Kensington Gneiss. Each major crystalline rock type yields a characteristic saprolite, and each kind of saprolite is related to a specific named soil.

Coastal Plain strata and upland gravel deposits form other areas of thick overburden that have physical properties radically different from those of saprolite. Cretaceous Potomac Group strata form the thickest and most extensive unit of overburden in the Coastal Plain of the eastern part of the District. They are overlain by marine beds of upper Cretaceous and Tertiary age southeast of the Anacostia River. The Coastal Plain sediment ranges from a feather edge along the fall line to more than 1,000 feet along the southeastern margin of the city; it increases to the southeast at a rate of about 100 feet per mile or less. Characteristic residual soils are formed on weathered, clay-rich layers or in sandy and gravelly parent materials.

The Coastal Plain strata and some of the Piedmont rocks are overlain in places by a much younger unit of fluviatile upland gravel and sand about 30 feet thick. The gravel commonly forms nearly flat-topped upland surfaces sloping gently to the southeast. Colluvium on Piedmont upland surfaces rarely exceeds 20 feet in thickness. Overburden is thin along most Piedmont stream valleys and lowlands, but in places alluvial and terrace deposits exceed 20 feet in thickness. Soils that formed in the alluvial and upland gravel deposits are diverse. The profiles of some soils that formed in upland gravel deposits have a clay-rich hardpan that impedes surface drainage. Alluvial soils are subject to recurrent flooding.

Areas of thin overburden are commonly favorable sites for heavy structures that require strong bedrock for maximum structural support. The same areas, on the other hand, would generally require more work and greater expense for utility lines and highway construction.

Areas of thick overburden provide favorable routes or excavation corridors in places for deep burial of utility lines and pipelines. Thick clay or saprolite that underlies relatively steep, natural slopes or slopes that are cut and artificially steepened during construction are likely to be less stable and more readily eroded than steep slopes where fresh bedrock is at the surface.

Published and unpublished sources of data were used to compile the overburden map shown in fig. 27. In addition, a limited amount of new fieldwork was carried out, particularly to help position the interface between rock and overburden; however, field checks were rapid and not intensive. Thus, the final result embodies interpretations synthesized from a variety of sources. Although overburden thickness can be generalized, striking local variations are common. As much as 25 percent variance from indicated thickness is possible, especially where overburden is less than 200 feet thick. The map cannot be used reliably in place of onsite investigation, which requires a detailed examination of surface geology in conjunction with engineering and other studies, such as core drilling and seismic surveys.

Contours on the top of bedrock.— The map showing contours on the top of bedrock (fig. 28) depicts the gradational contact between soft, weathered residual material (saprolite) and the underlying hard crystalline bedrock. The base of the thick saprolite mantle of the Piedmont in the western part of the District is undulatory and generally parallels the topographic surface. In the eastern part, however, the saprolite is thin and is mantled by sediment of the much younger Coastal Plain formations. The saprolite surface slopes regularly to the southeast at a rate of about 100 feet per mile.

The 50-foot contour interval exceeds the limits of subsurface and surface control in places, implying an accuracy not inherent in the available data. Local relief greater than the contour interval at the interface between rock and saprolite is possible.

Comparison of this map with the thickness of overburden map (*13*) and the preliminary geologic map (*14*) shows that bedrock "highs" commonly coincide with areas of thin saprolite on quartz bodies and with mafic and ultramafic rocks. This comparison also shows that closed depressions are found on schist or gneiss overlain by thick saprolite.

Contour trends are commonly alined parallel to the regional foliation; this suggests that subsurface routes of fluid migration may also be influenced by the orientation and inclination of the bedrock foliation planes. Parallel and intersecting joint systems might also strongly influence the routes of fluid migration.

This map can be used for preliminary evaluation of proposed excavation or tunneling corridors. Use of this map in conjunction with the preliminary geologic map may indicate possible routes of subsurface fluid migration, not only of ground water but of leachate from sanitary landfills, sewage disposal plants, or sludge pits. This map, used with relevant soils data and a topographic map, may suggest sites where ground water may emerge to mingle with surface streams, or where storm water runoff as well as ground water pollutants can enter a ground water aquifer.

Formation, Morphology, and Classification of the Soils

C. E. STEIN, graduate assistant, and D. S. FANNING, associate professor, Department of Agronomy, University of Maryland, College Park, Maryland, prepared the sections "Factors of Soil Formation," "Morphology of Soils," "Processes of Soil horizon Differentiation," and "Position, Parent Material, and Drainage Relationship among Soils." Certain parts of these sections were modified from the published soil surveys for Prince Georges County and Harford County Area, Maryland.

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

Factors of Soil Formation

This section discusses the major factors and processes that have affected the formation and morphology of the soils in the District of Columbia. Soils, as used in this discussion, are earthy materials on land surfaces—in places modified or made by man—that support or are capable of supporting plants that are higher in the evolutionary sense than lichens, such as mosses, trees, shrubs, and grasses.

Soils are formed through the interaction of five major factors: climate, plant and animal life, parent material, relief, and time. The relative influence of each factor varies from place to place, and in some places one factor dominates in the formation of a soil and determines most of its properties. Local variation in soils in the District of Columbia is caused mainly by differences in parent material, relief, time, and the effects of man.

In the urban environment of the District of Columbia, the influence of man on soils has been great. For example, with bulldozers and other earthmoving equipment man has destroyed some soils and created and highly modified others. Man has influenced each of the factors of soil formation. Thus, the effects of man are mentioned in the discussion of each factor.

Climate

The District of Columbia has a humid, continental climate marked by seasonal temperature changes. Annual precipitation is about 39 inches, and mean annual air temperature is about 57 degrees F. The distribution of rainfall, which is nearly uniform throughout the year, reaches a maximum in August. During the growing season, April through September, rainfall averages about 21 inches.

Although there are some differences in climate throughout the District, such as the somewhat cooler temperatures and shorter growing seasons at higher elevations away from the downtown areas, the differences have been too small to be reflected in soil properties. Also, urban heat in the downtown areas may make average soil temperatures somewhat higher in these areas (4), and greater extremes in temperature may occur around buildings.

The generally humid climate has caused strong weathering and leaching of the natural soils. In most places the soil materials have weathered to a considerable depth because of exposure to climatic forces for a long period of time. The only materials not deeply and strongly weathered are either highly resistant to weathering or have been exposed to weathering for only a short time, for example, the material on some steep slopes.

Most of the bases have been leached and the soils of the District contain no free carbonates (limestones) except where some of those materials, such as oyster shells, have been added by man. Almost all of the natural soils are acid, and some are strongly acid to extremely acid. Weathering and leaching have left the natural supply of plant nutrients low in most of the natural soils. Some of the youthful manmade soils may be high in content of certain nutrients; however, the content is commonly variable. Because of leaching of clay from surface horizons and the clay formation, the subsoil of most of the natural level to rolling upland soils is enriched in clay. Alternate wetting and drying and freezing and thawing are responsible for prismatic and blocky structure in a clay-enriched subsoil. The alternate wetting, especially in the presence of organic materials, and drying are also responsible for iron translocation and segregation in many soils.

For more detailed information on climate, see the section, "General Nature of the Area".

Plant and Animal Life

All living organisms, including vegetation, bacteria and fungi, and animals, are important to soil formation. Vegetation generally supplies the organic matter that decomposes and gives a dark color to soil surface horizons, and the vegetation supplies nutrients to these horizons. Many of the trees and other plants take up plant nutrients from the soil and store them in their roots, stems, and leaves. When these plants, or parts of them, decompose the elements are returned to the soil and can be used again. Bacteria and fungi are responsible for decomposing the vegetation and returning the nutrients. Also, many of the organic reactions and processes of the bacteria and fungi release materials that affect the soil-forming processes. Earthworms, ants, cicada, and burrowing animals mix soils and affect soil structure, which generally makes the soils more open and porous.

Man also affects soil structure and makes soils more porous in places by tillage and management practices. In other instances, however, man compacts the soils and makes them more dense by foot and vehicle traffic. This compaction problem has arisen in many soils in the District, where low volumes of soil air and stagnant soil atmospheres are the main limitations to healthy plant growth. Man's intensive use and disturbance of some soils has caused accelerated soil erosion losses, often accompanied by increased deposition on flood plains and in

depressions. In other instances man has used practices that have slowed the rate of erosion. Man has also altered many soils chemically through the use of limes and fertilizers, which make the soils more favorable for desired plants. Also, concrete pavements slowly dissolve and the chemical elements released are washed onto surrrounding soils. This appears to have a liming effect. On the other hand, deicing salt applied to highways often reaches adjacent soils and gives rise to salinity that is harmful to plants.

In many instances man has created new soils to suit his purposes. Sometimes these soils have been made only to support activities on the surface, and little attention has been paid to the physical, chemical, and mineralogical properties of the underlying layers. In other instances, such as at Constitution Gardens, man has attempted to control the properties of these new soils throughout their depth. Much remains to be learned, however, about ways to construct suitable soils. Man has introduced plants and animals not normally found in this area, and these will eventually affect the soil.

Thus, man, like all organisms, alters and disturbs the soil by his activities; however, in the District he has become a dominant force because of the extent and magnitude of the alterations.

Parent Material

Parent material is material from which soils form. It influences the mineral and chemical composition of the soil and to a large extent the rate at which soil formation takes place.

In the District of Columbia soils are formed in four general types of parent material. Residual material derived from the weathering of Piedmont rocks in place is one type. Unconsolidated Coastal Plain sediment consisting of sand, silt, clay, and rock fragments deposited over long periods of geologic time constitutes a second type; this sediment has been transported and deposited by water, wind, and gravity or a combination of these forces. Recent alluvial sediment and associated river dredgings, mostly recently eroded from the Piedmont and Coastal Plain, are a third type; this sediment has been deposited on flood plains by rivers and by man, in depressions, and on low stream terraces. The fourth type of material consists of rock fragments, saprolite, sand, silt, and clay and of organic and inorganic objects that are associated with human activities and have been deposited by man.

Residual parent material weathered from rocks in the Piedmont physiographic province covers roughly the northwestern third of the District. This residuum was derived from several kinds of metamorphosed Precambrian and lower Paleozoic igneous and sedimentary rocks. These rocks, in many places, are intruded by younger igneous rocks, mainly quartz diorite. The metamorphic rocks include schist and gneiss, which commonly contain considerable mica. Some of the soils that formed in material weathered in place from these rocks are Glenelg, Glenelg Variant, Manor, Ashe, and Brandywine soils.

The Coastal Plain sediment covers roughly two-thirds of the District. The Coastal Plain part of the District consists of stratified sandy, silty, clayey, and loamy sediment that also contains lignitized or other carbonaceous materials in places. These sediments range in geologic age from the Cretaceous to Quaternary. Most of the soils formed in material weathered from these formations retain many of the particle-size and mineralogy characteristics typical of the sediment.

The Coastal Plain formations deposited during Cretaceous are the oldest. They are composed of gray and yellow sand; red, brown, and gray clay containing iron nodules; and variegated red and yellow sand, clay, and fine gravel interbedded with layers of clay. In some areas these materials are capped by remnants of Pleistocene sand, gravel, silt, clay, or sandy clay. The Cretaceous materials are the parent material of the Christiana, Sunnyside, and other soils and are the subsoil of the Muirkirk Variant soils.

Paleocene, Miocene, and Pliocene deposits outcrop at various locations; however, the real extent of these outcrops is small. Pleistocene deposits are exposed at various elevations over much of the central and southeastern parts of the District. These deposits are composed of coarse and fine sand, silt, clay, and gravel. They are the parent material of the Sassafras, Fallsington, and Woodstown soils. Gravelly river outwash deposits of Pliocene and early Pleistocene age are the parent material of Croom soils. The Beltsville, Chillum, and Matapeake soils formed in a silty mantle, probably wind-deposited, that occurs over sediment of both Pleistocene and lower Cretaceous age.

The recent alluvial sediment consists of material that has been eroded from the Piedmont and Coastal Plain and deposited along streams. Micaceous sediment derived from the Piedmont and deposited on flood plains is the parent material of the Codorus soils. Most of the soils mapped as Bibb and Iuka soils and as Udifluvents and Fluvaquents formed in material recently eroded from the Coastal Plain province. In East Potomac and most of West Potomac Park and on Columbia Island, however, the soils formed in silt and sand that were dredged from the Potomac River between the years 1880 and 1911 (*6*). These dredgings were deposited in shallow water, on tidal flats, and in marshes that were in estuaries that bordered the city of Washington to the south, southwest, and southeast (*6*), and the elevation of many of these areas is low enough so that they still are flooded during storms, such as Hurricanes Agnes and Eloise. These deposits are probably mixtures of materials eroded from the Appalachian, Piedmont, and Coastal Plain provinces. Most soils formed in these materials are relatively homogenous and have developed color patterns that reflect drainage class differences. They have also developed prismatic and blocky soil structure, and for the most part these soils that formed in dredged material appear very much like

natural alluvial soils. The soils that formed in this silt and stratified silt and sand are Lindside, Melvin, and Dunning soils. The soils that formed in the sand and loamy sand are mapped as Iuka and Bibb soils and associated Udifluvents.

A large part of the District is made up of soils that formed in parent material that has been deposited or highly disturbed by man. This consists generally of Piedmont material, Coastal Plain sediment, and recent alluvial sediment that are commonly mixed with varying proportions of organic and inorganic objects associated with human culture. These objects, called artifacts, include bricks, glass, slag, coal, ash, concrete, asphalt, nails, lumber, paper, plastic and plastic containers, kitchen wastes (food), and metal alloys. The manmade and highly disturbed deposits make up the parent material of soils that formed on cut surfaces and on fill materials.

The soils that formed on cuts and similar excavation surfaces consist of former subsoil material and underlying material that are exposed at the surface. These areas have commonly been mapped as Udorthents, smoothed, and Udorthents. These are areas where cuts are made, and the material removed has been used to fill adjacent areas. In these areas the associated fill is generally made up of mixtures of the material from the site; therefore, the soils have many properties of the prior soil and underlying geologic material. Many of these cut and fill materials were estimated to be homogenous enough, with regard to particle-size class, to be mapped as subgroup units phased with family particle class modifers (for example, Udorthents, sandy, smoothed). Where the parent material was relatively heterogenous, the cut and fill materials were mapped as undifferentiated Udorthents, smoothed. Most of the fill in the mapping units where the soils have been cut and filled contains relatively few artifacts.

Most of the remaining soils in fill deposits are not associated with cut surfaces, and they contain varying amounts of artifacts. These fill deposits in the District can be further subdivided into two groups. One group consists of soils that formed in deposits that are mainly composed of mineral soil and geologic materials (from Piedmont residuum, Coastal Plain sediment, and recent alluvium) and inorganic artifacts. The artifacts generally include bricks, cinders, glass, concrete, wood, and metal. The largest areas of soil mapped in these deposits are in West Potomac and Anacostia Parks, in areas east of the Anacostia River near Bolling Air Force Base, on the Mall, and on Columbia Island. These fill materials exhibit marked heterogeneity over short distances, with regard to texture, thickness and arrangement of strata, content and types of artifacts, and volumes and type of coarse fragments. Bulk densities tend to be high but are variable. Although these deposits have some organic matter in places in the lower depths, the total amount is considered to be low as compared to the Udorthents, deep.

The second group of fill soils are Udorthents, deep (sanitary landfills). Here organic materials, such as paper and kitchen wastes, mixed with inorganic wastes are commonly covered with 3 to 4 feet of soil material resembling the parent material of Udorthents and Udorthents, smoothed.

The main property that makes this second group of fill soils different from the first is the large amount of organic matter at the lower depths. Because oxygen is not readily available to these materials, anaerobic conditions have developed. Under these conditions, hazardous gases such as methane and carbon dioxide are produced and build up in the soils and in their substratum. These soils are severely limited for most kinds of construction because of the subsidence problem and also because the gases may be explosive. Also the gases produced are harmful or toxic to many kinds of plants. Thus, justification exists for separation of soils in these materials into distinctive classes. Another limitation of these soils for construction is subsidence, which is caused by decomposition and collapse of the organic materials.

Recent studies by the National Park Service have shown that some of the other fill soils, presently included with Udorthents and Udorthents, smoothed, also have pockets where methane has built up in the soil atmosphere. It is not known with certainty whether this gas is originating from buried marshes that are under many of the fill soils in the District or from organic materials buried in the fill, or from both.

Relief

The District of Columbia straddles the boundary between the unconsolidated sediment of the Atlantic Coastal Plain in the southeast and the rocks of the Piedmont in the northwest. This boundary is called the Fall Line, and in the District it runs north to south through northwest Washington along Rock Creek Park. The Piedmont consists of gently rolling and level uplands strongly dissected by streams that have steep valley walls. The Coastal Plain is gently rolling to level at the margin where it joins the Piedmont area and on the southeast side of the Anacostia River. Near the lower central part of the city, which makes up the lower downtown business and parkland area, the topography is very gently sloping to level.

In soil formation, relief controls surface drainage and affects the percolation of water through the soil. Relief often affects the depth of the soil, the plant and animal life, and some of the soil-forming processes. Soils on steeper slopes, such as most Manor soils, generally are thin and have weakly expressed horizons because of erosion. Soils in landscape depressions are usually wet, whereas soils on higher convex surfaces are better drained.

Natural differences in elevation and shape of the land surface account for many of the differences among soils that formed in the same kind of parent material. This can be illustrated by Sassafras, Woodstown, and Fallsington soils. All three soils formed in loamy Coastal Plain sedi-

ment. The Sassafras soils are on higher, convex land surfaces and are well drained; the Woodstown soils are on intermediate landscape positions, are moderately well drained, and have grayish brown and strong brown mottles in the lower part of the B horizon; the Fallsington soils are in low positions that are commonly concave, are poorly drained, and have gray matrix colors in the B horizon. The differences in topography cause free water to leave the well drained soils and to accumulate in the poorly drained soils. Toposequences of soils in the District are given in Table 18 and illustrated in figs. 30 and 31.

In the District, man has become a complicating factor in the analysis of relief as a soil forming factor. Most soils on manmade land surfaces are too youthful to show differences in color and other properties that are normally associated with topographic differences. For this reason, different drainage classes of soils have normally not been recognized for the soils developed in man-deposited materials (Table 18). By shaping the land and making new landforms, man has often changed drainage relationships and thereby changed some of the chemical and physical processes operating in the soils. The Udorthents, smoothed, and the Udorthents mapping units display relief that has been created or strongly altered by man.

Time

The length of the time that the soil parent material has been in place and exposed to the active forces of climate and plant and animal life strongly influences the nature of the soil.

Very youthful soils, such as those that formed in recent alluvium or in recent man-deposited fill materials, are essentially unaltered parent material. Most of these soils are classified as Entisols (from rec*ent*). The C horizon in these soils extends essentially to the soil surface and is subdivided only on the basis of depositional stratification in the materials (Tables 14, 15, 16, and 17).

The age of some soils in the man-deposited fills is known from historical records or from artifacts in the soils. For example, champagne bottles from about 1840 were found in the fill at the National Christmas Tree site on the Ellipse near the White House. Well preserved newspapers from the summer of 1968 were found in a profile sampled at the Kenilworth sanitary landfill. Soils at these sites, mapped as Udorthents, showed little evidence of change from the parent material except for some development of soil structure. Earthworm activity was quite intense in the somewhat older soils on the Ellipse.

Soils in East Potomac Park, mapped in the Lindside and Melvin series, formed in river dredgings deposited in the late 1800's. These soils have developed soil structure in the subsoil, and iron in these soils has been segregated into mottles such that the drainage class of these soils can be inferred from soil color patterns. These soils and most soils in recent alluvium are classified as Inceptisols and Entisols.

Natural soils in the Piedmont and Coastal Plain uplands of the District normally are much older and have soil profile features reflecting this age. On the more nearly level land surfaces, these soils have a B horizon that has been enriched with clay by soil forming processes. Most of these soils are classified as Ultisols (from *ult*imate).

On steeper slopes natural soils on uplands, such as Manor and Ashe soils, are less developed, having only the structure and color of a B horizon but little clay enrichment. Such soils are classified as Inceptisols (Table 19).

Morphology of Soils

The results of the soil-forming factors are evidenced by the different layers, or soil horizons, in a profile. The soil profile extends from the surface down to materials that are little altered by the soil-forming processes.

Most soils contain three major horizons, the A, B, and C horizons (*33*). Some soils, particularly those in forests, also have an O (organic) horizon at the surface. This horizon is an accumulation of organic material, such as twigs and leaves, or of humified organic material that has little admixture of mineral material. The major horizons can be subdivided by the use of numbers and letters to indicate differences within the horizon. The B2t horizon, for example, represents the best developed part of a B horizon that has an accumulation of clay from overlying horizons. The Sassafras soils, for example, have a B2t horizon.

The A horizon is a mineral surface layer. An A1 horizon is darkened by humified organic matter. An Ap horizon is a plow layer, commonly also darkened with organic matter. The A horizon is the layer of maximum leaching or eluviation of clay and iron. If considerable leaching has taken place and organic matter has not darkened the material, the horizon is called the A2. Where it occurs, the A2 horizon is normally the lightest colored horizon in the profile.

The B horizon normally underlies the A horizon and is commonly called the subsoil. It is the horizon of maximum accumulation, or illuviation, of clay, iron, aluminum, or other compounds leached from the surface layer.

In some soils, such as the Manor soils, the B horizon is formed mainly by alteration of the original material rather than by illuviation. The alteration can be caused by the weathering of the parent material, the releasing of iron to give rusty colors, and the development of soil structure in place of the original rock or sediment structure. The B horizon commonly has blocky or prismatic structure; it generally is firmer and is lighter in color than the A1 horizon, but it is darker colored than the C horizon or the A2 horizon.

The C horizon is below the A or B horizon. It consists of materials that are little altered by the soil forming processes, but it may be modified by weathering.

In youthful soils, such as those that formed in recent alluvium or in man-deposited fill materials, the C horizon may reach to or nearly to the soil surface and the B horizon and in places even the A horizon may be absent.

Processes of Soil Horizon Differentiation

Several processes are involved in the formation of soil horizons. Among these are the accumulation of organic matter, the leaching of soluble constituents, the chemical reduction and movement of iron, the formation of soil structure, and the formation and translocation of clay minerals. These processes often operate simultaneously. Such processes have been going on for thousands of years in old soils.

The accumulation and incorporation of organic matter takes place as plant residue and man-deposited organic materials decompose and are mixed into the soil. These additions darken the mineral soil materials and are responsible for forming the A1 horizon.

In order for soils to have distinct subsoils, lime and more soluble materials must be leached before the translocation of clay minerals. Once this has taken place, the clay can disperse more easily and be moved as part of the percolate. Clay has accumulated in the Bt horizon of those soils classified as Ultisols by being leached from overlying horizons and stopping in the B horizon as a result of flocculation and the drying up of the percolating water. Also, clay from dissolved silica and aluminum has accumulated in these horizons. More inert materials such as silt and sand-size quartz are concentrated in the A horizon as the more soluble materials and clay are leached out.

A fragipan (Bx horizon) has formed in the subsoil of some of the moderately well drained soils. It is very firm and brittle when moist and very hard when dry. Soil particles are tightly packed so that bulk density is high and pore space is low. Genesis of these horizons is not fully understood, but studies indicate that swelling and shrinking take place in alternate wet and dry periods. This shrink-swell process and the materials filling the cracks account for the packing of soil particles and also for a gross polygonal pattern of cracks in the fragipan. Beltsville and Bourne soils are examples of soils in the District that have a fragipan.

The natural, well drained and moderately well drained soils in the District generally have yellowish brown or reddish brown subsoils. These colors come from finely divided iron oxide minerals that coat the sand, silt, and clay particles. These iron oxides have formed from iron released during the weathering of silicate minerals in the present soil or in soils that were the source of sediment in which the present soil developed. In more poorly drained soils, gray colors in subsoil horizons indicate the absence of free iron oxide coatings. In the gray zones the iron has been chemically reduced to a more soluble form during wet conditions when oxygen was excluded and the iron was either leached from the soils or was concentrated in iron oxide mottles and concretions.

Position, Parent Material, and Drainage Relationship Among Soils

Relationships between soil series or comparable classes of soils found in the District of Columbia are shown in Table 18.

Soil Series and Morphology

On the following pages each soil series in the survey area is described in detail. The series descriptions are presented in alphabetic order by series name.

For each series, some facts about the soil and its parent material are presented first. Then a pedon, a small three dimensional area of soil typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*33*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series mapped in this survey area. In the last paragraph the series is compared with similar soil series and with nearby soil series. Phases, or mapping units, of each soil series are described in the section "Soil Maps for Detailed Planning."

Ashe Series

The Ashe series consists of coarse-loamy, mixed, mesic Typic Dystrochrepts. These soils are moderately deep and somewhat excessively drained. They have a loam B horizon and a thick, variegated C horizon. They formed in residuum from gneiss. Ashe soils are on side slopes and ridgetops of strongly dissected uplands on the Piedmont Plateau. Slope ranges from 8 to 40 percent but is dominantly 15 to 40 percent.

Ashe soils are associated on the landscape with Brandywine, Glenelg, and Manor soils. They are not so micaceous as Manor soils and are sandier. Ashe soils have a thinner, less clayey solum than Glenelg soils. They lack the skeletal material typical of Brandywine soils.

Typical pedon of Ashe loam, 15 to 40 percent slopes, about 280 feet north of Military Road and 300 feet east of 30th Street NW., in Little Forest Park.

A1—0 to 6 inches, dark yellowish brown (10YR 4/4) loam; moderate medium granular structure; friable; many roots; extremely acid; gradual smooth boundary.

B1—6 to 9 inches, yellowish brown (10YR 5/6 and 5/8) sandy loam; weak medium subangular blocky structure; friable, slightly brittle; many roots; very few mica flakes; about 3 percent weathered gneiss and hard quartz pebbles; very strongly acid; gradual smooth boundary.

B2—9 to 18 inches, strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; friable; many roots; common mica flakes; about 3 percent weathered gneiss fragments and hard quartz pebbles; very strongly acid; gradual irregular boundary.

B3—18 to 23 inches, brown (7.5YR 4/4) and strong brown (7.5YR 5/6) loam; weak coarse angular and subangular blocky structure; friable, slightly brittle; many roots; many black (10YR 2/1) biotite flakes; about 3 percent weathered gneiss and hard quartz pebbles; very strongly acid; abrupt wavy boundary.

C—23 to 36 inches, variegated yellowish brown (10YR 5/6), yellowish red (5YR 5/6), black (10YR 2/1), and very pale brown (10YR 8/3) sandy loam; massive; inherent rock structure; firm in place, very brittle; common roots; common black (10YR 2/1) biotite flakes; about 2 percent very small hard quartz and gneiss pebbles; very strongly acid; gradual smooth boundary.

Cr—36 to 60 inches, variegated yellowish brown (10YR 5/6), yellowish red (5YR 5/6), black (10YR 2/1), and very pale brown (10YR 8/3) saprolite that crushes to loamy sand; massive; very hard and brittle in place; common roots along fractures; common black biotite flakes; about 3 percent very small hard quartz and weathered gneiss pebbles; very strongly acid.

The solum ranges from 14 to 36 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. Coarse fragments in the solum range from 2 to 5 percent in most pedons. Coarse fragments in the upper part of the C horizon are generally less than 15 percent.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 8.

The B horizon has hue of 10YR to 7.5YR, value of 4 or 5, and chroma of 4 to 6. The texture is loam or sandy loam.

The C horizon is commonly variegated. Texture is sandy loam or loamy sand. The Cr horizon is partially weathered gneiss.

Beltsville Series

The Beltsville series consist of fine-loamy, mixed, mesic Typic Fragiudults. These soils are deep, are moderately well drained, and have a fragipan. They formed in silty material deposited over very old sandy or gravelly deposits on uplands of the Coastal Plain. Slopes range from 0 to 8 percent.

Beltsville soils are near Bourne, Chillum, Matapeake, and Sassafras soils. Beltsville soils are not so well drained as Chillum, Matapeake, and Sassafras soils. They have a fragipan, which Chillum, Matapeake, and Sassafras soils lack. They are not so sandy as Bourne soils.

Typical pedon of Beltsville silt loam, 0 to 8 percent slopes, in a wooded area west of Trinity College, approximately 300 feet west of North Capitol Street and 330 feet north of Michigan Avenue.

0—2 inches to 0, partially decomposed leaf litter from mixed hardwoods.

A1—0 to 3 inches, dark brown (10YR 3/3) silt loam; weak fine granular structure; very friable; many roots; very strongly acid; abrupt smooth boundary.

A2—3 to 11 inches, pale brown (10YR 6/3) silt loam; weak fine granular structure; friable; many roots; very strongly acid; gradual smooth boundary.

B1—11 to 16 inches, yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; slightly hard, friable; many roots; very strongly acid; gradual smooth boundary.

B2t—16 to 21 inches, yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) heavy silt loam; moderate medium subangular blocky structure; hard, firm; few roots; distinct discontinuous clay films on ped surfaces; very strongly acid; gradual smooth boundary.

Bx—21 to 45 inches, light olive brown (2.5Y 5/6) loam; common medium distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; strong very coarse prismatic structure parting to strong medium platy structure; very dense and compact, very firm and brittle; no roots; distinct strong brown (7.5YR 5/8) clay films on surfaces of plates and faces of prisms; very strongly acid; gradual smooth boundary.

IIC—45 to 60 inches, variegated yellowish brown (10YR 5/6) and very pale brown (10YR 7/4) gravelly fine sandy loam; massive; very hard, very firm; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to the fragipan ranges from 20 to 24 inches.

The A horizon has hue of 10YR, value of 3 to 6, and chroma of 2 to 4.

The B1 horizon has hue of 2.5Y to 10YR, the B2t horizon has hue of 2.5Y to 7.5YR, and the Bx horizon has hue of 2.5Y or 10YR. The Bl and B2t horizons have value of 4 or 5 and chroma of 4 to 8. The Bx horizon has value and chroma of 4 to 6. The B horizon ranges from loam to heavy silt loam in texture.

The IIC horizon in most places is gravelly and is variegated. It ranges from sandy loam to clay loam in texture.

Bibb Series

The Bibb series consists of coarse-loamy, siliceous, acid, thermic Typic Fluvaquents. These soils are deep and poorly drained. They have a sandy C horizon that is commonly stratified. They formed in alluvium on flood plains of the Coastal Plain. Slopes range from 0 to 2 percent.

Bibb soils are associated with Fluvaquents, ponded, and Iuka soils. Bibb soils are wetter than Iuka soils. They are not ponded as are Fluvaquents, ponded.

Typical pedon of Bibb sandy loam in a wooded area about 150 feet northwest of junction of Polk Street and Anacostia Avenue NE.

A11—0 to 8 inches, very dark brown (10YR 2/2) sandy loam; weak fine granular structure; friable; many roots; extremely acid; clear smooth boundary.

A12—8 to 14 inches, grayish brown (2.5Y 5/2) sandy loam; weak fine granular structure; friable; many roots; extremely acid; gradual smooth boundary.

C1g—14 to 36 inches, gray or light gray (10YR 6/1) coarse sandy loam with common medium prominent yellowish red (5YR 5/6) mottles and common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; few roots; extremely acid; clear smooth boundary.

C2g—36 to 60 inches, gray or light gray (10YR 6/1) loamy sand; single grained; loose; black (10YR 2/1) stains on some sand grains; very strongly acid.

The A horizon has hue of 10YR or 2.5Y, value of 2 to 5, and chroma of 1 to 3.

The C horizon has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 1 or 2. The upper part generally is mottled. In some pedons the C horizon is variegated in color. The texture of individual layers in the C horizon ranges from loamy sand to silt loam. In some pedons the C horizon is stratified, and some strata contain 15 to 50 percent gravel.

Bourne Series

The Bourne series consists of fine-loamy, mixed, thermic Typic Fragiudults. These soils are deep, are moderately well drained, and have a fragipan. They have a clay loam and sandy loam B horizon and a thick, variegated, sandy loam C horizon. They formed in thick sandy sediment that contains moderate amounts of clay and silt. These soils generally are in fairly large areas on broad ridgetops at the higher elevations of the Coastal Plain. Slopes range from 0 to 15 percent.

Bourne soils are associated on the landscape with Beltsville, Chillum, Sassafras, and Woodstown soils. Bourne soils are not so well drained as Chillum and Sassafras soils. They are generally on higher elevations than Woodstown soils. Bourne soils have a fragipan, which Sassafras and Woodstown soils lack. They are not so silty as Beltsville soils.

Typical pedon of Bourne fine sandy loam, 8 to 15 percent slopes, in Barnard Hill Park, about 375 feet west of the junction of Eastern Avenue and Varnum Street.

A1—0 to 5 inches, dark brown (10YR 4/3) fine sandy loam; weak fine granular structure; friable; many roots; medium acid (limed); clear smooth boundary.

B1—5 to 11 inches, brownish yellow (10YR 6/6) fine sandy loam; moderate fine and medium granular structure; friable; many roots; medium acid; gradual wavy boundary.

B2t—11 to 18 inches, strong brown (7.5YR 5/6) clay loam; moderate fine and medium angular blocky structure; firm, slightly sticky; common roots; distinct clay films on ped surfaces; strongly acid; gradual smooth boundary.

Bx1—18 to 28 inches, strong brown (7.5YR 5/6) sandy clay loam; strong very coarse prismatic and weak thick platy structure; firm, hard, sticky; few roots along prisms; continuous clay films on ped surfaces; discontinuous thin layer of reddish brown (5YR 4/4) ironstone at depth of 20 inches; strongly acid; gradual wavy boundary.

Bx2—28 to 41 inches, variegated strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), yellowish red (5YR 4/8), and light brownish gray (10YR 6/2) fine sandy loam; strong very coarse prismatic and moderate thick platy structure; very firm, extremely hard and brittle; few fine roots along prisms; about 5 percent small rounded pebbles; very strongly acid; gradual smooth boundary.

Cx—41 to 60 inches, variegated yellowish red (5YR 5/6), strong brown (7.5YR 5/6), and yellowish brown (10YR 5/6) fine sandy loam; massive; very firm, extremely hard and brittle; about 20 percent small rounded pebbles; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to the fragipan ranges from 18 to 24 inches. Coarse fragments in the solum range from 0 to 5 percent in most pedons. Coarse fragments in the C horizon range from 5 to 30 percent.

The A horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. It is loam in a few pedons.

The Bt horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 8. It is clay loam or sandy clay loam. The Bx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. The lower part of the Bx horizon commonly is variegated and contains some low chroma mottles.

The C horizon in most places is variegated. In some pedons it is stratified.

Brandywine Series

The Brandywine series consists of sandy-skeletal, mixed, mesic Typic Dystrochrepts. These soils are deep and somewhat excessively drained to excessively drained. They have a gravelly loam B horizon and a thick, variegated, gravelly loamy sand C horizon. They formed in residuum from gneiss that has a high percentage of quartz. Brandywine soils are on side slopes and ridgetops of strongly dissected uplands of the Piedmont Plateau. Slope ranges from 0 to 40 percent but is dominantly 8 to 15 percent.

Brandywine soils are associated on the landscape with Ashe, Joppa, and Manor soils. Brandywine soils contain more coarse fragments than Ashe soils. They are not so red or micaceous as Manor soils. They are not so sandy or gravelly as Joppa soils.

Typical pedon of Brandywine gravelly loam, 15 to 40 percent slopes, in a wooded area along Rock Creek, about 1,500 feet southwest of Carter Barron Amphitheater.

O—1 inch to 0, loose hardwood leaf litter.

A1—0 to 3 inches, dark grayish brown (10YR 4/2) gravelly loam; weak fine granular structure; loose; many roots; very strongly acid; clear smooth boundary.

A2—3 to 10 inches, yellowish brown (10YR 5/4) gravelly loam; weak medium granular and weak medium subangular blocky structure; friable, many roots; common mica flakes; very strongly acid; gradual smooth boundary.

B2—10 to 22 inches, strong brown (7.5YR 5/6) gravelly loam; weak medium subangular blocky structure; friable; slightly sticky; many roots; common mica flakes; very strongly acid; clear wavy boundary.

C—22 to 60 inches, variegated yellowish brown (10YR 5/4), strong brown (7.5YR 5/8), and light olive brown (2.5Y 5/4) gravelly loamy sand; inherent rock structure; friable, few roots; many mica flakes; very strongly acid.

The solum ranges from 15 to 25 inches in thickness. Depth to bedrock ranges from about 4 to 10 feet. Coarse fragments in the solum range from 35 to 70 percent in most pedons. The C horizon is gravelly or very gravelly.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4.

The B horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6.

The C horizon commonly is variegated.

Chillum Series

The Chillum series consists of fine-silty, mixed, mesic Typic Hapludults. These soils are well drained and deep. They formed in a thin mantle of wind-deposited silty material underlain by deposits of very hard sandy and gravelly material. Chillum soils are on uplands of the Coastal Plain. Slope ranges from 0 to 40 percent but is dominantly 8 to 15 percent.

The Chillum soils are associated on the landscape with Bourne, Sassafras, Beltsville, Matapeake, and Croom soils. Chillum soils are better drained and lack the fragipan typical of Beltsville soils. They have a thinner silty mantle than Matapeake soils and a thicker one than Croom soils. They are not so sandy as Sassafras or Bourne soils, and they lack the fragipan typical of Bourne soils.

Typical pedon of Chillum silt loam, 8 to 15 percent slopes, on the side of an abandoned gravel pit at the National Arboretum approximately 800 feet west of the second pond down Hickey Run, NE.

A1—0 to 2 inches, very dark gray (10YR 3/1) silt loam; weak fine granular structure; very friable; many roots; very strongly acid; clear smooth boundary.

A2—2 to 12 inches, pale brown (10YR 6/3) silt loam; weak fine granular structure; very friable; many roots; very strongly acid; clear smooth boundary.

B21t—12 to 16 inches, brown (7.5YR 5/4) heavy silt loam; moderate medium subangular blocky structure; friable, slightly sticky; some clay films on ped faces; common roots; very strongly acid; gradual smooth boundary.

B22t—16 to 28 inches, yellowish red (5YR 5/6) silty clay loam; moderate medium subangular blocky structure; sticky and plastic; clay films on ped faces; common roots; strongly acid; abrupt smooth boundary.

IIC—28 to 60 inches, strong brown (7.5YR 5/6) very gravelly sandy loam; massive; very firm; few roots; about 60 percent well-rounded gravel; very strongly acid.

The solum ranges from about 20 to 30 inches in thickness. The solum of some pedons contains small amounts of smooth gravel, but it is commonly free of coarse fragments to the base of the Bt horizon. The IIC horizon is 10 to 60 percent gravel.

The A horizon has hue of 10YR and chroma of 1 to 4. Its value is 3 or 4 in the A1 horizon and 4 to 6 in the A2.

The B horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 4 to 6. It is heavy silty loam or silty clay loam.

The IIC horizon is variegated in some pedons. This horizon is hard, very firm, and gravelly.

Christiana Series

The Christiana series consists of clayey, kaolinitic, mesic Typic Paleudults. These soils are deep and well drained. They have a silty clay or clay B horizon and a thick, red or variegated, clayey C horizon. They formed in a thin mantle of silty material over much older deposits of plastic clay (fig. 31). These soils are on well-dissected uplands of the Coastal Plain. Slope ranges from 0 to 40 percent but is dominantly 8 to 15 percent.

Christiana soils are associated on the landscape with Keyport, Muirkirk Variant, and Sunnyside soils. Christiana soils are not so sandy in the upper part of the solum as Muirkirk Variant and Sunnyside soils. They are better drained than Keyport soils.

Typical pedon of Christiana silt loam, 8 to 15 percent slopes, in a wooded area directly northwest of the intersection of Benning Road and H street SE.

A1—0 to 4 inches, dark brown (10YR 3/3) silt loam; moderate fine granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.

B1—4 to 10 inches, yellowish brown (10YR 5/6) heavy silt loam; weak fine granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.

IIB21t—10 to 37 inches, red (2.5YR 5/6) silty clay; strong medium prismatic and moderate medium subangular blocky structure; firm, plastic and sticky; continuous clay films on ped surfaces; common roots; extremely acid; diffuse irregular boundary.

IIB22t—37 to 60 inches, red (2.5YR 5/6) silty clay; strong medium and coarse prismatic and strong medium and coarse subangular blocky structure; firm, very plastic and sticky; few roots; thick continuous clay films on ped surfaces; some ped surfaces coated with reddish gray (10R 6/1) material; extremely acid; diffuse irregular boundary.

IIC—60 to 75 inches; variegated pinkish white (7.5YR 8/2), red (2.5YR 5/6), strong brown (7.5YR 5/6), white (10YR 8/1), and dusky red (10R 3/4) silty clay; massive; very firm, sticky and plastic; no roots; extremely acid.

The solum ranges from 60 to 84 inches in thickness. The solum of most pedons is free of coarse fragments. In some pedons the IIC horizon has thin strata of sandy material and some sandstone fragments.

The A horizon has hue of 10YR or 5YR, value of 3 to 6, and chroma of 2 to 4.

The IIB horizon has hue of 10R, 5YR, or 2.5YR; value of 3 to 5; and chroma of 4 to 8. It ranges from silty clay to clay in texture.

The IIC horizon is red in some pedons, but it is dominantly variegated. It is firm and very sticky.

Codorus Series

The Codorus series consists of fine-loamy, mixed, mesic Fluvaquentic Dystrochrepts. These soils are deep and moderately well drained to somewhat poorly drained. They have a silt loam B horizon and a thick, stratified, highly micaceous C horizon. They formed in alluvium on flood plains of the Piedmont Plateau. Slopes range from 0 to 3 percent.

Codorus soils are associated on the landscape with Fluvaquents-Udifluvents complex, frequently flooded. Codorus soils are not so sandy or so stratified as Fluvaquents-Udifluvents complex, frequently flooded.

Typical pedon of Codorus silt loam located in a wooded area along Rock Creek, about 800 feet east of the junction of Wise Road and Beach Drive NW.

A1—0 to 8 inches, dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; many roots; strongly acid; clear smooth boundary.

B1—8 to 17 inches, yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; many roots; common mica flakes; strongly acid; clear smooth boundary.

B2—17 to 37 inches, yellowish brown (10YR 5/4) silt loam; few fine faint grayish brown (2.5Y 5/2) mottles and common medium distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; many roots; many mica flakes; strongly acid; gradual smooth boundary.

B3—37 to 50 inches, brown or dark brown (10YR 4/3) silt loam; with many fine distinct dark reddish brown (5YR 3/3) mottles; weak coarse subangular blocky structure; friable, slightly sticky; common roots; many mica flakes; strongly acid; clear smooth boundary.

IIC—50 to 60 inches, dark yellowish brown (10YR 3/4) stratified loam, silt loam, and sandy loam; friable; few roots; many mica flakes; some small pieces of black (10YR 2/1) decomposing plant matter; strongly acid.

The solum ranges from 36 to 60 inches in thickness. Coarse fragments make up 0 to 5 percent of most pedons. Content of coarse fragments in the IIC horizon is generally greater than that in the solum.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. The lower part of the B horizon has low- and high-chroma mottles. Its texture is silty clay loam in a few pedons.

The IIC horizon is variegated in some pedons.

Croom Series

The Croom series consists of loamy-skeletal, mixed, mesic Typic Hapludults. These soils are deep and well drained. They have a very gravelly sandy loam or sandy clay loam B horizon and a thick very gravelly sandy loam or sand C horizon. They formed in old deposits of sandy and clayey gravelly material. Croom soils are on ridgetops and side slopes of strongly dissected uplands of the Coastal Plain. Slope ranges from 0 to 40 percent but is dominantly 8 to 15 percent.

Croom soils are associated on the landscape with Sassafras, Chillum, and Beltsville soils. They have a thinner silty mantle than Chillum soils. Croom soils are better drained and more gravelly than Beltsville soils, and they lack the fragipan typical of Beltsville soils. They are more gravelly than Sassafras soils.

Typical pedon of Croom very gravelly sandy loam, 8 to 15 percent slopes, in a wooded area at the National Arboretum, about 1,600 feet east southeast of Arboretum office building and 800 feet west of the second pond down Hickey Run.

A1—0 to 2 inches, dark brown (10YR 4/3) very gravelly sandy loam; weak fine granular structure; very friable; many roots; about 30 percent smooth well-rounded pebbles; slightly acid; abrupt smooth boundary.

A2—2 to 12 inches, yellowish brown (10YR 5/6) very gravelly sandy loam; weak fine granular structure; very friable; common roots; about 60 percent smooth well-rounded pebbles; very strongly acid; clear smooth boundary.

B1—12 to 21 inches, yellowish brown (10YR 5/6) very gravelly sandy loam; weak medium subangular blocky structure; very friable, hard and firm in place; few roots; about 60 percent smooth well-rounded pebbles; very strongly acid; clear smooth boundary.

B2t—21 to 28 inches, yellowish red (5YR 5/6) very gravelly sandy clay loam; weak medium subangular blocky structure; friable, hard and firm in place; few roots; distinct clay films on ped faces; about 60

percent smooth well-rounded pebbles; very strongly acid; gradual wavy boundary.

B3—28 to 42 inches, strong brown (7.5YR 5/6) very gravelly sandy clay loam; weak medium subangular blocky structure; friable, firm and hard in place; few roots: about 60 percent smooth well-rounded pebbles; very strongly acid; gradual wavy boundary.

C—42 to 72 inches, strong brown (7.5YR 5/6) very gravelly sandy loam; light gray (10YR 7/2) and red (2.5YR 4/6) lenses; massive; hard; few roots; about 60 percent smooth well-rounded pebbles; very strongly acid.

The solum ranges from 40 to 120 inches in thickness. It is 35 to 70 percent coarse fragments.

The A horizon has hue of 10YR, value of 4 to 5, and chroma of 2 to 6.

The B horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 8. Its texture ranges from very gravelly sandy loam to gravelly sandy clay loam.

In some pedons the C horizon is variegated. In some pedons the C horizon is stratified and loose.

Dunning Series

The Dunning series consists of fine, mixed, mesic Fluvaquentic Haplaquolls. These soils are deep and poorly drained to very poorly drained. They have a silty clay loam or silty clay B horizon and a thick, black or grayish, stratified C horizon. They formed in alluvium or man-deposited dredged material on level or depressional areas of flood plains along the Anacostia River. Slope ranges from 0 to 2 percent.

Dunning soils are associated on the landscape with Udorthents and Melvin soils. They are more homogeneous and more poorly drained than Udorthents. Dunning soils have a darker surface layer and are more clayey than Melvin soils.

Typical pedon of Dunning soils in an open sodded area along a fence, about 1,400 feet east of the President's helicopter hangar, SE.

A11—0 to 16 inches, variegated yellowish red (5YR 5/8), greenish gray (5GY 6/1), and gray or light gray (N 6/) stratified sandy loam, sandy clay loam, and silty clay; massive, or weak coarse subangular blocky structure; firm, sticky; many roots; about 2 percent subrounded pebbles as much as 2 inches in diameter; some small pieces of wood and brick; extremely acid; abrupt smooth boundary.

IIA12b—16 to 27 inches, very dark grayish brown (10YR 3/2) silty clay loam; few medium distinct dark reddish brown (5YR 3/4) mottles and common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm, sticky; common roots; medium acid; gradual smooth boundary.

IIBbg—27 to 46 inches, very dark gray (5Y 3/1) silty clay loam; many medium prominent black (10YR 2/1) stains; weak medium angular blocky structure; firm, sticky; small pieces of black (10YR 2/1) decomposing plant matter; few roots; neutral; clear smooth boundary.

IICg—46 to 60 inches, black (10YR 2/1) stratified sandy loam, loam, and sandy clay loam; few fine distinct olive gray (5Y 5/2) mottles; massive; firm; small pieces of black (10YR 2/1) decomposing plant matter; no roots; mildly alkaline.

The solum ranges fom 40 to 50 inches in thickness. Coarse fragments range from 0 to 5 percent throughout the profile.

The A11 horizon is generally variegated. It ranges from sandy loam to silty clay in texture. The IIAb horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is mottled in most pedons.

The IIBbg horizon has hue to 10YR to 5GY, value of 3 or 4, and chroma of 1 or 2. The IIBbg horizon is heavily mottled. The texture ranges from silty clay loam to silty clay.

The IICg horizon is variegated in some pedons. Texture is silty clay in a few pedons.

Fallsington Series

The Fallsington series consists of fine-loamy, siliceous, mesic Typic Ochraquults. These soils are deep and poorly drained. They have a sandy loam or sandy clay loam B horizon and a thick, gray, stratified C horizon. They formed in old marine deposits of sandy material that contains low to moderate amounts of silt and clay. They are on the Coastal Plain. Slopes range from 0 to 2 percent.

Fallsington soils are associated on the landscape with Bibb, Iuka, and Woodstown soils. Fallsington soils are not subject to flooding, as are Iuka and Bibb soils. They are more poorly drained than Woodstown soils.

Typical pedon of Fallsington sandy loam in a wooded area about 1,500 feet east-northeast of Kenilworth Aquatic Gardens, NE.

A1—0 to 6 inches, black (10YR 2/1) sandy loam; weak medium granular structure; friable; many roots; very strongly acid; clear smooth boundary.

A2—6 to 13 inches, light brownish gray (10YR 6/2) sandy loam; many coarse distinct yellowish brown (10YR 5/6) mottles; weak coarse granular structure; friable; many roots; very strongly acid; gradual smooth boundary.

Btg—13 to 33 inches, grayish brown (2.5Y 5/2) heavy sandy loam; few medium distinct strong brown (7.5YR 5/6) mottles and few medium faint yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; friable; few roots; very strongly acid; gradual smooth boundary.

Cg—33 to 60 inches, gray (N 5/) loamy sand; few fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; no roots; very strongly acid.

The solum ranges from 30 to 40 inches in thickness. Coarse fragments in the solum range from 0 to 10 percent in most pedons. In some pedons the C horizon contains strata of gravelly material.

The A horizon has hue of 10YR or 2.5Y, value of 2 to 6, and chroma of 1 or 2.

The B horizon has hue of 5Y to 10YR, value of 4 to 6, and chroma of 0 to 2. The B horizon is mottled. Texture ranges from heavy sandy loam to sandy clay loam.

Galestown Series

The Galestown series consists of sandy, siliceous, mesic Psammentic Hapludults. These soils are deep and somewhat excessively drained. They have a loamy sand or sand B horizon and a thick loamy sand C horizon. They formed in old marine deposits of sand that have been at least partly reworked by wind. Galestown soils are on uplands and terraces of the Coastal Plain. Slope ranges from 0 to 15 percent but is dominantly 0 to 8 percent.

Galestown soils are associated on the landscape with Sassafras and Rumford soils. Galestown soils have a coarser textured B horizon than Sassafras or Rumford soils.

Typical pedon of Galestown loamy sand, 0 to 8 percent slopes in an area of Galestown and Rumford soils, about 150 feet northwest of Kenilworth Aquatic Gardens parking lot, NE.

A1—0 to 6 inches, very dark grayish brown (10YR 3/2) loamy sand; weak fine granular structure; loose; many roots; very strongly acid; abrupt smooth boundary.

A2—6 to 14 inches, dark yellowish brown (10YR 4/4) loamy sand; weak fine granular structure; loose; many roots; very strongly acid; gradual smooth boundary.

B2t—14 to 42 inches, strong brown (7.5YR 5/8) loamy sand; very weak fine blocky structure; very friable; common roots; sand grains coated with clay; very strongly acid; gradual smooth boundary.

C—42 to 60 inches, dark brown (7.5YR 4/4) and yellowish brown (10YR 5/6) loamy sand; single grained; very friable; few roots; very strongly acid.

The solum ranges from 35 to 45 inches in thickness. Coarse fragments in the solum range from 0 to 10 percent in most pedons. Coarse fragments in the C horizon range from 0 to 25 percent.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4.

The B horizon has hue of 10YR or 7.5YR, value of 4 to 5, and chroma of 4 to 8. It is sand in a few pedons.

In a few pedons the C horizon is more yellow in hue than the B horizon. In a few pedons the C horizon contains thin strata of fine material. A few pedons have a gravelly IIC horizon.

Glenelg Series

The Glenelg series consists of fine-loamy, mixed, mesic Typic Hapludults. These soils are deep and well drained. They have a heavy silt loam or silty clay loam B horizon and a thick, variegated, highly micaceous C horizon. They formed in residuum from micaceous schist and gneiss. Glenelg soils are on side slopes and ridgetops of strongly dissected uplands of the Piedmont Plateau. Slope ranges from 0 to 25 percent but is dominantly 8 to 15 percent.

Glenelg soils are associated on the landscape with Glenelg Variant, Manor, Brandywine, and Ashe soils. Glenelg soils are better drained than Glenelg Variant soils. They have a thicker and more clayey solum than Manor and Ashe soils. Glenelg soils are more clayey and contain less coarse fragments in the solum than Brandywine soils.

Typical pedon of Glenelg loam, 8 to 15 percent slopes, in a wooded area of Rock Creek Park, about 500 feet east of intersection of Oregon Avenue and Tennyson Street.

A1—0 to 2 inches, dark brown (10YR 3/3) loam; moderate fine granular structure; very friable; many roots; about 10 percent small quartz and schist fragments; very strongly acid; abrupt wavy boundary.

A2—2 to 9 inches, yellowish brown (10YR 5/4) loam; moderate medium granular structure; very friable; many roots; about 2 percent small quartz and schist fragments; very strongly acid; clear wavy boundary.

B21t—9 to 18 inches, strong brown (7.5YR 5/6) heavy silt loam; moderate medium subangular blocky structure; friable; patchy clay films in pores and on ped faces; common roots; about 2 percent small quartz and schist fragments; common mica flakes; very strongly acid; gradual smooth boundary.

B22t—18 to 28 inches, yellowish red (5YR 5/6) silty clay loam; moderate and strong medium and coarse subangular blocky structure; firm; continuous yellowish brown (10YR 5/4 and 5/6) clay films on ped faces; few roots; common mica flakes; few small quartz and schist fragments; very strongly acid; gradual irregular boundary.

C—28 to 60 inches, variegated yellowish red (5YR 5/6), yellowish brown (10YR 5/6), and red (2.5YR 4/6) loam; inherent rock structure; friable; few roots; highly micaceous; few small quartz and schist fragments; very strongly acid.

The solum ranges from 20 to 30 inches in thickness. Depth to bedrock ranges from 4 to 10 feet or more. Coarse fragments in the solum range from 0 to 5 percent in most pedons. A few pedons are channery, containing as much as 30 percent flat fragments of hard quartz and weathered schist. Coarse fragments in the C horizon are generally less than 10 percent but are as much as 35 percent in some pedons.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4.

The B horizon has hue of 7.5YR or 5YR, value of 5 or 6, and chroma of 6 to 8. The texture is silt loam or silty clay loam.

The C horizon is generally variegated. Texture ranges from loam to sandy loam.

Glenelg Variant

The Glenelg Variant consists of fine-loamy, mixed, mesic Aquic Hapludults. These soils are deep and moderately well drained. They have a silt loam and loam B horizon and a thick, variegated, highly micaceous C horizon. They formed in residuum from micaceous schist or gneiss. Glenelg Variant soils are on flats, in depressions, at the foot of hills, and around the heads of drainageways. They occur on the Piedmont Plateau. Slope ranges from 0 to 8 percent.

Glenelg Variant soils are associated on the landscape with Ashe, Brandywine, Manor, and Glenelg soils. Glenelg variant soils are not so well drained as any of those soils and are at lower elevations.

Typical pedon of Glenelg Variant silt loam, 0 to 8 percent slopes, in a wooded area of Rock Creek Park, about 100 feet off roadway on West Beach Drive and about 2,000 feet east of Montgomery County line.

O—1 to 0 inches, partially decomposed leaf litter from mixed hardwoods.

A1—0 to 3 inches, very dark grayish brown (10YR 3/2) silt loam; moderate medium granular structure; friable, slightly sticky; many roots; few mica flakes; strongly acid; abrupt smooth boundary.

A2—3 to 6 inches, yellowish brown (10YR 5/4) silt loam; weak medium granular structure; friable, slightly sticky; many roots; common mica flakes; strongly acid; gradual smooth boundary.

B21t—6 to 26 inches, yellowish brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; friable, slightly sticky; many roots; common clay films on ped surfaces; common mica flakes; very strongly acid; gradual smooth boundary.

B22t—26 to 34 inches, yellowish brown (10YR 5/6) loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm, slightly sticky; few roots; common patchy clay films on ped surfaces; common mica flakes; very strongly acid; gradual smooth boundary.

B3—34 to 41 inches, yellowish brown (10YR 5/6) loam; common medium light brownish gray (10YR 6/2) and yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; firm, slightly sticky; few roots; many mica flakes; very strongly acid; clear wavy boundary.

C—41 to 60 inches, variegated yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) fine sandy loam; inherent rock structure; very friable; high content of mica; very friable; very strongly acid.

The solum ranges from 30 to 48 inches in thickness. Depth to bedrock is 4 to 6 feet or more. Coarse fragments in the solum range from 0 to 5 percent in most pedons. A few pedons are channery or gravelly, containing as much as 30 percent fragments of quartz and schist. Coarse fragments in the C horizon are generally less than 10 percent, but some pedons have very channery layers in the C horizon; these layers are as much as 60 percent quartz fragments.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 5. It is loam in a few pedons.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The lower part of the B22t horizon and the B3 horizon are mottled. The texture ranges from loam to silty clay loam.

The C horizon is commonly variegated. Texture is loam or fine sandy loam.

Iuka Series

The Iuka series consists of coarse-loamy, siliceous, acid, thermic Aquic Udifluvents. These soils are deep and moderately well drained. They have a thick sandy loam C horizon. They formed in alluvium on flood plains of the Coastal Plain. Slopes range from 0 to 2 percent.

Iuka soils are associated on the landscape with Fluvaquents-Udifluvents complex, frequently flooded, and Bibb and Fallsington soils. They are generally better drained than and not so stratified as Fluvaquents-Udifluvents complex, frequently flooded. They are better drained than Bibb soils. Iuka soils are on flood plains, whereas Fallsington soils are on low-lying uplands.

Typical pedon of Iuka sandy loam on a flood plain, about 900 feet west of Minnesota Avenue and 1,200 feet north of Randle Circle SE.

A1—0 to 10 inches, dark grayish brown (10YR 4/2) sandy loam; weak medium granular structure; friable; many roots; strongly acid; clear smooth boundary.

B2—10 to 21 inches, yellowish brown (10YR 5/4) sandy loam; few fine distinct strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2) mottles; massive; friable; common roots; strongly acid; gradual wavy boundary.

Cg—21 to 60 inches, light brownish gray (2.5Y 6/2) sandy loam; many medium distinct reddish brown (2.5YR 5/4) mottles; massive; friable; few roots; many small pieces of black (10YR 2/1) decaying plant material; strongly acid.

The A horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4.

The C horizon has hue of 2.5Y to 7.5YR, value of 4 to 6, and chroma of 2 to 6. The colors of lower chroma always occur in the lower part of the C horizon. In some pedons the lower part of the C horizon has thin strata of sandy clay loam and loamy sand.

Joppa Series

The Joppa series consists of loamy-skeletal, siliceous, mesic Typic Hapludults. These soils are deep and well drained to excessively drained. They have a very gravelly sandy loam B horizon and a thick very gravelly sand C horizon. They formed in old sandy and very gravelly deposits at higher elevations in strongly dissected areas of the Coastal Plain. Some areas are isolated cappings on the Piedmont Plateau. Slope ranges from 0 to 40 percent but is dominantly 15 to 40 percent.

Joppa soils are associated on the landscape with Brandywine, Manor, and Sassafras soils. They are more gravelly than Brandywine and Sassafras soils. They are not so micaceous as Manor soils and contain more gravel than Manor soils.

Typical pedon of Joppa gravelly sandy loam, 15 to 40 percent slopes, in a wooded area of Rock Creek Park along Piney Branch, about 660 feet south of Argyle Terrace.

A1—0 to 3 inches, dark grayish brown (10YR 4/2) gravelly sandy loam; weak fine granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.

A2—3 to 7 inches, yellowish brown (10YR 5/4) gravelly sandy loam; weak fine granular structure; friable; many roots; about 30 percent rounded pebbles; very strongly acid; gradual wavy boundary.

B2t—7 to 27 inches, brown (7.5YR 5/4) very gravelly sandy loam; weak fine subangular blocky structure; friable; common roots; 50 to 60 percent rounded pebbles as much as 3 inches in diameter; clay films on pebbles and sand grains; very strongly acid; gradual wavy boundary.

C—27 to 60 inches, strong brown (7.5YR 5/6) very gravelly sand; single grained; friable; few roots; 60 percent rounded pebbles as much as 2 inches in diameter; extremely acid.

The solum ranges from 20 to 30 inches in thickness. Coarse fragments throughout the profile range from 35 to 60 percent in most pedons.

The A horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4.

The B horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. Texture is loam or sandy loam in the fine earth fraction.

In some pedons the C horizon is variegated. In a few pedons the C horizon contains thin strata of fine material.

Keyport Series

The Keyport series consists of clayey, mixed, mesic Aquic Hapludults. These soils are deep and moderately well drained. They have a silty clay and silty clay loam B2 horizon and a thick, gray silty clay loam C horizon. They formed in a thin mantle of fine sandy loam material over much older, more clayey deposits. These soils are generally at low elevations on dissected uplands of the Coastal Plain. Slope ranges from 0 to 15 percent but is dominantly 0 to 8 percent.

Keyport soils are associated on the landscape with Christiana, Muirkirk Variant, and Sunnyside soils. Keyport soils are not so well drained as any of these soils. They are not so sandy in the solum as Sunnyside or Muirkirk Variant soils.

Typical pedon of Keyport fine sandy loam, 0 to 8 percent slopes, on grounds of the National Arboretum, in crapemyrtle research plot, about 50 feet northeast of large willow oak and 400 feet south of Meadow Road.

Ap—0 to 5 inches, brown or dark brown (10YR 4/3) fine sandy loam; moderate medium granular structure; friable; many roots; mildly alkaline (limed); clear smooth boundary.

B1—5 to 12 inches, brownish yellow (10YR 6/6) fine sandy loam; moderate thin and very thin platy structure; firm, hard; common roots; very strongly acid; gradual smooth boundary.

B21t—12 to 21 inches, strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm, slightly sticky; thin continuous clay films on ped surfaces; few roots; very strongly acid; gradual smooth boundary.

B22t—21 to 40 inches, strong brown (7.5YR 5/8) silty clay; common medium distinct light brownish gray (2.5Y 6/2) mottles and few fine prominent yellowish red (5YR 5/6) mottles; strong medium angular blocky structure; firm, very sticky; very few fine roots; thick continuous clay films in pores and on ped surfaces; very strongly acid; gradual wavy boundary.

B23tg—40 to 52 inches, gray or light gray (5YR 6/1) silty clay; many coarse prominent yellowish red (5YR 5/8) mottles; moderate medium angular blocky structure; firm, very sticky; no roots; thick continuous clay films in pores and on ped surfaces; extremely acid; clear smooth boundary.

Cg—52 to 60 inches, variegated gray or light gray (5YR 6/1) and strong brown (7.5YR 5/6) silty clay loam; thin lenses of sandy clay loam; massive; firm, sticky; extremely acid.

The solum ranges from 40 to 60 inches in thickness. The solum of most pedons is generally free of coarse fragments.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B horizon has hue of 5YR, 10YR, or 7.5YR; value of 4 to 6; and chroma of 1 to 8. Low-chroma mottling usually occurs in the B horizon between depths of 2 and 30 inches. Texture of the B2 horizon is clay or silty clay.

In most pedons the C horizon is variegated, but in some it is gray or dark gray. In some pedons the C horizon is stratified. In some pedons the C horizon is sandy and contains thin layers of ironstone.

Lindside Series

The Lindside series consists of fine-silty, mixed, mesic Fluvaquentic Eutrochrepts. These soils are deep and moderately well drained. They have a mottled silt loam and silty clay loam B2 horizon and a thick, mottled, dark grayish brown silt loam C horizon. They formed in stratified man-deposited river dredgings and recently deposited alluvium on flood plains. In some areas these flood plains are manmade. Slope ranges from 0 to 3 percent.

Lindside soils are associated on the landscape with Fluvaquents, bouldery; Fluvaquents-Udifluvents complex, frequently flooded; Udifluvents, sandy; and Melvin soils. They are better drained than Melvin soils. They are not so well drained or so sandy as Udifluvents, sandy. They are not so wet or so bouldery as Fluvaquents, bouldery. They have better overall drainage than Fluvaquents-Udifluvents complex, frequently flooded.

Typical pedon of Lindside loam in East Potomac Park, about 0.1 mile northwest of Ecological Services Laboratory, just north of restrooms.

A1—0 to 4 inches, dark brown (10YR 3/3) loam; few fine faint mottles of dark brown (7.5YR 4/4); weak fine to moderate granular structure in top of horizon, grading to moderate medium subangular blocky structure in bottom; friable; common roots; some glass and charcoal; medium acid; abrupt smooth boundary.

IIB1—4 to 6 inches, dark brown (7.5YR 4/4) loam; few fine distinct mottles of strong brown (7.5YR 5/6); weak moderate subangular blocky structure; friable; common roots along ped faces and in worm channels; some glass with 5 percent, by volume, coarse fragments; slightly acid; abrupt smooth boundary.

IIIB21—6 to 17 inches, dark brown (10YR 3/3) silt loam; common fine faint dark yellowish brown (10YR 4/4) and very dark grayish brown (10YR 3/2) mottles; weak medium subangular blocky structure; friable; common roots along ped faces; some charcoal; medium acid; clear wavy boundary.

IVB22—17 to 23 inches, dark brown (10YR 4/3) silty clay loam; common medium distinct dark brown to brown (7.5YR 4/4) and dark grayish brown (10YR 4/2) mottles; moderate medium angular blocky structure parting to plates that separate along stratification lines; firm; common roots along faces and plates; medium acid; clear wavy boundary.

VB23—23 to 48 inches, dark grayish brown (10YR 4/2) silt loam; common medium distinct mottles of strong brown (7.5YR 5/6) and yellowish red (5YR 4/8); weak medium prismatic structure parting to weak to moderate medium subangular blocky structure; friable to firm; common roots along ped faces; many worm casts; strongly acid; clear smooth boundary.

VIC—48 to 60 inches, dark grayish brown (10YR 4/2) silt loam; common coarse distinct to prominent mottles of dark reddish brown (5YR 3/3 and 5YR 3/4); massive, with fine stratification; sticky; few fine roots; medium acid.

The solum ranges from 30 to 48 inches in thickness. Coarse fragments in the solum range from 0 to 5 percent in most pedons. Some subhorizons in the solum in a few pedons are gravelly. Coarse fragments include small pieces of artifacts such as charcoal, bricks, glass, wood, and cement. Coarse fragments in the C horizon are generally less than 5 percent. The C horizon generally does not contain artifacts.

The A horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 3 or 4; and chroma of 2 or 3. It is silt loam in a few pedons.

The B horizon has hue of 10YR to 2.5Y, value of 3 to 6, and chroma of 2 to 4. It is heavily mottled.

The C horizon is variegated in some pedons. In some pedons it is highly stratified.

In mapping unit Lp—Lindside silt loam, bedrock substratum, bedrock is within a depth of 48 inches.

Manor Series

The Manor series consists of coarse-loamy, micaceous, mesic Typic Dystrochrepts. These soils are deep and well drained to somewhat excessively drained. They have a loam and silt loam B horizon and a thick, variegated, highly micaceous C horizon. They formed in residuum from micaceous schist or gneiss. The Manor soils are on side slopes and ridgetops of strongly dissected uplands of the Piedmont Plateau. Slope ranges from 8 to 40 percent but is dominantly 8 to 15 percent.

Manor soils are associated on the landscape with Brandywine, Ashe, Glenelg, and Joppa soils. Manor soils are more micaceous and less sandy than Ashe and Brandywine soils. Manor soils have a thinner and less clayey solum than Glenelg soils. They are not so gravelly as Joppa soils.

Typical pedon of Manor loam, 15 to 40 percent slopes, about 940 feet east of Oregon Avenue and 260 feet south of Bingham Drive in Rock Creek Park.

O—2 inches to 0, partially decomposed leaf litter from hardwoods.

A1—0 to 4 inches, dark brown (10YR 3/3) loam; moderate fine granular structure; friable; many roots; few mica flakes; few flat quartz fragments about 1 inch in length; very strongly acid; gradual smooth boundary.

A2—4 to 8 inches, yellowish brown (10YR 5/4) loam; very weak fine subangular blocky and moderate medium granular structure; friable; many roots; many mica flakes; 3 percent hard flat quartz fragments, some as long as 3 inches; very strongly acid; gradual wavy boundary.

B2—8 to 18 inches, brown to dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; many roots; many mica flakes; 5 percent hard quartz fragments up to 3 inches in length; very strongly acid; gradual smooth boundary.

B3—18 to 23 inches, strong brown (7.5YR 5/6) loam; weak medium and coarse subangular blocky structure; friable; common roots; many mica flakes; 2 percent hard quartz fragments less than 1 inch in length; very strongly acid; gradual smooth boundary.

C1—23 to 36 inches, strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) light loam; massive; friable; common roots; many mica flakes; very few schist fragments; very strongly acid; gradual wavy boundary.

C2—36 to 60 inches, variegated greenish gray (5GY 5/1), reddish brown (5YR 4/4), and yellowish brown (10YR 5/6) light loam; massive, inherent rock structure; friable, loose; few roots; many mica flakes; many schist fragments; very strongly acid.

The solum ranges from 15 to 24 inches in thickness. Depth to bedrock ranges from 6 to 10 feet or more. Coarse fragments in the solum range from 0 to 5 percent in most pedons. A few pedons are channery, containing as much as 30 percent flat fragments of hard quartz and weathered schist. Coarse fragments in the C horizon are generally less than 10 percent, but some pedons have very channery subhorizons that contain as much as 50 percent hard quartz fragments.

The A horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 2 to 6.

The B horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. The texture ranges from loam to silt loam.

The C horizon is generally variegated. Texture is sandy loam in some subhorizons in the C horizon of some pedons.

Matapeake Series

The Matapeake series consist of fine-silty, mixed, mesic Typic Hapludults. These soils are deep and well drained. They have a silty clay loam and sandy clay loam B horizon and a thick sandy loam C horizon. They formed in old deposits of silty marine sediment over older, coarser textured sediment. Matapeake soils are on broad, smooth uplands of the Coastal Plain. Slope ranges from 0 to 15 percent.

Matapeake soils are associated on the landscape with Chillum, Beltsville, and Sassafras soils. They are thicker over gravelly material than Chillum soils. Matapeake soils are better drained than Beltsville soils and lack the fragipan typical of Beltsville soils. They are more silty in the solum than Sassafras soils.

Typical pedon of Matapeake silt loam in an area of Matapeake-Urban land complex, 0 to 8 percent slopes, on grounds of St. Elizabeth Hospital, about 180 feet northeast of tennis courts.

A1—0 to 6 inches, brown to dark brown (10YR 4/3) silt loam; strong medium and coarse granular structure; friable, slightly hard; many roots; strongly acid; clear smooth boundary.

A2—6 to 10 inches, yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable, slightly hard; many roots; strongly acid; abrupt smooth boundary.

B2t—10 to 30 inches, strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm, sticky and plastic; common roots; thin discontinuous clay films in pores and along root channels; very strongly acid; gradual smooth boundary.

IIB3t—30 to 38 inches, strong brown (7.5YR 5/6) sandy clay loam; weak medium subangular blocky structure; firm, sticky; few roots; patchy clay films on ped surfaces and in pores; strongly acid; gradual smooth boundary.

IIC—38 to 60 inches, strong brown (7.5YR 5/8) sandy loam; massive; friable, slightly sticky; no roots; 10 percent small rounded quartz pebbles; very strongly acid.

The solum ranges from 30 to 40 inches in thickness. Coarse fragments are generally lacking in the solum of most pedons. Coarse fragments in the C horizon are generally 10 percent or less.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. Colors of high value occur only in the A2 horizon.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The texture is heavy silt loam, silty clay loam, or sandy clay loam.

The C horizon is sand or loamy sand in a few pedons. In some pedons it is gravelly below a depth of 60 inches.

Melvin Series

The Melvin series consists of fine-silty, mixed, nonacid, mesic Typic Fluvaquents. These soils are deep and poorly drained. They have a heavy silt loam B horizon and a thick, gray silt loam C horizon. They formed in recently deposited alluvium or dredged material on flood plains of the Anacostia and Potomac Rivers. Slope ranges from 0 to 2 percent.

Melvin soils are associated on the landscape with Dunning and Lindside soils. They are not so clayey or so poorly drained as Dunning soils. Melvin soils are more poorly drained than Lindside soils.

Typical pedon of Melvin silt loam on the grounds of the U.S. Naval Station in an open field, about 500 feet northeast of Enterprise Hall.

A1—0 to 7 inches, brown to dark brown (10YR 4/3) silt loam; moderate medium granular structure; friable, slightly sticky; many roots; few mica flakes; few small pieces of red (2.5YR 5/8) brick; moderately alkaline; abrupt smooth boundary.

B2g—7 to 37 inches, gray (10YR 5/1) heavy silt loam; few medium distinct strong brown (7.5YR 5/6) mottles and few medium prominent dark reddish brown (2.5YR 3/4) mottles; weak medium angular blocky structure; firm, sticky; common roots; neutral; gradual smooth boundary.

Cg—37 to 60 inches, gray (5Y 5/1) light silt loam; common medium prominent yellowish red (5YR 4/6) mottles and few medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; few roots; neutral.

The solum ranges from 20 to 40 inches in thickness. Coarse fragments range from 0 to 5 percent in the solum of most pedons. Some pedons contain small pieces of brick, wood, shells, or other similar artifacts. In some pedons the C horizon is gravelly.

The A horizon has hue of 10YR, 2.5Y, or 5Y; value of 3 or 4; and chroma of 1 to 3.

The B horizon has hue of 2.5Y, 5Y, or 10YR; value of 4 to 6, and chroma of 0 to 2. The texture ranges from silt loam to light silty clay loam.

The C horizon is stratified in a few pedons.

Muirkirk Variant

The Muirkirk Variant consists of coarse-loamy over clayey, siliceous, mesic Typic Paleudults. These soils are deep and well drained to somewhat excessively drained. They have a sandy loam B21t horizon and a thick, red or variegated, clayey IIB22t horizon. They formed in a thin mantle of sandy material over much older deposits of plastic clay. These soils are on strongly dissected uplands of the Coastal Plain. Slope ranges from 0 to 40 percent but is dominantly 15 to 40 percent.

Muirkirk Variant soils are associated on the landscape with Sunnyside, Christiana, and Keyport soils. Muirkirk Variant soils are thinner over clay material than Sunnyside soils. They are not so silty in the upper part of the solum as Christiana soils. They are better drained than Keyport soils.

Typical pedon of Muirkirk Variant loamy sand in an area of Muirkirk Variant complex, 8 to 15 percent slopes, in a wooded area on grounds of the National Arboretum, about 300 feet east of Hickey Hill Road and 700 feet north of the confluence of Hickey Run and the Anacostia River.

O—1 inch to 0, partially decomposed leaf litter from hardwoods.

A1—0 to 5 inches, dark yellowish brown (10YR 4/4) loamy sand; weak fine granular structure; loose; many roots; very strongly acid; abrupt smooth boundary.

A2—5 to 11 inches, yellowish brown (10YR 5/6) loamy sand; weak fine granular structure; loose; many roots; extremely acid; gradual smooth boundary.

B21t—11 to 31 inches, strong brown (7.5YR 5/6) sandy loam; weak fine subangular blocky structure; friable; common roots; extremely acid; abrupt smooth boundary.

IIB22t—31 to 60 inches, red (2.5YR 5/6) clay; streaks of yellowish red (5YR 5/6); strong medium subangular blocky structure; firm, very sticky and plastic; few roots; extremely acid.

The solum ranges from 40 to 84 inches in thickness. In some pedons the A horizon and B21t horizon contain as much as 10 percent small rounded pebbles. In a few pedons the lower part of the IIB22t horizon contains a few flat ironstone fragments.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 6.

The B horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 4 or 5; and chroma of 6 or 8. The redder hues are generally restricted to the IIB22t horizon. Texture of the B21t horizon is sandy loam or loamy sand. Texture of the IIB22t horizon is silty clay or clay.

Neshaminy Series

The Neshaminy series consists of fine-loamy, mixed, mesic Ultic Hapludalfs. These soils are deep and well drained. They have a silt loam and clay loam B horizon and a thick, variegated loam C horizon. They formed in residuum from semibasic rock or mixed basic and acidic rocks. Neshaminy soils are on side slopes and ridgetops of strongly dissected uplands of the Piedmont Plateau. Slope ranges from 8 to 40 percent but is dominantly 15 to 40 percent.

Neshaminy soils are associated on the landscape with Chillum, Sassafras, and Manor soils. Neshaminy soils are not so gravelly in the lower part of the solum and in the substratum as Chillum soils. They are not so sandy as Sassafras soils. Neshaminy soils are not so micaceous as Manor soils.

Typical pedon of Neshaminy silt loam, 15 to 40 percent slopes, in a wooded area of Glover-Archbold Park about 1,200 feet north of junction of Reservoir Road and 44th Street NW.

O—2 inches to 0, partially decomposed hardwood leaf litter.

A1—0 to 4 inches, dark grayish brown (10YR 4/2) silt loam; weak medium granular structure; friable; many roots; strongly acid; clear smooth boundary.

A2—4 to 9 inches, yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; many roots; strongly acid; gradual smooth boundary.

B21t—9 to 18 inches, strong brown (7.5YR 5/6) heavy silt loam; weak medium subangular blocky structure; firm, slightly sticky; common roots; patchy discontinuous clay films on ped surfaces; medium acid; gradual smooth boundary.

B22t—18 to 34 inches, yellowish red (5YR 4/6) clay loam; moderate medium subangular blocky structure; firm, slightly sticky; common roots; thick distinct clay films in pores and on ped surfaces; medium acid; clear smooth boundary.

B3—34 to 40 inches, strong brown (7.5YR 5/6) clay loam; weak coarse subangular blocky structure; firm, slightly sticky; few roots; many small pieces of highly weathered semibasic rock; medium acid; gradual smooth boundary.

C—40 to 60 inches, variegated yellowish red (5YR 4/6), strong brown (7.5YR 5/6), and olive (5Y 5/4) loam; massive; friable; few roots; medium acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock ranges from 4 to 10 feet. Coarse fragments in the solum range from 0 to 15 percent in most pedons. A few pedons are gravelly, containing as much as to 25 percent rounded and angular pebbles. Coarse fragments in the C horizon are generally less than 10 percent.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4.

The B horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6.

The C horizon is generally variegated. Texture is loam or sandy loam.

Rumford Series

The Rumford series consists of coarse-loamy, siliceous, thermic Typic Hapludults. These soils are deep and somewhat excessively drained. They have a fine sandy loam to loamy sand B horizon and a thick fine sand C horizon. They formed in old marine deposits of sand that has been at least partly reworked by wind. Rumford soils are on uplands and terraces of the Coastal Plain. Slope ranges from 0 to 15 percent but is dominantly 0 to 8 percent.

Rumford soils are associated on the landscape with Sassafras and Galestown soils. Rumford soils have more clay in the B horizon than Galestown soils. They have less clay in the B horizon than Sassafras soils.

Typical pedon of Rumford loamy fine sand in an area of Galestown and Rumford soils, 0 to 8 percent slopes, on the grounds of D.C. Boys Village, about 800 feet northeast of Administration Building.

A1—0 to 6 inches, very dark grayish brown (10YR 3/2) loamy fine sand; weak fine granular structure; friable; many roots; very strongly acid; gradual smooth boundary.

A2—6 to 19 inches, dark yellowish brown (10YR 4/4) loamy fine sand; weak fine granular structure; friable, slightly brittle; common roots; strongly acid; gradual wavy boundary.

B2t—19 to 30 inches, strong brown (7.5YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable, slightly brittle; few roots; patchy clay films on ped faces; strongly acid; gradual smooth boundary.

B3t—30 to 39 inches, yellowish brown (10YR 5/4) loamy sand; weak coarse subangular blocky structure; friable, slightly brittle; few roots; clay films on sand grains; strongly acid; gradual smooth boundary.

C—39 to 60 inches, dark yellowish brown (10YR 4/4) fine sand; single grained; very friable; no roots; strongly acid.

The solum ranges from 30 to 50 inches in thickness. Coarse fragments in the solum range from 0 to 10 percent in most pedons. A few pedons are gravelly on the surface. Coarse fragments in the C horizon range from 0 to 30 percent.

The A horizon has hue of 10YR, value of 3 to 6, and chroma of 2 to 4.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. The texture ranges from loamy sand to light sandy clay loam.

The C horizon is fine sand, fine sandy loam, or sand. In a few pedons it is stratified.

Sassafras Series

The Sassafras series consists of fine-loamy, siliceous, mesic Typic Hapludults. These soils are deep and well drained. They have a sandy loam and sandy clay loam B horizon and a thick loamy coarse sand C horizon. They formed in old marine deposits of sandy sediment that contains moderate amounts of silt and clay. Sassafras soils are on side slopes and ridgetops of strongly dissected uplands of the Coastal Plain. Slope ranges from 0 to 40 percent.

Sassafras soils are associated on the landscape with Croom, Matapeake, Chillum, Joppa, Bourne, Woodstown, Galestown, and Rumford soils. They are not so gravelly as Joppa and Croom soils. They are not so silty as Chillum soils. Sassafras soils are not so sandy as Galestown and Rumford soils. They are better drained than Wood-

stown soils. They lack the fragipan characteristic of Bourne soils. Sassafras soils have a more sandy solum than Matapeake soils.

Typical pedon of Sassafras sandy loam in an area of Sassafras-Urban land complex, 0 to 8 percent slopes, on the grounds of D. C. Boys Village, about 200 feet northeast of entrance to Oxon Cove Sanitary Landfill and 300 feet east of Interstate 295.

A1—0 to 5 inches, very dark grayish brown (10YR 3/2) sandy loam; moderate medium granular structure; very friable; many roots; strongly acid; gradual wavy boundary.

A2—5 to 9 inches, brown (7.5YR 5/4) sandy loam; weak fine granular structure; friable; common roots; very strongly acid; gradual smooth boundary.

B21t—9 to 20 inches, strong brown (7.5YR 5/6) sandy loam; weak medium subangular blocky structure; friable; common roots; patchy clay films on ped surfaces; very strongly acid; gradual smooth boundary.

B22t—20 to 27 inches, yellowish red (5YR 5/6) light sandy clay loam; moderate medium subangular blocky structure; friable, sticky; few roots; continuous clay films on ped surfaces and in pores; very strongly acid; gradual smooth boundary.

B3—27 to 31 inches, strong brown (7.5YR 5/6) sandy loam; weak fine subangular blocky structure; very friable; few roots; strongly acid; clear smooth boundary.

C—31 to 60 inches, strong brown (7.5YR 5/6) loamy coarse sand; single grained; very friable; no roots; strongly acid.

The solum ranges from 25 to 45 inches in thickness. Coarse fragments range from 0 to 20 percent in the solum. Coarse fragments are as much as 30 percent in some subhorizons of the C horizon.

The A horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4.

The B horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8. Texture ranges from sandy loam to light sandy clay loam.

In a few pedons the C horizon is variegated. Texture is loamy coarse sand or sand.

Sunnyside Series

The Sunnyside series consists of fine-loamy, siliceous, mesic Typic Hapludults. These soils are deep and well drained. They have a sandy clay loam B horizon and a thick loamy sand C horizon. They formed in unconsolidated deposits of very old, dominantly sandy sediment. They are on strongly dissected uplands of the Coastal Plain. Slope ranges from 0 to 40 percent but is dominantly 8 to 15 percent.

Sunnyside soils are associated on the landscape with Muirkirk Variant, Keyport, and Christiana soils. They are deeper over clayey material than Muirkirk Variant soils. They are better drained and sandier than Keyport soils. They are deeper over clayey material and are sandier than Christiana soils.

Typical pedon of Sunnyside fine sandy loam, 8 to 15 percent slopes, on grounds of the National Arboretum, about 200 feet south of parking lot near the dogwood grove and 40 feet west of road in wooded area.

O—1 inch to 0, loose hardwood leaf litter.

A1—0 to 2 inches, dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; very friable; many roots; strongly acid; clear smooth boundary.

A2—2 to 5 inches, brown (7.5YR 5/4) fine sandy loam; weak fine granular structure; very friable; many roots; very strongly acid; clear smooth boundary.

B1—5 to 10 inches, yellowish red (5YR 4/6) light sandy clay loam; weak very fine subangular blocky structure; friable, slightly sticky; many roots; very strongly acid; clear smooth boundary.

B21t—10 to 20 inches, red (2.5YR 4/6) sandy clay loam; moderate medium and coarse subangular blocky structure; friable, slightly sticky; common roots; thin continuous clay films on ped surfaces and in pores; very strongly acid; gradual smooth boundary.

B22t—20 to 28 inches, yellowish red (5YR 5/6) gravelly sandy clay loam; weak coarse subangular blocky structure; very friable, slightly sticky; few roots; thin continuous clay films on ped surfaces and coating some pebbles; 20 percent small rounded pebbles; very strongly acid; diffuse smooth boundary.

C1—28 to 52 inches, stratified red (2.5YR 4/6) and reddish yellow (7.5YR 6/6) loamy sand; single grained; loose; few roots; 15 percent rounded and subrounded quartz pebbles in lower part of horizon; thin discontinuous sandy clay loam lamellae; extremely acid; clear smooth boundary.

C2—52 to 60 inches, reddish yellow (7.5YR 6/6) loamy very coarse sand; single grained; very loose; few roots; 5 to 10 percent smooth quartz pebbles; very strongly acid.

The solum ranges from 24 to 48 inches in thickness. Coarse fragments in the A horizon range from 0 to 5 percent. A few pedons have thin strata of ironstone or cemented sand within the solum. Coarse fragments in the B and C horizons range from 0 to 20 percent. Ironstone fragments are common in the C horizon of some pedons.

The A horizon has hue of 10YR or 7.5YR, value of 4 to 5, and chroma of 2 to 4.

The B horizon has hue of 5YR or 2.5YR, value of 4 to 6, and chroma of 4 to 8. Texture ranges from loam to sandy clay loam.

The lower part of the C horizon is clay or silty clay in many pedons. It is generally variegated.

Woodstown Series

The Woodstown series consists of fine-loamy, siliceous, mesic Aquic Hapludults. These soils are deep and moderately well drained. They have a sandy clay loam B horizon and a thick, grayish brown, coarse sandy loam C horizon. They formed in unconsolidated deposits of very old, sandy marine sediment. They are on uplands of the Coastal Plain. Slope ranges from 0 to 8 percent.

Woodstown soils are associated on the landscape with Sassafras and Matapeake soils. They are not so well drained as Sassafras or Matapeake soils. They are not so silty as Matapeake soils.

Typical pedon of Woodstown sandy loam in a vegetable garden plot about 200 feet southeast of the intersection of Oglethorpe and North Capitol Streets.

A1—0 to 8 inches, brown or dark brown (10YR 4/3) sandy loam; weak fine and medium granular structure; friable; many roots; strongly acid; abrupt smooth boundary.

A2—8 to 12 inches, yellowish brown (10YR 5/4) sandy loam; weak medium granular structure; friable; many roots; strongly acid; clear smooth boundary.

B21t—12 to 25 inches, yellowish brown (10YR 5/6) sandy clay loam; weak medium subangular blocky structure; friable, slightly sticky; common roots; patchy clay films on ped faces; very strongly acid; gradual smooth boundary.

B22t—25 to 40 inches, yellowish brown (10YR 5/6) sandy clay loam; common medium distinct reddish brown (5YR 5/4) and olive gray (5Y 4/2) mottles; moderate medium subangular blocky structure; friable, slightly sticky; few roots; discontinuous yellowish brown (10YR 5/4) clay films on ped faces; very strongly acid.

Cg—40 to 60 inches, grayish brown (2.5Y 5/2) coarse sandy loam; thin strata of loamy sand; common medium distinct reddish brown (5YR 5/4) and strong brown (7.5YR 5/6) mottles; massive; very friable; no roots; very strongly acid.

The solum ranges from 24 to 40 inches in thickness. Coarse fragments range from 0 to 5 percent. Some pedons have small rounded pebbles on the surface.

The A horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4.

The B horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 8. The B horizon has mottles that are low and high in chroma. It is sandy clay loam or sandy loam.

In some pedons the C horizon is stratified with material that ranges from fine sandy loam to sand and is variegated. Some pedons contain fine, smooth pebbles.

Classification of the Soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 (*34*). Readers interested in further details about the system should refer to the latest literature available (*36*).

The system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the bases for classification are the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 19 the soils of the survey area are classified according to the system. Classes of the system are briefly discussed in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Inceptisols.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and that are important to plant growth or that were selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ochrept (*Ochr*, meaning a surface horizon that is either light in color or low in organic matter, or both, plus *ept*, from Inceptisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. The name of a great group ends with the name of a suborder. A prefix added to the name suggests something about the properties of the soil. An example is Dystrochrepts (*Dystr*, meaning low base saturation-infertile, plus *ochrept*, the suborder of Inceptisols that are mainly light colored, brownish, and more or less freely drained).

SUBGROUP. Each great group is divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades that have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. The names of subgroups are derived by placing one or more adjectives before the name of the great group. The adjective *Typic* is used for the subgroup that is thought to typify the great group. An example is Typic Dystrochrepts.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is coarse-loamy, micaceous, mesic Typic Dystrochrepts.

SERIES. The series consists of a group of soils that are formed from a particular kind of parent material and have horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition. An example is the Manor series, which is a member of the family of coarse-loamy, micaceous, mesic Typic Dystrochrepts. The classification of each of the soil series or other comparable unit used in this soil survey is given in table 19.

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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.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping 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—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

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

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

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

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

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.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

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.

Channery soil. A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

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 coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

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

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

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

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

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

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

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

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

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

Delta. An alluvial deposit, commonly triangular in shape, formed largely beneath water and deposited at the mouth of a river or stream.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for 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, as for example in "hillpeats" and "climatic moors."

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 running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Fall line. The boundary between the Coastal Plain and the Piedmont. This line is actually a zone of considerable width in which the uplands are covered by Coastal Plain sediment and the stream channels consist of hard Piedmont rock. The prevalence of falls in the rocky channels prompted the term "fall line."

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 (heavy textured) soil. Sandy clay, silty clay, and clay.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average

of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

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

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

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.

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

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

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.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

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.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming 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.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks 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 from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

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.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Open shade. Areas that receive limited sunlight that is generally filtered through tree canopies or between tall buildings.

PAN. An air pollutant composed of peroxyacetyl nitrate that generally affects the lower leaf surface of plants. Causes collapse of tissue and also causes silvering, glazing, or bronzing.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

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. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristics that affect management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in 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 a semisolid to a plastic state.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Poorly graded. Refers to 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.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock. Soil scientists regard as soil only the part of the regolith that is modified by organisms and other soil-building forces. Most engineers describe the whole regolith, even to a great depth, as "soil."

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saprolite (geology). Soft, earthy, clay-rich, thoroughly decomposed rock formed in place by chemical weathering of igneous and metamorphic rock. In soil survey, the term saprolite is applied to any unconsolidated residual material underlying the soil and grading to hard bedrock below.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

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.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.005 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining 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).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. 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. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by 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*, *silt loam*, *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. Otherwise suitable soil material too thin for the specified use.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a 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 sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

A P P E N D I X

(Tables)

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

Month	Temperature[1]						Precipitation[1]				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of heating degree days[2]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	43.2	27.7	35.5	69	7	911	2.42	1.49	3.25	6	4.5
February---	46.0	29.2	37.6	73	9	776	2.82	1.63	3.78	6	5.3
March------	54.3	36.0	45.2	82	20	617	3.41	2.27	4.45	7	2.9
April------	66.8	46.0	56.4	90	31	265	3.14	1.89	4.25	7	.0
May--------	75.6	55.5	65.5	94	40	72	3.46	1.90	4.72	7	.0
June-------	83.7	64.7	74.2	98	51	0	3.62	1.87	5.04	6	.0
July-------	87.8	69.5	78.7	98	58	0	3.72	1.78	5.29	6	.0
August-----	86.0	68.2	77.1	97	55	0	4.55	2.04	6.58	6	.0
September--	79.9	61.5	70.7	95	45	14	2.79	1.27	4.03	5	.0
October----	69.2	49.7	59.4	89	31	190	2.60	1.39	3.62	4	.0
November---	56.9	39.4	48.2	80	22	510	2.91	1.32	4.19	5	.9
December---	46.2	31.2	38.7	71	14	856	3.29	1.60	4.67	6	4.1
Year-----	66.3	48.2	57.3	100	6	4,211	38.73	33.16	44.06	71	17.7

[1]Recorded in the period 1951-74 at Washington, D.C.

[2]A heating degree day is a unit of heat related to the energy required for space heating in homes and buildings. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature above which heating is not necessary (65 °F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature[1]		
	24°F or lower	28°F or lower	32°F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 25	April 4	April 12
2 years in 10 later than--	March 18	March 30	April 8
5 years in 10 later than--	March 5	March 20	March 30
First freezing temperature in fall:			
1 year in 10 earlier than--	November 22	November 10	October 23
2 years in 10 earlier than--	November 26	November 14	October 27
5 years in 10 earlier than--	December 5	November 23	November 5

[1]Recorded in the period 1951-74 at Washington, D.C.

TABLE 3.--GROWING SEASON LENGTH

Probability	Daily minimum temperature during growing season[1]		
	Higher than 24°F	Higher than 28°F	Higher than 32°F
	Days	Days	Days
9 years in 10	249	225	200
8 years in 10	257	233	206
5 years in 10	274	247	219
2 years in 10	290	261	231
1 year in 10	299	269	238

[1]Recorded in the period 1951-74 at Washington, D.C.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AsC	Ashe loam, 8 to 15 percent slopes	56	0.1
AsD	Ashe loam, 15 to 40 percent slopes	118	0.3
BdB	Beltsville silt loam, 0 to 8 percent slopes	52	0.1
BeB	Beltsville-Urban land complex, 0 to 8 percent slopes	651	1.5
Bg	Bibb sandy loam	174	0.4
BnB	Bourne fine sandy loam, 0 to 8 percent slopes	15	(1)
BnC	Bourne fine sandy loam, 8 to 15 percent slopes	75	0.2
BpB	Bourne-Urban land complex, 0 to 8 percent slopes	54	0.1
BrC	Brandywine gravelly loam, 8 to 15 percent slopes	61	0.1
BrD	Brandywine gravelly loam, 15 to 40 percent slopes	292	0.7
BtB	Brandywine-Urban land complex, 0 to 8 percent slopes	203	0.5
BtC	Brandywine-Urban land complex, 8 to 15 percent slopes	571	1.3
BtD	Brandywine-Urban land complex, 15 to 40 percent slopes	162	0.4
CcB	Chillum silt loam, 0 to 8 percent slopes	39	0.1
CcC	Chillum silt loam, 8 to 15 percent slopes	189	0.4
CcD	Chillum silt loam, 15 to 40 percent slopes	93	0.2
CdB	Chillum-Urban land complex, 0 to 8 percent slopes	566	1.3
CdC	Chillum-Urban land complex, 8 to 15 percent slopes	814	1.8
CdD	Chillum-Urban land complex, 15 to 40 percent slopes	129	0.3
CeB	Christiana silt loam, 0 to 8 percent slopes	74	0.2
CeC	Christiana silt loam, 8 to 15 percent slopes	206	0.5
CeD	Christiana silt loam, 15 to 40 percent slopes	252	0.6
CfB	Christiana-Urban land complex, 0 to 8 percent slopes	448	1.0
CfC	Christiana-Urban land complex, 8 to 15 percent slopes	1,116	2.5
CfD	Christiana-Urban land complex, 15 to 40 percent slopes	261	0.6
Ck	Codorus silt loam	191	0.4
Cn	Codorus-Urban land complex	108	0.2
CwB	Croom very gravelly sandy loam, 0 to 8 percent slopes	41	0.1
CwC	Croom very gravelly sandy loam, 8 to 15 percent slopes	115	0.3
CwD	Croom very gravelly sandy loam, 15 to 40 percent slopes	202	0.5
CxB	Croom-Urban land complex, 0 to 8 percent slopes	90	0.2
CxC	Croom-Urban land complex, 8 to 15 percent slopes	327	0.7
CxD	Croom-Urban land complex, 15 to 25 percent slopes	67	0.2
Dn	Dunning soils	51	0.1
Fa	Fallsington sandy loam	37	0.1
FB	Fluvaquents, bouldery	59	0.1
FD	Fluvaquents, ponded	68	0.2
FF	Fluvaquents-Udifluvents complex, frequently flooded	56	0.1
FH	Fluvaquents-Udifluvents-Urban land complex	106	0.2
GeB	Galestown-Urban land complex, 0 to 8 percent slopes	614	1.4
GfB	Galestown and Rumford soils, 0 to 8 percent slopes	95	0.2
GfC	Galestown and Rumford soils, 8 to 15 percent slopes	21	(1)
GgB	Glenelg loam, 0 to 8 percent slopes	61	0.1
GgC	Glenelg loam, 8 to 15 percent slopes	191	0.4
GgD	Glenelg loam, 15 to 25 percent slopes	52	0.1
GhB	Glenelg-Urban land complex, 0 to 8 percent slopes	219	0.5
GhC	Glenelg-Urban land complex, 8 to 15 percent slopes	527	1.2
GhD	Glenelg-Urban land complex, 15 to 25 percent slopes	42	0.1
GlB	Glenelg Variant silt loam, 0 to 8 percent slopes	81	0.2
GmB	Glenelg Variant-Urban land complex, 0 to 8 percent slopes	343	0.8
Ik	Iuka sandy loam	273	0.6
Ip	Iuka-Urban land complex	253	0.6
JtB	Joppa gravelly sandy loam, 0 to 8 percent slopes	15	(1)
JtC	Joppa gravelly sandy loam, 8 to 15 percent slopes	82	0.2
JtD	Joppa gravelly sandy loam, 15 to 40 percent slopes	153	0.3
JuB	Joppa-Urban land complex, 0 to 8 percent slopes	59	0.1
JuC	Joppa-Urban land complex, 8 to 15 percent slopes	77	0.2
JuD	Joppa-Urban land complex, 15 to 25 percent slopes	33	0.1
KeB	Keyport fine sandy loam, 0 to 8 percent slopes	112	0.3
KeC	Keyport fine sandy loam, 8 to 15 percent slopes	46	0.1
KmB	Keyport-Urban land complex, 0 to 8 percent slopes	354	0.8
KmC	Keyport-Urban land complex, 8 to 15 percent slopes	114	0.3
Ld	Lindside loam	117	0.3
Lp	Lindside silt loam, bedrock substratum	102	0.2
MbC	Manor loam, 8 to 15 percent slopes	277	0.6
MbD	Manor loam, 15 to 40 percent slopes	1,077	2.4
McC	Manor channery loam, 8 to 15 percent slopes	76	0.2
MdB	Manor-Urban land complex, 0 to 8 percent slopes	740	1.7
MdC	Manor-Urban land complex, 8 to 15 percent slopes	1,208	2.7
MdD	Manor-Urban land complex, 15 to 40 percent slopes	513	1.2

See footnotes at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
MgB	Matapeake silt loam, 0 to 8 percent slopes	25	0.1
MgC	Matapeake silt loam, 8 to 15 percent slopes	17	(1)
MhB	Matapeake-Urban land complex, 0 to 8 percent slopes	155	0.4
Mp	Melvin silt loam	117	0.3
MvB	Muirkirk Variant complex, 0 to 8 percent slopes	50	0.1
MvC	Muirkirk Variant complex, 8 to 15 percent slopes	217	0.5
MvD	Muirkirk Variant complex, 15 to 40 percent slopes	530	1.2
NeC	Neshaminy silt loam, 8 to 15 percent slopes	34	0.1
NeD	Neshaminy silt loam, 15 to 40 percent slopes	138	0.3
NuC	Neshaminy-Urban land complex, 8 to 15 percent slopes	79	0.2
NuD	Neshaminy-Urban land complex, 15 to 40 percent slopes	20	(1)
SaB	Sassafras sandy loam, 0 to 8 percent slopes	50	0.1
SaC	Sassafras sandy loam, 8 to 15 percent slopes	88	0.2
ScB	Sassafras gravelly sandy loam, 0 to 8 percent slopes	95	0.2
ScC	Sassafras gravelly sandy loam, 8 to 15 percent slopes	225	0.5
ScD	Sassafras gravelly sandy loam, 15 to 40 percent slopes	252	0.6
SgB	Sassafras-Urban land complex, 0 to 8 percent slopes	972	2.2
SgC	Sassafras-Urban land complex, 8 to 15 percent slopes	988	2.2
SgD	Sassafras-Urban land complex, 15 to 40 percent slopes	116	0.3
SmB	Sunnyside fine sandy loam, 0 to 8 percent slopes	63	0.1
SmC	Sunnyside fine sandy loam, 8 to 15 percent slopes	104	0.2
SmD	Sunnyside fine sandy loam, 15 to 40 percent slopes	90	0.2
SpB	Sunnyside-Urban land complex, 0 to 8 percent slopes	128	0.3
SpC	Sunnyside-Urban land complex, 8 to 15 percent slopes	380	0.9
SpD	Sunnyside-Urban land complex, 15 to 25 percent slopes	104	0.2
U1	Udorthents	2,102	4.8
U2	Udorthents, gravelly	114	0.3
U3	Udorthents, sandy	260	0.6
U4	Udorthents, loamy	222	0.5
U5	Udorthents, clayey	179	0.4
U6	Udorthents, smoothed	574	1.3
U7	Udorthents, gravelly, smoothed	353	0.8
U8	Udorthents, sandy, smoothed	335	0.8
U9	Udorthents, loamy, smoothed	256	0.6
U10	Udorthents, clayey, smoothed	533	1.2
U11B	Udorthents, deep, 0 to 8 percent slopes	291	0.7
U11C	Udorthents, deep, 8 to 15 percent slopes	61	0.1
U11D	Udorthents, deep, 15 to 25 percent slopes	18	(1)
UA	Udifluvents, sandy	52	0.1
Ub	Urban land	6,121	13.9
UcB	Urban land-Beltsville complex, 0 to 8 percent slopes	294	0.7
UdB	Urban land-Brandywine complex, 0 to 8 percent slopes	127	0.3
UeB	Urban land-Chillum complex, 0 to 8 percent slopes	848	1.9
UeC	Urban land-Chillum complex, 8 to 15 percent slopes	557	1.3
UfB	Urban land-Christiana complex, 0 to 8 percent slopes	81	0.2
UfC	Urban land-Christiana complex, 8 to 15 percent slopes	451	1.0
UkC	Urban land-Croom complex, 8 to 15 percent slopes	100	0.2
UmB	Urban land-Galestown complex, 0 to 8 percent slopes	153	0.3
UoC	Urban land-Joppa complex, 0 to 15 percent slopes	211	0.5
UpB	Urban land-Keyport complex, 0 to 8 percent slopes	188	0.4
UsB	Urban land-Manor complex, 0 to 8 percent slopes	160	0.4
UsC	Urban land-Manor complex, 8 to 15 percent slopes	255	0.6
UxB	Urban land-Sassafras complex, 0 to 8 percent slopes	1,434	3.2
UxC	Urban land-Sassafras complex, 8 to 15 percent slopes	716	1.6
UyC	Urban land-Sunnyside complex, 8 to 15 percent slopes	138	0.3
UzB	Urban land-Woodstown complex, 0 to 8 percent slopes	206	0.5
WoB	Woodstown sandy loam, 0 to 8 percent slopes	174	0.4
WpB	Woodstown-Urban land complex, 0 to 8 percent slopes	323	0.7
	Water	5,120	11.6
	Total	44,160	100.0

[1]Less than 0.1 percent.

TABLE 5.--PLANTS SUITABLE FOR SOILS OF THE AREA

Soil name and map symbol	Vines and ground cover	Shrubs	Trees	Grasses and legumes
Ashe: AsC, AsD	Bearberry, crownvetch, creeping thyme, wineleaf cinquefoil, Halls honeysuckle, memorial rose, creeping juniper, cotoneaster.	Autumn olive, graystem dogwood, privet, roseacacia, sumac, juliane barberry, Japanese holly, spreading juniper.	Norway maple, golden raintree, thornless honey locust, flowering dogwood, red maple, green ash, mountainash, hawthorn.	Bermudagrass, zoysia, annual ryegrass, red fescue, Ky-31 tall fescue, Korean lespedeza, sericea lespedeza, flatpea.
Beltsville: BdB, [1]BeB	Lily-of-the-valley, moss sandwort, plantainlily, Andorra juniper, pachysandra, creeping phlox, myrtle, forsythia.	Bayberry, chokeberry, dogwood, pyracantha, forsythia, privet, juliane barberry, Japanese holly, rhododendron, leatherleaf viburnum.	Norway maple, tuliptree, red maple, locust, sweetgum, ginkgo, flowering dogwood, flowering crabapple, Ohio buckeye.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Bibb: Bg	Bugleweed, common moonseed, ferns, wintergreen, swamp dewberry, plantainlily, daylily.	Chokeberry, shrub dogwood, elderberry, winterberry, nannyberry, spicebush, willow.	European alder, green ash, red maple, willow, London planetree, blackgum, quaking aspen, American holly.	Reed canarygrass, white clover, redtop.
Bourne: BnB, BnC, [1]BpB	Lily-of-the-valley, moss sandwort, plantainlily, Andorra juniper, pachysandra, creeping phlox, myrtle, forsythia.	Bayberry, chokeberry, dogwood, pyracantha, forsythia, privet, juliane barberry, Japanese holly, rhododendron, leatherleaf viburnum.	Norway maple, tuliptree, red maple, locust, sweetgum, ginkgo, flowering dogwood, flowering crabapple, Ohio buckeye.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Brandywine: BrC, BrD, [1]BtB, [1]BtC, [1]BtD	Bearberry, crownvetch, creeping thyme, wineleaf cinquefoil, Halls honeysuckle, memorial rose, creeping juniper, cotoneaster.	Autumn-olive, graystem dogwood, privet, roseacacia, sumac, juliane barberry, Japanese holly, spreading juniper.	Norway maple, golden raintree, thornless honeylocust, flowering dogwood, red maple, green ash, mountainash, hawthorn.	Bermudagrass, zoysia, annual ryegrass, red fescue, Ky-31 tall fescue, Korean lespedeza, sericea lespedeza, flatpea.
Chillum: CcB, CcC, CcD, [1]CdB, [1]CdC, [1]CdD	Carpet bugle, Halls honeysuckle, English ivy, spreading juniper, myrtle, pachysandra, rose wichuria, crownvetch.	Dogwood, forsythia, pyracantha, privet, azaleas, Japanese holly, rhododendron, yew species.	Tuliptree, southern magnolia, sweetgum, flowering crabapple, Bradford pear, ginkgo, golden raintree, thornless locust.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Christiana: CeB, CeC, CeD, [1]CfB, [1]CfC, [1]CfD	Carpet bugle, Halls honeysuckle, English ivy, spreading juniper, myrtle, pachysandra, rose wichuria, crownvetch.	Dogwood, forsythia, pyracantha, privet, azaleas, Japanese holly, rhododendron, yew species.	Tuliptree, southern magnolia, sweetgum, flowering crabapple, Bradford pear, ginkgo, golden raintree, thornless locust.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Codorus: Ck, [1]Cn	Lily-of-the-valley, moss sandwort, plantainlily, Andorra juniper, pachysandra, creeping phlox, myrtle, forsythia.	Bayberry, chokeberry, dogwood, pyracantha, forsythia, privet, juliane barberry, Japanese holly, rhododendron, leatherleaf viburnum.	Norway maple, tuliptree, red maple, locust, sweetgum, ginkgo flowering dogwood, flowering crabapple, Ohio buckeye.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.

TABLE 5.--PLANTS SUITABLE FOR SOILS OF THE AREA--Continued

Soil name and map symbol	Vines and ground cover	Shrubs	Trees	Grasses and legumes
Croom: CwB, CwC, CwD, [1]CxB, [1]CxC, [1]CxD	Bearberry, crownvetch, creeping thyme, wineleaf cinquefoil, Halls honeysuckle, memorial rose, creeping juniper, cotoneaster.	Autumn-olive, graystem dogwood, privet, roseacacia, sumac, juliane barberry, Japanese holly, spreading juniper.	Norway maple, golden raintree, thornless honeylocust, flowering dogwood, red maple, green ash, mountainash, hawthorn.	Bermudagrass, zoysia, annual ryegrass, red fescue, Ky-31 tall fescue, Korean lespedeza, sericea lespedeza, flatpea.
Dunning: Dn	Bugleweed, common moonseed, ferns, wintergreen, swamp dewberry, plantainlily, daylily.	Chokeberry, shrub dogwood, elderberry, winterberry, nannyberry, spicebush, willow.	European alder, green ash, red maple, willow, London planetree, blackgum, quaking aspen, American holly.	Reed canarygrass, white clover, redtop.
Fallsington: Fa	Bugleweed, common moonseed, ferns, wintergreen, swamp dewberry, plantainlily, daylily.	Chokeberry, shrub dogwood, elderberry, winterberry, nannyberry, spicebush, willow.	European alder, green ash, red maple, willow, London planetree blackgum, quaking aspen, American holly.	Reed canarygrass, white clover, redtop.
[3]Fluvaquents, bouldery: FB				
Fluvaquents, ponded: FD[2]				
[3]Fluvaquents-Udifluvents: FF, FH				
Galestown: [1]GeB, [1]GfB, [1]GfC	Bearberry, crownvetch, creeping thyme, wineleaf cinquefoil, Halls honeysuckle, memorial rose, creeping juniper, cotoneaster.	Autumn-olive, graystem dogwood, privet, roseacacia, sumac, juliane barberry, Japanese holly, spreading juniper.	Norway maple, golden raintree, thornless honeylocust, flowering dogwood, red maple, green ash, mountainash, hawthorn.	Bermudagrass, zoysia, annual ryegrass, red fescue, Ky-31 tall fescue, Korean lespedeza, sericea lespedeza, flatpea.
Glenelg: GgB, GgC, GgD, [1]GhB, [1]GhC, [1]GhD	Carpet bugle, Halls honeysuckle, English ivy, spreading juniper, myrtle, pachysandra, rose wichuria, crownvetch.	Dogwood, forsythia, pyracantha, privet, azaleas, Japanese holly, rhododendron, yew species.	Tuliptree, southern magnolia, sweetgum, flowering crabapple, Bradford pear, ginkgo, golden raintree, thornless locust.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Glenelg Variant: GlB, [1]GmB	Lily-of-the-valley, moss sandwort, plantainlily, Andorra juniper, pachysandra, creeping phlox, myrtle, forsythia.	Bayberry, chokeberry, dogwood, pyracantha, forsythia, privet, juliane barberry, Japanese holly, rhododendron, leatherleaf viburnum.	Norway maple, tuliptree, red maple, locust, sweetgum, ginkgo, flowering dogwood, flowering crabapple, Ohio buckeye.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.

See footnotes at end of table.

TABLE 5.--PLANTS SUITABLE FOR SOILS OF THE AREA--Continued

Soil name and map symbol	Vines and ground cover	Shrubs	Trees	Grasses and legumes
Iuka: Ik, [1]Ip	Lily-of-the-valley, moss sandwort, plantainlily, Andorra juniper, pachysandra, creeping phlox, myrtle, forsythia.	Barberry, chokeberry, dogwood, pyracantha, forsythia, privet, juliane barberry, Japanese holly, rhododendron, leatherleaf viburnum	Norway maple, tuliptree, red maple, locust, sweetgum, ginkgo, flowering dogwood, flowering crabapple, Ohio buckeye.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Joppa: JtB, JtC, JtD, [1]JuB, [1]JuC, [1]JuD	Bearberry, crownvetch, creeping thyme, wineleaf cinquefoil, Halls honeysuckle, memorial rose, creeping juniper, cotoneaster.	Autumn-olive, graystem dogwood, privet, roseacacia, sumac, juliane barberry, Japanese holly, spreading juniper.	Norway maple, golden raintree, thornless honey locust, flowering dogwood, red maple, green ash, mountainash, hawthorn.	Bermudagrass, zoysia, annual ryegrass, red fescue, Ky-31 tall fescue, Korean lespedeza, sericea lespedeza, flatpea.
Keyport: KeB, KeC, [1]KmB, [1]KmC-	Lily-of-the-valley, moss sandwort plantainlily, Andorra juniper, pachysandra, creeping phlox, myrtle, forsythia.	Bayberry, chokeberry, dogwood, pyracantha, forsythia, privet, juliane barberry, Japanese holly, rhododendron, leatherleaf viburnum.	Norway maple, tuliptree, red maple, locust, sweetgum, ginkgo, flowering dogwood, flowering crabapple, Ohio buckeye.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Lindside: Ld, Lp	Lily-of-the-valley, moss sandwort, plantainlily, Andorra juniper, pachysandra, creeping phlox, myrtle, forsythia.	Bayberry, chokeberry, dogwood, pyracantha, forsythia, privet, juliane barberry, Japanese holly, rhododendron, leatherleaf viburnum.	Norway maple, tuliptree, red maple, locust, sweetgum, ginkgo, flowering dogwood, flowering crabapple, Ohio buckeye.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Manor: MbC, MbD, McC, [1]MdB, [1]MdC, [1]MdD	Carpet bugle, Halls honeysuckle, English ivy, spreading juniper, myrtle, pachysandra, rose wichuria, crownvetch.	Dogwood, forsythia, pyracantha, privet, azaleas, Japanese holly, rhododendron, yew species.	Tuliptree, southern magnolia, sweetgum, flowering crabapple, Bradford pear, ginkgo, golden raintree, thornless locust.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Matapeake: MgB, MgC, [1]MhB	Carpet bugle, Halls honeysuckle, English ivy, spreading juniper, myrtle, pachysandra, rose wichuria, crownvetch.	Dogwood, forsythia, pyracantha, privet, azaleas, Japanese holly, rhododendron, yew species.	Tuliptree, southern magnolia, sweetgum, flowering crabapple, Bradford pear, ginkgo, golden raintree, thornless locust.	Annual ryegrass, perennial rye grass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Melvin: Mp	Bugleweed, common moonseed, ferns, wintergreen, swamp dewberry, plantainlily, daylily.	Chokeberry, shrub dogwood, elderberry, winterberry, nannyberry, spicebush, willow.	European alder greenash, red maple, willow, London planetree, blackgum, quaking aspen, American holly.	Reed canarygrass, white clover, redtop.

See footnotes at end of table.

TABLE 5.--PLANTS SUITABLE FOR SOILS OF THE AREA--Continued

Soil name and map symbol	Vines and ground cover	Shrubs	Trees	Grasses and legumes
Muirkirk Variant complex: MvB, MvC, MvD--------	Bearberry, crown vetch, creeping thyme, wineleaf cinquefoil, Halls honeysuckle, memorial rose, creeping juniper, cotoneaster.	Autumn olive, graystem dogwood, privet, roseacacia, sumac, juliane barberry, Japanese holly, spreading juniper.	Norway maple, golden raintree, thornless honey locust, flowering dogwood, red maple, green ash, mountain-ash, hawthorn.	Bermudagrass, zoysia, annual ryegrass, red fescue, Ky-31 tall fescue, Korean lespedeza, sericea lespedeza, flatpea.
Neshaminy: NeC, NeD, [1]NuC, [1]NuD-	Carpet bugle, Halls honeysuckle, English ivy, spreading juniper, myrtle, pachysandra, rose wichuria, crownvetch.	Dogwood, forsythia, pyracantha, privet, azaleas, Japanese holly, rhododendron, yew species.	Tuliptree, southern magnolia, sweetgum, flowering crabapple, Bradford pear, ginkgo, golden raintree, thornless locust.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Sassafras: SaB, SaC, ScB, ScC, ScD, 1SgB, [1]SgC, [1]SgD	Carpet bugle, Halls honeysuckle, English ivy, spreading juniper, myrtle, pachysandra, rose wichuria, crownvetch.	Dogwood, forsythia, pyracantha, privet azaleas, Japanese holly, rhododendron, yew species.	Tuliptree, southern magnolia, sweetgum, flowering crabapple, Bradford pear, ginkgo, golden raintree, thornless locust.	Annual ryegrass, perennial rye grass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Sunnyside: SmB, SmC, SmD, [1]SpB, [1]SpC, [1]SpD	Carpet bugle, Halls honeysuckle, English ivy, spreading juniper, myrtle, pachysandra, rose wichuria, crownvetch.	Dogwood, forsythia, pyracantha, privet, azaleas, Japanese holly, rhododendron, yew species.	Tuliptree, southern magnolia, sweetgum, flowering crabapple, Bradford pear, ginkgo, golden raintree, thornless locust.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
[3]Udorthents: U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11B, U11C, U11D				
[3]Udifluvents, sandy: UA				
[2]Urban land: [1]UcB----------	Lily-of-the-valley, moss sandwort, plantainlily, Andorra juniper, pachysandra, creeping phlox, myrtle, forsythia.	Bayberry, chokeberry, dogwood, pyracantha, forsythia, privet, juliane barberry, Japanese holly, rhododendron, leatherleaf viburnum.	Norway maple, tuliptree, red maple, locust, sweetgum, ginkgo, flowering dogwood, flowering crabapple, Ohio buckeye.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
[1]UdB----------	Bearberry, crownvetch, creeping thyme, wineleaf cinquefoil, Halls honeysuckle, memorial rose, creeping juniper, cotoneaster.	Autumn-olive, graystem dogwood, privet, roseacacia, sumac, juliane barberry, Japanese holly, spreading juniper.	Norway maple, golden raintree, thornless honey locust, flowering dogwood, red maple, green ash, mountain-ash, hawthorn.	Bermudagrass, zoysia, annual ryegrass, red fescue, Ky-31 tall fescue, Korean lespedeza, sericea lespedeza, flatpea.

See footnotes at end of table.

TABLE 5.--PLANTS SUITABLE FOR SOILS OF THE AREA--Continued

Soil name and map symbol	Vines	Shrubs	Trees	Grasses and legumes
[2]Urban land: [1]UeB, [1]UeC, [1]UfB, [1]UfC	Carpet bugle, Halls honeysuckle, English ivy, spreading juniper, myrtle, pachysandra, rose wichuria, crownvetch.	Dogwood, forsythia, pyracantha, privet, azaleas, Japanese holly, rhododendron, yew species.	Tuliptree, southern magnolia, sweetgum, flowering crabapple, Bradford pear, ginkgo, golden raintree, thornless locust.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
[1]UkC, [1]UmB, [1]UoC-----	Bearberry, crownvetch, creeping thyme, wineleaf cinquefoil, Halls honeysuckle, memorial rose, creeping juniper, cotoneaster.	Autumn-olive, graystem dogwood, privet, roseacacia, sumac, juliane barberry, Japanese holly, spreading juniper.	Norway maple, golden raintree, thornless honey locust, flowering dogwood, red maple, green ash, mountainash, hawthorn.	Bermudagrass, zoysia, annual ryegrass, red fescue, Ky-31 tall fescue, Korean lespedeza, sericea lespedeza, flatpea.
[1]UpB----------	Lily-of-the-valley moss sandwort, plantainlily, Andorra juniper, pachysandra, creeping phlox, myrtle, forsythia.	Bayberry, chokeberry, dogwood, pyracantha, forsythia, privet, juliane barberry, Japanese holly, rhododendron, leatherleaf viburnum.	Norway maple, tuliptree, red maple, locust, sweetgum, ginkgo, flowering dogwood, flowering crabapple, Ohio buckeye.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue bermudagrass, zoysia, crownvetch.
[1]UsB, [1]UsC, [1]UxB, [1]UxC, [1]UyC	Carpet bugle, Halls honeysuckle, English ivy, spreading juniper, myrtle, pachysandra, rose wichuria, crownvetch.	Dogwood, forsythia, pyracantha, privet, azaleas, Japanse holly, rhododendron, yew species.	Tuliptree, southern magnolia, sweetgum, flowering crabapple, Bradford pear, ginkgo, golden raintree, thornless locust.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
[1]UzB----------	Lily-of-the-valley, moss sandwort, plantainlily, Andorra juniper, pachysandra, creeping phlox, myrtle, forsythia.	Barberry, chokeberry, dogwood, pyracantha, forsythia, privet, juliane barberry, Japanese holly, rhododendron, leatherleaf viburnum.	Norway maple, tuliptree, red maple, locust, sweetgum, ginkgo, flowering dogwood, flowering crabapple, Ohio buckeye.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.
Woodstown: WoB, [1]WpB----------	Lily-of-the-valley, moss sandwort, plantainlily, Andorra juniper, pachysandra, creeping phlox, myrtle, forsythia.	Bayberry, chokeberry, dogwood, pyracantha, forsythia, privet, juliane barberry, Japanese holly, rhododendron, leatherleaf viburnum.	Norway maple, tuliptree, red maple, locust, sweetgum, ginkgo, flowering dogwood, flowering crabapple, Ohio buckeye.	Annual ryegrass, perennial ryegrass, red fescue, Ky-31 tall fescue, bermudagrass, zoysia, crownvetch.

[1]Urban land part not rated.
[2]Fluvaquents, ponded, (FD) and Urban land are not suitable for planting.
[3]These highly disturbed units generally consist of either steep cuts with excessive runoff or highly compacted, very dense fill material. In either case, low available moisture severely restricts the kinds of plants that can be grown.

TABLE 6.--BUILDING SITE DEVELOPMENT

["Depth to rock" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ashe:					
AsC	Severe: depth to rock.	Moderate: slope.	Severe: depth to rock.	Severe: slope.	Moderate: slope, frost action.
AsD	Severe: depth to rock.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Severe: slope.
Beltsville:					
BdB	Severe: wetness, cemented pan.	Severe: frost action, wetness.	Severe: wetness.	Severe: frost action.	Severe: frost action.
[1]BeB:					
Beltsville part	Severe: wetness, cemented pan.	Severe: frost action, wetness.	Severe: wetness.	Severe: frost action.	Severe: frost action.
Urban land part.					
Bibb:					
Bg	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Bourne:					
BnB	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Severe: wetness.	Moderate: low strength.
BnC	Severe: wetness.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope, wetness.	Moderate: slope, low strength.
[1]BpB:					
Bourne part	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Severe: wetness.	Moderate: low strength.
Urban land part.					
Brandywine:					
BrC	Moderate: slope, small stones, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope.
BrD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]BtB:					
Brandywine part	Moderate: small stones, depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight.
Urban land part.					
[1]BtC:					
Brandywine part	Moderate: slope, small stones, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope.
Urban land part.					

See footnotes at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Brandywine:					
[1]BtD:					
Brandywine part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.					
Chillum:					
CcB	Moderate: small stones.	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.
CcC	Moderate: slope, small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, low strength.
CcD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]CdB:					
Chillum part	Moderate: small stones.	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.
Urban land part.					
[1]CdC:					
Chillum part	Moderate: slope, small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, low strength.
Urban land part.					
[1]CdD:					
Chillum part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.					
Christiana:					
CeB	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
CeC	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: slope, low strength.	Severe: low strength, shrink-swell.
CeD	Severe: slope, too clayey.	Severe: slope, low strength.	Severe: slope, low strength.	Severe: slope, low strength.	Severe: slope, low strength.
[1]CfB:					
Christiana part	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Urban land part.					
[1]CfC:					
Christiana part	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: slope, low strength.	Severe: low strength, shrink-swell.

See footnotes at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Christiana: Urban land part.					
[1]CfD: Christiana part	Severe: slope, too clayey.	Severe: slope, low strength.	Severe: slope, low strength.	Severe: slope, low strength.	Severe: slope, low strength.
Urban land part.					
Codorus: Ck	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods.
[1]Cn: Codorus part	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods.
Urban land part.					
Croom: CwB	Severe: small stones.	Slight	Slight	Moderate: slope.	Moderate: frost action.
CwC	Severe: small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
CwD	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]CxB: Croom part	Severe: small stones.	Slight	Slight	Moderate: slope.	Moderate: frost action.
Urban land part.					
[1]CxC: Croom part	Severe: small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
Urban land part.					
[1]CxD: Croom part	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.					
Dunning: Dn	Severe: wetness.	Moderate: wetness, low strength.	Severe: wetness.	Moderate: wetness, low strength.	Severe: low strength, frost action.
Fallsington: Fa	Severe: wetness, cutbanks cave.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness, frost action.

See footnotes at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
[2]Fluvaquents: FB, FD, FF, FH.					
Galestown:					
[1]GeB:					
Galestown part-	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Urban land part.					
[1]GfB:					
Galestown part-	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Rumford part	Slight	Slight	Slight	Moderate: slope.	Slight.
[1]GfC:					
Galestown part-	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Rumford part	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Glenelg:					
GgB	Slight	Moderate: frost action.	Slight	Moderate: slope, frost action.	Moderate: frost action.
GgC	Moderate: slope.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
GgD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]GhB:					
Glenelg part	Slight	Moderate: frost action.	Slight	Moderate: slope, frost action.	Moderate: frost action.

See footnotes at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Glenelg: Urban land part.					
[1]GhC: Glenelg part	Moderate: slope.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
Urban land part.					
[1]GhD: Glenelg part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.					
Glenelg Variant: GlB	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Severe: frost action.
[1]GmB: Glenelg Variant part	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Severe: frost action.
Urban land part.					
Iuka: Ik	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.
[1]Ip: Iuka part	Severe: floods, wetness.	Severe: floods, wetness	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.
Urban land part.					
Joppa: JtB	Moderate: small stones.	Slight	Slight	Moderate: slope.	Slight.
JtC	Moderate: slope, small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
JtD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]JuB: Joppa part	Moderate: small stones.	Slight	Slight	Moderate: slope.	Slight.
Urban land part.					
[1]JuC: Joppa part	Moderate: slope, small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Urban land part.					

See footnotes at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Joppa:					
[1]JuD:					
Joppa part-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.					
Keyport:					
KeB----------	Moderate: wetness.	Severe: frost action.	Moderate: wetness.	Moderate: wetness.	Severe: frost action.
KeC----------	Moderate: wetness.	Severe: frost action.	Moderate: wetness.	Severe: slope.	Severe: frost action.
[1]KmB:					
Keyport part---	Moderate: wetness.	Severe: frost action.	Moderate: wetness.	Moderate: wetness.	Severe: frost action.
Urban land part.					
[1]KmC:					
Keyport part---	Moderate: wetness.	Severe: frost action.	Moderate: wetness.	Severe: slope.	Severe: frost action.
Urban land part.					
Lindside:					
Ld----------	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods, frost action.
Lp----------	Severe: floods, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods, frost action.
Manor:					
MbC----------	Moderate: slope.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength, frost action.
MbD----------		Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
McC----------	Moderate: slope, small stones.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength, frost action.
[1]MdB:					
Manor part-----	Slight----------	Moderate: frost action.	Slight----------	Moderate: slope, frost action.	Moderate: low strength, frost action.
Urban land part.					
[1]MdC:					
Manor part-----	Moderate: slope.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength, frost action.
Urban land part.					

See footnotes at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Manor:					
[1]MdD:					
Manor part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.					
Matapeake:					
MgB	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.
MgC	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength, frost action.
[1]MhB:					
Matapeake part	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.
Urban land part.					
Melvin:					
Mp	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, frost action.
Muirkirk Variant:					
[1]MvB	Severe: too clayey, cutbanks cave.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.
[1]MvC	Severe: too clayey, cutbanks cave.	Severe: low strength.	Severe: low strength.	Severe: slope, low strength.	Severe: low strength.
[1]MvD	Severe: slope, too clayey, cutbanks cave.	Severe: slope, low strength.	Severe: slope, low strength.	Severe: slope, low strength.	Severe: slope, low strength.
Neshaminy:					
NeC	Moderate: depth to rock.	Moderate: frost action.	Moderate: depth to rock.	Severe: slope.	Moderate: frost action.
NeD	Severe: slope.	Severe: slope.	Severe: frost action.	Severe: slope.	Severe: slope.
[1]NuC:					
Neshaminy part	Moderate: depth to rock.	Moderate: frost action.	Moderate: depth to rock.	Severe: slope.	Moderate: frost action.
Urban land part.					
[1]NuD:					
Neshaminy part	Severe: slope.	Severe: slope.	Severe: frost action.	Severe: slope.	Severe: slope.
Urban land part.					
Sassafras:					
SaB, ScB	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.

See footnotes at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Sassafras:					
SaC, ScC	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
ScD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]SgB:					
Sassafras part	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
Urban land part.					
[1]SgC:					
Sassafras part	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
Urban land part.					
[1]SgD:					
Sassafras part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.					
Sunnyside:					
SmB	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
SmC	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
SmD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]SpB:					
Sunnyside part	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
Urban land part.					
[1]SpC:					
Sunnyside part	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
Urban land part.					
[1]SpD:					
Sunnyside part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.					
[2]Udorthents: U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11B, U11C, U11D.					

See footnotes at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
[2]Udifluvents: UA.					
Urban land: Ub.					
[1]UcB: Urban land part.					
Beltsville part	Severe: wetness, cemented pan.	Severe: frost action, wetness.	Severe: wetness.	Severe: frost action.	Severe: frost action.
[1]UdB: Urban land part.					
Brandywine part	Moderate: small stones, depth to rock.	Slight----------	Moderate: depth to rock.	Moderate: slope.	Slight.
[1]UeB: Urban land part.					
Chillum part---	Moderate: small stones.	Slight----------	Slight----------	Moderate: slope.	Moderate: frost action, low strength.
[1]UeC: Urban land part.					
Chillum part---	Moderate: slope, small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, low strength.
[1]UfB: Urban land part.					
Christiana part	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
[1]UfC: Urban land part.					
Christiana part	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: slope, low strength.	Severe: low strength, shrink-swell.
[1]UkC: Urban land part.					

See footnotes at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Urban land: Croom part	Severe: small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
[1]UmB: Urban land part.					
Galestown part	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
[1]UoC: Urban land part.					
Joppa part	Moderate: small stones.	Slight	Slight	Moderate: slope.	Slight.
[1]UpB: Urban land part.					
Keyport part	Moderate: wetness.	Severe: frost action.	Moderate: wetness.	Moderate: wetness.	Severe: frost action.
[1]UsB: Urban land part.					
Manor part	Slight	Moderate: frost action.	Slight	Moderate: slope, frost action.	Moderate: low strength, frost action.
[1]UsC: Urban land part.					
Manor part	Moderate: slope.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength, frost action.
[1]UxB: Urban land part.					
Sassafras part	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
[1]UxC: Urban land part.					
Sassafras part	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
[1]UyC: Urban land part.					
Sunnyside part	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
[1]UzB: Urban land part.					

See footnotes at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Urban land: Woodstown part-	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope.	Severe: frost action.
Woodstown: WoB	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope.	Severe: frost action.
[1]WpB: Woodstown part-	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope.	Severe: frost action.
Urban land part.					

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

[2]These mapping units are variable in properties. See mapping unit descriptions for their composition and behavior.

TABLE 7.--SANITARY FACILITIES

["Depth to rock" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ashe: AsC, AsD	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: seepage.	Poor: thin layer.
Beltsville: BdB	Severe: percs slowly, wetness.	Moderate: slope.	Severe: seepage.	Moderate: wetness.	Fair: too clayey.
[1]BeB: Beltsville part--	Severe: percs slowly, wetness.	Moderate: slope.	Severe: seepage.	Moderate: wetness.	Fair: too clayey.
Urban land part.					
Bibb: Bg	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Bourne: BnB	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Good.
BnC	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Severe: wetness.	Fair: slope.
[1]BpB: Bourne part--	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Good.
Urban land part.					
Brandywine: BrC	Moderate: slope, depth to rock.	Severe: slope, seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones, thin layer.
BrD	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage.	Poor: slope, small stones, thin layer.
[1]BtB: Brandywine part--	Moderate: depth to rock.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones, thin layer.
Urban land part.					
[1]BtC: Brandywine part--	Moderate: slope, depth to rock.	Severe: slope, seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones, thin layer.
Urban land part.					
[1]BtD: Brandywine part--	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage.	Poor: slope, small stones, thin layer.

See footnotes at end of table.

TABLE 7.--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
Brandywine:					
Urban land part.					
Chillum:					
CcB	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Fair: thin layer.
CcC	Severe: percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope, thin layer.
CcD	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
[1]CdB:					
Chillum part	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Fair: thin layer.
Urban land part.					
[1]CdC:					
Chillum part	Severe: percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope, thin layer.
Urban land part.					
[1]CdD:					
Chillum part	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Urban land part.					
Christiana:					
CeB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor.
CeC	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor.
CeD	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey, area reclaim.
[1]CfB:					
Christiana part	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor.
Urban land part.					
[1]CfC:					
Christiana part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor.
Urban land part.					
[1]CfD:					
Christiana part	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey, area reclaim.
Urban land part.					

See footnotes at end of table.

TABLE 7.--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
Codorus: Ck	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Fair: too clayey.
[1]Cn: Codorus part	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Fair: too clayey.
Urban land part.					
Croom: CwB	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones, area reclaim.
CwC	Moderate: slope, percs slowly.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones, area reclaim.
CwD	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope, small stones, area reclaim.
[1]CxB: Croom part	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones, area reclaim.
Urban land part.					
[1]CxC: Croom part	Moderate: slope, percs slowly.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones, area reclaim.
Urban land part.					
[1]CxD: Croom part	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope, seepage.	Poor: slope, small stones, area reclaim.
Urban land part.					
Dunning: Dn	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: area reclaim.
Fallsington: Fa	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.
[2]Fluvaquents: FB, FD, FF, FH.					

See footnotes at end of table.

TABLE 7.--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
Galestown:					
[1]GeB:					
Galestown part	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: too sandy.
Urban land part.					
[1]GfB:					
Galestown part	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: too sandy.
Rumford part	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy, seepage.
[1]GfC:					
Galestown part	Moderate: slope.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: slope, too sandy.
Rumford part	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy, seepage.
Glenelg:					
GgB	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
GgC	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
GgD	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
[1]GhB:					
Glenelg part	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
Urban land part.					

See footnotes at end of table.

TABLE 7.--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
Glenelg:					
[1]GhC:					
Glenelg part-----	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.	Fair: slope.
Urban land part.					
[1]GhD:					
Glenelg part-----	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Urban land part.					
Glenelg Variant:					
GlB----------	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: small stones, thin layer.
[1]GmB:					
Glenelg Variant part----------	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: small stones, thin layer.
Urban land part.					
Iuka:					
Ik----------	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
[1]Ip:					
Iuka part--------	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
Urban land part.					
Joppa:					
JtB----------	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
JtC----------	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: slope, small stones.
JtD----------	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.
[1]JuB:					
Joppa part-------	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
Urban land part.					
[1]JuC:					
Joppa part-------	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: slope, small stones.
Urban land part.					
[1]JuD:					
Joppa part-------	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
Urban land part.					

See footnotes at end of table.

TABLE 7.--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
Keyport:					
KeB	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Severe: area reclaim.
KeC	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Severe: area reclaim.
[1]KmB:					
Keyport part	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Severe: area reclaim.
Urban land part.					
[1]KmC:					
Keyport part	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Severe: area reclaim.
Urban land part.					
Lindside:					
Ld	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
Lp	Severe: floods, wetness, depth to rock.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: area reclaim.
Manor:					
MbC	Moderate: slope.	Severe: slope, seepage.	Slight	Moderate: slope.	Fair.
MbD	Severe: slope.	Severe: slope, seepage.	Severe: slope.	Severe: slope.	Poor: slope.
McC	Moderate: slope.	Severe: slope, seepage.	Slight	Moderate: slope.	Fair: slope, small stones.
[1]MdB:					
Manor part	Slight	Severe: seepage.	Slight	Slight	Good.
Urban land part.					
[1]MdC:					
Manor part	Moderate: slope.	Severe: slope, seepage.	Slight	Moderate: slope.	Fair.
Urban land part.					
[1]MdD:					
Manor part	Severe: slope.	Severe: slope, seepage.	Severe: slope.	Severe: slope.	Poor: slope.
Urban land part.					
Matapeake:					
MgB	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
MgC	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.	Moderate: slope.

See footnotes at end of table.

TABLE 7.--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
Matapeake:					
[1]MhB:					
Matapeake part---	Moderate: percs slowly.	Moderate: slope, seepage.	Slight----------	Slight----------	Good.
Urban land part.					
Melvin:					
Mp----------	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Muirkirk Variant:					
[1]MvB----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Fair: too sandy.
[1]MvC----------	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Fair: slope, too sandy.
[1]MvD----------	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too sandy.
Neshaminy:					
NeC----------	Severe: percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: slope.	Fair: slope.
NeD----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
[1]NuC:					
Neshaminy part---	Severe: percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: slope.	Fair: slope.
Urban land part.					
[1]NuD:					
Neshaminy part---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Urban land part.					
Sassafras:					
SaB, ScB----------	Slight----------	Moderate: slope, seepage.	Severe: seepage.	Slight----------	Good.
SaC, ScC----------	Moderate: slope.	Severe: slope.	Severe: seepage.	Moderate: slope.	Fair: slope.
ScD----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
[1]SgB:					
Sassafras part---	Slight----------	Moderate: slope, seepage.	Severe: seepage.	Slight----------	Good.
Urban land part.					
[1]SgC:					
Sassafras part---	Moderate: slope.	Severe: slope.	Severe: seepage.	Moderate: slope.	Fair: slope.
Urban land part.					

See footnotes at end of table.

TABLE 7.--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
Sassafras:					
[1]SgD:					
Sassafras part---	Severe: slope.	Severe: slope.	Severe: slope, seepage.	Severe: slope.	Poor: slope.
Urban land part.					
Sunnyside:					
SmB---	Slight---	Moderate: slope, seepage.	Slight---	Slight---	Slight.
SmC---	Moderate: slope.	Severe: slope.	Slight---	Moderate: slope.	Moderate: slope.
SmD---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]SpB:					
Sunnyside part---	Slight---	Moderate: slope, seepage.	Slight---	Slight---	Slight.
Urban land part.					
[1]SpC:					
Sunnyside part---	Moderate: slope.	Severe: slope.	Slight---	Moderate: slope.	Moderate: slope.
Urban land part.					
[1]SpD:					
Sunnyside part---	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Severe: slope.
Urban land part.					
[2]Udorthents: U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11B, U11C, U11D.					
[2]Udifluvents: UA.					
Urban land: Ub.					
[1]UcB:					
Urban land part.					
Beltsville part--	Severe: percs slowly, wetness.	Moderate: slope.	Severe: seepage.	Moderate: wetness.	Fair: too clayey.
[1]UdB:					
Urban land part.					

See footnotes at end of table.

TABLE 7.--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
Urban land: Brandywine part--	Moderate: depth to rock.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones, thin layer.
[1]UeB: Urban land part.					
Chillum part-----	Severe: percs slowly.	Moderate: slope, seepage.	Slight----------	Slight----------	Fair: thin layer.
[1]UeC: Urban land part.					
Chillum part-----	Severe: percs slowly.	Severe: slope.	Slight----------	Moderate: slope.	Fair: slope, thin layer.
[1]UfB: Urban land part.					
Christiana part--	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor.
[1]UfC: Urban land part.					
Christiana part--	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor.
[1]UkC: Urban land part.					
Croom part-------	Moderate: slope, percs slowly.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones, area reclaim.
[1]UmB: Urban land part.					
Galestown part---	Slight----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: too sandy.
[1]UoC: Urban land part.					
Joppa part-------	Slight----------	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
[1]UpB: Urban land part.					
Keyport part-----	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight----------	Severe: area reclaim.
[1]UsB: Urban land part.					
Manor part-------	Slight----------	Severe: seepage.	Slight----------	Slight----------	Good.
[1]UsC: Urban land part.					
Manor part-------	Moderate: slope.	Severe: slope, seepage.	Slight----------	Moderate: slope.	Fair.

See footnotes at end of table.

TABLE 7.--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
Urban land:					
[1]UxB:					
Urban land part.					
Sassafras part---	Slight----------	Moderate: slope, seepage.	Severe: seepage.	Slight----------	Good.
[1]UxC:					
Urban land part.					
Sassafras part---	Moderate: slope.	Severe: slope.	Severe: seepage.	Moderate: slope.	Fair: slope.
[1]UyC:					
Urban land part.					
Sunnyside part---	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.	Moderate: slope.
[1]UzB:					
Urban land part.					
Woodstown part---	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Good.
Woodstown:					
WoB----------	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Good.
[1]WpB:					
Woodstown part---	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Good.
Urban land part.					

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

[2]These mapping units are variable in properties. See mapping unit descriptions for their composition and behavior.

TABLE 8.--CONSTRUCTION MATERIALS

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ashe:				
AsC, AsD	Poor: thin layer.	Unsuited	Unsuited	Poor: thin layer.
Beltsville:				
BdB	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, thin layer.
[1]BeB:				
Beltsville part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, thin layer.
Urban land part.				
Bibb:				
Bg	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Bourne:				
BnB	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
BnC	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
[1]BpB:				
Bourne part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Urban land part.				
Brandywine:				
BrC	Good	Unsuited: excess fines.	Fair: excess fines.	Poor: small stones.
BrD	Poor: slope.	Unsuited: excess fines.	Fair: excess fines.	Poor: slope.
[1]BtB:				
Brandywine part	Good	Unsuited: excess fines.	Fair: excess fines.	Poor: small stones.
Urban land part.				
[1]BtC:				
Brandywine part	Good	Unsuited: excess fines.	Fair: excess fines.	Poor: small stones.
Urban land part.				
[1]BtD:				
Brandywine part	Poor: slope.	Unsuited: excess fines.	Fair: excess fines.	Poor: slope.
Urban land part.				
Chillum:				
CcB	Good	Poor: excess fines.	Fair: excess fines.	Good.
CcC	Good	Poor: excess fines.	Fair: excess fines.	Fair: slope.

See footnotes at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Chillum:				
CcD	Poor: slope.	Poor: excess fines.	Fair: excess fines.	Poor: slope.
[1]CdB:				
Chillum part	Good	Poor: excess fines.	Fair: excess fines.	Good.
Urban land part.				
[1]CdC:				
Chillum part	Good	Poor: excess fines.	Fair: excess fines.	Fair: slope.
Urban land part.				
[1]CdD:				
Chillum part	Poor: slope.	Poor: excess fines.	Fair: excess fines.	Poor: slope.
Urban land part.				
Christiana:				
CeB, CeC	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, area reclaim.
CeD	Poor: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer.
[1]CfB:				
Christiana part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, area reclaim.
Urban land part.				
[1]CfC:				
Christiana part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, area reclaim.
Urban land part.				
[1]CfD:				
Christiana part	Poor: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer.
Urban land part.				
Codorus:				
Ck	Fair: wetness.	Unsuited	Unsuited	Fair: too clayey, small stones.
[1]Cn:				
Codorus part	Fair: wetness.	Unsuited	Unsuited	Fair: too clayey, small stones.
Urban land part.				
Croom:				
CwB, CwC	Fair: frost action.	Poor: excess fines.	Good	Poor: small stones.

See footnotes at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Croom:				
CwD	Poor: slope.	Poor: excess fines.	Good	Poor: slope, small stones.
[1]CxB:				
Croom part	Fair: frost action.	Poor: excess fines.	Good	Poor: small stones.
Urban land part.				
[1]CxC:				
Croom part	Fair: frost action.	Poor: excess fines.	Good	Poor: small stones.
Urban land part.				
[1]CxD:				
Croom part	Fair: slope, frost action.	Poor: excess fines.	Good	Poor: slope, small stones.
Urban land part.				
Dunning:				
Dn	Poor: low strength.	Unsuited	Unsuited	
Fallsington:				
Fa	Poor: wetness.	Fair: excess fines.	Unsuited	Poor: wetness.
[2]Fluvaquents: FB, FD, FF, FH.				
Galestown:				
[1]GeB:				
Galestown part	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Urban land part.				
[1]GfB:				
Galestown part	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.

See footnotes at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Galestown:				
Rumford part	Good	Poor: excess fines.	Poor: excess fines.	Poor: too sandy.
[1]GfC:				
Galestown part	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Rumford part	Good	Poor: excess fines.	Poor: excess fines.	Poor: too sandy.
Glenelg:				
GgB	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones.
GgC	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, small stones.
GgD	Fair: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
[1]GhB:				
Glenelg part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones.
Urban land part.				
[1]GhC:				
Glenelg part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, small stones.
Urban land part.				
[1]GhD:				
Glenelg part	Fair: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Urban land part.				
Glenelg Variant:				
GlB	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones.
[1]GmB:				
Glenelg Variant part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones.
Urban land part.				
Iuka:				
Ik	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
[1]Ip:				
Iuka part	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
Urban land part.				
Joppa:				
JtB, JtC	Good	Fair: excess fines.	Fair: excess fines.	Poor: small stones.

See footnotes at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Joppa:				
JtD	Poor: slope.	Fair: excess fines.	Fair: excess fines.	Poor: slope, small stones.
[1]JuB:				
Joppa part	Good	Fair: excess fines.	Fair: excess fines.	Poor: small stones.
Urban land part.				
[1]JuC:				
Joppa part	Good	Fair: excess fines.	Fair: excess fines.	Poor: small stones.
Urban land part.				
[1]JuD:				
Joppa part	Fair: slope.	Fair: excess fines.	Fair: excess fines.	Poor: slope, small stones.
Urban land part.				
Keyport:				
KeB, KeC	Poor: area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Moderate: thin layer.
[1]KmB:				
Keyport part	Poor: area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Moderate: thin layer.
Urban land part.				
[1]KmC:				
Keyport part	Poor: area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Moderate: thin layer.
Urban land part.				
Lindside:				
Ld	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Lp	Poor: low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Manor:				
MbC	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
MbD	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
McC	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
[1]MdB:				
Manor part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Urban land part.				
[1]MdC:				
Manor part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.

See footnotes at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Manor:				
Urban land part.				
[1]MdD:				
Manor part	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Urban land part.				
Matapeake:				
MgB	Good	Poor: excess fines.	Unsuited: excess fines.	Good.
MgC	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: slope.
[1]MhB:				
Matapeake part	Good	Poor: excess fines.	Unsuited: excess fines.	Good.
Urban land part.				
Melvin:				
Mp	Poor: wetness, frost action.	Unsuited	Unsuited	Poor: wetness.
Muirkirk Variant:				
[1]MvB, [1]MvC	Poor: low strength.	Fair: thin layer, excess fines.	Unsuited: excess fines.	Poor: too sandy, area reclaim.
[1]MvD	Poor: slope, low strength.	Fair: thin layer, excess fines.	Unsuited: excess fines.	Poor: slope, too sandy, area reclaim.
Neshaminy:				
NeC	Fair: frost action.	Unsuited	Unsuited	Fair: slope.
NeD	Poor: slope.	Unsuited	Unsuited	Poor: slope.
[1]NuC:				
Neshaminy part	Fair: frost action.	Unsuited	Unsuited	Fair: slope.
Urban land part.				
[1]NuD:				
Neshaminy part	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Urban land part.				
Sassafras:				
SaB	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
SaC	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: slope.
ScB, ScC	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: small stones.
ScD	Poor: slope.	Fair: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.

See footnotes at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Sassafras:				
[1]SgB:				
Sassafras part	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
Urban land part.				
[1]SgC:				
Sassafras part	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: slope.
Urban land part.				
[1]SgD:				
Sassafras part	Poor: slope.	Fair: excess fines.	Unsuited: excess fines.	Poor: slope.
Urban land part.				
Sunnyside:				
SmB	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
SmC	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
SmD	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
[1]SpB:				
Sunnyside part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Urban land part.				
[1]SpC:				
Sunnyside part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
Urban land part.				
[1]SpD:				
Sunnyside part	Fair: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Urban land part.				
[2]Udorthents: U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11B, U11C, U11D.				

See footnotes at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
[2]Udifluvents: UA.				
Urban land: Ub.				
[1]UcB: Urban land part.				
Beltsville part----	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, thin layer.
[1]UdB: Urban land part.				
Brandywine part----	Good----------	Unsuited: excess fines.	Fair: excess fines.	Poor: small stones.
[1]UeB: Urban land part.				
Chillum part-------	Good----------	Poor: excess fines.	Fair: excess fines.	Good.
[1]UeC: Urban land part.				
Chillum part-------	Good----------	Poor: excess fines.	Fair: excess fines.	Fair: slope.
[1]UfB: Urban land part.				
Christiana part----	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, area reclaim.
[1]UfC: Urban land part.				
Christiana part----	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, area reclaim.
[1]UkC: Urban land part.				
Croom part---------	Fair: frost action.	Poor: excess fines.	Good----------	Poor: small stones.
[1]UmB: Urban land part.				
Galestown part-----	Good----------	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
[1]UoC: Urban land part.				
Joppa part---------	Good----------	Fair: excess fines.	Fair: excess fines.	Poor: small stones.

See footnotes at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Urban land:				
[1]UpB:				
Urban land part.				
Keyport part	Poor: area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Moderate: thin layer.
[1]UsB:				
Urban land part.				
Manor part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
[1]UsC:				
Urban land part.				
Manor part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
[1]UxB:				
Urban land part.				
Sassafras part	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
[1]UxC:				
Urban land part.				
Sassafras part	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: slope.
[1]UyC:				
Urban land part.				
Sunnyside part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
[1]UzB:				
Urban land part.				
Woodstown part	Fair: wetness.	Poor: excess fines.	Unsuited	Fair: thin layer.
Woodstown:				
WoB	Fair: wetness.	Poor: excess fines.	Unsuited	Fair: thin layer.
[1]WpB:				
Woodstown part	Fair: wetness.	Poor: excess fines.	Unsuited	Fair: thin layer.
Urban land part.				

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

[2]These mapping units are variable in properties. See mapping unit descriptions for their composition and behavior.

TABLE 9.--WATER MANAGEMENT

["Seepage," and some of the other terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ashe: AsC, AsD	Depth to rock, seepage.	Depth to rock	Not needed	Not needed	Slope, depth to rock.	Slope, rooting depth.
Beltsville: BdB	Slope	Piping	Wetness, percs slowly.	Wetness, rooting depth, slope.	Erodes easily, percs slowly, slope.	Slope, percs slowly.
[1]BeB: Beltsville part	Slope	Piping	Wetness, percs slowly.	Wetness, rooting depth, slope.	Erodes easily, percs slowly, slope.	Slope, percs slowly.
Urban land part.						
Bibb: Bg	Seepage	Piping	Floods, wetness.	Floods, wetness.	Not needed	Not needed.
Bourne: BnB, BnC	Favorable	Favorable	Percs slowly, slope.	Droughty, erodes easily, percs slowly.	Erodes easily, percs slowly.	Erodes easily, percs slowly, droughty.
[1]BpB: Bourne part	Favorable	Favorable	Percs slowly, slope.	Droughty, erodes easily, percs slowly.	Erodes easily, percs slowly.	Erodes easily, percs slowly, droughty.
Urban land part.						
Brandywine: BrC, BrD	Seepage, depth to rock, slope.	Seepage, piping, slope.	Not needed	Fast intake, seepage, slope.	Piping, slope.	Droughty, slope.
[1]BtB: Brandywine part	Seepage, depth to rock, slope.	Seepage, piping, slope.	Not needed	Fast intake, seepage, slope.	Piping, slope.	Droughty, slope.
Urban land part.						
[1]BtC: Brandywine part	Seepage, depth to rock, slope.	Seepage, piping, slope.	Not needed	Fast intake, seepage, slope.	Piping, slope.	Droughty, slope.
Urban land part.						
[1]BtD: Brandywine part	Seepage, depth to rock, slope.	Seepage, piping, slope.	Not needed	Fast intake, seepage, slope.	Piping, slope.	Droughty, slope.
Urban land part.						
Chillum: CcB, CcC, CcD	Slope, seepage, piping.	Slope	Not needed	Slope, erodes easily.	Slope, erodes easily.	Slope.

See footnotes at end of table.

TABLE 9.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Chillum:						
[1]CdB:						
Chillum part	Slope, seepage, piping.	Slope	Not needed	Slope, erodes easily.	Slope, erodes easily.	Slope.
Urban land part.						
[1]CdC:						
Chillum part	Slope, seepage, piping.	Slope	Not needed	Slope, erodes easily.	Slope, erodes easily.	Slope.
Urban land part.						
[1]CdD:						
Chillum part	Slope, seepage, piping.	Slope	Not needed	Slope, erodes easily.	Slope, erodes easily.	Slope.
Urban land part.						
Christiana:						
CeB, CeC, CeD	Favorable	Compressible, unstable fill, hard to pack.	Not needed	Slow intake, percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
[1]CfB:						
Christiana part	Favorable	Compressible, unstable fill, hard to pack.	Not needed	Slow intake, percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Urban land part.						
[1]CfC:						
Christiana part	Favorable	Compressible, unstable fill, hard to pack.	Not needed	Slow intake, percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Urban land part.						
[1]CfD:						
Christiana part	Favorable	Compressible, unstable fill, hard to pack.	Not needed	Slow intake, percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Urban land part.						
Codorus:						
Ck	Seepage, wetness.	Piping, floods.	Floods, wetness.	Floods, wetness.	Not needed	Floods, wetness.
[1]Cn:						
Codorus part	Seepage, wetness.	Piping, floods.	Floods, wetness.	Floods, wetness.	Not needed	Floods, wetness.
Urban land part.						
Croom:						
CwB, CwC, CwD	Slope, seepage.	Seepage, erodes easily.	Not needed	Slope, rooting depth, droughty.	Rooting depth	Slope, droughty, rooting depth.
[1]CxB:						
Croom part	Slope, seepage.	Seepage, erodes easily.	Not needed	Slope, rooting depth, droughty.	Rooting depth	Slope, droughty, rooting depth.

See footnotes at end of table.

TABLE 9.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Croom: Urban land part.						
[1]CxC: Croom part	Slope, seepage.	Seepage, erodes easily.	Not needed	Slope, rooting depth, droughty.	Rooting depth	Slope, droughty, rooting depth.
Urban land part.						
[1]CxD: Croom part	Slope, seepage.	Seepage, erodes easily.	Not needed	Slope, rooting depth, droughty.	Rooting depth	Slope, droughty, rooting depth.
Urban land part.						
Dunning: Dn	Wetness	Low strength	Wetness, percs slowly, poor outlets.	Wetness	Not needed	Wetness.
Fallsington: Fa	Seepage	Piping, low strength, unstable fill.	Frost action, cutbanks cave, poor outlets.	Wetness	Not needed	Not needed.
[2]Fluvaquents: FB, FD, FF, FH.						
Galestown: [1]GeB: Galestown part	Seepage, slope.	Seepage	Not needed	Droughty, seepage.	Slope, piping.	Droughty, slope.
Urban land part.						
[1]GfB: Galestown part	Seepage, slope.	Seepage	Not needed	Droughty, seepage.	Slope, piping.	Droughty, slope.
Rumford part	Seepage	Seepage, piping.	Not needed	Droughty, seepage.	Favorable	Droughty.
[1]GfC: Galestown part	Seepage, slope.	Seepage	Not needed	Droughty, seepage.	Slope, piping.	Droughty, slope.

See footnotes at end of table.

TABLE 9.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Galestown: Rumford part	Seepage	Seepage, piping.	Not needed	Droughty, seepage.	Favorable	Droughty.
Glenelg: GgB, GgC, GgD	Seepage, slope.	Low strength, piping.	Not needed	Slope	Erodes easily	Erodes easily.
[1]GhB: Glenelg part	Seepage, slope.	Low strength, piping.	Not needed	Slope	Erodes easily	Erodes easily.
Urban land part.						
[1]GhC: Glenelg part	Seepage, slope.	Low strength, piping.	Not needed	Slope	Erodes easily	Erodes easily.
Urban land part.						
[1]GhD: Glenelg part	Seepage, slope.	Low strength, piping.	Not needed	Slope	Erodes easily	Erodes easily.
Urban land part.						
Glenelg Variant: GlB	Seepage	Piping	Wetness	Wetness	Not needed	Wetness, erodes easily.
[1]GmB: Glenelg Variant part	Seepage	Piping	Wetness	Wetness	Not needed	Wetness, erodes easily.
Urban land part.						
Iuka: Ik	Seepage	Piping	Floods, wetness.	Floods, wetness.	Not needed	Not needed.
[1]Ip: Iuka part	Seepage	Piping	Floods, wetness.	Floods, wetness.	Not needed	Not needed.
Urban land part.						
Joppa: JtB, JtC, JtD	Slope, seepage.	Seepage, piping.	Not needed	Seepage, fast intake, slope.	Piping, slope.	Erodes easily, slope.
[1]JuB: Joppa part	Slope, seepage.	Seepage, piping.	Not needed	Seepage, fast intake, slope.	Piping, slope.	Erodes easily, slope.
Urban land part.						
[1]JuC: Joppa part	Slope, seepage.	Seepage, piping.	Not needed	Seepage, fast intake, slope.	Piping, slope.	Erodes easily, slope.
Urban land part.						

See footnotes at end of table.

TABLE 9.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Joppa:						
[1]JuD:						
Joppa part	Slope, seepage.	Seepage, piping.	Not needed	Seepage, fast intake, slope.	Piping, slope.	Erodes easily, slope.
Urban land part.						
Keyport:						
KeB, KeC	Slope	Low strength	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.
[1]KmB:						
Keyport part	Slope	Low strength	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.
Urban land part.						
[1]KmC:						
Keyport part	Slope	Low strength	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.
Urban land part.						
Lindside:						
Ld	Seepage	Piping, low strength, compressible.	Floods	Wetness, floods.	Not needed	Wetness.
Lp	Seepage, depth to rock.	Low strength, erodes easily, piping.	Floods	Floods, wetness.	Not needed	Not needed.
Manor:						
MbC, MbD, McC	Seepage, slope.	Piping, seepage, slope.	Not needed	Slope, erodes easily.	Erodes easily, slope.	Erodes easily, slope.
[1]MdB:						
Manor part	Seepage, slope.	Piping, seepage, slope.	Not needed	Slope, erodes easily.	Erodes easily, slope.	Erodes easily, slope.
Urban land part.						
[1]MdC:						
Manor part	Seepage, slope.	Piping, seepage, slope.	Not needed	Slope, erodes easily.	Erodes easily, slope.	Erodes easily, slope.
Urban land part.						
[1]MdD:						
Manor part	Seepage, slope.	Piping, seepage, slope.	Not needed	Slope, erodes easily.	Erodes easily, slope.	Erodes easily, slope.
Urban land part.						
Matapeake:						
MgB, MgC	Seepage	Piping, seepage, low strength.	Not needed	Erodes easily, slow intake, slope.	Erodes easily, slope.	Erodes easily, slope.
[1]MhB:						
Matapeake part	Seepage	Piping, seepage, low strength.	Not needed	Erodes easily, slow intake, slope.	Erodes easily, slope.	Erodes easily, slope.

See footnotes at end of table.

TABLE 9.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Matapeake: Urban land part.						
Melvin: Mp	Wetness	Low strength	Wetness, floods.	Wetness, floods.	Not needed	Wetness.
Muirkirk Variant: [1]MvB, [1]MvC, [1]MvD	Favorable	Unstable fill	Not needed	Fast intake, droughty.	Erodes easily, piping.	Erodes easily, droughty.
Neshaminy: NeC, NeD	Depth to rock, slope.	Piping, low strength.	Not needed	Slope, percs slowly.	Erodes easily, slope.	Erodes easily, slope.
[1]NuC: Neshaminy part	Depth to rock, slope.	Piping, low strength.	Not needed	Slope, percs slowly.	Erodes easily, slope.	Erodes easily, slope.
Urban land part.						
[1]NuD: Neshaminy part	Depth to rock, slope.	Piping, low strength.	Not needed	Slope, percs slowly.	Erodes easily, slope.	Erodes easily, slope.
Urban land part.						
Sassafras: SaB, SaC	Slope, seepage.	Piping	Not needed	Slope	Slope	Slope.
ScB, ScC, ScD	Slope, seepage.	Piping, compressible.	Not needed	Slope	Slope	Slope.
[1]SgB: Sassafras part	Slope, seepage.	Piping	Not needed	Slope	Slope	Slope.
Urban land part.						
[1]SgC: Sassafras part	Slope, seepage.	Piping	Not needed	Slope	Slope	Slope.
Urban land part.						
[1]SgD: Sassafras part	Slope, seepage.	Piping	Not needed	Slope	Slope	Slope.
Urban land part.						
Sunnyside: SmB, SmC, SmD	Seepage, slope.	Piping	Not needed	Slope	Slope, piping.	Slope.
[1]SpB: Sunnyside part	Seepage, slope.	Piping	Not needed	Slope	Slope, piping.	Slope.
Urban land part.						
[1]SpC: Sunnyside part	Seepage, slope.	Piping	Not needed	Slope	Slope, piping.	Slope.

See footnotes at end of table.

TABLE 9.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Sunnyside: Urban land part.						
[1]SpD: Sunnyside part-	Seepage, slope.	Piping	Not needed	Slope	Slope, piping.	Slope.
Urban land part.						
[2]Udorthents: U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11B, U11C, U11D.						
[2]Udifluvents: UA.						
Urban land: Ub.						
[1]UcB: Urban land part.						
Beltsville part	Slope	Piping	Wetness, percs slowly.	Wetness, rooting depth, slope.	Erodes easily, percs slowly, slope.	Slope, percs slowly.
[1]UdB: Urban land part.						
Brandywine part	Seepage, depth to rock, slope.	Seepage, piping, slope.	Not needed	Fast intake, seepage, slope.	Piping, slope.	Droughty, slope.
[1]UeB: Urban land part.						
Chillum part---	Slope, seepage, piping.	Slope	Not needed	Slope, erodes easily.	Slope, erodes easily.	Slope.
[1]UeC: Urban land part.						
Chillum part---	Slope, seepage, piping.	Slope	Not needed	Slope, erodes easily.	Slope, erodes easily.	Slope.
[1]UfB: Urban land part.						
Christiana part	Favorable	Compressible, unstable fill, hard to pack.	Not needed	Slow intake, percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.

See footnotes at end of table.

TABLE 9.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Urban land:						
[1]UfC:						
Urban land part.						
Christiana part	Favorable	Compressible, unstable fill, hard to pack.	Not needed	Slow intake, percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
[1]UkC:						
Urban land part.						
Croom part	Slope, seepage.	Seepage, erodes easily.	Not needed	Slope, rooting depth, droughty.	Rooting depth	Slope, droughty, rooting depth.
[1]UmB:						
Urban land part.						
Galestown part	Seepage, slope.	Seepage	Not needed	Droughty, seepage.	Slope, piping.	Droughty, slope.
[1]UoC:						
Urban land part.						
Joppa part	Slope, seepage.	Seepage, piping.	Not needed	Seepage, fast intake, slope.	Piping, slope.	Erodes easily, slope.
[1]UpB:						
Urban land part.						
Keyport part	Slope	Low strength	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.
[1]UsB:						
Urban land part.						
Manor part	Seepage, slope.	Piping, seepage, slope.	Not needed	Slope, erodes easily.	Erodes easily, slope.	Erodes easily, slope.
[1]UsC:						
Urban land part.						
Manor part	Seepage, slope.	Piping, seepage, slope.	Not needed	Slope, erodes easily.	Erodes easily, slope.	Erodes easily, slope.
[1]UxB:						
Urban land part.						
Sassafras part	Slope, seepage.	Piping	Not needed	Slope	Slope	Slope.
[1]UxC:						
Urban land part.						
Sassafras part	Slope, seepage.	Piping	Not needed	Slope	Slope	Slope.
[1]UyC:						
Urban land part.						

See footnotes at end of table.

TABLE 9.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Urban land:						
Sunnyside part-	Seepage, slope.	Piping	Not needed	Slope	Slope, piping.	Slope.
[1]UzB:						
Urban land part.						
Woodstown part-	Seepage	Piping	Frost action, cutbanks cave.	Slope	Slope, erodes easily.	Slope, erodes easily.
Woodstown:						
WoB	Seepage	Piping	Frost action, cutbanks cave.	Slope	Slope, erodes easily.	Slope, erodes easily.
[1]WpB:						
Woodstown part-	Seepage	Piping	Frost action, cutbanks cave.	Slope	Slope, erodes easily.	Slope, erodes easily.
Urban land part.						

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

[2]These mapping units are variable in properties. See mapping unit descriptions for their composition and behavior.

TABLE 10.--RECREATIONAL DEVELOPMENT

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ashe:				
AsC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
AsD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Beltsville:				
BdB	Moderate: percs slowly.	Slight	Moderate: slope, wetness, percs slowly.	Slight.
[1]BeB:				
Beltsville part	Moderate: percs slowly.	Slight	Moderate: slope, wetness, percs slowly.	Slight.
Urban land part.				
Bibb:				
Bg	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Bourne:				
BnB	Severe: percs slowly.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
BnC	Severe: percs slowly.	Moderate: slope, wetness.	Severe: slope, wetness.	Moderate: wetness.
[1]BpB:				
Bourne part	Severe: percs slowly.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Urban land part.				
Brandywine:				
BrC	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope.	Moderate: small stones.
BrD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]BtB:				
Brandywine part	Moderate: small stones.	Moderate: small stones.	Moderate: slope, small stones.	Moderate: small stones.
Urban land part.				
[1]BtC:				
Brandywine part	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope.	Moderate: small stones.
Urban land part.				
[1]BtD:				
Brandywine part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnotes at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Brandywine: Urban land part.				
Chillum: CcB	Slight	Slight	Moderate: slope.	Slight.
CcC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
CcD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]CdB: Chillum part	Slight	Slight	Moderate: slope.	Slight.
Urban land part.				
[1]CdC: Chillum part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Urban land part.				
[1]CdD: Chillum part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.				
Christiana: CeB	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
CeC	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
CeD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]CfB: Christiana part	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Urban land part.				
[1]CfC: Christiana part	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
Urban land part.				
[1]CfD: Christiana part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.				
Codorus: Ck	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: wetness, floods.

See footnotes at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Codorus:				
[1]Cn:				
Codorus part	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: wetness, floods.
Urban land part.				
Croom:				
CwB	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
CwC	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
CwD	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
[1]CxB:				
Croom part	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
Urban land part.				
[1]CxC:				
Croom part	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
Urban land part.				
[1]CxD:				
Croom part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.
Urban land part.				
Dunning:				
Dn	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.
Fallsington:				
Fa	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
[2]Fluvaquents: FB, FD, FF, FH.				

See footnotes at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Galestown:				
[1]GeB:				
Galestown part	Moderate: too sandy.	Moderate: too sandy.	Severe: dusty, too sandy.	Moderate: too sandy.
Urban land part.				
[1]GfB:				
Galestown part	Moderate: too sandy.	Moderate: too sandy.	Severe: dusty, too sandy.	Moderate: too sandy.
Rumford part	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
[1]GfC:				
Galestown part	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope, dusty, too sandy.	Moderate: too sandy.
Rumford part	Moderate: slope, too sandy.		Severe: slope.	Moderate: too sandy.
Glenelg:				
GgB	Slight	Slight	Moderate: slope.	Slight.
GgC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
GgD	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
[1]GhB:				
Glenelg part	Slight	Slight	Moderate: slope.	Slight.
Urban land part.				
[1]GhC:				
Glenelg part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Urban land part.				
[1]GhD:				
Glenelg part	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Urban land part.				
Glenelg Variant:				
GlB	Moderate: wetness.	Moderate: wetness.	Severe: slope.	Moderate: wetness.
[1]GmB:				
Glenelg Variant part	Moderate: wetness.	Moderate: wetness.	Severe: slope.	Moderate: wetness.
Urban land part.				

See footnotes at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Iuka:				
Ik	Moderate: wetness.	Moderate: wetness, floods.	Moderate: wetness, floods.	Slight.
[1]Ip:				
Iuka part	Moderate: wetness.	Moderate: wetness, floods.	Moderate: wetness, floods.	Slight.
Urban land part.				
Joppa:				
JtB	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
JtC	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
JtD	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
[1]JuB:				
Joppa part	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
Urban land part.				
[1]JuC:				
Joppa part	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
Urban land part.				
[1]JuD:				
Joppa part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.
Urban land part.				
Keyport:				
KeB	Moderate: percs slowly.	Moderate: wetness.	Moderate: percs slowly, slope.	Slight.
KeC	Moderate: percs slowly.	Moderate: wetness.	Severe: slope.	Slight.
[1]KmB:				
Keyport part	Moderate: percs slowly.	Moderate: wetness.	Moderate: percs slowly, slope.	Slight.
Urban land part.				
[1]KmC:				
Keyport part	Moderate: percs slowly.	Moderate: wetness.	Severe: slope.	Slight.
Urban land part.				
Lindside:				
Ld	Severe: floods.	Moderate: floods, wetness.	Moderate: floods, wetness.	Slight.

See footnotes at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Lindside:				
Lp	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Manor:				
MbC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
MbD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
McC	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
[1]MdB:				
Manor part	Slight	Slight	Moderate: slope.	Slight.
Urban land part.				
[1]MdC:				
Manor part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Urban land part.				
[1]MdD:				
Manor part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.				
Matapeake:				
MgB	Slight	Slight	Moderate: slope.	Slight.
MgC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
[1]MhB:				
Matapeake part	Slight	Slight	Moderate: slope.	Slight.
Urban land part.				
Melvin:				
Mp	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
Muirkirk Variant:				
[1]MvB	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
[1]MvC	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
[1]MvD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Neshaminy:				
NeC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
NeD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnotes at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Neshaminy:				
[1]NuC:				
Neshaminy part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Urban land part.				
[1]NuD:				
Neshaminy part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.				
Sassafras:				
SaB	Slight	Slight	Moderate: slope.	Slight.
SaC, ScC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
ScB	Slight	Slight	Moderate: slope, small stones.	Slight.
ScD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]SgB:				
Sassafras part	Slight	Slight	Moderate: slope.	Slight.
Urban land part.				
[1]SgC:				
Sassafras part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Urban land part.				
[1]SgD:				
Sassafras part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land part.				
Sunnyside:				
SmB	Slight	Slight	Moderate: slope.	Slight.
SmC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
SmD	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]SpB:				
Sunnyside part	Slight	Slight	Moderate: slope.	Slight.
Urban land part.				
[1]SpC:				
Sunnyside part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Urban land part.				
[1]SpD:				
Sunnyside part	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnotes at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Sunnyside: Urban land part.				
[2]Udorthents: U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11B, U11C, U11D.				
[2]Udifluvents: UA.				
Urban land: Ub.				
[1]UcB: Urban land part.				
Beltsville part----	Moderate: percs slowly.	Slight----------	Moderate: slope, wetness, percs slowly.	Slight.
[1]UdB: Urban land part.				
Brandywine part----	Moderate: small stones.	Moderate: small stones.	Moderate: slope, small stones.	Moderate: small stones.
[1]UeB: Urban land part.				
Chillum part-------	Slight----------	Slight----------	Moderate: slope.	Slight.
[1]UeC: Urban land part.				
Chillum part-------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
[1]UfB: Urban land part.				
Christiana part----	Moderate: percs slowly.	Slight----------	Moderate: slope, percs slowly.	Slight.
[1]UfC: Urban land part.				
Christiana part----	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.

See footnotes at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Urban land:				
[1]UkC:				
Urban land part.				
Croom part	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
[1]UmB:				
Urban land part.				
Galestown part	Moderate: too sandy.	Moderate: too sandy.	Severe: dusty, too sandy.	Moderate: too sandy.
[1]UoC:				
Urban land part.				
Joppa part	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Moderate: small stones.
[1]UpB:				
Urban land part.				
Keyport part	Moderate: percs slowly.	Moderate: wetness.	Moderate: percs slowly, slope.	Slight.
[1]UsB:				
Urban land part.				
Manor part	Slight	Slight	Moderate: slope.	Slight.
[1]UsC:				
Urban land part.				
Manor part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
[1]UxB:				
Urban land part.				
Sassafras part	Slight	Slight	Moderate: slope.	Slight.
[1]UxC:				
Urban land part.				
Sassafras part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
[1]UyC:				
Urban land part.				
Sunnyside part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
[1]UzB:				
Urban land part.				
Woodstown part	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
Woodstown:				
WoB	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.

See footnotes at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Woodstown: [1]WpB:				
Woodstown part	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
Urban land part.				

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

[2]These mapping units are variable in properties. See mapping unit descriptions for their composition and behavior.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ashe:											
AsC, AsD	0-6	Loam	SM, SM-SC, ML, CL-ML	A-4	0-5	90-100	85-100	65-95	40-55	<25	[1]NP-7
	6-23	Loam, sandy loam.	SM, SM-SC	A-2, A-4	5-15	85-100	80-95	60-95	35-45	<25	NP-7
	23-60	Sandy loam, loamy sand.	SM	A-1, A-2, A-4	15-35	75-95	70-95	40-95	15-45	---	NP
Beltsville:											
BdB	0-16	Silt loam	ML, CL-ML	A-4	0	95-100	95-100	85-100	60-90	22-26	3-7
	16-21	Silt loam, loam	CL	A-4, A-6	0	95-100	95-100	85-100	65-90	29-32	9-12
	21-45	Silt loam, loam	CL, CL-ML	A-6, A-4	0	95-100	95-100	80-100	60-95	29-34	9-14
	45-60	Stratified gravelly sandy loam to gravelly clay loam.	SM, ML, CL	A-2, A-4, A-6	0	75-90	65-75	40-80	25-65	18-34	3-16
[2]BeB:											
Beltsville part	0-16	Silt loam	ML, CL-ML	A-4	0	95-100	95-100	85-100	60-90	22-26	3-7
	16-21	Silt loam, loam	CL	A-4, A-6	0	95-100	95-100	85-100	65-90	29-32	9-12
	21-45	Silt loam, loam	CL, CL-ML	A-6, A-4	0	95-100	95-100	80-100	60-95	29-34	9-14
	45-60	Stratified gravelly sandy loam to gravelly clay loam.	SM, ML, CL	A-2, A-4, A-6	0	75-90	65-75	40-80	25-65	18-34	3-16
Urban land part.											
Bibb:											
Bg	0-36	Sandy loam	SM, SM-SC	A-2, A-4	0-5	95-100	90-100	60-70	30-40	<30	NP-7
	36-60	Loamy sand, silt loam, gravelly loamy sand.	SM, SM-SC, ML, CL-ML	A-1, A-2, A-4	0-10	60-100	50-100	30-100	15-90	<30	NP-7
Bourne:											
BnB, BnC	0-11	Fine sandy loam	ML, SM, SM-SC	A-4	0	90-100	90-100	65-85	40-55	<25	NP-6
	11-18	Sandy clay loam, clay loam.	SC, CL	A-6, A-7	0	90-100	90-100	75-95	35-80	30-50	10-25
	18-28	Sandy clay loam	SC, CL, SM-SC	A-4, A-6	0	90-100	90-100	75-95	35-55	20-40	5-20
	28-60	Fine sandy loam, gravelly fine sandy loam.	SM, SM-SC	A-2, A-4	0	70-100	60-100	45-80	25-50	<20	NP-6
[2]BpB:											
Bourne part	0-11	Fine sandy loam	ML, SM, SM-SC	A-4	0	90-100	90-100	65-85	40-55	<25	NP-6
	11-18	Sandy clay loam, clay loam.	SC, CL	A-6, A-7	0	90-100	90-100	75-95	35-80	30-50	10-25
	18-28	Sandy clay loam	SC, CL, SM-SC	A-4, A-6	0	90-100	90-100	75-95	35-55	20-40	5-20
	28-60	Fine sandy loam, gravelly fine sandy loam.	SM, SM-SC	A-2, A-4	0	70-100	60-100	45-80	25-50	<20	NP-6

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Bourne:											
Urban land part.											
Brandywine:											
BrC, BrD----------	0-22	Gravelly loam---	SM, GM	A-2, A-4, A-6	0-25	55-90	30-55	25-50	20-40	21-39	2-11
	22-60	Very gravelly loamy sand, gravelly loamy sand.	SM, GW-GM	A-1	0-30	40-65	30-55	20-35	8-15	---	NP
[2]BtB:											
Brandywine part-	0-22	Gravelly loam---	SM, GM	A-2, A-4, A-6	0-25	55-90	30-55	25-50	20-40	21-39	2-11
	22-60	Very gravelly loamy sand, gravelly loamy sand.	SM, GW-GM	A-1	0-30	40-65	30-55	20-35	8-15	---	NP
Urban land part.											
[2]BtC:											
Brandywine part-	0-22	Gravelly loam---	SM, GM	A-2, A-4, A-6	0-25	55-90	30-55	25-50	20-40	21-39	2-11
	22-60	Very gravelly coarse sand, gravelly loamy sand.	SM, GW-GM	A-1	0-30	40-65	30-55	20-35	8-15	---	NP
Urban land part.											
[2]BtD:											
Brandywine part-	0-22	Gravelly loam---	SM, GM	A-2, A-4, A-6	0-25	55-90	30-55	25-50	20-40	21-39	2-11
	22-60	Very gravelly coarse sand, gravelly loamy sand.	SM, GW-GM	A-1	0-30	40-65	30-55	20-35	8-15	---	NP
Urban land part.											
Chillum:											
CcB, CcC, CcD-----	0-12	Silt loam-------	ML, CL	A-4	0	100	100	85-100	60-90	20-30	2-10
	12-28	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	70-95	26-44	6-20
	28-60	Very gravelly sandy loam, gravelly sandy loam.	GM, SM, GP-GM	A-1, A-2	0	45-90	30-75	20-50	10-30	---	NP
[2]CdB:											
Chillum part----	0-12	Silt loam-------	ML, CL	A-4	0	100	100	85-100	60-90	20-30	2-10
	12-28	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	70-95	26-44	6-20
	28-60	Very gravelly sandy loam, gravelly sandy loam.	GM, SM, GP-GM	A-1, A-2	0	45-90	30-75	20-50	10-30	---	NP
Urban land part.											

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Chillum:											
2CdC:											
Chillum part----	0-12	Silt loam-------	ML, CL	A-4	0	100	100	85-100	60-90	20-30	2-10
	12-28	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	70-95	26-44	6-20
	28-60	Very gravelly sandy loam, gravelly sandy loam.	GM, SM, GP-GM	A-1, A-2	0	45-90	30-75	20-50	10-30	---	NP
Urban land part.											
2CdD:											
Chillum part----	0-12	Silt loam-------	ML, CL	A-4	0	100	100	85-100	60-90	20-30	2-10
	12-28	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	70-95	26-44	6-20
	28-60	Very gravelly sandy loam, gravelly sandy loam.	GM, SM, GP-GM	A-1, A-2	0	45-90	30-75	20-50	10-30	---	NP
Urban land part.											
Christiana:											
CeB, CeC, CeD-----	0-10	Silt loam-------	CL-ML, CL	A-4	0	100	100	70-100	50-90	22-30	5-9
	10-75	Clay, silty clay	CL, CH, MH	A-7, A-6	0	100	100	95-100	80-100	40-59	17-31
2CfB:											
Christiana part-	0-10	Silt loam-------	CL-ML, CL	A-4	0	100	100	70-100	50-90	22-30	5-9
	10-75	Clay, silty clay	CL, CH, MH	A-7, A-6	0	100	100	95-100	80-100	40-59	17-31
Urban land part.											
2CfC:											
Christiana part-	0-10	Silt loam-------	CL-ML, CL	A-4	0	100	100	70-100	50-90	22-30	5-9
	10-75	Clay, silty clay	CL, CH, MH	A-7, A-6	0	100	100	95-100	80-100	40-59	17-31
Urban land part.											
2CfD:											
Christiana part-	0-10	Silt loam-------	CL-ML, CL	A-4	0	100	100	70-100	50-90	22-30	5-9
	10-75	Clay, silty clay	CL, CH, MH	A-7, A-6	0	100	100	95-100	80-100	40-59	17-31
Urban land part.											
Codorus:											
Ck----------	0-17	Silt loam-------	ML, CL	A-4, A-6	0	95-100	90-100	80-100	65-95	22-35	2-12
	17-50	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	95-100	90-100	80-100	65-85	22-35	2-12
	50-60	Stratified sandy loam to silt loam.	SM, ML	A-2, A-4	0	90-100	75-100	50-90	25-75	<35	NP-7
2Cn:											
Codorus part----	0-17	Silt loam-------	ML, CL	A-4, A-6	0	95-100	90-100	80-100	65-95	22-35	2-12
	17-50	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	95-100	90-100	80-100	65-85	22-35	2-12
	50-60	Stratified sandy loam to silt loam.	SM, ML	A-2, A-4	0	90-100	75-100	50-90	25-75	<35	NP-7
Urban land part.											

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Croom:											
CwB, CwC, CwD-----	0-21	Very gravelly sandy loam.	GP-GM, GM	A-1	0	40-55	30-50	20-30	10-15	8-15	NP-4
	21-42	Very gravelly sandy clay loam, very gravelly sandy loam.	GP-GM, GP-GC, GC, GM	A-1, A-2	0	40-60	30-50	20-45	10-30	8-36	2-16
	42-72	Very gravelly sandy loam, gravelly loamy sand.	GW, GM, GC, GP	A-1	0	40-50	30-50	15-35	4-20	<20	NP-4
[2]CxB:											
Croom part------	0-21	Very gravelly sandy loam.	GP-GM, GM	A-1	0	40-55	30-50	20-30	10-15	8-15	NP-4
	21-42	Very gravelly sandy clay loam, very gravelly sandy loam.	GP-GM, GP-GC, GC, GM	A-1, A-2	0	40-60	30-50	20-45	10-30	8-36	2-16
	42-72	Very gravelly sandy loam, very gravelly loamy sand.	GW, GM, GC, GP	A-1	0	40-50	30-50	15-35	4-20	<20	NP-4
Urban land part.											
[2]CxC:											
Croom part------	0-21	Very gravelly sandy loam.	GP-GM, GM	A-1	0	40-55	30-50	20-30	10-15	8-15	NP-4
	21-42	Very gravelly sandy clay loam, very gravelly sandy loam.	GP-GM, GP-GC, GC, GM	A-1, A-2	0	40-60	30-50	20-45	10-30	8-36	2-16
	42-72	Very gravelly sandy loam, very gravelly loamy sand.	GW, GM, GC, GP	A-1	0	40-50	30-50	15-35	4-20	<20	NP-4
Urban land part.											
[2]CxD:											
Croom part------	0-21	Very gravelly sandy loam.	GP-GM, GM	A-1	0	40-55	30-50	20-30	10-15	8-15	NP-4
	21-42	Very gravelly sandy clay loam, very gravelly sandy loam.	GP-GM, GP-GC, GC, GM	A-1, A-2	0	40-60	30-50	20-45	10-30	8-36	2-16
	42-72	Very gravelly sandy loam, very gravelly loamy sand.	GW, GM, GC, GP	A-1	0	40-50	30-50	15-35	4-20	<20	NP-4
Urban land part.											

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Dunning:											
Dn	0-16	(3)	---	---	---	---	---	---	---	---	---
	16-46	Silty clay loam, silty clay.	CL, CH, MH	A-7	0	100	90-100	90-100	80-95	42-55	18-28
	46-60	Stratified sandy loam to silty clay.	SM-SC, CL, CH, SC	A-2, A-6, A-4, A-7	0	100	90-100	50-100	30-95	20-55	5-28
Fallsington:											
Fa	0-13	Sandy loam	SM	A-2, A-4	0	100	95-100	65-70	30-40	<19	NP-5
	13-33	Sandy loam, loam, sandy clay loam.	SM, SC, CL, ML	A-2, A-4, A-6	0	100	85-100	65-85	30-55	<30	NP-12
	33-60	Loamy sand	SM	A-2	0	95-100	70-100	50-65	15-35	---	NP
Fluvaquents: FB, FD, ^{2}FF, ^{2}FH.											
Galestown:											
^{2}GeB:											
Galestown part--	0-60	Loamy sand, sand.	SP-SM, SM	A-1, A-2, A-3	0	95-100	80-100	45-70	7-20	---	NP
Urban land part.											
^{2}GfB:											
Galestown part--	0-60	Loamy sand, sand.	SP-SM, SM	A-1, A-2, A-3	0	95-100	80-100	45-70	7-20	---	NP
Rumford part----	0-19	Loamy fine sand	SM	A-2	0	90-100	85-100	45-75	15-30	<20	NP
	19-39	Fine sandy loam, loamy sand, sandy clay loam.	SM - SC, SM	A-2, A-4, A-6	0	95-100	85-100	55-85	15-50	<34	NP-12
	39-60	Fine sand, gravelly sand, fine sandy loam.	SM, SP, GP, GM	A-1, A-2, A-3, A-6	0	70-100	60-100	30-85	2-40	<25	NP-6
^{2}GfC:											
Galestown part--	0-60	Loamy sand, sand.	SP-SM, SM	A-1, A-2, A-3	0	95-100	80-100	45-70	7-20	---	NP

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Galestown:											
Rumford part----	0-19	Loamy fine sand	SM	A-2	0	90-100	85-100	45-75	15-30	<20	NP
	19-39	Fine sandy loam, loamy sand, sandy clay loam.	SM, SC, SM	A-2, A-4, A-6	0	95-100	85-100	55-85	15-50	<34	NP-12
	39-60	Fine sand, gravelly sand, fine sandy loam.	SM, SP	A-1, A-2, A-3, A-6	0	70-100	60-100	30-85	2-40	<25	NP-6
Glenelg:											
GgB, GgC, GgD-----	0-9	Loam----------	ML	A-4, A-6	0	90-100	90-100	75-95	50-80	32-40	7-12
	9-28	Channery silt loam, silty clay loam.	ML, CL-ML	A-4, A-6, A-7	0-10	95-100	90-100	85-100	65-85	34-46	9-14
	28-60	Loam, sandy loam, channery loam.	SM, ML	A-1, A-2, A-4	0-10	60-100	55-100	35-90	15-70	<40	NP-6
[2]GhB:											
Glenelg part----	0-9	Loam----------	ML	A-4, A-6	0	90-100	90-100	75-95	50-80	32-40	7-12
	9-28	Channery silt loam, silty clay loam.	ML, CL-ML	A-4, A-6, A-7	0-10	95-100	90-100	85-100	65-85	34-46	9-14
	28-60	Loam, sandy loam, channery loam.	SM, ML	A-1, A-2, A-4	0-10	60-100	55-100	35-90	15-70	<40	NP-6
Urban land part.											
[2]GhC:											
Glenelg part----	0-9	Loam----------	ML	A-4, A-6	0	90-100	90-100	75-95	50-80	32-40	7-12
	9-28	Channery silt loam, silty clay loam.	ML, CL-ML	A-4, A-6, A-7	0-10	95-100	90-100	85-100	65-85	34-46	9-14
	28-60	Loam, sandy loam, channery loam.	SM, ML	A-1, A-2, A-4	0-10	60-100	55-95	35-90	15-70	<40	NP-6
Urban land part.											
[2]GhD:											
Glenelg part----	0-9	Loam----------	ML	A-4, A-6	0	90-100	90-100	75-95	50-80	32-40	7-12
	9-28	Channery silt loam, silty clay loam.	ML, CL-ML	A-4, A-6, A-7	0-10	95-100	90-100	85-100	65-85	34-46	9-14
	28-60	Loam, sandy loam, channery loam.	SM, ML	A-1, A-2, A-4	0-10	60-100	55-95	35-90	15-70	<40	NP-6
Urban land part.											
Glenelg Variant:											
GlB----------	0-6	Silt loam-------	ML, CL-ML	A-4, A-6	0	90-100	85-100	75-95	50-80	32-40	7-12
	6-26	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0-10	90-100	80-100	60-95	50-85	34-46	7-14
	26-41	Loam, channery silt loam, silty clay loam.	SM, ML, CL	A-4, A-6, A-7	0-10	75-100	55-90	50-90	35-85	34-46	7-14
	41-60	Fine sandy loam, loam, channery loam.	ML, CL, SM	A-4, A-2, A-1	0-15	65-100	30-80	25-70	15-60	<30	NP-10

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Glenelg Variant:											
[2]GmB:											
Glenelg Variant part	0-6	Silt loam	ML, CL-ML	A-4, A-6	0	90-100	85-100	75-95	50-80	32-40	7-12
	6-26	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0-10	90-100	80-100	60-95	50-85	34-46	7-14
	26-41	Loam, channery silt loam, silty clay loam.	SM, ML, CL	A-4, A-6, A-7	0-10	75-100	55-90	50-90	35-85	34-46	7-14
	41-60	Fine sandy loam, loam, channery loam.	ML, CL, SM	A-4, A-2, A-1	0-15	65-100	30-80	25-70	15-60	<30	NP-10
Urban land part.											
Iuka:											
Ik	0-60	Sandy loam	SM, ML	A-2, A-4	0	100	100	60-70	30-40	<30	NP-5
[2]Ip:											
Iuka part	0-60	Sandy loam	SM, ML	A-4, A-2	0	100	100	60-70	30-40	<30	NP-5
Urban land part.											
Joppa:											
JtB, JtC, JtD	0-7	Gravelly sandy loam.	SP-SM, ML, SM	A-1, A-2, A-4	0	60-80	50-75	30-70	10-55	<35	NP
	7-27	Very gravelly sandy loam, gravelly loam.	GP-GM, GM	A-1, A-2, A-4	0	40-60	30-50	15-50	10-40	<30	NP
	27-60	Very gravelly sand.	GW, GP, GP-GM	A-1	0-15	40-50	30-45	15-25	2-7	<20	NP
[2]JuB:											
Joppa part	0-7	Gravelly sandy loam.	SP-SM, ML, SM	A-1, A-2, A-4	0	60-80	50-75	30-70	10-55	<35	NP
	7-27	Very gravelly sandy loam, gravelly loam.	GP-GM, GM	A-1, A-2, A-4	0	40-60	30-50	15-50	10-40	<30	NP
	27-60	Very gravelly sand.	GW, GP, GP-GM	A-1	0-15	40-50	30-45	15-25	2-7	<20	NP
Urban land part.											
[2]JuC:											
Joppa part	0-7	Gravelly sandy loam.	SP-SM, ML, SM	A-1, A-2, A-4	0	60-80	50-75	30-70	10-55	<35	NP
	7-27	Very gravelly sandy loam, gravelly loam.	GP-GM, GM	A-1, A-2, A-4	0	40-60	30-50	15-50	10-40	<30	NP
	27-60	Very gravelly sand.	GW, GP, GP-GM	A-1	0-15	40-50	30-45	15-25	2-7	<20	NP

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Joppa:											
Urban land part.											
2JuD:											
Joppa part------	0-7	Gravelly sandy loam.	SP-SM, ML, SM	A-1, A-2, A-4	0	60-80	50-75	30-70	10-55	<35	NP
	7-27	Very gravelly sandy loam, gravelly loam.	GP-GM, GM	A-1, A-2, A-4	0	40-50	30-50	15-50	10-40	<30	NP
	27-60	Very gravelly sand.	GW, GP, GP-GM	A-1	0-15	40-50	30-45	15-25	2-7	<20	NP
Urban land part.											
Keyport:											
KeB, KeC----------	0-12	Fine sandy loam	SM, SC	A-4	0	100	100	70-85	40-50	20-30	5-10
	12-60	Silty clay loam, clay loam, clay.	ML, CL, MH, CH	A-4, A-6, A-7	0	100	100	90-100	80-90	25-85	10-40
2KmB:											
Keyport part----	0-12	Fine sandy loam	SM, SC	A-4	0	100	100	70-85	40-50	20-30	5-10
	12-60	Silty clay loam, clay loam, clay.	ML, CL, MH, CH	A-4, A-6, A-7	0	100	100	90-100	80-90	25-85	10-40
Urban land part.											
2KmC:											
Keyport part----	0-12	Fine sandy loam	SM, SC	A-4	0	100	100	70-85	40-50	20-30	5-10
	12-60	Silty clay loam, clay loam, clay.	ML, CL, MH, CH	A-4, A-6, A-7	0	100	100	90-100	80-90	25-85	10-40
Urban land part.											
Lindside:											
Ld----------	0-6	Loam----------	ML, CL	A-4, A-6	0	100	95-100	85-100	60-75	25-35	2-12
	6-60	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	95-100	85-100	65-95	20-50	1-25
Lp----------	0-29	Silt loam-------	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	65-90	25-45	5-25
	29-44	Silt loam, loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	80-95	55-85	25-50	2-25
	44	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Manor:											
MbC, MbD----------	0-23	Loam----------	ML	A-4, A-6	0	95-100	95-100	80-100	55-90	32-40	6-12
	23-60	Loam, channery loam.	SM, ML	A-4, A-6	0-10	70-95	60-95	50-95	35-70	26-40	4-12
McC----------	0-23	Channery loam---	SM, ML	A-4, A-6	0-10	70-95	60-75	50-70	35-55	32-40	6-12
	23-60	Loam, channery loam.	SM, ML	A-4, A-6	0-10	70-95	60-95	50-95	35-70	26-40	4-12

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Manor:											
2MdB:											
Manor part------	0-23	Loam----------	ML	A-4, A-6	0	95-100	95-100	80-100	55-90	32-40	6-12
	23-60	Loam, channery loam.	SM, ML	A-4, A-6	0-10	70-95	60-95	50-95	35-70	26-40	4-12
Urban land part.											
2MdC:											
Manor part------	0-23	Loam----------	ML	A-4, A-6	0	95-100	95-100	80-100	55-90	32-40	6-12
	23-60	Loam, channery loam.	SM, ML	A-4, A-6	0-10	70-95	60-95	50-95	35-85	26-40	4-12
Urban land part.											
2MdD:											
Manor part------	0-23	Loam----------	ML	A-4, A-6	0	95-100	95-100	80-100	55-90	32-40	6-12
	23-60	Loam, channery loam.	SM, ML	A-4, A-6	0-10	70-95	60-95	50-95	35-85	26-40	4-12
Urban land part.											
Matapeake:											
MgB, MgC----------	0-10	Silt loam-------	ML, CL	A-4	0	100	100	80-100	70-80	20-33	3-9
	10-38	Silt loam, silty clay loam, sandy clay loam.	CL, ML, SC	A-4, A-6	0	100	100	80-100	35-90	27-35	10-15
	38-60	Sandy loam, loamy sand,	SM, SP-SM	A-1, A-2, A-4	0	95-100	85-100	45-70	5-40	<19	NP-3
2MhB:											
Matapeake part--	0-10	Silt loam-------	ML, CL	A-4	0	100	100	80-100	70-80	20-33	3-9
	10-38	Silt loam, silty clay loam, sandy clay loam.	CL, ML, SC.	A-4, A-6	0	100	100	80-100	35-90	27-35	10-15
	38-60	Sandy loam, loamy sand, sand.	SM, SP-SM	A-1, A-2, A-4	0	95-100	85-100	45-70	5-40	<19	NP-3
Urban land part.											
Melvin:											
Mp----------	0-7	Silt loam-------	ML, CL	A-4, A-6	0	95-100	90-100	80-100	65-95	25-40	5-20
	7-60	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	85-100	80-100	70-100	60-95	25-40	5-20
Muirkirk Variant:											
2MvB, 2MvC, 2MvD--	0-11	Loamy sand------	SM	A-2	0	100	85-100	50-70	15-25	---	NP
	11-31	Sandy loam------	SM	A-2, A-4	0	100	85-100	55-65	30-40	---	NP
	31-60	Clay, silty clay	CL, CH, MH	A-6, A-7	0	100	100	100	90-100	40-59	17-31

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Neshaminy:											
NeC, NeD----------	0-18	Silt loam-------	ML, CL	A-4, A-6	0-5	95-100	75-100	70-100	55-85	---	---
	18-40	Silt loam, gravelly silty clay loam, gravelly sandy clay loam.	ML, SM, MH, CL	A-4, A-7, A-2, A-6	0-5	85-100	75-100	65-100	30-75	25-55	NP-22
	40-60	Loam------------	CL-ML, CL	A-4, A-6	0-5	95-100	90-100	75-95	55-75	---	---
2NuC:											
Neshaminy part--	0-18	Silt loam-------	ML, CL	A-4, A-6	0-5	95-100	75-100	70-100	55-85	---	---
	18-40	Silt loam, gravelly silty clay loam, gravelly sandy clay loam.	ML, SM, MH, CL	A-4, A-7, A-2, A-6	0-5	85-100	75-100	65-100	30-75	25-55	NP-22
	40-60	Loam------------	CL-ML, CL	A-4, A-6	0-5	95-100	98-100	75-95	55-75	---	---
Urban land part.											
2NuD:											
Neshaminy part--	0-18	Silt loam-------	ML, CL	A-4, A-6	0-5	95-100	75-100	70-100	55-85	---	---
	18-40	Silt loam, gravelly silty clay loam, gravelly sandy clay loam.	ML, SM, MH, CL	A-4, A-7, A-2, A-6	0-5	85-100	75-100	65-100	30-75	25-55	NP-22
	40-60	Loam------------	CL-ML, CL	A-4, A-6	0-5	95-100	90-100	75-95	55-75	---	---
Urban land part.											
Sassafras:											
SaB, SaC----------	0-20	Sandy loam------	SM	A-2	0	85-100	80-100	50-65	25-35	<15	NP-10
	20-31	Sandy loam, sandy clay loam, gravelly sandy loam.	SM-SC, CL, ML	A-2, A-4, A-6	0	85-100	70-100	50-95	25-75	20-33	5-15
	31-60	Loamy coarse sand, sand, gravelly sand.	SP-SM, SM	A-1, A-2	0	70-100	60-100	25-75	5-30	---	NP
ScB, ScC, ScD-----	0-20	Gravelly sandy loam.	SM	A-1, A-2	0	80-85	70-75	45-50	20-30	<15	NP-10
	20-31	Sandy loam, sandy clay loam, gravelly sandy loam.	SM-SC, CL, ML	A-2, A-4, A-6	0	85-100	70-100	50-95	25-75	20-33	5-15
	31-60	Loamy coarse sand, sand, gravelly sand.	SP-SM, SM	A-1, A-2	0	70-100	60-100	25-75	5-30	---	NP
2SgB:											
Sassafras part--	0-20	Sandy loam------	SM	A-2	0	85-100	80-100	50-65	25-35	<15	NP-10
	20-31	Sandy loam, sandy clay loam, gravelly sandy loam.	SM-SC, CL, ML	A-2, A-4, A-6	0	85-100	70-100	50-95	25-75	20-33	5-15
	31-60	Loamy coarse sand, sand, gravelly sand.	SP-SM, SM	A-1, A-2	0	70-100	60-100	25-75	5-30	---	NP
Urban land part.											

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Sassafras:											
2SgC:											
Sassafras part--	0-20	Sandy loam------	SM	A-2	0	85-100	80-100	50-65	25-35	<15	NP-10
	20-31	Sandy loam, sandy clay loam, gravelly sandy loam.	SM-SC, CL, ML	A-2, A-4, A-6	0	85-100	70-100	50-95	25-75	20-33	5-15
	31-60	Loamy coarse sand, sand, gravelly sand.	SP-SM, SM	A-1, A-2	0	70-100	60-100	25-75	5-30	---	NP
Urban land part.											
2SgD:											
Sassafras part--	0-20	Sandy loam------	SM	A-2	0	85-100	80-100	50-95	25-35	<15	NP-10
	20-31	Sandy loam, sandy clay loam, gravelly sandy loam.	SM-SC, CL, ML	A-2, A-4, A-6	0	85-100	70-100	50-95	25-75	20-33	5-15
	31-60	Loamy coarse sand, sand, gravelly sand.	SP-SM, SM	A-1, A-2	0	70-100	60-100	25-75	5-30	---	NP
Urban land part.											
Sunnyside:											
SmB, SmC, SmD-----	0-5	Fine sandy loam	SM	A-4	0	95-100	95-100	70-85	40-50	<26	NP-4
	5-28	Sandy clay loam, gravelly sandy clay loam, loam.	SM, SC, CL, ML	A-2, A-4, A-6	0	95-100	70-100	55-95	30-75	<40	NP-24
	28-60	Loamy sand, loamy very coarse sand.	SM	A-1, A-2	0	95-100	75-100	40-65	15-25	---	NP
2SpB:											
Sunnyside part--	0-5	Fine sandy loam	SM	A-4	0	95-100	95-100	70-85	40-50	<26	NP-4
	5-28	Sandy clay loam, gravelly sandy clay loam, loam.	SM, SC, CL, ML	A-2, A-4, A-6	0	95-100	70-100	55-95	30-75	<40	NP-24
	28-60	Loamy sand, loamy very coarse sand.	SM	A-1, A-2	0	95-100	75-100	40-65	15-25	---	NP
Urban land part.											
2SpC:											
Sunnyside part--	0-5	Fine sandy loam	SM	A-4	0	95-100	95-100	70-85	40-50	<26	NP-4
	5-28	Sandy clay loam, gravelly sandy clay loam, loam.	SM, SC, CL, ML	A-2, A-4, A-6	0	95-100	70-100	55-95	30-75	<40	NP-24
	28-60	Loamy sand, loamy very coarse sand.	SM	A-1, A-2	0	95-100	75-100	40-65	15-25	---	NP
Urban land part.											

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Sunnyside:											
[2]SpD:											
Sunnyside part--	0-5	Fine sandy loam	SM	A-4	0	95-100	95-100	70-85	40-50	<26	NP-4
	5-28	Sandy clay loam, gravelly sandy clay loam, loam.	SM, SC, CL, ML	A-2, A-4, A-6	0	95-100	70-100	55-95	30-75	<40	NP-24
	28-60	Loamy sand, loamy very coarse sand.	SM	A-1, A-2	0	95-100	75-100	40-65	15-25	---	NP
Urban land part.											
Udorthents: U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11B, U11C, U11D.											
Udifluvents: UA.											
Urban land: Ub.											
[2]UcB: Urban land part.											

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Urban land:											
Beltsville part-	0-16	Silt loam-------	ML, CL-ML	A-4	0	95-100	95-100	85-100	60-90	22-26	3-7
	16-21	Silt loam, loam.	CL	A-4, A-6	0	95-100	95-100	85-100	65-90	29-32	9-12
	21-45	Silt loam, loam.	CL, CL-ML	A-6, A-4	0	95-100	95-100	80-100	60-95	29-34	9-14
	45-60	Stratified gravelly sandy loam to gravelly clay loam.	SM, ML, CL	A-2, A-4, A-6	0	75-90	65-75	40-80	25-65	18-34	3-16
[2]UdB:											
Urban land part.											
Brandywine part-	0-22	Gravelly loam---	SM, GM	A-2, A-4, A-6	0-25	55-90	30-55	25-50	30-55	21-39	2-11
	22-60	Very gravelly loamy sand, gravelly loamy sand.	SM, GW-GM	A-1	0-30	40-65	30-55	20-35	8-15	---	NP
[2]UeB:											
Urban land part.											
Chillum part----	0-12	Silt loam-------	ML, CL	A-4	0	100	100	85-100	60-90	20-30	2-10
	12-28	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	70-95	26-44	6-20
	28-60	Very gravelly sandy loam, gravelly sandy loam.	GM, SM, GP-GM	A-1, A-2	0	45-90	30-75	20-50	10-30	---	NP
[2]UeC:											
Urban land part.											
Chillum part----	0-12	Silt loam-------	ML, CL	A-4	0	100	100	85-100	60-90	20-30	2-10
	12-28	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	70-95	26-44	6-20
	28-60	Very gravelly sandy loam, gravelly sandy loam.	GM, SM, GP-GM	A-1, A-2	0	45-90	30-75	20-50	10-30	---	NP
[2]UfB:											
Urban land part.											
Christiana part-	0-10	Silt loam-------	CL-ML, CL	A-4	0	100	100	70-100	50-90	22-30	5-9
	10-75	Clay, silty clay	CL, CH, MH	A-7, A-6	0	100	100	95-100	80-100	40-59	17-31
[2]UfC:											
Urban land part.											
Christiana part-	0-10	Silt loam-------	CL-ML, CL	A-4	0	100	100	70-100	50-90	22-30	5-9
	10-75	Clay, silty clay	CL, CH, MH	A-7, A-6	0	100	100	95-100	80-100	40-59	17-31
[2]UkC:											
Urban land part.											

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Urban land:											
Croom part------	0-21	Very gravelly sandy loam.	GP-GM, GM	A-1	0	40-55	30-50	20-30	10-15	8-15	NP-4
	21-42	Very gravelly sandy clay loam, very gravelly sandy loam.	GP-GM, GP-GC, GC, GM	A-1, A-2	0	40-60	30-50	20-45	10-30	8-36	2-16
	42-72	Very gravelly sandy loam, very gravelly loamy sand.	GW, GM, GC, GP	A-1	0	40-50	30-50	15-35	4-20	<20	NP-4
[2]UmB:											
Urban land part.											
Galestown part--	0-60	Loamy sand, sand.	SP-SM, SM	A-1, A-2 A-3	0	95-100	80-100	45-70	7-20	---	NP
[2]UoC:											
Urban land part.											
Joppa part------	0-7	Gravelly sandy loam.	SP-SM, ML, SM	A-1, A-2, A-4	0	60-80	50-75	30-70	10-55	<35	NP
	7-27	Very gravelly sandy loam, gravelly loam.	GP-GM, GM	A-1, A-2, A-4	0	40-60	30-50	15-50	10-40	<30	NP
	27-60	Very gravelly sand.	GW, GP, GP-GM	A-1	0-15	40-50	30-45	15-25	2-7	<20	NP
[2]UpB:											
Urban land part.											
Keyport part----	0-12	Fine sandy loam	SM, SC	A-4	0	100	100	70-85	40-50	20-30	5-10
	12-60	Silty clay loam, clay loam, clay.	ML, CL, MH, CH	A-4, A-6, A-7	0	100	100	90-100	80-90	25-85	10-40
[2]UsB:											
Urban land part.											
Manor part------	0-23	Loam----------	ML	A-4, A-6	0	95-100	95-100	80-100	55-90	32-40	6-12
	23-60	Loam, channery loam.	SM, ML	A-4, A-6	0-10	70-95	60-95	50-95	35-85	26-40	4-12
[2]UsC:											
Urban land part.											
Manor part------	0-23	Loam----------	ML	A-4, A-6	0	95-100	95-100	80-100	55-90	32-40	6-12
	23-60	Loam, channery loam.	SM, ML	A-4, A-6	0-10	70-95	60-95	50-95	35-85	26-40	4-12
[2]UxB:											
Urban land part.											

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Urban land:											
Sassafras part--	0-20	Sandy loam------	SM	A-2	0	85-100	80-100	50-65	25-35	<15	NP-10
	20-31	Sandy loam, sandy clay loam, gravelly sandy loam.	SM-SC, CL, ML	A-2, A-4, A-6	0	85-100	70-100	50-95	25-75	20-33	5-15
	31-60	Loamy coarse sand, sand, gravelly sand.	SP-SM, SM	A-1, A-2	0	70-100	60-100	25-75	5-30	---	NP
[2]UxC:											
Urban land part.											
Sassafras part--	0-20	Sandy loam------	SM	A-2	0	85-100	80-100	50-65	25-35	<15	NP-10
	20-31	Sandy loam, sandy clay loam, gravelly sandy loam.	SM-SC, CL, ML	A-2, A-4, A-6	0	85-100	70-100	50-95	25-75	20-33	5-15
	31-60	Loamy coarse sand, sand, gravelly sand.	SP-SM, SM	A-1, A-2	0	70-100	60-100	25-75	5-30	---	NP
[2]UyC:											
Urban land part.											
Sunnyside part--	0-5	Fine sandy loam	SM	A-4	0	95-100	95-100	70-85	40-70	<26	NP-4
	5-28	Sandy clay loam, gravelly sandy clay loam, loam.	SM, SC, CL, ML	A-2, A-4, A-6	0	95-100	70-100	55-95	30-75	<40	NP-24
	28-60	Loamy fine sand, fine sandy loam, fine sand.	SM	A-1, A-2	0	95-100	75-100	40-65	15-25	---	NP
[2]UzB:											
Urban land part.											
Woodstown part--	0-12	Sandy loam------	SM	A-2, A-4	0	100	100	60-70	30-40	<15	NP-4
	12-40	Sandy clay loam, loam, sandy loam.	SM, CL, ML	A-2, A-4, A-6	0	100	90-100	55-90	25-60	<32	NP-12
	40-60	Sandy loam, loamy sand, sand.	SM, SP-SM	A-1, A-2, A-4	0	95-100	90-100	45-70	5-40	<15	NP-4
Woodstown:											
WoB----------	0-12	Sandy loam------	SM	A-2, A-4, A-6	0	100	100	60-70	30-40	<15	NP-4
	12-40	Sandy clay loam, loam, sandy loam.	SM, CL, ML	A-2, A-4, A-6	0	100	90-100	55-90	25-60	<32	NP-12
	40-60	Sandy loam, loamy sand, sand.	SM, SP-SM	A-1, A-2, A-4	0	95-100	90-100	45-70	5-40	<15	NP-4
[1]WpB:											
Woodstown part--	0-12	Sandy loam------	SM	A-2, A-4	0	100	100	60-70	30-40	<15	NP-4
	12-40	Sandy clay loam, loam, sandy loam.	SM, CL, ML	A-2, A-4, A-6	0	100	90-100	55-90	25-60	<32	NP-12
	40-60	Sandy loam, loamy sand, sand.	SM, SP-SM	A-1, A-2, A-4	0	95-100	90-100	45-70	5-40	<15	NP-4

See footnotes at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Woodstown: Urban land part.											

[1]NP means nonplastic.
[2]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.
[3]Texture too variable to be estimated.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater then. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Ashe:									
AsC, AsD	0-6	2.0-6.0	0.13-0.18	4.5-5.5	Low	Low	High	0.17	2
	6-23	2.0-6.0	0.10-0.14	4.5-5.5	Low	Low	High	0.17	
	23-60	2.0-6.0	0.08-0.12	4.5-5.5	Low	Low	High	0.24	
Beltsville:									
BdB	0-16	0.6-2.0	0.18-0.21	3.6-5.5	Low	Low	High	0.43	3
	16-21	0.6-2.0	0.18-0.21	3.6-5.5	Low	Low	High	0.43	
	21-45	<0.2	0.08-0.12	3.6-5.5	Low	Moderate	High	0.43	
	45-60	0.2-6.0	0.08-0.18	3.6-5.5	Low	High	High	0.43	
[1]BeB:									
Beltsville part	0-16	0.6-2.0	0.18-0.21	3.6-5.5	Low	Low	High	0.43	3
	16-21	0.6-2.0	0.18-0.21	3.6-5.5	Low	Low	High	0.43	
	21-45	<0.2	0.08-0.12	3.6-5.5	Low	Moderate	High	0.43	
	45-60	0.2-6.0	0.08-0.18	3.6-5.5	Low	High	High	0.43	
Urban land part.									
Bibb:									
Bg	0-36	0.6-2.0	0.12-0.18	4.5-5.5	Low	High	Moderate	0.20	---
	36-60	0.6-2.0	0.08-0.20	4.5-5.5	Low	High	Moderate	0.37	
Bourne:									
BnB, BnC	0-11	2.0-6.0	0.08-0.15	4.5-6.5	Low	Moderate	High	0.43	3
	11-18	0.6-2.0	0.11-0.16	3.6-5.5	Low	High	High	0.43	
	18-28	<0.2	0.08-0.12	3.6-5.5	Low	High	High	0.43	
	28-60	---	---	---	---	---	---	---	
[1]BpB:									
Bourne part	0-11	2.0-6.0	0.08-0.15	4.5-6.5	Low	Moderate	High	0.43	3
	11-18	0.6-2.0	0.11-0.16	3.6-5.5	Low	High	High	0.43	
	18-28	<0.2	0.08-0.12	3.6-5.5	Low	High	High	0.43	
	28-60	---	---	---	---	---	---	---	
Urban land part.									
Brandywine:									
BrC, BrD	0-22	2.0-6.0	0.09-0.18	3.6-5.5	Low	Low	High	0.24	3
	22-60	2.0-6.0	0.06-0.08	3.6-5.5	Low	Low	High	0.28	
[1]BtB:									
Brandywine part	0-22	2.0-6.0	0.09-0.18	3.6-5.5	Low	Low	High	0.24	3
	22-60	2.0-6.0	0.06-0.08	3.6-5.5	Low	Low	High	0.28	
Urban land part.									
[1]BtC:									
Brandywine part	0-22	2.0-6.0	0.09-0.18	3.6-5.5	Low	Low	High	0.24	3
	22-60	2.0-6.0	0.06-0.08	3.6-5.5	Low	Low	High	0.28	
Urban land part.									
[1]BtD:									
Brandywine part	0-22	2.0-6.0	0.09-0.18	3.6-5.5	Low	Low	High	0.24	3
	22-60	2.0-6.0	0.06-0.08	3.6-5.5	Low	Low	High	0.28	
Urban land part.									
Chillum:									
CcB, CcC, CcD	0-12	0.6-2.0	0.19-0.21	3.6-5.5	Low	Moderate	High	0.32	3
	12-28	0.6-2.0	0.19-0.22	3.6-5.5	Low	Moderate	High	0.32	
	28-60	0.2-2.0	0.03-0.12	3.6-5.5	Low	Low	High	0.17	

See footnotes at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Chillum:									
[1]CdB:									
Chillum part----	0-12	0.6-2.0	0.19-0.21	3.6-5.5	Low-------	Moderate------	High----------	0.32	3
	12-28	0.6-2.0	0.19-0.22	3.6-5.5	Low-------	Moderate------	High----------	0.32	
	28-60	0.2-2.0	0.03-0.12	3.6-5.5	Low-------	Low-----------	High----------	0.17	
Urban land part.									
[1]CdC:									
Chillum part----	0-12	0.6-2.0	0.19-0.21	3.6-5.5	Low-------	Moderate--- --	High----------	0.32	3
	12-28	0.6-2.0	0.19-0.22	3.6-5.5	Low-------	Moderate------	High----------	0.32	
	28-60	0.2-2.0	0.03-0.12	3.6-5.5	Low-------	Low-----------	High----------	0.17	
Urban land part.									
[1]CdD:									
Chillum part----	0-12	0.6-2.0	0.19-0.21	3.6-5.5	Low-------	Moderate------	High----------	0.32	3
	12-28	0.6-2.0	0.19-0.22	3.6-5.5	Low-------	Moderate------	High----------	0.32	
	28-60	0.2-2.0	0.03-0.12	3.6-5.5	Low-------	Low-----------	High----------	0.17	
Urban land part.									
Christiana:									
CeB, CeC, CeD-----	0-10	0.2-2.0	0.18-0.24	3.6-5.0	Low-------	Moderate------	High----------	0.43	3
	10-75	0.06-0.6	0.14-0.20	3.6-5.0	Moderate	High----------	High----------	0.28	
[1]CfB:									
Christiana part-	0-10	0.2-2.0	0.18-0.24	3.6-5.0	Low-------	Moderate------	High----------	0.43	3
	10-75	0.06-0.6	0.14-0.20	3.6-5.0	Moderate	High----------	High----------	0.28	
Urban land part.									
[1]CfC:									
Christiana part-	0-10	0.2-2.0	0.18-0.24	3.6-5.0	Low-------	Moderate------	High----------	0.43	3
	10-75	0.06-0.6	0.14-0.20	3.6-5.0	Moderate	High----------	High----------	0.28	
Urban land part.									
[1]CfD:									
Christiana part-	0-10	0.2-2.0	0.18-0.24	3.6-5.0	Low-------	Moderate------	High----------	0.43	3
	10-75	0.06-0.6	0.14-0.20	3.6-5.0	Moderate	High----------	High----------	0.28	
Urban land part.									
Codorus:									
Ck----------	0-17	0.6-2.0	0.14-0.20	4.5-7.3	Low-------	High----------	Moderate-------	0.49	4
	17-50	0.6-2.0	0.14-0.18	5.1-6.5	Low-------	High----------	Moderate-------	0.37	
	50-60	2.0-20	0.04-0.08	5.1-6.5	Low-------	High----------	Moderate-------	0.24	
[1]Cn:									
Codorus part----	0-17	0.6-2.0	0.14-0.20	4.5-7.3	Low-------	High----------	Moderate-------	0.49	4
	17-50	0.6-2.0	0.14-0.18	5.1-6.5	Low-------	High----------	Moderate-------	0.37	
	50-60	2.0-20	0.04-0.08	5.1-6.5	Low-------	High----------	Moderate-------	0.24	
Urban land part.									
Croom:									
CwB, CwC, CwD-----	0-21	0.2-2.0	0.05-0.10	4.5-6.0	Low-------	Low-----------	High----------	0.37	3
	21-42	0.2-2.0	0.05-0.10	4.5-6.0	Low-------	Low-----------	High----------	0.17	
	42-72	0.6-20	0.04-0.07	4.5-6.0	Low-------	Low-----------	High----------	0.17	
[1]CxB:									
Croom part------	0-21	0.2-2.0	0.05-0.10	4.5-6.0	Low-------	Low-----------	High----------	0.37	3
	21-42	0.2-2.0	0.05-0.10	4.5-6.0	Low-------	Low-----------	High----------	0.17	
	42-72	0.6-20	0.04-0.07	4.5-6.0	Low-------	Low-----------	High----------	0.17	
Urban land part.									

See footnotes at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Croom:									
[1]CxC:									
Croom part------	0-21	0.2-2.0	0.05-0.10	4.5-6.0	Low-------	Low----------	High----------	0.37	3
	21-42	0.2-2.0	0.05-0.10	4.5-6.0	Low-------	Low----------	High----------	0.17	
	42-72	0.6-20	0.04-0.07	4.5-6.0	Low-------	Low----------	High----------	0.17	
Urban land part.									
[1]CxD:									
Croom part------	0-21	0.6-2.0	0.10-0.18	4.5-6.0	Low-------	Low----------	High----------	0.43	3
	21-42	0.2-2.0	0.05-0.10	4.5-6.0	Low-------	Low----------	High----------	0.17	
	42-72	0.6-20	0.04-0.07	4.5-6.0	Low-------	Low----------	High----------	0.17	
Urban land part.									
Dunning:									
Dn----------	0-16	---	---	---	----------	----------	----------	---	---
	16-46	0.6-2.0	0.19-0.22	5.6-7.3	Moderate	Moderate------	Moderate------	---	
	46-60	0.06-0.2	0.14-0.22	6.6-7.8	Low-------	Moderate------	Moderate------	---	
Fallsington:									
Fa----------	0-13	0.6-6.0	0.15-0.24	3.6-5.5	Low-------	High----------	High----------	0.28	4
	13-33	0.6-2.0	0.15-0.18	3.6-5.5	Low-------	High----------	High----------	0.43	
	33-60	2.0-6.0	0.06-0.10	3.6-5.5	Low-------	High----------	High----------	0.43	
Fluvaquents:									
FB, FD, [1]FF, [1]FH.									
Galestown:									
[1]GeB:									
Galestown part--	0-60	>6.0	0.06-0.08	3.6-5.5	Low-------	Low----------	High----------	0.17	5
Urban land part.									
[1]GfB:									
Galestown part--	0-60	>6.0	0.06-0.08	3.6-5.5	Low-------	Low----------	High----------	0.17	5
Rumford part----	0-19	>6.0	0.06-0.12	3.6-5.5	Low-------	Low----------	High----------	0.24	4
	19-39	2.0-6.0	0.07-0.15	4.5-6.0	Low-------	Low----------	High----------	0.17	
	39-60	>2.0	0.04-0.12	4.5-5.5	Low-------	Low----------	High----------	0.17	
[1]GfC:									
Galestown part--	0-60	>6.0	0.06-0.08	3.6-5.5	Low-------	Low----------	High----------	0.17	5
Rumford part----	0-19	>6.0	0.06-0.12	3.6-5.5	Low-------	Low----------	High----------	0.24	4
	19-39	2.0-6.0	0.07-0.15	4.5-6.0	Low-------	Low----------	High----------	0.17	
	39-60	>2.0	0.04-0.12	4.5-5.5	Low-------	Low----------	High----------	0.17	
Glenelg:									
GgB, GgC, GgD-----	0-9	0.6-2.0	0.14-0.24	4.5-5.5	Low-------	Low----------	High----------	0.32	3
	9-28	0.6-2.0	0.10-0.20	4.5-5.5	Low-------	Low----------	High----------	0.43	
	28-60	0.6-2.0	0.10-0.19	4.5-5.5	Low-------	Low----------	High----------	0.43	
[1]GhB:									
Glenelg part----	0-9	0.6-2.0	0.14-0.24	4.5-5.5	Low-------	Low----------	High----------	0.32	3
	9-28	0.6-2.0	0.10-0.20	4.5-5.5	Low-------	Low----------	High----------	0.43	
	28-60	0.6-2.0	0.10-0.19	4.5-5.5	Low-------	Low----------	High----------	0.43	
Urban land part.									
[1]GhC:									
Glenelg part----	0-9	0.6-2.0	0.14-0.24	4.5-5.5	Low-------	Low----------	High----------	0.32	3
	9-28	0.6-2.0	0.10-0.20	4.5-5.5	Low-------	Low----------	High----------	0.43	
	28-60	0.6-2.0	0.10-0.19	4.5-5.5	Low-------	Low----------	High----------	0.43	
Urban land part.									

See footnotes at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Glenelg:									
[1]GhD:									
Glenelg part----	0-9	0.6-2.0	0.14-0.24	4.5-5.5	Low-------	Low----------	High----------	0.32	3
	9-28	0.6-2.0	0.10-0.20	4.5-5.5	Low-------	Low----------	High----------	0.43	
	28-60	0.6-2.0	0.10-0.19	4.5-5.5	Low-------	Low----------	High----------	0.43	
Urban land part.									
Glenelg Variant:									
GlB----------	0-6	0.6-2.0	0.16-0.24	4.5-5.5	Low-------	Low----------	High----------	0.37	3
	6-26	0.6-2.0	0.18-0.24	4.5-5.5	Low-------	Low----------	High----------	0.37	
	26-41	0.6-2.0	0.14-0.20	4.5-5.5	Low-------	Moderate------	High----------	0.37	
	41-60	0.6-2.0	0.14-0.18	4.5-5.5	Low-------	Moderate------	High----------	0.28	
[1]GmB:									
Glenelg Variant part----------	0-6	0.6-2.0	0.16-0.24	4.5-5.5	Low-------	Low----------	High----------	0.37	3
	6-26	0.6-2.0	0.18-0.24	4.5-5.5	Low-------	Low----------	High----------	0.37	
	26-41	0.6-2.0	0.14-0.20	4.5-5.5	Low-------	Moderate------	High----------	0.37	
	41-60	0.6-2.0	0.14-0.18	4.5-5.5	Low-------	Moderate------	High----------	0.28	
Urban land part.									
Iuka:									
Ik----------	0-60	0.6-2.0	0.10-0.15	5.1-6.0	Low-------	Moderate------	Moderate-------	0.24	---
[1]Ip:									
Iuka part-------	0-60	0.6-2.0	0.10-0.15	5.1-6.0	Low-------	Moderate------	Moderate-------	0.24	---
Urban land part.									
Joppa:									
JtB, JtC, JtD-----	0-7	2.0-6.0	0.12-0.18	3.6-5.5	Low-------	Low----------	High----------	0.28	4
	7-27	2.0-20	0.06-0.10	3.6-5.5	Low-------	Low----------	High----------	0.28	
	27-60	2.0-20	0.02-0.05	3.6-5.5	Low-------	Low----------	High----------	0.28	
[1]JuB:									
Joppa part------	0-7	2.0-6.0	0.12-0.18	3.6-5.5	Low-------	Low----------	High----------	0.28	4
	7-27	2.0-20	0.06-0.10	3.6-5.5	Low-------	Low----------	High----------	0.28	
	27-60	2.0-20	0.02-0.05	3.6-5.5	Low-------	Low----------	High----------	0.28	
Urban land part.									
[1]JuC:									
Joppa part------	0-7	2.0-6.0	0.12-0.18	3.6-5.5	Low-------	Low----------	High----------	0.28	4
	7-27	2.0-20	0.06-0.10	3.6-5.5	Low-------	Low----------	High----------	0.28	
	27-60	2.0-20	0.02-0.05	3.6-5.5	Low-------	Low----------	High----------	0.28	
Urban land part.									
[1]JuD:									
Joppa part------	0-7	2.0-6.0	0.12-0.18	3.6-5.5	Low-------	Low----------	High----------	0.28	4
	7-27	2.0-20	0.06-0.10	3.6-5.5	Low-------	Low----------	High----------	0.28	
	27-60	2.0-20	0.02-0.05	3.6-5.5	Low-------	Low----------	High----------	0.28	
Urban land part.									
Keyport:									
KeB, KeC----------	0-12	0.6-2.0	0.12-0.18	3.6-4.4	Moderate	High----------	High----------	0.43	3-2
	12-60	<0.2	0.16-0.20	4.5-5.0	Moderate	High----------	High----------	0.43	
[1]KmB:									
Keyport part----	0-12	0.6-2.0	0.12-0.18	3.6-4.4	Moderate	High----------	High----------	0.43	3-2
	12-60	<0.2	0.16-0.20	4.5-5.0	Moderate	High----------	High----------	0.43	
Urban land part.									

See footnotes at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Keyport:									
[1]KmC:									
Keyport part----	0-12	0.6-2.0	0.12-0.18	3.6-4.4	Moderate	High----------	High----------	0.43	3-2
	12-60	<0.2	0.16-0.20	4.5-5.0	Moderate	High----------	High----------	0.43	
Urban land part.									
Lindside:									
Ld----------	0-6	0.6-2.0	0.18-0.26	5.1-6.5	Low-------	Moderate------	Low----------	---	---
	6-60	0.2-2.0	0.18-0.22	5.6-7.3	Low-------	Moderate------	Moderate-------	---	
Lp----------	0-29	0.6-2.0	0.20-0.26	5.1-6.5	Low-------	Moderate------	Low----------	---	---
	29-44	0.6-2.0	0.17-0.22	5.1-6.5	Low-------	Moderate------	Low----------	---	
	44	0.6-2.0	0.17-0.22	5.1-6.5	Low-------	Moderate------	Low----------	---	
Manor:									
MbC, MbD----------	0-23	0.6-2.0	0.17-0.21	4.5-5.5	Low-------	Low----------	Moderate-------	0.43	3
	23-60	0.6-2.0	0.14-0.20	4.5-5.5	Low-------	Low----------	Moderate-------	0.28	
McC----------	0-23	0.6-2.0	0.14-0.17	4.5-5.5	Low-------	Low----------	Moderate-------	0.43	3
	23-60	0.6-2.0	0.14-0.20	4.5-5.5	Low-------	Low----------	Moderate-------	0.28	
[1]MdB:									
Manor part------	0-23	0.6-2.0	0.17-0.21	4.5-5.5	Low-------	Low----------	Moderate-------	0.43	3
	23-60	0.6-2.0	0.14-0.20	4.5-5.5	Low-------	Low----------	Moderate-------	0.28	
Urban land part.									
[1]MdC:									
Manor part------	0-23	0.6-2.0	0.17-0.21	4.5-5.5	Low-------	Low----------	Moderate-------	0.43	3
	23-60	0.6-2.0	0.14-0.20	4.5-5.5	Low-------	Low----------	Moderate-------	0.28	
Urban land part.									
[1]MdD:									
Manor part------	0-23	0.6-2.0	0.17-0.21	4.5-5.5	Low-------	Low----------	Moderate-------	0.43	3
	23-60	0.6-2.0	0.14-0.20	4.5-5.5	Low-------	Low----------	Moderate-------	0.28	
Urban land part.									
Matapeake:									
MgB, MgC----------	0-10	0.6-2.0	0.16-0.24	4.5-5.5	Low-------	Low----------	Moderate-------	0.32	3
	10-38	0.2-2.0	0.18-0.24	3.6-5.5	Low-------	Moderate------	Moderate-------	0.43	
	38-60	0.6-6.0	0.08-0.18	3.6-5.5	Low-------	Low----------	High-----------	0.28	
[1]MhB:									
Matapeake part--	0-10	0.6-2.0	0.16-0.24	4.5-5.5	Low-------	Low----------	Moderate-------	0.32	3
	10-38	0.2-2.0	0.18-0.24	3.6-5.5	Low-------	Moderate------	Moderate-------	0.43	
	38-60	0.6-6.0	0.08-0.18	3.6-5.5	Low-------	Low----------	High-----------	0.28	
Urban land part.									
Melvin:									
Mp----------	0-7	0.6-2.0	0.18-0.23	6.1-7.8	Low-------	High----------	Low----------	0.43	---
	7-60	0.6-2.0	0.18-0.23	6.1-7.8	Low-------	High----------	Low----------	0.43	
Muirkirk Variant:									
[1]MvB, [1]MvC, [1]MvD--	0-11	6.0-20	0.06-0.08	3.6-5.0	Low-------	Low----------	High-----------	0.17	3
	11-31	2.0-6.0	0.12-0.16	3.6-4.5	Low-------	Low----------	High-----------	0.17	
	31-60	0.06-0.2	0.12-0.18	3.6-4.5	Moderate	High----------	High-----------	0.43	

See footnotes at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Neshaminy:									
NeC, NeD----------	0-18	0.6-2.0	0.16-0.20	5.1-6.0	Low-------	Moderate------	Moderate-------	0.32	4
	18-40	0.2-0.6	0.10-0.14	5.1-6.0	Low-------	Moderate------	Moderate-------	0.17	
	40-60	0.6-2.0	0.14-0.18	5.6-6.0	Low-------	Moderate------	Moderate-------	0.17	
[1]NuC:									
Neshaminy part--	0-18	0.6-2.0	0.16-0.20	5.1-6.0	Low-------	Moderate------	Moderate-------	0.32	4
	18-40	0.2-0.6	0.10-0.14	5.1-6.0	Low-------	Moderate------	Moderate-------	0.17	
	40-60	0.6-2.0	0.14-0.18	5.6-6.0	Low-------	Moderate------	Moderate-------	0.17	
Urban land part.									
[1]NuD:									
Neshaminy part--	0-18	0.6-2.0	0.16-0.20	5.1-6.0	Low-------	Moderate------	Moderate-------	0.32	4
	18-40	0.2-0.6	0.10-0.14	5.1-6.0	Low-------	Moderate------	Moderate-------	0.17	
	40-60	0.6-2.0	0.14-0.18	5.6-6.0	Low-------	Moderate------	Moderate-------	0.17	
Urban land part.									
Sassafras:									
SaB, SaC----------	0-20	0.6-6.0	0.12-0.20	3.6-5.5	Low-------	Low-----------	High-----------	0.28	4
	20-31	0.6-2.0	0.08-0.22	3.6-5.5	Low-------	Low-----------	High-----------	0.43	
	31-60	0.6-20	0.04-0.12	3.6-5.5	Low-------	Low-----------	High-----------	0.17	
ScB, ScC, ScD-----	0-20	0.6-6.0	0.10-0.12	3.6-5.5	Low-------	Low-----------	High-----------	0.24	4
	20-31	0.6-2.0	0.08-0.22	3.6-5.5	Low-------	Low-----------	High-----------	0.43	
	31-60	0.6-6.0	0.04-0.08	3.6-5.5	Low-------	Low-----------	High-----------	0.17	
[1]SgB:									
Sassafras part--	0-20	0.6-6.0	0.12-0.20	3.6-5.5	Low-------	Low-----------	High-----------	0.28	4
	20-31	0.6-2.0	0.08-0.22	3.6-5.5	Low-------	Low-----------	High-----------	0.43	
	31-60	0.6-20	0.04-0.08	3.6-5.5	Low-------	Low-----------	High-----------	0.17	
Urban land part.									
[1]SgC:									
Sassafras part--	0-20	0.6-6.0	0.12-0.20	3.6-5.5	Low-------	Low-----------	High-----------	0.28	4
	20-31	0.6-2.0	0.08-0.22	3.6-5.5	Low-------	Low-----------	High-----------	0.43	
	31-60	0.6-20	0.04-0.08	3.6-5.5	Low-------	Low-----------	High-----------	0.17	
Urban land part.									
[1]SgD:									
Sassafras part--	0-20	0.6-6.0	0.12-0.20	3.6-5.5	Low-------	Low-----------	High-----------	0.28	4
	20-31	0.6-2.0	0.11-0.22	3.6-5.5	Low-------	Low-----------	High-----------	0.43	
	31-60	0.6-20	0.04-0.12	3.6-5.5	Low-------	Low-----------	High-----------	0.17	
Urban land part.									
Sunnyside:									
SmB, SmC, SmD-----	0-5	0.6-2.0	0.12-0.18	4.5-5.5	Low-------	Low-----------	High-----------	0.32	4
	5-28	0.6-2.0	0.10-0.24	3.6-5.0	Low-------	Low-----------	High-----------	0.28	
	28-60	2.0-6.0	0.05-0.08	3.6-4.5	Low-------	Low-----------	High-----------	0.28	
[1]SpB:									
Sunnyside part--	0-5	0.6-2.0	0.12-0.18	4.5-5.5	Low-------	Low-----------	High-----------	0.32	4
	5-28	0.6-2.0	0.10-0.24	3.6-5.0	Low-------	Low-----------	High-----------	0.28	
	28-60	2.0-6.0	0.05-0.08	3.6-4.5	Low-------	Low-----------	High-----------	0.28	
Urban land part.									
[1]SpC:									
Sunnyside part--	0-5	0.6-2.0	0.12-0.18	4.5-5.5	Low-------	Low-----------	High-----------	0.32	4
	5-28	0.6-2.0	0.10-0.24	3.6-5.0	Low-------	Low-----------	High-----------	0.28	
	28-60	2.0-6.0	0.05-0.08	3.6-4.5	Low-------	Low-----------	High-----------	0.28	
Urban land part.									

See footnotes at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Sunnyside:									
[1]SpD:									
Sunnyside part--	0-5	0.6-2.0	0.12-0.18	4.5-5.5	Low	Low	High	0.32	4
	5-28	0.6-2.0	0.10-0.24	3.6-5.0	Low	Low	High	0.28	
	28-60	2.0-6.0	0.05-0.08	3.6-4.5	Low	Low	High	0.28	
Urban land part.									
Udorthents: U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11B, U11C, U11D.									
Udifluvents: UA.									
Urban land: Ub.									
[1]UcB:									
Urban land part.									
Beltsville part-	0-16	0.6-2.0	0.18-0.21	3.6-5.5	Low	Low	High	0.43	3
	16-21	0.6-2.0	0.18-0.21	3.6-5.5	Low	Low	High	0.43	
	21-45	<0.2	0.08-0.12	3.6-5.5	Low	Moderate	High	0.43	
	45-60	0.2-6.0	0.08-0.18	3.6-5.5	Low	High	High	0.43	
[1]UdB:									
Urban land part.									
Brandywine part-	0-22	2.0-6.0	0.09-0.18	3.6-5.5	Low	Low	High	0.24	3
	22-60	2.0-6.0	0.06-0.08	3.6-5.5	Low	Low	High	0.28	
[1]UeB:									
Urban land part.									
Chillum part----	0-12	0.6-2.0	0.19-0.21	3.6-5.5	Low	Moderate	High	0.32	3
	12-28	0.6-2.0	0.19-0.22	3.6-5.5	Low	Moderate	High	0.32	
	28-60	0.2-2.0	0.03-0.12	3.6-5.5	Low	Low	High	0.17	
[1]UeC:									
Urban land part.									
Chillum part----	0-12	0.6-2.0	0.19-0.21	3.6-5.5	Low	Moderate	High	0.32	3
	12-28	0.6-2.0	0.19-0.22	3.6-5.5	Low	Moderate	High	0.32	
	28-60	0.2-2.0	0.03-0.12	3.6-5.5	Low	Low	High	0.17	
[1]UfB:									
Urban land part.									
Christiana part-	0-10	0.2-2.0	0.18-0.24	3.6-5.0	Low	Moderate	High	0.43	3
	10-75	0.06-0.6	0.14-0.20	3.6-5.0	Moderate	High	High	0.28	
[1]UfC:									
Urban land part.									
Christiana part-	0-10	0.2-2.0	0.18-0.24	3.6-5.0	Low	Moderate	High	0.43	3
	10-75	0.06-0.6	0.14-0.20	3.6-5.0	Moderate	High	High	0.28	
[1]UkC:									
Urban land part.									
Croom part------	0-21	0.2-2.0	0.05-0.10	4.5-6.0	Low	Low	High	0.37	3
	21-42	0.2-2.0	0.05-0.10	4.5-6.0	Low	Low	High	0.17	
	42-72	0.6-20	0.04-0.07	4.5-6.0	Low	Low	High	0.17	
[1]UmB:									
Urban land part.									

See footnotes at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Urban land:									
Galestown part--	0-60	>6.0	0.06-0.08	3.6-5.5	Low--------	Low-----------	High-----------	0.17	5
[1]UoC:									
Urban land part.									
Joppa part------	0-7	2.0-6.0	0.12-0.18	3.6-5.5	Low--------	Low-----------	High-----------	0.28	4
	7-27	2.0-20	0.06-0.10	3.6-5.5	Low--------	Low-----------	High-----------	0.28	
	27-60	2.0-20	0.02-0.05	3.6-5.5	Low--------	Low-----------	High-----------	0.28	
[1]UpB:									
Urban land part.									
Keyport part----	0-12	0.6-2.0	0.12-0.18	3.6-4.4	Moderate	High-----------	High-----------	0.43	3-2
	12-60	<0.2	0.16-0.20	4.5-5.0	Moderate	High-----------	High-----------	0.43	
[1]UsB:									
Urban land part.									
Manor part------	0-23	0.6-2.0	0.17-0.21	4.5-5.5	Low--------	Low-----------	Moderate--------	0.43	3
	23-60	0.6-2.0	0.14-0.20	4.5-5.5	Low--------	Low-----------	Moderate--------	0.28	
[1]UsC:									
Urban land part.									
Manor part------	0-23	0.6-2.0	0.17-0.21	4.5-5.5	Low--------	Low-----------	Moderate--------	0.43	3
	23-60	0.6-2.0	0.14-0.20	4.5-5.5	Low--------	Low-----------	Moderate--------	0.28	
[1]UxB:									
Urban land part.									
Sassafras part--	0-20	0.6-6.0	0.12-0.20	3.6-5.5	Low--------	Low-----------	High-----------	0.28	4
	20-31	0.6-2.0	0.08-0.22	3.6-5.5	Low--------	Low-----------	High-----------	0.43	
	31-60	0.6-20	0.04-0.08	3.6-5.5	Low--------	Low-----------	High-----------	0.17	
[1]UxC:									
Urban land part.									
Sassafras part--	0-20	0.6-6.0	0.12-0.20	3.6-5.5	Low--------	Low-----------	High-----------	0.28	4
	20-31	0.6-2.0	0.08-0.22	3.6-5.5	Low--------	Low-----------	High-----------	0.43	
	31-60	0.6-20	0.04-0.08	3.6-5.5	Low--------	Low-----------	High-----------	0.17	
[1]UyC:									
Urban land part.									
Sunnyside part--	0-5	0.6-2.0	0.12-0.18	4.5-5.5	Low--------	Low-----------	High-----------	0.32	4
	5-28	0.6-2.0	0.12-0.24	3.6-5.0	Low--------	Low-----------	High-----------	0.28	
	28-60	2.0-6.0	0.08-0.18	3.6-4.5	Low--------	Low-----------	High-----------	0.28	
[1]UzB:									
Urban land part.									
Woodstown part--	0-12	0.6-6.0	0.08-0.21	3.6-5.5	Low--------	Low-----------	High-----------	0.28	4
	12-40	0.6-2.0	0.10-0.21	3.6-5.5	Low--------	Moderate-------	High-----------	0.37	
	40-60	0.6-6.0	0.06-0.16	3.6-5.5	Low--------	Moderate-------	High-----------	0.28	
Woodstown:									
WoB---------------	0-12	0.6-6.0	0.08-0.21	3.6-5.5	Low--------	Low-----------	High-----------	0.28	4
	12-40	0.6-2.0	0.10-0.21	3.6-5.5	Low--------	Moderate-------	High-----------	0.37	
	40-60	0.6-6.0	0.06-0.16	3.6-5.5	Low--------	Moderate-------	High-----------	0.28	
[1]WpB:									
Woodstown part--	0-12	0.6-6.0	0.08-0.21	3.6-5.5	Low--------	Low-----------	High-----------	0.28	4
	12-40	0.6-2.0	0.10-0.21	3.6-5.5	Low--------	Moderate-------	High-----------	0.37	
	40-60	0.6-6.0	0.06-0.16	3.6-5.5	Low--------	Moderate-------	High-----------	0.28	
Urban land part.									

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 13.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
Ashe: AsC, AsD	B	None	---	---	>6.0	---	---	20-40	Rippable	Low.
Beltsville: BdB	C	None	---	---	1.5-2.5	Perched	Nov-Apr	>60	---	High.
[1]BeB: Beltsville part	C	None	---	---	1.5-2.5	Perched	Nov-Apr	>60	---	High.
Urban land part.										
Bibb: Bg	C	Common	Brief	Dec-May	0.5-1.5	Apparent	Dec-Apr	>60	---	---
Bourne: BnB, BnC	C	None	---	---	1.5-2.5	Perched	Dec-May	>60	---	---
[1]BpB: Bourne part	C	None	---	---	1.5-2.5	Perched	Dec-May	>60	---	---
Urban land part.										
Brandywine: BrC, BrD	C	None	---	---	>6.0	---	---	>48	Hard	Low.
[1]BtB: Brandywine part	C	None	---	---	>6.0	---	---	>48	Hard	Low.
Urban land part.										
[1]BtC: Brandywine part	C	None	---	---	>6.0	---	---	>48	Hard	Low.
Urban land part.										
[1]BtD: Brandywine part	C	None	---	---	>6.0	---	---	>48	Hard	Low.
Urban land part.										
Chillum: CcB, CcC, CcD	B	None	---	---	>6.0	---	---	>60	---	Moderate.
[1]CdB: Chillum part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
[1]CdC: Chillum part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
[1]CdD: Chillum part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										

See footnotes at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
Christiana: CeB, CeC, CeD----	C	None--------	---	---	>6.0	---	---	>60	---	Moderate.
[1]CfB: Christiana part	C	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
[1]CfC: Christiana part	C	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
[1]CfD: Christiana part	C	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
Codorus: Ck----------	C	Common------	---	---	1.0-2.0	Apparent	Nov-Apr	>60	---	High.
[1]Cn: Codorus part---	C	Common------	---	---	1.0-2.0	Apparent	Nov-Apr	>60	---	High.
Urban land part.										
Croom: CwB, CwC, CwD----	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
[1]CxB: Croom part-----	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
[1]CxC: Croom part-----	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
[1]CxD: Croom part-----	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
Dunning: Dn----------	D	Rare--------	---	---	1.5-2.5	Apparent	Dec-May	>60	---	High.
Fallsington: Fa----------	D	None--------	---	---	0-1.0	Apparent	Dec-May	>60	---	High.
Fluvaquents: FB, FD, [1]FF, [1]FH.										
Galestown: [1]GeB: Galestown part-	A	None--------	---	---	>6.0	---	---	>60	---	Low.
Urban land part.										
[1]GfB: Galestown part-	A	None--------	---	---	>6.0	---	---	>60	---	Low.

See footnotes at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
Galestown: Rumford part---	B	None--------	---	---	>6.0	---	---	>60	---	---
[1]GfC: Galestown part-	A	None--------	---	---	>6.0	---	---	>60	---	Low.
Rumford part---	B	None--------	---	---	>6.0	---	---	>60	---	---
Glenelg: GgB, GgC, GgD----	B	None--------	---	---	>6.0	---	---	>48	Rippable	Moderate.
[1]GhB: Glenelg part---	B	None--------	---	---	>6.0	---	---	>48	Rippable	Moderate.
Urban land part.										
[1]GhC: Glenelg part---	B	None--------	---	---	>6.0	---	---	>48	Rippable	Moderate.
Urban land part.										
[1]GhD: Glenelg part---	B	None--------	---	---	>6.0	---	---	>48	Rippable	Moderate.
Urban land part.										
Glenelg Variant: GlB----------	C	None--------	---	---	2.0-3.0	Apparent	Feb-Apr	>60	---	High.
[1]GmB: Glenelg Variant part----------	C	None--------	---	---	2.0-3.0	Apparent	Feb-Apr	>60	---	High.
Urban land part.										
Iuka: Ik----------	C	Common------	Brief-----	Dec-Apr	1.0-3.0	Apparent	Dec-Apr	>60	---	---
[1]Ip: Iuka part------	C	Common------	Brief-----	Dec-Apr	1.0-3.0	Apparent	Dec-Apr	>60	---	---
Urban land part.										
Joppa: JtB, JtC, JtD----	B	None--------	---	---	>6.0	---	---	>60	---	Low.
[1]JuB: Joppa part-----	B	None--------	---	---	>6.0	---	---	>60	---	Low.
Urban land part.										
[1]JuC: Joppa part-----	B	None--------	---	---	>6.0	---	---	>60	---	Low.
Urban land part.										
[1]JuD: Joppa part-----	B	None--------	---	---	>6.0	---	---	>60	---	Low.
Urban land part.										

See footnotes at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
Keyport:										
KeB, KeC	C	None	---	---	1.5-4.0	Perched	Nov-May	>60	---	High.
[1]KmB:										
Keyport part	C	None	---	---	1.5-4.0	Perched	Nov-May	>60	---	High.
Urban land part.										
[1]KmC:										
Keyport part	C	None	---	---	1.5-4.0	Perched	Nov-May	>60	---	High.
Urban land part.										
Lindside:										
Ld	C	Common	Brief	Jan-May	1.5-3.0	Apparent	Dec-Apr	>60	---	High.
Lp	C	Frequent	Very brief	Sep-Jun	1.5-3.0	Apparent	Dec-Apr	40-60	Hard	High.
Manor:										
MbC, MbD, McC	B	None	---	---	>5.0	---	---	>60	---	Moderate.
[1]MdB:										
Manor part	B	None	---	---	>5.0	---	---	>60	---	Moderate.
Urban land part.										
[1]MdC:										
Manor part	B	None	---	---	>5.0	---	---	>60	---	Moderate.
Urban land part.										
[1]MdD:										
Manor part	B	None	---	---	>5.0	---	---	>60	---	Moderate.
Urban land part.										
Matapeake:										
MgB, MgC	B	None	---	---	>6.0	---	---	>60	---	Moderate.
[1]MhB:										
Matapeake part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
Melvin:										
Mp	D	Common	Brief	Feb-May	0.0-1.0	Apparent	Dec-May	>48	---	---
Muirkirk Variant:										
[1]MvB, [1]MvC, [1]MvD	B	None	---	---	>6.0	---	---	>60	---	Low.
Neshaminy:										
NeC, NeD	B	None	---	---	4.0-7.0	Apparent	---	>48	Hard	Moderate.
[1]NuC:										
Neshaminy part	B	None	---	---	4.0-7.0	Apparent	---	>48	Hard	Moderate.
Urban land part.										
[1]NuD:										
Neshaminy part	B	None	---	---	4.0-7.0	Apparent	---	>48	Hard	Moderate.
Urban land part.										

See footnotes at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
Sassafras: SaB, SaC, ScB, ScC, ScD	B	None	---	---	>6.0	---	---	>60	---	Moderate.
[1]SgB: Sassafras part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
[1]SgC: Sassafras part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
[1]SgD: Sassafras part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
Sunnyside: SmB, SmC, SmD	B	None	---	---	>6.0	---	---	>60	---	Moderate.
[1]SpB: Sunnyside part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
[1]SpC: Sunnyside part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
[1]SpD: Sunnyside part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Urban land part.										
Udorthents: U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11B, U11C, U11D.										
Udifluvents: UA.										
Urban land: Ub.										
[1]UcB: Urban land part.										
Beltsville part	C	None	---	---	1.5-2.5	Perched	Nov-Apr	>60	---	High.
[1]UdB: Urban land part.										
Brandywine part	C	None	---	---	>6.0	---	---	>48	Hard	Low.
[1]UeB: Urban land part.										

See footnotes at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
Urban land: Chillum part---	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
[1]UeC: Urban land part.										
Chillum part---	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
[1]UfB: Urban land part.										
Christiana part	C	None--------	---	---	>6.0	---	---	>60	---	Moderate.
[1]UfC: Urban land part.										
Christiana part	C	None--------	---	---	>6.0	---	---	>60	---	Moderate.
[1]UkC: Urban land part.										
Croom part-----	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
[1]UmB: Urban land part.										
Galestown part-	A	None--------	---	---	>6.0	---	---	>60	---	Low.
[1]UoC: Urban land part.										
Joppa part-----	B	None--------	---	---	>6.0	---	---	>60	---	Low.
[1]UpB: Urban land part.										
Keyport part---	C	None--------	---	---	1.5-4.0	Perched	Nov-May	>60	---	High.
[1]UsB: Urban land part.										
Manor part-----	B	None--------	---	---	>5.0	---	---	>60	---	Moderate.
[1]UsC: Urban land part.										
Manor part-----	B	None--------	---	---	>5.0	---	---	>60	---	Moderate.
[1]UxB: Urban land part.										
Sassafras part-	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
[1]UxC: Urban land part.										
Sassafras part-	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.

See footnotes at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
Urban land:										
[1]UyC:										
Urban land part.										
Sunnyside part-	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
[1]UzB:										
Urban land part.										
Woodstown part-	C	None--------	---	---	1.5-2.5	Apparent	Feb-Apr	>60	---	High.
Woodstown:										
WoB----------	C	None--------	---	---	1.5-2.5	Apparent	Feb-Apr	>60	---	High.
[1]WpB:										
Woodstown part-	C	None--------	---	---	1.5-2.5	Apparent	Feb-Apr	>60	---	High.
Urban land part.										

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 14--PHYSICAL CHARACTERISTICS OF SELECTED SOILS

[Dashes indicate that no determination was made]

Soil name and sample number	Depth	Sand	Silt	Clay	Bulk density	Particle density	Pore space
	In	Pct	Pct	Pct	G/cc	G/cc	Pct
Ashe loam:	0-6	62.0	29.7	8.3	1.26	2.65	47.55
(S74-DC-1-12)	6-9	62.7	27.6	9.7	---	---	---
	9-18	63.45	22.7	13.8	1.58	2.65	59.62
	18-23	63.4	20.1	16.5	---	---	---
	23-36	75.7	14.6	9.7	1.79	2.65	67.55
	36-60	79.2	14.4	6.4	---	---	---
Lindside silt loam:	0-9	19.06	65.59	15.36	1.41	2.61	45.97
(S73-DC-1-5)	9-18	6.23	66.99	26.78	1.34	2.62	48.85
	18-28	2.02	54.43	43.47	1.37	2.62	49.70
	28-49	3.53	75.36	21.11	1.34	2.63	49.04
	49-65	67.61	28.94	3.45	1.33	2.65	44.81
	65	2.17	71.17	26.66	---	---	---
Manor loam:	0-4	51.6	33.9	14.5	1.23	2.65	46.42
(S74-DC-1-11)	4-7	49.5	32.7	17.8	---	---	---
	7-12	49.6	28.9	21.5	---	---	---
	12-18	52.8	24.6	22.6	1.44	2.65	54.34
	18-22	60.6	18.0	21.4	---	---	---
	22-31	76.4	13.5	10.1	1.49	2.65	56.23
	31-38	75.5	14.9	9.6	---	---	---
	38-60	80.6	11.8	7.6	---	---	---

TABLE 15--PHYSICAL CHARACTERISTICS OF SELECTED SOIL SAMPLES OF HIGHLY VARIABLE MAPPING UNITS

[Dashes indicate that no determination was made]

Soil name and sample number	Depth	Percentage of			Bulk density	Particle density	Pore space
	In	Sand	Silt	Clay	G/cc	G/cc	Pct
Udorthents:	0-4	34.72	48.79	16.49	---	2.56	---
(man-made)	4-6	29.82	53.07	16.99	2.12	2.56	17.18
(S70-DC-1-2)	6-11	31.98	39.65	28.37	1.81	2.65	31.69
	11-15	39.40	28.92	31.68	2.02	2.54	20.47
	15-32	43.61	39.59	16.81	1.95	2.54	23.22
	32	59.61	25.59	14.79	2.08	2.59	19.69
Udorthents:	0-9	32.0	46.0	22.0	2.08	2.40	13.33
(man-made)	9-23	40.0	26.0	34.0	1.81	2.47	26.72
(S71-DC-1-2)	23-28	38.0	38.0	24.0	1.90	2.50	24.00
	28	38.0	32.0	30.0	2.00	2.42	21.87
Udorthents:	0-8	41.61	42.38	15.96	---	2.38	---
(man-made)	8-12	48.10	34.32	17.58	---	2.62	---
(S73-DC-1-4)	12-21	24.52	52.41	23.07	---	2.62	---
	21-29	6.23	66.99	26.78	---	2.58	---
	29-38	44.65	31.62	23.73	---	2.58	---
	29-38	23.20	55.06	21.75	---	2.58	---
	38-42	49.77	33.81	16.42	---	2.58	---
	42-96	66.52	29.73	3.75	---	---	---
	42-96	52.27	34.75	12.98	---	---	---
Udorthents, deep:	0-3	52.89	29.25	17.86	1.02	2.25	54.66
(man-made)	3-5	65.42	23.11	11.47	1.27	2.59	50.96
(S73-DC-1-1)	5-23	50.02	27.58	22.39	1.85	2.56	27.73
	23-28	48.37	33.18	18.44	1.65	2.62	37.02
	28-43	53.95	32.00	14.05	---	2.74	---
	43-48	---	---	---	---	---	---
Udorthents, deep:	0-3	52.66	31.12	16.22	1.28	2.42	47.10
(man-made)	3-25	48.52	30.72	20.77	1.90	2.58	26.35
(S73-DC-1-3)	25-38	27.88	32.51	34.61	1.82	2.57	29.18
	38	---	---	---	---	---	---

TABLE 16--CHEMICAL CHARACTERISTICS OF SELECTED SOILS

[Dashes indicate that no determination was made]

Soil name and sample number	Depth	Organic matter	pH 1:1 H_2O	Extractable cations					Cation exchange capacity		Free iron
				Ca	Mg	Na	K	H	Sum	NH_4OA_c	
	In	Pct		Meq/100g	Meq/100g	Meq/100g	Meq/100g	Meq/100g	Meq/100g	Meq/100g	Pct
Ashe loam:	0-6	---	4.4	0.4	0.4	---	0.3	12.1	13.2	12.7	0.5
(S74-DC-1-12)	6-9	---	4.8	0.7	0.4	---	0.2	7.6	8.9	---	0.6
	9-18	---	5.0	0.2	0.8	---	0.5	9.1	10.6	10.0	0.6
	18-23	---	5.0	0.4	1.6	(1)	0.8	9.2	12.0	11.4	1.0
	23-36	---	5.0	0.1	1.7	---	0.5	6.4	8.7	---	0.7
	36-60	---	5.1	2.6	3.3	---	0.4	3.6	9.9	10.2	0.4
Lindside silt loam:	0-9	2.72	4.5	2.7	1.0	0.3	0.4	10.0	14.4	12.3	0.96
(S73-DC-1-5)	9-18	2.54	5.1	5.7	2.2	0.4	0.5	---	---	13.9	1.64
	18-28	2.59	4.8	7.7	1.9	0.5	0.4	---	---	15.2	1.74
	28-49	2.04	5.9	7.7	1.3	0.3	0.2	8.0	17.5	3.3	1.87
	49-65	0.79	6.3	3.4	0.4	0.2	0.1	2.0	6.0	13.6	0.66
	65	3.24	7.0	10.9	1.7	0.4	0.2	---	---	16.4	1.73
Manor loam:	0-4	---	3.7	0.1	0.1	---	0.2	8.5	8.9	8.9	1.3
(S74-DC-1-11)	4-7	---	4.3	(1)	0.1	---	0.2	8.0	8.3	6.6	1.6
	7-12	---	4.4	---	(1)	---	0.2	7.7	7.9	6.6	1.9
	12-18	---	4.5	(1)	0.1	---	0.3	8.2	8.6	7.5	2.1
	18-22	---	4.6	0.2	0.6	0.1	0.2	8.4	9.5	7.5	2.2
	22-31	---	4.9	0.2	0.9	0.1	0.2	4.4	5.8	5.6	1.5
	31-38	---	4.9	0.1	0.9	(1)	0.2	4.6	5.8	5.4	1.6
	38-60	---	4.9	0.1	0.6	---	0.2	3.8	4.7	5.2	1.0

[1]Trace.

TABLE 17--CHEMICAL CHARACTERISTICS OF SELECTED SOIL SAMPLES OF HIGHLY VARIABLE MAPPING UNITS

[Dashes indicate that no determination was made]

Soil name and sample number	Depth	Organic matter[1]	pH 1:1 H_2O	Extractable cations meq/100g					Cation exchange capacity meq/100g		Free iron
	In	Pct		Ca	Mg	Na	K	H	Sum cations	NH_4OAc	Pct
Udorthents:	0-4	3.80	5.9	4.3	1.1	0.4	0.2	7	13.0	9.0	0.82
(man-made)	4-6	2.05	5.6	4.8	1.4	0.3	0.3	6	12.8	7.7	0.81
(S70-DC-1-2)	6-11	0.53	5.7	2.4	4.3	0.4	0.1	---	---	12.3	---
	11-15	0.44	5.4	7.0	2.5	0.4	0.2	---	---	9.9	2.26
	15-32	0.86	5.7	4.3	0.9	0.1	0.1	6	11.4	---	---
	32	0.33	5.8	---	---	---	---	---	---	---	---
Udorthents:	0-9	3.82	5.6	7.1	1.2	0.1	0.5	8	17.1	13.9	0.67
(man-made)	9-23	0.07	4.6	5.7	1.6	0.3	0.1	8	15.7	10.8	2.67
(S71-DC-1-2)	23-28	0.13	7.2	7.2	1.5	0.3	0.1	3	12.1	6.9	0.94
	28	0.47	8.1	10.6	2.0	0.3	0.1	1	14.0	8.2	1.32
Udorthents:	0-8	3.37	5.4	5.7	1.0	0.3	0.2	8	15.2	10.3	1.50
(man-made)	8-12	0.65	6.2	5.3	1.0	0.4	0.2	4	10.9	6.2	1.65
(S73-DC-1-4)	12-21	0.37	6.5	6.9	1.0	0.3	0.1	5	13.3	10.7	1.79
	21-29	0.56	7.2	8.6	1.2	0.3	0.2	4	14.3	9.6	2.25
	29-38	0.65	6.7	5.4	1.1	0.4	0.2	2	9.1	5.8	1.79
	29-38	0.24	6.7	5.4	1.1	0.4	0.2	2	9.1	5.8	0.74
	38-42	1.15	6.6	5.7	0.7	0.4	0.1	2	8.9	8.6	0.86
	42-96	2.82	6.4	3.6	0.4	0.3	0.1	3	7.4	4.8	0.42
	42-96	0.61	6.3	3.9	0.9	0.3	0.2	---	---	6.1	1.34
Udorthents, deep:	0-3	9.14	7.3	12.8	1.2	0.4	0.3	9	23.7	20.2	1.41
(man-made)	3-5	0.56	7.0	9.5	1.3	0.2	0.1	3	14.0	8.1	0.61
(S73-DC-1-1)	5-23	0.24	4.8	4.8	2.4	0.4	0.1	2	16.8	8.6	1.83
	23-28	0.56	7.6	10.7	3.3	0.6	0.2	0	17.3	9.7	1.16
	28-43	0.55	7.8	12.8	3.6	0.7	0.2	---	---	8.5	1.39
	43-48	---	---	---	---	---	---	---	---	---	---
Udorthents, deep:	0-3	4.44	6.9	12.4	1.4	0.4	0.2	4	18.4	10.2	1.27
(man-made)	3-25	0.56	6.1	7.4	1.3	0.4	0.2	2	11.3	8.1	1.29
(S73-DC-1-3)	25-38	0.56	5.2	6.0	3.7	0.8	0.3	5	15.8	15.3	---
	38	---	---	---	---	---	---	---	---	---	---

[1]By present criteria of soil taxonomy, these soils would classify as Fluvents, but a proposal has been made to change the criteria so that the soils would classify as Orthents.

TABLE 18.--RELATIONSHIP BETWEEN POSITION, PARENT MATERIAL, AND DRAINAGE OF SOIL SERIES AND OTHER TAXA

Parent Material	Excessively drained	Somewhat excessively drained	Well drained	Moderately well drained	Somewhat poorly drained	Poorly drained	Very poorly drained
UPLAND SOILS FORMED IN PIEDMONT RESIDUUM							
Micaceous schist and impure quartzite.		Manor	Manor				
Acid schist and impure quartzite.			Glenelg	Glenelg Variant			
Gneiss.	Ashe	Ashe					
Gneiss-skeletal.	Brandywine	Brandywine					
Semibasic or mixed basic and acidic rocks.			Neshaminy				
UPLAND SOILS FORMED IN COASTAL PLAIN SEDIMENT							
Clay and silty clay.			Christiana	Keyport			
Sand over clay, silty clay, or sandy clay.		Muirkirk Variant	Sunnyside				
Silt over sandy sediment.			Matapeake				
Silt over compacted silt, sand, and gravel.			Chillum	Beltsville			
Sand, silt, and clay.			Sassafras	Woodstown		Fallsington	
Sand, silt, and clay over compacted sand.				Bourne			
Sand and loamy sand.		Galestown					
Loamy sand and sandy loam.		Rumford					
Gravelly silt and sand.	Joppa	Joppa	Joppa				
Old gravelly sediment.		Croom					
FLOOD-PLAIN SOILS FORMED IN RECENT ALLUVIUM AND RIVER DREDGINGS							
Alluvium from Piedmont material.				Codorus	Codorus	Fluvaquents and Fluvents.	Fluvaquents and Fluvents.
Alluvium from Coastal Plain sediment.			Udifluvents	Iuka		Bibb	
Sandy alluvium and river dredgings.			Udifluvents, sandy.	Udifluvents, sandy.		Bibb	
Silty alluvium and river dredgings.				Lindside		Melvin	Dunning

TABLE 18.--RELATIONSHIP BETWEEN POSITION, PARENT MATERIAL, AND DRAINAGE OF SOIL SERIES AND OTHER TAXA--Continued

	UPLAND, TERRACE, AND FLOOD-PLAIN SOILS FORMED IN MATERIALS DISTURBED BY MAN[1]						
Gravelly cuts and fills.	----------	----------	Udorthents, gravelly, smoothed.	----------	----------	----------	----------
Sandy cuts and fills.	----------	----------	Udorthents, sandy, smoothed.	----------	----------	----------	----------
Loamy cuts and fills.	----------	----------	Udorthents, loamy, smoothed.	----------	----------	----------	----------
Clayey cuts and fills.	----------	----------	Udorthents, clayey, smoothed	----------	----------	----------	----------
Variable textured cuts and fills.	----------	----------	Udorthents, smoothed.	----------	----------	----------	----------
Gravelly fills.	----------	----------	Udorthents, gravelly.	----------	----------	----------	----------
Sandy fills.	----------	----------	Udorthents, sandy.	----------	----------	----------	----------
	UPLAND, TERRACE, AND FLOOD PLAIN SOILS FORMED IN MATERIALS DISTURBED BY MAN[1]						
Loamy fills.	----------	----------	Udorthents, loamy.	----------	----------	----------	----------
Clayey fills.	----------	----------	Udorthents, clayey.	----------	----------	----------	----------
Variable textured fills.	----------	----------	Udorthents-------	----------	----------	----------	----------
Variable textured fills over sanitary landfills.	----------	----------	Udorthents, deep.	----------	----------	----------	----------

[1]These soils are mostly well drained, some of them are in other drainage classes. Mottled colors reflecting wetness differences normally have not had time to develop.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Ashe	Coarse-loamy, mixed, mesic Typic Dystrochrepts
Beltsville	Fine-loamy, mixed, mesic Typic Fragiudults
Bibb	Coarse-loamy, siliceous, acid, thermic Typic Fluvaquents
Bourne	Fine-loamy, mixed, thermic Typic Fragiudults
Brandywine	Sandy-skeletal, mixed, mesic Typic Dystrochrepts
Chillum	Fine-silty, mixed, mesic Typic Hapludults
Christiana	Clayey, kaolinitic, mesic Typic Paleudults
Codorus	Fine-loamy, mixed, mesic Fluvaquentic Dystrochrepts
Croom	Loamy-skeletal, mixed, mesic Typic Hapludults
Dunning	Fine, mixed, mesic Fluvaquentic Haplaquolls
Fallsington	Fine-loamy, siliceous, mesic Typic Ochraquults
Fluvaquents	Fluvaquents
Galestown	Sandy, siliceous, mesic Psammentic Hapludults
Glenelg	Fine-loamy, mixed, mesic Typic Hapludults
Glenelg Variant	Fine-loamy, mixed, mesic Aquic Hapludults
Iuka	Coarse-loamy, siliceous, acid, thermic Aquic Udifluvents
Joppa	Loamy-skeletal, siliceous, mesic Typic Hapludults
Keyport	Clayey, mixed, mesic Aquic Hapludults
Lindside	Fine-silty, mixed, mesic Fluvaquentic Eutrochrepts
Manor	Coarse-loamy, micaceous, mesic Typic Dystrochrepts
Matapeake	Fine-silty, mixed, mesic Typic Hapludults
Melvin	Fine-silty, mixed, nonacid, mesic Typic Fluvaquents
Muirkirk Variant	Coarse-loamy over clayey, siliceous, mesic Typic Paleudults
Neshaminy	Fine-loamy, mixed, mesic Ultic Hapludalfs
Rumford	Coarse-loamy, siliceous, thermic Typic Hapludults
Sassafras	Fine-loamy, siliceous, mesic Typic Hapludults
Sunnyside	Fine-loamy, siliceous, mesic Typic Hapludults
Udorthents	Udorthents
Udifluvents	Udifluvents
Woodstown	Fine-loamy, siliceous, mesic Aquic Hapludults

DISTRICT OF COLUMBIA

F I G U R E S

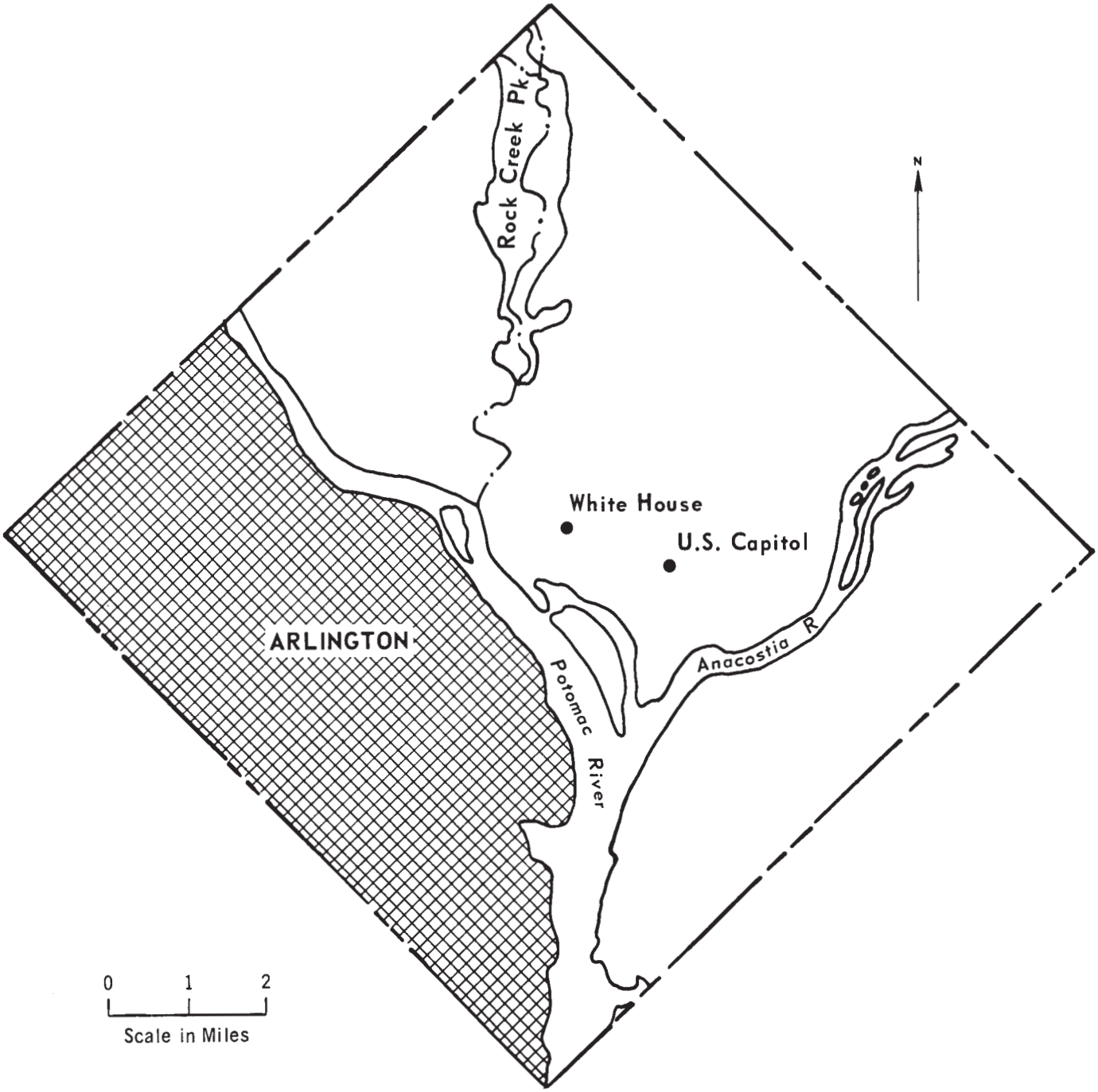

Figure 1.—The heavy broken line bounds the original area of the District of Columbia. The light area on the map covers the present District of Columbia. The crosshatched area shows the section returned to Virginia in 1846.

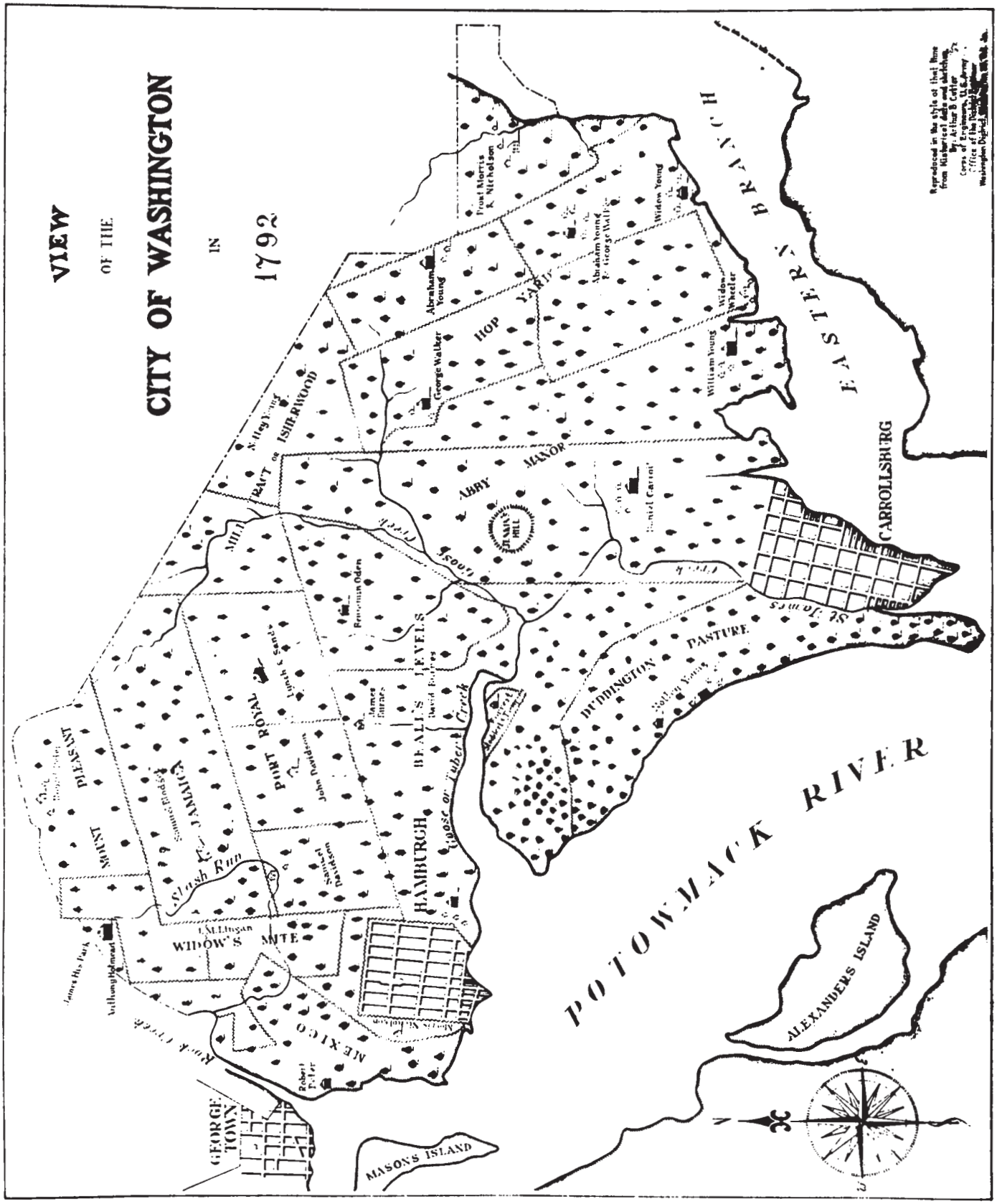

Figure 2.—Farm tracts in the District of Columbia in 1792.

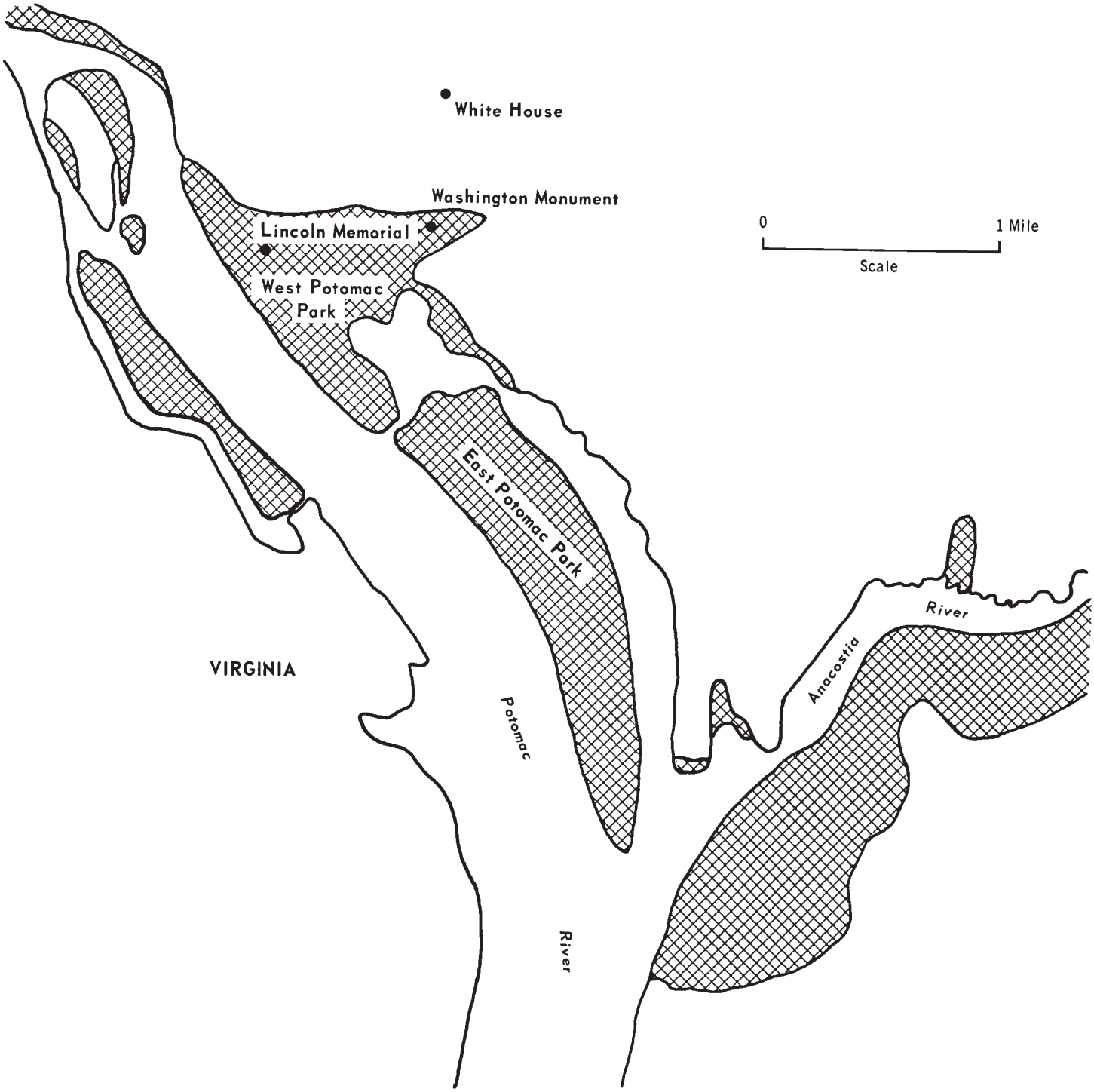

Figure 3.—Crosshatched areas of East and West Potomac Parks were water areas in 1837. The parks were formed from river dredgings. The other crosshatched areas were formed from a combination of river dredgings and other types of fill.

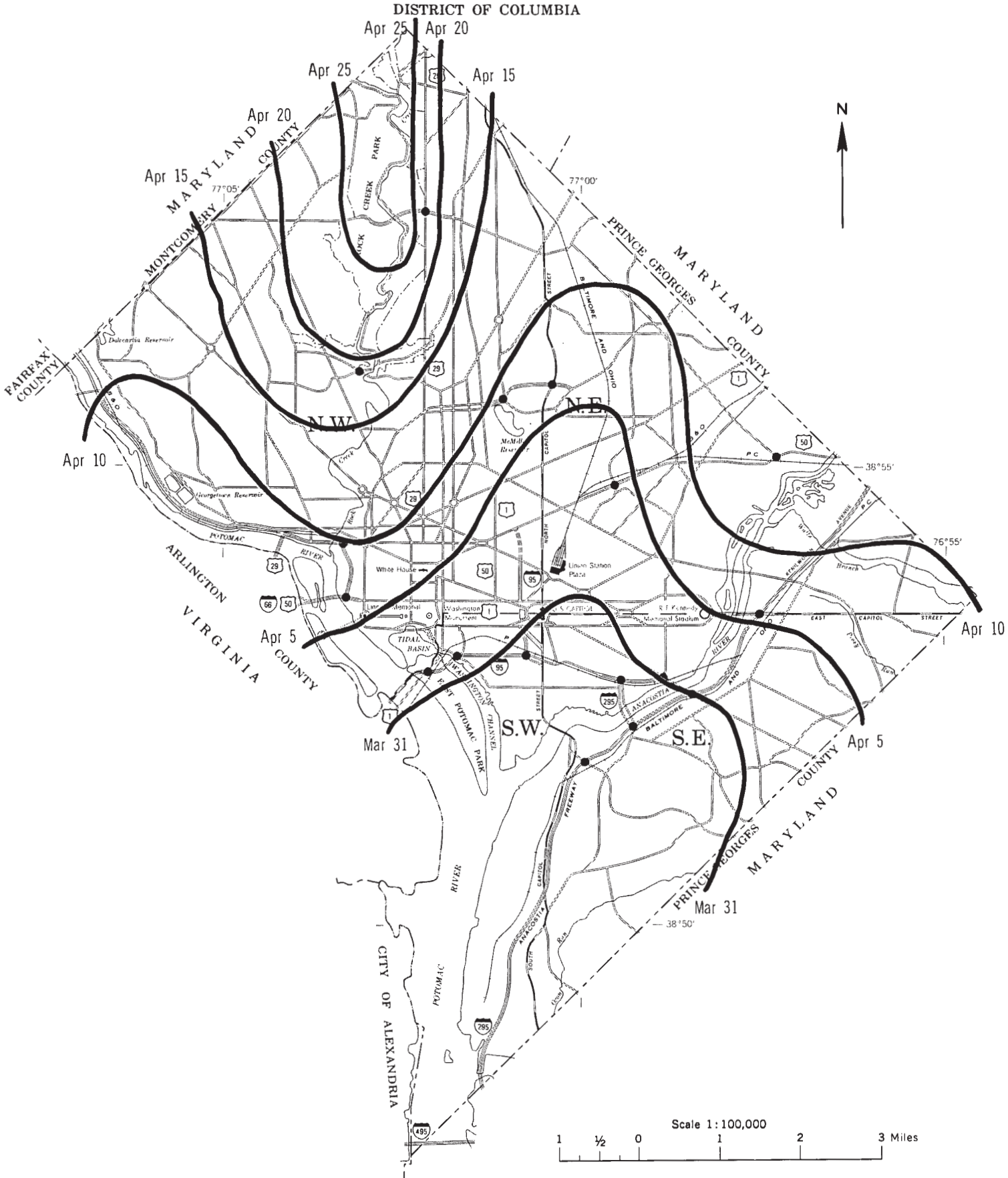

Figure 4.—Average dates of last freezing temperatures in spring.

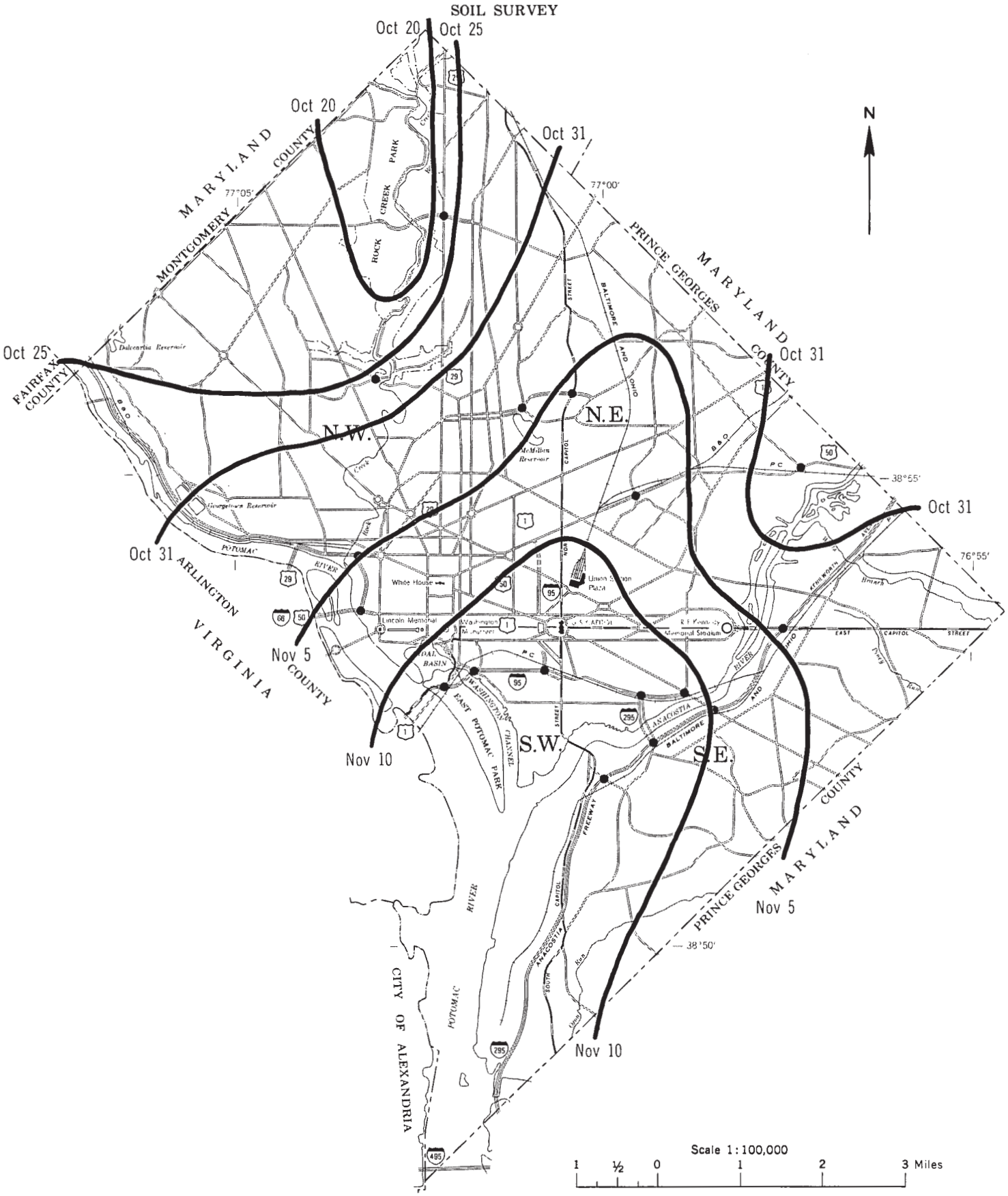

Figure 5.—Average dates of first freezing temperatures in fall.

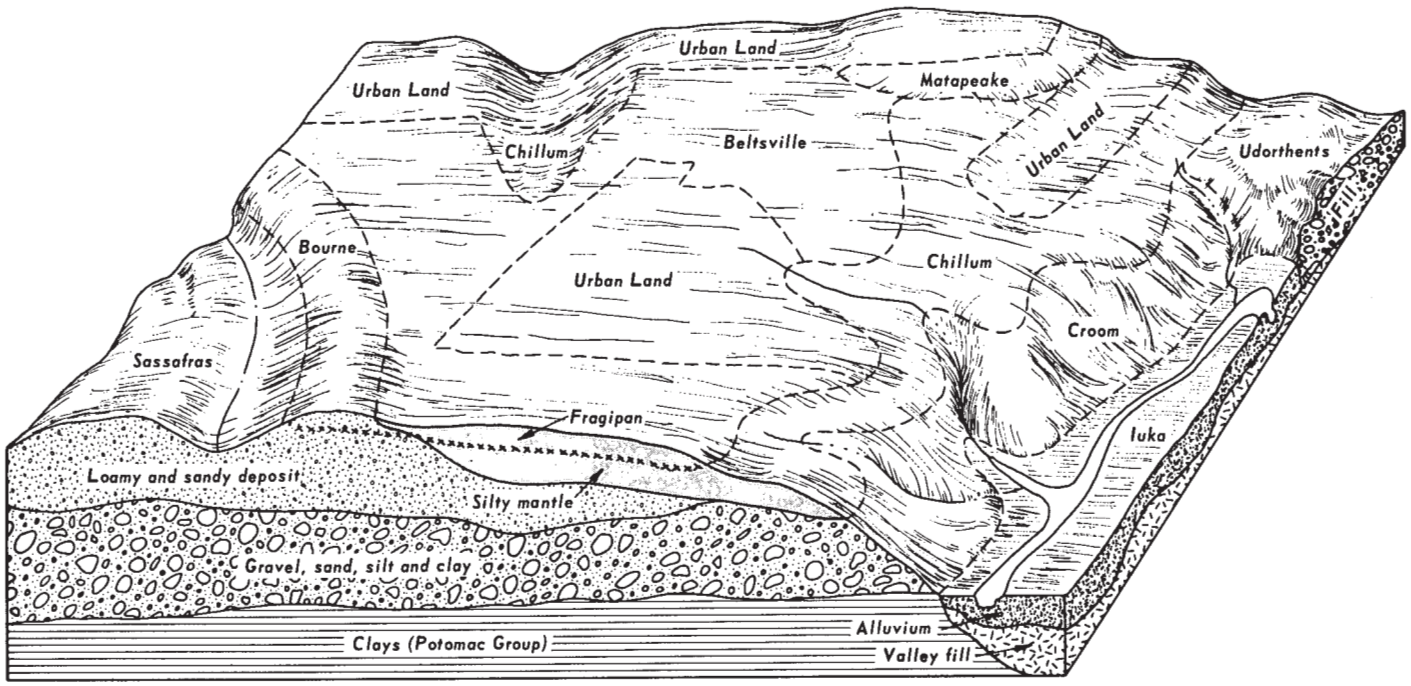

Figure 6.—Typical pattern of soils and parent material in the Urban land-Beltsville-Chillum association.

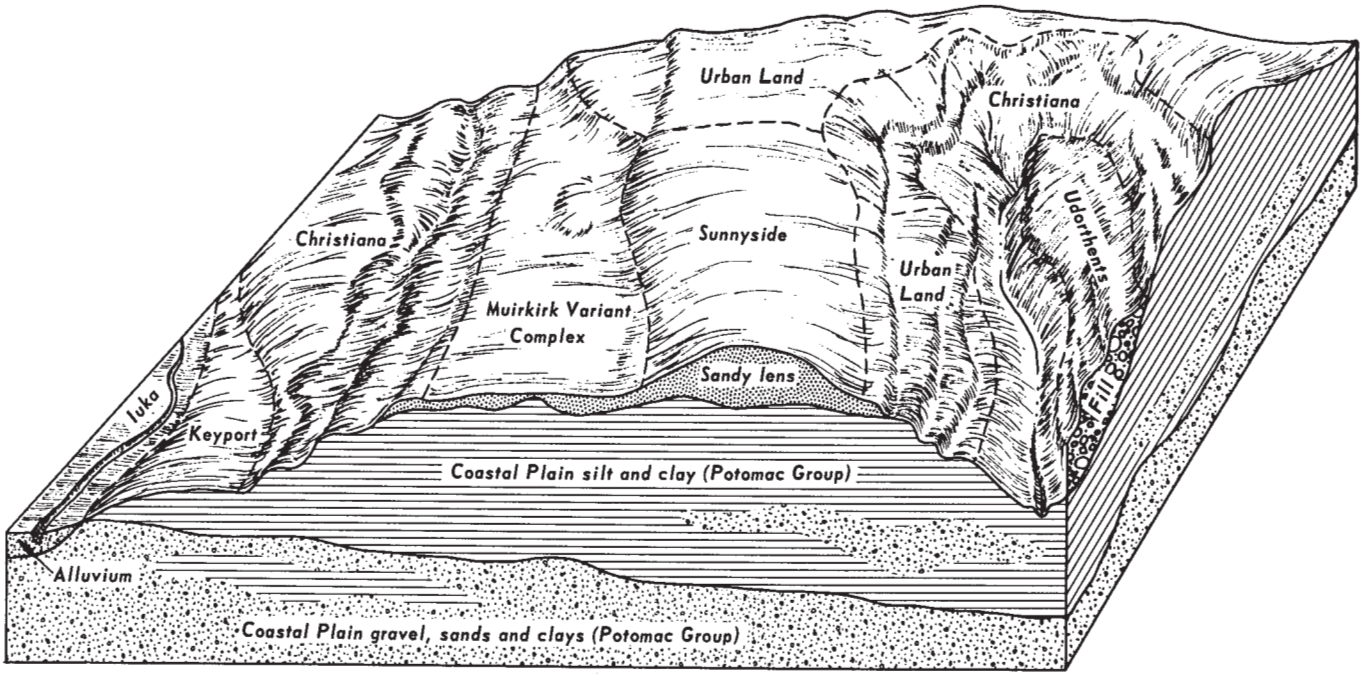

Figure 7.—Typical pattern of soils and parent material in the Urban land-Christiana-Sunnyside association.

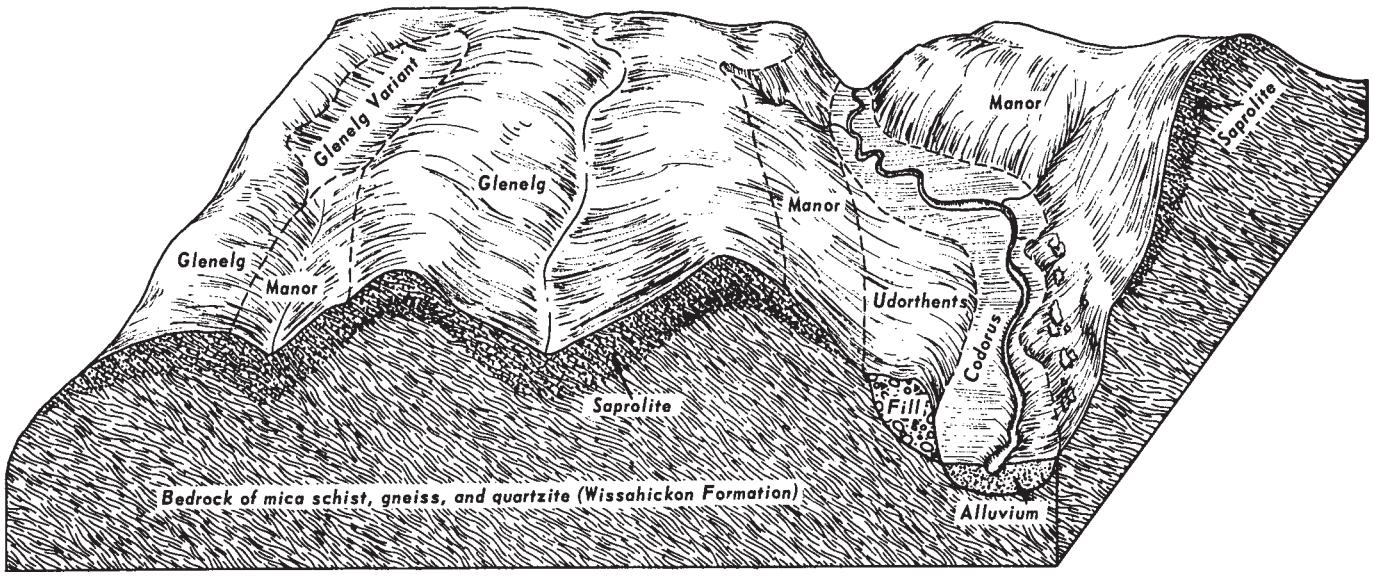

Figure 8.—Typical pattern of soils and parent material in the Manor-Glenelg association.

Figure 9.—Water standing on the surface of Beltsville silt loam, 0 to 8 percent slopes, after a heavy rain.

Figure 10.—Profile of Chillum silt loam showing the contrasting materials in which the soil formed. Increments on marker are 20 centimeters apart.

Figure 11.—Parking lot on Christiana-Urban land complex, 15 to 40 percent slopes, has collapsed because of slope and poor stability.

Figure 12.—Unstable soil material from an area of Christiana-Urban land complex, 15 to 40 percent slopes, has flowed down the slope to block this street. The steep slope had been graded.

Figure 13.—Profile of Croom very gravelly sandy loam. Entire profile formed in very gravelly Coastal Plain material. Increments on marker are 20 centimeters apart.

Figure 14.—Typical area of Fluvaquents, bouldery, along the Potomac River.

Figure 15.—Typical area of Udorthents.

Figure 16.—Profile of Udorthents, loamy. Dark area is incinerated material.

Figure 17.—Typical area of Udorthents, clayey, smoothed. Before cutting and grading, the soil at this site was Christiana silt loam.

Figure 18.—Poor stability has caused cracks in this retaining wall on Christiana-Urban land complex, 0 to 8 percent slopes.

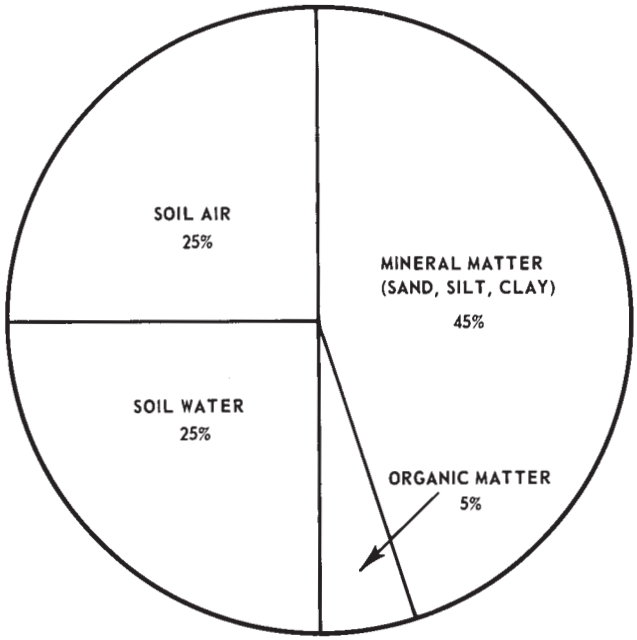

Figure 19.—A schematic representation of ideal soil composition.

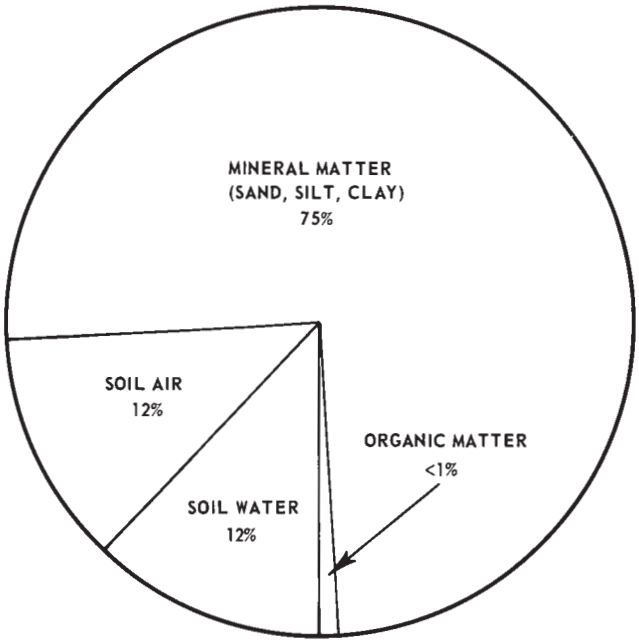

Figure 20.—Diagram showing the generalized composition of a compacted soil.

Figure 21.—Tulip Library, maintained by the National Park service, in an area of Udorthents.

Figure 22.—Vegetable garden in an area of Neshaminy silt loam.

Figure 23.—Biking and hiking trail along the Chesapeake and Ohio Canal in an area of Udorthents.

Figure 24.—This wet area provides good habitat for muskrat, bullfrogs, and other wetland species. Areas such as this are generally included in mapping with Fluvaquents, bouldery, and Lindside silt loam, bedrock substratum.

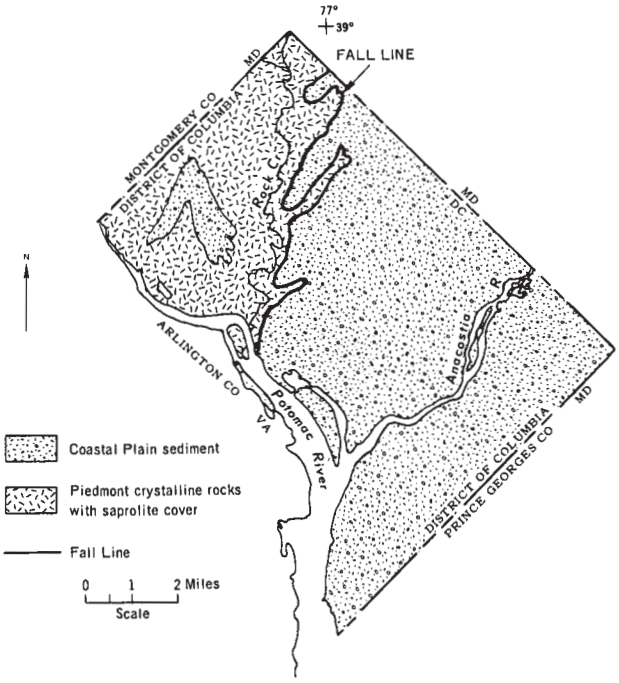

Figure 25.—Fall line between the Coastal Plain and the Piedmont Plateau.

LEGEND

UNCONSOLIDATED MATERIALS
(Mainly Coastal Plain sediments)

(Queried where uncertain - ?)

QUATERNARY

RECENT

af

Artificial fill

Local unconsolidated material from nearby cuts and river dredgings; includes sanitary landfill.

Qal

Alluvium and artificial fill

Gravel, sand, silt, and clay of lowest stream terraces and bottoms; only larger deposits shown. Thickness of a few inches to 25 feet or more. Many large areas of fill, especially along Potomac River and Anacostia River.

PLIOCENE (?) & PLEISTOCENE

Unconformity

Qt

River terrace deposits

Gravel, sand, and loam; basal part is generally unsorted boulders, pebbles, and sand; locally contains plant fossils and peat beds. Average thickness of 30 feet; occurs at various levels.

TERTIARY

MIOCENE(?) & PLIOCENE (?)

Unconformity

Tug

Upland gravel and sand

Gravel and sand in orange loam matrix, capping remnants of former plateau. Coarse material at base. Gravel largely quartzite; some vein quartz, crystalline rock fragments, and chert. Average thickness 30 feet. Deposited by ancestral Potomac River.

MIOCENE

Unconformity

Tc

Calvert Formation

Very fine sand mixed with clay. Compact, dark gray to green where fresh, weathered outcrops are soft gray or buff sand. Thickness of 20 to 80 feet. In places contains shells and impressions, bone fragments, shark teeth, fish scales, and remains and impressions of plants.

PALEOCENE

Unconformity

Ta

Aquia Formation

Where fresh, bluish- or greenish-black, moderately fine sand mixed with clay, greensand (glauconite), organic matter, and chalky white marine fossil shells. Weathered material is gray, buff, or reddish-brown sand, with ironstone concretions in places. Thickness less than 50 feet.

MESOZOIC

Unconformity

UPPER CRETACEOUS

Km

Monmouth Formation

Dark micaceous sand with considerable greensand (glauconite). Weathers to brown sand with limonite cemented crusts and concretions. In places contains marine shells or impressions, mostly mollusks. Thickness of as much as 50 feet.

Unconformity

LOWER & UPPER CRETACEOUS

Kpc / Kps

Potomac Group

Kpc- clay and silt facies Kps - sand and gravel facies

Kpc-beds in eastern part of area are chiefly pink, red, and gray silty clay with interbedded irregular sand and gravel lenses that in places grade into clay. Contains fossil bones, plant remains, and lignite. Kps-basal part in western part of District is gravel, sand, and arkose with occasional sandy clay lenses, generally light gray in color. This unit overlies crystalline rocks. Thickness of total Potomac Group increases to the east, where it exceeds 700 feet.

CONSOLIDATED ROCKS AND WEATHERED RESIDUUM
(Mainly Piedmont crystalline rocks and saprolite)

(Queried where uncertain - ?)

PRECAMBRIAN, LOWER PALEOZOIC, OR BOTH

Kg

Kensington gneiss

Medium to coarse, crystalline, light gray, layered to nearly massive, jointed quartz diorite gneiss consisting of quartz, feldspar, and mica; overlain on valley slopes and uplands by grayish-brown, soft, weathered, sandy and silty, well drained saprolite residuum as much as 120 feet thick.

Gm / U

Georgetown mafic complex

Mixed group of metaigneous and metavolcanic rocks consisting of fine to coarse-crystalline, dark gray green to black, foliated to massive, jointed gabbro, tonalite, diorite, amphibolite, and chloritic schist. The predominant minerals are amphibole, chlorite, plagioclase feldspars, and mica; overlain by 10 to 50 feet of red brown, ferruginous, poorly drained, clay-rich saprolite.

U - Ultramafic rocks, chiefly serpentinite, talc schist, and chlorite schist with little or no saprolite on weathered, dark green rock.

GLENARM SERIES

Wp Wd

Wissahickon Formation

Wp - pelitic schist facies Wd - diamictite gneiss facies

Wp - Fine to coarse crystalline, foliated quartz-mica schist and chlorite quartz schist with fine garnets; overlain on uplands by reddish brown, soft, micaceous, silty, well drained saprolite residuum as much as 160 feet thick.

Wd - Medium to coarse crystalline, layered to massive, jointed quartz-feldspar-biotite gneiss with scattered quartz pods and schist and amphibolite cobbles; overlain by sandy, reddish-brown, well drained saprolite as much as 120 feet thick on uplands but less than 25 feet thick where overlain by Coastal Plain strata.

DISTRICT OF COLUMBIA

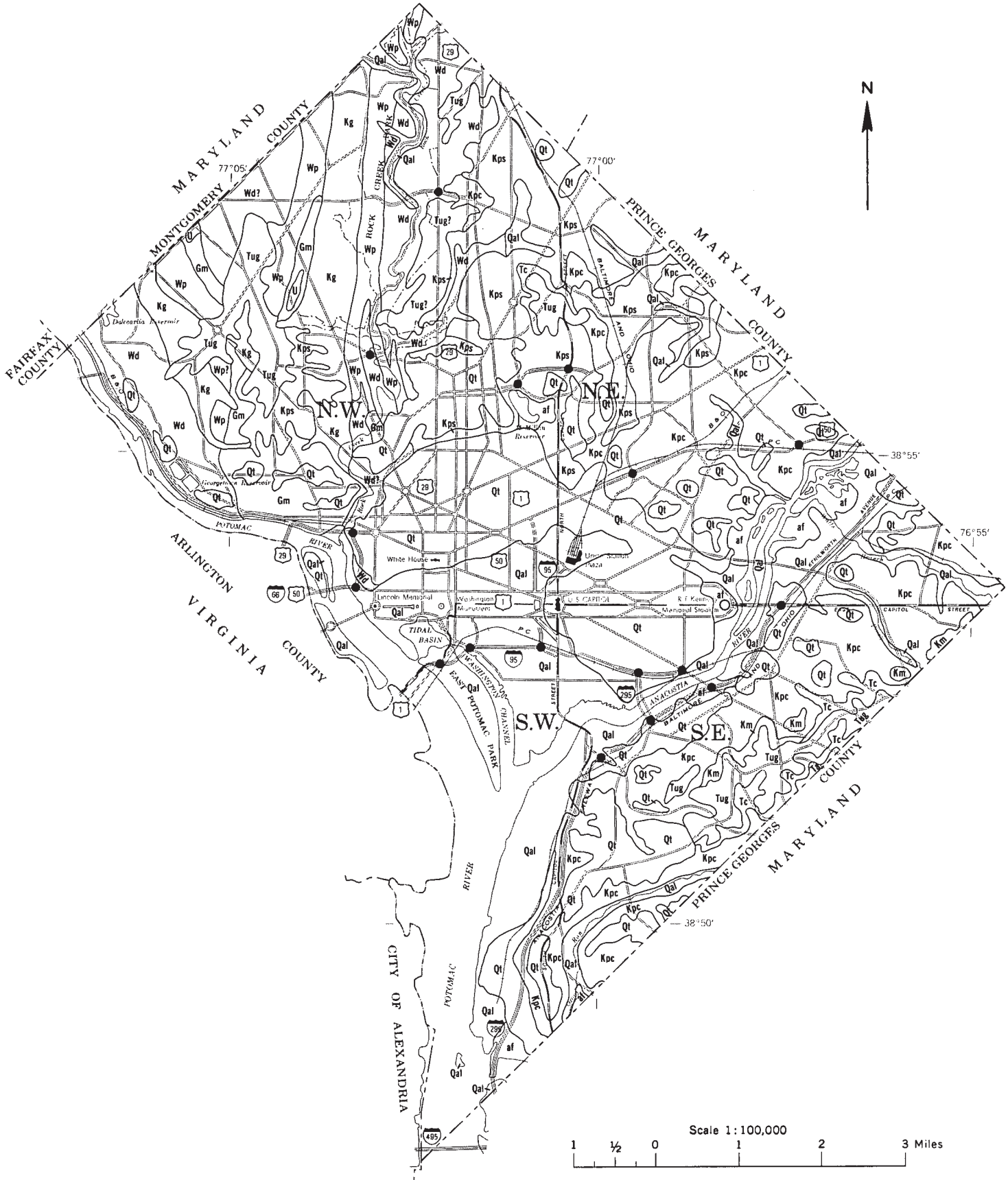

Figure 26.—Reduced Preliminary Geology Map of the District of Columbia.

Figure 27.—Map showing thickness of overburden in the District of Columbia.

Figure 28.—Map showing contours on top of bedrock.

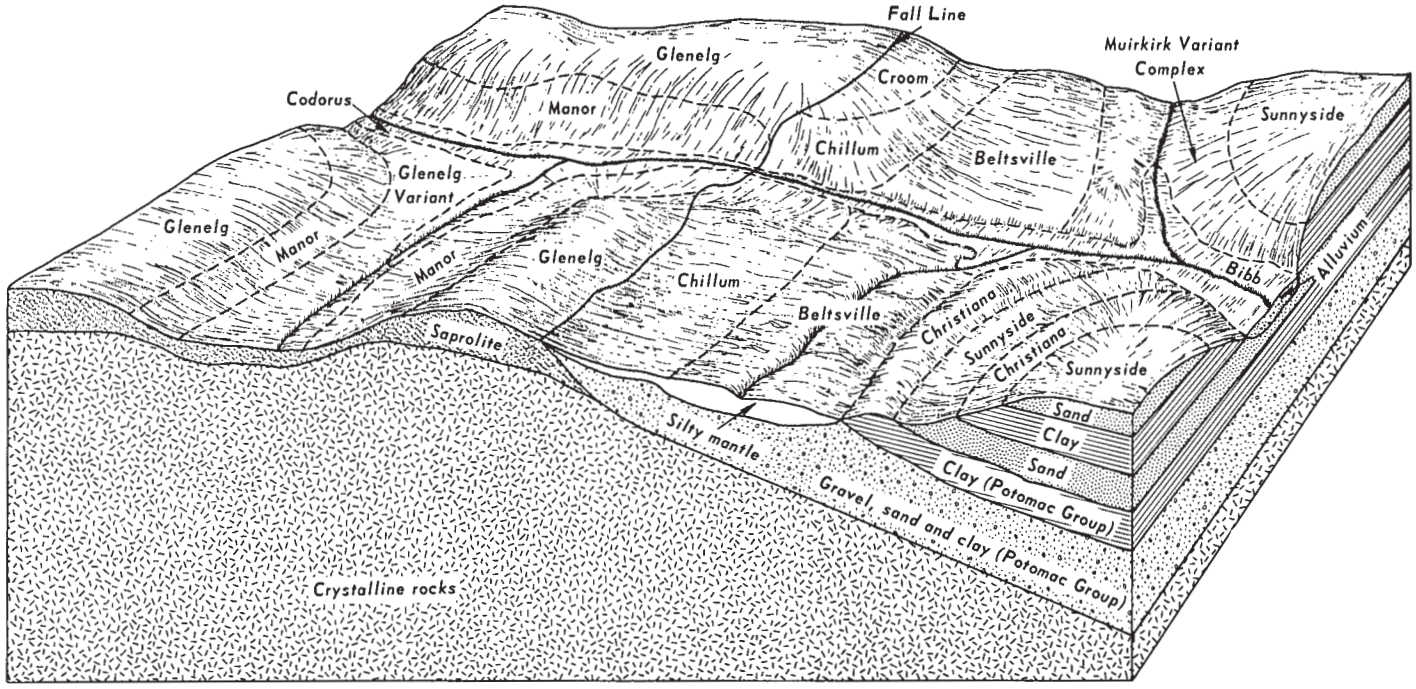

Figure 29.—Diagram of fall line between the Piedmont Plateau and the Coastal Plain. Diagram also shows the relationship of parent material and topography.

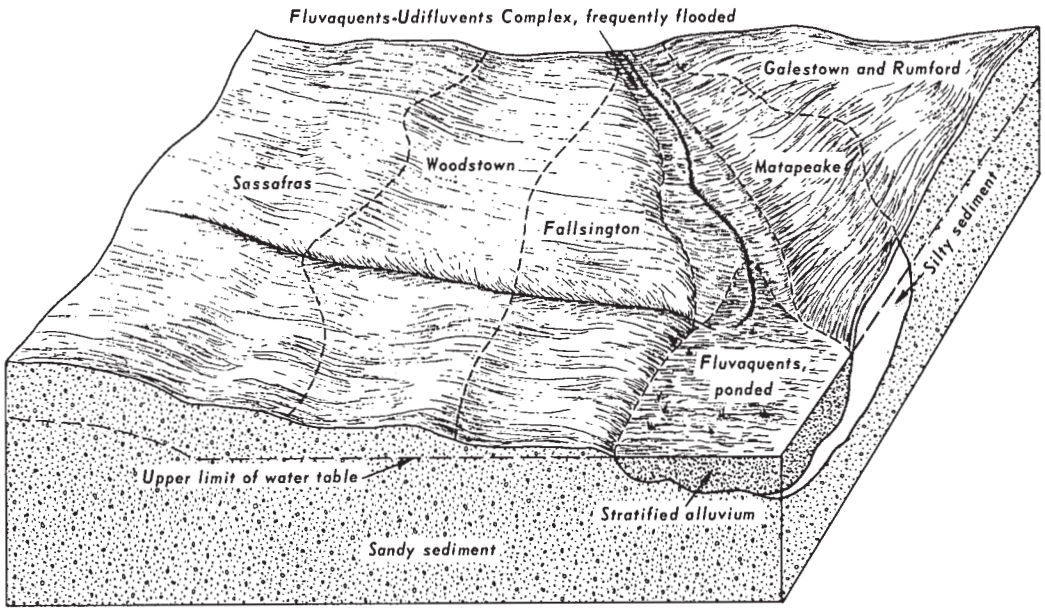

Figure 30.—Diagram of Coastal Plain showing the pattern of soils and parent material.

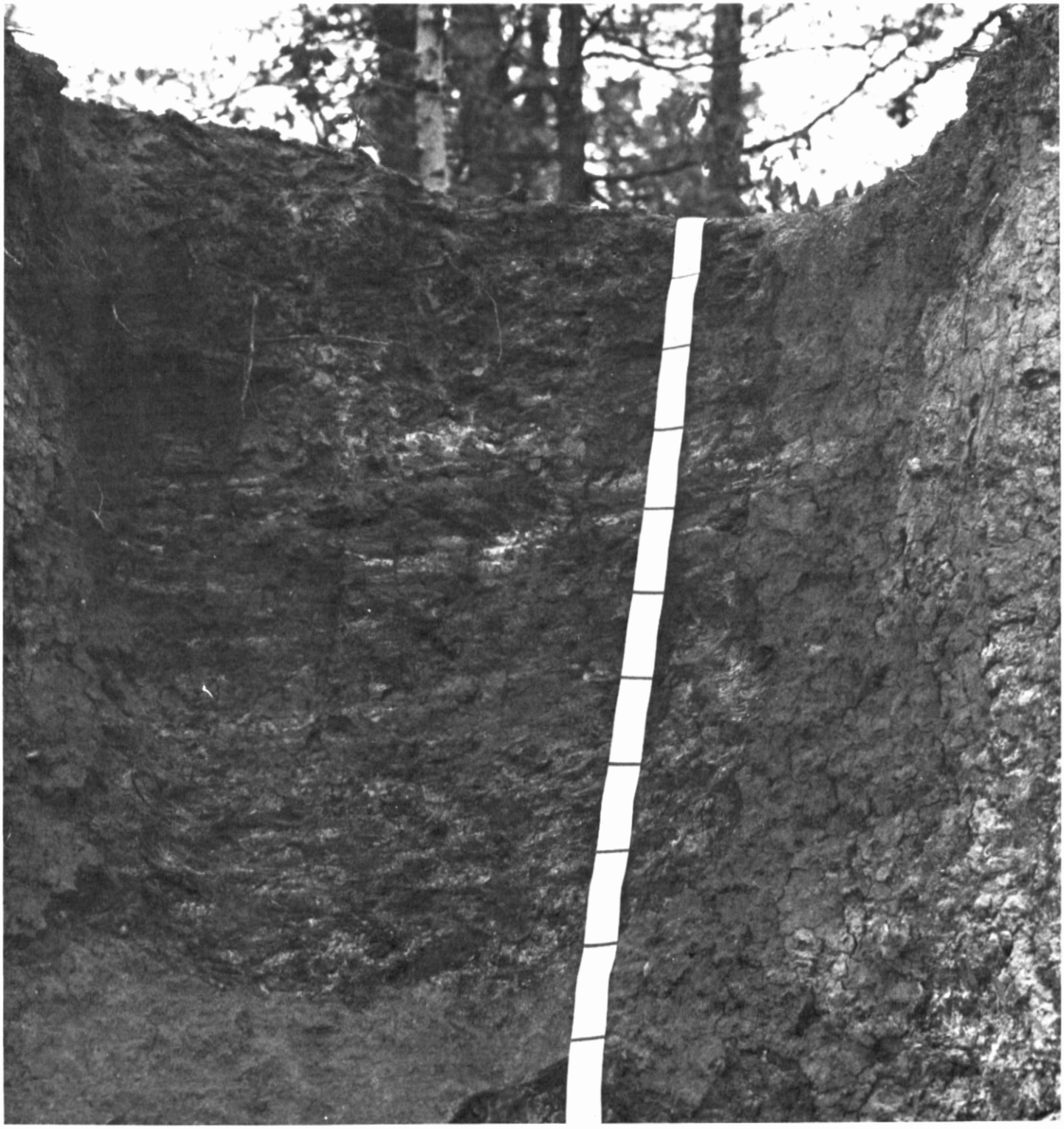

Figure 31.—Profile of Christiana silt loam. Increments on marker are 20 centimeters apart.

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